

THE RICE SECTOR

Paul Dorosh, Nilar Aung, and Bart Minten¹

Recent major local shocks have negatively affected Myanmar's economy and its people. Disruptions in the world economy linked to the outbreak of COVID-19 in early 2020 and the Ukraine war in 2022 and 2023 have led to sharp price increases for petroleum products, wheat, vegetable oils, and other food products, as well as agricultural inputs, such as chemical fertilizers. Myanmar's rice sector has also been adversely affected by increases in insecurity in rural areas, higher world prices, and reduced cross-border exports to China.

This chapter explores the implications of these shocks for Myanmar's rice exports, domestic rice production, and domestic rice prices. First, we discuss Myanmar's rice economy. Next, we describe the equations, database, and parameters of the partial equilibrium model of Myanmar's rice economy used in this analysis. We then present model simulation results, covering the effects of the income and price shocks in 2022, negative rice production shocks accompanied by lower rice exports in 2023, and implications of a cessation of cross-border rice exports to China. The final section summarizes the results, discusses policy implications, and suggests areas for further work.

Overview of Myanmar's rice sector

Rice production

Paddy rice is a very important product for farmers' livelihoods in Myanmar. Almost two-thirds of farm households grow rice during the monsoon period (Chapter 10). Paddy made up 36 percent of all land sown in the country in

¹ We thank the Myanmar Rice Federation for providing data and other information on Myanmar's rice exports and Olivier Ecker and Andrew Comstock for econometric estimates of household elasticities of demand for rice. An earlier version of this chapter was presented at the Myanmar's Agrifood System: Assuring Resilience to Adversity Conference, Bangkok, Thailand, May 31–June 1, 2023.

2019/20 (MOALI 2022). Rice production data vary substantially by source, with sharp increases and decreases in some years (Dorosh, Win, and van Asselt 2019).² USDA data indicate that from 1990 to 2000, Myanmar enjoyed relatively rapid growth in paddy production, primarily due to area growth (USDA 2023a; Table 11.1 and Figure 11.1). Overall, production of paddy increased 35.6 percent, while area and yield growth were 25.1 percent and 8.8 percent, respectively. Total production stagnated from 2000 to 2010, however. Area increased by 17.5 percent, but yields fell by 21.0 percent.³

Since 2010, the rice area harvested has remained nearly constant, decreasing by only 0.7 percent. Yields have risen by a total of 13.9 percent, however, so that paddy production increased by 13.0 percent. All of this increase in yields is pre-COVID. Yields increased by 16.3 percent from 2010 to 2020 and fell by 4.9 percent between 2020 and 2022, but then recovered a bit in 2023.⁴ For the 2010 to 2023 period in total, area declined by an annual average of 0.1 percent per year; yields rose by 1.0 percent per year, and production of paddy rose by 0.9 percent per year.⁵

Rice production systems and consumption patterns are diverse. Among other differences, there is a large variation in paddy rice varieties planted and consumed in the country. Emata and Pawsan are widely grown varieties. Aromatic and short-grain Pawsan varieties typically have lower yields, and they are more expensive than the long-grain Emata varieties (Goeb et al. 2022). The former became popular only relatively recently (Proximity Designs 2016). Pawsan is almost exclusively grown during the monsoon season and mostly consumed by rich urban domestic consumers, while Emata varieties are both consumed domestically and exported.

Chemical fertilizer is one of the most widely used but also the most costly inputs in paddy production. Fertilizer use is lower than in other countries in the region (Chapter 3), but it has seemingly increased compared with the

2 Numerous phone surveys in recent years have also provided information on rice production and markets, though these data are not necessarily comparable to earlier estimates of production. See, for example, MAPSA (2023c).

3 Note that there is a sharp break in the data between 2003 and 2004. Area increased by 7.9 percent, but yields fell by 17.3 percent from 2.94 to 2.43 tons of paddy per hectare. As a result, production fell 10.8 percent.

4 Other sources indicate more substantial declines in recent years. Using area estimates done by the Asian Disaster Preparedness Center (ADPC) for major paddy rice areas in the country, paddy rice production at the national level was estimated to have decreased by 13 percent in 2022 compared with 2021 (ADPC 2023).

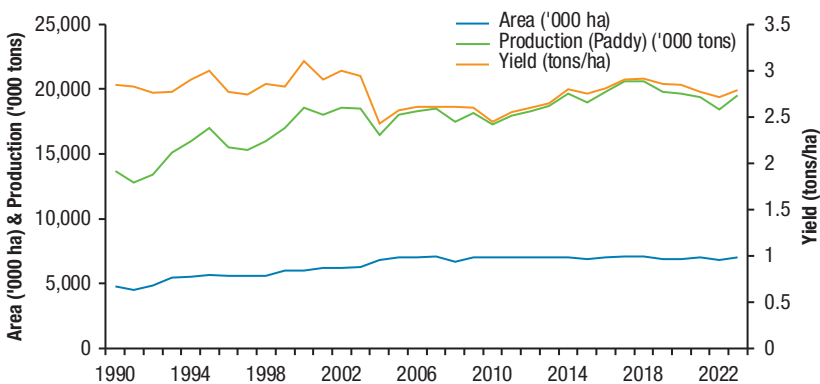
5 Trends in milled rice production from 2007 to the present are the same as those for paddy (unmilled rice). USDA data from before 2007 use a milling ratio of 0.58 tons of milled rice per 1.0 ton of paddy. For data since 2007, a milling ratio of 0.64 is used. See, for example, USDA (2023a).

TABLE 11.1 Rice area, yield, and production, 2011–2023

Year(s)	Area ('000 ha)	Yield (tons/ha)	Production, milled rice (million tons)
1990	4,797	2.85	7.94
2000	6,000	3.10	10.77
2010	7,050	2.45	11.06
2018	7,080	2.91	13.20
2019	6,900	2.86	12.65
2020	6,900	2.85	12.60
2021	7,000	2.77	12.40
2022	6,800	2.71	11.80
2023	7,000	2.79	12.50
<i>Percentage change</i>			
1990–2000	25.1%	8.8%	35.6%
2000–2010	17.5%	–21.0%	2.7%
<i>Annual average percentage change</i>			
2010–2020	–2.1%	16.3%	13.9%
2020–2023	1.4%	–2.1%	–0.8%
2020–2023 ^a	0.1%	–0.9%	–0.7%
2004–2023	2.9%	14.8%	18.4%
2004–2023 ^a	0.2%	0.7%	0.9%

Source: Authors' calculations using USDA (2023a) data.

Note: ^a Yield of unmilled rice (paddy). The milling ratio from 2007 to 2023 was 0.640 kg milled rice per kg of paddy; the milling ratio from 1990 to 2006 was 0.580. ha = hectare(s).

FIGURE 11.1 Rice area, yield, and production, 1990–2023

Source: Data from USDA (2023a).

mid-2010s (World Bank 2019). Table 11.2 shows fertilizer use on the largest rice plots of paddy farmers during recent seasons. Higher use of fertilizer occurred in the dry season compared with the monsoon, seemingly because returns to fertilizer use during the latter period are riskier given less predictable water availability, leading to lower use. Over the three monsoon seasons, there was an important reduction in fertilizer use of 20 percent, partly explained by the war in Ukraine leading to significantly higher fertilizer prices internationally. A slight reduction in use was also noted for the dry season in 2022. However, this lower level was reversed in 2023, seemingly because of the improved profitability of fertilizer use linked to lower fertilizer prices and higher paddy prices.

The reduced availability of agricultural labor in the country, as well as the availability of alternative agricultural technologies, is leading to important changes in rice farmers' technology choices. The adoption of labor-saving agricultural technologies—mechanization (tractors and combine harvesters), herbicides, and direct seeding of rice—increased rapidly over the period of economic reform before 2020 (MAPSA 2023d). Over the span of only 10 years, the share of rice farmers who used tractors for plowing increased by 43 percentage points, combine harvesters by 41 points, herbicides by 39 points, and direct seeding (or broadcasting) of rice—instead of transplanting—by 20 points. Table 11.2 shows that tractor use for plowing has changed little since 2020.

Overall, we note significant increases in input expenditures in paddy rice cultivation in recent years, mostly driven by high input price increases. Despite these increases, productivity has been negatively affected by the crisis. Table 11.2 shows that monsoon productivity in 2022 was 9.5 percent lower than two years earlier, which is higher than the decline reported by USDA (2023a). Yields during the dry season were, however, more stable than during the monsoon. MAPSA (2023b) shows that a typical inverse productivity–plot size relationship exists in Myanmar, with small rice plots having higher productivity levels. The same study shows, however, that rising mechanization fees—more so in conflict-affected townships—attenuated this inverse relationship. Increases in fatal violent events during the first year after the coup also reduced rice total factor productivity by about 4 percent on average in the short run (MAPSA 2023a).

Myanmar's rice exports

Myanmar was the world's leading rice exporter for much of the early 20th century, exporting nearly three million tons per year in the 1930s. The country's

TABLE 11.2 Productivity and input use on the major rice plot of rice farmers, by season and year

Season/use	Level			Change (%)		
	2020	2021	2022	2021 vs. 2020	2022 vs. 2021	2022 vs. 2020
<i>Monsoon</i>						
Fertilizer use (kg/acre)	68	59	54	-12.8	-8.4	-20.1
... of which urea (kg/acre)	38	33	33	-13.4	1.2	-12.4
Used tractor for plowing (%)	85	86	83	0.6	-3.8	-3.3
Commercial expenditures ('000 kyat/acre)	204	223	301	9.3	35.0	47.5
Yield (kg/acre)	1,285	1,257	1,163	-2.2	-7.5	-9.5
<i>Dry season</i>						
Fertilizer use (kg/acre)	75	71	99	-6.2	39.9	31.2
... of which urea (kg/acre)	50	45	66	-10.4	46.7	31.4
Used tractor for plowing (%)	92	92	95	-0.2	3.4	3.2
Commercial expenditures ('000 kyat/acre)	265	306	459	15.5	50.0	73.2
Yield (kg/acre)	1,681	1,657	1,677	-1.4	1.2	-0.2

Source: Authors' calculations based on MAPS (IFPRI 2023).

exports declined precipitously, however, from 1.2 million tons per year in the 1960s, to only 500,000 to 600,000 tons per year in the 1970s and 1980s, to just 400,000 tons per year in the first decade of the 2000s (Dorosh, Win, and van Asselt 2019; World Bank 2014).

Myanmar's macroeconomic policies played a role in this decline, as a steady appreciation of the kyat raised the price of inputs in Myanmar rice in dollar terms. Improvements in the quality of rice of other exporters also increased their competitiveness relative to Myanmar's rice. In part, this was due to insufficient investment in rice production technology and irrigation infrastructure in Myanmar, along with state control of markets that provided little incentive for private investment in rice milling. In contrast to the stagnation of the Myanmar rice sector, Cambodia and Viet Nam modernized their rice industries and captured a significant share of the international market (Wong and Wai 2013; World Bank 2014).

Beginning in 2012, however, Myanmar began exporting lower quality rice across land borders to China. This trade increased rapidly, so that trade across land borders (mainly to China and Thailand) accounted for more than half of exports each year from 2012/13 through 2017/18. Rice trade

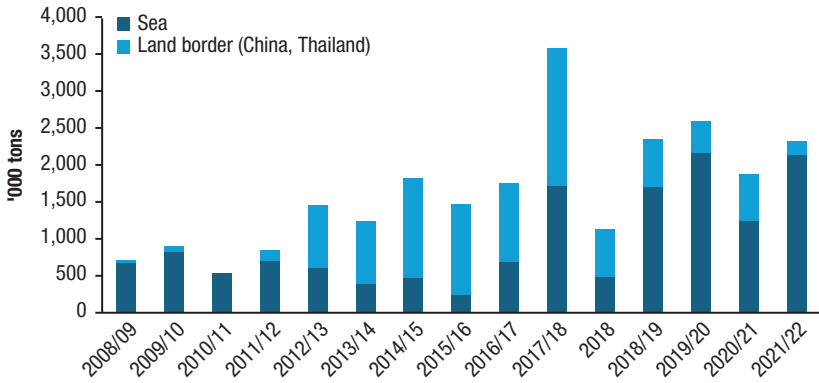
with China has declined sharply since then, however. From 2018/19 through 2021/22, exports through seaports accounted for 79 percent of exports (Figure 11.2). Despite the reduction in trade with China, total rice exports averaged 2.3 million tons per year from 2019 to 2022, equal to approximately 18 percent of domestic production, and 740,000 tons (50 percent) more than average annual rice exports from 2012/13 to 2016/17. Trade across land borders (mainly to China and Thailand) fell from an average of 1.1 million tons per year from 2012/13 through 2017/18 (59 percent of total exports) to only 470,000 tons per year (21 percent of total exports) from 2019/20 to 2022/23.

Myanmar's rice exports are typically of lower quality, so have a lower price than the major grades traded in international markets. For example, the average price of all exports in February 2023 was \$469 per ton, equal to 85.1 percent of the free on board (f.o.b.) Bangkok price of A1 rice (Figure 11.3). One hundred percent broken rice—A and B grades—respectively accounted for 11 percent and 28 percent of the quantity of exports in 2022/23. These grades were mainly traded across land borders with China and to Europe for use by breweries and for feed. The price of rice exports over land borders was 11 percent to 17 percent below the average price of exports (5 percent broken) by sea.

Important changes have happened over the last 30 years regarding barriers to international rice exports from Myanmar (Figure 11.4). Lower export taxes were imposed on rice in most recent years: they were, on average, 25 percent during the period from 1996 to 2000 but declined to 4 percent between 2016 and 2021. On the other hand, the importance of nontariff measures has surged over time, with more stringent requirements for sanitary and phytosanitary measures, technical barriers to trade, and pre-export inspection. Using data on nontrade measures—from the TRAINS database of UNCTAD (2024)—and estimating ad valorem equivalents of such nontrade measures using the gravity model approach developed by Kee and colleagues (2006)—the ad valorem equivalent of the nontariff measures has increased substantially over time, from 3 percent in 1996–2000 to 21 percent in 2016–2021. Few changes in the combined total rates are therefore observed over time, as total rates were only reduced from 27 to 25 percent between the 1996–2000 and 2016–2021 periods.

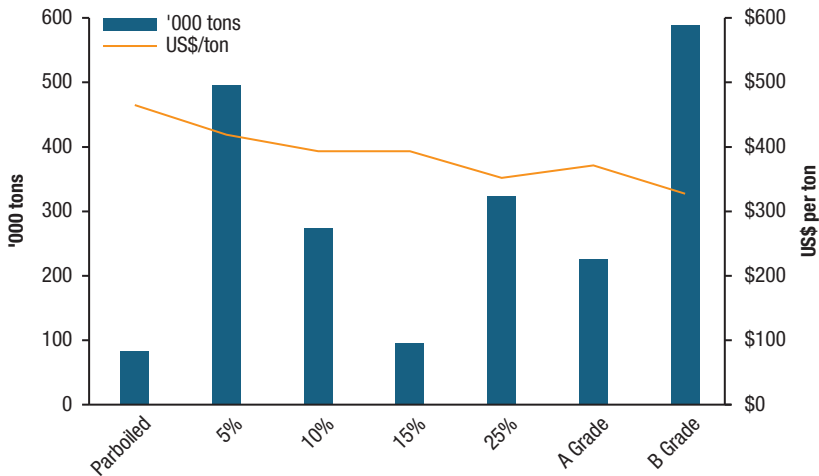
Domestic and international prices

Given the substantial export trade, it is not surprising that Myanmar's domestic prices are correlated with international prices. The correlation is far from perfect, however, and the gaps between domestic and international prices

FIGURE 11.2 Myanmar rice exports (tons), 2008/09 to 2021/22

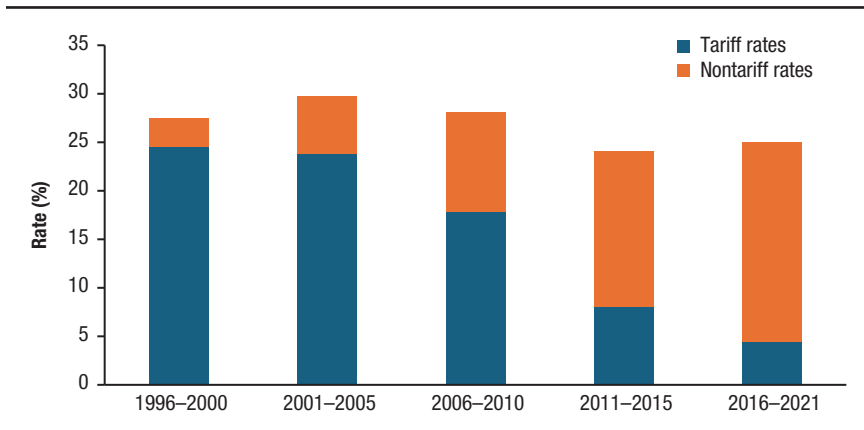
Source: Data from MRF (2023).

Note: All exports to Thailand across land borders are milled rice (not broken). Exports across land borders to China include both broken and nonbroken rice. Data for 2008/09 to 2017/18 are for the period from April to March; for 2018/19 to 2021/22, from October to September; and for 2018, from April 2018 to September 2018.

FIGURE 11.3 Myanmar rice exports by type of rice (tons), April 2022–February 2023

Source: MRF (2023).

Note: A Grade (also called A 1:2) and B Grade (also called B 1:2) are 100 percent broken and sold mainly for export to China and Europe. Both are well-milled Sortex rice; A grade is polished rice; B grade is not polished.

FIGURE 11.4 Trade barriers to rice exports, 1996–2021

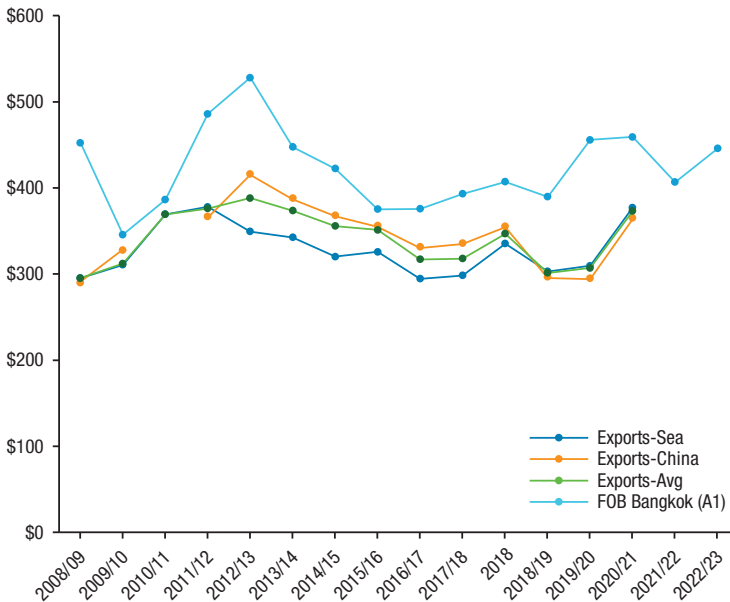
Source: Authors.

Note: The authors thank Dr. Yuhang of Zhejiang University for providing these calculations.

have varied substantially in recent years. As shown in Figure 11.5, Myanmar’s annual average export price was only about 15 percent below Thailand’s export price (f.o.b., A1 grade) between 2014/15 and 2017/18. The correlations in prices are seen most clearly by comparisons of monthly data of individual varieties and qualities of rice (rather than average prices across several types of rice).

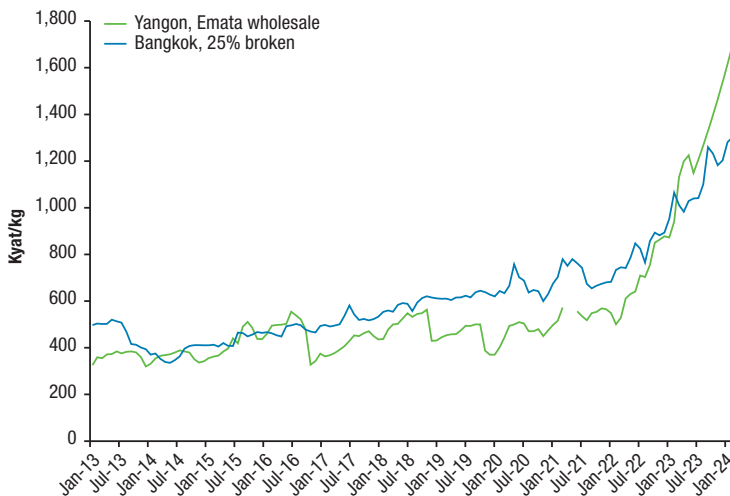
As shown in Figure 11.6, the wholesale price of Emata rice in Yangon closely tracked export prices of Thai A1 rice (converted to kyat at the official exchange rate) from 2014 through 2018. The two series diverged in 2018/19 and 2019/20. However, average export prices of Myanmar rice in 2020/21 were still only 19 percent below the average export price for Thailand (f.o.b., A1 grade). Over this period, exports of some grades of rice were still profitable, as evidenced by a large volume of trade, especially to China. However, from early 2023, local prices rapidly climbed higher than Thai prices.

Deflating both series of prices by Myanmar’s consumer price index highlights the stability in real prices from 2013 to 2021, as well as the sharp rise in real prices after mid-2021 (Figure 11.7). The average real (inflation-adjusted) export price of Thai A1 rice from July 2014 to June 2021 was 821 (2023) kyat/kg, 23 percent higher than the average real wholesale price of Emata rice in Yangon (670 [2023] kyat/kg). Real prices of both types of rice rose between July 2021 and January 2024. However, the real price of rice in Myanmar (Emata wholesale, Yangon) rose by 76 percent, while Thailand’s price rose by only 13 percent.

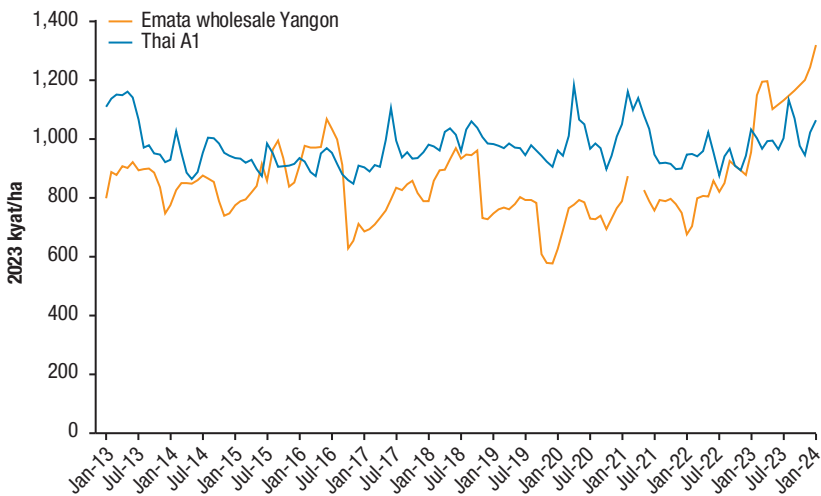
FIGURE 11.5 Myanmar and Thai rice export prices (US\$/ton), 2008/09 to 2022/23

Source: IMF (2023), MRF (2023), World Bank (2023), and authors' calculations.

Note: Data for 2008/09 to 2017/18 are for the period from April to March; for 2018, from April to September; and for 2018/19 to 2022/23, from October to September. Avg = average for all exports.

FIGURE 11.6 Rice prices in Myanmar and Thailand (kyat/kg), 2013–2023

Source: IMF (2023), MRF (2023), World Bank (2023), and authors' calculations.

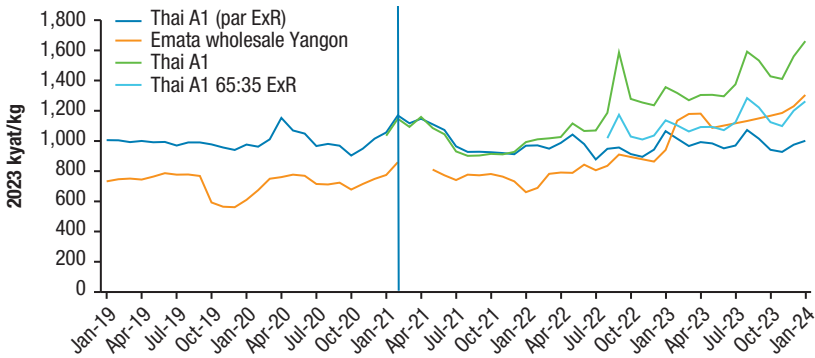
FIGURE 11.7 Real rice prices in Myanmar and Thailand (2023 kyat/kg), 2013–2023

Source: IMF (2023), MRF (2023), World Bank (2023), and authors' calculations.

The links between domestic and international rice prices have been obscured since the military takeover in early 2021 by the emergence of a large parallel market for foreign exchange and the introduction of a dual official exchange rate system in August 2022. As shown in Figure 11.8, domestic rice prices (Emata, wholesale Yangon) tracked Thai export prices measured at official (kyat/US\$) exchange rates (Thai A1 in Figure 11.8) from June 2020 to October 2021. Subsequently, from the end of 2022 onward, domestic prices more closely tracked Thai prices measured using weighted average exchange rates (65 percent for official exchange rates and 35 percent for parallel market exchange rates—Thai A1 65:35 ExR).^{6,7}

The large increase in domestic prices beginning in February 2023 reflects lower domestic production, high macro-inflation, and a loss of competitiveness relative to Thai rice at official exchange rates. Nonetheless, rice exports appeared to remain profitable at world prices converted to kyat at the parallel exchange rate (Thai A1 [par ExR] in Figure 11.8), though not at the 65:35 percent weighted average exchange rate (Thai A1 65:35 ExR).

- 6 This average reflects the share of foreign exchange earnings (35 percent) that exporters were allowed to keep; the remainder had to be exchanged with the bank at the official exchange rate.
- 7 Note that the exchange rate policies changed again in the later parts of 2023, beyond the period of analysis (for more details, see Chapter 14).

FIGURE 11.8 Real rice prices (2023 kyat/kg), 2019–2023

Source: IMF (2023), MRF (2023), World Bank (2023), and authors' calculations.

Note: Thai A1 (par ExR) = kyat/kg at the parallel exchange rate; Emata wholesale Yangon = kyat/kg at the domestic rice price; Thai A1 = kyat/kg at official exchange rate; 65:35 ExR = kyat/kg with 65% percent at official exchange rate and 35% at parallel market exchange rate.

Rice consumption

Relatively little recent empirical data on rice consumption in Myanmar exist. Moreover, estimates of consumption derived from household surveys vary widely from estimates calculated as the difference between supply (production plus imports less losses, adjusted for changes in stocks) and other demand (for seed, feed, and industrial uses).⁸

One of the last nationally representative household surveys done in person was the Myanmar Poverty and Living Conditions Survey (MPLCS) 2014–2015 (World Bank 2021). Using data from this survey, per capita quantities of rice consumed are estimated to be much higher in rural areas (160.4 and 160.6 kg/capita/year for the rural poor and nonpoor, respectively) than in urban areas (118.6 and 109.4 kg/capita/year for the urban poor and nonpoor, respectively) (Table 11.3). The average price paid for rice in urban areas is 30 percent higher (5,800 kyat/kg) than the average price in rural areas (4,464 kyat/kg), in part due to marketing margins between rural and urban areas. There are important quality differences, as well, as the average price paid by the urban nonpoor is 19 percent higher than the average price paid by the urban poor.

⁸ For example, using the 2015/16 USDA estimate of paddy production of 18.77 million tons and the consumption estimate derived from the Integrated Household Living Conditions Assessment II (IHLCA) 2009–2010 data on per capita consumption, total rice consumption would be 7.31 million tons and rice exports (calculated as a residual) would be 4.10 million tons (MNPED, UNDP, and Sida 2011). Using the export trade data showing 1.50 million tons exported in that year, however, household consumption would be 9.92 million tons, a difference of 2.61 million tons.

TABLE 11.3 Household rice demand, 2014/15

Household	Population (millions)	Quantity (tons/yr)	Quantity (kg/cap/yr)	Total expenditure (bil. kyat/ yr)	Expenditure per capita (kyat/cap)	Rice expenditure (bil. kyat/ yr)	Rice budget share (%)
Urban poor	2.4	28.5	118.6	1,334.0	554.8	143.9	10.8
Urban nonpoor	10.9	119.3	109.4	16,971.2	1,556.4	713.6	4.2
Rural poor	16.2	259.5	160.4	7,386.5	456.5	1,107.1	15.0
Rural nonpoor	17.0	272.6	160.6	13,518.2	796.6	1,268.3	9.4
Total	46.5	680.0	146.4	39,209.9	843.9	3,232.8	8.2

Source: Authors' calculations based on MPLCS 2014–2015 data.

Note: yr = year. cap = capita. bil. = billion.

Rice is the main staple, accounting for 59 percent of calories consumed on average—51 and 62 percent of urban and rural calories consumed, respectively—making it crucial for food security in the country (Table 11.4).⁹ Rural residents consume almost 50 percent more than urban ones. Rice is especially important for the poor, for whom it makes up 69 percent of all calories, compared with 55 percent for the nonpoor. Rice is a relatively cheap source of calories as it makes up only 18 percent of all food expenditures, significantly less than its share in the contribution to calories consumed. Markets are important for the acquisition of rice: 71 percent of all rice consumed is obtained from the market, compared with 27 percent originating from own production. In rural areas, this is one-third. The share of own production is especially high in the Hills and Mountains agroecological zone, where it reaches 43 percent.

Seasonality

Rice production and trade in Myanmar are characterized by substantial seasonal variation. Most paddy is produced during the rain-fed season, the monsoon. A second or third production period is possible in some areas during the dry season—the winter or summer season—but often only if irrigation is available. However, the monsoon is the most important production season by far. In the 2020/21 season, it was estimated that monsoon and dry season rice made up 83 (87) and 17 (13) percent, respectively, of all paddy rice production (and area cultivated).¹⁰ The share of crop farmers harvesting paddy during different months of the year is shown in Figure 11.9.¹¹ The peak production month is November, when a quarter of paddy rice growers harvest. The month with the

9 Estimated in 2015, based on MPLCS 2014–2015.

10 Estimates by the Ministry of Agriculture, Livestock, and Irrigation.

11 Estimated during the monsoon of 2022 and the dry season of 2023.

TABLE 11.4 Importance of rice for calorie consumption, in food expenditures, and for markets

	Residence			Poverty		Agroecological zone			
	National	Urban	Rural	Poor	Non-poor	Delta	Coastal Zone	Dry Zone	Hills and Mountains
<i>Daily energy consumption per adult equivalent (calories)</i>									
Rice	1,633	1,218	1,796	1,593	1,651	1,843	1,872	1,548	1,625
Share of rice in total (%)	59.0	52.0	61.2	69.5	55.2	60.8	67.7	54.0	64.4
<i>Daily expenditure per adult equivalent (kyat)</i>									
Rice	216.3	197.2	223.8	190.6	228.1	219.1	207.3	211.5	235.8
Share of rice in food budget (%)	17.9	14.2	19.7	28.2	15.7	17.5	18.9	18.3	21.4
<i>Use of markets</i>									
Share purchased (%)	71.2	95.2	64.8	72.2	70.7	67.8	75.1	74.9	54.7
Share from own production (%)	27.0	3.5	33.3	25.7	27.6	31.2	21.6	23.2	42.6
Share in-kind gifts (%)	1.8	1.3	1.9	2.0	1.7	1.0	3.4	1.9	2.7

Source: Authors' calculations based on MPLCS 2014–2015.

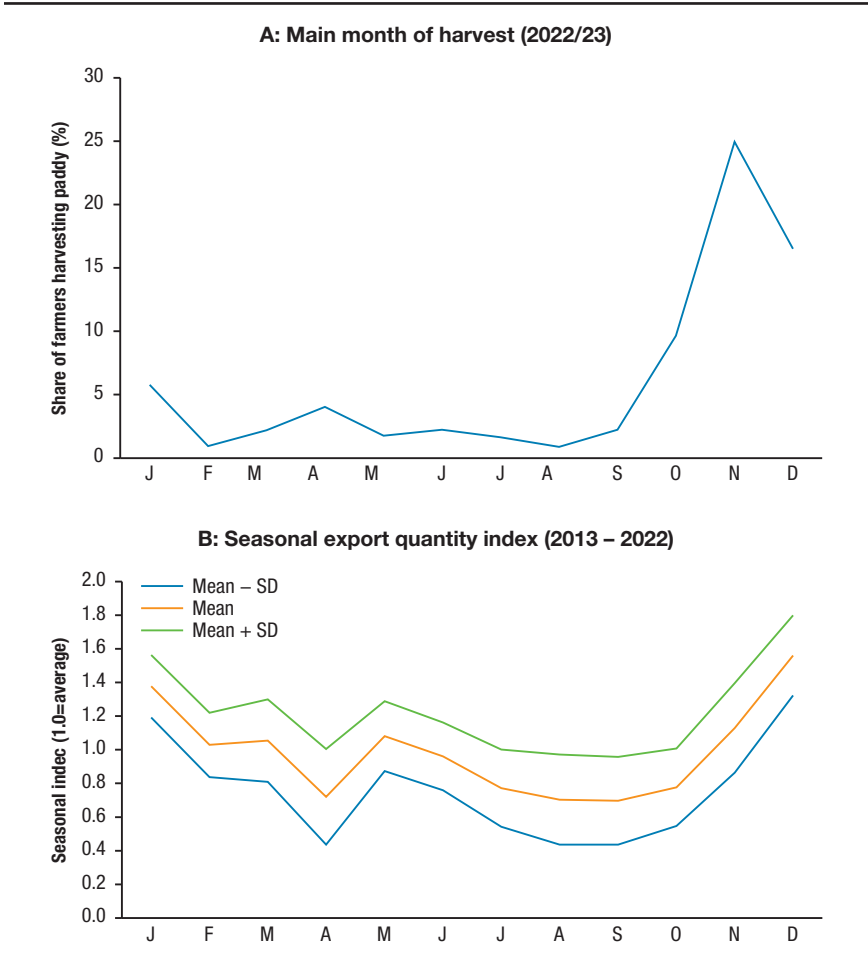
lowest number of farmers reporting paddy harvest is August, considered the peak of the lean period. While shares of farmers growing rice and areas cultivated are much lower during the dry season, yields during this season are often higher than during the monsoon, as farmers are typically willing to use substantially more inputs given the more controlled growing environment.

Strong seasonality is also seen in exports. A seasonality index of quantities of rice exported—calculated based on the 12-month moving average method over the period 2013 to 2022—shows substantial seasonal patterns. The quantity exported in December, a month after the peak in harvest, is 56 percent higher than the annual average. A small second peak is also noted after the harvest of summer rice in May. Exports are lowest in August and September when the monsoon paddy rice is typically still in the field.

Marketing and processing

Seasonality in rice production and trade has important implications. First, to ensure that rice is available for consumption throughout the year, storage of sufficient quantities over the year is required. Such storage is traditionally done at the farm level but is increasingly done by other agents midstream, often by mills. Drying paddy rice is important to reduce grain moisture levels, which are high immediately after harvest, to levels that are suitable for either storage or milling. This is traditionally done through sun drying, but modern dryers are increasingly being used, especially in more humid areas.

FIGURE 11.9 Seasonality in rice production and exports



Source: MAPS Rounds 3 and 4, calculated based on harvesting of largest plot and share of crop farmers growing rice; export quantities as published by Central Statistical Organization (CSO).
Note: SD = standard deviation.

Paddy also needs to be processed, converting it into rice in rice mills. The rice milling sector has shown rapid transformation over the years, with significant advances in the use of improved milling machines, color sorters, polishers, and mist polishers, dramatically improving milling efficiency and the quality of rice produced (Goeb et al. 2022) (see Chapter 13). While the number of modern mills is still relatively small compared to traditional ones, they have become increasingly important in terms of total rice produced. Using a

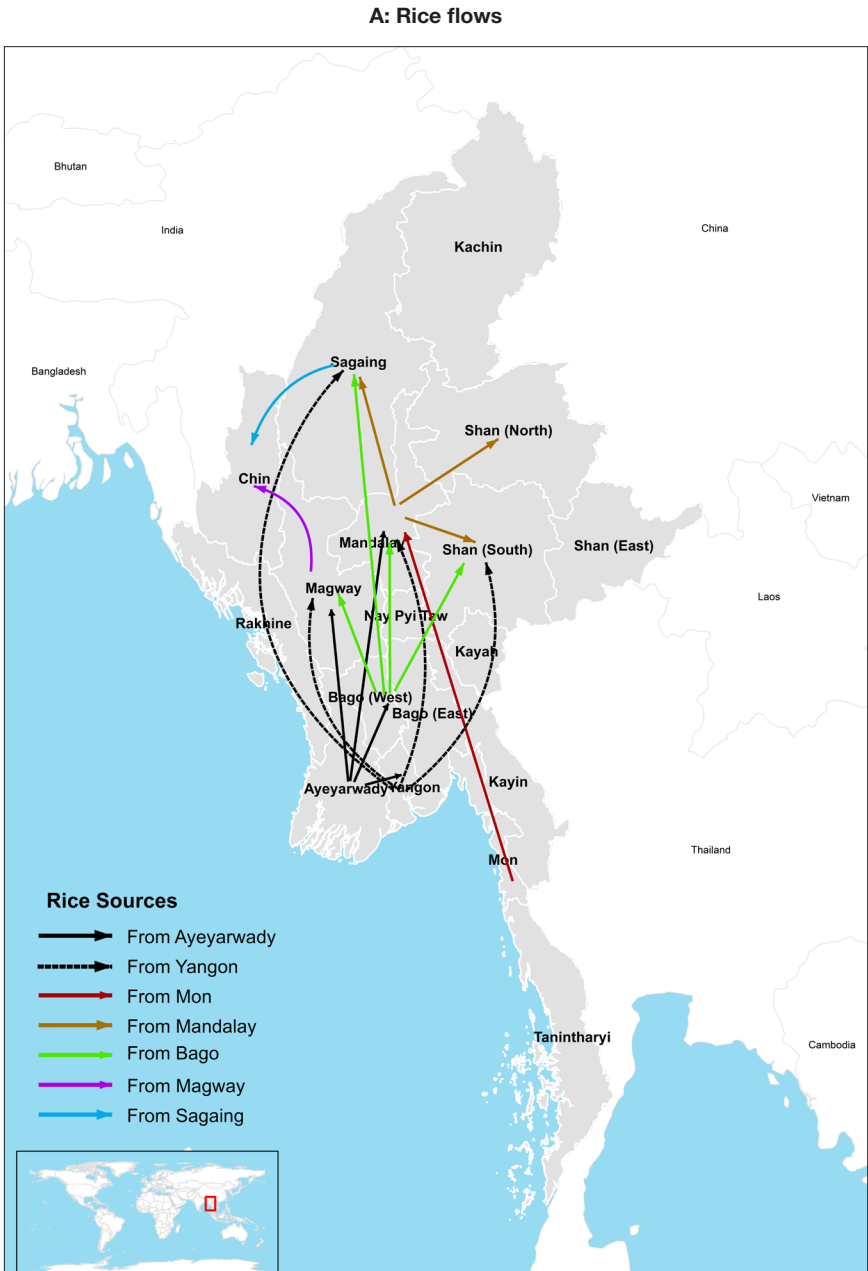
survey of rice mills in Myanmar, Goeb et al. (2022) illustrate that the increasing modernization of the milling sector in Myanmar is resulting in the production of higher quality rice, which is reflected in higher rice prices being obtained by these rice mills as well as better paddy prices offered to farmers who supply these mills. They also find that milling byproducts—such as broken rice and bran—are frequently sold (often to be used for feed) and are important for overall profit margins of rice mills.

Some regions are particularly important for national rice production, most notably the Ayeyarwady, Bago, and Yangon Regions in the Delta and the Sagaing Region in the Dry Zone. Combined, they typically make up two-thirds of the total rice production in the country—their shares of national rice production in the 2020/21 season, based on official MOALI data, were 31, 18, 8, and 10 percent, respectively. The regional concentration of rice production means that trading and transporting over long distances is important to ensure that rice is available countrywide at desired levels, as well as for export (Figure 11.10). Rice is transported by trucks and boats. Transportation costs are reflected in differential rice prices, which are typically much higher in areas close to the border and the Hills and Mountains (Goeb et al. 2022). Moreover, the conflicts in recent years led to higher rice prices in those areas of the country most affected by conflict, such as Sagaing, Kayah, and Chin.

Figure 11.11 illustrates how rice and paddy prices changed during the crisis years between 2021 and 2023, as measured by average national prices collected in large farm and food vendor surveys. We note, on average, few changes over the years 2021 and 2022, but paddy and rice prices then increased steeply, seemingly driven by increasing international prices and exchange rate depreciations. Distribution costs also increased substantially. We calculate average distribution costs as the difference between retail and paddy rice equivalent¹² farm prices, presented by bars in Figure 11.11. We note a substantial increase over time in these costs by 31 and 146 percent during the monsoon and dry season, respectively. This increase seems linked to higher transportation costs, mobility constraints, and conflict. Minten et al. (2023) estimated that the increased distribution margin at the end of 2021 led to 11 percent higher average retail prices compared with a year earlier, implying welfare losses of almost \$0.5 billion for the country. Given increased insecurity, higher fuel costs, and, thus, higher distribution costs, these welfare losses since have further increased.

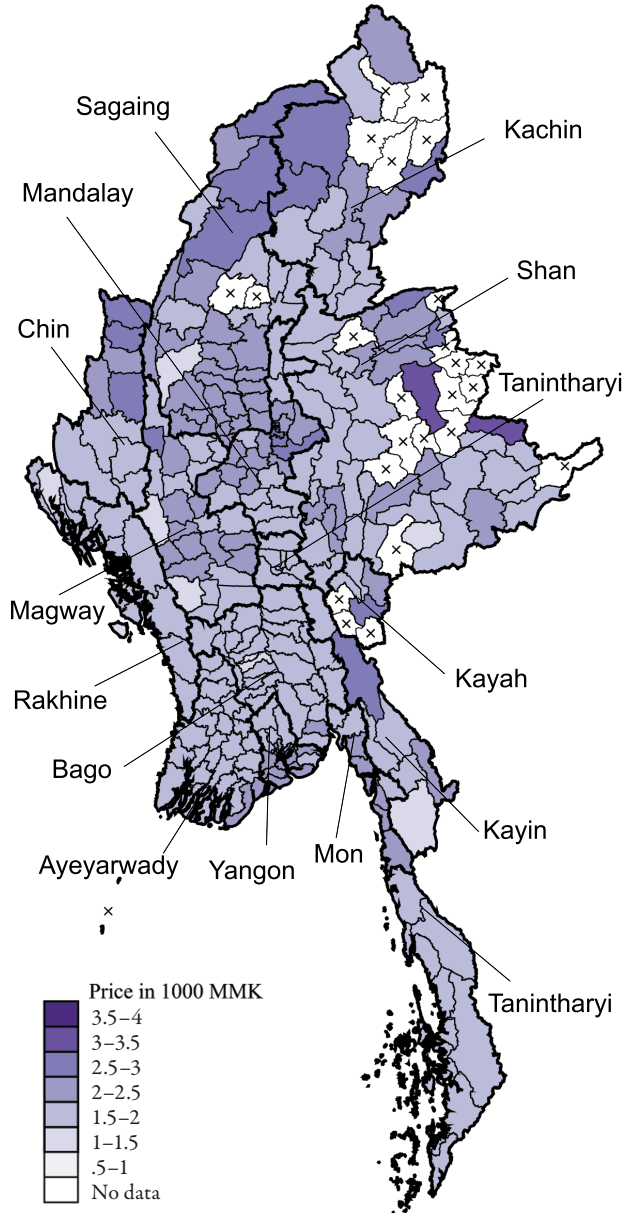
12 Using a milling ratio of 68 percent.

FIGURE 11.10 Spatial patterns in rice markets



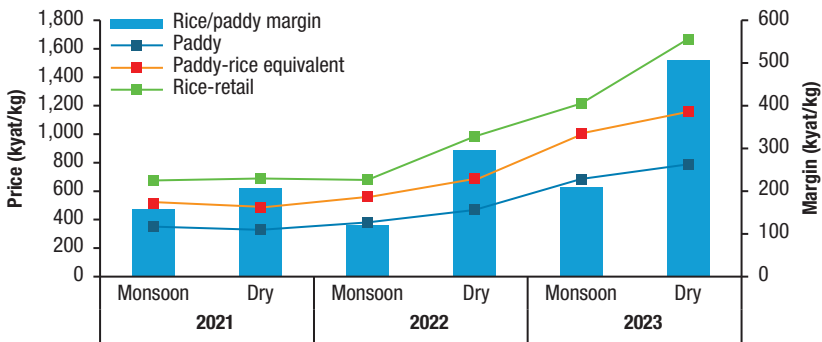
Source: Vivero and Oo (2019).

B: Median rice prices ('000 kyat per pyi), end 2023



Source: Authors' calculations from Round 6 of Myanmar Household Welfare Survey (MAPSA 2024).

Note: 1 pyi (Myanmar measurement unit of volume) of rice is approximately 2.13 kilograms.

FIGURE 11.11 Rice and paddy prices, 2021–2023

Source: Authors' calculations based on MAPS and the food vendor surveys.

A partial equilibrium model of Myanmar's rice sector

Model structure

Following Dorosh, Win, and van Asselt (2019), we model production, consumption, and prices of a single commodity: rice (Table 11.5).¹³ The current model differs from the earlier version in two ways, however. First, household incomes are split into an endogenous agricultural income and an exogenous nonagricultural income. Second, two alternative specifications of the model are used for international trade and prices. In the first version, used for most of the simulations, exports are endogenous, and domestic prices are set equal to international prices adjusted for marketing margins (converted to kyat at a fixed exchange rate). In the second version, the quantity of exports is exogenous, and domestic prices adjust to balance total supply and demand.

As in the earlier version of the model, production is modeled as the base level of production (X_{0i}) multiplied by an exogenous production shock (x_{shocki}) and the ratio of the simulated market price to the base (previous year's) market price (P_i/P_{0i}) raised to the power esi (the own-price elasticity of supply) (equation 1). Domestic supply S_i is equal to production (X_i), net of a constant percentage deduction ($loss_i$) for seed, feed, and wastage (equation

13 The one commodity model used in this analysis is similar to the model of the Bangladesh rice economy in Dorosh (2001). Further analysis involving interactions with other agriculture sectors would require a multimarket model that explicitly models other crops. See Braverman and Hammer (1986), Sadoulet and de Janvry (1995), and Croppenstedt et al. (2007).

TABLE 11.5 Myanmar rice model equations, variables, and parameters

Production	(1) $X_i = X_{0i} * xshock(i) * (P_i/P_{0i})^{es(i)}$
Domestic supply	(2) $S_i = X_i * (1 - loss(i))$
Household income	(3) $Y_h = YNA0_h * (1 + ynashk(h) + (P_i * va(i,h) * X_{i,h}) - (P_{0i} * va0(i,h) * X_{0i,h}))$
Demand (consumption)	(4) $D_{ih} = D_{0ih} * (P_i/P_{0i})^{ed(i,h)} * (Y_h/Y_{0h})^{eY(i,h)}$
Equilibrium	(5) $S_i = \sum_h D_{ih} + E_i$
<i>Variable name (0 denotes base level)</i>	
D_i	Demand (consumption) of commodity i (rice)
E_i	Exports
P_i	Domestic price of rice
S_i	Total supply of rice
X_i	Total national production of rice
Y_h	Household income
$YNA0_h$	Nonagricultural household income
<i>Parameter</i>	
$ed(i,h)$	Own-price elasticity of demand
$eY(h)$	Income elasticity of demand
$es(i)$	Own-price elasticity of supply
$loss(i)$	Percent losses and nonfood use
$xshock(i)$	Exogenous production shock
$va(i,h)$	Value-added share of production
$ynashk(h)$	Nonagricultural income shock

Source: Authors' calculations.

2). Household income (Y_h) is calculated as the base level of nonagricultural income ($YNA0_h$), multiplied by an exogenous income shock ($ynashk[h]$) plus value added from the household's rice production (equation 3). Household demand of each of the four household groups is modeled as a log-linear function of household per capita income and market prices (equation 4). The base year for the model is 2022. Total supply (S_i) equals total demand (the sum of household demands [D_{ih}] and net exports [E_i]) (equation 5).

Model parameters

Household demand parameters are derived from econometric estimates by Ecker and Comstock (2021a; 2021b). As shown in Table 11.6, the estimated expenditure elasticities of nonpoor households are generally lower than those of poor households, as small percentage changes in incomes for these households do not result in large changes in rice consumption. Patterns for absolute

TABLE 11.6 Myanmar household rice demand parameters

Household	Own-price elasticity	Expenditure elasticity
Urban poor	-0.460	0.357
Urban nonpoor	-0.348	0.246
Rural poor	-0.674	0.504
Rural nonpoor	-0.653	0.494
Myanmar average	-0.599	0.449

Source: Econometric estimates using MPLCS 2014–2015 data. See Ecker and Comstock (2021b).

values of own-price elasticities are similar—estimated own-price elasticities of nonpoor households are generally lower in absolute magnitudes than those of poor households. Likewise, the absolute magnitudes of the estimated expenditure elasticities are lower in urban areas (0.246 to 0.357) than in rural areas (0.494 to 0.504). The elasticity of supply of rice is set to 0.30 in the main simulations.

Model data

The base data for quantities of supply and demand aggregates are taken from USDA (2023c). Production of milled rice in the base year of the model (2022) is equal to 12.50 million tons. Exports are 2.40 million tons, and net offtake from public stock is 0.20 million tons. Total supply is equal to production plus exports minus net offtake: 10.30 million tons. Seed use is estimated to be 2.9 percent of paddy production, and feed use to be 7.1 percent, so total seed and feed use is 10.0 percent of production. Consumption is, thus, 9.05 million tons. Consumption per household was calculated using the shares of the national total quantity of rice consumed by each household group in the MPLCS (2014/15) survey. The base rice price is 655 kyat/kg, and the world rice price (f.o.b. Bangkok) is 1,225 kyat/kg.

Model simulation results

Myanmar's rice economy and both urban and rural households have suffered severe shocks in the past several years, as domestic conflict has prevented cultivation of rice in some areas and disrupted input supplies. At the same time, negative shocks to household incomes have reduced domestic rice demand. Export demand has also declined. As a result, incentives for rice producers and consumers, along with levels of production, consumption, and exports, have all been affected.

This section presents model simulations designed to highlight the major effects of these shocks, as well as the potential shock of a hypothetical sharp reduction in rice exports to China. We first simulate the effects of the major shocks to Myanmar's rice sector in 2023: reductions in household incomes in Simulation 1, lower rice production due to lower input supply and other factors in Simulation 2, and in Simulation 3, the combined effects of Simulations 1 and 2. In these simulations, we assume that domestic prices are equal to import parity levels, consistent with the relatively constant percentage margin between domestic and international rice prices in recent years. In Simulation 4, we model the effects of a 365,000-ton reduction in rice exports, allowing domestic prices to vary from import parity due to the drop in demand for rice. Simulation 5 combines Simulations 3 and 4 to show the overall effects of the major shocks to the rice sector in 2023. Finally, Simulation 6 highlights the role of rice exports to China by modeling the effects of a hypothetical cessation of rice exports to China.

Impacts on Myanmar's rice economy of economic decline and productivity shocks

In Simulation 1, urban and rural household incomes are reduced by 13 percent and 27 percent, respectively, reflecting the actual estimated decline in household incomes in 2023 by MAPSA (Table 11.7 and Figure 11.12). We assume no change in rice production or prices in this simulation. As a result of these negative income shocks, household rice consumption falls by 8.1 percent: by 4.9 and 3.4 percent for urban poor and nonpoor households, respectively, and by 11.3 and 7.4 percent for rural poor and nonpoor households, respectively (Figure 11.13). Total rice consumption falls by 730,000 tons, freeing up this amount for additional rice exports (which increase by 30.5 percent).

In Simulation 2, we model a 20 percent decrease in rice productivity and production. With prices fixed and incomes unchanged, there is no change in consumption by urban households. Income declines occur in rural households because of lower rice production, so consumption falls by 2.2 percent for the rural poor and 4.7 percent for the rural nonpoor. Nonetheless, the decline in production (2.5 million tons) is larger in magnitude than the decline in consumption (0.25 million tons) and other uses (seed and feed), so exports fall by 2.0 million tons.

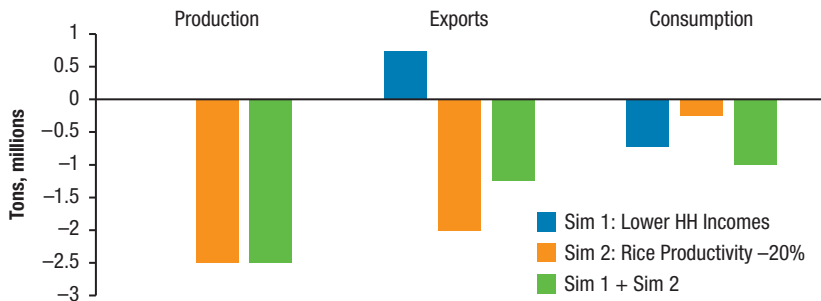
Combining Simulations 1 and 2 for Simulation 3, lower incomes and lower rice production result in an 11.1 percent decline in consumption and a 52 percent drop in exports. Rural households have the largest declines in rice consumption: 13.8 and 12.5 percent for the rural poor and rural

TABLE 11.7 Model simulation results, percentage change from baseline

	Base (2022/23)	Sim 1	Sim 2	Sim 3	Sim 4	Sim 5	Sim 6
	Million tons	Lower household incomes	20% drop rice pro- ductivity	Sim 1 + Sim 2	Lower rice exports	Sim 3 + Sim 4	No rice exports to China
Production	12.50	0.0	-20.0	-20.0	-1.2	-17.2	-3.1
Exports	2.40	30.5	-83.5	-52.0	-15.2	-15.2	-33.3
Consumption	9.05	-8.1	-2.7	-11.1	2.6	-17.3	5.0
<i>Households</i>							
Urban poor	0.38	-4.9	0.0	-4.9	2.7	-12.2	7.5
Urban nonpoor	1.59	-3.4	0.0	-3.4	2.0	-9.0	5.6
Rural poor	3.45	-11.3	-2.2	-13.8	3.2	-21.3	7.3
Rural nonpoor	3.63	-7.4	-4.7	-12.5	2.2	-17.6	2.2
Rice price (kyat/kg)	655.00	0.0	0.0	0.0	-14.6	-5.6	19.0

Source: Model simulations.

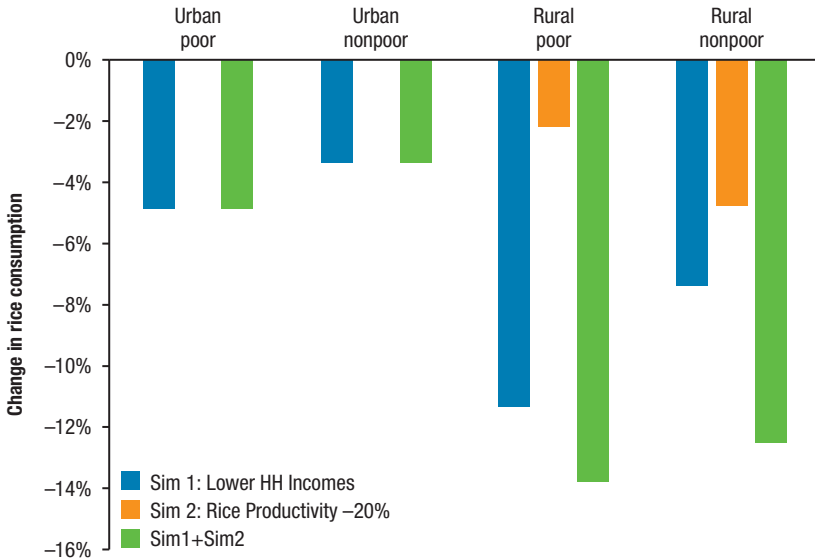
Note: Sim 1: lower household incomes: 13 percent drop for urban households; 27 percent drop for rural households. Sim 2: 20 percent decrease in rice productivity and production. Sim 3: combining the effects of lower household incomes and reduced rice productivity (Sims 1 and 2). Sim 4: rice exports reduced by 365,000 tons (15.2 percent lower relative to the base level). Sim 5: combining the effects of lower household incomes, reduced rice productivity, and lower exports (Sims 1, 2, and 4). Sim 6: ban on all rice exports from Myanmar to China. Sim = Simulation.

FIGURE 11.12 Impacts of lower incomes and lower rice productivity on amounts produced, exported, and consumed

Source: Model simulations.

Note: HH = household. Sim = Simulation.

FIGURE 11.13 Impacts of lower incomes and lower productivity on rice consumption by household type, percentage change in consumption



Source: Model simulations.

Note: HH = household. Sim = Simulation.

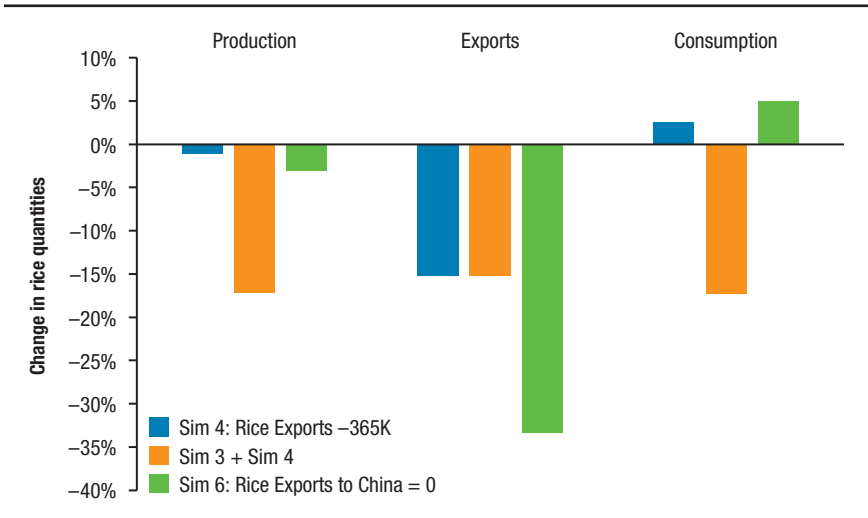
nonpoor, respectively. In contrast, urban consumption declines are only 3.4 to 4.9 percent, as in Simulation 1.

Impacts of reduced rice exports

In Simulation 4, with rice exports reduced by 365,000 tons (15.2 percent relative to the base level), domestic prices of rice fall by 5.6 percent (Figure 11.14).¹⁴ Production falls by 1.2 percent, but lower prices help induce an increase in total consumption of 2.6 percent. Consumption of rice increases for all households, though increases are highest for the poor (who are more sensitive to price changes than the nonpoor), at 2.7 and 3.2 percent for the urban and rural poor, respectively (Figure 11.15). Consumption by the urban and rural nonpoor increases by only 2.0 and 2.2 percent, respectively, in

¹⁴ In Simulations 4, 5, and 6, we assume that exports are exogenous (set at a predetermined level) and that domestic prices adjust to equate to total supply and demand. Thus, unlike the other simulations, the margin between domestic prices and world prices changes in these two simulations. In part, this change (increase) in margins could represent an increase in the overall quality of total rice exports, as exports of lower quality rice to China are reduced.

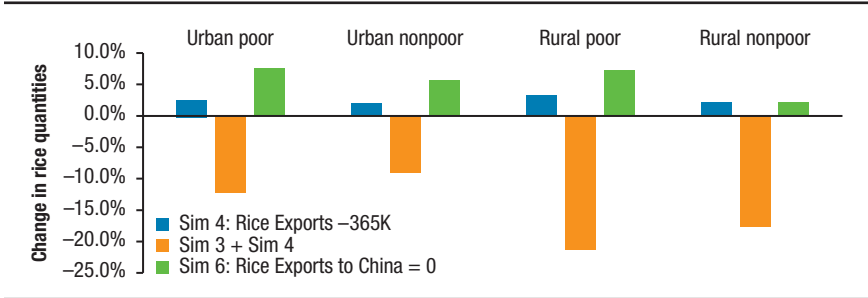
FIGURE 11.14 Impacts of lower rice export demand on amounts produced, exported, and consumed



Source: Model simulations.

Note: Sim = Simulation. PRC = People's Republic of China.

FIGURE 11.15 Impacts of lower household incomes, reduced rice productivity, and lower exports on rice consumption by household type



Source: Model simulations.

Note: Sim = Simulation.

part due to the nonpoor experiencing a loss in their rice incomes that offsets some of the increase in their demand resulting from the price decline.

Combining the effects of lower household incomes, reduced rice productivity, and lower exports in Simulation 5, rice production and consumption both fall steeply (by 17.2 and 17.3 percent, respectively). Rice prices rise by 19.0 percent as the drop in production of 2.15 million tons far exceeds the

decline in exports (−0.37 million tons). The declines in rice consumption are especially steep for rural households (21.2 and 17.6 percent for poor and non-poor households, respectively). Rice consumption also falls sharply for urban poor (12.2 percent) and urban nonpoor households (9.0 percent), however.

Impacts of a hypothetical cessation of rice exports to China

Finally, in Simulation 6, a hypothetical ban is imposed on all rice exports from Myanmar to China. In the absence of any other income shocks, this 33.3 percent reduction in total exports results in a 14.6 percent drop in domestic prices due to lower demand for (lower quality) rice. Lower rice prices reduce incentives for production, which falls by 3.1 percent, compared with 1.2 percent in Simulation 4. However, rice consumption increases by 5.0 percent, with large increases by the urban poor (7.5 percent) and rural poor (7.3 percent).

Note, however, that these results do not imply that the net effects of rice exports to China are negative for Myanmar. Although Myanmar's rice consumption would be higher in the absence of these exports, incomes from rice—including incomes from other parts of the rice value chain and the broader food system—would be lower.

Summary and conclusions

The impact of economic growth during the 2010s and economic contraction during the crisis period (2020–2023) on the functioning of the rice sector is not well understood. In the decade before the crisis, it was shown that Myanmar's rice sector was lagging behind its peers, with lower and less efficient modern input use and, therefore, much lower productivity (World Bank 2014). Myanmar's value chain further suffered from inadequate infrastructure—access to electricity, roads, and ports—limiting improved performance (Basu and Sharma 2019). Moreover, it faced unpredictable trade policies, most often because of ad hoc changes by China.¹⁵ Most of the exported rice from Myanmar is still often low quality, used for industrial purposes—for noodles, animal feed, and alcohol (processed in distilleries) in China—making exported quality in terms of broken rice often not an important consideration (Dorosh, Win, and van Asselt 2019).

15 Dorosh, Win, and van Asselt (2019) show how policies instituted by China starting around 2010 enabled rice exports to China from Myanmar to surge. However, sudden policy changes in China in mid-2016 then significantly reversed this new export demand.

However, important changes occurred during the crisis years, and they are discussed in detail in this chapter. Myanmar's rice economy has been battered by severe shocks, including increased insecurity in rural areas, higher world rice and fertilizer prices, and sharp declines in cross-border exports to China between 2019/20 and 2021/22. Rice production has stagnated in recent years, as well. Since 2010, area harvested has remained nearly constant, decreasing by 0.7 percent. Although yields rose steadily between 2010 and 2020, increasing by a total of 16.3 percent in this period, they declined by 4.9 percent between 2020 and 2022. Thus, rice production has declined in recent years.

Nonetheless, rice exports have continued. Total rice exports averaged 2.3 million tons per year from 2019 to 2022, which is equal to about 18 percent of domestic production and 740,000 tons (50 percent) more than the average from 2012/13 to 2016/17. Trade across land borders (mainly to China and Thailand), which accounted for more than half of exports each year from 2012/13 through 2017/18, has declined in recent years, however, falling to an average of only 470,000 tons per year (21 percent of total trade) from 2019/20 to 2022/23. Given this substantial trade, it is not surprising that domestic rice prices (Emata, wholesale Yangon) tracked Thai export prices when measured at prevailing market (kyat/US\$) exchange rates.

Model simulations indicate that rice exports are highly sensitive to changes in household incomes and world prices. The income shocks of 2022, which led to 13 and 27 percent reductions in urban and rural household incomes, respectively, when simulated in the model, reduce domestic rice demand and result in a 30 percent increase in rice exports (Simulation 1). A 20 percent reduction in rice production also decreases consumption (by 3 percent) as well as exports (by 83 percent). Together, a decrease in household incomes combined with lower production results in a 52 percent decrease in rice exports, while rice consumption of the urban and rural poor falls by 5 and 14 percent, respectively. In contrast, if rice exports to China fall to zero, but exports of high-quality rice continue, domestic rice prices could fall by 15 percent, leading to a 1 percent drop in production and a 3 percent increase in consumption.

Further analysis is needed to show the sensitivity of these results to changes in key parameters, particularly the own-price and expenditure elasticities that determine the responsiveness of rice demand to changes in rice prices and household incomes. A disaggregation of agricultural households and production by agroecology would enable an analysis of the regional implications of shocks and policy changes. Finally, a broader analysis that includes the supply of and demand for other commodities using a multi-market model or a

computable general equilibrium model could provide additional insights on the spillover effects of rice policy on other sectors.

Nonetheless, the model simulations and other analyses presented here provide evidence that shocks to Myanmar's rice economy have resulted in significant declines in rice consumption for both rural and urban households in recent years. Higher world prices have spurred exports to some extent, but negative production shocks and lower incomes have resulted in lower rice consumption. Reversing these adverse economic outcomes will require renewed economic growth, particularly in rural areas; wide availability of fertilizer and other inputs into rice production; and the creation of targeted safety nets for those most affected.

References

- ADPC (Asian Disaster Preparedness Center). 2023. *Rice Area and Production Estimates for the 2022 Post-Monsoon Season*. Yangon, Myanmar. Agricultural Crop Yield Estimation Project, ADPC.
- Basu, S., and S. Sharma. 2019. "Replenishing the Rice Bowl: Productivity and Quality in Myanmar's Rice Export Industry." International Growth Center [blog], July 17.
- Braverman, A., and J.S. Hammer. 1986. "Multimarket Analysis of Agricultural Pricing Policies in Senegal." In *Agricultural Household Models: Extensions, Applications, and Policy*, eds. I. Singh, L. Squire and J. Strauss, 233–254. Baltimore: Johns Hopkins University Press.
- Croppenstedt, A., Bellú, L.G., F. Bresciani, and S. DiGiuseppe. 2007. "Agricultural Policy Impact Analysis with Multi-Market Models: A Primer." ESA Working Paper No. 07-26. Rome: Food and Agriculture Organization of the United Nations (FAO).
- Dorosh, P.A. 2001. "Trade Liberalization and National Food Security: Rice Trade between Bangladesh and India." *World Development* 29 (4): 673-689.
- Dorosh, P., M.T. Win, and J. van Asselt. 2019. "Production Shocks, Exports, and Market Prices: An Analysis of the Rice Sector in Myanmar." IFPRI Discussion Paper 01830. International Food Policy Research Institute (IFPRI), Washington, DC.
- Ecker, O., and A.R. Comstock. 2021a. *Income and Price Elasticities of Food Demand (E-FooD) Dataset: Documentation of Estimation Methodology*. Washington, DC: IFPRI.
- Ecker, O., and A.R. Comstock. 2021b. "Income and Price Elasticities of Food Demand (E-FooD) Dataset, Version 1.0." Harvard Dataverse. <https://doi.org/10.7910/DVN/OXZ0H6>
- Goeb, J., P.P. Zone, N.L.K. Synt, A. Myint Zu, Y. Tang, and B. Minten. 2022. "Food Prices, Processing, and Shocks: Evidence from Rice and COVID-19." *Journal of Agricultural Economics* 73 (2): 338–355.

- IFPRI. 2023. “Myanmar Agricultural Performance Survey (MAPS).” Harvard Dataverse, V1. Round 1: <https://doi.org/10.7910/DVN/SPMYR4>; Round 2: <https://doi.org/10.7910/DVN/IUCGVE>; Round 3: <https://doi.org/10.7910/DVN/SFX6ME>
- IMF (International Monetary Fund). 2023. “International Financial Statistics.” <https://data.imf.org/regular.aspx?key=61545850>
- Kee, H.L., A. Nicita, and M. Olarreaga. 2006. “Estimating Trade Restrictiveness Indices.” Policy Research Working Paper 3840. Washington, DC: World Bank.
- MAPSA (Myanmar Agriculture Policy Support Activity). 2023a. “Agricultural Mechanization Services, Rice Productivity, and Farm/Plot Size: Insights from Myanmar.” Myanmar Strategy Support Program Working Paper 35. MAPSA, IFPRI, Washington, DC.
- MAPSA. 2023b. “Conflict and Agricultural Productivity: Evidence from Myanmar.” Myanmar Strategy Support Program Working Paper 30. MAPSA, IFPRI, Washington, DC.
- MAPSA. 2023c. *Paddy Rice Productivity and Profitability in Myanmar: Assessment of the 2022 Monsoon Season*. Myanmar Strategy Support Program Working Paper 34. MAPSA, IFPRI, Washington, DC.
- MAPSA. 2023d. “The Continuous Rise—During Economic Growth, the COVID-19 Pandemic, and Conflict—in the Adoption of Labor-Saving Agricultural Technologies in Myanmar: Evidence and Implications.” Myanmar Strategy Support Program Working Paper 43. MAPSA, IFPRI, Washington, DC.
- MAPSA. 2024. “Livelihoods and Welfare: Findings from the Sixth Round of the Myanmar Household Welfare Survey.” Myanmar Strategy Support Program Working Paper 53. MAPSA, IFPRI, Washington, DC.
- Minten, B., J. Goeb, K.Z. Win, and P.P. Zone. 2023. “Agricultural Value Chains in a Fragile State: The Case of Rice in Myanmar.” *World Development* 167: 106244.
- MNPED (Ministry of National Planning and Economic Development), UNDP (United Nations Development Programme), and (Sida Swedish International Development Cooperation Agency). 2011. *Integrated Household Living Conditions Assessment Survey 2009-2010, Technical Report*. Yangon, Myanmar.
- MOALI (Ministry of Agriculture, Livestock and Irrigation). 2022. *Myanmar Agriculture at a Glance*. Nay Pyi Taw.
- MRF (Myanmar Rice Federation). 2023. Unpublished data. Yangon, Myanmar.
- Proximity Designs. 2016. *Paddy to Plate, the Rice Ecosystem in Myanmar: Challenges and Opportunities*. Yangon, Myanmar.
- Sadoulet, E., and A. de Janvry. 1995. *Quantitative Development Policy Analysis*. Baltimore: Johns Hopkins University Press.

- UNCTAD (United Nations Conference on Trade and Development). 2024. TRAINS (Trade Analysis and Information System) portal. <https://trainsonline.unctad.org/home>
- USDA (United States Department of Agriculture). 2023a. *Burma: Grain and Feed Annual*. Foreign Agricultural Service Report BM2023-0002. Washington, DC.
- USDA. 2023b. “PSD: Production, Supply, and Distribution.” Foreign Agricultural Service, USDA. August 11. <https://apps.fas.usda.gov/psdonline/app/index.html#/app/downloads>
- USDA. 2023c. “Production, Supply, and Distribution (PSD) online.” Foreign Agricultural Service, United States Department of Agriculture.” August 11. <https://apps.fas.usda.gov/psdonline/app/index.html#/app/downloads>
- Vivero, J.L., and T.N. Oo. 2019. “Myanmar Food Security Atlas.” Presented at MOALI, July 3, Nay Pyi Taw.
- Wong, L.C.Y., and E.M.A. Wai. 2013. *Rapid Value Chain Assessment: Structure and Dynamics of the Rice Value Chain in Myanmar*. Strategic Agricultural Sector and Food Security Diagnostic for Myanmar—Background Paper No. 6. East Lansing; Yangon, Myanmar: Michigan State University; Myanmar Development Resource Institute—Centre for Economic and Social Development.
- World Bank. 2014. *Myanmar—Capitalizing on Rice Export Opportunities*. Washington, DC.
- World Bank. 2019. *Myanmar Rice and Pulses: Farm Production Economics and Value Chain Dynamics*. Washington, DC.
- World Bank. 2021. “Poverty and Living Conditions Survey 2014–2015: Myanmar, 2015.” *Microdata Library*. <https://microdata.worldbank.org/index.php/catalog/4036>
- World Bank. 2023. “Commodity Markets: ‘Pink Sheet’ data.” Washington, DC. www.worldbank.org/en/research/commodity-markets

