Potential trade policy reforms in Southeast Asian rice markets: Domestic and international impacts

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ABSTRACT

This paper examines the impact of rice trade policy in Indonesia and Malaysia using a global rice model based on a partial equilibrium framework. The simulation results suggest that the hypothetical rice tariffication in these two countries in 2021 would increase their imports by as much as 84.8% (Indonesia) and Malaysia (11.4%). We also find that farm prices would fall by 3.3% for Indonesia and 13.3 1% for Malaysia, while retail prices would drop by 6.2% in Indonesia. We estimate the fall in total inflation in 2021 at 0.3% for Indonesia and 0.4% for Malaysia, and less over time. The simulation results also show a slight increase in world prices, which led to small increases in the domestic prices Southeast Asian rice markets. The additional tariff revenue from rice tariffication should be used to not only soften the negative price effects to rice growers, but also help them to either increase their competitiveness and modernize their rice production or shift to other crops.

Keywords: Rice Tariffication; Southeast Asia; Partial equilibrium model

I. Introduction

The decades-long policy of the Philippine government in maintaining domestic rice prices above international prices was concluded in March 2019 through the enactment of the Rice Tariffication Law (RTL, Republic Act No. 11203). The policy reform has abandoned the quantitative restrictions on imports, replacing them with ad valorem tariffs to finally comply with the principles and rules of the World Trade Organization. Tariffication is generally regarded as a move towards trade liberalization, as well as stabilizing both world and domestic prices.

The policy reform abandoned the quantitative restrictions on imports that have been in place for more than thirty years, replacing them with ad valorem tariffs to finally comply with the principles and rules of the World Trade Organization (WTO). Another important aspect of the reform was the elimination of the role of the National Food Authority (NFA) in rice imports. For many years, the NFA had a monopoly on the importation of rice, and more recently, it issued a limited number of import licenses to private traders. The NFA has long been considered a source of huge inefficiencies and inappropriate interventions in markets (Clarete, 2019; Galvez, 2019; Ramos, 2019). The RTL opened up the market to private sector traders, eliminating the de facto market power exercised by the NFA for decades. The role of the NFA is now limited to maintaining food security rice stocks procured from Philippine farmers.

The RTL had replaced the quantitative restrictions on rice imports with applied tariff rates as follows: (i) in- and out-quota tariff of 35% for rice imports originating from the Association of Southeast Asian Nations (ASEAN) member states, (ii) in-quota tariff of 40% for rice imports originating from non-ASEAN WTO member states within the minimum access volume (MAV) of 350,000 metric tons, (iii) out-quota tariff of 50% for imports originating from non-ASEAN WTO member states above the MAV, and (iv) bound tariff rate of 180% for imports from non-ASEAN countries above 350 thousand tons (Briones, 2019; NEDA, 2019; USDA, 2019).

Yet trade liberalization may result in both winners and losers in each country (Gulati and Narayanan, 2003; Wailes, 2005). Indeed, the recently enacted RTL in the Philippines has generated two types of lower price effects, those in which consumers would enjoy increasing purchasing power, and those in which farmers would face declining income. An example of the

former is the micro-simulation study by Balié et al. (2021) who found that poor households benefit from lower rice prices with the poorest quintiles gaining the most. In contrast they found that rice net sellers are the main losers with a decline in welfare of 7.7%.

These opposing welfare effects corroborate the ongoing debates on how rice tarrification would affect food security and poverty. Some policymakers, prominent groups of farmers and a few members of academia have criticized the reform on the grounds that by reducing paddy price, it would impoverish small rice growers who are already close to the poverty line and vulnerable to market and other shocks. Other stakeholders have pointed out the risk for the national food security of raising the import dependence, becoming more exposed and vulnerable to shocks in the international rice market. Proponents of the RTL argue that the losses to rice farmers are small relative to the gains to consumers and the country as a whole. They further pointed out that the tariff revenue can be used to support farmers with rural investments (Briones, 2019).

The rice tarrification debate is well-anchored in economic research, but there is still scope for additional work. Some authors have focused on only one importing country in analyzing the effect of rice tariffication. Examples for the Philippines include Balié et al. (2021), Balié and Valera (2020), Perez and Pradesha (2019), and Corroraton and Yu (2019). A more complete analysis would examine other countries that are contemplating a reform of their rice price policy.

This indicates the necessity of undertaking empirical study that includes major rice importing countries to assess the potentially strong implications of rice trade policy reforms for rice market participants including farmers, consumers, traders, policy makers and government agencies. This study fills this gap in the literature by investigating those impacts in Indonesia and Malaysia using the IRRI Global Rice Model based in a partial equilibrium framework. These two countries are among the world's top rice importers, collectively accounting for about 4 to 5% of the world’s imports (USDA, 2020), and hence they play an important role in Southeast Asian rice markets.

2. Methodology

2.1. Rice trade modeling

Our modeling strategy draws on a modified version of the IRRI Global Rice Model (IGRM). IGRM is a dynamic partial equilibrium framework which has a structure similar to the well-established Global Rice Arkansas Model (AGRM) of the University of Arkansas (Wailes and Chavez, 2011). IGRM has been used as an analytical framework for rice trade liberalization studies in the Southeast Asian rice markets (Hoang and Myers, 2015; Balié and Valera, 2020; Balié et al., 2021). In this study, we extended the modeling of the Philippine rice tariffication in IGRM to study the impacts of a hypothetical rice tariffication in Indonesia and Malaysia.

The representation of the global rice market in IGRM comprises 25 countries and five regional aggregates, accounting for about 90% of the global rice consumption and production. Asian countries include Bangladesh, Cambodia, China, India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, South Korea, Sri Lanka, Taiwan, Thailand and Vietnam. The African countries include Cote d'Ivoire, Egypt, Kenya, Mozambique, Nigeria and South Africa, while American countries featured in the model are Brazil, Uruguay and the USA. The five regional aggregates in the model consist of other Africa, other Asia, other Latin America, the European Union, and the Rest of the World. The net importing countries in the model cover about 44% of the world's rice import and about 10% collectively for Indonesia, Malaysia and the Philippines. The world reference price for the model is the Thai FOB 5% broken price. The Thai 5% broken price is solved to close the model such that the Thailand's net exports equal the sum of the net trade of the remaining countries.

The structure of the global rice model is built upon a standard partial equilibrium framework with four major components for each country model, namely: supply, demand, trade, and price relationships. Supply comprises production, beginning stocks and imports. The model assumes profit-maximizing behavior of rice farmers who maximize net returns subject to a set of constraints in the production function. Demand is composed of domestic consumption, ending stock and exports. The model assumes that rice consumers maximize their utility subject to a budget constraint. Endogenous variables comprise yield, area, production, per capita consumption, ending stocks, beginning stocks, net imports, net exports, rice farm gate price, rice

retail price, rice wholesale price, Thai 5% broken rice price, Vietnam rice export price, world urea price and fertilizer use. Exogenous variables include world crude oil price, producer prices of competing crops, percentage of irrigated area, trend variables and policy variables. Additionally, exogenous macroeconomic indicators include gross domestic product (GDP), GDP deflator, consumer price index, exchange rates and total population. Model equations are estimated using ordinary least squares.

The historical data for country models mostly cover the period 1990–2018. The model was used to create a baseline from which policy comparisons can be made. The baseline estimates for Indonesia, Malaysia and the Philippines assume continuation of the QR policy. In terms of implementing the analysis in IGRM for Indonesia and Malaysia, their country models are re-estimated while other country models remain the same, except for data updates.

Furthermore, IGRM utilizes data on rice production, consumption, ending stocks, imports and exports from the U.S. Department of Agriculture Foreign Agriculture Service Production, Supply and Distribution database in developing baseline projections of the model. Unlike recent studies (Balié and Valera, 2020; Balié et al., 2021), we used historical and projected macroeconomic data on real gross domestic product (GDP), GDP deflator, CPI and exchange rate from the World Economic Outlook (International Monetary Fund, 2020). The historical data on population and projections were compiled from the 2019 World Population Prospects of the United Nations. The historical data on prices of rice and other crops were obtained from statistical yearbooks and price statistics database of the Food and Agriculture Organization (FAO). The historical data on Thai 5% broken price and Vietnamese 5% broken price were obtained from FAO's Global Information and Early Warning System (GIEWS).

2.2. Impacts of rice tariffication

In this study, we simulate the following three QR removal scenarios to measure the impact of rice tariffication policy on imports, production, consumption and prices:

Scenario 1: QR policy is removed and we assume that a 35% tariff is imposed to imports from WTO member countries.

Scenario 2: QR policy is eliminated and we assume the imposition of 35% tariff to WTO member countries.

Scenario 3: QR policy is removed. In addition, this scenario combined the imposition of a 35% import tariff with 1.5% yield increase per year over 5 years. The yield increase is based on examination of the trends in yield growth in Indonesia and Malaysia. As such, scenario 3 only takes into account for the historical trend in productivity increase and does not try to capture the potential effects of yield-increasing policy or program.

To evaluate the first round effects of the four policy shocks, we need to insert the quantitative restrictions QR_t into net import equation IM_t. The following equations are specified to account for QR_t in IM_t and market clearance for the domestic farm price p_t^f at the national level:

$$IM_t = if(IM_t \leq QR_t, IM_t, QR_t) \quad (1)$$

$$IM_t + PROD_t + ES_{t-1} = CON_t + ES_t \quad (2)$$

In Equation (3), the market clearing price p_t^f is determined by the sum of IM_t, total milled production ($PROD_t$), beginning stocks (ES_{t-1}), equal to the sum of total consumption (CON_t) and ending stocks (ES_t). The model solves for the new world equilibrium prices (P_t^{*w}) in each tariff scenario. To analyze the impact of the QR removal on trade and domestic rice markets, net imports and retail prices (p_t^r) are directly linked to P_t^{*w}, while p_t^f is linked to p_t^r. These linkages can be represented as follows:

$$IM_t = (P_t^{*w}) * (1 + \tau) \quad (3)$$

$$p_t^r = f((P_t^{*w}) * (1 + \tau), p_t^f) \quad (4)$$

where τ denotes the applied tariffs mentioned above. We also measure the effect of the rice tariffication policy on inflation by multiplying the percent change in retail prices with the percent share of rice in the consumer price index (CPI) basket. Rice in Indonesia and Malaysia respectively account for about 4% and 3% of the CPI basket.

3. Empirical results

3.1. Baseline results

We begin our economic modeling exercise with an analysis of baseline results assuming continuation of QR policy. To this end, we report a 5-year time horizon of the baseline projection from 2021 to 2025 to compare short and medium term effects. An important policy implication of this information is that policymakers can compare various aspects of the projection for effects that maybe substantial in the earlier stage of the reform but soon diminish in the presence of market forces. Farm prices of rice, for instance, could drop more pronouncedly after the reform but eventually mitigate as the market forces adjust to the new domestic rice market conditions. In the case of a sudden fall in farm prices, policymakers may have the ability to soften the negative short-term effect of lower prices for rice producers through safety net mechanisms.

Table 1 shows baseline results on net imports assuming continuation of QR policy. Full results on domestic production, consumption, stocks and prices are reported in Appendix, Table A1. Overall net imports are projected to decline as per rice consumption is projected to decline under a QR mechanism. As a result of declining per capita consumption, net imports in Indonesia are projected to decrease at an annual rate of 1.2% compared to that of 0.9% in Malaysia. In 2021, net imports are projected to reach 509 thousand tons for Indonesia and 1,070 thousand tons for Malaysia.

INSERT TABLE 1 HERE

3.2. Simulation results

Next, we turn to the analysis of the impacts on net imports and farm prices for all three scenarios as provided in Table 2. Complete results are presented in Appendix, Tables A2, A3 and A4. When the QR is removed and replaced with tariffs (scenario 1) in the case of Indonesia, net imports are estimated to increase from 509 thousand tons to 941 thousand tons in 2021 or by 84.8% from the baseline level. Likewise, net imports rise from 1,047 thousand tons to 1,194 thousand tons or by14% in 2021 when the QR is eliminated in Malaysia. By 2025, the increase in net imports levels off as population and income growth stabilize. We also found that tariffication alone (scenarios 1 and 2) has a bigger impact on net imports than a joint tariffication and yield increase (scenario 2). Overall, we show that trade can be a useful instrument for the

national food security, especially when there are domestic production shortfalls. Those empirical results complement those in Balié and Valera (2020) using a similar modeling approach. By using the IGRM and removing QR, Balié and Valera (2020) conclude that the rice tariffication in the Philippines would lead to a sharp increase in imports.

INSERT TABLE 2 HERE

Although net imports increase significantly in Indonesia, farm prices only decline by 3.9% or from Rp 2360/kg to Rp 22657/kg in 2021 (scenario 1, Table 2). The decline in farm prices is relatively large in the case of Malaysia as a result of a sharp increase in imports. In particular, farm prices decrease from RM 0.86/kg to RM 0.75/kg or by 13.2% in 2021 (scenario 1). Figure 1 illustrates the aforementioned results of farm price effect along with baseline projections and estimates for all three scenarios. Three notable patterns emerge. Firstly, under scenario 3, farm prices exhibit substantially more pronounced decline compared to the baseline and scenario 1 or 2. This suggests that the production response through a yield increase of 1.5% kicks in rapidly, compounding the effect of the surge in import bringing the farm prices further down. Secondly, since the decline in farm prices remains lower than in the baseline over the outlook period, it could be expected that retail prices would also decrease benefitting consumers over time. Thirdly, all three scenarios show that farm prices would remain below their pre-reform levels in the medium term, i.e. starting from 2021.

INSERT FIGURE 1 HERE

The above results indicate that rice production will be less profitable due to lower farm prices if production costs do not fall simultaneously and proportionately as result of productivity gains. This indicates that it is important that rice tariffication should be accompanied by policies that could distribute the welfare benefits from net rice consumers to net rice producers in order to ensure the efficacy of such a reform process. More importantly, it matters to identify policy options to mitigate such adverse effects on rice farmers. They may not be able or not have

enough time to adjust to the sudden and sustained decline in farm prices over the medium term on their own.

The impacts on the world reference prices (Thai 5%) together with Vietnamese 5% prices are shown in Table 3. Eliminating the QR and imposing tariffs instead (scenario 1) increases Thai 5% price by 2% relative to the baseline, from $414.2/MT to $422.6/MT in 2021 and from $450.6/MT to $457.6/MT or by 1.6% in 2025. The increase in Vietnamese 5% price from its baseline level is slighter at 1.9% and 1.4% in 2021 and 2025, respectively. This increase in world prices, although marginal, stems from the surge in demand in Indonesia and Malaysia as a response to lower domestic prices. One important message is that due to the size of its market, these two countries are able to influence rice prices internationally, albeit moderately.

INSERT TABLE 3 HERE

Figure 2 and Table 4 show the impact of the reform on retail prices for Indonesia[1] under the three scenarios. Unlike farm prices, the decline in retail prices is larger from Rp 6281/kg to Rp 5991/kg or by 6.2% in 2021 (scenario 1). Under scenario 3, retail prices decline further to Rp 5160/kg in 2021. While the large fall in retail prices dissipates in the near term, the downward price effect is persistent over the simulation period for all three scenarios, as shown in Figure 2. Moreover, retail prices stay below their pre-reform levels under scenario 3 but at significantly lower levels than farm prices. One potential explanation for such a pattern is that the remarkable increase in imports would lead to substantial rice stocks. Because stocks are costly, they cannot be held indefinitely. The release of these stocks into the market would lead to larger decline in retail prices in the near term than would have been the case otherwise. Our result show that the objective of the rice tariffication to increase rice supply, through trade openness and rice productivity increase, successfully translates into a low rice price policy for consumers. This policy would benefit many poor consumers in so far it would improve their financial access to the basic food staple.

[1] Results for retail prices of rice in Malaysia are not available from IGRM since the data are not available.

INSERT FIGURE 2 HERE

INSERT TABLE 4 HERE

As a response to lower retail prices, demand increases while inflation declines, as reported in Table 5. When the QR is eliminated in Indonesia, per capita consumption increases to 132.6 kg per year (scenario 1) and 135.2 kg per year (scenario 3) in 2021 corresponding to a 1.1% and 3.0% increase relative to the baseline, respectively. As for Malaysia, per capita consumption rises to 91.5 kg per year (scenario 1) and 90.9 kg per year (scenario 3) in 2021 or by 3.8% and 3.2% increase relative to the baseline, respectively. Both per capita consumption in Indonesia and Malaysia remain higher than in the baseline, but these decrease over time. This pattern is consistent with the literature that indicates a decline in rice consumption per capita over time (Sharma, 2014), partly due to income growth and shifting food preferences.

INSERT TABLE 5 HERE

Table 5 also shows that the decline in retail prices as a result of the tariffication contributes to the reduction in inflation. In 2021, Inflation falls by 0.3% in Indonesia and 0.4% in Malaysia (scenario 1). The fall in inflation becomes smaller over time. In sum, our results suggest that the rice tariffication exhibits the characteristics of a pro-poor policy because it primarily benefits the poorest consumers through lower prices of rice, the main food staple, and lower overall inflation. For the poor consumers who spend 20% of their income on rice alone, lower retail prices for rice means that they can increase their purchasing power. They can afford to consume more rice as well as other foods by reallocating some of their expenditure to more nutritious and diversified foods (Dawe, 2014) that are usually more expensive as well as other goods.

Finally, we consider the impact of tariffication on third-countries looking at the changes in the domestic prices by import sources. Since the world price of rice slightly increases, Table 6 shows that farm and retail or wholesale prices rise a bit over time for all scenarios in most of the

countries under study. Relative to the baseline in 2021, the increase in farm prices (scenario 1) is more pronounced in Thailand (1.5%) and Myanmar (1.1%). For all scenarios, the increases in domestic farm prices are lower in Cambodia, India and Vietnam, ranging between 0.1% and 0.7%. Table 6 also shows that retail prices noticeably decline from the baseline in Cambodia, Myanmar and Thailand, ranging between 1.6% and 3.5%.

INSERT TABLE 6 HERE

The finding of higher prices, especially in more competitive exporting countries such as Thailand and Vietnam, has an important bearing on their domestic rice markets. Higher domestic prices in exporting countries would stimulate their rice production and benefit the net sellers of rice. This in turn may increase demand for agricultural labor, lead to higher wages and hence better employment conditions. Although that may be detrimental to the net buyers of rice facing higher prices in the short run, agricultural laborers and small farmers could benefit as they augment their income from agricultural wage earnings.

4. Concluding remarks

In this paper, we have analyzed the impacts of the hypothetical rice tariffication in Indonesia and Malaysia. We have assessed the potentially strong implications for rice market participants including farmers, consumers, traders, policy makers, and government agencies. We used the IRRI Global Rice Model based on a partial equilibrium framework to investigate those impacts

As expected, the simulation results indicate that the reform would lead to a sharp increase in imports of 941 thousand tons (or 84.8%) in Indonesia and 1,192 thousand tons (or 11.4%) in Malaysia in 2021 and remain high in the following years. Rice exporters in Vietnam and Thailand would be the primary beneficiaries.

The additional supply of foreign rice in the domestic market would drive both farm prices and retail prices %) down in the short run. This pattern is largely consistent across the various regions of the country indicating price integration of the rice market. These prices would remain below the baseline levels. The large and persistent decline in retail prices explains the substantial

increase in rice consumption that would primarily benefit the poorest consumers to access the main food staple. We also estimate the fall in total inflation due to lower rice prices at 0.3% (Indonesia) and 0.4% (Malaysia) in 2021 and less over time. Lower inflation would also benefit the poor.

We also show that the reform of the rice sector in Indonesia and Malaysia would lead to a slight increase in the world price and influence an increase in the domestic prices of most South and South East Asian countries. In terms of policy options, it is important to offset the short term effect of lower price for producers especially the small ones through safety net mechanisms in order to ensure the efficacy of such a liberalization process. Those policies might include immediate cash or income support to affected rice farmers, price support and other agricultural input subsidies. While rice tariffication is largely pro-poor consumers, policy makers would need to use the substantial additional tariff revenue to help rice growers. A share of these funds could be used to help potentially competitive rice growers to increase their productivity and modernize their rice production through higher yielding varieties, adequate use of inputs, and mechanization. For those farmers that could not become competitive for structural or other reasons, government support would be needed to help them shift to other higher-value crops.

Rice trade policy reforms represent an opportunity for the structural transformation of the sector. Hence, accompanying measures for sector modernization are required and they include but are not limited to better varieties, labor productivity-enhancing investments, and marketing strategies. Additionally, the reform would have heterogeneous effects across the regions as well as farmer categories. This points to the need for more refined studies to identify better targeting of policy measures.

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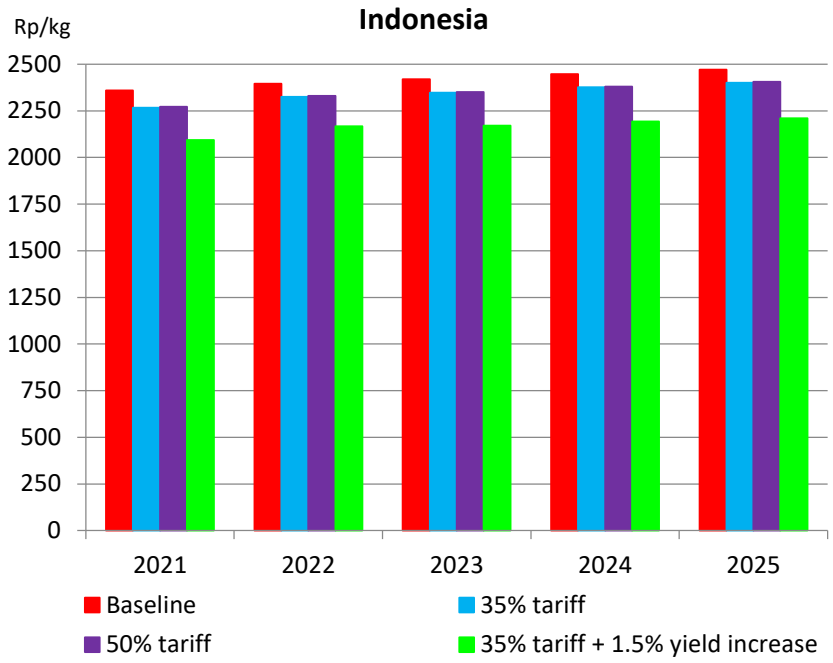
Figure 1. Impact on rice farm prices



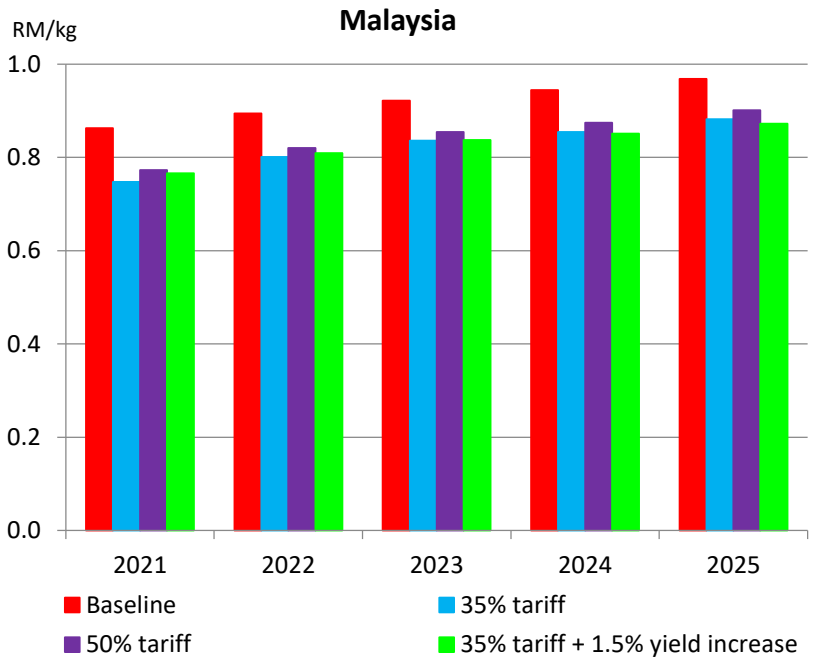


Figure 2. Impacts on rice retail prices

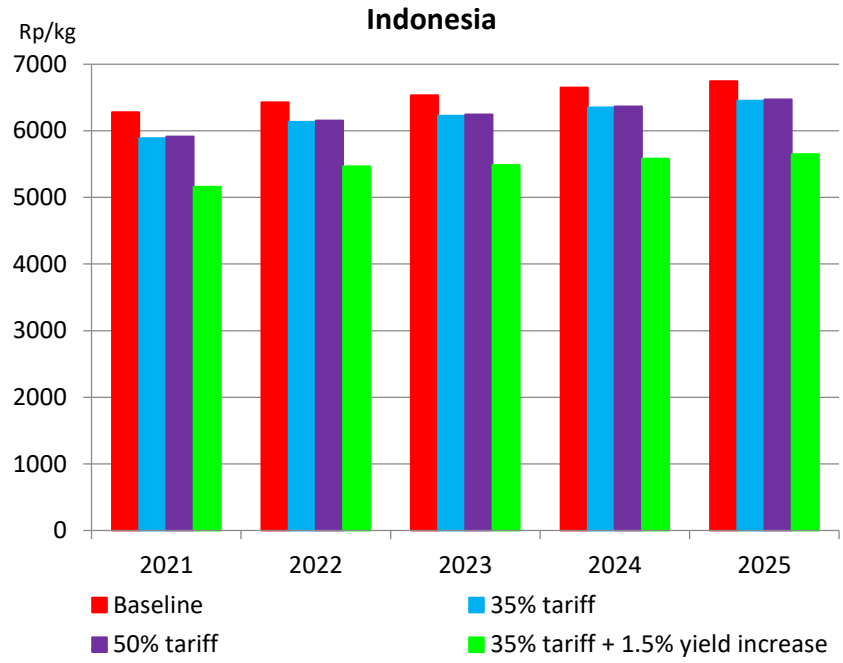
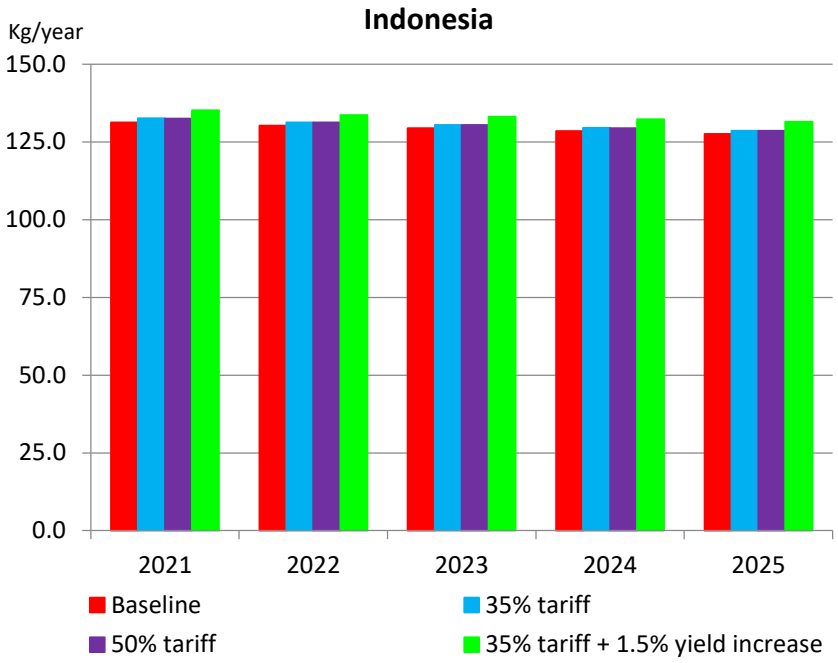


Figure 3. Impact on rice per capita consumption



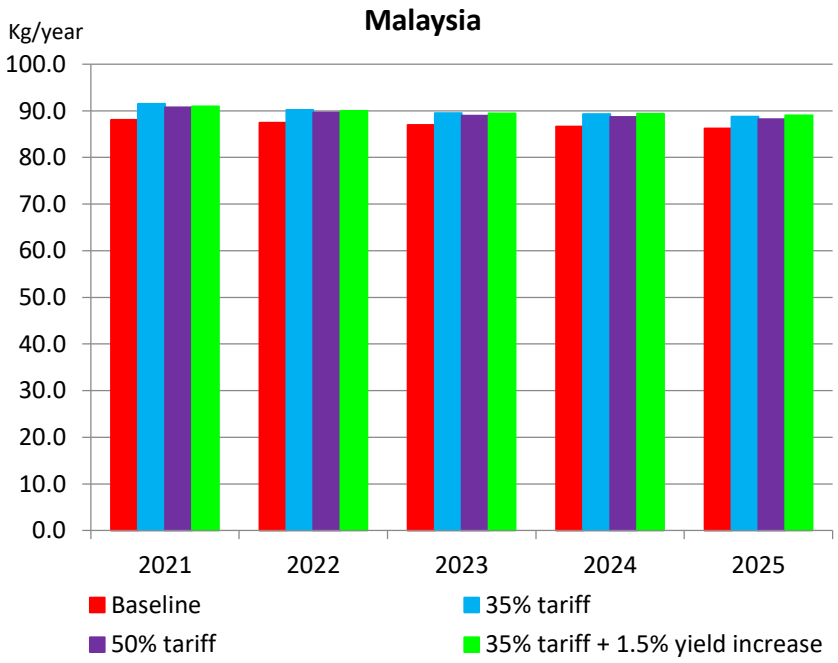
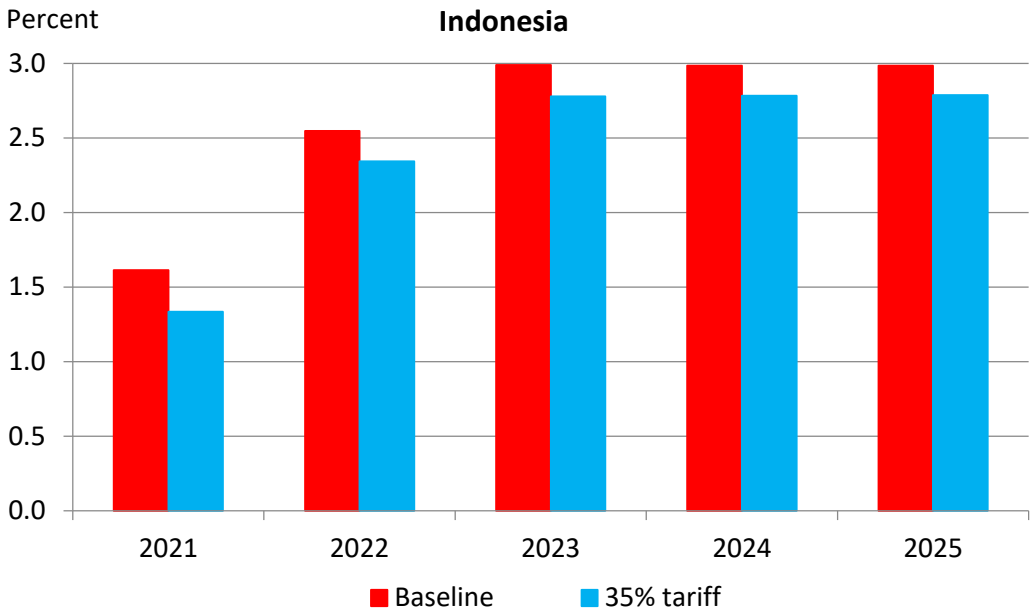


Figure 4. Impact on inflation



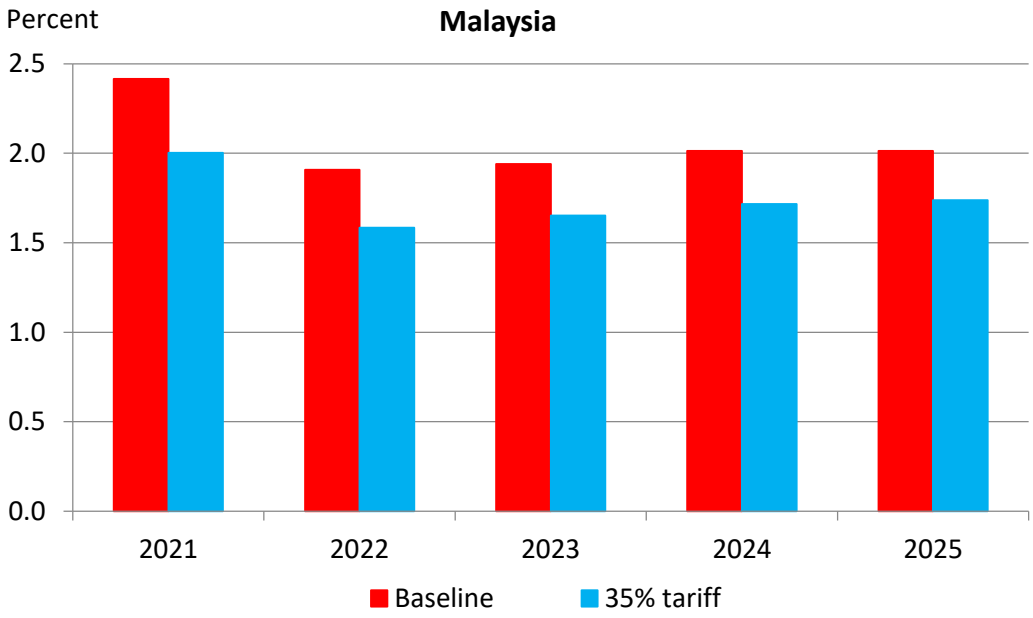


Figure 5. Impact on the domestic prices of third countries

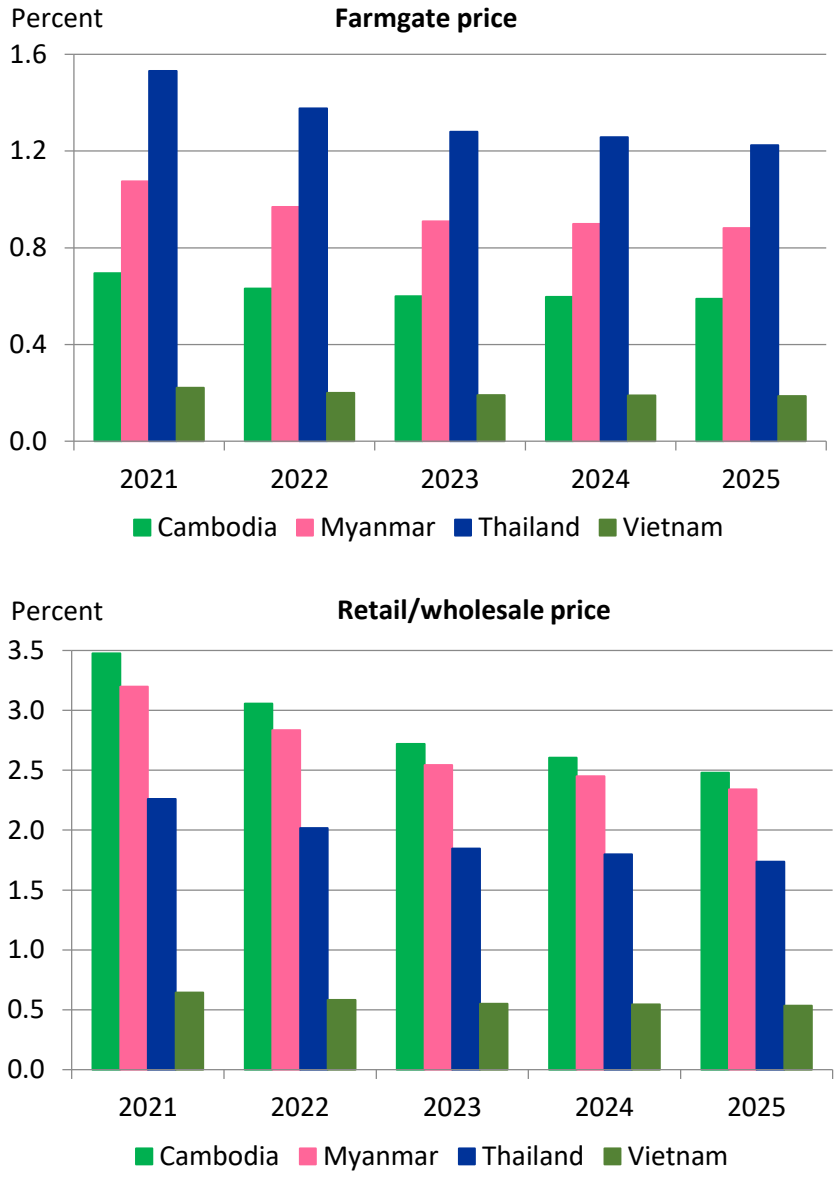


Table 1. Baseline results: net import impacts (1000 mt)

	2021	2022	2023	2024	2025	AGR (%)
Indonesia	509	501	497	495	492	-1.2
Malaysia	1,070	1,060	1,048	1,040	1,033	-0.9

Source: Model calculations. Note: AGR is average annual growth rate (2021-2025).

Table 2. Effects on farm prices and net imports relative to the baseline in 2021-2025

	Baseline	Scenario 1			Scenario 2			Scenario 3		
	1000 mt	1000 mt	Change	Change (%)	1000 mt	Change	Change (%)	1000 mt	Change	Change (%)
Net imports										
2021										
Indonesia	509.4	941.5	432.1	84.8	916.4	407.0	79.9	876.5	367.2	72.1
Malaysia	1070.4	1192.1	121.8	11.4	1165.3	95.0	8.9	1159.4	89.0	8.3
2023										
Indonesia	497.2	931.4	434.2	87.3	905.3	408.0	82.1	874.2	376.9	75.8
Malaysia	1047.9	1194.9	146.9	14.0	1160.2	112.3	10.7	1146.4	98.5	9.4
2025										
Indonesia	491.9	919.8	427.9	87.0	893.0	401.1	81.5	859.8	367.8	74.8
Malaysia	1032.9	1177.3	144.4	14.0	1141.6	108.6	10.5	1118.6	85.7	8.3
Farm prices										
2021										
Indonesia	2359.8	2266.9	-92.9	-3.9	2272.3	-87.5	-3.7	2092.9	-266.8	-11.3
Malaysia	0.86	0.75	-0.1	-13.3	0.77	-0.09	-10.4	0.77	-0.10	-11.2
2023										
Indonesia	2419.5	2346.4	-73.0	-3.0	2350.9	-68.6	-2.8	2170.7	-248.7	-10.3
Malaysia	0.92	0.84	-0.1	-9.3	0.85	-0.07	-7.3	0.84	-0.08	-9.1
2025										
Indonesia	2470.5	2400.4	-70.1	-2.8	2404.8	-65.7	-2.7	2208.9	-261.7	-10.6
Malaysia	0.97	0.88	-0.1	-8.9	0.90	-0.07	-6.9	0.87	-0.10	-9.9

Source: Model calculations. Note: AGR is average annual growth rate (2021-2025).

Table 3. Real Thai 5% and Vietnamese 5% prices, 2021–2025 ($/MT)

	2021[a] (actual)	2021	2022	2023	2024	2025
Baseline						
Thai 5%	415.4	414.2	419.7	435.2	443.4	450.6
Viet 5%	172.0	172.7	171.1	168.9	166.2	163.6
Scenario 1						
Thai 5%		422.6	427.2	442.4	450.5	457.6
Viet 5%		173.7	171.9	169.7	167.0	164.4
Scenario 2						
Thai 5%		421.9	426.7	441.8	450.0	457.1
Viet 5%		173.6	171.9	169.7	166.9	164.3
Scenario 3						
Thai 5%		420.9	425.6	440.6	448.6	455.5
Viet 5%		173.5	171.8	169.5	166.8	164.1
Change in Thai 5%, scenario relative to the baseline (%)						
Scenario 1		2.01	1.80	1.66	1.62	1.57
Scenario 2		1.86	1.67	1.53	1.49	1.44
Scenario 3		1.61	1.40	1.25	1.17	1.10

Source: Model calculations. Prices are deflated using US CPI (2005 = 100).

Table A1. Baseline projections: Supply, utilization and domestic prices, 2021-2025

Variable	Unit	2021	2022	2023	2024	2025	AGR
Indonesia							
Area	1000 ha	11,731.8	11,700.9	11,720.3	11,734.1	11,749.4	0.05
Yield	mt/ha	4.8	4.8	4.8	4.8	4.8	0.45
Milled Production	1000 mt	35,899.7	35,854.0	35,957.9	36,039.6	36,126.2	0.50
Per capita consumption	kg/year	131.2	130.2	129.4	128.5	127.6	-0.39
Total consumption	1000 mt	36,263.4	36,349.2	36,459.2	36,543.8	36,625.7	0.58
Ending stocks	1000 mt	3,638.7	3,644.3	3,640.2	3,631.1	3,623.5	0.75
Net imports	1000 mt	509.4	500.9	497.2	495.0	491.9	-1.20
Farm price	lcu/kg	2,359.8	2,394.6	2,419.5	2,446.9	2,470.5	0.02
Retail price	lcu/kg	6,280.8	6,427.0	6,531.6	6,647.0	6,746.2	0.06
Malaysia							
Area	1000 ha	692.9	697.7	706.0	713.1	719.2	0.55
Yield	mt/ha	4.0	4.1	4.1	4.1	4.1	0.57
Milled Production	1000 mt	1,816.8	1,841.4	1,874.3	1,903.3	1,929.5	1.12
Per capita consumption	kg/year	88.1	87.5	87.0	86.6	86.2	-0.80
Total consumption	1000 mt	2,886.5	2,901.8	2,920.5	2,941.7	2,961.1	0.39
Ending stocks	1000 mt	424.3	424.0	425.7	427.2	428.5	0.23
Net imports	1000 mt	1,070.4	1,060.2	1,047.9	1,039.8	1,032.9	-0.85
Farm price	lcu/kg	0.86	0.89	0.92	0.94	0.97	3.96

Source: Model calculations. Note: AGR is average annual growth rate (2021-2025).

Table A2. Utilization, supply and price differences under QR removal with 35% tariff scenario relative to the baseline in 2021-2025

Variable	Unit	2021	2022	2023	2024	2025	AGR
Indonesia							
Area	1000 ha	11,731.9	11,649.3	11,681.7	11,693.5	11,709.9	-0.02
Yield	mt/ha	4.8	4.8	4.8	4.8	4.8	0.45
Milled Production	1000 mt	35,900.1	35,686.9	35,832.5	35,907.9	35,998.0	0.43
Per capita consumption	kg/year	132.6	131.3	130.4	129.5	128.6	-0.22
Total consumption	1000 mt	36,645.9	36,638.5	36,765.9	36,844.9	36,925.8	0.75
Ending stocks	1000 mt	3,688.6	3,678.1	3,676.1	3,665.8	3,657.7	0.95
Net imports	1000 mt	941.5	941.1	931.4	926.7	919.8	15.56
Farm price	lcu/kg	2,266.9	2,325.0	2,346.4	2,375.9	2,400.4	-0.50
Retail price	lcu/kg	5,890.7	6,135.0	6,224.8	6,348.7	6,451.6	-0.70
Malaysia							
Area	1000 ha	693.2	667.6	681.6	690.8	695.6	-0.11
Yield	mt/ha	4.0	4.1	4.1	4.1	4.1	0.64
Milled Production	1000 mt	1,817.7	1,766.7	1,815.0	1,849.6	1,872.2	0.53
Per capita consumption	kg/year	91.5	90.2	89.5	89.3	88.7	-0.22
Total consumption	1000 mt	2,997.5	2,993.1	3,005.1	3,032.1	3,048.5	0.98
Ending stocks	1000 mt	436.0	423.7	428.4	429.2	430.1	0.32
Net imports	1000 mt	1,192.1	1,214.1	1,194.9	1,183.3	1,177.3	1.87
Farm price	lcu/kg	0.75	0.80	0.84	0.85	0.88	2.12

Source: Model calculations. Note: AGR is average annual growth rate (2021-2025).

Table A3. Utilization, supply and price differences under QR removal with 50% tariff scenario relative to the baseline in 2021-2025

Variable	Unit	2021	2022	2023	2024	2025	AGR
Indonesia							
Area	1000 ha	11,731.9	11,652.3	11,683.9	11,696.0	11,712.4	-0.01
Yield	mt/ha	4.8	4.8	4.8	4.8	4.8	0.45
Milled Production	1000 mt	35,900.1	35,696.6	35,839.7	35,915.9	36,005.9	0.44
Per capita consumption	kg/year	132.5	131.2	130.4	129.4	128.6	-0.23
Total consumption	1000 mt	36,623.7	36,621.7	36,747.3	36,826.3	36,906.9	0.74
Ending stocks	1000 mt	3,685.7	3,676.2	3,673.9	3,663.6	3,655.6	0.94
Net imports	1000 mt	916.4	915.6	905.3	900.2	893.0	14.55
Farm price	lcu/kg	2,272.3	2,329.1	2,350.9	2,380.3	2,404.8	-0.47
Retail price	lcu/kg	5,913.3	6,151.9	6,243.5	6,367.1	6,470.1	-0.65
Malaysia							
Area	1000 ha	693.2	674.2	686.7	695.6	700.8	0.04
Yield	mt/ha	4.0	4.1	4.1	4.1	4.1	0.67
Milled Production	1000 mt	1,817.7	1,785.9	1,830.6	1,864.8	1,888.5	0.70
Per capita consumption	kg/year	90.7	89.6	88.9	88.7	88.2	-0.35
Total consumption	1000 mt	2,973.3	2,974.2	2,986.8	3,012.2	3,029.1	0.85
Ending stocks	1000 mt	433.4	424.2	428.2	429.2	430.3	0.32
Net imports	1000 mt	1,165.3	1,179.1	1,160.2	1,148.5	1,141.6	1.21
Farm price	lcu/kg	0.77	0.82	0.85	0.87	0.90	2.50

Source: Model calculations. Note: AGR is average annual growth rate (2021-2025).

Table A4. Utilization, supply and price differences under QR removal with 30% tariff and 1.5% yield increase scenario relative to the baseline in 2021-2025

Variable	Unit	2021	2022	2023	2024	2025	AGR
Indonesia							
Area	1000 ha	11,731.9	11,552.7	11,593.4	11,595.9	11,608.4	-0.19
Yield	mt/ha	4.9	5.0	5.0	5.0	5.0	1.13
Milled Production	1000 mt	36,849.9	36,406.8	36,645.3	36,750.3	36,887.8	0.94
Per capita consumption	kg/year	135.2	133.6	133.1	132.2	131.5	0.23
Total consumption	1000 mt	37,362.5	37,299.3	37,504.0	37,619.6	37,745.3	1.20
Ending stocks	1000 mt	3,856.9	3,852.5	3,868.0	3,867.2	3,869.5	2.15
Net imports	1000 mt	876.5	888.1	874.2	868.5	859.8	13.16
Farm price	lcu/kg	2,092.9	2,166.2	2,170.7	2,193.2	2,208.9	-1.97
Retail price	lcu/kg	5,159.9	5,467.8	5,486.8	5,581.2	5,647.0	-2.86
Malaysia							
Area	1000 ha	693.1	672.4	683.6	691.2	694.7	-0.14
Yield	mt/ha	4.1	4.1	4.2	4.2	4.3	1.41
Milled Production	1000 mt	1,832.9	1,807.1	1,863.7	1,908.9	1,942.7	1.27
Per capita consumption	kg/year	90.9	90.0	89.4	89.4	89.0	-0.16
Total consumption	1000 mt	2,979.8	2,985.4	3,003.6	3,035.5	3,058.0	1.04
Ending stocks	1000 mt	436.1	428.2	434.7	438.0	441.3	0.83
Net imports	1000 mt	1,159.4	1,170.4	1,146.4	1,129.9	1,118.6	0.80
Farm price	lcu/kg	0.77	0.81	0.84	0.85	0.87	1.85

Source: Model calculations. Note: AGR is average annual growth rate (2021-2025).