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PRICE TRANSMISSION ANALYSIS OF RED CHILI PEPPERS (Capsicum annuum L.) IN ACEH PROVINCE

Oki Maulana[1], Indra[2], Suyanti Kasimin[3]

[1] Student of Agribusiness Study Program, Faculty of Agriculture
[2] Lecturer of Agribusiness Study Program, Faculty of Agriculture
[3] Lecturer of Agribusiness Study Program, Faculty of Agriculture
Universitas Syiah Kuala, Aceh, Indonesia
E-mail: siokimaulana@gmail.com

Abstract

For horticultural commodities in general, the role of marketing for red chili commodities makes an important contribution in improving the performance of red chili commodity farming as a whole considering the unique characteristics of horticultural commodities in general such as perishability, perishability, volumenious, production is seasonal while consumption occurs throughout the year. Red chili marketing from farmers to the consumer level, the interaction between marketing agencies becomes important in forming prices. Producing farmers still seem to face price fluctuations, especially during harvest, and it is traders who have more access to obtain higher prices. The purpose of this research is to analyze the price transmission pattern of red chili at the producer level, wholesalers and consumers as well as analyzing what factors influence the formation and movement of red chili prices at the level of red chili producers, wholesalers and consumers in Aceh Province. The results of the study, during 2017-2021 the transmission of red chili prices took place indirectly, meaning that there was a short-term asymmetry at the level of producers to wholesalers and wholesalers to producers. One of the factors causing price formation to occur in the period 2017-2021 is the available supply, while the price of fuel oil is not significant because the price of changes in fuel oil does not fluctuate except at the end of 2021 until now. During 2017-2021 the transmission of red chili prices took place indirectly, meaning that there was a short-term asymmetry at the producer to wholesale and wholesale to producer levels. One of the factors causing price formation to occur in the period 2017-2021 is the available supply, while the price of fuel oil is not significant because the price of changes in fuel oil does not fluctuate except at the end of 2021 until now. During 2017-2021 the transmission of red chili prices took place indirectly, meaning that there was a short-term asymmetry at the producer to wholesale and wholesale to producer levels. One of the factors causing price formation to occur in the period 2017-2021 is the available supply, while the price of fuel oil is not significant because the price of changes in fuel oil does not fluctuate except at the end of 2021 until now.

Keywords: ***Red Chili, Price Transmission, Marketing.***

1. INTRODUCTION

Nationally, the red chili commodity in Aceh Province is one of the leading commodities. In 2020 chili production in Aceh is in the highest order of production in all regions of the island of Sumatra with a value of 58,385 tons (Central Statistics Agency, 2022) and the annual harvested area of red chilies in Aceh Province in that year is 5,743 ha (Food Crops Agriculture Service Aceh Province, 2021).

Red chili is a commodity that has a fairly large price fluctuation. Red chili price fluctuations can be caused by the large number of offers and the large number of requests. The higher the number of bids, the lower the price, while the smaller the number of bids, the higher the price (ceteris paribus). Chili is a commodity that has large price fluctuations. Chili price fluctuations can be caused by the large number of offers and the large number of requests. The higher the number of bids, the lower the price, while the smaller the number of bids, the higher the price.

Yustiningsih (2012) argues that the higher the distribution margin indicates that the actors in the distribution channel have sufficient market power to set prices above their marginal costs and indicates that the actors are in a concentrated market. In line with that, Conforti (2004) explains that the large price disparity in the marketing chain can be caused by two things, namely the long marketing channels and the presence of market power owned by intermediary traders. Both will cause the margins formed in upstream to downstream (vertical) marketing to be very large and inefficient.

In connection with the red chili marketing process from farmers to the consumer level, the interaction between marketing agencies becomes important in forming prices. This interaction between marketing agencies can be seen from the market behavior of each marketing agency in setting prices. Nurasa and Darwis (2007) show that red chili marketing institutions include farmers, collectors, wholesalers (PIKJ) and retailers.

In line with what was stated by Hasibuan (1993) that behavior is a pattern of response and adjustment of an industry in the market to achieve its goals. Due to differences in market structure between farmers and traders, the rationality of farmers is limited, namely they only take advantage of existing price variations. In contrast, the rationality of traders who are able to set prices and other behaviors. In this case every institution (farmers and traders) involved in red chili marketing tries to maximize its utility.

In view of the differences in the conditions of the market structure, the market behavior of farmers and other marketing institutions will be mapped. In this case, the interaction process between marketing agencies will be modeled in order to obtain pricing behavior by various parties (marketing institutions). In relation to price transmission, Peltzman (2000) states that it is necessary to understand the vertical market linkages in order to understand the phenomenon of asymmetric prices.

2. LITERATURE REVIEW

The concept of market integration is always associated with the development of price transmission which plays a role in the price formation process in a particular market. If the market integration system occurs in the long term, it can be said that the form of market integration tends to be weak and is accompanied by an asymmetrical price transmission system. Price asymmetry in theory can lead to a market competition relationship with imperfect characteristics and this is usually caused by information lag, promotion, and also weak market concentration (Henderson & Quant, 1980).

Analysis of chili price transmission vertically through three aspects including the magnitude of the response of price adjustments to changes in other market prices, the adjustment time of the lag, the asymmetric adjustment of the positive shock that is transmitted differently from the negative shock. There are five factors that can influence transmission, 3) Differentiated homogeneous products, 4) Existence of exchange rates, 5) Policies of a region.

Price transmission in a marketing process chain becomes an indicator of the performance of marketing institutions in a marketing chain. The marketing chain is said to be efficient and vertically integrated if the pattern of interaction of prices at each level depends on the production

costs, where changes from farmer's level prices are transformed to the level of aligned retail traders (Jumiana et al., 2018). Such a pattern of price transmission usually occurs due to traders who have monopsony power and they will control the price at the producer level. In addition to marketing margins and price transmission, the level of integration is another indicator in analyzing the efficiency between markets that interact vertically and spatially (Syahidin, 2021).

Kustiari et al. (2018) mentioned vertical market integration as well as partial structure, performance and behavior of a market. The chain of marketing will be efficient if price patterns in changing markets are transmitted to other markets that are aligned in a way that distinguishes transaction costs. Where the vertical price transmission will look at the price of a market level in the same market chain in one region by making adjustments to the information and changes in prices at other market levels.

Asmarantaka (2012) links market integration from efficiency to market system prices. Efficiency at prices is achieved when there is coordination of marketing agency activities. In the case of agricultural products, the red chili market is said to be efficient if changes in either an increase or decrease in prices at the market level (consumer market) are continued at other market levels in the same pattern (farmer level).

Prices of agricultural commodities have an important role for economic activity. Prices are a determinant of the trade process in determining the amount of profit earned on the sale of a commodity. The formation of commodity prices is influenced by forces from the demand side as well as market supply. If the quantity supplied increases, the demand for the price will decrease, conversely, if the price increases, the demand will be greater than the supply. The balance between demand and supply causes fluctuations in commodity prices. The form of price determination according to economic theory depends on the existing market structure of competitive markets, namely monopolistic and close to monopoly and oligopoly (Sukmawati and Dasipah, 2021).

Price formation occurs due to supply and demand. The relationship between the amount that consumers want and price, then the higher the price, the amount that consumers want will decrease. In addition, the relationship between the quantity supplied and the price of goods, if a higher price makes sales more profitable, encourages producers to sell more of these goods (Aktivani, 2021).

The factors that affect demand are the price of the product itself, the existence of a population, the price of income, the value of consumer tastes and preferences, and the availability of other goods and prices. Relatively prices will decrease according to the number of goods that will be demanded, but the number of residents and income is positive from demand, the assumption of tastes and preferences of consumers remains. An increase in demand from an increase in income will be relatively small compared to an increase in demand (Naizullah et al., 2021).

Changes in the balance of demand and supply cause fluctuations in commodity prices. The form of pricing according to economic theory depends on the prevailing market structure in the form of competitive markets, for example monopolistic and close to monopoly and oligopoly. Seasonal production has an effect on fluctuations for price changes (Andania and Nusrila, 2021).

3. RESEARCH METHOD

3.1. Research Time and Place

This research was conducted in Aceh Province. Determination of the research area was selected by purposive sampling by deliberately setting the research objectives in consideration. By considering being one of 21 regions in Indonesia which has become a center for the production of red chili plants. The research time will be carried out from August to October 2022.

3.2 Research Design

The data used is secondary data in the form of data on producer prices, wholesale prices and consumer (retail) prices. The data was collected systematically in the form of time series data over the 5 year period 2017-2021. The data studied were monthly data which totaled 60 observations. In analyzing the transmission pattern of red chili prices from the producer, consumer and wholesale levels, the monthly prices of producers, wholesalers and consumers of red chili commodities in Aceh Province are analyzed. The data used to analyze the factors that influence the formation of red chili prices at the producer level are monthly producer prices, wholesale prices, consumer prices, the cost of fuel oil (BBM) and prices at the producer level from the previous month.

3.3 DataAnalysis Techinique

This approach will use price transmission analysis for red chilies with the Asymmetric Error Correction Model (AECM) according to Von Cramon-Taubadel and Loy in 1996 (Bibi et al., 2021). Previously, estimation will be carried out using the Error Correction Model approach and pre-estimation testing as follows:

1) Unit Root Test

To estimate the stationarity of data in a time series. Time series data that has a process called stochastic with stationary and non-stationary properties. Non-stationary stochastic results in a number of non-stationary data trends, but when regressed it causes spurious regression. Therefore the steps will be carried out to test the stationarity of the data.

In this research, we will also estimate the stationarity of the data by carrying out the Augmented Dickey Fuller Test (ADF Test). In stationary data with a constant mean, co-variance and variance over a long time (Tenriawaru et al., 2021). The data is classified as not stationary because there are mean, co-variance and variance values that change in line with changes in time. There is an ADF Test Equation model, namely (Ahmed et al., 2022):

Δ□□ = □0+ □□□−1 + ∑ □□□□−□+1 + □□ ……………………….(1)

Δ□□ = □0 + □□□−1+ ∑ □□Δ□□−□+1 + □□……………(2)

Pt in equation (1) is the equation for the stationary variable level level, but Δ□□ in equation (2) is the equation in the first derivative or first difference (Pt-Pt-1) in the variable being tested. While t is the period of time, j is the length for the lag, and ε is the error term data. The hypothesis tested in the statistics is H0: $\gamma=0$, for time series data with a unit root, the data is not stationary. H1: $\gamma\neq0$, time series data does not contain unit roots, the data is very stationary. If non-stationary data is obtained, differentiation will be continued at the first difference level to the next level, until data at the same level is obtained. The Eviews program can be tested by comparing the critical Mackinon value with the ADF statistical value. If the t-statistic value on ADF <

2) Determination of Optimal Lag (Order) data

Determination of the optimal lag aims to analyze how long the variable is related to other variables so as to avoid residual autocorrelation of the VAR system (Qodri and Wahyudi, 2021). Optimal lag in the model is determined by criteria, namely the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and the Hannan – Quinn Criterion (HQ). Research using the Schwarz Information Criterion (SIC) as well as the Hannan – Quinn Criterion (HQ) is carried out by determining the data value at the optimal lag. Optimal lag is determined based on the Schwarz Information Criterion (SIC) and Hannan – Quinn Criterion (HQ) values as cited by Agbo (2021), which are as follows.

(□) = □ ln ((□)) + □ ln(□)……………………………..(3)

Information:

Q = Totalobservation,

k = lag length,

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SSRS = Sum Squares Residual,
n = Total parametersestimate.
HQ = -2Lmax + 2k(ln(n)……(4)
Information:
lmax = Log-likelihood ratio
K =Number of parameters
N = Totalobservation

3) Cointegration Data Testing

The cointegration data test is for the trend of movement in data that is not stationary but moves together for the long term. Where, the variables in the model method are said to be cointegrated data if the variables that are stationary in degrees with the same value move at the same wavelength value (Camba and Camba, 2021). The cointegration data testing method developed by Johansen (1991) is called the Johanssen Cointegration Test. The existence of an inter-relationship in the long run using the trace test (TS) of the maximum eigenvalue (ME) according to the equation:

(□) = 1 − □ ln (1 – □ 2)……..(5)

and maximum eigenvalue (ME) according to the equation:

(□) = 1 − □ ln (1 – □□+1)……(6)

If the TS value is also ME > compared to the t-statistic value, then cointegration is in the analyzed variable. Use in the Eviews software, namely decision making is tested on critical values and trace statistics. If the trace statistic > critical value then the equation is cointegrated, so the hypothesis H0 = non-cointegration will be rejected or accepted by H1 as cointegration.

4) Causality Test

Causality testing aims to determine a two-way relationship (cause and effect) of the VAR system variables. The causality test is used to be able to see the transmission of the direction of red chili prices to producers, consumers and wholesalers. The causality test according to research uses the Granger test method as in Hutagalung et al. (2021) with the following models:

$Yt = + + e1t$... (unrestricted Y)...(7) $\sum_{i=1}^{n} \alpha iYt - 1 \sum_{i=1}^{n} \beta iXt - i$

X = + + □1□…(unrestricted X)…...(8) $\sum_{i=1}^{n} \gamma iXt - 1 \sum_{i=1}^{n} \lambda iYt - i$

To determine the variables that affect and are affected, the restricted equation in the unrestricted equation above is formulated:

$$= \sum_{i=1}^{n} \square\square\square\square - 1 + e2t \text{... (restricted Y).....(8)}$$

$$Xt = \sum_{i=1}^{m} \gamma iXt - 1 + e2t \text{… (restricted X)……...(9)}$$

This analysis is used by calculating the value of F in the residual sum of square (RSS) in the equation of a restricted and unrestricted variable, namely

Where:

RSSR= Residual sum of squares (restricted),
RSSUR = Residual sum of squares (unrestricted),
n = total observations,
m = Total lag,
k = Total parameters for estimation (unrestricted).

The criterion factor in the test with a significant effect if H0 is rejected is the calculated F value > F table.

5) Error Correction Model analysis

Analysis Analysis of the transmission of red chili prices is the Asymmetric Error Correction Model (AECM) according to Von Cramon-Taubadel and Loy in 1996 (Bibi et al., 2021). This model in ECM was invented by Sargan, continued by Hendry, then popularized by Engle and Granger in 1987. The cointegration method of economic data (time series) is not stationary in the presence of a system of short-term imbalances from long-term data analysis. The ECM model on corrected short-run imbalances includes adjustment data in the correction of short-run imbalance data for long-term balances. Von Cramon - Taubadel and Loy in 1996 and Von Cramon - Taubadel in 1998 found that the relationship between the two prices is Pi as well as cointegrated Pj,

Δ□□, = □0 + □1Δ□□, + □2□□□□−1 + □3(□)Δ□□,□−1 + □4(□)Δ□□,□□,□□,□□,□−1 +

In equation (5), Pi is the market price I, Pj is the market price J, and ECT is the error correction term, where L is the lag polynomial. According to equation (5) developed by Von Cramon - Taubadel and Loy in 1996, separating positive and negative ECT with changes in the increase and decrease in the independent variable in order to get a data transmission model at asymmetric prices (asymmetric price transmission), so that the equation form isl

$$\Delta\square i,=\beta 0+\beta\ {}^{+}_{2}\Delta\square+j,t+\beta\ {}^{-}_{1}P^{-}j,t+\beta\ {}^{+}ECT^{+}t-1+\beta\ {}^{-}ECT^{-}$$
$$t-1+\beta 3(\square)\Delta L\square,\square-1+\square 4(\square)\Delta L\square,\square-1+\square\square\ \ldots(11)$$

CT is an error*correction term*, where L is the lag polynomial, (+) is a price increase and (-) is a price decrease. Based on this, the analysis of red chili price transmission from producers, consumers and wholesalers of Nanggroe Aceh Darussalam Province using the Asymetric Error Correction Model (AECM) is as follows:

$$\Delta HP_t = a_0 + \sum_{i=1}^{n}\beta^{-}\Delta HP^{-}_{t-i} + \sum_{i=0}^{n}\beta^{-}\Delta HG^{-}_{t-i} + \Pi_1^{-}ECT^{-}_{t-1} + \sum_{i=1}^{n}\beta^{+}\Delta HP^{+}_{t-i} + \sum_{i=0}^{n}\beta^{+}HG^{+}_{t-i} + \Pi_2^{+}ECT^{+}_{t-1} + \epsilon_t$$

$$\Delta HG_t = a0 + \sum_{i=1}^{n}\beta^{-}\Delta HK^{-}_{t-i} + \sum_{i=1}^{n}\beta^{-}\Delta HG^{-}_{t-i} + \Pi_1^{-}\,ECT^{-}_{t-1} + \sum_{i=1}^{n}\beta^{+}\Delta HK^{+}_{t-i} + \sum_{i=1}^{n}\beta^{+}HG^{+}_{t-i} + \Pi_2^{+}\,ECT^{+}_{t-1} + \varepsilon_t$$

$$\Delta HK_t = a0 + \sum_{i=1}^{n}\beta^{-}\Delta HK^{-}_{t-i} + \sum_{i=1}^{n}\beta^{-}\Delta HP^{-}_{t-i} + \Pi_1^{-}\,ECT^{-}_{t-1} + \sum_{i=1}^{n}\beta^{+}\Delta HK^{+}_{t-i} + \sum_{i=1}^{n}\beta^{+}\Delta HP^{+}_{t-i} + \Pi_2^{+}\,ECT^{+}_{t-1} + \varepsilon_t$$

Information:

HPt : Price of red chilies to producers month-t (Rp/kg)
HGt : Pricered chili to wholesalers t month (Rp/kg)
HKt : Price of red chilies to consumers month-t (Rp/kg)
ECT : *Error correction term*which is the lag of the residual equilibrium equation in the long run
α : intercepts
ε : *Error term*
n : Long on lag

A positive sign (+) indicates an increase in price, while a negative sign (-) indicates a decrease in price. However, ECT+ is an adjustment to the dependent variable for changes in the independent variable that deviates from the price above its equilibrium, besides that ECT- occurs when the price deviation is just below the equilibrium. Testing the transmission in the walking price of symmetry and asymmetry statistically uses the wald test. Transmission analysis on price asymmetry for the short term uses the following hypothesis:

H0 : □− = □+

The hypothesis is that there is no difference and the response of the downstream price

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when the upstream price increases and decreases in the period t or t-1 (short term). In addition, to test asymmetric price transmission data in the long run, we use the following hypothesis:

H0 : □1 = □2

The hypothesis of testing the difference in the ECT+ or ECT- coefficients explains that there is no difference in the downstream price response when there are increases and decreases in long-term upstream prices. The ECT coefficient at the time of adjustment is required for the follower market to increase and decrease the prices formed from the reference market in order to obtain an equilibrium line. The price adjustments required towards equilibrium in the long run are calculated by multiplying the ECT coefficient over 12 months.

6) Wald Method Test

Price transmission analysis is able to run symmetrically and asymmetrically with the Wald test statistic. In the short term, the Wald test obtains significant value with price asymmetry which is influenced by the cost factor for adjustment. However, the long-term Wald test has a significant value, namely asymmetry in price transmission, which is influenced by factors for market power. Short-term or long-term price asymmetry transmission is written ie

a) Short Term

$$H0 : \sum_{i=0}^{n} \square- = \sum_{i=0}^{n} \square+ = \text{Price symmetry in the short term}$$

$$H1 : \sum_{i=0}^{n} \square- \neq \sum_{i=0}^{n} \square+ = \text{Price asymmetry in the short term}$$

b) Long Term

$H0 : \pi^{-} = \pi^{+}$ = Symmetry of prices in the long run

$H1 : \pi^{-} \neq \pi^{+}$ = Price asymmetry in the long run

The results of the Wald test show that receiving H0 in the short term and in the long term the transmission of red chili prices in the Province of Nanggroe Aceh Darussalam runs symmetrically. If the results of the Wald test show the rejection of H0 in the short and long term, the transmission for the price of red chilies in Nanggroe Aceh Darussalam Province is asymmetrical.

Tests on the second objective are the factors that influence the formation of red chili prices in Aceh Province producers using the ECM model analysis. ECM is an analysis for variables that have dependencies often known as cointegration. ECM is balancing short-term inter-economic relationships on variables that have balance and long-term economic relationships. The ECM model in factors for the formation of red chili prices, namely:

□HP_t □ a0□a1□HKt □ a2□HGt □ a3□BBM t □ a4□HCRt+□HPt-1□ γECT (□1) □ et…(12)

Where:

HPt = The price of red chili at the t-month producer (Rp/kg),
HKt = Pricered chili to t-month consumers (Rp/kg),
HGt = Pricered chili at wholesale month t (Rp/Kg),
HCmt =Producer level red chili prices month-t (Rp/Kg)
ECT = Error correction terms.
HBBMt = t month retail gasoline price (Rp/liter),
Q =time (month)
ε = *error*.

4. RESULTS AND DISCUSSION

4.1. Red Chili Price Movements

Red chili prices at the producer, wholesaler and consumer levels are based on secondary data from the Pusdatin website, the Indonesian Ministry of Agriculture, the Aceh Province Food Security Agency, the Aceh Agriculture Service and the National Strategic Food Price Information Center (PIHPS). Furthermore, these data were tested using E-view version 12 and SPSS 24 to test the monthly fluctuations or price movements of red chilies from 2017-2021.

Movements in the price of red chilies in Aceh Province, it is estimated that the stock or materials available at the consumer level are carried out seasonally and there is a concentration of red chili production areas that causes price fluctuations. Figure 1 shows the price movement of red chili that occurs at various levels, namely producers, wholesalers and consumers.

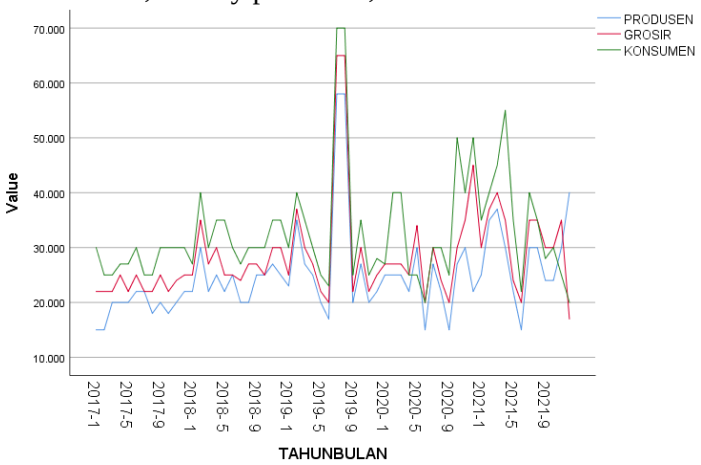

Figure 1. Prices of Red Chili at Producer, Wholesale, Consumer levels (2017-2021)

Figure 1shows that the price of red chilies per month from 2017 to 2019 has fluctuated with different movement patterns between producers, wholesalers and consumers. However, an increase in the price of red chilies at the consumer level occurred in 2019 reaching a price of Rp. 70,000 (seventy thousand rupiah), followed by an increase in wholesale prices reaching Rp. 65,000 (sixty thousand rupiah) and the producer price is below Rp. 60,000 (sixty thousand rupiah). Based on the data above, it can be concluded that prices at the consumer level are higher than prices at the wholesale and producer levels.

To be able to see the price movement of red chilies from 2017-2021 per month, use SPSS to create a chart. Meanwhile, the monthly data for 2017-2021 comes from Indonesian Agriculture, BPS (Aceh Central Bureau of Statistics), and the Agriculture and Plantation Service of Aceh Province.

Table 1. Statistical Description of Producer, Wholesale and Consumer Levels of Monthly Red Chili Prices from 2017-2021

Descriptive Statistics

	N	Minimum	Maximum	Means	std. Deviation
Manufacturer's Price	60	15	58	24.98	8,192
Wholesale price	60	17.00	65.00	28.5000	8.82504
Consumer Price	60	20.00	70.00	32.7667	10.04796
Valid N (listwise)	60				

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Mark*variance coefficient*at each level of marketing shows that the price of red chili at the consumer level tends to fluctuate or change more quickly when compared to the prices formed at the producer and wholesale levels which tend to be more stable when compared to consumer prices. Fluctuations in the price of red chilies at the consumer level are influenced by several factors, namely production patterns that are seasonal, demand and supply, as well as rising fuel prices which will affect the availability of red chilies in certain months, poor storage facilities and are influenced by their fast rotting nature. commonly owned by horticultural agricultural commodities.

4.2 Price Transmission of Red Chili at Producer, Wholesale and Consumer Levels in Aceh Province.

Stationarity Test Results *(Unit Root Test)*

To see the consistency of price time series data movements, as well as to prevent spurious regression or good conditions at the producer, wholesaler and consumer levels, the following are the results of the ADF test (remark: * stationary at 5 percent significance level):

Table. 2 Data Stationarity Test Results

Variable	ADF Test Value	
	Levels	FirstDifference
Manufacturer's Price	0.40*	0.00
Wholesale price	0.00*	0.00
Consumer Price	0.00	0.00 *

The results of the data stationarity test show that the red chili price data at the producer, wholesaler and consumer levels is stationary at the level. To retest, further data stationarity is carried out on the first difference. After the stationarity test was carried out at the first difference, all data variables were said to be stationary.

Optimal Lag Determination

Determination of the optimum lag aims to see how long a variable reacts to other variables. The results of determining the optimum lag on the price of red chili at the level are as shown in Table 3:

Table. 3 Optimal Lag Test Results

	Criteria		
lag	LogL	SC	HQ
0	-1661,882	60.65066*	60.58351*
1	-1654,180	61.02633	60.75773
2	-1646,916	61.41793	60.94788
3	-1644522	61.98662	61.31512
4	-1635,766	62.32398	61.45103
5	-1628,594	62.71892	61.64452

Note: *Indication of lag orders based on criteria

Based on the Schwarz information criteria (SIC) and Hannan-Quinn Information criteria (HQ) red chili prices at the producer, wholesaler and consumer levels can react to other variables for one day (-1).

Cointegration Test Results

The co-integration test in the market integration analysis is used to see the statistical significance of the linear relationship between variables, so that it can be ensured that the regression equation being analyzed becomes meaningful and not spurious regression.

This test uses the Johansen Cointegration test approach. Equality testing is carried out based on SC and HQ criteria, namely at lag one (-1) with the assumption that the selected intercept is no trends. The co-integration test results on the red chili price variable at the producer, wholesaler and consumer levels are shown in Table 4.

Table 4. Johanssen Cointegration test results.

Variable	hypothesis Zero	trace Statistics	CVs 5 percent	Max Eigen Statistics	CV=5 percent
Manufacturer's Price	At most*	42.98	29.79	28.41	21.13
Wholesale price	At most*	15.57	15.49	14.16	14.26
Consumer Price	At most*	0.41	3.84	0.41	3.84

The cointegration test results show that the trace statistical and maximum eigenvalue values are greater than the critical value with a significance level of five percent, so the null hypothesis which states that there is no cointegration is rejected, and the alternative hypothesis which states that there is cointegration is not rejected. Based on the cointegration test, it can be said that the price of large red chilies in Aceh Province is vertically integrated, but cannot guarantee that integration will occur perfectly.

Causality Test

The Granger Causality estimation results with a significant level at the 5 percent significance level as shown in Table 5 show that in the red chili marketing chain, prices at the producer market level have the power to influence prices at both the wholesaler and consumer levels. The following are the results of the causality test:

Table 5. Causality Test Results

Connection	F-Statistics	Prob
HG-HP	0.613	0.545
HP-HG	0.227	0.797
HK-HP	0.053	0947
HP-HK	0.151	0.860
HK-HG	0.255	0.775
HG-HK	0.208	0.812

The results of the causality test show that wholesale prices have the power to influence prices at the consumer level at the ten percent level of significance. This relationship runs in one direction, meaning that prices at the wholesale level affect prices at the consumer level but prices at the consumer level are unable to influence prices at the wholesale level. This is in line with research by Elvina (2016) which states that the price of red chili affects prices at the producer and consumer level and takes place in one direction or asymmetrically.

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Table 6. AECM Estimation Results

Variables	coefficient	std. Error	t-Statistics	Prob.
D (Manufacturer)	0.022398	7.18E-15	3.12E+12	0.0000
D (Wholesale)	0.006830	3.20E-15	2.13E+12	0.0000
D (consumer)	-0.008875	3.25E-15	-2.73E+12	0.0000
D (ECT)	1.000000	3.17E-13	3.15E+12	0.0000
R-squared	1.000000	Mean dependent var		30.42373
Adjusted R-squared	1.000000	SD dependent var		0.834667
SE of regression	7.37E-11	Akaike info criterion		-43.75765
Sum squared residue	2.99E-19	Schwarz criterion		-43.61680
Likelihood logs	1294,851	Hannan-Quinn criter.		-43.70267
Durbin-Watson stat	2.825886			

The estimation results show that in the short term changes in price increases and decreases at the wholesale level significantly affect consumer prices. Increases in prices affect real consumer-level prices at a significant level of five percent, and when wholesale price decreases affect real consumer-level prices at a significant level of ten percent. The decline in consumer prices in the previous period also significantly affected consumer prices in the current period at a significant level of five percent, but not significantly when there was a price increase. The transmission of wholesale prices to consumer prices in the long term can be seen through ECT. The ECT value in the estimation results shows a significant value indicating that in the long term wholesale prices affect the formation of consumer level prices. To prove this, need to be tested statistically using the Wald test. The Wald test results can be seen in the table below.

Wald Test Results

The results of the Wald test of the price transmission relationship between institutions involved in the red chili marketing chain in Aceh in Indonesia during 2017-2022 are presented in Table 7:

Table 7. Wald test results

Null hypothesis (Ho)	F-Statistics	Probability
	1,477	
0.237		
ECT+ = RCT-	0.0001	0.015

The results of the Wald test show that in the short term and long term there is no statistical difference. The wholesale price to the consumer level price is not significant, which means that in the short run there is no asymmetric price transmission between the wholesale price level and the consumer level price. The results of the ECT coefficient test also show that there is no transmission of asymmetry in wholesale prices to consumer level prices. So that it can be said that the price transmission between wholesalers and consumers is symmetrical. This is in line with research by Elvina (2016) which proves that the wholesale price of red chili to consumer prices runs symmetrically in the short and long term. Thus the marketing of large red chilies in Aceh Province is efficient in terms of price efficiency.

Table 8 Summary of Results of the Analysis of Red Chili Price Asymmetry in Aceh

Connection	Asymmetric	
	Short-term	Long-term
Manufacturer → Wholesale	√	X
Consumer → Wholesale	√	√
Consumer	√	X

The results of research on the transmission of red chili prices in this study are in table 8. The results show that the transmission of red chili prices takes place asymmetrically in the short term at the producer and wholesale levels, which can be interpreted that the price increases that occur at the wholesale level are not transmitted perfectly on the manufacturer. While the transmission of red chili prices is slender symmetrically both in the long and short term at the level level, meaning that increases or decreases in prices that occur at the producer, wholesaler and consumer levels will be transmitted perfectly at each level.

5. CONCLUSION AND SUGGESTION

5.1. CONCLUSION

Based on the results of the research conducted, the following conclusions are obtained:

1. Red chili price movements fluctuate with different movement patterns between prices at the producer, wholesaler and consumer levels throughout 2017-2021. Throughout 2017-2021 the transmission of red chili prices took place indirectly, meaning that there was a short-term asymmetry at the level of producers to wholesalers and wholesalers to producers.
2. One of the factors causing price formation to occur in the period 2017-2021 is the available supply, while the price of fuel oil is not significant because the price of changes in fuel oil does not fluctuate except at the end of 2021 until now.

5.2 Suggestions

Based on the results of the conclusions described, the suggestions that can be conveyed are as follows:

1. The government must pay attention to the increase in a commodity because an increase in the price of an item will affect other goods so that in making policies it must pay attention to the interests of the community, because one of the factors in determining the price of red chili is government intervention. To monitor and evaluate regulations related to the price of red chili which aims to ensure the adequacy and smooth distribution of red chili.
2. Then for further research, asymmetry analysis can be carried out on other marketing channels, such as by adding the price variable of other market players that bridges red chili marketing between producers and consumers.

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