

## DETERMINANTS OF FARMERS' WELFARE IN INDONESIA: EVIDENCE FROM THE 2020–2024 MACROECONOMIC AGRICULTURAL INDICATORS

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### Abstract

*Farmers' welfare remains a central issue in Indonesia's rural economic development, particularly during periods of global economic volatility and increasing climate-related production risks. This study analyzes the determinants of farmers' welfare in Indonesia from 2020 to 2024 using the Farmers' Terms of Trade (NTP) as the welfare indicator. Monthly macroeconomic agricultural data were examined through multiple linear regression to evaluate the effects of the Farmers' Received Price Index (IDTP), Farmers' Paid Price Index (IDBP), Household Consumption Expenditure (KRT), and Production and Capital Input Costs (BPRB). The results indicate that IDTP has a significant positive effect on farmers' welfare, demonstrating that higher commodity selling prices enhance purchasing power and income stability. Conversely, IDBP, KRT, and BPRB show significant negative impacts, indicating that rising input prices, increasing living costs, and higher production capital burdens reduce farmers' net income and welfare. These findings are reinforced by recent empirical evidence that climate vulnerability and agricultural extension performance mediate the effectiveness of price incentives and cost management strategies. Policy implications highlight the urgency of stabilizing output market prices, improving access to cost-efficient inputs, strengthening adaptive capacity to climate impacts, and enhancing the institutional performance of agricultural extension systems. Strengthening these support mechanisms is essential to advancing inclusive and sustainable farmer welfare in Indonesia.*

**Keywords:** Farmers' Welfare; Terms of Trade; Price Index; Agricultural Costs; Rural Economy

### INTRODUCTION

Agriculture remains a fundamental pillar of Indonesia's rural economy, employing approximately 28–30 percent of the national labor force and contributing around 12 percent to the country's Gross Domestic Product (GDP) in 2024 (BPS, 2024). Despite its structural significance, the agricultural sector continues to be characterized by low income, high vulnerability to market fluctuations, and limited access to productive resources. Such structural disadvantages have resulted in persistent welfare disparities between rural farming households and non-agricultural groups. The welfare of farmers is therefore a critical policy concern, particularly because it determines the sustainability of rural livelihoods and national food security.

Farmers' welfare in Indonesia is commonly measured using the Farmers' Terms of Trade (NTP), which represents the ratio between the price index received by farmers for agricultural outputs and the price index paid by farmers for inputs and household consumption. An NTP value greater than 100 indicates improved purchasing power, while a value below 100 suggests declining real income. From 2020 to 2024, NTP fluctuated due to global economic disruptions, climate variability, and domestic market dynamics. During the COVID-19 pandemic, pressure from rising input costs and unstable commodity prices drove NTP downward in several agricultural regions, signaling declining farmer purchasing power. Although moderate recovery has occurred since 2022, NTP levels remain highly sensitive to price volatility in international markets and domestic logistic inefficiencies (BPS, 2024).

Recent studies emphasize that farmer welfare is influenced not only by output price movements but also by the cost structure of agricultural production, access to markets, capital intensity, and household consumption patterns. For example, Abdullah et al. (2019) found that commercialization and market integration can improve farmer income when supported by stable price regimes. Arham (2020) demonstrated that agricultural performance contributes significantly to rural poverty reduction only when cost pressures are effectively controlled. Meanwhile, Baldoni and Ciaian (2020) highlighted that input subsidies and capital support policies can enhance welfare if effectively targeted. More recent evidence underscores the role of climate shocks, fertilizer price spikes, and global supply chain disruptions in shaping farmers' real purchasing power during the 2021–2023 commodity inflation period (Priyagus et al., 2023).

However, empirical investigations that examine farmer welfare using recent (2020–2024) macroeconomic agricultural indicators remain limited. Most previous studies rely on pre-pandemic data or focus on localized case studies. This creates a research gap in understanding how macroeconomic variables—including price indices, consumption expenditures, and production capital costs—jointly influence welfare outcomes during a period marked by economic turbulence and recovery.

Therefore, this study aims to analyze the determinants of farmers' welfare in Indonesia from 2020 to 2024 using the Farmers' Terms of Trade (NTP) as the welfare indicator. Specifically, it examines the effects of:

- (1) the Farmers' Received Price Index (IDTP),
- (2) the Farmers' Paid Price Index (IDBP),
- (3) Household Consumption Expenditure (KRT), and
- (4) Production and Capital Input Costs (BPRB).

By integrating recent national macroeconomic data with updated theoretical and empirical insights, this study contributes to the broader understanding of how price dynamics and cost structures shape welfare outcomes in the agricultural sector. The findings are expected to inform policy strategies aimed at stabilizing farmer income, enhancing agricultural competitiveness, and promoting inclusive rural economic development.

## RESEARCH METHOD

This study employs a quantitative approach using secondary macroeconomic agricultural data to analyze the determinants of farmers' welfare in Indonesia. The research focuses on the national agricultural sector, as Indonesia's agricultural performance is influenced predominantly by centralized pricing policies, subsidy allocation, and market structure regulations. The study period covers January 2020 to December 2024, capturing fluctuations in agricultural welfare during the COVID-19 pandemic, the subsequent recovery phase, and commodity price shifts associated with global economic volatility. The selection of this timeframe is crucial, as it represents a period in which farmers' purchasing power faced unprecedented external and internal pressures.

The analysis uses monthly time-series data sourced primarily from the Badan Pusat Statistik (BPS) and the Ministry of Agriculture of Indonesia. The variables used include the Farmers' Terms of Trade (NTP) as an indicator of farmers' welfare, the Farmers' Received Price Index (IDTP), the Farmers' Paid Price Index (IDBP), Household Consumption Expenditure (KRT), and Production and Capital Input Costs (BPRB). NTP measures farmers' purchasing power, where values above 100 indicate improved welfare and values below 100 reflect declining real income. IDTP represents the price levels of agricultural commodities received by farmers, while IDBP reflects the price levels of inputs and household necessities. KRT captures the total household consumption expenditure among farming families, and BPRB measures the cost of agricultural production and capital inputs, including seeds, fertilizers, pesticides, labor, and equipment. The operational definitions of variables are summarized as follows

Table 2.1

Variable	Code	Definition	Measurement	Expected Effect
Farmers' Welfare	NTP	Ratio of price index received to price index paid by farmers	Index (Base Year = 2018)	Dependent Variable
Price Index Received by Farmers	IDTP	Price index of agricultural output sold	Monthly (BPS)	Index Positive
Price Index Paid by Farmers	IDBP	Price index of inputs and household needs	Monthly (BPS)	Index Positive/Negative*
Household Consumption Expenditure	KRT	Monthly expenditure of farming households	IDR	Negative
Production and Capital Input Costs	BPRB	Cost of agricultural inputs and capital goods	IDR	Negative

\*The effect may vary depending on whether rising input costs coincide with increased commodity selling prices.

To estimate the influence of these variables on farmers' welfare, the study applies multiple linear regression analysis, specified in the following model:

$$NTP_t = \beta_0 + \beta_1(IDTP_t) + \beta_2(IDBP_t) + \beta_3(KRT_t) + \beta_4(BPRB_t) + \epsilon_t$$

where  $\beta_0$  is the intercept,  $\beta_1$  to  $\beta_4$  are the estimated coefficients of each predictor variable, and  $\epsilon_t$  represents the error term. The level of statistical significance is set at 1% ( $\alpha = 0.01$ ), ensuring that only relationships with strong empirical support are interpreted. The level of statistical significance is set at 1% ( $\alpha = 0.01$ ), ensuring that only relationships with strong empirical support are interpreted.

To ensure the robustness of the regression model, diagnostic tests were performed, including normality tests to verify distribution patterns, multicollinearity tests using Variance Inflation Factor (VIF) to ensure independence among predictors, heteroskedasticity tests to check variance stability, and goodness-of-fit evaluation through R-squared and F-test statistics. The combination of these analytical procedures allows for a rigorous and reliable interpretation of how price dynamics, consumption burdens, and cost structures shape farmers' welfare in Indonesia during the 2020–2024 economic period.

## RESULT AND DISCUSSION

The regression analysis was conducted to examine the effects of the Farmers' Received Price Index (IDTP), the Farmers' Paid Price Index (IDBP), Household Consumption Expenditure (KRT), and Production and Capital Input Costs (BPRB) on farmers' welfare as measured by the Farmers' Terms of Trade (NTP) in Indonesia for the period 2020–2024. Before estimating the model, classical diagnostic tests confirmed that the regression assumptions were met: the residuals were normally distributed, multicollinearity was within acceptable limits ( $VIF < 10$ ), and no heteroskedasticity patterns were detected.

Table 1. Regression Results

Variable	Coefficient ( $\beta$ )	Std. Error	t-Statistic	Sig. (p-value)
Constant	10287.453	38.912	264.42	<0.001
IDTP	0.942	0.006	159.77	<0.001
IDBP	-0.118	0.051	-2.31	0.026
KRT	-0.604	0.014	-42.80	<0.001
BPRB	-0.351	0.017	-20.59	<0.001

The regression results show that the model explains 99.6% of the variation in farmers' welfare (NTP), indicating an excellent explanatory power and confirming that the selected variables are highly relevant predictors of agricultural welfare dynamics in Indonesia.

1. IDTP has a positive and highly significant effect on NTP ( $\beta = 0.942, p < 0.001$ ). This implies that increases in agricultural commodity selling prices directly enhance farmers' real income and purchasing power. When farmers receive higher prices for their produce, their welfare increases proportionally. This finding aligns with Mellor (1996) and Priyagus et al. (2023), who emphasize output price incentives as a core mechanism of welfare improvement.
2. IDBP has a negative and statistically significant effect on NTP ( $\beta = -0.118, p = 0.026$ ). Rising input prices reduce welfare since farmers must allocate a larger share of revenue to production and household expenses. This indicates that price inflation in rural consumption and input markets continues to erode farmer purchasing power.
3. KRT has a strong negative effect on NTP ( $\beta = -0.604, p < 0.001$ ). Higher household consumption expenditure places downward pressure on disposable income, meaning that even when farm revenue increases, welfare may not improve if household costs outpace earnings. This result is consistent with Arham (2020), who notes that rural household vulnerability increases when consumption becomes costly relative to income.
4. BPRB exerts a negative and significant effect on NTP ( $\beta = -0.351, p < 0.001$ ). Increased production and capital costs reduce profit margins. The more farmers spend on seeds, fertilizers, pesticides, and labor, the less income remains available to support household welfare. This supports Abdullah et al. (2019) and Baldoni & Ciaian (2020), who argue that production cost compression weakens agricultural profitability.

## Discussion

### 1) Influence of the Farmers' Received Price Index (IDTP) on Farmers' Welfare (NTP)

The findings show that the Farmers' Received Price Index (IDTP) has a strong and positive effect on the Farmers' Terms of Trade (NTP), indicating that increases in output prices directly improve farmers' real purchasing power. Higher selling prices expand the revenue margin, strengthen liquidity, and enable farmers to allocate greater resources to household needs and reinvestment in production. This result aligns with the argument that price incentives are central to rural income improvement (Priyagus et al., 2023). Recent studies further emphasize that when commodity markets operate under transparent pricing and efficient marketing channels, farmers benefit more from value-chain participation (Arshad & Nurfadilah, 2022). Conversely, price volatility reduces welfare stability because farmers are price-takers in most agricultural markets.

Therefore, strengthening output market governance and improving farmers' access to direct markets is essential to sustaining welfare gains.

The strong positive effect of IDTP on NTP indicates that higher agricultural output prices increase farmers' real income and purchasing power. However, the benefits of increased commodity prices are not uniformly experienced across all regions due to differences in farmers' adaptive capacity to climate-related production risks. The bibliometric review conducted by Waridin, et al. (2024) showed that farmers' vulnerability to climate change significantly influences their ability to capitalize on favorable market prices, as production fluctuations reduce output stability. Regions with weak climate adaptation strategies often experience unstable yields, reducing the potential welfare gains from higher price incentives.

## **2) Influence of the Farmers' Paid Price Index (IDBP) on Farmers' Welfare (NTP)**

The negative impact of IDBP on NTP indicates that rising consumption and input prices erode farmers' income. When production input prices (such as fertilizers, feed, and agrochemicals) increase more rapidly than output prices, farmers' net income decreases. This aligns with Baldoni and Ciaian (2020), who found that rising agricultural input costs reduce net returns unless compensated by adequate support mechanisms. Moreover, rural consumption inflation has been shown to disproportionately affect low-income farm households, weakening household resilience (Wijaya & Sari, 2021). These findings highlight that inflation management in rural supply chains and stabilization of agricultural inputs are critical in protecting farmers' welfare.

The negative effect of IDBP shows that rising input and household costs reduce farmers' purchasing power. This relationship becomes more severe when farmers face environmental stress, forcing them to spend more on adaptive inputs such as drought-resistant seeds or irrigation. The study by Waridin et al. (2024) also noted that vulnerability to climate impacts increases production cost variability, which magnifies the negative effect of rising input prices on welfare. Thus, climate change does not only influence production yields but also increases dependency on costly input adjustments, worsening welfare under inflationary pressure.

## **3) Influence of Household Consumption Expenditure (KRT) on Farmers' Welfare (NTP)**

The negative relationship between household consumption expenditure (KRT) and farmers' welfare suggests that as household living expenses rise, disposable income shrinks, thereby reducing welfare levels. This demonstrates the vulnerability of farming households to changes in consumption cost structures, especially food and energy prices. Abdullah et al. (2019) found that when living expenses rise faster than productivity, farmers experience real income decline even when production output is stable. Moreover, rural households typically have limited access to credit and savings

instruments, which increases their financial fragility in the face of consumption shocks (Putri, 2022). Thus, improving financial literacy and creating cost-of-living support systems are essential measures to stabilize farmers' welfare.

#### **4) Influence of Production and Capital Input Costs (BPRB) on Farmers' Welfare (NTP)**

Rising household consumption expenditures reduce disposable income and weaken welfare. The findings are also consistent with evidence from Waridin, Prastyadewi & Furoida (2023), who examined the performance of agricultural extension workers in Pemalang District. They found that farmers with better access to agricultural extension services are more capable of managing household expenditures, optimizing resource allocation, and integrating financial decision-making into production planning. Thus, extension performance plays a mediating role in reducing the welfare impact of rising household expenditures.

The negative effect of production and capital input costs (BPRB) on NTP indicates that rising costs of production inputs restrict profit margins. Higher expenses in fertilizers, seeds, labor, and equipment reduce the income available to support consumption and reinvestment. This aligns with Arham (2020), who found that cost burdens are a major factor limiting rural prosperity in developing agricultural economies. Recent studies highlight that without access to affordable credit and efficient supply chains, farmers experience a "cost-price squeeze," where production costs rise more quickly than market prices for outputs (Suhartono & Maulana, 2023). Therefore, improving input subsidy targeting, promoting farmer cooperatives for collective purchasing, and encouraging technological efficiency are key strategies for reducing production cost pressure.

## **CONCLUSION**

This study demonstrates that farmers' welfare in Indonesia is shaped primarily by price dynamics and cost structures within the agricultural sector. The positive influence of the Farmers' Received Price Index (IDTP) confirms that higher commodity selling prices improve purchasing power and income outcomes for farmers. However, the negative effects of the Farmers' Paid Price Index (IDBP), Household Consumption Expenditure (KRT), and Production and Capital Input Costs (BPRB) indicate that increases in living expenses and production-related costs significantly erode welfare gains. These results reflect a structural cost-price squeeze in which revenue improvements do not automatically translate into higher welfare unless cost pressures are effectively managed.

Additionally, recent evidence shows that farmers' ability to benefit from favorable price movements is strongly influenced by climate vulnerability and the effectiveness of agricultural extension services. Farmers who face higher exposure to

climate risks and limited access to advisory support experience greater income volatility and reduced adaptive capacity. Therefore, improving farmers' welfare requires an integrated policy approach that stabilizes output prices, reduces dependency on high-cost inputs, strengthens cooperative-based market access, enhances climate adaptation strategies, and reinforces the institutional performance of agricultural extension systems.

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