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Export performance of agricultural trade in India

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Abstract

The present study explores the export performance of agriculture trade in India. Agriculture continues to occupy a central position in the Indian economy. It contributes significantly to the Gross Domestic Product (GDP), provides employment to a substantial segment of the population, ensures food security, and supplies raw materials to various agro-based industries. The sector also plays a crucial role in generating foreign exchange earnings through exports of agricultural commodities. Agriculture remains a cornerstone of global food security and international trade.

The specific objective for the present study was to assess performance of agricultural trade in India. The secondary data from last 20 years on export quantity, export value was collected from various government publications and websites such as FAO Trade database APEDA, India stat and world Trade Integrated Solution. The data pertains for the year 2005 to 2024. The present analysis has used analytical technique like Compound Growth Rate (CGR), Coefficient of Variation (CV) & Cuddy-Della Valle Index (CDVI).

It could be seen from the result, the India's agricultural exports and imports recorded significant positive growth during the study period. Export quantity and value increased substantially, with overall annual growth rates of 6.09 and 9.88 per cent, respectively, while import quantity and value grew by 5.98 and 11.89 per cent, respectively. India's share in world agricultural export quantity increased from 0.96 per cent in 2005 to 3.63 per cent in 2024, while the share of import quantity increased from 0.79 per cent to 2.38 per cent, showed growing integration with international agricultural markets. However, agricultural trade exhibited moderate instability, particularly in trade values, due to fluctuations in international prices, domestic production, trade policies and changing global market conditions. Hence, the growing importance of agricultural trade in India's economy and indicate the need for policies aimed at enhancing export competitiveness, promoting value-added agricultural products, reducing trade instability and strengthening India's position in international agricultural markets.

Keywords: Agricultural trade, compound growth rate, coefficient of variation, Cuddy-Della Valle index, index number, export performance

Introduction

International trade has emerged as a fundamental driver of economic growth and structural transformation across nations. It enables countries to specialize according to their comparative advantage, promotes efficient allocation of resources, facilitates capital accumulation, and enhances technological progress. Over the past few decades, many developing economies, particularly in Asia, have experienced rapid economic expansion largely attributed to their increasing integration into global trade systems. Trade liberalization, coupled with domestic economic reforms, has played a pivotal role in accelerating growth, reducing poverty, and improving living standards. In the context of India, the evolution of trade policy reflects a gradual shift from a highly regulated and inward-looking regime to a more open and market-oriented system. In the initial decades following independence, India adopted a protectionist approach, emphasizing self-reliance and import substitution.

The primary objective during this period was to achieve food security and reduce dependence on external markets, particularly in the agricultural sector, which served as the backbone of the economy and the principal source of livelihood for a large proportion of the population.

India's agricultural trade has witnessed notable changes in recent years. The agricultural sector has also demonstrated resilience in the face of global economic uncertainties and domestic challenges. Despite fluctuations in global markets, the sector has maintained a positive trade balance, indicating that exports have consistently exceeded imports. India's agricultural export landscape over the past decade reflects substantial growth, though uneven across commodity groups. Changes in comparative advantage and evolving global market conditions continue to shape export performance, while also influencing the future potential for expanding agricultural exports (Suresh and Mathur, 2016) ^[7]. This highlights the sector's potential as a stable contributor to

economic growth and foreign exchange earnings. The significance of this study lies in its potential to contribute to policy formulation and strategic planning in the agricultural sector.

Objective

To assess performance of agricultural trade in India

Material and Method

The data regarding Agricultural trade and export of major agricultural product collected through various government publications and websites; Food and Agriculture Organization, (FAO) trade database, Indiastat and world Trade Integrated Solution (WTIS), Reserve Bank of India (RBI), World Trade Organization (WTO), Agricultural and Processed Food Products Export Development Authority (APEDA), etc. Data pertaining to export quantity, export value, import quantity, import value, etc. The data pertains for past 20 years from Year 2005 to 2024. The period has been divided into two sub-periods and overall period,

- Period I (2005 to 2014)
- Period II (2015 to 2024)
- Overall period (2005 to 2024)

Compound Growth Rate

The performance agriculture trade was estimated by calculating Growth Rate and Cuddy-Della Valle Index (CDVI).

The performance of agricultural trade in India was estimated by using following exponential model.

$$Y = a \cdot b^t \dots\dots\dots (1)$$

Where,

Y= Export/Import (Quantity and Value)

a= Intercept

b= Regression Coefficient

t = Time variable

Now,

$$\log Y = \log a + \log b \dots\dots\dots (2)$$

Percent compound growth rate compounded by using

$$\text{CGR}(r) = [\text{Antilog}(\log b) - 1] * 100 \dots\dots\dots (3)$$

r = Compound Growth Rate

Test of significance = student t- test

Coefficient of Variation

$$\text{Coefficient of variation (\%)} = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

$$\text{CV} = \frac{\sigma}{\bar{x}} \times 100$$

$$\text{Standard deviation } (\sigma) = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$$

Where,

σ = Standard deviation

$\bar{x}$ = Mean

x_i = Variable

n = Number of observation

Cuddy-Della Valle Index

Cuddy-Della Valle index (CDVI) is calculated by using;

$$\text{CDVI} = \text{CV} \sqrt{1 - R^2}$$

Where,

CV = Coefficient of variation

R^2 = Coefficient of determination of the trend regression

Adjusted R^2 = Coefficient of regression adjusted by the degrees of freedom.

Index number

An index number is statistical measure design to show changes in variables or group of related variables with respect to the time. Index number were calculated by using initial triennium average (2005 to 2007) as a base year. The following formula used to estimate the index number.

$$\text{Index number} = \frac{\text{Current year value}}{\text{Base year value}} \times 100$$

Result and Discussion

Over the years, India's agricultural exports and imports have undergone significant changes due to factors such as economic liberalization, implementation of the World Trade Organization (WTO) Agreement on Agriculture, changing global demand, technological advancements, price fluctuations, and various regional and bilateral trade agreements. Therefore, an assessment of the performance of agricultural trade is essential to understand its growth pattern, composition, direction, and overall contribution to the national economy. In this context, the present section examines the trends and performance of India's agricultural exports and imports during the study period (2005 to 2024) using appropriate statistical measures and analytical tools to provide a comprehensive understanding of the country's agricultural trade dynamics.

India's share in world agriculture trade

An analysis of India's share in world agricultural trade provides valuable insights into its contribution to global markets and its changing position in international agricultural commerce. The India's share in world agriculture trade in per cent is presented in Table 1.

Table 1 depicts India's percentage share in world agricultural trade in terms of quantity and value during the period 2005–2024. The results indicated that a significant improvement in India's contribution to global agricultural exports over the study period. India's share in world agricultural export quantity increased from 0.96 per cent in 2005 to 3.63 per cent in 2024, reaching a peak of 5.17 per cent in 2022.

Similarly, the share in export value rose from 1.65 per cent in 2005 to 3.00 per cent in 2024, with the highest share of 3.70 per cent recorded in 2013. Rupee depreciation (2012–13) made Indian farm goods cheaper for foreign buyers — explaining why *quantity* share (4.18%) rose much faster than *value* share (3.70%). The increase in export share reflects the expansion of agricultural production, improved export competitiveness, diversification of export commodities, and greater integration with international markets.

Table 1: India's share in world agriculture trade

Year	India's per cent share in world agricultural trade (%)			
	Export		Import	
	Quantity	Value	Quantity	Value
2005	0.96	1.65	0.79	0.82
2006	1.23	1.85	1.26	0.99
2007	1.58	2.32	0.91	0.89
2008	2.06	1.93	0.92	0.87
2009	0.87	1.95	1.28	1.38
2010	1.77	2.13	0.78	1.01
2011	2.68	2.72	0.93	1.37
2012	3.53	3.41	1.12	1.59
2013	4.18	3.70	1.18	1.44
2014	3.60	3.15	1.74	1.55
2015	2.87	2.81	2.05	1.78
2016	2.42	2.51	1.90	1.90
2017	2.73	2.69	2.40	1.96
2018	2.78	2.65	1.68	1.51
2019	2.58	2.56	1.82	1.55
2020	3.33	2.71	1.60	1.44
2021	4.77	2.97	1.52	1.76
2022	5.17	3.01	1.62	1.96
2023	4.02	2.84	1.88	1.75
2024	3.63	3.00	2.38	2.05
CGR	6.95	2.34	4.82	4.23
CV	42.69	20.29	33.74	26.28
CDVI	27.06	15.95	21.49	14.54

(***, **, * represent significant at 1%, 5% and 10% respectively)

On the import side, India's share in world agricultural import quantity increased from 0.79 per cent in 2005 to 2.38 per cent in 2024, while the import value share rose from 0.82 per cent to 2.05 per cent during the same period. The import quantity share was highest in 2024 (2.38 per cent), whereas the maximum import value share was also recorded in 2024 (2.05 per cent). The gradual rise in import shares reflects increasing domestic demand for selected agricultural commodities.

The export quantity recorded the highest growth rate of 6.95 per cent, followed by import quantity (4.82%), import value (4.23%), and export value (2.34%), indicating that the expansion in trade was driven more by growth in physical volumes than by trade value. The Coefficient of Variation (CV) reveals that export quantity exhibited the highest variability (42.69%), followed by import quantity (33.74%), import value (26.28%), and export value (20.29%), suggesting that trade quantities fluctuated more than trade values over time. Similarly, the Cuddy-Della Valle Instability Index (CDVI), which measures instability after accounting for the trend, showed that export quantity experienced the highest instability (27.06%), followed by import quantity (21.49%), export value (15.95%), and import value (14.54%).

India's export share rises mainly through volume-driven, price-competitive surges (2012–13, 2021–22) — often triggered by policy liberalization or restriction removal, surplus stocks from good harvests, global supply shocks (Ukraine war, pandemic) that open market gaps, and currency depreciation. But value share consistently lags quantity share, indicating India remains a supplier of relatively low-value bulk commodities rather than high-value processed agricultural exports.

Per cent share of India's Agriculture trade in India's national trade

The analysis provides an understanding of the contribution of the agricultural sector to India's overall trade performance and examines how its share has changed over time in response to economic growth, trade liberalization, global market conditions, and agricultural trade policies. The per cent share of India's agriculture trade in Indian national trade is presented in Table 2.

Table 2: Per cent share of India's agriculture trade in India's national trade

Year	Per cent share of India's agriculture trade in India's national trade (%)	
	Export	Import
2005	6.53	6.54
2006	6.49	6.75
2007	7.83	6.32
2008	6.98	5.63
2009	6.60	7.75
2010	5.98	5.05
2011	7.75	6.32
2012	9.99	6.47
2013	10.84	6.00
2014	9.53	6.63
2015	8.54	7.40
2016	7.37	7.54
2017	7.68	7.36
2018	7.23	4.92
2019	7.05	5.23
2020	8.18	5.70
2021	7.70	5.46
2022	7.30	5.42
2023	6.85	4.78
2024	6.81	5.01
CGR	0.20	-1.27**
CV	16.22	15.31
CDVI	16.16	13.30

(***, **, * represent significant at 1%, 5% and 10% respectively)

It is observed from Table 2 that, agriculture consistently contributed a significant, though fluctuating, share to India's overall merchandise trade. The share of agricultural exports in total national exports varied between 5.98 per cent and 10.84 per cent during the study period. It increased from 6.53 per cent in 2005 to a peak of 10.84 per cent in 2013, reflecting robust growth in agricultural exports driven by higher production, favourable global demand, and improved export competitiveness. Thereafter, the export share exhibited a gradual declining trend, falling to 6.81 per cent in 2024, indicating that the growth of non-agricultural exports outpaced agricultural exports in recent years. On the import side, the share of agricultural imports in total national imports remained relatively lower and more stable, fluctuating between 4.78 per cent and 7.75 per cent. The highest import share was recorded in 2009 (7.75 per cent), while the lowest was observed in 2023 (4.78 per cent). The declining share of agricultural imports in recent years suggests that India's overall imports have become increasingly dominated by non-agricultural commodities such as petroleum, machinery, electronics, and other manufactured products.

The Compound Growth Rate shows a marginal positive growth of 0.20 per cent in the share of agricultural exports, indicating a slight increase in agriculture's contribution to the country's total exports over time. In contrast, the share of agricultural imports recorded a negative growth rate of -1.27 per cent, suggesting a gradual decline in agriculture's contribution to India's total imports. The Coefficient of Variation values reveal relatively low variability in both export (16.22%) and import (15.31%) shares, indicating that the proportion of agricultural trade in national trade remained fairly consistent over the study period. Similarly, the Cuddy-Della Valle Instability index values of 16.16 per cent for exports and 13.30 per cent for imports indicate low instability after removing the long-term trend, reflecting a stable pattern in the contribution of agricultural trade to India's overall trade.

Index number of India’s agricultural trade

The index numbers of India's agricultural trade are used to measure the relative changes in the value, quantity, and unit value of agricultural exports and imports over time with reference to a base year. These indices provide a clear understanding of the growth pattern, price movements, and overall performance of India's agricultural trade during the study period. Index number of India’s agricultural trade is presented in Table 3

Table 3: Index number of India’s agricultural trade (Base year = Initial Triennium ending average of 2005-2007)

Year	Export quantity	Export value	Import quantity	Import value
2005	77.94	72.80	75.50	79.56
2006	92.52	89.92	124.41	105.15
2007	129.54	137.28	100.08	115.29
2008	97.30	139.76	99.88	135.98
2009	73.16	125.17	141.97	190.93
2010	86.73	155.55	90.53	154.92
2011	130.94	247.65	114.12	264.34
2012	186.69	319.93	147.06	309.88
2013	211.42	365.41	158.71	295.24
2014	180.46	318.70	178.68	330.53
2015	148.36	254.08	217.36	347.27
2016	136.63	231.36	240.76	374.11
2017	155.43	273.29	286.98	425.55
2018	158.99	278.02	200.93	339.51
2019	150.10	266.34	219.49	344.40
2020	201.81	291.96	199.56	332.90
2021	294.29	372.50	197.23	477.16
2022	313.93	685.76	209.82	979.72
2023	241.64	644.39	239.27	861.86
2024	218.70	679.31	292.27	986.38

It is revealed from Table no.3, the index numbers of India's agricultural trade for export value, import value, export quantity, and import quantity during the period 2005–2024. The results indicate a substantial expansion in India's agricultural trade over the study period, with a more pronounced increase in trade values than in trade quantities. The export value index increased from 72.80 in 2005 to 679.31 in 2024, while the import value index increased more sharply from 79.56 to 986.38, indicated a significant rise in the monetary value of agricultural trade. Similarly, the export quantity index increased from 77.94 to a peak of 313.93 in

2022 before declining to 218.70 in 2024, whereas the import quantity index exhibited a steady upward trend from 75.50 in 2005 to 292.27 in 2024, the highest value recorded during the study period.

The faster growth in value indices compared to quantity indices suggests that, increasing international prices, higher unit value realisation, and changes in the composition of traded agricultural commodities contributed significantly to the expansion of agricultural trade. India's agri-trade value growth since 2020, especially 2021-2022, was driven overwhelmingly by global commodity price inflation (the Russia-Ukraine war shock) rather than by India trading proportionally more physical quantity. This applies to *both* exports (India earned much more per unit exported) and imports (India paid much more per unit imported) — meaning the war's price shock was a double-edged sword for India's agri-trade bill, inflating both earnings and costs simultaneously, and explaining why value indices in 2022-2024 are running at roughly 6-10 times the 2005-07 base while quantity indices are only 2-3 times the base.

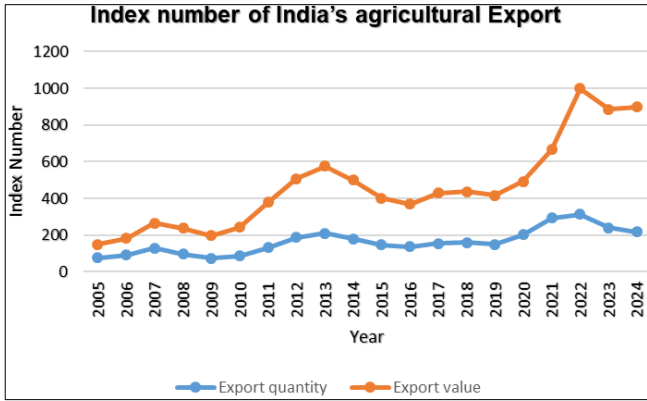


Fig 1: Index number of India’s agricultural Export (Base year = Triennium ending average of 2005-2007)

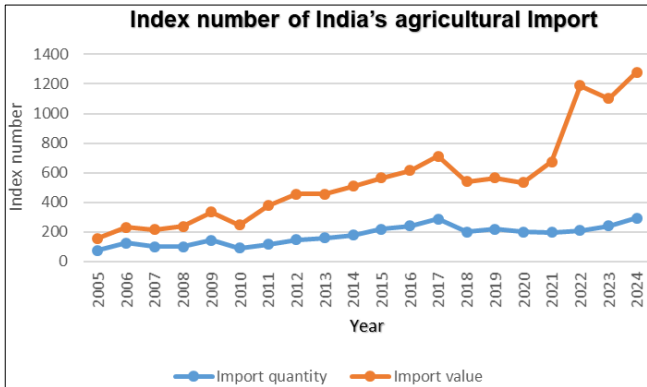


Fig 2: Index number of India’s agricultural Import (Base year = Triennium ending average of 2005-2007)

Figures 1 and 2 present the index numbers of India’s agricultural exports and imports, respectively, in terms of quantity and value during 2005–2024, taking the triennium ending average of 2005–2007 as the base (=100). The figures revealed that both agricultural exports and imports experienced a substantial overall expansion during the study period, although considerable year-to-year fluctuations were observed. In the case of exports, the quantity index increased

gradually, with notable growth during 2011–2013 and reaching its highest level of around 300 in 2022, before declining to approximately 220 in 2024. In contrast, the export value index increased more sharply, rising from around 150 in 2005 to nearly 570 in 2013 and subsequently fluctuating before recording a substantial increase after 2020. It reached a peak of about 1,000 in 2022 and remained at around 900 during 2023–2024. Similarly, the import quantity index showed a gradual upward movement, reaching around 300 in 2017 and again in 2024, whereas the import value index increased considerably from around 150 in 2005 to nearly 700 in 2017 and subsequently exhibited fluctuations. A particularly sharp increase was observed after 2021, with the import value index reaching approximately 1,200 in 2022 and about 1,300 in 2024, the highest level recorded during the study period. The substantially higher increase in the value indices compared with the quantity indices for both exports and imports indicates that the expansion in the value of agricultural trade

was influenced not only by changes in physical quantities but also by changes in international prices and the commodity composition of trade. The comparative movement further showed that agricultural imports experienced a stronger increase in value during the later years than exports.

Compound Growth Rate and Instability index of India’s agricultural trade

The analysis of compound growth rate and instability index provides a comprehensive assessment of the long-term growth performance and year-to-year fluctuations in India’s agricultural trade. While the compound growth rate measures the average annual rate of increase in exports and imports, the instability index evaluates the consistency and variability of trade performance for overall agricultural trade and major commodities such as rice, wheat, and cotton during the study period. The Compound growth rate and Instability index of India’s agricultural trade is presented in Table 4.

Table 4: Compound Growth Rate and Instability index of India’s agricultural trade (%)

	Export						Import					
	Quantity			Value			Quantity			Value		
	Period I	Period II	Overall period	Period I	Period II	Overall period	Period I	Period II	Overall period	Period I	Period II	Overall period
CGR	10.34***	8.29***	6.09***	19.41***	13.98***	9.88***	7.11***	0.55	5.98***	17.62**	13.16***	11.89***
CV	39.53	31.64	41.34	53.84	48.17	61.35	26.76	15.07	36.29	47.33	50.95	72.50
CDVI	26.69	20.16	23.69	16.47	22.50	27.99	18.38	15.88	18.43	12.42	31.49	24.91

(***, **, * represent significant at 1%, 5% and 10% respectively)

It is revealed from Table 4. that, the India's overall agricultural trade recorded positive and statistically significant growth in both exports and imports. The compound Growth Rate indicated a significant positive growth in agricultural exports throughout the study period. Export quantity grew at an annual rate of 10.34 per cent during Period I, 8.29 per cent during Period II, and 6.09 per cent over the overall period, with all estimates being statistically significant at the one per cent level. Similarly, export value recorded even higher growth rates of 19.41 per cent, 13.98 per cent, and 9.88 per cent during Period I, Period II, and the overall period, respectively, suggesting that, export earnings increased faster than export volumes, mainly due to higher export prices and improved value realization. On the import side, import quantity registered significant annual growth of 7.11 per cent during Period I and 5.98 per cent over the overall period, whereas the growth during Period II (0.55 per cent) was statistically insignificant, indicating a temporary slowdown in import expansion. Import value grew significantly throughout the study period, recording annual growth rates of 17.62 per cent, 13.16 per cent, and 11.89 per cent for Period I, Period II, and the overall period, respectively. The relatively higher growth in import value compared to import quantity reflects increasing international prices and higher import costs. The Coefficient of Variation (CV) revealed moderate to high variability in agricultural trade. Export quantity exhibited moderate variability, with CV values ranging from 31.64 to 41.34 per cent across the three periods. Export value showed relatively higher variability, particularly during Period I (53.84 per cent) and Period II (48.17 per cent), indicating considerable fluctuations in export earnings. Import quantity

was comparatively more stable during Period II, with the lowest CV of 15.07 per cent, while the overall variability remained moderate (36.29 per cent). Import value recorded the highest variability among all trade indicators, increasing from 47.33 per cent in Period I to 50.95 per cent in Period II and reaching 72.50 per cent during the overall period, indicating substantial fluctuations in import expenditure over time.

The Cuddy - Della Valle Instability Index (CDVI) further confirmed the extent of trade instability after accounting for long-term growth trends. Export quantity recorded moderate instability, with CDVI values of 26.69, 20.16, and 23.69 for Period I, Period II, and the overall period, respectively, indicating an improvement in export stability during the second period. Export value also showed moderate instability, with the highest instability observed during the overall period (27.99 per cent). Import quantity remained relatively stable throughout the study period, with CDVI values ranging between 15.88 and 18.43 per cent. Import value exhibited the greatest instability during Period II (31.49 per cent), although the instability moderated to 24.91 per cent over the overall period. These results suggested that, while India's agricultural trade experienced sustained growth, fluctuations in international prices, domestic production, policy interventions, and changing global market conditions contributed to moderate levels of instability, particularly in trade values.

Conclusion

1. The study concludes that India’s agricultural trade witnessed substantial expansion during 2005–2024, with a marked improvement in the country’s position in

- global agricultural markets.
2. India's share in world agricultural export quantity increased from 0.96 per cent in 2005 to 3.63 per cent in 2024, while the share of import quantity increased from 0.79 per cent to 2.38 per cent, showed growing integration with international agricultural markets.
 3. Agricultural exports and imports recorded positive and statistically significant growth over the study period, with export quantity and value growing at 6.09 and 9.88 per cent annually, respectively, while import quantity and value increased by 5.98 and 11.89 per cent, respectively.
 4. The substantially faster growth in trade values than quantities showed that international price movements and higher unit value realisation played an important role in the expansion of agricultural trade.
 5. The index analysis further confirms a considerable increase in both export and import values, particularly during 2021–2024, although this expansion was accompanied by considerable fluctuations in trade values.
 6. Despite the overall positive growth, the relatively high coefficient of variation and Cuddy–Della Valle instability index for trade values showed that India's agricultural trade remains vulnerable to international price fluctuations, domestic production conditions, policy interventions, and global market shocks.
 7. Hence, India has strengthened its presence in global agricultural trade. however, greater emphasis on value addition, export diversification, processed agricultural products, market stability, and measures to reduce exposure to global price and supply shocks would be essential for achieving sustained and resilient agricultural trade growth.

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