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RESEARCH ARTICLE

Analysis of Price Transmission Chili at the Level from Producer to Consumer in Tapin Regency

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ABSTRACT

The fluctuating prices of chili peppers can significantly impact farmers positively and negatively. Farmers cultivating bird's eye chili can reap substantial profits with high prices. However, they earn less when bird's eye chili prices are low. Currently, market integration refers to the evolution of costs across different market sectors and the extent to which market sectors in various geographical locations are informed about the supply and demand occurring in a market. This study aims to: 1) analyze the price developments of bird's eye chili at the producer, wholesale, and consumer levels in Tapin Regency; 2) examine the price transmission of bird's eye chili from the producer level to the consumer level through prices at the wholesale level and the production of bird's eye chili in Tapin Regency. The data used in this research are secondary in the form of monthly time series data. The study utilized the documentation method, with data collected from January 2017 to December 2022, totaling 72 data points. The data analysis method employed is the Vector Error Correction Model (VECM), with tests including the Stationarity Test, Optimal Lag Length Test, Stability Test, Cointegration Test, VECM Estimation, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD). The findings indicate that the prices of bird's eye chili exhibit monthly fluctuations. The higher price fluctuations at the producer level indicate that farmers have weak bargaining power in setting the prices of bird's eye chili. The stationarity test shows that the prices of bird's eye chili at the consumer (HK), wholesale (HG), and producer (HP) levels, along with bird's eye chili production (PC), are stationary at the first difference. The optimal lag test, with the smallest Akaike Information Criterion (AIC), is lag 2. The cointegration test shows that the trace statistic and max-eigen values are greater than the critical value, thus accepting H_1, indicating a long-term relationship. In the short term, the increase in bird's eye chili prices is influenced by the two previous periods. The analysis results demonstrate asymmetric price transmission from the producer level to the consumer price level.

Keywords: Bird's eye chili prices, Bird's eye chili production, Price transmission, Vector Error Correction Model.

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1. Introduction

1.1. Background

The agricultural industry is a cornerstone of Indonesia's economy. This is due to the robust agricultural economy of Indonesia, which benefits from a resource-rich agricultural environment. Given these conditions, agricultural areas in Indonesia certainly need attention in every development cycle. Regardless of socioeconomic status, most Indonesians favor bird's eye chili, making it one of the most important food crops in the country. Due to the Indonesian penchant for using bird's eye chili as a complementary ingredient in various culinary dishes, the market demand for bird's eye chili remains high, ranging from traditional companies to basic retailers [1].

Besides the financial aspects of cultivating bird's eye chili, the highly fluctuating chili prices can also impact farmers both positively and negatively. Farmers who cultivate bird's eye chili can reap substantial profits when

the prices are high. However, they earn less when the prices are low. Currently, market integration refers to the development of costs in various market sectors and the extent to which market sectors in different geographical locations receive information about supply and demand shocks occurring in a market. Furthermore, understanding how markets and marketing channels operate is crucial for comprehending the impacts of various economic tactics, such as trade regulations [2].

Prices of bird's eye chili often start low during the main harvest season and increase sharply as the next harvest approaches. Both minor and major low price seasons occur in the primary producing areas of bird's eye chili during the grand harvest season. Farmers typically sell their crops shortly after harvesting, which usually occurs between April and June.

Prices of bird's eye chili at the producer level are more stable compared to those at the consumer level. Although the sale of bird's eye chili may indicate market integration, there are still issues in the price transmission process from producers to consumers. Due to this price transmission pattern, changes in the bird's eye chili producers' market are often less volatile compared to those in the consumer market. It is undeniable that nearly half of the price is marked up from the farmer to the wholesaler. This significant markup results in only modest profits for bird's eye chili farmers, as high prices set by farmers lead wholesalers to increase their prices further, thus elevating the final consumer prices [3].

Given the prevailing conditions, this study will utilize a vertical transmission strategy to examine the price levels of bird's eye chili at the producer, wholesaler, and consumer stages in Tapin Regency. Price transmission not only helps in forecasting future price movements but is also crucial for understanding how changes in consumer prices affect producer prices and vice versa. This understanding fosters a favorable environment for economic actors, and business entities, including the government, to effectively establish policies related to the development of these products in alignment with their objectives.

1.2. Objectives and Benefits of the Study

In light of the issues identified in the research, the objectives of this study are:

1. To analyze the price developments of bird's eye chili at the producer, wholesale, and consumer levels in Tapin Regency,
2. to analyze the price transmission of bird's eye chili from the producer level to the consumer level through prices at the wholesale level, and the production of bird's eye chili in Tapin Regency.

2. Research Methodology

2.1. Location and Duration

This study was conducted in Tapin Regency, South Kalimantan Province, from January 2023 to July 2023.

2.2. Type and Source of Data

The data used in this study were secondary, in the form of monthly time series data. The data were obtained from the Tapin Regency Agricultural Office and the Tapin Regency Central Statistics Agency, including consumer-level prices of bird's eye chili, farmer-level prices of bird's eye chili, wholesale-level prices of bird's eye chili, and the production of bird's eye chili in Tapin Regency.

2.3. Data Collection Method

This study employed the documentation method. The secondary data included in this study consist of monthly time series data covering the period from 2017 to 2022, totaling 72 samples. There was no need for further observation and interviews, as the researcher was able to gather all necessary information from the existing data using this approach.

2.4. Data Analysis

To analyze the price transmission of bird's eye chili at different levels in Tapin Regency, a price transmission analysis was conducted. The Vector Error Correction Model (VECM) approach, a technique used to study the dynamic impacts of one disturbing factor on the system variables, was utilized. This model serves as a reliable analytical tool for characterizing data and making trustworthy predictions for multivariate equations.

The stationarity test was performed using the Augmented Dickey-Fuller (ADF) test. If the absolute value of the ADF statistic is less than 0.05, it can be concluded that the data are stationary at a significant level; hence, H_0 is accepted, and H_1 is rejected. If the data are not stationary at the level based on the ADF test results, differential action must be taken until the data becomes stationary.

Determining the optimal lag is a crucial step in the VECM model to capture the effects of each variable. The lag value of a variable can influence other variables because it takes time for one variable to respond to movements in another.

The stability test aims to determine whether the employed VECM model is stable. If the VECM model is unstable, the results of the estimation using this model will not have a high level of validity. A model is considered to have high stability if it has modulus values of no more than one and all are within the unit circle.

The cointegration test is the next step in the VECM estimation process and is used to examine the relationships among variables in terms of their long-term equilibrium. Cointegration occurs when the trace statistic is greater than the critical value. If cointegration exists, the investigation proceeds with the VECM. If not, the examination can be conducted using a VAR difference model.

In price transmission analysis, the short-term economic interaction corrective variable is analyzed using the Vector Error Correction Model (VECM) in this study. Below is the VECM for the pricing of bird's eye chili:

$$\begin{aligned} Hk_t &= \alpha + \sum_{i=1}^{p} \beta_1 Hk_{t-i} + \sum_{i=1}^{p} \beta_2 Hp_{t-i} \\ &+ \sum_{i=1}^{p} \beta_3 Hg_{t-i} + \sum_{i=1}^{p} \beta_4 Pc_{t-i} \end{aligned}$$

$$+ \sum_{i=1}^{p} \beta_5 Ch_{t-i} + e_t$$

$$HP_t = \alpha + \sum_{i=1}^{p} \beta_1 Hk_{t-i} + \sum_{i=1}^{p} \beta_2 Hp_{t-i} + \sum_{i=1}^{p} \beta_3 Hg_{t-i} + \sum_{i=1}^{p} \beta_4 Pc_{t-i} + \sum_{i=1}^{p} \beta_5 Ch_{t-i} + e_t$$

$$Hg_t = \alpha + \sum_{i=1}^{p} \beta_1 Hk_{t-i} + \sum_{i=1}^{p} \beta_2 Hp_{t-i} + \sum_{i=1}^{p} \beta_3 Hg_{t-i} + \sum_{i=1}^{p} \beta_4 Pc_{t-i} + \sum_{i=1}^{p} \beta_5 Ch_{t-i} + e_t$$

$$Pc_t = \alpha + \sum_{i=1}^{p} \beta_1 Hk_{t-i} + \sum_{i=1}^{p} \beta_2 Hp_{t-i} + \sum_{i=1}^{p} \beta_3 Hg_{t-i} + \sum_{i=1}^{p} \beta_4 Pc_{t-i} + \sum_{i=1}^{p} \beta_5 Ch_{t-i} + e_t$$

where
α – constant
β – variable coefficient
Pc – production of bird's eye chili (kg)
Hp – price of bird's eye chili at the producer level (IDR)
Hg – price of bird's eye chili at the wholesale level (IDR)
Hk – price of bird's eye chili at the consumer level (IDR)
t – time/period

The Impulse Response Function (IRF) is a technique used to determine how endogenous variables react to a shock. The impact of a shock on future events in endogenous variables is measured with IRF, aimed at decisively identifying a shock to clarify its effect, further implying that a variable cannot be influenced by a shock.

The purpose of Forecast Error Variance Decomposition (FEVD) in the Vector Error Correction Model (VECM) is to estimate how specific changes will affect the variance percentage of each variable. The Impulse Response Function (IRF) examination observes the impact of shocks from one variable on different variables, which is then utilized. This is used to illustrate the relative importance of shocks from each variable within the VECM system in FEVD analysis.

3. Results and Discussion

3.1. Price Development of Bird's Eye Chili

Bird's eye chili is consistently a volatile commodity. Each month, there are variations in the price of bird's eye chili. The average price of bird's eye chili at the consumer level in Tapin Regency often follows the wholesale and producer prices. Due to fluctuations in wholesale market prices, the price of bird's eye chili varies. When supply and demand are balanced, prices stabilize. If supply exceeds demand, prices fall, and vice versa, unlike the producer side, where supply increases in response to price hikes and decreases in response to price drops. Producers who offer or sell their goods in the market depend on the prevailing prices.

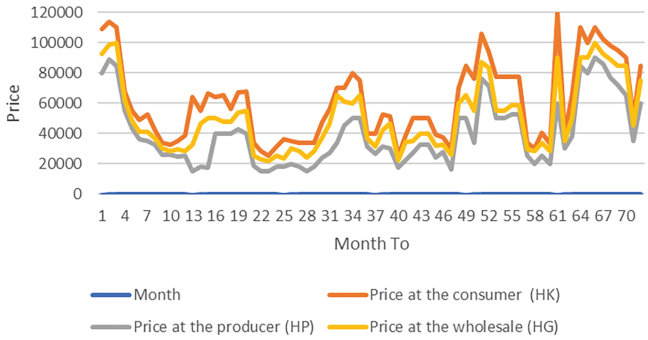

Fig. 1. Bird's eye chili sales price chart, 2017–2022. Source: Tapin Regency Agricultural Office, 2017–2022 (processed) [4].

Data obtained from the Tapin Regency Agricultural Office show that the lowest producer prices for bird's eye chili were in January, October, and November 2018, at IDR 15,000, while the lowest wholesale prices occurred in November 2018 at IDR 21,500. Furthermore, the lowest consumer prices were noted in November 2018 and April 2020 at IDR 25,000. It is evident that when the price of bird's eye chili decreases at the consumer level, the prices at the wholesale and producer levels also experience a similar decline, as observed in November 2018.

Regarding the peak prices, the highest producer prices for bird's eye chili were recorded in June 2022 at IDR 90,000, while the highest wholesale prices were noted in March 2017 and June 2022 at IDR 100,000. Meanwhile, the peak consumer price reached IDR 120,000 in January 2022. This indicates that when bird's eye chili prices rise at the consumer level, they do not necessarily increase at the wholesale or producer levels. It can be explained that when prices are high at the consumer level, the information is slow to reach the farmers, whereas if the prices decrease at the producer level, the information quickly reaches the consumer-level traders. Fig. 1 provides further information on the monthly price fluctuations of bird's eye chili in Tapin Regency.

Based on bird's eye chili data from 2017 to 2022 in Tapin Regency, the formulation of desired production policies and price stabilization by farming business actors depends on price analysis. When there is strong consumer demand without significant inventory at the producer level, prices often rise. Conversely, low supply coupled with abundant demand can decrease costs. Market actors directly involved in the production of bird's eye chili can observe the bird's eye chili marketing chain. Traders often do not immediately adjust market prices to the prevailing prices. Therefore, traders are claimed to play a role in determining market prices. They are free to choose not to pass on price increases to producers directly if they occur at the consumer level in the market. However, they do so if consumer prices fall.

3.2. Price Transmission Analysis

The price transmission analysis of bird's eye chili from the hands of the producers to the end consumers generally shows that farmers often sell their produce to collectors. Farmers' harvests are sold to interregional traders through wholesale traders. Interregional traders then transport these harvests to the main markets. Retailers often go

TABLE I: Stationarity Test Results

Variable	t-Statistic (ADF)	Probability	Result
HK	−3.267723	0.0203	Stationary
HG	−2.960416	0.0438	Stationary
HP	−2.894716	0.0511	Non-Stationary
PC	−4.022194	0.0023	Stationary

Source: Data processed, 2023.

TABLE II: Stationarity Test Results at First Difference

Variable	t-Statistic (ADF)	Probability	Result
HK	−5.184521	0.0000	Stationary
HG	−4.891996	0.0001	Stationary
HP	−4.693147	0.0003	Stationary
PC	−6.420340	0.0000	Stationary

Source: Data processed, 2023.

directly to these main markets to purchase bird's eye chili for the purpose of resale. From the retailers, it reaches the consumers, both for domestic consumption and industrial needs.

To examine the short-term or long-term relationships that occur, a price transmission analysis is conducted. Prices at the producer level, wholesale level, consumer level, and the production of bird's eye chili are the market price linkages that will be evaluated using this data. There are seven testing steps in the price transmission analysis using the Vector Error Correction Model (VECM): Stationarity Test, Optimal Lag Determination Test, Stability Test, Cointegration Test, VECM Estimation, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD).

3.2.1. Stationarity Test

In the stationarity data analysis, from results shown in Table I the consumer price level variable (HK) had a probability of 0.0203 < 0.05; the wholesale level (HG) had a probability of 0.0438 < 0.05; and bird's eye chili production (PC) had a probability of 0.0438 < 0.05; all these values are less than 0.05, indicating that these three variables reject the null hypothesis (Ho) and are stationary at level. However, the producer price level variable (HP) had a probability of 0.0511, suggesting acceptance of Ho, meaning the variable is non-stationary at the level. Therefore, it is necessary to continue stationarity testing at the first difference or I(1) to achieve stationarity.

According to Table II After transformation to the first difference, all variables became stationary, indicating probabilities >0.05. Thus, the stationarity test accepts H_1, indicating stationarity at the first difference. If stationarity at the first difference is found in the stationarity test, the analysis will proceed using the VECM model.

3.2.2. Determination of Optimal Lag

Based on the results of the optimal lag test, of all lag values, the lowest AIC value is at lag 2 with a value of 1.929110, was selected as the optimal lag. This indicates that the prices at the consumer level (HK), wholesale level (HG), producer level (HP), and the production of bird's eye chili (PC) have a short-term influence, specifically from two months prior, which is explained in table III.

TABLE III: Results of Optimal Lag Determination Analysis

Lag	AIC	Indication
0	2.012097	–
1	2.072644	–
2	1.929110	Optimal lag
3	2.082901	–
4	2.157446	–
5	2.231471	–
6	2.418127	–

Source: Data processed, 2023.

TABLE IV: Stability Test Results Analysis

Root	Modulus
-0.035321 − 0.622238i	0.623239
-0.035321 + 0.622238i	0.623239
-0.207201 − 0.471248i	0.514788
-0.207201 + 0.471248i	0.514788
−0.474541	0.474541
-0.084877 − 0.376932i	0.386370
-0.084877 + 0.376932i	0.386370
−0.023431	0.023431

Source: Data processed, 2023.

3.2.3. Stability Test

A VECM equation can be considered stable if the modulus values are <1 or all roots are still within the unit circle. From the stability test results shown in Table IV, it can be concluded that the chosen VECM estimation is stable. This is indicated by all variables being within the unit circle, as demonstrated by modulus values <1, allowing the analysis to proceed to the next test, which is the cointegration test.

3.2.4. Cointegration Test

Cointegration is addressed about short-term dynamics. The cointegration test is conducted at a 5% significance level by comparing the trace statistic with the critical value and the maximum eigenvalue. According to Table V, there are 4 cointegrated equations at r = 3. This is observed with a trace statistic and max-eigen value of 23.59830, which is greater than the critical value of 3.841466. Additionally, the results of the cointegration also show all probability values of the trace statistic and max-eigen value <0.05, indicating a long-term integration relationship. The analysis results accept H_1, meaning there is cointegration, which indicates a long-term relationship at the 5% significance level with 4 cointegrated equations and cointegration rank r = 3.

3.2.5. VECM (Vector Error Correction Model) Estimation

The VECM model illustrates the interrelationships among variables over time, as indicated by the presence of cointegration. The prior cointegration test confirmed the existence of cointegrated equations in long-term relationships. From Table VI In the long term, the price of bird's eye chili at the consumer level has a significant impact on the price at the producer level (−16.1942 > 1.995469), and the price at the producer level significantly affects bird's eye chili production (−5.95387 > 1.995469), with production significantly influencing the wholesale price of

TABLE V: Cointegration Test Analysis Results

Hypothesis		Trace statistic	Critical value	Probability
Ho	H_1			
r = 0	r = 1	149.5814	47.85613	0.0000
r = 1	r = 2	1.01219	29.79707	0.0000
r = 2	r = 3	53.66146	5.49471	0.0000
r = 3	r = 4	23.59830	3.841466	0.0000
Hypothesis		Max-Eigen value	Critical value	Probability
Ho	H_1			
r = 0	r = 1	58.56921	7.58434	0.0000
r = 1	r = 2	7.35072	21.13162	0.0001
r = 2	r = 3	30.06316	4.26460	0.0001
r = 3	r = 4	3.59830	841466	0.0000

Source: Data processed, 2023.

TABLE VI: Long-Term VECM Analysis Results

Cointegration equation	Bird's Eye Chili Price Variables			
	HG	HK	HP	PC
Kointegrasi 1	1.000000	−0.727702	−0.259697	−0.042839
		(0.04494)	(0.04362)	(0.00785)
		[−16.1942]	[−5.95387]	[−5.45909]

Note: () standard errors, [] t-statistics, t-table value: t(α = 5%) = 1,995469.
Source: Data processed, 2023.

bird's eye chili (−5.45909 > 1.995469). For every IDR 1000 increase in the wholesale price of bird's eye chili, there is a consequent decrease of IDR 7277 at the consumer price level, IDR 2596 at the producer price level, and a reduction in production by 428.39 kg.

To establish short-term VECM relationships with the presence of long-term equilibrium interconnections among variables, the equilibrium error is proposed. If there is a long-term equilibrium interconnection among variables, this connection can be expressed as the Error Correction Term (ECT). The error correction term (ECT) from the long-term equilibrium equation for bird's eye chili prices at the producer, wholesale, and consumer levels and production is denoted by ξ1t and shows a significant effect on short-term dynamics of 140251.5. This coefficient indicates that any imbalance occurring in bird's eye chili production in the short term will be corrected by 1.402%.

According to the VECM model, from table VII in the short term, an IDR 1000 increase in the wholesale price of bird's eye chili in the previous period will lead to a decrease of IDR 8015.6. An IDR 7071.6 increase is caused by an IDR 1000 increase in the consumer price of bird's eye chili in the previous period, and IDR 4272.5 is caused by an IDR 1000 increase two periods prior. There will be a price decrease of IDR 5988 at the current producer level for every IDR 1000 increase in the price of bird's eye chili from the previous period.

3.3. *Impulse Response Function*

The period used in this study spans 24 periods, meaning the response of a variable will persist for up to 24 future periods (two years). The Impulse Response Function (IRF) graph for each of the bird's eye chili price variables is presented in Fig. 2.

TABLE VII: Short-Term VECM Analysis

Error correction	D (HG)	D (HK)	D (HP)	D (PC)
CointEq1	−0.455285	1.226539	1.737770	14.02515
	(1.39372)	(1.49910)	(1.54588)	(5.10268)
	[−0.32667]	[0.81819]	[1.12413]	[2.74859]
D (HG (−1), 2)	−0.714193	−1.225887	−1.322728	−8.015672
	(0.96847)	(1.04169)	(1.07420)	(3.54575)
	[−0.73745]	[−1.17682]	[−1.23136]	[−2.26064]
D (HG (−2), 2)	−0.702528	−0.890780	−0.716104	−3.392419
	(0.56932)	(0.61237)	(0.63148)	(2.08440)
	[−1.23397]	[−1.45465]	[−1.13401]	[−1.62752]
D (HK (−1), 2)	0.051344	0.076910	1.119232	7.071686
	(0.80583)	(0.86676)	(0.89381)	(2.95030)
	[0.06372]	[0.08873]	[1.25221]	[2.39694]
D (HK (−2), 2)	0.369781	0.324050	0.502676	4.272503
	(0.49053)	(0.52761)	(0.54408)	(1.79591)
	[0.75385]	[0.61418]	[0.92390]	[2.37902]
D (HP (−1), 2)	−0.168370	0.268829	−0.598862	0.921667
	(0.27004)	(0.29046)	(0.29952)	(0.98867)
	[−0.62350]	[0.92553]	[−1.99938]	[0.93222]
D (HP (−2), 2)	−0.141799	0.083091	−0.288504	−0.571790
	(0.24069)	(0.25889)	(0.26697)	(0.88123)
	[−0.58913]	[0.32095]	[−1.08065]	[−0.64886]
D (PC (−1), 2)	0.015597	0.062384	0.064290	−0.284182
	(0.04912)	(0.05284)	(0.05449)	(0.17985)
	[0.31751]	[1.18065]	[1.17989]	[−1.58007]
D (PC (−2), 2)	−0.014808	0.017564	0.009296	−0.267005
	(0.03686)	(0.03965)	(0.04089)	(0.13496)
	[−0.40171]	[0.44298]	[0.22735]	[−1.97839]
C	0.006288	0.005517	0.004546	−0.000175
	(0.04801)	(0.05164)	(0.05325)	(0.17576)
	[0.13097]	[0.10684]	[0.08538]	[−0.00099]
R-squared	0.527766	0.508824	0.495321	0.453453

Note: () standard errors, [] t-statistics, t-table value: t(α = 5%) = 1995469.
Source: Data processed, 2023.

When shocks occur, they result in both positive and negative responses. For instance, a shock equivalent to one standard deviation in the price of bird's eye chili can cause prices to rise or fall. This effect is influenced by prices at the wholesale level, producer level, consumer level, and the production of bird's eye chili. These dynamics illustrate how interconnected the elements of the bird's eye chili market are, showing how a change in one segment can ripple through to others.

3.4. *Forecast Error Variance Decomposition*

The forecast error variance decomposition analysis is conducted to determine the extent to which changes in a variable originate from the variable itself, following the impulse response function testing at the producer, wholesale, and consumer levels, and the production of bird's eye chili.

From Table VIII, it is apparent that the primary source of variation in the wholesale price of bird's eye chili is shocks from the wholesale price level itself, which explains 100% of the price changes at the wholesale level in the initial period, with minimal contribution from other factors. The influence of bird's eye chili production on wholesale price variation is relatively small throughout the periods.

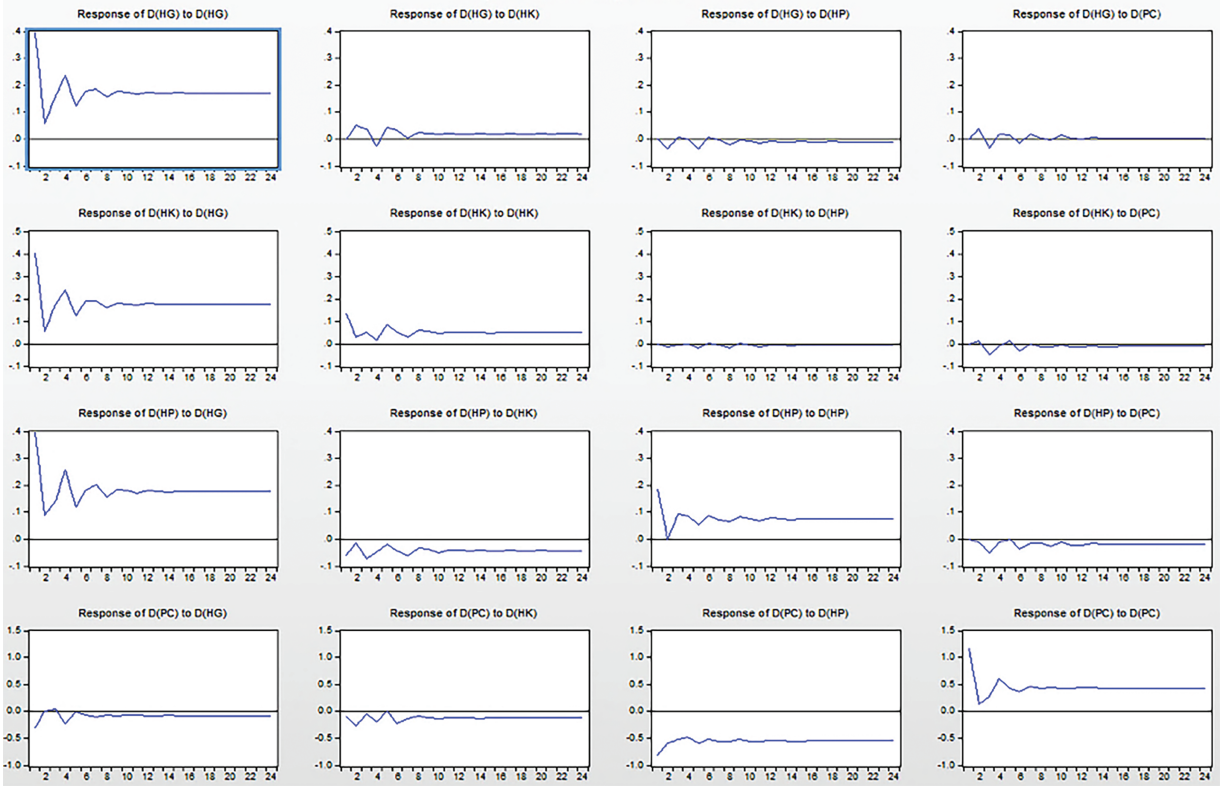

Fig. 2. Impulse response function analysis results. Source: Data processed, 2023.

TABLE VIII: FEVD Analysis Results for Wholesale Price

Period	Shock (%) on wholesale price			
	D (HG)	D (HK)	D (HP)	D (PC)
1	100.0000	0.000000	0.000000	0.000000
2	96.62872	1.515784	0.845802	1.009692
3	95.83182	1.992632	0.759174	1.416373
4	96.37305	1.834925	0.588342	1.203686
5	95.45682	2.346103	1.001963	1.195115
6	95.54487	2.421454	0.900583	1.133090
7	95.88906	2.171674	0.812575	1.126695
8	95.83884	2.198800	0.912680	1.049682
9	96.05876	2.131014	0.840716	0.969507
10	96.22364	2.044566	0.794377	0.937418
11	96.29121	2.034729	0.792161	0.881902
12	96.45429	1.967253	0.752695	0.825762
13	96.56249	1.921578	0.728531	0.787396
14	96.63344	1.906760	0.711626	0.748176
15	96.73412	1.867631	0.687226	0.711021
16	96.81396	1.834636	0.671244	0.680163
17	96.87870	1.814078	0.656436	0.650781
18	96.94589	1.790013	0.639863	0.624238
19	97.00433	1.767957	0.627099	0.600614
20	97.05799	1.748625	0.615227	0.578155
21	97.10884	1.730081	0.603374	0.557704
22	97.15391	1.713947	0.593056	0.539087
23	97.19646	1.698598	0.583388	0.521550
24	97.23670	1.683729	0.574275	0.505296

Source: Data processed, 2023.

From Table IX, shocks to bird's eye chili prices at the wholesale level and the consumer level themselves are significant sources of price variation from the first period to the last. Specifically, the impact of production-related shocks is relatively small. Initially, no other factors contribute to the variability of bird's eye chili prices at the consumer level. This can be attributed to changes in the wholesale price of bird's eye chili, which accounts for 90.33% of the variation, and changes at the consumer level, which contributes 9.66% to the variation.

According to Table X the FEVD results for the producer level show that the primary drivers of price variability are the shocks from the wholesale price of bird's eye chili, the consumer price, and the producer price itself. In the initial period, the changes in wholesale price (80.38%), consumer price (1.80%), and producer price (17.80%) are the main factors explaining the variability at the producer level. The influence of bird's eye chili production remains relatively small throughout the periods.

From Table XI, the shocks in the wholesale price of bird's eye chili, consumer price, producer price, and the production of bird's eye chili itself from the first to the last period are the primary sources of variation in the production of bird's eye chili, while the shocks from the consumer price level of bird's eye chili are relatively small. Throughout the first period, changes in the price of bird's eye chili at the wholesale level (4.33%), consumer level (0.47%), producer level (30.58%), and production level (64.59%) contribute to explaining the variability in bird's eye chili output.

The transmission of bird's eye chili prices from the producer to the consumer through wholesale prices and the production of bird's eye chili indicates price efficiency, which also encompasses the price information gathered from the producer level to the consumer level.

Based on the data analysis, the price of bird's eye chili is transmitted from the producer level to the consumer level.

TABLE IX: FEVD Analysis Results for Consumer Price

Period	Shock (%) in consumer price			
	D (HG)	D (HK)	D (HP)	D (PC)
1	90.33258	9.667416	0.000000	0.000000
2	89.93010	9.841094	0.157847	0.070960
3	89.34979	9.389091	0.156852	1.104268
4	91.37213	7.571723	0.127331	0.928814
5	89.41541	9.449193	0.247466	0.887928
6	89.54786	9.159824	0.223291	1.069021
7	90.37653	8.439134	0.217388	0.966950
8	90.08466	8.662071	0.293814	0.959458
9	90.15121	8.636719	0.269817	0.942255
10	90.41571	8.442553	0.260798	0.880940
11	90.44563	8.399558	0.280027	0.874783
12	90.58017	8.288098	0.266971	0.864762
13	90.66254	8.247454	0.261519	0.828491
14	90.70681	8.220566	0.260796	0.811830
15	90.80923	8.136808	0.255102	0.798861
16	90.87514	8.091060	0.253020	0.780781
17	90.91435	8.068744	0.250152	0.766748
18	90.97444	8.025742	0.246354	0.753467
19	91.02642	7.987526	0.244674	0.741378
20	91.06723	7.958842	0.242570	0.731363
21	91.10798	7.931145	0.240006	0.720869
22	91.14530	7.905256	0.238224	0.711216
23	91.18051	7.879904	0.236528	0.703059
24	91.21345	7.856666	0.234794	0.695090

Source: Data processed, 2023.

TABLE X: FEVD Analysis Results for Producer Price

Period	Shock (%) on producer price			
	D (HG)	D (HK)	D (HP)	D (PC)
1	80.38892	1.802725	17.80836	0.000000
2	81.00838	1.844614	17.07740	0.069607
3	76.84835	3.860325	18.20136	1.089961
4	79.40335	3.607084	16.12694	0.862626
5	79.49924	3.504000	16.18067	0.816090
6	78.99965	3.603381	16.33600	1.060969
7	79.24158	4.085986	15.68411	0.988322
8	79.38144	4.040150	15.60359	0.974821
9	79.38124	3.957430	15.64861	1.012718
10	79.41929	4.118769	15.49972	0.962216
11	79.51583	4.149537	15.35674	0.977893
12	79.53826	4.153745	15.31795	0.990040
13	79.58454	4.182399	15.27045	0.962615
14	79.64272	4.196595	15.19659	0.964097
15	79.66067	4.228777	15.14410	0.966460
16	79.69843	4.246942	15.09777	0.956865
17	79.73478	4.252386	15.05869	0.954144
18	79.75537	4.270865	15.02259	0.951183
19	79.78167	4.287672	14.98323	0.947431
20	79.80586	4.296782	14.95181	0.945552
21	79.82543	4.307061	14.92512	0.942385
22	79.84536	4.318039	14.89702	0.939584
23	79.86313	4.327719	14.87120	0.937947
24	79.87940	4.336331	14.84849	0.935775

Source: Data processed, 2023.

This discrepancy arises because producers, distributors, and consumers do not have the same understanding of bird's eye chili prices. Price transmission from producer traders to consumer traders is relatively poor in the bird's eye chili marketing industry. Although consumer-level prices are essentially fixed, powerful traders can influence the purchase prices of bird's eye chili producers, allowing them to minimize producer prices and maximize their profits. Similarly, traders cannot fully pass on price increases to farmers when bird's eye chili prices rise at the consumer level.

TABLE XI: FEVD Analysis Results for Bird's Eye Chili Production

Period	Shock (%) on bird's eye chili production			
	D (HG)	D (HK)	D (HP)	D (PC)
1	4.338564	0.477590	30.58387	64.59998
2	3.581949	3.176516	39.21516	54.02638
3	3.205761	2.886494	43.92611	49.98163
4	4.137011	3.380523	41.94622	50.53625
5	3.613103	2.953469	45.14721	48.28622
6	3.346667	3.728939	46.56136	46.36304
7	3.196098	3.686500	47.60764	45.50976
8	2.982032	3.500184	48.87731	44.64048
9	2.862774	3.473350	49.44187	44.22201
10	2.729271	3.499973	50.27722	43.49354
11	2.609920	3.487860	50.97540	42.92682
12	2.526778	3.439494	51.46094	42.57279
13	2.444248	3.408565	51.92423	42.22296
14	2.368044	3.412671	52.35726	41.86202
15	2.303357	3.398930	52.74839	41.54932
16	2.246505	3.377543	53.07590	41.30006
17	2.194199	3.364020	53.36918	41.07260
18	2.146303	3.356976	53.65016	40.84656
19	2.103027	3.348069	53.90292	40.64598
20	2.063888	3.336684	54.12793	40.47149
21	2.027892	3.327665	54.33548	40.30896
22	1.994405	3.321243	54.52930	40.15505
23	1.963607	3.314369	54.70810	40.01392
24	1.935262	3.307070	54.87219	39.88548

Source: Data processed, 2023.

Farmers do not react quickly to price changes at the consumer or wholesale level because the price formation of bird's eye chili is not interdependent. For farmers, any increase in the producer-level price of bird's eye chili is concerning as it impacts their ability to enjoy profits, considering that the costs of maintaining chili cultivation require significant capital. Farmers look forward to periods when bird's eye chili prices spike.

Local prices for bird's eye chili will indeed plummet when there is an increase in supply due to imports. As key players in price setting within the marketing industry, wholesale traders react to market conditions by lowering their buying and selling prices at the wholesale level to reduce the risk of losses.

The perishable nature of bird's eye chili supports the mechanism of price adjustment. Once harvested, bird's eye chili will lose its freshness within one to three days if not processed further. If storage is required, the costs are significant. Meanwhile, bird's eye chili continues to be distributed to consumer areas and enters the main markets. Given these considerations, market actors cannot engage in conditional activities to enhance their profits, such as withholding supply or manipulating prices.

Price transmission occurs where the price of bird's eye chili at the producer level has a more significant impact on the fluctuations of prices at the buyer level. This is presumed to be due to the stock of bird's eye chili originating from various districts and a large number of chili farmers. Even though farmers are known as price takers in selling their goods, they have the opportunity to increase their income by choosing marketing channels for their products.

In a market with only one supplier, the farmer's price is determined by the trader, thus creating a price transmission pattern. Lower-level farmers, who are also producers and marketers, function as price receivers, accepting prices set by wholesale traders. Prices for bird's eye chili often fluctuate, and farmers usually do not have any influence over these prices.

Therefore, the best action for traders is to monitor market prices as this will help each trader secure a better price. Even though the base price obtained by retail traders might differ slightly from that obtained by other traders, the prices at the retail level tend to remain consistent. Market forces are not sufficient for any trader to control prices. Given this, it can be said that the process of market supply and demand influences the formation of prices in the market.

4. Conclusion and Recommendations

4.1. Conclusion

Based on the results of the study, the following conclusions can be drawn:

1. The price of bird's eye chili exhibits monthly fluctuations. There is a higher price fluctuation at the producer level, which indicates that the bargaining power of farmers in setting the price of bird's eye chili is considered weak. Data from the Tapin Regency Agricultural Office shows that the highest producer price for bird's eye chili was in June 2022 at IDR 90,000, while the highest consumer price was in January 2022 at IDR 120,000. It is observed that when prices rise at the consumer level, prices do not increase at the producer level.
2. There is asymmetric price transmission from the producer level to the consumer level for bird's eye chili. Short-term and long-term relationships exist in prices at the consumer level, wholesale level, producer level, and bird's eye chili production. When price shocks occur, they result in both positive and negative responses, where a shock of one standard deviation in the price of bird's eye chili can cause prices to rise or fall, as an effect caused by prices at the wholesale level, producer level, consumer level, and bird's eye chili production. Additionally, wholesale prices have a significant impact on price changes of bird's eye chili from the producer to the consumer level in Tapin Regency.

4.2. Recommendations

Based on the findings and discussions of this study, several recommendations are proposed:

1. Government policies should regulate the supply and demand of bird's eye chili to stabilize prices at the consumer level (in the market). This is necessary because strong consumer demand, not matched by high stock levels at the producer level, leads to price fluctuations.
2. A smooth information technology system should be established to quickly relay information about bird's eye chili prices at the consumer level, so it can be promptly communicated to the producer level (farmers).

Conflict of Interest

The authors declare that they do not have any conflict of interest.

References

[1] Arizka H. Analisis Faktor-Faktor Yang Mempengaruhi Fluktuasi Harga Cabai Rawit Di Pasar Barandasi, Kabupaten Maros [Analysis of Factors Affecting Fluctuations in Prices of Cayenne Pepper at Barandasi Market, Maros Regency]. e-jurnal. Program Studi Agribisnis, Fakultas Pertanian, Universitas Muslim Indonesia; 2018.

[2] Firdaus M, Gunawan DI. Integration among regional vegetable markets in Indonesia. *J Int Soc Southeast Asian Agri Sci*. 2012;18(2):96–106.

[3] Conforti P. *Price Transmission in Selected Agricultural Markets. Commodity and Trade Policy Research Working Paper 7*. Rome: Food and Agriculture Organization (FAO); March 2004.

[4] Dinas Pertanian Kabupaten Tapin. *Data Statistik Tanaman Hortikultura [Horticultural Crops Statistical Data]*. Kabupaten Tapin Kalimantan Selatan; 2017–2021.