

Evaluation Of The Government Purchase Price Policy (Hpp) Of Grain On The Exchange Rate Of Rice Farmers: An Analysis Study Of The Provinces Of The Special Region Of Yogyakarta And Central Java

Suriadi¹, Imamudin Yuliadi², Agus Tri Basuki²

^{1,2}Master of Development Economics Study Program, University of Muhammadiyah Yogyakarta, Indonesia
Correspondence:

Email: imamudin2006@yahoo.co.id

Abstract.

Farmer Terms of Trade (NTP) is a key indicator of farmer welfare, reflecting the relationship between prices received and prices paid by farmers. This study analyzes the determinants of NTP across 40 regencies/cities in the Special Region of Yogyakarta and Central Java during 2018–2025 using regency-level panel data regression ($n = 320$). The variables examined include the Government Purchase Price (HPP) of unhusked rice, inflation, poverty, subsidized fertilizer price, and agricultural productivity. Sequential specification tests (Chow and Hausman) indicate that the Fixed Effects model with Driscoll–Kraay standard errors is the most appropriate estimator to address the autocorrelation and cross-sectional dependence detected in diagnostic testing. The estimation results show that HPP and productivity have a significant positive effect on NTP, while poverty has a significant negative effect; inflation and subsidized fertilizer price show no significant effect. The model explains 52.1% of the variation in NTP (within R^2). These findings confirm that price-stabilization policy and productivity improvement are the primary instruments for strengthening rice farmers' welfare.

Keywords: Farmer Terms of Trade; Government Purchase Price; Agricultural Productivity; Panel Data and Farmer Welfare.

I. INTRODUCTION

The agricultural sector plays a strategic role in the Indonesian economy, both as a labor absorber, food provider, social stability supporter, and rural economic driver (FAO, 2017). Inclusive agricultural development is closely linked to the Sustainable Development Goals agenda, especially without poverty, without hunger, as well as decent work and economic growth (Sayed, 2015). Despite its significant contribution to macroeconomic stability, the welfare of farmers' households still faces structural challenges, the aging of the agricultural workforce and declining interest of the younger generation, limited land area, and fluctuations in commodity prices (Badan Pusat Statistik Indonesia, 2023; Susilowati, 2016), in a weak bargaining position in the food distribution chain, so that its real income is vulnerable to market price fluctuations (Suryana, 2014). One of the indicators commonly used to photograph the purchasing power and relative welfare of farmers is the Farmer Exchange Rate (NTP), which is the ratio of the price index received by farmers (I_t) to the price index paid by farmers (I_b) in the form of a percentage. An NTP above 100 indicates a surplus or increase in welfare, while a value below 100 indicates purchasing power pressure due to high consumption costs and production inputs (Badan Pusat Statistik Indonesia, 2024).

This study chose Central Java and the Special Region of Yogyakarta (DIY) because of three considerations. First, the two provinces are neighboring and have a close relationship in the food supply chain, but show contrasting agricultural structures, making it relevant to test whether the determinants of NTP work uniformly or heterogeneously between regions. Second, Central Java is one of the national rice barns with large production scales and adequate irrigation infrastructure, so that HPP policies and commodity price dynamics have a significant aggregate impact on the regional economy and national food security. Third, DIY represents contrasting agrarian characteristics: small-scale farming, high land fragmentation, and pressure on land conversion due to property expansion, tourism, and education (BPS DIY, 2025). These structural differences make the sensitivity of NTP to subsidized fertilizer prices, inflation, and productivity potentially different between regions, so that the combination of 40 districts/cities in the two provinces provides sufficient variety to comprehensively analyze the determinants of NTP (Afifah & Nalurita, 2022).

As an instrument of market intervention to protect farmers' income from falling prices during the harvest season, the government has established a grain HPP policy (Badan Pangan Nasional, 2025), tasked Bulog with absorbing crop yields to maintain producer price stability as well as national food reserves.

The effectiveness of HPP in increasing real income remains debated due to price disparities, limited absorption quotas, as well as rising rural inflation and cost factors (Maulana & Rachman, 2011). Previous studies have found that commodity prices, inflation, and productivity are important determinants of NTP, although the direction and significance of their effects often differ between regional and period contexts (Nirmala et al., 2016 ; Widi, 2021). Therefore, an analysis that accommodates heterogeneity between regions is needed while correcting typical econometric problems of panel data such as autocorrelation and interunit dependency (Nainggolan & Soetjpto, 2016). Based on this background, this study aims to: (1) analyze the influence of grain HPP, inflation, poverty rate, subsidized fertilizer prices, and productivity on NTP in 40 districts/cities in Yogyakarta and Central Java during 2018–2025; and (2) obtain robust parameter estimation by accommodating typical econometric problems of panel data. The contribution of this research lies in the use of Driscoll–Kraay estimators to ensure the validity of regional level statistical inference.

II. LITERATURE REVIEW

NTP is calculated as a comparison of the price index received by farmers (*It*) to the price index paid by farmers (*Ib*), expressed as a percentage. The *It* index is sourced from a manufacturer-level price survey, while *Ib* includes the price of household consumption goods as well as the cost of production and the addition of capital goods (Badan Pusat Statistik Indonesia, 2024). NTP conceptually reflects the exchange rate of farmers' produce for the expenses they have to bear, and is often used as a proxy for the relative welfare of farmers (Sukirno, 2006), in line with the theory of farmer welfare which assumes that the improvement of rural living standards is directly correlated with the ability of agricultural commodities to exchange for non-agricultural goods.

Triwidia et al., (2024), using panel data from 34 provinces in Indonesia for the 2019–2022 period, it was found that rice productivity and the price index paid by farmers had a significant effect on farmers' welfare, while rice production had a negative effect, indicating that production volume alone did not automatically increase the NTP without improving the price structure. At the provincial level, (Purba et al., 2024), found that although West Java is the third largest rice producer nationally, its food crop NTP (NTPTP) was below 100 in the two years of observation, with the selling price of milled dry grain being the only factor that had a real effect on the increase in NTPTP. These findings show a dissociation between the aggregate production capacity of a region and the level of welfare of its farmers, a relevant phenomenon tested in the context of Central Java and DIY with contrasting production structures. However, the majority of previous studies still focused on the provincial or national level with a relatively short observation period and have not accommodated structural heterogeneity between districts/cities, so the estimates have the potential to be biased due to aggregation biases that ignore micro-regional variations.

Grain HPP is a minimum price policy (floor price) designed as a safety net to maintain production incentives and producer price stability, especially during the harvest (Maulana & Rachman, 2011). The increase in HPP is expected to raise the IT index so as to protect farmers from the exploitation of long market chains (Saleh et al., 2024). The effectiveness of HPP on farmers' welfare is still an empirical debate: research on the dry grain HPP policy for harvested grain shows that its effectiveness is highly dependent on the policy period and the magnitude of the increase in input costs, where in one period the price increase is driven more by the increase in production costs. On the other hand, a study on Lombok Island found that the implementation of HPP relatively maintained grain price stability at the farmer level during the observation period, although the price disparity of grain and rice still occurred due to asymmetrical price transmission. Recent developments show that the government will continue to increase the HPP progressively in 2024–2025 (Badan Pangan Nasional, 2025). However, studies that examine the impact of this recent increase in HPP on NTP directly within the framework of regional panel data are still limited. Based on this description, the first hypothesis (H1) is proposed: Grain HPP has a positive effect on NTP.

The influence of inflation on the NTP is ambiguous. Inflation stemming from the increase in agricultural commodity prices can improve the NTP, while inflation, which is dominated by an increase in the price of consumer goods and production inputs, actually suppresses it (Nirmala et al., 2016; Agustian,

2025). With the estimation of the fixed effect model on the NTP of smallholder plantations, it was found that the price inflation of plantation products had a significant positive effect, indicating that when the source of inflation came from the commodity prices of farmers themselves, the impact was beneficial. In the context of food crops with a more dominant input cost structure, other studies showed an inverse relationship, indicating that the source and composition of inflation did not merely determine the direction of its influence on the NTP. These studies generally used a univariate time series approach or provincial panels without distinguishing specific commodities (rice) at the district/city level, so that the sensitivity of inflation to rice NTP in areas with different agrarian structures such as DIY and Central Java has not been widely explored. Based on this uncertainty, a second hypothesis (H2) was proposed: Inflation has a significant effect on NTP. The level of rural poverty reflects the weak purchasing power and bargaining position of farmers' households. Areas with high poverty tend to have a price structure and economic capacity that is less favorable to farmers, so it is estimated that the NTP will decrease (Christiaensen et al., 2011). The domestic literature generally positions NTP as an explanatory variable for poverty, while the opposite direction of the influence of regional poverty on NTP in the context of district/city panel data has relatively not been explicitly tested, thus opening up space for empirical contribution to this study. Based on this correlation, a third hypothesis (H3) is proposed: Poverty level has a negative effect on NTP.

Fertilizer is the main component of the production cost of farming. The increase in subsidized fertilizer prices increases the I_b component, thus potentially depressing the NTP. However, because subsidized fertilizer prices are set through the Highest Retail Price (HET) and are relatively controlled, their effect on NTP can be insignificant at the regional level if the distribution. Marsudi et al., (2020), found that the rice NTP in Aceh Province has a downward trend while the price of subsidized urea fertilizer is increasing, with a regression model explaining about 63 percent variation in rice NTP through harvest area, subsidized urea fertilizer prices, inflation, and rupiah exchange rates. These findings are relevant to the context of DIY which is dominated by small-scale farming, as it indicates that the sensitivity of NTP to subsidized fertilizer prices has the potential to differ between large land areas (Central Java) and high-land fragmented areas (DIY), a dimension of spatial heterogeneity that has not been widely tested in the integrated regional panel data framework. Based on these dynamics, a fourth hypothesis (H4) is proposed: Subsidized fertilizer prices have a negative effect on NTP.

Rice productivity, measured through production output per hectare, is a supply-side determinant that determines the volume of commodities that farmers can sell. Increased productivity allows farmers to obtain greater production value without increasing land area, thus potentially increasing the I_t and NTP indices, as long as the increase in volume is not followed by a decrease in prices due to oversupply during the harvest. Triwidia et al., (2024), found that rice productivity had a significant positive effect on the welfare of farmers in 34 provinces, in line with Afifah & Nalurita (2022) found that rice productivity had a significant positive effect on the NTP of the food crop subsector, while GDP had a negative effect implying that the increase in production capacity at the agricultural level was more directly felt by farmer households than by the increase in the regional economic scale. These studies were generally conducted at the provincial level with a relatively short observation period and did not consider the interaction between productivity and price policies (HPP) as well as the structural condition of land between regions. In Central Java with a large production scale, productivity increases have the potential to have a significant aggregate impact on NTP, while in fragmented Yogyakarta, the impact on farmers' real income may be relatively limited. Based on this description, a fifth hypothesis (H5) is proposed: Productivity has a positive effect on NTP.

The literature synthesis shows three research gaps that are the basis of the novelty of this research. First, the majority of previous studies used provincial or national analysis units with short observation periods (generally no more than four years); this study fills it with 40 districts/cities in two provinces with contrasting agricultural structures during 2018–2025, covering a period of progressive HPP increase 2024–2025 (Badan Pangan Nasional, 2025) that have not been covered by previous studies. Second, methodologically, most previous studies have not explicitly tested and corrected autocorrelations and interunit dependencies, even though both commonly appear in regional panel data connected through

commodity supply chains and simultaneous national price policies. This study applies a robust Driscoll–Kraay standard errors estimator to heteroscedasticity, autocorrelation, and dependency between units simultaneously (Driscoll & Kraay, 1998; Hoechle, 2007). Third, substantively, no studies have been found that examine the five determinants simultaneously in the regional contexts of DIY and Central Java, so this study is expected to make a new empirical contribution to food price policies that are more sensitive to the heterogeneity of agrarian structures between regions.

III. RESEARCH METHOD

1. Types and Data Sources

This quantitative research applies panel data analysis (nearly balanced panel) to objectively test the influence of macroeconomic variables on NTP (Creswell & Creswell, 2017). The panel data design is used to combine cross-section and time series variations, control unobserved heterogeneity, and improve estimation efficiency (Wooldridge, 2010; Baltagi, 2025). The unit analysis covers 40 districts/cities in Yogyakarta and Central Java during 2018–2025 ($n = 320$ observations), a range that represents policy dynamics from the pre-pandemic phase, Covid-19 disruption, to progressive price adjustments. The research variables consisted of NTP (dependent) and HPP of grain, inflation, poverty rate, subsidized fertilizer prices, and productivity (independent). The secondary data used were entirely sourced from official publications of the Central Statistics Agency, the National Food Agency, and the Ministry of Agriculture.

2. Model Specifications and Variable Operational Definitions

The structural relationships between variables are formulated into the following linear panel data regression model:

$$NTP_{it} = \beta_0 + \beta_1 HPP_{it} + \beta_2 INF_{it} + \beta_3 MISKIN_{it} + \beta_4 HPS_{it} + \beta_5 \ln PROD_{it} + \alpha_i + \varepsilon_{it}$$

where i expresses district/city units, t expresses year, α_i individual effects, and ε_{it} errors. Three estimation models were tested: Pooled OLS (ignoring α_i), Fixed Effects (treating α_i as a fixed parameter of the group), and Random Effects (treating α_i as a random component) (Wooldridge, 2010; Gujarati, 2012).

Table 1. Variable Operational Definitions

Variabel	Symbol	Definitions and Units
Farmer's Exchange Rate	NTP_{it}	The ratio of the price index received to the price index paid by farmers (index)
Government Purchase Price	HPP_{it}	Basic price of grain purchase by the government (Rp/kg)
Inflation	INF_{it}	Annual inflation rate (percent)
Poverty	$MISKIN_{it}$	Persentase penduduk miskin (persen)
Subsidized fertilizer prices	HPS_{it}	Percentage of poor population (percent)
Productivity	$PROD_{it}$	Rice productivity (tons/ha); incorporated into the model in the form of $\ln$

Note: the interpretation of the HPP and HPS symbols is an adjustment based on the range of data values.

3. Stages of Model Selection and Assumption Test

The estimation of the panel data model began with the Chow test to choose between the Common Effect Model (CEM) and the Fixed Effect Model (FEM), followed by the Hausman test to compare the FEM and the Random Effect Model (REM) (Wooldridge, 2010; Gujarati, 2012). After the best model is selected, the residual is evaluated through four classical assumption tests to ensure the Best Linear Unbiased Estimator (BLUE) criteria: multicollinearity test ($VIF < 10$), heteroscedasticity test (modified Wald test), autocorrelation test (Wooldridge test), and interunit dependency test (Pesaran CD test) to anticipate spatial interconnectedness between districts/cities kota (Drukker, 2003; Pesaran, 2021). If the test results indicate violations of heteroscedasticity, autocorrelation, or interunit dependencies, the study applies the Driscoll–

Kraay standard errors correction (Driscoll & Kraay, 1998; Hoechle, 2007). which produces a robust standard error for the three violations without changing the estimation coefficient of the basic model parameters.

IV. RESULT AND DISCUSSION

1. Descriptive Statistics

The development of NTP in both provinces during 2018–2025 (Figure 1) shows a pattern consistent with the structural heterogeneity argument in the preliminary section, the NTP of Central Java is generally above the DIY NTP throughout the observation period, with the gap widening in 2023 along with the beginning of a progressive increase in HPP (Figure 2). This pattern is the initial empirical motivation for the analysis of NTP determinants carried out in the next section.

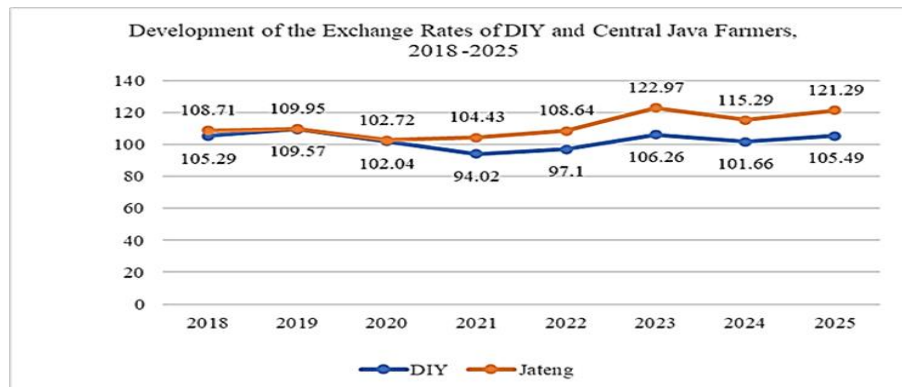


Fig. 1. Development of the Exchange Rate of Farmers in Yogyakarta and Central Java, 2018–2025

Source: National Food Agency (Processed), 2026

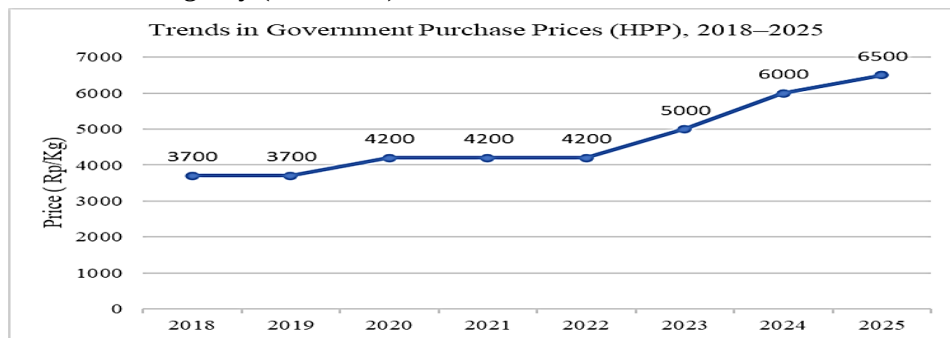


Fig 2. Government Purchase Price (HPP) Trends, 2018–2025

Source: National Food Agency (Processed), 2026.

The descriptive statistics in Table 2 show sufficient variability for regression estimation. The NTP generally reflects the real income surplus conditions for farmers in Yogyakarta and Central Java, although the minimum–maximum range shows wide disparities in welfare between regions and between periods. This pattern of heterogeneity provides an empirical justification for the use of panel data models compared to ordinary linear models. The high coefficient of variation in the HPP confirms that this variable dominantly captures intertemporal variations due to periodic adjustments of national regulations, while inflation records the highest fluctuations among all macro variables, reflecting the impact of regional supply chain disruptions and the transmission of global price volatility to the domestic level. Structural gaps were also identified at poverty levels, separating highly economically diversified urban areas and agrarian-based rural areas. Subsidized fertilizer prices showed moderate and stable variability, in line with centralized HET policies, while productivity diversity confirmed the asymmetry of farming efficiency between districts/cities due to differences in land quality, irrigation infrastructure, and technology adoption. Overall, cross-section and time-series variations across these variables indicated unobserved region-specific effects (unobserved heterogeneity), thus confirming the importance of testing model specification at a later stage.

Table 2. Descriptive Statistics

Variabel	Obs	Average	Std. Dev.	Min	Max
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<https://ijersc.org>

ntp	320	110,62	7,37	94,02	122,97
hpp	320	4.687,50	986,98	3.700	6.500
inflation	320	2,75	1,27	1,28	6,49
poverty	320	10,69	3,52	3,80	18,38
hps	320	2.081,25	218,20	1.800	2.250
productivity	320	5,52	0,55	3,56	7,53

Source: Research Data Processing Results (2026).

2. Correlation Matrix

Correlation results showed that the relationship between independent variables was at low to moderate levels, with the highest coefficient of 0.645 between HPP and subsidized fertilizer prices (HPS) still below the general threshold for identifying multicollinearity. The variables inflation, poverty, and ln (productivity) showed only weak correlations with other variables, indicating that each variable provided different information in explaining NTP variation and was worthy of simultaneous inclusion in the model. These findings were further confirmed through the VIF test.

Table 3. Pearson Correlation Matrix

variabel	hpp	inflation	poverty	hps	lnprod
hpp	1,000				
inflation	-0,189*	1,000			
poverty	-0,150*	-0,022	1,000		
hps	0,645*	0,223*	-0,069	1,000	
ln(productivity)	-0,026	-0,049	-0,109	-0,083	1,000

Source: Research Data Processing Results (2026).

3. Multicollinearity Test

The VIF values of all independent variables ranged from 1.02–2.20 with an average of 1.56, all below the threshold of 10. Thus, the model did not indicate significant multicollinearity so that all independent variables were feasible for use in panel regression estimation.

Table 4. VIF Value

Variabel	VIF	1/VIF
hpp	2,20	0,455
inflation	2,19	0,456
poverty	1,33	0,753
hps	1,04	0,960
ln(produktivitiy)	1,02	0,979
Average VIF	1,56	-

Source: Research Data Processing Results (2026).

4. Model Selection and Diagnostic Tests

The selection of the model was carried out through the Chow test and Hausman test. The results showed that the Fixed Effects (FE) model was most suitable for estimating the influence of HPP, inflation, poverty, subsidized fertilizer prices, and productivity on NTP, because it was able to accommodate unobserved heterogeneity in each district/city so as to produce more consistent estimates. Diagnostic testing showed that the model did not experience heteroscedasticity, but there was autocorrelation and cross-sectional dependence. This condition indicates that the conventional standard error in the FE model has the potential to produce biased inference, so the final estimate uses robust Driscoll–Kraay standard errors on these three issues.

Table 5. Summary of Assumption Test

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Test	Statistics	p-value	Conclusion
Modified Wald (heteroscedasticity)	$\chi^2 (40) = 18,59$	0,999	Homoskedostic
Wooldridge (autokorelasi)	F (1,39) = 168,05	0,000	There is an autocorrelation
Pesaran CD (heteroscedasticity)	CD = 61,50	0,000	There are dependencie

Source: Research Data Processing Results (2026).

5. Estimated Results

The results of the estimation of FE, RE, and FE with Driscoll–Kraay standard errors (FE-DK) show that the coefficients of FE and FE-DK are relatively the same, while the difference lies in the standard error that has been corrected to overcome the potential for heteroscedasticity, autocorrelation, and interunit dependence. The interpretation of the results of the study therefore refers to the FE-DK model as a more inferentially robust estimator. The FE-DK model explains 52.1% of the variation in NTP (R^2 within = 0.521) and is statistically significant (F-statistic = 22.71; $p < 0.001$), indicating that the independent variables together have an effect on the change in NTP.

Table 6. Comparison of Estimated Results (Bound Variable: NTP)

Variabel	FE	RE	FE Driscoll–Kraay
hpp	0,0032*** (0,0007)	0,0054*** (0,0005)	0,0032** (0,0010)
inflation	0,6059* (0,3213)	1,2107*** (0,2851)	0,6059 (0,8489)
poverty	−2,7735*** (0,7214)	−0,1494 (0,0912)	−2,7735* (1,4441)
hps	0,0003 (0,0023)	−0,0039* (0,0021)	0,0003 (0,0052)
ln(produktivty)	9,7394** (4,7601)	9,2734*** (3,1564)	9,7394*** (2,2508)
Konstanta	106,47*** (11,82)	75,94*** (6,63)	106,47*** (14,95)
Observations	320	320	320
Number of units	40	40	40
R^2 (within)	0,521	0,497	0,521

Note: Standard error in parentheses. $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6. Discussion

6.1. The Effect of Government Purchase Price (HPP) on Farmers' Exchange Rates

The results of the FE-DK estimate show that the HPP of grain has a positive and significant effect on the NTP (coefficient 0.0032; $p = 0.012$). Economically, the increase in HPP of Rp100/kg is related to the increase in NTP of around 0.32 points, indicating that the HPP policy still plays an important role in strengthening the economic position of rice farmers in Yogyakarta and Central Java. The mechanism can be explained through the relationship between the price index received (It) and the farmers' paid (Ib): when the HPP rises and is transmitted to the price received by farmers, it increases, and if the increase exceeds the change in Ib, the NTP will increase. The HPP thus works not only as a pricing instrument, but also as a mechanism to protect farmers' income when there is price pressure in the harvest period with the potential for oversupply in line with the theory of producer welfare and the concept of the price floor, and is consistent with the findings (Saleh et al., 2024), which places HPP as an instrument with consequences for producers and consumers. However, the relatively small amount of HPP coefficient suggests that the increase in HPP

does not fully translate into an improvement in farmers' welfare. Possible causes are the gap between policy prices and actual transaction prices, as well as differences in market access, institutional capacity of farmers, and the government's ability to absorb grain between regions. The implication is that the government needs to maintain a HPP policy that is adaptive to production costs and market conditions, accompanied by strengthening grain absorption mechanisms, farmers' access to formal markets, and institutional strengthening of farmer groups.

6.2. The Effect of Productivity on Farmers' Exchange Rates

Rice productivity showed a positive and significant influence on NTP (coefficient 9.74; $p = 0.003$). Since productivity was included in logarithm, a 10% increase in productivity was associated with an increase in NTP of about 0.97 points, confirming that increased productivity is an important mechanism in improving farmers' welfare. The mechanism is explained through an increase in output per unit area of land, when productivity increases, farmers produce a larger volume of grain from the same land, and if the selling price is relatively fixed and production costs do not increase proportionally, the farmer's income increases so that the NTP improves. This relationship remains dependent on market conditions, because oversupply at harvest can depress grain prices. These findings are in line with Triwidia et al., (2024) ; Afifah & Nalurita, (2022), Both found that rice productivity has a significant positive effect on farmers' welfare/NTP, reinforcing evidence that increased production per unit of land is more directly related to farmers' welfare than simply increasing aggregate production. Differences in regional contexts still need to be considered, in Central Java, increased productivity has the potential to generate greater additional income due to the wider scale of farming, while in Yogyakarta, increased productivity on narrow land may result in more limited additional absolute income. The implication of the policy is that increased productivity needs to be placed as a core part of the farmer welfare strategy, through access to superior seeds, cultivation technology, irrigation, mechanization, and extension, accompanied by marketing policies so that additional production does not depress prices during the harvest.

6.3. The Effect of Poverty on Farmers' Exchange Rates

The poverty rate had a negative effect on the NTP (coefficient -2.77 ; $p = 0.096$, significant at the level of 10%), supporting the third hypothesis: districts/cities with higher poverty tended to have a lower farmer exchange position. The welfare of farmers was determined not only by prices and productivity, but also by the socio-economic conditions that surrounded them. Mechanismally, high poverty reflects limited household access to capital, technology, market information, and productive resources, so that farmers' adaptation capacity to increased production costs or decreases in grain prices is lower and their bargaining position weakens. These findings are in line with (Christiaensen et al., 2011), which emphasizes the role of the agricultural sector in poverty reduction, while expanding the literature that has positioned NTP as a variable that affects poverty, this study actually examines the opposite direction at the district/city level. The implication is that the increase in NTP cannot be separated from rural poverty reduction policies that are directed at access to business capital, technology, markets, and strengthening farmers' economic institutions, not just short-term consumptive assistance.

6.4. The Effect of Inflation on Farmers' Exchange Rates

In contrast to the research hypothesis, inflation had no significant effect on the NTP in the FE-DK model ($p = 0.498$). These results suggest that the change in general inflation is not strong enough to explain the change in the NTP after considering district/city heterogeneity, autocorrelation, and inter-regional dependency. Theoretically, the effect of inflation on the NTP is indeed ambiguous: inflation from increases in farmers' commodity prices can increase IT, while inflation from increases in consumption and input prices can increase Ib, so that the aggregate inflation does not necessarily reflect the direction of changes in farmers' welfare. The insignificance of inflation may be due to the characteristics of NTP that are more sensitive to commodity prices and specific production costs than changes in general prices, plus the use of the Driscoll–Kraay standard error that accommodates interunit dependencies and autocorrelations so that the influence of inflation that may appear strong in conventional models becomes insignificant after correction.

Differences with previous research (Widi, 2021) those who find significant relationships do not necessarily indicate theoretical contradictions, given differences in units of analysis, commodities, periods, and estimation methods. The implication of the policy is that the government does not sufficiently use general inflation as the main indicator of the evaluation of farmers' welfare; monitoring should be directed to the development of grain prices received by farmers as well as input prices and consumption needs that directly form the NTP.

6.5. The Effect of Subsidized Fertilizer Prices on Farmers' Exchange Rates

The price of subsidized fertilizers had no significant effect on the NTP ($p = 0.958$), so the fourth hypothesis did not receive empirical support. Theoretically, the increase in fertilizer prices should increase the Ib and suppress the NTP, but the empirical results showed that this mechanism was not strong enough to produce a statistically significant relationship, possibly because subsidized fertilizer prices were relatively homogeneous due to the government's HET policies, quotas, and distribution mechanisms, so that the variation between regions faced by farmers was limited. These results differed from the findings (Marsudi et al., 2020), in Aceh, this is likely due to differences in regional characteristics, research periods, and the level of dependence of farmers on subsidized fertilizers. The insignificance of fertilizer prices does not mean that fertilizer policies are not important for farmers; these findings are more accurately interpreted that the variation in subsidized fertilizer prices during the study period and area has not been large enough to be the main determinant of NTP changes. The policy focus therefore needs to shift from simply maintaining fertilizer prices to improving the accuracy of distribution and availability of fertilizers at the time needed

6.6. Policy Implications

Overall, the results of the study show that increasing the NTP of rice farmers requires a combination of price policy and structural policy. HPP and productivity were shown to be positively and significantly related to NTP, while poverty suppressed farmers' exchange positions; inflation and subsidized fertilizer prices did not show a significant influence in the FE-DK model. The model explains about 52.1% of the variation in NTP, so there are still other factors outside the model that have the potential to affect farmers' welfare. Based on these findings, five policy directions are proposed. First, HPP policies that are adaptive to changes in production costs and market conditions, accompanied by increasing the government's grain absorption capacity so that policy prices become an effective reference at the farmer level. Second, increasing productivity per hectare through improvements in irrigation, seeds, cultivation technology, mechanization, and extension, is integrated with marketing strengthening so that additional production does not depress prices during the harvest. Third, the integration of agricultural policies with rural poverty reduction strategies through access to business capital, technology, market information, and farmers' economic institutions. Fourth, the evaluation of farmers' welfare should not only rely on macro indicators such as inflation, but also monitor grain prices at the producer level, input costs, market access, and marketing margins. Fifth, subsidized fertilizer policies need to emphasize more on the accuracy of targets and distribution effectiveness rather than simply maintaining low prices. Thus, improving the welfare of rice farmers cannot rely on just one policy instrument: HPP provides protection from price risks, productivity increases income capacity, while poverty reduction strengthens farmers' ability to access and utilize productive resources. The combination of these three approaches is more in line with the characteristics of agriculture in Yogyakarta and Central Java, which have structural heterogeneity between regions.

V. CONCLUSION

This study analyzed the determinants of Farmer Exchange Rate (NTP) in 40 districts/cities in Yogyakarta and Central Java during 2018–2025 using panel data regression. The Fixed Effects model with standard error Driscoll–Kraay (FE-DK) provides robust empirical evidence that grain HPP and rice productivity have a positive and significant effect on NTP, while poverty levels have a negative effect on farmers' purchasing power. Inflation and subsidized fertilizer prices did not show a significant effect after considering inter-regional dependency and autocorrelation. The model was able to explain 52.1% of NTP

variations, emphasizing the importance of price policies, production efficiency, and socio-economic conditions in determining farmers' welfare.

For policymakers, HPP policies need to be adaptive and accompanied by strengthening grain absorption capacity, while productivity enhancement and rural poverty reduction need to be integrated as a package of farmer welfare policies, not stand-alone instruments. For further research, this model only explains 52.1% of the NTP variation, so it is necessary to include broader structural factors such as access to credit, farmer group institutions, and marketing infrastructure, as well as dynamic approaches (e.g., dynamic or spatial panel models) to capture changes in farmers' welfare and the effects of long-term inter-regional linkages.

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