Analysis of Supply Response and Market Integration of Cayenne Pepper in West Nusa Tenggara Province

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Abstract: This study aims to identify factors influencing the supply of cayenne pepper, supply response, price variation, and vertical and horizontal market integration of cayenne pepper in West Nusa Tenggara Province. This study uses a descriptive method. The type of data used is quantitative data in the form of secondary monthly time series data for 2016-2023. Data collection uses documentation techniques, by accessing and downloading data from official websites and from report books provided by various related agencies. Data analysis uses the Cobb-Douglas model, coefficient of variation, and the *Vector Autoregression* (VAR), from *Vector Error Correction Model* (VECM). The results of the study show that the factors that positively and significantly influence the supply of cayenne pepper in NTB Province are the planting area ($X1_{t-2}$), and the price of curly chilies ($X3_{t-2}$) two months earlier; negatively and significantly is the price of large chilies ($X4_{t-2}$), price of SP-36 fertilizer ($X5_{t-2}$), and rainfall ($X6_{t-2}$) two months earlier. The supply response of cayenne pepper in NTB Province is determined by the area of planting area ($X1_{t-2}$) as big as +0,5567, price of cayenne pepper ($X2_{t-2}$) as big as -0,2163, price of curly chilies ($X3_{t-2}$) as big as 1,5807, price of large chilies ($X4_{t-2}$) as big as -1,4345; price of SP-36 fertilizer ($X5_{t-2}$) as big as -4,7946 and rainfall ($X6_{t-2}$) as big as -0,6444. Variations Price of cayenne pepper in West Nusa Tenggara Province sto live Over the past eight years (2016-2013), prices have fluctuated significantly. At the producer level, the coefficient of variation was 0.40, and at the consumer level, it was 0.61. Vertical integration of the cayenne pepper market in West Nusa Tenggara Province is weak. This means that changes in the price of cayenne pepper in NTB at the consumer level are not well transmitted to the producer level, or vice versa. Meanwhile, horizontal market integration between cities/regencies in West Nusa Tenggara Province has been good in both the short and long term. This means that price changes in one city or regency, such as Mataram City as the reference market, affect prices in other cities or regencies.

Keywords: Supply Response, Price Variation, Market Integration, Coefficient of Variation.

I. INTRODUCTION

Chili peppers are a horticultural commodity with high demand in both domestic and international markets. This is because Indonesians generally use chili peppers as a cooking ingredient at home. However, chili peppers are also used in industrial and pharmaceutical applications (Wardhana *et al.*. 2022). According to data from the Central Statistics Agency (BPS), the average consumption of cayenne pepper in Indonesia in 2023 was 2.19 kilograms/capita/year, a 5.8% increase, the highest since 2019. Imagine that with a population of 280.73 million (BPS, 2024), Indonesia needs 614.7987 kilograms of chili peppers/year.

Chilies are one of the important food products in Indonesia, and can even influence the rate of inflation (Arizka *et al.* 2018). The demand for cayenne pepper to meet daily needs can fluctuate, which is caused by the instability of cayenne pepper prices that occur in the retail market. Price fluctuations in the retail market are caused by factors that affect both the demand side and the supply side. From the supply side, it shows that the process of supply (production and distribution) of chilies is not fully mastered by farmers. The main factor causing this is small chili farmers, whose production decision-making process is allegedly not handled and supported by good production and price forecasting (Palar *et al.* 2016).

West Nusa Tenggara (NTB) Province is the sixth-highest producer of cayenne pepper in Indonesia. In 2023, cayenne pepper production in NTB Province reached 67,977.8 tons (NTB Agriculture and Plantation Service, 2023). The highest cayenne pepper producing region is East Lombok Regency, which reached 550,148 quintals or 80.93% of NTB production. On the other hand, the demand for cayenne pepper in NTB Province is also quite high. Based on data from the Central Statistics Agency (BPS) of NTB Province in 2023, the average per capita monthly expenditure on cayenne pepper reached Rp. 10,616, the highest expenditure for the vegetable group. The seasonal nature of cayenne pepper causes price variations. These price variations form a pattern of regular price fluctuations that occur annually. The tendency of the price of cayenne pepper to fluctuate occurs almost throughout the year and makes farmers and consumers anxious about the uncertainty of the price of cayenne pepper, however, there has not been any appropriate handling from the government to overcome this problem (Jumaina *et al.* 2018).

The seasonal nature of cayenne peppers results in price fluctuations. These price variations create a pattern of regular fluctuations that occur annually. This fluctuating trend in cayenne pepper prices occurs almost year-round, making farmers and consumers anxious about the uncertainty of cayenne pepper prices. However, the government has not yet taken appropriate action to address this issue (Jumaina *et al.* 2018).

The price of cayenne pepper in West Nusa Tenggara (NTB) fluctuates over time. This price fluctuation is often influenced by various external and internal factors, including unpredictable weather, natural disasters, and an imbalance between market supply and demand. High price fluctuations impact farmers' well-being. When prices drop drastically, farmers often incur losses because the selling price cannot cover production costs. One factor influencing cayenne pepper price fluctuations is the integration of the cayenne pepper market itself. The cayenne pepper market in West Nusa Tenggara still faces challenges in terms of distribution and market connectivity. Prices established in the reference market often do not keep pace with price changes in the retail market due to a lack of information.

Market integration can be both vertical and horizontal. According to Irawan & Rosmayanti (2016), vertical integration can occur when there is a change or difference in prices at the wholesale level, followed by a subsequent change in prices at the community or consumer level. Horizontal integration refers to the difference in prices between the consumer and producer levels. The existence of both vertical and horizontal market integration demonstrates the need for supply response analysis. Supply response is particularly dependent on the level of vertical market integration. Without proper integration, price information does not flow effectively to farmers, preventing them from optimizing production and distribution decisions appropriately. Consequently, even when consumer market prices are high, supply from farmers does not necessarily increase. This has the potential to create supply shortages, market imbalances, and price volatility that are detrimental to all parties.

Based on the problems above, it is necessary to identify and analyze the factors that influence supply, supply response, price variation levels, vertical and horizontal market integration of the cayenne pepper market in West Nusa Tenggara Province.

II.   RESEARCH METHODOLOGY

This study uses a descriptive method by selecting West Nusa Tenggara Province (NTB) as the research area, because this province is one of the centers of cayenne pepper production in Indonesia. The type of data used is quantitative data in the form of secondary time series data. Data collection uses documentation techniques, by accessing and downloading available data from official government agency websites; and from report books provided by various related agencies, which are in the form of monthly time series data for 96 months from January 2016 to December 2023. The available and collected data include data on the area of cayenne pepper planting, the price of cayenne pepper, the price of curly chili, the price of large chili, the price of SP-36 fertilizer, and rainfall data in each district/city in West Nusa Tenggara Province. The data are analyzed sequentially according to the order of research objectives as follows:

1. Factors suspected of influencing the supply of cayenne pepper were analyzed using the Cobb-Douglas model with the following sequence of activities:

a. Inventory the factors that influence supply theoretically and based on previous research experience.

b. Collecting data available from official government agencies or other relevant government agencies, in the form of time series data over a sufficiently long period; at least 6 years or 72 months.

c. Determining the lag in the analysis, because the decision to start a cayenne pepper farming business at this time will determine the amount of cayenne pepper offered several months later, namely when the cayenne pepper is harvested.

d. Formulating a Cobb-Douglas regression model. Based on the results of the previous activities, the Cobb-Douglas regression model can be formulated as follows:

AND= $aX1_{t-2}^{b1} \ X2_{t-2}^{b2} \ X3_{t-2}^{b3} \ X4_{t-2}^{b4} \ X5_{t-2}^{b5} \ X6_{t-2}^{b6}$

To facilitate the estimation of the Cobb-Douglas function above, the equation is transformed into the following logarithmic form:

Log Y = $\log \alpha + b_1 \ log \ log \ X1_{t-2} + b_2 \ log \ log \ X2_{t-2} + b_3 \ log \ log \ X3_{t-2} + b_4 \ log \ log \ X4_{t-2} + b_5 \ log \ log \ X5_{t-2}$

$\qquad + b_6 \ log \ log \ X6_{t-2}$

Where:

α= Constant

b_i = Regression coefficient of the i-th independent variable

Y = Supply of cayenne pepper (kg/month)

$X1_{t-2}$ = Area of cayenne pepper two months previously (ha/month)

$X2_{t-2}$ = Price of cayenne pepper two months ago (Rp/kg)

$X3_{t-2}$ = Price of curly chilies two months ago (Rp/kg)

$X4_{t-2}$ = Price of large chilies two months ago (Rp/kg)

$X5_{t-2}$ = Price of SP-36 fertilizer two months earlier (Rp/kg)

$X6_{t-2}$ = Rainfall two months ago (mm/month)

e. Regression Model Testing:

The results of the regression model analysis above were then tested theoretically, statistically and econometrically (classical assumptions) as follows>

1. Sign Test (Theory Test)

The sign test is used to assess the direction of the estimated parameter coefficients' alignment with relevant economic theory. This test does not focus on the magnitude or statistical significance of the coefficients, but rather on the direction (positive or negative) of the independent variable's influence on the dependent variable, and whether it aligns with the theoretical hypothesis.

2. Statistical Criteria Test, namely the coefficient of determination test, F test and t test.

➢ Coefficient of Determination (R^2)

The coefficient of determination describes the portion of the total variable that can be explained by the model. The greater the value, the greater the R^2 (approaching 1), then the model is said to be getting better.

➢ F Test (Simultaneous Test)

The hypothesis proposed in this test is as follows:

H0: Prob (F-count) > 0.10, then together (simultaneously) all independent variables ($X1_{t-2}, X2_{t-2}, X3_{t-2}, X4_{t-2}, X5_{t-2}$, And $X6_{t-2}$) included in the model does not have a significant effect on the supply of cayenne pepper (Y).

Ha: Prob (F-count) ≤ 0.10, then at least one of the independent variables ($X1_{t-2}, X2_{t-2}, X3_{t-2}, X4_{t-2}, X5_{t-2}$, And $X6_{t-2}$) has a significant effect on the supply of cayenne pepper (Y).

➢ T-Test (Partial Test)

The hypothesis proposed in this test is as follows:

H0: prob > 0.10, then partially or individually each independent variable ($X1_{t-2}, X2_{t-2}, X3_{t-2}, X4_{t-2}, X5_{t-2}$, And $X6_{t-2}$)

does not have a real or significant effect on the dependent variable (Y).

Ha: prob ≤ 0.10, then partially or individually each independent variable ($X1_{t-2}, X2_{t-2}, X3_{t-2}, X4_{t-2}, X5_{t-2}$, And $X6_{t-2}$) has a real or significant effect on the dependent variable (Y).

3. Econometric Criteria Test

➢ Multicollinearity Test

The multicollinearity test is intended to test whether there is a perfect or definite linear relationship between some or all of the explanatory variables in the regression models.

H0 : VIF > 10, then there are symptoms of multicollinearity

between independent variables.

Ha : VIF < 10, then there are no symptoms

multicollinearity between independent variables.

➢ Heteroscedasticity Test

The heteroscedasticity test is used to determine whether or not there is a deviation from classical assumptions.

H0 : P > α = 10%, then there is no problem in

heteroscedasticity.

Ha : P < α = 10%, then there is a problem in

heteroscedasticity.

➢ Autocorrelation Test

The autocorrelation test is a classical assumption test that aims to explain whether there is a relationship between one period and the previous period.

H0 : P > α = 10%, then there is no correlation between

variables.

Ha : P < α = 10%, then there is a correlation between the variables.

2. The supply response of cayenne pepper is defined as the elasticity of supply for each factor suspected of influencing the supply of cayenne pepper. Therefore, the supply response of cayenne pepper to each factor is the regression coefficient for each factor in the Cobb-Douglas model analysis above.

3. To analyze the level of price variation, the coefficient of variation analysis is calculated using the following formula:

Coefficient of Variation (CV) = $\frac{Sp}{P}$

$$Sp = \sqrt{\frac{\sum (p - p')^2}{n - 1}}$$

Where:

Sp = Standard deviation of price

P = Price of cayenne pepper at each level

P' = Average price of cayenne pepper at each level

n = Number of series

Prices in a city/province are said to be stable if the value of the price variation coefficient is in the range of 0-0.09, if it is more than 0.09 it indicates that prices fluctuate highly and are unstable (Nuraeni *et al.* 2015).

4. Vertical market integration analysis

In this study, vertical market integration is examined from the perspective of the parent market (consumers) and the follower market (producers). The following are several tests to determine the analytical model used:

a. Data Stationarity Test

The stationarity test aims to determine whether the data contains a unit root or not (i.e. whether the data is stationary).

b. Determining the optimal lag length

Determining the optimum lag in market integration analysis is very important because it is used to capture the time delay in price transmission between markets.

c. Granger causality test

This test is used to see the causal or reciprocal relationship between two research variables so that it can be known whether the two variables statistically influence each other (two-way or reciprocal relationship, have a unidirectional relationship or no relationship).

d. Model *Vector Autoregression* (VAR)

Model *Vector Autoregressive* (VAR) is a very useful analytical tool in understanding the existence of reciprocal relationships (*interrelationship*) between economic variables and in the formation of a structured economy (Iskandar, 2019).

The steps for testing the VAR method used in this study are as follows:

● Stationary Test

● Determining Optimal Lag Length

● VAR Stability Test

● Granger Causality Test

● VAR Estimation

● Analysis *Impulse Response Function* (IRF)

● Analysis *Forecast Error Variance Decomposition* (FEVD)

e. Analysis *Impulse Response Function* (IRF)

The purpose of IRF is to observe the impact of changes in the system on other changes by providing shocks (*shock*) on one of the variables (Juanda and Junaidi, 2019).

f. Analysis *Forecast Error Variance Decomposition* (FEVD)

The FEVD analysis in this study is used to explain the contribution of each change in the price of cayenne pepper at the consumer, producer, and Mataram City levels to the Nine Regencies/Cities in West Nusa Tenggara towards the formation of cayenne pepper prices due to shocks (*shock*).

5. Horizontal/Spatial Market Integration Analysis

To analyze horizontal market integration, a model is used.*Vector Error Correction Model* (VECM) by going through the same testing steps as the VAR analysis, the difference is that there is a cointegration test in the analysis with the VECM model.

a. Cointegration Test

The purpose of the cointegration test is to assess the stationarity of the residuals obtained from the regression analysis. If one or more variables exhibit varying degrees of integration, then the variables cannot be classified as cointegrated.

b. Model *Vector Error Correction Model* (VECM)

Vector Error Correction Model (VECM) is a method used in econometric analysis of time series with several variables (*multivariate*).

The steps for testing the VECM method used in this study are as follows:

- Stationary Test

- Determining Optimal Lag Length

- Cointegration Test

- VECM Estimation

- VECM Stability Test

- Granger Causality Test

- Analysis *Impulse Response Function* (IRF)

- Analysis *Forecast Error Variance Decomposition* (FEVD)

III. RESULTS AND DISCUSSION

A. *Factors Affecting the Supply of Chili Peppers in West Nusa Tenggara Province*

Based on the results of the estimation of the cayenne pepper supply model in NTB Province in 2018–2023 using the Eviews 12 program, the regression coefficient value, standard error, t-value, error probability of each independent variable, as well as the results of the F test, the overall error probability and the determination coefficient value (R^2). The results of the analysis are presented in Table 1.

Table 1. Results of Estimating Parameters of Chili Supply in West Nusa Tenggara Province 2018-2023

Variable Bebas	Coefficient	Std. Error	T-count	Probability of Error
Constantly = C	24,2763	3,3861	7,1694	0,0000
Land Area =$X1_{t-2}$	0,5567	0,3295	1,6897	0,0960
Price of Chili Peppers =$X2_{t-2}$	-0,2163	0,2294	-0,9426	0,3495
Curly Chili Price =$X3_{t-2}$	1,5807	0,5423	2,9150	0,0049
Price of Large Chili =$X4_{t-2}$	-1,4345	0,5420	-2,6467	0,0103
SP36 Fertilizer Price =$X5_{t-2}$	-4,7946	0,9793	-4,8957	0,0000
Rainfall =$X6_{t-2}$	-0,6444	0,3197	-2,0158	0,0481
F-count	= 8,3424			
Prob (F-count)	= 0,0000			
R2	= 0,3897			

Source: Processed secondary data (2025)

Based on the results of the analysis above, the supply function of cayenne pepper in West Nusa Tenggara Province can be formulated as follows:

$$AND_t = 24,2763 \; X1_{t-2}^{0,5567} \; X2_{t-2}^{-0,2163} \; X3_{t-2}^{1,5807} \; X4_{t-2}^{-1,4345} \; X5_{t-2}^{-4,79467} \; X6_{t-2}^{-0,6444}$$

Based on the sign test shown in the regression coefficient, it is clear that land area and the price of curly chilies have a positive effect on the supply of cayenne pepper, while the price of cayenne pepper, the price of large chilies, the price of SP-36 fertilizer, and rainfall have a negative effect on the supply of cayenne pepper two months later. At first glance, the influence of prices, whether the price of cayenne pepper, curly chilies, or large chilies, seems contrary to theory or reality in the field. However, it seems that cayenne pepper farmers realize that their decision to plant cayenne pepper now will determine the supply of cayenne pepper several months later, namely when the cayenne pepper is harvested, approximately two months later. Therefore, it is not surprising that experienced farmers will decide to plant cayenne pepper when the price of cayenne pepper and its complementary commodity (large chilies) is low in the hope that the price will be high at harvest time. Conversely, when faced with a substitute commodity, such as curly chilies, farmers will decide to plant cayenne pepper (*with various other things*), when the price of curly chilies is high. The status of curly chilies as a substitute

commodity for cayenne peppers is supported by Siddik's research results *et al.* (2022) found that curly chilies can replace cayenne peppers because they are spicier than large chilies; and they can also replace large chilies because they are less spicy than large chilies. Meanwhile, cayenne peppers, like large chilies, tend to complement dishes that often use large chilies. They are used as flavor enhancers in these dishes.

Meanwhile, the positive impact of land area and the negative impact of SP-36 fertilizer prices and rainfall align with theory and initial predictions. The larger the area of land used for chili cultivation, the higher the production and supply of chilies. The higher the price of SP-36 fertilizer and rainfall, the lower the production and supply of cayenne peppers.

Furthermore, based on the results of statistical testing, it shows that the number of independent variables included in the model has a very small contribution, as indicated by the coefficient of determination of 38.97%. This means that approximately 61.03% of the supply of cayenne pepper in West Nusa Tenggara Province is influenced by variables other than the model. This is understandable because supply is influenced by many factors, including the price of other inputs outside of SP-36 fertilizer, but due to the limited time series data of these variables, it cannot be analyzed. However, based on the F test, together the variables that have been included in the model show a very significant influence. Likewise, with partial testing (t-test), almost all of these variables each significantly influence the supply of cayenne pepper, except for the price of cayenne pepper which has an insignificant negative influence.

Testing the classical assumptions on the regression model used also did not show any serious deviations, so it can be concluded that the factors identified as influencing the supply of cayenne pepper in West Nusa Tenggara Province are planting area, price of curly chili, price of large chili, price of SP-36 fertilizer and rainfall.

B. Response to Chili Pepper Supply in West Nusa Tenggara Province

Supply response is defined as supply elasticity. The regression coefficients of the Cobb-Douglas model indicate the elasticity of each independent variable with respect to the dependent variable (Gujarati, 2003; Debertin, 2018). Therefore, the regression coefficients of the Cobb-Douglas model supply function above indicate the magnitude of each variable's response to the supply of cayenne pepper in West Nusa Tenggara (NTB) Province.

Table 1, column two, displays the regression coefficient for each independent variable, which also indicates the elasticity or response of each independent variable to the supply of cayenne pepper in NTB. If, at the time of the decision to undertake farming activities, the planted area is increased by 1%, then the supply of cayenne pepper two months later will increase by approximately 0.56%. Conversely, if, at the time of the decision to undertake farming activities, the price of cayenne pepper increases by 1%, then the supply of cayenne pepper two months later will decrease by approximately 1.63%.

Meanwhile, if at the time of the farming decision, the price of curly chilies increases by 1%, then the supply of cayenne peppers will increase by around 1.58% two months later. Conversely, if the price of large chilies increases by 1% (*with various other things*), will reduce the supply of cayenne peppers two months later by 1.4345%. The different responses of the two chili prices to the supply of cayenne peppers indicate the different status of these commodities in relation to cayenne peppers. Curly chilies tend to be substitute goods, and large chilies tend to be complementary goods to cayenne peppers.

Furthermore, if at the time of the farming decision, the price of SP-36 fertilizer increases by 1%, it will reduce the supply of cayenne pepper two months later by around -4.7946%. This is very reasonable, because SP-36 fertilizer is a production factor, so if the price increases, it will increase production costs, so that its use tends to be increasingly limited, impacting the decline in production and supply of cayenne pepper. The same response if rainfall increases by 1%, it will reduce production or supply by -0.6444%. This is because the commodity is very sensitive to heavy rainfall and grows well in the dry season.

Based on the results of the analysis above, the highest response to the supply of large chilies comes from changes in the price of SP-36 fertilizer, then changes in the price of curly chilies, changes in the price of large chilies, changes in rainfall, changes in planting area and the smallest is the change in the price of cayenne pepper.

C. Variations in Chili Prices in West Nusa Tenggara Province

The price variation analysis in this study separates the annual price variation level (January 2016-December 2023) and the price variation level over 8 years (2016-2023) with the analysis results presented in Figure 1 and Figure 2.

Source: Processed secondary data, 2025

Figure 1: Variation in Chili Prices in NTB 2016-2023
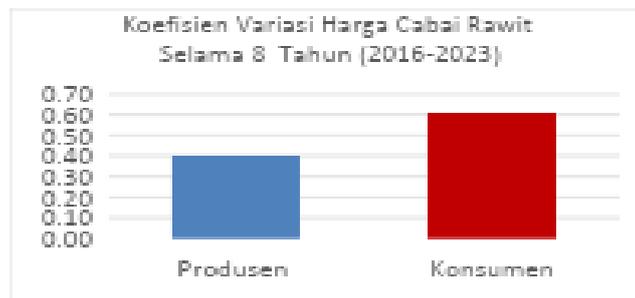
Source: Processed secondary data, 2025

Figure 2: Variation in Chili Prices in NTB 2016-2023

Based on the analysis of the price variation coefficient in Figure 1, during the period of January 2016 - December 2023 shows a fluctuating movement pattern. It can be seen that only in 2017 did the price of cayenne pepper at the producer level experience price stability with a coefficient value of 0.09, other than in 2017, the price of cayenne pepper in NTB Province at the producer and consumer levels was high and unstable based on the Ministry of Trade criteria, which is above 0.09. Meanwhile, Figure 2 shows the value of the price variation coefficient of cayenne pepper for 8 years shows instability or high fluctuation with a value of 0.40 at the producer level and 0.61 at the consumer level.

D. Vertical Market Integration for Chili Peppers in West Nusa Tenggara Province

Model estimation*Vector Autoregression*The VAR analysis aims to determine the dynamic relationship between cayenne pepper prices at the producer and consumer levels. The VAR estimation results for cayenne pepper prices at the consumer and producer levels in West Nusa Tenggara Province can be seen in Table 2.

Table 2. VAR Estimation Results for Consumer and Producer Price Data

	KONSUMEN	PRODUSEN
KONSUMEN(-1)	0.749396 (0.12598) [5.94837]	0.072330 (0.06396) [1.13090]
KONSUMEN(-2)	-0.085069 (0.12579) [-0.67627]	-0.107667 (0.06386) [-1.68596]
PRODUSEN(-1)	0.405082 (0.25914) [1.56318]	0.667745 (0.13156) [5.07567]
PRODUSEN(-2)	-0.500326 (0.26073) [-1.91895]	0.064108 (0.13236) [0.48433]
C	16969.22 (5311.60) [3.19475]	9940.594 (2696.55) [3.68641]

Source: Processed secondary data, 2025.

From Table 2, the following equation is obtained:

Consumers = 0.749*Consumers (-1) – 0.085*Consumers (-2) + 0.405*Producers (-1) – 0.500*Producers (-2) + 16,969,221

The consumer coefficient (-1) of 0.749 indicates that current consumer prices are positively influenced by consumer prices one period earlier. This means that if consumer prices one period earlier increased by Rp 1, then current consumer prices will increase by Rp 0.749. Meanwhile, the consumer coefficient (-2) of -0.085 indicates that current consumer prices are negatively influenced by consumer prices two periods earlier, but the effect is relatively small.

The producer coefficient (-1) of 0.405 indicates that current consumer prices are positively influenced by producer prices one period earlier. This means that if producer prices one period earlier increased by Rp 1, then current consumer prices would increase by Rp 0.405. Then the producer coefficient value (-2) of -0.500 indicates that current consumer prices are negatively influenced by producer prices two periods earlier. This means that if producer prices two periods previously increased by Rp 1, then current consumer prices would decrease by Rp 0.500. The constant of 16,969.221 indicates that consumer prices have a positive base value.

Producer = 0.072*Consumer (-1) – 0.108*Consumer (-2) + 0.668*Producer (-1) + 0.064*Producer (-2) + 9,940,594

The consumer coefficient (-1) of 0.072 indicates that current producer prices are positively influenced by consumer prices one period earlier, but the effect is relatively small. Meanwhile, the consumer coefficient value (-2) of -0.108 indicates that current producer prices are negatively influenced by consumer prices two periods earlier, but the effect is relatively small. The producer coefficient (-1) of 0.668 indicates that current producer prices are positively influenced by producer prices one period earlier. This means that if producer prices one period earlier increased by Rp 1, then current producer prices will increase by Rp 0.668. Then the producer coefficient value (-2) of 0.064 indicates that current producer prices are positively influenced by producer prices two periods earlier, but the effect is relatively small. The constant of 9,940.594 indicates that producer prices have a positive base value.

E. Horizontal Market Integration for Chili Peppers in West Nusa Tenggara Province

The results of the VECM analysis for Mataram City are presented in Table 3, providing an overview of the long-term and short-term relationships between prices in Mataram City and 9 other districts/cities in NTB.

Table 3. Estimation of the Short-Term Equilibrium Relationship of Chili Prices in Mataram City and 9 Regencies/Cities in West Nusa Tenggara Province

Variables	Coefficient	t-stat	Standard errors
C	113,018	0,076	1,479,12
East Lombok Regency	-0,038	-0,229	0,167
West Lombok Regency	0,300	2,214	0,136
Loteng Regency	0,005	0,048	0,110
Sumbawa Regency	-0,049	-0,296	0,166
Dompu Regency	-0,324	-2,675	0,121
Kab. Lotar	0,017	0,145	0,115
Bima Regency	-0,004	-0,031	0,144
Sumbawa Regency B	0,087	0,582	0,150
Bima City	0,090	0,662	0,135
ECT (-1)	-0,059	-0,453	0,131
Adjusted R-squared = 0,992			*Prob(F-statistic)* = 1,921

Source: Processed secondary data, 2025.

D(Kota Mataram) = 113,018 – 0,038*D(Kab_Lotim) + 0,300*D(Kab_Lobar) + 0.005*D(Loteng_Regency) –

0.049*D(Sumbawa_Regency) - 0.324*D(Dompu_Regency) + 0.017*D(Kab_Lotar)

- 0.004*D(Kab_Bima) + 0.087*D(Kab_SB) + 0,090*D(Kota_Bima) – 0,059*(ECTt-1)

The estimation results show that the ECT coefficient (lag–1) is –0.059 with a t-statistic = –0.453, which means that only about 5.9% of the deviation from the short-term equilibrium in the previous period is corrected in the current period. However, because this value is not significant, it can be said that the automatic correction mechanism towards long-term equilibrium is not working effectively. Of the response coefficients for Mataram City, only West Lombok Regency has a significant value, namely a coefficient of 0.300 with a t-statistic of 2.214, indicating that the price adjustment response to Mataram City is quite strong. On the other hand, several regions show a negative response that is also significant, such as

Dompu Regency (–0.324; t = –2.675), which indicates that price changes in Dompu move in the opposite direction to Mataram City. Other regions such as East Lombok Regency (–0.038), Loteng (0.005), Sumbawa (–0.049), Lotar (0.017), Bima Regency (–0.004), West Sumbawa (0.087), and Bima City (0.090) have small coefficient values and insignificant t-statistics, which indicate a very low response or no response at all.

IV. CONCLUSION

Based on the results and discussion in this study, the following conclusions can be drawn:

1. Factors that positively and significantly influence the supply of cayenne pepper in NTB Province are the planting area ($X1_{t-2}$), and the price of curly chilies ($X3_{t-2}$) two months earlier; negatively and significantly is the price of large chilies ($X4_{t-2}$), price of SP-36 fertilizer ($X5_{t-2}$), and rainfall ($X6_{t-2}$) two months earlier.

2. The supply response of cayenne pepper in NTB Province is determined by the area of planting area ($X1_{t-2}$) by +0.5567, the price of cayenne pepper ($X2_{t-2}$) of -0.2163, the price of curly chilies ($X3_{t-2}$) of 1.5807, the price of large chilies ($X4_{t-2}$) as big as **-**1.4345; price of SP-36 fertilizer ($X5_{t-2}$) of -4.7946 and rainfall ($X6_{t-2}$) of -0.6444.

3. The price of cayenne pepper in West Nusa Tenggara Province fluctuated significantly over the eight years (2016-2013). The coefficient of variation at the producer level was 0.40 and at the consumer level, 0.61.

4. Vertical integration of the cayenne pepper market in West Nusa Tenggara Province is weak. This means that changes in cayenne pepper prices in NTB at the consumer level are not properly transmitted to the producer level, or vice versa.

5. Horizontal market integration between cities/regencies in West Nusa Tenggara Province has been successful in both the short and long term. This means that price changes in one city or regency, such as Mataram City as the reference market, affect prices in other cities or regencies.

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