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Did the Opening Up of Rice Importation in the Philippines Worsen Income Poverty and Inequality? A General Equilibrium with Microsimulation Approach

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Did the Opening Up of Rice Importation in the Philippines Worsen Income Poverty and Inequality?

A General Equilibrium with Microsimulation Approach

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Abstract

Tariffication of quantitative restrictions on rice imports was a key policy reform of the Duterte administration. This study reviews recent trends in the rice market, and assesses the poverty and distributional effects of rice tariffication using a computable general equilibrium model with microsimulation. Owing to the price difference between domestic prices in Philippines and exporting countries, imports of rice have surged under tariffication. As a result, domestic prices have fallen, though gross marketing margins have increased, amplifying the effect of the drop in retail prices on both wholesale prices and palay prices. The price and associated economic adjustments are expected to cause an increase in income poverty as conventionally measured. However, the increases are rather small, and would diminish over time. The value of the income loss suffered by the poor is far below what the amount provided by law to address problems in the rice economy with tariffication.

Keywords: Computable general equilibrium, microsimulation, trade liberalization, poverty, income distribution

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Roehlano M. Briones[1]

1. Introduction

Up to early 2019, imports of rice in the Philippines were limited by a regime of quantitative restrictions (QRs), implemented by a system of direct importation and import licensing by the National Food Authority (NFA). A landmark policy reform was implemented by the Duterte administration in 2019, under Republic Act (RA) 11203. The new law repealed the regulatory and import functions of NFA, and converted QRs into ordinary customs duties, also known as "tariffication". Part of the justification for tariffication has been to reduce the price of the country's key staple and make it more affordable, especially to poor consumers. Anticipating adverse impacts of tariffication on palay farmers, the law also mandates an annual Rice Fund as production support and other assistance for rice farmers. The Fund equals at least Php 10 billion pesos per year (plus any tariff collection on rice imports in excess of Php 10 billion), over six years.

Very recently, high profile objections have been raised against tariffication. The Federation of Free Farmers (FFF), a large alliance of farmer organizations, has called for amendments RA 11203, to again allow QRs.[2] A senator has called for an investigation of reports about a recent drop in palay prices.[3] The Board of the Mindanao Development Authority (MinDA) approved a resolution calling for a review and amendment of RA 11203 in order to help farmers who have been hit by the drop in palay prices.[4] The governor of Cotabato provinces affirms this call.[5]

A key consideration in assessing a policy is its impact on poverty and equity. Did the policy reform reduce poverty and contribute to a more equal income distribution? Was it a pro-poor measure? If so, what measures may be undertaken to reinforce the favorable impact on poverty and distribution? If not, what measures may be taken to mitigate the unfavorable impacts?

Answering these questions entails a quantitative analysis that incorporates the various economic factors that determine household incomes. A common way to implement such quantitative analysis is to combine a computable general equilibrium (CGE) model, which generates *ex ante* estimates of economywide impacts of a policy, with a microsimulation module. Microsimulation "refers to a wide variety of modeling techniques that operate at the level of individual units (such as persons, firms, or vehicles), with rules applied to simulate changes in state or behavior" (Figari, Paulus, and Sutherland, 2015).

This study aims to analyze the poverty and distributional effects of rice tariffication using a CGE model with microsimulation. This study will also review recent trends in the rice market since the effectivity of the law last March 2019.

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[1] Senior Research Fellow at the Philippine Institute for Development Studies
[2] https://businessmirror.com.ph/2020/10/01/as-palay-prices-plunge-rtl-review-sought/
[3] https://newsinfo.inquirer.net/1341292/farmers-cry-for-help-as-palay-prices-drop.
[4] http://www.minda.gov.ph/news/525-farm-gate-prices-down-to-p11-kilo-mindanao-leaders-ask-congress-to-review-massive-rice-importation
[5] https://newsinfo.inquirer.net/1343568/cotabato-governor-calls-on-congress-to-amend-rice-importation-law.

The study will determine, using a modeling approach, whether the policy has contributed to an increase, or a reduction in poverty, as conventionally measured. The model is the Agricultural Model for Policy Evaluation (AMPLE) CGE model (Briones, 2018). The review and analysis informs on-going implementation of tariffication, which has recently come under heavy fire.

2. The rice market and tariffication

Perspective of a farmer federation

A farmer federation claims that benefits of tariffication were captured mostly by importers and retailers rather than consumers, while inflicting huge losses on farmers.

A position paper of the FFF (Montemayor, 2020) offers a detailed analysis of tariffication from the farmers' perspective:

- In the first year of implementation, about 2.57 million tons of rice were imported. This led to declines in farmgate price. Based on comparison of farmgate prices between 12-month intervals March 2019 – February 2020, and March 2018 – February 2019, farmers suffered a drop in palay price of 21.3 percent, equivalent Php 80 billion in gross revenue loss based on total harvest (over the same interval). Accounting for home consumption of palay farmers, the decline is Php 66.5 billion.
- The paper compares retail prices between the same pairs of intervals for well-milled rice (WMR), and regular milled rice (RMR). For WMR the drop was 6.9 percent for 2018-19 vs 2019-2020; for RMR the drop was 9.4 percent. Consumers saved on Php 38.6 billion over this period (based on estimated consumption over the 2019-2020 interval).
- Claims that Filipinos were paying "twice or triple" what consumers in other countries were spending for rice were "deceptive and overblown." Moreover, RA 11203 led to the removal of cheap NFA rice from the retail market, leaving only imported rice, which was still selling Php 10 per kg more than NFA rice. One reason is that importers tend to procure the equivalent of well-milled rice; in the first year of tariffication, an estimated 85 percent of imports were WMR with 5% brokens.
- Traders' margin increased, soaking up the gains from tariffication. in the first year of tariffication, compared to March 2017 – February 2018, farmers lost Php 40 billion, consumers gained only Php 232 million as retail prices "hardly budged"; palay traders and millers basically broke even; importers, wholesalers, and retailers gained Php 57.5 billion.

While the impact numbers offered by the paper are contentious, some of the facts provided are well-documented (though some others are also controversial). We review some of these market trends in the following.

Trends in imports

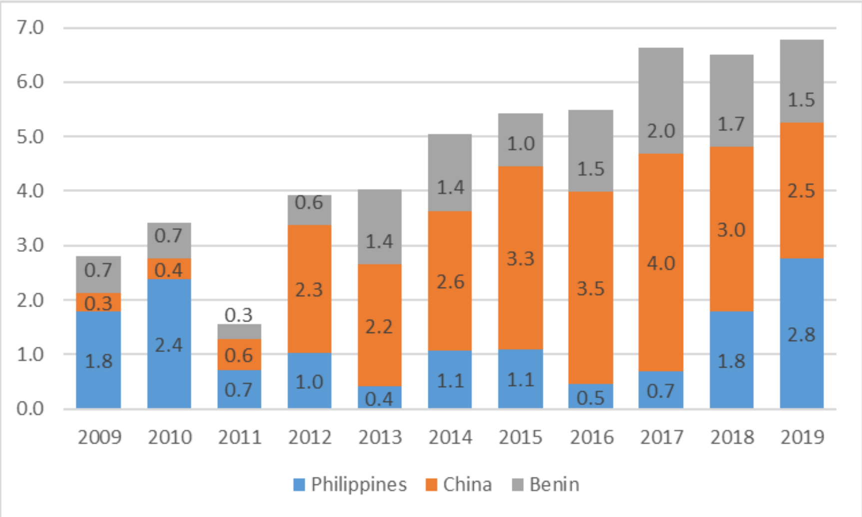
Tariffication had the expected effect of raising imports of the Philippines, even as international rice prices remained mostly stable up to April this year.

In 2019, the Philippines did indeed become the world's largest rice importer, at 2.8 million tons (Figure 1). This topped its previous highest import level of 2.4. million tons back in 2010. Also shown are the other two top importers of 2019, which is China and Benin; the former was in fact the largest rice importer over the past ten years. From 2015 to 2018, China's imports of rice ranged from 3 million up to 4 million tons, dwarfing the largest ever imports of Philippines.

Meanwhile, Benin's imports over this period ranged from a low of 0.3 million to a high of 2.0 million tons.

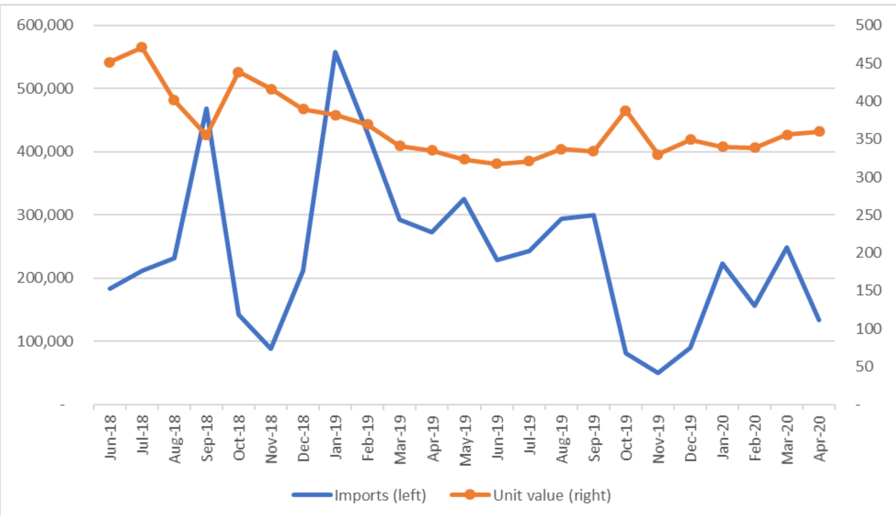
Figure 2 shows monthly rice imports of the Philippines starting from June 2018, peaking to September, but then falling dramatically in October-November, when unit value of rice imports exceeded USD 400 per ton. Imports picked up again in December, peaking at 557 thousand tons in January. From the effectivity of RA 11203 in March, monthly rice imports averaged only 210 thousand tons, with average unit value of USD 318 per ton. Despite fears to the contrary, unit value of rice imports encountered no dramatic changes despite increased participation of Philippines in international rice trade; however thin the world rice market appears, it seems more than able to absorb significant import demands from any one country, even China.

Figure 1: Annual rice imports of the top-ranking rice importers of 2019, 2009 – 2019, in millions of tons



Source: International Trade Center (2020).

Figure 2: Monthly rice imports of the Philippines, June 2018 to April 2020



Source: Bureau of Customs

Trends in domestic prices

As expected, domestic price of rice fell at the retail, wholesale, and farmgate level; gross marketing margin of traders increased (except for wholesalers of RMR).

Data from PSA cited in the FFF paper are reproduced in Table 1. Retail prices for WMR fell by 6.9 percent, while those of RMR by 9.5 percent – this seems inconsistent with the characterisation of "hardly budged". The decline in wholesale prices have been even sharper, at 15.4 percent and 19.8 percent respectively for WMR and RMR. Lastly, the decline in palay prices have been sharpest at 21.8 percent (though this is only 2 percentage points highest than the drop in RMR wholesale price.)

Table 1: Changes in prices and margins, March 2018 – February 2019 and March 2019 – February 2020, by type of rice

	Price, Php per kg		Margin, Php per kg, milled rice equivalent		Change in price (%)	Change in margin (%)
	2018-19	2019-20	2018-19	2019-20		
WMR, retail	45.32	42.21	5.14	8.20	-6.9	59.5
RMR, retail	41.19	37.29	3.00	6.67	-9.5	122.3
WMR, wholesale	40.18	34.01	9.30	9.72	-15.4	4.5
RMR, wholesale	38.19	30.62	7.31	6.33	-19.8	-13.5
Palay	20.07	15.79			-21.3	

Note: milled-rice equivalent of palay assumes a recovery rate of 0.65.

Source of basic data: Montemayor (2020).

The Table also displays the percentage change in gross marketing margin per unit of milled-rice equivalent. The RMR retailer's margin shows the largest increase, more than doubling at 122.3 percent; the WMR retailer's margin also expands considerably, by 59.5 percent. However, the RMR wholesaler's margin actually falls by 13.5 percent for RMR, and rises mildly by 4.5 percent for WMR.

The decline in domestic price can be exactly decomposed into changes in upstream price and the marketing margin.

To clarify the relationship between downstream price, upstream price, and marketing margin, consider the following equality:

$$PW \cdot QW = PP \cdot QP + mw \cdot QW \quad (1)$$

Here PW denotes wholesale price, QW the quantity of milled rice at wholesale level, PP the palay price, QP the quantity of palay purchased by wholesalers, and mw the wholesaler's marketing margin per unit milled rice. Quantities at wholesale and palay levels are related as follows:

$$QW = r \cdot QP \quad (2)$$

Letting subscripts for 0 and 1 denote sequential periods, and the Δ symbol denote change, then (1) and (2) imply:

$$\frac{\Delta PW}{PW_0} = \frac{\Delta PP}{PP_0} \cdot \left(\frac{PP_0}{PP_0 + rmw_0} \right) + \frac{\Delta mw}{mw} \cdot \frac{mw_0}{PW_0} \quad (3)$$

The term on the left is the percentage change in wholesale price (in ratio form); if there is no change in wholesaler's margin ($\Delta mw = 0$), then this is equal to the percentage change in palay price multiplied by a weighting term. Note this can be written as $PP_0 / (r \cdot PW_0)$, hence it may be referred to as the *relative downstream price*. Equation (3) makes it clear that the relative palay price is less than one. Hence, a fixed margin implies that the percentage change in palay price must exceed the percentage change in wholesale price.

If on the other hand the wholesaler's margin does change, then the whole of (3) must be considered. The second term is composed of the percentage change in wholesaler's margin, multiplied by the relative wholesaler margin (i.e. margin as a percentage of the wholesaler's price). Equation (3) is effectively a decomposition formula for the percentage change in wholesale price.

A similar expression for the change in retail price can be derived (note that in this segment of the market, the recovery rate is unity):

$$\frac{\Delta PR}{PR_0} = \frac{\Delta PW}{PW_0} \cdot \left(\frac{PW_0}{PW_0 + mr_0} \right) + \frac{\Delta mr}{mr} \cdot \frac{mr_0}{PR_0} \tag{4}$$

Here *PR* denotes retail price and *mr* the retailer's margin. Analogous to (3), Equation (4) is a decomposition formula for the percentage change in the retail price; the first component is the percentage change in wholesale price (weighted by the relative downstream price); the second is the percentage in margin (weighted by the relative margin).

Table 3 applies the decomposition formulas to the data in Table 1. Note that the change in retailer margin goes up even though retail price went down (for both WMR and RMR), hence the retailer margin makes a **negative** contribution to the change in retail price. Retail price is able to drop because of the even sharper reduction in wholesale price. Similarly, the wholesaler margin for WMR goes up even as wholesale price went down, hence the wholesaler margin makes a negative contribution to the change in wholesale price; the sharp reduction in palay price accounts for the actual change in wholesale price. Lastly for RMR, the wholesaler margin for RMR makes a positive contribution (equal to 13 percent) to the change in wholesale price, because the margin drops together with the wholesale price. The remainder of the change (equal to 87 percent) is due to the drop in palay price.

Table 2: Decomposition of change in retail and wholesale price (%)

	Relative downstream price	Relative margin	Change due to downstream price	Change due to marketing margin	Total change
WMR, retail	88.7	11.3	198	-98	100
RMR, retail	92.7	7.3	194	-94	100
WMR, wholesale	76.8	23.2	107	-7	100
RMR, wholesale	80.9	19.1	87	13	100

Source of basic data: FEF (2020).

The increase in retailer margin cannot be attributed solely to exercise of market power.

The fact that the gross marketing margin moves in opposite direction to the drop in market price does seem to indicate that traders have captured the gains from more open trade. Montemayor (2020, p. 10) attributes these changes in the margin to market power:

> It is therefore logical to conclude that any variation in the gains of consumers vis-à-vis losses of farmers arising from trade liberalization will not be influenced by the proportion of consumers to producers. Rather, it will depend on the volume of imports that come in and the magnitude of profit-seeking behavior of market intermediaries *who will decide how much of the gains they will pass on to consumers and how much of the losses they will ask farmers to absorb* [underscoring supplied.]

The underscored clause is a clear statement of a belief in market power on the side of market intermediaries. However, the causal link is far from convincing. In the first place, wholesaler margin for the most common type of rice (RMR) has fallen, whereas that of retailers has increased. Retailers are mostly small and well dispersed nationwide, whereas wholesalers involve some very large local players; the more likely locus of real market power rather will be among wholesalers rather than retailers (Briones, 2019b). Second, proponents of the market power hypothesis fail to hypothesize the converse, that a decline of the marketing margin (as among wholesalers of RMR) implies a loss of market power.

Note furthermore that marketing margin, whether at wholesale or retail level, changes all the time, and moves differently in different locations. Table 2 presents changes in annual retail, wholesale, and farmgate prices, as well as in retailer and wholesaler margins, by province, between 2017 and 2018, for RMR.[6] The first data row shows the simple average across provinces. Over this interval, all prices increase, but the largest increase is observed at the wholesale level, followed by the palay price. And whereas the wholesale margin increases considerably by 22.6 percent, this time the retail margin contracts by 66.3 percent. Lastly, there appears to be a very high dispersion of changes in price and marketing margins across provinces. The multitudinous determinants of changes in price and margins cannot be reduced to a single explanation.

Table 3: Changes in annual prices and margins, RMR, by province, 2017 – 2018 (%)

	Change in price, retail	Change in price, wholesale	Change in retailer margin	Change in price, palay	Change in wholesaler margin
Average	8.1	18.2	-66.3	17.0	22.6
Cagayan	9.8	12.7	-94.8	13.8	8.6
Zambales	6.4	23.0	-92.9	10.2	190.2
Batangas	4.4	0.1	32.0	9.7	-39.0
Rizal	3.3	18.3	-80.6	11.4	38.1
Marinduque	3.1	3.7	-35.3	43.4	-85.9
Antique	17.0	30.5	-81.7	19.8	66.8
Iloilo	8.7	30.3	-57.7	14.7	107.5
Negros Occidental	14.7	27.8	-80.8	22.6	52.0
Leyte	7.5	17.9	-69.3	14.4	31.1
Zamboanga Sibugay	6.1	15.1	-100.0	12.9	21.8
Surigao del Sur	9.3	23.9	-89.7	16.8	64.7
Average	8.1	18.2	-66.3	17.0	22.6

Source: PSA Openstat.

For instance, it may be the case that wholesale prices react earlier and faster to trade shocks, compared to retail prices, simply because wholesalers own more stocks (and incur higher cost of storage) and are exposed to greater market risk. A retailer whose normal inventory is 10

[6] Provinces with incomplete data, and where wholesale prices are below retail prices, have been omitted.

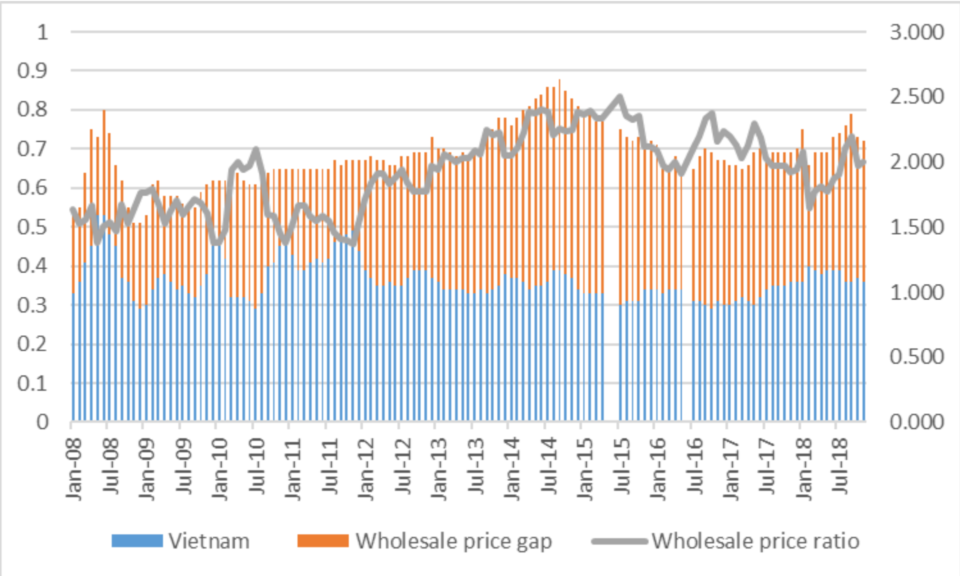
sacks of rice may be able to stock up an additional five sacks in an odd corner of her shop; however, a wholesaler already stocking 100,000 sacks may have run out of space for an additional 50,000 sacks. Moreover, wholesalers may be more specialized in rice, and therefore be more averse to an expected decline in price; a retailer may be more willing to take on the risk of a fall in price as rice may be only a small part of her overall inventory of goods. These considerations add up to the relative inertia in reducing price among retailers, but a greater willingness to cut price among wholesalers.

Other domestic market comparisons

Wholesale price of RMR in the Philippines was nearly double on average that of Vietnam from 2008 to early 2019.

Comparisons of retail prices across countries is very tricky given the large variety and quality differences owing to differences in brands, packaging, and the like. Usually price comparisons are better made at the wholesale level. Figure 3 presents the wholesale price in Vietnam in USD per kg as a blue bar; the gap between wholesale prices in Philippines and Vietnam in USD per kg (hence the height of the column is the wholesale price of rice in the Philippines). While wholesale prices in Philippines over that period never quite tripled that of Vietnam, in many cases it was more than double; on average the monthly wholesale price in Philippines was 90 percent higher than that of Vietnam.

Figure 3: Monthly wholesale price gap and wholesale price ratio, Vietnam, An Giang, Rice (25% broken), and Philippines, Metro Manila, RMR, 2008 – 2018 (in USD per kg)



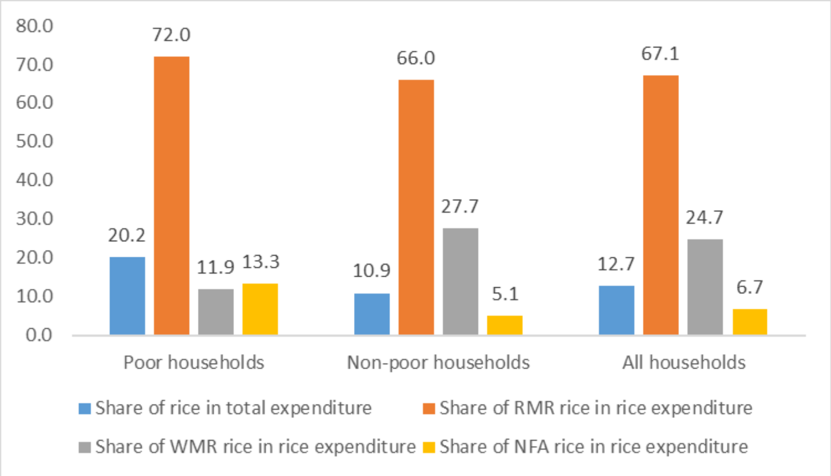
Source of basic data: FAO (2020).

The poor devote a large share of their household spending on rice, which is concentrated on RMR, with NFA rice being a minor contributor.

Rice accounts for a fifth of the household expenses of the poor (Figure 4); this is very high, considering that the non-poor devote only about one-eighth. Of this rice spending of the poor, 72 percent is allocated to RMR, which is cheaper than WMR; rice spending even of the non-poor are likewise skewed towards RMR, though the latter devote a larger share of their rice spending on the higher quality rice.

NFA rice is only a small proportion of the rice spending of the non-poor (less than 7 percent); the NFA spending share is much higher for the poor, but this still accounts for just 13.3 percent. This means 87 percent of rice spending of the poor is for commercial rice. Whereas RA 11203 has stopped the sale of affordable NFA rice, the bulk of their spending is anyway for commercial RMR rice which has become considerably cheaper upon tariffication.

Figure 4: Shares of rice in expenditure, by type of household, 2015 (%)



Source of basic data: PSA PUF of the FIES (2018).

Analytical approaches

The before-and-after approach offers only a narrow perspective on the impact of tariffication compared to the with-and-without approach.

Montemayor (2020) argues (p.10):

> On the average, each Filipino consumer bought and consumed around 100 kilos of rice during the first year of RTL implementation. (This excludes the volume that farmers did not sell commercially and used for their own family consumption.) Of this quantity, 90 kilos came from local farmers while 10 kilos were imported. If price of local rice goes down by Php 1 per kilo, and trading margins and costs did not change, the value of palay needed to produce one kilo of rice should also go down by Php 1. Hence, consumer gains would cancel out farmers losses overall. The only variation would come from the 10 kilos of imports, from which consumers gain because of the lower price, but farmers are not affected because they did not produce and sell this quantity. Even then, total consumer gains would not exceed producer losses by a significant amount despite the fact that consumers outnumber farmers by ten to one.

This argument applies a "before-and-after" estimate of a change in price, on an "after" estimate of quantity, to arrive at this result. In their analysis, as both consumption and production are fixed, then a given drop in price for consumers leads to savings that is matched by the loss in revenue of farmers; effectively reducing market exchange to a zero-sum game.

Simply comparing the state of markets before and after tariffication offers at best an incomplete analysis. The alternative is a with-and-without approach which offers a more complete analysis of the impact of tariffication. A with-and-without approach shows that market exchange is a positive sum game, **owing to quantity adjustments**. The relevant adjustments are: i) the increase in domestic consumption; ii) the decrease in domestic production; and iii) the increase in imports. The lower price owing to the 10% imports causes an increase in consumption supplied by imports; since the value of the incremental consumption exceeds the import cost, society gains from this quantity adjustment. The decline in domestic price causes domestic output to fall, to be replaced by more imports; this is also an efficiency gain because the same units of output are now sourced from a lower-cost supplier (the rice exporter).

This is not to deny there has been a significant transfer effect from farmers to consumers. This was precisely the rationale for the incorporation of Rice Fund in RA 11203, to address the transfer effect.

General equilibrium analysis offers the more comprehensive approach towards understanding the full effects of tariffication.

In the long run, the transfer effect is best minimized once farmers switch to other crops for which relative profitability is greater, i.e. as they maximize profit given the new set of relative prices. This segues into general equilibrium analysis, which goes far beyond the single-market analysis above. The wider effects of tariffication include:

- Growers of palay at the margin switching to other crops in response to lower relative price of palay;
- Lower demand for labor in palay farming releasing workers to work on other crops, or outside agriculture altogether;
- Households realize savings from cheaper rice, and allocate these to other goods (boosting demand for these goods), or to actual savings, leading to higher investment;
- Greater demand for other goods can cause factor prices to adjust and raise household incomes;
- Higher import demand tends to appreciate the dollar and thereby boost exports.

The analytical tool for this is the AMPLE-CGE model, which is used to project a without-tariffication reference scenario, as well as a with-tariffication scenario, and compare the differences between the two. As stated in the Introduction, a household module has been integrated into AMPLE-CGE to permit microsimulation of income poverty and distribution changes. Antecedents to this approach are first reviewed in the next section.

3. Review of Related Economic Modeling Literature

CGE models with microsimulation

All CGE models already have an institutional representation of the household, which participates in the economy by spending on consumer goods, receiving factor income, and setting aside household saving for use of investors. However, a standard CGE model will typically model household as an aggregate, or at least disaggregated to representative household groups. A CGE with microsimulation however seeks to incorporate the household at the individual or microlevel into the analysis. Data on household level outcomes is derived from an existing household-level survey. For the Philippines, a number of economic models have been developed for the Philippines which incorporate microsimulation in this manner, e.g. beginning with Cororaton (2003), and most recently in Dizon (2019).

Tiberti et al (2019) classify the various options to combining CGE with microsimulation as follows:

- the top down micro-accounting approach;
- the top-down with behavior approach;
- the bottom-up approach;
- the top down/bottom up or iterative approach.

The top-down micro-accounting approach is simpler as it enforces only accounting consistency between CGE social accounts and the microsimulation household accounts; no separate behavioral adjustment of households is simulated. An early application of this is Cororaton and Cockburn (2006) to analyze the impact of the WTO Agreement on the Philippine economy. The CGE model has 13 agricultural sectors, together with other industrial and service sectors. There are six urban and six rural household groups, distinguished by employment and education of household head. Changes in income are estimated for each household each household category and then applied to all corresponding households in the 39,615-household 2000 FIES. The last step permits calculation of poverty and income distribution impacts of trade policy adjustment.

The most widely practiced approach is top-down with behavior approach. This involves subjecting a microsimulation model to the results of a CGE model, such as change in price, factor income, and employment. A prior microeconometric estimation introduces a labor supply function to incorporate unemployment, and perhaps consumption and savings effects.

The bottom-up approach is most difficult to implement as it seeks to incorporate disaggregated, individual-level households directly into the CGE and calculate household level outcomes for the thousands of sample households from a household survey. A compromise between the two is the top-down/bottom-up or iterative approach with still solves the CGE model separately from the microsimulation module but performs an iteration towards a convergent solution between the two models. Nonetheless, Colombo (2010) has found, for a sample CGE-microsimulation scenario analysis, that bottom-up and integrated top-down/bottom-up have quantitatively similar results as a top-down approach.

Mult-market equilibrium modeling of rice tariffication

As rice tariffication is a very recent reform, few published multi-market or general equilibrium studies have been conducted on the issue. Hoang and Myers is an early multi-market equilibrium model of rice trade liberalization. Their model is global in scope, but focus on the five large importing and exporting countries in Southeast Asia, namely Indonesia, Malaysia, and Philippines (importing), together with Thailand and Vietnam (exporting). Removal of non-tariff barriers leads to an increase in world price by as much of 20%; nonetheless domestic prices in importing countries decline by as much as 34%.

Balie and Valera (2020) is another global rice model, with a unique regional disaggregation of the Philippines sub-system of the global model. Their simulations find the following:

- Imports shall increase by 2.47 million tons;
- Farmgate prices shall decline by 30.1% at farmgate, and 17.4% at retail.
- The decline in farmgate prices are shared quite evenly among regions.

- Farmgate prices to return to pre-reform levels in the near-term.

Perez and Pradesha (2019) confine their analysis to the Philippines, but apply an economywide CGE model. They project the following impacts of rice tariffication:

- Rice imports shall increase to 3.97 million tons by 2025 – an increase of 2.34 million tons from QR level.
- Consumer and producer prices of rice shall drastically decline by 26 percent, with minimal increase of 0.64 percent in world prices.
- Domestic rice production shall decline by as much as 9.7 percent (1.3 million tons) from 7.2 percent reduction in harvested area
- Rice consumption per capita shall increase by 6.3 per-cent to 120 kg per year.
- Nutrition status of the country shall to improve with 2.1 million less hungry people and malnourished children.

Briones (2019a) also undertakes scenario analysis of rice tariffication using CGE, in a model where households are disaggregated by income deciles. This allows for a convenient bottom-up approach; however, as households are still highly aggregated, the analysis stops short of a microsimulation. The findings of the policy simulations are as follows:

- Value of benefits of liberalization exceed the value of costs, hence society is better off. Benefits of liberalization are distributed throughout the population, while the costs are borne by the narrow segment of net rice producers.
- Disaggregating the welfare change across the income deciles (combining consumers and producers), rice tariffication confers positive benefit for all the income deciles. For all income deciles, net benefit from liberalization is positive.
- The relative gain of lower income deciles is larger than that of higher income deciles. Net benefit of poorer deciles is relatively larger than that of richer deciles.

The paper of Cororaton and Yu (2019) is closest to the objectives of this study as it actually implements a microsimulation, allowing it to determine poverty and distributional impacts of rice tariffication. Households at the base case of the model were the sample households of the 2015 FIES. They specify four scenarios as follows:

- SIM1: corresponds to rice self-sufficiency program where rice imports lower by 50%;
- SIM 2: corresponds to full liberalization where the import quota for rice is removed;
- SIM 3: corresponds to tariffication, a rice tariff equivalent (48.9%) is imposed in lieu of an import quota, and tariff revenues are distributed to low-income households based on the following allocation: 40% to decile 1, 30% to decile 2; 20% to decile 3, 7% to decile 4, and 3% to decile 5;
- SIM4: corresponds to gradual liberalization, in which the rice tariff of SIM 3 declines to 25% over a ten-year period, and the tariff revenues generated are transferred according to the same scheme as SIM3.

Their analysis finds the following: Tariffication (SIM 2 and SIM3) reduces poverty and reduces income inequality. The impacts are greater when tariffs are further reduced (SIM 4). However, tighter quantitative restriction on rice imports (SIM 1) makes poor households worse off, and benefits rich households, thereby worsening income inequality

4. Methodology

CGE Model

Data

The data of the model is organized into a 2018 Social Accounting Matrix (SAM). The original data set is the 2006 input-output (IO) table, originally in 240 sectors, which provides data (in millions of pesos) on intermediate inputs, final demands (of households, producers, government, and rest of the world). It also provides value disaggregated into compensation for labor, operating surplus (which are returns to capital and land), and indirect taxes (net of subsidies). The original IO sectors are re-classified into the AMPLE-CGE sectors, listed in Table 1.[7] Total number of sectors is 36, grouped into Agriculture, Industry, and Services; Agriculture is the most disaggregated (17 sectors), further divided into three sub-groups (Crops, Livestock and Poultry, Fisheries, and Other sectors). For industry, manufacturing linked to agriculture are likewise disaggregated, resulting in twelve sectors. Lastly, Services are divided into six sectors.

A 2006 SAM was then compiled using information from the consolidated income accounts,. The SAM was then updated to 2018 data using information from national income accounts for that year. The method used to compile the 2018 SAM is similar to the one described in Galang (2017). Lastly, the non-tariff barrier for rice is estimated using the nominal protection rate (NPR), applicable only to rice. In 2018, the estimate for the NPR is 65 percent.

Table 4: Sectors of the AMPLE-CGE model

Agriculture	Industry	Services
Crops	18. Mining	31. Transportation
1. Palay	19. Rice and corn milling	32. Storage
2. Corn	20. Meat	33. Trade
3. Coconut	21. Processed fish	34. Finance
4. Sugarcane	22. Sugar	35. Other private service
5. Banana	23. Other food manufacture	36. Public service
6. Mango	24. Beverage manufacture	
7. Other fruit	25. Pesticide manufacture	
8. Other crops	26. Other agri-based manufacture	
9. Rootcrops	27. Feed manufacture	
10. Vegetables	28. Other manufacture	
Livestock and poultry	29. Agri-machinery manufacture	
11. Hog	30. Other industry	
12. Other livestock		
13. Poultry		
Fishery		
14. Capture fishery		
15. Aquaculture		

[7] A more recent IO table is available for 2012; however, the sectors of the 2012 IO are too aggregated to permit re-classification into the AMPLE-CGE sectors.

Other sectors
16. Agricultural services
17. Forestry

Source: Author's model.

Structure of the model

This study updates the AMPLE – CGE model, whose model structure was documented in Briones (2018). The model is divided into several blocks of equations:

Households: The model can be disaggregated into various household categories; in this version there is only one representative household. Savings is a fixed proportion of household income. Consumption is modeled as a linear expenditure system (LES). Household have fixed endowments of labor and capital, and earn factor income from wages and rental payments for capital. They pay out income taxes and receive transfers from government and from abroad. Households savings are part of total savings.

Producers and investment: Capital services are modeled as mobile across sectors; its owners are compensated by rental payments. New to this version of AMPLE-CGE is the allocation of total labor supply to either agricultural or non-agricultural sectors according to a constant elasticity of substitution (CES) function. Agricultural labor is mobile among the agricultural sectors; likewise, industry-service labor is mobile across the nonagricultural sectors.

With the exception of crops, production is obtained by combining labor and capital in a CES production function to produce value added. Meanwhile gross output is obtained by combining value added with intermediate inputs using a Leontief production function. In the case of crops, supply is modeled using a yield x area harvested framework; the crop mix is determined to maximize net revenue where cropping area is substituted across crops according to a CES function. Finally, total investment is allocated to the sectors according to fixed shares.

Government: government consumption is also allocated to the sectors according to fixed shares. Government provides fixed transfers to households, and collects taxes, both directly from households, as well as indirectly by taxing business and imports. Government savings are part of total savings.

Rest of the world: goods purchased from abroad are imports, paid for by foreign exchange (US dollars); goods sold to foreigners are exports, earning foreign exchange. Imports are modeled using an Armington formulation where demand is split into a home-produced component and a foreign component. Similarly, exports are modeled using a constant elasticity of transformation (CET) formulation where the destination is split into a home market and a foreign market. The rest of the world also provides a transfer to government and to households; households. New to this model is the dependence of foreign transfers on the exchange rate, determined by a constant elasticity function. Transfers to government are however fixed. Foreign savings are part of total savings.

Closure. The model is closed by equating total investment with total savings; that total demand for factors equal available endowment of factors; and that home demand equal to home market supply. Owing to Walras' Law, one of the model equations is redundant. To enforce uniqueness of equilibrium, the consumer price index (CPI) is kept equal to its base year value. In other words, model closure maintains all values in real terms based on the CPI.

Multi-period scenarios

Exogenous to the model are population; the stock of capital; government transfers to households; aggregate area harvested; the various tax rates (on income, on value added, and on imports); state of technology; import prices; export prices; and non-tariff barriers. Scenarios are generated by projecting annual values of exogenous variables over a time horizon, here fixed at 2018 to 2030, and solving model equilibrium over each period.

The reference scenario corresponds to a projection in which the non-tariff barrier is kept constant. The tariffication scenario differs from the reference scenario, in only one respect, that is the elimination of the non-tariff barrier in 2019. The reference scenario may be regarded as the counterfactual, because in fact tariffication was implemented in 2019.

Minimalist model dynamics is introduced by having gross capital formation, net of depreciation expense, add to the total capital stock in each period. Further dynamics is introduced with population growth (derived from PSA projections), and technical progress (to replicate expected GDP growth over the projection horizon). A negative shock is applied to production functions to replicate the net economic contraction that is expected to prevail in 2020 owing to the COVID-19 pandemic.

Microsimulation based on household incomes

Structure and basic equations

The study will develop a top-down micro-accounting approach. Let y_H denote per capita income of household H = 1, 2…, N; here income is the proxy of household standard of living. As explained below, N here is 20,051 (explained below). Suppose the index H is sorted such that $y_H \le y_{H+1}$, i.e. in ascending order. Denote the poverty threshold as z, $y_1 < z < y_N$; let *P*, $0 < P < N$ such that $y_P \le z$ and $y_{P+1} > z$. The Foster-Greer-Thorbecke index $F(\alpha)$ is computed as follows:

$$F(\alpha) = \frac{1}{N} \cdot \sum_{h=1}^{P} \left(\frac{z - y_h}{z} \right)^{\alpha}; \alpha = 0,1,2. \quad (5)$$

Hence, $F(0)$ is the simply the poverty incidence of households; $F(1)$ is the poverty-gap measure of households; and $F(2)$ is the squared poverty-gap measure of households.

The mean per capita income is denoted $\bar{y}$. The distribution of per capita incomes is represented by the Gini index, computed as follows:

$$G = \frac{2}{N^2 \cdot \bar{y}} \sum_{H=1}^{N} H \cdot \left(y_H - \bar{y} \right). \quad (6)$$

Note that the actual formulas apply the sample weights found in the Family Income and Expenditure Survey (FIES); moreover, official statistics on poverty incidence adopt different poverty lines by province, and between urban and rural areas. Sampling design of the FIES allows for a representative sample down to the regional level, hence poverty is disaggregated between urban and rural areas, and by region. The Gini ratio however is computed only for the national level.

Note that an alternative indicator of household living standard is household expenditure; poverty and distribution measures can be computed using equations (5) and (6), substituting household per capita expenditure for household per capita income.

Data and projections

The most recent FIES with public use file is the 2015 edition, which is the one adopted here. Information to be used are: per capita household income; per capita household expenditures; family size; sample weights; income from wages (disaggregated between agriculture and non-agricultural sources); income from assets (rent, dividend, interest, etc.); and net entrepreneurial income from agriculture disaggregated by sector. Note though that sector disaggregation of net agricultural income is absent from the FIES. To fill up these gap, occupation information for the household head from the Labor Force Survey (LFS) is used. The first quarter 2016 LFS is therefore merged with the 2015 FIES, which results in data set for the household microsimulation module of the AMPLE-CGE.

Household per capita income computed as follows:

$$y_H = PLA \cdot \lambda Ag_H + PLIS \cdot \lambda IS_H + PKAP \cdot kape_H + \sum_{j=1}^{TJ} NEA_{H,j} + yoth_H \qquad (7)$$

Here *PLA*, *PLIS*, and *PKAP* refer to factor prices of agricultural labor, nonagricultural labor, and capital (rent); *NEA* refers to net entrepreneurial income from agricultural, and *j* denotes the agricultural sector generating entrepreneurial income; and *yoth* denotes other sources of income. Equation (7) is used for making household per capita income projections, abstracting from supply decisions of households. Net entrepreneurial income of the household from agriculture is posited to take the following form:

$$NEA_{H,j} = k_{H,j} \cdot PVA_j \cdot QVA_{H,j} \qquad (8)$$

Here *PVA* denotes the price of value added and *QVA* the quantity of value added. Note that strictly speaking there can be no profit at equilibrium within the neoclassical framework of the AMPLE-CGE; hence net entrepreneurial income is compensation for household-owned factors of production, assumed to be a fixed proportion of value added from the household enterprise, denoted $k_{H,j}$ in (8). Therefore:

$$\frac{\Delta NEA_{H,j}}{NEA_{H,j}} = k_{H,j} \cdot QVA_{H,j} \frac{\Delta PVA}{PVA} \cdot \frac{PVA}{NEA_{H,j}} = \frac{\Delta PVA}{PVA} \qquad (9)$$

Let $s_{LA}, s_{LIS}, s_{KAP}, s_j, s_{OTH}$ denote income shares by component (with obvious notation). Using (7) and (9), and assuming income from other sources is fixed:

$$\frac{\Delta y_H}{y_H} = \frac{\Delta PLA}{PLA} \cdot s_{LA} + \frac{\Delta PLIS}{PLIS} \cdot s_{LIS} \frac{\Delta PKAP}{PKAP} \cdot s_{KAP} + \sum_j \frac{\Delta PVA}{PVA} \cdot s_j \qquad (10)$$

The Δ terms on the right hand side are derived from their corresponding scenarios from AMPLE-CGE.

5. Results of scenario analysis

In the following, scenarios are presented as three-year averages from 2019 to 2030, as the annual equilibrium feature of most CGE models (including AMPLE-CGE) is too restrictive.

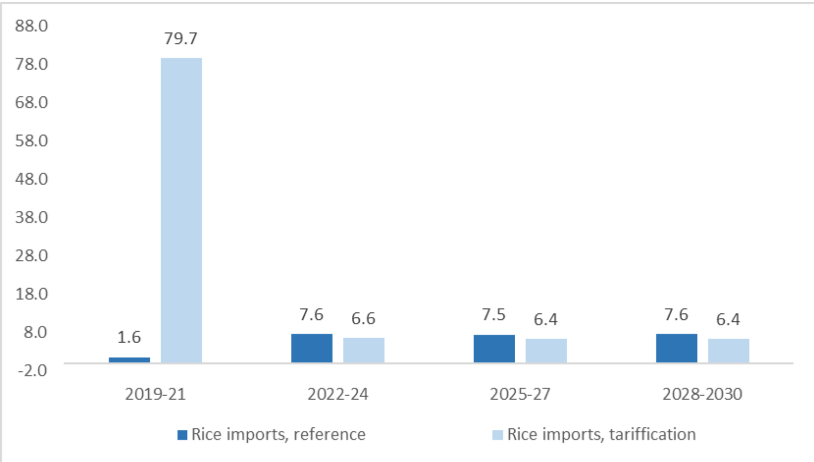
Rather, market-clearing is more realistically represented as a medium-term phenomenon, in turn is better approximated by medium-term averages of the annual model solution.

Market scenarios

Imports

In the absence of tariffication, the reference scenario involves consistently positive growth of imports, owing to the rising domestic demand as population and income continue to rise (Figure 5). The tariffication scenario however causes a surge in import growth in 2019 – 21, import growth averages 78.1 percentage points higher than in the reference scenario. However, imports stabilize quickly; from 2022 – 30, import growth is 1.0 to 1.2 percentage points per annum slower under tariffication.

Figure 5: Growth rate of rice imports, by scenario, 2019 – 2030 (%)



Source: Author's calculation.

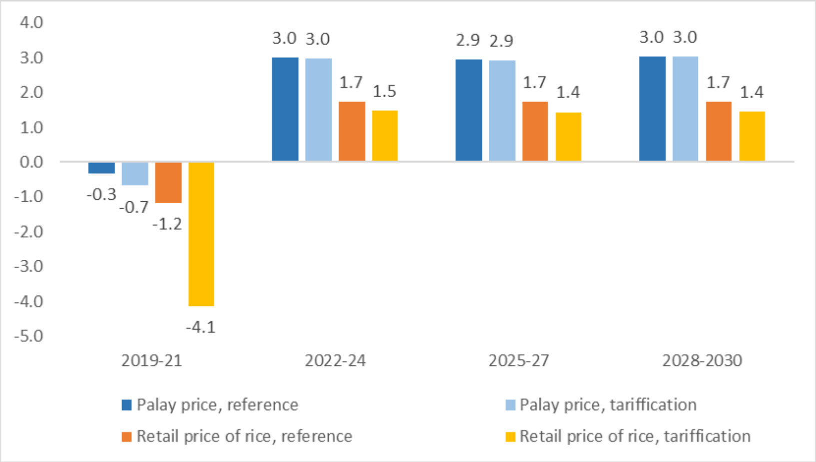
Rice prices

In the absence of tariffication, retail price of rice, as well as price of palay, is expected to post a decline on average relative to 2018 levels, owing mainly to the steep economic contraction of 2020 (Figure 6). However, with economic recovery up to 2030, both prices are expected to grow, at 2.9 to 3.0 percent annually (for palay) and 1.7 percent (for retail rice).

It is important to note that this projection, under our minimalist scenarios, involves a constant wedge (in *ad valorem* terms) between domestic and border prices, and that border prices are fixed. In fact, border prices vary with world prices, and the NFA was historically prone to mistiming import arrivals, leading to intermittent price crises and ballooning of the price wedge (Briones, 2017). This was evident most recently in the rice price crisis of 2018 (Tolentino and de la Pena, 2019). This projection will therefore likely underestimates the average rate of increase of the domestic retail price.

With tariffication, the influx of cheap imports depresses the domestic price of both retail rice and palay. The drop is much larger for the former, at about 2.9 percentage points in 2019-21 (levelling off at 0.2 to 0.3 percentage points afterwards). Surprisingly the drop in palay price is much milder, at just 0.4 percentage points in 2019-21, and essentially no change in the rest of the period. The model suggests that the dramatic swings observed in palay price in 2019 are temporary disruptions that will moderate as markets adjust to the new normal of open trade.

Figure 6: Annual growth in price of palay and retail milled rice, by scenario, 2019 – 2030 (%)

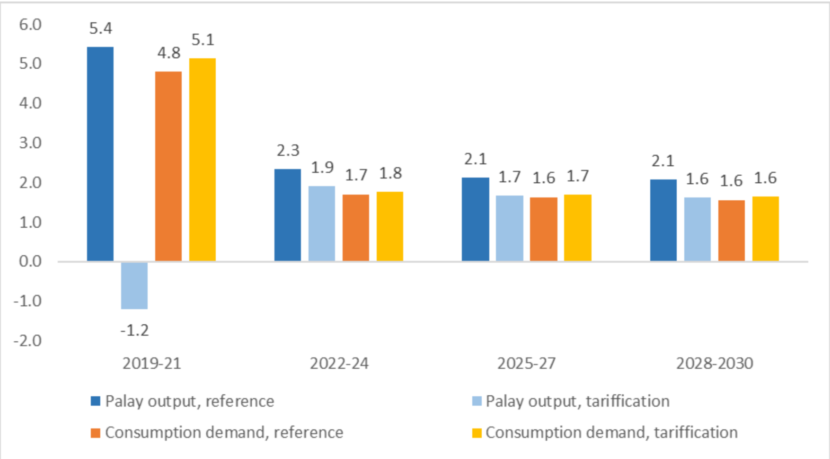


Source: Author’s calculation.

Rice output and consumption

Palay output continues to grow under the reference scenario, fairly rapidly in 2019-21, decelerating somewhat to an annual growth of 2.1 to 2.3 percent after 2021. Similarly, consumption growth starts at 4.8 percent per year in 2019-21, slowing down to 1.6 to 1.7 percent from 2022 onward. With tariffication though, palay output contracts by an average of 1.2 percent per year in 2019-21; palay output then stabilizes and posts positive growth, though at slightly slower rate than in the reference scenario. Meanwhile consumption of retail rice is higher by 0.3 percentage points in 2019-21, and by 0.0 to 0.1 percentage point afterwards. Both trends consistent with the price projections of Figure 6.

Figure 7: Annual growth in palay output and rice consumption, by scenario, 2019 – 2030 (%)

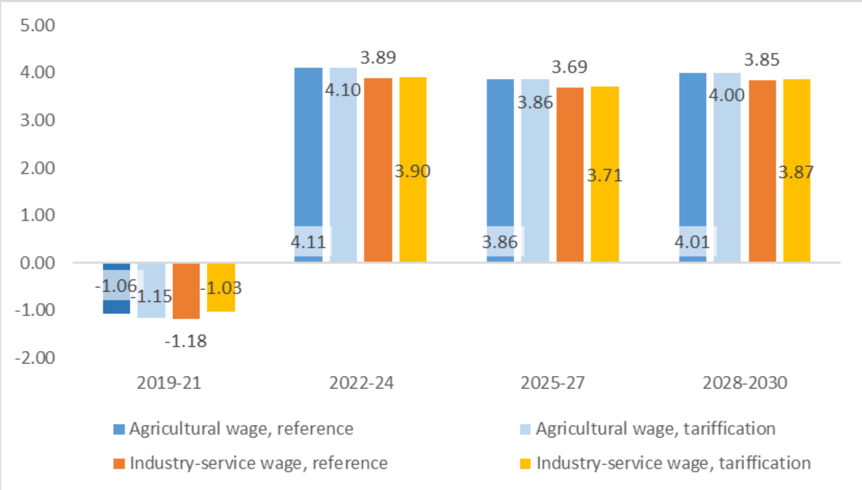


Source: Author’s calculation.

Wages

Without the reform, wages both in agriculture and in industry-service are expected to post an average drop in 2019-21 (again owing to the COVID-19 recession). Real wages are then expected to rise, with industry-service wage edging that of agriculture. Tariffication though leads to a somewhat faster drop in agricultural wage in 2019-21, and slightly slower wage growth in agriculture after 2021. Meanwhile under tariffication, the decline in industry-service wage in 2019-21 is slower, while wage growth after 2021 is slightly faster.

Figure 8: Annual growth in wages, by scenario, 2019 – 2030 (%)

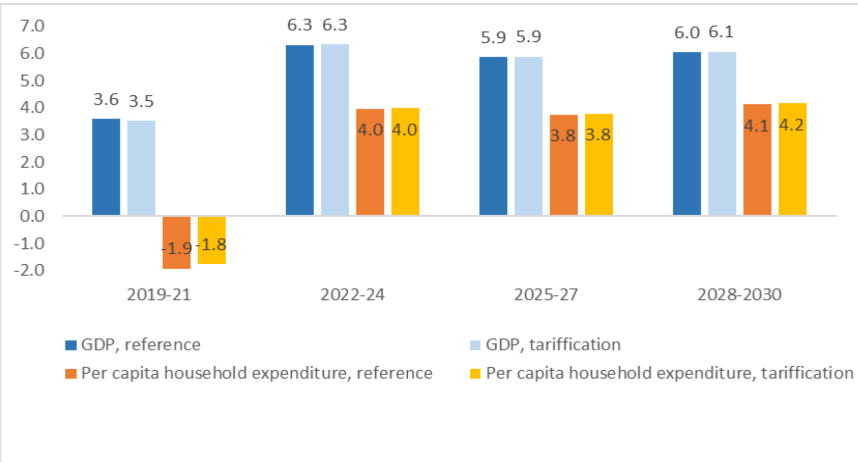


Source: Author's calculation.

GDP and consumption spending

Under the reference scenario, economic growth starts out low in 2019-21 owing to the great 2020 recession; growth then accelerates to around its pre-COVID levels in 2022 – 2030. Per capita household expenditure meanwhile contracts in 2019 – 2021, then increases at 3.8 to 4.1 percent per annum afterwards.

Figure 9: Annual growth in GDP and per capita expenditure, by scenario, 2019 – 2030 (%)



Source: Author's calculation.

Tariffication causes only a mild reduction in GDP growth in 2019-2021; and practically no change over the period 2022 – 2027. GDP growth accelerates slightly in 2028-2030 with tariffication. The import surge itself is subtracts from GDP; however, the extra purchasing power of households from cheaper imported rice leads to an increase in demand and re-allocation of resources to other sectors, adding to GDP. The net effect is slightly negative at the start of the period, and turns positive at the end of the period.

Per capita household expenditure suffers a smaller drop in 2019-21 with tariffication, i.e. the reform has a positive effect on household expenditure. Per capita expenditure effectively remains constant even with tariffication, and accelerates mildly in 2028-2030.

Income poverty and distribution

As previously discussed, tariffication dampens wage growth in agriculture but only slightly, conversely, it exerts a small positive effect on wages in the rest of the economy. Furthermore, it reduces price of value added in rice, but has a mix of positive and negative impacts on value added of other agricultural sectors. The net effect on incomes of the poor are investigated using microsimulation. At the national level, impact of tariffication on income poverty and income distribution of the population are shown in Table 5.

Tariffication causes a slight increase in income poverty, by 0.56 percentage points annually in 2019-21, and again in 2022-24; the effect is attenuated in 2025 to 2030. Likewise, poverty gap and squared poverty gap both increase; this suggests that the income difference is slightly skewed towards the poorer households. This is consistent with the increase in the Gini ratio projected over the period. However, the poverty and inequality measures all show only minimal increments.

The weakness of the poverty impact is striking, considering the bulk of workers who are poor are in agriculture, and that rice farming likely generates the most employment, whether for own-account or hired workers. The reason is that general equilibrium analysis accounts for various intersectoral effects that may mitigate the loss in palay farmers' and workers' income, with income gains of the poor elsewhere in the economy.

The fact that poverty increments are positive seems contradictory to the result of Cororaton and Yu (2019) which found a negative poverty impact. However, their scenario incorporates income transfers – as shown below, it takes only a relatively small amount of transfers to reverse the poverty impact.

Table 5: Annual percentage point changes in poverty measures, population, due to tariffication (%)

	2019-21	2022-24	2025-27	2028-2030	2019-2030
Poverty incidence	0.56	0.56	0.23	0.07	0.29
Poverty gap ratio	0.25	0.19	0.04	0.01	0.08
Squared poverty gap ratio	0.13	0.08	0.01	0.00	0.03
Gini ratio	0.07	0.07	0.08	0.08	0.08

Source: Author's calculation.

A similar set of findings hold even when poverty measures are disaggregated between urban and rural areas (Table 6). Both urban and rural populations shall suffer an increase in income poverty, whether measured as incidence, poverty gap ratio, or squared poverty gap ratio. The decrement though is small. Compared with the national estimates, changes in poverty measures tend to be lower in urban areas, compared with rural areas. This is expected as palay-dependent households tend to reside in rural barangays.

Table 6: Percentage point changes in poverty incidence, urban versus rural population, due to tariffication, 2019 - 2030 (%)

	2019-21	2022-24	2025-27	2028-30	2019-30
Urban					
Poverty incidence	0.45	0.43	0.10	0.03	0.19
Poverty gap ratio	0.16	0.11	0.02	0.00	0.04
Squared poverty gap ratio	0.08	0.05	0.01	0.00	0.02
Rural					
Poverty incidence	0.65	0.65	0.32	0.10	0.36
Poverty gap ratio	0.32	0.24	0.06	0.02	0.11
Squared poverty gap ratio	0.17	0.11	0.02	0.01	0.05

Source: Author's calculation.

Table 7 presents results related to regional populations (Table 7). For ease of presentation, only estimates for poverty incidence are displayed. As with national estimates, tariffication causes an increase in poverty, across all regions, throughout the projection period. In the aftermath of tariffication (2019 – 2021), the highest impact is observed for Region IV-B, Region VII, and Region VI; only Region VI is a region with a large rice-growing area. The country's largest rice growing region, namely Region III, experiences only a 0.39 percentage point increase in poverty incidence, owing to low poverty rates at the base year. ARMM, the poorest region of the country, suffers only a 0.48 percentage point decline, owing to its relatively small rice-growing areas. The poverty impact tends to fade in the long run (i.e. from 2025 onward).

Table 7: Percentage point changes in poverty incidence, by regional population, due to tariffication, 2019 – 2030 (%)

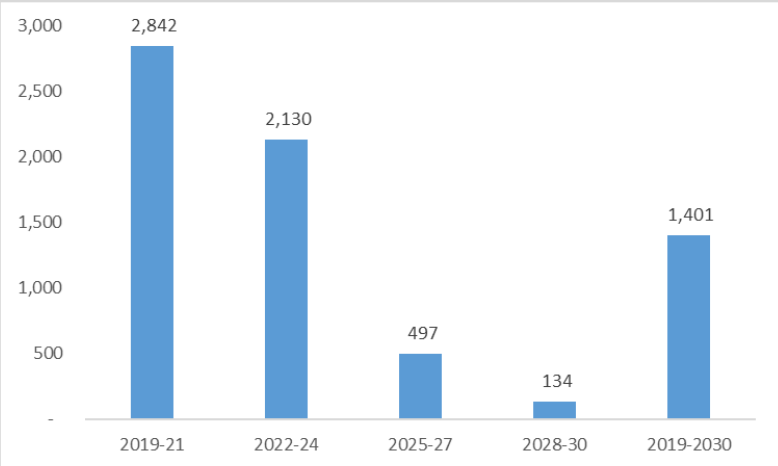
	2019-21	2022-24	2025-27	2028-30	2019-2030
NCR	0.28	0.28	0.00	0.00	0.09
CAR	0.58	0.70	0.62	0.07	0.46
Region I	0.62	0.55	0.19	0.06	0.26
Region II	0.61	0.40	0.03	0.00	0.14
Region III	0.39	0.54	0.10	0.00	0.21
Region IV-A	0.52	0.47	0.14	0.02	0.21
Region IV-B	1.10	0.42	0.39	0.00	0.27
Region V	0.73	0.83	0.30	0.21	0.45
Region VI	0.78	0.67	0.34	0.06	0.36
Region VII	0.90	0.67	0.26	0.04	0.32
Region VIII	0.76	0.70	0.42	0.14	0.42
Region IX	0.56	0.61	0.06	0.11	0.26
Region X	0.55	0.60	0.26	0.24	0.37

	2019-21	2022-24	2025-27	2028-30	2019-2030
Region XI	0.34	0.44	0.33	0.03	0.27
Region XII	0.57	0.86	0.39	0.13	0.46
Caraga	0.42	0.75	0.51	0.28	0.52
ARMM	0.48	0.63	0.73	0.24	0.54

Source: Author's calculation.

How large, in monetary terms, are these poverty impacts? One way to gauge this is with peso value of the difference between per capita annual income of poor households with and without tariffication. This number also denotes the amount of cash transfers needed to bring poor households back to their without-tariffication incomes. Figure 10 shows that the difference in incomes of the poor due to tariffication. In the first three years the annual average is just Php 2.84 billion; this declines to Php 2.1 billion in 2022-24.

Figure 10: Difference in annual incomes of the poor, with tariffication, 2019 – 2030, (Php millions)



Source: Author's calculation.

Afterwards the annual poverty gap is down to about Php 500 million per year in 2025-2027, and further down to Php 134 million in 2028 – 2030. The total absolute poverty gap in the six-year period is Php 14.9 billion in total; this is the minimum amount of cash transfers needed to compensate the poor for the increase (if any) in their respective absolute poverty gaps, due to tariffication. This amount is far below the Php 60 billion minimum allocated for the Rice Fund under RA 11203. The Rice Fund even exceeds the total income difference cumulating over the twelve years of the scenario, equivalent to just Php 16.8 billion. In short, if properly targeted, the Rice Fund already budgeted in the tariffication law is more than enough to offset the impact of tariffication on income poverty.

6. Conclusion

In summary: Some of the expected effects of tariffication have indeed materialized. Owing to the price difference between domestic prices in Philippines and exporting countries, imports of rice have surged with opening of the rice market to international trade. As a result, domestic prices have fallen. On the other hand, an unexpected development has been an increase in gross marketing margin at both wholesale, and most noticeably at the retail level. This increase in the margin has amplified the effect of the drop in retail prices on both wholesale prices and palay prices. The drop in retail price, especially in regular milled rice, has been highly beneficial to the poor; however, the negative impacts on the rice economy in terms of income poverty and distribution should also be taken seriously.

Using CGE analysis with microsimulation, this study finds the shock to the rice economy ultimately causes an increase in income poverty, across a variety of measures, geographic categories, and over time. However, the increments are small, and diminish over time. The value of the income loss suffered by the poor is far below what the amount provided by law to address problems in the rice economy with tariffication.

This study is part of a continuing research agenda on policy reforms in agriculture. From a modeling standpoint, further study is needed to value the benefits received by consumers from cheaper rice prices, as was done in Briones (2019a). However, such welfare changes are typically not incorporated in the standard methodology for measuring poverty and income inequality. It is possible nonetheless to explore these welfare changes within in a microsimulation framework.

Beyond modeling however, there is a strong need to pursue empirical work on the rice sector, in at least two directions. The first involves a deeper study of rice marketing along the value chain from traders to millers, wholesalers, retailers, and consumers. This will help explain the rise and fall of marketing margins which are key to determining the spread of benefits from policy reform. The second involves a study of Rice Fund programs and their impact on the rice industry at the grassroots (farm operators, farm workers, and other entrepreneurs and workers in the value chain). Both of these require extensive collection of primary data, preferably through a field survey. Such data is essential to assess whether in fact RA 11203 has adequately compensated the losers of the policy reform, and had led to an accelerated transformation of rice and other agricultural value chains.

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