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Research paper

The Food Import Dilemma: A Major Challenge for Indonesia's Food Self-Sufficiency

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Abstract

Indonesia faces the challenge of dependence on food imports. The import policies implemented have an impact on national food self-sufficiency, particularly in terms of availability, accessibility, and price stability of food. The purpose of this study is to analyze the inter-dependence of the Food Security Index on food imports, inflation, population, and the rupiah exchange rate, as well as to analyze the impact of import shocks. The research method used a Vector Error Correction Model and data from the Central Statistics Agency (BPS). The results show a correlation between the Food Security Index, inflation, and food imports. In the long term, the exchange rate variable has a significant effect on the Food Security Index, while the population and import variables have no effect on the Food Security Index variable. In the short term, the import, population, and exchange rate variables do not affect the Food Security Index in Indonesia.

Keywords: *Food Imports; FDI; Inflation; Exchange Rate; Population.*

1. Introduction

Food security is a crucial issue in global development because food is a basic human need that cannot be replaced and is an absolute requirement for social and economic sustainability (Godfray et al., 2010). The global food crisis in 2007–2008 showed how fragile the international food system is when food prices rose sharply due to a combination of speculation, the energy crisis, climate disruption, the impact of El Niño, and protectionist policies from major exporting countries. This causes net importing countries such as Indonesia to experience serious food inflationary pressures (Headey & Fan, 2008). In Indonesia, Reuters (2024) and Mongabay (2024) noted that El Niño triggered a 16–25% surge in rice prices, mainly due to a decline in national rice production and restrictions on rice exports from exporting countries such as India. This price surge has a direct impact on domestic food inflation (volatile food), which is one of the determining components of the food security index—the economic access dimension. This price increase reduces the ability of poor households to purchase quality food, thereby worsening the food security index score (Food Security Index or National Food Security Index). El Niño not only affects food production but also worsens global commodity market conditions. Production uncertainty and the threat of a food crisis cause the market to view exporting countries as critical points, thereby affecting trade flows and international capital movements. The European Central Bank (2023) asserts that El Niño can drive up energy and food commodity prices, which indirectly affect the exchange rates of importing countries. When global food prices increase, countries such as Indonesia must spend more foreign exchange to import rice, corn, or wheat. This increases pressure on the rupiah exchange rate and triggers depreciation.

The increase in international food prices (imported foodstuffs) tends to weaken the dimensions of availability and stability in the framework of a country's food security, especially for those that are highly dependent on food imports. Shen et al. (2024); Ben Abdallah et al. (2021); Ritzel et al. (2024); Shobur et al. (2025); Rozaki et al. (2021).

Indonesia is a country with a population of more than 270 million people that has enormous and diverse food needs, so it is not surprising that every fluctuation in global food supply and prices immediately affects domestic conditions (Miladinov, 2023). As an agricultural country, Indonesia actually has great

potential to achieve food self-sufficiency, but various structural factors, such as land conversion, environmental degradation, low agricultural productivity, and climate change, have resulted in domestic production being unable to meet national demand (Rozaki, 2021). As a result, food imports have become an inevitable policy choice to cover the supply deficit, especially for strategic commodities such as wheat, soybeans, sugar, and beef (Subramaniam & Ariffin, 2022).

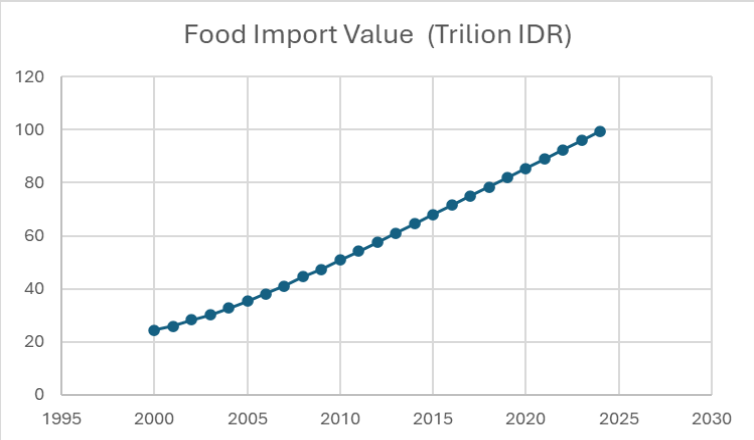

Fig. 1: Value of Indonesian Food Imports from 2000 to 2024

Indonesia's dependence on wheat imports is one of the clearest examples of how dependence on international markets creates long-term vulnerability. Indonesia has become one of the world's largest wheat importers because it lacks a domestic production base, while wheat consumption continues to increase due to changes in the consumption patterns of urban communities towards processed food products such as bread and instant noodles (Glauber et al., 2022). A similar case occurred with sugar and beef, where import dependency made domestic prices vulnerable to global price volatility (Distefano et al., 2020).

The 1997–1998 Asian monetary crisis also showed how fragile Indonesia's food security was when the rupiah exchange rate fell sharply against the US dollar, causing imported food prices to rise dramatically and driving inflation that exacerbated poverty (Headey & Fan, 2008). The exchange rate pass-through (ERPT) mechanism is a major factor in the transmission of exchange rate shocks to domestic prices, and the literature shows that in developing countries, ERPT tends to be high and asymmetric, so that currency depreciation is faster and has a greater effect on raising prices than appreciation has on lowering them (Jasova et al., 2019). In the context of Indonesia, empirical research shows that rupiah depreciation has a significant impact on food inflation, making exchange rate stability a key variable in food security policy (Widarjono et al., 2023). The crisis caused by the Russia-Ukraine war in 2022 reinforces the evidence that global geopolitical shocks can directly disrupt the national food system. Disruptions to wheat exports from both countries triggered a surge in global food prices, and Indonesia, as the largest wheat importer in Asia, felt the impact directly through increases in the prices of wheat flour and its derivative products (Glauber et al., 2022). This situation serves as a reminder that food imports can indeed be a short-term instrument to maintain availability, but in the long term, they create dependencies that erode food stability (FAO, 2021).

Rapid population growth and massive urbanization have exacerbated Indonesia's food import dilemma. Population growth has increased daily calorie requirements, while urbanization has shifted consumption patterns from traditional staple foods such as rice to processed foods that are often made from imported ingredients (Miladinov, 2023). This demographic transition means that not only is the amount of food demand increasing, but the structure of demand is also shifting towards products that increase dependence on imports (Distefano et al., 2020). In the long term, this condition poses a serious risk to national food security because any external shock will have a greater impact on an already fragile food system. Therefore, empirical analysis of the relationship between the Food Security Index (FSI), food imports, inflation, population, and the rupiah exchange rate is very important. The FSI, as a comprehensive indicator of food security, covers the dimensions of availability, access, utilization, and stability, all of which are influenced by import policies (FAO, 2021). However, the relationship between these variables is not simple, but rather interrelated in the short and long term, requiring an analytical approach that can capture this complexity.

This study aims to analyze the interdependence between FSI, food imports, inflation, population, and the rupiah exchange rate in the Indonesian context. The analysis was conducted using a Vector Error Correction Model (VECM) capable of explaining long-term relationships through cointegration, while also capturing short-term adjustments due to external shocks (Hartono, 2023). Furthermore, this study also aims to evaluate the effect of import shocks on GDP, inflation, population, and the rupiah exchange rate using impulse response functions (IRF) and forecast error variance decomposition (FEVD) to understand the relative contribution of import shocks in influencing food system dynamics (Lestari et al., 2024). So far, studies on the relationship between food imports and food security in Indonesia are still dominated by descriptive research or those using simple regression methods. Many studies only focus on one commodity, such as rice or soybeans, without integrating macroeconomic variables such as inflation and exchange rates (Subramaniam & Ariffin, 2022). International studies emphasize the importance of demographic factors and global trade dynamics in influencing food security, but there has not been much research that integrates the five main variables, namely GDP, imports, inflation, population, and exchange rates, into a single dynamic analytical framework for the case of Indonesia (Miladinov, 2023). This indicates a significant research gap, as Indonesia, as a major food importer, is in dire need of a more comprehensive empirical analysis.

Several international studies have proven the relevance of the dynamic econometric approach in analyzing food prices and trade. For example, a study on the impact of oil price and exchange rate shocks on food prices in Indonesia using VECM shows that these variables have a significant impact in both the short and long term on domestic food prices (Nurvitasari et al., 2017). Another study using IRF and FEVD in the food sector in Southeast Asia found that external shocks can explain considerable variation in domestic food prices, confirming the importance of this approach to understanding the interrelationships within the food system (Lestari et al., 2024). However, very few studies have applied this framework to analyze the FSI comprehensively, so this study is expected to fill that gap.

Thus, the research gap that this article seeks to bridge is the absence of studies that simultaneously analyze the interrelationships between the FSI, food imports, inflation, population, and the rupiah exchange rate within a dynamic econometric framework in Indonesia. Most previous studies have only highlighted partial aspects, such as the relationship between imports and food availability, inflation and purchasing power, or exchange rates and food prices, without integrating all five variables into a single comprehensive model (Subramaniam & Ariffin, 2022). However, understanding the interdependence of these variables is crucial for designing food policies that are not only reactive but also capable of enhancing long-term resilience. Furthermore, there has been no research that explicitly analyzes how important instrument shocks affect the FSI and related variables using IRF and FEVD in Indonesia. In fact, this type of shock analysis is very important for simulating the impact of trade policies or external disturbances on food security, thereby helping to formulate more targeted

mitigation strategies (Lestari et al., 2024). Therefore, this study is expected to provide empirical and practical contributions to academic literature and public policy in Indonesia.

2. Literature Review

2.1. The relationship between the food security index and food import values

According to Smith & Haddad (2015) in Food Security and Development, food security is influenced by four pillars: availability, access, utilization, and stability. One of the prominent factors in the availability pillar is international trade and food imports. Imports serve as a balancing mechanism when domestic production is insufficient, thereby increasing the food security index score. However, excessive dependence on imports can create vulnerability when global food prices fluctuate or supply constraints occur. Todaro & Smith (2020) in Economic Development emphasize that food trade openness allows developing countries to increase food availability at more affordable prices. In the context of the food security index, food imports increase affordability and availability but can also weaken stability if there is excessive dependence. Therefore, the relationship between imports and food security is interdependent and contextual.

According to Zainuddin (2025), in lower-middle-income countries, domestic agricultural production is insufficient to meet demand, leading to increased dependence on imports, but food security indicators (malnutrition, food insecurity, health problems) remain poor. This means that imports alone do not automatically improve the food security index if production capacity and community access are weak. In upper-middle-income and high-income countries, food imports actually support the achievement of food security indicators because they are balanced by fiscal capacity and a good distribution system, and are able to provide nutritious and high-quality food.

Provincial FSI data for 2024 shows considerable variation between regions. Many regions with relatively low FSI scores face food production deficits and rely on food imports as a quick way to maintain availability. Conversely, regions with higher FSI scores generally have a combination of sufficient domestic production and/or smooth access to imports and good food reserve policies. In 2024, El Niño weather conditions put pressure on food production in Indonesia. As a result, the government and the market responded by increasing food imports, especially rice, to maintain supply and price stability. This response was important in terms of availability and stability in the food security index. However, affordability and utilization remain vulnerable points. Entering 2025, with targets to increase domestic production and strengthen national food reserves, the role of food imports remains significant as a buffer when production is not yet optimal. Thus, the relationship between food imports and the FSI is dynamic: imports help maintain the FSI score, but do not guarantee an increase in the FSI score without improvements in domestic production, distribution, access, and nutrition.

2.2. The relationship between the food security index and inflation

According to Smith & Haddad (2015) in Food Security and Development, one of the pillars of food security is stability. Inflation, especially food inflation, directly affects affordability and availability. Rising inflation will reduce the purchasing power of poor households and cause a decline in the food security index score. In Economic Development, Todaro & Smith (2020) explain that inflation affects the distribution of income and consumption among the population. Food inflation is more dangerous because it absorbs a large portion of poor households' expenditures. As a result, inflation is negatively related to food security because it weakens people's access to nutritious food. Timmer, Falcon, & Pearson (1983) in Food Policy Analysis emphasize that food price stability is a key component in maintaining national food security. High inflation causes domestic food price volatility, thereby affecting availability and stability in the food security index. Food inflation control policies (through price stabilization of rice, wheat, etc.) are considered a basic strategy for maintaining food security.

2.3. The relationship between the food security index and exchange rates

In International Economics: Theory and Policy, Krugman, Obstfeld, & Melitz (2018) explain that exchange rate depreciation causes the price of imported goods to rise. For countries that depend on food imports, this reduces food affordability and increases the risk of food inflation. The increase in imported food prices directly affects the food security index, especially for poor households that are sensitive to prices. According to Timmer, Falcon, & Pearson (1983) in Food Policy Analysis, the exchange rate is a critical macroeconomic factor for food price stability. Exchange rate fluctuations affect the prices of agricultural inputs (e.g., fertilizers, seeds, agricultural machinery), many of which are imported. As a result, the availability and prices of domestic food are also pushed up, thereby weakening food security. Pinstrup-Andersen (2014) in Food Policy for Developing Countries emphasizes that exchange rate volatility is one of the main external risks to food security in developing countries. For this reason, exchange rate stabilization policies and diversification of food import sources are considered strategies to maintain FSI stability. Thirlwall & Pacheco-López (2017) in Economics of Development explain that developing countries are highly vulnerable to exchange rate fluctuations because most of their strategic food needs are still imported. Exchange rate depreciation contributes to food inflation, which directly lowers the national food security score.

3. Methodology

The research was conducted in the Indonesian region using secondary data from January 2000 to 2024 from the National Statistics Agency. The use of VAR model analysis tools in the study requires several tests, including: stationarity test, optimal lag determination, model stability test, and cointegration test. Vector autoregression (VAR). Univariate autoregression is a linear equation, a single variable linear model in which the current value of a variable is explained by its own lagged value. VAR is an n-variable linear equation model in which each variable is in turn explained by its own lagged value, plus the current and past values of the remaining n-1 variables. This simple framework provides a systematic way to capture the rich dynamics in multiple time series, and the statistical tools that accompany VAR are easy to use and interpret. As Sims (1980) and others argued in a series of influential early papers, VARs promise to provide a coherent and credible approach to data description, estimation, structural inference, and policy analysis. (Stock et al., 2001) .

VAR is a method that treats all variables symmetrically without distinguishing between dependent and independent variables (Sims in Gujarati 2003: 848). The VAR model used is;

$$\mathrm{FSI_t} = \mathrm{IMP_t} + \mathrm{INF_t} + \mathrm{JP_t} + \mathrm{NT_t} + \mathrm{IMP_{t-1}} + \mathrm{INF_{t-1}} + \mathrm{JP_{t-1}} + \mathrm{NT_{t-1}} + \mathrm{FSI_{t-1}} \quad (1)$$

Where:

FSI: Food Security Index
IMP: Imports (Rupiah)
INF: Inflation (%)
JP: Population (Millions)
NT: Exchange Rate
The VECM model is used when time series data is not stationary at the level, but is stationary in differentiated data and cointegrated, thus indicating a theoretical relationship between variables. Therefore, a VECM model, also known as a restricted VAR, is estimated. VECM is a form of restricted VAR due to the existence of data that is not stationary at the level but is cointegrated. The next step is the Impulse Response Function (IRF) instrument. Each method has a specific function in explaining the interaction between variables in the model. IRF is a Vector Moving Average application that aims to see how long the shock from one variable affects another variable. Next Variance Decomposition Analysis (VD) describes the relative importance of each variable in the VAR system due to shocks. Variance decomposition in VAR aims to analyze how much a variable contributes to another variable.

4. Result

The first test stage is the Stationarity Test. The results of the stationarity test of the variable data studied are as follows:

Table 1: Stationarity Test Results

Variable	ADF-test Level	ADF-test 1st difference	ADF test 2nd difference	Critical test 1%	Critical test 5%	Critical test 10%
FSI	-0.297852	-5.311143	-	-3.670170	-2.963972	-2.621007
IP	0.765949	-6.627260	-	-3.679322	-2.967767	-2.622989
JP	-0.410501	-5.679364	-	-3.670170	-2.963972	-2.621007
NT	-1.601009	-6.812434	-	-3.670170	-2.963972	-2.621007

Source: Results of the Unit Root test using Eviews 8.0.

From the Augmented Dikey Fuller results in Table 4.1, it can be seen that all data are stationary at the first difference level, where the ADF-test value is greater than the critical value at various confidence levels (1%, 5%, 10%).
The second stage of testing is to test the optimal lag length, which is useful for eliminating the problem of autocorrelation (correlation between the disturbance in period t and the error in t-1, sorted by time) in the VAR system.

Table 2: Lag Length Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-113.0658	NA	0.068575	8.671538	8.863514	8.728623
1	-10.82322	166.6175	0.000117	2.283202	3.243081*	2.5686624
2	6.450196	23.03123	0.000117	2.188874	3.916657	2.702635
3	31.90861	26.40132*	7.37e-05*	1.488251	3.983937	2.230349*
4	50.26389	13.59650	0.000106	1.313786*	4.577375	2.28222

The results of the Optimal Lag Length Test in Table 5.2 show that each criterion has a different optimal lag reference. The SC and HQ criteria refer to a lag time of zero, while the LR criterion refers to a lag time of one at a significance level of 5%, and the FPE and AIC criteria refer to a lag time of three. Based on these conditions, the optimal lag to use is three.
The third test stage is the VAR Model Stability Test. A VAR system is said to be stable if all of its roots have a modulus smaller than one [34] (Gujarati & Econometrics, 2004) . From the test results in Table 3, it is known that the modulus value of all unit roots is < 1

Table 3: VAR Stability Test

Root	Modulus
0.999897	0.999897
0.691800-0.333638i	0.768050
0.691800 + 0.333638i	0.768050
0.702037	0.702037
- 0.457516	0.457516
- 0.313172 – 0.29706i	0.431619
- 0.313172 + 0.29706i	0.431619
0.029025	0.029025

The fourth stage of testing is the cointegration test. The cointegration test is conducted to determine the existence of relationships between variables, particularly in the long term. If there is cointegration in the variables used in the research model, then a long-term relationship between the variables can be confirmed. If cointegration is found, then VECM estimation is performed. If the trace statistic value and the Max-Eigen statistic value are greater than the critical value of 5%, then the data are cointegrated. The following are the results of the cointegration test using the Johansen method. In Table 4, there are four integrated equations because they have trace statistics greater than the critical value of 5% according to Johansen. It can be concluded that the data are cointegrated or that there is a long-term relationship between the research variables. The cointegration test results indicate that the movements of FSI, IP, JT, and NT have a stable or balanced relationship and similar movements in the long term.

Table 4: Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob**
None *	0.583302	59.33846	47.85613	0.0029
At most 1*	0.446891	34.82746	29.79707	0.0121
At most 2*	0.341558	18.24586	15.49471	0.0188
At most 3*	0.208447	6.545250	3.841466	0.0105

Indonesian Food Security Index Model, Vector Error Correction Model (VECM)
After conducting several preliminary tests, it was found that the data were stationary at the first difference level and cointegration occurred, so the next step was to form a VECM model. VECM shows short-term and long-term relationships. In the short term, the variables in the study will tend to adapt to other variables to form a long-term equilibrium. The following are the results of the VECM lag 2 estimation based on the LR, FPE, AIC, and HQ criteria in determining the optimal lag.

Table 5: Short-Term and Long-Term VECM Estimates

Variable	Coefficient	t-statistic	Interpretation
LONG TERM			
C	-1.827831		
D(IP(-1))	-0.505835	-0.36940	Not Influential
D(JP(-1))	0.642896	0.11975	Not Influential
D(NT(-1))	-0.168882	-3.26236	Influential
SHORT TERM			
CointEq1	0.009886	0.25153	Not influential
D(FSI(-1))	-0.105630	-0.45965	Not Influential
D(FSI(-2))	-0.000957	-0.00421	Not Influential
D(IP(-1))	0.153329	0.7057	Not Influential
D(IP(-2))	0.166787	0.76079	Not Influential
D(JP(-1))	0.074519	0.11029	Not Influential
D(JP(-2))	-0.709433	-1.04153	No effect
D(NT(-1))	0.016007	0.89468	Not Influential
D(NT(-2))	0.018223	0.97912	Not Influential
C	0.000319	0.02992	Not Significant

Source: EViews 10.

VECM estimation results with Lag-2 for the observation period 1994 - 2024, VECM model for FSI, IP, JP, and NT variables following the Food Security Index (FSI) model in the long term in Indonesia, before simulation.

$$D(FSI) = -1.827831 - 0.505835\ D(IP(-1)) + 0.642896\ D(JP(-1)) - 0.168882\ D(NT(-1)) - ECT \quad (2)$$

From the results of data processing using the Eviews program, it can be seen that in the long term, the IP and JP variables have no effect, while the NT variable has a significant effect on the FSI (Food Security Index). The coefficient for the Exchange Rate (NT) is -0.168882, meaning that a 1-unit appreciation of the Exchange Rate will result in a decline in the Food Security Index (FSI). Meanwhile, the Food Security Index model for the short term is as follows:

$$D(FSI) = 0.000319 - 0.105630\ D(FSI(-1)) - 0.000957\ D(FSI(-2)) + 0.153329\ D(IP(-1)) + 0.166787\ D(IP(-2)) + 0.074519\ D(JP(-1)) - 0.709433\ D(JP(-2)) + 0.016007\ D(NT(-1)) + 0.018223\ D(NT(-2)) \quad (3)$$

The FSI equation model has different conditions in the long term and the short term. In the long term, the variables of imports (IP) and population (JP) have no effect, while the variable of exchange rate (NT) has an effect. In the short term, the variables of imports, population, and exchange rate do not affect the Food Security Index (FSI) variable.

4.1. Variance decompositions

Table 6: Variance Decomposition

Variance Decompositions of FSI					
Period	S.E	FSI	IP	JP	NT
1	0.010461	100.0000	0.00000	0.000000	0.000000
2	0.014158	98.50616	0.105864	0.022875	1.365105
3	0.017180	96.20454	0.150112	0.382903	3.265105
4	0.019398	96.43372	0.233860	0.455495	2.876924
5	0.021545	95.47551	0.326097	0.567073	3.631316
6	0.023612	95.42577	0.273533	0.585637	3.715056
7	0.025509	95.64877	0.280107	0.576150	3.494972
8	0.027384	95.94470	0.319933	0.559264	3.176098
9	0.029221	96.19898	0.367000	0.539845	2.894178
10	0.031002	96.39381	0.401623	0.525606	2.674463

From the results of the variance decomposition analysis, we can see how the variables FSI, IP, JP, and NT contributed to FSI over ten periods. In the first period, FSI was only influenced by FSI itself. In the second period, besides the FSI variable itself, the exchange rate was the largest contributor. In the third period, the largest contributors were FSI itself and the exchange rate. In the fourth period, the largest contributors were FSI and the exchange rate. In the fifth period, the largest contributor was the exchange rate. In the sixth period, the largest contributor was the exchange rate. The seventh period's largest contributor was the Exchange Rate, the eighth period's largest contributor was the Exchange Rate, the ninth period's largest contributor was the Exchange Rate, and the tenth period's largest contributor was the Exchange Rate. The contributors to changes in the Food Security Index over the past ten years were FSI and the Exchange Rate.

4.2. Impulse response function

Table 7: Impulse Response

Period	FSI	IP	JP	NT
1	0.010461	0.000000	0.000000	0.0000
2	0.009382	0.000461	-0.000214	0.001654
3	0.009301	0.000481	-0.001041	0.002626
4	0.008882	0.000661	-0.000764	0.001093

5	0.008963	-0.000796	-0.000958	0.002456
6	0.009427	0.000107	-0.000796	0.001964
7	0.009506	0.000546	-0.000696	0.001425
8	0.009853	0.000759	-0.000667	0.001037
9	0.010095	0.000857	-0.000645	0.000946
10	0.010254	0.000852	-0.000665	0.000997

Based on the impulse response function (IRF) results, shocks to the Food Price Index (FSI) variable produce a persistent positive response to the FSI itself, from the coefficient in period 1 to the coefficient in period 10. This indicates food price rigidity and a slow price adjustment process. The response of Food Imports (IP) to FSI shocks in the early period also shows a positive pattern from period 1 to period 10, reflecting an increase in food imports to meet domestic demand when prices are under pressure. Although there was a small correction in the fifth period due to a decline in import values to (- 0.000796), the medium-term pattern shows a resumption of growth in food imports. Conversely, the response of Population (JP) to FSI shocks was consistently negative over the 10 periods, as indicated by negative coefficient values from period 1 to period 10, indicating that food price shocks actually suppressed domestic production because the agricultural sector has low elasticity and requires a long adjustment period. For the Exchange Rate (ER) variable, the FSI shock produced a positive response in almost all periods, especially in the early periods, indicating a temporary improvement in the food trade balance, although this effect subsided in subsequent periods.

5. Discussion

In the long and short term, the variable of food import value (IP) does not affect the Food Security Index (FSI). The results of this study are in line with Shen et al. (2024), Ben Abdallah et al. (2021), Ritzel et al. (2024), and Shobur et al. (2025). The food security index covers the aspects of availability, access, utilization, and stability. When import prices rise, the aspect of availability (the quantity of food available) It can be directly affected if imports are an important source. Similarly, stability is affected because price fluctuations increase supply volatility. This condition may differ for countries that have good domestic production capacity or import substitution, which can mitigate this pressure, so that the effect of rising import prices on the food security index is not always linear or negative. The government must pay attention to trade policies (tariffs, quotas, protection), national food stocks, and stabilization mechanisms, which are important variables that moderate the impact of import prices on food security indicators. Financial speculation on imported commodities will add to external price pressures, and importing countries will be affected by global fluctuations. Lestari's (2025) research analyzes the short-term and long-term relationship between the prices of strategic food commodities (rice, cayenne pepper, and shallots) and inflation in East Java. Using VECM, this study found that these three commodities have a cointegration relationship with inflation, and that chili and shallot price shocks have the greatest impact on inflation. IRF shows a pattern whereby increases in food commodity prices have a persistent impact on inflation. This study is relevant to SDG 2 (Zero Hunger) and SDG 1 (No Poverty) because food price stability greatly affects people's welfare.

Population size is a source of labor, according to research by Basri et al. (2024), which examines the relationship between economic growth and various sustainable development indicators (SDGs) in Indonesia using VECM. The results show a long-term relationship between economic growth and the sustainable development index. Shocks to growth variables have a significant impact on socio-economic indicators related to SDGs. This study reinforces that macroeconomic policies greatly influence the SDGs agenda. Population size also does not affect the Food Security Index in the long term or the short term. Empirical studies that support the results of this study include research by Allee, Lynd, and Vaze (2021), which confirms that household purchasing power is the strongest determinant of variations in the Global Food Security Index (GFSI). While demographic variables such as population size do not contribute significantly after economic aspects are controlled for (Allee et al., 2021). This means that income and consumption dynamics have a much greater impact on food security than population size alone. A similar trend was found by Jambor and Elias (2024), who analyzed the determinants of food security in East Asia, South Asia, and Southeast Asia. They concluded that economic growth and agricultural productivity are more significant than population size, and specifically for Southeast Asia, the impact of economic size or population size on food security is "not statistically significant" (Jambor & Elias, 2024). This indicates that in regions structurally similar to Indonesia, population size is not the primary determining factor. Research based in Indonesia further confirms that population density or growth does not necessarily reduce per capita consumption; rather, its effect is mediated by human capital. (Liu & Yamauchi, 2014). Thus, the significance of population size for food security depends heavily on the quality of human resources, not their absolute number. Meanwhile, Poudel and Gopinath (2021) emphasize that differences in food security achievements between countries are more influenced by economic development and urbanization than by population size. Therefore, population size is only a background factor, while economic variables, urbanization, and public policy are more dominant in determining food security index scores. Population size is not a significant determinant of the food security index. This can be explained because the dimensions of food security are more determined by structural economic factors, agricultural productivity, distribution capacity, and the quality of human capital than by population size alone.

The Exchange Rate (NT) variable has a significant long-term effect on the Food Security Index (FSI). The coefficient for the Exchange Rate (NT) is -0.168882, meaning that a 1 percent increase in the Exchange Rate will result in a decrease in the Food Security Index (FSI/FSI) of 0.168882. This finding can be explained through the exchange rate pass-through mechanism, whereby currency depreciation increases the price of imports in domestic currency and increases food costs, thereby weakening the affordability and stability dimensions of food security. Empirical evidence from Egypt confirms that exchange rate policy has direct consequences for economic growth and food security. (Ahmed, 2024). Dorosh (2008) also emphasizes that nominal exchange rate instability is a major threat to food price stability, especially in net importing countries such as Indonesia. Furthermore, global research on food supply chains shows that exchange rate volatility is negatively correlated with the volume of international food trade, thereby reducing availability and undermining domestic price stability (Steinbach, 2021). Another study by Manogna and Kulkarni (2024) found that monetary policy through interest rate and exchange rate instruments has a significant effect on food commodity prices, which directly affects food security. In the household context, evidence from Nigeria shows that food price increases, partly triggered by currency depreciation, reduce food security. (Amolegbe et al., 2021).

This cross-country evidence shows a consistent pattern that the exchange rate is a key macroeconomic variable that affects food prices, trade flows, and people's purchasing power, thereby significantly impacting the food security index.

6. Conclusions

The results of the study show that in the long and short term, the Food Import (IP) variable means that food security strategies do not need to rely on imports as the main solution, but rather on improving the domestic food production and distribution systems. In addition, food security is more influenced by domestic production capacity and effective distribution policies than by the volume of imports. Therefore, the government needs to continue strengthening the domestic agricultural sector, logistics infrastructure, and national food reserves to maintain the stability of food supply and prices, regardless of the volume of imports. Population size does not affect the Food Security Index (FSI), so the government needs to emphasize human capital development through education, training, and agricultural technology so that the population can contribute optimally to food availability and access. In addition, strategies to improve food security should focus more on economic policy, agricultural productivity, and food distribution, rather than simply controlling population size. The Exchange Rate variable has a significant effect on the FSI. Diversifying food import sources can reduce the risk of exchange rate shocks to domestic prices. Dependence on certain supplier countries makes Indonesia more vulnerable to exchange rate fluctuations and global market turmoil. Diversifying suppliers, including regional and bilateral cooperation, is important to strengthen supply security.

Author Contribution

Dr. Fitrawaty formulated the research problem, developed the conceptual framework, designed the research objectives and questions, conducted comprehensive data processing and analysis, and compiled the initial interpretation of the research results. Dr. Isnaini Harahap provided methodological guidance from the planning stage, ensured the conceptual framework was consistent with relevant theories, contributed to deepening the interpretation of the results, and linked them to relevant literature. M. Farras Nasrida prepared the research design, developed the research instruments, and collected the data. Prof. Indra Maipita assisted in the interpretation of the analysis results and provided input related to the analytical framework and critical guidance to strengthen the arguments in the discussion.

Data Availability Statement

The data used in this study were obtained from the Central Statistics Agency and the Food Security Agency – Ministry of Agriculture. The data are freely accessible to the public. These data sources contain data on food security indices, inflation, population, and the Indonesian rupiah-US dollar exchange rate for the period 2000–2024.
Because this study uses long-term annual series and prioritizes data consistency and finality, it limits the analysis period to 2000–2024, which is the last year for which official and complete annual data are available. Official annual food import data from the Central Statistics Agency (BPS) that are consistent with the data series we are currently using are only available up to 2024. The 2024 data was published in Indonesia's Foreign Trade Statistics – Imports 2024, released in July 2025 (Indonesian Central Statistics Agency). We consider this 25-year period to be long enough to capture the long-term dynamics of food imports and related variables.

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