

CHAPTER II

LITERATURE REVIEW

2.1. Price Theory

Price dynamics lie at the heart of economic theory, serving as both a signal and an outcome of market interactions. In food markets, prices not only coordinate the behavior of consumers and producers but also reflect the underlying balance between supply and demand forces that are often disturbed by unpredictable shocks. Understanding how prices adjust to such shocks is crucial for analyzing price volatility, particularly in staple commodities like rice, eggs, and cooking oil, where even small disturbances can trigger significant welfare implications. This section presents the theoretical foundation underpinning the study of price movements and volatility, drawing on classical price theory and elasticity concepts to explain how market adjustments to shocks generate the fluctuations later modeled econometrically.

In microeconomic theory, prices emerge as equilibrating signals in competitive markets, coordinating the decisions of consumers and producers. The equilibrium price is the point at which the quantity consumers wish to purchase equals the quantity suppliers wish to sell. This equilibrium reflects the collective interaction of demand and supply and changes dynamically as new information arrives in the market.

A simple linear representation of this relationship is given by:

$$Q_t^d = \alpha - \beta P_t + u_{d,t}, \quad \beta > 0, \quad (1)$$

$$Q_t^s = \gamma - \delta P_t + u_{s,t}, \quad \delta > 0, \quad (2)$$

where Q_t^d and Q_t^s denote quantity demanded and supplied at time t ;

α, γ are intercepts; β and δ represent the slopes (price sensitivities); and $u_{d,t}, u_{s,t}$ capture external shocks, such as weather disturbances, policy interventions, or transportation bottlenecks, that shift demand or supply.

Equilibrium occurs when $Q_t^d = Q_t^s$, yielding:

$$(\beta + \delta)P_t^* = (\alpha - \gamma) + (u_{d,t} - u_{s,t}) \Rightarrow P_t^* = \frac{\alpha - \gamma}{\beta + \delta} + \frac{u_{d,t} - u_{s,t}}{\beta + \delta}. \quad (3)$$

The equilibrium price thus consists of two parts:

1. A deterministic component $\frac{\alpha - \gamma}{\beta + \delta}$, representing the baseline equilibrium determined by market structure, and
2. A stochastic component $\frac{u_{d,t} - u_{s,t}}{\beta + \delta}$, capturing fluctuations due to random disturbances.

To understand how external shocks translate into price changes, we can take the partial derivatives of the equilibrium price with respect to the stochastic components:

$$\frac{\partial P_t^*}{\partial u_{\{d,t\}}} = \frac{1}{\beta + \delta}, \quad \frac{\partial P_t^*}{\partial u_{\{s,t\}}} = -\frac{1}{\beta + \delta} \quad (4)$$

These comparative-statics results show that the magnitude of price response to demand or supply shocks is inversely related to the combined slope $(\beta + \delta)$. Markets where demand and supply are highly responsive to prices (large β, δ) will experience muted price fluctuations. Conversely, when responsiveness is low

(inelastic behavior), even small shocks can lead to large and persistent price deviations.

If the shocks are random with zero mean and variance $\sigma_u^2 = \text{Var}(u_{d,t} - u_{s,t})$, then the variance of the equilibrium price is:

$$\text{Var}(P_t^*) = \frac{\sigma_u^2}{(\beta + \delta)^2} \quad (5)$$

This expression provides a theoretical definition of price volatility, the statistical dispersion of equilibrium prices around their mean, and highlights that volatility is endogenous to market structure. Inelastic markets, such as staple food markets, naturally exhibit greater price volatility due to their weaker adjustment mechanisms.

The price elasticity of demand, which measures the percentage change in quantity demanded in response to a percentage change in price, is defined as:

$$\varepsilon_d = \frac{\partial Q}{\partial P} \cdot \frac{P}{Q} = (-\beta) \frac{P}{Q}. \quad (6)$$

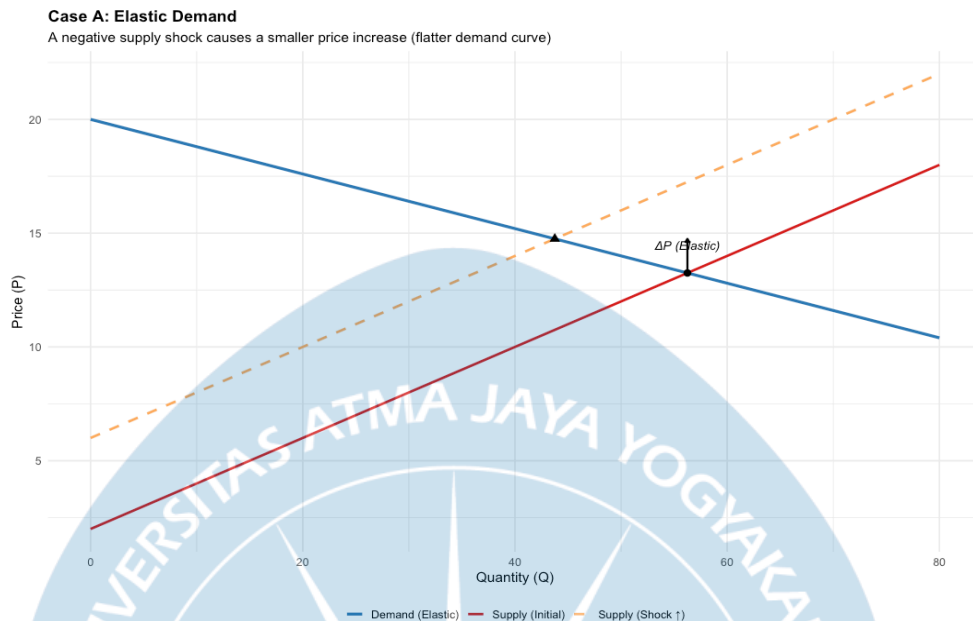
A smaller absolute value of ε_d (inelastic demand) implies that consumers do not significantly alter consumption when prices rise. Essential goods, such as rice, cooking oil, or eggs; typically have $|\varepsilon_d| < 1$, reflecting the necessity-driven rigidity of household demand.

In such markets, shocks, like droughts, import restrictions, or logistic disruptions, cannot be offset through quantity adjustments. As a result, prices bear the full burden of market adjustment, amplifying volatility. Conversely, luxury or

substitutable goods (e.g., processed foods or electronics) with elastic demand experience smaller price shifts because consumers can easily alter consumption patterns.

The theoretical relationships described earlier can be illustrated through the classical supply–demand framework, as shown in Figures 2.1 and 2.2. These diagrams visualize how the slope of the demand curve, representing elasticity, determines the magnitude of price adjustments when the market experiences a supply disturbance.

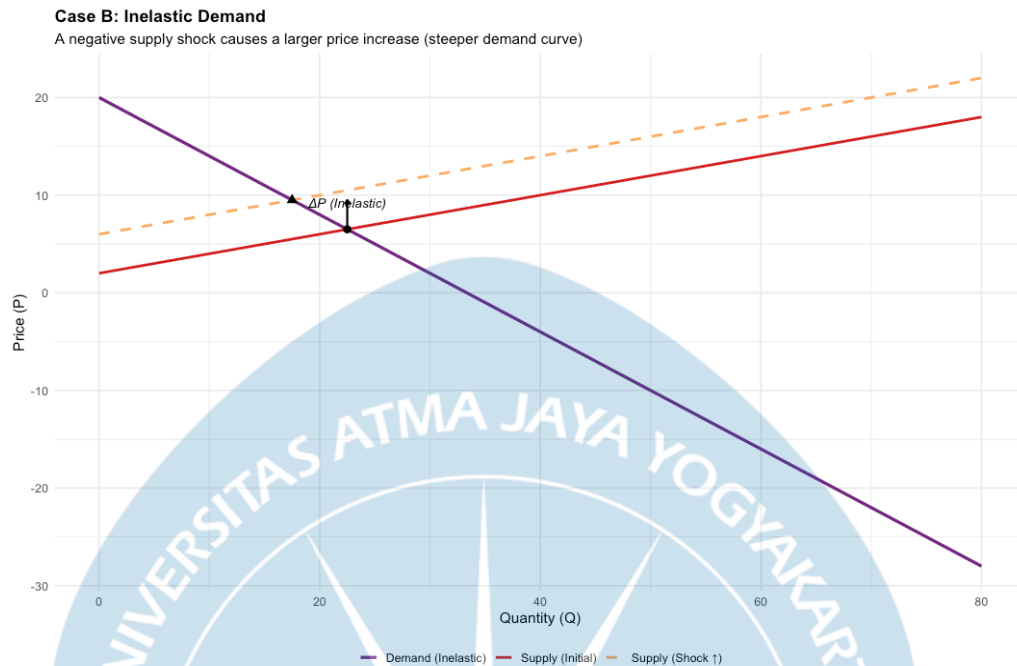
In Figure 2.2, the market exhibits elastic demand (depicted by the flatter blue line). A negative supply shock, represented by the upward shift of the supply curve from the red line (initial supply) to the orange dashed line (post-shock supply), leads to a relatively small increase in the equilibrium price (ΔP elastic) and a larger decrease in quantity traded. Because consumers in such markets are highly responsive to price changes, even a modest price rise triggers a significant reduction in demand, which dampens the overall price adjustment. This situation is typical for non-essential or substitutable goods, where households can easily alter consumption patterns or switch to alternatives when prices rise.



Source: Processed by Author (2025)

Figure 2.1
Elastic Demand Curve

In contrast, Figure 2.2 illustrates a market with inelastic demand (the steeper purple line). When faced with the same negative supply shock, such as a poor harvest, import disruption, or higher production cost, the equilibrium price increases substantially (ΔP inelastic), while the change in quantity traded is minimal. Consumers of staple commodities like rice, eggs, or cooking oil have few viable substitutes and limited flexibility to reduce consumption, meaning that supply disruptions are absorbed primarily through price increases rather than quantity adjustments.



Source: Processed by Author (2025)

Figure 2.2

Inelastic Demand Curve

These contrasting cases reveal the critical role of elasticity in shaping price dynamics. The steeper (more inelastic) the demand curve, the larger the price reaction to a given supply disturbance. Therefore, markets for essential goods inherently experience higher price volatility, even when external shocks are of similar magnitude to those affecting other goods. Ultimately, these figures provide an intuitive link between microeconomic behavior and macro-level volatility patterns. They demonstrate that price instability in staple food markets is not only a reflection of random shocks but also a structural outcome of inelastic market behavior, where rigid consumption needs to magnify the transmission of disturbances into prices. This theoretical insight justifies the empirical

investigation of volatility patterns in staple food markets undertaken in later sections of this thesis.

2.2. Price Volatility

Price volatility reflects the degree of fluctuation in market prices over time and represents how markets absorb and transmit shocks originating from both supply and demand sides. In economic theory, volatility arises from the continuous adjustment of prices as markets respond to new information, such as changes in weather, policy, transportation costs, or expectations about future conditions. When such shocks occur, prices act as the mechanism that restores equilibrium between buyers and sellers. The extent to which these adjustments translate into sharp or moderate price movements depends largely on the elasticity of demand and supply, as discussed earlier in Section 2.1.

In markets characterized by inelastic demand, such as staple food markets where consumers have limited substitution options, small disruptions in supply can generate disproportionately large price increases. Because consumers cannot significantly reduce consumption of essential goods like rice or cooking oil, the burden of adjustment falls primarily on prices rather than quantities. Consequently, even minor weather disturbances or logistic delays may cause noticeable price spikes. Conversely, in markets with elastic demand and supply, consumers and producers can more readily adjust their behavior, leading to smaller and more transient price changes.

From a theoretical standpoint, price volatility is therefore a reflection of market rigidity. The less responsive the market participants are to price signals, the more erratic and persistent price movements tend to be. In other words, volatility is not purely a statistical property of price series but a structural characteristic that reveals how efficiently a market incorporates and diffuses new information. High volatility in staple commodities often indicates limited flexibility in production, storage, and distribution systems, as well as the absence of effective price-stabilizing mechanisms such as trade integration or government reserves.

Moreover, volatility also serves as a signal of uncertainty. In efficient markets, prices adjust rapidly to reflect all available information, and fluctuations tend to be short-lived. However, in developing or segmented markets, where information flow is slower and market institutions are weaker, prices may overreact or remain unstable for extended periods. This persistence amplifies the impact of external shocks on household welfare, particularly among lower-income groups that allocate a significant portion of their spending to food.

In this context, analyzing price volatility provides valuable insight into both market performance and consumer vulnerability. It bridges the theoretical understanding of price formation with the empirical measurement of instability, offering a means to evaluate how well markets absorb shocks over time. By examining volatility patterns across staple foods, policymakers and researchers can better assess the resilience of the food system and identify areas where

interventions, such as improved logistics, trade facilitation, or price stabilization policies, are most needed.

2.3. The Pervasive Impact of Food Price Volatility

The stability of food prices is a cornerstone of economic well-being and social tranquility, particularly in developing nations where food expenditure constitutes a significant portion of household budgets (Bellemare, 2015). Over the past two decades, the global food system has been marked by recurrent price shocks and heightened volatility, posing profound challenges to poverty reduction, nutritional security, and macroeconomic stability (Headey, 2018). Food price volatility, characterized by significant and often unpredictable fluctuations in price levels, creates an environment of uncertainty that reverberates from the microeconomic decisions of individual households to the macroeconomic stability of entire nations (Gilbert et al., 2010). This review synthesizes the extensive body of literature on the multifaceted socio-economic consequences of food price volatility, establishing the theoretical and empirical foundations for a deeper analysis of this phenomenon in the Indonesian context. It examines the direct impacts on income and poverty, the indirect consequences for human capital through health and nutrition, and the broader macro-social manifestations. The evidence overwhelmingly demonstrates that food price volatility is not merely a market inconvenience but a potent driver of hardship and a significant impediment to sustainable development.

The most immediate and well-documented transmission mechanism through which food price volatility affects households is the erosion of real income and purchasing power. For households that are net buyers of food, a category that includes nearly all urban dwellers and a surprisingly large portion of the rural poor, sudden price increases directly diminish their capacity to purchase essential goods and services (Purwantini et al., 2022). This relationship is straightforward: as the price of food rises against a static or slowly adjusting income, the quantity of goods a household can afford necessarily declines, leading to a direct reduction in welfare. The literature consistently finds a significant and negative impact of food price volatility on household welfare, with poor households.

This erosion of purchasing power translates directly into higher rates of poverty. The World Bank estimates that the 2010-2011 global food price spike pushed an additional 8.3 million people worldwide into poverty. Empirical studies from various developing countries corroborate this link. Research in Pakistan, for instance, employed a pseudo-panel fixed-effect technique to demonstrate that food price volatility has a significant and negative impact on the welfare of urban households, who are predominantly net food buyers. This vulnerability is heightened in developing economies where rapid urbanization and population growth place continuous pressure on food demand and prices.

In Indonesia, the relationship between food prices and poverty is particularly stark. The country's poverty line is defined using a basic needs approach in which the food poverty line constitutes a dominant component,

making poverty indicators highly sensitive to food price inflation. Empirical evidence for Indonesia shows that increases in staple food prices and greater price volatility significantly reduce household welfare and exacerbate poverty, especially among vulnerable and food dependent households (Purwantini et al., 2022). These findings highlight that maintaining the stability of key staple food prices, such as rice, vegetables, and protein sources, is a critical element of effective poverty alleviation strategies in Indonesia.

The impact of food price volatility is not uniform and reveals complex patterns of inequality that extend beyond simple urban and rural classifications. While urban households are often perceived as the primary victims of food price increases, evidence from Indonesia and other developing countries points to a more nuanced reality. Many rural households are not surplus producers but net food consumers, including landless agricultural laborers and smallholder farmers whose landholdings are insufficient to meet subsistence needs. As a result, rising food prices can increase poverty more sharply in rural areas than in urban centers by eroding real incomes and purchasing power among vulnerable rural households (Headey, 2018). This dynamic demonstrates that food price volatility does not merely transfer income from urban consumers to rural producers but frequently exacerbates inequality within rural communities themselves. The primary beneficiaries of higher food prices are typically larger and more productive farm owners rather than the rural poor. Consequently, the net food buyer perspective provides a more accurate framework for identifying vulnerability than geographic classification alone, implying that broad and untargeted policies that rely on

higher agricultural prices to support rural incomes may be inefficient and fail to protect the most vulnerable households.

2.4. Conceptual Framework

Big data has fundamentally transformed the landscape of economic research by enabling the analysis of complex phenomena at an unprecedented scale and level of detail. It is commonly characterized by high volume, velocity, variety, veracity, and value, all of which require advanced analytical techniques to transform large and often unstructured datasets into meaningful economic insights. The principal contribution of big data to economics lies in its ability to expand the scope of empirical inquiry while substantially improving measurement accuracy. The availability of large scale administrative and proprietary datasets allows researchers to track economic activity with greater precision and to develop innovative empirical strategies, including quasi experimental and natural experiment designs that were previously difficult to implement (Einav et al., 2014).

From a methodological perspective, machine learning techniques are increasingly integrated into econometric analysis. These methods are particularly valuable when working with high dimensional data, as they facilitate variable selection, regularization, and more robust predictive modeling. They also enable practices such as nowcasting, where alternative data sources including search engine queries or satellite imagery are used to generate real time economic indicators. Advances in computational capacity and distributed processing frameworks have further expanded economists' ability to analyze extremely large

datasets, making complex regressions, panel data analysis, and time series modeling feasible at a scale that was previously unattainable for individual researchers. Together, these developments have shifted empirical economics toward the use of more granular, timely, and unstructured data sources, fundamentally reshaping how economic phenomena are measured and analyzed (Harding et al., 2018).

Digital traces generated from mobile devices, online platforms, and sensor based systems increasingly complement traditional official statistics, enabling economists to capture economic activity with greater timeliness and detail. This diversification of data sources enhances the measurement of outcomes such as employment conditions, price dynamics, and population mobility, while simultaneously raising concerns related to data quality, representativeness, and privacy. Scholars emphasize the dual nature of big data for economic research and policy design. On the one hand, it offers powerful predictive and analytical capabilities, while on the other, reliance on large scale and often proprietary datasets introduces risks of limited accessibility and potential bias. Importantly, predictive models must also account for behavioral responses that may arise when policies are implemented based on data driven insights, as such responses can alter the underlying relationships being measured (Einav et al., 2014). When combined with advanced computational techniques, big data therefore has the potential to fundamentally reshape both economic research and policy analysis.

2.5. Tolerance Band

A tolerance band in price policy can be understood as a range of prices that policymakers regard as socially acceptable or stable for a given good, beyond which intervention is justified to protect economic welfare. In agricultural and commodity markets, such bands are often created through deliberate policy instruments that limit how far market prices can deviate from a target region. One influential study in this tradition analyzes commodity price stabilization programs in the United States, where governments used coordinated purchases and sales to maintain prices within a designated support and release range. These “price band buffer stock programs” explicitly set upper and lower price bounds so that commodity prices remain within an acceptable tolerance band, reducing the likelihood of sharply rising or falling prices that could otherwise harm consumers or producers. The analysis by Miranda and Helmberger (1988) shows how such stabilization mechanisms have been used pragmatically to contain volatility in key markets, especially for crops like soybeans, and to moderate the risk of extreme price outcomes.

Beyond traditional agricultural policy, the conceptual logic of tolerance bands extends to price control theory, where regulators impose ceilings or floors on prices with the aim of constraining movements that are socially or politically unacceptable. Price ceilings prevent prices from rising above a maximum level, often to protect consumers from high food costs, while price floors prevent prices from falling below a minimum level, typically to support producer incomes. These bounds, which in effect form a policy tolerance band around the competitive

market price, alter market equilibrium by changing incentives along the supply chain and influencing the allocation of production factors. In his supply-chain approach to price regulation, Mulligan (2025) demonstrates that compliance with price controls requires adjustments throughout the market, with effects on trade volumes and production decisions that differ depending on whether price bounds are binding. This perspective highlights that tolerance bands in price theory are not mere static boundaries but dynamic constraints that shift the underlying economic equilibrium.

Taken together, the literature on price stabilization and price controls provides a coherent theoretical foundation for tolerance bands as operational ranges for price policy. In commodity markets, explicit support and release price mechanisms serve to keep actual prices within predetermined bounds, directly limiting volatility and reducing the frequency and severity of price shocks. In broader market contexts, price ceilings and floors similarly define the upper and lower tolerable limits of market prices, with significant consequences for supply and demand outcomes. These frameworks illustrate that tolerance bands in economic theory are grounded in bounded price expectations and intervention thresholds that aim to balance efficiency with social stability, making them useful conceptual tools for designing early warning systems and policy rules that guard against destabilizing price movements.

2.6. Empirical Studies on Food Price Volatility in Developing Economies

The academic literature on food price volatility in Indonesia and other developing countries is extensive and methodologically diverse, employing a

wide range of econometric approaches to examine welfare impacts, poverty responses, market transmission, and price risk. Despite this diversity, two structural data limitations consistently reduce the policy relevance of existing studies. The first is the temporal resolution of available data. Most analyses rely on low frequency observations such as monthly, quarterly, or annual series. While suitable for identifying long run relationships, these data are poorly suited to capturing short term but severe price shocks that fundamentally define volatility. When prices are aggregated to lower frequencies, sharp fluctuations are smoothed out, obscuring the dynamics that are most relevant for real time policy intervention. This limitation highlights the importance of high frequency price data for accurately measuring volatility and understanding its economic consequences (Cavallo et al., 2016).

The second limitation concerns the spatial dimension of analysis. Much of the existing literature adopts a national perspective, implicitly assuming homogeneous market behavior across Indonesia's highly fragmented food system. Provincial level evidence suggests that this assumption is misleading, as the drivers and intensity of food price volatility vary substantially across regions due to differences in production structures, market integration, infrastructure, and exposure to shocks. Such regional heterogeneity reduces the informational value of national models and limits their usefulness for subnational policy formulation. Recent methodological developments have therefore moved beyond purely descriptive volatility measures toward risk oriented frameworks that explicitly quantify the likelihood and magnitude of extreme price movements. Incorporating

risk based measures allows researchers to assess vulnerability to severe price shocks rather than average fluctuations alone, offering a more policy relevant understanding of food price dynamics across regions (Setiadi et al., 2024).

Building on these insights, this study addresses both the temporal and spatial limitations identified in previous research by applying asymmetric GARCH models, specifically EGARCH, GJR-GARCH, and TGARCH, to a newly constructed dataset of daily consumer food prices in West Java. The first stage of analysis estimates conditional volatility and examines persistence through the sum of α and β coefficients, indicating the degree of shock absorption or volatility rigidity over time, complemented by model selection using AIC and BIC criteria. The second stage visualizes the volatility paths across time, highlighting spikes in specific commodities and clustering patterns that remain invisible in lower-frequency data.

In the final stage, the analysis integrates a Value at Risk framework to establish tolerance thresholds for daily price changes, providing an operational measure of downside risk that can support early warning systems and market stabilization policies. The Value at Risk approach allows extreme price movements to be identified based on probabilistic thresholds rather than average volatility alone, making it well suited for monitoring food price risks faced by consumers. These tolerance thresholds are subsequently recalibrated using daily price data from West Java to ensure that they reflect local market conditions and volatility dynamics. By focusing on asymmetric volatility responses, the framework captures situations in which negative price movements exert a stronger

influence on future volatility than positive movements of similar magnitude. Such insights are essential for designing real time monitoring and targeted intervention mechanisms that protect households from destabilizing food price shocks (Engle et al., 2004).

2.7. Synthesis

The literature reviewed in this chapter highlights the multifaceted consequences of food price volatility for poverty, inequality, and macroeconomic stability, especially in developing countries where food spending constitutes a major share of household expenditure. In Indonesia, the problem is amplified by structural characteristics of its food markets, high dependence on staple commodities and substantial regional heterogeneity. Existing studies have relied heavily on traditional GARCH-based approaches, which, while effective in capturing volatility clustering, are constrained by their use of low-frequency and nationally aggregated data. These limitations obscure short-term shocks and interprovincial variations that are crucial for policy formulation.

Recent methodological developments in volatility and risk analysis have sought to overcome the limitations of conventional approaches by exploiting high frequency data and advanced econometric frameworks. Rather than focusing solely on average volatility, risk based methods explicitly quantify the probability and magnitude of extreme price movements, allowing analysts to identify tail risks and potential systemic exposure in commodity markets. The Value at Risk framework and its extensions provide a structured way to model such risks by linking conditional return distributions to observable information sets. By

emphasizing distributional asymmetries and extreme outcomes, these approaches offer more informative signals for monitoring market stress and designing policy responses to price instability. This shift toward explicit risk quantification enhances both predictive performance and policy relevance in the analysis of food price dynamics (Engle et al., 2004).

Building upon these insights, this thesis addresses the temporal and spatial limitations of prior Indonesian studies by employing asymmetric GARCH models, specifically EGARCH, GJR-GARCH, and TGARCH, on daily provincial-level food price data for West Java. The integration of a VaR-based framework further contextualizes volatility spikes within quantifiable risk thresholds, providing an empirical foundation for localized early-warning systems and market stabilization strategies. Through this combined approach, the study contributes to a more precise and policy-relevant understanding of food price volatility, bridging the gap between econometric modeling and actionable economic governance in Indonesia's staple food markets.