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license**SOCIOECONOMIC DIMENSIONS OF FOOD PRICE
FLUCTUATIONS AND REGIONAL INFLATION IN
INDONESIA: INSIGHTS FROM JAVA AND SUMATRA****Wirda Zahra Siregar^{1*}, Rulianda Purnomo Wibowo¹, Elisabet
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20222, Indonesia*Correspondence E-Mail: wirdazahra03@gmail.comDOI: <https://doi.org/10.30598/baileofisipvol3iss2pp332-352>**ABSTRACT**

This study investigates the socioeconomic dynamics of food price volatility and its asymmetric impacts on regional inflation across Java and Sumatra, Indonesia's two most economically influential islands. The research aims to analyze the short- and long-term effects of food commodity price fluctuations on regional inflation, compare the structure and magnitude of price transmission mechanisms between the two regions, and identify key commodities that drive inflation disparities. Using a quantitative explanatory approach integrated with sociological interpretation, monthly time-series data from 2020 to 2024 across six provinces are analyzed through ADF stationarity tests, VAR/VECM models, Granger causality, impulse response functions, and variance decomposition, complemented by sociological indicators such as logistics index, GRDP per capita, and household food expenditure ratio. The findings show that short-term inflationary pressures stem mainly from price shocks in red chili, shallots, and cooking oil, while long-term persistence is driven by dependence on rice, beef, and chili. Inflation in Java is largely demand-driven, whereas Sumatra's inflation reflects supply-side constraints and weak market integration. The study's novelty lies in combining macroeconomic modeling with regional sociological analysis, offering a socioeconomic inflation dynamics framework that reframes inflation as a socially embedded process. The research advances economic sociology by linking inflation behavior with social structure, regional inequality, and policy responsiveness.

Keywords: Consumption Inequality, Economic Sociology, Food Price Volatility, Inflation Dynamics, Regional Disparity

INTRODUCTION

Indonesia's economic landscape has long been characterized by regional diversity, not only in terms of culture and geography but also in its varied resilience and vulnerability to external shocks (Indrajaya et al., 2022; Riggs et al., 2021). One of the most persistent challenges to Indonesia's macroeconomic stability is the volatility of food prices, which often manifests unevenly across regions (Anas et al., 2022; Putra et al., 2021). Although the central government has made significant efforts to maintain inflation within a manageable range, regional disparities continue to distort these outcomes. Java, the political and economic core of the nation, benefits from superior infrastructure, market access, and distribution networks, which contribute to relatively stable price formation. By contrast, Sumatra, despite its rich natural resources and

agricultural potential, faces logistical bottlenecks and market fragmentation that heighten its exposure to food price shocks. These asymmetries become particularly visible during crises, such as the COVID-19 pandemic and the subsequent recovery period, when disruptions in supply chains and shifts in consumption patterns amplified regional differences in inflationary experiences (Santacreu & LaBelle, 2022; Yu et al., 2022). The problem is not merely economic but deeply social, reflecting the uneven geography of opportunity and resilience across Indonesia's islands.

Inflation, in this context, is more than a macroeconomic indicator, it is a mirror of how societies manage scarcity, inequality, and uncertainty. When the prices of basic food items such as rice, chili, or cooking oil surge, the effects ripple across household welfare, labor productivity, and even political stability. Harianja (2025) and Mayasari and Nengzih (2025) demonstrate that food inflation contributes disproportionately to Indonesia's overall inflation rate, particularly affecting low-income households that allocate more than half of their expenditures to food. The recurring phenomenon of volatile food inflation is thus both an economic and sociological concern, as it reshapes everyday realities of consumption, livelihood, and trust in government institutions. Understanding how food price volatility interacts with regional dynamics is crucial not only for policymakers seeking effective inflation management but also for scholars who view economic stability as a socially embedded construct, produced and reproduced through networks of infrastructure, policy, and human adaptation.

Recent scholarship has moved beyond monetary perspectives, examining inflation as a manifestation of complex social systems. Dou et al. (2023), Kouskoura et al. (2024), and Shil and Eusufzai (2022) argue that regional price disparities often arise from structural differences in market integration, transportation costs, and governance capacity. In the Indonesian context, Nookhwun and Waiyawatjakorn (2024) and Purwa et al. (2025) observe that although the national inflation target has remained relatively stable, regional inflation gaps persist due to distinct local market characteristics. Aginta (2024) further highlights the significance of local food systems and their sensitivity to climatic and logistical disruptions. Collectively, these studies suggest that inflationary pressures in Indonesia cannot be fully understood through national aggregates alone; they require a spatially differentiated approach that considers how local economies interact with broader market forces.

The literature has also underscored the role of infrastructure and logistics in shaping regional inflation patterns. Ohakwe and Wu (2025) and Pan et al. (2022) reveal that provinces with higher logistics performance indices tend to experience lower and more stable inflation rates. Similarly, Amin et al. (2024) and Priatama et al. (2022) find that transportation costs account for a significant share of price disparities between Java and the outer islands. However, these studies often stop short of linking infrastructural efficiency to social outcomes such as consumption inequality or household welfare. The tendency to treat logistics as a purely technical variable overlooks its embeddedness within social relations and governance structures. Thus, while it is well established that better roads reduce costs, less is known about how

infrastructural inequities translate into differential inflationary experiences among regions and communities.

Another strand of research explores the dynamics of food price transmission in Indonesia. Kharisma and Indrawan (2023) and Muflikh et al. (2024) employ Vector Autoregression (VAR) models to demonstrate that food prices in Java exert a leading influence on national inflation, suggesting stronger market integration on the island. In contrast, Kamaruddin et al. (2021) and Muflikh et al. (2021) identify a slower and more fragmented price transmission mechanism in Sumatra, where inter-island trade frictions limit price adjustments. Furthermore, Krisnamurthi and Utami (2022) and Yavishan et al. (2024) show that volatility in key commodities such as red chili and shallots often originates in production centers outside Java but generates stronger inflationary effects within Java's urban markets due to higher consumption demand. These findings underscore the interdependence of regional markets while revealing the asymmetric nature of that interdependence, Java as the consumption hub and Sumatra as the production periphery.

Beyond econometric modeling, sociological perspectives on inflation remain underdeveloped. Gallagher and Petracca (2024) and Gardezi and Stock (2021) argue that markets are not autonomous systems but socially constructed institutions shaped by trust, norms, and power relations. Consistent with this view, Corrêa et al. (2024) and Korsgaard et al. (2022) emphasize the importance of social embeddedness in explaining market behavior, including price dynamics. In Indonesia, inflation reflects not only monetary policy outcomes but also the social organization of production, distribution, and consumption. Amirtha et al. (2025) and Putri and Karimi (2024) attempt to integrate sociological insights into analyses of economic inequality, suggesting that inflation amplifies existing hierarchies by disproportionately burdening vulnerable groups. Nevertheless, empirical work that synthesizes these sociological insights with quantitative inflation models remains scarce.

Recent studies on regional inflation have increasingly employed econometric techniques such as Vector Error Correction Models (VECM) to capture dynamic relationships among variables. Nisa' (2022) uses VECM to analyze inflation in eastern Indonesia, finding strong long-term causality between food prices and consumer price indices. Likewise, Kismawadi (2024) applies impulse response functions to show that certain food commodities, especially rice, chili, and cooking oil, generate persistent inflationary effects. Yet, these studies tend to focus on economic causality or short-term volatility, seldom situating such patterns within broader social or spatial contexts. Consequently, the literature still leaves open the question of how regional social structures mediate the relationship between price volatility and inflation, and why some regions exhibit greater resilience than others.

While the existing body of research provides valuable insights, it often treats inflation as a purely economic outcome, detached from its social underpinnings. Many models are designed to forecast inflation or assess monetary policy effectiveness, yet they rarely account for regional inequality, consumption behavior, or infrastructural access. This disconnect between

macroeconomic findings and the lived realities of households experiencing inflationary pressures persists. Moreover, few studies adopt a comparative framework across major islands such as Java and Sumatra, despite their contrasting economic compositions and social infrastructures. This absence of spatial comparison leaves a significant gap in understanding how geography, infrastructure, and social systems interact to shape regional inflation dynamics in Indonesia.

The present study addresses this intellectual and empirical gap by offering a comparative socioeconomic analysis of food price volatility and inflation between Java and Sumatra. Unlike prior research that isolates provinces or focuses solely on national aggregates, this study situates inflation within the broader context of regional inequality and market integration. By combining quantitative econometric modeling, such as VAR, VECM, Granger causality, impulse response, and variance decomposition, with sociological interpretation, it bridges the methodological divide between economics and sociology. This interdisciplinary approach provides a more nuanced understanding of inflation, not merely as a statistical pattern but as a social process that reflects infrastructural disparities, consumption hierarchies, and collective vulnerabilities.

The study introduces a conceptual framework termed the socioeconomic inflation dynamics framework, which links food price volatility with infrastructural and social dimensions. This perspective recognizes that economic behavior is embedded within spatial and institutional contexts, where access to markets, logistics, and information determines who bears the costs of price fluctuations. In post-pandemic Indonesia, where food systems and supply chains have undergone structural transformation, this framework offers fresh insights into the geography of inflation.

Accordingly, this research aims to analyze the short- and long-term effects of food price volatility on regional inflation in Java and Sumatra, compare the strength and structure of price transmission mechanisms between the two islands, and identify the dominant food commodities contributing to inflation disparities. Beyond these analytical goals, the study seeks to enrich the sociology of inflation by demonstrating that price movements are not merely market signals but expressions of social structure, of who has access to infrastructure, whose consumption is prioritized, and whose welfare is most at risk. In doing so, it underscores the need for regionally adaptive and socially informed inflation management policies, reaffirming that price stability ultimately depends on the stability of social and infrastructural foundations.

RESEARCH METHOD

The research methodology in this study was systematically designed to address the central question of how food price fluctuations influence regional inflation dynamics in Indonesia, with a particular focus on comparing the islands of Java and Sumatra. The study employed a quantitative explanatory approach integrated with socioeconomic interpretation, allowing statistical results to not only illustrate numerical relationships among variables but also to be interpreted within their broader social and structural contexts (Bowen, 2025). This

methodological integration provides a more comprehensive understanding of how social structures, infrastructural disparities, and consumption patterns shape interregional inflation dynamics.

The research areas were determined through a purposive sampling strategy, based on both conceptual and empirical considerations. Java and Sumatra were selected because they represent two primary poles within Indonesia's national economic system. Java serves as the core of economic activity, consumption, and national distribution, making its inflation mechanism predominantly demand-pull, driven by demand-side pressures (Taherdoost, 2022). In contrast, Sumatra exhibits distinct characteristics: despite its resource richness and significant contribution to national food production, it continues to face infrastructural limitations, market integration challenges, and interregional distribution inefficiencies. These disparities make food prices in Sumatra more vulnerable to supply-side shocks.

Six provinces were selected to represent the two islands: North Sumatra, West Sumatra, and South Sumatra for Sumatra; and West Java, Central Java, and East Java for Java. These provinces were chosen due to their strategic roles as major centers of food production and consumption, as well as their substantial contributions to both regional and national inflation formation.

This study relied on secondary data in the form of monthly time series data from January 2020 to December 2024. The dataset included variables of regional inflation (measured by the Consumer Price Index per province) and the prices of nine key food commodities with significant contributions to inflation, rice, beef, broiler chicken, chicken eggs, cooking oil, shallots, garlic, red chili, bird's eye chili, and granulated sugar.

Data were sourced from official institutions such as Bank Indonesia, Statistics Indonesia (Badan Pusat Statistik [BPS]), the Provincial Economic Reports (LPP), and the National Strategic Food Price Information Center (PIHPS). Additional reports and scholarly literature were utilized to strengthen the socioeconomic interpretation of empirical findings. Secondary data were chosen due to their reliability and representativeness of macroeconomic trends and regional dynamics during the post-pandemic period, which forms a critical contextual framework for this research.

Data were analyzed using the Vector Autoregression (VAR) and Vector Error Correction Model (VECM) approaches, in accordance with the characteristics of time-series data and the analytical objective of identifying both short- and long-term causal relationships among variables. The VAR model was employed due to its capability to capture the dynamic interdependence among endogenous economic variables, where each variable can influence and be influenced by others. The general VAR formulation follows the framework of Bozkurt et al. (2025), which conceptualizes all economic variables as components of an interconnected system. In this study, regional inflation (INF) served as the dependent variable, while the prices of various food commodities acted as independent variables. This model allowed the identification of the extent to which price changes in certain commodities, such as rice or red chili, affect inflation in both

the short and long term.

The analytical process began with a stationarity test using the Augmented Dickey–Fuller (ADF) method to ensure that the data did not contain unit roots, which could bias estimation results. If the data were found to be non-stationary at the level, differencing was applied until stationarity was achieved. The next step involved determining the optimal lag length using several criteria, including the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan–Quinn Criterion (HQ). The lag with the smallest value across these criteria was selected, as excessively short lags may overlook intertemporal dynamics, while overly long lags could reduce the model’s degrees of freedom (Sardana et al., 2023).

Following this, model stability testing was performed to ensure the validity of the estimation results. Stability was verified by calculating the roots of the characteristic polynomial, requiring that all roots lie within the unit circle. Once the model was confirmed stable, the Granger causality test was conducted to determine the direction of relationships among variables, whether unidirectional, bidirectional, or non-causal. This test provided valuable insights into causal pathways, such as whether increases in cooking oil prices precede inflationary pressures or vice versa.

When long-term relationships among variables were detected, the analysis proceeded with the VECM model, a restricted form of VAR suitable for non-stationary but cointegrated data. The VECM framework enabled the analysis of long-run equilibrium relationships through the Error Correction Term (ECT), which indicates the speed of adjustment toward equilibrium following short-term shocks. Consequently, the VECM provides a comprehensive picture of how food price shocks influence inflation dynamics across different time horizons and how rapidly the system returns to equilibrium after disturbances.

To enrich the interpretation of the model’s findings, two additional analyses were conducted: the Impulse Response Function (IRF) and Variance Decomposition (VD). The IRF was used to observe the dynamic responses of inflation to shocks in specific food commodity prices over time, offering insights into both the magnitude and persistence of the effects until the system stabilizes. Meanwhile, the VD analysis quantified the relative contribution of each variable to total inflation variance. Through VD, the study identified which commodities exert the most dominant influence on inflation in each region and how the structure of these influences differs between Java and Sumatra.

RESULTS AND DISCUSSION

Socioeconomic Patterns of Food Price Movements and Inflationary Pressures Across Java and Sumatra

The findings of this study reveal how the volatility of food prices has tangibly manifested in the asymmetric patterns of regional inflation between Java and Sumatra. Although both islands constitute Indonesia’s largest centers of production and consumption, variations in price

transmission mechanisms, household consumption structures, and infrastructural distribution capacities have shaped distinct inflationary characteristics across the two regions. Data from Statistics Indonesia indicate that the national inflation rate stood at 1.57% (year-on-year) in December 2024, relatively stable compared to the 5.51% inflation surge observed in 2022. However, national stability does not fully reflect regional experiences, as substantial disparities in inflationary pressures persist across provinces. This aligns with the argument of Borzenko (2025) that national inflation is an aggregation of regional inflations weighted by their respective contributions; hence, spatial disparity is a structural inevitability within an economy characterized by local diversity such as Indonesia's.

Disparities become more apparent when examining provincial contributions to inflation across Sumatra and Java. As shown in Table 1, the three representative provinces in Sumatra, North Sumatra, West Sumatra, and South Sumatra, recorded 2024 inflation rates of 0.85%, 1.75%, and 1.90% (year-on-year), respectively. Meanwhile, the three representative provinces of Java, West Java, Central Java, and East Java, recorded inflation levels of 1.35%, 1.65%, and 1.80%, respectively. On average, inflation in Java is relatively more stable and closer to the national target of $2.5 \pm 1\%$, whereas Sumatra demonstrates higher sensitivity to shocks, particularly those related to strategic food commodities.

Table 1 Inflation Rates in 38 Indonesian Provinces, 2024 (% year-on-year)

Province	Inflation (%)	Province	Inflation (%)
Aceh	0.70	DKI Jakarta	1.20
North Sumatra	0.85	West Java	1.64
West Sumatra	1.75	Bengkulu	1.15
Riau	1.60	Jambi	1.30
Bangka Belitung	2.65	Banten	1.05
Riau Islands	1.45	East Java	1.80
Lampung	1.00	Central Java	1.65

Source: Statistics Indonesia (BPS), 2024 (processed data)

Empirical findings affirm that food price volatility serves as a major driver of regional inflation dynamics. In North Sumatra, inflationary pressures were primarily triggered by increases in rice, cooking oil, and sugar prices, as well as non-food items such as jewelry and clove cigarettes. This phenomenon suggests that inflation is not solely rooted in supply-side issues but also shaped by shifts in urban–rural consumption preferences and inflation expectations. Policy initiatives through the 4K Framework (Availability, Affordability, Accessibility, and Communication) and the National Movement for Food Inflation Control (Gerakan Nasional Pengendalian Inflasi Pangan [GNPIP]) have mitigated pressures to a certain degree, though they have not fully neutralized the region's sensitivity to seasonal shocks and distributional disruptions.

A more extreme variation was observed in West Sumatra, where inflation volatility was closely associated with supply shocks caused by natural disasters such as the eruption of Mount

Marapi, floods, and landslides. These events constrained food logistics and drove inflation to 4.04% (year-on-year) in the second quarter of 2024. This indicates a sociological dimension wherein regional vulnerability to inflation is not merely economic but also shaped by the interaction between ecological risks, social perceptions of scarcity, and the institutional capacity of local governments to manage price emergencies. Consistent with Aginta's (2022) notion of adaptive institutions, the inflation dynamics in West Sumatra demonstrate that local governance plays a decisive role in mitigating economic shocks.

In contrast, South Sumatra exhibited a disinflationary trend in the third quarter of 2024 due to improved food supply conditions during the harvest season. This pattern corresponds with the Food Price Transmission Theory, which posits that regions dependent on domestic production cycles tend to experience more "seasonal" inflation rather than structural inflation transmission as seen in Java. Nonetheless, projections for the fourth quarter of 2024 indicate a potential inflation rebound, driven by increased aggregate demand during regional elections (Pilkada) and major religious holidays (Hari Besar Keagamaan Nasional [HBKN]). This phenomenon aligns with the expectations-augmented Phillips Curve, which suggests that changes in inflation expectations can stimulate aggregate demand and generate upward price pressures.

In contrast to Sumatra, the provinces of Java exhibit more stable and moderated inflationary behavior. West Java and Central Java benefited from harvest momentum that helped lower the prices of horticultural commodities such as chili and tomatoes. Improved interregional coordination and more advanced distribution infrastructure contributed to maintaining price stability. According to data from jatengprov.id, successful inflation control in these provinces was largely attributed to synergistic cooperation between local governments and stakeholders, as well as to the effectiveness of daily inflation monitoring systems. However, East Java continued to experience pressures associated with global commodity price transmission, particularly gold, oil, and sugar. These pressures represent forms of imported inflation and are therefore structurally distinct from the domestic production-related inflationary mechanisms observed in Sumatra.

The dynamics of food price movements reveal distinct fluctuation patterns across provinces. Sumatra experienced more aggressive volatility in red chili, bird's eye chili, shallots, and garlic, while Java displayed relatively controlled cycles, though still sensitive to chili and horticultural price swings. The increase in beef prices in North Sumatra in November 2024, as reported by Databoks (2024), reinforces the observation that food price shocks in Sumatra often manifest regionally and do not immediately follow national patterns. This supports the conclusions of Jamaludin (2022) and Rachman (2025), who argued that food price turbulence in Indonesia frequently exhibits anomalous behavior, prices do not automatically align with international declines or normalized supply conditions due to the presence of oligopolistic market structures, extended distribution chains, and regional speculative dominance.

The structural differences in price transmission were examined using the Vector Autoregressive (VAR) and Vector Error Correction Model (VECM) approaches. Prior to estimation, data were tested for stationarity using the Augmented Dickey–Fuller (ADF) method. Long-term relationships between food prices and inflation were assessed using the following model:

$$\Delta INF_t = \alpha + \beta_1 \Delta Rice_t + \beta_2 \Delta Chili_t + \beta_3 \Delta Shallots_t + \beta_4 \Delta Oil_t + \lambda (INF_{t-1}) \quad (1)$$

The VECM results indicate that shocks in red chili, shallot, and cooking oil prices exert stronger short-term effects on inflation in Sumatra, while in Java, these transmissions are more muted and require longer adjustment periods to become significant. Conversely, price shocks in rice and beef demonstrate strong long-term relationships in sustaining core inflation in both regions. This finding confirms that staple food commodities in Indonesia serve as anchor inflation variables, making inflation persistently entrenched over the long run.

Dynamics of Inflation and Food Price Volatility in North Sumatra Province: An Integrated VAR–VECM Analysis

Inflation fluctuations in North Sumatra Province are not merely statistical figures but represent the pulse of the regional economy, which relies heavily on food price stability. In a region where household consumption structures are dominated by food commodities, even a slight price fluctuation can weaken purchasing power and induce economic anxiety, particularly among middle- and lower-income groups. Consequently, understanding the dynamics of inflation and its interconnection with strategic food commodity prices is not only essential for academic purposes but also crucial for formulating responsive, evidence-based, and household-oriented price stabilization policies. A comprehensive analysis of inflation movements must consider both short-term and long-term temporal aspects to identify the sources of shocks that can serve as a basis for preventive and corrective policy interventions. Therefore, dynamic econometric approaches such as the Vector Autoregressive (VAR) and Vector Error Correction Model (VECM) frameworks are highly relevant for capturing the complex relationships among commodity prices and inflation in North Sumatra.

The first analytical step to ensure the validity of the estimation results is the stationarity test, which examines whether each variable exhibits a stable data pattern over time. The Augmented Dickey–Fuller (ADF) test results indicate that all variables are stationary at the first-difference level. This finding provides a solid foundation for employing the VAR–VECM framework since all variables meet the requirements for dynamic relationship estimation.

Table 2 Stationarity Test Results for North Sumatra Province Data at the First-Difference Level

Variable	ADF Statistic	McKinnon Critical 1%	5%	10%	Result
Inflation	-8.849252	-3.550396	-2.913549	-2.594521	Stationary
Rice Price	-5.040143	-3.548208	-2.912631	-2.594027	Stationary
Beef Price	-22.32598	-3.548208	-2.912631	-2.594027	Stationary
Chicken Meat Price	-7.468988	-3.550396	-2.913549	-2.594521	Stationary
Egg Price	-8.088272	-3.550396	-2.913549	-2.594521	Stationary
Cooking Oil Price	-5.024386	-3.548208	-2.912631	-2.594027	Stationary
Shallot Price	-8.028684	-3.550396	-2.913549	-2.595521	Stationary
Garlic Price	-10.11330	-3.548208	-2.912631	-2.594027	Stationary
Red Chili Price	-6.874102	-3.550396	-2.913549	-2.594521	Stationary
Cayenne Pepper Price	-6.571458	-3.555023	-2.915222	-2.595365	Stationary
Sugar Price	-4.657815	-3.548208	-2.912631	-2.394027	Stationary

Source: Processed by the author (2025)

After confirming data stability, the next step involves determining the optimal lag length. The estimation results suggest that a lag of two periods is optimal. This decision aligns not only with statistical criteria but also with economic reasoning, price changes in food commodities typically require a transmission period before exerting significant effects on inflation.

Table 3 Optimal Lag Length Test Results for North Sumatra Province Data

Lag	LogL	LR	FPE	AIC	SC
0	-5046.730	NA	3.27e+63	177.4642	177.8585*
1	-4859.149	296.1809	3.39e+62	175.1280	179.8593
2	-4722.609	162.8903*	3.13e+62*	174.5828*	183.6510

Source: Processed by the author (2025)

The model's stability test indicates that all characteristic roots have a modulus less than one and lie within the unit circle, confirming that the VAR model is stable. Consequently, further analyses such as the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) can be interpreted reliably. The model's stability suggests that the inter-variable relationships accurately reflect consistent economic dynamics without divergence tendencies.

The Granger causality test offers insights into the directionality of relationships and the transmission of effects among variables. The results reveal that not all food commodities exhibit direct causal linkages with inflation. A unidirectional causality is identified from red chili prices to inflation, indicating a potential price pressure originating from red chili volatility, though not necessarily triggering a bidirectional inflationary response.

Further analysis using the Johansen cointegration test confirms the existence of long-run relationships among commodity prices and inflation. The identification of eleven cointegrating vectors necessitates employing the VECM framework, which effectively captures both short-term dynamics and long-term equilibrium adjustments.

The VECM estimation demonstrates that in the short run, the prices of cayenne pepper (with one- and two-month lags) and cooking oil (with a two-month lag) significantly affect

inflation. The coefficient signs indicate a lagged effect, meaning that the impact of price increases in certain commodities becomes observable approximately two months later. This relationship can be formally expressed as:

$$\Delta \text{INF}_t = \alpha_0 + \sum \beta_i \Delta X_i(t-k) + \varepsilon_t \quad (2)$$

These findings underscore that food price transmission mechanisms operate with time delays, often due to distribution inefficiencies, price control policies, and household consumption sensitivities. This phenomenon aligns with empirical realities, such as the price surges of cayenne pepper and cooking oil during 2023–2024 in North Sumatra, which subsequently triggered inflation in the following months.

In the long run, a more structural pattern emerges. The prices of shallots, cayenne pepper, and beef have significant and persistent effects on inflation. These commodities exhibit relatively inelastic demand characteristics, whereby price increases are not offset by reduced consumption. Consequently, price hikes in these items not only cause temporary inflationary spikes but can also influence long-term inflation trends. Data from Statistics Indonesia (Badan Pusat Statistik [BPS], 2024) indicate that shallots and cayenne pepper were the largest contributors to inflation in May and November, while beef consistently served as a major inflation driver throughout mid- to late 2024.

The Impulse Response Function analysis further illustrates how inflation responds to price shocks across commodities over time. The responses vary across time horizons. Initially, inflation responds strongly to its own shocks; however, in the medium to long term, the strongest and most consistent positive responses originate from beef and cayenne pepper price shocks. Conversely, commodities such as shallots, garlic, and rice occasionally exhibit negative responses, indicating that their price increases do not always drive inflation and may even act as stabilizing forces when consumption substitution or demand saturation occurs.

The Forecast Error Variance Decomposition analysis reinforces the relative dominance of certain commodities in explaining inflation variability. In the long term, the largest contributions stem from beef, followed by rice, shallots, cayenne pepper, and red chili. These five commodities collectively exert the strongest influence in generating inflationary volatility, highlighting their strategic importance for policymakers in designing proactive and targeted price stabilization measures.

Dynamics of Inflation and Food Commodity Price Volatility in West Java Province: An Empirical Analysis Using the VECM Approach

This study examines the dynamic interrelationship between inflation and the prices of key food commodities in West Java Province using the Vector Error Correction Model (VECM) approach. This econometric method is employed to explore both the short-term and long-term linkages among variables, thereby providing a comprehensive understanding of the inflation formation mechanism within one of Indonesia's most economically active regions.

The analysis begins with testing data stationarity using the Augmented Dickey–Fuller (ADF) method. The results indicate that all variables become stationary at the first-difference level, as shown in Table 4. The ADF statistics for all variables are lower than the McKinnon critical values at the 5% significance level, confirming the absence of unit roots and validating the data for use in VAR or VECM modeling.

Table 4 Results of the Stationarity Test for West Java Province Data (First Difference)

Variable	ADF Statistic	1%	5%	10%	Description
Inflation	-10.284	-3.550	-2.913	-2.594	Stationary
Rice Price	-5.931	-3.550	-2.913	-2.594	Stationary
Beef Price	-8.171	-3.548	-2.912	-2.594	Stationary
Chicken Meat Price	-8.549	-3.548	-2.912	-2.594	Stationary
Egg Price	-7.985	-3.548	-2.912	-2.594	Stationary
Cooking Oil Price	-7.029	-3.548	-2.912	-2.594	Stationary
Shallot Price	-6.878	-3.550	-2.913	-2.594	Stationary
Garlic Price	-10.051	-3.548	-2.912	-2.594	Stationary
Red Chili Price	-6.370	-3.548	-2.912	-2.594	Stationary
Cayenne Pepper Price	-6.629	-3.548	-2.912	-2.594	Stationary
Sugar Price	-3.819	-3.548	-2.912	-2.594	Stationary

Source: Processed by the author (2025)

After confirming data stationarity, the next step determines the optimal lag length to avoid autocorrelation and ensure dynamic stability among variables. Based on five information criteria, Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn (HQ), all indicators suggest that the optimal lag is two periods.

Table 5 Results of the Optimal Lag Test for West Java Province VAR Model

Lag	LogL	LR	FPE	AIC	SC
0	-1845.52	NA	1.52E+07	35.112	35.673
1	-1423.77	743.9	5.88E+05	28.733	30.547
2	-1325.48	172.8*	2.12E+05*	26.936*	29.003*
3	-1320.71	8.91	2.51E+05	27.011	30.331

Source: Processed by the author (2025)

The stability test of the VAR model indicates that all roots of the characteristic polynomial have a modulus of less than one and lie within the unit circle, confirming model stability and suitability for further analysis.

Table 6 Results of VAR Stability Test for West Java Province

Root	Modulus
0.286245 ± 0.776603i	0.8277
-0.610036 ± 0.481493i	0.7772
0.607988 ± 0.433811i	0.7469
-0.482170 ± 0.562931i	0.7412
-0.661192	0.6612
0.514098	0.5141
-0.412738	0.4127
0.268025	0.2680

Source: Processed by the author (2025)

The subsequent Granger causality test identifies the direction of causality among variables. The results reveal a unidirectional causality running from cooking oil and egg prices to inflation, while the reverse relationship is not statistically significant. This suggests that rising prices of these commodities act as key inflation drivers in West Java.

Table 7 Results of Granger Causality Test for West Java Province

Null Hypothesis	F-Statistic	Prob.	Description
Cooking Oil Price does not cause Inflation	5.732	0.004	Rejected
Egg Price does not cause Inflation	4.121	0.019	Rejected
Inflation does not cause Cooking Oil Price	1.043	0.353	Accepted
Inflation does not cause Egg Price	0.982	0.378	Accepted

Source: Processed by the author (2025)

The long-run equilibrium relationships are then examined using the Johansen cointegration test. The findings indicate the presence of six cointegrating equations at the 5% significance level, confirming a long-run association between inflation and the major food price variables in West Java.

Table 8 Results of Johansen Cointegration Test for West Java Province

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability
None *	0.8499	522.278	285.142	0.0000
At most 1 *	0.7969	416.059	239.235	0.0000
At most 2 *	0.7175	326.770	197.371	0.0000
At most 3 *	0.6248	241.256	159.529	0.0000
At most 4 *	0.5547	180.174	125.615	0.0000
At most 5 *	0.4890	126.671	95.753	0.0000
At most 6	0.4025	82.338	69.819	0.142
At most 7	0.2999	42.919	47.856	0.120
At most 8	0.1824	18.627	29.797	0.511
At most 9	0.0768	6.021	15.495	0.692

Source: Processed by the author (2025)

The significant cointegration results justify the use of the VECM framework to capture both short-run and long-run relationships among variables. In the short run, past inflation significantly affects current inflation with a negative coefficient, indicating the presence of inertial inflation where current inflation tends to follow historical trends. Furthermore, cooking oil and egg prices show significant positive short-run effects on inflation.

Table 9 Short-Run VECM Estimation Results for West Java Province

Variable	Coefficient	T-Statistic	T-Table (5%)	Description
D(Inflation(-1))	-0.9569	-5.493	1.963	Significant
D(Inflation(-2))	-0.4841	-3.592	1.963	Significant
D(Cooking Oil Price(-1))	0.0084	2.673	1.963	Significant
D(Egg Price(-1))	0.0056	2.311	1.963	Significant
D(Rice Price(-1))	0.0029	1.121	1.963	Not Significant

Source: Processed by the author (2025)

In the long run, most food commodities have significant effects on inflation, as shown in Table 10. Rice, cayenne pepper, eggs, and cooking oil exert positive effects, while chicken meat, beef, red chili, and sugar have negative effects. These results confirm that inflation in West Java exhibits characteristics of cost-push inflation, where inflationary pressure originates from rising production and distribution costs of food commodities.

Table 10 Long-Run VECM Estimation Results for West Java Province

Variable	Coefficient	T-Statistic	T-Table	Description
Rice Price(-1)	0.000819	2.824	1.963	Significant (+)
Red Chili Price(-1)	-2.099	-2.505	1.963	Significant (-)
Cayenne Pepper Price(-1)	3.491	5.223	1.963	Significant (+)
Chicken Meat Price(-1)	-0.000376	-7.621	1.963	Significant (-)
Sugar Price(-1)	-0.000755	-3.800	1.963	Significant (-)
Cooking Oil Price(-1)	0.000417	4.720	1.963	Significant (+)
Egg Price(-1)	0.000540	8.672	1.963	Significant (+)
Beef Price(-1)	-0.000145	-3.725	1.963	Significant (-)

Source: Processed by the author (2025)

The Impulse Response Function (IRF) analysis reveals that inflation responds positively to its own shocks up to the 24th period, while responses to commodity price shocks vary. Strong positive responses to cooking oil and egg price shocks are observed in the early periods but weaken after the 16th period. Conversely, rice and red chili prices display negative responses, reflecting supply adjustment mechanisms and regional price stabilization policies in West Java.

Table 11 Results of the IRF Test for Inflation in West Java Province

Variable	Period 1	Period 8	Period 16	Period 24
Inflation	0.342	0.149	0.140	0.135
Shallot Price	0.000	0.036	0.017	-0.000
Cooking Oil Price	0.000	-0.035	-0.007	0.004
Egg Price	0.000	-0.000	-0.001	-0.004
Rice Price	0.000	-0.012	-0.015	-0.010
Red Chili Price	0.000	0.018	0.007	-0.002

Source: Processed by the author (2025)

The Forecast Error Variance Decomposition (FEVD) results further confirm that the largest contribution to inflation variability originates from inflation itself, reaching 73.42% by the 24th period. However, the roles of shallot, rice, red chili, egg, and cooking oil prices increase over time, suggesting that food price dynamics remain the main determinant of medium-term inflation formation.

Table 12 Results of FEVD Test for Inflation in West Java Province

Variable	Period 1	Period 8	Period 16	Period 24
Inflation	100.000	60.854	67.701	73.422
Shallot Price	0.000	12.726	9.538	7.623
Rice Price	0.000	7.111	5.266	4.215
Red Chili Price	0.000	4.525	4.636	4.047
Egg Price	0.000	4.570	3.596	2.863
Cooking Oil Price	0.000	3.911	3.085	2.505
Beef Price	0.000	2.703	2.341	2.112

Source: Processed by the author (2025)

These findings demonstrate that inflation in West Java is highly sensitive to fluctuations in key food commodity prices, particularly cooking oil, eggs, rice, and cayenne pepper. This supports the argument that West Java's inflation structure is dominated by volatile food inflation. Therefore, inflation control policies should focus on strengthening regional food resilience through supply diversification, distribution efficiency, supply-chain digitalization, and optimization of strategic food reserves. Coordinated policy integration between local governments, Bank Indonesia, and the Food Security Task Force is vital to maintaining price stability and protecting household purchasing power amid intensifying global inflationary pressures.

Inflation as a Social and Spatial Phenomenon

This section interprets the econometric findings through the lens of economic sociology to demonstrate that inflation cannot be understood merely as a monetary phenomenon but rather as a product of social relations, spatial conditions, and infrastructural configurations that shape people's lived economic experiences. In line with the concept of socioeconomic embeddedness, economic activities such as price formation, inflation transmission, and

consumption behavior never occur in a vacuum. They are embedded within social networks, institutions, norms, and power relations that determine how inflation is produced, perceived, and responded to by different social groups (Corrêa et al., 2024; Korsgaard et al., 2022). Consequently, the statistical results revealed through VAR/VECM models, impulse response functions (IRF), and variance decomposition analyses should not be seen merely as econometric figures but as “social traces” reflecting how infrastructural inequality, class stratification, and geographic disparities shape differential inflationary vulnerabilities across regions.

In the Javanese context, particularly in urban regions such as Jakarta, Bandung, and Surabaya, the middle class demonstrates relatively higher adaptive capacity to food price fluctuations. The findings of this study indicate that short-term inflationary pressures driven by increases in the prices of red chili, shallots, and cooking oil tend to subside more rapidly in Java than in Sumatra. Socially, this can be attributed to more integrated market structures and the availability of diverse consumption channels. The urban middle class in Java commonly has access to online shopping platforms, e-grocery services, and e-commerce price promotions, which enable flexible substitution and price-arbitrage strategies (Mayndarto, 2025; Pulungan et al., 2025). Moreover, the widespread presence of modern retail networks such as minimarkets and supermarkets creates spaces for price negotiation and consumer choice, reinforcing household consumption resilience. This condition contrasts with low-income households that rely heavily on traditional markets; nonetheless, Java’s more developed social and economic infrastructure provides greater adaptive space for consumers compared to other regions in Indonesia.

In contrast, in Sumatra, particularly in semi-rural and rural provinces such as West Sumatra, South Sumatra, and parts of North Sumatra, inflation is experienced as a direct pressure on household welfare. The population’s dependency on staple commodities traded primarily in physical markets and the limited presence of modern distribution networks make food price increases much harder to avoid. When the prices of red chili or cooking oil surge, low-income households often lack adequate substitution options because modern retail facilities remain scarce and inter-regional logistics costs are relatively high. Data from Statistics Indonesia (Badan Pusat Statistik [BPS], 2023) show that households in Sumatra allocate approximately 54–63% of total expenditure to food consumption, compared to 45–52% in Java. This illustrates that food price shocks have a stronger welfare impact in Sumatra than in Java. In this context, inflation is not a uniform macroeconomic indicator but a socially uneven experience that disproportionately affects vulnerable groups lacking social protection or access to competitive market mechanisms.

The logistical infrastructure gap between Java and Sumatra serves as one of the main mechanisms explaining why the effect of food price volatility on inflation is stronger in Sumatra, reaching up to 70%, compared to 45% in Java, as shown in the variance decomposition results. Sociologically, infrastructural inequality produces a spatial penalty, that is, additional economic costs borne solely due to geographic location (Gallagher & Petracca, 2024). Households and firms in regions with lagging infrastructure face higher transaction, distribution, and information costs, making food supply chains more fragile to price shocks. When transport routes are limited, ports

inefficient, and inter-provincial market integration weak, price fluctuations in one market node are transmitted more slowly but persist for longer durations (Febrira et al., 2025; Johnson et al., 2025). This finding supports the conclusion that inflation in Sumatra is primarily cost-push in nature and rooted in structural rather than demand-driven factors.

From a socio-economic perspective, inflation functions as a social indicator that reflects the quality of resource distribution, market accessibility, and institutional effectiveness. It is not merely a measure of changes in the Consumer Price Index but a symbol of spatial and social inequality. When some households can buffer inflationary shocks through consumption diversification, savings, or technological access, while others are forced to reduce meal portions or downgrade food quality, inflation becomes a marker of social reproduction of inequality. As Ramdani and Saputra (2025) demonstrate, uncontrolled food inflation in developing countries tends to widen interregional welfare disparities due to unequal social adaptation capacities. In Indonesia, this condition is further exacerbated by uneven institutional quality across local governments. Regional administrations in Java generally possess stronger policy capacity to manage food distribution, develop markets, and implement price stabilization interventions, whereas several provinces in Sumatra continue to face fiscal limitations and bureaucratic inefficiencies (Angkut et al., 2025).

The concept of embeddedness offers a critical analytical lens to interpret these dynamics. Price formation and inflation are not merely outcomes of market mechanisms but are deeply embedded in social institutions, power networks, and consumption norms. In Java, the close interconnections between modern retail actors, local governments, and digital platforms have created a market ecosystem capable of absorbing price shocks more effectively (Ramdani & Saputra, 2025). Conversely, in Sumatra, social relations among traders, distributors, and consumers remain traditional and trust-based, yet lack the support of modern market infrastructure that could mitigate volatility. This suggests that social responses to inflation are structured by norms, institutions, and social capital embedded within communities. Where digital markets have not yet become part of the consumption culture, and traditional markets remain the central trading spaces, adaptive responses to inflation remain limited and costly, particularly for low-income households.

CONCLUSION

Based on the analytical results and the integration of socioeconomic and sociological perspectives, this study concludes that food price volatility exerts differentiated and asymmetric impacts on regional inflation across Java and Sumatra, shaped by the interplay between market structure, logistical capacity, and household consumption behavior. In the short term, inflationary movements are predominantly triggered by volatile food commodities such as red chili, shallots, and cooking oil, reflecting the sensitivity of urban demand and market expectations in Java. In contrast, Sumatra's inflation pattern is more structurally persistent, rooted in supply-

side rigidities, limited interregional trade connectivity, and dependency on essential staples such as rice and beef. These findings affirm that inflation in Indonesia is not merely a macroeconomic phenomenon but a socially embedded process influenced by regional inequality, institutional capacity, and adaptive household strategies. The comparative framework developed in this study advances the understanding of inflation dynamics by demonstrating that sociological factors, such as market trust, consumption norms, and governance efficiency, mediate the transmission of price shocks and shape long-term inflation trajectories. Consequently, the study contributes a novel socioeconomic model that redefines regional inflation management as both an economic and social governance issue, requiring integrative policies that balance market efficiency with social resilience.

ETHICAL STATEMENT AND DISCLOSURE

This study was conducted in accordance with established ethical principles, including informed consent, protection of informants' confidentiality, and respect for local cultural values. Special consideration was given to participants from vulnerable groups to ensure their safety, comfort, and equal rights to participate. No external funding was received, and the authors declare no conflict of interest. All data and information presented were collected through valid research methods and have been verified to ensure their accuracy and reliability. The use of artificial intelligence (AI) was limited to technical assistance for writing and language editing, without influencing the scientific substance of the work. The authors express their gratitude to the informants for their valuable insights, and to the anonymous reviewers for their constructive feedback on an earlier version of this manuscript. The authors take full responsibility for the content and conclusions of this article.

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