

DETERMINANTS OF THE FARMERS' PRICE INDEX (NTP) ACROSS PROVINCES IN INDONESIA, 2020–2024

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Abstract

This study aims to analyze the determinants of the Farmers' Price Ratio (FPR) across provinces in Indonesia during the 2020–2024 period. The FPR is used as an indicator of farmers' relative well-being because it reflects farmers' ability to exchange their production output for household consumption needs and production costs. This study employs a quantitative approach using balanced panel data covering 33 provinces and five years of observation, resulting in 165 observations. The dependent variable in this study is the NTP, while the independent variables include the Consumer Price Index (CPI), rice productivity, corn productivity, and labor productivity. The analysis method used is panel data regression with model selection via the Chow test, Hausman test, and Lagrange Multiplier test. The test results indicate that the Random Effects Model is the best fit. The estimation results show that the CPI has a positive and significant effect on the NTP, while rice productivity, corn productivity, and labor productivity do not have a significant effect. These findings suggest that price dynamics play a more dominant role in explaining changes in the NTP compared to physical productivity. Therefore, policies aimed at improving farmers' welfare should focus not only on increasing productivity but also on strengthening selling prices, controlling input costs, improving distribution, and enhancing market access.

Keywords: Farmgate Price, Consumer Price Index, Rice Productivity, Corn Productivity, Labor Productivity.

INTRODUCTION

The agricultural sector remains one of the key pillars of Indonesia's economy. Its role is not limited to food production but also serves as a source of livelihood for many households in rural areas. For this reason, discussions regarding farmers' welfare have always held a prominent place in development studies. One indicator that can be used to assess farmers' welfare is the Farmer's Price Ratio (NTP). The NTP is the ratio between the price index received by farmers (I_t) and the price index paid by farmers (I_b). The NTP can be used to assess farmers' purchasing power, both for household needs and for production costs. According to the study by Trimono et al. (2020) the NTP is also recognized as a relevant indicator for assessing farmers' welfare, though it cannot stand alone without considering the context of production, costs, and the regional economic structure. Based on BPS data from March 2026, the national NTP stood at 125.35, a decrease of 0.08% compared to the previous month. This decline occurred because the increase in the Farmer's Received Price Index (0.33%) was still smaller than the increase in the Farmer's Paid Price Index (0.415%). This data indicates that improvements in agricultural output prices do not automatically strengthen farmers' economic position, especially when, at the same time, household consumption costs and production costs also rise. Thus, changes in the NTP cannot be fully understood solely

from the perspective of agricultural output prices but must be considered alongside other economic factors operating at the regional level.

The well-being of farmers in Indonesia still faces significant challenges. The Central Statistics Agency reports that the percentage of the rural poor in September 2025 reached 10.72%, higher than the 6.60% rate of the urban poor. On the other hand, the results of the 2023 Agricultural Census show that the number of Farming Households (RTUP) reached 28.42 million households, and over the past ten years, the number of small-scale RTUPs has actually increased by approximately 2.64 million households. This situation indicates that a significant portion of farming households still operate on a small and vulnerable scale, meaning that increases in agricultural production do not always directly translate to equitable improvements in farmers' well-being. Under these conditions, farmers' well-being cannot be assessed solely based on the volume of production; it must also be evaluated in terms of their ability to maintain purchasing power and cover living expenses and farming costs.

The NTP plays a crucial role as an indicator of farmers' relative well-being: when the NTP rises, farmers' purchasing power tends to improve, whereas when the NTP falls, farmers' economic position tends to weaken. This role also makes the NTP relevant for assessing the extent to which government policies aimed at protecting farmers, stabilizing prices, increasing production, and controlling input costs actually lead to improvements in well-being at the farm household level. BPS data shows that the NTP is compiled based on the Rural Price Survey conducted monthly across 38 provinces in Indonesia, meaning this indicator is specifically designed to track changes in farmers' purchasing power on a regular basis and across regions. Recent studies also confirm that the NTP remains a key benchmark for assessing farmers' welfare, although it is influenced by numerous factors such as inflation, cost structures, productivity, labor, and the characteristics of agricultural subsectors (Sellinawaty, 2024 ; Mulyana et al., 2024 ; Istianto et al., 2026).

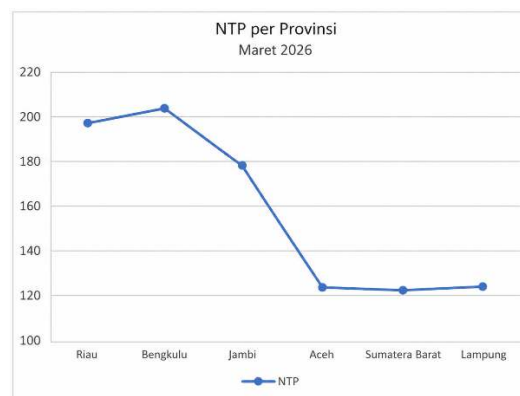


Figure 1. Interprovincial NTP for March 2026

As shown in Figure 1, variations in the NTP across regions remain quite pronounced. The NTP, which fluctuates over time, also reveals significant disparities among provinces. This gap indicates that the welfare conditions of farmers in Indonesia are not uniform. This implies that regional factors likely play a role in determining the level of the NTP. It is under these conditions that panel data analysis becomes relevant, as this approach allows researchers to examine both inter-regional variations and changes over time in a more comprehensive manner.

One of the variables identified in the research by Saruksuk (2025) to explain changes in the NTP is the Consumer Price Index (CPI). The CPI reflects changes in the prices of goods and services consumed by households, thereby illustrating the cost-of-living pressures that also affect farming households. The Central Statistics Agency (BPS) reported that in March 2026, year-on-year inflation stood at 3.48%, with a national CPI of 110.95. At the provincial level, the highest inflation occurred in Aceh at 5.31% with a CPI of 114.01, while the lowest was in Lampung at 1.16% with a

CPI of 110.32. This data indicates that consumption price pressures are not uniform across regions. In the context of the NTP, an increase in the CPI tends to raise the expenditure burden on farming households and production costs, thereby potentially increasing lb. If the rise in It cannot offset this increase, the NTP will be under pressure. Empirically, this view is supported by Sellinawaty (2024) , who found that inflation has a significant negative effect on the NTP of the food crops subsector in the long term. Similar results were also demonstrated by Indah et al.(2023) in Lampung Province, who stated that inflation has a significant effect on the NTP. At the subsector level, Musyarrofah et al.(2025) also showed that inflation has a significant partial effect on the rice NTP in South Kalimantan Province. Furthermore, in a study that directly used the CPI variable, Saruksuk (2025) found that the CPI has a significant impact on the NTP in Riau Province. Furthermore, Setiawan et al. (2024) in Central Java demonstrated that inflation has a significant effect on farmers' terms of trade in the long run, which is conceptually consistent with the NTP as an indicator of farmers' purchasing power. These findings suggest that the CPI should be positioned as a key determinant of the NTP because changes in consumer prices affect farmers' household living costs and, ultimately, influence the balance between the price index received by farmers and the price index paid by farmers. However, different results are shown by Syafa'at (2025) indicating that the research findings show inflation does not have a partial effect on the NTP. Istianto et al. (2026) state that statistically, the NTP is not significantly influenced by inflation; rather, it is overshadowed by other more dominant variables. Thus, the CPI should be positioned as a key determinant of the NTP across provinces in Indonesia, although the strength of its influence may still vary by region and observation period.

Another factor that may influence the NTP is the productivity of food commodities, particularly rice productivity, since rice paddy fields cannot continue to be expanded, while the demand for rice remains high. BPS data shows that the national rice paddy area decreased from 7,463,948 hectares in 2019 to 7,384,341 hectares in 2024, or a reduction of approximately 79,600 hectares. At the same time, Indonesia's population by mid-2025 is projected to reach 284.44 million people, and rice production in 2025 for domestic consumption is expected to reach 34.69 million tons. This means that food demand pressure remains high, making production increases impossible if relying solely on land expansion. The Central Statistics Agency (BPS) notes that in 2025, national rice productivity reached 53.18 quintals per hectare, with rice production amounting to 60.21 million tons of milled dry paddy. At the provincial level, the differences are quite significant; Bali achieved a productivity of 60.95 quintals per hectare, while West Kalimantan only reached 28.75 quintals per hectare. These differences indicate that the efficiency of rice farming varies greatly across regions. Theoretically, higher rice productivity increases output per unit of land, expands farmers' income opportunities, and ultimately drives an increase in income. Empirical results, however, are not entirely consistent. Triwidia et al. (2024) indicate that rice productivity has a positive and significant effect on farmers' welfare, as proxied by the NTP. The study by Kuncorojati et al. (2025) indicates that productivity is one of the factors influencing rice NTP. Maizunati (2018) shows that rice productivity has a positive and significant effect on NTP. However, by Daud et al. (2025) explicitly explains that rice productivity does not significantly affect NTP due to structural constraints, such as unstable yield distribution and market prices. Meanwhile, Mulyana et al. (2024) explain that in provinces where the agricultural sector plays the largest role, many farmers only control small plots of land. This condition indicates that increased rice productivity does not always automatically improve the NTP if it is not accompanied by supportive price and distribution conditions.

Another relevant variable is corn productivity, as corn plays a broad economic role as a staple food and a primary feed ingredient. According to the Ministry of Agriculture's 2024 corn yield data, corn accounts for approximately 40–50% of poultry feed formulations in Indonesia, indicating that demand for corn comes not only from households but also from the livestock industry. Based on BPS data from the 2024 Ubinan Survey, the national average corn productivity reached 51.80

quintals per hectare, while the highest average productivity was recorded on Java Island at 61.82 quintals per hectare. Increasing corn productivity is crucial to maintaining output availability amid continuously rising demand pressures. From the NTP perspective, corn productivity is relevant because an increase in yield per hectare can boost the income of food crop farmers, particularly in regions where the agricultural structure does not rely solely on rice. The higher the corn productivity, the greater the potential for farm income, thereby improving farmers' purchasing power for consumer goods and reducing production costs. Siadari et al. (2024) found that corn production has a significant positive impact on the NTP of the food crop subsector in Jambi Province. The study Tana et al. (2024) indicates that increased production and income from corn farming contribute to improvements in the NTP of corn farmers. Additionally, Burhansyah (2011) in corn production centers in West Kalimantan indicates that productivity is a factor with a positive influence on the corn NTP, whereas Sellinawaty (2024) shows that secondary crop production has a significant negative effect on the NTP of the food crops subsector in Indonesia because an increase in secondary crop output, including corn, may not raise the NTP if the additional production actually depresses prices at the farmer level, while input costs and living expenses remain high. Hanifah & Hidayah (2025) found that farmer productivity has a positive but insignificant effect on Indonesia's NTP, suggesting that increased productivity alone is insufficient to directly improve farmers' welfare unless accompanied by commodity price stability, distribution efficiency, and adequate value addition. Therefore, the relationship between corn productivity and the NTP remains relevant for further testing, particularly in cross-provincial studies that capture broader variations in food production.

More broadly, labor productivity should also be considered as a determinant of the NTP. According to the BPS, the GDP growth rate per worker—or real GDP growth per employed person—is one measure of labor productivity. Based on 2023 BPS data, the Agricultural Value Added Divided by the Number of Workers in the Agricultural Sector is as follows: Aceh 73,688,193.17/worker, North Sumatra 96,896,334.46/worker, West Sumatra 68,222,976.67/worker, Riau 235,350,879.04/worker, Jambi 114,799,868.80/worker, South Sumatra 41,893,250.02/worker, Bengkulu 56,376,195.91/worker, and Lampung 61,626,262.83/worker. These variations indicate that the efficiency and capacity for labor value-added creation differ across provinces. In relation to the NTP, higher labor productivity may reflect better regional economic efficiency, greater income opportunities, and the ability of farming households to maintain their purchasing power. However, previous research findings have not been entirely consistent. Istianto et al. (2026) found that agricultural labor has a positive and significant effect on the NTP. Conversely, Mulyana et al. (2024) showed that labor productivity actually has a negative and significant effect on the NTP, while Andriyani & Ananda (2023) found that the labor force participation rate in the agricultural sector has a positive but insignificant effect on the NTP. These differing findings suggest that labor variables remain relevant, but the direction of their influence is likely determined by production structure, mechanization, and the efficiency of the agricultural labor market in each region. A number of previous studies have also shown that issues regarding farmers' welfare cannot be explained by a single factor alone. The study Purba et al. (2023) in the Indonesian Journal of Agricultural Science indicates that in the case of West Java, regions with high rice production do not necessarily automatically have high levels of farmer welfare; factors such as production- s, productivity, milled rice prices, production costs, and additional capital continue to play a role in determining the farmers' terms of trade for food crops. This finding reinforces the hypothesis that the NTP is the result of the interaction of many factors, not merely a reflection of the sheer volume of agricultural production.

Based on the above discussion, research on the determinants of the Farmer's Price Ratio (FPR) across provinces in Indonesia is important to conduct, particularly because the FPR is a key indicator reflecting farmers' welfare. Through the NTP, it is possible to determine the extent to which farmers are able to exchange their production output to meet household consumption needs

and farming production costs. Thus, changes in the NTP are directly related to increases or decreases in purchasing power and the economic position of farmers. However, to date, there are still significant differences in the NTP across regions, so a national approach alone is insufficient to explain the actual conditions of farmers' welfare. Furthermore, changes in the CPI indicate varying levels of cost-of-living pressure across provinces, while differences in rice and corn productivity reveal that production capacity within the food crop subsector remains uneven. Variations in labor productivity also indicate that regional economic capacity to generate added value differs across regions. Therefore, an empirical analysis of the effects of the Consumer Price Index, Rice Productivity, Corn Productivity, and Labor Productivity on the Farmers' Price Ratio (NTP) is essential to identify the key factors driving changes in farmers' welfare across provinces in Indonesia. The results of this study are expected to serve as a basis for formulating more targeted policies regarding price control, increasing food sector productivity, and strengthening farmers' welfare in accordance with the characteristics of each region.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

Farmers' Exchange Rate

The Farmer's Price Ratio (NTP) is an indicator of farmers' terms of trade and purchasing power, calculated by comparing the price index received by farmers (I_t) to the price index paid by farmers (I_b). The Central Statistics Agency (BPS) emphasizes that the NTP reflects farmers' ability to exchange their produce for goods and services for household consumption and production costs. Conceptually, the relationship between rice variables and the provincial composite NTP is indeed not as direct as the relationship with the food crops subsector NTP (NTPP), but it remains logical and robust. The reason is that rice falls within the food crops subsector, which is one of the components forming the NTP; thus, changes in rice harvest area, productivity, and production will affect farmers' income, particularly in provinces where the agricultural structure is heavily reliant on food commodities. Therefore, in cross-provincial research, the rice variable can be positioned as an agro-economic determinant that influences the NTP through the channels of farm income and farmers' purchasing power. This is also consistent with the BPS statistical framework, which distinguishes between the aggregate NTP and the food crops subsector NTP. (previous research) (longer and more detailed version)

Consumer Price Index and Farmgate Price Index

The Consumer Price Index (CPI) reflects changes in the prices of goods and services consumed by households. In the context of farming households, a rise in the CPI reflects an increase in the cost of living, and in many cases is accompanied by rising prices of production inputs. Since the NTP is the ratio of I_t to I_b , a rise in the CPI tends to push I_b upward. If the price increases received by farmers are insufficient to offset the rise in consumption and production costs, the NTP tends to decline. This variation indicates that the price pressures faced by farmers differ across regions.

A number of empirical studies indicate that the effect of inflation on the NTP tends to be negative, although the level of significance is not always consistent. Syafa'at (2025) found in the case of West Java Province that inflation has a negative relationship with the NTP, although it is not statistically significant at the partial level. Research by Sellinawaty (2024) across 33 Indonesian provinces from 2016 to 2021 found that inflation has a negative and significant effect on the NTP of the food crops subsector in the long term. Meanwhile, the study Istianto et al. (2026) also reported that inflation has a negative but insignificant impact on the NTP. These findings suggest that, theoretically, inflation has the potential to suppress the NTP, but the magnitude of the effect may vary across regions and observation periods.

Based on the above discussion, this study treats regional inflation as a variable that is hypothesized to have a negative effect on the NTP. The higher the inflation rate in a province, the greater the likelihood that farmers' costs will rise, causing their purchasing power to weaken.

The Effect of Rice Crop Productivity on the NTP

Rice productivity reflects the ability to generate output per unit of land area. In the theory of production efficiency, higher productivity means that farmers are able to obtain greater yields from the same resources. This should increase farm income, lower the average cost per unit of output, and improve farmers' economic bargaining power. Therefore, theoretically, rice productivity is expected to have a positive impact on the NTP. At the food policy level, the Ministry of Agriculture also includes productivity, along with harvested area and production, as key indicators in national rice performance assessments and projections.

However, empirical results from the past five years again show variation. Triwidia et al. (2024) found that rice productivity had a positive and significant effect on farmers' welfare, as proxied by the NTP, across 34 provinces in Indonesia. Conversely, Mulyana et al. (2024) found that rice productivity was not significant for the NTP in 10 provinces with the highest share of the agricultural sector. Daud et al. (2025) also reported that rice productivity is not significantly associated with the NTP, which they attributed to distribution constraints and market price volatility. This implies that an increase in productivity does not necessarily automatically raise the NTP if the increase in output is not accompanied by favorable selling prices or adequate cost efficiency.

The Effect of Corn Productivity on the Net Farm Income

Corn productivity, like rice productivity, reflects the efficiency of land use in generating output. The higher the corn productivity, the greater the potential income for farmers from the food crop subsector, especially in provinces where the agricultural structure does not rely solely on rice. Through its publications on corn productivity and provincial corn statistics tables, BPS demonstrates that corn productivity is a key indicator for assessing food crop production capacity. Since the NTP essentially reflects farmers' purchasing power, an increase in corn productivity can theoretically boost the NTP through increased output and income.

Empirical studies that directly examine the productivity of corn in relation to NTP are still relatively limited. Available evidence from studies on corn output capacity. Siadari et al. (2024) finds that corn production has a positive and significant effect on the NTP of the food crops subsector in Jambi Province. Conversely, Sellinawaty (2024) —finds that *secondary crop* production has a negative and significant effect on the NTP of the food crops subsector in Indonesia. These conflicting findings suggest that an increase in corn or secondary crop output does not always raise the NTP; its effect may depend on the market's ability to absorb the output, price stability at the farm level, and the structure of production costs. Therefore, the corn productivity variable remains relevant to test, but the direction of its positive relationship should be treated as a theoretical hypothesis, not an empirical certainty.

The Impact of Labor Productivity on the Net Farm Income

Labor productivity reflects the workforce's ability to generate value added or output in economic activities. BPS metadata explains that labor productivity indicators are used to assess the extent to which the workforce contributes productively to economic activities. BPS also publishes indicators such as the real GDP growth rate per employed person and agricultural value added divided by the number of workers in the agricultural sector, which can serve as measures of labor productivity. These variations indicate that labor efficiency varies across regions. In relation to the NTP, higher labor productivity theoretically increases efficiency, value added, and income opportunities for farming households, thereby improving farmers' purchasing power.

Empirically, research findings on labor and the NTP have not yielded consistent results. Istianto et al. (2026) found that agricultural labor has a positive and significant effect on Indonesia's NTP. Conversely, Mulyana et al. (2024) showed that labor productivity actually has a significant and negative impact on the NTP in the 10 provinces with the highest share of the agricultural sector.

Andriyani & Ananda (2023) add that the labor force participation rate in the agricultural sector has a positive but not significant effect on the NTP in 34 Indonesian provinces during the pandemic; the variables tested in previous studies are not always identical to “labor productivity,” so it should be noted that direct empirical evidence for this variable remains limited. Nevertheless, theoretically, labor productivity remains relevant as a determinant of the NTP because it is related to production efficiency, value added, and the ability of farming households to maintain their well-being.

Formulation of the Hypothesis

Based on the theoretical review and empirical findings, the research hypotheses can be formulated as follows:

H1: The Consumer Price Index has a positive effect on the Farmer’s Price Ratio (FPR) across provinces in Indonesia.

H2: Rice productivity has an effect on the Farmer’s Price Ratio (NTP) across provinces in Indonesia.

H3: Corn productivity influences the Farmer’s Price Ratio (NTP) across provinces in Indonesia.

H4: Labor productivity has an effect on the Farmer’s Price Ratio (NTP) across provinces in Indonesia.

RESEARCH METHODS

This study employs a quantitative approach with an explanatory design. The data used are secondary panel data, which combine *cross-sectional* data across provinces in Indonesia with annual time-series data for the period 2020–2024. The study population includes all provinces in Indonesia. The sample was determined using a saturated sampling technique, which includes all provinces with complete data, except for the Special Capital Region of Jakarta, as there is no data on corn productivity for the years 2020–2024. Additionally, the provinces of South Papua, Central Papua, Papua Mountains, and Southwest Papua were established in 2022; therefore, complete and consistent data for these new provinces are not available for the years prior to their formation. The sample size was adjusted based on data availability, comprising 33 provinces, resulting in a total of 165 panel observations. Data were collected through documentation techniques from official publications of the Central Statistics Agency (BPS), including data on the Net Farm Income (NTP), Consumer Price Index, rice productivity, corn productivity, and labor productivity by province. The data were analyzed using panel data regression with the following model:

$$NTP_{it} = \alpha + \beta_1 IHK_{it} + \beta_2 PRICE_{it} + \beta_3 PCORN_{it} + \beta_4 PLP_{it} + \varepsilon_{it} \quad (1)$$

Note:

NTP_{it} = Farmers' Exchange Rate in province i in year t

α = constant

$\beta_1 \beta_2 \beta_3 \beta_4$ = regression coefficient

IHK_{it} = Consumer Price Index in province i in year t

$PRICE_{it}$ = Rice productivity in province i in year t

$PCORN_{it}$ = Corn productivity in province i in year t

PLP_{it} = Labor productivity in province i in year t

ε_{it} = error term

i = province

t = 2020–2024

The model was used to analyze the effects of the Consumer Price Index, Rice Productivity, Corn Productivity, and Labor Productivity on the Farmers’ Terms of Trade across provinces in Indonesia from 2020 to 2024. The analysis begins with a descriptive analysis, followed by the selection of the best model using the Chow Test, Hausman Test, and Lagrange Multiplier Test to

determine whether the most appropriate model is the Common Effects Model, Fixed Effects Model, or Random Effects Model. After the best model was obtained, classical assumption tests and hypothesis tests were conducted, including the coefficient of determination (R^2), t-test, and F-test. All tests were conducted at a 5% significance level.

RESULTS AND DISCUSSION

This study uses balanced panel data comprising 33 provinces in Indonesia over the 2020–2024 period, resulting in 165 observations. The dependent variable in this study is the Farmer's Price Index (FPI), while the independent variables include the Consumer Price Index (CPI), rice productivity, corn productivity, and labor productivity.

Table 1. Descriptive Statistics of Variables

Variable	Mean	Std. Dev.	Min	Max
NTP	111.218	15.256	92.84	181.9
CPI	112,171	5,801	103.7	125.17
Rice Productivity	45,438	8,383	26.92	62.07
Corn Productivity	52,325	11,697	23.85	76.79
Labor Productivity	86,324	52,596	24.94	291.04

Source: Data Analysis

Based on Table 1, the average NTP during the observation period was 111.218 with a standard deviation of 15.256. The minimum NTP value was 92.84 (story behind) and the maximum value was 181.9 (story behind). This indicates significant variation in the NTP across provinces during the 2020–2024 period. Meanwhile, the average CPI was 112.171, rice productivity was 45.438 quintals per hectare, corn productivity was 52.325 quintals per hectare, and labor productivity was 86.324. The differences between the minimum and maximum values for each variable indicate that economic conditions and agricultural productivity across provinces in Indonesia remain quite diverse.

Table 2. Model Selection Test Results

Test	Statistic	Value	p-value	Decision
Chow: Pooled OLS vs. Fixed Effects	F	16.529	<0.0001	Fixed Effects
Breusch-Pagan LM: Pooled OLS vs. Random Effects	Chi-square	184.517	<0.0001	Random Effects
Hausman: Fixed Effects vs. Random Effects	Chi-square	3.258	0.5156	Random Effect

Source: Data Analysis

The selection of the panel data regression model was conducted using the Chow test, the Breusch-Pagan Lagrange Multiplier test, and the Hausman test. The results in Table 2 show that the Chow test yielded an F-value of 16.529 with a p-value < 0.0001. These results indicate that the Fixed Effects model is superior to the Common Effects model. Furthermore, the Breusch-Pagan Lagrange Multiplier test yielded a chi-square value of 184.517 with a p-value < 0.0001, indicating that the Random Effects model is more appropriate than the Common Effects model. However, the results of the Hausman test showed a chi-square value of 3.258 with a p-value of 0.5156. Since the p-value is greater than 0.05, the Random Effects model was selected as the best model. Thus, differences in characteristics across provinces were still accounted for, but were not found to be systematically correlated with the independent variables. The selection of the Random Effects Model is also consistent with the research by falah et al. (2016), who used a panel data regression approach to analyze the price indices received and paid by farmers at the provincial level.

Table 3. Comparison of Models

Model	R ²	Adj. R ²
Pooled OLS	0.279	0.261
Fixed Effect Province	0.860	0.820
Random Effect	0.512	-

Source: Data Analysis

The summary of model comparisons in Table 3 shows that the Fixed Effect model has the highest R² value, namely 0.860, while the Random Effect model has an R² value of 0.512. Although the Fixed Effect model demonstrates higher explanatory power in terms of descriptive statistics, the results of the Hausman test remain the primary basis for determining the best model. Therefore, the Random Effect Model is used as the primary model in this study because it is more appropriate for the data structure and the results of the model selection test.

Table 4. Estimation Results of the Random Effects Model

Variable	Coefficient	Std. Error	t-stat	p-value
Constant	-15.550	15.167	-1.025	0.3129
CPI	1.180	0.165	7.164	<0.0001
Rice Productivity	-0.315	0.201	-1.567	0.1270
Corn Yield	0.131	0.103	1.266	0.2146
Labor Productivity	0.022	0.055	0.388	0.7005

Source: Data Analysis

The results of the Random Effects Model estimation in Table 4 indicate that the CPI variable has a positive and significant effect on the NTP. The CPI coefficient is 1.180, with a t-statistic of 7.164 and a p-value of <0.0001. This means that every 1-point increase in the CPI is associated with an increase in the NTP of approximately 1.180 points, assuming all other variables remain constant. This finding indicates that price changes reflected through the CPI have a strong relationship with changes in the NTP. Conceptually, the NTP is the ratio of the price index received by farmers to the price index paid by farmers. Therefore, the positive relationship between the CPI and the NTP suggests that price increases during the observation period are more closely linked to increases in output prices or prices received by farmers than to increases in consumption and production costs. This aligns with the explanation provided by the Central Statistics Agency in 2025, stating that the NTP reflects farmers' purchasing power through the comparison of prices received and prices paid by farmers.

Unlike the CPI, the rice productivity variable does not have a significant effect on the NTP. The rice productivity coefficient is -0.315 with a p-value of 0.1270. The negative sign of the coefficient indicates that an increase in rice productivity is not always followed by an increase in the NTP. This can occur when an increase in production is not offset by a rise in the prices received by farmers. Under certain conditions, increased production can actually depress selling prices if supply rises, while market structure and production costs do not favor the farmers' terms of trade. This finding aligns with research Daud et al. (2025), which found that rice productivity does not significantly affect the NTP in Indonesia. These results are further supported by Mulyana et al. (2024) who demonstrated that rice productivity is not always the primary determining factor in improving the farmers' terms of trade.

Corn productivity has a positive coefficient of 0.131, but it is not statistically significant due to a p-value of 0.2146. This indicates that increases in corn productivity are not strong enough to explain changes in the NTP across provinces. This situation may be due to differences in the structure of major commodities across regions. Not all provinces rely on corn as a dominant commodity, so changes in corn productivity do not necessarily have a direct impact on aggregate

farmer income. Furthermore, the NTP is influenced not only by production volume but also by selling prices, input costs, distribution costs, and farmers' bargaining power in the market. Therefore, increased agricultural commodity productivity does not necessarily directly improve farmers' welfare unless accompanied by improvements in prices and cost efficiency.

The labor productivity variable also does not have a significant effect on the NTP. The labor productivity coefficient is 0.022 with a p-value of 0.7005. This small coefficient value indicates that increases in labor productivity have not yet had a tangible impact on the rise in the NTP. This may be because labor productivity in the agricultural sector is not always accompanied by an increase in farmers' net income. Productivity gains may still be constrained by high input costs, limited market access, farmers' weak bargaining power, and disparities in agricultural technology across provinces. Daud et al.(2025) also found that informal agricultural labor does not have a significant effect on the NTP, so the results of this study are supported empirically by previous research.

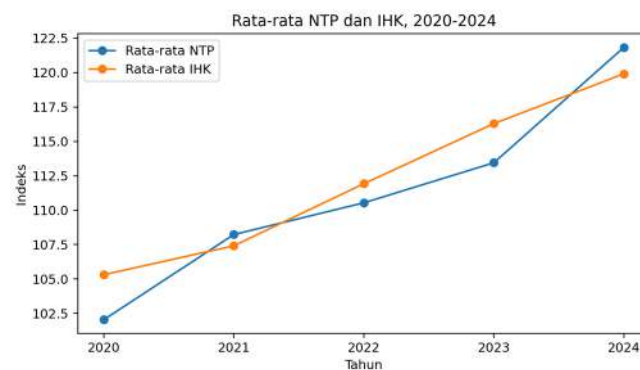


Figure 2. Average NTP and CPI, 2020–2024

Visually, Figure 2 shows the annual trends in average NTP and CPI. The graph indicates that CPI and NTP movements tend to move in the same direction during the observation period. This supports the results of the Random Effects model estimation, namely that CPI has a positive effect on NTP.

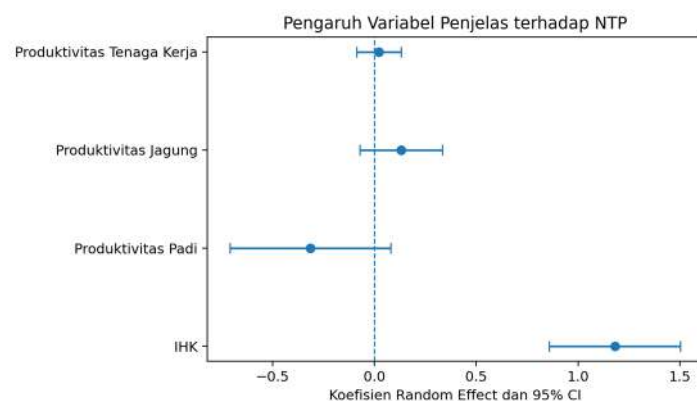


Figure 3. Random Effect Coefficients

Next, Figure 3 shows the random effect coefficients along with their 95% confidence intervals. The graph indicates that the CPI is the variable with the strongest and most significant influence on the NTP, while rice productivity, corn productivity, and labor productivity have confidence intervals that cross the zero line. This means that these three productivity variables have not yet demonstrated a statistically significant influence. Figure 3 shows a comparison between the actual NTP and the NTP predicted by the model. This graph illustrates that the model is capable of

capturing the general pattern of changes in the NTP, although there are still discrepancies between the actual and predicted values in some observations.

Table 5. Sensitivity Test Results

Variable	Coefficient	Std. Error	t-stat	p-value
Constant	-61,589	84,659	-0.727	0.4722
CPI	1,608	0.791	2.034	0.0503
Rice Productivity	-0.310	0.196	-1.580	0.1239
Corn Productivity	0.108	0.098	1.108	0.2762
Labor Productivity	0.029	0.050	0.575	0.5696

Source: Data Analysis

The results of the sensitivity test with the year control in Table 5 indicate that the year effect is significant in the model. The test of the year effect yielded an F-value of 3.675 with a p-value of 0.0073. This suggests that annual changes in conditions—such as price dynamics, macroeconomic policies, distribution disruptions, and post-pandemic economic shifts—also influence variations in the NTP. When the year dummy was included in the Random Effects model, the CPI coefficient remained positive at 1.608 with a p-value of 0.0503. Although its significance weakened, the direction of its effect remained consistent. Meanwhile, rice productivity, corn productivity, and labor productivity remain insignificant. Thus, the results of the sensitivity test reinforce the conclusion that price factors are more dominant in explaining NTP variation than physical productivity factors.

The findings of this study indicate that the increase in the NTP cannot be fully explained by an increase in agricultural productivity alone. The NTP is more closely related to the relationship between the prices received by farmers and the prices paid by farmers. Bague et al. (2024) explain that inflation in food commodities can increase the NTP if such price increases raise the prices received by farmers. However, inflation can also depress the NTP if price increases are greater on the consumption and production cost sides. Therefore, the impact of prices on the NTP must be examined carefully, as the effect depends on which side experiences the larger increase. Studies by Nirmala et al. (2016) and Apipah (2021) also indicate that the factors influencing the NTP can vary across regions, depending on commodity characteristics, cost structures, and agricultural market conditions.

Based on these findings, a policy implication that can be proposed is the need to strengthen policies that focus not only on increasing production but also on raising the prices received by farmers. Local governments need to improve market access, strengthen farmer institutions, reduce distribution costs, maintain the stability of input prices, and ensure that productivity gains actually increase farmers' incomes. Thus, improvements in farmers' welfare depend not only on the volume of production but also on farmers' ability to obtain fair selling prices and manage production costs more efficiently.

CONCLUSION

Based on the results of panel data regression across 33 provinces in Indonesia during the 2020–2024 period, the most appropriate model for this study is the Random Effects Model. The selection of this model is based on the results of the Chow test, the Breusch-Pagan Lagrange Multiplier test, and the Hausman test. The test results indicate that there are differences in characteristics across provinces, but these differences were not found to be systematically correlated with the independent variables. Therefore, the Random Effects Model is considered more appropriate for explaining the determinants of the Farmer's Exchange Rate across provinces in Indonesia.

The estimation results indicate that the CPI has a positive and significant effect on the NTP. These findings suggest that price changes play a key role in explaining variations in the NTP. An

increase in the CPI during the study period was associated with an increase in the NTP, indicating that price increases likely stemmed primarily from the prices received by farmers. Meanwhile, rice productivity, corn productivity, and labor productivity do not have a significant effect on the NTP. Thus, an increase in physical productivity does not automatically improve farmers' terms of trade and purchasing power.

In general, the results of this study confirm that the NTP is influenced more by price dynamics than by productivity alone. Therefore, efforts to improve farmers' welfare cannot rely solely on increasing production and productivity. Agricultural policies need to be directed toward strengthening the selling prices of agricultural products, controlling input costs, improving distribution, increasing market access, and strengthening farmers' bargaining power. With such policies, it is hoped that productivity gains will truly lead to increased income and improved well-being for farmers.

This study has limitations because it uses only data from 2020–2024 and variables available in secondary data, namely the CPI, rice productivity, corn productivity, and labor productivity. Future research could include additional variables, such as the farmer price index, the farmer cost index, agricultural input costs, harvested area, production of major commodities, market access, and subsidy policies. The inclusion of these variables is expected to provide a more comprehensive picture of the factors influencing the NTP in Indonesia.

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