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SUGAR PRICE BEHAVIOR AND PRICE RELATIONSHIPS AT THE MARKET LEVEL BEFORE AND DURING COVID-19 PANDEMIC

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ABSTRACT
An efficient commodity market creates a price relationship between two or more markets. This study provides an overview of the behavior of premium granulated sugar prices and the price relationship between market levels. Time series data for the period January 2018-March 2022, are used in this study. Graphical trend analysis; and cointegration analysis with Vector Auto-regression (VAR) approach to find research objectives. The research found that the price behavior of premium quality granulated sugar in the traditional market and the modern market is more dynamic than the price at the wholesaler level. The highest price spike occurred in the early period of covid-19, and several months later it returned to stability. Price behavior in traditional markets does not follow movements at other market levels simultaneously but takes some time to reach equilibrium. There is a long-term rionship (cointegration) between prices at the level of traditional markets, modern markets, and wholesalers, which contribute to the balance in the market. Market players need to take a strategic role in maintaining price balance at every level of the market in order to create an efficient and fair market.

KEY WORDS
Price relationship, sugar price, wholesalers, modern market, traditional market, cointegration.

Granulated sugar as one of the strategic foods also determines inflation in Indonesia. The Central Statistics Agency (BPS) of the Republic of Indonesia (2021) reports that in the last ten years, sugar production in Indonesia has decreased by 13.5%, while sugar consumption tends to increase. Sugar consumption in 2018 was 5.2 million tons; in 2021 it increased to 5.3 million tons. The shortage of sugar consumption in 2021 to reach 600 thousand tons is met through imports. The largest volume of sugar imports from Thailand in 2020 and in 2021 the volume of large importers from India. India is the largest sugar-producing country in the world (FAO, 2019). The largest volume of sugar imports is in the form of raw sugar, which is then processed in Indonesia into sugar for consumption.

The largest sugar producer in Indonesia comes from East Java Province with a contribution of 46.19% of national production. East Java is the main supplier of granulated sugar to various regions, one of which is the Province of East Nusa Tenggara (ENT). ENT's dependence on sugar from East Java is very large. The price of sugar in ENT especially in Kupang City as the capital of ENT Province is strongly influenced by the supply of sugar from East Java. In 2020, the COVID-19 pandemic has also affected the price fluctuations of sugar in Kupang City because the supply chain was disrupted. Distribution disruptions due to transportation barriers due to weather and ocean waves have also disrupted prices between markets. Considering that ENT is an archipelago, where sea transportation is the mainstay in the distribution of goods. Disparities between regions are also the cause of the weak flow of trade in goods and market information systems. The smooth supply of granulated sugar in

Kupang City also determines the price movement of granulated sugar in Kupang City between increasing traditional, modern markets and wholesalers.

Before the Covid-19 period, sugar prices tended to move up. In 2018 the price of granulated sugar at the traditional market level of Rp. 14,750/kilogram rose to Rp. 16,650/ kilogram in 2019. Entering 2020 the price of sugar was Rp. 17,000/kilogram then entering the covid-19 period in March 2020 the price became Rp. 21,500/kilogram. Prices at the modern market level and wholesalers also move up, and supply from East Java is disrupted, due to the effects of the COVID-19 pandemic. Observing price behavior before the COVID-19 pandemic and during the pandemic and how the price relationship between market levels will provide clues on how strategies and policies need to be taken by market participants in maintaining balance.

Previous studies on price behavior carried out by Barwa, KC, et al. (2021) found that there were differences in prices due to changes in seasons and cycles, the price fluctuation index used the coefficient of variation. Measuring the causal relationship between markets is carried out by, X. (2019) in the state of Mitwertern using cointegration and Granger. Several other studies with the approach same were done by Rayhan, SJ, et al. (2019); Zunggo, et al. (2019); Chaudhary, et al. (2019); Guo & Tanaka (2020); Zavale & da Cruz Macao (2020); Zanin, et al. (2020); Ozturk, (2020); Huang & Ziong, (2020); Roman, M. (2020); Mulyana & Lastinawati (2020), Hao & Nye (2020), Bouchard (2020), Ahmed & Huo (2020). Muflikh, YN, et al (2021). The approach taken proves that the pattern of the relationship between the integrated market in the market situation is influenced by seasons and cycles. This study wants to observe the behavior and price relationship in the COVID-19 pandemic situation.

This study is to find out the behavior of sugar prices before and during the covid-19 pandemic and how prices relate between traditional market levels, modern markets, and wholesalers in responding to market situations due to the pandemic with a cointegration approach.

METHODS OF RESEARCH

Time series data on premium quality granulated sugar prices for weekly and monthly periods from January 2018 to March 2022. Data sources from the Indonesian Central Statistics Agency (2028 to 2022) and the National Strategic Food Price Information Center (2018-2022). The location of data is Kupang City as the Capital City of East Nusa Tenggara (ENT) Province, Kupang City relies on the supply of premium granulated sugar from outside the province, namely East Java, to meet the consumption of granulated sugar.

To find price behavior by measuring price variations at each market level with the coefficient of variation (CV) and graphical trend analysis. Cointegration relationship between market levels with the Vector Autoregression (VAR) approach. Steps to find the VAR model through the process:

Data Stationarity Test. Testing the stationarity of the data with Augmented Dickey-Fuller (ADF) to find out whether there is a trend in price movements at the same degree (level or different) until stationary data is obtained. Stationary data, that is, the variance is not too large and has a tendency to approach the average value (Enders, 1995; Nendissa, et al 2018). ADF test as follows:

$$\Delta P_t = \alpha_0 + \gamma_1 P_{t-1} + b_I \sum_{I=1}^{n} \Delta P_{t-1} + \hat{e}_{it}$$

Where:

P_t = Price of granulated sugar in each market in period t (Rp/kg);

P_{t-1} = Price of granulated sugar in each market in the previous period (Rp/kg).

$$\Delta P_t = P_t - P_{t-1}$$

$$\Delta P_{t-1} = P_{t-1} - \Delta P_{(t-1)-1}$$

Where: n = number of lags; α_0 = intercept; α, b, γ = parameter coefficient; $\hat{e}_t$ = residual.

Hypothesis testing:

- $H_0 : \gamma = 0$ data is not stationary;
- $H_1 : \gamma < 0$ stationary data

The lag check is used to determine the optimal lag length to be used in the next analysis and will find parameter estimates for the VAR model. Optimal lag length can take advantage of some information, namely through the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC), with the following formula:

$$\ln(AIC) = \ln + \frac{\Sigma \hat{e}_i^2 2k}{n\ n}$$

$$\ln(SIC) = \ln\left(\frac{\Sigma \hat{e}_i^2}{n}\right) + \frac{k}{n}\ln(n)$$

Where: $\hat{e}_i^2$ = sum of the squared residuals; k = number of independent variables; n = number of observations.

The lag used is the smallest AIC and SIC value.

The cointegration test aims to determine the long-term equilibrium relationship between premium quality granulated sugar prices at the traditional market level, modern markets/supermarkets, and wholesalers of premium quality granulated sugar prices in traditional markets. The long-term equation can be formulated as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 \beta X_3 + \beta_n X_n + \hat{e}$$

Where: Y = dependent variable; α = independent variable; β = constant; X = coefficient of the independent variable; $\hat{e}$ = remainder.

The VAR method is used to protect the system on the sugar price variable in the three markets and measure the dynamic impact of the disturbances contained in the equation. There are three price variables, namely Y_{1t} is the price of sugar in wholesalers, Y_{2t} is the price of premium granulated sugar in the modern market and Y_{3t} is the price of premium granulated sugar in the traditional market. As an illustration of the VAR model for the three variables, namely:

$$Y_{1t} = \alpha_{10} + \alpha_{11(1)} Y_{1t-1} + \alpha_{12(1)} Y_{2t-1} + e_{1t}$$

$$Y_{2t} = \alpha_{20} + \alpha_{21(1)} Y_{1t-1} + \alpha_{22(1)} Y_{2t-1} + e_{2t}$$

$$Y_{3t} = \alpha_{30} + \alpha_{31(1)} Y_{1t-1} + \alpha_{32(1)} Y_{2t-1} + e_{3t}$$

Analyze this used in determining the response of an endogenous variable to the presence of a shock from a particular variable. IRF analysis can be used to find out how long it takes the variable to return to its equilibrium point before the shock occurs (Ekananda, 2016; Widarjono, 2016 Basuki & Prawoto, 2017).

This analysis of variance decomposition describes the relative importance of each variable in the VAR system because there is a shock. Variant decomposition is useful for predicting the percentage contribution of variance for each variable due to changes in certain variables in the VAR system (Ekananda, 2016; Widarjono, 2016; Basuki & Prawoto, 2017).

RESULTS AND DISCUSSION

The demand for sugar consumption in Kupang City, East Nusa Tenggara (ENT) Province is the largest supplied from East Java Province and West Nusa Tenggara Province (WNT) in small quantities. The main pattern of granulated sugar distribution in ENT before the COVID-19 pandemic was through 3-4 distribution chains, involving several market players (Figures 1-2).

Figure 1 – Distribution pattern of MTF Sand Sugar Trading Percentage in ENT, 2021 (BPS RI, 2021)

Distributors sell 75% of granulated sugar to wholesalers, the remaining 25% is sold to traditional markets/retailers. The traditional market and modern market are then entirely sold to final consumers/households. Thus the supply of sugar from outside the province is used for household consumption. Unlike other regions, in addition to consuming sugar, it is also used as industrial raw material. The industry made from raw sugar has not yet developed.

Figure 2 – Main Pattern of Sugar Trade Distribution and percentage of MTF, 2021, (BPS RI, 2021)

As an archipelago, the problem of transportation and distribution of goods affects the distribution pattern of the Margin of Trade and Freight (MTF). The total MTF for ENT sugar in 2021 is 45.45%, which was previously 25.51% in 2018 (BPS RI 2021). This is the highest MTF figure in Indonesia in 2021, and compared to Indonesia's MPF it is only 25.86%. The higher the MTF number, the more inefficient the marketing system is. The increase in MTF and the number of market participants is suspected to be the effect of the COVID-19 pandemic.

Premium Sugar Price Behavior. The behavior of sugar prices before and during the covid 19 pandemic was observed for price fluctuations through the value of CV. The bigger the CV, the bigger the fluctuation. During the covid-19 pandemic (2020-2021) the price variation rate (CV) increased more than 2 times compared to before. This happened in traditional markets (4.35% increased by 8.56%) and modern markets/supermarkets (CV 6.93% increased to 13.66%). Because when we entered the covid-19 pandemic, there was a panic buing, especially in modern markets/supermarkets. Meanwhile, at the wholesalers' level, CV price fluctuations have actually become more stable during the pandemic, from 7.44% to 2.30%.

The price movement of premium quality granulated sugar in the period January 2018 – December 2020 at wholesalers, traditional markets and in the modern market of Kupang City shown in Figure 3.

The price movement of premium quality granulated sugar in the period January 2018 - December 2020 at wholesalers, in traditional markets, and in the modern market of Kupang City shows an inefficient price movement pattern. The price movement of premium quality

granulated sugar in traditional markets is quite high than the price at wholesalers because price changes that occur in traditional markets follow price changes that occur in wholesalers. Meanwhile, prices in modern markets do not follow prices in traditional markets and wholesalers. The lowest price movement of premium quality granulated sugar between wholesalers and traditional markets occurred around October 2018 - March 2019, in the previous month the highest sugar price occurred in January 2018, and entering June 2019 the price of sugar again rose to its highest point. In the next period, The highest prices occur in May and June 2020. High price movements are caused by reduced stock/scarcity of goods or due to price increases from wholesalers, and prices will fall again if there is additional stock. Sugar scarcity is usually caused by a small production because of increased demand or because of certain momentum such as big holidays.

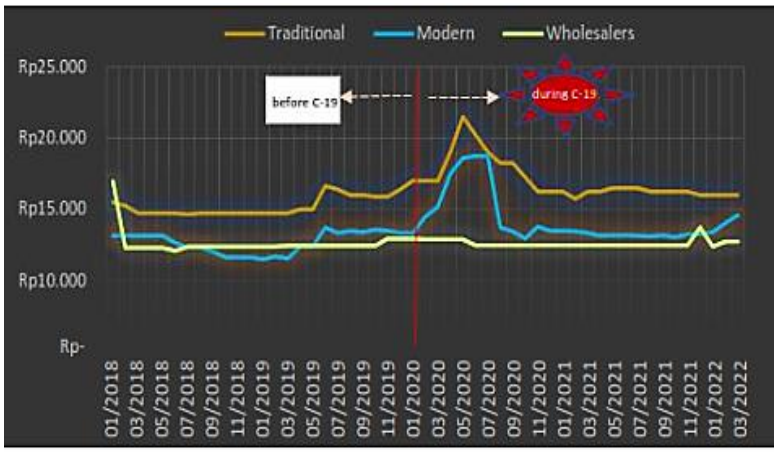

Figure 3 – The trend of changes in the monthly price of premium quality granulated sugar in Kupang City, 2018 – 2020 (data processed)

The price movement of premium quality granulated sugar, especially in the modern market, has its own price movement pattern. The price movement of premium quality granulated sugar has the highest price only in January 2018 and after the next period in February 2018 - December 2020; it fell back to the standard price. It can be said that the price of premium quality granulated sugar in the traditional market does not affect the price in the modern market, and vice versa, the price at wholesalers does not affect the price in the modern market in other words the price of premium quality sugar that occurs in the modern market does not. Following/not driven by prices that occurs in traditional markets and wholesalers. Prices that move on their own can be caused by the unbalanced flow of market information. Mayasari et al (2019), in their study, found that the price behavior of consumers and red chili producers in Jember district in the last seven years found that price information was not perfectly transmitted from the consumer market to the market. The behavior of agricultural commodity prices is caused by cycles, seasons, or trends. StudyFakari, et al (2013), Sabu, et al (2019), Nendissa, et al (2018), and Nendissa et al (2020) prove this.

Table 1 – ADF Test Results at Level

Variable	ADF	Mc Kinnon Critical Value 5 percent	P-Value	Information
Modern market	-20.64336	-2.948404	0.0001	Stationary
Traditional market	-1.792135	-2.951125	0.3779	Not stationary
Wholesalers	-1.611329	-2.612874	0.4663	Not stationary

Source: Processed data, 2020.

A stationarity test was conducted to avoid spurious regression. The results of the ADF stationarity test for premium quality granulated sugar price data at wholesalers, premium quality granulated sugar price data in traditional markets, and premium quality granulated sugar price data in the Modren market are as follows in Table 1.

Based on the test results of the unit root in Table 1 developed by Dickey-Fuller, it is known that at this level condition the sugar price variable in the modern market is directly stationary, while the traditional market variable and wholesaler variable are not stationary at the level level,then the solution is to test at the first difference level.

Table 2 – ADF Test Results at the First Difference Level

Variable	ADF	Mc Kinnon Critical Value 5 percent	P-Value	Information
Traditional market	-4.277207	-2.951125	0.0019	Stationary
Wholesalers	-4.878523	-2.612874	0.0004	Stationary

Source: Processed data, 2020.

From table 2 above, it can be seen that all the variables used in this study are stationary at the first different levels. This can be seen in each stationarity test result at the first difference level where it is known that the value of the probability of ADF t-statistics for modern market variables is smaller than the Mc Kinnon Critical Value value of 5 percent. Therefore, the next step is to perform a cointegration test on the price of sugar in those 3 (three) markets.

The cointegration test is one of the tests carried out with the aim of knowing the long-term relationship of the variables studied. Cointegration testing in this study uses the VAR method with a Critical Value of 0.05 shown in Table 3.

Table 3 – Cointegration VAR Estimation Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob**
None*	0.474360	32.95046	29.79707	0.0210
Al most 1	0.273102	12.37000	15.49471	0.1400
Al most 2	0.065359	2.162973	3.841466	0.1414

Note: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level.

Based on table 3, it is found that there is a cointegration relationship on the price of premium quality granulated sugar at wholesalers, traditional markets and modern markets at a significant level of 5%. It can be shown by the trace statistic value of 32.95046 which is greater than the critical value with a significance level of 5 percent (0.05).

Cointegration indicates that there is a long-run equilibrium for the observed variables. On the way to achieving balance, there must be a shock or shock from one of the variables which will certainly have an impact on the balance of the other variables.

The figure of impulse response results, but there are only six graphs 4.2.; 4.3; 4.4; 4.6; 4.7 and 4.8 answer the analysis while graphs 4.1; 4.5, and 4.9 explain the response of a variable due to the shock of the variable itself. How is the response of sugar prices to wholesalers due to the shock of sugar prices in the modern market? At the beginning of the period wholesalers did not respond to the sugar price shock in the modern market, in the next period wholesalers began to respond significantly and at the end of the period wholesalers began to reduce their response.

Then the response to the price of granulated sugar in the modern market due to the shock in sugar prices at wholesalers and in traditional markets tends to respond slightly downwards in the early stages then responds again in the middle stage and tends to stabilize towards equilibrium at the final stage. Meanwhile, the response to the price of granulated sugar in the traditional market due to the sugar price shock at the wholesalers was no response at the beginning, then decreased in the middle stage and returned to balance in the final stage.

Similarly, the response to the price of sugar in the traditional market is due to the shock of sugar prices in the modern market. In the early stages, the response increased, and in the middle stage the response was still up, then in the final stage the response decreased towards equilibrium.

Overall, the price response that occurs in one trading system due to price shocks in other trading system institutions begins with an up or down response and in the final stage, the response leads to a condition of price balance in each existing trading system.

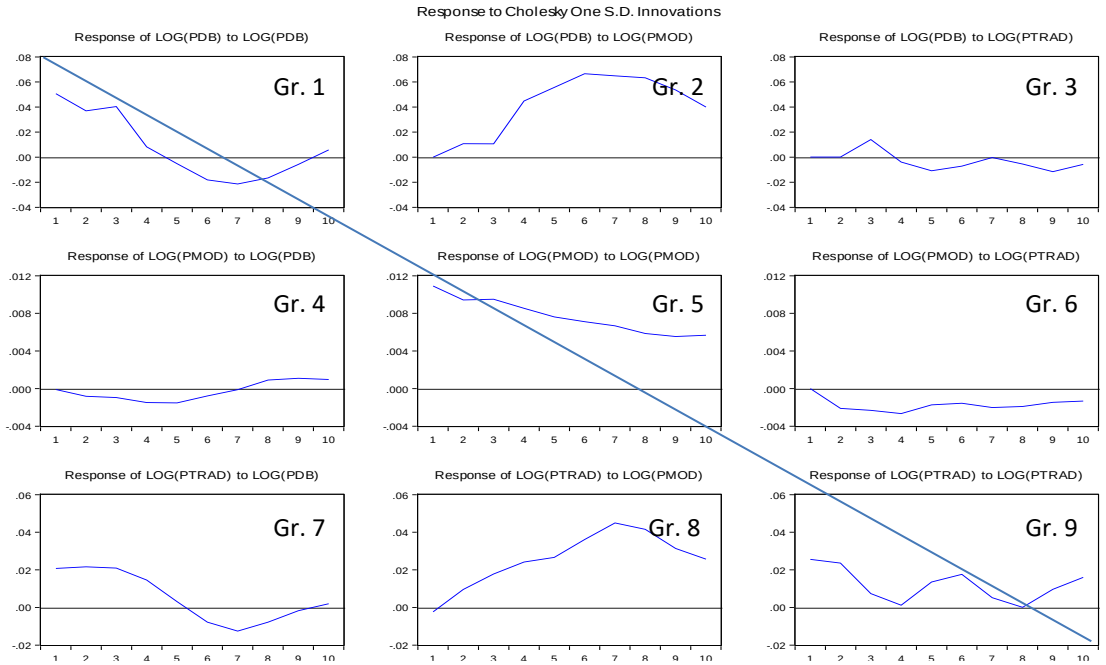

Figure 6 – Impulse Response VAR

Decomposition variance is useful for predicting the contribution of the percentage variance of each variable due to changes in certain variables in the VAR system. Analysis of the variance decomposition of the relationship between the price of sugar in traditional markets, prices in modern markets/supermarkets, and wholesalers over the next 10 months is shown in Tables 4, 5, and 6.

Table 4, describes the predicted contribution of the percentage of sugar price variance in traditional markets to changes in granulated sugar price variables at wholesalers and in traditional markets.

Table 4 – Traditional market decomposition variance

Variance Decomposition of LOG(PTRAD):				
Period	SE	LOG(GDP)	LOG(PMOD)	LOG(PTRAD)
1	0.033034	39.55279	0.499656	59.94756
2	0.046974	40.66641	4.416014	54.91758
3	0.054920	44.30071	13.72556	41.97372
4	0.061787	40.58562	26.21161	33.20277
5	0.068720	33.01322	36.25254	30.73424
6	0.079990	25.32427	47.15163	27.52410
7	0.092774	20.66094	58.55843	20.78063
8	0.101940	17.69788	65.09046	17.21165
9	0.107106	16.05836	67.53457	16,40708
10	0.111329	14.89550	67.85077	17.25373

The price variance in the traditional market is explained by the variable price of granulated sugar at wholesalers by 39.55%, while the rest is explained by 0.4997% and 59.95% by the variable price of granulated sugar in the modern market, and the price of sugar in the traditional market. In period 2, the variable explained by the sugar price variable at wholesalers was 40.67%, the rest was explained at 4.42% and 54.92% by the sugar price variable in the modern market and the sugar price variable in the traditional market. Up to period 10, the variance is explained by the variable price of granulated sugar in wholesalers by 14.90%, then the rest is explained by 67.85% and 17.25 by the variable price of granulated sugar in the modern market and the variable price of sugar in the traditional market.

Table 5 describes the predicted contribution of the percentage of sugar price variance in the modern market to changes in the sugar price variable at wholesalers and in traditional markets.

Table 5 – Variance of Modern/Supermarket decomposition

Variance Decomposition of LOG(PMOD):				
Period	SE	LOG(GDP)	LOG(PMOD)	LOG(PTRAD)
1	0.010909	0.008771	99.99123	0.000000
2	0.014594	0.327303	97.59532	2.077374
3	0.017593	0.521780	96.30859	3.169633
4	0.019792	0.976714	94.70554	4.317742
5	0.021334	1.355762	94.27566	4.368582
6	0.022557	1.332941	94.28040	4.386659
7	0.023611	1.218883	94.04145	4.739663
8	0.024420	1.276141	93.68266	5.041202
9	0.025109	1.397696	93.48876	5.113540
10	0.025795	1.463218	93.42770	5.109083

The price variance of granulated sugar in the modern market is explained by the variable price of granulated sugar at wholesalers of 0.0087%. In period 2, the variance is explained by the variable price of granulated sugar at wholesalers by 0.3273%, the rest is explained by 97.59% and 2.07% by the variable price of granulated sugar in the modern market, and the variable price of granulated sugar in the traditional market. Until the 10th period, the variance is explained by the variable price of granulated sugar at wholesalers by 1.46%, and the rest is explained by 93.43% and 5.11% by the variable price of granulated sugar in the modern market, and the variable price of granulated sugar in the traditional market.

Table 6 illustrates the predicted contribution of the percentage of sugar price variance at wholesalers to changes in the price of granulated sugar in the modern market and in the traditional market.

Table 6 – Wholesaler Decomposition Variance

Variance Decomposition of LOG(GDP):				
Period	SE	LOG(GDP)	LOG(PMOD)	LOG(PTRAD)
1	0.050669	100,0000	0.000000	0.000000
2	0.063606	97.15791	2.841855	0.000235
3	0.077347	92.90748	3.806865	3.285656
4	0.089846	69.67133	27.70246	2.626211
5	0.106370	49.94908	47.13907	2.911852
6	0.126981	37.08569	60.54997	2.364344
7	0.144171	30.97804	67.18741	1.834547
8	0.158409	26,74630	71.61306	1.640643
9	0.167725	23.97375	74.08529	1.940963
10	0.172611	22.74949	75.30752	1.942987

The price variance of granulated sugar at wholesalers is explained by the variable itself by 100%. In period 2, the variance explained by the variable itself is 97.16%, while the rest is explained by 2.84% and 0.00024% by the variable price of sugar in the modern market and the

variable price of sugar in the traditional market. Until the 10th period, the variance was explained by the variable itself by 22.75%, and the rest was explained by 75.31% and 1.92% by the variable price of sugar in the modern market and the variable price of sugar in the traditional market. Thus, according to the results of the analysis for 10 months, it can be said that in the long term the price variance of granulated sugar at wholesalers, modern markets and traditional markets, the contribution of each market is more balanced.

CONCLUSION

The behavior of the price of premium quality granulated sugar shows a movement that has increased by 2 times greater in modern markets/supermarkets and in traditional markets during the COVID-19 pandemic, while prices at wholesalers happen the other way around. Panic buying is one of the reasons for the trend of increasing price movements. The trend of price changes between traditional and modern market levels follows price changes but the movements are not symmetrical. Each market has a mechanism of movement towards equilibrium.

There is a long-term relationship with the price of premium quality granulated sugar in traditional markets, modern markets, and wholesalers. The results of the impulse response and the decomposition variance show the price response that occurs at the market level due to price shocks in other markets, others begin with an up or down response and in the final stage the response leads to an equilibrium condition. In the long term, the price variance of granulated sugar at wholesalers, modern markets and traditional markets, the contribution of each market is getting more balanced when it enters its tenth month.

In situations of extreme price movements, government intervention is needed to stabilize prices and reduce economic panic. Market participants are more sensitive in acting by absorbing accurate market information.

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