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UNDERSTANDING THE DYNAMICS OF CORN MARKET INTEGRATION

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ABSTRACT

This study aims to analyze price variations at both the producer and consumer levels (1), investigate price transmission elasticity (2), and assess the degree of integration in the vertical corn market between producers (farmers) and consumers (retailers) in East Java Province (3). The analysis of market integration serves as vital input for the government in formulating agricultural development policies within the research area. Conducted as a quantitative study, this research utilized secondary data, specifically monthly time series data spanning from January 2018 to December 2021. The data included corn price information at the producer level sourced from the Agriculture and Food Security Office of East Java Province, and consumer-level corn price data obtained from the East Java Province Industry and Trade Office (SiSKAPERBAPO website). The data underwent descriptive quantitative analysis. The findings reveal that the coefficient of price variation at the producer level is 8.9 percent, indicating high fluctuation and instability, whereas at the consumer level, it stands at 2.8 percent, signifying lower and stable fluctuations. The price elasticity (et) of corn for the years 2019-2021 was calculated as 0.0033 (inelastic), -0.2029 (inelastic), and 2.6359 (elastic), respectively. These results suggest that the rate of price change at the consumer level exceeded that at the producer level (an et value > 1 indicates inefficient corn marketing). The analysis of corn market integration in East Java reveals weak integration between producer and consumer markets in both the short and long terms. This indicates imperfect transmission of market information by market participants, particularly large traders who play a significant role as price setters.

Keywords: Producers; Consumers; Price Transmission; Fluctuations; Market Integration.

INTRODUCTION

In the fourth quarter of 2021, East Java's GDP grew by 0.14 percent compared to the same period in 2020. While most industries in East Java experienced economic growth, there were declines in some sectors, including agriculture, forestry, and fisheries. The transportation and warehousing industry saw a significant increase of 19.62 percent, and the accommodation and food services sector grew by 7.71 percent. The manufacturing sector, with a growth of 2.17 percent, marked the largest increase among all industries.

Agriculture is one of the key industries driving East Java's economy. Based on GDP allocation per sector, the agricultural industry's growth was 10.06 percent in 2019, which increased to 10.40 percent in 2020 but slightly declined to 10.22 percent in 2021 after experiencing a 0.34 percent rise (Badan Pusat Statistik Jatim, 2021). In East Java's economy, corn is a significant crop. After rice, corn is one of the main commodities contributing substantially to economic growth. Corn contributes 15.67 percent to the

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GDP of the food crop sub-sector and grows at an annual rate of 1.2 percent (Sulaiman & Widarma, 2018). This indicates that corn has a considerable impact on the national economy and the food crop sub-sector.

Besides being a food source like rice, corn has other advantages, including its use as a raw material in various industries and animal feed. Consequently, the demand for corn increases year by year, aligning with population growth. Due to the high demand and lucrative prices, farmers are highly motivated to cultivate and expand their corn plantations. From 2012 to 2021, the harvested area of corn in East Java grew at an average rate of 0.25 percent per year, while production increased by an average of 1.34 percent annually (Badan Pusat Statistik Jatim, 2021). The trade and price of corn are influenced by the increasing demand. During the months leading up to harvest, corn prices at both producer and consumer levels are highly volatile, often dropping during the peak harvest season. Moreover, there is often a shortage of corn, which is insufficient to meet the demand in East Java due to variations in production and consumption across regions and throughout the year.

Traders often exploit corn price fluctuations to manipulate price information at the producer level, leading to asymmetric price shifts from consumer markets to producer markets. When consumer prices rise, the increase is not quickly reflected at the producer level and vice versa (Nuraeni et al., 2015; Simatupang, 1999). The higher demand for animal feed compared to the corn supply causes price volatility for both producers (farmers) and consumers (especially feed mills and egg producers). The disparity between market demand and supply affects trade and other market prices through market integration. Corn prices at the producer level influence prices at the consumer level.

This situation demonstrates market integration between farmers (producers) and consumers (Rapsomanikis et al., 2006; Sari et al., 2021). Market integration is a way to analyze price relationships between markets. According to Zunaidah et al. (2015), market integration refers to the movement of price levels across regions where, under similar conditions, a product has the same price even when sold in different locations, and price information is communicated uniformly. Accurate and continuous market information is essential for this integration. When consumers and producers have precise and ongoing market information, market participants can react swiftly to price changes, enabling quick and accurate decision-making (Nuraeni et al., 2015).

Market integration explains the response to price shocks across markets. With an integrated market, changes in consumer corn prices are expected to be reflected and monitored at the producer level. However, current agricultural conditions indicate that significant increases in consumer corn prices are not adequately followed by corresponding changes in producer prices. This trend is consistent with corn price developments in East Java at both producer and consumer levels, showing that changes in producer prices do not match changes in consumer prices. This indicates that price information is not well-distributed and that the transmission of corn prices to East Java is still relatively low. This study aims to provide an overview of corn market integration in East Java Province by examining changes in corn prices at the farmer (producer) and consumer levels, serving as valuable information for improving corn marketing policies in the province.

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METHODS

The method used in this research is a quantitative method, as the data involved is also quantitative. The purpose of utilizing quantitative data is to make the content more easily understood, to categorize and summarize it concisely, and to identify general patterns that emerge from the data. The data source for this research is secondary data, obtained from various sources as second-hand, third-hand, and so on. The data collected includes monthly data on the average price of dry shelled corn at the producer (farmer) and consumer levels in East Java. This time series data spans from January 2018 to December 2021.

Data was acquired from several relevant institutions, including producer price data from the East Java Provincial Agriculture and Food Security Office, consumer price data from the East Java Provincial Industry and Trade Office (via the SiSKAPERBAPO website), the Central Bureau of Statistics, books, journal reports, and other sources.

The data collection technique employed was observation. Observation is a data collection technique that involves direct observation of the research object and systematically recording phenomena related to the research. The data analysis technique used in this research is descriptive quantitative analysis. Descriptive quantitative analysis is a data analysis method that uses numbers, from data collection, interpretation, to presentation of the results. It is used to describe market integration of corn in the research location. Several data analysis methods were employed in this study:

1. Corn Price Variation Analysis Using the Coefficient of Variation

   The coefficient of variation is the standard deviation of a variable divided by its mean, mathematically formulated as:

   $$Coefficient\ of\ Variation\ (CV) = \frac{Standard\ Deviation}{Mean} \times 100\%$$

   The coefficient of variation of corn prices illustrates periodic fluctuations (deviation from the mean) used to determine the stability of a specific commodity price. A city's/province's price is considered stable if the price variation factor ranges between 5-9%. If the coefficient of variation exceeds 9%, it indicates that the price is highly volatile and unstable (Ministry of Trade, 2010).

2. Price Elasticity Analysis of Corn Market

   Price transmission elasticity is calculated to determine the relationship between product prices and final consumer prices. Price elasticity is calculated as the ratio of the relative price change at the producer level (Pf) to the relative price change at the consumer level (Pr). The following formula is used to calculate price transmission elasticity:

   $$e_t = \frac{\Delta Pf}{\Delta Pr} \times \frac{Pr}{Pf}$$

   Where:

   e_t = price transmission elasticity
   ΔPr = change in consumer prices
   ΔPf = change in producer prices
   Pr = average change in consumer prices
   Pf = average change in producer prices

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3. Corn Market Integration Analysis
   The method used to analyze corn market integration in East Java Province is the Vector Error Correction Model (VECM). This model requires that all dependent variables be stationary (mean, variance, and covariance are constant) and that all residuals are white noise, meaning they have a zero mean, constant variance, and are independent.

RESULTS AND DISCUSSION

Food crops, particularly corn, are products that frequently experience price fluctuations due to their constant demand throughout the year. However, seasonal production is the most crucial factor influencing the prices of these goods. In this context, analyzing price fluctuations is essential for planning price stabilization and increasing corn production, as well as forecasting future corn prices. Additionally, price analysis is often used to examine price behavior and related variables. To understand trends, cycles, or the stability of commodity prices at specific points in time, the use of price analysis is important (Santika, 2008).

Corn production is seasonal because it is a preferred crop for farmers, often planted alongside rice. Furthermore, corn serves as a substitute crop that can be grown by farmers besides horticultural crops. Corn is typically planted after the rice harvest (during the dry season), resulting in price variations. The price fluctuations of corn are actually caused by two factors: supply fluctuations (such as agricultural production decisions, weather, pests and diseases, and harvested area) while demand tends to increase, and the one-sided corn pricing system. This one-sided supply system is characterized by prices set by intermediaries for purchasing corn from farmers. In the context of corn purchasing prices in East Java, farmers act as price takers while intermediaries act as price makers. Price information is a critical component of market information needed by farmers, especially as producers.

The corn season leads to price fluctuations. These price fluctuations create a pattern of regular price movements that occur annually. The tendency for corn prices to fluctuate almost throughout the year causes concern among farmers and consumers due to the uncertainty of corn prices. Generally, the discussion about corn prices, their formation, and variations is determined by key factors such as location, market structure, and time. This discussion will focus on the variation in corn prices over time at the producer and consumer levels.

Development of Corn Price Variation at the Producer Level in East Java

Stabilizing corn prices is a major economic issue for corn farmers in East Java Province due to continuous price fluctuations throughout the year. When corn prices drop, farmers are less inclined to cultivate it. In subsequent periods, production declines, leading to a gradual increase in corn prices. This situation affects the purchasing power of low-income consumers and accelerates inflation. Below is the development of the average monthly corn prices in East Java Province from 2018 to 2021.

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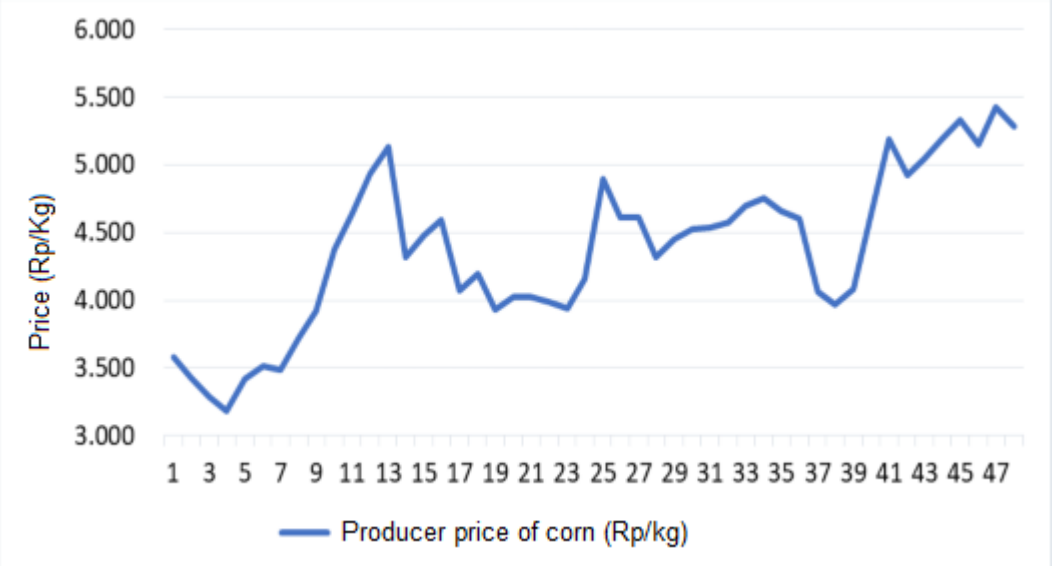

Figure 1. Development of Average Corn Prices at the Producer Level (Rp/Kg) for the Period 2018-2021 (Monthly)
Source: Based on data from the Department of Agriculture and Food Security of East Java Province (2022), after processing.

Based on Figure 8, it is shown that the development of corn prices at the farmer level in East Java Province for the period 2018-2021 (monthly) tends to fluctuate. There is an average annual price pattern. In early 2018, prices showed an upward trend, stabilizing mid-year, but rising again towards the end of the year. A significant price change occurred in December 2021, reaching Rp.5,130/Kg, which caused concern among consumers. This significantly increased the interest of corn farmers to boost production. However, when production increases during the harvest season across various regions, intermediary traders with limited capital struggle to absorb all the production, while the market is oversupplied and unable to store large quantities for long. As a result, corn prices gradually drop to Rp 3,970/Kg. This price decline also leads to a reduction in cultivation areas, as corn farming primarily uses rice paddies and dry lands also used for horticultural crops.

An analysis of price variations conducted on the average monthly corn prices at the farmer level from January 2018 to December 2021 shows a fluctuating pattern. The results from the average coefficient of price variation for corn during 2018-2021 (Table 2) indicate that price fluctuations in East Java Province at the farmer level are high and approach instability based on the Ministry of Trade's criteria of above 9 percent, with an average coefficient of variation of 8.9 percent. A detailed analysis of the coefficient of price variation for corn in East Java Province is shown in the figure below.

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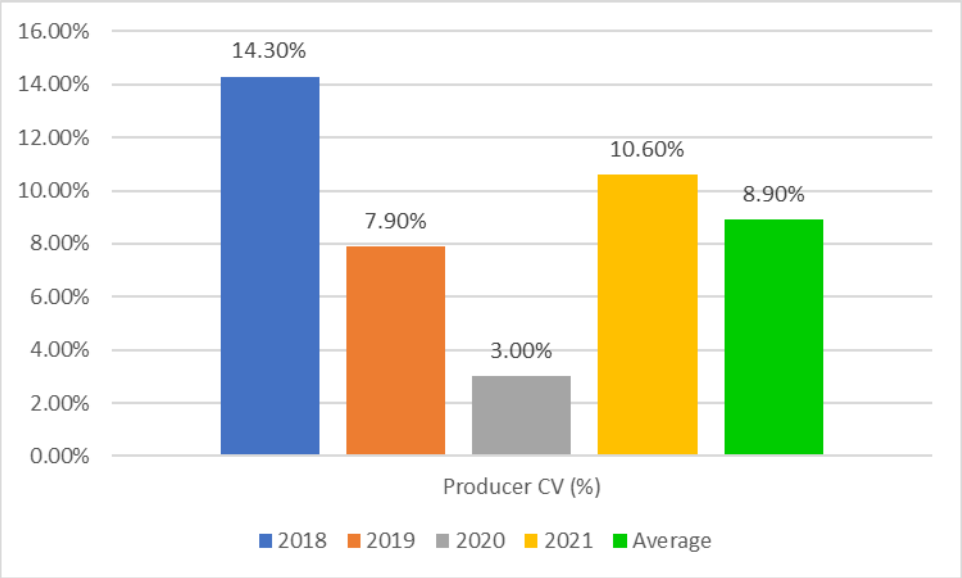

Figure 2. Coefficient of Price Variation for Corn at the Producer Level
Source: Based on data from the Department of Agriculture and Food Security of East Java Province (2022), after processing.

Figure 2 shows that the highest coefficient of variation was in 2018, reaching 14.3 percent, followed by 10.6 percent in 2021. The coefficient of variation was relatively stable in 2019 at 7.9 percent and in 2020 at 3 percent. High price variation occurs when corn availability is abundant in the market, but short-term demand remains consistent throughout the year. Consequently, corn prices reached their lowest point at Rp 3,185/Kg. The analysis of the coefficient of price variation in East Java shows that corn price fluctuations at the producer level are high and unstable based on the Ministry of Trade's criteria, as they approach above 9 percent. Large fluctuations are due to uneven distribution throughout the year and inefficient storage mechanisms, resulting in production during the season being unable to meet off-season demand (Irawan, 2007; Bappenas, 2013; Reza, 2015).

This research is consistent with Sandra et al. (2012), who found that the price of raw materials for curly red chili varies significantly. The coefficient of variation for consumption area is smaller than for production area (consumer CV 42.35% < producer CV 64.41%). This indicates that the price of curly red chili is relatively stable compared to the price at the farmer level, meaning the price variation is higher at the farmer level than at the consumer level. Nuraeni et al. (2015) also stated that the price fluctuation of vegetable crops is greater at the farmer level compared to the consumer level. For example, the price fluctuation of shallots at the producer, wholesale, and retail levels is significant and unstable. This is demonstrated by comparing the coefficients of variation (producer CV 24.15% > consumer CV 21.15%), according to the Ministry of Trade's criteria, price fluctuations for shallots are large and unstable as they exceed 9 percent.

Price fluctuations due to changes in supply and demand balance occur when supply exceeds demand, causing prices to drop, or vice versa. Creating a competitive market requires price volatility. Without price fluctuations, the market cannot function effectively as farmers are not incentivized to increase production. Price fluctuations become problematic when prices rise rapidly due to scarce and unpredictable product supplies, creating uncertainty that can increase risks for producers, retailers, consumers,

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and the government. Price changes that do not align with market functions cause new problems that can lead to government decision-making errors (Ministry of Trade, 2010).

Variation in Consumer Corn Prices

Changes in corn prices can influence traders' behavior, prompting them to adjust the prices of other related food commodities. Repeated increases and decreases in prices can lead to price instability. The following is the monthly average corn price trend at the consumer level in East Java Province from 2018 to 2021.

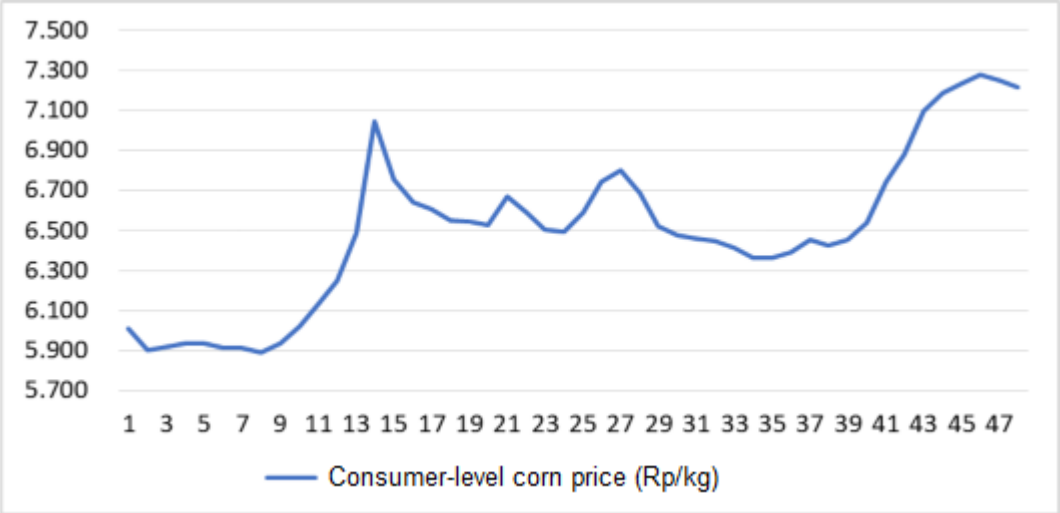

Figure 9. Average Consumer-Level Corn Price Trend (Rp/Kg) from 2018 to 2021 (Monthly)

Source: Source: Based on data from SISKAPERBAPO, East Java Provincial Department of Industry and Trade (2022), after processing.

Figure 9 shows that the monthly average corn prices at the consumer level in East Java Province from 2018 to 2021 exhibit a fluctuating trend. Within a year, the average price typically follows a regular pattern. At the beginning of 2018, prices tended to rise and remained stable in the middle of the year but increased again towards the end of the year, reaching Rp 6,247/kg in December. When prices changed to Rp 7,216/kg in December 2021, it caused significant concern among consumers. This price hike greatly encouraged corn farmers to increase their production. However, simultaneous harvest seasons across different regions led to middlemen with limited capital being overwhelmed by the abundant production, resulting in an oversupply in the market that could not be stored for long. Consequently, corn prices gradually dropped to Rp 5,903/kg. The decline in corn prices also led to a reduction in the cultivated area. Farmers primarily use their farmland for corn cultivation, alternating with horticultural crops.

Based on the analysis of price variation conducted on the monthly average consumer corn prices from January 2018 to December 2021, the price movement exhibited a fluctuating pattern. The average coefficient of variation for corn prices from 2018 to 2021 (Table 1) indicates that the price fluctuation at the consumer level in East Java Province was low and close to stable according to the criteria set by the Ministry of Trade, which is below 9 percent. The average coefficient of variation was 2.8 percent. The complete analysis of the coefficient of variation in consumer corn prices in East Java Province is shown in the following figure.

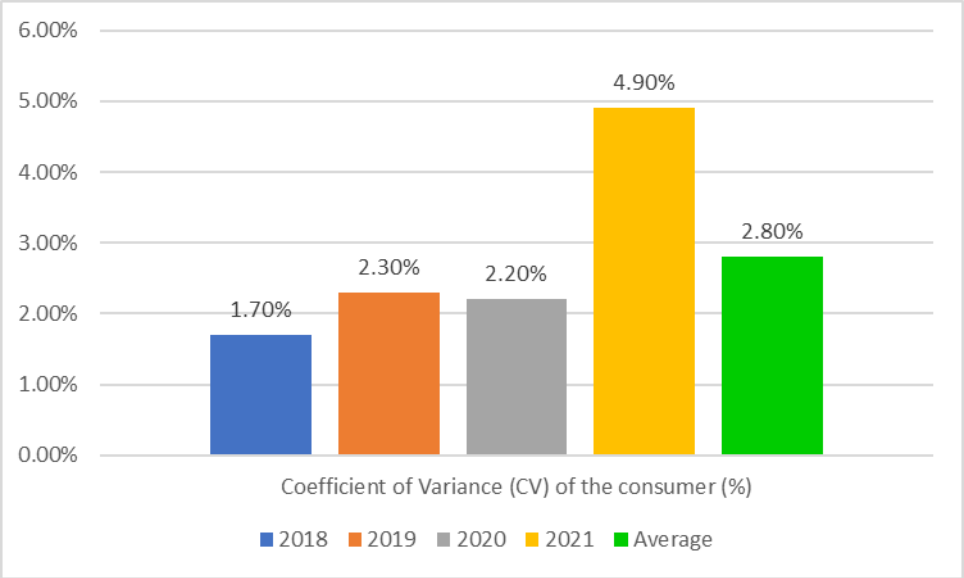

Figure 3. Coefficient of Variation in Consumer Corn Prices
Source: Based on data from SISKAPERBAPO, East Java Provincial Department of Industry and Trade (2022), after processing.

Based on the coefficient of variation in corn prices shown in Figure 3, it is evident that the fluctuation in consumer-level corn prices in East Java is low and stable according to the Ministry of Trade's criteria, as it is below 9 percent (2% < 9%).

Elasticity of Corn Price Transmission in East Java Province

Price elasticity is used to understand the relationship between prices at the farmer level and those at the final consumer level. Price transmission elasticity is calculated as the ratio of the relative change in producer prices (Pf) to the relative change in consumer prices (Pr). The complete analysis of corn price transmission elasticity in East Java Province is illustrated in the following figure.

Figure 4. Elasticity of Corn Price Transmission
Source: Processed from secondary data

Based on Figure 4, it is evident that the price elasticity (et) of corn in East Java Province in 2019 was 0.0033 (et < 1). This indicates that if the consumer price of corn

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increases by 0.0033%, the producer price will increase by 0.0033%, ceteris paribus (and vice versa). This means that a 1 percent change in consumer prices results in less than a 1 percent change in producer prices, suggesting an imperfectly competitive and inefficient market.

In 2020, the price elasticity (et) of corn in East Java Province was -0.2029 (et < 1). This signifies that if the consumer price of corn rises by 0.2029%, the producer price will decrease by 0.2029%. This also indicates that a 1 percent change in consumer prices results in less than a 1 percent change in producer prices, pointing to an imperfectly competitive and inefficient market. In 2021, the price elasticity (et) of corn in East Java Province was 2.6359 (et > 1). This indicates that a 1 percent change in consumer prices results in a more than 1 percent change in producer prices. This shows that the rate of price change at the consumer level is smaller compared to the rate of price change at the producer level. An et value greater than 1 suggests that corn marketing is inefficient. This inefficiency is likely due to corn sale prices being determined by only a few marketing institutions, leading to an imperfectly competitive market. These findings align with Widiastuti (2012) research, where an et value greater than 1 indicates ineffective commercialization. Additionally, this trend is caused by high market margins due to the selling prices set by middlemen.

According to Acharya et al. (2013), effective marketing occurs in a truly competitive market structure. However, this is rarely the case in practice. Common marketing structures are oligopsony or oligopoly, which are competitive market structures. Price transmission is also influenced by government policies in both markets, whether under normal conditions or specific circumstances, such as when commodity prices are extremely low or high.

Vertical Corn Market Integration at the Consumer Level in East Java Province

Market integration measures how much price changes in the reference market (upstream markets such as retailers) result in changes in downstream markets (e.g., farmer markets). This shows that market integration analysis is closely related to market structure analysis (Asmarantaka, 2009). Conceptually, market integration can be divided into two types: regional market integration and vertical market integration. Regional market integration refers to the relationship between one regional market and another, while vertical market integration refers to the relationship between different marketing institutions within the marketing chain (Simbalon, 2013).

Vertical marketing integration demonstrates a close relationship between marketing institutions within the marketing chain. Vertical market integration is influenced by the distribution of price information, which must be evenly distributed among all market institutions (producers - wholesalers - retailers - consumers). If this information is not perfectly communicated to consumers, the prices formed in the market do not reflect good vertical market integration (Asmarantaka, 2009).

According to Irawan and Ros, the analysis of corn market integration in this study focuses on corn prices at the farmer level compared to the consumer level. Corn price indicators are used to observe market conditions and understand the relationship between the producer and consumer markets. The analysis of corn market integration employs the VECM method, with the following steps:

1. Stationarity Test

The stationarity test is performed on all variables to ensure that the survey data, which is time series data, is stationary and to avoid spurious regression models. The stationarity of corn price data at the producer and consumer levels is determined using the ADF unit root test with the following hypotheses:

H0: Non-stationary data

H1: Stationary data

Decision-making in this stationarity test is as follows: if the absolute value of the ADF-test > ADF-table at a 5 percent confidence level, H0 is rejected, indicating that the data is stationary. Conversely, if the absolute value of the ADF-test < ADF-table, H1 is rejected, indicating that the data is non-stationary. The stationarity test of corn prices is conducted using the Augmented Dickey-Fuller Test at a 5 percent significance level at both the level and first difference. The stationarity test results are presented in Table 5.

Table 5. Stationarity Test on HK and HP Variables Using Augmented Dickey-Fuller Test at First Difference (EViews)

Variable	Augmented Dickey-Fuller test t-Statistic	Test Critical Values (5%)	Description
Level Condition			
HK	-2.926622	-2.926622	Not stationary
HP	-1.387224	-2.926622	Not stationary
First Difference Condition			
HK	-4.227407	-2.928142	Stationary
HP	-4.721426	-2.928142	Stationary

Source: Processed Secondary Data (2023)

Table 5 shows that the corn prices at the producer and consumer levels are stationary at the first difference, with t-statistics lower than the 5 percent test critical values. The corn price variables at the producer and consumer levels are indicated by values of (-4.227407) and (t-statistic -4.721426) < critical value (5% = -2.928142). Thus, the model accepts H1, indicating that both variables are stationary at the degree of integration 0, meaning that the original data can be used for subsequent tests.

2. Optimal Lag Test

The optimal lag length test is used to eliminate autocorrelation in the VECM system, preventing autocorrelation and heteroskedasticity (Enders, 1995). Determination of the optimal lag length is done using the Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQ). Based on the determination of the optimal lag length in Table 6, the criteria LR, FPE, AIC, SC, and HQ tested indicate lag 2 as optimal.

Table 6. Determination of Optimal Lag Length for Producer and Consumer Corn Prices

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-515.1002	NA	1.03e+10	28.72779	28.81576	28.75849
1	-473.4903	76.28485*	1.27e+09	26.63835	26.90227*	26.73046*
2	-469.3629	7.108333	1.27e+09*	26.63127*	27.07114	26.78480
3	-468.1254	1.993717	1.49e+09	26.78474	27.40056	26.99968
4	-467.0852	1.560288	1.77e+09	26.94918	27.74094	27.22552
5	-464.8919	3.046230	2.00e+09	27.04955	28.01726	27.38731
6	-463.4227	1.877377	2.36e+09	27.19015	28.33380	27.58931
7	-462.8719	0.642561	2.98e+09	27.38177	28.70137	27.84235
8	-459.5493	3.507148	3.26e+09	27.41941	28.91495	27.94139
9	-457.3363	2.090127	3.88e+09	27.51868	29.19017	28.10208
10	-453.9734	2.802397	4.44e+09	27.55408	29.40152	28.19888
11	-448.4953	3.956423	4.68e+09	27.47196	29.49534	28.17817
12	-445.3827	1.902141	5.87e+09	27.52126	29.72059	28.28889

Source: Processed Secondary Data (2023)

The determination of the lag number (order) is done by looking at the most frequent sign (*) on the lag number row for each variable. Table 6 shows that the optimal lag length test using the AIC criterion indicates that lag 2 is optimal. Using lag 2 as the optimal lag in the model implies that, from an economic perspective, all variables within the model influence each other not only in the current period but also in the previous period.

3. Cointegration Test

The cointegration test is used to determine the relationship between producer and consumer corn markets using the Johansen cointegration test, which compares the trace statistic (TC) and maximal eigenvalue (ME) to the t-statistic. The cointegration test results are presented in Table 7.

Table 7. Cointegration Test on HK and HP Variables Using Augmented Dickey-Fuller Test at First Difference (EViews)

Hypothesis	Trace Statistic	Critical Value (5%)	Max-Eigen Statistic	Critical Value
None	9.406222	15.49471	7.500743	14.26460
At most 1	3.841465	3.841465	1.905479	3.841465

Source: Processed Secondary Data (2023)

Table 7 shows that the trace statistic (TC) and maximal eigenvalue (ME) are higher than the t-statistic at the 5 percent level, indicating a long-term cointegration relationship between producer and consumer corn prices.

4. Granger Causality Test

The Granger causality test is conducted to determine whether the dependent variable can be influenced by the independent variable. If the test results indicate a causal relationship between the two variables, the independent variable influences the dependent variable and vice versa. Table 8 presents the results of the Granger causality test.

Table 8. Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
K1 does not Granger Cause P1	44	0.72639	0.5799
P1 does not Granger Cause K1		6.10505	0.0008

Source: Processed Secondary Data (2023)

Based on Table 8, the hypothesis used is:

H0: Producer prices do not influence consumer prices

H1: Producer prices influence consumer prices

If the probability is above 5 percent, H0 is accepted. Conversely, if the probability is below 5 percent, H1 is accepted. Since the probability values in Table 8 are below 5 percent, H1 is accepted, indicating that producer corn prices influence consumer corn prices. This assumption aligns with the research of Sari et al. (2021), who found that consumers (food producers and others) can detect fluctuations through quick and accurate market price information at the farmer level in the local corn market. Additionally, improvements in drying, storage, and transportation infrastructure can reduce transaction costs, making corn more competitive.

5. Vector Error Correction Model (VECM) Test

According to Maya & Pereira (2015), VECM is a restricted VAR model with non-stationary variables that have the potential to be cointegrated. This model includes the speed of adjustment from the short term to the long term, indicated by the Error Correction Term (ECT). The results of the VECM test are presented in Table 9.

Table 9. Short-Term VECM Estimation Results for Corn Prices at the Producer and Consumer Levels

Error Correction:	D(PRICE_C...	D(PRICE_PRODUCER)
CointEq1	-0.015952	0.139821
	(0.01626)	(0.04075)
	[-0.98077]	[3.43081]
D(PRICE_CONSUMER...	0.178716	-0.087164
	(0.15747)	(0.39458)
	[1.13493]	[-0.22090]
D(PRICE_CONSUMER...	-0.034766	0.567735
	(0.14091)	(0.35308)
	[-0.24673]	[1.60797]
D(PRICE_PRODUCER...	0.203740	0.271947
	(0.06638)	(0.16634)
	[3.06921]	[1.63492]
D(PRICE_PRODUCER...	0.079519	0.289757
	(0.07472)	(0.18724)
	[1.06416]	[1.54750]
C	12.63844	8.862917
	(17.1643)	(43.0096)
	[0.73632]	[0.20607]

Source: Processed Secondary Data (2023)

The VECM results in Table 9 show that the ECT value in the model is small, less than one, significant, and negative, indicating weak market integration. The above ECM

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estimation results indicate that the corn price at the farmer level significantly influences the corn price at the consumer level in both the short and long term. The ECM model is considered valid if the error correction coefficient (ECT) is negative and statistically significant (Widarjono, 2009).

The t-table value is known to be 2.01174 (as per the t-table results). The following are the decision-making criteria through the t-statistic test:

If the t-statistic < t-table, it is not significant.

If the t-statistic > t-table, it is significant.

Based on the VECM model results in Table 10, it can be concluded that in the short term, changes in corn prices at the producer level in the previous period significantly affect the current corn prices at the consumer level, with a t-statistic value of 3.07 > t-table 2.01174. If the corn price at the producer level in the previous period increased by 1 rupiah, it would cause the current corn price at the consumer level to rise by 0.203740 rupiah. Analyzing the influence of each variable in the short term, it is found that changes in consumer corn prices are also affected by changes in consumer prices one month and two months prior, by 0.178 and -0.034, respectively. This indicates that a 1,000 rupiah increase in consumer corn prices one month prior will raise current consumer prices by 178 rupiah, and a 1,000 rupiah increase in consumer prices two months prior will decrease current consumer prices by 34 rupiah. Changes in producer corn prices are influenced by changes in producer prices one month and two months prior by 0.2037 and 0.079, respectively. This means that a 1,000 rupiah increase in producer prices one month prior will raise current producer prices by 203 rupiah, and a 1,000 rupiah increase in producer prices two months prior will raise current producer prices by 79 rupiah.

According to Asmara & Ardhiani (2010), market integration is weak when the price transmission between markets (coefficients δ and β) is less than 50 percent. A low ECT coefficient (<50%) means that the ECM test results indicate weak vertical market integration at several levels in each market. Based on Table 8, the low ECT value (<50%) indicates weak market integration. It is also acknowledged that current consumer corn prices are influenced by historical producer corn prices, despite the weak relationship. This weak vertical market integration shows that market participants do not properly communicate market information. However, previous changes in consumer prices were not well communicated to producers (farmers). As a result, farmers do not receive changes in consumer corn prices. Farmers are generally price takers and are not affected by reference or local markets due to the insignificant change levels.

This analysis is supported by the market structure analysis above, where the corn market is an oligopsony. An oligopsony is a market type with two or more buyers (usually traders) dominating the market in terms of obtaining goods or acting as the only buyers in the goods market. Farmers sell corn after drying it to village collectors, regional collectors, or large traders, who have become regular buyers of the farmers' produce. These traders then sell the corn to feed mills or egg producers for use as animal feed. This shows that the corn market is dominated by buyers from village/regional collectors and large traders (feed mills and egg producers).

This finding aligns with Rahayu (2013) research, which analyzed the corn market structure in Grobogan Regency and found that the corn market is oligopsonistic, showing that traders significantly influence the market. It is also consistent with

Rahmadani (2022) findings that the market structure in Campagaya Village, Galesong District, Takalar Regency, tends towards an oligopsony type, and the market behavior in Campagaya Village, Galesong District, Takalar Regency, indicates that collectors play a crucial role in price setting.

An oligopsonistic market structure also shows that large traders play a critical role in determining corn prices. This is because the number of large traders (large feed mills) is relatively small with a large market share. This proves that the corn marketing system is still ineffective.

Table 10. Long-Term VECM Estimation Results

Variable	Coefficient	t-statistic
Consumer Price (-1)	1.000000	
Producer Price (-1)	-3.472129	-3.87964
Trend	70.97941	2.16126
C	6959.486	

Source: Processed Secondary Data (2023)

Based on Table 10, it can be seen that producer corn prices significantly influence consumer prices, with a t-statistic value of 3.87964 > t-table 2.01174. The trend also significantly influences consumer prices, with a t-statistic value of 2.16126 > t-table 2.01174. The constant value of 6959.486 means that the average consumer corn price will rise by Rp 6,959.486 when there is an increase in producer corn prices. Overall, based on the ECM analysis of the corn market in East Java, integration between the product market and the consumer market is weak in the short term, while long-term integration is ongoing. There is no direct relationship between consumer prices and production prices in the short term. At the same time, the producer and consumer markets are integrated in the long term, as price changes in each market mutually influence each other over the long term.

The weak integration between producer and consumer markets in the short term indicates that the producer market tends toward imperfect competition. Sexton et al. (1991) suggest that agricultural commodity market structures are generally oligopsonistic, where farmers receive lower prices due to the lack of market information. Such market structures are disadvantageous for producers because price setting is controlled by one party—the traders. In these market conditions, producers tend to accept lower prices as traders aim to maximize their profits and market information, especially regarding the prices received by market participants, is incomplete. This limited market information can prevent farmers from adjusting their supply to achieve more profitable prices (Irawan & Rosmayanti, 2007).

6. Impulse Response Function (IRF) Analysis

The results of the impulse response function (IRF) analysis by Maya & Pereira (2015) are used to study the response of producer and consumer corn prices to shocks or to a one standard deviation shock in the variables. The IRF results are presented in Figure 10.

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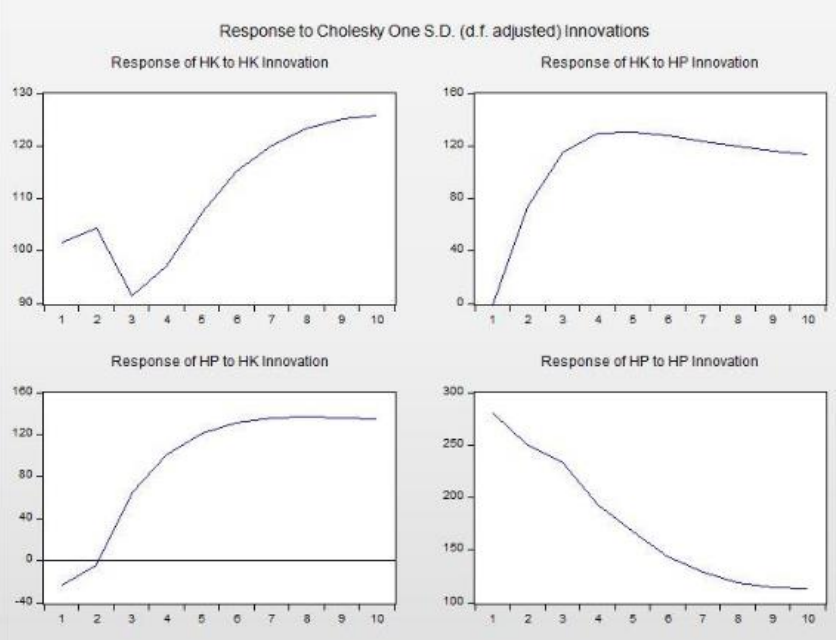

Figure 10. Impulse Response Function Analysis Results
Source: Secondary Data (2023), processed data

Figure 10 shows the impulse response function of consumer corn prices to innovations in consumer corn prices, consumer corn prices to innovations in producer corn prices, producer corn prices to innovations in consumer corn prices, and producer corn prices to innovations in producer corn prices. The response graph shows cyclical increases and decreases. The impulse response function analysis results indicate that the reaction of consumer corn prices to consumer price innovations begins to show a negative response in the third period, and this reaction is generally small. This is because changes in consumer corn prices do not affect the innovations in consumer corn prices. From the fourth to the tenth period, the reaction flattens out, leading to an increase in consumer corn prices.

The response of corn consumption to producer price innovations shows a negative reaction in the first period. This is because changes in consumer corn prices do not affect innovations in producer corn prices. However, the response to producer price innovations becomes positive in the third period. The reaction of producer corn prices to consumer price innovations shows a negative response at the beginning of the season but then increases in the second period and flattens out from the third period to the end of the season. The immediate response of producer corn prices to consumer price innovations is consistent with previous explanations that producer price innovations influence consumer corn prices in the short term. Even when consumer price innovations are shocking, the response is negative from the start of the season. The response stabilizes from the third to the tenth period. The response of producer corn prices to producer price innovations is positive initially but trends downward, leading to a decrease in producer corn prices.

7. Variance Decomposition Analysis

The results of the variance decomposition analysis provide estimates of the extent to which a variable affects changes in itself and other variables over several future periods, measured as percentages. This helps identify which variable is likely to have the most significant impact on a particular variable. The variance decomposition results show that

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fluctuations in consumer corn prices are influenced by producer corn prices, as presented in Table 11.

Table 11. Variance Decomposition Analysis Results

Variance Decomposition of HK:			
Period	S.E.	HK	HP
1	101.6281	100.0000	0.000000
2	163.3591	79.51947	20.48053
3	220.0534	61.09394	38.90606
4	273.2065	52.24980	47.75020
5	321.2376	48.96016	51.03984
6	364.4228	48.03940	51.96060
7	403.1549	48.14504	51.85496
8	438.1900	48.68149	51.31851
9	470.2356	49.35472	50.64528
10	499.8875	50.01921	49.98079
Variance Decomposition of HP:			
Period	S.E.	HK	HP
1	281.6467	0.672209	99.32779
2	376.7646	0.391550	99.60845
3	447.3683	2.323717	97.67628
4	497.5306	5.939482	94.06052
5	538.7450	10.12167	89.87833
6	572.8527	14.18949	85.81051
7	602.6462	17.90475	82.09525
8	629.3624	21.13951	78.86049
9	653.9636	23.89449	76.10551
10	677.0511	26.22632	73.77368
Cholesky One S.D. (d.f. adjusted)			
Cholesky ordering: HK HP			

Source: Processed Secondary Data (2023)

The variance decomposition results in Table 11 show that the variable expected to have the largest contribution to consumer prices is consumer prices themselves, accounting for 100 percent in the first period. In the second month, consumer corn price variability is influenced by its own price by 83.98 percent but continues to decline. By the tenth month, variability is influenced by producer prices by 19.74 percent. The influence of producer corn prices on consumer prices starts at 16.01 percent in the first period and increases to 19.74 percent in the tenth period. This indicates that from the second to the tenth period, consumer price variability begins to be influenced by producer prices.

The variance decomposition analysis of producer prices in Table 11 shows that the variable expected to have the largest contribution to producer prices is producer prices themselves, accounting for 99.61 percent, followed by consumer prices contributing 1.38 percent in the first period. The influence of consumer corn prices on producer prices starts at 12.70 percent in the sixth period and increases to 17.56 percent in the tenth period.

CONCLUSIONS

Based on the analysis of price fluctuations, it was found that the average corn price from 2018 to 2021 exhibited a high fluctuation coefficient at the producer level in East Java, indicating significant volatility. According to the Ministry of Trade, this fluctuation is considered unstable, with a coefficient of variation of 8.9 percent, which is close to the Ministry's instability threshold of greater than 9 percent. Conversely, the consumer price fluctuation coefficient in East Java was relatively low and stable, with a coefficient of 2.8 percent, well below the Ministry of Trade's instability threshold of greater than

9 percent. Furthermore, the price transmission elasticity results for corn from 2019 to 2021 revealed elasticity values of 0.0033 (elastic), -0.2029 (elastic), and 2.6359 (elastic), respectively. This indicates that the rate of price change at the consumer level was higher in 2019 and 2020 and lower than the producer level in 2021 (net value > 1), suggesting that corn marketing remains limited and ineffective. Additionally, the analysis of corn market integration in East Java indicates weak integration between producer and consumer markets in both the short and long term. The weak short-term market integration suggests that market participants are inefficient in transmitting market information, with wholesalers primarily acting as price makers.

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