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Domestic and international impacts of the rice trade policy reform in the Philippines

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ABSTRACT

Faced with high domestic rice prices that have fueled inflation above the 2018 target and penalized poor consumers the most, the government of the Philippines has decided to abandon the quantitative restrictions on imports and replace them with tariffs. This paper uses a global rice model based on a partial equilibrium framework to assess the possible impacts of this reform on imports, production, consumption and prices. In contrast with past similar studies, we address three key concerns (i) the heterogeneity in farm price across 16 regions in response to the combined effect of the tarriffication and the average historical trend in productivity increase at 1.5% between 2001 and 2018, (ii) the differentiation of imports by origin partly due to the different tariffs applied to countries within and beyond the Association of South East Asian Nations, and (iii) the effect on domestic prices in third countries. The simulation results suggest that the reform would increase imports by 2.47 million tons (20.7%) in 2019. We also find a large decline in farm prices and retail prices respectively by PhP 6.1/kg (30.1%) and PhP 7.6/kg (17.4%) in 2019 that explains an increase in rice consumption. We estimate the fall in total inflation at 1.2% in 2019 but less over time. Further, the large fall in farm prices in 2019 is shared quite evenly among regions in the short term but returns to pre-reform levels in the near term. Using a higher price elasticity of supply for one region obtained from panel data surveys, we show a more pronounced decline in production than the national average. Such differentiated results confirm the relevance of using a regionally disaggregated model to design more targeted policies. We also show a slight increase in world prices, which led to small increases in the domestic prices of South and Southeast Asian rice markets. While this reform is largely pro-poor consumers, policy makers would need to use the additional tariff revenue to help rice growers either increase their competitiveness and modernize their rice production or shift to other crops.

1. Introduction

The Philippine government had a long history of using quantitative restrictions to control rice imports that resulted in rice prices to raise and remain well above those of most of the other nations in South East Asia. In an effort to improve the welfare of consumers to tackle the rising inflation in 2018 partly attributed to high rice prices, the government has decided to adopt the rice tariffication (RT) policy.

The probable effects of this rice trade reform, often presented as a rice trade liberalization (RTL), has triggered much debate among policy makers, academics and representatives of farmers' groups. Hosoe (2016) pointed out that national food security is one of the key justifications to oppose a RTL. However, Tanaka and Hosoe (2011) argued against the Japanese government position that a RTL would threaten national food security in the event of crop failure. Moreover, Srinivasan and Jha (2001) noted that a RTL in India had raised concerns as the reform would likely increase domestic price variability and increase the costs of price stabilization. In contrast, Tolentino (2002), Dawe (2006) and Habito (2016) regard the process of RTL in the Philippines and a gradual opening up of the rice sector to the world rice market as a key means for improving food security, agricultural productivity and domestic rice market's competitiveness, and lowering inflation. A third position, often referred to as the neutral view, is that RTL may not necessarily accrue to those who were initially targeted and cannot be relied upon for long-run food security as a result of a trade policy reform. Instead, greater emphasis should be placed on institutional changes and other policy reforms that provide safety nets, improve access to food and reduce transaction costs for farmers (Anderson and Strutt, 2014; Brooks, 2014; Gillespie et al., 2015).

This paper examines the effects of the RT policy in the Philippines. With qualifications, we agree that the RT lowers rice prices to the benefit of consumers and helps reduce inflation. Newly and more

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importantly, we account for the spatial heterogeneity of the price effect of the RT policy. We find that, at least in the short run, the sudden and large fall in farm prices is shared quite evenly among regions, but return to pre-reform levels in the near term. We also show that previously reported large rise in world and domestic prices due to RTL in Southeast Asian importing countries (Hoang and Meyers, 2015) vanish when we solely focus on liberalizing rice trade in the Philippines.

To our knowledge, Hoang and Meyers (2015) are the first to study in detail the effect of RTL in Southeast Asian rice markets. The authors apply the so-called Associations of Southeast Asian Nations or ASEAN-5 model, a modified version of the International Rice Research Institute Global Rice Model or IGRM based on a partial equilibrium (PE) framework, to analyze the impact of RTL on the domestic and world rice prices. They show that full trade liberalization in importing countries significantly lowers the domestic price but increases the world price of rice. With these findings, they conclude that: “If only one importing country opens to trade while others do not, the price effect on that country would be more detrimental to its producers since it has to absorb all the market volatility” (p. 35).

We build upon and contribute to the literature in three ways. Firstly, from a rice policy evaluation perspective, we conclude that adverse price effect to rice producers can improve the quality of the policy advice insofar as it is based on the extent of changes in producer prices in different producing regions. However, previous studies have at most only analyzed the national level changes in producer prices, missing a potentially important regional heterogeneity. For this reason, we pursue our objective by studying important regional differences in the response of producer prices to the RT policy.

Secondly, on the modelling approach, most previous studies have aggregated a country’s rice imports regardless of their origin. Thus, the differences in rice imports by origin are not visible. This is problematic because it does not allow capturing the effects of the different applied tariff rates and tariff-rate quota (TRQ) system used under the RT policy of the Philippines. A natural way to confront this problem is to differentiate imports by origin. This study classifies the Philippines’ rice imports data according to the following four categories: Thailand, Vietnam, other ASEAN and non-ASEAN imports sources.

Thirdly, we notice that the third-country effects of the RTL are largely unexplored in the literature. A full free trade scenario suggests that rice should flow from countries where prices are lower, e.g. Thailand, to where prices are higher due to the rice protection, e.g. the Philippines. Imports in turn would flow into, e.g. the Philippines, to reduce high domestic prices to world levels following a mechanism that would benefit consumers. This effect by itself would trigger exports in exporting countries where domestic prices would rise to equalize with world prices. Thus, a more complete analysis of the impact of the RTL policy would capture the domestic price effects on third countries. This paper offers a perspective on the changes in the domestic prices of selected South and South-East Asian countries that drive the world rice market including the world’s top rice exporters such as India, Thailand and Vietnam and the main importers such as Indonesia, Malaysia and the Philippines.

The paper is structured as follows. Section two discusses the importance of the rice tariffication and offers a synthesis of previous studies on RTL. The third section presents the model and scenarios. The fourth section discusses the empirical results and provides implications for policy. The final section concludes.

2. Why does rice tariffication policy matter?

Tariffication or the switch from quantitative import restriction to tariff only is generally considered as a move towards trade liberalization. It is important insofar as it is based on the belief that it stabilizes both world and domestic prices respectively in terms of world and domestic supply or demand (Abbott and Paarlberg, 1998; Tyers and Anderson, 1992). However, Gulati and Narayanan (2003) and Wailes (2005) pointed out that trade liberalization may result in both winners and losers in each country. Dawe et al. (2006, pp. xi–xii), writing about the Philippine context, made this point directly: “Like all changes, rice trade liberalization would have both positive and negative effects. Lower palay[1] and rice prices would of course hurt palay farmers, especially those with large surpluses to sell… On the other hand, lower prices would benefit the many poor consumers who spend more than 20% of their income on rice alone.”

The Philippines, where rice is by far the dominant staple food, has been a traditional rice-importing country. That is why many trade analysts recognize the importance of tariff and nontariff trade barriers reductions on the Philippine rice sector to promote economic efficiency (see, for example, Magno and Yanagida, 2000; Salehezadeh and Henneberry, 2002; Dawe, 2006; Briones, 2013; Layaoen, 2014). It is only with the law adopted on March 5, 2019 that the Philippine government replaced the quantitative restrictions (QR) on rice with tariffs in accordance with the Rice Liberalization Act (RA 11203).

The main argument in support of the reform is that it will help the government achieve greater and faster country-wide food security and ultimately benefit rice producers, consumers, traders and the economy as a whole. This reform was necessary to fulfill the international commitment made when the country joined the World Trade Organization (WTO) in 1995. The main features of the reform are the applied tariff rates:

1. 35% for rice imports originating from ASEAN member states;
2. 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; and
3. out-quota tariff of 50% for imports originating from non-ASEAN WTO member states above the MAV.

There are at least four reasons in support of the RT policy. Firstly, the National Food Authority (NFA) has exercised a total control of rice imports for many decades. The NFA was the country’s sole rice importer before 1996. Subject to the authorization of the NFA, a few private enterprises were also authorized to import minimal quantities of rice after the enactment of the Agricultural Tariffication Act in 1996 (Yao et al., 2007). The NFA used to set levels of rice imports by allocating import quotas to private companies and issuing import licenses. However, the use of public funds for price stabilization (Tolentino and De La Pena, 2009) and NFA’ responsibility in under-and over-importation in some years (Briones, 2012) were among the main concerns raised to remove the state agency’s role in rice trading. The other main motivation to curb the mandate of the NFA was its alleged responsibility in deteriorating the budget deficit and the national debt (Intal and Garcia, 2005).

Secondly, domestic rice prices in the Philippines have been consistently higher than the world price of rice (Dawe, 2001, 2006, 2014), negatively impacting consumers over a long period. Figs. 1 and 2 show that the Philippines had the highest farm and retail prices as compared to Thailand and Vietnam for decades. These higher prices are attributed to the higher production (mostly labor) costs and a low supply of paddy in the Philippines (Cabling and Dawe, 2006; Moya et al., 2016). Therefore, policymakers advocate for the RT policy to address high rice prices, which are problematic insofar as they tend to increase poverty and the number of food insecure people (Rahman et al., 2008; Raihan et al., 2008).

Thirdly, increasing rice prices in 2018 due to very low supply of rice has contributed to substantial inflationary pressure in the economy. Fig. 3 displays retail prices in the Philippines which markedly increased in September 2018 when inflation reached 6.7%. The role of rice prices

[1] Palay is the Filipino word for rice at harvest or paddy, before the husk is removed.

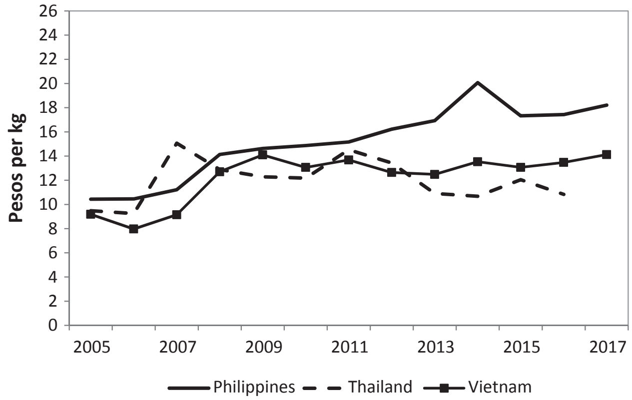

Fig. 1. Farm gate prices of rice in the Philippines, Thailand and Vietnam.
Source: Farm prices data for the Philippines are obtained from the Philippine Statistics Authority. Farm prices data for Thailand and Vietnam are sourced from FAO. Exchange rate data are compiled from International Monetary Fund, International Financial Statistics.

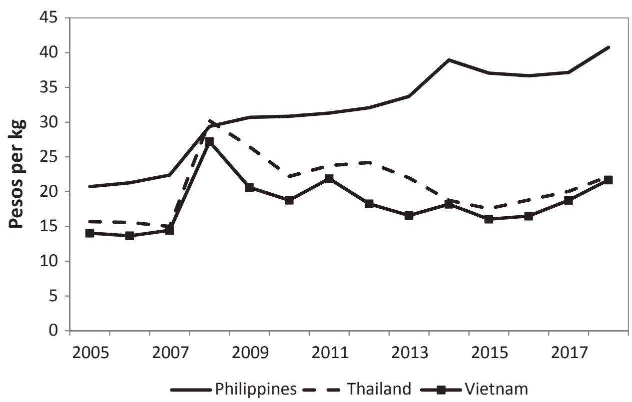

Fig. 2. Retail prices of rice in the Philippines and prices of Thai 5% and Vietnamese 5% broken rice.
Source: Retail prices data for the Philippines are obtained from the Philippine Statistics Authority. Retail prices data for Thailand and Vietnam are sourced from FAO. Exchange rate data are compiled from International Monetary Fund, International Financial Statistics.

in driving inflation also motivated the decision of the government to pursue the rice trade policy reform. Policymakers have also recognized that rising rice prices and inflation reduce effective purchasing power and adversely affects the food security of poor consumers (Dawe, 2014; Hossain and Deb, 2012). More specifically, Fujii (2013) found that food inflation in the Philippines severely and adversely affect the poorest, whether they are in agricultural households or not.

Fourthly, the government justifies the RT policy on the ground that it will stimulate a greater participation in the rice trading and marketing from a variety of domestic and international actors. Under the new tariffication regime, due to the reduced government (NFA) intervention, private importers are expected to help significantly increase domestic supply and, as a result, lower domestic rice prices. This expectation is consistent with the literature. Dorosh (2001) found that, through separate trade liberalizations in the early 1990s, private sector imports have augmented domestic supplies and stabilized prices in Bangladesh and import parity levels. In the Philippines, the annual average volume of supply deficit has been close to 1.9 million tons over the period 2005 to 2018 (Table 1). To fill this supply deficit, imports administered by the NFA averaged 1.5 million tons from 2005 to 2018 (Fig. 4 and Table 1). This volume represented about 13.5% and 11.4% of total milled production and consumption on average over the period, respectively.

Many studies have examined the impact of RTL on the world and domestic prices of rice as reported in Table 2. Most studies have used Partial Equilibrium (PE) models to isolate rice (or other commodity markets) from the rest of the economy and capture the effects of a wide range of agricultural policies. Recent studies have applied the IGRM (Hoang and Meyers, 2015), the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) (IFPRI, 2010; Perez and Pradesha, 2019), and a single-country PE model (Briones, 2012; Soon et al., 2019). Other papers have also built upon the Arkansas Global Rice Model (AGRM) and RICEFLOW of the University of Arkansas (Cramer et al., 1993; Cramer et al., 1999; Wailes, 2005). Some analyses of RTL also relied on a spatial equilibrium model (Acosta and Kagatsume, 2003; Minot and Goletti, 2000; Hranaiova and Gorter, 2006; Chen, Chang and McCarl, 2011). Other studies have examined RTL using a Computable General Equilibrium (CGE) framework to capture the economy-wide effects, including non-agricultural markets (see, for example, Bouët (2008); Cororaton and Yu (2019); Perez and Pradesha (2019)). Irrespective of the modelling frameworks employed,

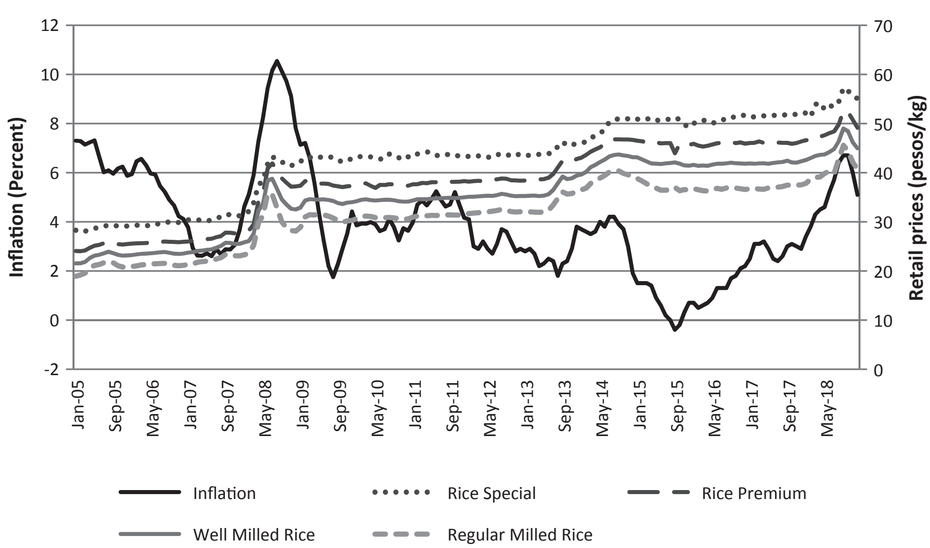

Fig. 3. Monthly inflation and retails prices of rice in the Philippines.
Source: Inflation data are from the Bangko Sentral ng Pilipinas. Data on retail prices of rice are from the Philippine Statistics Authority.

Table 1
Milled rice production, consumption and import of the Philippines.
Source: Milled rice production and consumption data are obtained from USDA Production, Supply and Distribution (PSD) database. Rice import data came from the National Food Authority.

Year	Milled production (1000 mt)	Consumption (1000 mt)	Supply deficit (1000 mt)	Total imports (1000 mt)	Share of total imports to milled production	Share of total imports to total consumption
2005	9821	10,722	−901	1830	18.63	17.06
2006	9775	12,000	−2225	1723	17.63	14.36
2007	10,479	13,499	−3020	1810	17.27	13.41
2008	10,755	13,100	−2345	2439	22.68	18.62
2009	9772	13,125	−3353	1784	18.26	13.59
2010	10,539	12,900	−2361	2386	22.64	18.50
2011	10,710	12,860	−2150	710	6.63	5.52
2012	11,428	12,850	−1422	1056	9.24	8.22
2013	11,858	12,850	−992	405	3.42	3.15
2014	11,914	13,000	−1086	1093	9.17	8.41
2015	11,008	12,900	−1892	1533	13.93	11.88
2016	11,686	12,900	−1214	620	5.31	4.81
2017	12,235	13,250	−1015	890	7.28	6.72
2018	11,800	14,100	−2300	2065	17.50	14.65
Average	10,984	12,861	−1877	1453	13.54	11.35

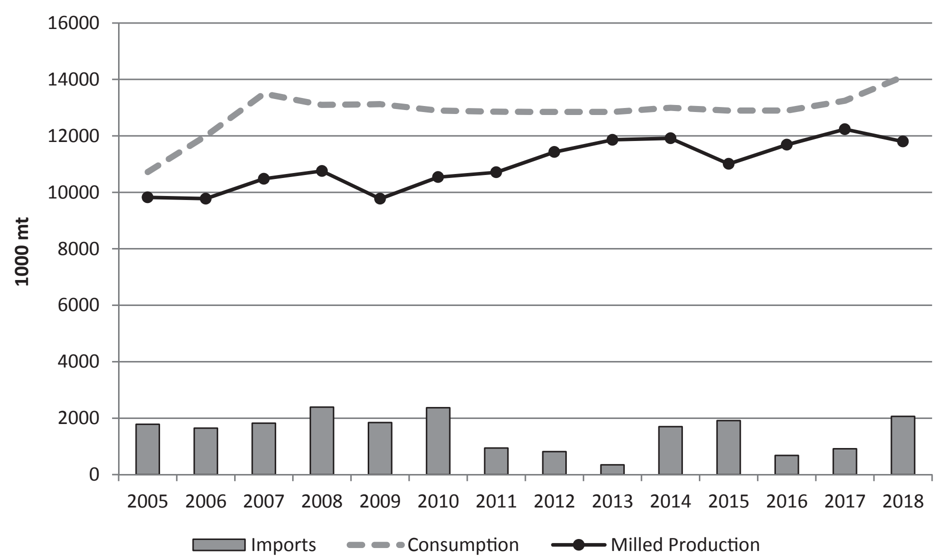

Fig. 4. Milled rice production, consumption and import of the Philippines, 2000–2018.
Source: Milled rice production and consumption are compiled from USDA Production, Supply and Distribution (PSD) database. Rice imports data are obtained from the Philippine Statistics Authority.

a very mixed picture is obtained as to the impact of RTL on the world and domestic prices of rice.

Studies such as Wailes (2005) and Hoang and Meyers (2015) show the extent of changes in the world and domestic prices of rice as a result of free trade in the Southeast Asian rice markets. As mentioned earlier, Hoang and Meyers (2015) argue that the price effect of RTL would be more harmful to farmers of an importing country if only one country opens to trade while others do not. This has implications for both rice trade modelling and for policy analysis. In contrast to the existing published literature on liberalization of Asian rice markets, the present study allows for the differentiation of imports by origin to capture the effect of different applied tariff rates under the RT policy in the Philippines. In assessing the adverse price effect of the RT policy on farmers, our modelling approach adds to the literature because it captures the heterogeneous response in farm prices across regions to the reform.

3. Methodology

3.1. Partial equilibrium trade model for the global rice economy

The model used for this study is a version of IGRM specifically modified to study the rice tariffication policy in the Philippines, henceforth called the PRT model. Contrary to previous analyses of rice trade liberalization using the IGRM (e.g. Hoang and Meyers, 2015), the PRT model has several unique characteristics with respect to estimating the effects of the RT policy on the domestic and world rice markets. These include incorporation of net imports by origin, linkage between national retail price and regional farm prices, and a regional supply response of rice. The PRT model solves the national domestic farm price within the country model by equating total supply with total demand.

The PRT model estimates four equations for the Philippines's net imports from Thailand, Vietnam, other ASEAN countries and non-ASEAN countries. This permits us to introduce the pre-reform QR on rice imports and the post-reform applied tariffs in each of those four net import equations. Fig. 5 illustrates the PRT model that features differentiation of rice imports by origin. More detailed specifications of the PRT model are provided in Table 3. For the PRT model, we re-estimated

Table 2
Summary of studies of rice trade liberalization, 1993–2019.

Authors	Focus countries	Reform and policy changes	Results
Part A. Partial and spatial equilibrium framework			
Soon et al. (2019)	South Korea	Shifted to TRQ system in 2015; reduce (raise) over-quota tariff rate (TRQ quantity) scenarios	Both policy changes increases imports, which are sensitive to consumer preferences for different rice types
Perez and Pradesha (2019)	Philippines	Removerice imports quota	Removal of QR increases imports to 3.97 million tons in 2025, reduces domestic prices by 26%, and rises world prices by 0.64%
Hoang and Meyers (2015)	Indonesia, Malaysia, Philippines	Remove AFTA tariffs and STEs; free trade scenarios	Removal of STEs in importing countries lowers (raises) domestic (world) rice prices by 34% (20%)
Briones (2012)	Philippines	Rice tariff reductions	Tariff reductions raise imports to 3.5 million tons and consumption to 15.9 million tons. Retail prices would fall from PhP 33.7/kg to PhP 33/kg while farm prices would decline from PhP 14.4/kg to PhP 13.3/kg
Chen et al. (2011)	Japan, Taiwan	TRQ expansion and out-quota tariff reduction	Domestic price is higher in an out-quota tariff reduction than in TRQ expansion scenario
IFPRI (2010)	Global	Trade liberalization	World rice prices increases by 14%
Hranaiova and Gorter (2006)	South Korea	TRQ under import STEs	Modest rise (fall) in quota (out-of-quota tariff) to binding levels raises imports
Wailes (2005)	Global	Remove all trade barriers and domestic support	Full liberalization raises world rice prices by 22% (80%) for long-grain (medium/short grain) rice; increase of 1.8% in the export prices of long-grain rice and 71% for medium/short grain rice, and 33% for all rice
Acosta and Kagatsume (2003)	Indonesia, Malaysia, Philippines	Remove AFTA rice tariffs	AFTA tariffs removal significantly lowers domestic rice prices in importing countries
Minot and Goletti (1998)	Vietnam	Remove rice export quota	Domestic prices of milled rice and export prices drop by 20.3–22% and 2.1–3.7%, respectively
Cramer, Hansen and Wailes (1999)	Japan	Rice tariffication policy in April 1999; assume South Korea maintain (increase) its minimum access imports from 2004 to 2010	Tariffication reduces Japan's rice imports in 1999 and 2000, which are less than the required minimum access quantities; world prices increase by about $10 per metric ton
Cramer et al. (1993)	Brazil, Japan, Philippines, South Korea, Taiwan, U.S.	Remove direct and indirect trade barriers	Trade liberalization raises total U.S. export revenue by 109%; free trade reform by Japan has significant effects on world rice trade and on its domestic rice production
Part A. Computable General Equilibrium framework			
Cororaton and Yu (2019)	Philippines	Remove rice import quota	Farm gate (retail) price falls by 3.7% (10.9%); imports (consumption) rises by 113.3% (3.5%)
Bouët (2008)	Global	Remove tariffs and export subsidies	World rice prices increases by 3%

Notes: TRQ is tariff rate quota. AFTA is Association of Southeast Asian Nations Free Trade Agreement. STE is state-trading enterprise. QR is quantitative restrictions.

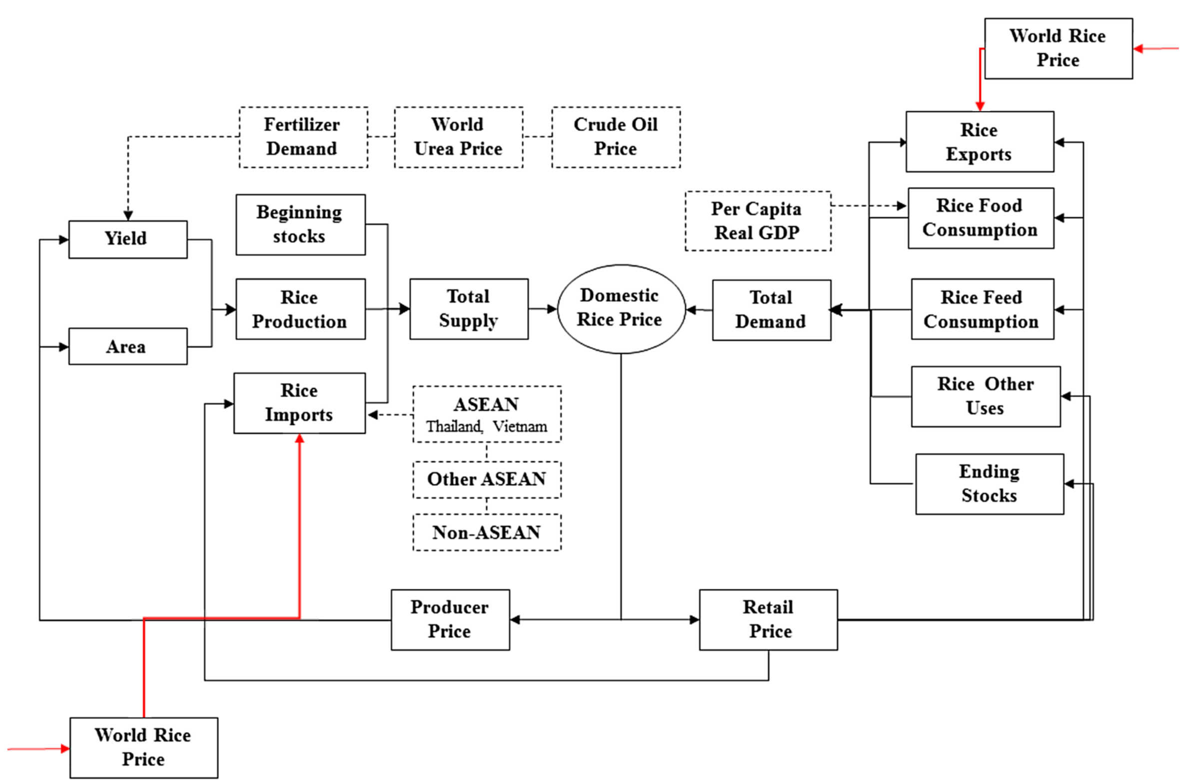

Fig. 5. IGRM model structure.
Source: IGRM Documentation, IRRI (2019).

Table 3
Philippine Rice Tariffication (PRT) model specifications.

Model equations for the Philippines

Net imports by origin

$IM_t^o = f\,(if\,(IM_t^o \le QR_t,\ IM_t^o,\ QR_t),\ P_t^{world} * (1+\tau),\ p_t^{retail} * 100/CPI_t,\ PROD_t,\ CONT_t)$

$IM_t = \sum_{o=1}^{s} IM_t^o$

Production

Without Minimum Support Price:

$HA_t^{region} = f\,(HA_{t-1}^{region},\ p_{t-1}^{farm} * 100/CPI_{t-1},\ pc_{t-1}^{farm} * 100/CPI_{t-1})$

With Mimumum Support Price:

$HA_t^{region} = f\,[p_t^{farm} * (1 - qspp_t^{region}) + (gpp_t * qspp_t^{region})]$

$YLD_t^{region} = f\,(FU_t^{region},\ IHA_t^{region})$

$PROD_t^{region} = HA_t^{region} * YLD_t^{region} * mr_t$

$PROD_t = \sum_{r=1}^{16} PROD_t^{region}$

Consumption

$\ln CONCAP_t = f\,(\ln p_t^{retail} * 100/CPI_t,\ \ln GDP_t * 100/CPI_t)$

$CON_t = CONCAP_t * POP_t$

Ending stocks

$ES_t = f\,(p_t^{retail} * 100/CPI_t,\ PROD_t,\ ES_{t-1})$

Price linkages

Philippines

$p_t^{retail} = f\,(P_t^{world} * (1+\tau),\ p_t^{farm} * 100/CPI_{t-1})$

$p_t^{farm,region} = f\,(p_t^{retail} * 100/CPI_{t-1})$

Exporting countries (India, Myanmar, Pakistan, Thailand, Vietnam)

$p_t^{retail} = f\,(P_t^{world})$

$p_t^{farm} = f\,(P_t^{retail})$

Market clearance

Domestic (Philippines)

$M_t + PROD_t + ES_{t-1} = CON_t + X_t + ES_t$

Global

$\mathrm{EX}_{\mathrm{Thailand}} = \sum_{i=1}^{n} \mathrm{IM}_i + \sum_{j=1}^{k} \mathrm{EX}_j$

$i \ne j \ne$ Thailand

Definitions of variables:

- IM_t – net imports of the Philippines by origin
- M_t – total imports
- X_t – total exports
- τ – tariff
- HA_t – harvested area
- HA_{t-1} – the previous year's harvested area
- $qspp_t$– regional quantity share of production procured
- gpp_t– government purchase price
- YLD_t – paddy yield per hectare
- YLD_{t-1}– the previous year's paddy yield
- $PROD_t$ – total milled production
- CONCAP – per capita rice consumption
- CON – total consumption
- ES_t – ending stocks
- ES_{t-1} – beginning stocks
- p_t^{farm}– national farm gate price of rice
- $p_t^{farm,region}$– regional farm gate price of rice
- p_t^{retail}– retail price of rice at the national level
- P_t^{world} – the world reference price
- IM_i – net imports of countries i
- EX_j – net exports of countries j
- $\mathrm{EX}_{\mathrm{Thailand}}$ – Thailand's net exports
- FU – fertilizer use per hectare
- IHA – % irrigated rice area
- GDP – Gross Domestic Product per capita
- *mr* – milling rate
- *o,s* – country of origin of imports of the Philippines
- *i,j* – country *i* and *j* in the model except for Thailand
- *k* – the number of countries j
- *n* – the number of countries i
- *r* – the region
- *t* – year

the Philippine model while the other country models were left unchanged if compared to the original IGRM model, except for data updates. The data are updated to 2018 with a baseline that covers the period 2019–2025.

The representation of the global rice market in the model comprises 25 countries and four regional aggregates. Those countries account 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 four 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 more than 6% of those for the Philippines (USDA-PSD, 2018). 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 PE 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 behaviour 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 the OLS method.

3.2. Impacts of rice tariffication

We simulate four QR removal scenarios to measure the impact of rice tariffication policy on imports, production, consumption, and prices.

Scenario 1: QR is removed and we assume that a 35% tariff is imposed to imports from ASEAN countries and a 40% tariff to non-ASEAN WTO member countries within the MAV. This scenario is highly possible in reality because rice imports of the Philippines have been generally and historically sourced from Vietnam and Thailand. To capture the effects of the aforementioned applied tariffs, we simulate this scenario through the PRT model that distinguishes imports coming from Vietnam and Thailand, other ASEAN countries, and non-ASEAN countries.

Scenario 2: QR is eliminated and we assume the imposition of 35% tariff to ASEAN countries and 50% tariff to non-ASEAN WTO member countries beyond the MAV. This captures the fact that the Philippines also sourced its rice imports outside the ASEAN. For example, the Philippines have been importing rice from China, India and Pakistan in recent years. Accordingly, we have simulated this scenario through the PRT model that differentiates rice imports coming from Vietnam and Thailand, other ASEAN and non-ASEAN countries.

Scenario 3: QR is removed. Instead, this scenario assumes 35% and 45% tariff combined with 1.5% yield increase per year over 7 years. We have formulated this scenario by examining the trends in yield growth in five regions of the Philippines over the period 2001–2018. These five regions are among those exhibiting the highest yield. The average yield growth in these five regions ranges between 1.0% and 2.0% as reported in Appendix, Table A1. Accordingly, we used a conservative estimate of 1.5% yield increase and employed this in the yield simulations for the 16 regions of the country. In other words, scenario 3 only accounts for the historical trend in productivity increase and does not try to capture the potential effects on productivity of the Rice Competitiveness Enhancement Program launched in 2019 due to a lack of evidence on the main channels through which the program would operate.

Scenario 4: QR is removed and this scenario assumes a tariff of 35% or 45% combined with a Minimum Support Price (MSP). This scenario is justified by the current (late 2019) policy discussions that explore options to mitigate the negative price effect of the tariffication on producers. Specifically, we implement a MSP of 19 pesos per kilogram which has been extensively debated in the national press.

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

$$IM_t^o = if\,(IM_t^o \leq QR_t, IM_t^o, QR_t) \tag{1}$$

$$IM_t = \sum_{o=1}^{s} IM_t^o \tag{2}$$

$$IM_t + PROD_t + ES_{t-1} = CON_t + ES_t \tag{3}$$

where o and s denote country of origin of imports of the Philippines. In Eq. (3), the market clearing price p_t^{farm} 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^{*world}, 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^{retail}) are directly linked to the world price, while p_t^{farm} is linked to p_t^{retail}, and regional farm price $p_t^{farm,region}$ is linked to p_t^{retail}. The expressions to represent these linkages are as follows:

$$IM_t = (P_t^{*world}) * (1 + \tau) \tag{4}$$

$$p_t^{retail} = f\,((P_t^{*world}) * (1 + \tau), p_t^{farm}) \tag{5}$$

$$p_t^{farm,region} = f\,(p_t^{retail}) \tag{6}$$

where τ denotes the applied tariffs mentioned above. We also measure the effect of RT 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 the Philippines accounts for about 9% of the CPI basket (PSA, 2012).

Following Wailes and Chavez (2011), we incorporate the MSP in the rice harvested area equation by region as follows:

$$HA_t^{region} = f\,[p_t^{farm} * (1 - qspp_t^{region}) + (gpp_t * qspp_t^{region})] \tag{7}$$

where $qspp_t^{region}$ is regional quantity share of production procured, and gpp_t is government purchase price.

4. Data and empirical results

4.1. Data

We employ data on rice production, consumption, ending stocks, imports and exports from the U.S. Department of Agriculture Foreign Agriculture Service Production, Supply & Distribution tables in developing baseline projections of the global rice model. The historical and predicted macroeconomic variables such as real gross domestic product (GDP), GDP deflator, CPI and exchange rate were obtained from International Monetary Fund's International Financial Statistics, and Food and Agricultural Policy Research Institute (FAPRI). The historical data on population and projections were compiled from the 2015 revision-median level of 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).

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 estimate for the Philippines assumes continuation of the QR policy. We prepare a 7-year time horizon of the baseline projection from 2019 to 2025 to compare short and medium term effects. This information is crucial for policy makers when making comparison between various aspects of the projection for effects that maybe dramatic in the earlier stage of the reform but soon diminish in the presence of market forces. For example, farm prices of rice could fall more pronouncedly after the reform but eventually mitigate as the market forces adjust to the new domestic rice market conditions. Other effects may be consistent over the time frame considered such as the increase in net imports which should stabilize during the projection period due to population and income growth.

We use data on actual rice imports by origin to investigate the impact of rice tariffication in the Philippines. Data on rice imports were obtained from the Philippine Statistics Authority (PSA). The Philippines' major sources of imports are Vietnam and Thailand (see Appendix, Fig. A1). Together, these two countries accounted for about 86.4% of total imports of the Philippines in 2018. About 4.5% of the Philippine rice imports in 2018 came from India while the next import sources were Myanmar, Pakistan and other countries, each accounting for roughly 3% of the trade. For the most part, the Philippines imports of low- and medium quality rice come from Vietnam where prices are normally lower than Thai prices even for the same quality.

For farm prices, we employed both national and regional data on paddy prices. We used national level price data on well-milled rice for retail prices.

4.2. Baseline results

Table 4 reports baseline results on net imports by origin assuming continuation of QR policy. Total net imports in 2019 are projected to

Table 4
Baseline results of the Philippines rice net import (1000 MT) by country of origin.
Source: Model calculations. ASEAN is Association of Southeast Asian Nations and AGR is average growth rate.

	2019	2022	2025	AGR (%)
Net import				
Thailand	508	524	531	0.73
Vietnam	1223	1292	1325	1.36
Other ASEAN	150	156	158	0.93
Non-ASEAN	168	175	179	1.06
Total	2049	2147	2194	1.15
Percent share				
Thailand	24.8	24.4	24.2	
Vietnam	59.7	60.2	60.4	
Other ASEAN	7.3	7.3	7.2	
Non-ASEAN	8.2	8.2	8.2	
Total	100.0	100.0	100.0	

Table 5
Baseline results of the Philippines farm prices by region and retail prices.
Source: Model calculations. AGR is average growth rate.

Region	2019	2022	2025	AGR (%)
Farm price				
Philippines	20.4	24.3	29.8	6.6
CAR	19.0	22.9	28.4	7.0
Ilocos Region	20.0	24.1	29.6	6.8
Cagayan Valley	19.2	23.1	28.5	6.8
Central Luzon	18.0	21.8	27.0	7.0
CALABARZON	18.6	22.1	26.8	6.3
MIMAROPA	18.8	22.7	28.1	7.0
Bicol Region	17.5	21.0	25.8	6.8
Western Visayas	17.6	21.1	25.8	6.6
Central Visayas	21.1	24.6	29.2	5.6
Easter Visayas	21.7	25.6	30.9	6.1
Zamboanga Peninsula	20.0	23.7	28.7	6.2
Northern Mindanao	19.8	23.5	28.7	6.4
Davao Region	20.9	24.9	30.4	6.5
SOCCSKSARGEN	16.8	20.3	25.2	7.1
CARAGA	17.8	21.2	25.9	6.5
ARMM	16.9	19.8	23.6	5.8
Retail price	43.7	51.9	63.0	6.4

reach 2049 thousand tons of which 1223 thousand tons and 508 thousand tons will respectively come from Vietnam and Thailand. The two countries are projected to remain the dominant sources of the Philippines' rice imports until 2025. Net imports from other ASEAN countries, mainly from Myanmar, and non-ASEAN countries, mostly from India, are projected to account for about 15% of total net imports. Overall net imports are projected to increase as rice consumption is projected to rise a little faster than production as shown in Appendix, Table A2 which reports the complete baseline results.

The most immediate impact of RT policy is primarily expected on the domestic price level change relative to the baseline estimates. Table 5 reports farm and retail prices in nominal terms. In the baseline, farm prices at the national level are projected to grow from PhP 20.4/kg in 2019 to PhP 29.8/kg in 2025 or by 6.6% annually. Retail prices are projected to increase from PhP 43.7/kg in 2019 to PhP 63/kg in 2025 or by 6.4% annually. The increase in retail prices is in line with global market trends and the pressure on demand that is driven by population, income growth and increasing urbanization. Retail prices increase as total consumption grows by 1.2% annually (Table A2).

The largest and smallest farm prices that are projected in 2019 at the regional level are PhP 21.7/kg and PhP 16.8/kg in Eastern Visayas and SOCCSKSARGEN[2], respectively. Table 5 shows that farm prices in different regions are much higher before the RT policy than the cost of paddy production at PhP 12.41/kg as shown in Moya et al. (2016), suggesting that paddy production was more profitable before the trade reform. However, farm prices have increased under the previous QR policy due the supply constraint arising from the government's restrictions of rice import quantities each and every year (Dawe et al., 2006).

4.3. Empirical results

Our simulation exercise starts off with Table 6 which reports the effects on net imports for all four scenarios in terms of percent and absolute changes. The full results are reported in Appendix, Tables A3–A6. In the following discussion, we focus only on the results for scenario 1 and scenario 3 as their estimates are more pronounced in most of the cases. In general, the combination of tariffication and yield increase has a bigger impact on net imports and prices than increasing tariff alone (scenario 2). We also report key results for scenario 4 mainly to reflect the discussions in government in early 2020 to attenuate the impact of the reform on producers. Some decision makers have even argued that the RT should be reversed altogether.

When the QR is removed and replaced with tariffs (scenario 1), total net imports increase from 2049 thousand tons to 2473 thousand tons in 2019 or by 20.7% from the baseline level. By 2025, the increase in net imports levels off as population and income growth stabilize. We also note that imports noticeably increase from all sources as soon as the QR is eliminated in 2019 (scenario 1). As expected, the largest increases in imports originate from Vietnam and Thailand with 206 thousand tons and 131 thousand tons, respectively. Imports from other ASEAN and non-ASEAN sources are also relatively large, with a combined increase in import volume of 87 thousand tons due to the policy. These results conform with the expectation of the government that an enhanced participation of traders in rice trading following the reform would promptly increase and diversify the source of imports. Thus, we show that trade can be a useful instrument for the national food security, especially when there are domestic production shortfalls. The full results are presented in Table 6.

It is worth mentioning the impact of the RT on the world reference price (Thai 5% broken) along with Vietnamese 5% broken price. The effects are shown in Fig. 6 and Table 7. Removing the QR and imposing tariffs instead (scenario 1) marginally increases Thai 5% price by 1.1% relative to the baseline, from $412.9/MT to $417.4/MT in 2019 and from $509.8/MT to $513.9/MT or by 0.8% in 2025 (Table 7). The increase in Vietnamese 5% price from its baseline level is even slighter at 0.7% and 0.5% in 2019 and 2025, respectively. This increase in world prices, although marginal, stems from the surge in demand in the Philippines as a response to lower domestic prices. One important message is that due to the size of its market, the Philippines are able to influence rice prices internationally, albeit moderately.

Our empirical results complement the literature on the subject. They are similar to those in Hoang and Meyers (2015) and Minot and Goletti (2000) with different modelling approaches and trade reform scenarios. By using the IGRM and removing state-trading enterprises (STEs) and the ASEAN Free Trade Agreement (AFTA) tariff among Southeast Asian importing countries, Hoang and Meyers (2015) conclude that the mechanism for triggering a sharp increase in world price with free trade in the rice market only works if importing countries coordinate among themselves during the liberalization process. We show that the unilateral rice tariffication in the Philippines can influence world prices, albeit moderately. Similar to our results, Minot and Goletti (2000), using the Viet Nam Agricultural Spatial Equilibrium Model (VASEM), report a relatively small impact on export prices at 2.1–3.7% if Vietnamese rice export quota in 1995 was eliminated.

We now consider the impact of the RT on the domestic prices of rice. We first focus on farm price results in 2019 (see Table 8) since the price effect of the RT policy on rice farmers is expected to be more pronounced at the beginning of the reform. The full simulation results are presented in Appendix (see Tables A3–A6). As expected, since net imports increase significantly, farm prices at the national level decrease precipitously, from PhP 20.4/kg to PhP 14.3/kg or by 30.1% in 2019 (scenario 1). The large decline in farm prices is also evident in several regions. Farm prices notably fall in a range between PhP 14.1/kg and PhP 15.9/kg in the regions of CAR, Ilocos Region, Cagayan Valley, Central Luzon and MIMAROPA (scenario 1, Table 8).

Given our knowledge of the rice sector of the Philippines, we expect a regionally heterogeneous production response to the policy reform. We argue that this heterogeneity can be captured through regional modelling approach. To show that, we used an estimate of the price elasticity of supply from a most recent study (Silva et al., 2018) that made use of the IRRI loop surveys for Central Luzon region (Table 9). We incorporated the average elasticity for the wet and dry seasons into the model for this specific region. The Central Luzon Loop Survey was collected at farm level every 4–5 years during the 1966–2015 period

[2] The acronym refers to South Cotabato, Cotabato, Sultan Kudarat, Sarangani and General Santos City or Region XII.

Table 6
Effects on rice imports by origin relative to the baseline in 2019–2025.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price.

	Baseline	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	1000 mt	1000 mt	Change	Change (%)	1000 mt	Change	Change (%)	1000 mt	Change	Change (%)	1000 mt	Change	Change (%)
2019													
Thailand	508.4	639.5	131.1	25.8	639.5	131.1	25.8	634.1	125.7	24.7	653.5	145.1	28.5
Vietnam	1222.8	1428.5	205.7	16.8	1428.5	205.7	16.8	1412.3	189.5	15.5	1470.3	247.5	20.2
Other ASEAN	149.9	186.2	36.3	24.2	186.2	36.3	24.2	184.7	34.9	23.3	190.0	40.1	26.8
Non-ASEAN	168.2	218.8	50.6	30.1	218.5	50.3	29.9	218.2	50.0	29.7	220.5	52.3	31.1
Total	2049.3	2473.1	423.8	20.7	2472.8	423.5	20.7	2449.4	400.1	19.5	2534.3	485.0	23.7
2022													
Thailand	524.4	674.1	149.7	28.5	674.1	149.7	28.5	661.7	137.2	26.2	675.4	151.0	28.8
Vietnam	1292.0	1539.8	247.8	19.2	1539.9	247.9	19.2	1503.8	211.8	16.4	1544.0	252.0	19.5
Other ASEAN	155.8	197.9	42.1	27.0	197.9	42.1	27.0	194.1	38.3	24.6	198.1	42.2	27.1
Non-ASEAN	175.2	229.5	54.4	31.0	229.2	54.0	30.8	228.1	53.0	30.2	229.7	54.5	31.1
Total	2147.4	2641.4	494.0	23.0	2641.1	493.7	23.0	2587.7	440.3	20.5	2647.2	499.7	23.3
2025													
Thailand	531.0	682.1	151.1	28.5	682.1	151.1	28.5	661.7	130.7	24.6	681.4	150.4	28.3
Vietnam	1325.3	1572.3	247.0	18.6	1572.3	247.0	18.6	1515.1	189.8	14.3	1570.3	245.0	18.5
Other ASEAN	158.4	201.2	42.8	27.0	201.2	42.8	27.0	194.6	36.2	22.8	201.0	42.5	26.9
Non-ASEAN	179.2	234.7	55.5	31.0	234.3	55.2	30.8	232.5	53.3	29.8	234.6	55.4	31.0
Total	2193.9	2690.4	496.5	22.6	2690.0	496.1	22.61	2603.9	410.0	18.69	2687.2	493.4	22.49

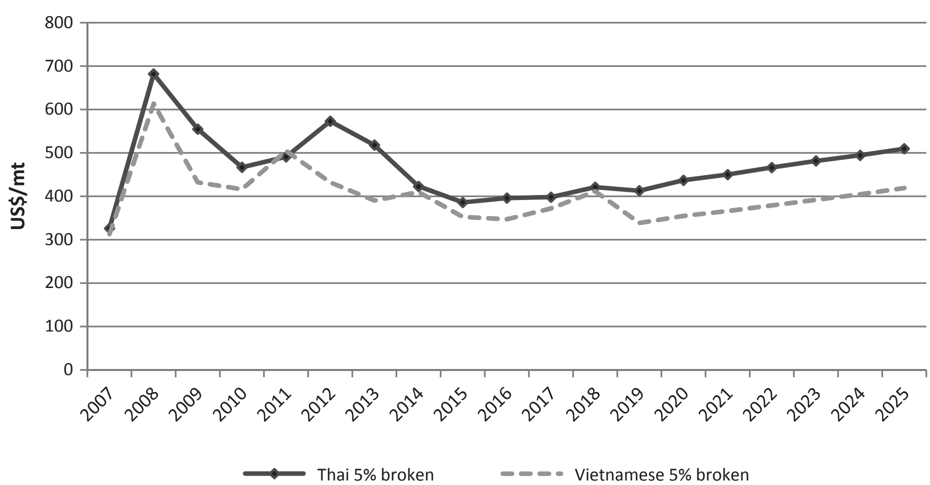

Fig. 6. Baseline projections: World reference prices (Thai 5% broken) and Vietnamese 5% broken price, 2019–2025.
Source: Model calculations.

Table 7
Effects on Thai 5% broken and Vietnamese 5% broken prices relative to the baseline in 2019–2025.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price.

	Baseline	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	$/mt	$/mt	Change	Change (%)	$/mt	Change	Change (%)	$/mt	Change	Change (%)	$/mt	Change	Change (%)
2019													
Thai 5%	412.9	417.4	4.5	1.1	417.4	4.5	1.1	417.1	4.2	1.0	418.0	5.1	1.2
Viet 5%	338.7	340.9	2.3	0.7	340.9	2.3	0.7	340.8	2.1	0.6	341.3	2.6	0.8
2022													
Thai 5%	466.4	470.3	3.9	0.8	470.3	3.9	0.8	469.8	3.4	0.7	470.4	4.0	0.9
Viet 5%	379.2	381.2	2.0	0.5	381.2	2.0	0.5	380.9	1.7	0.5	381.2	2.0	0.5
2025													
Thai 5%	509.8	513.9	4.2	0.8	513.9	4.2	0.8	513.2	3.4	0.7	513.9	4.2	0.8
Viet 5%	419.2	421.4	2.1	0.5	421.4	2.1	0.50	421.0	1.7	0.41	421.3	2.1	0.5

Table 8
Effects on farm prices by region relative to the baseline in 2019.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price.

	Baseline	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	pesos/kg	pesos/kg	Change	Change (%)	pesos/kg	Change	Change (%)	pesos/kg	Change	Change (%)	pesos/kg	Change	Change (%)
Philippines	20.4	14.3	−6.1	−30.1	14.3	−6.1	−30.1	13.5	−6.9	−33.8	16.2	−4.2	−20.6
CAR	19.0	14.8	−4.2	−22.2	14.8	−4.2	−22.2	13.8	−5.2	−27.3	17.3	−1.7	−9.0
Ilocos Region	20.0	15.9	−4.1	−20.6	15.9	−4.1	−20.6	14.9	−5.1	−25.4	18.3	−1.7	−8.4
Cagayan Valley	19.2	15.2	−4.0	−20.8	15.2	−4.0	−20.8	14.3	−4.9	−25.6	17.6	−1.6	−8.5
Central Luzon	18.0	14.1	−4.0	−22.0	14.1	−4.0	−22.0	13.2	−4.9	−27.1	16.4	−1.6	−9.0
CALABARZON	18.6	15.4	−3.2	−17.3	15.4	−3.2	−17.3	14.6	−4.0	−21.3	17.3	−1.3	−7.1
MIMAROPA	18.8	14.7	−4.1	−22.0	14.7	−4.1	−22.0	13.7	−5.1	−27.1	17.1	−1.7	−9.0
Bicol Region	17.5	14.0	−3.5	−20.2	14.0	−3.5	−20.1	13.2	−4.3	−24.8	16.1	−1.4	−8.2
Western Visayas	17.6	14.2	−3.4	−19.3	14.3	−3.4	−19.2	13.5	−4.2	−23.7	16.3	−1.4	−7.8
Central Visayas	21.1	18.4	−2.6	−12.4	18.4	−2.6	−12.4	17.8	−3.2	−15.3	20.0	−1.1	−5.1
Easter Visayas	21.7	18.4	−3.3	−15.4	18.4	−3.3	−15.4	17.6	−4.1	−19.0	20.4	−1.4	−6.3
Zamboanga Peninsula	20.0	16.7	−3.3	−16.6	16.7	−3.3	−16.6	15.9	−4.1	−20.5	18.6	−1.4	−6.8
Northern Mindanao	19.8	16.2	−3.6	−18.0	16.2	−3.6	−18.0	15.4	−4.4	−22.1	18.3	−1.4	−7.3
Davao Region	20.9	17.0	−3.9	−18.6	17.0	−3.9	−18.6	16.1	−4.8	−22.9	19.3	−1.6	−7.6
SOCCSKSARGEN	16.8	13.0	−3.8	−22.6	13.0	−3.8	−22.6	12.1	−4.7	−27.8	15.2	−1.5	−9.2
CARAGA	17.8	14.5	−3.3	−18.3	14.5	−3.3	−18.3	13.8	−4.0	−22.6	16.5	−1.3	−7.5
ARMM	16.9	14.6	−2.3	−13.6	14.6	−2.3	−13.6	14.1	−2.8	−16.7	15.9	−0.9	−5.5

Table 9
Supply elasticities
.*Source:* [a] IGRM-PRT model calculations. [b] Supply elasticity of price is based on estimation using the Central Luzon Loop Survey.

	IGRM-PRT[a] Supply elasticity with respect to Own price	Silva et al. (2018)[b] Supply elasticity with respect to		
		Own price: Wet season	Own price: Dry season	Own price: Average
CAR	0.10			
Ilocos Region	0.11			
Cagayan Valley	0.10			
Central Luzon	0.12	0.51	0.59	0.55
CALABARZON	0.15			
MIMAROPA	0.12			
Bicol Region	0.13			
Western Visayas	0.12			
Central Visayas	0.12			
Easter Visayas	0.11			
Zamboanga Peninsula	0.12			
Northern Mindanao	0.06			
Davao Region	0.16			
SOCCSKSARGEN	0.11			
CARAGA	0.11			
ARMM	0.11			

with the objective of monitoring changes over time in crop management and household characteristics in rice-based farming systems (Moya et al., 2015). The survey consists of a panel data covering the provinces of Bulacan, La Union, Nueva Ecija, Pampanga, Pangasinan and Tarlac in Central Luzon, one of the 16 regions of the Philippines. Given that the value for Central Luzon is three-fold the national average, the (negative) supply response in this region is substantially more pronounced than in the average region with a drop in production of more than 11% in the first year as reported in Table 10.

We believe that this example demonstrates the validity of the regional analysis as well as the usefulness of the PRT model to capture the regional heterogeneity of the impact of the reform. Unfortunately, we cannot provide the price elasticity of all the 16 regions of the country, an exercise that is beyond the scope of this paper. However, we believe that our example could encourage the government to invest resources to estimate the price elasticity of supply for each region as it would allow for a more granular analysis of the impact and treatment of the reform.

Fig. 7 illustrates the aforementioned results of farm price effect both at the national and regional levels along with baseline projections and estimates for all three scenarios. A few glaring 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 historical average yield increase (1.5%) kicks in rapidly, compounding the effect of the surge in import bringing the farm prices further down. Secondly, since the large decline in farm prices occurs in all regions and remains lower than in the

Table 10
Comparison of effects on farm prices and production in Central Luzon region based on the different supply elasticities of price of rice.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price. PRT uses supply elasticity of price based IGRM estimation. Loop Survey uses supply elasticity of price based on most recent estimates using Central Luzon Loop Survey (Silva et al., 2018).

	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	2019	2022	2025	2019	2022	2025	2019	2022	2025	2019	2022	2025
Farm price (%)												
IGRM-PRT	−22.04	−7.11	−6.41	−22.03	−7.08	−6.40	−27.12	−19.55	−26.26	−8.97	−6.86	−7.24
Loop Survey	−22.56	−2.35	−3.56	−22.54	−2.34	−3.55	−27.78	−14.04	−20.58	−2.97	−2.48	−4.67
Production (%)												
IGRM-PRT	0.00	−2.98	−2.85	0.00	−2.98	−2.85	1.24	−0.35	1.26	−2.98	−3.26	−2.69
Loop Survey	0.00	−9.48	−7.73	0.00	−9.47	−7.72	1.24	−7.84	−8.14	−11.11	−9.38	−7.00

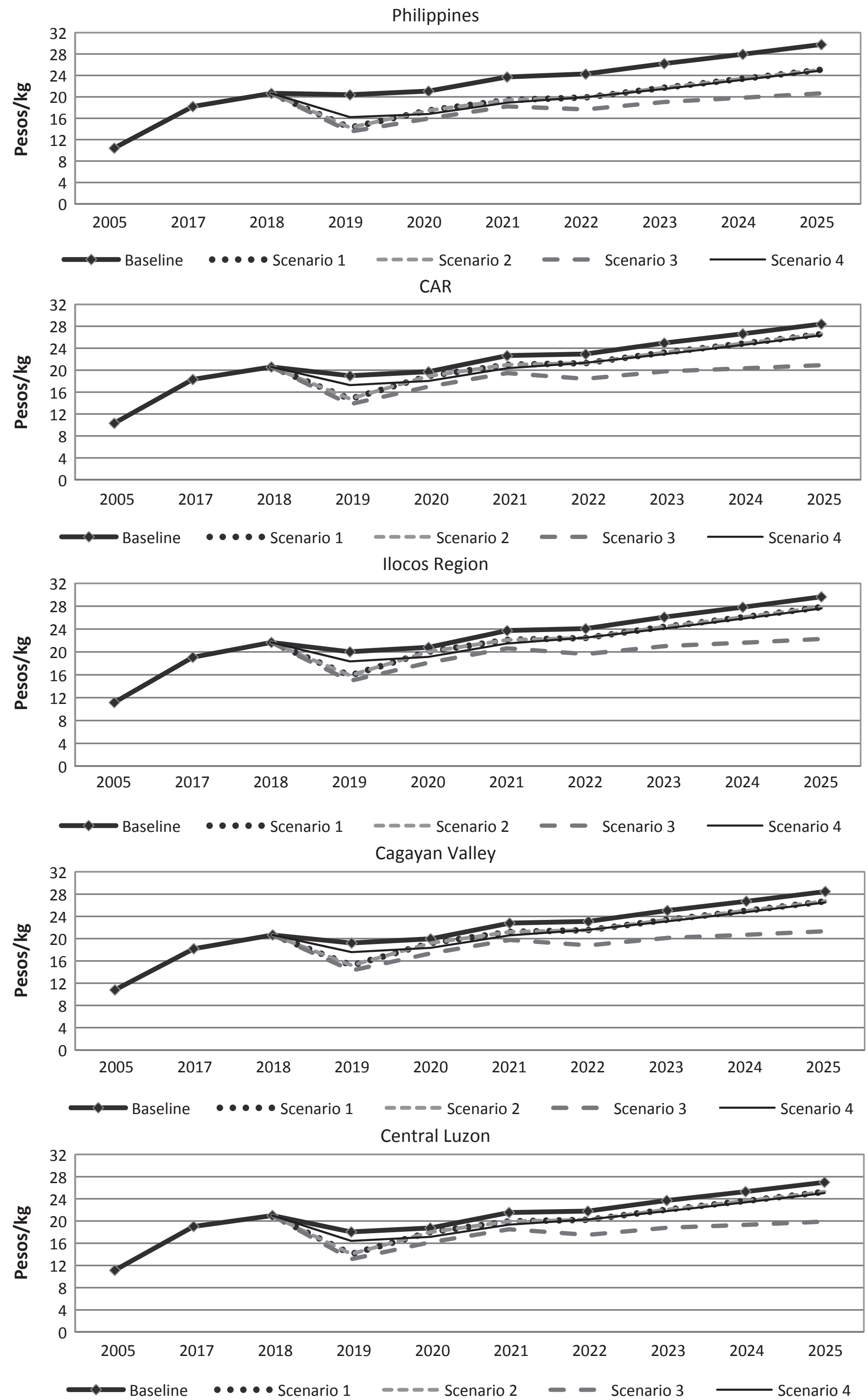

Fig. 7. Effects on farm prices of rice relative to the baseline in 2019–2025.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price.

baseline over the period, it could be expected that retail prices would also durably decrease benefitting consumers over time. Thirdly, under scenarios 1 and 2, farm prices in all regions, though still below the baseline levels, would return to and even exceed their pre-reform levels in the near term, i.e. starting from 2021. This appears to be an important and reassuring message for the policy makers concerned about the medium term effects of the reform on producers. However, under scenario 3, the compounded effect of the trade and productivity shocks are such that farm prices would durably remain below their pre-reform levels.

The above results suggest that paddy production will be less profitable due to lower farm prices if production costs do not decrease simultaneously and proportionately as result of productivity gains. From a policy perspective, it matters to identify options to mitigate such

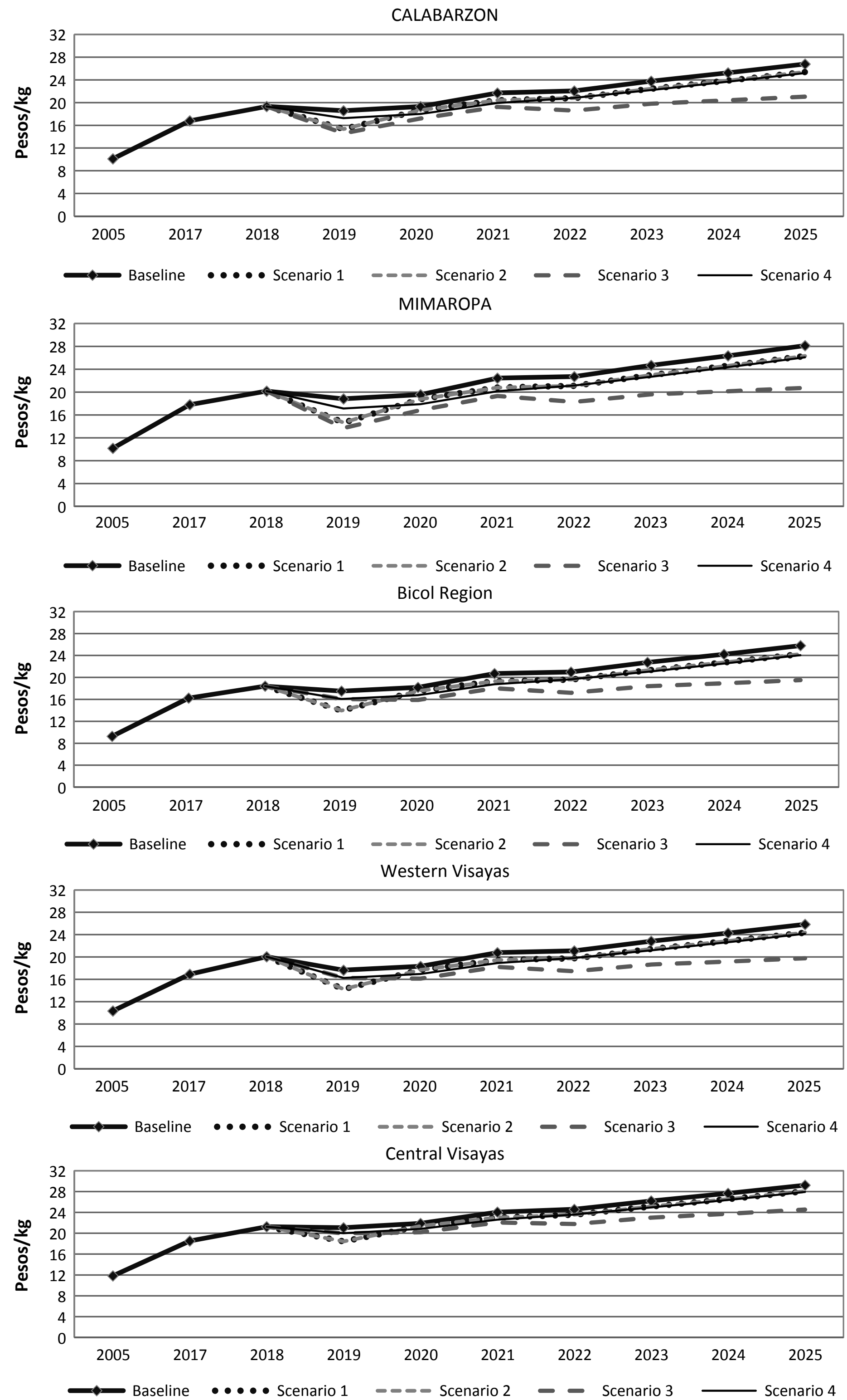

Fig. 7. (*continued*)

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.

In early 2020, there were intense discussions to identify policy options to mitigate the negative impact of the RT on producer prices. The dominant option consisted in procuring paddy (or unhusked rice) through the NFA and/or adopting a minimum support price (MSP) supported by a budget of P 14 billion (roughly USD 275 million). The fourth scenario simulates the implementation of a MSP at 19 pesos/kg as announced by the government in January 2020 while also capturing the effects of the quantities procured by regions. Our simulation results show that the MSP buffers farmers but only in the first year following the reform. The MSP is no longer binding after this first year. However, the MSP does not prevent production from falling in the first year. These results are likely to be of interest to the government in the short run. While we recognize that policy action needs to be taken to mitigate

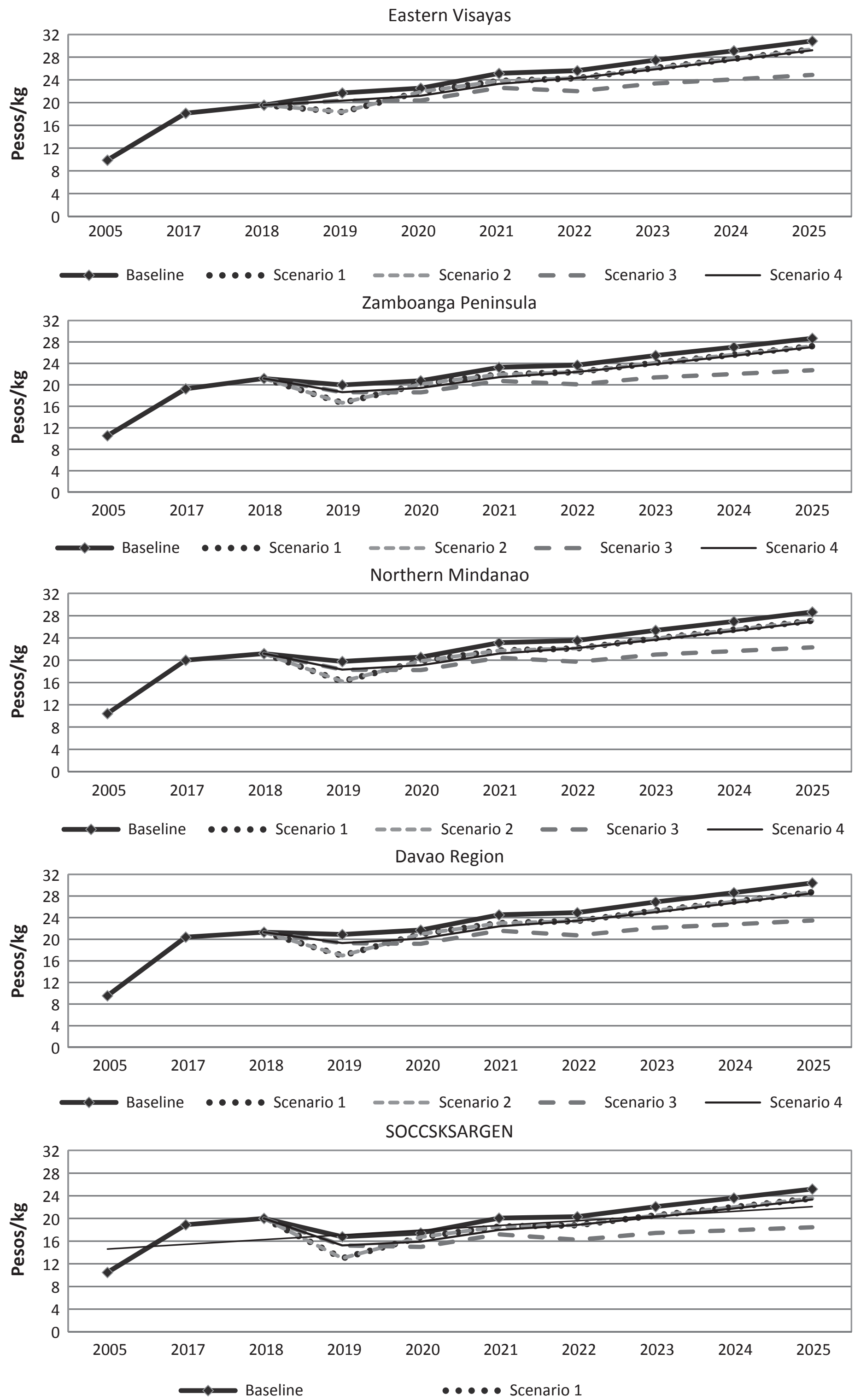

Fig. 7. (*continued*)

the adverse impact of the reform on the most vulnerable (uncompetitive) farmers, our results lead us to argue that the MSP does not seem to be the most appropriate response. Rather the government may need to provide support to rice farmers to make the required adjustments either by increasing productivity or switching to other crops. The government should consider promptly and carefully dispensing emergency cash support[3] to those farmers that are likely to be affected the most. Targeted measures focusing on those farmers that could seize the reform as an opportunity to step up and modernize should be prioritized. Measures to be encouraged are those that would raise productivity through high yielding varieties and irrigation and reduce

[3] The popular press has voiced numerous calls on policy-makers to impose safeguard measures and restore temporary import controls to tackle the difficulty that rice farmers are facing due to the reform. In this regard, Habito (2019a, 2019b) had coined the so-called "rifle"-focused approach to helping rice farmers versus the "shotgun" solution of halting imports.

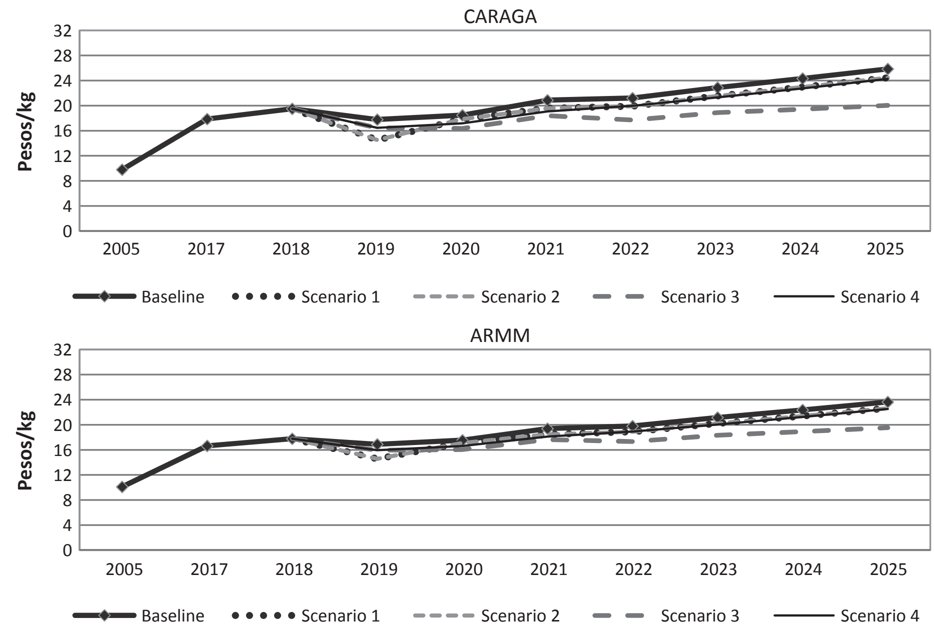

Fig. 7. (*continued*)

the production costs through mechanization and better practices to substitute expensive labor. For those farmers that are unlikely to thrive in rice production due to structural or other reasons, government incentives should help them to switch to other higher value crops[4] or even move out of agriculture in some cases. Opportunities for such ambitious policy actions exist as large import tariff revenues are already being collected[5]. These additional financial resources should be reinvested to benefit rice farmers and help the transition towards a modernized rice sector.

Fig. 8 and Table 11 show the impact of the reform on retail prices under the three scenarios. Just like farm prices, retail prices substantially decline from PhP 43.7/kg to PhP 36.1/kg or by 17.4% in 2019 (scenario 1). Under scenario 3, retail prices decline further to PhP 33.2/kg in 2019. 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 Fig. 8. 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.

As a response to lower retail prices, demand increases while inflation declines, as reported in Table 11. When the QR is eliminated, per capita consumption increases to 132.5 kg per year (scenario 1) and 133.7 kg per year (scenario 3) in 2019 corresponding to a 2.5% and 3.5% increase relative to the baseline, respectively. Although it remains higher than in the baseline, per capita consumption declines over time while total rice demand increases. This pattern is consistent with the literature that indicates an increase in rice consumption globally due to population growth, but a decline in rice consumption per capita over time (Sharma, 2014), partly due to income growth and shifting food preferences. Interestingly, the combination of the tariffication and the productivity shock leads to a much higher increase in total demand (scenario 3).

Table 11 further reveals that the sharp decline in retail prices as a result of the tariffication contributes to the reduction in inflation. Inflation declines by 1.6% in scenario 2 and 2.2% in scenario 3 in 2019, although the drop becomes smaller over time. We also suggest that the model on which the analysis relies is accurate as the changes in prices are very close to the actual price changes (see Appendix, Table A7). This also holds for other variables. As a result, we believe that the IGRM can reliably be adapted and used to conduct ex-ante policy analysis of similar reforms in the future.

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. Overall, the world price of rice slightly increases. Accordingly, Table 12 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 2019, farm (wholesale) prices increase by 1.0% (1.2%) in Thailand while farm (retail) prices increase by 0.7% (0.8%) in the case of Vietnam (scenario 1). A similar pattern is observed when both the tariff and a yield increase are imposed (scenario 3). For all scenarios, the increases in domestic prices are lower in Cambodia, India and Myanmar, ranging between 0.2% and 0.3% for farm prices and 0.2–0.7% for retail prices. The impacts on farm and retail prices in Pakistan do not change in 2019, but increase by 0.4–0.5% in 2025.

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

[4] See Dawe et al. (2006) for more discussions on switching to other crops after rice trade liberalization.

[5] The Department of Finance of the Philippines reported that the government had already collected 11.4 billion pesos from the importation of rice at end of October 2019.

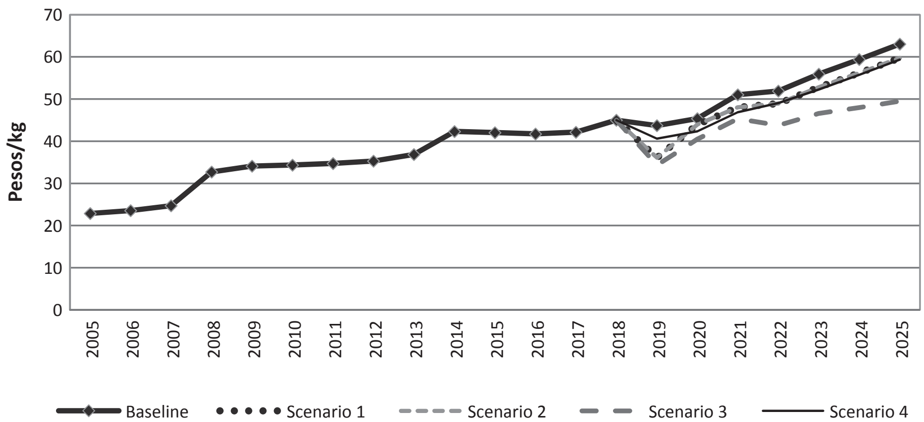

Fig. 8. Effects on retail prices of rice relative to the baseline in 2019–2025.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price.

Table 11
Effects on per capita consumption, total consumption and inflation relative to the baseline in 2019–2025.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price.

	Baseline	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	Estimate	Estimate	Change	Change (%)	Estimate	Change	Change (%)	Estimate	Change	Change (%)	Estimate	Change	Change (%)
Retail price (kg/pesos)													
2019	43.7	36.1	−7.6	−17.4	36.1	−7.6	−17.4	34.4	−9.3	−21.4	37.5	−6.2	−14.2
2022	51.9	48.9	−3.0	−5.7	49.0	−2.9	−5.7	43.8	−8.1	−15.7	53.8	1.9	3.6
2025	63.0	59.7	−3.3	−5.2	59.8	−3.3	−5.2	49.5	−13.5	−21.5	52.1	−10.9	−17.3
Per capita consumption (kg)													
2019	129.2	132.5	3.2	2.5	132.5	3.2	2.5	133.2	4.0	3.1	130.5	1.3	1.0
2022	128.6	129.7	1.1	0.9	129.7	1.1	0.9	131.7	3.1	2.4	129.6	1.1	0.9
2025	127.4	128.6	1.1	0.9	128.6	1.1	0.9	132.1	4.6	3.6	128.7	1.3	1.0
Total consumption (1000 mt)													
2019	13,969.0	14,319.8	350.8	2.5	14,319.6	350.6	2.5	14,400.5	431.6	3.1	14,111.7	142.7	1.0
2022	14,513.5	14,641.6	128.1	0.9	14,641.0	127.5	0.9	14,865.6	352.1	2.4	14,637.1	123.6	0.9
2025	14,993.9	15,127.2	133.3	0.9	15,127.0	133.1	0.9	15,539.9	546.0	3.6	15,144.5	150.6	1.0
Inflation effect (%)													
2019		−1.56			−1.56			−1.92			−1.28		
2022		−0.51			−0.51			−1.41			0.04		
2025		−0.47			−0.47			−1.93			−1.32		

Table 12
Effects on domestic prices in selected third countries relative to the baseline in 2019–2025.
Source: Model calculations. Scenario 1 is 35% and 40% tariff, Scenario 2 is 35% and 50% tariff, Scenario 3 is 35% and 40% tariff and 1.5% yield increase, and Scenario 4 is 35% and 40% tariff and Minimum Support Price.

	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	2019	2022	2025	2019	2022	2025	2019	2022	2025	2019	2022	2025
Farm price												
Cambodia	0.18	0.15	0.14	0.18	0.15	0.14	0.17	0.13	0.12	0.21	0.15	0.14
India	0.34	0.24	0.20	0.34	0.24	0.20	0.32	0.21	0.16	0.39	0.25	0.20
Myanmar	0.27	0.22	0.21	0.27	0.22	0.21	0.25	0.19	0.17	0.31	0.22	0.21
Pakistan	0.00	0.63	0.65	0.00	0.62	0.65	0.00	0.61	0.54	0.00	0.63	0.65
Thailand	0.96	0.76	0.74	0.96	0.76	0.74	0.91	0.66	0.60	1.10	0.78	0.73
Vietnam	0.72	0.57	0.55	0.72	0.57	0.55	0.68	0.49	0.45	0.82	0.58	0.55
Retail/wholesale price												
Cambodia	0.72	0.57	0.55	0.72	0.57	0.55	0.68	0.49	0.45	0.83	0.59	0.55
India	0.20	0.15	0.12	0.20	0.15	0.12	0.19	0.13	0.10	0.23	0.15	0.12
Myanmar	0.62	0.49	0.48	0.62	0.49	0.48	0.58	0.42	0.39	0.70	0.50	0.48
Pakistan	0.00	0.54	0.56	0.00	0.54	0.56	0.00	0.52	0.47	0.00	0.54	0.56
Thailand[a]	1.22	0.94	0.91	1.22	0.94	0.91	1.15	0.82	0.74	1.40	0.97	0.91
Vietnam	0.76	0.60	0.58	0.76	0.60	0.58	0.72	0.52	0.47	0.87	0.61	0.58

[a] Changes in wholesale price of rice.

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.

As a whole, we argue that the reform in the Philippines has substantial political significance domestically and regionally. The reform is driven by domestic considerations notably the historically high price for poor consumers. However, the results also show that the reform has an impact on neighboring countries, albeit moderate, such as Vietnam and Thailand which are major world players in the rice markets. These results support the long-term effort by the WTO to encourage countries such as the Philippines to discipline their policy interventions. In line with WTO claims that excessive border protection decreases overall welfare, our results show that the vast majority of the net-buyers are better off with this reform which also increases the government revenue while recognizing that the most uncompetitive Filipino farmers are seriously hurt. We find that the reform adopted by the Philippines drives farm price upward in rice exporting countries of the region and also affects the world price slightly. In other words, the policy stance of the Philippines government on rice trade matters domestically but also beyond the Filipino borders. From a world or regional perspective, the real concern today is whether this long overdue reform could be reversed due to domestic political considerations.

In terms of avenue for future research, this blanket rice trade reform suggests the need to examine the distributional implications of the Rice Tariffication Law across regions or provinces and across household categories. This future work could be done using farm level data collected through surveys such as the IRRI's Central Luzon Loop survey and/or the Family Income and Expenditure Survey administered by the Philippines Statistics Authority.

5. Concluding remarks

The literature on the impact of agricultural trade liberalization is vast. Researchers have been discussing this issue in depth at the global and national levels for the past few decades. The rice tariffication policy of the Philippines adopted in March 2019 constitutes an interesting illustration of such trade reforms with some unique features. In this paper, we have analyzed the impacts of the removal of quantitative restrictions and the imposition of different tariff rates on rice imports depending on the country of origin. We have assessed the potentially strong implications for rice market participants including farmers, consumers, traders, policy makers, and government agencies.

The study used the IRRI Global Rice Model based on a partial equilibrium framework to investigate those impacts with a special focus on (i) the differentiation of rice imports by origin to capture the effect of different applied rates for imports originating from Thailand, Vietnam, and other countries within and outside of the ASEAN, (ii) the impact on the world price and the domestic prices in third countries exporting to the Philippines, and (iii) the effects of the reform on farm prices across 16 regions of the Philippines.

As expected, the simulation results indicate that the reform would lead to a sharp increase in import of nearly 2.5 million tons (or 20.7%) in 2019 and remain high in the following years while domestic production would decline. Rice exporters in Vietnam and Thailand would be the primary beneficiaries. This rapid increase in imports is largely explained by the emergence of many market players, including domestic and international traders, a situation that is in sharp contrast with the past when the National Food Authority exercised a total and exclusive control over rice trading activities.

This additional supply of foreign rice in the domestic market would drive both farm prices (30.1%) and retail prices (17.4%) 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 although they would increase above their pre-reform levels in the medium term in response to the increase in demand resulting from both population and income growth. However, the use of more detailed data on the price elasticity of supply for one region suggests a more heterogeneous regional production response to the reform. This suggests that a more systematic estimation of regional price elasticities of supply would permit a more detailed analysis of the impact and treatment of the reform. Hence, it would be of great interest to the government to invest resources in this line of analysis.

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 1.2% in 2019 and less over time. Lower inflation would also benefit the poor.

We also show that the reform of the rice sector in the Philippines 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.

If adequately implemented, the Rice Competitiveness Enhancement Fund program of the government to increase productivity at farm level could raise production above the baseline level in the near term and partly counteract the surge in imports. It would however push farm and retail prices further down. We also show that the imposition of a Minimum Support Price as currently envisioned would only mitigate the decline of producer price in the first year post reform and, as such, probably embody more political than policy significance.

While this reform 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.

Authors' contributions

Jean Balié: Conceptualization, Methodology, Investigation, Validation, Formal analysis, Resources, Writing - Review & Editing, Visualization, Supervision. **Harold Glenn Valera:** Conceptualization, Methodology, Modelling, Validation, Formal Analysis, Investigation, Writing - Original draft preparation, Writing - Review & Editing, Visualization, Project administration.

Declaration of Interest

None.

Conflict of Interest

The authors declare no conflict of interest.

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Appendix A

See Fig. A1 and Tables A1–A7.

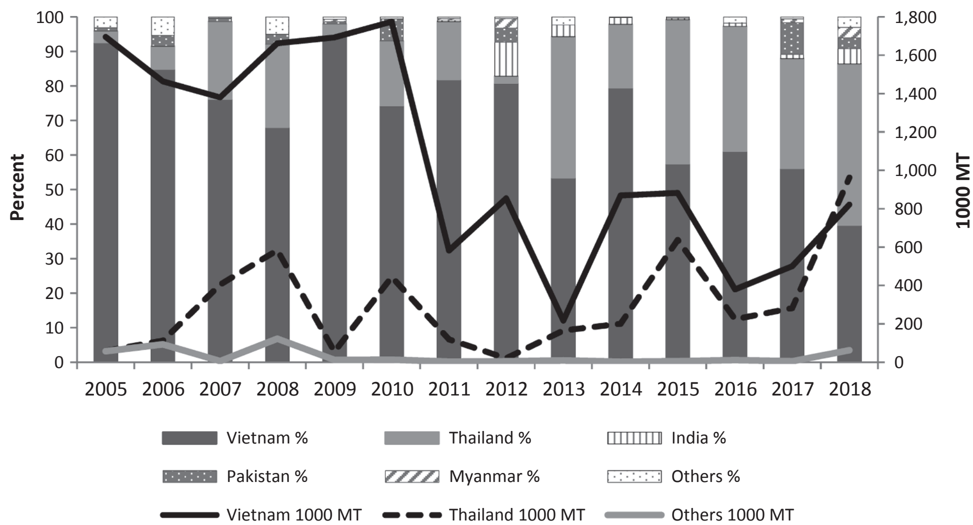

Fig. A1. Rice imports of the Philippines from Thailand, Vietnam and other countries, and percent share of imports by origin, 2005–2018.
Source: Rice imports data are obtained from the Philippines Statistics Authority.

Table A1
Trends in yield growth in five regions of the Philippines, 2001–2018.
Source: Rice yield data are calculated by dividing paddy production by area harvested data obtained from from the Philippines Statistics Authority.

Year	Yield (mt/ha)					Growth rate (%)				
	Ilocos Region	Cagayan Valley	Central Luzon	Northern Mindanao	Davao Region	Ilocos Region	Cagayan Valley	Central Luzon	Northern Mindanao	Davao Region
2001	3.48	3.63	3.90	3.64	3.80	1.15	0.19	9.76	4.99	2.10
2002	3.45	3.70	4.04	3.67	3.94	−0.78	2.11	3.64	1.01	3.73
2003	3.68	3.70	4.20	3.62	4.04	6.65	−0.12	4.13	−1.57	2.49
2004	3.63	3.87	4.36	3.59	4.34	−1.40	4.67	3.69	−0.85	7.37
2005	3.82	3.90	4.46	3.68	4.34	5.21	0.72	2.27	2.52	0.05
2006	4.24	3.88	4.52	3.77	4.37	11.12	−0.54	1.27	2.45	0.77
2007	4.35	4.03	4.59	3.88	4.38	2.57	4.00	1.67	3.11	0.25
2008	4.35	3.87	4.52	4.02	4.40	−0.02	−3.98	−1.45	3.41	0.37
2009	3.47	3.89	4.22	3.96	4.41	−20.21	0.52	−6.62	−1.37	0.20
2010	3.95	3.45	4.34	4.09	4.20	13.89	−11.48	2.70	3.31	−4.69
2011	4.08	3.81	4.24	4.01	4.14	3.30	10.53	−2.25	−2.03	−1.50
2012	4.31	4.16	4.77	4.12	4.31	5.52	9.26	12.38	2.76	4.29
2013	4.30	4.14	4.80	4.26	4.08	−0.19	−0.56	0.65	3.47	−5.38
2014	4.36	4.25	5.25	4.42	4.36	1.24	2.67	9.45	3.74	6.71
2015	4.30	4.26	4.72	4.43	4.45	−1.19	0.27	−10.04	0.14	2.23
2016	4.37	4.19	4.75	4.44	4.27	1.65	−1.72	0.52	0.26	−4.03
2017	4.55	4.53	5.04	4.54	4.29	3.91	8.04	6.21	2.31	0.33
2018	4.24	4.23	4.97	4.62	4.58	−6.80	−6.44	−1.47	1.73	6.83
Average	4.05	3.97	4.54	4.04	4.26	1.42	1.01	2.03	1.63	1.23

Table A2
Baseline projections: Philippines supply, utilization and domestic prices, 2019–2025.
Source: Model calculations. AGR is average annual growth rate.

Variable	Unit	2019	2020	2021	2022	2023	2024	2025	AGR
Area	1000 ha	4850.0	4833.2	4842.0	4899.7	4902.5	4937.2	4964.6	0.4
Yield	mt/ha	4.0	4.0	4.0	4.0	4.0	4.1	4.1	0.5
Milled Production	1000 mt	12,179.5	12,117.0	12,156.0	12,417.1	12,476.6	12,653.1	12,812.1	0.9
Per capita consumption	kg	129.2	129.4	128.0	128.6	128.0	127.7	127.4	−0.2
Total consumption	1000 mt	13,969.0	14,194.9	14,245.2	14,513.5	14,652.4	14,824.1	14,993.9	1.2
Ending stocks	1000 mt	3747.8	3781.1	3835.5	3886.6	3885.1	3897.2	3909.2	0.7
Net imports	1000 mt	2049.3	2111.2	2143.6	2147.4	2174.3	2183.1	2193.9	1.1
Farm price	peso/kg	20.4	21.1	23.7	24.3	26.2	28.0	29.8	6.6
CAR	peso/kg	19.0	19.7	22.7	22.9	24.9	26.6	28.4	7.0
Ilocos Region	peso/kg	20.0	20.8	23.7	24.1	26.1	27.8	29.6	6.8
Cagayan Valley	peso/kg	19.2	20.0	22.8	23.1	25.0	26.7	28.5	6.8
Central Luzon	peso/kg	18.0	18.7	21.5	21.8	23.7	25.3	27.0	7.0
CALABARZON	peso/kg	18.6	19.3	21.7	22.1	23.8	25.2	26.8	6.3
MIMAROPA	peso/kg	18.8	19.5	22.4	22.7	24.7	26.4	28.1	7.0
Bicol Region	peso/kg	17.5	18.2	20.7	21.0	22.7	24.2	25.8	6.8
Western Visayas	peso/kg	17.6	18.3	20.8	21.1	22.8	24.3	25.8	6.6
Central Visayas	peso/kg	21.1	21.9	24.0	24.6	26.2	27.7	29.2	5.6
Easter Visayas	peso/kg	21.7	22.6	25.1	25.6	27.5	29.1	30.9	6.1
Zamboanga Peninsula	peso/kg	20.0	20.8	23.3	23.7	25.5	27.0	28.7	6.2
Northern Mindanao	peso/kg	19.8	20.5	23.2	23.5	25.4	27.0	28.7	6.4
Davao Region	peso/kg	20.9	21.7	24.5	24.9	26.9	28.6	30.4	6.5
SOCCSKSARGEN	peso/kg	16.8	17.4	20.1	20.3	22.1	23.6	25.2	7.1
CARAGA	peso/kg	17.8	18.5	20.9	21.2	22.9	24.3	25.9	6.5
ARMM	peso/kg	16.9	17.5	19.4	19.8	21.1	22.4	23.6	5.8
Retail price	peso/kg	43.7	45.4	51.0	51.9	55.9	59.4	63.0	6.4

Table A3
Utilization, supply and price differences under QR removal with 35% and 40% tariff scenario relative to the baseline in 2019–2025.
Source: Model calculations. AGR is average annual growth rate.

Variable	Unit	2019	2020	2021	2022	2023	2024	2025	AGR
Area	1000 ha	4850.0	4667.3	4748.3	4791.4	4796.5	4832.1	4861.3	0.1
Yield	mt/ha	4.0	3.9	4.0	4.0	4.0	4.0	4.1	0.3
Milled Production	1000 mt	12,179.5	11,526.0	11,828.6	12,049.0	12,113.0	12,288.8	12,448.9	0.4
Per capita consumption	kg	132.5	130.0	129.2	129.7	129.1	128.8	128.6	−0.5
Total consumption	1000 mt	14,319.8	14,258.6	14,376.9	14,641.6	14,783.3	14,956.0	15,127.2	0.9
Ending stocks	1000 mt	3820.7	3728.9	3811.2	3860.3	3859.3	3871.2	3883.3	0.3
Net imports	1000 mt	2473.1	2640.5	2631.1	2641.4	2669.4	2679.0	2690.4	1.4
Farm price	peso/kg	14.3	17.5	19.4	19.9	21.7	23.4	25.1	10.0
CAR	peso/kg	14.8	18.9	21.0	21.3	23.2	24.9	26.6	10.6
Ilocos Region	peso/kg	15.9	20.0	22.1	22.5	24.4	26.1	27.8	10.0
Cagayan Valley	peso/kg	15.2	19.2	21.2	21.5	23.4	25.0	26.7	10.1
Central Luzon	peso/kg	14.1	18.0	20.0	20.2	22.1	23.6	25.3	10.5
CALABARZON	peso/kg	15.4	18.7	20.4	20.8	22.5	23.9	25.4	8.9
MIMAROPA	peso/kg	14.7	18.8	20.8	21.1	23.0	24.6	26.3	10.5
Bicol Region	peso/kg	14.0	17.5	19.3	19.6	21.3	22.7	24.3	9.9
Western Visayas	peso/kg	14.2	17.7	19.5	19.8	21.4	22.9	24.4	9.6
Central Visayas	peso/kg	18.4	21.4	23.0	23.6	25.1	26.6	28.1	7.3
Easter Visayas	peso/kg	18.4	21.9	23.8	24.3	26.1	27.7	29.4	8.3
Zamboanga Peninsula	peso/kg	16.7	20.1	22.0	22.4	24.1	25.6	27.2	8.7
Northern Mindanao	peso/kg	16.2	19.9	21.8	22.1	23.9	25.5	27.1	9.1
Davao Region	peso/kg	17.0	21.0	23.0	23.4	25.3	27.0	28.7	9.4
SOCCSKSARGEN	peso/kg	13.0	16.7	18.6	18.8	20.6	22.0	23.6	10.7
CARAGA	peso/kg	14.5	17.9	19.6	19.9	21.6	23.0	24.4	9.3
ARMM	peso/kg	14.6	17.1	18.5	18.9	20.2	21.4	22.6	7.7
Retail price	peso/kg	36.1	44.0	48.1	48.9	52.8	56.2	59.7	8.9

Table A4
Utilization, supply and price differences under QR removal with 35% and 50% tariff scenario relative to the baseline in 2019–2025.
Source: Model calculations. AGR is average annual growth rate.

Variable	Unit	2019	2020	2021	2022	2023	2024	2025	AGR
Area	1000 ha	4850.0	4667.4	4748.5	4791.3	4796.6	4832.1	4861.3	0.1
Yield	mt/ha	4.0	3.9	4.0	4.0	4.0	4.0	4.1	0.3
Milled Production	1000 mt	12,179.5	11,526.2	11,829.1	12,048.6	12,113.7	12,288.9	12,449.1	0.4
Per capita consumption	kg	132.5	130.0	129.2	129.7	129.1	128.8	128.6	−0.5
Total consumption	1000 mt	14,319.6	14,258.2	14,377.3	14,641.0	14,783.4	14,955.8	15,127.0	0.9
Ending stocks	1000 mt	3820.7	3728.9	3811.4	3860.2	3859.4	3871.2	3883.3	0.3
Net imports	1000 mt	2472.8	2640.2	2630.6	2641.1	2668.9	2678.7	2690.0	1.4
Farm price	peso/kg	14.3	17.5	19.4	19.9	21.7	23.4	25.1	10.0
CAR	peso/kg	14.8	18.9	21.0	21.3	23.2	24.9	26.6	10.6
Ilocos Region	peso/kg	15.9	20.0	22.1	22.5	24.4	26.1	27.8	10.0
Cagayan Valley	peso/kg	15.2	19.2	21.2	21.5	23.4	25.0	26.7	10.1
Central Luzon	peso/kg	14.1	18.0	20.0	20.2	22.1	23.6	25.3	10.5
CALABARZON	peso/kg	15.4	18.7	20.4	20.8	22.5	23.9	25.4	8.9
MIMAROPA	peso/kg	14.7	18.8	20.8	21.1	23.0	24.6	26.3	10.5
Bicol Region	peso/kg	14.0	17.5	19.3	19.6	21.3	22.7	24.3	9.9
Western Visayas	peso/kg	14.3	17.7	19.5	19.8	21.4	22.9	24.4	9.6
Central Visayas	peso/kg	18.4	21.4	23.0	23.6	25.1	26.6	28.1	7.3
Easter Visayas	peso/kg	18.4	21.9	23.8	24.3	26.1	27.7	29.4	8.3
Zamboanga Peninsula	peso/kg	16.7	20.1	22.0	22.4	24.1	25.6	27.2	8.7
Northern Mindanao	peso/kg	16.2	19.9	21.8	22.2	23.9	25.5	27.1	9.1
Davao Region	peso/kg	17.0	21.0	23.0	23.4	25.3	27.0	28.7	9.4
SOCCSKSARGEN	peso/kg	13.0	16.7	18.6	18.8	20.6	22.0	23.6	10.7
CARAGA	peso/kg	14.5	17.9	19.6	19.9	21.6	23.0	24.4	9.3
ARMM	peso/kg	14.6	17.1	18.5	18.9	20.2	21.4	22.6	7.7
Retail price	peso/kg	36.1	44.0	48.0	49.0	52.8	56.2	59.8	8.9

Table A5
Utilization, supply and price differences under QR removal with 35% and 50% tariff and 1.5% yield increase scenario relative to the baseline in 2019–2025.
Source: Model calculations. AGR is average annual growth rate.

Variable	Unit	2019	2020	2021	2022	2023	2024	2025	AGR
Area	1000 ha	4850.0	4647.0	4709.2	4761.7	4742.4	4769.4	4781.6	−0.2
Yield	mt/ha	4.0	4.0	4.0	4.1	4.2	4.2	4.3	1.1
Milled Production	1000 mt	12,318.7	11,755.6	11,954.1	12,369.9	12,446.9	12,731.2	12,977.4	0.9
Per capita consumption	kg	133.2	131.4	130.3	131.7	131.4	131.8	132.1	−0.1
Total consumption	1000 mt	14,400.5	14,416.2	14,497.9	14,865.6	15,046.3	15,294.9	15,539.9	1.3
Ending stocks	1000 mt	3855.6	3796.6	3862.8	3954.9	3969.4	4011.9	4053.3	0.8
Net imports	1000 mt	2449.4	2601.6	2610.0	2587.7	2614.0	2606.1	2603.9	1.1
Farm price	peso/kg	13.5	16.0	18.2	17.7	19.0	19.9	20.7	7.6
CAR	peso/kg	13.8	17.0	19.5	18.4	19.8	20.3	20.9	7.6
Ilocos Region	peso/kg	14.9	18.1	20.6	19.6	21.0	21.6	22.3	7.2
Cagayan Valley	peso/kg	14.3	17.4	19.8	18.8	20.2	20.7	21.3	7.2
Central Luzon	peso/kg	13.2	16.2	18.5	17.5	18.8	19.3	19.9	7.5
CALABARZON	peso/kg	14.6	17.2	19.3	18.6	19.8	20.4	21.1	6.5
MIMAROPA	peso/kg	13.7	16.9	19.3	18.3	19.6	20.2	20.8	7.5
Bicol Region	peso/kg	13.2	15.9	18.0	17.2	18.4	18.9	19.5	7.1
Western Visayas	peso/kg	13.5	16.1	18.2	17.5	18.7	19.2	19.8	6.9
Central Visayas	peso/kg	17.8	20.2	22.1	21.8	23.0	23.7	24.5	5.6
Easter Visayas	peso/kg	17.6	20.4	22.6	22.0	23.4	24.1	24.9	6.1
Zamboanga Peninsula	peso/kg	15.9	18.6	20.8	20.1	21.4	22.0	22.7	6.4
Northern Mindanao	peso/kg	15.4	18.2	20.5	19.7	21.0	21.6	22.3	6.6
Davao Region	peso/kg	16.1	19.2	21.6	20.7	22.1	22.8	23.5	6.8
SOCCSKSARGEN	peso/kg	12.1	15.0	17.2	16.2	17.5	17.9	18.5	7.7
CARAGA	peso/kg	13.8	16.4	18.4	17.7	18.9	19.4	20.0	6.7
ARMM	peso/kg	14.1	16.1	17.6	17.3	18.3	18.9	19.5	5.8
Retail price	peso/kg	34.4	40.5	45.3	43.8	46.6	48.0	49.5	6.5

Table A6
Utilization, supply and price differences under QR removal with 35% and 50% tariff and Minimum Support Price scenario relative to the baseline in 2019–2025.
Source: Model calculations. AGR is average annual growth rate.

Variable	Unit	2019	2020	2021	2022	2023	2024	2025	AGR
Area	1000 ha	4706.6	4718.9	4768.3	4787.3	4816.2	4846.2	4874.5	0.6
Yield	mt/ha	4.0	4.0	4.0	4.0	4.0	4.0	4.1	0.3
Milled Production	1000 mt	11,820.2	11,761.5	11,880.2	12,014.9	12,156.3	12,310.7	12,468.2	0.9
Per capita consumption	kg	130.5	130.6	129.6	129.6	129.3	129.0	128.7	−0.2
Total consumption	1000 mt	14,111.7	14,332.6	14,429.3	14,637.1	14,807.6	14,976.0	15,144.5	1.2
Ending stocks	1000 mt	3730.8	3760.3	3833.5	3858.6	3869.4	3879.5	3890.4	0.7
Net imports	1000 mt	2534.3	2600.7	2622.4	2647.2	2662.2	2675.5	2687.2	1.0
Farm price	peso/kg	13.5	16.0	18.2	17.7	19.0	19.9	20.7	7.6
CAR	peso/kg	13.8	17.0	19.5	18.4	19.8	20.3	20.9	7.6
Ilocos Region	peso/kg	14.9	18.1	20.6	19.6	21.0	21.6	22.3	7.2
Cagayan Valley	peso/kg	14.3	17.4	19.8	18.8	20.2	20.7	21.3	7.2
Central Luzon	peso/kg	13.2	16.2	18.5	17.5	18.8	19.3	19.9	7.5
CALABARZON	peso/kg	14.6	17.2	19.3	18.6	19.8	20.4	21.1	6.5
MIMAROPA	peso/kg	13.7	16.9	19.3	18.3	19.6	20.2	20.8	7.5
Bicol Region	peso/kg	13.2	15.9	18.0	17.2	18.4	18.9	19.5	7.1
Western Visayas	peso/kg	13.5	16.1	18.2	17.5	18.7	19.2	19.8	6.9
Central Visayas	peso/kg	17.8	20.2	22.1	21.8	23.0	23.7	24.5	5.6
Easter Visayas	peso/kg	17.6	20.4	22.6	22.0	23.4	24.1	24.9	6.1
Zamboanga Peninsula	peso/kg	15.9	18.6	20.8	20.1	21.4	22.0	22.7	6.4
Northern Mindanao	peso/kg	15.4	18.2	20.5	19.7	21.0	21.6	22.3	6.6
Davao Region	peso/kg	16.1	19.2	21.6	20.7	22.1	22.8	23.5	6.8
SOCCSKSARGEN	peso/kg	12.1	15.0	17.2	16.2	17.5	17.9	18.5	7.7
CARAGA	peso/kg	13.8	16.4	18.4	17.7	18.9	19.4	20.0	6.7
ARMM	peso/kg	14.1	16.1	17.6	17.3	18.3	18.9	19.5	5.8
Retail price	peso/kg	34.4	40.5	45.3	43.8	46.6	48.0	49.5	6.5

Table A7
Comparison of endogenous farm prices from IGRM-PRT model and actual farm prices in 2019.
Source: Estimated from prices are from model calculations. Actual farm prices are obtained from the Philippines Statistics Authority.

	IGRM-PRT 2019 estimated farm prices					2019 actual farm prices												
Region	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Philippines	20.4	14.3	14.3	13.5	16.2	18.9	18.4	17.5	16.8	16.9	16.5	17.3	16.2	14.8	14.4	14.6	15.3	16.5
CAR	19.0	14.8	14.8	13.8	17.3	19.1	18.9	17.8	17.9	16.5	15.8	19.9	14.9	15.6	15.3	15.1	13.5	16.7
Ilocos Region	20.0	15.9	15.9	14.9	18.3	21.0	19.2	18.6	18.1	17.6	17.6	17.5	16.1	16.1	14.7	15.4	15.7	17.3
Cagayan Valley	19.2	15.2	15.2	14.3	17.6	20.8	17.7	16.2	16.8	16.5	15.9	16.6	15.9	14.3	13.7	14.3	16.3	16.2
Central Luzon	18.0	14.1	14.1	13.2	16.4	18.9	17.3	16.7	15.4	15.2	14.9	16.3	13.9	13.9	13.8	14.2	16.4	15.6
CALABARZON	18.6	15.4	15.4	14.6	17.3	18.7	18.5	16.9	16.1	15.6	15.4	14.6	12.5	14.0	14.7	13.0	13.2	15.3
MIMAROPA	18.8	14.7	14.7	13.7	17.1	18.9	18.8	19.7	19.0	19.6	19.1	19.8	16.7	13.5	14.8	14.9	15.4	17.5
Bicol Region	17.5	14.0	14.0	13.2	16.1	16.6	18.5	16.7	16.2	16.5	14.7	15.0	15.2	12.6	13.2	13.3	13.3	15.1
Western Visayas	17.6	14.2	14.3	13.5	16.3	17.6	17.7	17.7	19.3	18.9	18.5	17.8	17.1	14.6	14.3	14.3	14.2	16.8
Central Visayas	21.1	18.4	18.4	17.8	20.0	20.6	21.6	19.2	20.2	20.3	19.7	19.5	19.3	17.8	18.4	18.1	17.6	19.4
Easter Visayas	21.7	18.4	18.4	17.6	20.4	22.7	20.8	16.8	17.0	17.0	16.4	15.0	15.6	16.6	17.8	16.8	16.7	17.4
Zamboanga Peninsula	20.0	16.7	16.7	15.9	18.6	20.5	19.6	20.4	21.4	20.0	20.3	19.6	17.5	15.5	13.2	12.9	15.3	18.0
Northern Mindanao	19.8	16.2	16.2	15.4	18.3	19.3	20.3	19.0	19.4	18.9	19.7	19.4	18.7	16.9	15.2	14.8	16.0	18.1
Davao Region	20.9	17.0	17.0	16.1	19.3	21.0	20.8	17.8	17.3	16.9	17.3	17.4	17.2	16.4	16.9	16.6	17.4	17.8
SOCCSKSARGEN	16.8	13.0	13.0	12.1	15.2	15.9	17.7	16.6	17.3	15.9	16.1	15.9	15.3	15.2	15.2	14.6	14.6	15.9
CARAGA	17.8	14.5	14.5	13.8	16.5	17.5	18.1	16.5	15.8	15.6	15.4	14.2	14.0	17.9	15.1	15.3	14.7	15.8
ARMM	16.9	14.6	14.6	14.1	15.9	16.3	17.5	19.0	20.4	20.8	22.1	15.8	13.2	12.9	13.5	13.2	13.9	16.5

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