Marketing efficiency of red chilli pepper in North Sumatera Province

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Abstract. This study aims to analyse the marketing of red chili pepper using price efficiency analysis. The data used is secondary data, namely time series data of monthly red chili pepper prices at the level of farmers, intermediate traders, wholesalers, retailers and consumers during 2015 to 2019. Data processing was carried out using quantitative descriptive analysis. Based on the results of the price efficiency analysis conclude that in the short and long term the red chili pepper market at the farm level is strongly intermediate traders, wholesalers, retailers and consumers. This can be seen from the IMC value which is smaller than 1 and the coefficient b2 which is greater than 0.05. This integration shows the marketing of red chilies in North Sumatra is efficient when viewed from price efficiency.

1. Introduction
Red chili pepper is the main spice of Indonesian cuisine and is also one of the horticultural products that play an important role in trade and production in Indonesia. This is evidenced by the increase and decrease in market prices of Red Chili Peeper which can affect the Indonesian economy. The price of red chili pepper is highly volatile, especially the dry season in 2019 last year which gave the effect of increasing the price of red chili pepper at the consumer level. Even inflation in 2019 was contributed by red chili pepper price by 0.20% [1,2] from previously in 2018 which was only 0.07% [3].

To face consumer sensitivity of red chili pepper and to anticipate the need of red chili pepper, as in the previous year the Directorate General of Horticulture, Ministry of Agriculture [4] re-established red chili pepper as part of the commodities in the 2020 horticultural development policies and programs. This policy is not only related to the upstream and on farm sectors but also to the off farm and marketing sectors. Based on [4] there are 32 areas that are part of the distribution area of red chili pepper in Indonesia, and among these 32 areas, North Sumatra is one of the areas.

For North Sumatra, this is nothing new, considering that North Sumatra as second place after West Java as main red chilli pepper producer with a 17.94% of the total national red chili pepper production [5]. Based on BPS data, there are 3 regencies that produce the largest red chili peppers in North Sumatra, namely Simalungun, Batu Bara and Deli Serdang [6].

The position of North Sumatra as one of the 3rd largest production centre in Indonesia gives hope for the local government to be able to improve the welfare of red chili pepper farmers by increasing the
income of red chili pepper farmers. Red chili pepper as part of North Sumatra's competitive advantage provides an opportunity for North Sumatra to control price stability, especially at the producer (farmer) level because supply is always maintained. However, this hope is not like reality. Like other agricultural products, North Sumatra's red chili pepper farmers do not enjoy being the centre of red chili pepper production. This is due to the position of farmers who do not have bargaining power and caused the price that farmers receive. Even the government through the Director-General of Horticulture has provided an open market price for red chillies pepper, but access to this information is uneven, which caused many farmers still accept whatever price is set by traders even though they are not satisfied with the price they receive. This will be exacerbated if the farmer has a capital attachment to the wholesaler, so regardless of the price set must be accepted by the farmer due to this attachment.

On the other hand, price fluctuation is also an obstacle in the marketing of red chili pepper. If the price of red chili pepper is low, it will have a negative impact on farmers because they do not get a profit, on the contrary, if the price of red chili pepper goes up, consumers will be affected. So, the price fluctuation of red chili greatly affects intermediate goods or the final consumer of red chilli.

One of the causes of fluctuation in red chili pepper prices is the length of the marketing channels. The longer the marketing chain, the higher the price. Based on data [5], currently, the percentage difference between the price received by farmers and marketing institutions is 42.4%, which means almost half of the consumer price is enjoyed by marketing.

This study aims to analyse the marketing of red chili pepper using price efficiency analysis. It is hoped that this information will contribute to the right policies to improve farmer welfare.

2. Materials and methods

2.1. Data and method collecting data

Data collection was carried out in North Sumatra. Data collection was carried out from January 2015 to December 2019. This journal uses primary data and secondary data. Primary data were collected using a survey method through direct interviews with traders and Agribusiness Sub-Terminal (STA). Secondary data collection is obtained through searching data with internet tools, such as the agricultural commodity price information site on the application pertanian.go.id, visiting libraries and related institutions.

2.2. Method of analysis

Data processing using quantitative descriptive analysis. Quantitative analysis is used to conduct market integration analysis. Processing and calculation of price efficiency using Eviews 10 software.

2.3. Vertical market integration analysis

Vertical market integration is an integration that occurs in an industry (agribusiness system), which is the linkage of marketing institutions with other marketing agencies in one marketing chain (for example, from farmer-level institutions with institutions at the factory or consumer level) [7,8]. The model used in this research can be written as follows:

\[ P_t = (1 + b_1)P_{t-1} + b_2 (P_t - P_{t-1}) + (b_3 - b_1)P_{t-1} + b_4X \]  

(1)

Where:

- \( P_t \) = Price of red chilli pepper at the farmer level (time t) (Rp/Kg)
- \( P_{t-1} \) = Price of red chilli pepper at the farmer level (time t-1) (Rp/Kg)
- \( P_t \) = Price of red chilli pepper at the consumer level (time t) (Rp/Kg)
- \( P_{t-1} \) = Price of red chilli pepper at the consumer level (time t-1) (Rp/Kg)
- \( X \) = Other factors that influence
The coefficient $b_2$ shows how far the price changes at the consumer level are transmitted to the farmer level. The coefficients $(1 + b_1)$ and $(b_3 - b_1)$ reflect the relative contribution of the previous period price from the farm level and the consumer level to the current price level at the farm level. The ratio between the two is a market relationship index (Index of Market Connection) or IMC which shows the level of integration between the two markets concerned and is formulated:

$$IMC = \frac{(1 + b_1)}{(b_3 - b_1)}$$

where:
IMC = Index of market connection

The market is unrelated / not integrated in the short term if the IMC is high and in the long run if the value is very close to 0. Integration can be strong and weak (Table 1). Strong integration means that if the price changes at the exporter level can actually be felt by farmers. While integration is weak, it means that the price change at the farm level will affect the price at the exporter level not very significantly.

**Table 1. Terms of an integrated market or not**

| No | Information                  | Short Term     | Long Term       |
|----|------------------------------|----------------|-----------------|
| 1  | Strong Integration           | IMC close to 0 | b2 close to 1 (>0,5) |
|    |                              | IMC<1          |                 |
| 2  | Weak Integration             | IMC > 1        | b2 close to 0 (<0,5) |
| 3  | No Connection / Not Integrated | IMC high       | b2 very close to 0 |

Source: [9]

Analysis of vertical market integration was carried out for 5 marketing institutions, namely farmers, intermediate traders and STA traders, wholesalers, retailers and consumers. There are 4 outlines of the analysis carried out in this study, namely:

A. Analysis of Farmers' Level as Local Market
   1. Analysis at the farmer level as a local market and at the Intermediate Level and STA Traders as a reference market
   2. Analysis at the farmer level as a local market and at the wholesaler level as a reference market.
   3. Analysis at the farmer level as a local market and at the retailer level as a reference market.
   4. Analysis at the farmer level as a local market and at the consumer level as a reference market.

B. Analysis of Intermediate Level and STA Traders as Local Market
   1. Analysis at the Intermediate level and STA traders as a local market and at the wholesale level as a reference market.
   2. Analysis at the Intermediate level and STA traders as a local market and at the retailer level as a reference market.
   3. Analysis at the Intermediate level and STA traders as a local market and at the consumer level as a reference market.

C. Analysis of Wholesalers Level as Local Markets
   1. Analysis at the wholesaler level as a local market and at the retailer level as a reference market.
   2. Analysis at the wholesaler level as a local market and at the retail consumer level as a reference market.

D. Analysis of Retailers Level as Local Markets
   1. Analysis at the retailer level as a local market and at the consumer level as a reference market.
3. Results and discussion

3.1. Development of North Sumatra red chili pepper production

Based on 2019 Indonesian Red Chili Pepper Commodity Trade Distribution Data, North Sumatra is the third largest red chili pepper producing centre. This can be realized with the support of several red chili pepper producing districts in North Sumatra, namely Simalungun Regency, Batu Bara Regency and Deli Serdang Regency.

As a red chili pepper production centre, North Sumatra's [10] big chili (including red chili pepper) production has been recorded fluctuating every year. The biggest fluctuation can be seen in figure 1, where in 2014 there was a significant decrease in production caused by natural factors (weather) and pests [11]. In the following year (2015) production of big chili increased again by 27%, although the production was not the same in subsequent years (2016). Until 2019, fluctuations of red chili pepper production continued, but not significantly. Even at the end of 2019, show that North Sumatra's red chili pepper fell to 154,008 tons due to drought.

![Figure 1. North Sumatra chili production 2010-2019](image)

3.2. Development of North Sumatra red chili pepper prices

![Figure 2. Price of Red Chili Pepper in 2015-2019](image)

Like production, red chili pepper price fluctuation is also high at the consumer and farmer level. Based on the price data in Figure 2, the lowest price received by farmers in the range 2015 - 2019 was...
IDR 7,000 / kg in January 2019, while the price obtained in November 2016 was IDR 63,483.20 / kg. The lowest price for red chili pepper at the consumer level was 13,711.10 / kg in June 2017 and the highest was obtained in August 2019 at IDR 77,667 / kg.

Based on research, the price fluctuation of red chili pepper can occur due to several things, including: 1) availability of local red chili pepper supply; 2) factors supporting the availability of red chili pepper production (weather, pests, and diseases); 3) availability of red chili pepper supplies from other region; and 4) distribution facilities (marketing activities).

3.3. Vertical market integration analysis
According to [12], vertical integration occurs at various levels in the supply chain. The integration between producers and distributors allows for better information flow and physical and transportation systems. In addition, in vertical market integration, the most discussed issues are demand fluctuation, environmental uncertainty, customer focus, information technology and level of competition. And in this study, the focus is on price fluctuations that have an effect on the marketing efficiency of red chili pepper.

All the results of the analysis of vertical market integration have fulfilled the classical assumptions which are important things in conducting regression model analysis using time series data, in order to avoiding multicollinearity, heteroscedasticity and autocorrelation.

3.4. Short term integration
Based on the results of short-term market integration analysis using the Index of Market Connection (IMC), it was found that the IMC value for the entire market integration analysis in red chili marketing was less than one (table 2). The IMC value indicates that the current relative percentage of producer prices in the local market is affected by changes in the reference market in the past. This means, there is a strong integration in the marketing of red chili pepper in the short term.

| Local Market | Reference market | IMC  | Information          |
|--------------|-----------------|------|----------------------|
| Farmer       | intermediate traders and STA Traders | -1.51 | Strong Integration   |
| Wholesaler   | -2.23 | Strong Integration   |
| Retailer     | -2.15 | Strong Integration   |
| Consumer     | -2.02 | Strong Integration   |
| Intermediate traders and STA Traders | Wholesaler | -1.15 | Strong Integration   |
| Retailer     | -1.29 | Strong Integration   |
| Consumer     | -1.25 | Strong Integration   |
| Wholesaler   | -1.10 | Strong Integration   |
| Consumer     | -1.09 | Strong Integration   |
| Intermediate traders | Consumer | -1.01 | Strong Integration   |

Strong short term integration shows that changes of prices at the consumer level can be felt by producers. Any price changes that occur at the reference market level will be directly felt by the local market. Any price changes that occur in the consumer market will be immediately felt by the retail market. Price changes in the retail market will be immediately felt by the wholesaler market. Price changes in the wholesaler market will be directly felt by the intermediate trader market and the price changes in the intermediate trader market will be directly felt at the producer level (farmers). Farmers as producers will feel this price change more if they have access of price information provided by the Director General of Horticulture.

The results of this study show similarities with the results of research conducted by [13] and [14], which state that in the red chili market there is integration at the level of farmers, wholesalers and
retailers. However, [14] stated that the vertical integration of the red chili pepper market in Indonesia is not strong enough, as found in this study.

3.5. Long term integration
Long run market integration is related to the relationship between price changes in the reference market that are transmitted to the local market in the long run. This can be seen from the coefficient value \( b_2 \). The resulting value is close to unity. If the coefficient value of \( b_2 \) is 1 (\( b_2 = 1 \)), then the two markets are integrated in the long run. In this analysis, the long-term integration analysed is related to the analysis between red chili pepper farmers, red chili pepper intermediate traders and STA traders, wholesalers and retailers.

| Local Market               | Reference market                  | Long Run (b2) |
|----------------------------|-----------------------------------|---------------|
| Farmer                     | Intermediate Traders dan STA      | 0.83          |
|                            | Traders                           |               |
|                            | Wholesaler                        | 0.73          |
|                            | Retailer                          | 0.68          |
|                            | Consumer                          | 0.66          |
| Intermediate Traders dan STA Traders | Wholesaler                        | 0.94          |
|                            | Retailer                          | 0.88          |
|                            | Consumer                          | 0.86          |
| Wholesaler                 | Consumer                          | 0.94          |
|                            | Consumer                          | 0.92          |
| Retailer                   | Consumer                          | 0.98          |

From all analysis results it was found that the value of \( b_2 \) is greater than 0.5. This means, there is a strong integration of the price change in the long run of red chili pepper from the consumer, trader and producer levels.

Strong integration in the short and long run shows that price changes at the consumer level are transmitted to the producer level. In addition, the vertical integration of the red chili pepper market also shows that there is closeness between the reference market and the local market. Changes in the reference market will have an impact on the local market. This result shows that the reference market and local market should be included in the efficient market. With this efficient market position, of course the marketing agencies should be satisfied with the price they receive. However, to ensure further, more analysis is needed regarding analysis with an operational approach to obtain an overview of the margins or functions that are carried out by these marketing agencies. On the other hand, a price stability policy that considers justice for all parties must also be implemented. This is very important because until now, the price fluctuation of red chili pepper has greatly affected trade stability and economic conditions.

4. Conclusions

4.1. Conclusions
There is strong long-term and short-term integration in the reference market with the local market. This shows that the marketing of red chilies in North Sumatra can be said efficient when viewed from price efficiency.
4.2. Suggestions
To strengthen the results of this study, further research is needed related to operational efficiency in marketing red chilies in North Sumatra. It is necessary to expand access to complete price information at each marketing agency so that price data sources can be utilized by all marketing agencies.

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