International Journal of Innovations & Research Analysis (IJIRA)
(An International Quarterly Multidisciplinary Peer Reviewed Refereed Journal)
e-ISSN :2583-0295, Impact Factor: (Cosmos 7.662 & I2OR 5.105), Volume 06, No. 02(II), April- June, 2026, pp 161-170

Two Decades of the Indian Cereals Trade: Analysis Using RCA and NRCA

Avinash[1] | Vikas Batra[2*]

[1]Research Scholar, Indira Gandhi University, Meerpur-Rewari, Haryana.
[2]Professor, Department of Economics, IGU, Meerpur-Rewari, Haryana.

[*]Corresponding Author: vikasbatra7@gmail.com

Citation: Avinash, A. & Batra, V. (2026). Two Decades of the Indian Cereals trade: Analysis Using RCA and NRCA. International Journal of Innovations & Research Analysis, 06(02(II)), 161–170. https://doi.org/10.62823/IJIRA/6.2(II).9176

ABSTRACT

Indian agriculture has undergone many transformations; one of them is becoming an exporter of agricultural products from food importers after independence. Today, India's agriculture can produce a surplus, ensure food security and export to other countries. Overall, India is the world's largest producer and exporter of cereals, and the second-largest producer of rice and wheat. Past studies have analysed the comparative advantage of agricultural commodities using RCA as the primary tool. This approach faces significant limitations and yields biased and inconsistent results. The current study aimed to analyse the comparative advantages of the rice and wheat cereal trade. The study utilised secondary data from the World Integrated Trade Solutions (WITS) database from 2001 to 2023. We incorporated the compound annual growth rate (CAGR), coefficient of variation (CV), and Cuddy-Della's Instability Index for growth and variation in cereal exports. Furthermore, we have incorporated RCA for comparative advantage and NRCA to address the limitations of RCA. The study also employed an RC measure to ensure that the import was included in the analysis. The overall comparative advantage of cereals is resilient only due to the dominance of rice exports, whereas wheat exports contribute negligibly. Rice had higher RCA and NRCA scores and stable RC scores over the years. In contrast, wheat exports fluctuate widely. Wheat is susceptible to price fluctuations, domestic supply, and frequent quantitative export restrictions. India's evolving agricultural export basket focuses on products with stable demand and competitive advantages, ensuring that rice remains a pillar of its agricultural exports while navigating the complexities of wheat export growth.

***Keywords**: Comparative Advantage, Cereals, Agriculture Trade, RCA, NRCA.*
***JEL Code:** Q10, Q17, F13, F14*

Introduction

Indian agriculture has undergone many phases, one of which is becoming a net exporter of agricultural products from food importers after independence. The agricultural transformation was a result of significant events that led to the growth of agriculture. First, the Green Revolution led to a significant increase in the country's food production, making it self-sufficient (S. Singh et al., 2017). India can now produce sufficient food grains, leaving a surplus that can be exported (Rana et al., 2022). The 1991 reform and the joining of the World Trade Organisation (WTO) in 1995 were considered the subsequent major events for the agriculture sector, affecting its growth path in later years (Jagdambe, 2017). Under the WTO regime, the Agreement on Agriculture (AoA) broadly focuses on market access, domestic support, and export subsidies (Bathla & Sharma, 2017). India ratified its policy to align with the AoA and gain its benefits, significantly redefining agricultural trade in India. Liberalisation in agriculture impels the export of agricultural products and has spillover effects on the economy. Eventually, it helps increase allocative efficiency in the agriculture sector, increases real investment, and helps reduce poverty (Parikh et al., 1997).

Observing the positive effects on the economy, the Government of India (GOI) formulated the Agriculture Export Policy in 2018, which aims to double agricultural exports and further strengthen the integration of Indian farmers into the GVC (GOI, 2018). Rising agricultural product exports reflect the impetus provided to the agricultural sector. For example, the trade of agriculture exported worth ₹ 20.3 thousand crores in 1995-96 has risen to ₹ 28.6 thousand crores in 2000-01, a 40.49 per cent jump in just five years (Kumar, 2021). Exports increased from ₹29 thousand crores in 2001-02 to ₹89.5 thousand crores in 2009-10, with an annual growth rate of 16.3per cent (Sharma & Jain, 2011). Agricultural exports reported a 15.72per cent CAGR from 2000 to 2018 (Bhatia et al., 2021). In 2022-23, agriculture exports accounted for 11.81per cent of total national exports worth ₹427.66 thousand crores (Government of India, 2024). According to the Trade Statistical Review 2023, India accounted for a 2.4per cent share of world agricultural product exports in 2022 (WTO, 2023). Indian agriculture encompasses a diverse range of products, including cereals, processed foods, fruits and vegetables, oilseeds, fish, meat, spices, tea, and coffee. Among export baskets, the cereal category holds a special position. India is the world's largest producer and exporter of cereals (APEDA, 2024). In 2023-24, India exported cereals worth ₹90,961.67 crore.

Table 1 was created using World Trade Integrated Solution (WITS) data. The table represents cereal exports and their sub-categories: wheat and meslin, rye, barley, oats, maise, rice, grain sorghum, buckwheat, millets, and canary seeds. Rice alone accounted for 83.41per cent of the total cereals, while wheat and meslin accounted for only 7.31per cent. In our study, we included only two cereal sub-categories: rice and wheat (due to their largest production in India)

Table 1: India's Export of cereals to the world from 2001 to 2023

India Exports of Cereals	Trade value	Percentage
Wheat and Meslin	**10078146.69**	**7.317893**
Rye	3821.609	0.002775
Barley	481398.109	0.34955
Oats	2998.071	0.002177
Maise	11099808.24	8.059737
Rice	**114878242.5**	**83.41481**
Grain sorghum	418535.19	0.303905
Buckwheat, millets, and canary seeds	756284.224	0.549149
Total cereals	137719234.639	100

Source: Author's calculation

Several studies (Arun D et al., 2024; Bakhshinejad & Hassanzadeh, 2012; Bhatia et al., 2021; Borges Aguiar & Balogh, 2022; Fertö & Hubbard, 2003; Ishchukova & Smutka, 2013; Jagdambe, 2017; ŞAHİNLİ, 2014; Sarker & Ratnasena, 2014; O. P. Singh et al. (2020) analysed the comparative advantage of RCA or its modified versions. At the same time, most of the articles analysed aggregated categories of agriculture. We focused solely on one category, namely cereals, and its two subcategories: rice and wheat. Using the RCA as a primary tool for analysing the comparative advantage may be problematic due to its limitations and inconsistent results. Furthermore, since India joined the WTO and the recent COVID-19 pandemic, the pattern of Indian agricultural trade has changed. With the changing pattern of agricultural products, especially cereals, this study aims to determine the comparative advantage of cereal trade, specifically between rice and wheat.

The following study is divided into the following sections. Section 1 begins with an introduction, followed by Section 2, which provides the theoretical background. Section 3 describes the data and methodology used in this study. Next, Section 4 presents the empirical findings based on the methods employed. Section 5 presents a discussion, followed by a conclusion and policy recommendation section.

Theoretical Background

The foremost advocate of international trade was Adam Smith (1776), who criticised the mercantilist trade perspective. The theory of absolute advantage affirms that both countries can gain from trade by specialising in the native country's single commodity, which has the absolute advantage. David Ricardo (1817) proposed the law of comparative advantage, which states that if one country has an absolute disadvantage, it can still gain from trade if it specialises in a product with a less absolute disadvantage. The law infers that a country with a comparative advantage in its products has a low production cost. Hecksher (1919) and Ohlin (1933) further advanced the theory of comparative

advantage. The Hecksher-Ohlin model describes a model of different resource endowments within a country that can serve as the basis for trade between two countries. However, Ricardo and Heckscher-Ohlin's theory of comparative advantage faces limitations because empirical analysis for relative prices under a closed economy is not observable[1]. The relative production cost governs these pre-trade relative prices. Balassa (1965) proposed the concept of comparative advantage, which is "revealed" by the trade patterns by excluding other necessary constituents that impact a country's comparative advantage. Balassa formulated the "Revealed Comparative Advantage (RCA)" index to calculate comparative advantage using post-trade data. RCA helps to measure international trade specialisation by revealing comparative advantages or disadvantages (Bhatia et al., 2021).

RCA is the most widely applied technique in empirical trade research. Gnidchenko and Salnikov (2021) screened 131 papers from 2013 to 2019 and found that two-thirds of the studies applied RCA to analyse comparative advantage. While the Balassa RCA index is famous among scholars, it faces severe criticism on many grounds. The limitations mentioned by Yu et al. (2009) and Stellian and Danna-Buitrago (2022) were biased towards small market countries, lacked ordinal or cardinal properties, and exhibited asymmetric properties, which led to inconsistent and misleading results. Several modifications to RCA have been made, and new methods have been developed to overcome these limitations. Vollarth (1991) suggested using a logarithmic RCA to make it more symmetrical. Proudman and Redding (1998) employed an arithmetic mean weight in the RCA score, and Hoen and Oosterhaven (2006) proposed an additive RCA index (Yu et al., 2009). Yu et al. (2009) developed the NRCA index, which also addresses the shortcomings of RCA and other modified RCA indices. Despite these modifications to the RCA index, minimal guidance is available for selecting the best alternative comparative advantage index (Gnidchenko & Salnikov, 2021). Furthermore, choosing an appropriate index for the analysis requires a cautious approach, which ultimately affects the interpretation of the results.

Data and Methodology

The United Nations Statistical Division's Commodity Trade (UNSD-COMTRADE) database was used to extract trade data from 2001 to 2023, utilising World Integrated Trade Solutions software. The data was categorised in the Harmonised System (HS) and accessed from the 2-digit to the 6-digit level. We extracted data from the HS 2-digit code for cereals and the HS 4-digit code for its sub-category.

To assess the growth rate over time, we calculated the compound annual growth rate (CAGR) using a semi-log growth model. Additionally, we employed the coefficient of variation (CV) and Cuddy-Della index to evaluate stability in the export trend.

The CAGR was calculated by,

$$Y = AB^{t}U_{t}$$

Taking log i.e.

$\log Y = \log A + t \log B + \log U_t$

Y = export, A = constant, B = regression coefficient, U_t = disturbance term, t = time in years starting from the base year. To compute CAGR, we used the following formula:

r = {antilog (b) –1} × 100.

The coefficient of variation, we use

$$CV = \left(\sigma/\bar{x}\right) * 100$$

Where σ is the standard deviation and $\bar{x}$ represents an average of the parameter. The higher the CV score, the higher the parameter variability (or instability) and vice versa. However, the CV cannot capture the trends incorporated into the time series. Cuddy and Della's (1978) tool was employed to measure instability to overcome the shortcomings of CV. The given formula was used to compute the instability index.

[1] A country will have a comparative advantage if the relative price of a specific good in the domestic market is lower than that in the world market.

Index of instability = $CV * \left(\sqrt{1 - Adj.R^2}\right)$

CV = coefficient of variation.

Adj. R^2 = Adjusted R-squared

We have employed the Revealed Comparative Advantage (RCA) index developed by Balassa (1965) to analyse the comparative advantage. RCA was calculated using the following formula:

$$RCA_{ij} = \left(\frac{Xij}{Xi} \Big/ \frac{Xwj}{Xw} \right)$$

X_{ij} = country i^{th} export of j^{th} product

X_i = total exports of country i^{th}

X_{wj} = total export of the j^{th} product in the world

X_w =total export value of all products in the world.

The RCA value ranged from 0 to infinity. A value between 0 and 0.5 indicates an export disadvantage, whereas a value ranging from 0.5 to 1 indicates a strong export advantage. A value greater than 1 indicates a strong comparative advantage. However, RCA has been severely criticised based on biased comparison and magnitude. To overcome the shortcomings of RCA, we employed the NRCA developed by Yu et al. (2009).

The NRCA is a robust comparative advantage technique that provides a proper indication incorporated in the comparative advantage (Sarker & Ratnasena, 2014). Stellin and Danna-Buitrago (2022) demonstrated that NRCA is well-suited for several dimensions, including compatibility with the Kunimoto-Vollarth principle, the relative nature of comparative advantage across countries and products, symmetry, avoidance of small-country bias, and additivity across products and countries. Thus, we employed this technique to overcome the shortcomings of the RCA index. The NRCA begins by measuring the comparative-advantage-neutral point[1] representing the relative scale of the world export market.

To calculate the normalised revealed comparative advantage:

$$E_j^i = {E^i E_j}\Big/{E}$$

$$\Delta E_j^i = E_j^i - \hat{E}_j^i = E_j^i - E^i E_j / E$$

E^i= country's export of all commodities

E_j = country's export of commodity j to the world

E= Export of all commodities by country's

Normalise this difference by total world exports to get the normalised RCA.

$$NRCA_j^i = \left(E_j^i \Big/ E \right) - \left(E_j E^i \Big/ EE \right)$$

If NRCA > 0, the country's actual commodity export is higher than its neutral comparative advantage. This indicates that the country has a comparative advantage over commodity j. As a relative concept, the magnitude of NRCA has a meaningful economic interpretation in terms of comparative advantage. The greater the NRCA score, the stronger the comparative advantage. If $NRCA_{ij} = 0$, then the comparative advantage is neutral; no country has a comparative advantage (Yu et al., 2009). The above two techniques only use export data but do not consider import data, which reflects the country's demand. This study applied RC developed by Vollarth (1991) to incorporate the role of imports into the analyses. To calculate RC, we must first calculate revealed export advantage (RXA) and revealed import advantage (RMA). Subsequently, transform into logarithmic RXA and RMA and subtract them.

[1] The actual export of countries that deviated from the comparative-advantage-neutral point.

Revealed Export Advantage (RXA) and Revealed Import Advantage (RMA):

RXA = RCA,

RMA = $(M_{ij}/M_i)/(M_{wj}/M_w)$

M_{ij}= country i^{th} import of j^{th} product

M_i = total import of country i^{th}

M_{wj} = total output of the j^{th} product in the world

M_w = total import value of all products in the world.

Logarithmic transformation of the RCA

RCA = *ln* (RXA_{ij})

RMA = *ln* (RMAij)

Revealed Competitiveness (RC)

RC = *ln* (RXA_{ij}) - *ln* (RMA_{ij})

A positive RC value indicates a comparative advantage, whereas a negative RC value indicates a comparative disadvantage.

Findings

Growth and Stability of Cereal, Rice, and Wheat Exports

The growth rate of cereal exports from 2001 to 2023 is presented in Table 2. The table shows India's total exports, including cereals, rice, and wheat. Furthermore, the coefficient of variation indicates the stability of exports for the respective categories.

Table 2: CAGR, CV, and Cuddy–Della Index from 2001 to 2023

	CAGR	C.V.	Cuddy-Della
Cereal export	11.75	66.55	29.30
Wheat export	10.65*	141.72	128.72
Rice export	13.00	66.64	58.17
Total export	9.90	51.81	13.89

Source: Author's calculation. * = Not significant.

Table 2 shows that India's total trade grew at a 9.90per cent CAGR from 2001 to 2023, with a moderate CV (51.81per cent) and Cuddy-Della (13.89), indicating stable growth in total Indian exports. The cereals were grown at an 11.75per cent CAGR with a CV score of 66.55per cent and exhibited a higher growth rate, albeit with moderate instability. However, the Cuddy-Della score of 29.30, which accounts for the trend in the time series, is lower than its counterpart, indicating lower instability in cereal exports. Table 1 shows that rice alone dominates the cereal trade. We found that rice had the highest CAGR of 13.00per cent compared to cereals and wheat, and the CV score was 66.64per cent, similar to that of cereal exports. Meanwhile, the Cuddy-Della score of 58.17 indicates moderate instability in rice exports over time. In contrast to the cereals, the Cuddy-Della score for rice is the dominant category. The CAGR of wheat was 10.65, which is insignificant and reflects the lack of relationship between wheat export trends and the analysis time. This may be attributed to the high variation in wheat exports. It is the most unstable cereal sub-category, with a CV score of 141.72per cent. The Cuddy-Della score of 128.72 indicates higher instability.

Cereal

According to the FAO (2024), world cereal production was estimated at 2,850.4 million tonnes in 2023, and 45per cent (approximately 1,282.5 million tonnes) of this production was sourced from Asia. Regarding global production, India contributes 304.36 million tons (APEDA, 2024), accounting for 10.67per cent of the world's production and 23.73per cent of Asia's production, respectively. Moreover, cereal production plays a crucial role in food security for most populus countries, leaving a surplus that can be exported. Thus, we employed RCA and NRCA to assess cereal export performance. Figure 1 presents the comparative advantage of cereals from 2001 to 2023.

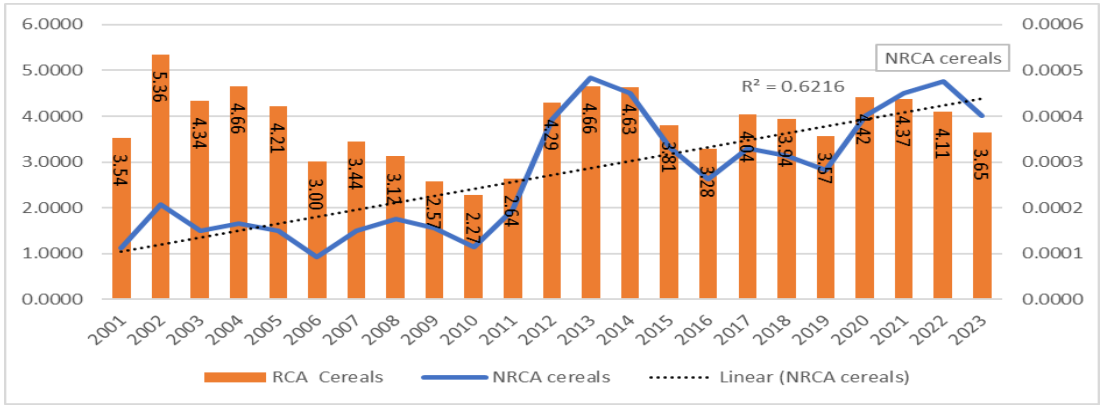

Figure 1: India's RCA and NRCA for cereals exported from 2001 to 2023

Source: Author's calculation

The RCA trend indicates a strong comparative advantage for cereals in the world market; however, it fluctuates over time. The RCA score exceeds 2 within the stated time frame, indicating a strong comparative advantage for the cereal category. However, the RCA trend does not follow a stable path; instead, it fluctuates. Starting from 2001, the RCA score was 3.54 in 2001, reaching its highest value of 5.36 in 2002. Subsequently, the RCA declined to its lowest value of 2.27 in 2010. The RCA rose to 4.66 in 2013, the second highest after 2002. The impact of COVID-19 does not appear to have affected cereal exports, as indicated by the 2019 RCA value. Following the COVID-19 pandemic, the RCA score increased to 4.42 in 2020, but subsequently declined. In 2023, the RCA score was below 4, indicating a downward shift in the RCA of cereal exports. The RCA of cereals was 3.82 on average, indicating a more substantial comparative advantage. NRCA values greater than zero indicate a comparative advantage. The NRCA value follows a similar pattern to the RCA value in the same year. Moreover, NRCA exhibits a rising trend, as indicated by a 0.62 r-square value. NRCA peaks its value after 2011 and reaches its peak in 2013. Subsequently, the NRCA value drops in later years, spikes again in 2022 (following the COVID-19 pandemic), and declines thereafter.

Wheat

India is the second-largest wheat producer after China and the second-most important crop in India's food basket. India achieved new production levels, producing 113.29 million tonnes of wheat in 2023-24 (Government of India, 2024). Regarding trade, India exported 188.28 thousand metric tons of wheat worth 470.83 crores in 2023-24 (APEDA, 2024). However, the comparative advantage of wheat exports reveals some interesting facts. Wheat export performance is volatile, as revealed in Table 2. The following figure shows that the RCA and NRCA reveal wheat's comparative export advantage.

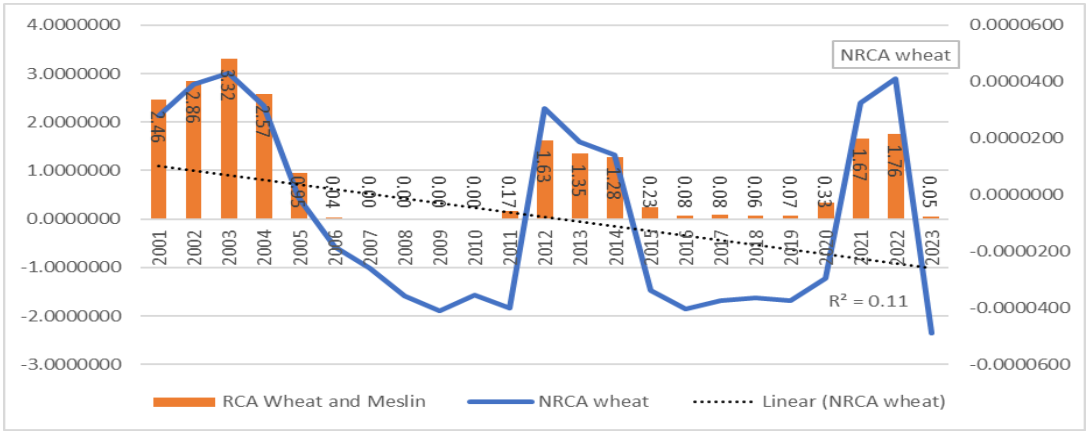

Figure 2: India RCA and NRCA of wheat exported from 2001 to 2023

Source: Author's calculation

Figure 2 shows the trends in RCA and NRCA for wheat from 2001 to 2023. The overall trend of wheat exports shows no signs of increasing exports, whether through wide fluctuations or a lack of upward trend. In 2003, the RCA peaked at 3.32 in 2003, revealing a strong comparative advantage. However, the RCA trend declined further and reached 0.00, indicating a poor comparative advantage for wheat export. From 2006 to 2011, the comparative advantage of wheat remained very low (around 0.00) and rose to 1.63 in 2012. However, the RCA score declined again in 2015 and remained low until 2019, revealing wheat's abysmal export performance in the world market. The RCA score began to surge in 2020, and after the COVID-19 pandemic, it reached 1.67 and 1.76 in 2021 and 2022, respectively. The COVID-19 pandemic had a positive impact on wheat exports. However, the RCA score declined in 2023 and reached 0. From 2001 to 2023, the average RCA score was 0.91, indicating a low comparative advantage for wheat. Owing to the limitation of RCA, it cannot be negative. The NRCA shows wheat has a very low comparative advantage from its neutral point. The NRCA score was negative from 2005 to 2011, indicating a poor comparative advantage for wheat exports. Similarly, the NRCA scored negatively from 2015 to 2020. Moreover, the NRCA trendline is depicted as downward, with a very high correlation (r^2 = 0.11). Wheat is the only agricultural commodity in the cereal category with a negative NRCA score. The factors that may result in poor comparative advantage during the two periods are discussed.

Rice

In 2023-24, rice production reached 137.83 million tonnes (Government of India, 2024). India exports rice in basmati and non-basmati (Arun D et al., 2024). India's basmati rice is world-renowned and exported to the Middle East and the USA. 2023-24, India exported 5.2 million metric tons of basmati rice worth Rs 48.38 thousand crores. At the same time, non-basmati rice was exported to the African region, reaching 11.11 million metric tonnes worth Rs 37,804 crore in 2023-24 (APEDA, 2024). Indian rice exports worldwide have shown tremendous growth and a rising trend, as shown in Figure 3.

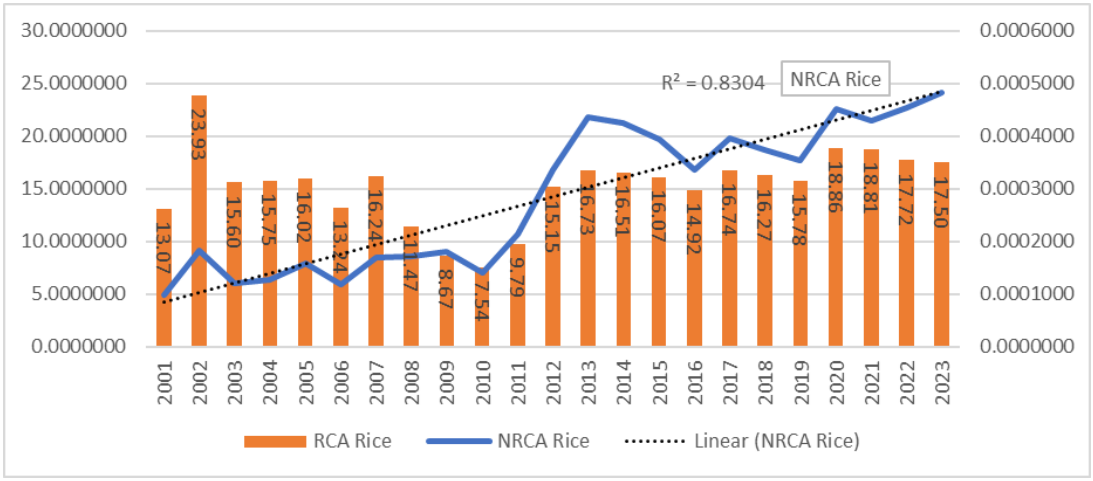

Figure 3: India RCA and NRCA of rice exported from 2001 to 2023

Source: Author calculation

Figure 3 shows the RCA and NRCA of rice exports from India from 2001 to 2023. The overall RCA trend shows a rising trend. The RCA value peaked at 23.93 in 2002, indicating a strong comparative advantage for rice exports. However, it declined to its lowest value of 7.54 in 2010. Despite its low RCA value, it has a strong comparative advantage in rice production. The RCA trend then rose again in 2012. The RCA trend of rice has been rising even after the 2019 pandemic, indicating no significant impact on rice exports during the COVID-19 pandemic. Post-COVID-19, rice exports strengthened, and the RCA score rose to 18.81 in 2021. On average, the rice RCA value from 2001 to 2023 was 15.32, indicating a higher overall RCA value. The NRCA revealed a rising trend over time, whereas the trend line revealed a higher trend that departed from the RCA trend. Moreover, the NRCA value exhibits a rising trend with a strong correlation (0.83), indicating that India's share of world rice exports is greater than its overall share in world trade. India has achieved specialisation in rice production and its exports. Furthermore, the NRCA of rice has increased after the COVID-19 pandemic, indicating a higher demand for Indian rice in the global market.

Revealed Competitiveness of Cereals, Rice, and Wheat

The above analysis of RCA and NRCA for cereals, rice, and wheat includes only exports of these categories. However, it ignores the demand side, i.e., imports of these products, which may lead to different perspectives. The Revealed Competitiveness Index measures cereal exports and imports.

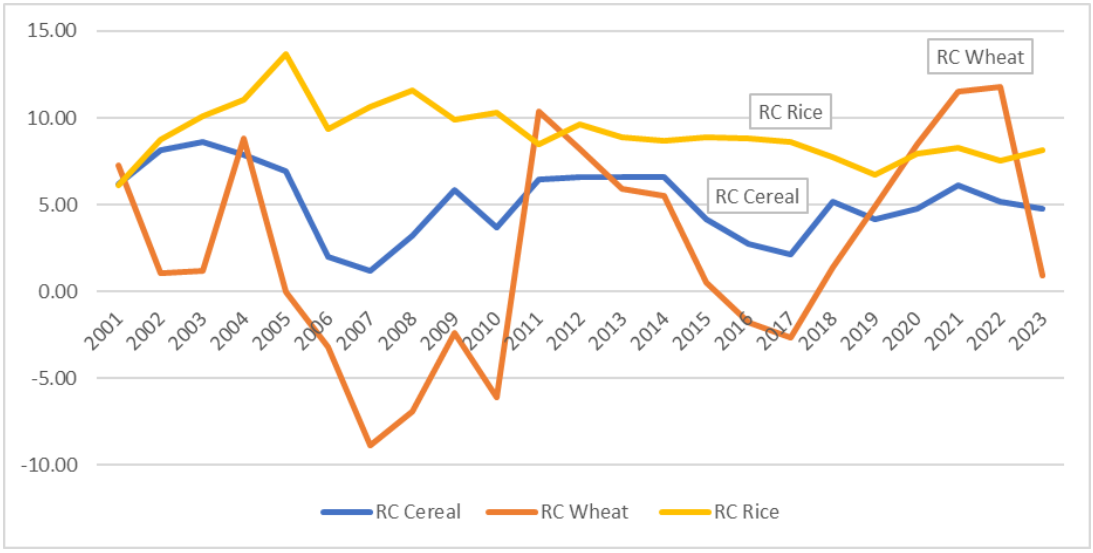

Figure 4: India's RC of cereals, rice, and wheat exported from 2001 to 2023

Source: Author's calculation

Figure 5 shows the RC of cereals, rice, and wheat from 2001 to 2023. The RC shows no rising or downward trends starting with cereals, but wide fluctuations over time. The fluctuations in cereal production may be attributed to the poor performance of the wheat RC trend. The RC of cereals dropped to its lowest level in 2007, when wheat was negative. Subsequently, cereals began to rise and stabilise from 2011 to 2014. Afterwards, cereals declined again due to poor wheat performance. Rice also follows a stable path from 2001 to 2023. Rice stability indicates a strong export performance with negligible imports from other countries. However, RCA and NRCA revealed a rising trend of rice comparative advantage, whereas no rising trend was observed when RC was analysed. Wheat fluctuates widely over the years and reaches a negative RC value in two phases, in contrast to rice. From 2006 to 2010, the wheat RC value declined, indicating a lower comparative advantage and increased import dependency. From 2015 to 2017, the wheat RC again reached a negative value. The COVID-19 pandemic seems to have boosted wheat exports, with the RC value reaching an all-time high in 2022. However, it fell significantly in 2023.

Discussion

The findings highlight important insights into India's comparative advantage in rice and wheat exports. Although India is the second-largest producer of rice and wheat globally, data reveal contrasting trends in their export performance. Our analysis suggests that Indian rice is highly competitive globally, whereas wheat faces challenges with fluctuating export levels. Rice has emerged as the most exported cereal, exhibiting a high RCA, which past studies have confirmed (Bhatia et al., 2021; Saxena et al., 2023). Wheat has a less stable comparative advantage, with frequent fluctuations reported in other studies (O. P. Singh et al., 2020). Wheat exports registered negative NRCA values during two key periods: 2005–2011 and 2015–2020, likely due to domestic and international factors. From 2001 to 2008, India experienced an economic boom (Nagaraj, 2013), which initially boosted cereal exports. However, while other cereals saw growth, wheat exports declined after 2005. The 2008 global recession was a significant event that contributed to this downturn. Although Indian agriculture was less affected than other sectors, cereal exports, particularly wheat, fell sharply as key trading partners, such as Japan, the U.S., the U.K., and other European and Asian countries, were impacted by the recession (Kumar et al., 2010). During this period, rice exports demonstrated resilience, maintaining a strong comparative advantage despite declines in other agricultural exports. However, wheat dropped to a zero RCA score

with a negative NRCA. Additionally, the recession led India to implement policies to control food inflation and stabilise domestic supplies. These policies included quantitative restrictions on cereal exports to protect consumers, although they often had adverse effects on farmers. As Ghosh (2017) noted, frequent policy changes created uncertainty, leading to volatility in export levels.

The 2013 National Food Security Act (NFSA), introduced in 2013, significantly shaped export dynamics. Aimed at shielding vulnerable populations from food price fluctuations, the NFSA intensified domestic wheat demand. Some studies, such as Debnath et al. (2018), suggest that subsidised rice under the NFSA hurt rice exports; however, our analysis found that rice's comparative advantage remained largely unaffected, whereas wheat exports showed a clear downward trend. The decline in wheat exports from 2015 to 2019 can be attributed to low domestic production and price fluctuations. Pesticide residues in rice and wheat have become a significant concern for Indian exports. Saxena (2023) identified pesticide residues as a primary reason for export rejections, particularly in the U.S. and European Union (EU) markets, which have stringent import standards. These rejections affected both export volumes and India's international reputation.

Another significant event, the COVID-19 pandemic, led to a global economic slowdown. However, unlike previous economic downturns, the pandemic did not negatively affect rice and wheat exports. Exports surged, possibly due to international support programmes for vulnerable countries and increased demand for staple grains. Ultimately, India's agricultural export basket has undergone significant evolution over the years. While food grains were the primary export from 1992 to 2013, by 2020–21, the composition had shifted to focus on marine goods, spices, buffalo meat, and rice (Vinod Kumar, 2021). This shift may have contributed to the decline in wheat exports as other products gained priority in India's export strategy.

Conclusion

Indian agriculture is mainly dominated by rice and wheat, and is the second-largest producer in the world (APEDA, 2024). The agriculture sector's contribution to foreign earnings has positively affected the economy. Comparative advantage plays a pivotal role in boosting a country's exports. This indicates low production costs and efficiency, allowing goods to be exported at competitive prices. In this study, we analysed the comparative advantage of Indian agricultural cereals. India's cereal export landscape is a tale of two grains: rice and wheat. While rice has proven to be a resilient and highly competitive export commodity that maintains a strong comparative advantage despite economic fluctuations, wheat exports have been far more inconsistent. The overall comparative advantage of cereals is resilient only due to the dominance of rice exports, whereas wheat exports contribute negligibly. Rice had higher RCA and NRCA scores and stable RC scores over the years.

In contrast, wheat exports fluctuate widely. Wheat is susceptible to price fluctuations, domestic supply, and frequent quantitative export restrictions. Factors such as the 2008 global recession, pesticide residue issues, and frequent shifts in agricultural export policies have affected the global performance of wheat. Additionally, the National Food Security Act (NFSA) and shifting domestic demand priorities have limited wheat export potential, aiming to safeguard food security. To meet international demands, stabilising wheat exports may require strategic policy consistency, quality improvement initiatives, and pesticide standards. India's evolving agricultural export basket focuses on products with stable demand and competitive advantages, ensuring that rice remains a pillar of its agricultural exports while navigating the complexities of wheat export growth.

References

1. APEDA. (2024). *Cereal*. Agricultural and Processed Food Products Export Development Authority (APEDA). https://apeda.gov.in/apedawebsite/six_head_product/cereal.htm
2. Arun D, V.R., R., Venkatesh, P., Devi, A., Kumar, P., & Sharma, A. (2024). Exploring Rice Export Competitiveness in India: A Comparative Analysis of Rice Products. *Indian Journal of Economics and Development*, *20*(4), 621–628. https://doi.org/10.35716/IJED-23240
3. Bakhshinejad, M., & Hassanzadeh, A. (2012). Comparative advantage of selected agriculture products in Iran: a revealed comparative advantage assessment. *Agricultura Tropica et Subtropica*, *45*(1), 28–31.
4. Bathla, S., & Sharma, S. K. (2017). An Overview of Indian Agriculture in the Global Context. In S. K. Sharma & S. Bathla (Eds.), *Indian Agriculture Under Multilateral and Regional Trade Agreements Competitiveness and Food Security* (1st ed., pp. 1–18). Bookwell.

5. Bhatia, J. K., Mehta, V. P., Bhardwaj, N., & Nimbrayan, P. K. (2021). *Export-Import Performance of Major Agricultural Commodities in India Export-Import Performance of Major Agricultural Commodities in India*. *March*. https://doi.org/10.46852/0424-2513.1.2021.15

6. Borges Aguiar, G. M., & Balogh, J. M. (2022). Analysis of the Competitiveness in the Agri-food sector: The case of Latin America and the Caribbean Region. *Competitio*, *21*(1–2), 92–117. https://doi.org/10.21845/comp/2022/1-2/2

7. Fertö, I., & Hubbard, L. J. (2003). Revealed comparative advantage and competitiveness in Hungarian agri-food sectors. *World Economy*, *26*(2), 247–259. https://doi.org/10.1111/1467-9701.00520

8. Gnidchenko, A. A., & Salnikov, V. A. (2021). *TRADE INTENSITY , NET TRADE , AND REVEALED COMPARATIVE ADVANTAGE* (WP BRP 244/EC/2021; Economics).

9. GOI. (2018). Agriculture Export Policy. In *Department of Commerce, Ministry of Commerce and Industry*. https://commerce.gov.in/wp-content/uploads/2020/02/NTESCL636802085403925699_AGRI_EXPORT_POLICY.pdf

10. Government of India. (2024). *Agricultural Statistics at a Glance, 2023*. https://desagri.gov.in/wp-content/uploads/2024/09/Agricultural-Statistics-at-a-Glance-2023.pdf

11. Ishchukova, N., & Smutka, L. (2013). Revealed comparative advantage of Russian agricultural exports. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *61*(4), 941–952. https://doi.org/10.11118/actaun201361040941

12. Jagdambe, S. (2017). Analysis of Revealed Comparative Advantage in Export of India's Agriculture Products. In S. K. Sharam & S. Bathla (Eds.), *Indian Agriculture Under Multilateral and Regional Trade Agreements Competitiveness and Food Security* (1st ed., pp. 45–70). Centre for WTO studies.

13. Kumar, V. (2021). Trends and Performance of India ' s Agricultural Trade in the Midst of COVID-19 Pandemic. *Indian Journal of Agricultural Economics*, *76*(3), 352–370.

14. Parikh, K. S., Narayana, N. S. S., Panda, M., & Kumar, A. G. (1997). Agricultural trade liberalisation: growth, welfare and large country effects. *Agricultural Economics*, *17*(1), 1–20. https://doi.org/10.1111/j.1574-0862.1997.tb00460.x

15. Rana, A., Arya, V., & Sharma, N. (2022). Heavy Uses of Pesticides in India: A Quantitative Analysis. *Indian Journal of Ecology*, *49*, 994–1004. https://doi.org/10.55362/ije/2022/3627

16. ŞAHİNLİ, M. A. (2014). Revealed Comparative Advantage and Competitiveness: Turkey Agricultrue Sector. *YYU J AGR SCI*, *24*(3), 210–217. https://doi.org/10.29133/yyutbd.236276

17. Sarker, R., & Ratnasena, S. (2014). *Revealed Comparative Advantage and Half-A-Century Competitiveness of Canadian Agriculture: A case study of Wheat, Beef and Pork Sectors* (165675; CATPRN Working Paper 2014-01). https://ageconsearch.umn.edu/record/165675

18. Sharma, V. P., & Jain, D. (2011). High-Value Agriculture in India: Past Trends and Future Prospects. *Indian Institute of Management Working Paper*, 1–51.

19. Singh, O. P., Anoop, M., & Singh, P. . (2020). Revealed Comparative Advantage, Competitiveness and Growth Performance:Evidences from India's Foreign Trade of Agricultural Commodities. *Indian Journal of Agriclture Economic*, *75*(4), 560–577. https://isaeindia.org/wp-content/uploads/2021/03/12-Article-OP-Singh.pdf

20. Singh, S., Chand, R., Sendhil, R., & Singh, R. (2017). Tracking the performance of Indian agriculture. *Indian Journal of Agricultural Sciences*, *87*(12), 1619–1626. https://doi.org/10.56093/ijas.v87i12.76492

21. Stellian, R., & Danna-Buitrago, J. P. (2022). Which revealed comparative advantage index to choose? Theoretical and empirical considerations. *CEPAL Review*, *2022*(138), 45–66. https://doi.org/10.18356/16840348-2022-138-3

22. WTO. (2023). *World Trade Statistical Review 2023*.

23. Yu, R., Cai, J., & Leung, P. S. (2009). The normalised revealed comparative advantage index. *Annals of Regional Science*, *43*(1), 267–282. https://doi.org/10.1007/s00168-008-0213-3

❑❑❑