International Journal of Accounting and Finance in Asia Pasific (IJAFAP) **Vol. 6 No. 1, pp. 12-26, February, 2023**
P-ISSN: 2684-9763 /E-ISSN: 2655-6502
https://ejournal.aibpmjournals.com/index.php/IJAFAP

Disparity And Volatility of Horticultural Prices In Indonesia Before and During Pandemic Period (2019 and 2020)

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ARTICLE INFORMATION

Publication information

Research article

HOW TO CITE
Bhinadi, A. (2023). Disparity and volatility of horticultural prices in Indonesia before and during pandemic period (2019 And 2020). *International Journal of Accounting in Asia Pacific*, *6*(1), 12-26.
DOI:
https://doi.org/10.32535/ijafap.v6i1.2116

Received: 23 December 2023
Accepted: 11 January 2023
Published: 20 February 2023

ABSTRACT

Disparity, volatility, and asymmetry of horticultural agricultural commodity prices are important to study during the COVID-19 pandemic. The increase in horticultural prices can cause inflation and reduce the level of real welfare. The disparity in horticultural prices will encourage the flow of goods from low-priced to high-priced areas. The volatility of food prices during the COVID-19 pandemic will add economic pressure to the community. This study aims to analyze the disparity and volatility of horticultural prices and the transmission of food prices from upstream to downstream before and during the 2019-2020 pandemic. The analytical tools used are the average, price difference, coefficient of variation, and error correction model. The results show a disparity in food prices between provinces in Indonesia. Price disparities increase during the pandemic. Price volatility during the pandemic for horticultural commodities is higher than before the pandemic. Changes in horticulture prices at the upstream level significantly affect price changes at the downstream level.

Keywords: Asymmetry, Disparity, Pandemic, Volatility.

INTRODUCTION

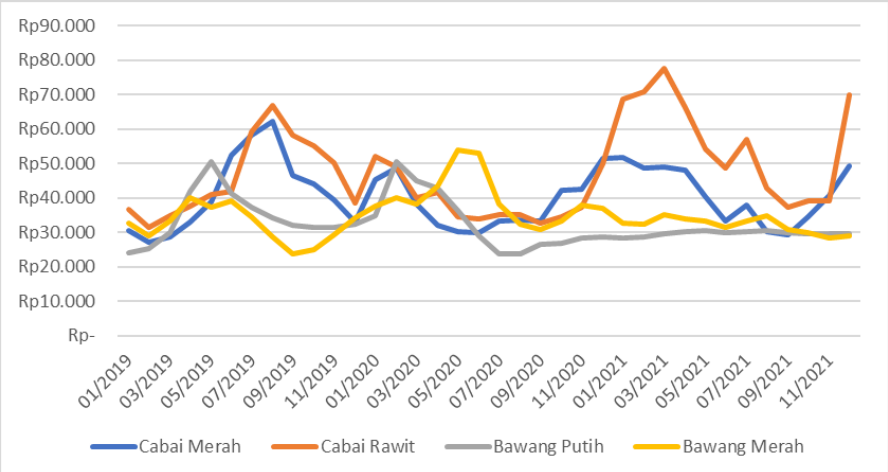
The issue of food prices becomes important during the COVID-19 pandemic situation. During a health crisis that has an impact on the economic crisis, the issue of food is always a concern because it is a basic need of the community. According to Sinolungan, Kimbal, and Kawulur (2022), the pricing must be appropriate, because the price level is expected to cover costs and generate profits. The government's response in various countries to the COVID-19 pandemic has created a multidimensional crisis. The health crisis turned into a social and economic crisis due to two things, namely the existence of physical and social restrictions, and the closure of several economic activities. The economic shock of the COVID-19 pandemic was felt globally as individual countries also closed their markets. If the crisis is not managed properly it can lead to mass unemployment and business closures. Uncertainty about the duration of the crisis can lead to a bad situation for consumption and investment (Ozili & Arun, 2020; Loayza & Pennings, 2020).

Uncertainty about the end of the COVID-19 pandemic has driven commodity market uncertainty. Uncertainty hurts commodity market volatility. The issue of volatility during the COVID-19 pandemic has become important amid the deteriorating situation in production, consumption, and investment as stated by Loayza and Pennings (2020). There are very few studies on commodity price volatility during the pandemic. Several studies on volatility during the pandemic are more related to financial and capital markets (Albulescu, 2020; Onali, 2020; Ercolani & Natoli, 2020; Bakas & Triantafyllou, 2020).

Agricultural commodity markets are considered capable of describing a high level of volatility. First, agricultural yields vary from period to period due to natural shocks such as weather and pests. Second, the elasticity of demand is relatively small due to low price and supply elasticity, at least in the short run. Third, production in agriculture requires a relatively long time, so the supply of commodities cannot respond to many price changes in the short term. Volatility in food commodities risks two parties, consumers and producers, which cannot be avoided (Braun & Tadesse, 2012).

During the 2019 and 2020 pandemic, horticultural commodity prices in Indonesia experienced quite high fluctuations. As shown in Figure 1, cayenne pepper prices have the highest price fluctuation compared to other commodities. During the pandemic, these fluctuations appear to be higher than before the pandemic.

Figure 1. Commodity Prices in Indonesia During the Pandemic



Source: https://hargapangan.id (data processed).

Agricultural commodities that have high volatility are horticulture. Horticultural products are strategic food commodities and are included in the volatile commodity category. Studying horticultural commodities is important before and after the pandemic to understand the magnitude of volatility and the alleged asymmetry in the agricultural market. This study aims to analyze the disparity and volatility of horticulture prices, as well as the transmission of food prices from upstream to downstream before and during the 2019-2020 pandemic.

LITERATURE REVIEW

Volatility is the variability of the price series around a central value, i.e., the tendency of prices to vary far from their average value. Volatility is often defined as a high deviation from the general trend. Understanding price volatility will help to design appropriate policies and help market participants to accommodate this phenomenon (Santeramo, Lamonaca, Contò, Nardone, & Stasi, 2018).

In Christanty's research (2013), there are two kinds of volatility. The first is temporary volatility caused by excessive demand for a commodity. Price fluctuations or changes are temporary and will eventually return to their original price. The second volatility is fundamental volatility. In fundamental volatility, what is used as a reference is the fundamental value. Where the price changes that occur are caused by the fundamental value that changes unexpectedly. Factors that influence it are more external, such as political issues.

Knowledge of volatility is important in many scopes of study (Gujarati, 2004). The volatility issue becomes important when the data movement on an economic variable shows a big change. Volatility measures the possible variation or movement of a particular economic variable (e.g., price). Prices change with rapid adjustments to market conditions. (Tothova, 2011).

Volatility is the variation of an economic variable over time. Price variations become a problem if the variation is large and cannot be anticipated so it can increase the risk for producers, consumers, and governments (IMF et al., 2011). Volatility measures how far the fluctuating value spreads to the average value in time series data (Asmara, 2011). Gilbert and Morgan (2010) state that volatility is a measure used to discuss price or quantity variability, focusing on the standard deviation that can affect many aspects, such as food security, financial markets, and trade (Miguez & Michelena, 2011) and relates to the price of a commodity. Such as agricultural commodities.

Observing food price volatility in developing countries is important because it can lead to higher inflation. The increased volatility in food prices also impacts the uncertainty of commodity prices in the agricultural sector. Farmers are the ones who do not benefit from the fluctuations in food prices. (Onour & Sergi, 2011). Research by Moshin and Zaman (2012) reveals that food commodity price shocks tend to have a blurred and heterogeneous effect on developing countries. The increase in food commodity prices can stimulate several countries' agricultural sector performance.

One of the economic variables that are in great demand for observation is the price of food and commodity prices in the agricultural sector. The nature of food commodities which are basic needs and vulnerable to price changes attracts various researchers to observe. Minot (2011) observed the volatility of food prices in Africa. Kornher and Kalkuhl (2013) looked at the volatility of food prices and their determinants in developing countries. Fulton and Reynolds (2015) examine the political economy of food price

volatility in Vietnam. The conclusions from the various studies are the same, namely that there is volatility in food prices in the various countries observed.

RESEARCH METHOD

This study uses data from the regional and Indonesian Food Price Monitoring Survey conducted by Bank Indonesia and recorded at Pusat Informasi Harga Pangan Strategis Nasional (Information Center for National Strategic Food Prices). The food price data is the weekly average food price from the first week of January 2019 to the fourth week of December 2020. There are 4 (four) horticultural commodities recorded and studied, namely shallots, garlic, red chilies, and cayenne pepper.

The analytical tool used to analyze the disparity is the difference between the average prices of Indonesian food commodities and the provinces. Price volatility is measured using the coefficient of variation in food prices. The formula for the coefficient of variation in food prices in Indonesia is:
CV =SD/M x100%
CV is the coefficient of variation, SD is the standard deviation, and M is the average price of Indonesian rice. This calculation provides the benefit of standard statistics for comparing variations over time. The value of the coefficient of variation is usually used as an indicator of price stability. The low value of CV indicates the stability of staple food prices. Based on the Strategic Plan of the Ministry of Trade of the Republic of Indonesia 2010-2014, staple food prices are stable if the coefficient of price variation is 5% to 9% or lower (Jati, 2014).

Analysis of the transmission of strategic food commodity prices is carried out in several stages. The first stage is checking the producer and consumer price data stationarity. The second stage is a cointegration test. The third stage is an asymmetric analysis of prices using the ECM-EG method.
The ECM model used in this study can be formulated as follows.

$$HProd_t = \alpha_0 + HE_t + \delta \Delta HProd_{t-1} + HE_{t-1} + ect(-1) + e_t$$

HProd = food commodity prices at the producer
HE = food commodity prices at the retailer level
0 = intercept
,δ,γ = regression coefficient
ect = error correction term
e = error term
t = shows the period

RESULTS

Disparity and volatility of shallot

Calculations of average price, price disparity, and price variation coefficient shallots in Indonesia are presented in Table 1. There are differences in results between the pre-pandemic period (in 2019) and 2020. The price variation coefficient of shallots in 2020 is higher than in 2019.

Table 1. Average Prices and Price Disparities of Shallots Before and During the Pandemic Between Provinces in Indonesia

No.	Province	Average		Price Disparity		Coefficient of Variation	
		2019	2020	2019	2020	2019	2020
	Indonesia	32,337	39,443			16.26%	18.40%
1	Aceh	32,323	39,607	-13	163	16.19%	22.66%
2	North Sumatra	31,617	37,310	-719	-2,134	15.79%	23.61%
3	West Sumatra	27,195	32,138	-5,141	-7,305	19.71%	21.41%
4	Riau	28,574	34,324	-3,763	-5,119	18.15%	24.52%
5	Riau Islands	32,814	37,940	478	-1,503	11.69%	8.92%
6	Jambi	26,907	32,836	-5,430	-6,608	21.10%	24.62%
7	Bengkulu	29,698	36,762	-2,638	-2,682	23.07%	21.68%
8	South Sumatra	32,069	37,699	-267	-1,744	17.39%	22.07%
9	Bangka Belitung Islands	34,338	40,615	2,002	1,172	20.51%	20.83%
10	Lampung	26,485	33,597	-5,852	-5,846	24.72%	22.86%
11	Banten	31,175	38,292	-1,162	-1,151	21.26%	23.74%
12	West Java	29,442	36,259	-2,894	-3,185	21.87%	22.27%
13	DKI Jakarta	35,647	42,639	3,311	3,196	19.32%	21.17%
14	Central Java	26,907	33,512	-5,430	-5,932	22.83%	23.40%
15	DI Yogyakarta	27,510	33,933	-4,827	-5,511	23.10%	20.04%
16	Java	25,145	32,296	-7,191	-7,147	22.65%	21.66%
17	Bali	25,863	32,246	-6,474	-7,197	26.31%	21.62%
18	West Nusa Tenggara	23,848	29,493	-8,488	-9,950	31.16%	20.93%
19	East Nusa Tenggara	28,499	31,805	-3,838	-7,638	24.67%	17.68%
20	West Kalimantan	29,292	40,646	-3,044	1,203	14.01%	19.74%
21	South Kalimantan	30,246	36,630	-2,090	-2,813	21.92%	21.81%
22	Central Kalimantan	32,682	40,718	345	1,275	20.41%	19.66%
23	East Kalimantan	31,820	40,921	-516	1,478	20.76%	21.96%
24	North Kalimantan	37,638	45,443	5,301	6,000	14.15%	20.18%
25	Gorontalo	36,239	44,745	3,903	5,302	18.94%	21.05%
26	South Sulawesi	29,758	35,846	-2,579	-3,597	13.63%	22.42%
27	Southeast Sulawesi	36,047	45,080	3,711	5,637	13.16%	18.31%
28	Central Sulawesi	33,120	40,622	784	1,179	14.76%	18.39%
29	North Sulawesi	35,048	44,606	2,712	5,163	18.75%	22.42%
30	West Sulawesi	33,513	36,208	1,177	-3,236	17.99%	19.72%
31	Maluku	38,903	48,169	6,566	8,726	16.99%	21.09%
32	North Maluku	44,764	55,389	12,428	15,946	15.22%	19.22%
33	Papua	48,950	57,563	16,613	18,120	15.75%	20.72%
34	West Papua	44,120	55,591	11,784	16,148	14.77%	22.67%

Source: https://hargapangan.id (data processed).

The estimation results of the asymmetric price transformation model for the shallot commodity are presented in Table 2.

Table 2. The Estimation Results of the Red Onion APT Model PIHPS PE

Variable	Coefficient	Std.Error	t-Statistic	Prob.	Description
Konstanta	-426.4038	263.8326	-1.616190	0.1210	not significant
D(BM _PRODUSEN)	2.603047	0.173889	14.96963	0.0000	significant
D(BM_PE(-1))	-0.300910	0.189072	-1.591506	0.1264	not significant
D(BM _PRODUSEN(-1))	0.153394	0.190867	0.803669	0.4306	not significant
Ect (-1)	-1.075893	0.269960	-3.985377	0.0007	significant
R2	0.936713				
Adjusted R2	0.924658				
F-Stat	77.70516				
Prob.F-stat	0.000000				

Garlic price disparity and volatility

The results of the calculation of the average price, price disparity, and coefficient of variation in Garlic prices in Indonesia are presented in Table 1. There are differences in results between the pre-pandemic period (in 2019) and 2020. The price variation coefficient of Garlic in 2020 is higher than in 2019.

Table 3. Average Prices and Disparities of Garlic Prices Before and During the Pandemic Between Provinces in Indonesia

period	Province	Average		Price Disparity		Coefficient of Variation	
		2019	2020	2019	2020	2019	2020
	Indonesia	34,471	32,863			22.41%	25.87%
1	Aceh	32,198	29,495	-2,273	-3,367	31.09%	29.18%
2	North Sumatra	32,397	29,875	-2,074	-2,988	27.14%	26.84%
3	West Sumatra	31,384	29,499	-3,088	-3,363	29.10%	28.89%
4	Riau	30,738	28,102	-3,734	-4,761	25.84%	29.28%
5	Riau Islands	28,937	31,138	-5,535	-1,725	15.23%	23.36%
6	Jambi	31,291	26,780	-3,180	-6,083	33.41%	30.44%
7	Bengkulu	32,228	28,580	-2,243	-4,283	36.75%	33.42%
8	South Sumatra	33,847	31,554	-624	-1,309	26.88%	27.27%
9	Bangka Belitung Islands	31,476	28,769	-2,995	-4,093	24.52%	30.65%
10	Lampung	29,355	27,595	-5,116	-5,267	25.93%	28.72%
11	Banten	33,227	31,323	-1,244	-1,539	24.17%	29.47%
12	West Java	34,598	32,253	127	-610	25.43%	27.21%
13	DKI Jakarta	44,474	40,903	10,003	8,040	23.70%	23.43%
14	Central Java	33,078	29,488	-1,393	-3,374	23.56%	29.04%
15	DI Yogyakarta	35,077	30,654	606	-2,209	23.05%	28.96%
16	Java	27,825	25,268	-6,646	-7,594	24.94%	34.69%
17	Bali	27,695	25,960	-6,776	-6,903	25.46%	37.18%
18	West Nusa Tenggara	32,126	30,426	-2,345	-2,437	25.72%	32.19%
19	East Nusa Tenggara	39,559	38,005	5,088	5,142	26.34%	30.31%
20	West Kalimantan	27,730	27,377	-6,741	-5,486	15.53%	32.50%
21	South Kalimantan	31,672	30,541	-2,799	-2,321	26.76%	28.28%
22	Central Kalimantan	33,538	33,337	-933	474	20.68%	27.26%

period	Province	Average		Price Disparity		Coefficient of Variation	
		2019	2020	2019	2020	2019	2020
23	East Kalimantan	33,634	33,112	-838	249	36.01%	28.94%
24	North Kalimantan	36,091	36,200	1,620	3,338	16.62%	24.27%
25	Gorontalo	41,278	37,789	6,807	4,927	25.72%	25.00%
26	South Sulawesi	31,921	29,813	-2,550	-3,050	24.83%	28.08%
27	Southeast Sulawesi	39,969	40,436	5,498	7,573	25.54%	21.08%
28	Central Sulawesi	35,822	32,304	1,351	-559	29.14%	30.62%
29	North Sulawesi	34,210	32,861	-262	-2	32.30%	25.98%
30	West Sulawesi	33,990	31,324	-481	-1,538	26.50%	25.45%
31	Maluku	38,032	38,874	3,561	6,012	24.16%	26.08%
32	North Maluku	43,413	47,837	8,942	14,974	21.74%	15.99%
33	Papua	45,245	43,692	10,774	10,830	22.38%	22.03%
34	West Papua	44,293	45,106	9,822	12,243	20.23%	19.54%

Table 4. Estimation Results of Garlic APT Model PIHPS PE

Variable	Coefficient	Std.Error	t-Statistic	Prob.	Description
Constant	-173.6501	857.8477	-0.202425	0.8415	Not Significant
D(BP _PRODUCER)	0.065957	0.579603	0.113796	0.9105	Significant
D(BP_PE(-1))	0.397187	0.171068	2.321805	0.0304	Significant
D(BP _PRODUSENEN(-1) 0.330)	-0.511079	0.576330	-0.886782	0.3852	not significant
Ect (-1)	-0.478925	0.172769	-2.772055	0.0114	Significant
R2	0.361499				
Adjusted R2	0.239880				
F-Stat	2.972383				
Prob.F-stat	0.043157				

Disparity and volatility of red chili prices

The results of the calculation of the average price, price disparity and the coefficient of variation of Red Chili prices in Indonesia are presented in Table 1. There are differences in results between the pre-pandemic period (in 2019) and 2020. The price variation coefficient of Red Chilli in 2020 is lower than in 2019.

Table 5. Average Prices and Disparities of Red Chili Prices Before and During the Pandemic Between Provinces in Indonesia

No	Province	Average		Price Disparity		Coefficient of Variation	
		2019	2020	2019	2020	2019	2020
	Indonesia	41,488	38,486			28.11%	20.92%
1	Aceh	41,329	33,406	-159	-5,080	51.09%	26.30%
2	North Sumatra	41,461	30,916	-27	-7,569	48.65%	30.43%
3	West Sumatra	42,032	34,690	544	-3,795	40.34%	35.13%
4	Riau	44,214	36,013	2,727	-2,472	36.30%	29.72%
5	Riau Islands	57,104	43,256	15,616	4,770	29.26%	31.54%
6	Jambi	38,802	29,229	-2,686	-9,257	46.09%	40.49%
7	Bengkulu	39,714	31,855	-1,773	-6,631	42.29%	38.30%
8	South Sumatra	44,973	37,353	3,486	-1,133	38.94%	34.56%
9	Bangka Belitung Islands	58,976	55,273	17,488	16,788	19.86%	13.53%
10	Lampung	36,662	33,512	-4,826	-4,974	43.59%	39.31%
11	Banten	42,268	39,854	781	1,368	36.99%	44.45%
12	West Java	39,525	39,408	-1,963	922	37.47%	38.21%
13	DKI Jakarta	48,687	47,105	7,199	8,619	32.87%	38.61%
14	Central Java	32,083	29,700	-9,405	-8,786	42.29%	50.00%
15	DI Yogyakarta	35,879	31,552	-5,609	-6,934	37.25%	52.17%
16	Java	29,780	30,234	-11,708	-8,252	40.33%	49.59%
17	Bali	29,317	29,038	-12,170	-9,447	37.99%	51.21%
18	West Nusa Tenggara	30,384	30,229	-11,104	-8,257	37.11%	38.15%
19	East Nusa Tenggara	48,838	45,912	7,351	7,426	22.56%	28.25%
20	West Kalimantan	46,613	47,312	5,125	8,826	19.58%	18.28%
21	South Kalimantan	40,224	36,943	-1,263	-1,542	35.84%	23.12%
22	Central Kalimantan	56,261	52,243	14,773	13,758	21.97%	15.15%
23	East Kalimantan	46,420	40,201	4,933	1,715	31.78%	14.99%
24	North Kalimantan	55,432	53,554	13,944	15,068	20.15%	11.59%
25	Gorontalo	35,703	34,235	-5,785	-4,251	32.94%	27.66%
26	South Sulawesi	28,385	25,592	-13,103	-12,893	40.60%	37.87%
27	Southeast Sulawesi	39,974	34,777	-1,513	-3,709	35.17%	19.48%
28	Central Sulawesi	32,510	28,846	-8,978	-9,639	33.16%	28.16%
29	North Sulawesi	30,883	31,063	-10,605	-7,423	30.65%	34.10%
30	West Sulawesi	31,386	27,163	-10,102	-11,323	41.82%	37.07%
31	Maluku	53,427	57,586	11,939	19,100	17.86%	24.08%
32	North Maluku	38,151	43,317	-3,337	4,832	20.45%	19.84%
33	Papua	46,140	59,540	4,653	21,055	24.81%	28.12%
34	West Papua	50,024	47,588	8,537	9,103	19.08%	22.04%

Source: https://hargapangan.id (data processed).

Table 6. Estimation Results of Red Chili APT Model PIHPS PE

Variable	Coefficient	Std.Error	t-Statistic	Prob.	Description
Constant	-79.84434	667.6872	-0.119583	0.9060	Not Significant
D(CM _PRODUCER,2)	1.584042	0.166251	9.528043	0.0000	Significant
D(CM_PE(-1),2)	-0.566086	0.110633	-5.116787	0.0001	Significant
D(CM _2) MANUFACTURER(-1),2)	0.180387	0.203882	0.884763	0.3868	Not Significant
Ect (-1)	-0.938229	0.230385	-4.072434	0.0006	Significant
R2	0.882213				
Adjusted R2	0.858656				
F-Stat	37.44962				
Prob. F-stat	0.000000				

Disparity and volatility of cayenne pepper price

The results of the calculation of the average price, price disparity, and the coefficient of variation in the price of shallots in Indonesia are presented in Table 1. There are differences in results between the pre-pandemic period (in 2019) and the 2020 pandemic. The price variation coefficient of Cayenne Pepper in 2020 is higher than in 2019.

Table 7. Average Price and Disparity of Cayenne Pepper Prices Pandemic Inter-Provincial

No.	Province	Average		Price Disparity		Coefficient of Variation	
		2019	2020	2019	2020	2019	2020
	Indonesia	46,259	39,182			24.78%	20.06%
1	Aceh	42,131	35,418	-4,128	-3,763	28.23%	20.90%
2	North Sumatra	40,517	30,431	-5,741	-8,751	34.30%	31.48%
3	West Sumatra	44,217	33,543	-2,041	-5,638	21.01%	22.14%
4	Riau	43,133	33,766	-3,126	-5,415	33.97%	24.49%
5	Riau Islands	51,995	37,254	5,737	-1,928	28.25%	24.57%
6	Jambi	44,701	37,127	-1,558	-2,055	37.55%	36.76%
7	Bengkulu	40,388	30,254	-5,870	-8,928	34.57%	23.82%
8	South Sumatra	48,701	39,380	2,442	198	28.85%	26.56%
9	Bangka Belitung Islands	49,909	40,491	3,650	1,310	24.14%	20.50%
10	Lampung	40,863	33,459	-5,396	-5,723	40.01%	34.23%
11	Banten	41,008	35,207	-5,251	-3,975	41.80%	37.33%
12	West Java	39,908	34,521	-6,351	-4,661	43.03%	34.77%
13	DKI Jakarta	44,904	39,975	-1,355	793	39.70%	34.65%
14	Central Java	32,539	26,534	-13,719	-12,648	44.92%	45.48%
15	In Yogyakarta	32,895	27,197	-13,363	-11,985	42.73%	45.10%
16	East Java	26,703	22,796	-19,556	-16,386	53.42%	48.24%
17	Bali	32,031	26,595	-14,228	-12,587	48.28%	40.26%

No.	Province	Average		Price Disparity		Coefficient of Variation	
		2019	2020	2019	2020	2019	2020
18	West Nusa Tenggara	29,389	25,836	-16,869	-13,346	42.61%	52.18%
19	East Nusa Tenggara	56,238	50,068	9,980	10,887	24.88%	29.40%
20	West Kalimantan	60,167	57,432	13,909	18,250	22.41%	18.97%
21	South Kalimantan	37,545	31,284	-8,713	-7,898	34.09%	30.29%
22	Central	45,811	40,887	-448	1,705	25.06%	17.50%
23	East Kalimantan	50,865	40,146	4,607	964	28.97%	16.20%
24	North Kalimantan	68,185	70,448	21,926	31,266	19.86%	14.14%
25	Gorontalo	62,217	42,862	15,959	3,680	42.92%	28.28%
26	South Sulawesi	32,411	25,007	-13,848	-14,175	37.14%	39.18%
27	Southeast Sulawesi	54,313	41,303	8,054	2,121	28.16%	38.99%
28	Central Sulawesi	58,047	42,040	11,788	2,859	30.39%	16.54%
29	North Sulawesi	54,014	37,775	7,756	-1,407	47.84%	24.16%
30	West Sulawesi	32,169	23,343	-14,089	-15,838	32.94%	30.06%
31	Maluku	63,178	49,269	16,919	10,088	29.83%	26.81%
32	North Maluku	61,661	75,410	15,402	36,228	15.00%	15.54%
33	Papua	51,242	57,711	4,984	18,529	26.15%	32.65%
34	West Papua	62,832	55,883	16,573	16,701	24.39%	29.66%

Source: https://hargapangan.id (data processed).

Table 8. Estimation Results of APT Chili Rawit Model PIHPS PE

Variable	Coefficient	Std.Error	t-Statistic	Prob.	Description
Constant	102.5949	639.9047	0.160328	0.8742	Not significant
D(CR _PRODUCER)	1.987499	0.171841	11.56593	0.0000	Significant
D(CR_PE(-1))	-0.297168	0.242402	-1.225931	0.2338	Not significant
(CR -035	-0.069935	0.207870	-0.336437	0.7399	Not significant
Ect (-1)	-0.936710	0.323573	-2.894898	0.0087	Significant
R2	0.883111				
Adjusted R2	0.860847				
F-Stat	39.66453				
Prob. F-stat	0.000000				

DISCUSSION

Shallots

The price of shallot during the observation period is volatile. This is in line with previous research (Braun & Tadesse, 2012; Fulton & Reynolds, 2015; and Jati, 2014). The average price of shallots in Indonesia during the 2020 pandemic is higher than in 2019. The disparity in the price of shallots is quite high between provinces in Indonesia. The average price of shallots in the province of West Nusa Tenggara is lower than the national average price. In 2019 and 2020, the average price of shallots in the province of West Nusa Tenggara was IDR 8,488 and IDR 9,950 lower than the national average price. The average price of shallots in Papua Province is much higher than the national average price. The average price of shallots in Papua Province in 2019 and 2020 was Rp16,613 and Rp18,120 more expensive than the national average price of shallots. The volatility of shallot prices during the pandemic is higher than in the pre-pandemic period. The coefficient of variation of shallots in 2020 is 18.4%, higher than in 2019, which was 16.26%. Overall, the shallots' price was unstable before and during the pandemic.

In the short term, changes in national shallot prices at the producer level significantly affect changes in national shallot prices at the retail level. The ECT coefficient is negative and significant, meaning that the price of shallots at the producer and retailer level is cointegrated in the long run. As for the significant negative ECT value, this indicates that there is a long-term relationship between national shallot prices between producers and retailers. The reaction to price changes is shown faster by traders when the price of shallots rises compared to when the price of shallots falls. Conversely, when the price of shallots at the producer level falls, retail traders will be slower to participate in lowering the prices of shallots.

Garlic

The price of garlic during the observation period is volatile. This is in line with previous research (Braun & Tadesse, 2012; Fulton & Reynolds, 2015; and Jati, 2014). The average price of garlic in Indonesia during the 2020 pandemic is lower than the average price of garlic in 2019. There is a fairly high disparity in garlic prices between provinces in Indonesia. The lowest average price of garlic in 2019 was in the province of Bali, Rp6,776 lower than the national average price of garlic. The lowest average price of garlic in 2020 was in East Java Province, Rp7,594 lower than the national average price. The highest average price of garlic in 2019 was in the province of Papua, IDR 10,774 more expensive than the national average price. The highest average price of garlic in 2020 was in the province of North Maluku, Rp14,974 more expensive than the national average price. The volatility of garlic prices during the pandemic is higher than in the pre-pandemic period. The coefficient of garlic variation in 2020 is 25.87%, higher than in 2019 at 22.41%. Overall, the price of garlic was unstable before and during the pandemic.

In the short term, changes in national garlic prices at the producer level do not significantly affect changes in national garlic prices at the retail level. The ECT coefficient is negative and significant, meaning that the price of garlic at the producer and retailer level is cointegrated in the long run. The significant negative ECT value indicates a long-term relationship between the national garlic price and producers and retailers. A faster reaction is shown by traders when the price of garlic goes up than when the price goes down. On the other hand, when the price of garlic at the producer level rises, retail traders will be slower to participate in increasing the price of garlic.

Red Chili

The price of red chili during the observation period is volatile. This is in line with previous research (Braun & Tadesse, 2012; Jati, 2014; and Fulton & Reynolds, 2015). The average price of red chili in Indonesia during the 2020 pandemic is lower than that of red chili in 2019. There is a high disparity in the price of red chili between provinces in Indonesia. The average price of red chili in South Sulawesi Province is much lower than the national average. In 2019 and 2020, the average price of red chilies in South Sulawesi province was Rp13,103 and Rp12,893 lower than the national average price for red chilies. The highest average price of red chili in 2019 was in the Province of the Bangka Belitung Islands, IDR 58,975, IDR 17,488 more expensive than the national average price of red chili. The highest average price of red chili in 2020 was in the province of Papua, IDR 59,540, IDR 21,055 more expensive than the national average price. The volatility of red chili prices during the pandemic is lower than in the pre-pandemic period. The red chili coefficient of variation in 2020 is 20.92%, lower than in 2019, which was 28.11%. Overall, red chili prices were not stable before and during the pandemic.

In the short term, the price of national red chili at the producer level significantly affects the price of national red chili at the retail level. The ECT coefficient is negative and significant, meaning that the price of red chili at the producer and retailer level is cointegrated in the long run. As for the significant negative ECT value, this indicates that there is a long-term relationship with the national red chili price between producers and retailers. Traders react faster when the price of red chili goes up than when the price of red chili goes down.

Cayenne Pepper

The price of cayenne pepper during the observation period is volatile. This is in line with previous research (Braun & Tadesse, 2012; Fulton & Reynolds, 2015; and Jati, 2014). The average price of cayenne pepper in Indonesia during the 2020 pandemic was lower than that of cayenne in 2019. There is a very high disparity in the price of cayenne pepper between provinces in Indonesia. The average price of cayenne pepper in East Java Province is much lower than the national average. In 2019 and 2020, the average price of cayenne pepper in East Java Province was Rp19,556 and Rp22,796 lower than the national average price of cayenne pepper. The highest average price of cayenne pepper in 2019 was in North Kalimantan Province at IDR 68,185, IDR 21,926 more expensive than the national average price. The highest average price of cayenne pepper in 2020 was in the province of North Maluku Rp75,410, Rp36,288 more expensive than the national average price. The price volatility of cayenne pepper during the pandemic is lower than in the pre-pandemic period. The coefficient of variation of cayenne pepper in 2020 was 20.06%, lower than in 2019 at 24.78%. Overall, the price of cayenne pepper was very unstable in the period before and during the pandemic.

In the short term, changes in the price of national cayenne pepper at the producer level significantly affect the price of national cayenne pepper at the retail level. The ECT coefficient is negative and significant, meaning that the price of cayenne pepper at the producer and retailer level is cointegrated in the long run. The significant negative ECT value indicates a long-term relationship between the price of national cayenne pepper between producers and retailers. Traders react faster when the price of cayenne pepper goes up than when the price of cayenne pepper goes down.

CONCLUSION

There is a high price disparity of shallots between provinces in Indonesia. The price of shallot during the observation period is volatile. The volatility increases during the pandemic period. In the short and long term, there is no asymmetry in shallot prices. Changes in shallot prices at the producer level affect shallot prices at the retail level.

There is a high price disparity of garlic between provinces in Indonesia. The price of garlic during the observation period is volatile. The volatility increases during the pandemic period. In the short and long term, there is no asymmetry in garlic prices. Changes in garlic prices at the producer level affect garlic prices at the retail level.

There is a high price disparity of red chili between provinces in Indonesia. The price of red chili during the observation period is volatile. The volatility decreased during the pandemic period. In the short and long term, there is no asymmetry in red chili prices. Changes in red chili prices at the producer level affect red chili prices at the retail level.

There is a high price disparity of cayenne pepper between provinces in Indonesia. The price of cayenne pepper during the observation period is volatile. The volatility decreased during the pandemic period. In the short and long term, there is no asymmetry in shallot prices. Changes in cayenne pepper prices at the producer level affect cayenne pepper prices at the retail level.

Overall, the average price of horticultural commodities in Indonesia during the 2020 pandemic is higher than in 2019. There is a high disparity in horticultural prices between provinces in Indonesia. The volatility of horticulture prices during the pandemic is higher than in the pre-pandemic period.

In the short term, changes in horticulture prices at the producer significantly affect retail prices. There is a long-term relationship between national horticultural prices between producers and retailers. The reaction of horticultural traders is faster when the price goes up than when the price goes down.

The findings of this study are interesting to continue with research in the post-pandemic period. Will post-pandemic price behavior return to pre-pandemic or pandemic times, or will it have a different behavior again? Post-pandemic research is important to get a more complete picture of the price behavior of horticultural commodities.

ACKNOWLEDGMENT

I thank the various parties who have assisted in this research. Especially to the Bank of Indonesia which has helped fund various research and assistants who helped collect data.

DECLARATION OF CONFLICTING INTEREST

I warrant that the article is the Authors' original work. I warrant that the article has not received prior publication and is not under consideration for publication elsewhere.

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