The Dynamic Impact of Rice Production and Harvested Area on Agricultural Product Prices During COVID-19

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Abstract. The Covid-19 pandemic has caused several economic conditions to experience obstacles, especially related to the distribution of rice to the community. Indirectly this can have an impact on the availability of the selling price of rice to the community. The purpose of this article is to analyze the events that occurred by providing the price of rice during the Covid-19 pandemic in East Java Province. The method used is parametric quantitative. The analysis used is Vector Auto Regression using secondary data from the Central Statistics Agency of East Java Province and the Department of Agriculture and Food Security of East Java Province. The findings in this study are that there is a pattern in the same direction between rice production and the selling price of rice during the pandemic. It is developed that production so far is also due to the supply chain sector that must be supported so that distribution patterns are not hampered. The social restrictions issued by the central government are quite a challenge in the distribution of rice commodities which have become the needs of the general public so far. In addition, the harvested area has an inversely proportional impact on the current rice price. It was recorded that during the 2020–2021 period, there was a decrease which had an impact on the increase in the selling price of rice. Government policies need to provide limitations on the availability of harvested area to ensure the continuity of the production process is maintained to provide benefits both from the producer and consumer side.

Keywords: Price of Rice · Covid-19 · Vector Auto Regression · Social Restrictions

1 Introduction

Indonesian people are known to be very dependent on agricultural commodities, one of which is rice. The level of public rice consumption nationally in 2019 was 20,685,619 tons [1]. In addition, there are no substitutes that can replace the role of the rice commodity in meeting the primary daily needs of the community. It is recorded that around 77.5 kg per capita of people consume rice every year.

This also applies in the province of East Java. According to [2] The population level of 41.14 million people is the second largest nationally, depending on the availability of rice commodities to meet the needs of the community. Uncontrolled population growth can also pose a threat to the increase in demand for a primary need.

Therefore, a high level of demand can affect the selling price on the market [3, 4]. To meet the level of demand, it must be supported by the level of production of rice commodities in the province of East Java which was recorded in January-April 2022 Reaching 4.75 Million Tons of GKG. Thus, the total potential for rice production in the January-April 2022 Subround reaches 4.75 million tons of GKG, or an increase of 0.09 million tons of GKG (2.00%) compared to the same Subround in 2021 which amounted to 4.66 million tons. Then if you look at the development of rice production in East Java during 2021 according to the [1], there will be a decrease in rice production successively in the May-August 2021 and September-December 2021 Subrounds, which are 0.40 million tons of Milled Dry Rice, respectively. /GKG (10.82%) and 0.22 million tons of GKG (10.44%) compared to the same period in 2020.

The decline in rice production in East Java was contributed by a decrease in the harvested area that occurred in the May-August 2021 [5]. Subround which amounted to 80.66 thousand hectares (11.65%) and the September-December 2021 Subround which amounted to 24.64 thousand hectares (7.29%). This can be said to be risky when compared with the increase in the population of East Java people by 0.79% per year. The level of production that cannot keep up with the level of demand will cause price increases which of course tend to be unwanted by the majority of the community.

The level of production that is required to meet the level of community demand must be supported by the availability of sufficient land [6, 7]. This is one of the concerns faced in industrialization projects that tend to sacrifice rice farming land. For information, the level of availability of rice fields in East Java has decreased significantly in recent years. From 1.754 million hectares in 2020 to 1.747 million hectares in 2021 [1].

The reduction in the level of an agricultural land area needs special attention from the government [8–10]. Policies regarding the development of residential areas are prohibited from compromising the availability of agricultural land and rice fields that have existed so far. Because it is considered to sacrifice productive land. The development of residential or industrial areas is prioritized on non-rice fields so as not to disturb the ecosystem of the productive land of rice fields [11].

Based on this, this article aims to discuss conditions related to the number of levels of rice production, the area of rice fields, and the price of rice in traditional markets in East Java Province. This is important considering the increasing population of East Java which continues to increase and has an impact on the increasing demand side, threatening the availability of rice through the existing production. Because this can be directly related to the stability of the price of rice sold in the market. It is hoped that

this research can be used as input for policies related to rice in East Java Province in the future.

2   Literature Review

A. *The Concept of Supply and Demand Theory*

The combination of supply. And demand models are the. The main theory in modeling the concept of supply and demand [12]. The supply curve shows a positive relationship between the number of commodities to be sold and the level of commodity prices, while the demand curve is expressed in the form of a curve that shows a negative relationship between the quantity demanded and the price that consumers will buy [13–15].

Referring to commodity prices, the process of forming market prices is influenced by factors that affect supply and demand so the theory of demand and supply becomes the main basis for developing a market price [16–18]. Three factors determine the marketing analysis of agricultural products, namely supply, demand, and price [19–21]. According to [22] the point of the combination of price and quantity is determined by supply and demand from the consistency of buyers and sellers, whereas [23], put forward the market for goods and services at the price and quantity is a determination of the interaction of supply and demand curves.

Pricing policies are often regulated by the government. In practice, the basis for policy decisions regarding the basic price is based on the relationship between the means of production (inputs) and production (outputs) [24–26]. Another policy in the form of regulations regulated by the government such as the floor price and the highest price or the ceiling price. According to [27] The floor price is needed to keep the market price at harvest time from falling far below what producers should receive and it should be done so that the market price is at least equal to the base price. On the other hand, a ceiling price or maximum price is still needed, especially during lean seasons, when production supplies are limited. Thus the price policy is said to be very effective if the market price is between the floor price and the ceiling price [28].

In a state of harvest, production is very abundant so that the market price is below the proper price (price balance) therefore a higher price policy is needed than the market price [29–31]. With the entry into force of this basic price, the consequence is that the government has to buy excess production. Of course, the market works on a price floor.

Another case during famine season is the situation where the amount of available products is limited, while the number of consumers remains or continues to grow. In this situation, the market price tends to be high or higher than the balance price if the roof price is not applied. The situation during this famine is the opposite of the harvest situation. When during the harvest, the government has to buy several excess products, and during a famine, the government has to sell the stock (supply or reserves) of agricultural commodities which is the responsibility [32].

No	Variables	Symbol	Source
1	Rice Price	price	Department of Agriculture and Food Security of East Java Province
2	Production	prod	Central Bureau of Statistics of East Java Province
3	Harvest Area	harv	Central Bureau of Statistics of East Java Province

Source: Authors (2022)

3 Method

The design of this study uses quantitative methods, while the data in this study is secondary and sourced from the Information System Availability and Price Development of Staples in East Java which consists of 38 Traditional and Modern Markets in 38 Regencies and Cities in East Java Province and the Central Bureau of Statistics of East Java Province. In addition, the large number of people also contributes to the importance of the availability and affordability of rice commodity prices for the people of East Java [33]. However, fluctuations in food commodity prices in East Java often occur, the cause does not come from one problem but comes from several causes. This research process was carried out from the beginning of the Covid-19 pandemic in January 2020 to April 2022. Using the E-Views 12 application to determine the relationship between variables (Table 1).

$$\Delta price = a + \sum_{i=1}^{n} \beta i \Delta price_{t-i} + \sum_{i=1}^{n} \beta i \Delta prod_{t-i}$$
$$+ \sum_{i=1}^{n} \beta i \Delta harv_{t-i} + \lambda EC_{t-1} + \varepsilon_t \quad (1)$$

It denotes that t is a deterministic trend a_0 is a constant, t is adeterministic trend and is the error term. If there is a unit root in the autoregressive function of Y (Y_ (t-1)) contains aunit root, then the ratio t for a_1 should be compatible with the null hypothesis that a_1 = 0.

$$\lambda_{Trace}(r) = -T \sum_{i=r+1}^{g} in(1 - \lambda_i) \quad (2)$$

$$\lambda_{Max}(r, r + 1) = -T \ln(1 - \lambda_{r+1}) \quad (3)$$

4 Discussion of Results

The study makes use of the Augmented DickyaFuller Test and a 5% critical value. The data under test are assumed to be stationary and devoid of unit roots if the t-ADF value is less than the Mackinnon value. Information about the outcome of stationary test data utilizing the ADF1test is provided in Table 2. All variables are stationary at the standard level, according to the data in the table.

Table 2. Results ADF test

Variables	Decision	Coefficient Value
Price	Stationer in level	0.0437
Prod	Stationer in level	0.0003
Harv	Stationer in level	0.0001

Source: Authors (2022)

Furthermore, when viewed from the stationarity test results, it can be concluded that:

According to [34], is to solve the autocorrelation issue in a VAR. It also functions as a measure of how long a variable interacts with others. In this study, the Schwarz Information Criterion (SIC) approach was used in the lag test (Table 3).

The cointegration test is then conducted following the optimal lag test. Johansen trace statistics test cointegration test method to examine of variables that stationary or not stationary1at the level of level still satisfy the requirements of the integration process. The testing criteria based on trace statistics are what matter most in cointegration tests. The alternative hypothesis is accepted if the trace statistic's value is higher then the threshold of 5% (Table 4).

It is apparent from the trace test value that all equations that co-integrated with one another exist. There is one cointegrated equation, according to the results of the max eigenvalue test. As a result, a long-term association can be found with the variable of rice price.

According to the analysis' findings utilizing the VAR, there is a relationship between the variables production, harvest area, and rice price (Table 5).

Several variables have a higher level of influence when compared to other variables. This demonstrates that outside causes, particularly in the previous two years, have an indirect impact on rice prices in East Java Province. The results of the Vector Auto Regression analysis show that the two variables analyzed have an R Square level of 0.68%. This means that the price variable during the pandemic is 68% influenced by two production variables and harvested area.

One of the factors in this research, the production of rice, reflects a finding that, has a positive and considerable impact. Accordingly, it has a coefficient value of 0.37. Which means that every 1% increase in production this month will increase prices by 0.3% next

Table 3. The Optimum Lag Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-193.65	NA	1364.8	15.732	15.878*	15.772
1	-183.23	17.499	1228.6	15.618	16.204	15.781
2	-167.48	22.677*	743.68*	15.079*	16.103	15.363*
3	-165.07	2.9007	1385.8	15.605	17.068	16.011

Source: Authors (2022)

Table 4. Unrestricted.Cointegration/Rank/Test

Hypothesized No..of CE(s)	Eigenvalue	Trace/ Statistic	0.05/ Critical Value1	Prob.**
None***	1364.8	15.732	15.878*	15.772
At most 1*	1228.6	15.618	16.204	15.781
At most 2*	743.68*	15.079*	16.103	15.363*
Hypothesized No.of CE(s)	**Eigenvalue**	**Max-Eigen. Statistic**	**Eigenvalue**	**Prob.**
None*	0.720421	33.13619	21.13162	0.0007
At most 1	0.364400	11.78282	14.26460	0.1191
At most 2*	0.332290	10.50145	3.841465	0.0012

Source: Authors (2022)

Table 5. Vector Autoregression Estimates

Variables	Result	
	Coefficient	*t-statistics*
PROD(-1)	-0.029602	-0.05088
PROD(-2)	0.378229	0.64808
HARV(-1)	1.003615	1.66258
HARV(-2)	-1.129018	-1.90954
C	0.554859	0.61422
Coefficient Determination (R2)	**0,68**	

Source: Authors (2022)

month. Of course, this rarely happens in general and is a new finding. The condition of the Covid-19 pandemic, people are faced with a dilemma between maintaining their health by not leaving the house, but on the other, the need for rice is still needed to meet their daily needs [35–37]. During the COVID-19 pandemic, many government regulations and policies must be equated with the current situation [38–40]. The price policy when it has been determined must change because the Large-Scale Social Restriction Policy (PSBB) in various regions, directly or indirectly affects the price of rice at the farmer level or changes in food demand at the consumer level. Household food consumption has decreased in all its components [41].

Meanwhile, since the beginning of the pandemic until now, there have been no significant obstacles to the food supply [42–44]. However, there are many obstacles in the supply chain due to restrictions on activities or movements during the Covid-19 pandemic. If these obstacles are established in the long term, then of course they can also result in disruption of the supply of food commodities [45]. The changes in the supply and demand side of food in turn have an impact on the level of food prices [46]. For the

main food commodities needed by residents, changes in food prices have an impact on changing consumption patterns and demand due to price gaps which result in difficulty for people to access the food commodities they need. The price of a commodity is a very important aspect of a market economy because it coordinates the decisions of producers and consumers to behave under conditions of perfect competition. Each price created should be able to satisfy all market participants, whether farmers, traders, or consumers. The phenomenon of price transmission has attracted the attention of many researchers in some commodity markets. In recent years, much research has been done to analyze the relationship between farmers, wholesalers, and retail markets. The main focus of the research is oriented on the estimation of elasticity and the speed at which price shocks are transmitted at different levels in the marketing chain [47].

Cheap and affordable rice prices will have a positive impact on the poor, because the ability or purchasing power of the community becomes high enough to meet food needs, especially rice [45]. In addition, cheap rice prices can still benefit farmers if commodity prices to produce agricultural production can also be maintained low, for example, fertilizer prices, seed prices, transportation costs, etc. Thus, farmers can still enjoy a sizable margin.

The condition of the rice harvested area in this case has results that are inversely proportional to the previous variable. The harvested area has a coefficient value of -1.12. This means that every 1% decrease in the harvested area will have an impact of a -1.12% price increase in the next period. According to (Tanti Novianti, Silvia Sari Busnita, 2017) degradation of paddy fields which results in the harvested area has a significant impact on farmers' grain yields.

[41] noted that the rice harvested area in Indonesia will reach 10.41 million hectares in 2021. This value is down 2.3% compared to the previous year which was 10.66 million hectares. One of the reasons for the decline in rice harvested area is the high dry rate during August-September 2021. The second reason is the shift to other crops besides rice. The majority of provinces with the largest rice harvested area are in Java. East Java ranks at the top with rice harvested area reaching 1.75 million hectares last year.

Rice production is the product of the rice harvested area with the productivity of rice per hectare of land, so how much production depends on how much area is harvested in that year or what the level of productivity is [31–33]. The available harvest area is generally also very narrow and limited. The narrow harvest area of course has implications for the limited yields obtained. Production results that are little or not optimal will result in decreased food availability. Less than the maximum productivity of the rice harvest also causes a decrease in production yields and affects the availability of food in an area itself [44].

Even so, Launching the official website of the East Java Central Statistics Agency [41] in the report on Harvest Area and Rice Production in East Java Province 2021, it was noted that during the Covid-19 pandemic, which had a fairly large impact on the regional economy of East Java, the agricultural sector showed good performance. Which is quite good. This is evidenced by the development of the agricultural sector which grew positively by 1.01% in East Java's economic contraction of 2.33% in 2020 and continued to grow positively to reach 1.75% in 2021.

"In addition, the strategic role of the agricultural sector is also shown by its contribution to the largest employment absorption compared to other sectors, which is around 31.68% based on the results of the National Labor Force Survey in August 2021. Local governments continue to seek to carry out several programs to increase the production capacity of rice/rice in East Java [45]. In this regard, the availability of timely and accurate data on harvested area and rice production is the foundation for realizing targeted national and regional rice policies.

5   Conclusion

Based on the explanation above, it can be concluded that the two variables analyzed provide the main majority that affects rice prices during the COVID-19 pandemic in East Java province. In the production sector, it has a positive impact on price increases. Of course, this must continue to be improved to meet the needs of the community. Constraints in the supply chain caused by periodic restrictions are one of the barriers and have an impact on rice price stability during the Covid 19 pandemic. In addition, the rice harvested area has the opposite impact, the level of the harvested area tends to decrease and is caused by the degradation of agricultural land to the agricultural sector. The industry is a challenge in itself. Seen from the continued reduction in harvested area from 2020 to 2021, it is a serious fact to provide policies related to the degradation of agricultural land in East Java Province.

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