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Growing Demand for Broken Rice for Feed and Food: The Implications for Global Trade

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Abstract

Rice is one of the world's most widely cultivated and consumed crops, and the efficient operation of the rice market is a critical concern for global food security. From 1991 to 2021, the share of rice used for animal feed and industrial use increased from 4.6 to 7.6 percent. Broken rice (a byproduct of milling) is sold at a lower price than full grain rice for direct consumption, animal feed, or for industrial use. From 2020 to 2022, China more than tripled the volume of broken rice imports (largely for use in animal feed) when prices surged in global corn and wheat coupled with low broken rice prices from India. In 2022, India banned exports of broken rice, rice prices rose and China cut imports back to pre-2021 levels. A potential exists that increased demand for broken rice for feed and industrial use could affect importing countries that depend on broken rice for food. The report authors did not find this potential to be the case in 2021–22. They examined recent broken rice trade fluctuations in detail and analyzed related shifts in rice policy and consumer preferences, based on multiple sources of trade data.

Keywords: Broken rice, animal feed, China, food security, imports

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About the Authors

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A report summary from the Economic Research Service *April 2025*

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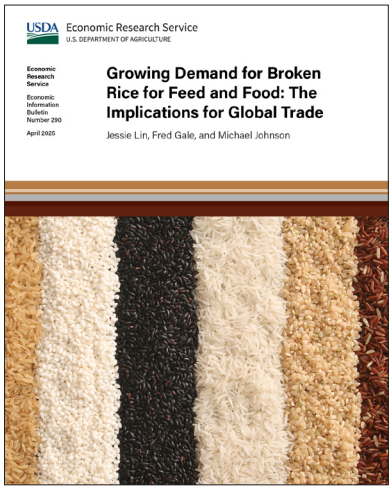


What Is the Issue?

Rice is one of the world's most widely cultivated and consumed crops, and the efficient operation of the rice market is a critical concern for global food security. Increasingly, low-grade rice (or broken rice) has become an alternative substitute for animal feed, industrial processing, and blending in consumer products. Most consumers around the world prefer full grain[1] rice. The exception is consumers in a few countries in West Africa who prefer broken rice as food. How has the expansion of broken rice trade altered global markets? What led to the recent shifts in broken rice trade toward feed use in China? Could this shift affect broken rice imports in countries that consider broken rice as a food staple? To explore these questions, the report authors analyzed the emerging global markets for broken rice for human food, animal feed, and industrial purposes, focusing on China as the largest importer of broken rice.

What Did the Study Find?

In the past decade, the rice market has experienced an increase in the use of broken rice as animal feed and for other industrial purposes, in contrast to broken rice's traditional use as a low-cost staple food:

- Per capita consumption of all rice has decreased in China and other traditional rice-consuming countries in Asia as diets shift from grains toward proteins.
- Rice is increasingly used in the animal feed market, depending on prices of common feed grain alternatives (e.g., corn, wheat, and sorghum).
- The trend toward industrial use of rice partially reflects domestic policies that enabled the stockpiling of rice in many rice-producing countries.
- Broken rice is preferred for use in animal feed when its price drops below that of corn or other feed grains. In 2021 and 2022, China increased its imports of broken rice as domestic prices for corn, wheat, and sorghum rose.

[1] In the United States, "full grain rice" is also referred to as "head rice."

How Was the Study Conducted?

This report utilized multiple data sources. U.S. Department of Agriculture, Foreign Agricultural Service's Production and Supply Distribution, Trade Data Monitor, United Nation's Food and Agriculture Organization (FAOSTAT), Organisation for Economic Cooperation and Development's (OECD) Agricultural Outlook, and National Bureau of Statistics of China data are used to analyze and compare rice production (human and feed), consumption, and import/export trends. We analyzed data on West African rice imports from Base pour l'Analyse du Commerce International (BACI) of the Centre d'Etudes Prospectives et d'Informations Internationales or CEPII. The BACI database reconciles inconsistencies in import and export data reported by countries to the United Nations. BACI data were available up to 2021 only.

The report authors analyzed the relationships between rice consumption trends (food versus feed) imports, exports and the evolution of the rice market in China and other parts of the world.

The authors reviewed articles in academic journals, reports from international organizations, and reports of current events for background information.

Growing Demand for Broken Rice for Feed and Food: The Implications for Global Trade

Introduction

Rice is one of the world's most widely cultivated and consumed crops. Due to its importance as a food staple (especially in Asia), rice has also been one of the most regulated crops with low volumes traded in global markets (Tortajada & Zhang, 2021). Rice price volatility and export bans were prominent concerns during the global food price crisis of 2006–07 and at the onset of the Coronavirus (COVID-19) pandemic in 2020. India's ban of broken rice exports starting in 2022 was another prominent event that affected global markets (Glauber & Mamun, 2024).

The rice market is composed of multiple products that range from premium fragrant varieties to generic long- and short-grain varieties, white, brown, parboiled, and broken rice. Traditionally a staple food mainly in Asia, rice is now consumed by households of all income strata, as well as industrial users and feed mills on every continent. This diversification results in multiple submarkets for differentiated rice products, each with its own price and supply trends. These niche markets are interrelated, each linked to overall supply and demand conditions. While rice's central role in diets of middle- and upper-income East Asian countries has diminished (Timmer, 2010), many low-income households around the world still rely on rice as both a staple food and for food security. Those dependent on rice remain vulnerable to supply disruptions and price volatility.

This report examined one of the submarkets for rice: 100-percent broken rice. Broken rice is a byproduct of rice milling, the fragments of white rice removed from rice products meant for human consumption. In most of the world, broken rice sells at a discount to other rice products and is used in animal feed, food processing, pet food, for various industrial purposes, and for blending with higher grade rice to reduce the cost of consumer rice products (Phillips et al., 2024). However, broken rice is also an inexpensive source of calories for poorer consumers around the world. In West Africa, broken rice is a key ingredient of popular local dishes such as thieboudienne[2] in Senegal (Glauber & Mamun, 2024), and broken rice's demand in West Africa may be increasing with rising income and urbanization.[3]

Data on trade in broken rice from the United Nation's Food and Agriculture Organization (FAO) show that the volume of broken rice traded in the global market grew from under 1 million metric tons in the early 1990s to more than 10 million metric tons in 2022 (figure 1). West Africa was the chief source of growth in broken rice imports during the early 2000s—when the region's imports first reached 2 million metric tons—and during 2010–14 when West Africa's imports reached 4 million metric tons. European broken rice imports grew steadily at a slower pace, reaching 1.2 million metric tons in 2022. Figure 1 shows that China emerged as the leading importer of broken rice in 2022 as its imports more than tripled from less than 1 million metric tons in 2019 to 3.5 million that year.

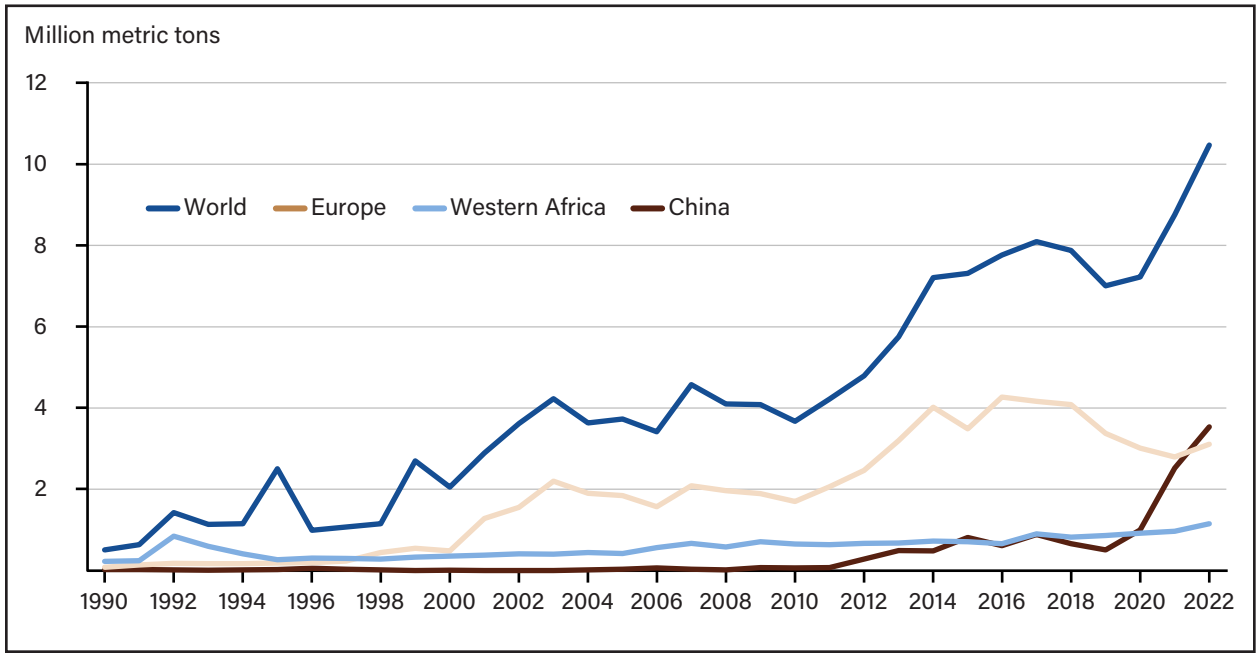
While rice is a traditional food staple in China, Chinese rice consumption has stagnated as diets of more affluent and more urban Chinese consumers diversified to include more animal and fish protein, vegetables, fruits, processed foods, and restaurant meals (Mendez et al., 2004; Pingali, 2007; China Ministry of

[2] Thieboudienne is a dish that combines broken rice with fish, vegetables and seasonings. It originated in Senegal and is popular in other West African countries

[3] See Gyimah-Brempong et al. (2016) for the example of Nigeria.

Agriculture and Rural Affairs, 2023). Moreover, Chinese consumers have become more discerning in their rice consumption, valuing high-quality milled rice. China's surging imports of broken rice during 2020–22 were used mainly as substitutes for animal feed due to the grain supply chain disruption as a result of Russia's war with Ukraine. Thus, China's surge in imports suggests that feed mills in China compete with lower income consumers in West Africa to purchase broken rice in the international market.

Figure 1
Broken rice trade has increased over time in major importing regions



Source: USDA, Economic Research Service analysis of data accessed from Food and Agriculture Organization of the United Nations.

What are the implications of the growing use of broken rice for feed and industrial purposes in China and other industrialized countries? This report covers the emerging trends in global markets, focusing on China as the market force driver of broken rice trade. The authors examined how the broken rice trade and consumption has evolved and assessed its specific uses and future demand potential among major importers and the implications for long-term global trade. China (as a leading global economy) has emerged as a major industrial hub, with rising urban incomes and the demand for more diversified diets. This change has implications for future rice consumption as a basic staple and food supply for the countries that depend on broken rice and for its use as animal feed and for other industrial purposes.

Background

Declining Per Capita Rice Consumption in Asia and Consumption's Relation to Rice as Animal Feed

Per capita consumption of rice in many East Asian countries has declined, due to income increases and urbanization. Huang and David (1993) found that urbanization had negative effects on demand for rice in East Asia and that urbanization accounted for negative income elasticities for rice. Furthermore, changes in market systems and occupations were main factors that drove structural change in Asian food demand (Huang & Bouis, 2005). Asian food consumption patterns are converging toward a Western diet of more

wheat, temperate fruits and vegetables, and high protein and energy-dense food. The proliferation of global supermarket chains and fast-food restaurants is reinforcing these trends. Per capita rice consumption declines as income grows. A decline in per capita rice consumption was observed spreading from Japan and South Korea to China, Malaysia, and Thailand. The commercialization of smallholder[4] production has responded to these market trends (Pingali, 2007).

Although rice has historically been used mainly for human consumption, one of the byproducts—broken rice—can be a valuable animal feed ingredient, especially during times of tight grain supplies (Papanikou & Mavromichalis, 2023). Unprocessed rice, also known as paddy rice, has a fibrous hull surrounding the grain. Rice milling removes the hull to produce brown rice and then removes the bran to produce white rice (Kim et al., 2021). Some grains of rice are broken in the milling process. These grains contain the same nutritional content as whole grains but are sold at a discount due to consumer preferences. Broken rice is usually sold to consumers in low-income countries or exported to China and the European Union for use as animal feed.

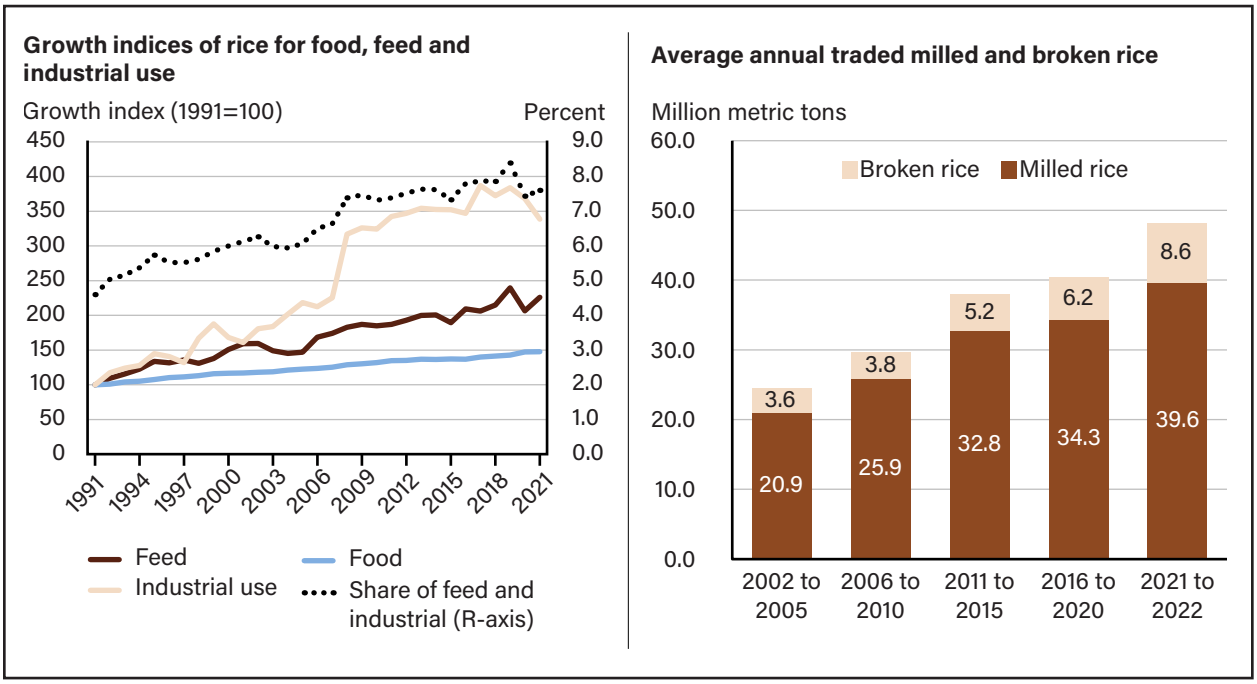
From a nutritional standpoint, broken rice is high in starch, low in fiber, fat, and crude protein (Vicente et al., 2009), which makes broken rice a feasible replacement for corn in animal feed (Embrapa, 2022), especially when corn prices are high. The degree to which rice is used as animal feed depends on the rice's price relative to corn. A report by Skorbiansky et al. (2018) observed that countries like South Korea, Japan, and Thailand had diverted excess rice stocks into the livestock feed market. China was not a significant factor at the time of the study but has followed a similar path by releasing large volumes of low-quality rice reserves for use as animal feed and by importing broken rice as animal feed.

Broken Rice in International Trade

Broken rice is a byproduct of the milling process. Typically, rice is traded with specifications on how much broken rice is included; the higher the proportion of broken rice, the lower the price. On a global level, broken rice has played a role in the growing volume of rice trade since the beginning of the 2000s. The authors of this report analyzed the growth in global broken rice trade using a dataset from a French research institute that reconciles inconsistencies in import and export data reported in United Nations statistics. The data from Base pour l'Analyse du Commerce International (BACI) reported that the volume of global rice trade nearly doubled from under 25 million metric tons to almost 50 million metric tons between 2002–05 and 2021–22. Broken rice has played a role in the growth in rice trade. Trade in broken rice rose from 12.8 percent of all milled and broken rice trade during 2006–10 to about 17.8 percent during 2021–22 (figure 2, right panel). While rice is used predominantly for human consumption, the FAO estimates indicate that growth in industrial and feed use of rice has increased during the 2000s, a development consistent with the growth in trade of broken rice (figure 2, left panel). The left panel of figure 2 shows that the share of rice utilized for both feed and other industry uses almost doubled, from about 4.5 percent in 1991 to a peak exceeding 8 percent of total rice supply in 2018.

[4] Smallholders are small-scale farmers using mostly family labor for production and utilize parts of their production for own consumption.

Figure 2
Share of feed in total rice supply and share of broken in milled rice traded at the global level



Source: USDA, Economic Research Service analysis of data accessed from the United Nations Food and Agriculture Organization Food balance sheets (FAOSTAT) for uses of rice and Base pour l'Analyse du Commerce International (BACI) of Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) for trade (see Gaulier and Zignago, 2010).

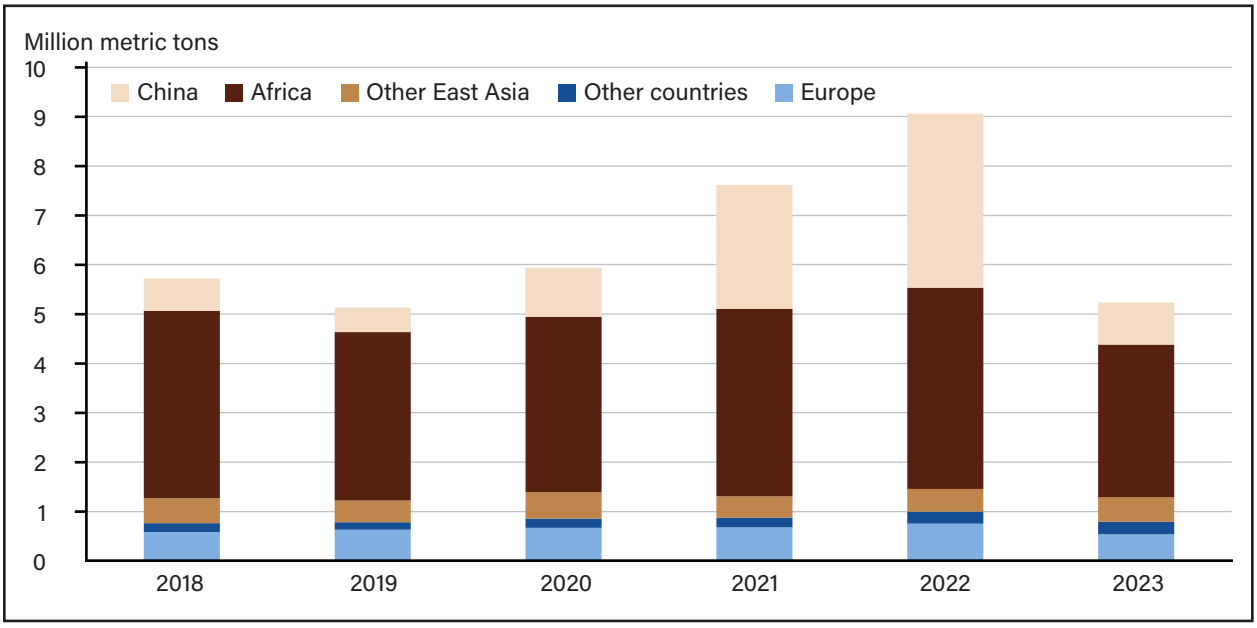
The differentiated markets for specialized rice products often lead to varying patterns of price trends, depending on their demand and supply in global markets. However, the prices of rice products typically move in tandem. How adaptable these markets operate has important implications for the food supply of some of the world's major importing countries, a majority of which are in Sub-Saharan Africa. Markets can quickly become volatile whenever major exporting countries impose export restrictions related to food security concerns to correct for any misalignments in their domestic markets (e.g., to prevent food price inflation or to replenish domestic stocks). The 2008 food price crisis is an example of major rice exporters such as India and Vietnam imposing a ban on rice exports to counter domestic food inflation, further raising global food prices (Gulati & Dutta, 2010; Dawe, 2010).

India's ban on exports of 100-percent broken rice in September 2022 and a ban on nonbasmati rice exports in 2023 threatened a repeat of the past food price crisis (Reed et al., 2023). Growing competition for broken rice for feed and other industrial purposes potentially raises the risk of new food crises. However, the growing volume of rice trade since the 2006–07 food crisis—driven in part by the use of rice as animal feed—may be a mitigating factor that reduces the risk of volatility from export bans or other disruptions by a single country.

African countries are typically the largest importers of broken rice, but China accounted for most of the growth in broken rice imports between 2019 and 2022 (figure 1). African imports of broken rice fluctuated between 3.4 million metric tons and 3.8 million metric tons during 2018–21, then rose to 4.1 million metric tons in 2022 (figure 3). Among 21 African broken rice importers, the largest share was imported by West African countries—including Senegal, Burkina Faso, Guinea, Cote d'Ivoire, Ghana, Togo, and Benin. China's amount of broken rice imports jumped from about 500,000 metric tons in 2019 to more than 3.25 million metric tons in 2022. In 2023, the amount of African imports fell to 3.1 million metric tons, a decrease of 1 million metric tons from the previous year. The amount of China's imports fell dramatically

to 850,000 metric tons that year, slightly more than its import volume during 2018 and 2019. The level of imports by other East Asian countries (led by Indonesia and Philippines), European, and other countries remained relatively small and stable throughout 2018–23. Vietnam's data were not included in figure 3,[5] but the report authors confirmed that Vietnam had a surge of imports during 2021 and 2022 (see box, "Vietnam Also Imported More Broken Rice").

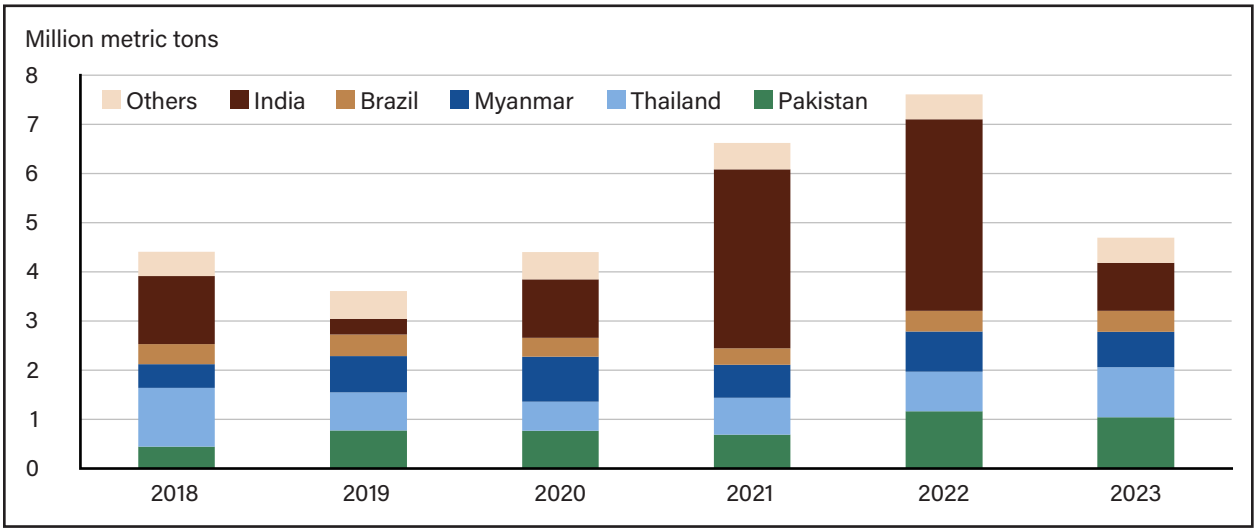
Figure 3
Imports of broken rice by region 2018–23



Note: Europe includes the European Union, United Kingdom, and other countries in Europe.

Source: USDA, Economic Research Service analysis of data accessed from Trade Data Monitor.

Figure 4
Top exporters of broken rice by volume, 2018–23



Source: USDA, Economic Research Service analysis of data accessed from Trade Data Monitor.

[5] Trade Data Monitor, the source used in the report, does not include Vietnam data.

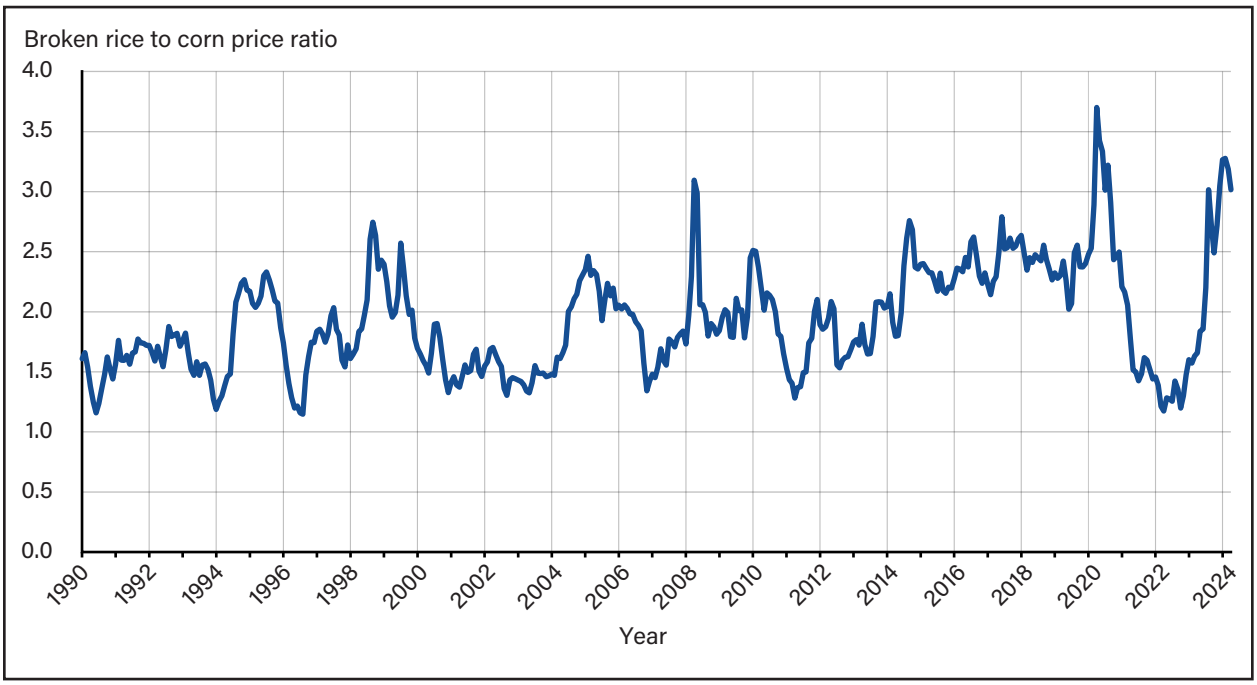
As one of the world's top broken rice exporters, India's expansion and contraction of exports matched trends in the total global trade value of broken rice, customs data from Trade Data Monitor showed. A surge of exports by India facilitated the surge of broken rice imports during 2019–20 (figure 4). Export volume from India decreased in 2023, due to the export ban implemented in the latter half of 2022. Prior to 2021, the levels of exports of broken rice were more evenly distributed among the major exporting countries—Brazil, Pakistan, and Thailand.

Vietnam Also Imported More Broken Rice

USDA, Foreign Agricultural Service (2022) observed that Vietnam became a major importer of broken rice. Vietnam's imports are not included in the database analyzed in this report, so the report authors examined the sum of broken rice exports to Vietnam during 2019–23. Trade Data Monitor showed that exports of broken rice by eight countries rose from 28,000 metric tons in 2020 to 435,940 metric tons in 2021, then fell to 232,860 metric tons in 2022 and 40,900 metric tons in 2023. India's exports accounted for all of the increase in broken rice exports to Vietnam during 2021 and 2022. These data indicate that Vietnam was the second-leading Asian importer of broken rice during 2021 and 2022.

Low prices for India's broken rice were one factor driving India's export boom. USDA, Foreign Agricultural Service (2022) showed that price quotes for Indian broken rice were below those of competing exporters. Another factor driving the demand for broken rice as animal feed was high global corn prices. Corn prices in China began rising during 2020, as feed demand grew with recovery of its swine sector from a 2018–19 African swine fever epidemic and impacts of the COVID-19 pandemic that began in 2020. Global corn prices rose higher during 2022, following the Russian military invasion of Ukraine. The rapid rise in corn prices led to an unusually low rice-to-corn price ratio in 2021 and 2022 (figure 5). The lower ratio made it cost efficient to substitute broken rice for corn in animal feed production. The lower ratio during 2021 and 2022 corresponded to China's rapid growth in broken rice imports. The rice-to-corn ratio rose after India's announced ban of broken rice exports in September 2022 led to resurging rice prices. At the same time, corn prices decreased at the beginning of 2023, following record corn harvests in Brazil (Formiga, 2023). The return to a higher relative price for broken rice versus corn led to a drop in broken rice imports worldwide during 2023 and 2024.

Figure 5
Monthly price ratio trends of broken rice versus corn, 1990–2023



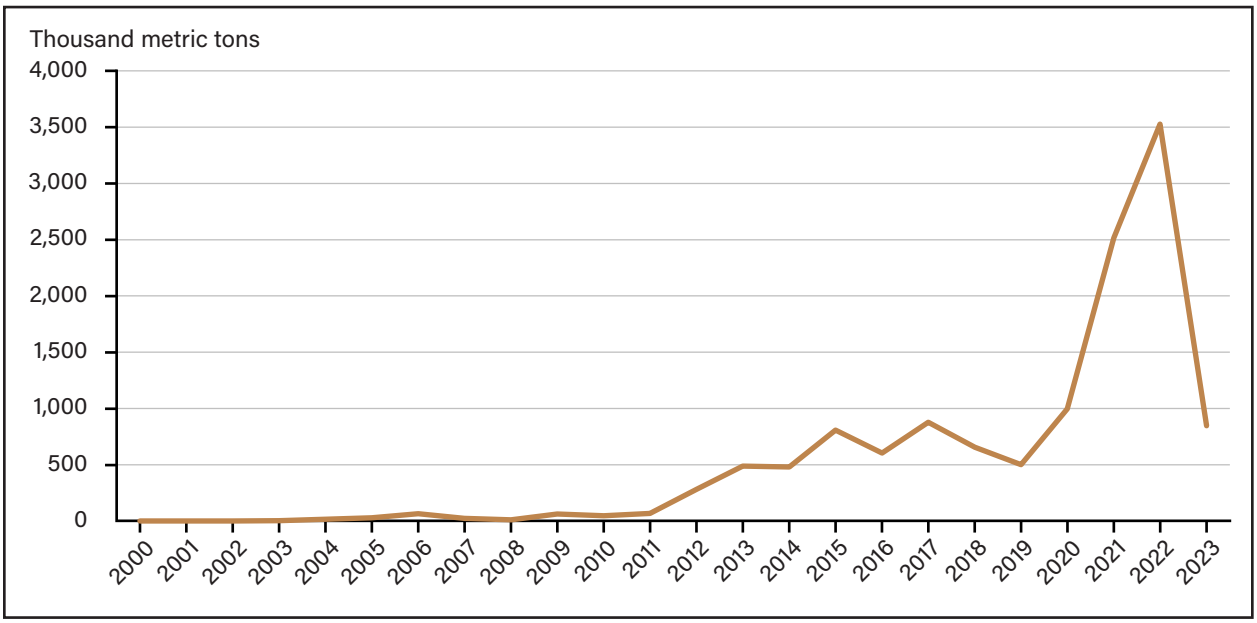
Note: The price ratio is simply a ratio of the price of broken rice over the price of corn. For broken rice, the authors used the Thai A.1 Super (100 percent broken) free on board (f.o.b.) Bangkok price (U.S. dollar per metric ton) as the benchmark, as the data were the most comprehensive. For corn, they used Number 2, yellow variety, f.o.b. U.S. Gulf ports price (U.S. dollar per metric ton) as the benchmark.

Source: USDA, Economic Research Service analysis of data accessed from World Bank Commodity Price Data (The Pink Sheet) for monthly prices.

Zooming in on China's Recent Trade of Broken Rice as Animal Feed

Prior to 2020, the amount of broken rice imports in China was under 1 million metric tons annually. Broken rice imports rose to 2.5 million metric tons in 2021 and peaked at more than 3.5 million metric tons in 2022 (figure 6). The amount of broken rice imports exceeded semi-milled or wholly milled rice imports during both 2021 and 2022. Then, the amount of broken rice imports plunged to 845,000 metric tons in 2022, less than half the 1.7-million-ton imports of semi-milled or wholly milled rice that year.

Figure 6
The amount of China's broken rice imports peaked in 2022



Source: USDA, Economic Research Service estimates using Chinese customs data from Trade Data Monitor.

The surge of broken rice imports was driven by both availability and market conditions in China. Imported broken rice came mainly from India. In 2020, China started to import rice from India for the first time in 30 years due to limiting supplies from Thailand, Myanmar, and Vietnam and because of India's relatively competitive prices. The peak in China's rice imports was reversed in 2023, as India banned exports of broken rice in 2022 and rice prices in the international market surged.

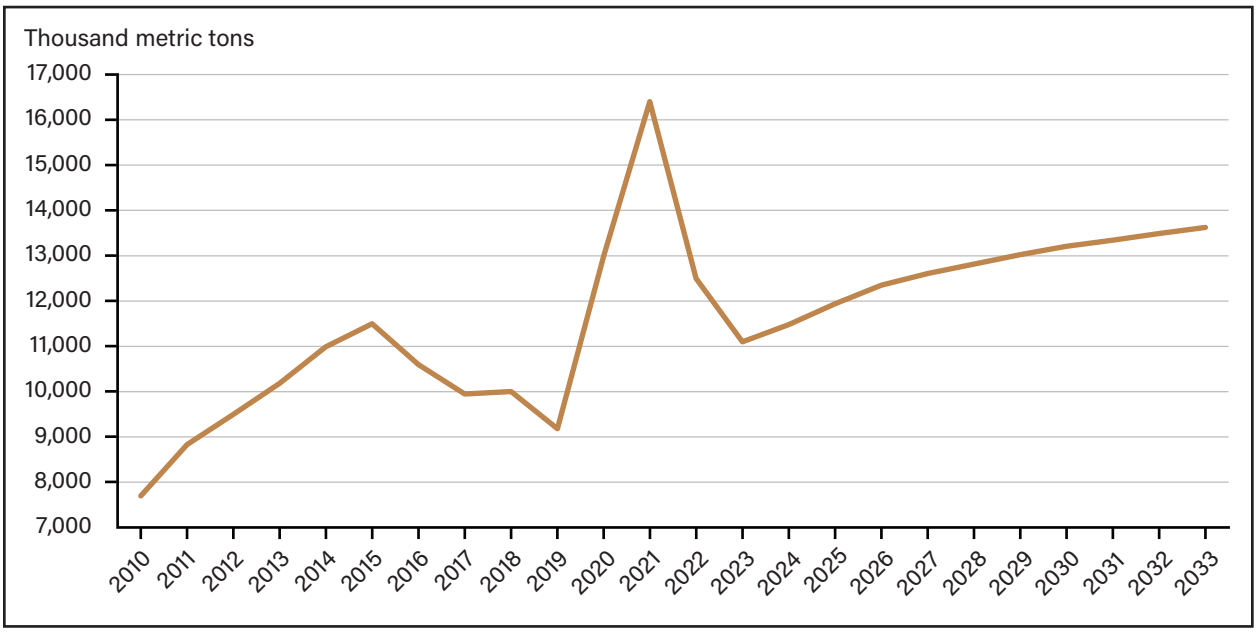
The use of broken rice as a feed ingredient also potentially establishes a link between rice markets and feed grain markets. China's surge in imports of broken rice in 2021 and 2022 coincided with an increase in domestic prices of feed grains such as corn, sorghum, and wheat[6] after the COVID-19 pandemic. The Russian military invasion of Ukraine disrupted grain shipments from the Black Sea region, further disrupted global commerce, and led to concerns that some countries might ban food exports.

The rising price of corn in 2020/21 stimulated demand for alternative grains to feed pigs and poultry. This phenomenon was particularly strong in China, where the pork sector was recovering from an African swine fever epidemic that had shrunk swine inventories dramatically during 2018–19 (Gale et al., 2023).

China has no published data measuring the use of ingredients in animal feed, but estimates by the Organisation for Economic Cooperation and Development (OECD) and the UN's FAO show a surge in use of rice as animal feed during 2019–21. The estimates show China's use of rice as animal feed increased from more than 7 million metric tons in 2018 to a peak of more than 15 million metric tons in 2020 (figure 7). The spike in feed use reflects both the increase in rice imports and the Chinese Government's disposal of excess reserves through a series of auctions targeted at feed companies beginning in 2018. Though this usage decreased in the following year, OECD/FAO (2024) projected that the use of broken rice as animal feed will increase steadily throughout the next decade.

[6] Wheat is used in animal feed grain in China during years when corn prices exceed wheat prices.

Figure 7
China's use of rice as animal feed, 2010–32



Source: USDA, Economic Research Service calculations based on data from the Organisation for Economic Cooperation and Development-United Nations Food and Agriculture Organization's Agricultural Outlook.

The Role of China in the Growing Use of Broken Rice as Feed

Human consumption is the main use of rice in China. China's food security policy prioritizes "absolute security" of rice and wheat supplies, since these grains are considered to be critical staple foods (State Council, 2014). However, China's consumption of staple foods has been stagnant, as population growth slowed and Chinese consumers diversify their diets (China Ministry of Agriculture and Rural Affairs, 2023). China has no official data on human consumption of rice, but FAS China & Demoss (2024) noted that many young urban Chinese consumers are switching from rice to wheat-based products and other foods. China's official household survey has reported a decline in annual per capita cereal grain consumption (rice and wheat combined) from 138.9 kilograms to 120.6 kilograms between 2013 and 2023.[7] Estimates by OECD and FAO show that per capita consumption of rice as food in China decreased dramatically from 87 kilograms per capita in the early 2000s to below 77 kilograms per capita by 2006 and is projected to hover around this rate up to 2030 (OECD/FAO, 2024). National Bureau of Statistics of China (2024) reported declining population for the first time in 2022 and 2023, an additional factor restraining growth in aggregate rice consumption.

The diversification of Chinese diets away from rice means that rice is often available for industrial and feed uses. Research Center for Rural Economy, China Ministry of Agriculture and Rural Affairs (2017) estimated that 80 percent or more of paddy rice is milled for human consumption while other uses of rice in China include manufacturing of food products such as cakes, rice flour, rice noodles, starch, amino acids, and liquor.

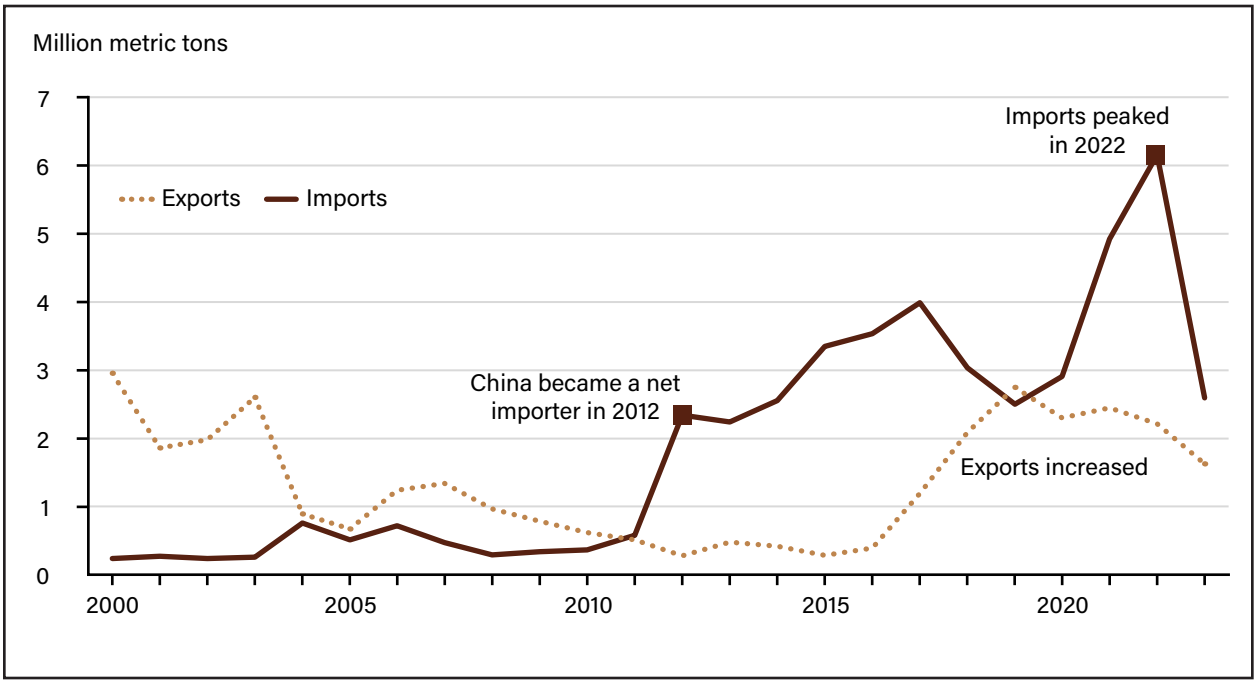
[7] Data were compiled from editions of China National Bureau of Statistics, China Statistical Yearbook, Beijing: China Statistical Press. The bureau stopped reporting rice consumption separately in 2013.

Animal feed is one of the most dynamic uses of grains in China. China's Feed Industry Association reported that annual industrial feed output rose from 193 million metric tons to 321.6 million metric tons between 2013 and 2023. Corn is the primary ingredient, but rice is one of many other grains, oilseed meals, and processing coproducts such as distillers' grains used as raw material for China's animal feed (Gale, 2015). FAS China Staff (2022) estimated that more than 200 million metric tons of corn were used as feed annually in China, but many other grains are used in feed when prices are cost competitive—including sorghum, barley, wheat, and rice. The authors' compilation of monthly reports by China's Feed Industry Association (2022–2024) found that the proportion of corn used in feed fluctuated between 20 percent and 40 percent during 2022–2024, as feed mills and livestock producers adjusted feed formulations in response to changes in prices and availability of different ingredients. China's Feed Industry Association does not report the percentage of rice used. Feed use of rice is a relatively small portion of feed raw materials and is also a relatively small component of China's rice consumption. Nevertheless, the use of raw materials by China's feed industry is so large that its use of rice can have a noticeable effect on the rice market.

China's rice reserve is also a factor in the feed use of rice. Chinese authorities purchase significant volumes of each year's rice crop to store in reserves for emergency use or for market stabilization (Bai, 2015). Rice purchased through a minimum price program is also held in reserves. FAS China & Demoss (2024) noted that China is believed to target 8–9 months of consumption for its rice reserve, and some imported rice may also be held in reserves. Rice is typically stored for 3 years or more before being sold or auctioned to the market, but some rice is held much longer and consequently degrades in quality. Much of the rice released from reserves is not suited for human consumption and is used for industrial or feed manufacturing.

Despite its declining per capita consumption and large reserves, China imports rice when foreign rice has a cost advantage over domestic rice. China's transition from a net exporter to a net importer of rice since 2012 indicates the price sensitivity of China's trade in rice. China's rice imports surged in 2012 when rice prices in international markets dropped below the minimum price for rice in China (figure 8).

Figure 8
China's rice imports and exports trends, 2000–23



Source: USDA, Economic Research Service analysis of China customs data accessed with Trade Data Monitor.

China's minimum price program led to the surge in imports during 2012–18. The support price exceeded the price in international markets, creating a strong incentive to import rice during those years. At the same time, rice purchases to support prices during 2012–18 led to ballooning rice reserves (Research Center for Rural Economy, 2017). China does not reveal the amount of rice purchased or held in reserves, but USDA's Production, Supply, and Distribution database estimates that China's rice inventory peaked at 116.6 million metric tons in 2019/20, double the amount held in 2012/13. Research Center for Rural Economy (2017) reported that Chinese authorities built and rented new storage facilities, gave aid to refurbish warehouses, and shifted grain from one province to another to cope with large rice reserves accumulated during those years.

The disposal of excess rice reserves was the initial factor that led to the surge in China's feed use of rice during 2021 and 2022. A campaign to dispose of excess rice stockpiles was declared by officials in 2018 (Xinhua, 2018). Officials sold nearly 54 million metric tons of rice at public auctions between 2020 and 2022, and additional auctions were held during 2023 (McGrath, 2023). Few details are available about the use of rice sold at these auctions, but market analysts and Chinese Government officials reported that rice held in inventories for many years, reportedly unfit for human consumption, was sold at a discount price targeted to animal feed mills (FAS China Staff, 2022; *Farmers Daily*, 2023). Private sales were made to designated animal feed companies to dispose of rice that was unsuitable for human consumption (China Feed Information Net, 2023). China Feed Industry Association (2023) reported that 18 million metric tons of rice from reserves sold to feed companies was unmilled medium grain rice produced in northeastern provinces during 2017–19; 2 million metric tons of long grain rice were sold.[8] FAS China Staff (2022) reported price quotes demonstrating the low cost of auctioned rice for Chinese feed mills.

The surge in China's imports of broken rice occurred at the same time authorities were releasing rice from reserves. The timing of the imports may be explained by China's approval of rice imports from India and by movements in rice and feed grain prices that made rice an attractive feed ingredient. Some measures to liberalize rice imports may have facilitated the imports of broken rice. In 2004, China entered into a free trade agreement with Southeast Asian countries that cut the tariff on rice imports from that region from the 65-percent most favored nation rate to 20 percent (Research Center for Rural Economy, 2017). In July 2018, China reduced its "most favored nation" tariff on broken rice imports from 65 percent to 10 percent (China General Administration of Customs, 2017). These lower tariffs may have made imports feasible without having to apply for the tariff rate quota (TRQ) that allows successful applicants to import at a 1-percent tariff. The TRQ system permits up to 2.66 million metric tons of long grain rice and up to 2.66 million metric tons of medium or short grain rice to be imported annually at the 1-percent tariff.

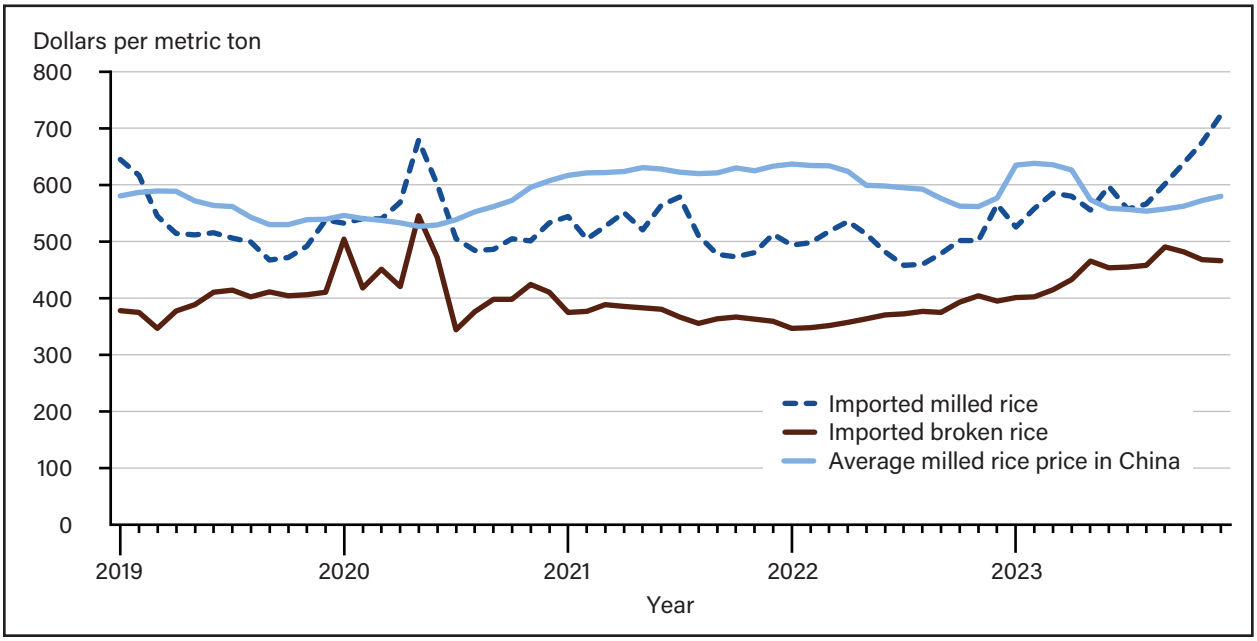
China's imports of broken rice came mainly from Southeast Asian countries until the resolution of quality issues allowed Indian rice to enter China in 2020. After years of negotiations that included the registration of Indian exporters and a phytosanitary protocol issued by China's General Administration of Customs (GEP, 2019), Indian rice traders executed the first contracts to ship 100,000 metric tons of broken rice to China during 2020–21 (Reuters, 2020). GEP (2019) and Reuters (2020) reported buyers in China sought rice from India as a lower cost alternative to more expensive rice from China's traditional Southeast Asian origins.

The cost advantage of imported broken rice in China is illustrated by monthly prices (figure 9). During 2020, China imported broken rice mainly from Myanmar and Thailand at an average price about $100–$150 per ton less than imported milled rice and domestic milled rice wholesale prices in China (figure 9). Domestic rice prices in China rose during the second half of 2020, as China recovered from the first wave

[8] Despite the disposal of reserves, China still held an estimated 60 percent of the world's rice reserves at the end of the 2022/23 marketing year, according to estimates in USDA's Production, Supply, and Distribution database in 2024.

of COVID-19 outbreaks and lockdowns. Imported rice prices fluctuated during the first half of 2020 but fell later that year as Chinese prices were rising. China began importing Indian broken rice in 2021, and the value fell to about $250 per ton less than the average wholesale price of rice in China.[9] The price advantage of both imported milled rice and imported broken rice persisted throughout 2021 and 2022. Examination of customs data showed that China's imports of Indian broken rice tapered off during the last 3 months of 2022 and ceased entirely by June 2023. The price advantage of imported rice diminished as international prices rose during 2023. The spread between Chinese wholesale price and imported broken rice narrowed to less than $100 per metric ton in early 2023.

Figure 9
Average monthly rice prices in China, 2019–23



Note: Imported rice prices are calculated as unit values from Chinese customs data. Domestic price is the average wholesale market price of long grain rice in China.

Source: USDA, Economic Research Service analysis of data from Trade Data Monitor and United Nations Food and Agriculture Organization, Global Information and Early Warning System on Food and Agriculture database.

Imported broken rice also gained a price advantage over corn and wheat during 2021 and 2022, making the rice a viable alternative as an ingredient in animal feed. Corn is the most common feed grain used in China. Rice is not widely used in animal feed in most years because its price exceeds the price of corn.

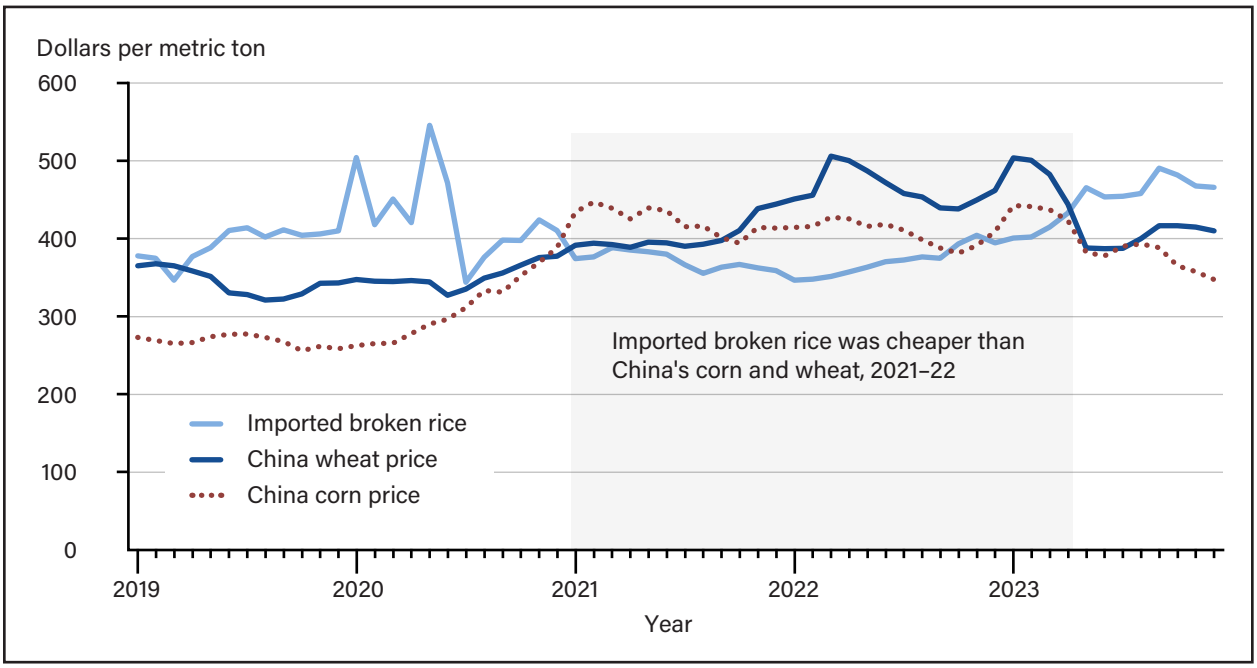
Imported broken rice value per metric ton exceeded the Chinese corn price by $100 or more during 2019 (figure 10). Chinese corn prices rose 75 percent during 2020 due to tighter supplies in China and increased demand for feed, as China's hog sector expanded as the sector recovered from a major disease outbreak. Wheat (like rice, primarily a food grain in China) was used as a substitute for corn in feed during 2020–21, as corn prices rose above the price of wheat. During 2020 and early 2021, Chinese authorities auctioned wheat from state reserves to supplement feed grain supplies, but the release of wheat stocks slowed during 2022 (FAS China Staff, 2022). Wheat prices rose above corn prices in 2022, following the Russian military invasion of Ukraine, discouraging the use of wheat in animal feed (figure 10).

[9] An examination of customs data showed that China's imports of Indian broken rice surged in January 2021. This surge could reflect the utilization of tariff rate quotas by importers, since the quotas are usually distributed once annually at the end of the calendar year.

Imported broken rice prices had exceeded Chinese corn and wheat prices during 2019–20—making the rice prices too expensive for use in animal feed (figure 10). Broken rice prices fell below Chinese corn and wheat prices during 2021 and 2022, stimulating the surge of broken rice imports for use in animal feed. FAS China Staff (2022) showed that the price of imported broken rice at one of China's major ports was less than prices of other feed commodities (Chinese corn and imported corn, sorghum, and barley) during 2022.

The incentive to import broken rice was reversed in 2023, as rice prices surged and Chinese corn and wheat prices dropped. Broken rice from India was no longer available to Chinese importers, international rice prices had increased, and Chinese authorities reduced the volume of rice auctioned from reserves that year. These price movements restored the pre-2020 price relationship in which broken rice was more expensive than wheat or corn. China's imports of broken rice declined sharply during 2023, as price incentives shifted in favor of corn. The annual statistical report from China's Feed Industry Association noted that the use of corn in feed manufacturing increased by 7 percent in 2023, while use of rice decreased by an unspecified amount.

Figure 10
Trends in broken rice, wheat, and corn prices in China



Source: USDA, Economic Research Service calculations based on data from Trade Data Monitor and the China National Bureau of Statistics, Market Prices of Important Means of Production in Circulation (2019–23).

Conclusion

Rice is the world's most cultivated crop that has historically been used for human consumption. This scene has altered since the mid-2000s, when global imports of broken rice for animal feed and other industrial uses (such as food processing and distilling alcohol in countries in East Asia) increased. This change was partly the result of governments implementing policies that incentivized overplanting that led to over inflated rice stocks that governments would release from time to time for animal feed uses (Skorbiansky et al., 2018). The availability of rice for these uses was facilitated by a waning demand for rice, as diets have diversified to include more nonstaple foods with incomes rising in many Asian countries (Mendez et al., 2004; Pingali, 2007). With

this ongoing dietary trend in major rice consuming region, broken rice is increasingly viewed as an ingredient in animal feed and industrial products. These uses of broken rice peaked in 2021 and 2022 (particularly in China) when prices surged in corn and wheat, coupled with low broken rice prices from India.

This analysis shows that the rice market is highly adaptable to global contexts and responsive to market conditions. China, as the top rice consumer, has the potential to alter global rice trade flows. Broken rice imports have an inverse relationship with price, and countries have adapted to rice's economic trends in relation to corn prices. Historical trends show that the price of broken rice has fluctuated in the past three decades. One of the consequences is the food supply implications for those who depend on rice for food consumption. Some countries (such as Senegal, the Gambia, and Cote d'Ivoire in Africa) are unique in that consumers strongly prefer broken rice, driven by a popular local dish that uses broken rice as a key ingredient and by population growth and urbanization (Faye et al., 2022; Twine et al., 2022). It would be expected that demand for broken rice as a food staple in these countries to be relatively more inelastic than in China, for example.

While global trade in broken rice remains primarily a niche market for feed, food, and industrial use, broken rice's growing share of rice trade (driven by changing demographics and dietary preferences, especially in Asia) is a trend to observe closely. An important consideration is whether the global broken rice market has the potential to grow its competing demands for food and feed markets, especially if incomes continue to rise in West Africa and Asia. Of particular concern is whether a rise in broken rice use for feed and other industrial purposes can affect food security, as has occurred with corn's alternative use for biofuel production.

In reviewing import trends for broken rice, the authors' research found no evidence that this concern is yet the case. Although China's feed demand for broken rice increased during 2021 and 2022 when prices were cheaper than alternative feed grains, the food supply was not adversely affected, especially among major importers in West Africa. The broken rice supply response in global markets appears resilient, even with the 2022 export ban of broken rice by India.[10] For food security to be affected, however, depends on future movements in relative prices and growth in demand among competing feedstuffs. This price movement was observed from the recent brief spike in corn and wheat prices following the Russian military invasion of Ukraine. China quickly shifted to broken rice to substitute for corn and wheat as feed ingredients. To what extent the food supply could be adversely affected, especially among the import-dependent countries in West Africa (with relatively inelastic demand for broken rice), will depend on many uncertain factors that affect relative prices and how much the broken rice market will grow over the next 10 to 20 years. These uncertainties, combined with a persistently high prevalence rate of undernourishment in West Africa of 19.5 percent in 2024 (Cardell et al., 2024), make this an issue to monitor closely in the coming years, as both Asia and West Africa continue to invest and grow their economies and ensure food security.

[10] It is important to note that India exempted some African countries from the ban, Senegal included.

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