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SPATIAL INTEGRATION ANALYSIS OF RED ONION COMMODITIES IN WEST NUSA TENGGARA

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Abstract: **This study aims to: (1) Analyze the spatial integration of shallot commodity prices in West Nusa Tenggara; (2) Analyze the transmission of shallot prices that occur between regions in West Nusa Tenggara. The data used in this study are weekly shallot price data in time series from January 1, 2020 to August 31, 2024 from the National Strategic Food Price Information Center website at 4 main shallot markets in West Nusa Tenggara, namely: Amahami Bima Market, Seketeng Sumbawa Market, Aikmel Market, East Lombok and Mandalika Market, Mataram City. Data analysis using root test (stationary data), optimal lag test, correlation test, Error Correction Model (ECM), Variance Decomposition (VC) and Impulse Response Function (IRF).**

The results of the study show that: (1) The price of shallots in Amahami against the Aikmel, Mandalika and Seketeng markets is strongly integrated in the long term and weakly integrated in the short term; (2) Price transmission that occurs in the markets in West Nusa Tenggara including Amahami, Aikmel, Mandalika and Seketeng markets can be transmitted well where, Amahami Market is a market reference because its production center is in Amahami Market, so it can quickly adjust to the Mandalika market and other markets also adjust indirectly market information can be received by the four markets.

Suggestions from this study are (1) Provision of accurate price information and dissemination of price information need to be improved again so that every shallot marketing institution and consumer can find out about price changes that occur quickly and accurately; (2) The importance of cooperation between markets to control prices in order to minimize the symptoms of excessive price fluctuations that apply in the market. And there needs to be an in-depth study for further research related to the Shallot commodity in West Nusa Tenggara.

Keywords: **Shallots, Market Integration, Price Transmission. ECM.**

I. INTRODUCTION

West Nusa Tenggara Province is the center of shallot production, with Bima Regency as one of the main producing areas that produces superior varieties, namely the Super Phillip variety. In the distribution of shallots from producers to end consumers in West Nusa Tenggara, an integrated market is needed so that it can provide welfare for producers and consumers and ensure regional balance between surplus and deficit areas (Anggriani, 2021) .In addition, an integrated market can help orient market development policies and facilitate marketing of results in this case shallot commodities. In West Nusa Tenggara there are four main markets as controllers of basic necessities prices, namely Amahami Market, Seketeng Market, Mandalika Market, and Aikmel Market. The four markets function as the Main Market in each region. Price changes in a region will quickly affect the market in a short period of time, normatively prices must be transmitted from one market to another. If the price of one market with another market is the same, the market experiences price transmission which will have a positive impact on producers and consumers or shallot distributors. Based on the description above, the problems in this study can be formulated as follows: (1) How is the special integration of shallots in West Nusa Tenggara? (2) How is the price transmission that occurs between regions in West Nusa Tenggara?

The objectives of this study are: (1) To analyze the spatial integration of shallot commodity prices in West Nusa Tenggara; (2) To analyze the transmission of shallot prices that occurs between regions in West Nusa Tenggara.

II. RESEARCH METHODOLOGY

The method used in this study is a descriptive method. The types of data used include quantitative data with data sources being primary data and secondary data (Basuki, 2017).

The method used in this study is a descriptive method, which aims to solve existing problems through data collection, compilation, analysis, and interpretation, then drawing conclusions. Data collection is carried out using survey techniques, which involve collecting information from a number of units or individuals simultaneously within a specified time. (Sugiono, 2015).

The unit of analysis in this study are four main markets, Mandalika Market (Mataram City), Aikmel Market (East Lombok Regency), Seketeng Market (Sumbawa Regency), and Amahami Market (Bima City). From the strategic food price information center (PIHPS), the price of shallots in West Nusa Tenggara was obtained.

A. Data Analysis

Data analysis in this study uses a quantitative approach. To analyze the transmission of prices and integration of the shallot commodity market in West Nusa Tenggara, retail shallot price data (time series) will be processed using Excel and Eviews software. The model applied in this analysis is the Error Correction Model (ECM), which involves several stages as follows:

1. 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). Time series data is generally not stationary, while various econometric methods applied to time series data assume that the data is stationary. If the time series data is not stationary, the application of statistical analysis will produce spurious results, namely inaccurate or misleading results (Juanda and Junaidi, 2019 in Astuti, 2020). In this study, stationarity testing was carried out using the Augmented Dickey-Fuller (ADF) unit root test, which was estimated according to the procedure described by Gujarati (2016). The unit root test is used to determine whether time series data is stationary or not based on the movement of the data to be tested. The ADF test consists of regression calculations formulated as follows:

$Xt = \alpha + \rho Xt{-}1 + \varepsilon t$

both sides are reduced by Xt-1 to obtain

$Xt - Xt{-}1 = \alpha + \rho Xt{-}1 - Xt{-}1 + \varepsilon t$

$\Delta Xt = \alpha + (\rho - 1)\mathrm{t}{-}1 + \varepsilon t$

or written as $\Delta Xt = \alpha + \beta Xt{-}1 + \varepsilon t$

with Xt representing time series economic data,

$\Delta Xt{-}j = Xt{-}j - Xt{-}j{-}1$ (first difference) and if $\rho = 1$ means there is a unit root (random walk).

Testing to determine the stationarity of the time series can be done using the Dickey-Fuller approach. The Dickey-Fuller non-stationarity test is done by comparing the β/Seβ value with zero. The standard t statistic used refers to the Dickey-Fuller table, not to the t-table (normal distribution).

For stationarity testing using the Augmented Dickey-Fuller (ADF) method, the model used often includes time trend and autoregressive components.

2. Cointegration Test

The cointegration test is a further phase that follows the implementation of the unit root test and the assessment of the degree of integration. The purpose of the cointegration test is to assess the stationarity of the residuals obtained from the regression analysis. If there are one or more changes in variables that show different degrees of integration, then the variables cannot be classified as cointegrated. However, if there are two or more variables that are not stationary at the level but become stationary after differentiation, then there is an indication that cointegration may exist between the variables. The degree of cointegration test is carried out using the Engle-Granger and Johansen Cointegration tests to determine the amount of cointegration that occurs between variables. The Engle-Granger test uses ADF (Augmented Dickey Fuller) for Residuals, the ADF test is usually used to test the stationarity of residuals. If the ADF residual test has a unit root (not stationary) then there is no cointegration, but if the p-value of the ADF test is smaller than the selected significance level, then we can conclude that the residual is stationary, so there is further cointegration to ensure that the next Johansen test is carried out if both tests provide the same conclusion then there is consistency regarding the existence of a cointegration relationship between the variables tested in the long term. The Johansen test is carried out by looking at the results of the Trace Test and the maximum Eigen value (Maximum Eigenvalue). The formulation of the Johansen equation is:

$\Delta Pt = \sum \Gamma i\ j{=}1\ \Delta Pt{-}1 + \Pi Pt{-}k + \beta Xt + et$

The target variable in this study is the price of red onions in Bima (Amahami) other variables are the price of red onions in East Lombok Regency (Aikmel), Sumbawa (Seketeng), and Mataram (Mandalika). In the unrestricted VAR model, each variable has the same opportunity to become an endogenous variable or an exogenous variable. However, if there is one or more cointegration between variables, the restricted VAR/ECM (Error Correction Model) model is used.

ECM Model (Error Correction Model)

The equation for the ECM model is stated as follows:

$\Delta Yt = \alpha 0 + \alpha 1 + \alpha\ \Delta Xt + \alpha 2Ect\text{-}1 + et$

$\Delta Yt = Yt\text{-}Yt\text{-}1$

$\Delta Xt = Xt\text{-}Xt\text{-}1$

$ECTt{-}1 = Pt{-}1 - \gamma 0 + \gamma 1Xt{-}1$

$CTt{-}1$ = error correction term at time t-1 The ECT parameter indicates the speed of adjustment towards long-term equilibrium when there is a short-term dynamic relationship between variables. The analysis of the dynamics of adjustment allows us to study how quickly prices can move from one location to another.

3. Variance Decomposition (VD)

Variance decomposition is a technique to obtain the relationship between the variability value of the target variable with its lag variable and other independent variables. Through this technique, it can be known which independent variables have the greatest influence on the target variable over time. VD in this study is used to explain the contribution of each change in the price of shallots in the four main markets in West Nusa Tenggara to the formation of the price of shallots due to shocks. In other words, VD can provide information on how much the volatility caused by the uncertainty of a variable in the future affects other variables, especially the target variable on other variables.

4. Impulse Response Function (IRF)

The next analysis in market integration after the formation of the ECM model is the Impulse Response Function (IRF). Parameter estimation in ECM is often difficult to interpret, so one of the commonly used approaches is the Impulse Response Function (Gujarati, 2016). The purpose of IRF is to observe the impact of changes in the system on other changes by giving a shock to one of the variables (Juanda and Junaidi, 2019). The period analyzed is weekly from January 2019 to August 1, 2024. This period of about 5 years is considered sufficient to determine when the equilibrium condition is reached and how long the impact of the shock is felt.

III. RESULTS AND DISCUSSION

B. Data Identification

The data obtained in this study are weekly time series price data starting from the first week of January 2021, to the fourth week of August 2024. In this time span, the development of the price of shallots in West Nusa Tenggara showed a fairly similar movement pattern, namely the highest price occurred in the 17th week or on May 13, 2022 (Figure 3). This is in line with research conducted by Basuki (2017) with the results found that the movement of the price of shallots tends to be the same at certain times because the price of shallots tends to be stable compared to the prices of other staple commodities..

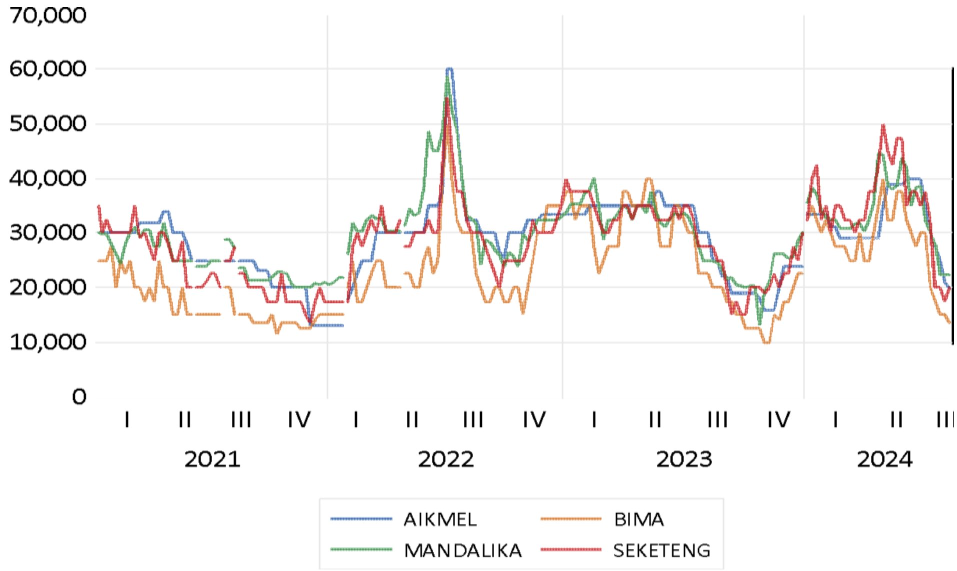

Figure 1. Shallot Price Movements in Four Main Markets

Descriptive statistical data shows that the resulting values tend to be asymmetric (right-leaning) as indicated by a skewness value greater than zero with a kurtosis value of more than 3 (leptokurtic) except for the Amahami market (mesokurtic).

Table 1. Statistical Description of Shallot Prices in Four Markets in West Nusa Tenggara, January 1, 2020-August 30, 2024

	Aikmel	Amahami	Mandalika	Seketeng
Mean	29022.10	23348.07	29866.02	28640.88
Median	30000.00	22500.00	30000.00	30000.00
Maximum	60000.00	50000.00	58750.00	55000.00
Minimum	13000.00	10000.00	13000.00	13500.00
Std. Dev.	7491.815	8163.459	7055.706	7708.998
Skewness	0.373851	0.510252	0.833279	0.312815
Kurtosis	5.328396	2.428479	4.482339	3.091985
Jarque-Bera	45.10285	10.31748	37.51787	3.015708
Probability	0.000000	0.005749	0.000000	0.221385
Sum	5253000.	4226000.	5405750.	5184000.
Sum Sq. Dev.	1.01E+10	1.20E+10	8.96E+09	1.07E+10
Observations	181	181	181	181

Data source processed, 2024.

The average price of shallots obtained at each of the largest markets, namely the Mandalika market, is IDR 29,866. and the lowest at the Amahami market of IDR 23,348. This is closely related to Amahami being an area with a surplus of shallot production as explained in the background. The highest price of shallots during January 2020 - August 2021 was achieved in the quarter to July 2022, which was an average of IDR 55,379 and for the 4 main markets in NTB from Aikmel, Mandalika, Seketeng, and Amahami, respectively, IDR 60,000, IDR 58,000, IDR 55,000, and IDR 50,000. The difference in shallot prices in the same period raises the suspicion that the four markets have market power in forming and setting prices in the markets in West Nusa Tenggara. Therefore, overall, the red onion price data follows a normal distribution pattern as seen from the Jarque-Bera coefficient probability value which is much greater than the 10 percent significance level (Table .1).

C. Unit Root Test

Table 2. Stationarity Test of Red Onion Price Variables in Markets in West Nusa Tenggara.

Price in the arket	equation test (trend dan intercept)	t-stat	Probabilities
Aikmel	Level	3.227.448	0.0021
Mandalika	Diferensiasi pertama	1.206.659	0.0000
Seketeng	Level	3.146.295	0.0250
Amahami	Diferensiasi Pertama	1.099.076	0.0000

Data source processed, 2024.

The results of the stationarity test at the level and first difference or first differentiation of the price of shallots in 4 markets in West Nusa Tenggara each have a t-statistic value greater than its probability value at a 5% error rate. This indicates that the 4 markets are jointly integrated, meaning that the prices prevailing in the 4 markets influence each other and the time-series data of shallot prices in the 4 markets in West Nusa Tenggara are stationary at different degrees of integration, namely the Amahami market and Mandalika market are stationary at the first difference or first differentiation degree, while the Seketeng and Aikmel markets are stationary at the Level degree. The existence of differences in stationarity in the data requires further testing using the Error Correction Model (ECM) where if the variables in the model have different stationary levels (there are I (0) and I (1)). This model allows for the analysis of short-term and long-term relationships between these variables. Before entering this model, the data is first analyzed to see how the long-term relationship between non-stationary variables at the same level is. The Engle-Granger cointegration test and the Johansen cointegration test will show whether these variables have the same trend in the long term.

D. Cointegration Analysis and Spatial Integration

Spatial cointegration analysis was conducted on four main markets in West Nusa Tenggara which are used as a reference by Bank Indonesia in monitoring the development of strategic food prices in each district/city. The time series data that has been collected was then tested for data stationarity and then analyzed to determine the relationship and strength.

1. Correlation

The simplest technique to determine the existence of an association (co-movement) from time series data is by testing the correlation. The following table presents the correlation coefficient matrix between the 4 main markets studied. The table indicates a strong and significant positive correlation between the four markets analyzed during the study period. A very high degree of correlation occurs between the Seketeng market and the Amahami market and the Mandalika market with the Seketeng market (degree of correlation >80%) meaning that the Mandalika, Seketeng, Aikmel and Amahami shallot markets are interconnected.

This table also indicates the importance of the role of the Amahami market in the model. This is not surprising because the Amahami market is located in the Bima area which is the center of shallot production in West Nusa Tenggara and its distribution connecting to four markets is a strong reason for being used as a target variable in the model.

Tabel 3. Matriks korelasi antar variabel

Market	*AIKMEL*	*MANDALIKA*	*SEKETENG*	*AMAHAMI*
Aikmel	1			
Mandalika	0,8407	1		
Seketeng	0,8349	0,8707	1	
Amahami	0,7919	0,8266	0,8808	1

Data source processed, 2024.

Based on the table above, it shows that the largest targeted production market is from Amahami market to Seketeng and the second largest is Seketeng market to Mandalika. Amahami market is one of the areas with the highest surplus of red onion production in West Nusa Tenggara, so it is not surprising that Amahami gets a high correlation value and is quite strongly related to other markets, but in this case the strongest correlation is between Amahami market and Seketeng market, this is closely related to the area of red onion production produced by these 2 areas which are abundant, it should be noted that those who cultivate red onions are mostly on Sumbawa Island and its surroundings are the Bima community, most of the land used to plant red onions in Sumbawa and its surroundings is rented. The second highest correlation is the red onion commodity sent from Seketeng to Mandalika, this is closely related to the volume of red onions produced in Sumbawa and then sent to Mandalika Market.

E. Estimation of Long-Term Equilibrium Relationship

1. Engle-Granger Cointegration

Because the four variables have not been integrated to the same degree, I(1), then the Engle-Granger test is carried out to see the cointegration of the 4 markets studied. The results of the coefficient estimation are presented in Table .4.

Table 4. Estimation of Long-Term Equilibrium Relationship of Shallot Prices in Four Markets in West Nusa Tenggara from January 1, 2021-August 30, 2024

Variabel	Koefisien	t-statistic	Prob.
C	-56.58565	1.223.613	0.0000
Aikmel	0.124243	0.074464	0.0900
Mandalika	0.223569	0.088504	0.0100
Seketeng	0.653741	0.079682	0.0000
Adjusted R-squared= 0.793772		*Prob(F-statistic)* = 0,000000	

Data source processed, 2024.

(P_ Amahami) = -56.58565 +0.653741(P_Aikmel)+0.223569(P_Mandalika)+ 0.421445(P_Seketeng)

The next stage is to test the unit root on the residual. From the results of the residual test of the long-term equilibrium relationship of the price of shallots in the Amahami market which is the reference for the other 3 markets. It can be seen in the table above that the Amahami market has a stronger long-term relationship with the Seketeng market, which is 65.37% compared to other markets. Although there is a long-term relationship with other markets, it is not as strong as the market (Amahami with Seketeng)

Table 5. Residual Test of the Long-Term Equilibrium Relationship of Shallot Prices in the Amahami Market to the Mandalika, Seketeng and Aikmel Markets from January 1, 2021-August 30, 2024

Variabel	Koefisien	t-statistik	Prob.
EC(-1)	-1.721840	-12.05834	0.0000
D(EC(-1))	0.571690	5.413926	0.0000
D(EC(-2))	0.264306	3.600398	0.0000
C	61.32165	0.208162	0.8353
Adjusted R-squared= 0.598671		*Prob(F-statistic)* = 0,00000	

Data source processed, 2024.

The results of the residual root unit illustrate that if the probability value is smaller than, the critical value α = 0.05 (0.0001 <0.05). This indicates that there is cointegration. The Engle-Granger cointegration test between the 4 markets in West Nusa Tenggara shows that there is cointegration between variables where the probability value of the test is smaller than α: 5%. Based on the table above, it shows that the markets in West Nusa Tenggara are integrated with each other. If there is cointegration, there has been a balance of spatial integration of the shallot commodity in the long term.

2. Johansen Cointegration

Furthermore, to ensure the results obtained from the Engle-Granger test, a test was carried out using the Johansen cointegration test method by looking at the probability values of the Trace and Maximum Eigen statistics. The results of the Trace test and Maximum Eigen statistics indicate that there is one cointegration equation in the model. This means that there is a long-term relationship between the price of shallots in the Amahami market and the Mandalika, Seketeng, and Aikmel markets. Therefore, a test is conducted on the normalized cointegrating coefficients to obtain more complete information from the long-term relationship between the variables. The Johansen Cointegration Table is presented in Table 6.

Table 6. Cointegration Test Using the Johansen Cointegration Test

Johansen Cointegration Test

Date: 10/23/24 Time: 21:38
Sample: 1 181
Included observations: 181
Lags interval (in first differences): 1 to 4
Endogenous variables: AMAHAMI AIKMEL MANDALIKA SEKETENG Deterministic assumptions: Case 3 (Johansen-Hendry-Juselius): Cointegrating relationship includes a constant. Short-run dynamics include a constant.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.103246	57.45141	47.85613	0.0049
At most 1 *	0.086469	38.27213	29.79707	0.0042
At most 2 *	0.077792	22.35501	15.49471	0.0040
At most 3 *	0.044990	8.101834	3.841465	0.0044

Trace test indicates 4 cointegrating equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Max-eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.** Critical Value
None	0.103246	19.17927	27.58434	0.4008
At most 1	0.086469	15.91712	21.13162	0.2297
At most 2	0.077792	14.25318	14.26460	0.0502
At most 3 *	0.044990	8.101834	3.841465	0.0044

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 7: Normalized Cointegration Coefficient

Normalized cointegrating coefficients (standard error in parenthe AMAHAMI

AMAHAMI	AIKMEL	MANDALIKA	SEKETENG
1.000.000	0,365216	0,165953	-1,721,330
	(0.33471)	(0, 39905)	(0.34560)
t-statistic	1,668, 495	2, 526,081	8,204,369

Data source processed, 2024.

The sign on the normalized cointegration coefficient has no effect, namely there is a positive influence from the Mandalika, Seketeng, and Aikmel markets on the price of shallots in the Amahami market. The influence of the Mandalika market is strongest as indicated by the large value of the coefficient and is significant. This means that a 1 rupiah increase in the price of shallots in the Mandalika market causes a price increase rate of more than 0.16 in the Amahami market.

F. Estimation of Short-Term Relationships

Because there is cointegration between variables, the Error Correction Model (ECM) model is the most appropriate alternative model to use in the analysis. ECM is a very useful model for explaining the dynamics of short-term prices between markets without losing information about their long-term relationships. In addition, ECM estimates the speed of its target variable returning to equilibrium after other variables change if there is a shock to one of the variables to reach its long-term equilibrium. However, this model is only suitable if the data for each variable is not stationary at the same level, integrated at the level and first difference levels and cointegration is found between variables.

The equation for the ECM model in this study is generally stated as follows:

$$\Delta P_t = \gamma_o + \sum_{i=1}^{m} \gamma 1 \, \Delta P_{t-i} + \sum_{i=1}^{m} \delta 1 \, \Delta X_{t-i} + e_{it}$$

$$ECT_{t-1} = P_{t-1} - \gamma 0 + \gamma 1 X_{t-1}$$

ECT_{t-1} = *error correction term* pada waktu t-1

ECT is a lag variable from the residual of the cointegration equation that describes the long-term relationship between variables. ECT indicates the speed of adjustment towards equilibrium (convergence) if the explanatory variables fluctuate. Thus, ECT is theoretically negative with a value between 0 and 1 to ensure the model converges towards long-term equilibrium.

1. ECM (Err0r Correction Model)

In this study, ECM is used primarily to obtain an explanation of the short-term dynamics of shallot prices in the four markets with the Amahami market as the target variable. The results of the parameter estimation are presented in Table 8. and the following equation:

Table 8. Estimation of the Short-Term Equilibrium Relationship of Shallot Prices in the Amahami Market and the Aikmel, Mandalika and Seketeng Markets

Variabel	Koefisien	t-statistik	Prob.
C	200.4059	0.912664	0.3627
DAikmel)	0.196524	2.195298	0.0295
D(Mandalika)	0.217734	-2.417080	0.0167
D(Seketeng)	0.294065	-4.287933	0.0000
ECT (-1)	-0.167409	-4.350424	0.0000
Adjusted R-squared= 0.388119		*Prob(F-statistic*) = 0,00000	

Data source processed, 2024.

D(Amahami) = 200.4059 + 0.196524*D(Aikmel) + 0.217734*D(Mandalika) + 0.294065*D(Seketeng) – 0.167409*(ECTt-1)

The estimation results show a sign of the main parameter ECT $\gamma 1$ is negative less than 1 ($-0.167409\ ECTt{-}1$) to ensure the existence of a short-term equilibrium price relationship between regions. The ECT coefficient of 0.167409 means that the deviation from the short-term equilibrium relationship in the previous period is corrected in the current period with an adjustment speed of 16.74% while the adjustment speed for the Amahami market against the market with the highest value is Seketeng with a value of 29%, the second is Mandalika with a value of 21% and Aikmel 19%. The negative ECT value indicates a slow adjustment of price increases in the Amahami market reference market. This is closely related to the magnitude of the negative ECT coefficient indicating that the test variable adjustment process is quite slow (Juanda and Junaidi, 2019). This condition is caused because the ECT coefficient value is close to zero. According to Widarjono (2017) the ECT imbalance correction coefficient in the form of absolute value explains how fast it takes to get the equilibrium value. The price condition of shallots in the Amahami market has a slow adjustment, indicating that the price information of shallots in the Amahami market to other markets is quite long.

Based on the t-statistic value, only Aikmel with a t-statistic value of 2.195298 has a short-term adjustment speed with the Amahami Market, but the Seketeng and Mandalika Markets experience delays in their adjustments, this can be seen from the t-statistic values, which are respectively -2, 417080 and -2.487933.

In the short term, the price of shallots in the Amahami Market is positively influenced, but the speed in getting price information is quite slow to be accepted by the price in the market (Aikmel, Mandalika and Seketeng). However, in the long term, the price of shallots in the three markets has a positive effect and has a speed in getting price information on the price in the Amahami Market.

G. Price Transmission Analysis

1. Variance Decomposition (VD)

The variance decomposition test is to measure the magnitude of the contribution of an independent variable to its dependent variable. By using variance decomposition, we can gain a more detailed understanding of how changes in the price of a variable are influenced by other factors, both from within and outside the variable itself. The variance decomposition value of the target variable for the next 4 weeks (1 month) is presented in Table 9.

Table 9. Variance Decomposition

variance decomposition of Amahami					
Period	S.E.	L.Amahami	L Aikmel	L. Mandalika	L.Seketeng
1	3504.068	100.0000	0.000000	0.000000	0.000000
2	493.5910	97.97.443	0.250724	1.651435	0.123412
3	582.5759	95.92.612	0.390576	3.477049	0.206254
4	642.6087	93.69.610	0.427319	5.492246	0.384332

Data source processed, 2024.

Table 9 above explains the Variance decomposition of the Amahami Market variable and how much other variables contribute to the Amahami Market variable. In period 1, the forecast error variance of the price of shallots in the Amahami market is 100% derived from the error variance of the variable itself. The Aikmel variable in the 2nd period contributed 25% to Amahami and will continue to increase until the 4th period, but the scale of the increase is not as high as the increase in Mandalika, where Mandalika contributed from the 4th period to continue to increase and will continue to increase until the 4th period. Likewise, the Seketeng Market from the 2nd to the 4th period continued to experience an increase in its contribution to the Amahami market. While Amahami will continue to decline in its contribution to other markets. This is because the shallots originating from Amahami (Bima) are actually more, exported and sent outside the West Nusa Tenggara region and even abroad. According to the Indonesian Red Onion Association (ASABRI) via the Ukmiindonesia.com page in 2023, it stated that red onions with super philip quality are in Bima through PT. Karya Tani Indonesia, Bima red onions are exported to Thailand, Singapore, Taiwan and several Middle Eastern countries and based on the recognition of the Bima Regency Food Security Agency via the pemkab.bima.go.id page. Red onions from Bima are also sent to areas with red onion deficits such as Surabaya, Makassar, Timika-Papua, South Kalimantan with a total distribution in October 2023 of 78.50 tons. This happened because it turned out that Bima shallots were less in demand by the people of Lombok Island because of their rather spicy taste and not too large size and the most in demand were large shallots imported from Java, so shallots were sent outside the NTB area or if the stock had piled up and the price had plummeted especially in the Mandalika market then the Trade Office made deliveries to other areas or held auctions online and this took place more than 4 times a year (West Nusa Tenggara Trade Office).

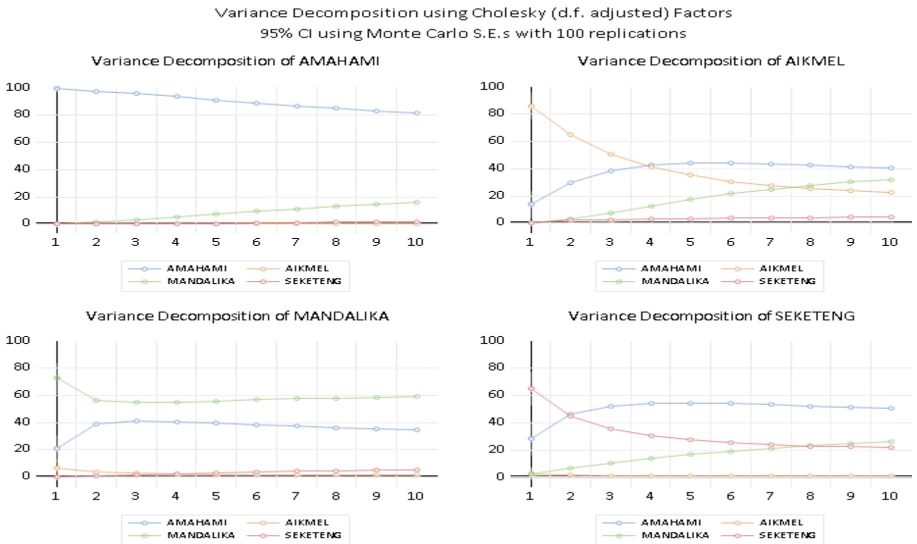

Figure 2. Decomposition of variants in four main markets in West Nusa Tenggara

From the graph, it can be seen that for all markets, the contribution of the error variant of the price of shallots in the Amahami market is quite large but continues to decline over time. In fact, other markets continue to increase even though the percentage is small. The implication is that to stabilize the price of shallots in West Nusa Tenggara, it starts from the price stabilization that provides the largest contribution itself, namely starting from the Mandalika market.

This Variance Decomposition (VD) also shows that the increase or decrease in prices in the Amahami market will be transmitted to price changes in the market (Aikmel, Mandalika, and Seketeng) and its contribution decreases from period to period even though the percentage of contribution is small.

2. Impulse Response Function (IRF)

IRF provides an overview of how shocks or shocks that occur in one variable will spread and affect other variables in the model. In addition, IRF also helps us identify which variables are most vulnerable to these shocks and how long the influence of these shocks will last. IRF analysis was carried out on two main markets, namely Amahami and Seketeng, which showed a significant contribution to production in NTB. The analysis emphasized the evolution of the response because the data used had been tested for stationary. If there is a positive shock of 1 standard deviation in the Amahami market in the current period, the price in the Seketeng market will not increase until the next 10 weeks and will then remain stagnant or decrease. However, if the shock occurs in the Seketeng market, the impact on the increase in the price of shallots in the Amahami market will also relatively increase until the 5th week. After that, the impact of the shock begins to slow down towards a steady state until the 10th week. If the shock occurs in the Mandalika and Aikmel markets, the impact on the increase in the price of shallots in Amahami is relatively very small, and even has no impact on the Mandalika market. The following figure presents the response of two main variables if there is a shock of 1 standard deviation.

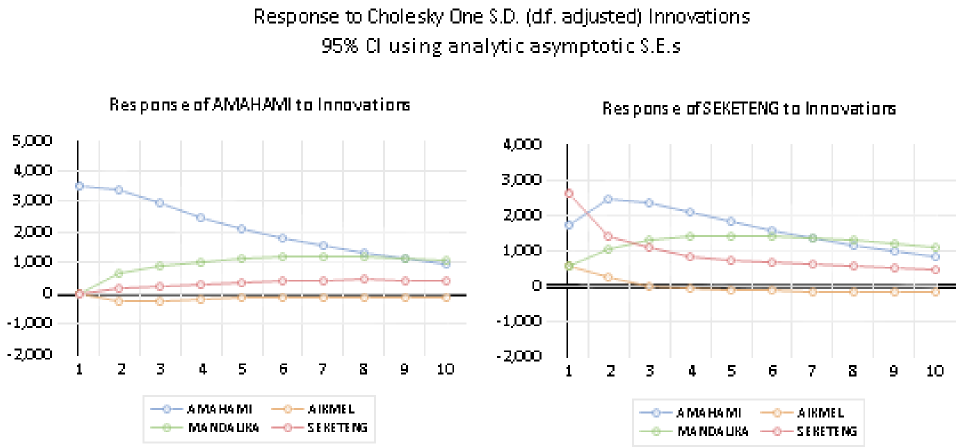

Figure 3. Response of Two Major Markets to Price Shocks in Four Markets

Based on the results of IRF (Impulse Response Function) and VD (Variance Decomposition), it is known that prices in the Mandalika market have a greater contribution to being responded to by prices in other markets. Thus, in the shallot market in West Nusa Tenggara within a certain period of time, the prevailing price is determined by the Mandalika market, adjustments to price changes that occur in the Mandalika market are responded to quickly by the Amahami market and other markets also adjust, meaning that the price transmission that occurs in the Amahami market will be responded to slowly by other markets. This can be seen in the graph above how fast the Amahami market adjusts to market information in Mandalika and vice versa and other markets also adjust, although the adjustment was seen starting in the fourth week and onwards, this was due to indications of transportation and transaction costs used in distributing shallots to other markets, as well as less interest in shallots from Bima and shallots from Bima were distributed more outside the NTB area, causing the price adjustment to be responded to late. This requires supervision and policy considerations from the government to distribute shallots both from within NTB and from outside NTB. This condition is in line with research conducted by Ayu et al. in 2021 on price transmission and volatility of shallots in East Java, which stated that the speed or slowness of a market in responding to price changes can cause the role of traders to be higher than that of producers or farmers in determining prices in the market.

IV. CONCLUSION

Based on the research that has been conducted, it can be concluded:

1) The price of shallots in Amahami against the Aikmel, Mandalika and Seketeng markets is strongly integrated in the long term and weakly integrated in the short term

2) Price transmission that occurs in the markets in West Nusa Tenggara including the Amahami, Aikmel, Mandalika and Seketeng markets can be transmitted well where, the Amahami Market is a market reference because the production center is in the Amahami Market, so it can quickly adjust to the Mandalika market and other markets also adjust indirectly, market information can be received by the four markets.

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