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Dynamic Analysis on the Determinants of Prevalence of Undernourishment in Indonesia: A System GMM Approach

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ABSTRACT

Research Originality: This original study examines the determinants of undernourishment in Indonesia with mediating variables.

Research Objectives: This study examines the impact of food production, inflation, unemployment, and social food assistance on undernourishment with people's purchasing power as a mediating variable.

Research Methods: Dynamic panel analysis with the Generalized Method of Moment (GMM) and Sobel test examines direct and mediation relationships for the data period 2018-2023.

Empirical Results: The results show the direct and indirect effects of inflation, unemployment, and social food assistance on the prevalence of undernourishment in Indonesia through the mediation of people's purchasing power. Meanwhile, food production has no effect either directly or indirectly.

Implications: This study implies that the government must maintain stable inflation, create jobs, effectively target food assistance, and reduce reliance on social food assistance.

Keywords:
prevalence of undernourishment; food insecurity; people's purchasing power; dynamic panel analysis

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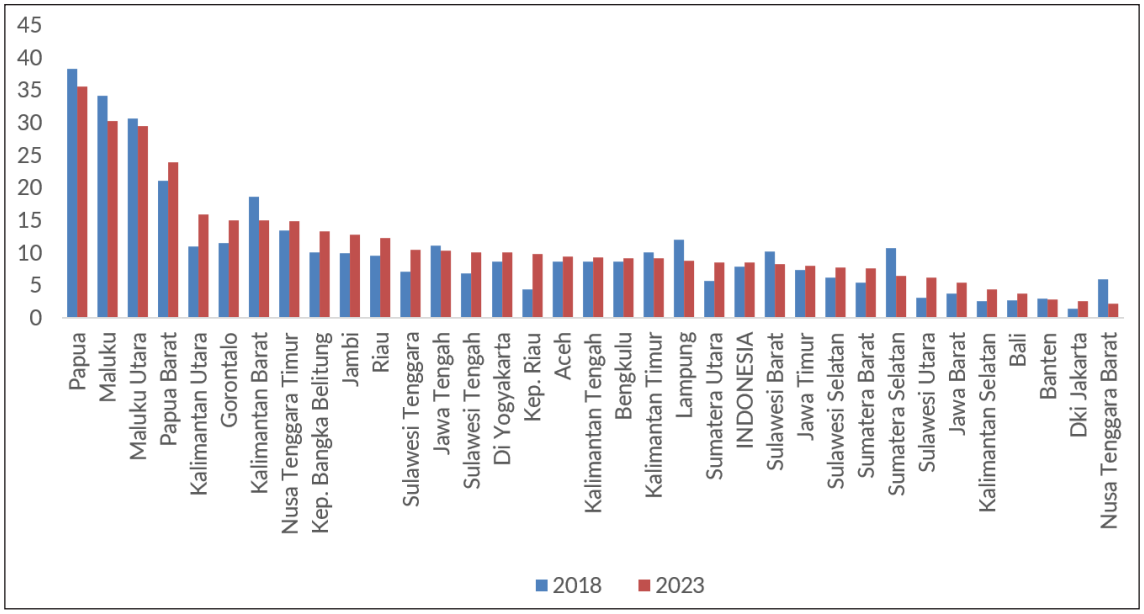
INTRODUCTION

Food security has become a significant issue that has received serious attention from the Indonesian government. As a country with a population of about 280 million people (BPS-Statistics Indonesia, 2023), Indonesia faces significant challenges in ensuring the availability of sufficient, safe, and nutritious food for all people, as stated in the Food Security Law No.18 of 2012. Climate change has caused various negative impacts on the agricultural sector, such as changes in growing season patterns, increased frequency and intensity of natural disasters, and decreased land productivity. These conditions have decreased domestic food production, impacting national food availability. In addition, the COVID-19 pandemic that has hit the world since early 2020 has also put additional pressure on Indonesia's food security system. Supply chain disruptions, declining purchasing power, and mobility restrictions have affected food distribution, especially in hard-to-reach areas. The crisis has exposed the vulnerability of national food security and prompted the government to strengthen a more resilient and sustainable food system (Sjahrir & Dawam, 2022).

Figure 1. Prevalence of Undernourishment in Indonesia by Province in 2018 and 2023 (Percent)



Source: BPS-Statistics Indonesia, 2024

As part of efforts to understand and address food insecurity, the National Food Agency in 2023 identified the prevalence of undernourishment as a key indicator in assessing food security conditions. This indicator represents the percentage of the population whose habitual food consumption is insufficient to provide the dietary energy levels required to maintain a normal, active, and healthy life. It is included as an indicator in the second Sustainable Development Goal (SDG), namely no hunger. The prevalence of undernourishment is categorized into five very low statuses (<2.5%), low (2.5% to 4%), medium (5% to 19%), high (20% to 34%), and very high (>35%) (Ministry of

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Agriculture, 2022). Based on data in Figure 1, most provinces in Indonesia fall within the medium category, with four provinces—West Papua, North Maluku, Maluku, and Papua—classified as having a high prevalence of undernourishment. Alarmingly, 23 out of 34 provinces have experienced an increase in undernourishment levels between 2018 and 2023. Additionally, 22 provinces have undernourishment rates exceeding the national average, emphasizing the urgency of investigating the determinants of undernourishment in Indonesia.

The ability to meet food consumption needs in a region is strongly tied to the income levels of its residents. According to Keynes's consumption theory, consumption is influenced by income levels, where disposable income directly determines people's purchasing power (Dornbusch et al., 2018; Du, 2022). Purchasing power, in turn, affects food accessibility, influencing individuals' ability to acquire sufficient and nutritious food (Hristov et al., 2022). Several studies have found that higher purchasing power reduces undernourishment prevalence (Dai & Sulila, 2020; Mazouzi & Amina, 2024; Reuveni, 2024; Hashim, 2016). Increased purchasing power will encourage changes in people's consumption patterns for the better, so that undernourishment can be resolved (Shabnam et al., 2021). Similarly, El-Laithy et al. (2023) argue that food insecurity generally results from households' low access to food due to low purchasing power.

Food availability plays a crucial role in food security. Increased food production helps ensure food supply and maintains a balanced nutritional intake, thereby reducing the prevalence of undernourishment (Marson et al., 2023). A rise in food production during harvest typically lowers food prices, improving purchasing power and food consumption levels. Various studies support the positive relationship between food production and undernourishment reduction (Njangang et al., 2024; Grewal et al., 2024; Domguia et al., 2023). However, recent research suggests that increasing agricultural production alone is insufficient to improve food security without complementary improvements in food distribution and access policies (Daccache et al., 2024; Squires & Gaur, 2020). Achieving food security requires effective public policies that focus not only on increasing agricultural production but also on aspects of demand and access through markets and supply (Fanzo, 2023; Fanzo & Davis, 2021; Rukhsana & Alam, 2021; Woodhill et al., 2022).

Another key determinant is price stability. Price fluctuations influence the level of food consumption. Inflation, especially when it leads to rising food prices without proportional wage increases, diminishes purchasing power and compels low-income households to opt for cheaper, less nutritious food, exacerbating undernourishment (El-Laithy et al., 2023; Obiora et al., 2023). High inflation rates directly impact food affordability, both as a result of rising food prices and as a result of budget constraints due to rising costs of utilities, housing, and services (Stone et al., 2024; Dhar et al., 2024; Dorward, 2012; Lieb & Schuffels, 2022). Furthermore, Johnstone and Lonnie (2023) argued that price increases, especially food prices not accompanied by wage increases, make it difficult for low-income people to buy or access healthy food. Research by Domguia et al. (2023), Arrohmah et al. (2023), and Cancino and Cancino-escalante (2023) found that inflation can increase the prevalence of undernourishment. Inflation also increases

the risk of child undernutrition, especially wasting and stunting (Headey & Ruel, 2023; Akerele et al., 2024). Despite the negative impact it creates, low and moderate levels of inflation can be beneficial. Some studies highlight the positive effects of controlled inflation; moderate inflation with appropriate policies, such as wage rate adjustments, can provide opportunities for balanced economic growth and maintained purchasing power (Chowdhury & Sundaram, 2023; Gumata & Ndou, 2017; Kar & Kar, 2024). Research by Jordà and Nechi (2023) and Raza et al. (2023) highlight that inflation can increase wages. In a tight labor market and high-inflation environment, workers tend to demand higher compensation to maintain their purchasing power. When purchasing power is maintained, food consumption needs can be met.

Unemployment is another factor that is thought to have an influence. Unemployment occurs not only because of a lack of jobs but also because of a mismatch between educational qualifications and the jobs offered, which creates educated unemployment (Albert et al., 2023; Susanto et al., 2024). Based on BPS (2023), Indonesia's unemployment rate (diploma graduates and above) reached 11 percent. High unemployment levels indicate that a substantial portion of the population lacks a stable income and thus faces difficulties in meeting food consumption (Haini et al., 2023). Unemployment heightens food insecurity risks by reducing disposable income and food accessibility (Sam et al., 2019). Several studies confirm the relationship between unemployment and undernourishment (Abebaw et al., 2020; Owens et al., 2020; Enakhe & Tamuno, 2021; Etana & Tolossa, 2017). Unemployed people generally have limited financial resources, so they prefer to consume less or less nutritious food because the price is more affordable, which will impact undernourishment.

Government intervention through social food assistance programs serves as a crucial mitigating factor. Such programs aim to reduce the financial burden on low-income households and improve their access to nutritious food. Social protection policies, including food assistance, have been shown to enhance purchasing power and food security. Sustaining the social food assistance program helps ensure the food security of beneficiary households (Sartiyah & Suriani, 2019). Studies indicate that food assistance programs effectively lower the prevalence of undernourishment; research results by Mary et al. (2018), Tranchant et al. (2019), and Treloar et al. (2024) suggest that social assistance programs such as food assistance can reduce the prevalence of undernourishment. Food assistance is a form of government transfer that can increase beneficiaries' income or real income so that people can meet their food needs. Suriani and Sartiyah (2020) further demonstrate that government food assistance enhances food security among vulnerable groups. On the other hand, Schuler (2023) and Proshin (2022) state that food social assistance can lead to community dependence on the assistance because it is consumptive and only focuses on fulfilling basic needs such as food. This will not change the people who receive assistance to become more empowered and able to develop their potential.

Several studies have examined the determinants of the prevalence of undernourishment, as explained earlier. However, previous research has not adequately explored the mediating role of purchasing power in the relationship between economic factors and

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undernourishment. This study aims to fill that gap by investigating how purchasing power mediates the effects of food production, inflation, unemployment, and food assistance on the prevalence of undernourishment. By introducing this mediation analysis, this research provides a novel perspective on the interconnected factors influencing food security in Indonesia.

Based on the issues discussed above, this study aims to analyze the effects of food production, inflation, unemployment, social food assistance, and purchasing power on the prevalence of undernourishment in Indonesia. Besides that this study also examine the mediating role of purchasing power in the relationship between food production, inflation, unemployment, and food assistance on undernourishment.

The remainder of this article is structured as follows: Section 2 details the data, variables, and methodology. Section 3 presents and discusses the findings, including mediation test results (Sobel test). Section 4 concludes with insights and policy implications based on the results.

METHODS

This study utilizes panel data from 34 provinces in Indonesia over the 2018-2023 period (6 years), resulting in 204 observations. The data employed are secondary data entirely sourced from BPS-Statistics Indonesia. Table 1 shows this study's variable types, definitions, units, and data sources.

Table 1. Explanation of Variables

Variable	Explanation	Units	Source(s)
Prevalence of undernourishment (POU)	The proportion of the population in an area that consumes food below the standard threshold of adequate energy needed	Percent (%)	BPS-Statistics Indonesia
Food Production (FP)	Total rice production	Million tons	BPS-Statistics Indonesia
Inflation (CPI)	Inflation based on consumer price index	Indeks	BPS-Statistics Indonesia
Unemployment (UNE)	Open unemployment rate	Percent (%)	BPS-Statistics Indonesia
Social Food Assistance (FA)	Realization of social food assistance expenditure	Trillion rupiahs	BPS-Statistics Indonesia
People's purchasing power (PP)	Adjusted per capita expenditure	Million rupiahs	BPS-Statistics Indonesia

Source: author's compilation

Economic variables in reality have a dynamic relationship, which is characterized by the lag of the dependent variable between the independent variables. There are two models in this study, the first model is to see the effect of independent variables on the mediating variable, PP. The second model is to see the effect of the independent variables on the

dependent variable by including the mediating variable. Because there are differences in units between variables, some variables are converted into natural logarithms to facilitate interpretation, except for POU and UNE variables, which already have percent units. The model in this study is written as follows:

Model 1:

$$PP = f\ (FP,CPI,UNE,FA) \tag{3}$$

$$lnPP_{it} = \alpha_1 + \delta_{11} lnPP_{i,t-1} + \beta_{11} lnFP_{it} + \beta_{12} lnCPI + \beta_{13} UNE_{it} + \beta_{14} lnFA_{it} + u_{it} \tag{4}$$

with i denoting province and t denoting time. α_1 is a constant, δ_{11} is the lag coefficient of the dependent variable, $\beta_{11}\beta_{12}\beta_{13}\beta_{14}$ are regression coefficients, and u_{it} is the error term. PP stands for people's purchasing power, FP for food production, CPI for inflation, UNE for unemployment rate, and FA for social food assistance.

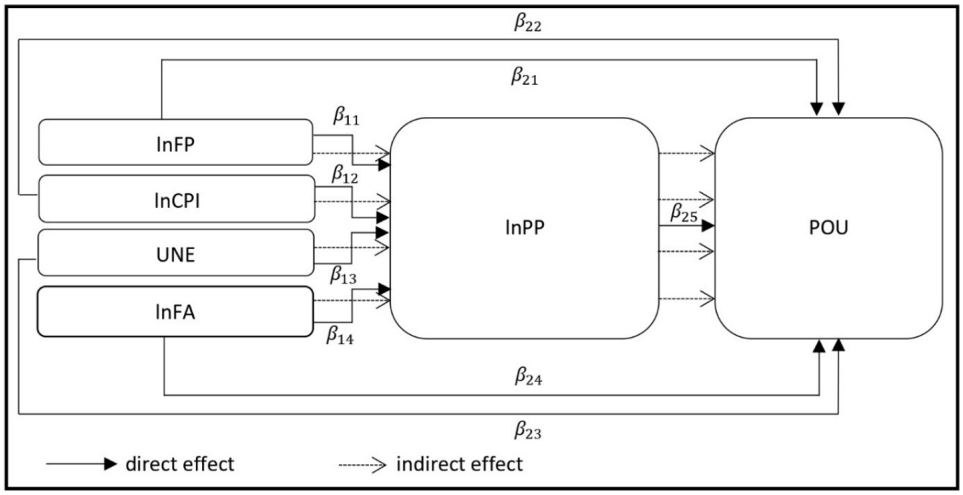
Model 2:

$$POU = f(FP,CPI,UNE,FA,PP) \tag{5}$$

$$POU_{it} = \alpha_2 + \delta_{21} POU_{i,t-1} + \beta_{21} lnFP + \beta_{22} lnCPI_{it} + \beta_{23} UNE_{it} + \beta_{24} lnFA_{it} + \beta_{25} lnPP_{it} + u_{it} \tag{6}$$

with i denoting province and t denoting time. α_2 is a constant, δ_{21} is the lag coefficient of the dependent variable, $\beta_{21}\beta_{22}\beta_{23}\beta_{24}\beta_{25}$ are regression coefficients, and u_{it} is the error term. POU is the prevalence of undernourishment, FP is food production, CPI is inflation, UNE represents the unemployment rate, FA is social food assistance, and PP is people's purchasing power.

Figure 2. Framework Analysis



Source: author's framework

The analysis method used in this research is dynamic panel analysis with the Generalized Method of Moment (GMM). The GMM dynamic panel method was chosen because it is designed for panel data situations with small T and large N that match the data conditions of this study (Igbinigie et al., 2020; Levendis, 2023; Han & Kim, 2023). The type of estimator used is the Generalized Method of Moments System (SYS-GMM)

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or the so-called Blundell-bond estimator, which is claimed to be more efficient than the Arrellano Bond estimator (Baltagi, 2021). This is due to the use of additional level information, namely the moment of condition and matrix of instrument variable level in addition to the first difference by combining the moment of condition and matrix of instrument variable (first difference and level). Several model specification tests were carried out to ensure that the model used was valid, consistent, and unbiased, namely the Sargan test, Arrellano Bond test, and estimator unbiasedness test (Bernardelli & Carrasco-Gutierrez, 2024; Das, 2019; Levendis, 2023; Ullah et al., 2023). Furthermore, the Sobel test is used to see the mediation effect of the mediator variable. If there is a mediation effect, then there is a direct and indirect influence between the independent variable and the dependent (Kidd & Lin, 2024; Solimun & Fernandes, 2017). An illustration of the framework conducted in this study can be seen in Figure 2.

RESULTS AND DISCUSSION

The analysis started with examining the descriptive statistics for all variables and the correlation matrix among the independent variables, as presented in Table 2 and Table 3. Descriptive statistics provide insights into the variability and distribution of the variables, assist in detecting patterns or anomalies in the data, and provide preliminary information prior to more in-depth statistical analysis. Descriptive statistics show that the total data used for each variable of this study amounted to 204 observations. The average prevalence of undernourishment is 11.54 percent. The maximum value is 38.35 percent, which is the figure achieved by Papua in 2018.

Furthermore, the minimum value is 1.43 percent, which is the number achieved by DKI Jakarta in 2019. Food production has an average value of 0.93 million tons, with a maximum value of 6.01 million tons and a minimum of 0.0002 million tons. The average value of the consumer price index as an indicator of inflation is 108.19 points, with a maximum value of 120.05 points and a minimum of 99.87 points. The unemployment rate has an average value of 5.10 percent, with the highest value occurring in 2020 in DKI Jakarta, which amounted to 10.95 percent, and the lowest in 2018 in Bali, which amounted to 1.40 percent. During 2018-2023, the average realization of social food assistance issued by the government was 1.03 trillion rupiahs. The largest social food assistance was allocated to West Java in 2021, amounting to 10.30 trillion rupiahs, and the lowest was allocated to Bangka Belitung Islands in 2018, amounting to 0.02 trillion rupiahs. The average people's purchasing power of the community during the 2018-2023 period is 10.92 million rupiah, with the highest purchasing power value in DKI Jakarta amounting to 19.37 million rupiah in 2023 and the lowest in Papua amounting to 6.95 million rupiah in 2020.

The standard deviation of the prevalence of undernourishment, inflation, unemployment, and people's purchasing power is below its mean and median values, indicating that this variable has low variation. Meanwhile, the standard deviation of the food production and social food assistance is more significant than its mean and median values, indicating that the food production and variable show that the data has high variability.

Next, the correlation coefficient was calculated to assess the potential for multicollinearity in the estimated model. One of the criteria for obtaining a BLUE (Best Linear Unbiased Estimator) estimator is the absence of perfect multicollinearity among the independent variables. Perfect multicollinearity is characterized by the value of the correlation coefficient between the independent variables approaching 1 (Das, 2019; Iacobucci et al., 2017; Kalnins, 2022). The correlation matrix in Table 3 shows that the independent variables do not have perfect multicollinearity.

Table 2. Summary Statistics for The Variables

Variables	Mean	Median	Std. dev.	Min	Max	Obs
POU	11.5443	9.3600	8.5599	1.4300	38.3500	204
FP	0.9318	0.2977	1.5455	0.0002	6.0068	204
CPI	108.1869	106.2900	5.6880	99.8700	120.0500	204
UNE	5.1035	4.7000	1.7506	1.4000	10.9500	204
FA	1.0259	0.3970	1.9291	0.0156	10.3002	204
PP	10.9223	10.7730	2.2073	6.9540	19.3730	204

Source: author's computation

The estimation results in Table 4 show the validity test of the instruments used to estimate the GMM system for both models. The validity test uses the Sargan test to check for overidentifying constraints. The null hypothesis tested is that the overidentifying restriction condition in the model estimation is valid. The probability value of the Sargan test in model 1 is 0.0580, and in model 2 is 0.4398. Since the probability value for both models is greater than 0.05, it is concluded that the instrumental variables in both models are acceptable. Furthermore, checking the serial correlation for both models with the Arellano Bond Test on AR(1) and AR(2) with the expected condition for the estimator to be consistent is the AR(2) condition. The results obtained from both models are as expected. They reject H_0 in AR(1) and fail to reject H_0 in AR(2), concluding that the estimators of both models are consistent.

Table 3. Correlation Matrix of Independent Variables

Variables	lnFP	lnCPI	UNE	lnFA	lnPP
lnFP	1.0000				
lnCPI	-0.0246	1.0000			
UNE	-0.1577	-0.0658	1.0000		
lnFA	0.6849	0.2879	0.1971	1.0000	
lnPP	-0.1705	0.1231	0.3158	0.0441	1.0000

Source: author's computation

Pooled OLS and fixed effect estimates should be reported to evaluate the unbiasedness of the SYS-GMM estimates. Then a comparison of GMM independent

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variable lag estimators with FEM (Fixed Effect Model), which is biased downward, and PLS (Pooled Least Squares), which is biased upward. The results in Table 4. show that the lag coefficients of the independent variables of FD-GMM and SYS-GMM are between the FEM and PLS models, which means that the estimators of the two models are unbiased. The testing instrument validity, consistency, and unbiased results indicate that the SYS-GMM model meets the requirements and can be further analyzed.

In the GMM model, regression coefficients are obtained for both the short and long run. The estimation results with SYS-GMM for Model 1 show that inflation, unemployment, and social food assistance significantly affect people's purchasing power in the short and long run. Meanwhile, food production is not statistically significant in the short and long run. The research results in Model 1 do not prove the hypothesis that increased food production directly affects people's purchasing power. This finding is in line with previous research (Woodhill et al., 2022; Grewal et al., 2024), which highlighted the importance of factors other than production, such as food distribution and accessibility, in determining people's purchasing power (Bonuedi et al., 2022; Waarts et al., 2021).

Table 4. Estimation Result

Variables	Model 1 lnPP		Model 2 POU	
	Short Run	Long Run	Short Run	Long Run
lnPPt-1	0.7238*** (0.0423)			
POUt-1			0.2236*** (0.0368)	
lnFP	0.00003 (0.0036)	0.0001 (0.0132)	0.7630 (0.4749)	0.9828 (0.5773)
lnCPI	0.4218*** (0.0217)	1.5273*** (0.2081)	33.0176*** (1.8842)	42.5279*** (2.1664)
UNE	-0.0069*** (0.0012)	-0.0249*** (0.0066)	0.3347*** (0.1029)	0.4312** (0.1461)
lnFA	-0.0417*** (0.0022)	-0.1555*** (0.0261)	-0.8123*** (0.2170)	-1.0463*** (0.2881)
lnPP			-27.1243*** (3.4696)	-34.9371*** (3.7563)
Number of obs	170		170	
Prob. AR(1)	0.0286**		0.0138**	
Prob. AR(2)	0.8405		0.3216	
Prob. Sargan test	0.0580		0.4398	
lnPPt-1 (FEM)	0.4510***			
lnPPt-1 (PLS)	1.0026***			
POUt-1 (FEM)			0.1089	
POUt-1 (PLS)			0.7772***	

Source: author's computation

Note: This table presents regression results using eq (4) and (5). Standard error in parentheses. Superscripts *** and ** denote statistically significant at 0.01 and 0.05.

The results of this study are related to Law No. 19/2013, which regulates various aspects of ensuring the welfare of farmers, including the protection of production prices. One of the important points is Article 15, which states that the government is obliged to protect farmers from adverse market price fluctuations through government purchase price (HPP) policies or subsidy policies. When there is a drop in the price of agricultural products, the government can take steps such as directly buying farmers' crops through state-owned enterprises (BUMN) or other agencies to maintain price stability.

Inflation positively affects people's purchasing power in the short and long term. This result shows that when there is an increase in prices or inflation, the people's purchasing power will increase. The positive relationship indicates that inflation stability can maintain people's purchasing power. In the economic mechanism of society, a price increase is necessary as it motivates individuals to engage in production activities, stimulating the economy and boosting national production (Silvia, 2021; Solaymani, 2017). When prices rise, buyers pay more for goods and services. However, simultaneously, sellers earn more from their sales. Since most people generate income by selling their services, such as labor, income inflation occurs alongside price inflation. Based on data in Table 5, during the study period (2018-2023), Indonesia's inflation was low, with an average annual value below 6 percent. In 2018, 2019, and 2023, the actual inflation was within BI's target range, which shows that inflation in that year was moderate (maintained).

The average wage has generally increased with the inflation rate, except during the COVID-19 pandemic (2020-2021). In the COVID-19 period, inflation was below BI's target, and average wages declined. In 2022, there was inflation of 5.51 percent, which is the highest inflation in the last 6 years. In line with this, the wage level increased by 12 percent, the most significant over the last 6 years. This condition aligns with research by Jordà and Nechi (2023) and Raza et al. (2023). They explained that inflation can cause wages to rise as workers demand higher compensation to maintain their purchasing power. Therefore, Wage rate adjustments can provide opportunities for balanced economic growth and maintained purchasing power (Chowdhury & Sundaram, 2023; Gumata & Ndou, 2017; Kar & Kar, 2024).

Table 5. Target and Realization of Inflation and Average Wages in Indonesia, 2018-2023

Year	Inflation Target (%)	Actual Inflation *year on year* (%)	Average Wages (Rupiahs)	% Change of Average Wages
2018	3,5±1%	3,13	2,829,130	3.15
2019	3,5±1%	2,72	2,913,897	3.00
2020	3±1%	1,68	2,756,345	-5.41
2021	3±1%	1,87	2,736,463	-0.72
2022	3±1%	5,51	3,070,756	12.22
2023	3±1%	2,61	3,178,227	3.50

Source: Bank of Indonesia dan BPS-Statistics Indonesia, 2024

One of the policies that regulates wage regulations to maintain people's purchasing power during inflation is Law No. 13/2003 on Manpower. The law stipulates that the

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government must set a minimum wage adjusted to inflation and decent living needs. Wage adjustments that follow inflation aim to prevent workers from being trapped in economic hardship due to the ever-increasing prices of goods and services so that their purchasing power is maintained. Without regulations that consider inflation, rising prices of goods will make it difficult for workers to fulfill their basic needs, even if employed.

Furthermore, unemployment negatively affects people's purchasing power in the short and long term. This indicates that when unemployment increases, people's purchasing power will decrease. This result is in line with Halim et al. (2022), Hurd and Rohwedder (2017), Gebretsadik (2016), and Al-Yasiri and Al-Yasiri (2022). When someone loses their job, their income decreases or even disappears completely, leaving them with less money to spend. Social food assistance negatively and significantly affects people's purchasing power. Surprisingly, this result contradicts the idea that government transfers such as food aid and social assistance can increase people's purchasing power. This study's results align with Schuler (2023) and Proshin (2022), who state that food social assistance can lead to community dependence on the assistance because it is consumptive and only focuses on fulfilling basic needs, such as food. This condition will not change the people who receive assistance to become more empowered and able to develop their potential.

The estimation results using SYS-GMM for Model 2 show that the inflation, unemployment rate, social food assistance, and people's purchasing power significantly affect the prevalence of undernourishment in the short and long term. Meanwhile, food production is not statistically significant in the short and long term. This condition can occur due to unequal distribution and access gaps in some areas that can lead to food insufficiency despite sufficient food production nationally, as suggested by Daccache et al. (2024) and Squires and Gaur (2020). The tendency of farmers or rice producers to send their crops to other regions that offer higher prices can lead to inequitable food distribution, so even though rice production in the area is abundant, local people still experience difficulties in meeting their food needs because most of the rice supply is allocated to other regions, resulting in limited access to local food. Therefore, food security depends not only on food availability through agricultural production but also on physical and economic access, which requires infrastructure development, economic development, and fair wage policies (Fanzo, 2023; Fanzo & Davis, 2021; Rukhsana & Alam, 2021; Woodhill et al., 2022)

Regulations on equitable food distribution in Indonesia can be found in Law No. 18/2012 on food, emphasizing the importance of equitable food distribution to achieve food security. The government should ensure fair and equitable food distribution throughout Indonesia so everyone can access adequate and nutritious food regardless of geographical location or economic status. In addition, Law No. 7/2014 on Trade also includes provisions on food trade and distribution control. Food distribution must prioritize sustainability and equity, including reasonable prices for producers and consumers.

Inflation positively influences the prevalence of undernourishment in Indonesia in the short and long term. This is in line with what was stated in the research of Domguia et al. (2023), Arrohmah et al. (2023), Saccone (2021), and Cancino and Cancino-escalante (2023). An increase in the price of food can cause food to become more expensive and less affordable for most people, especially those on low incomes. As a result, they may

reduce the amount or quality of food consumed to save costs. High inflation directly impacts food affordability, both as a result of rising food prices and as a result of budget constraints due to rising costs of utilities, housing, and services. Rising prices can make food more expensive and less affordable for low-income people without wage adjustments. As a result, they may reduce the amount or quality of food consumed to save costs, leading to increased undernourishment (Stone et al., 2024; Dhar et al., 2024; Dorward, 2012; Lieb & Schuffels, 2022).

Unemployment positively influences the prevalence of undernourishment in Indonesia in the short and long term. This is in line with the findings by Abebaw et al. (2020), Owens et al. (2020), Enakhe and Tamuno (2021), and Etana and Tolossa (2017). A high unemployment rate diminishes individuals' ability and opportunity to access sufficient and nutritious food, thereby increasing the prevalence of undernourishment. Furthermore, social food assistance has a negative and significant influence on the prevalence of undernourishment in Indonesia in the short and long term. This finding is in line with the findings of Mary et al. (2018), Tranchant et al. (2019), and Treloar et al. (2024). The purpose of the food assistance program is to provide more balanced nutrition to beneficiary families.

People's purchasing power has a negative effect on the prevalence of undernourishment in Indonesia in the short and long term. This result is consistent with Keynes's consumption theory, which states that consumption is part of disposable income. When disposable income increases, consumption levels will also increase (Dornbusch et al., 2018). This finding aligns with a previous study (Ghosh, 2021; Herforth & Ahmed, 2015; Kaur & Kaur, 2016; Labidi et al., 2024). With sufficient purchasing power, individuals and families can choose a more varied and nutritious diet, improving their nutritional status and overall health..

Table 6. Sobel Test's Result

Variables	Short Term Coefficient			Long Term Coefficient		
	Test statistic	Direct	Indirect	Test statistic	Direct	Indirect
lnFP	-0.0075 (0.0987)	0.7630	-0.0007	-0.0075 (0.4605)	0.9828	-0.0035
lnCPI	-7.2550*** (1.5771)	33.0176***	-11.4419***	-5.7613*** (9.2614)	42.5279***	-53.3580***
UNE	4.6489*** (0.0400)	0.3347***	0.1862***	3.5052*** (0.2477)	0.4312**	0.8683***
lnFA	7.2328*** (0.1563)	-0.8123***	1.1302***	5.2030*** (1.0130)	-1.0463***	5.2705***

Source: author's computation
Note: Standard error in parentheses. Superscripts *** and ** denote statistically significant at 0.01 and 0.05.

The Sobel test was used to determine the effect of mediating variables on the relationship between the independent and dependent variables in this study. The Sobel test measures the coefficient and standard error in the short and long term. The results of the Sobel test are in Table 5. show that the mediating variable, namely people's purchasing

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power, significantly mediates the effect of inflation, unemployment, and social food assistance on the prevalence of undernourishment. Because the three variables have direct and indirect effects, people's purchasing power is called a partial mediation variable (Carrión et al., 2017; Gaskin et al., 2023; Hair et al., 2021).

The Sobel test analysis in Table 6 shows a significant direct and indirect effect (through people's purchasing power) of the variables inflation, unemployment rate, and food assistance on the prevalence of undernourishment, which is the main finding of this research. Inflation has a complex impact on food consumption inadequacy. Directly, inflation can increase the prevalence of undernourishment because rising prices reduce people's access to basic needs, especially for low-income people. Rising food prices, in particular, make it difficult for low-income earners to buy sufficient quantity or quality food. Indirectly, inflation can have a different impact if people's purchasing power increases through increased income. In this case, an increase in income can increase people's ability to buy food despite rising prices, reducing the prevalence of undernourishment. Thus, the impact of inflation on food consumption is determined by price increases and changes in purchasing power as a mediating factor. Economic policies aimed at protecting purchasing power, such as wage adjustments, could mitigate the negative impact of inflation on the prevalence of undernourishment.

Furthermore, the coefficient of the indirect effect of unemployment on the prevalence of undernourishment is positive, indicating the same direction as the direct effect. This result indicates that an increase in unemployment can worsen the prevalence of undernourishment through a decrease in purchasing power. Therefore, the government is expected to increase employment and investment in education to improve skills, especially for the working-age population.

Food assistance's direct and indirect effects on the prevalence of undernourishment also have different effects. Directly, food assistance can reduce the prevalence of undernourishment by providing direct access to food for needy groups. Food assistance ensures that the basic needs of vulnerable people are met, especially in times of crisis or extreme poverty. Indirectly, however, food assistance also has the potential to increase the prevalence of undernourishment through reduced purchasing power. This happens when there is a dependency on food assistance. When people become overly dependent on food assistance, their purchasing power does not develop or even decline as the assistance discourages people from finding sustainable income alternatives or developing their economic capacity. Hence, sustainable food assistance policies and government support are important in independently increasing people's purchasing power. Well-designed food assistance must be accompanied by efforts to improve recipients' economic capacity and self-reliance so that they are not solely dependent on assistance to meet their food needs.

CONCLUSION

This study aims to analyze the determinants of the prevalence of undernourishment in Indonesia by addressing how economic and social factors contribute to this issue and providing policy recommendations based on empirical findings. The method used is dynamic

panel regression for the 2018-2023 data period with SYS GMM and path analysis. Several requirements were carried out, such as model specification tests, namely the Sargan, Arrellano Bond, and estimator tests. A mediation test with the Sobel test was also conducted to determine the effect of the mediating variables. The results show that food production has no significant effect, directly or indirectly, on the prevalence of undernourishment. Meanwhile, inflation, unemployment, and social food assistance play a significant role, both directly and indirectly, in influencing the prevalence of undernutrition in Indonesia through the mediation of people's purchasing power. This result highlights the need for targeted policy interventions that address food supply, economic stability, and employment opportunities.

Based on these findings, several policy recommendations can be proposed. First, strengthening food diversification policies reduces dependence on one type of food, such as rice, by promoting local and alternative food sources to enhance national food security, and second, maintaining price stability, particularly for essential food commodities, by implementing appropriate monetary and fiscal policies to control inflation. It is crucial to strike a balance, ensuring that inflation does not rise too high—causing reduced purchasing power—nor fall too low—hindering economic growth. Third, the long-term dependency on food assistance should be minimized by promoting economic self-sufficiency. This condition can be done by integrating social assistance programs with skill development and entrepreneurship training, enabling beneficiaries to generate sustainable income sources. Fourth, the accuracy and transparency of the data collection system should be improved, and the monitoring and evaluation mechanisms for food assistance distribution should be strengthened. Community participation in determining beneficiaries should be enhanced to ensure that food aid reaches those who need it. Fifth, fair labor market policies should be ensured by facilitating structured and transparent wage negotiations between workers and employers, where the minimum wage is adjusted periodically in line with inflation rates and expectations. Sixth, policies supporting labor-intensive sectors' growth and improving workforce skills through vocational training programs can encourage employment expansion and economic resilience.

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