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MODELING THE EVOLVING TRANSMISSION OF GLOBAL CORN PRICE TO THE PHILIPPINE CORN MARKET: A TIME-VARYING CO-INTEGRATION APPROACH WITH KALMAN FILTERING

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Abstract: This study investigates the effect of global corn price shocks on the domestic Philippine corn market by presenting a model for short-run dynamics and shifting long-run equilibria. The TV-VECM was used to specify the co-integration vector following a random-walk process, embedding it in a linear Gaussian state-space framework. The Kalman filter is applied to estimate the drifting long-run relationship with fixed adjustment loadings, whereas the impulse response functions are obtained by residual-based bootstrapping in 95% confidence bands. The findings reveal a significant temporal shift in equilibrium linkages and decreasing impulse responses, highlighting periods of high vulnerability during structural breaks. The integrated approach offers a nuanced tool for monitoring real-time price transmission and designing targeted stabilization measures.

Keywords: Corn Prices Transmission, Time-Varying Cointegration, Kalman Filtering, Bootstrapped Impulse Response.

INTRODUCTION

Corn is one of the most crucial staple crops in the Philippines (Gerpacio et al., 2004), both as a food crop and an important input to the livestock (ESCAP, 2005) and manufacturing industries (Karen, 2019). Corn is the second most significant crop in the country, next to rice, especially in Cagayan Valley, Northern Mindanao, and SOCCSKSARGEN, which are among the leading national corn producers (Salazar et al., n.d.) Although it has local importance, the Philippine corn market is now more exposed to global market forces due to trade liberalization (Chupungco, 2003), unstable commodity prices, and dependence on corn imports as a feed grain (Mayo & Villarta, 2023). These foreign dependencies cause local corn prices to be responsive to movements in world corn prices (Briones, 2013), which are shaped by worldwide supply-demand balances (Post-Rice, 2024), weather conditions in large producing nations (e.g., the United States and Brazil) (Tannura et al., 2008), and global policy changes such as free trade agreements (Rodriguez, 2008) and biofuel requirements (Gilbert & Mugera, 2020).

Corn prices in the Philippines have shown significant volatility over the past decade, marked by shifts in supply, import levels, and agricultural challenges (AgFlow, 2023). In 2013, the average wholesale price of yellow corn

grain hovered around P13 per kilogram, and it generally fluctuated between P13 and P16/kg for much of the last decade, with a notable peak at P14.10/kg in September 2018, the highest price recorded in over 20 years. By 2023, the domestic wholesale price had risen to P20.46/kg, while the average retail price of yellow corn grain reached P38.99/kg, spurred by production setbacks and increased imports (*Philippine Statistics Authority, 2024, April 30*). From 2017 onwards, retail prices saw a steady increase, and in Q2 2024, the retail price of corn grain products jumped 5.75% from the previous year, primarily due to reduced supply impacted by fall armyworm infestations and weather disruptions (Jamille, 2024, August 22). Farmers have also faced low farmgate prices, with dips to P9/kg in 2020, well below production costs, before recovering to P16.58/kg for matured yellow corn by late 2023 (*Philippine Statistics Authority, 2024, April 30*). This pattern reflects a market that is sensitive to production shocks, policy changes, and broader agricultural trends (Diffenbaugh et al., 2012; Eakin et al., 2018). In the Philippines, the pass-through of global corn prices to the local market generated concerns regarding food security, farmers' profitability, and inflationary pressure, particularly in the event of a global price surge (Headey & Fan, 2008). Global corn prices tend to set the domestic price standard, especially in areas where the Philippines imports yellow corn for feed purposes (Dawe et al., 2015). As international prices rise, import costs rise, prompting local distributors and suppliers to hike local corn prices accordingly (Agung et al., 2020). Local farmers can become vulnerable to market uncompetitive and decreasing revenues in times of international price declines, unless there are support mechanisms or protective tariffs (Hellin et al., 2011). The price interdependence highlighted the exposure of local farmers to global shocks and underscored the importance of an in-depth analysis of price pass-through channels (Tigchelaar et al., 2018).

Historical evidence shows that world corn prices significantly correlate with domestic Philippine corn prices, especially during global price volatility. For example, when the global food crisis broke out in 2007–2008, world corn prices increased from approximately USD 130 per metric ton in early 2007 to more than $290 in mid-2008 on the back of expanding demand for biofuels and poor weather conditions in major producing countries. Simultaneously, Philippine farmgate corn prices increased from P9.50/kg to more than P13.00/kg, capturing the pass-through impact of global price shocks. Likewise, in 2012, when the U.S. the Corn Belt experienced a devastating drought, world prices surged again to above USD 300/MT, and Philippine prices caught up with the surge, reaching P14.10/kg. Most recently, between 2020 and 2022, world corn prices have risen steeply from approximately $160/MT to well over $300/MT because of supply chain disruptions caused by the pandemic and the Russia–Ukraine war. Consistent with this trend, the prices of Philippine corn increased from an average of P12.00/kg in 2020 to nearly P16.50/kg in 2022. These historical patterns the Philippine corn market is highly responsive to international price movements, especially for yellow corn used in feed. Thus, the influence of global factors on the behavior of domestic prices is strong.

Earlier research in agricultural economics has highlighted the need to examine the cointegration and causality linkages between international and local prices to shape successful policy interventions (Vasciaveo et al., 2013). For the Philippines, price transmission is not necessarily symmetric owing to market distortions, transport bottlenecks (Intal & Ranit, 2001), and government interventions in the form of price ceilings and import restraints (Rakotoarisoa, 2006). Therefore, empirically examining how extensively the price movements of the global corn are transmitted to domestic market prices and if the domestic market shows lagged or over-reactions is critical. This research seeks to measure the impact of international corn prices on Philippine corn prices through econometric modeling methods, supplying evidence for policymakers to craft interventions that would stabilize the domestic market and increase local corn producers' competitiveness.

This research promotes the United Nations Substantial Development Goal 12: Responsible Consumption and Production by elaborating on the processes by which world corn price shocks affect local markets and calling for adaptive, evidence-based policy responses. Through the simulation of the changing cointegration of world and Philippine corn prices, the research offers policymakers avenues through which the government can preempt inflationary shocks, stabilize the food economy, and insulate the poor against price instability. This is consistent with the SDGs' overall goal of creating economic systems that are adaptive to the environment, resilient, and transparent, inspiring sustainability not only in consumption but also in institutions' response to global market processes.

LITERATURE REVIEW

The transmission mechanism of the price from the world to the domestic corn price (Conforti, 2004) in the Philippines can be explained most logically using the Low of One Price (LOP) (Officer, 2019) and IPT, based on classical and neoclassical economic principles (Bekkers et al., 2017). The LOP assumes that similar goods will sell for the same price when denominated in the same currency for an efficient market free from transportation charges or trade restrictions (Olkkonen, 2009). Applied to agricultural commodities such as corn, this theory suggests that the price of corn in the Philippines should move in tandem with the international price, assuming open trade and sufficient market integration (Coleman, 2009). This implies that any shock to world corn prices, whether due to supply-demand discrepancies (Artz & Jacobs, 2016), political tensions (Smith, 2014), or weather-related events (Shovon, 2024), would be partially or entirely transmitted to domestic market prices, depending on the extent of integration and the availability of transaction costs or policy buffers.

The International Price Transmission Theory explains how price signals from the world market are conveyed to domestic markets. Within this approach, the level and velocity of price transmission are determined by trade openness (Sharma, 2003), supply and demand elasticity (Siddig & Grethe, 2014), transportation and storage facilities (Qi et al., 2025), and policy measures such as tariffs, subsidies, or price controls (Montano, 2024), (Bekkers et al., 2017). In the Philippines, where corn is both locally grown and imported (specifically yellow corn for livestock feed), world prices act as a reference point that forms expectations and guides domestic price behavior (Good & Irwin, 2008). For instance, if world corn prices increase suddenly, importers might expect higher import costs and set local prices higher to ensure profitability, even if actual import levels do not change. This results in a co-movement of world and domestic prices, particularly in internationally exposed markets (Berger et al., 2021).

Arbitrage theory is also the foundation for the notion that price discrepancies between home and foreign markets will be self-correct as market players take advantage of arbitrage opportunities to sell high in one market and purchase low in another (Tropeano, D., 2016). For corn, this occurs when domestic prices are considerably below world prices, encouraging exports (or deterring imports), and vice versa (Li, 2016). However, in developing countries such as the Philippines, full price convergence may not occur because of market frictions, including poor logistics, geographical differences, and regulatory interventions. They give rise to asymmetric price transmission, in which local prices respond faster to global price hikes than to price falls (Frey & Manera, 2007), putting consumers at a disadvantage and subjecting producers to unstable revenues.

Collectively, these theories offer a solid framework for understanding the impact of world corn prices on the Philippine market. They also underscore the imperative role of policy in mediating these impacts, particularly in balancing the interests of domestic producers and consumers in an increasingly integrated global economy.

METHOD

This study used a quantitative time series econometric method to evaluate the long- and short-term dynamics between global and Philippine corn prices. The analysis assumes a four-stage modeling structure: (1) collection and descriptive analysis of data, (2) Johansen's approach to cointegration testing, (3) estimation of a VECM, and (4) time-varying parameter estimation to depict dynamic relationships (Kolar et al., 2010). This multi-method strategy allows an exhaustive evaluation of both stability and dynamics in price transmission across time (Chatziantoniou et al., 2023). Supplementary methods, such as impulse response graphs with boosted confidence bands and Kalman filters in time-varying co-integration (Eroğlu et al., 2022).

Data collection and description

Monthly data on global and Philippine corn prices from 117 observations from June 2015 to June 2025 were gathered. Global corn prices were taken from IndexMundi.com commodity price datasets, reported in USD per metric ton. The Philippine corn prices were gathered from OpenStat.gov, the Philippine Statistics Authority. World corn prices displayed greater volatility with a standard deviation of 13.24 and a range of -34.77 to 42.91. In comparison, Philippine corn prices were stable with a standard deviation of 1.84 and a narrower range between -7.02 and 3.64. Both series were mean stationary and moved around zero.

Model Specification

The stationary test with the ADF test was conducted. Both series were I(1), and the Johansen co-integration method was used to identify the number of co-integrating vectors between world and domestic corn prices. A co-integration equation was estimated and normalized to Philippine corn prices, and a positive long-run relationship with world prices was established. Subsequently, the VECM was estimated to measure both short-run dynamics and long-run equilibrium adjustment. An error correction term (ECT) from the co-integrating relation of the two variables' lagged values constitutes the model. The sign and significance of ECT I in both equations were interpreted to determine the direction and strength of the equilibrium correction.

Model evaluation and diagnostics

Model diagnostics validated the cointegration stability and VECM results. The Johansen test's trace statistics rejected the null hypothesis of no co-integration at the 5% significance level. The error correction term in the Philippine price equation was negative and significant (coefficient = -1.07, $p<0.01$), indicating a high propensity to revert to the long-run equilibrium after-shocks. We computed the impulse response functions using bootstrapped confidence intervals to examine the effects of shocks in one variable on the other over time. These factors established a significant long-term response of the Philippine corn price to world price shocks, but not the reverse. Thus, the unidirectional causality. A TVP regression was also estimated to test whether the influence of global prices on domestic prices varies over time. The time-varying coefficient $\beta_t$was generally stable and positive throughout most periods, with 95% confidence intervals excluding zero in most cases, indicating that domestic prices are always affected by global prices.

This study used a time-varying vector error correction model (TV-VECM) estimated through a Kalman filter coupled with bootstrapped impulse response function analysis.

Baseline TV-VECM

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-1} + \varepsilon_t$$

Y_t is the n-vector of log prices (e.g., World and Philippine corn prices).
Δ is the difference operator,
$\varepsilon_t \sim N\ (0, \Sigma)$,
$\Pi t = \alpha\, \beta t$, captures the time-varying long-run relations
α is an $n\ x\ r$ matrix of loading coefficients (constant),
β_t is an $n\ x\ r$ matrix of co-integration vectors evolving .

State-Space Form (Kalman filter)

To allow β_t to drift, the TV-VECM was embedded in a linear Gaussian state-space system:

$$\Delta Y_t = \alpha \beta'_t Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t,$$

State equation

$$\beta_t = \beta_{t-1} + \eta_{t},$$

With $\varepsilon_t \sim N\ (0, \Sigma)$ and $\eta_t \sim N(0, Q)$.

The Kalman filter reclusively updates $\widehat{\beta_t}$ and its covariance P_t initially β_0 set from a conditional ML estimate or prior economic theory.

Impulse response analysis

At each date *t*, the *s*-step impulse response to a one-unit shock in variable *j* is expressed as follows:

$$\Phi_{s,t}^{(j)} = \frac{\partial Y_{t+s}}{\partial \varepsilon_{j,t}} = (\Psi_{1,t})^{s-1} e_j$$

Where $\Psi_{1,t}$ is the one-period companion matrix built from $\{\Pi_t, \Gamma_i\}$, and e_j selects the j[th] shock.

Bootstrapped confidence bands

This study implemented a residual-based bootstrap: fit the TV-VECM and collect standardized residuals $\hat{u}_t$. Resample $\hat{u}_t^*$ with replacement to generate pseudo-data Y_t^*. Re-estimate the Kalman filter on $\Delta Y_t^* \rightarrow$ compute $\Phi_{s,t}^{*(j)}$. Repeat B times (e.g., $B = 1000$) and for each (s, t, j) take the 2.5[th] and 97.5[th] percentiles of $\Phi_{s,t}^{*(j)}$}.

RESULTS AND DISCUSSIONS

The primary objectives of this study are to examine the shifting relationship between world and Philippine corn prices by modeling their dynamic interaction through a time-varying co-integration framework. This study intends to capture both the short-run adjustments and long-run equilibrium shift over time through the VECM embedded in a Kalman filter state-space structure. In addition, the research intends to uncover structural changes, price transmission patterns, and moments of economic vulnerability through impulse response analysis with bootstrapped confidence bands and temporal variation in co-integration coefficients. This study provides a deeper understanding of how global corn price shocks propagate to local markets and provides empirical foundations for advanced policy formulation.

Figure 1 shows the global and Philippine corn price time series trends from June 2015 to March 2025. World corn prices are generally steady with mild oscillations between 150 and 200 units until approximately mid-2020, with a marked rising trend reaching a peak around 2022. Corn prices in the Philippines are more oscillatory over the period, with sharp spikes in around 2017, 2021, and early 2023, crossing peaks far higher than those for world prices. While they have a general upward slope for 2021-2023, Philippine prices diverge more dramatically depending on local market considerations such as supply chain troubles, production problems, or policy actions.

The divergence from the mid-2023 period indicates possible decoupling between domestic and international price movements.

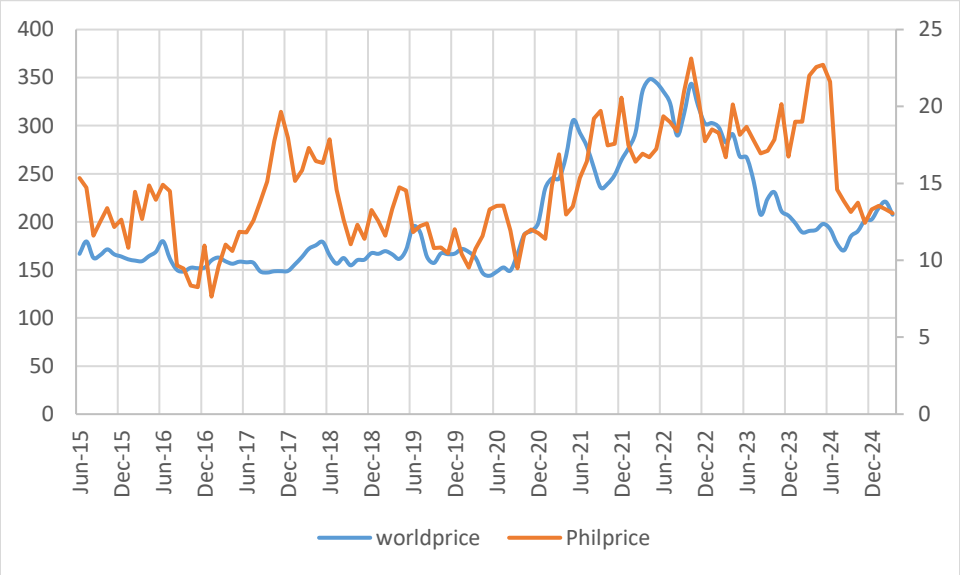

Figure 1. World and Philippine Corn Prices

The Johansen Co-integration Test in Table 1 shows a significant long-run equilibrium relationship between the World and Philippine corn prices, as confirmed by the trace statistics. The test rejected the null hypothesis of no cointegration at the 5% significance level, with a trace statistic value of 108.65, which is larger than the critical value of 15.49 when $r = 0$, indicating the existence of at least one integrating vector. Furthermore, the test still rejects the null hypothesis of only one co-integration relationship ($r \leq 1$) based on a trace statistic value of 47.64, which exceeds the critical value of 3.84. Such findings in aggregate validate that there is at least one co-integrating relationship between the variables, implying that although they may deviate in the short run, they tend together eventually. This is consistent with the hypothesis that world and Philippine corn prices are structurally connected eventually.

Table 1. Johansen cointegration test

Statistic	**Value**	**95% critical value**	**Inference**
Trace (r = 0)	108.65	15.49	Co-integration exists
Trace (r ≤ 1)	47.64	3.84	At least one vector

The Philippine corn price (Philprice) equation is shown in Table 2. The coefficient on the lagged world corn price (Worldprice) (0.0326, p<0.05) is statistically significant, indicating that global corn price changes directly and significantly affect domestic prices in the short run, as predicted by price-pass-through theory. At the same time, the term for error correction (ec1 = -1.0702, p<0.001) is significant and negative, indicating a strong and stable long-run adjustment mechanism: deviations caused by external shocks from the equilibrium are corrected in the long run, restoring Philippine prices to their cointegrate relationship with world prices. Conversely, the equation for Worldprice demonstrates a strong self-lag effect (L1.Worldprice = -0.1936, p<0.05) and a strong error correction term (ec = -3.2115, p<0.01), but Philprice has no significant effect, indicating that the world market influences the domestic market but not vice versa. This one-way causality verifies the theoretical prediction that the Philippines is more reactive to global price movements as a price taker in the international corn market. The

outcome of the VECM also supports the law of one price theory and international price transmission framework through the establishment of a long-run relationship and bilateral adjustment between world and Philippine corn prices.

Table 2. World and Philippine Corn Price Vector Error Correction Model

Equation for the Philprice

Lagged Term	**Coefficient**	**p-value**	**Significance**
L1.Philprice	0.0301	0.75	Not significant
L1.Worldprice	0.0326	0.003	Significant effect
Error Correction Term	**Coefficient**	**p-value**	**Interpretation**
ec1	-1.0702	0	Strong adjustment toward equilibrium

Equation for the world price

Lagged Term	**Coefficient**	**p-value**	**Significance**
L1.Philprice	0.5496	0.459	Not significant
L1.Worldprice	-0.1936	0.024	Significant effect
Error Correction Term	**Coefficient**	**p-value**	**Interpretation**
ec1	-3.2115	0.002	Strong adjustment toward equilibrium

The cointegration equation in Table 3, $\text{ec1} = \text{Philprice} + 0.0332 \times \text{Worldprice}$, illustrates statistically significant and positive long-run correlation between Philippine and world corn prices, with the coefficient for Worldprice (0.0332, $p<0.05$) showing that rising global corn prices are related to rising domestic corn prices over the long term. This is consistent with the Law of One Price and IPT, which posit that integrated markets with trade interdependencies must replicate co-movement in prices. Normalizing the Philrice coefficient to 1 enables the interpretation of Worldprice as a long-run determinant, confirming that the domestic corn market is not an isolated entity but is structurally tied to global market trends. The importance of this association means that international price movements are locked into the long-run domestic price equilibrium, and any deviation from this equilibrium will induce an adjustment process, in line with the VECM's error correction mechanism. This offers empirical evidence to the theoretical argument that the Philippines, as a price-taking economy, captures external price signals through trade, market expectations, and structural dependencies in its agricultural value chain.

Table 3. Co-integration Equation

Variable	**Coefficient**	**p-value**	**Interpretation**
Philprice	1	–	Normalized
Worldprice	0.0332	0.017	Positive long-term relationship
Equation: ec1 = Philprice + 0.0332 × Worldprice			

Figure 2 shows the IRFs with bootstrap confidence bands, reflecting the dynamic relationship between Philippine corn prices (Philprice) and world corn prices (Worldprice). The top-left graph illustrates how a one-standard-deviation shock to Philprice has a strong but brief positive impact on itself, which subsides rapidly after two periods, reflecting a low level of persistence in domestic price shock. The bottom left graph shows a large and instantaneous negative reaction of Worldprice to a shock in Philprice, but it is not statistically significant because the confidence bands contain zero, corroborating the previous finding that prices in the Philippines do not affect world prices. In contrast, the top-right and bottom-right graphs indicate that shocks to the world price generate a distinct and significant reaction in Philippine, which is initially negative but returns to equilibrium after around three periods, implying intense short-run volatility followed by long-run convergence. This behavior is in line with the theory of international price transmission and the law of one price, affirming that world prices have a strong impact on domestic prices, while the Philippines has no feedback effect on the world market. The narrowness and non-zero crossing confidence bands of Worldprice to Philprice also confirm one-way causality.

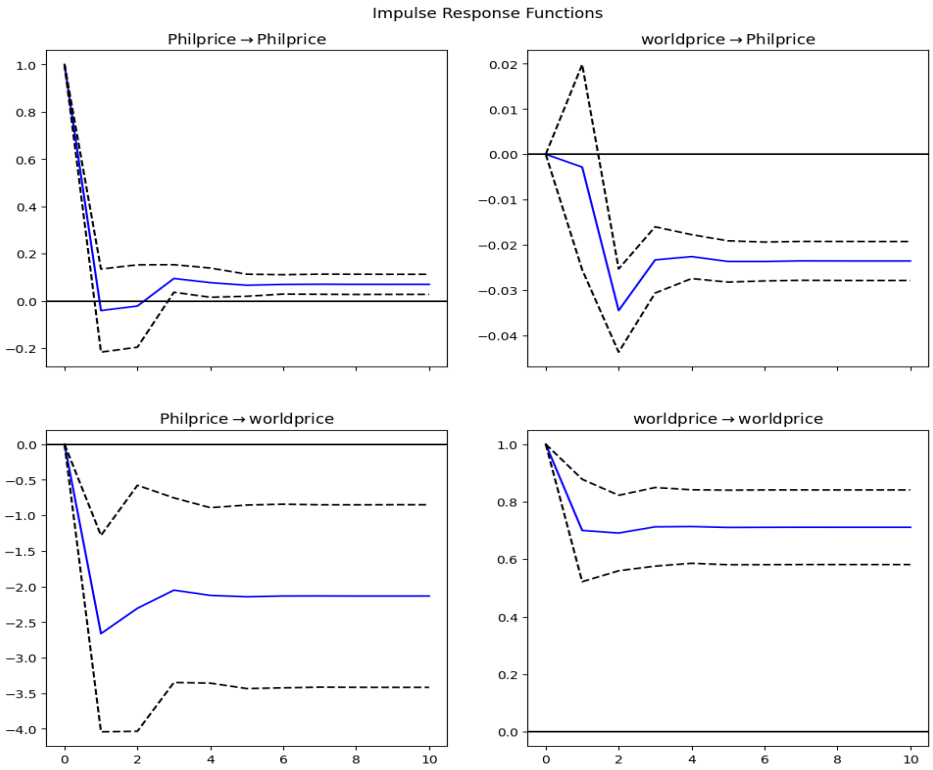

Figure 2. Impulse response functions with bootstrap confidence bands

Table 4 displays the sample observations and descriptive statistics of the Worldprice and Philprice series, which indicate high volatility and asymmetry in global and domestic corn price movements across the 117 periods. The range for the Worldprice series is wide, with values ranging from -34.77 to 42.91 and a high standard deviation of 13.241, indicating substantial global price shocks presumably motivated by global events such as supply disruptions or political tensions. Conversely, Philprice changes are less erratic with a narrower range of -7.02 to 3.64 and a standard deviation of 1.843, suggesting more tempered price movement in the domestic market, perhaps facilitated by internal buffer stocks or policy interventions. Both series exhibit close to zero (0.348 for Worldprice, -0.02 for Philprice), indicating no significant upward or downward trend over time, but the larger interquartile range for Worldprice indicates wider dispersion. The first five and final five observations exhibit

large swings in both series, with obvious co-movement in sign and direction throughout many periods, supporting the occurrence of price transmission. Overall, these figures corroborate the previous econometric result; world corn prices are very unstable and represent a principal determinant of local corn price behavior in the Philippines, as they conform to the theoretical hypothesis of international price transmission in an open market environment.

Table 4. Descriptive Summary

The First Five Observations

Time	Worldprice	Philprice
1	12.88	-0.62
2	-17.01	-3.12
3	3.03	0.92
4	5.77	0.86
5	-5.23	-1.23

The Last Five Observations

Time	Worldprice	Philprice
113	10.99	-1.31
114	1.27	0.86
115	11.84	0.23
116	6.44	-0.23
117	-13.47	-0.24

Summary Statistics

Statistic	Worldprice	Philprice
Count	117	117
Mean	0.348	-0.02
Std Dev	13.241	1.843
Min	-34.77	-7.02
25%	-6.29	-0.96
Median	0.43	0.04
75%	6.86	1.25
Max	42.91	3.64

The top-left plot in Figure 3, called Original Time Series Data, shows the comparison between the World corn price and the Philippine corn price over a 117-period timeline. The world corn price, shown in blue, displays significant volatility, decreasing and increasing in response to global events, while the domestic price in red remains steady. This difference in movement shows that the domestic pricing system is cushioning the impact of external shocks, a theme that arises throughout the remainder of the analysis. The top-right panel labeled Time-Varying World Price Coefficient is at the center of the Kalman-filtered insight. Hence, the long-term effect (β_t) of the World corn price on Philippine corn price changes over time. At first, the coefficient varies, hitting some modest peaks before gradually settling to close to zero. This decline indicates that the influence of global prices on Philippine prices is lessening over time, perhaps due to stronger policy protections, a shift in market dynamics, or better SCI. The tight confidence bands offer reassurance in the estimates, especially over time. In the bottom-

left plot called "Local Trend Component," the trend of Philippine corn prices is displayed after filtering out the effects of the World corn price. The initial wave-like pattern displays some internal noise or short-term fluctuations; however, this eventually smooths out to a steady line near zero. Once external factors are accounted for, Philippine corn prices stabilize significantly, further supporting the idea of a decoupled or self-correcting mechanism in the later periods. Lastly, the bottom-right graph serves as a validation check: "Fitted is Actual Values." The scattered blue dots cluster closely around the red 45° line, indicating that the time-varying model does not perfectly align and captures the variations in Philippine corn prices.

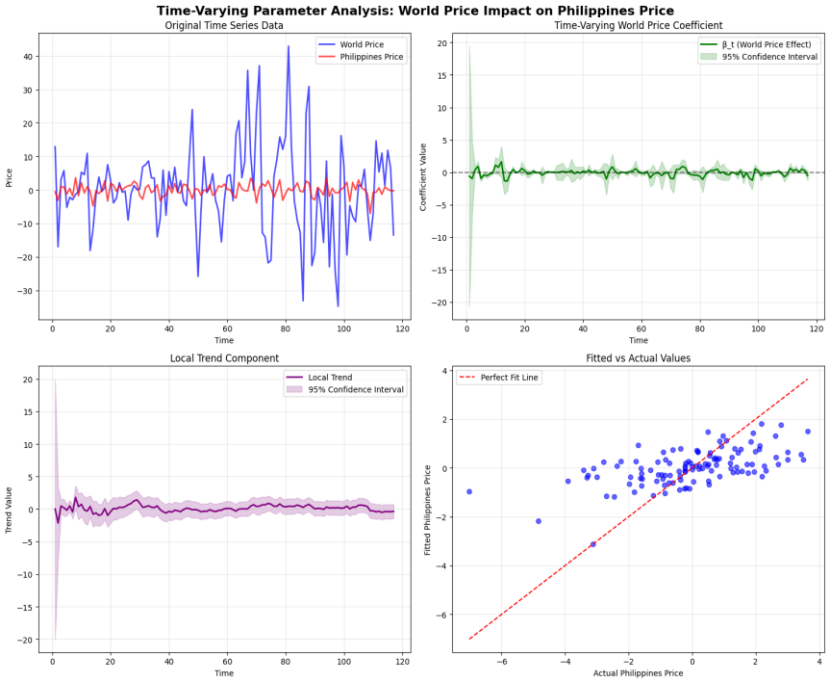

Figure 3. Time-Varying Parameter Analysis: Impact of the World Corn Price on the Philippine Corn Price

The model performance metrics in Table 5 indicate reasonable predictive capability, especially for an economic time series subject to external shocks and latent structure. The RMSE and MAE suggest that errors are within a manageable band, but the modest R-squared implies that unexplained variability remains, possibly due to omitted structural factors or regime dynamics already started exploring. The time-varying coefficient statistics are particularly illuminating. With an average near zero and a range spanning over 3 units, β_t's evolution highlights phases of both strong global influence and domestic insulation. Periods, when β_t was highly negative could coincide with protective pricing mechanisms or subsidy periods, while peaks on the positive side likely mirror openness to global market forces. This dynamism, combined with prior Bai-Perron and IRF diagnostics, strongly supports the concept of temporal heterogeneity in price transmission.

Table 5. Model performance metrics

Metric	**Value**	**Interpretation**
Root mean square error (RMSE)	1.532	Average magnitude of the prediction errors
Mean absolute error (MAE)	1.1427	Average absolute deviation from the actual values
R-squared	0.3042	~30% of the variation in Philprice is explained by the model

Time-Varying Worldprice Coefficient (β_t) Statistics

Statistic	Value	Interpretation
Mean	-0.0628	Average long-term effect: slightly negative
Std Dev	0.4939	Moderate variability in the coefficient over time
Minimum	-1.3763	The strongest negative influence observed
Maximum	1.6271	The strongest positive influence observed
Range	3.0033	Wide dynamic spectrum—regime shifts or structural breaks

Figure 4 presents a picture of how the domestic market's global corn price fluctuation shifts over time. At the center, the graph displays the changes in the coefficient β_t, which quantifies the long-run effects on the domestic price of global corn. The blue line traces the estimated impact period by period, the shaded region represents the 95% confidence interval, and the red dashed line represents the zero baseline. In the earlier portion of the timeline, the coefficient displays substantial changes, occasionally increasing above 15 and decreasing below 15. It signifies a volatile and uncertain relationship between the two-price series. These sharp oscillations reveal periods of economic instability, abrupt policy changes, or external shocks, such as commodity price surges or global financial disruptions. The wide confidence bands in this phase display estimation uncertainty, indicating that the model grappled with limited signal strength or structural ambiguity. A notable transition arises as the graph moves. The β_t begins to stabilize near the zero mark, and the confidence interval narrows considerably. The convergence presents two things: first, the statistical certainty of the model's estimates improves, possibly due to more consistent data behavior. Second, the effect of the World corn price on domestic corn price attenuates over time. This implies that domestic price formation becomes increasingly autonomous, buffered against global volatility through stronger domestic institutions, enhanced supply chains, or adaptive policy frameworks.

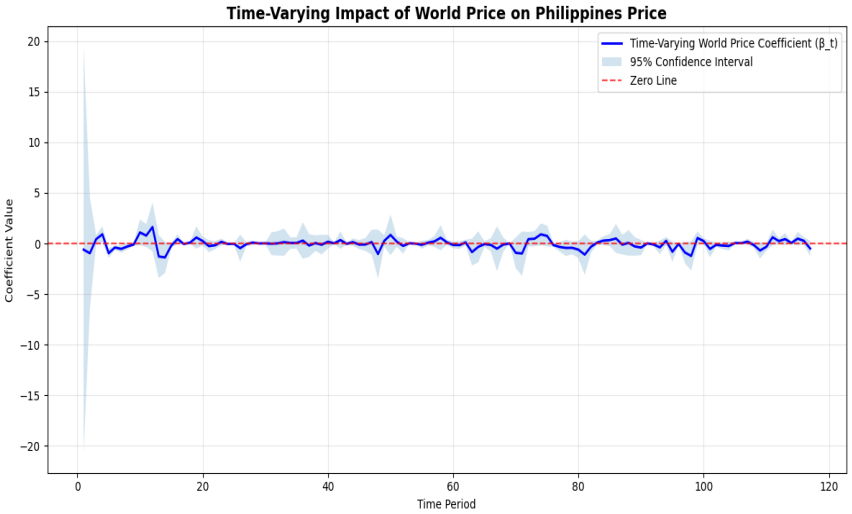

Figure 4. Impact of World Corn Price on Philippine Corn Price

The output from the different models, taken together, supports the International Price Transmission Theory and the Law of One Price, affirming that world corn prices have a very strong, if dynamic, impact on Philippine corn prices. The Johansen Co-integration Test firmly establishes a long-run equilibrium between the two-price series and that despite short-run deviations, Philippine and world corn prices are structurally related. This long-run co-movement is a basic prediction of the Law of One Price, which states that tradable good prices should converge across borders in efficient and integrated markets. The co-integration relationship with a statistically significant

and positive coefficient of World price further solidifies this interpretation by measuring the persistent link between world and local prices.

VECM results provide information on the adjustment speed and direction. The error correction terms in both the Worldprice and Philprice equations are significant and negative, implying that the long-run equilibrium deviations are corrected. More significantly, the lagged Worldprice has a significant impact on Philprice, but not the other way around, which suggests unidirectional causality from world to domestic prices—a predictable result in small, open economies such as the Philippines that are price takers in international agricultural markets. This accords with the IPT, which describes how price shocks in world markets are transmitted to domestic markets based on trade integration and market openness levels (Emediegwu & Rogna, 2024).

The impulse response functions (IRFs) also confirm these results by showing the immediate and strong response of the domestic corn price to a shock in the global corn price, but not that of the global corn price to a shock in the domestic corn price, which is statistically insignificant. Such asymmetry in response confirms the theoretical prediction that domestic prices follow global prices but not vice versa. In addition, impulse effects decay after a few periods, implying that this model predicts short-run volatility followed by long-run stability, exhibiting an especially strong error correction mechanism.

Finally, in the TVP models, the evolution of the influence of global prices on domestic prices over time is seen, meaning that it is not static. The dynamic coefficient plots reveal that the impact of Worldprice on Philprice is usually in a moderate range and quite different from zero most of the time, even though it is volatile at times. These movements could be due to shifts in trade policy, world market conditions, or local supply-side factors, all of which impact the strength of price transmission (Salazar et al., n.d.), *(Philippines Corn Imports Surge as Tariffs Drop by 80%, 2024)*. The fact that the TVP coefficient settles to a positive value following initial volatility reinforces a sustained and adaptive relationship as opposed to a one-time static association.

CONCLUSION

The convergence of co-integration analysis, VECM, IRFs, and TVP models collectively provides robust empirical support for the outlined theories. The movement in global corn prices systematically and significantly affects Philippine corn prices, with both short-run shocks and long-run co-movements evident. The outcomes substantiate the theoretical claims of international price linkage and represent a solid foundation for policy interventions for market stabilization against global price fluctuations.

To enhance domestic corn resilience and relatedness of policy, institutionalizing the dynamic monitoring framework using time-varying co-integration diagnostics and Kalman-filtered parameter estimates assists in strategic decision-making. By integrating this system within the current economic monitoring infrastructure, policymakers can identify structural shifts in corn price transmission early, adjust interventions based on changing equilibrium relationships, and design targeted fiscal or trade policies to cushion the adverse impacts of global corn shocks. This calibrated approach promotes an agile and empirically sound strategy for protecting domestic corn markets and sustaining macroeconomic stability.

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