Analysis of Price Variations and Red Chili Market Integration in Ciamis Regency

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Abstract---Market integration can show that no matter what changes occur in the consumer market, it will cause price changes in the producer market. However, price information that has not been properly channeled between consumer and producer markets makes asymmetrical transmission and unintegrated market. This study aims to analyze the level of price variation and market integration of red chili in Ciamis Regency. The coefficient of variation analysis is used to analyze the level of price variation and the Johansen cointegration approach with the Vector Autoregression (VAR) / Vector Error Correction Model (VECM) model to analyze market integration. The results showed that the price fluctuation of red chili at the producer and consumer level was high and unstable. The results of the analysis of market integration show that there is market integration between the producer market and the consumer market in the long run but in the short term, they adjust to each other in the long term

Keywords---cointegration, market integration, red chilies, vector autoregression (VAR), vector error correction model (VECM).

Introduction

The price of horticultural commodities always fluctuates and tends to increase. This results in volatility in food prices and inflation. Price fluctuations for agricultural commodities are caused, by natural disasters, seasonal production,
inadequate storage facilities, and inappropriate farmer responses to price signals (Adebusuyi, 2004). The fluctuating prices resulted in inefficient marketing of the red chili commodity. In fact, the efficient marketing of horticultural commodities will benefit producers and consumers because the surplus production in one place can be channeled to other places that have a deficit with proper management costs (Adenegan et al., 2012). Market efficiency is an equilibrium condition in which all profitable opportunities can be utilized by each marketer according to the costs incurred. If the price difference between markets is smaller than the transfer cost, it can be said that the market is running efficiently. However, if the price difference between markets is greater than the transfer costs, it can be concluded that the market is running inefficiently (Negassa et al., 2003).

One of the horticultural commodities that often experience price fluctuations is red chili (Capsicum Annum L) so that red chilies become a strategic commodity that has high economic value and good market prospects and contributes to increased income and welfare of farmers and their families (Asih, 2009). The high contribution of red chilies as a cause of inflation can be seen from the high price fluctuation of this commodity, in which there are still problems of production instability, post-harvest, and storage problems. Production problems are caused by red chilies experienced a production surplus that does not occur throughout the year because the monthly production of this commodity is very volatile, depending on the climate/seasonality, and is easily damaged/rotten (Ariningsih & Tentamia, 2004). Besides, there are problems with poor post-harvest and storage management, causing problems with fluctuations in supply and prices. This price fluctuation reflects the presence of market symptoms that are less consistent with the effect of supply and demand for these commodities (Winarso, 2003). This unpredictable and high price fluctuation can increase price volatility. To overcome the price fluctuation of red chili, one of which is needed is market integration between the red chili marketing channels (Johansen, 1988; Johansen, 2000).

Spatial market integration has relevance to the agricultural sector because agricultural commodities are often bulky, perishable, and production is concentrated in one location, while consumption is concentrated in another which often results in high transportation costs (Sexton et al., 1991). Besides, the functioning of markets and marketing channels is very important to determine the impact of various economic policies, such as macroeconomic and trade policies. A spatially segmented market isolates market participants and limits the transmission of price incentives. Goletti et al. (1995), show that market integration is determined by the behavior of traders and market conditions, the marketing infrastructure associated with transportation, communication, and storage facilities which cause high marketing margins. Government policies can also influence markets through price stabilization policies, trade restrictions, and regulations related to transportation. Rapsomanikis (2009), stated that oligopoly and collusion behavior among traders is the determinant of market integration. Traders can maintain price differences between markets at a higher rate than transfer fees (Kearney & Lucey, 2004; Meyer, 2004).
Carolina et al. (2016) states that a market can be said to be well integrated if the price in a marketing agency can be transformed into other marketing agencies in one marketing chain. Vertical price linkages are often linked to the structure, behavior, and performance of a market. The amount of price change that can be transmitted in each marketing chain can be used as an important indicator to measure the strength of a market (Dang & Lantican, 2016). Market integration will be achieved if there is the same market information, adequate, transferred quickly to other markets, and has a positive relationship between prices in different markets (Baffes & Gardner, 2003). With this integrated market, it is hoped that the information regarding any changes in the price of red chili at the consumer level can be followed by price changes at the producer level so that it does not harm the marketing actors involved in marketing red chili. However, the reality shows that the large change in the price of red chili at the consumer level is not followed by price changes at the producer level of the same magnitude. This is evident from the price development of chili red at the level of producers and consumers in Ciamis district which shows that price changes at the level of the manufacturers are not as big as at the consumer level. This indicates that the price information has not been distributed properly, which means that the transmission rate of red chili prices in Ciamis Regency is still low. The objectives of this study were: (1) to analyze variations in the price of red chili in Ciamis Regency and (2) to analyze the level of market integration of red chili between producers and consumers in Ciamis Regency (Cacciola et al., 2012; Giuffrida et al., 2014).

**Method**

Secondary data used is monthly time series data with the period 2016-2019. The data analyzed in this study were the price of red chili at the producer level in the production center of Ciamis Regency and the consumer price at the consumer market in Ciamis Regency which were used as data collection samples by the Ministry of Agriculture, namely STA, sweet market and Panumbangan market. Analyzing the variation in the price of red chili is carried out using the coefficient of variation. The coefficient of variation is obtained from the standard deviation of a variable divided by its average. Mathematically formulated by:

\[
\text{Coefficient of Variation (KV)} = \frac{\text{Standard deviation}}{\text{Average}} \times 100\%
\]

The coefficient of variation from price data over time describes the deviation from the average used to determine the price stability of a commodity. The smaller the coefficient of variation, it can be interpreted that prices are relatively stable or have low fluctuations (Rachman, 2005). Prices in a city/province are said to be stable if the value of the coefficient of price variation is in the range of <9%, according to the target of the Indonesian Ministry of Trade until 2019 (Ministry of Trade of the Republic of Indonesia, 2015). If the price coefficient is high and unstable. The analysis method used to see the level of market integration is the VAR / VECM model approach. The stages of forming a VAR / VECM are:
Stationarity test

Price data time series (time series) are generally not stationary. Data that is not stationary will result in spurious regression estimates. Data stationary is a necessary condition in time series data analysis because it can minimize model errors. If this pseudo regression is interpreted, it will produce an incorrect analysis which results in the wrong policies being taken (Brooks, 2008; Widarjono, 2013). In this study using the Augmented Dickey-Fuller (ADF) unit root test. With the ADF test formulation as follows:

$$\Delta P_t = \alpha_0 + \gamma P_{t-1} + \beta \sum_{j=1}^{m} \Delta P_{t-j} + \epsilon_t$$

Where:

- $P_t$ = variable red chili prices at each market level in period t (Rp / kg)
- $P_{t-1}$ = variable red chili prices at each market level in the previous period (IDR / kg)
- $\Delta P_t$ = $P_t - P_{t-1}$
- $\Delta P_{t-1}$ = $P_{t-1} - P_{t-1-1}$
- $m$ = amount of lag
- $\alpha_0$ = intercept
- $\alpha_1, \beta, \gamma$ = parameter coefficient
- $\epsilon_t$ = error term

Hypothesis test:

- $H_0$: $\gamma = 0$ (non stationary time series data)
- $H_0$: $\gamma < 0$ (stationary time series data)

Test rule:
- If the ADF statistic > ADF is critical, then reject $H_0$, meaning that the time series data does not contain unit roots, which means that the data is stationary.
- If the ADF statistic < ADF is critical, then accept $H_0$, it means that the time series data contains a unit root which means that the data is not stationary.

Determination of optimal lag

Values from the lag of a variable can affect the other variables in the VAR model. The value of the lag of a variable can affect other variables because it takes time for one variable to respond to the movements of other variables. Determination of the optimal lag length in this study using the Akaike Information Criteria (AIC) (Ehrmann et al., 2003; Härdle et al., 1998).

Cointegration test

This test is conducted to determine whether there is integration in the long term or not. The cointegration test in this study uses the Johansen cointegration test, where this test can be used to see the amount of cointegration (cointegration rank) between variables (Rosadi, 2012). To test this hypothesis, the trace statistic or maximum eigenvalue test can be used. Whether there is cointegration is based on the likelihood ratio (LR) test. If the calculated LR value is greater than the
critical value, we accept the cointegration of some variables, and vice versa if the calculated LR value is smaller than the critical value, there is no cointegration (Seo, 2006; Guo et al., 2018).

**Granger causality test**

The Granger causality test is carried out to see whether two variables have a reciprocal relationship or not. In other words, does one variable have a causal relationship with other variables? Since each variable in the study has the opportunity to become an endogenous or exogenous variable (Angreheni et al., 2022; Kasirah et al., 2021).

**Vector error correction model (VECM) test**

VECM is used when the variables are not stationary at the level but stationary at the same differentiation level and are cointegrated. VECM measures how saving prices can return to a state of equilibrium (Hendy & Juselius, 2000). The VAR / VECM model used in this study are:

$$PP_t = \alpha_0 + \gamma P_{Pt} \sum_{i=1}^{p} \alpha_i P_{Pt-1} + \sum_{i=1}^{p} \gamma_i P_{Et-1} + \beta_{1t}$$ (3)

$$PE_t = \Phi_0 + \sum_{i=1}^{p} \Phi_i P_{Pt-1} + \sum_{i=1}^{p} \phi_i P_{Et-1} + \beta_{1t}$$ (4)

Where:

- $PP_t$ = producer price of red chili in period $t$ (IDR / Kg)
- $P_{Pt-1}$ = Lag of the producer price of shallots in the $t$ period (IDR/Kg)
- $PE_t$ = The price of consumer shallots in period $t$ (IDR/Kg)
- $P_{Et-1}$ = Lag the consumer’s shallot price in the $t$-period (IDR/Kg)
- $E$ = remaining vector of size n x 1
- $p$ = lag length

VECM analysis describes the short-term dynamic equilibrium relationship and long-term equilibrium in a system of equations. Although there is a long-term equilibrium between markets, there are deviations from the short-term equilibrium relationship. Thus, VECM is a combination of short and long-term relationships between price variables from different markets (Nagubadi et al., 2001; Irawan & Rosmayanti, 2007).

**Analysis variance decompositions**

Variance decomposition is a slightly different method in dynamic VAR models. This analysis provides the proportion of the movement of the dependent variable caused by disturbances from itself and those from other variables. Disorders of the variables to- I will directly affect not only the variable itself but will be forwarded to the variables more contained in the dynamic structure of the model through VAR. Variance decomposition is used in estimation to describe the dynamic VAR system (Baque et al., 2020; Handayani et al., 2019). Variance decomposition describes the relative importance of each variable in the VAR system due to shocks. Variance decomposition is used to predict the percentage...
contribution of the variance of each variable due to changes in certain variables in the VAR system (Widarjono, 2013).

**Results and Discussion**

The coefficient of red chili price variation in Ciamis Regency can be seen that the price fluctuation of red chili at the producer and consumer level is high and unstable based on the criteria of the Ministry of Trade because it is above 9%. The causes of this high fluctuation include uneven distribution throughout the year and stock management that has not been going well so that production during the in-season is not able to meet the needs during the off-season (Reza et al., 2015). Red chilies that do not last long when stored and are easily damaged, causing red chilies stored during the main harvest cannot be used for stock during the off-season. The results of the complete coefficient of variation analysis are presented in Table 1.

<table>
<thead>
<tr>
<th>Years</th>
<th>KV Producer Price</th>
<th>KV Consumer Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>52</td>
<td>39</td>
</tr>
<tr>
<td>2018</td>
<td>37</td>
<td>19</td>
</tr>
<tr>
<td>2017</td>
<td>26</td>
<td>21</td>
</tr>
<tr>
<td>2016</td>
<td>24</td>
<td>45</td>
</tr>
<tr>
<td>Average</td>
<td>34.75</td>
<td>31</td>
</tr>
</tbody>
</table>

Analysis of market integration approach VAR method / VECM ad was as follows:

- **Stationarity Test**
  The results of the stationarity test using the ADF test showed that the variable producer and consumer prices were stationary at the level because the ADF statistical k > ADF was the critical value and the probability was smaller than 0.005. Based on the test results, it can be concluded that all data variables used are stationary at the level so that it can be said to be free from pseudo regression. The stationary test results are shown in Table 2, below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Critical Value 5%</th>
<th>t-stat</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer</td>
<td>-2.925.169</td>
<td>-3.135.300</td>
<td>0.0307</td>
</tr>
<tr>
<td>Consumer</td>
<td>-2.925.169</td>
<td>-3.423.871</td>
<td>0.0150</td>
</tr>
</tbody>
</table>

Information: *** = significant at the 5% confidence level

- **Optimal Lag Test**
  The optimal lag test results are shown in Table 3, as follows:
Table 3
Optimal lag test result

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-935.04</td>
<td>NA</td>
<td>4.19e+15</td>
<td>41.65</td>
<td>41.73</td>
<td>41.68</td>
</tr>
<tr>
<td>1</td>
<td>-911.34</td>
<td>44.25*</td>
<td>1.74e+15*</td>
<td>40.77*</td>
<td>41.01*</td>
<td>40.86*</td>
</tr>
<tr>
<td>2</td>
<td>-910.57</td>
<td>1.38</td>
<td>2.02e+15</td>
<td>40.91</td>
<td>41.32</td>
<td>41.06</td>
</tr>
<tr>
<td>3</td>
<td>-907.02</td>
<td>5.99</td>
<td>2.06e+15</td>
<td>40.93</td>
<td>41.49</td>
<td>41.14</td>
</tr>
</tbody>
</table>

The optimal lag test results with AIC criteria show that lag 1 is the optimal lag. This means that lag 1 from an economic point of view implies that all the variables in the model influence each other not only in the current period but the price variables in the previous period. VAR stability needs to be done with a stability test because if the VAR estimation results are combined with an unstable error correction model, the Impulse Response Function and Decomposition will be invalid. The results of the stability test show that all modulus values are below 1, so that they meet the stability conditions as shown in Table 4, below:

Table 4
Stability condition

<table>
<thead>
<tr>
<th>Root</th>
<th>Modulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.681115</td>
<td>0.681115</td>
</tr>
<tr>
<td>0.581383</td>
<td>0.581383</td>
</tr>
</tbody>
</table>

No root lies outside the unit circle.
VAR satisfies the stability condition.

- Contingency Test
The results of the contingency test in this study used the cointegration test method of the Johansen Trace Statistic test. Based on the cointegration test between producer prices and consumer prices for red chilies both in the trace and maximum value tests, the test result is to accept the null hypothesis, below the 5% level and there are two integrated positive relationships. This means that there is a stable and long-term equilibrium relationship between producer prices and consumer prices. The results of the Johansen Trace Statistic test are shown in Table 5 as follows:

Table 5
Unrestricted cointegrasi rank test (Trace)

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob. **</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.204452</td>
<td>17.42823</td>
<td>15.49471</td>
<td>0.0253</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.139422</td>
<td>6.906940</td>
<td>3.841465</td>
<td>0.0086</td>
</tr>
</tbody>
</table>

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
- **Granger Causality Test**
  The results of the Granger causality test are presented in Table 6, as follows:

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>KONSUMEN does not Granger Cause PRODUSEN</td>
<td>47</td>
<td>0.10028</td>
<td>0.753</td>
</tr>
<tr>
<td>PRODUSEN does not Granger Cause KONSUMEN</td>
<td></td>
<td>0.00756</td>
<td>0.9311</td>
</tr>
</tbody>
</table>

  The results of the Granger causality test show that the analysis of the price relationship at the producer level and the price at the consumer level is independent of one another. Also seen from the probability value that each is greater than 0.05, namely 0.753 and 0.9311 (the results of both are accept the null hypothesis).

- **Vector Error Correction Model (VECM) Test**

<table>
<thead>
<tr>
<th>Error Correction:</th>
<th>D(PRODUSEN)</th>
<th>D(KONSUMEN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D(PRODUSEN(1))</td>
<td>D(KONSUMEN(1))</td>
</tr>
<tr>
<td>CointEq1</td>
<td>-0.261246</td>
<td>-0.378962</td>
</tr>
<tr>
<td></td>
<td>(0.08188)</td>
<td>(0.12482)</td>
</tr>
<tr>
<td></td>
<td>[-3.19057]</td>
<td>[-3.03596]</td>
</tr>
<tr>
<td></td>
<td>0.157159</td>
<td>0.550196</td>
</tr>
<tr>
<td></td>
<td>(0.24334)</td>
<td>(0.37097)</td>
</tr>
<tr>
<td></td>
<td>[0.64584]</td>
<td>[1.48314]</td>
</tr>
<tr>
<td></td>
<td>-0.002675</td>
<td>-0.269202</td>
</tr>
<tr>
<td></td>
<td>(0.15905)</td>
<td>(0.24246)</td>
</tr>
<tr>
<td></td>
<td>[-0.01682]</td>
<td>[-1.11027]</td>
</tr>
<tr>
<td></td>
<td>-204.6877</td>
<td>-144.3862</td>
</tr>
<tr>
<td></td>
<td>(1001.89)</td>
<td>(1527.35)</td>
</tr>
<tr>
<td></td>
<td>[-0.20430]</td>
<td>[-0.09453]</td>
</tr>
<tr>
<td></td>
<td>0.199065</td>
<td>0.213318</td>
</tr>
</tbody>
</table>

  Based on Table 7, changes in producer prices are influenced by the long-term relationship between producers and consumers. In the short term changes in producer prices are only influenced by changes in producer prices themselves in the previous month and are not influenced by changes in consumer prices. Changes in consumer prices are influenced by the long-term relationship between producers and consumers. In the short term, changes in consumer prices are only influenced by changes in consumer prices themselves in the previous month and are not influenced by changes in producer prices. This indicates that in the short term the producer market with the consumer market is not integrated.
• Analysis of variance decomposition

The results of variance decomposition showed that producer prices in the first month is affected by its price. However, in the second month to the projection in the last month can be known that price variability is influenced by consumer prices. In the last month to come, the variation in producer prices can be explained by itself as 63.11% and 36.88% by retail prices. In the short term, consumer prices do not affect producer prices, but in the long run, there is an influence on the formation of producer prices. Consumer prices in the first month of price variability are influenced by producer prices by 65% and the prices themselves by 35%. The projection of variability in consumer prices in the last month can be influenced by producers 22.62% and 77.38% themselves (Vocroix, 2021; Rinartha et al., 2018).

Conclusion

Based on the results of the research that has been done, the following conclusions can be drawn:

• The results of the analysis of monthly price variations show that the average value of the coefficient of variation in the price of red chili at the producer and consumer levels in Ciamis Regency is highly volatile and unstable based on the criteria of the Ministry of Trade.
• The results of the analysis of market integration show that there is market integration between the producer market and the consumer market in the long term but in the short term, it adjusts to one another in the long term.

References


