

Study on Identification and Projection of Food Commodity Price Cycles during the COVID-19 Pandemic Period as a Study of Supervision Aspects of Food Product Marketing in Bangka Belitung

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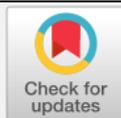
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ARTICLE INFO

Publication Info:
Research Article



How to cite:

Akbar, M. F., & Fahria, I. (2022). Study on Identification and Projection of Food Commodity Price Cycles during the COVID-19 Pandemic Period as a Study of Supervision Aspects of Food Product Marketing in Bangka Belitung. *Society*, 10(1), 45-64.

DOI: [10.33019/society.v10i1.322](https://doi.org/10.33019/society.v10i1.322)

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ABSTRACT

This study examined the projected price of food marketing in the Province of the Bangka Belitung Islands as a step in deepening the issue of food security due to the COVID-19 pandemic. The COVID-19 pandemic in the Province of the Bangka Belitung Islands had a significant impact on the issue of food security. This was caused by the deficit of several strategic food commodities and caused the prices of this food to increase quite high compared to other provinces in Indonesia, such as several provinces in Sumatra and Java. Therefore, local governments as policymakers have a high enough interest in maintaining prices for strategic commodities, especially food. This study intends to compare the volatility of food prices before and after the COVID-19 pandemic. The data used is time-series data on weekly food prices in a traditional Pangkalpinang City market for September 2018 to February 2021. The data analysis technique uses the Vector Autoregression (VAR) method or Vector Error Correction Model (VECM) with the help of statistical software EViews. The results of this study indicate that several important commodities that support community life are predicted to increase significantly, including rice, chicken meat, and chicken eggs. The three food commodities that experienced an increase had a fairly high fluctuation. Beef and red chilies show declining projections in the 8-week forecast period. Meanwhile, cooking oil prices, granulated sugar, shallots, and garlic are still stable.

Received: July 13, 2021;
Accepted: October 25, 2021;
Published: June 30, 2022;

Keywords: *Food Security Issues; Pangkalpinang City; Time Series; VAR/VECM Models*

1. Introduction

The concept of resilience includes “food availability and community accessibility to equitable and affordable food” (Asmarantaka & Oktaviani, 2009). Food price fluctuations can occur in an area due to scarcity of supply and increasing public demand for these commodities (Setiawan & Hadianto, 2014). The archipelagic region has advantages and disadvantages in managing the supply of food products, especially in the distribution chain. The government has made significant preparations to optimize the use of ports. It is known that the food prices in the Province of the Bangka Belitung Islands are quite high compared to other provinces, such as several provinces on the islands of Sumatra and Java. This is due to a deficit in several food products such as rice, beef, and vegetables. The issue of food security in Bangka Belitung became more complex when the COVID-19 pandemic hit the Province of the Bangka Belitung Islands. Until February 2020, the number of patients exposed to it increased.

The impact of COVID 19 on the economy is getting wider. Not only on the health side, but the COVID-19 pandemic is capable of causing serious shocks to economic, social, and political aspects. Food prices are a very central issue for people in the Third World. Especially during the pandemic, many economic sectors are affected and have an impact on high unemployment rates, low people’s purchasing power, and poverty problems. Policymakers are highly interested in maintaining strategic commodity prices, especially food. Cashin & McDermott (2002) state that food prices are not the only issue the government and the public should be aware of. However, price fluctuations also considerably impact the business cycle and public confidence at various income levels. This study intends to conduct a comparative study on the volatility of food prices before and after the pandemic.

Bangka Belitung, an archipelagic area, has various problems regarding the issue of food security and food price levels, which are the main focus of the majority community. Not only harvest problems but distribution channels are also a major issue in the availability of food supplies in Bangka Belitung. Several commodities are still in deficit in Bangka Belitung Islands Province, including beef, rice, shallots, and garlic.

The development of food prices in Bangka Belitung Province can be considered stable. However, the issue of the COVID-19 pandemic caused significant fluctuations in the prices of sugar and cooking oil commodities. Pay attention to the following data:

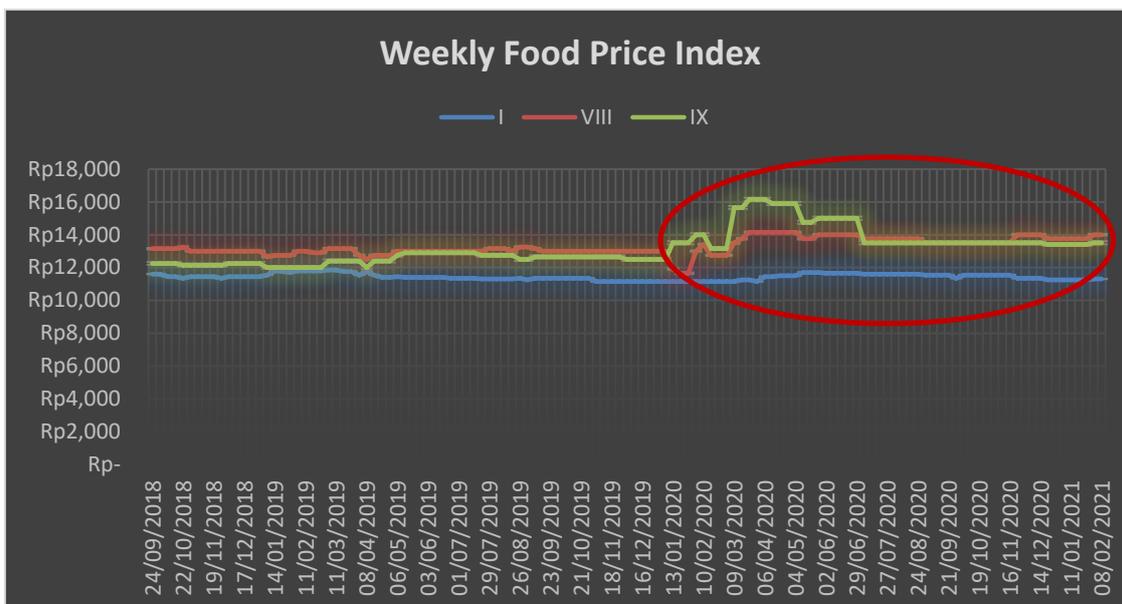


Figure 1. Weekly Food Price Index

Source: Processed Data

The figure above shows that the COVID-19 pandemic issues, which began in February 2020, fluctuate basic commodities prices. The highest prices began in March and April when COVID-19 patients entered the Bangka Belitung Islands Province. The government began to impose access restrictions at airports and ports.

Vegetable prices tend to be more volatile when compared to rice and other food prices. Look at the following figure:

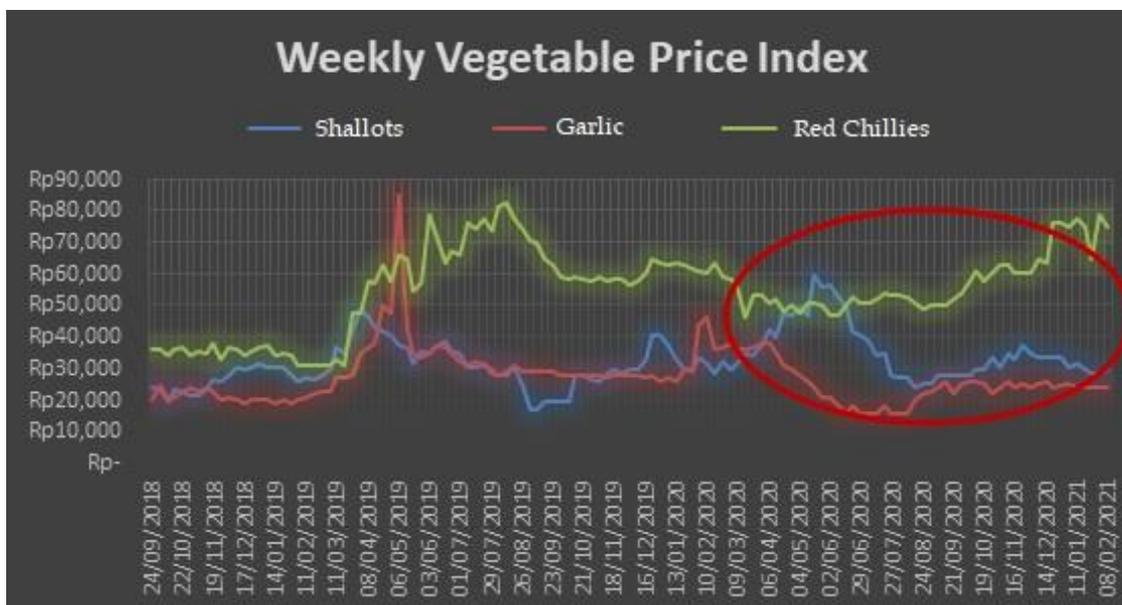


Figure 2. Weekly Vegetable Price Index

Source: Center for Information of Strategic Food Prices

An interesting finding occurs in vegetable data where fluctuations do not only occur during a pandemic but fluctuations can occur over time depending on community demand. It is known that Bangka Belitung has not been able to meet its supply of shallots, garlic, and red chillies.

Hence, price fluctuations greatly affect suppliers and the smooth distribution of goods outside the island. This study suspect that these three commodities have different price development behavior from commodities such as rice and cooking oil because they are not durable goods.

Center for Information of Strategic Food Prices data shows that weekly side dish prices do not fluctuate too much. Data show that before and after the pandemic, provisional estimates explain that domestic beef, chicken, and chicken eggs prices are relatively stable. Through the Food Task Force, the government continues to conduct reviews to ensure supply availability and food price stability in the market. Look at the following figure:

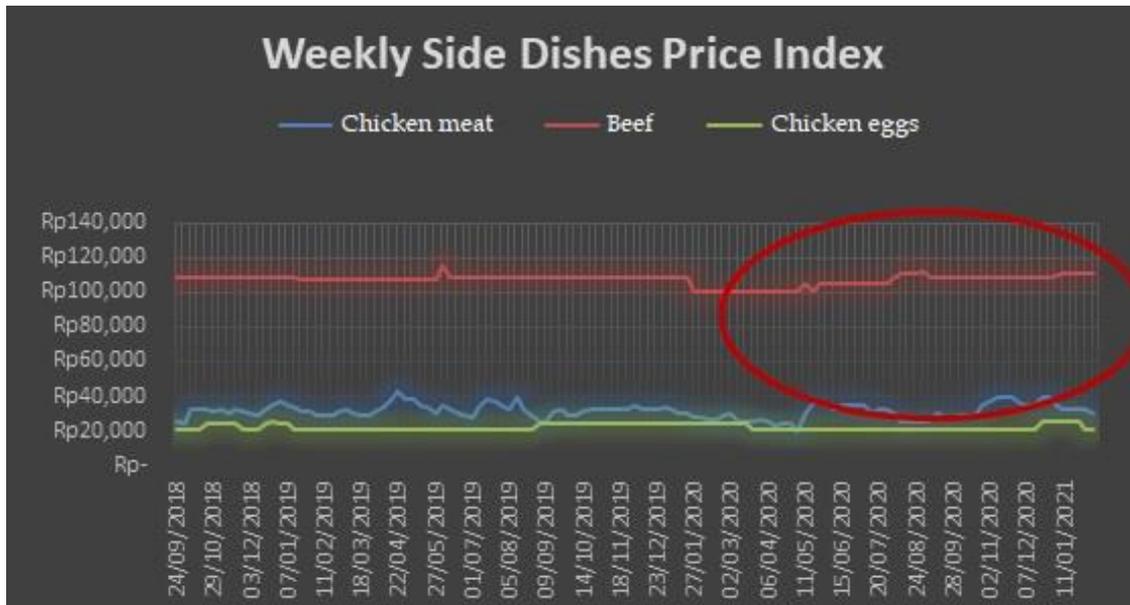


Figure 3. Weekly Side Dishes Price Index

Source: Pusat Informasi Harga Pangan Strategis Nasional

The following data is daily food price data from September 24, 2018, to January 11, 2021, originating from the Pasar Pagi Pangkalpinang (a morning market). The data shows that the prices of the three food commodities remained stable before and after the pandemic.

This study intends to conduct a study on food price fluctuations in a more measurable manner using the time-series analysis method. Time-series data has advantages in terms of analysis and projection so that researchers can provide a general description of the behavior of food price developments in the market. Several methods can be considered for making projections, including VAR, VECM, ARIMA, ARCH, and GARCH, depending on the conditions of each data in terms of stationarity and cointegration status.

Śmiech et al. (2019) identified food price volatility using Generalized VAR, finding that food price volatility can occur as a result of global problems and is related to fluctuations in oil commodity prices and other world energy markets. VAR can also capture natural time variations of the overflow of world oil price fluctuations. Furthermore, Abbott et al. (2009), Gilbert (2010), and Roache (2010), explain that financial speculation can increase food price fluctuations due to the policy of restricting international trade, tightening the money supply, and others. Harvey & Pilgrim (2011) also confirm that the world energy market can also provide a shock to food prices through the transmission of foreign trade policies. A study is needed that conducts an in-depth study of food product supervision, which is an important issue in handling the COVID-19 pandemic.

This study explores the issue of food security. The issue of food security will be studied through the identification of price movements before and after the COVID-19 pandemic. The COVID-19 pandemic will be used as an instrument of shock for food price developments. The objective of identification will be to conclude how effective the local government is in stabilizing pagan prices in the Bangka Belitung Islands Province so that community access to food can be maintained properly. Two implications will be experienced in the food commodity market. The first is from the supply side. Activity restrictions and restrictions on the distribution of goods from one area to another pose problems in the supply chain of food commodities, so there is a threat of scarcity. Second, from the demand side, people's fear of a pandemic caused many people who panic at the beginning of the pandemic, so sudden demand pressure caused prices to increase. However, after the pandemic lasted several months, a stable supply made panic buying subside. Still, the number of layoffs and disruption of work activities caused welfare to decline, and demand would also fall.

2. Conceptual Framework

2.1. Welfare Line Model

The Welfare Line Theory by [Deaton & Muellbauer \(1980\)](#) is an illustration of the ability of the community to be faced with the choice of buying food and non-food items. The price of the two types of products will affect the welfare of society. The increase in food prices is an obstacle that will cause people's welfare to decline and still impact the lower classes of society.

Theoretically, [Deaton & Muellbauer \(1980\)](#) explains that food prices can influence people's food consumption, especially the lower middle class. The assumptions used are (1) there are only two commodities that are consumed, namely food and non-food groups, (2) the further to the right the indifference curve indicates the more prosperous, (3) food is a normal good, (4) the price of non-food goods remains constant and (5) consumers are limited by income and can choose a bundle of food commodities and non-food commodities so that the equation for the budget line is as follows:

$$m = Px * x_1 + Py * y_1$$

Desc:

m : Income

Px : Food Prices

Py : Non-Food Prices

Look at the following figure:

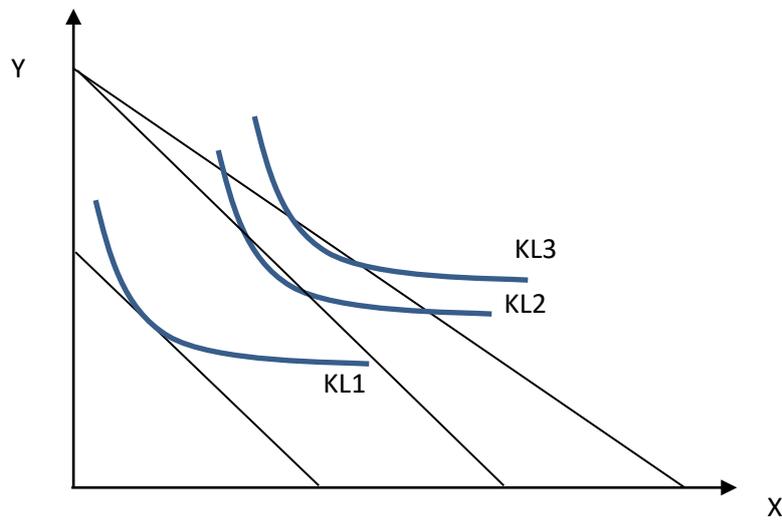


Figure 4. Community Welfare Level
Source: Nicholson (1999)

Concept the graph above shows the level of welfare received by the community if there are two conditions, namely:

- 1) The average income level of the community increases, it will cause KL1 to level up to KL2 because the community's ability to increase in making purchases (buying power increases)
- 2) People have more ability to buy food because the price is getting cheaper. The level of food prices fell as a result. As a result of the lower food price level, a shift from KL2 to KL3 could occur.

Food Security Concepts and Indicators According to Government Regulation No 68 of 2002 (Republik Indonesia, 2002), food security is the condition of fulfilling food for households which is reflected in the availability of sufficient food, both quantity and quality, safe, equitable and affordable. Food availability is an important prerequisite for sustainable consumption but is considered insufficient. For this reason, it is necessary to understand the performance of food consumption by region and income.

Indicators that can be used to assess consumption performance are the level of participation and food consumption. Both indicate physical and economic access to food (Direktorat Jenderal Perikanan Tangkap, 2003). This accessibility describes the distribution and affordability of the population to food. Equity implies the distribution of food throughout the region to the household level. At the same time, affordability is a condition where households can continuously access food according to their needs for a healthy and productive life. Another indicator is food quality, which can be assessed based on food safety criteria and nutritional content. Food safety is a condition and effort needed to prevent food from being contaminated by biological, chemical, and other objects that can interfere, harm, and endanger human health. To obtain good nutritional quality, it is necessary to vary consumption with an instrument that can be used: the Expected Food Pattern score (Hariyadi et al., 2003).

2.2. Volatility Model

Beckmann et al. (2014) argue that speculation by the big players in the corn market may lead to spillover volatility in the cotton and wheat markets. Gardebroek et al. (2015) revealed

that the wheat and corn markets are the main sources of volatility spillover towards the soybean market. Hamadi et al. (2017) found significant two-way volatility spillovers between the corn, wheat, soybean, and soybean oil markets. However, a stronger spillover effect was observed from the soybean and soybean oil markets to the corn and wheat markets.

Two methodological approaches used to look at the transmission of shocks and volatility spillover from global issues to agricultural commodity markets are the Multivariate Garch model (Creti et al., 2013; Serra et al., 2010; Trujillo-Barrera, 2012; Zhang et al., 2009). Furthermore, Awartani et al. (2016), Batten et al. (2014), Chevallier & Ielpo (2013), Kang et al. (2017), and Magkonis (2017) measured the volatility of food prices using the Volatility Spillover calculation.

3. Research Methodology

3.1. The Scope of Research

This study examines the issue of food security and is carried out using research methods. Quantitative research emphasizes theory testing through measuring research variables using numbers and analyzing data through statistical procedures. The scope of the research is limited to the price of basic commodities such as:

- 1) Rice
- 2) Beef
- 3) Chicken
- 4) Eggs
- 5) Red Chili
- 6) Shallots
- 7) Garlic
- 8) Cooking Oil
- 9) Granulated Sugar

Using the ARIMA and VECM methods in this study, it is hoped to identify food price volatility before and after the COVID-19 pandemic in the Bangka Belitung Islands Province. The identification aims to conclude how effectively local governments are stabilizing food prices so that public access to food commodities can be well maintained.

3.2. Data Types and Sources

The data used in this study is monthly time series data for September 2018 to February 2021. The data used is a type of secondary data in the form of monthly food price developments at the consumer level, which is the average price at the Pangkalpinang City level, Bangka Belitung Islands Province. The data is food price data from one of the markets most visited by consumers, especially in Pangkalpinang City, namely the Pasar Pagi Pangkalpinang (a morning market). Data were obtained from the official website of the Center for Information of Strategic Food Prices of Pangkalpinang City and literature studies obtained from various sources, such as books, scientific journals, and the internet.

3.3. Data Collection Technique

The data collection technique in this study was carried out by collecting data on food price movements directly through the official website of the Center for Information of Strategic Food Prices.

3.4. Data Analysis Technique

The data analysis technique used is the Vector Autoregression (VAR)/Vector Error Correction Model (VECM) method depending on the condition of each data, both in terms of stationarity and cointegration status. The VAR method analyses the data if the variables used are stationary and cointegrated at the level. However, if the variables used are stationary and cointegrated in the first difference, the VECM method is used. The researchers chose the VAR/VECM method to provide a more measurable overview of the behavior of food price developments in the market. The general equation model for VAR, according to [Enders \(2014\)](#) as follows:

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + e_t \quad (1)$$

Where:

Y_t = endogenous variable vector ($Y_{1t}, Y_{2t}, \dots, Y_{nt}$) sized (n.1)

A_0 = intercept vector sized (n.1)

A_i = coefficient matrix sized (n.n), $i = 1, 2, \dots, p$

P = lag in equation

t = time

e = vector error ($e_{1t}, e_{2t}, \dots, e_{nt}$) sized (n.1)

The stages in conducting the analysis using the VAR/VECM method are as follows:

1) Data Stationarity Test

The data stationarity test is carried out to check whether the time-series data contains a unit root. When entered into statistical processing, data that have unit roots or are not stationary will result in spurious regression. To test the presence or absence of a unit root in the data, the Augmented Dickey-Fuller (ADF) test is used ([Ariefianto, 2012](#)).

2) Optimal lag length determination

Determining the optimal lag in the VAR method is necessary to find out/capture the effect of each variable on other variables in the VAR method. Several criteria can be used to determine the optimal lag, namely: Likelihood Ratio (LR), Akaike Information Criterion (AIC), Schwarz Criterion (SC), Final Prediction Error (FPE), and Hannan-Quinn Criterion (HQ) ([Juanda & Junaidi, 2012](#)).

3) Model Stability Test

The stability test of the VAR model can be done by calculating the roots of the polynomial function. If the absolute value is < 1 , the VAR model is considered stable so that the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) generated are considered valid ([Enders, 2014](#)).

4) Cointegration Test

The cointegration test aims to determine whether or not the non-stationary variables are cointegrated. The cointegration concept shows the long-term balance between the observed variables. A cointegration test can be done using the Johansen Cointegration test method. After the number of cointegrated equations has been known, the next step is the analysis of the Vector Error Correction Model (VECM) ([Enders, 2014](#)).

5) Vector Error Correction Model (VECM)

Suppose the variable used in a state contains a unit root or is not stationary at the level but is stationary in the data differentiation process. In that case, it must be tested whether the data is cointegrated or not (Firdaus, 2011). If it is cointegrated, the model used is the Vector Error Correction Model (VECM). In general, the form of the VECM equation, according to Enders (2014), is:

$$\Delta Y_t = \mu_{0x} + \mu_{1x}t + \Pi_x Y_{t-1} + \Sigma \Gamma_k \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

Where:

- ΔY_t = vector containing the variables in the study
- μ_{0x} = intercept vector
- μ_{1x} = regression coefficient vector
- t = time trend
- Π_x = $\alpha_x \beta$, where β contains the long-run cointegration equation
- Y_{t-1} = in-level variable
- Γ = regression coefficient matrix
- $k - 1$ = VECM order of VAR
- ε_t = error term

4. Results and Discussion

4.1. Projection of Rice, Sugar, and Cooking Oil Commodities

Today Indonesia is facing a serious problem in the food situation, which is a basic need of everyone. The problem of the main food commodity of the Indonesian people is due to the scarcity of rice or rice (Dekasari, 2018). Rice is a commodity that must be analyzed qualitatively and quantitatively. The projection/forecasting of rice prices is an illustration given in the study.

This study uses two methods to explore projections and long-term relationships between the prices of basic commodities. First, projections will be made of 9 commodities separated into three figures. Look at the following figure.

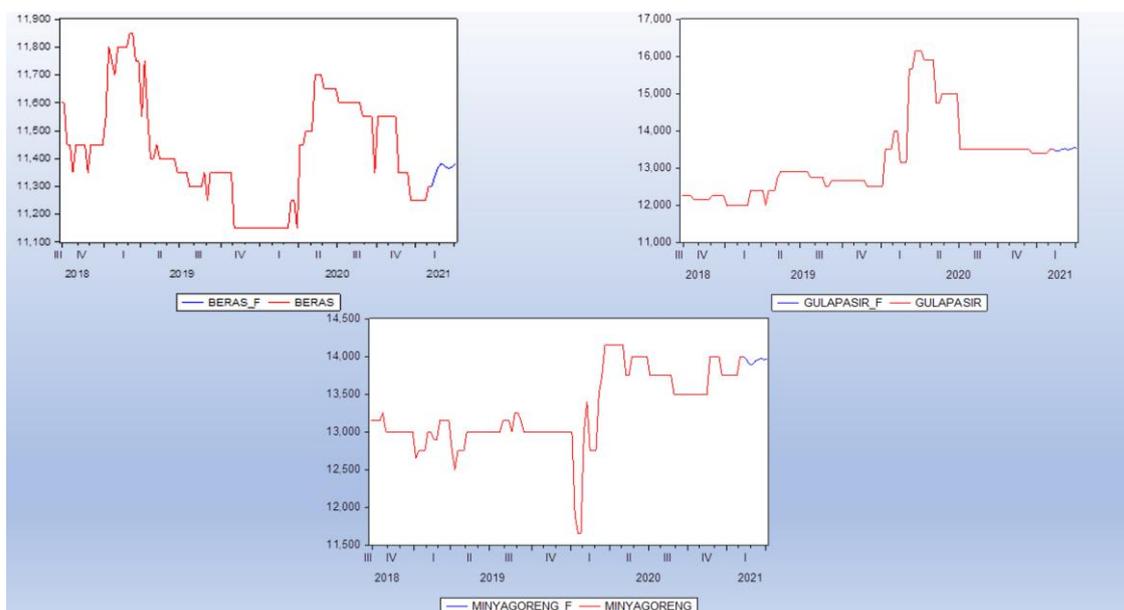


Figure 5. Projected Results of Rice, Sugar, and Cooking Oil Prices

Source: Processed Data

Description:

- Beras = Rice
- Gula Pasir = Sugar
- Minyak Goreng = Cooking Oil

Projections are performed using the ARIMA seasonal method. The results show that some data, such as the price of rice, sugar, and cooking oil, have not been stationary at the level and must go through a first differencing process. It can be seen from **Figure 5** that the projected prices for the three commodities have increased. The commodity price of rice experienced a significant increase, while the price of sugar and cooking oil tended to be stable following the prices that had been in effect for the last five months.

Rice commodity prices experienced a significant increase in the range of Rp11,332 to Rp11,383. To understand the details in more detail, consider the following table:

Table 1. Results of Projected Prices of Rice, Cooking Oil and Sugar Commodities

Projection Date	Predicted Rice Prices	Predicted Cooking Oil Prices	Predicted Sugar Prices
2/15/2021	11,332.19	13,694.10	13,458.68
2/22/2021	11,364.78	13,900.62	13,449.78
3/1/2021	11,380.04	13,887.97	13,508.08
3/8/2021	11,377.38	13,937.04	13,517.19
3/15/2021	11,368.38	13,954.03	13,482.39
3/22/2021	11,365.03	13,978.77	13,508.04
3/29/2021	11,371.36	13,955.69	13,548.87
4/5/2021	11,383.24	13,964.68	13,533.66

Source: Processed Data

The results show that the price range of the three commodities tends to be stable in 8 weeks after the final data, namely 2/08/2021. This research is projected from the second week of February to the first week of May. The projection results show that the price range is not too dynamic and tends to be quite stable, except for the rice price projection.

4.2. Projection of Shallots, Garlic, and Red Chili Commodities

The second indicator in the commodities studied is the commodity prices of shallots, garlic, and red chilies. Compared to other basic commodities, the prices of shallots, garlic, and red chilies fluctuate quite high. Because the value of the commodity prices of shallots, garlic, and red chilies is strongly influenced by the distribution and availability of goods in Pangkalpinang. Look at **Figure 6**.

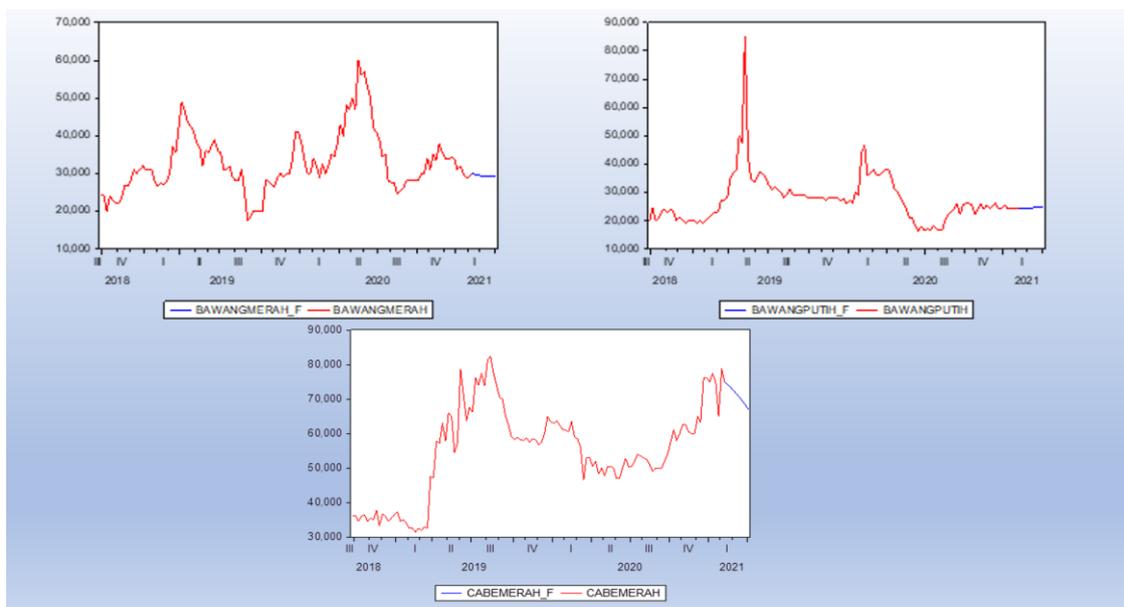


Figure 6. Projected Results of Commodity Prices of Shallots, Garlic and Red Chili
Source: Processed Data

Description:

- Bawang Merah* = Shallots
- Bawang Putih* = Garlic
- Cabai Merah* = Red Chili

The results show that the prices of shallots and garlic show stability in the forecasting period (second week of February to the first week of May 2021). **Figure 6** shows red chili prices decreased significantly over the next eight weeks. To see the data details in tabulated form, consider **Table 2**: The red line shows the actual data, while the blue line is the result of the projection of each price using ARIMA/SARIMA.

Table 2. Projected Results of Commodity Prices of Shallots, Garlic and Red Chili

Projection Date	Predicted Shallots Prices	Predicted Garlic Prices	Predicted Red Chili Prices
2/15/2021	29,740.51	24,145.01	74,181.19

Projection Date	Predicted Shallots Prices	Predicted Garlic Prices	Predicted Red Chili Prices
2/22/2021	29,532.26	24,253.60	73,360.93
3/1/2021	29,372.88	24,359.26	72,459.34
3/8/2021	29,259.82	24,456.56	71,483.10
3/15/2021	29,190.33	24,547.07	70,439.19
3/22/2021	29,161.52	24,631.08	69,334.87
3/29/2021	29,170.41	24,709.05	68,177.60
4/5/2021	29,213.92	24,781.41	66,975.02

Source: Processed Data

The results show that the prices of shallots and garlic do not show significant dynamics. In contrast to the case of onion commodities, the price of red chili experienced a fairly deep decline, with the latest data showing that the price level was at Rp74,181 and became Rp66,975 in the eighth week of the projection period.

4.3. Projection of Chicken, Beef, and Chicken Egg Commodities

The next projection is carried out on the main side dishes consisting of chicken meat, beef, and chicken eggs. Especially for chicken meat, prices fluctuate and change dynamically every week. The projected chicken meat data in the blue line shows a change in the declining pattern, starting to rise slowly at around Rp30,000 per kilo. Meanwhile, beef and chicken egg prices tend to be stable but move in different directions. Beef is projected to experience a minor decline while chicken eggs have increased in price but to a very low level. To get a clear picture, consider **Figure 7**.

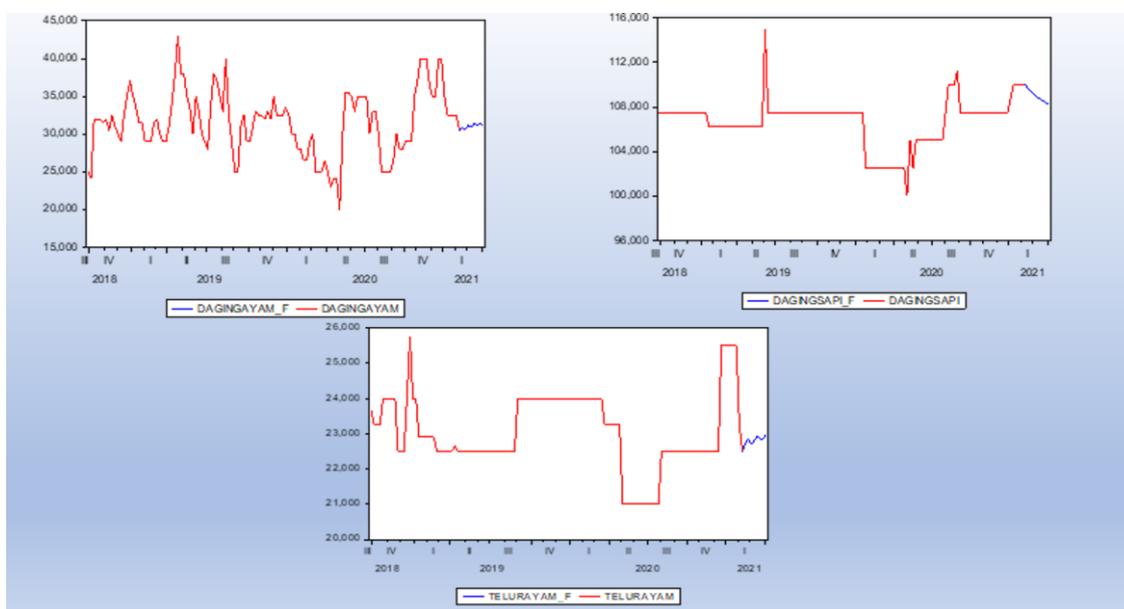


Figure 7. Projected Results of Commodity Prices of Chicken, Beef and Chicken Eggs

Source: Processed Data

Description:

Daging Ayam = Chicken Meat

Daging Sapi = Beef

Telur Ayam = Chicken Eggs

The projection data shows that the three side dishes in the Pangkalpinang market experience a change in trend where the price increase of the three commodities is not too significant and tends to be stable in the next eight weeks of observation. Look at the following table:

Table 3. Projected Results of Commodity Prices of Chicken, Beef and Chicken Eggs

Projection Date	Predicted Chicken Meat Prices	Predicted Beef Prices	Predicted Chicken Eggs Prices
2/15/2021	30,773.51	109,584.65	22,731.99
2/22/2021	30,593.03	109,362.29	22,862.55
3/1/2021	31,213.95	109,106.71	22,704.62
3/8/2021	30,905.48	108,896.78	22,800.54
3/15/2021	31,414.56	108,700.37	22,947.20
3/22/2021	31,054.14	108,526.21	22,846.31
3/29/2021	31,504.01	108,368.40	22,856.65
4/5/2021	31,126.69	108,226.66	22,982.88

Source: Processed Data

4.4. Analysis Results using VAR/VECM

The VAR/VECM diagnostic test begins by testing the stationarity of the three components of the commodity to be analyzed. This research interpolates three categories of data by calculating the average value of commodity prices. For clarity, consider the following table:

Table 4. Commodity Group Stationarity Test Results

Commodity	Commodity Category	Stationarity Status
Rice	Basic Commodity 1	not Stationary at Level
Cooking Oil		
Sugar		
Shallots	Basic Commodity 2	not Stationary at Level
Garlic		
Red Chili		
Chicken Meat	Basic Commodity 3	Stationary at Level (alpha; 5%)
Beef		
Chicken Eggs		

Source: Processed Data

Determination of Lag Criteria is done to see the optimum effect between variables. The impact of a variable movement on other variables, but the reaction of the movement between variables sometimes cannot be felt directly, so this test can illustrate how many periods it takes for a variable to react to the movement of other variables. Note the following results:

VAR Lag Order Selection Criteria
 Endogenous variables: RATABHNPOKK RATAPROTEIN RATASAYUR
 Exogenous variables: C
 Date: 07/09/21 Time: 13:50
 Sample: 9/24/2018 4/05/2021
 Included observations: 115

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3055.248	NA	2.52e+19	53.18692	53.25853	53.21598
1	-2776.550	538.0081	2.31e+17*	48.49652*	48.78295*	48.61278*
2	-2774.437	3.969200	2.61e+17	48.61629	49.11754	48.81975
3	-2771.640	5.107651	2.91e+17	48.72417	49.44024	49.01482
4	-2761.727	17.58426	2.87e+17	48.70830	49.63919	49.08614
5	-2750.130	19.96698	2.75e+17	48.66313	49.80884	49.12817
6	-2745.158	8.301606	2.96e+17	48.73318	50.09371	49.28541
7	-2738.850	10.20258	3.12e+17	48.77999	50.35535	49.41942
8	-2736.208	4.134134	3.50e+17	48.89058	50.68075	49.61720
9	-2723.686	18.94745*	3.33e+17	48.82932	50.83431	49.64313
10	-2713.011	15.59443	3.27e+17	48.80019	51.02001	49.70120

* indicates lag order selected by the criterion
 LR: sequential modified LR test statistic (each test at 5% level)
 FPE: Final prediction error
 AIC: Akaike information criterion
 SC: Schwarz information criterion
 HQ: Hannan-Quinn information criterion

Figure 8. Optimum Lag Structure Test Results

Source: Processed Data

The results show that the optimum lag can be obtained at lag 2. This indicates that the prices of basic commodities can influence each other and require two periods to affect the prices of other basic goods. The search is also continued to diagnose that the unit root circle is stable so that this modeling can be continued.

Cointegration is a long-term relationship that can occur between variables. This study uses the Johansen Cointegration Test at a maximum lag of 2 periods to see the long-term relationship between commodity prices in the three groups. After passing the Stationarity Test using the Unit Root Test, the search continued on the Co-integration Test between Food Group Commodities 1,2 and 3. To see the calculation results, consider the following image:

Date: 07/09/21 Time: 13:57
 Sample (adjusted): 10/15/2018 2/08/2021
 Included observations: 122 after adjustments
 Trend assumption: Linear deterministic trend
 Series: RATABHNPOKK RATAPROTEIN RATASAYUR
 Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.117249	26.84089	29.79707	0.1056
At most 1	0.052854	11.62601	15.49471	0.1758
At most 2 *	0.040164	5.001113	3.841466	0.0253

Trace test indicates no cointegration at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.117249	15.21488	21.13162	0.2741
At most 1	0.052854	6.624893	14.26460	0.5344
At most 2 *	0.040164	5.001113	3.841466	0.0253

Max-eigenvalue test indicates no cointegration at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Figure 9. Cointegration Test Results Using the Johansen Method

Source: Processed Data

The results show that lag 2 becomes the optimum lag after two tests showing cointegration between variables. After an initial diagnosis of stationarity, cointegration, and stability, the VECM model fulfills the requirements to be carried out and provides a specific description of the relationship between variables. Pay attention to the results of the impulse response function calculations below:

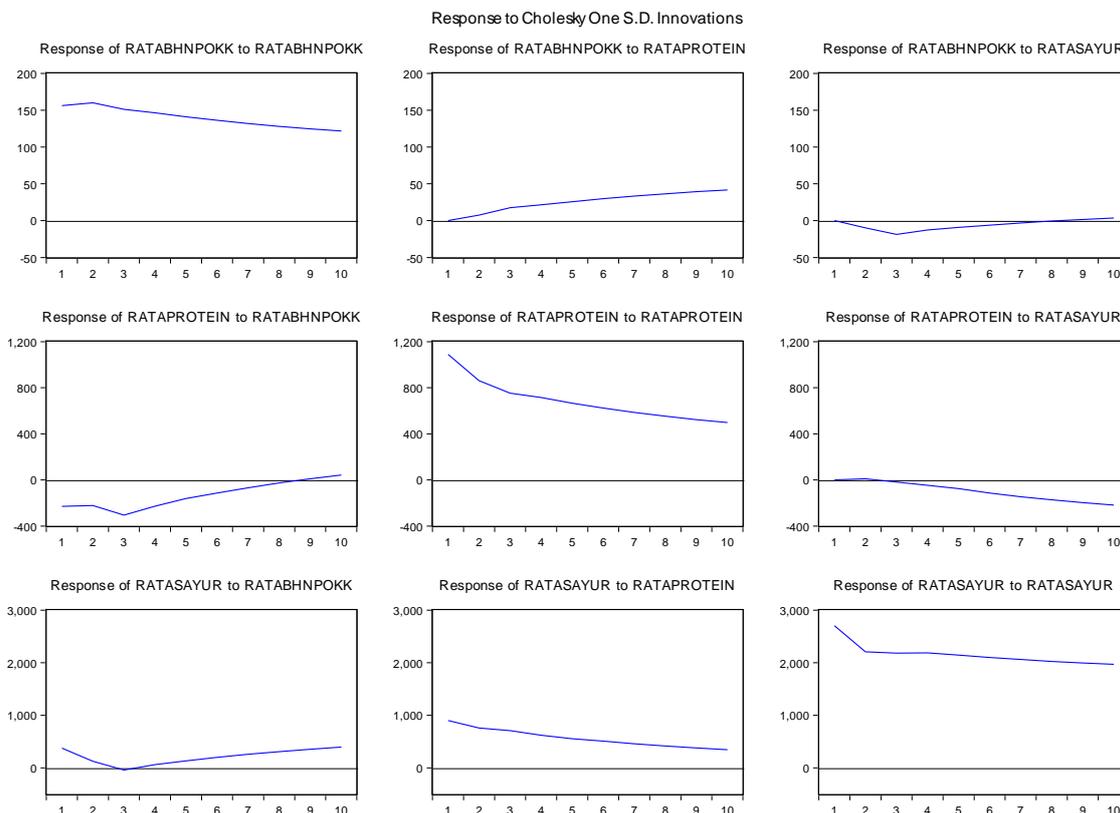


Figure 10. The Result of the Impulse Respond Function of Commodity Prices

Source: Processed Data

The results show that a shock that occurs by one standard deviation on the prices of staple food group 1 (rice, cooking oil, and sugar) will give a positive increase in the prices of basic ingredients in group 3 (chicken, beef, and chicken eggs) in the second period and so on. The next interesting finding is the data showing that price shocks that occur in basic commodities group 3 will cause a decrease in prices of basic commodities in commodity group 2 (shallots, garlic, and red chilies) starting after the next three periods. The results also illustrate the relationship between food groups 1 and 2, where the shocks between the two do not affect each other. Further testing will be conducted on the decomposition of variance between food groups. Look at the following figure:

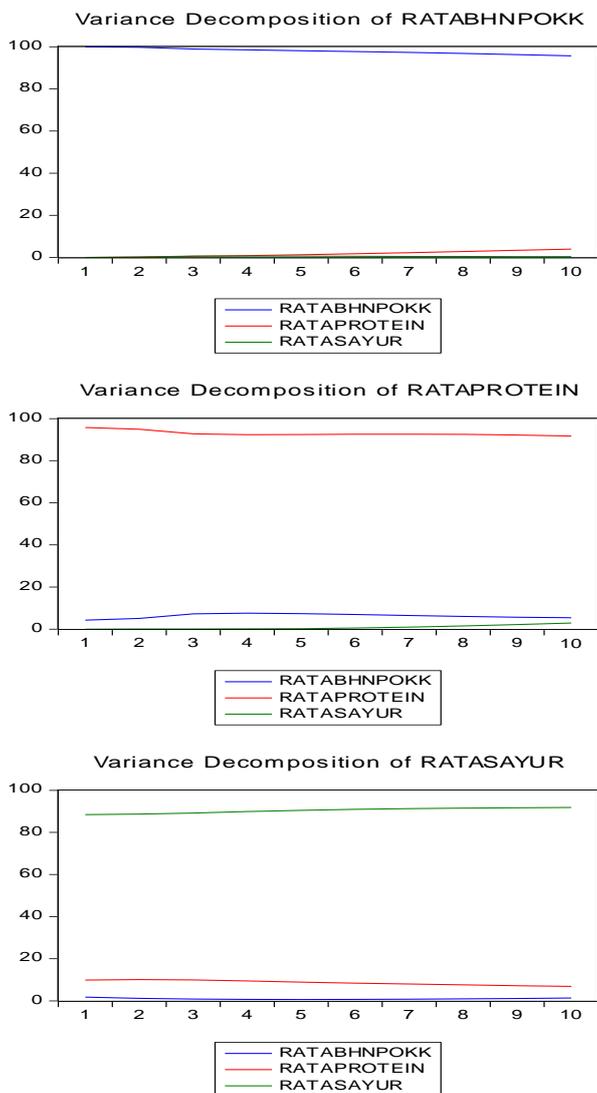


Figure 11. Testing of Decomposition Variance in 3 Food Groups
Source: Processed Data

The discussion results provide information about the direction of influence and contribution of the price of each food commodity. The results show that there is no cross dominance of the influence of food prices. This means that the commodity variables' movement causes most food price movements. VECM provides further information about the causal relationship that has been described using the Variance Decomposition test.

5. Conclusion

Several methods are used to produce information regarding the price movements of traded food commodities. The ARIMA/SARIMA method produces a price projection for each commodity to be measured. In contrast, the Vector Error Correction Model method is used to see the long-term relationship and map the effect of price shocks for basic commodities. This study projects and investigates the relationship between food price groups in Pangkalpinang City.

The results show that several important commodities that support community life are predicted to increase significantly, including rice, chicken meat, and chicken eggs. The three food commodities that experienced an increase had a fairly high fluctuation. Beef and red

chilies show declining projections in the 8-week forecast period. Meanwhile, cooking oil prices, granulated sugar, shallots, and garlic are still stable.

The results of calculations using VECM illustrate that the three food groups are bound to each other and have a long-term relationship. The optimum lag for two periods shows that shocks in certain food groups will impact the next two periods. The results of the analysis also illustrate that a shock that occurs by one standard deviation on the prices of basic commodities 1 (rice, cooking oil, and sugar) will increase the prices of basic ingredients in group 3 (chicken, beef, and chicken eggs) in the second period and so on positively. The next interesting finding is the data showing that price shocks that occur in basic commodities group 3 will cause a decrease in prices of basic commodities in commodity group 2 (shallots, garlic, and red chilies) starting after the next three periods.

6. Acknowledgment

This study was carried out well due to the support of guidelines and funding from the Institute for Research and Community Service, Universitas Bangka Belitung, through the Research Program for Lecturers at the University Level based on the Decree of the Rector of the Universitas Bangka Belitung No 18.29/UN50/PP/III/2021. Furthermore, the research team was facilitated by complete data from the Center for Information of Strategic Food Prices so that the projections could be carried out properly. The researcher expresses his gratitude for the extraordinary input from Universitas Bangka Belitung and the Center for Information of Strategic Food Prices in improving this research.

7. Declaration of Conflicting Interests

The authors have declared no potential conflicts of interest concerning this article's research, authorship, and/or publication.

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