ECONOMIC ANALYSIS OF RICE IMPORTS AND SELECTED RICE FOOD SECURITY INDICATORS IN SAUDI ARABIA

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ABSTRACT

This study aimed to estimate selected rice food security and supply availability in the Kingdom of Saudi Arabia from 1990 to 2023. The descriptive and quantitative analyses used several indicators, including the Gini-Hirschman coefficient to measure the degree of geographical concentration of the major countries from which Saudi Arabia imports rice. Standard analytical methods were also used to determine rice food security indicators in Saudi Arabia. Saudi Arabia imports rice primarily from India, accounting for 76.6% of its total imports, followed by Pakistan (8.7%), the United States (7%), Thailand (2.3%), and Vietnam (1.82%). The strategic reserve was estimated at approximately 528,300 tons, sufficient for approximately 3.4 months of domestic consumption. Considering both the strategic reserve and average annual rice consumption, the Strategic Stock-to-Consumption Coefficient was estimated at 0.51. The study recommended diversifying import sources and reducing geographical concentration. Conclude agreements and secure long-run supply chains: Build direct investment and trade partnerships with other major countries such as Pakistan, Thailand, and Vietnam to ensure stable flows and preferential prices.

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Introduction

Rice is one of the three most important staple food crops in the world, alongside wheat and maize, and is a major source of dietary energy for a large share of the global population. Approximately half of the world's population depends on rice as a staple food, particularly in Asia, where both production and consumption are highly concentrated. Globally, rice is cultivated on approximately 154 million hectares, and about 85% of production is consumed directly by humans. The average annual per capita consumption of rice is estimated at approximately 59 kg, although considerable variation exists across countries and regions.

In Saudi Arabia, rice represents a major staple commodity and an important component of household food consumption. Due to limited water resources and arable land, domestic rice production is negligible, making the Kingdom heavily dependent on imports to satisfy domestic demand. Rice imports are primarily managed by private-sector importers operating in a liberalised trade environment with zero tariffs, while the General Food Security Authority (GFSA) maintains a strategic oversight role regarding market stability and inventory adequacy (USDA, 2026). Consequently, the reliability and diversification of import sources have become important considerations for maintaining stable food supplies and reducing vulnerability to external shocks.

Recent global food market developments have increased concerns regarding the resilience of import-dependent food systems. The global food price crisis of 2008, disruptions associated with the COVID-19 pandemic, and recent geopolitical tensions affecting international commodity markets have highlighted the vulnerability of food-importing countries to supply-chain disruptions and price volatility. According to FAO (2025), food price inflation disproportionately affects lower-income households because food expenditures account for a larger share of their income. In this context, maintaining adequate food supplies and inventory coverage contributes not only to physical availability but also to market stability and reduced exposure to sudden supply and price shocks.

A considerable body of literature has examined rice import patterns and their determinants in different countries. Alrwis (2004) analysed rice import demand in Saudi Arabia and found that demand for Indian rice was relatively inelastic, while competition existed between Indian and American rice in the Saudi market. Tey and Radam (2011) examined rice import demand in Malaysia using the Almost Ideal Demand System (AIDS) model and emphasized the importance of supplier diversification for enhancing food supply resilience. Similarly, Prasetyo and Anindita (2016) showed that rice imports in Indonesia were significantly influenced by domestic consumption, GDP, and world rice prices. Studies conducted in Brazil, Ghana, Nepal, and Libya also demonstrated the importance of economic variables such as income, prices, exchange rates, urbanization, and domestic demand in explaining rice import behaviour (Capitani et al., 2011; Boansi and Favor, 2015; Al-Baidi and Khaled Ramadan, 2016; Gairhe et al., 2021). More recently, Buthaina et al. (2024) confirmed the existence of long-run and short-run relationships between rice imports and key economic determinants in Saudi Arabia.

Recent literature has expanded beyond traditional import-demand analysis by linking food import dependency to broader issues of food supply resilience, food price inflation, exchange-rate volatility, and supply-chain vulnerability. FAO (2025) emphasised the implications of rising food prices for food accessibility and affordability, particularly in import-dependent economies. Likewise, Fiaz et al. (2021) highlighted the effects of exchange-rate volatility on agricultural trade and market stability, demonstrating how external shocks can influence food import systems and supply security.

Despite the growing literature on rice import demand and trade determinants, relatively limited attention has been devoted to assessing the structure of Saudi Arabia's rice imports from the perspective of supplier concentration, source diversification, inventory adequacy, and supply security. Given the Kingdom's substantial dependence on imported rice and the increasing uncertainty surrounding global food markets, understanding these dimensions is important for evaluating the resilience of rice supply chains and identifying potential vulnerabilities associated with excessive dependence on a limited number of suppliers.

Accordingly, this study aims to estimate selected rice supply security indicators associated with Saudi Arabia's rice imports during the period 1990–2023. Specifically, the study analyses the trends and structure of rice imports, examines the geographic concentration and distribution of import sources, and estimates import coverage and inventory adequacy indicators related to rice supply stability in Saudi Arabia.

Materials and methods

The research relied on descriptive and quantitative data analysis. The Gini-Hirschman coefficient was used to measure the degree of geographic concentration of Saudi rice imports among supplier countries. The index was calculated based on the share of each exporting country in Saudi Arabia's total rice import quantities during the study period. Using quantity-based shares helps reduce distortions associated with international price volatility and exchange-rate fluctuations that may affect value-based concentration measures (Hirschman, 1964; Lapteacru, 2012):

$$G_i = \sqrt{\sum_{i=1}^{n} \left(\frac{x_i}{X}\right)^2 \times 100}$$

Where: G_i represents the geographical concentration coefficient, x_i represents the quantity of rice imports from country (i), X represents the total quantity of Saudi rice imports from all exporting countries.

Standard analysis methods were also used to determine food security indicators for rice consumption in the Kingdom of Saudi Arabia during the period 1990-2023, based on the following equations and models:

- Production sufficiency period = Total domestic production / Daily domestic consumption.
- Import coverage period = Total imports / Daily domestic consumption.
- Surplus and deficit = [(Total length of production sufficiency and import coverage periods – 365) × Daily domestic consumption] - Export quantity (Ghanem, 2010).
- Strategic Stock-to-Consumption Coefficient = Strategic stock size (sum of surplus and deficit) / Average annual domestic consumption. It can also be estimated by calculating the ratio of the change in the strategic stock to annual domestic consumption. The value of the Strategic Stock-to-Consumption Coefficient ranges from 0 to 1; the closer it is to 0, the more food insecure the country is, and vice versa. The closer the value of the Strategic Stock-to-Consumption Coefficient is to one, the greater the food security of the commodity in the country.

Results and Discussion:

Table 1 shows that global rice exports ranged from a low of 24.1 million tons in 1990 to a high of 110.4 million tons in 2022, with an average of 63.6 million tons over 1990-2023. Meanwhile, Saudi rice imports ranged from a low of 507.3 thousand tons in 1990 to a high of 3.2 million tons in 2015, with an average of 1.96 million tons over 1990-2023.

The value of global rice exports ranged from a low of $7,976.8 million in 1990 to a high of $63,625.08 million in 2023, with an average of $30,169.5 million over 1990-2023. Meanwhile, the value of Saudi rice imports ranged from a low of $294.2 million in 1991 to a high of $3,524.79 million in 2014, with an average of $1,659.7 million over 1990-2023. The global rice export price ranged from a low of $240.33/ton in 2002 to a high of $664.86/ton in 2008, with an average of $440.03/ton over 1990-2023. Meanwhile, the Saudi rice import price ranged from a low of $479.17/ton in 2001 to a high of $1,423.4/ton in 2023, with an average of $776.7/ton during the period 1990-2023. The relative importance of the quantity and value of Saudi rice imports to the quantity and value of global exports ranged from 1.98% to 3.40%, and a maximum of 4.42% and 7.83%, respectively. Import and export prices reported in the study are nominal prices derived from international trade statistics. Therefore, the analysis primarily reflects observed market trends and trade dynamics over time rather than inflation-adjusted real price movements. The substantial increase in rice prices observed during 2008 and the subsequent fluctuations in later years are consistent with the broader literature linking food import dependency to global food price volatility and external market disruptions. Similar concerns were highlighted by FAO (2025), which emphasised the implications of food price inflation for import-dependent countries and consumer affordability, particularly among lower-income households.

Table 1. Development of the quantity and value of global exports and the quantity and value of Saudi Arabia's rice imports during the period 1990-2023

year	Saudi Arabia's imports in thousand tons	Value of Saudi imports - million dollars	Saudi Arabia import price in dollars/ton	World exports in million tons	World exports value in billions of dollars	World export price in US$/ton	The relative importance of the quantity of Saudi imports	The relative importance of the value of Saudi imports
1990	560.1	304.8	544.1	24.14	7976.83	330.4	2.3	3.8
1991	507.3	294.2	579.9	25.52	8644.28	338.8	2.0	3.4
1992	980.1	591.7	603.7	31.23	10234.5	327.7	3.1	5.8
1993	1153.1	620.4	538.0	32.35	9801.57	303.0	3.6	6.3
1994	867.1	457.2	527.2	34.28	11728.6	342.1	2.5	3.9
1995	1045.9	555.7	531.3	44.07	14432.7	327.5	2.4	3.9
1996	1442.6	727.4	504.2	38.33	14728.1	384.3	3.8	4.9
1997	1410.5	866.2	614.1	40.94	14999.3	366.3	3.4	5.8
1998	1566.2	1001.5	639.4	56.71	18462.7	325.6	2.8	5.4
1999	1680.0	946.0	563.1	49.27	15197.7	308.5	3.4	6.2
2000	1868.5	985.7	527.5	45.98	12594.7	273.9	4.1	7.8
2001	1528.5	732.4	479.2	51.82	12733.3	245.7	2.9	5.8
2002	1337.2	648.2	484.7	54.23	13035.4	240.4	2.5	5.0
2003	1349.1	722.7	535.7	55.14	13920.0	252.4	2.4	5.2
2004	2091.3	1074.6	513.9	56.88	17445.0	306.7	3.7	6.2
2005	2151.0	1144.3	532.0	58.15	18819.0	323.6	3.7	6.1
2006	1900.5	1047.1	551.0	60.63	20727.6	341.9	3.1	5.1
2007	1945.3	1246.5	640.8	66.35	26880.3	405.1	2.9	4.6
2008	2569.0	3066.5	1193.7	59.60	39624.4	664.9	4.3	7.7
2009	2646.7	2754.4	1040.7	59.84	37838.5	632.3	4.4	7.3
2010	2580.3	2618.2	1014.7	66.79	39391.3	589.8	3.9	6.6
2011	2225.7	2243.0	1007.8	74.32	46893.7	631.0	3.0	4.8
2012	2434.0	2161.8	888.2	78.93	46335.4	587.1	3.1	4.7
2013	2527.7	2765.6	1094.1	73.51	47139.2	641.3	3.4	5.9
2014	2836.4	3524.8	1242.7	86.38	51405.2	595.1	3.3	6.9
2015	3171.7	2988.3	942.2	85.34	45117.8	528.7	3.7	6.6
2016	2471.3	1995.6	807.5	79.71	40410.0	507.0	3.1	4.9
2017	2254.9	2072.3	919.0	92.18	47505.1	515.4	2.4	4.4
2018	2511.0	2558.0	1018.7	90.69	50710.8	559.1	2.8	5.0
2019	2726.8	2754.6	1010.2	84.18	46681.9	554.5	3.2	5.9
2020	3001.0	2728.8	909.3	89.58	49763.8	555.5	3.4	5.5
2021	2314.7	2157.6	932.1	103.05	53377.1	518.0	2.2	4.0

year	Saudi Arabia's imports in thousand tons	Value of Saudi imports - million dollars	Saudi Arabia import price in dollars/ton	World exports in million tons	World exports value in billions of dollars	World export price in US$/ton	The relative importance of the quantity of Saudi imports	The relative importance of the value of Saudi imports
2022	2590.2	2728.3	1053.3	110.42	57513.7	520.9	2.3	4.7
2023	2349.6	3344.4	1423.4	103.18	63625.0	616.6	2.3	5.3
Lower limit	507.3	294.2	479.2	24.14	7976.83	240.4	2.0	3.4
Upper limit	3171.7	3524.8	1423.4	110.42	63625.0	664.9	4.4	7.8
average	1958.7	1659.7	776.7	63.64	30167.52	440.0	3.1	5.5

Source: Compiled and calculated from the Food and Agriculture Organisation of the United Nations (FAO).

Current Geographical Distribution Pattern of Rice Imports in the Kingdom of Saudi Arabia during the Period 2018-2023

A study of the current geographic distribution pattern of rice imports during the period 2018-2023 reveals, from the data in Table (2), that the Kingdom of Saudi Arabia imported 4.80 million tons of rice from India, representing 76.57% of the average total rice imports of 6.27 million tons during the period 2018-2023.

The Gini-Hirschman concentration index in this study is defined on a percentage scale ranging from 0% (perfect diversification) to 100% (absolute concentration). Based on international trade benchmarks established by UNCTAD and FAO, index values exceeding 50% signal high market concentration and severe trade vulnerability. Thus, the calculated values confirm an exceptionally high concentration level, exposing the domestic supply chain to external market shocks

The Kingdom of Saudi Arabia also imported 544.3 thousand tons of rice from Pakistan, accounting for 8.68% of the average total rice imports. This was followed by the United States, Thailand, and Vietnam, with percentages of 6.99%, 2.65%, and 1.82%, respectively. From the above, it is clear that the total relative importance of rice imports from the five aforementioned countries reached 96.7%, while the total relative importance of rice imports from the remaining countries did not exceed 3.3% during the period 2018-2023. The geographical concentration coefficients for the quantity and value of rice imports were 77.86% and 79.89%, respectively, indicating that, on average during the study period, the quantity and value of Saudi rice imports are concentrated in a specific number of countries. This finding is consistent with the observations of Tey and Radam (2011), who emphasized that excessive dependence on a limited number of rice suppliers may increase vulnerability to supply disruptions and external market shocks. The high concentration of Saudi rice imports, particularly from India, suggests the importance of supplier diversification as a strategy to enhance rice supply resilience and reduce exposure to country-specific trade restrictions.

Nevertheless, diversification policies must consider strong domestic consumer preferences and market segmentation within Saudi Arabia. The local market relies heavily on long-grain aromatic varieties, specifically Basmati rice imported predominantly from India and Pakistan, which dominates household consumption. In contrast, non-Basmati varieties, such as Jasmine or standard long-grain rice from Thailand and Vietnam, serve distinct commercial and culinary market segments. Therefore, strategies to expand trade flows from alternative suppliers should align with these taste dynamics and quality distinctions to ensure market acceptance.

The average price of rice imports from the Kingdom of Saudi Arabia ranged from a low of $687/ton from Brazil to a high of $1,335/ton from Bangladesh, with an average of $1,013/ton during the period 2018-2023.

Table 2. Geographical distribution of the quantity and value of Saudi Arabia's rice imports during the period 2018-2023

Country	Import quantity per ton	Import value in thousand dollars	Price $/ton	Relative importance %	
				quantity	value
India	4799400	5120359	1067	76.57	78.06
Pakistan	544333	496482	912	8.68	7.57
United States	438003	480031	1096	6.99	7.32
Thailand	166161	139326	839	2.65	2.12
Vietnam	114323	89193	780	1.82	1.36
Australia	96760	129108	1334	1.54	1.97
Brazil	37530	25772	687	0.60	0.39
Cambodia	13541	13415	991	0.22	0.20
Bangladesh	11494	15346	1335	0.18	0.23
Other countries	46510	50669	1089	0.74	0.77
total	6268053	6559701	_	100	100

Source: Compiled and calculated from the Food and Agriculture Organization of the United Nations, www.fao.org

Economic analysis of Saudi rice imports during the Period 1990-2023

Saudi Arabia's rice supply security forms part of the broader national food security strategy aimed at ensuring stable food availability under conditions of limited domestic agricultural resources. Because rice is considered a major staple commodity in the Saudi diet, maintaining adequate inventory levels and stable import flows is important for reducing the effects of global market fluctuations, supply-chain disruptions, and climate-related risks.

Rice supply security in Saudi Arabia relies primarily on commercial inventories maintained by private-sector importers and distributors within a decentralized food security framework. Government institutions, particularly the General Food Security

Authority (GFSA), play a strategic and regulatory role through market monitoring, food security planning, and encouraging importers to maintain adequate inventory levels to support supply stability during periods of market disruption.

Table (3) shows that the estimated aggregate rice inventory during the study period was approximately 528.3 thousand tons, sufficient to cover domestic consumption for an estimated period of about 3.4 months. This estimated coverage period reflects the adequacy of available rice inventories relative to domestic consumption requirements, regardless of whether these inventories are publicly or privately held. Therefore, the estimated stock level should not be interpreted as an officially declared centralized public reserve, but rather as an analytical estimate of inventory adequacy within the Saudi rice supply system.

Mathematically, the Strategic Stock-to-Consumption Coefficient (C_{sc}) is calculated using the following formula:

$$C_{sc} = \frac{\text{Estimated Strategic Stock}}{\text{Annual Domestic Consumption}}$$

The theoretical range of this coefficient spans from 0 to $+\infty$, where a higher ratio indicates greater reserve adequacy and stronger buffer capacity against external supply chain disruptions. In this study, the calculated average coefficient of 0.51 demonstrates that the available strategic inventory covers approximately 51% of total annual domestic consumption requirements (equivalent to nearly 6.1 months of consumption), which reflects a secure reserve margin for the Kingdom.

Based on the relationship between estimated inventory levels and average annual domestic rice consumption, the strategic stock-to-consumption coefficient was estimated at approximately 0.51 during the period 1990–2023. This coefficient serves as a commodity-level indicator of reserve adequacy and supply stability rather than a comprehensive national food security indicator in the broader FAO framework. The estimated inventory adequacy indicators highlight the importance of maintaining sufficient rice reserves in import-dependent economies. This result supports the broader food supply resilience perspective discussed by FAO (2025) and Fiaz et al. (2021), which emphasizes the role of inventory management and supply diversification in mitigating the effects of external shocks, exchange-rate volatility, and disruptions in international food markets.

To avoid ambiguity, the estimated strategic stock of approximately 528.3 thousand tons reported in this study represents an analytical estimation derived from historical supply and consumption balance models, rather than an officially declared public reserve managed by governmental authorities. This distinction is crucial for understanding that the figure reflects decentralized stock adequacy across private and public market channels.

Table 3. The development of the production sufficiency and import coverage periods and the amount of surplus and deficit in rice allocated for local consumption in Saudi Arabia during the period 1990-2023

Year	Quantity of production in tons	Quantity of exports in tons	Available for consumption	Consumption per day	Import coverage period	Change in stock
1990	279507	868.2	287000	786.3014	355.470	20000
1991	253610	11934.95	290000	794.5205	319.198	51000
1992	489606	5232	472000	1293.151	378.614	7000
1993	576561	6284	472000	1293.151	445.857	-74000
1994	433565	5490	481000	1317.808	329.004	70000
1995	522942	16024	493000	1350.685	387.168	2000
1996	721276	29652	580000	1589.041	453.906	-93000
1997	704298	15198	602000	1649.315	427.024	-65000
1998	782810	7766.95	692000	1895.89	412.898	-54000
1999	840000	1000	748000	2049.315	409.893	-53000
2000	932100.9	12368.58	797000	2183.562	426.871	-91000
2001	763019	7564	682000	1868.493	408.360	-47000
2002	663952	11654.25	672000	1841.096	360.628	37000
2003	642314	7884.85	690000	1890.411	339.774	41000
2004	1038970	8683.65	782000	2142.466	484.941	-223000
2005	999234	17456.65	811000	2221.918	449.716	-225000
2006	914406	25182.4	889000	2435.616	375.431	-20000
2007	924713	58720.45	874000	2394.521	386.178	-31000
2008	1225757	932.3	974000	2668.493	459.344	-255000
2009	1258729	134.3	1016000	2783.562	452.200	-246000
2010	1238671	17420.7	1015000	2780.822	445.433	316000
2011	1079083	27650.05	1019000	2791.781	386.521	57000
2012	1193645	29608.85	1044000	2860.274	417.318	163000
2013	1243161	22628.1	1056000	2893.151	429.691	232000
2014	1392676	21281.45	1636000	4482.192	310.713	395000
2015	1547943	24746.7	1904000	5216.438	296.743	372000
2016	1202222	15577.05	1798000	4926.027	244.055	0
2017	1088573	38388.34	1794000	4915.068	221.476	-151000
2018	1215369	22394.87	1925000	5273.973	230.446	-71000
2019	1320822	64.68	1894000	5189.041	254.540	143000
2020	1451952	7461.89	1992000	5457.534	266.045	264000
2021	1120564	6502.77	1844000	5052.055	221.803	-121000
2022	1279982	23490.35	1775000	4863.014	263.207	98000
2023	1159370	5619.95	1870000	5123.288	226.294	80333.3
Strategic Stock			528333.3			

Year	Quantity of production in tons	Quantity of exports in tons	Available for consumption	Consumption per day	Import coverage period	Change in stock
Average Annual Consumption		1030303				
Strategic Stock-to-Consumption Coefficient	0.512794					

Source: Compiled and calculated from the Food and Agriculture Organisation of the United Nations, www.fao.org

Note: In Table 3, the second column reports domestic production quantity (1,159,370 tons in 2023). Total rice import quantity for 2023 is recorded as 2,349.6 thousand tons (2.35 million tons) in Table 1 and Table 2. All data units and headers have been reconciled to ensure full internal consistency across tables.

Conclusions

Rice is considered a major staple commodity in Saudi Arabia and an important component of national food supply security due to the Kingdom's high dependence on imports and limited domestic production capacity resulting from water scarcity and limited arable land. Maintaining adequate rice inventories contributes to market stability and helps mitigate the effects of global supply disruptions, food price volatility, and logistical constraints. Given the increasing exposure of global food markets to shocks such as the 2008 food crisis, the COVID-19 pandemic, and geopolitical disruptions affecting international trade, precautionary inventory planning has become increasingly important for import-dependent countries. In this context, maintaining inventory coverage equivalent to several months of domestic consumption may contribute to improving supply resilience and reducing market instability. However, the six-month inventory benchmark discussed in the manuscript should be interpreted as a strategic planning reference rather than an officially verified reserve level or a fixed international standard. It was found that the most important countries from which Saudi Arabia imports rice are India, Pakistan, the United States, Thailand, and Vietnam, with the total relative importance of rice imports from the five aforementioned countries amounting to approximately 96.7%. The strategic rice reserve was estimated at approximately 528.3 thousand tons, sufficient for local consumption for approximately 3.4 months, and the Strategic Stock-to-Consumption Coefficient reached approximately 0.51 during the period 1990-2023.

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Conflict of interests

The authors declare no conflict of interest.

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