

“Evaluating The Export Competitiveness of Indian Cotton Value Chain: A Dual Matrix Approach”



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Abstract

Cotton, termed as ‘White Gold’, is an important component of Indian agriculture and the industrial sector. While India has enjoyed advantages in cotton production and export for a long time, historical dominance does not ensure future competitiveness. This study investigates whether India’s export growth is supported by price competitiveness or structural market share across the value chain from raw cotton to cotton fabric. A quantitative research design was employed utilizing twenty years of secondary time series data (2004–2023). India’s overall competitiveness was evaluated using a dual matrix approach, cross-referencing price efficiency (Nominal Protection Coefficient - NPC) with global market performance (Revealed Comparative Advantage - RCA). India remains a competitive exporter of raw cotton and cotton yarn, maintaining both price efficiency (NPC < 1) and significant structural advantages (RCA > 1) due to a strong manufacturing base, competitive labour costs, and widespread adoption of high-yielding Bt cotton varieties. However, a price-performance gap was observed in value-added products like cotton thread and cotton fabric. These segments hold structural advantages (RCA > 1) but lack price competitiveness (NPC > 1) due to high domestic production costs and fragmented weaving units. Historical structural advantages alone cannot ensure future competitiveness against domestic price distortions and aggressive global competitors.

Keywords: *Cotton value chain, Export competitiveness, Dual matrix approach*

1. Introduction

Cotton, termed as ‘White Gold’, is an important component of Indian agriculture and the industrial sector. India is one of the largest producers of raw cotton in the world. In the Indian economy the cotton industry plays a crucial role. It contributes approximately 2 per cent to the GDP and providing a livelihood to over 45 million people (Ministry of Textiles, 2025). Besides, India is the second largest exporter of cotton (USDA, 2026). It boosts the Indian economy by generating valuable foreign exchange through cotton export. Thus, India has a dominant place in the domestic as well as global cotton market.

However, the expiration of the Multi-Fibre Arrangement (MFA) in the year 2005 has changed the international trade market over the period. It transitioned from a quota-based system to a hyper-competitive, quality-driven market. Only sustainable and price-efficient suppliers can survive in this highly competitive global cotton market (Hashim, 2005).

Though India has enjoyed advantages in cotton production and export for a long time, historical dominance does not ensure future competitiveness. It is necessary to scrutinise the ‘Indian Advantages’ in cotton export. This study investigates whether India’s export growth is supported by price competitiveness (NPC) or structural market share (RCA). It provides comprehensive insight into the value chain of cotton from raw cotton to cotton fabric.

2. Review of Literature

The Indian cotton industry has undergone various phases of trade liberalisation. Various studies have clearly identified the changes in the export competitiveness of Indian cotton over the periods. Initially, the Indian cotton industry was ‘disprotected’ to benefit domestic cotton mills Pursell and Gulati (1993). However, after the 1991 reforms, the Indian trade composition was changed, and it shifted to the specialised spinning sector Srinivasan and Bhalla (1998). Gulati et al. (2013) analysed the export competitiveness of Indian raw cotton during the peak adoption of Bt cotton and concluded that even though, domestic yield secure highly competitive advantages, aggressive hikes in domestic Minimum Support Price (MSP) and export restrictions threatened the sector. Manisha (2022) noted that India has competitive advantages in the export of basic, raw or low-tech cotton commodities but struggle in production and export of advanced or finished items. Indian weaving sector is dominated by the small-scale decentralised power-loom units. They lack economies of scale to compete with vertically integrated, state backed factories of rival countries like Vietnam and China. Gyan et al. (2024) observed that though, margin between domestic and international prices is narrow down due to increasing production and input costs, India has maintained high competitiveness in the export of cotton compared to other countries in the

international market. Furthermore, domestic price disadvantages are leveraged by external trade barriers such as lack of Duty-Free Quota-Free (DFQF) access to major markets compared to competitors Chakraborty and Gupta (2026).

3. Research Methodology

The quantitative research design was employed to study India's competitiveness in export of cotton. Twenty years secondary time series data from 2004 to 2023 was utilised for the study purpose. It was divided into three periods, Period I (2004-2013), Period II (2014-2023) and overall Period III (2004-2023). The data related to domestic prices, international prices and export value and quantity were collected from the DGCIS, Ministry of Commerce, Ministry of Textiles & Cotton Corporation of India, UN Comtrade and FAOSTAT. The collected data was analysed using NPC and RCA as under:

3.1 Nominal Protection Coefficient (NPC)

To test Price Competitiveness, the NPC is calculated to determine the degree of domestic price deviation from the international benchmark.

$$NPC = \frac{P_d}{P_b}$$

Where:

P_d = Domestic price of the cotton product

P_b = Border or international price

$NPC < 1$ indicates competitiveness whereas $NPC > 1$ indicates protection/inefficiency. However, NPC does not account for non-price factors like "Quality" or "Brand Value," which are critical in the Cotton Fabric sector.

3.2 Revealed Comparative Advantage (RCA)

To measure export specialization across the cotton value chain, Balassa's (1965) classical Revealed Comparative Advantage (RCA) index was used.

Although, various alternative mathematical modifications of index are there but this study still adheres to the traditional relative export share specification. Standard Balassa index gives more clear results when cross examined with the Nominal Protection Coefficient (Vollrath, 1991).

$$RCA = \frac{X_{ij}/X_{it}}{X_{wj}/X_{wt}}$$

Where:

X_{ij} = India's exports of cotton product j

X_{it} = India's total exports

X_{wj} = World exports of cotton product j

X_{wt} = Total world exports

$RCA > 1$ implies a comparative advantage; $RCA < 1$ implies a comparative disadvantage.

3.3 Instability Analysis (CV)

To test structural stability, the Coefficient of Variation (CV) was utilized to measure the consistency of competitiveness over time. A lower CV indicates higher stability in competitiveness.

$$CV \% = \sigma \mu \times 100$$

Where:

σ = Standard deviation

μ = Arithmetic mean

Competitiveness Matrix

India's overall competitiveness in export of cotton was evaluated using dual matrix approach. The competitiveness matrix involves cross-referencing of price efficiency (Nominal Protection Coefficient - NPC) with global market performance (Revealed Comparative Advantage - RCA).

Quadrant	Price Efficiency	Performance	Description	Competitiveness
I	$NPC < 1$	$RCA > 1$	Export strength backed by price efficiency	Highly Competitive
II	$NPC > 1$	$RCA > 1$	High export volume but domestic prices are uncompetitive	Protected Advantage
III	$NPC < 1$	$RCA < 1$	Price efficient but lacks global market share	Latent Potential
IV	$NPC > 1$	$RCA < 1$	Both price and market share are weak	Non-Competitive

Results and Discussion

Product wise analysis of NPC

The NPC value of raw cotton exports shows an increasing trend during the study period. It ranged from 0.68 in the year 2004 to 1.09 in the year 2022. However, it generally remains below or near to one with overall twenty years mean value 0.92. It indicates competitive advantages in export of raw cotton as domestic prices of raw cotton were lower than international prices due to large production and lower labour cost.

In case of cotton yarn, the NPC remained below one in all years except 2006 (1.02), 2021 (1.04) and 2022 (1.12). It ranges from 0.77 in 2015 to 1.12 in 2022 with mean value 0.93. The results shows that India had strong competitive advantages in export of cotton yarn. This may be due to availability of raw material, and competitive labour costs which results in lower domestic prices of cotton yarn compared to international prices.

The export of cotton thread registered NPC value less than one up to the year 2010 except 2008 (1.10). It was either more than or closer to one in rest of the years. The minimum NPC (0.62) was for the year 2006 which gradually tends to increase and reached to 2.08 in the year 2023. The average NPC for the study period was 1.15. The result indicates that India had competitive advantages in the export of cotton thread in the initial years, but it turned into a competitive disadvantage in the latter part of the study period as domestic prices were significantly higher than international prices. The possible reasons may be rising production costs or intense competition in the global markets.

Export of cotton fabric exhibited the highest volatility in NPC, widely ranging from highly competitive (0.49) in the year 2018 to extremely uncompetitive (2.89) in the year 2023. The average NPC was 1.50, but drastic

hype was observed at different points of the study period, specifically in 2008 (1.54), 2009 (1.96), 2012 (2.58), 2015 (2.42), 2019 (2.71) and 2023 (2.89). A sever decrease in price competitiveness (2.89) was observed in the year 2023. This major spike in NPC was driven by international as well as domestic effects. Persistent inflation and surplus inventory in the US and EU collapsed global demand resulted in sharp decrease in international fabric prices. On the other hand, Indian weavers could not decrease prices due to rising electricity tariffs and sticky raw material costs. It indicates that the domestic fabric market faces stiff price competition with the international fabric market due to fragmentation, lack of scale, and competition from highly efficient producers like China and Bangladesh, who benefit from favourable trade agreements.

Temporal change in NPC of cotton products

A decrease in competitive advantages was observed in cotton yarn (0.91 to 0.94) and raw cotton (0.84 to 1.00) from period I to period II. Whereas increasing competitive disadvantages (1.29 to 1.70) were observed for the export of cotton fabric. A notable change from competitive advantage to competitive disadvantage (0.87 to 1.42) was noticed in the export of cotton thread from period I to period II.

Thus, the analysis of Nominal Protection Coefficient (NPC) indicates varied competitiveness across products and periods in the export of cotton from India. Cotton yarn exhibited the strongest and most stable competitive advantages, followed by raw cotton. Whereas, cotton fabric and cotton thread in the later period frequently exhibited structural uncompetitiveness due to higher domestic production costs relative to international benchmarks. This is in line with Saini and Gulati (2017) who stated that high domestic support architectures and tariff barriers on key processing materials elevate the domestic cost of production.

Table 1: Nominal protection coefficient (NPC) of Cotton products of India

Year	Raw Cotton	Cotton Thread	Cotton Yarn	Cotton Fabric
2004	0.68	0.71	0.96	0.86
2005	0.79	0.74	0.96	0.88
2006	0.91	0.62	1.02	0.87
2007	0.92	0.66	0.97	0.81
2008	0.83	1.10	0.90	1.54
2009	0.94	0.78	0.91	1.96

2010	0.78	0.68	0.89	0.53
2011	0.72	1.09	0.91	0.57
2012	0.92	1.10	0.83	2.58
2013	0.91	1.26	0.81	2.32
2014	0.97	1.30	0.83	0.80
2015	0.96	1.04	0.77	2.42
2016	0.99	1.13	0.90	1.22
2017	1.03	0.92	0.97	1.58
2018	1.03	0.85	0.85	0.49
2019	1.02	1.84	0.99	2.71
2020	1.01	1.26	0.99	1.38
2021	1.08	1.91	1.04	1.85
2022	1.09	1.83	1.12	1.65
2023	0.85	2.08	0.98	2.89

Product wise analysis of RCA

Raw cotton export exhibited RCA values significantly above one during all the years of study period which confirms India's strong comparative advantages in export of raw cotton. RCA broadly ranged from lowest 2.39 (2004) to highest 15.27 (2007) with an average 8.67. The key reasons for consistent comparative advantages are high production due to adoption of high yielding varieties of BT cotton, favourable agro-climatic conditions and competitive labour costs in the agricultural sector.

The cotton yarn export showed consistently high RCA values across two decades of the study period ranging from 9.21 in 2009 to 16.47 in 2015, with the average value of 13.99. This is evident that India is a dominant supplier of cotton yarn in the global market and enjoys strong advantages in cotton yarn export compared to rest of the countries in the world. Availability of abundant raw material, followed by support received from the spinning industry, enables the Indian cotton industry for efficient, large-scale production of cotton yarn at competitive prices, which results in a deeply rooted structural advantage in this sector.

In spite of notable shift, export of cotton thread maintained a significant comparative advantage throughout the study period. It showed more than one RCA during whole study period, ranging from a

minimum (3.71) and maximum (24.11) value in the years 2009 and 2004 respectively. The overall RCA average was 8.86. It was very high in the initial years of the study period, but gradually it decreased and reached 5.79 in the year 2023. However, it remained well above the threshold of one. This indicates that India has strong place in the global thread market. Constant but decreasing comparative advantage in cotton thread export imply India's expertise in quality or specialised thread production but increased competition or market saturation in the world.

Cotton fabric export shows consistent and moderate comparative advantages during whole study period. However, it was significantly lower than cotton yarn and raw cotton. The RCA remains above one across all the years ranging from 2.19 in the year 2010 to 4.91 in the year 2021 with an average 3.62. It indicates that India can compete in the global fabric market but advantages is less due to global competition from the countries like China and Bangladesh. The results also revealed that India has consistent presence and expertise in the global fabric market but also have to faces challenges related to scale or value addition compared to raw cotton and yarn market. Thus, it can be evident that fabric sector faces more intense competition globally than raw cotton or cotton yarn.

Temporal change in RCA of cotton products

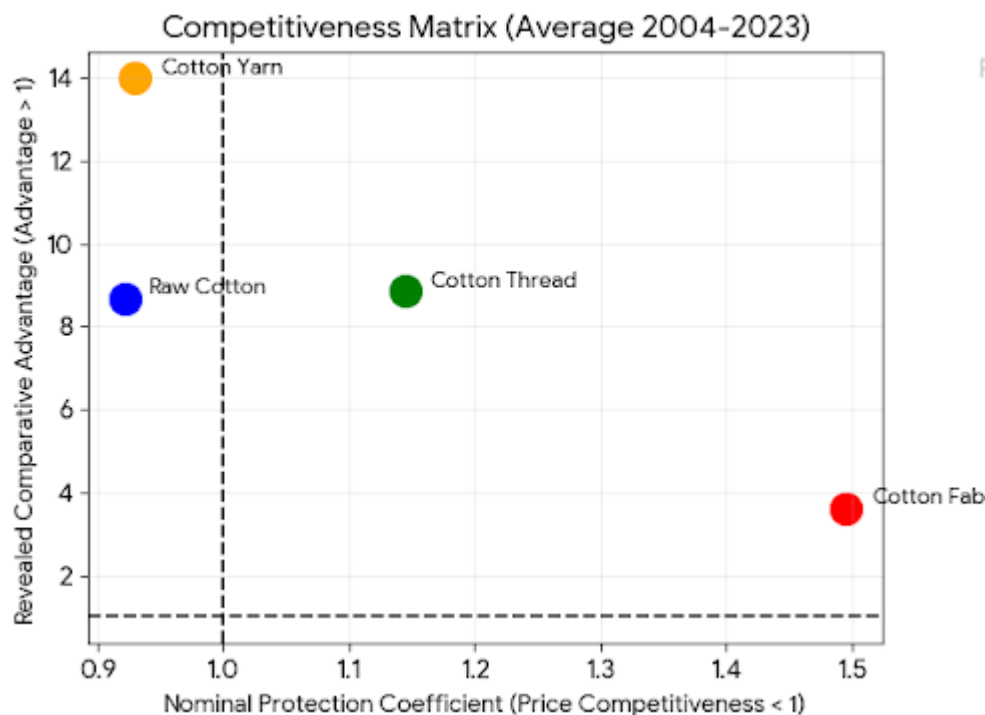
Decrease in comparative advantages was observed in raw cotton (10.42 to 6.92) and cotton thread (10.52 to 7.20) from period I to period II. Whereas increasing comparative advantages were observed for the export of cotton yarn (13.66 to 14.32) and cotton fabric (3.05 to 4.19) from period I to period II. This slight moderation in RCA value may be due to increased domestic consumption or rising input costs.

Thus, the analysis of Revealed Comparative Advantage (RCA) revealed that India holds strong comparative advantages in all four categories of cotton products and during both periods. Cotton yarn exhibits highest and most stable advantages followed by raw cotton, cotton thread and cotton fabric. This confirms India's structural competitiveness in global market due to domestic raw material availability and established processing capabilities.

Table 2: Revealed comparative advantage (RCA) of Cotton products of India

Year	Raw Cotton	Cotton Thread	Cotton Yarn	Cotton Fabric
2004	2.39	24.11	15.75	4.08
2005	3.91	16.40	14.89	3.28
2006	10.09	14.10	14.75	3.09
2007	15.27	9.64	15.01	3.14
2008	13.70	3.93	13.68	3.31
2009	8.82	3.71	9.21	2.65
2010	14.44	11.81	13.68	2.19
2011	10.01	7.66	11.04	2.40
2012	11.46	7.40	13.46	3.33
2013	14.07	6.41	15.17	3.07
2014	11.78	5.98	15.33	3.46
2015	10.90	5.69	16.47	3.72
2016	7.57	7.11	15.09	3.59
2017	6.99	9.26	13.93	3.60
2018	7.78	7.89	15.03	3.93
2019	3.94	6.37	11.93	4.37
2020	6.34	8.09	14.48	4.81
2021	8.27	8.73	15.18	4.91
2022	3.06	7.12	11.60	4.77
2023	2.59	5.79	14.18	4.70

Export competitiveness of Cotton products from India



India's overall competitiveness in export of cotton was evaluated using dual matrix approach using cross referencing price efficiency (Nominal Protection Coefficient - NPC) with global market performance (Revealed Comparative Advantage - RCA). Cotton yarn followed by raw cotton were the major components of Indian cotton export (Fig. 1). Both products depict consistently high competitiveness during the study period. Cotton yarn was the most competitive and stable with high mean RCA value (13.99) and low RCA CV (12.79%). It indicates that India's competitiveness in export of cotton yarn is not only due to price fluctuations but also due to structural efficiency and strong manufacturing base. Whereas, cotton thread and cotton fabric exhibited potential competitiveness. They maintained RCA >1 but their mean NPC values were 1.15 and 1.50 respectively. It suggests that domestic prices of cotton thread and cotton fabric are frequently higher than international benchmarks. Moreover, the high volatility in fabric prices (CV = 52.11 %) indicates that India remains a significant global player in fabric exports but its position is vulnerable to international price shocks and domestic input cost escalations.

India has competitiveness in the export of cotton yarn (NPC < 1 and RCA > 1), whereas potential competitiveness in the export of cotton fabric (NPC > 1 and RCA > 1) during both Period I and Period II (Table 3). The major changes were observed in the export of raw cotton and cotton thread. While India has competitiveness (NPC < 1 and RCA > 1) in the export of raw cotton and cotton thread in Period I, it shifts to potential competitiveness (NPC ≥ 1 and RCA > 1) in Period II.

Table 3: Temporal changes in export competitiveness of cotton products from India

Period	Product	Raw Cotton		Cotton Thread		Cotton Yarn		Cotton Fabric	
	Measures	NPC	RCA	NPC	RCA	NPC	RCA	NPC	RCA
Period I	Mean	0.84	10.42	0.87	10.52	0.91	13.66	1.29	3.05
	SD	0.09	4.40	0.23	6.32	0.06	2.05	0.75	0.54
	CV (%)	10.71	42.28	26.44	60.07	6.59	15.0	58.14	17.55

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Period II	Mean	1.00	6.92	1.42	7.20	0.94	14.3 2	1.70	4.19
	SD	0.07	3.08	0.45	1.26	0.11	1.52	0.79	0.58
	CV (%)	7.00	44.47	31.69	17.47	11.70	10.6 1	46.47	13.92
Period III	Mean	0.92	8.67	1.15	8.86	0.93	13.9 9	1.50	3.62
	SD	0.12	4.11	0.45	4.75	0.09	1.79	0.78	0.80
	CV (%)	12.56	47.40	39.23	53.60	9.44	12.7 9	52.11	22.02

Conclusion

India remains a competitive exporter of raw cotton and cotton yarn. It maintains both price efficiency ($NPC < 1$) and significant structural advantages ($RCA > 1$) throughout the study period due to strong manufacturing base, competitive labour costs, and the widespread adoption of high-yielding BT cotton varieties. However, price-performance gap was observed in value added products, cotton thread and cotton fabric. It holds structural advantages ($RCA > 1$) in these products. But high domestic production costs, fragmentation of weaving units, and a lack of economies of scale makes it less price competitive ($NPC > 1$) than competitors which indicates India's potential competitiveness in export of cotton thread and cotton fabric. The results confirms that historical structural advantages alone cannot ensure future competitiveness against domestic price distortions and aggressive global competitors like China and Bangladesh.

Policy Implications

Strategic interventions suggested to sustain and enhance dominant position of India in the global cotton market:

1. Domestic support policies (MSP) should be aligned with international price to prevent price distortions in export of cotton that hinder export competitiveness.
2. Fragmented weaving units should be integrated to achieve the economies of scale that support fabric sector to compete globally.
3. Focus should be shifted from export of raw material to enhancing the cost-efficiency of the specialized spinning and weaving

sectors to capture higher margins in the global value chain.

4. Trade agreements should be increased to secure Duty-Free Quota-Free (DFQF) access in major markets that offset the price disadvantages faced by Indian fabric and thread.

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