INDONESIAN PEPPER IN THE JAPANESE MARKET: COMPETITIVEENESS AND EXPORT PERFORMANCE

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ABSTRACT

This study examines the competitiveness and export performance of Indonesian pepper in the Japanese market from 1990 to 2024, in comparison with China and Malaysia. Using Revealed Comparative Advantage (RCA), Constant Market Share (CMS), and Vector Error Correction Model (VECM), the study finds that all three countries maintained RCA values above 1,0 throughout the observation period, confirming sustained comparative advantage. Indonesia's average RCA was 4,05; China's was 2,54; and Malaysia's was 9,87. CMS analysis reveals that the commodity composition effect for Indonesia and Malaysia was marginally positive, while the competitiveness effect yielded negative averages for Indonesia and China, but positive for Malaysia. VECM estimation identifies a long-run cointegrating relationship among the competitiveness variables, and Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) analyses demonstrate that Indonesia's dynamic market share (CMS) is the primary external driver of Japan's total pepper import value. Policy implications point to the need for sustained premium quality positioning, supply chain improvement, and optimal utilization of trade agreements such as RCEP.

Keywords: *Indonesian pepper, Japanese market, Revealed Comparative Advantage, Constant Market Share, VECM*

A. Introduction

International trade is one of the main pillars in driving economic growth, opening access to wider markets, promoting production specialization, and increasing the efficiency of resource utilization. For developing countries like Indonesia, exports of primary commodities particularly from the plantation sector remain a significant source of foreign exchange and support for Gross Domestic Product (GDP) growth. Pepper (Piper nigrum) is one such leading commodity, with Indonesia ranked among the world's major pepper producers alongside China and Malaysia (DIREKTORAT JENDERAL PERKEBUNAN, 2025).

Indonesia's national pepper production reached approximately 75-89 thousand tons in 2022, primarily from Lampung and Bangka Belitung provinces, before declining to 58-63 thousand tons in 2024 due to stagnant productivity and lack of farmer

regeneration. In the global export landscape, China dominates with 361,35 million tons (2024), followed by Indonesia at 55,75 million tons and Malaysia at 9,57 million tons (UN COMTRADE, 2025).

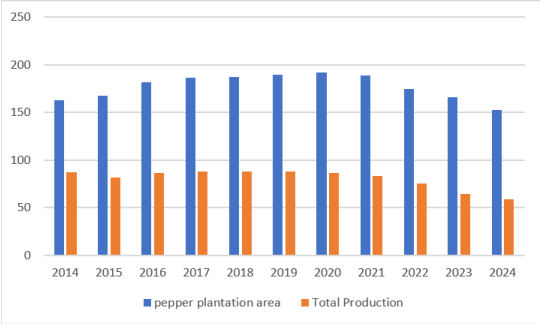


Figure 1 Pepper Plantation Area (In Thousand Hectares) and Total Pepper Production (in Thousand Tons) (Source: CNBC Indonesia (2025, data processed))

Japan has emerged as a strategically important destination market for pepper trade. A key driver is Japan's rapidly expanding culinary tourism sector: in 2024, 36,87 million international tourists visited Japan, 82,2% of whom cited eating Japanese food as a primary motivation. Tourist spending on food and beverages reached approximately ¥1,76 trillion, or 21-23% of total tourist expenditure (JNTO, 2025). The shichimi togarashi spice market a traditional Japanese condiment incorporating pepper is projected to grow at a CAGR of 9,33%, while Japan's overall spice market was valued at USD 992,4 million in 2024 (IMARCH, 2025).

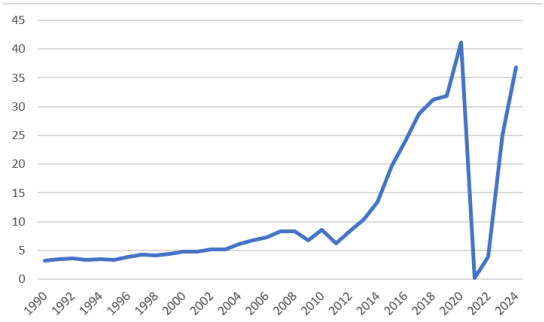


Figure 2 (Total Number of Foreign Tourist Arrivals in Japan 1990-2024 (In Millions) (Source: JNTO, 2025)

Indonesia, China, and Malaysia together control approximately 95% of Japan's piper pepper import market, with respective export values of approximately USD 14 million, USD 20 million, and USD 65 million. Despite its smaller volume, Indonesia earns the highest unit export value to Japan at USD 7.812/unit 42,3% higher than China (USD 4.565) confirming Japan's role as a premium market for Indonesian pepper (Trademap, 2025).

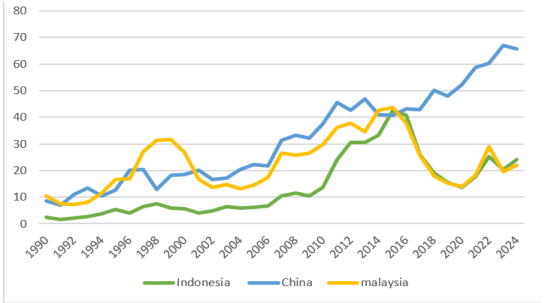


Figure 3 Top Pepper Exporters to Japan from 1990 to 2024 (Source: UN Comtrade, 2025)

Previous empirical research has predominantly focused on aggregate export trends or short-term competitiveness indicators, without integrating destination-specific market dynamics over an extended period. This study fills that gap by systematically analyzing the competitiveness and export performance of Indonesian pepper in the Japanese market from 1990 to 2024, using an integrated framework of RCA, CMS, and VECM analyses. The research objectives are: (1) to evaluate and compare the RCA values of Indonesia, China, and Malaysia in the Japanese pepper market; (2) to decompose export performance through CMS analysis; (3) to identify the economic determinants of Japan's pepper import demand; and (4) to examine long-run equilibrium and short-run dynamics using the VECM approach.

B. Research Methodology

This study employs a quantitative descriptive approach using time-series data spanning 1990-2024 for Indonesia, China, and Malaysia in the Japanese market. Data on pepper export values, total commodity exports, and world export aggregates were sourced from the International Trade Centre (ITC), UN COMTRADE, and the World Trade Organization (WTO). The three analytical stages are as follows.

1. Revealed Comparative Advantage (RCA)

The RCA method, developed by Balassa (1965), is used to measure the comparative competitiveness of a country's specific commodity in a destination market. A country is considered to have comparative advantage when its share of exports in a particular commodity exceeds the world's share of that commodity in total world trade. In this study, RCA is applied to evaluate the competitive position of pepper exports from Indonesia, China, and Malaysia in the Japanese market over the period 1990-2024. The formula is as follows:

$$\text{RCA} = \frac{Xij/Xit}{Wi/Wt}$$

Xij = Value of commodity i (Pepper) exports from country j (Indonesia)
Xit = Value of total commodity exports from country j (Indonesia)
Wi = Value of commodity i exports in the world (Pepper)
Wt = Value of total commodity exports in the world

2. Constant Market Share (CMS)

In this study, CMS analysis is applied to assess whether Indonesia's pepper export growth in the Japanese market is driven by genuine

competitive strength or merely by favorable global market conditions. The method works by holding market shares constant at a base period level and comparing actual export growth against what would have been expected if market shares had remained unchanged. Any difference between the two is then broken down into four structural components, revealing the specific sources of export performance gains or losses. The decomposition is as follows:

Standard Growth Effect: $r = \frac{W_t - W_{(t-1)}}{W_{(t-1)}}$

This measures the baseline world export growth rate, serving as a benchmark to evaluate whether a country's exports grow faster or slower than the global average.

Commodity Composition Effect: $\frac{\sum_i (r_i - r) E_{i(t-1)}}{E_{(t-1)}}$

This captures whether a country's export structure is concentrated in commodity segments with above-average global demand growth. A positive value indicates favorable specialization.

Market Distribution Effect: $\frac{\sum_i \sum_j (r_{ij} - r_i) E_{ij(t-1)}}{E_{(t-1)}}$

This measures whether a country's exports are directed toward destination markets that are growing faster than the global average for that commodity.

Competitiveness Effect: $\frac{\sum_i \sum_j \left| E_{ij}(t) - E_{ij(t-1)} - r_{ij} E_{ij(t-1)} \right|}{E_{(t-1)}}$

This is the most economically significant component. A positive value indicates that a country has succeeded in gaining market share from competitors beyond what global growth alone would explain, while a negative value signals competitive erosion.

3. Stationarity Test and Optimal Lag Determination

All variables are tested for unit roots using the Augmented Dickey-Fuller (ADF) Panel Unit Root Test. The optimal lag length is selected by comparing Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ) criteria for VAR Lag Order Selection, with a maximum lag of 2 given the annual data frequency.

4. VAR,Johansen Cointegration and VECM

Following confirmation of I(1) stationarity, the Johansen Cointegration Test (Trace and Maximum Eigenvalue statistics) identifies long-run equilibrium relationships among the variables:

RCA Indonesia, RCA China, RCA Malaysia, CMS Indonesia, CMS China, CMS Malaysia, and Total Pepper Imports of Japan. If cointegration is confirmed, the VECM framework is estimated to recover both long-run cointegrating equations (β matrix) and short-run adjustment coefficients (α matrix, ECT). Granger Causality (Block Exogeneity Wald Tests), IRF, and FEVD are subsequently applied to trace shock transmission and variance contributions. Data processing was conducted using Microsoft Excel 2010 and EViews 12.

C.Hasil Penelitian dan Pembahasan

1. Results

a. Revealed Comparative Advantage (RCA)

Year	Indonesia	China	Malaysia
1990	1,550528974	5,786883818	15,69870855
1991	1,070601375	4,360561591	10,52926901
1992	1,274508287	4,675948553	7,785540798
1993	3,258409475	9,638806056	15,39700994
1994	4,339110103	5,836838418	21,46676542
1995	8,142984374	7,465868316	33,92636368
1996	1,564760877	2,943384189	8,47170817
1997	2,041381809	2,227584974	10,89418964
1998	2,754190448	1,401284552	14,5999761
1999	1,918562688	1,763933827	11,97918824
2000	1,811907898	1,804412525	9,918177077
2001	1,70800943	2,170776148	8,143384523
2002	2,481103374	1,954299449	8,983093585
2003	2,914047898	1,695892434	8,81121942
2004	2,539427378	1,741867406	7,536810099
2005	2,606876612	1,768603747	8,632989116
2006	2,581463039	1,676985785	10,3192284
2007	2,517054726	1,574062973	9,839607474
2008	2,939543679	1,959658532	9,337527351
2009	3,037672933	1,657664807	10,04199672
2010	3,420335727	1,720590672	9,17650396
2011	4,669325584	1,641382681	7,871483247
2012	6,185794762	1,473989869	7,49772911
2013	6,424889626	1,568744753	7,053017423
2014	6,987234744	1,218406882	7,889235398
2015	8,068836361	0,948934656	7,61960408
2016	8,584366916	1,052215999	8,356421611
2017	6,910999749	1,376970432	7,051316246
2018	5,644411309	1,827747073	6,005595468
2019	5,822854945	1,935591414	5,917121896
2020	5,355571522	1,944964755	5,302515643
2021	5,633524949	1,978642163	5,76071336
2022	5,277168955	1,918741996	6,675918492
2023	4,46287732	2,11025014	5,482752533
2024	5,125250609	1,92320235	5,642670797
Average	4,046445384	2,535591255	9,874724359

Table 1 RCA Calculation Results: Indonesia, China, and Malaysia, 1990-2024 (Source: Data processed by the author, 2026)

Indonesia's RCA peaked at 8,58 in 2016 and reached its lowest at 1,07 in 1991, with a 35-year average of 4,05. Malaysia consistently demonstrated the strongest comparative advantage, peaking at 33,93 in 1995 and averaging 9,87. China's RCA peaked at 9,64 in 1993, declined steadily to a low of 0,95 in 2015, then partially recovered to 1,92 by 2024, averaging 2,54. Indonesia's sharp rise after 2010 reflects

expanding pepper export share in Japan outpacing global pepper export growth, while China's decline reflects structural shifts in its export orientation. Malaysia's dominance stems from its historically central role as Japan's premier pepper supplier, though pandemic-related supply chain disruptions temporarily depressed its values in 2020.

b. Constant Market Share (CMS)

The CMS decomposition results for the four effects are summarized below. The Standard Growth Effect shows that all three countries' average export growth in the Japanese market falls below global pepper export growth averages (Indonesia: 0,0950, China: 0,0734, Malaysia: 0,0466, versus the world standard of 0.0988), indicating that all three face structural competitive pressure in Japan. The Commodity Composition Effect averages are marginally positive for Indonesia (0,000063) and Malaysia (0,000035), and slightly negative for China (-0,0000020), suggesting that Indonesia and Malaysia have been marginally better at aligning their pepper export mix with Japanese demand preferences.

CMS Effect	Indonesia	China	Malaysia
Standard Growth Effect	0,0950	0,0734	0,0466
Commodity Composition Effect	0,000063	-0,000002	0,000035
Market Distribution Effect	-0,0000325	-0,0000858	-0,0000858
Competitiveness Effect	-0,00064	-0,00044	0,00082

Table 2 Constant Market Share Results (1990-2024) (Source: Data processed by the author, 2026)

The Market Distribution Effect averages are negative for all three countries (Indonesia: -0,0000325; China: -0,0000858; Malaysia: -0,0000858), indicating that none of the three countries successfully directed their pepper exports toward the fastest-growing demand segments within Japan. The Competitiveness Effect averages reveal a notable contrast: Indonesia (-0,00064) and China (-0,00044) display negative averages, while Malaysia achieves a positive average of 0,00082. This implies that, on average, Malaysia outperforms both Indonesia and China in capturing market share within Japan, while Indonesia and China face structural competitive weaknesses.

c. Multiple Linear Regression

A preliminary multiple linear regression was estimated to examine the joint significance of RCA and CMS variables in explaining Total Pepper

Imports of Japan (Y). The model yielded an R-squared of 0.7536, meaning 75.36% of the variation in Japan's total pepper import value is explained by the six predictors. The F-statistic is significant (p < 0,001). Among individual variables: RCA Indonesia (X1) exerts a positive and significant effect (coefficient: 10,574,959; p < 0,001), while RCA China (X2) and RCA Malaysia (X3) show significant negative effects, reflecting substitution dynamics between competing exporters. CMS Indonesia (X4) exhibits a positive and significant dynamic competitiveness effect, confirming that Indonesia's market share gains directly expand Japan's aggregate import value.

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	61630899	9644589	6,390199	0,001<
RCA Indonesia	10574959	1705361	6,201008	0,001<
RCA China	-4561359	1889843	-2,413618	0,0226
RCA Malaysia	-2242654	685702,1	-3,270595	0,0028
CMS Indonesia	8,22E+08	1,06E+09	0,774429	0,4452
CMS China	-1,84E+08	9,00E+08	-0,204446	0,8395
CMS Malaysia	28366361	3.27E+08	0,086781	0,9315
R-squared			0,753647	
Prob (F-statistic)			0,001<	

Table 3 Multiple Linear Regressions Test Results (Source: Data processed by the author, 2026)

d. Unit Root Test (Stationarity Test)

Panel Unit Root Test results using ADF-Fisher Chi-Square (statistic: 181,494; p < 0,001) and ADF-Choi Z-stat (-11,8536; p < 0,001) confirm that all variables become stationary at the first difference level (I (1)). Individual probabilities for D (RCA Indonesia), D (RCA China), D (CMS Indonesia), D (CMS China), and D (Total Pepper Imports of Japan) are all below 0,003; satisfying the I (1) prerequisite for the Johansen cointegration test.

Method	Statistic	Prob.
ADF-Fisher Chi-Square	181,494	0,001<
ADF-Choi Z-stat	-11,8536	0,001<

Series	Prob.	Lag	Max Lag	Obs
D (RCA Indonesia)	0,001<	0	7	33
D (RCA China)	0,001<	0	7	33
D (RCA Malaysia)	0,001<	1	7	32
D (CMS Indonesia)	0,001<	0	7	33
D (CMS China)	0,001<	0	7	33
D (CMS Malaysia)	0,0002	4	7	29
D (Total Pepper Imports of Japan)	0,0029	0	7	33

Table 4 Stationarity Test Results (Source: Data processed by the author

e. Optimal Lag Determination

VAR Lag Order Selection Criteria tests over a maximum of 2 lags identified Lag 2 as optimal, supported by the majority of criteria: LR, FPE, AIC (20,61994), and HQ (22,22208). The SC criterion suggested Lag 1

(24,96124), but Lag 2 was selected on the basis of the majority rule, ensuring that the model captures the delayed two-period transmission mechanism typical in annual commodity trade data.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-404,2018	NA	157,0101	24,92132	25,23876	25,02813
1	-313,9583	136,7325	13,81161	22,42171	24,96124*	23,27619
2	-235,2290	85,88646*	3,514758*	20,61994*	25,38156	22,22208*

Table 5 VAR Lag Order Selection Criteria (Source: Data processed by the author, 2026)

f. Var Stability Test

The VAR stability test via Inverse Roots of AR Characteristic Polynomial confirms that all characteristic roots lie strictly within the unit circle, verifying system stability. This ensures that shocks to the model's variables will eventually dissipate and revert to equilibrium rather than producing explosive divergence.

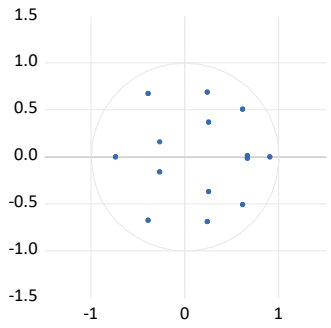


Figure 4 Inverse Roots of AR Characteristic Polynomial (Source: Processed by the author using EViews 12, 2026)

g. Johansen Cointegration Test

Long-run VECM estimation (Table 11) reveals that RCA China, RCA Malaysia, CMS Malaysia, and Total Pepper Imports of Japan all exert statistically significant influences on the cointegrating equilibrium, as evidenced by t-statistics of 7,52; -14,17; -11,91 and -19,79 respectively all exceeding the critical threshold of ±1,96. The positive coefficient of RCA China in the cointegrating equation implies that China's comparative advantage strengthens the long-run equilibrium, while the negative coefficients of RCA Malaysia and CMS Malaysia indicate inverse long-run relationships with the dependent variable.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None	0,0969566	304,4533	125,6154	0,001<
At most 1	0,908843	192,7033	95,75366	0,001<
At most 2	0,807360	116,0580	69,81889	0,001<
At most 3	0,687154	63,35617	47,85613	0,0009

Table 6 Unrestricted Cointegration Rank Test (Trade) (Source: Data processed by the author, 2026)

In the short-run equation (Table 12), the ECT for D (RCA Malaysia) has a t-statistic of 4,83 and D (CMS China) of 2,57; both exceeding 1,96; confirming short-run adjustment significance for these variables.

However, the ECT for D (Total Pepper Imports of Japan) yields a t-statistic of only 0,45, indicating short-run insignificance. This result is theoretically coherent: Japan's total import absorption adjusts to long-run structural forces rather than reacting to immediate period-by-period disturbances.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None	0,0969566	111,7500	46,23142	0,001<

Table 7 Unrestricted Cointegration Rank Test (Maximum Eigenvalue) (Source: Data Processed by the author, 2026)

h. Granger Causality test

Block Exogeneity Wald Test results reveal that RCA China and RCA Malaysia significantly Granger-cause RCA Indonesia ($p < 0,001$ and $p = 0,0006$; respectively), indicating that competitor movements directly influence Indonesia's short-run competitive position. A unidirectional causality from RCA China to RCA Malaysia ($p < 0, 001$) is also found. Importantly, no independent variable demonstrates statistically significant short-run causality toward Total Pepper Imports of Japan (Y), consistent with the finding that Japan's import response is driven by long-run cumulative interactions rather than immediate short-run shocks.

Dependent variabel: RCA Indonesia (X1)			
Exclude	**Chi-sq**	**df**	**Prob.**
RCA China (X2)	28,98226	2	0,001<
RCA Malaysia (X3)	14,80240	2	0,0006
CMS Indonesia (X4)	0,569982	2	0,7520
CMS China (X5)	2,727626	2	0,2557
CMS Malaysia (X6)	0,517567	2	0,7720
Total Pepper Imports of Japan (Y)	4,505988	2	0,1051
All		10	
Dependent variabel: RCA China (X2)			
Exclude	**Chi-sq**	**df**	**Prob.**
RCA Indonesia (X1)	1,571634	2	0,4557
RCA Malaysia (X3)	23,57024	2	0,001<
CMS Indonesia (X4)	1,652181	2	0,4378
CMS China (X5)	0,210569	2	0,9001
CMS Malaysia (X6)	1,057439	2	0,5894
Total Pepper Imports of Japan (Y)	0,531619	2	0,7666
All		10	
Dependent variabel: Total Pepper Imports of Japan (Y)			
Exclude	**Chi-sq**	**df**	**Prob.**
RCA Indonesia (X1)	0,155990	2	0,9250
RCA China (X2)	0,348246	2	0,8402
RCA Malaysia (X3)	0,522360	2	0,7701
CMS Indonesia (X4)	0,783629	2	0,6758
CMS China (X5)	0,968203	2	0,6163
CMS Malaysia (X6)	0,185142	2	0,9116
All		12	

Table 8 VAR Granger Causality / Block Exogeneity Wald Test Results (Source: Data processed by the author, 2026)

i. VECM Estimation

Long-run VECM estimation (Table 12) reveals that RCA China, RCA Malaysia, CMS Malaysia, and Total Pepper Imports of Japan all exert statistically significant influences on the cointegrating equilibrium, as evidenced by t-statistics of 7,52; **-**14,17; **-**11,91 and **-**19,79 respectively all exceeding the critical threshold of ±1,96. The

positive coefficient of RCA China in the cointegrating equation implies that China's comparative advantage strengthens the long-run equilibrium, while the negative coefficients of RCA Malaysia and CMS Malaysia indicate inverse long-run relationships with the dependent variable.

Cointegrating Eq:	CointEq1
RCA Indonesia (-1)	1,000000
RCA China (-1)	0,968715 (0,12885) [7,51796]
RCA Malaysia (-1)	-0,870592 (0,06144) [-14,1707]
CMS Indonesia (-1)	-288,0719 (112,031) [-2,57137]
CMS China (-1)	-27,34975 (70,8671) [-0,38593]
CMS Malaysia (-1)	-486,7014 (40,8792) [-11,9058]
Total Pepper Imports of Japan (-1)	-1,07E-07 (5,4E-09) [-19,7905]
C	9,515041

Table 9 Long-Run Cointegration Equation Estimation Results (Source: Data processed by the author, 2026).

In the short-run equation (Table 13), the ECT for D (RCA Malaysia) has a t-statistic of 4,83; and D (CMS China) of 2,57; both exceeding 1,96; confirming short-run adjustment significance for these variables. However, the ECT for D (Total Pepper Imports of Japan) yields a t-statistic of only 0.45, indicating short-run insignificance. This result is theoretically coherent: Japan's total import absorption adjusts to long-run structural forces rather than reacting to immediate period-by-period disturbances.

Error Correction	D (RCA Indonesia)	D (RCA China)	D (RCA Malaysia)
CointEq1 Std.Error [t-stat]	0,102973 (0,07570) [1,36024]	0,246849 (0,60330) [1,99335]	0,772916 (0,77946) [4,83090]
D (CMS Indonesia)	D (CMS China)	D (CMS Malaysia)	D (Total Pepper Import of Japan)
0,000296 (0,00021) [4,83090]	0,000846 (0,00033) [1,38364]	0,001708 (0,00067) [2,56534]	429173,2 (960083,) [0,44702]

Tabel 10 Short-Run Cointegration Equation Estimation Results (Source: Data processed by the author, 2026)

j. Impulse Response Function (IRF) Analysis

The IRF analysis traces how each variable responds dynamically to a one standard deviation shock from other variables in the system over a ten-period horizon. The first pattern of interest involves the response of RCA Indonesia to shocks originating from RCA China. As shown in Figure 5, RCA Indonesia remains relatively stable in the first two periods before spiking sharply in the third period, reflecting intense short-term competitive pressure from China, after which the

system gradually stabilizes toward a new equilibrium.

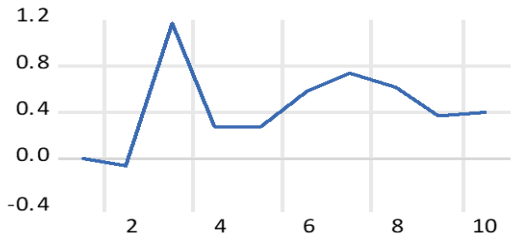


Figure 5 Response of Variable RCA Indonesia (X1) to Shock of Variable RCA China (X2) Based on IRF (Source: Processed by the author using EViews 12, 2026)

A more extreme dynamic is observed in the response of RCA Malaysia to RCA China shocks. Figure 6 shows a near-vertical climb in the third period followed by a sharp decline into negative territory in the fourth period, before recovering after the sixth period. This pattern reveals that Malaysia's competitive position in Japan is highly sensitive to innovations in China's comparative advantage, with stability only emerging after the seventh period.

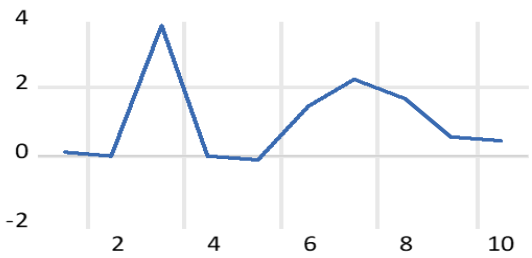


Figure 6 Response of Variable RCA Malaysia (X3) to Shock of Variable RCA China (X2) Based on IRF (Source: Processed by the author Eviews 12, 2026)

Turning to the primary dependent variable, Total Pepper Imports of Japan responds to an RCA Indonesia shock with an initial decline over the first three periods before exhibiting a robust positive recovery from the fourth period onward. As illustrated in figure 7, this lagged reversal confirms the existence of a policy transmission period before Indonesia's improved comparative advantage materially drives aggregate Japanese pepper import growth.

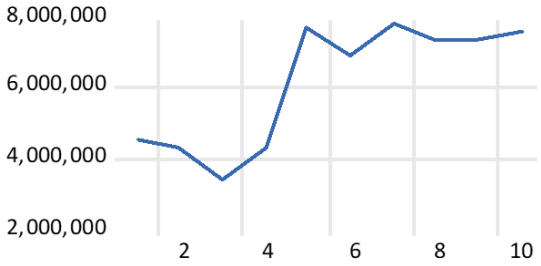


Figure 7 Response of Variable Total Pepper Imports of Japan (Y) to Shock of Variable RCA China (X2) Based on IRF (Source: Processed by the author using EViews 12, 2026)

In contrast, Figure 8 shows that shocks to RCA China produce a significant negative response in Total Pepper Imports of Japan during the first three periods, reaching its trough before gradually recovering toward the positive region by the fifth period. This indicates that periods of intensified

Chinese competitive dominance tend to compress the overall value of the Japanese pepper market in the short run.

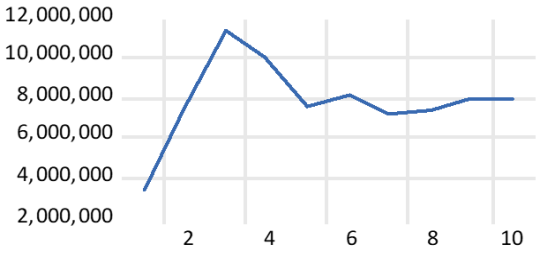


Figure 8 Response of Variable Total Pepper Imports of Japan (Y) to Shock of Variable CMS Indonesia (X4) Based on IRF (Source: Processed by the author using EViews 12, 2026)

Among all variables, shocks to CMS Indonesia generate the strongest and most sustained positive response in Total Pepper Imports of Japan. Figure 9 displays a sharp upward movement peaking in the third period that remains consistently above zero through the end of the observation horizon, establishing CMS Indonesia as the dominant positive transmission channel for Japanese pepper import expansion.

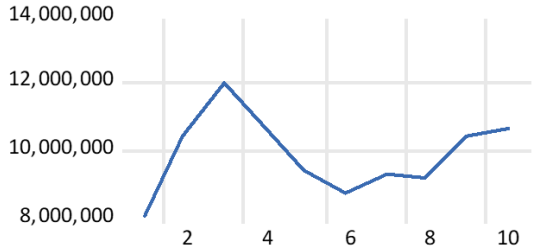


Figure 9 Response of Variable Total Pepper Imports of Japan (Y) to Shock of Variable Y Based on IRF (Source: Processed by the author using EViews 12, 2026)

k. Forecast Error Variance Decomposition (FEVD)

While IRF reveals the direction and timing of shock responses, FEVD quantifies the relative contribution of each variable's innovations to the forecast error variance of other variables across time horizons. Figure 10 shows that RCA China's contribution to the variance of RCA Indonesia starts near zero in the first two periods before surging to approximately 25% in the third period, then stabilizing around 15% in subsequent periods confirming a structural dependence between the two countries competitive positions.

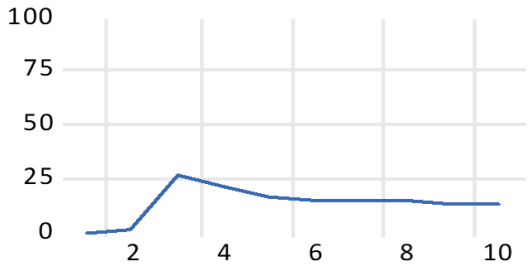


Figure 10 Response of Variable RCA Indonesia (X1) to Shock of Variable RCA China (X2) Based on FEVD (Source: Processed by author using EViews 12, 2026)

RCA Malaysia displays an even stronger dependence on RCA China innovations. As illustrated in Figure 11,

RCA China's contribution to RCA Malaysia variance rises dramatically from near zero to over 60% by the third period, remaining above 40% through the end of the observation. This dominance indicates that Malaysia's export stability in the Japanese market is fundamentally tied to the trajectory of China's competitive movements.

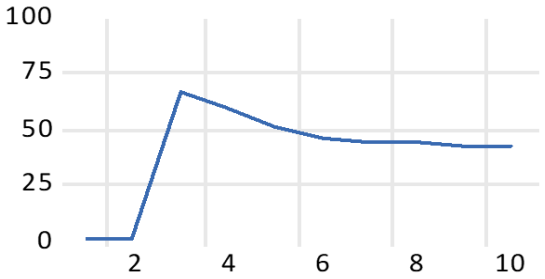


Figure 11 Response of Variable RCA Malaysia (X3) to Shock of Variable RCA China (X2) Based on FEVD (Source: Processed by the author using EViews 12, 2026)

Figure 12 presents a different pattern for CMS Indonesia, where RCA China's contribution increases gradually and steadily, stabilizing in the 15% range from the third period onward without sharp oscillations. This controlled transmission pattern suggests that while China exerts a moderate and persistent influence on Indonesia's dynamic market share, it does not destabilize the system.

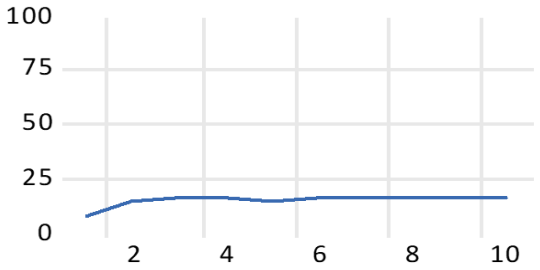


Figure 12 Response of Variable CMS Indonesia (X4) to Shock of Variable RCA China (X2) Based on FEVD (Source: Processed by the author using EViews 12, 2026)

For the primary dependent variable, Figure 13 shows that RCA Indonesia's contribution to the forecast error variance of Total Pepper Imports of Japan exhibits a lagged effect starting low and gradually rising to approximately 15% by the ninth period. This cumulative growth confirms that comparative advantage influences Japan's import demand through long-run channels rather than immediate short-term transmission.

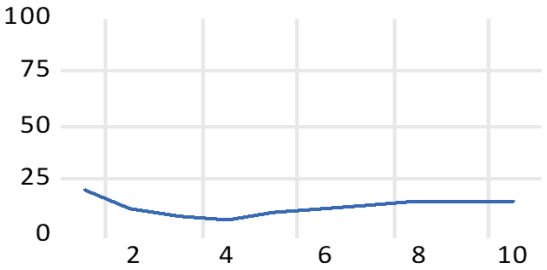


Figure 13 Response of Variable Total Pepper Imports of Japan (Y) to Shock of Variable RCA Indonesia (X1) Based on FEVD (Source: Processed by the author using EViews 12, 2026)

Finally, figure 14 establishes CMS Indonesia as the single most important external determinant of Total Pepper Imports of Japan variance. Its contribution rises sharply to approximately 25% from the fourth period onward and remains stable through the tenth period confirming that Indonesia's ability to actively capture market share in Japan, rather than merely maintaining a favorable comparative position, is the decisive long-run driver of Japanese pepper import growth.

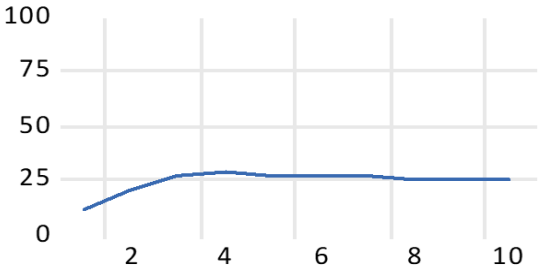


Figure 14 Response of Variable Total Pepper Imports of Japan (Y) to Shock of Variable CMS Indonesia (X4) Based on FEVD (Source: Processed by the author using EViews 12, 2026)

Finally, Figure 15 establishes CMS Indonesia as the single most important external determinant of Total Pepper Imports of Japan variance. Its contribution rises sharply to approximately 25% from the fourth period onward and remains stable through the tenth period confirming that Indonesia's ability to actively capture market share in Japan, rather than merely maintaining a favorable comparative position, is the decisive long-run driver of Japanese pepper import growth.

2. Discussion

The RCA findings are consistent with David Ricardo's comparative advantage theory: Indonesia's consistently high RCA (average 4,05) reflects genuine production advantages rooted in superior pepper-growing conditions in Bangka Belitung and Lampung unique soil chemistry, drainage, and organic content that produce pepper with higher uniformity, weight, and solids content (Riani, 2023). This is reinforced by Japan's premium pricing for Indonesian pepper: at USD 7.812/unit, Indonesian pepper commands a 42,3% premium over Chinese pepper in the Japanese market (Trademap, 2025), empirically validating Indonesia's premium positioning strategy. These results align with Porter's (1990) Diamond Model, wherein demanding Japanese buyers (demand conditions) and Indonesia's unique factor endowments jointly generate sustained competitive advantage.

The CMS results reveal a more nuanced picture. Despite positive commodity composition effects for Indonesia and Malaysia, the universally negative market distribution effects across all three countries confirm a strategic gap: none of the exporters has successfully concentrated exports toward the fastest growing Japanese demand segments, such as the shichimi togarashi ingredient market or premium packaged spice products for the foodservice industry. Indonesia's negative average competitiveness effect (-0.00064) is a critical policy signal: it means that on average, Indonesia has been losing relative market share in Japan to competitors, even while maintaining a high RCA position. The divergence between high RCA and negative competitiveness effect suggests that Indonesia's comparative advantage is not being fully converted into actual market share capture a finding consistent with Erlikasna et al. (2024), who noted competitiveness volatility in Indonesian pepper exports despite favorable RCA values.

The VECM and Granger causality results carry important strategic implications. The absence of direct short-run causality from any independent variable to Total Pepper Imports of Japan combined with the presence of four cointegrating relationships empirically demonstrates that Japan's pepper import dynamics are governed by long-run structural forces rather than reactive short-run adjustments. This means temporary export promotions or reactive policy responses to short-term price movements are unlikely to produce lasting improvements in Japan's import absorption of Indonesian pepper. Instead, sustained improvements in comparative advantage (RCA) and dynamic market share (CMS) built through consistent quality investment, supply reliability, and strategic market penetration represent the empirically validated pathway to long-run market expansion. The finding that CMS Indonesia is the most powerful external determinant of Total Pepper Imports of Japan (FEVD contribution: 25%) further validates this priority, confirming that Indonesia's ability to actively capture market share rather than merely maintain a favorable comparative position is the decisive factor for Japanese market expansion.

D. Conclussions

This study provides comprehensive empirical evidence on the competitiveness and export performance of Indonesian pepper in the Japanese market from 1990 to 2024. All three major exporters Indonesia, China, and Malaysia have maintained sustained comparative advantages (RCA > 1) in the Japanese market throughout the 34-year observation period, with average values of 4,05; 2,54; and 9,87; respectively. CMS analysis reveals that while Indonesia and Malaysia achieve marginally positive commodity composition effects, all three countries face negative market distribution effects, reflecting strategic failures to concentrate exports on Japan's fastest-growing demand segments. The competitiveness effect averages for Indonesia (-0,00064) and China (-0,00044) are negative, while Malaysia maintains a positive value (0,00082), indicating that Malaysia has been the most effective at direct market share capture in Japan.

The VECM framework confirms the existence of four cointegrating long-run relationships among the competitiveness variables, while Granger causality tests find no significant short-run causality toward Japan's total import value establishing that Japan's pepper import dynamics are fundamentally long-run phenomena. IRF analysis reveals CMS Indonesia as the single strongest positive driver of Japanese pepper import growth, and FEVD confirms CMS Indonesia's dominant 25% contribution to the forecast error variance of Total Pepper Imports of Japan. China's RCA exerts structural systemic influence on both Indonesian and Malaysian competitive positions, making competitor monitoring an essential element of Indonesian export strategy.

Policy implications are clear and prioritized: (1) Sustain and strengthen productivity investment crop rejuvenation programs, farmer regeneration support, and adoption of precision agriculture are critical to reversing declining production trends. (2) Maintain the premium positioning strategy consistently Japan's willingness to pay a 42,3% unit price premium for Indonesian pepper must not be undermined by quality inconsistencies or supply disruptions. (3) Develop high-value derivative pepper products targeting Japan's pharmaceutical, cosmetic, and

premium food manufacturing sectors to deepen market penetration. (4) Optimize market distribution leverage RCEP provisions and bilateral trade diplomacy to expand presence in Japan's fastest-growing demand segments, including the shichimi togarashi ingredient supply chain. (5) Monitor competitor strategies continuously given the structural Granger causality from RCA China and RCA Malaysia to RCA Indonesia, competitive intelligence on China's and Malaysia's policy shifts is essential for proactive positioning.

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