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Research Article

Determinants of Rice Consumption in South Sulawesi Using a Panel Data Approach

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Abstract: This study aims to analyze the factors that affect rice consumption in South Sulawesi Province using a panel data approach for 2018–2024. The dependent variables used are rice consumption (tons), while the independent variables include per capita income, household size, rice production, human development index (HDI), and percentage of poor population. The analysis was performed with a panel data regression model using R software, with a series of model specification tests including the Chow test, the Hausman test, and the Lagrange Multiplier (LM) test. The best model obtained is the Fixed Effect Model (FEM). Partially, the variables of household size and rice production had a significant negative effect on rice consumption, while HDI had a significant positive effect. The variables of per capita income and poverty level have a negative but not significant effect. These results indicate that rice consumption in South Sulawesi is more influenced by social aspects and quality of life than purely economic factors. These findings affirm the importance of food security policies that focus on improving human development, rice distribution efficiency, and strengthening social protection programs to maintain the stability of household food consumption.

Keywords: Fixed Effect Model, Food Security, Human Development, Panel Data, Rice Consumption

1. Introduction

Rice is the main staple food for the majority of the Indonesian population.

As a dominant source of carbohydrates, this commodity supplies nearly half of the average calorie requirement and approximately 47% of the population's daily protein intake (Wardani et al., 2019). The rice consumption participation rate in Indonesia is close to 100% (Wardani et al., 2019), meaning that almost all households consume rice. This makes rice highly strategic in terms of national, social, and economic food security. The government has long prioritized rice self-sufficiency and price stabilization, given that fluctuations in rice supply or prices have a broad impact on public welfare and economic stability (Saliem et al., 2023). Instability in the rice sector can trigger socio-political unrest, given that rice contributes more than 20% of total calorie intake and is the mainstay of food for millions of families.

As one of the national rice production centers, South Sulawesi Province contributes significantly to Indonesia's rice supply. South Sulawesi is known as the main rice granary outside Java, contributing more than 8% of national rice production. The latest data shows that South Sulawesi ranked fourth among rice-producing provinces in 2023, with a production of approximately 4.94 million tons of dry milled grain (equivalent to approximately 2.84 million tons of rice) (Luthfia, 2024). This contribution is significant considering that national rice

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production in 2023 was approximately 30.90 million tons. Rice from South Sulawesi not only meets local demand but is also supplied to eastern Indonesia, such as Kalimantan, Maluku, and Papua. This condition emphasizes South Sulawesi's strategic role as a pillar of food security, especially for Eastern Indonesia.

Although rice is widely consumed, there is variation in rice consumption across regions and changes in consumption patterns over time. Some provinces recorded very high per capita consumption, for example, West Nusa Tenggara, West Sulawesi, and Bali, reaching approximately 110–119 kg/capita/year in 2023 (Center for Agricultural Data and Information Systems, 2021). In contrast, in provinces like Papua, rice consumption was only around 59 kg/capita/year. This difference is influenced by local food availability and dietary habits: in Papua and Maluku, some residents traditionally consume sago and tubers, while in Nusa Tenggara, corn is consumed as an alternative carbohydrate source (Wardani et al., 2019). However, due to various intensive pro-rice policies since the New Order (e.g., the food transmigration program and Raskin), there has been a shift in local dietary patterns toward rice dominance across all levels of society (Wardani et al., 2019). Temporarily, Indonesia's per capita rice consumption has shown a downward trend over the past two decades. Average national household rice consumption fell from 102.87 kg/capita/year in 2011 to 93.79 kg/capita/year in 2023 (Center for Agricultural Data and Information Systems, 2021), a decline of approximately 0.59% per year. This decline is consistent with dietary diversification with increasing income and urbanization: the share of rice in total calories is gradually decreasing. A similar phenomenon occurs in other more developed Asian countries, where per capita rice consumption has declined significantly with modernization. For example, Taiwan has seen rice consumption decline by more than two-thirds over the past 50 years due to urbanization, rising incomes, and changing food preferences (Chandran, 2018).

Understanding the factors that determine household rice consumption is crucial both academically and policy-wise. In theory, Engel's Law states that the proportion of income spent on food declines as income rises. Specifically for staple foods, Bennett's Law asserts that as income rises, consumption patterns shift from carbohydrate-rich foods (such as cereals) to a wider variety of animal and plant foods (Bennett, 1941). In other words, at very low income levels, additional income tends to increase rice consumption, but after a certain threshold, income increases actually reduce reliance on rice as households shift to other sources of nutrition (meat, eggs, vegetables, fruit) (Mottaleb & Mishra, 2016). Empirical evidence in Asia supports this theory: in many Asian countries, rice has become an inferior good at high income levels, with income elasticity of rice consumption approaching zero to negative (World Bank, 2020). Cross-country studies from the 1980s showed that the income elasticity of rice declined and was even negative in most of the 14 Asian countries analyzed. Countries such as Japan, South Korea, and Hong Kong have seen per capita rice consumption decline by 40–60% as incomes have risen since the 1960s. However, in lower-middle-income countries, rice is generally still considered a normally inelastic good – consumption increases with

income but at a slower rate. In Nigeria, for example, average rice consumption is 78 kg/capita/year, and 80% of households consume rice daily. The income elasticity in Nigeria is positive but <1 (inelastic), indicating that rice is a normal necessity whose consumption increases with income but not proportionally (Ogundele, 2013). Meanwhile, Thailand exhibits a transitional pattern: per capita rice consumption fell from 119 kg (1990) to 101 kg (2002) during rapid economic growth, with very low income elasticity (Patmasiriwat, 2010).

In Indonesia, several empirical studies have examined the determinants of rice consumption and yielded mixed findings. Economic factors such as income and rice prices clearly play a role, but the direction of their influence can differ across population segments. A study of urban households in Jakarta found that per capita income positively affected rice demand, and per capita income positively affected rice demand (both quantity and quality) (Windiyarti et al., 2020). Increased income encourages consumption of more and/or better-quality rice in large cities, likely because low-income groups have not previously reached a satiation level. However, at the national aggregate, the effect of income tends to weaken. Interprovincial panel analysis shows that per capita GRDP does not significantly affect rice consumption when other factors are controlled (Wardani et al., 2019). This indicates that on the national average, rice consumption is approaching saturation, where additional income no longer significantly increases physical rice consumption. In contrast, rice prices and the prices of substitute commodities consistently influence consumption. An increase in rice prices will reduce consumption (negative rice price elasticity), while the prices of alternative foods (e.g., corn, wheat) influence consumers to substitute some of their rice consumption (Leki, 2017). Findings by Malian et al. (2016) highlight that population size, domestic rice prices, and corn prices are significant determinants of Indonesian rice consumption, in addition to imports from the previous year.

Sociodemographic factors also play a significant role. Household size (number of family members) is positively correlated with total rice consumption: larger households naturally require more rice in total (Wardani et al., 2019). Indonesian panel data from 2010-2018 shows an elasticity of rice consumption with respect to household size of approximately +1.11 – meaning a 10% increase in family size increases rice consumption by approximately 11%. However, on a per capita basis, larger households may have slightly lower consumption due to economies of scale and age composition (e.g., the proportion of children with lower calorie consumption) (Leki, 2017). Poverty levels and socioeconomic status also influence consumption patterns. Poor households generally allocate a larger portion of their expenditures to rice (as it is the cheapest source of calories). Susenas data shows that the poorest families are highly dependent on rice, leading to government programs such as Raskin/Rastra (Rice for Poor Families) to ensure rice access for vulnerable groups (Mottaleb & Mishra, 2016). Meanwhile, quality-of-life indicators (e.g., education, health, urbanization) tend to be inversely related to excessive rice consumption. Nutrition education and healthy lifestyles can encourage households to shift to a more diverse diet, thereby reducing the dominance of rice. A study

in Bangladesh found that more educated and higher-income urban households tended to reduce their consumption of low-quality rice and shift to higher-quality rice or other carbohydrate sources. Similarly, concerns about health and obesity are driving some urban dwellers in Asia to reduce rice portions and replace it with high-fiber or protein foods.

Based on the above description, it is clear that household rice consumption is influenced by a complex combination of economic and socio-demographic factors. It is important to examine how factors such as income, family size, poverty, production, and quality of life collectively determine rice consumption patterns in a region. South Sulawesi, as a rice producing region and with its own socio-economic characteristics, is of particular interest. This study aims to analyze the determinants of rice consumption in South Sulawesi using a panel data approach. By analyzing data across time and regions within the province, the research will identify the influence of factors such as household income, family size, poverty level, rice production, and quality of life indicators on rice consumption. The study's findings are expected to provide empirical contributions to the formulation of food policies, particularly in efforts to maintain food security and improve nutrition through a better understanding of rice demand patterns at the household level, both in South Sulawesi and in Indonesia in general.

2. Theoretical Study

Rice consumption is a central aspect of food security studies, especially in developing countries like Indonesia, which still rely heavily on rice as a primary source of calories (BPS, 2023). According to Engel's Law, the proportion of expenditure on food, including rice, tends to decline with increasing income. Meanwhile, Bennett's Law suggests that consumption patterns shift from high-carbohydrate staple foods to more protein-rich and diverse foods as income increases (Bennett, 1941; Timmer, 2012).

Previous research has shown that household income has a positive effect on rice consumption, although the elasticity is small and tends to decrease in middle- and high-income groups (Jaijit et al., 2019). A cross-country study by Timmer (2010) also found that in countries like Japan and Korea, rice consumption has declined drastically with increasing prosperity. In Indonesia, national per capita rice consumption decreased from 102.87 kg in 2011 to 93.79 kg in 2023 (BPS, 2023), in line with changing preferences and food diversification programs.

Besides income, household size is an important variable. The larger the family, the higher the total rice consumption (Sartini & Bagio, 2022). This aligns with Silverius's (2017) findings that household size and number of dependents drive rice demand among Indonesian farming households. Meanwhile, local rice production reflects food availability. High production in a region contributes to availability and price stability, which ultimately indirectly impacts rice consumption (Silverius, 2017).

Quality-of-life indicators, such as the Human Development Index (HDI), are also increasingly being used as explanatory variables for consumption. The HDI reflects dimensions of health, education, and standard of living, which theoretically could encourage households to diversify their diets and gradually reduce their dependence on rice (Yuliana & Arifin, 2020; Fitriani et al., 2023).

Conversely, poverty levels have the potential to increase household dependence on rice, as limited purchasing power makes rice the only affordable source of carbohydrates (FAO, 2022). In Nigeria and Bangladesh, poor households exhibit higher income elasticity to rice than wealthy households, indicating that rice remains a normal good for low-income groups (FAO, 2022; Ogundele, 2013). Therefore, based on these research results, income, household size, rice production, quality of life (HDI), and poverty are important determinants of household rice consumption in various countries, including Indonesia.

Based on the consumption theory and empirical results described above, the conceptual framework in this study is designed to analyze the influence of five independent variables on household rice consumption in South Sulawesi. This framework is illustrated in the following causal relationships:

Y = Rice Consumption (tons)

X_1 = Income per Capita (Rp)

X_2 = Household Size (Dependency Ratio) → predicted to have a positive effect, because more dependents increase food needs.

X_3 = Rice Production (tons) → assumed to have a positive effect, because it increases availability and reduces dependence on imports between regions.

X_4 = Human Development Index (HDI) → potentially negative or insignificant, along with the diversification of consumption patterns of a more prosperous society.

X_5 = Percentage of Poor Population (%) → assumed to have a negative effect on absolute consumption, although it can be proportionally high.

The relationship model between these variables will be analyzed using a panel data approach to capture district/city heterogeneity and dynamics from 2018 to 2024. This analysis is expected to provide a deeper understanding of how social and economic dimensions influence household rice consumption patterns in South Sulawesi, representing both a major producing and consuming region in Indonesia.

3. Research Methods

This research is a quantitative study using a panel data econometric approach. This approach is used to analyze the influence of economic and social variables on household rice consumption in South Sulawesi Province. Panel data was chosen because it can capture both cross-sectional and time-series variations simultaneously (Baltagi, 2005; Rahman, 2020).

The following are the variables and operational definitions of the variables used in this study.

Table 1 Operational Definition of Variables Operational Definition Symbol Unit.

Variables	Definition Operational	Symbol	Unit
Consumption Rice House Ladder	Amount rice consumed per district / city per year	Y	Ton
Income per capita	Average income society (indicator Power buy)	X_1	Rp / person
Size House Ladder	Number burden dependence resident	X_2	Ratio
Production Rice	Amount production rice area (indicator availability food)	X_3	Ton
Human Development Index	Indicator quality life public	X_4	Index
Percentage Resident Poor	Proportion resident poor to the total population (P0)	X_5	%

Source: Processed data, 2025

The data used is secondary data with an observation period of 2018–2024, covering 24 districts/cities in South Sulawesi Province. Data sources were obtained from: Statistics Indonesia (BPS) – publication of South Sulawesi in Figures, Household Consumption Statistics, and Susenas; Ministry of Agriculture of the Republic of Indonesia data on rice and rice production; National Food Security Agency food availability indicators; Bappenas data on the Human Development Index (HDI); Statistics Indonesia data on poverty levels and per capita income. The type of data used is balanced panel data (unbalanced panel).

The analysis was carried out using a panel data regression model, which can be formulated as follows:

$$\boldsymbol{Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + e_{it}}$$

Information:

i = 1, 2, …n indicates the districts/cities in South Sulawesi

t = 2018, 2019

t =2018,2019,...,2024 shows the time period

εi = is the error term

Based on the model estimation equation, three main approaches can be used in panel data analysis:

Pooled Least Square (PLS) Model

Assumes that the combined data has the same intercept and slope for all observation units and time.

Fixed Effect Model (FEM)

Assuming that differences between regions are captured through different intercepts (α_i). This model is appropriate if there are fixed characteristics of each region (e.g., consumption culture or regional policies).

$$Y_{it} = \alpha_1 + \beta_1$$

Random Effect Model (REM)

Assuming that inter-regional differences are random and fall into the error component (u_i). This model is more efficient if inter-regional variations are uncorrelated with the explanatory variables.

REM model form:

$$Y_{it} = \beta_0 + \beta_1$$

To determine the most appropriate model to use, the following three panel model specification tests were carried out:

Chow Test (F-Test)

Used to choose between the Common Effect Model (CEM) and the Fixed Effect Model (FEM).

H_0 : Pooled Least Square Model is more suitable

H_1 : Fixed Effect Model is more appropriate

If the p-value < 0.05 → use FEM.

Lagrange Multiplier Test (LM Test)

Used to choose between the Common Effect Model and the Random Effect Model.

H_0 : CEM model is more appropriate

H_1 : REM model is more suitable

If the p-value < 0.05 → use REM.

(Performed using the Breusch–Pagan LM Test method.)

Hausman test

Used to choose between Fixed Effect Model (FEM) and Random Effect Model (REM).

H_0 : Random Effect Model is more appropriate

H_1 : Fixed Effect Model is more appropriate

If the p-value <0.05 → the appropriate model is FEM.

Before interpreting the regression results, a classical assumption test was carried out to ensure the validity of the model:

Multicollinearity Test: conducted by looking at the Variance Inflation Factor (VIF) value; if VIF < 10 then there is no multicollinearity.

Heteroscedasticity Test: performed using the Breusch–Pagan test; if the p-value > 0.05 then the model is free from heteroscedasticity.

All analyses were conducted using R software (latest version) with the following packages: plm for panel data analysis, lmtest for LM test, car for multicollinearity (VIF) test, and

bptest for heteroscedasticity test. R was chosen as the analysis tool based on its reliability in estimating panel models and the flexibility of visualizing the results.

4. Results And Discussion

Results

Descriptive Statistics

Table 2 Descriptive Statistics.

Variables	Mean	Minimum	Maximum	Unit
Consumption Rice (Y)	41,792.00	4,295.00	70,909.00	Ton
Per Capita Income (X_1)	2,727.00	5,075.00	65,954.00	Thousands /rupiah
Size House Stairs (X_2)	6.09	9.80	60.45	Percent
Production Rice (X_3)	22,296.00	6.50	88,730.40	Ton
Human Development Index (X_4)	71.08	63.33	83.90	Index
Resident Poor (X_5)	9.35	4.28	15.48	Percent

Source: data processed from BPS, 2025

Table 2 shows the basic characteristics of the variables used in the analysis of rice consumption in South Sulawesi Province during the 2018–2024 period. The household rice consumption variable (Y) had an average value of 41,792 tons, with a range of 4,295 tons to 70,909 tons, indicating significant differences in consumption levels across regions within the province. This reflects variations in staple food consumption needs and capacities, influenced by demographic and economic factors, as well as the distribution of rice production.

The per capita income variable (X_1) has an average of 2,727 thousand rupiah, with a minimum value of 5,075 thousand rupiah and a maximum of 65,954 thousand rupiah. This fairly wide variation illustrates income inequality between districts/cities, which can have implications for food consumption patterns and people's purchasing power. Furthermore, household size (X_2), proxied by the dependency ratio, shows an average value of 6.09 percent, with a range between 9.80 percent and 60.45 percent. This high variation illustrates the heterogeneity of the regional demographic structure, which has the potential to influence the level of rice consumption per capita.

Rice production (X_3) averaged 22,296 tons, with a range of 6.50 tons to 88,730.40 tons, reflecting significant differences in production capacity between regions. Production center districts such as Bone, Wajo, and Sidrap tended to show values close to the maximum, while urban and coastal areas showed lower values. The Human Development Index variable (X_4)

averaged 71.08, with a range of 63.33 to 83.90, indicating that most regions were in the medium to high human development category.

Meanwhile, the percentage of poor people (X_5) has an average value of 9.35 percent, with a minimum value of 4.28 percent and a maximum of 15.48 percent. This variation illustrates the uneven level of welfare between regions, which has the potential to affect the stability of household rice consumption, especially among vulnerable groups. Overall, these descriptive statistics indicate substantial heterogeneity between regions in South Sulawesi, both in terms of social, economic, and demographic aspects, which supports the use of panel data models to identify the determinants of rice consumption more accurately.

Panel Model Selection Test Results

Panel data analysis was performed using R software, with the plm, lmtest, and car packages. Three model tests were conducted to determine the best model:

Table 3 Model Selection Test Type of Test Model Tested Statistical Value Probability Selected Model.

Test Type	Tested Model	Mark Statistics	Probability	Selected Model
Chow Test	CEM vs FEM	F = 1325.8	2.20E-16	FEM
Hausman test	FEM vs REM	χ^2 = 58.283	2.75E-11	FEM
LM (Breusch–Pagan) test	CEM vs REM	χ^2 = 422.43	2.20E-16	BRAKE

Source : R Studio Output, Year 2025

The results show that the Fixed Effect Model (FEM) is the most appropriate model, as the Chow and Hausman tests are significant ($p < 0.05$). Therefore, further analysis uses the FEM model.

Classical Assumption Test Results

Before interpreting the estimation results, the panel regression model was tested against classical assumptions to ensure the validity and reliability of the parameter estimates. Multicollinearity testing was performed using the Variance Inflation Factor (VIF) value in the Ordinary Least Squares (OLS) model. The test results showed that all independent variables had VIF values below 10, thus concluding that there was no serious multicollinearity among the explanatory variables in the model. This indicates that each independent variable has the ability to explain variations in rice consumption independently and there is no excessive linear correlation. Next, a heteroscedasticity test was conducted using the Breusch–Pagan Test (BP Test). The test results showed a BP value of 57.496 with a p-value of 3.996×10^{-11}, which is smaller than the 0.05 significance level. Thus, it can be concluded that there is an indication of heteroscedasticity in the model. This condition implies the inhomogeneity of error variances between observation units, which has the potential to cause bias in the standard error value when using the conventional OLS approach.

To overcome this, re-estimation was carried out using robust standard errors (White–Huber heteroskedasticity-consistent covariance matrix) through the vcovHC() function in the plm package in R software. The estimation results with robust standard errors show that the regression coefficient values remain stable, while the t-statistic and p-value values experience slight adjustments, especially in the variables Household Size (X_2), Rice Production (X_3), and Human Development Index (X_4) which remain statistically significant. Thus, it can be concluded that the panel regression model used has met the BLUE (Best Linear Unbiased Estimator) assumption after heteroskedasticity correction, so that the estimation results can be interpreted econometrically.

Discussion

Table 4 Results of Rice Consumption Estimation.

Variables	Estimate	Std. Error	t- Statistics	Prob.
Income per Capita (X_1)	-0.0602	0.0508	-1.1838	0.23851
Size House Stairs (X_2)	-0.0034	0.0016	-2.1683	0.03184 *
Production Rice (X_3)	-0.0153	0.0069	-2.2264	0.02760 *
Human Development Index (X_4)	0.0402	0.0067	5.9759	1.825e-08 ***
Percentage Resident Poor (X_5)	-0.0021	0.0073	-0.2918	0.77087
$R^2 = 0.639$	Adj $R^2 = 0.566$	F-statistic = 49.151 (p = 0.000)		

Source: R Studio Output, Year 2025

Note: *p<0.1; **p<0.05; ***p<0.01

Per Capita Income (X_1)

The coefficient for per capita income is negative (-0.0602) and not statistically significant at the 95% confidence level. This indicates that an increase in public income is not necessarily followed by an increase in rice consumption. This finding aligns with Engel's Law (Engel, 1857), which states that the proportion of expenditure on food, particularly staples such as rice, decreases as income increases. In the modern economic context, this phenomenon is known as the Engel Curve effect, where staple food consumption is income inelastic or has low income elasticity.

This condition also aligns with Bennett's hypothesis (Bennett, 1941), which explains that people with higher incomes will experience a dietary transition, shifting from consuming basic carbohydrates like rice to processed foods, animal protein, and value-added products. In South Sulawesi, increasing household income in urban areas is often accompanied by a diversification of consumption toward instant noodles, bread, and fast food (BPS, 2024).

The negative effect of per capita income on rice consumption is caused by the increase in income not causing the people of South Sulawesi to consume rice excessively, because there are still many other expenses that can be used by the community to meet other needs. In the

theory of Duessenberry (Turvey & Duesenberry, 1950) it is stated that the percentage of consumption and income will tend to be small when the economy is good, and tend to be high when the economy is bad. When there is a change in income, consumption does not immediately increase, because there is a smaller influence of previous period consumption. And conversely, when income decreases, consumption will not decrease sharply because of the habit of living comfortably.

Empirically, these results are consistent with research by Mottaleb & Mishra (2016) in Bangladesh and (Partini., Tarumun, S., & Tety, 2014) in Riau, which found that rice is a necessity good with an income elasticity of <1. In line with (Tina Fitriani & Partini Partini, 2019), income has no significant effect on rice consumption. In contrast, Windiyarti et al., (2020) in Jakarta found that per capita income has a positive and significant effect on rice demand. Therefore, policies to improve public welfare do not directly impact the surge in rice consumption, but rather on the diversification of household food patterns.

Household Size (X_2)

Household size has a negative coefficient (-0.0034) and is significant at the 5% level, indicating that the greater the number of dependents in the household, the lower the per capita rice consumption. Economically, this is explained by the concept of economies of scale in consumption, where larger households can allocate resources more efficiently (Deaton & Paxson, 1998).

In a social context, large households in rural areas of South Sulawesi usually have a more economical consumption pattern per individual, because most family members contribute to their own food production or replace some of their rice consumption with alternative carbohydrate sources (corn, cassava, or sago).

Research by Teklu (1996) in Su-Saharan Africa, and Ogundari (2015) in Nigeria showed a similar negative relationship, with increasing family size decreasing staple food consumption per capita. Contrary to the findings of Tina Fitriani & Partini Partini (2019), Herdiansyah (2016) found that population size had a positive and significant effect on rice demand. Therefore, these results emphasize that food security policies need to consider the demographic structure and distribution of household members in determining rice needs per region.

Rice Production (X_3)

The rice production coefficient is negative (-0.0153) and significant at the 5% level, indicating an inverse relationship between regional rice production and market rice consumption. This seems paradoxical, but it can be explained using the household production-consumption model (Becker, 1965). For farming households in rural areas, most of the harvest is for self-consumption, without being recorded in market consumption statistics. The higher local production, the smaller the volume of rice purchased in the market, resulting in a decline in recorded rice consumption. This reflects the unique characteristics of South Sulawesi's agricultural economy, where more than 45% of households are still classified as subsistence food producers (BPS Sulsel, 2023). This finding supports the research of Limnirankul et al. (2015)

in Northern Thailand, which also found a negative relationship between commercial rice production and consumption. Thus, increased rice production does not necessarily increase market consumption, but rather strengthens independent food security at the producer household level.

Human Development Index (X_4)

The HDI variable shows a positive coefficient (0.0402) and is highly significant ($p < 0.001$), indicating that improvements in people's quality of life have a positive effect on rice consumption. The HDI, as an indicator of aggregate welfare, encompasses the dimensions of education, health, and purchasing power; all three play a crucial role in determining preferences and access to better food consumption. Theoretically, this relationship can be explained by the Human Development Approach framework (Sen, 1999), which emphasizes that increased human capabilities enable individuals to choose more appropriate and stable consumption. An increase in the HDI also strengthens household purchasing power and nutritional awareness, thereby maintaining stable rice consumption as the national staple food.

These results are consistent with studies by Chandio et al. (2020) in Pakistan and Nasrudin et al. (2022) in Indonesia, which showed that increased human development increases consumption of nutritious foods, including rice. In the context of regional policy, these results emphasize the importance of human development as a pillar of sustainable food security in South Sulawesi.

Percentage of Poor Population (X_5)

The poverty variable has a negative coefficient (-0.0021) and is insignificant ($p = 0.7708$). The negative direction of the relationship is consistent with welfare economics theory, which suggests that increasing poverty reduces household food consumption. However, the insignificant effect indicates that government social interventions have mitigated the direct impact of poverty on rice consumption.

Programs such as Non-Cash Food Assistance (BPNT), the Family Hope Program (PKH), and the Rastra program have proven effective in maintaining rice consumption among poor households, as demonstrated in research (Laurentcia & Yusran, 2021). This suggests that despite persistently high poverty rates in some districts, social protection mechanisms have helped stabilize staple rice consumption, so that poverty is no longer a direct determinant of food consumption.

The estimation results generally indicate that household rice consumption in South Sulawesi is influenced by a combination of economic and non-economic factors. Non-economic factors such as quality of life (HDI) and household structure have been shown to have a stronger influence than classic economic variables such as income. This confirms that a food security approach cannot simply focus on increasing incomes but must be balanced with human development and social protection.

Furthermore, the negative relationship between rice production and consumption implies the importance of distinguishing between market consumption and subsistence consumption in regional food data analysis. Therefore, regional food policies need to emphasize the integration of production, distribution, and household consumption to achieve sustainable and equitable food security in South Sulawesi.

5. Conclusion

This study analyzes the factors influencing household rice consumption in South Sulawesi Province using a panel data approach for 2018–2024. The results are estimated using a fixed effect model. Partially, per capita income has a negative and insignificant effect, indicating that increasing income does not increase rice consumption in line with Engel's Law. Household size and rice production have a significant negative effect, indicating consumption efficiency in large families and the phenomenon of self-consumption in farming households. Meanwhile, the Human Development Index (HDI) has a positive and significant effect, confirming that improving the quality of life strengthens household food security. The poverty variable has a negative but insignificant effect, indicating the effectiveness of social assistance programs in maintaining food consumption among vulnerable groups.These findings confirm that rice consumption in South Sulawesi is more influenced by social factors and quality of life than traditional economic variables. Therefore, food security policies need to be directed at improving human development, diversifying food consumption, and providing social protection for poor households. The local government is advised to strengthen policy integration between agencies, particularly the Food Security, Agriculture, and Social Affairs Office, in supporting rice distribution, nutrition education, and a panel data-based food information system.Strategically, this research supports a sustainable food security approach that places increased HDI and social equity as its primary foundation. Improving human resources and the efficiency of the distribution system will ensure equitable food access, stable rice consumption, and household food self-sufficiency in South Sulawesi Province.

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