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Effects of rice import tariffs on farmer and consumer welfare in Indonesia

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Abstrak

Indonesia, the world's fourth most populous country, is heavily dependent on rice imports — the staple food of its population. Left unaddressed, this import dependency poses a serious threat to national food security. This study aims to examine the impact of rice import tariffs on domestic supply and demand and assess their effect on changes in the welfare of Indonesian society. This study employs secondary documentary data obtained from relevant institutions and agencies and publicly released, pertaining to the issues under investigation at the macro (global) level over a 15-year period spanning 2009 to 2023. The analytical tools employed include Two-Stage Least Squares (2SLS) and economic surplus. The results show that simulations of tariff adjustments at the baseline rate of Rp450/kg reveal that a tariff reduction benefits consumers but harms farmers, whereas a tariff increase protects farmers but burdens consumers and generates deadweight loss. A reduction in the import tariff enhances consumer welfare and aggregate economic efficiency, but is detrimental to farmers and reduces government revenue.

Dampak tarif impor beras terhadap kesejahteraan petani dan konsumen di Indonesia

Abstract

Indonesia sebagai negara dengan jumlah penduduk peringkat 4 terbanyak di dunia mengalami ketergantungan impor pada bahan makanan berupa beras, yang mana beras adalah makanan pokok masyarakat Indonesia. Ketergantungan impor ini, jika tidak diberi perhatian, akan mengancam ketahanan pangan nasional. Tujuan dari penelitian ini adalah untuk menganalisis dampak tarif impor beras terhadap permintaan dan penawaran beras di Indonesia, dan menganalisis dampak tarif impor beras terhadap perubahan kesejahteraan masyarakat Indonesia. Penelitian ini menggunakan data sekunder berupa dokumen yang diperoleh dari lembaga dan instansi terkait serta yang telah dipublikasikan, yang berkaitan dengan isu-isu yang diteliti pada tingkat makro (global) selama periode 15 tahun, yaitu dari tahun 2009 hingga 2023. Alat analisis yang digunakan adalah Two-Stage Least Squares (2SLS) dan surplus ekonomi. Hasilnya menunjukkan bahwa simulasi kenaikan dan penurunan tarif impor Rp450/kg menunjukkan bahwa penurunan tarif menguntungkan konsumen, namun merugikan petani, kenaikan tarif melindungi petani tetapi membebani konsumen dan menciptakan deadweight loss.Penurunan tarif impor meningkatkan kesejahteraan konsumen dan efisiensi ekonomi secara keseluruhan, namun merugikan petani dan mengurangi pendapatan pemerintah.

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Indonesia ranks as the fourth most populous country in the world, with a total population of 281.6 million (BPS, 2024). This substantial population growth has directly amplified demand for food, particularly rice as a staple commodity that plays a strategic role in national social and economic stability. A primary challenge confronting the country is the diminishing availability of agricultural land due to the conversion of paddy fields into residential and industrial areas. Although national rice productivity has demonstrated a positive trend, rising from 51.28 ku/ha in 2020 to 52.90 ku/ha in 2024, harvested area has declined by 5.73% over the same period (BPS, 2024). Rice production for food consumption in 2024 was recorded at 30.62 million tons, reflecting a 1.54% decrease compared to the previous year (BPS, 2024).

Table 1. Rice Production, Consumption, and Imports (2019-2023)

Year	Production (000 MT)	Consumption (000 MT)	Imports (MT)
2019	56.604	36.000	495.646
2020	54.649	35.400	356.277
2021	54.415	35.300	407.726
2022	54.748	35.600	429.205
2023	53.980	36.200	3.062.853

Source: BPS, (2024)

As presented in Table 1, despite national rice production remaining relatively stable at approximately 53–56 million tons and consistently exceeding domestic consumption of 35–36 million tons, rice imports surged dramatically in 2023 to exceed 3 million tons — nearly tenfold compared to preceding years (BPS, 2024). This paradox between production surplus and the continuation of imports is also observable at the regional level. Setiawan et al., (2022) documented a comparable phenomenon in East Java, where rice imports persisted despite a production surplus, indicating systemic issues in food distribution governance.

From a welfare perspective, rice imports generate heterogeneous impacts. Kusumastuti et al., (2024) argue that the relatively lower prices of imported rice tend to suppress the income of smallholder farmers, while Mubarok & Anjani, (2025) assert that import policies pose long-term risks to national food security. Basia et al., (2025) further note that imports create a trade-off between consumer surplus and producer surplus. Collectively, these studies reveal a gap in the existing literature regarding the comprehensive measurement of the welfare effects of rice import tariffs. Accordingly, this study aims to analyze the impact of rice import tariffs on the supply and demand for rice in Indonesia, as well as to quantify the resulting welfare changes attributable to such policy interventions.

METHODS

This study employs secondary data in the form of documentary data obtained from relevant institutions and agencies that have been publicly released, pertaining to the issues under investigation at the macro (global) level over a 15-year period spanning 2009 to 2023. Data were collected using the documentation method. The data analysis methods applied correspond to each research objective, as follows:

1st purpose requires simultaneous regression estimation using the Two-Stage Least Squares (2SLS) method. The models constructed in this study are as follows:

$$\boldsymbol{Qd_t = a_0 + a_1 Pb + a_2 Ic + a_3 Pj + a_4 Dd_{t-1} + U_{1t}} \quad \boldsymbol{Qs_t = b_0 + b_1 Pb + b_2 Pr + b_3 St + b_4 Im + U_{2t}}$$

Explanation:

Qd_t : Domestic rice demand (tons)
Qs_t : Domestic rice supply (tons)
Pb_t : Domestic rice price (IDR/kg)
Ic_t : Average monthly per capita income (IDR)
Pj_t : Price of dry shelled corn (IDR/kg)
Dd_{t-1} : Domestic rice demand in the previous year (tons)
Pr_t : Domestic rice production (tons)

St_t : Rice stock held by Perum Bulog as of January (tons)
Im_t : Indonesian rice imports (tons)
U_{it} : Error term for i=1,2,3

Subsequently, simulations were conducted by decreasing and increasing the tariff rate by 250 in Simulations 1 and 2, respectively, followed by calculations in accordance with the notation proposed by Tweeten. The calculation notation is presented in Table 2 below:

Table 2. Measurement of the Impact of Rice Import Tariff Policy

Variable	Notation or Formula
CIF price (IDR/kg)	P
Import tariff (IDR/kg)	T
Rice price (IDR/kg)	P'
Rice demand (tons)	Qc
Rice supply (tons)	Qp
Rice imports (tons)	Qc-Qp
Demand elasticity	Ed
Supply elasticity	Es
Rice price increase under new tariff (IDR/kg)	P'-P
Change in supply (tons)	ΔQp = Es Qp (P'-P)/P
Change in demand (tons)	ΔQc = Ed Qc (P'-P)/P
Supply after import tariff (tons)	Qp' = Qp+ ΔQp
Demand after import tariff (thousand tons)	Qc' = Qc+ ΔQc
Imports after import tariff (tons)	Qc'-Qp'
Change in consumer surplus (IDR)	Qc (P'-P) – 0,5 (P'-P) (Qc-Qc')
Change in producer surplus (IDR)	Qp (P'-P) – 0,5 (P'-P) (Qp'-Qp)
Government revenue from tariff (IDR)	T (Qc'-Qp')
Net welfare effect (IDR)	0,5 (P'-P) (Qp'-Qp) + 0,5 (P'-P) (Qc-Qc')

Source: Tweteen, (1989)

2nd purpose is analyzed through the calculation of economic surplus, encompassing producer surplus, consumer surplus, government tariff revenue, and net welfare effect. The calculations employ the analytical framework developed by Tweeten (1989).

RESULTS

Table 4. Result of 2SLS Analysis

Endogenous Variable	*F-Value*	*Prob.F*	R^2	*Adj. R-Squared*
Demand	16.858	0.0002	0.819	0.770
Suplly	23.488	0.0008	0.798	0.759

Source: Primary Data Processed, (2025)

Table 5. 2SLS Estimation Results for the Rice Demand Equation

Variable	Coefficient	*Std. Error*	*t-Statistic*	*Prob.*
C	13.64797	0.775779	17.59260	0.0002
Ln_Pb	-0.443242	0.111869	-0.396214	0.0169
Ln_Ic	0.228615	0.043521	5.253046	0.0003
Ln_Pj	0.196531	0.097154	-0.202290	0.0843

Source: Primary Data Processed, (2025)

Table 6. 2SLS Estimation Results for the Rice Supply Equation

Variable	Coefficient	*Std. Error*	*t-Statistic*	*Prob.*
C	21.15230	0.980019	1.175798	0.2669
Ln_Pb	0.292094	0.036121	-1.362358	0.2030
Ln_Pr	0.958652	0.044744	21.42519	0.0000
Ln_St	-0.019631	0.003485	-5.633485	0.0002
Ln_Im	0.023438	0.002979	7.867257	0.0000

Source: Primary Data Processed, (2025)

Table 7. Estimated Rice Demand and Supply Under Tariff Simulations

Variable	Baseline (Tariff IDR450/kg)	Simulation 1 (Tariff IDR200/kg)	Simulation 2 (Tariff IDR700/kg)
CIF Price (IDR/kg)	9.235	9.235	9.235
Import Tariff (IDR/kg)	450	200	700
Rice Price (IDR/kg)	11.580	11.330	11.830
Rice Demand (tons)	26.139.195	26.139.195	26.139.195
Rice Supply (tons)	56.233.320	56.233.320	56.233.320
Rice Imports (tons)	3.062.853	3.062.853	3.062.853
Demand Elasticity	-0,443	-0,443	-0,443
Supply Elasticity	0,292	0,292	0,292
Rice Price Increase under New Tariff (IDR/kg)	0	-250	250
Change in Supply (tons)	0	−354.493	354.493
Change in Demand (tons)	0	249.993	-249.993
Supply after Import Tariff (tons)	56.233.320	55.878.827	56.587.813
Demand after Import Tariff (tons)	26.139.195	26.389.188	25.889.202
Imports after Import Tariff (tons)	3.062.853	3.312.846	2.812.860
Change in Consumer Surplus (IDR)	0	6.556.047.875	-6.503.549.625

Variable	Baseline (Tariff IDR450/kg)	Simulation 1 (Tariff IDR200/kg)	Simulation 2 (Tariff IDR700/kg)
Change in Producer Surplus (IDR)	0	-8.799.051.750	8.854.693.250
Government Tariff Revenue (IDR)	1.378.283.85 0	662.569.200	1.969.002.000
Net Welfare Effect (IDR)	0	-1.570.434.675	4.320.145.625

Source: Primary Data Processed, (2025)

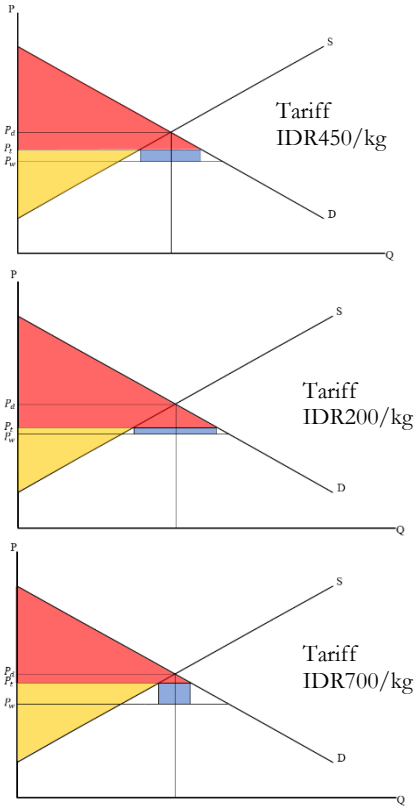

Figure 1. Tariff Simulation Curve
Source: Tweteen, (1989)

DISCUSSIONS

Impact of Rice Import Tariffs on Rice Demand and Supply in Indonesia

Model identification was conducted prior to estimation using the 2SLS method. The results indicate that both the demand and supply equations for rice are overidentified, thereby satisfying the necessary conditions for 2SLS estimation. Simultaneous equation analysis using 2SLS was carried out in this study to obtain demand and supply elasticity values to be subsequently applied in the tariff simulation calculations. The elasticity values derived from the price coefficients are presented in Tables 5 and 6. The estimation yielded a demand elasticity of −0.443 and a supply elasticity of 0.292.

Based on the demand and supply elasticities obtained from the 2SLS estimation, simulations of rice import tariff changes were subsequently conducted using the Tweeten (1989) framework, with 2023 data serving as the reference period. Two scenarios were simulated:

- **Scenario 1:** Reduction of the import tariff from IDR 450/kg to IDR 200/kg
- **Scenario 2:** Increase of the import tariff from IDR 450/kg to IDR 700/kg

The calculations above demonstrate that post-tariff supply (Qp') and post-tariff demand (Qc') move in opposite directions across all three scenarios. Under the baseline tariff of IDR 450/kg, Qp' = 56,233,320 tons and Qc' = 26,139,195 tons. Under Simulation 1 with a tariff of IDR 200/kg, Qp' declines to 55,878,827 tons while Qc' rises to 26,389,188 tons — supply and demand diverge, widening the gap that must be covered by imports. Under Simulation 2 with a tariff of IDR 700/kg, Qp' increases to 56,587,813 tons while Qc' falls to 25,889,202 tons, both variables converge, narrowing the import requirement. These findings are consistent with Widayanti et al., (2022) who established that a tariff reduction reduces supply and increases demand, whereas a tariff increase raises supply and suppresses demand.

Rice imports contribute to stabilizing prices and ensuring supply during periods of domestic production shortfalls; however, this policy increases dependence on international markets and poses competitive challenges for local farmers. The dynamics of Qp' and Qc' in Simulation 1 (IDR 200/kg tariff) directly illustrate this mechanism: a lower tariff depresses domestic production while simultaneously stimulating consumption, thereby expanding the space for

imports. The reverse pattern is observed in Simulation 2 (IDR 700/kg tariff), where a higher tariff encourages domestic production and restrains consumption simultaneously, thereby reducing import dependency (Yasinta et al., 2025)

Rice import volumes across the three scenarios form a linear gradient. Under the baseline tariff of IDR 450/kg, import volume stands at 3,062,853 tons. Under Simulation 1 with a tariff of IDR 200/kg, imports increase to 3,312,846 tons, a rise of 249,993 tons or approximately 8.16% relative to the baseline. Under Simulation 2 with a tariff of IDR 700/kg, imports decline to 2,812,860 tons, a reduction of 249,993 tons or 8.16% from the baseline. The symmetric nature of import changes across both simulations confirms that, within this model, each IDR 250/kg change in tariff produces an equally proportionate but directionally opposite impact on import volume. Import demand arises when domestic demand exceeds domestic supply; therefore, a country's import volume reflects the difference between domestic consumption and domestic production inclusive of carry-over stocks. In this context, the largest gap occurs under Simulation 1 (IDR 200/kg tariff), where supply contracts and demand expands simultaneously, while the smallest gap occurs under Simulation 2 (IDR 700/kg tariff), where both variables move in opposing directions. The government must implement well-targeted and measured rice import policies to achieve a balance between maintaining food price stability, protecting local farmers, and meeting national food demand (Kurniawan et al., 2024). The results across the three simulations reveal that no scenario is without cost: Simulation 1 benefits consumers but erodes farmer competitiveness and deepens import dependency, whereas Simulation 2 protects farmers and reduces imports but burdens consumers, particularly low-income households.

Impact of Rice Import Tariffs on the Welfare of Indonesian Society

The mechanism of surplus changes can be further clarified through graphical representation. Figure 2 presents three simulation curves illustrating the effects of rice import tariff changes, each representing the baseline condition (tariff IDR 450/kg), Simulation 1 (tariff IDR 200/kg), and Simulation 2 (tariff IDR 700/kg). The red-shaded area represents the consumer surplus region, the yellow-shaded area denotes producer surplus, and the blue-shaded area indicates government revenue. The analysis is conducted using a comparative static approach, with the IDR 450/kg tariff serving as the baseline scenario. The surplus changes presented reflect deviations from this baseline condition, not absolute surplus values. Accordingly, under the IDR 450/kg reference tariff, no surplus change occurs as there is no price shift ($P' - P = 0$).

Under the baseline scenario, consumer surplus and producer surplus remain unchanged as they serve as the reference point. Should the government reduce the rice import tariff from IDR 450/kg to IDR 200/kg as in Simulation 1, consumer surplus would increase by IDR 6.56 billion. Conversely, should the government raise the rice import tariff from IDR 450/kg to IDR 700/kg as in Simulation 2, consumer surplus would decrease by IDR 6.50 billion. This near-symmetric pattern of change is driven by the exceptionally large scale of demand (exceeding 26 million tons), such that each IDR 250/kg price shift yields a substantial impact in absolute terms. The rice price increase under Simulation 2 (IDR 700/kg tariff) directly exacerbates the financial burden on low-income households, given that rice constitutes a significant component of the poverty line and food inflation (Mubarok & Anjani, 2025). This condition is reflected in Figure 2, where the red region representing consumer surplus is visibly largest under Simulation 1 (IDR 200/kg tariff), while under Simulation 2 (IDR

700/kg tariff), the red region narrows as a portion of consumer surplus is redistributed to producers and the government.

In contrast to consumer surplus, should the government reduce the rice import tariff from IDR 450/kg to IDR 200/kg as in Simulation 1, producer surplus would decline by IDR 8.79 billion, whereas an increase to IDR 700/kg as in Simulation 2 would raise producer surplus by IDR 8.85 billion. The change in producer surplus, approximately twice the magnitude of the consumer surplus change, is attributable to the substantially larger supply base (56.2 million tons) relative to the demand base (26.1 million tons). Tariff protection policies have been shown to effectively raise domestic prices, production levels, and farmer income (Warsito & Syam, 2024); conversely, the tariff reduction in Simulation 1 serves as a serious warning signal, as it threatens the competitiveness of local farmers and heightens the risk of poverty in the agricultural sector (Kusumastuti et al., 2024). This is consistent with the findings of (Laily et al., 2021), who demonstrated that tariff increases stimulate domestic product consumption and reduce import demand, thereby incentivizing farmers to enhance rice production and productivity in Indonesia. In Figure 2, the yellow region representing producer surplus is visibly largest under Simulation 2 (IDR 700/kg tariff), reflecting a scenario in which producers benefit from the highest selling prices at the greatest production volume.

Government revenue under the baseline tariff of IDR 450/kg amounts to IDR 1.37 billion, declining to IDR 662.5 million under Simulation 1 (IDR 200/kg tariff). Despite the increase in import volume, the reduction in the per-kilogram tariff rate is not offset by the additional volume. Under Simulation 2 (IDR 700/kg tariff), the higher tariff applied to a still-substantial import volume of 2,812,860 tons generates the highest government revenue of IDR 1.96 billion, an increase of approximately 43% relative to the baseline. This pattern indicates that a low-tariff policy not only disadvantages producers but also constrains the government's fiscal space for financing food security programs and agricultural subsidies (PSEKP Kementan, 2018). As illustrated in Figure 2, the blue region representing government revenue is smallest under Simulation 1 (IDR 200/kg tariff), reflecting the diminished capacity to fund social protection programs and agricultural investment, precisely the instruments needed to offset the adverse effects of low tariffs on farmers.

The net welfare effect under Simulation 1 (IDR 200/kg tariff) is −IDR 1.57 billion, indicating that the tariff reduction results in a net welfare loss for society. This occurs because the combined gains from consumer surplus and government revenue are insufficient to compensate for the loss in producer surplus, resulting in a net deadweight loss of IDR 1.57 billion that accrues to no party. Under Simulation 2 (IDR 700/kg tariff), the net welfare effect amounts to IDR 4.32 billion, indicating that the tariff increase generates a net welfare gain in aggregate. This arises because the combined gains in producer surplus and government revenue collectively exceed the loss in consumer surplus, yielding a net surplus of IDR 4.32 billion. (Siswanto et al., 2018) affirm that the application of rice import tariffs exerts a positive effect on production but a negative effect on consumption, and in aggregate tends to reduce overall social welfare. While rice import policies can stabilize prices and ensure supply in the short run, they risk undermining the incentives of local farmers to expand production. These policies must therefore be carefully calibrated to safeguard food security without compromising the long-term viability of domestic agriculture.

CONCLUSION AND RECOMMENDATIONS

Based on the results of the analysis, the following conclusions are drawn:

1. A reduction in the import tariff leads to a decline in supply and an increase in demand, whereas an increase in the import tariff results in higher production and lower consumption.
2. A reduction in the import tariff enhances consumer welfare and aggregate economic efficiency, but is detrimental to farmers and reduces government revenue. Conversely, an increase in the import tariff benefits farmers and government revenues but burdens consumers and generates deadweight loss. These findings underscore the need for a balanced tariff policy, accompanied by targeted protective measures for groups adversely affected in either scenario.

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