



An Exponential Growth Model Analysis of Agricultural Commodity Exports Status in Karnataka

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Abstract

Agriculture plays an important role in the economic development of Karnataka by providing employment, raw materials, food security and export earnings. Karnataka has a diversified agricultural base consisting of cereals, pulses, oilseeds, fruits, vegetables, coffee, spices, sugar and various processed agricultural products. The state has also emerged as an important exporter of coffee, spices, cereals, fruits, vegetables and processed food products. The study has two major objectives: (1) to examine the performance and growth of agricultural commodity exports in Karnataka, and (2) to analyse the growth trends of major agricultural commodities and their exports in the state. The value of agricultural commodity exports increased from about USD 1,299.84 million in 2019–20 to USD 2,457.02 million in 2024–25 as per the Economic Survey of Karnataka (2025).

The estimated exponential growth rate indicates positive long-term growth, although considerable year-to-year fluctuations are observed. Coffee, tea, mate and spices constitute an important component of Karnataka's agricultural exports. The results indicate that agricultural commodity exports recorded an estimated positive annual growth rate of 8.61%, with a positive exponential regression coefficient ($B = 0.0826$), indicating an overall upward trend. The coefficient of determination ($R^2 = 0.330$) shows that approximately 33.0% of the variation in agricultural commodity exports is explained by the time trend. The correlation coefficient ($r = 0.575$) indicates a moderate positive relationship between time and agricultural commodity exports. The export value increased from US\$1,299.84 million in 2019–20 to US\$2,457.02 million in 2024–25, although considerable year-to-year fluctuations were observed. The findings demonstrate that Karnataka has experienced positive long-term growth in agricultural commodity exports, supported by the increasing contribution of major commodities such as coffee, spices, cereals, fruits, nuts, and processed agricultural products. The study concludes that strengthening export infrastructure, improving value addition, enhancing quality standards, and diversifying international markets could further improve Karnataka's agricultural export performance.

Keywords

Agriculture, Agricultural Commodities, Exports, Karnataka, Coffee, Spices, Export Performance, Trendline Analysis and Exponential Growth Model.



1. Introduction

Agriculture is one of the important sectors of Karnataka's economy and provides livelihood opportunities to a substantial proportion of the rural population. The state has diverse agro-climatic conditions, enabling the production of cereals, pulses, oilseeds, sugarcane, fruits, vegetables, coffee, spices and plantation crops. This diversity provides a strong foundation for both domestic agricultural development and international trade. Karnataka has traditionally been known for commodities such as coffee, spices, silk and horticultural products. In recent years, agricultural exports have increasingly included processed food products, cereals, fruits, vegetables, sugar and other value-added commodities. The state's export structure therefore reflects both primary agricultural production and the growing importance of agro-processing. India's agricultural exports were valued at approximately USD 51.91 billion in 2024–25, highlighting the importance of agricultural trade to the country's external sector. According to the Karnataka Economic Survey (2025), various major agricultural export groups like coffee, tea, mate and spices. In 2024–25, this group recorded exports of about USD 1,259.47 million, making it the largest category among the agricultural commodities reported by the state. Agricultural commodity exports as a whole increased from USD 2,043.70 million in 2023–24 to nearly USD 2,457.02 million in 2024–25.

2. Research Objectives

The major objectives of the study are:

1. To examine the performance and development of agricultural commodity exports in Karnataka.
2. To analyse the growth trends of major agricultural commodities and their exports in the state.

Hypothesis

1. There is a significantly agricultural commodity exports in Karnataka have increased over the past few years.

3. Material and Methods

The study primarily uses secondary data obtained from the Karnataka Economic Survey (2025), Directorate of Economics and Statistics (2019 to 2025), Department of Agriculture, Department of Industries and Commerce, DGCIS, and APEDA. Government of Karnataka, Visvesvaraya Trade Promotion Centre (VTPC), Directorate General of Commercial Intelligence and Statistics (DGCIS), Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce and Industry, Government of India, Government annual reports, publications, reputed journals, research articles, books, newspapers, websites, and other reliable sources. The study covers six years from 2019 to 2025 to examine the trend of agricultural commodity exports in Karnataka.

Statistical Techniques: The present study used statistical techniques, including percentage growth, Annual Growth Rate (AGR), Compound Annual Growth Rate (CAGR), Exponential growth model, Coefficient of determination (R^2), Trend analysis, and Commodity-wise comparative analysis. The data analysis was carried out using Microsoft Excel, SPSS 21, EVIEWS, and Gretl.

4. Status of Agricultural Commodity Exports and Its Growth in Karnataka



Karnataka occupies a significant position in India's agricultural export sector, ranking 7th among Indian states in terms of its share of agricultural commodity exports, with an estimated 8.31% share of the country's total agricultural export value. The state's agricultural and allied commodity exports reached approximately USD 2.46 billion during 2024–25, highlighting the growing importance of Karnataka in India's international agricultural trade. Karnataka is a major producer and exporter of several important agricultural commodities. The state is one of India's leading producers of maize and coffee and has a particularly strong position in the coffee sector. Karnataka accounts for approximately 70% of India's coffee production, making it the country's dominant coffee-producing state. The state also holds a prominent position in the production of nutri/coarse cereals and contributes substantially to the production and export of spices, cashew, silk and processed food products.

The agricultural sector of Karnataka recorded a growth rate of 9.1% during 2025–26, representing a significant recovery compared with the preceding years. This improvement was largely associated with favourable monsoon conditions and improved agricultural performance. The recovery indicates the continued importance of climatic conditions in determining agricultural output and growth in the state. Karnataka's export performance extends beyond agricultural commodities. In terms of total merchandise exports across all sectors, the state ranks 4th in India, reflecting its diversified export base and strong industrial and service-sector linkages. Overall, the state's substantial contribution to agricultural production, agricultural commodity exports, and merchandise exports demonstrates its strategic role in India's agricultural and international trade economy.

5. Results and Discussion

5.1. Growth in Trends of Agricultural Commodity Exports in Karnataka

In Karnataka, agricultural commodity exports rose from USD 2,043.70 million in 2023–24 to USD 2,457.42 million in 2024–25, registering an increase of nearly 20%. The growth in exports reflects the improved competitiveness, diversification, and global integration of the state's production base. Karnataka's overall exports have increased by 13.78% during 2025–26 compared to 2024–25 (Economic Survey of Karnataka -2025). The agricultural commodity exports from Karnataka from 2019 to 2024 are shown in Table 1.

Table 1: Commodity-wise Major Agricultural Commodities Exported from Karnataka (2023 to 2024)

(Value in Mn USD)

Sl. No.	Commodity	2023-24	2024-25	Change
1	Dairy Products including Honey	27.83	31.98	4.15
2	Live Trees, Flowers and Plants	4.14	4.81	0.67
3	Edible Vegetables	104.65	108.98	4.33
4	Edible Fruits & Nuts	80.56	92.19	11.63
5	Coffee, Tea, Mate & Spices	791.55	1,259.47	467.92
6	Cereals	129.51	129.87	0.36
7	Flour (Milling) Products	50.93	36.74	-14.19
8	Oil Seeds, Grains & Medicinal Plants	86.58	74.66	-11.92
9	Lac, Gums, Resins, etc.	142.62	159.04	16.42
10	Vegetable Plaiting Materials	5.68	5.59	-0.09
11	Animal or Vegetable Fats and Oils	53.53	29.60	-23.93
12	Edible Preparations of Meat & Fish	0.17	0.77	0.60

13	Sugar and Confectionery	190.88	102.95	-87.93
14	Cocoa & Cocoa Preparations	6.46	7.87	1.41
15	Preparations of Cereals, Flour, Starch & Milk	22.54	23.98	1.44
16	Preparations of Vegetables, Fruits & Nuts	184.85	206.90	22.05
17	Miscellaneous Edible Preparations	149.01	167.68	18.67
18	Beverages, Spirits & Vinegar	12.23	13.95	1.72
	Total	2,043.70	2,457.02	413.30

Source: Government of Karnataka (2025), Economic Survey of Karnataka – 2025

Note: Coffee, tea, mate and spices were by far the largest agricultural commodity export group in 2024–25, rising from USD 791.55 million in 2023–24 to USD 1,259.47 million.

The table indicates a substantial improvement in Karnataka's agricultural commodity exports between 2023–24 and 2024–25. Total exports increased from USD 2,043.70 million in 2023–24 to USD 2,457.02 million in 2024–25, representing an absolute increase of USD 413.30 million, or approximately 20.22%. The most significant contributor to this increase was the Coffee, Tea, Mate & Spices category. Its export value increased sharply from USD 791.55 million to USD 1,259.47 million, registering an increase of USD 467.92 million. This category alone accounted for the major portion of the overall increase in agricultural exports and highlights the importance of coffee and spices in Karnataka's export basket.

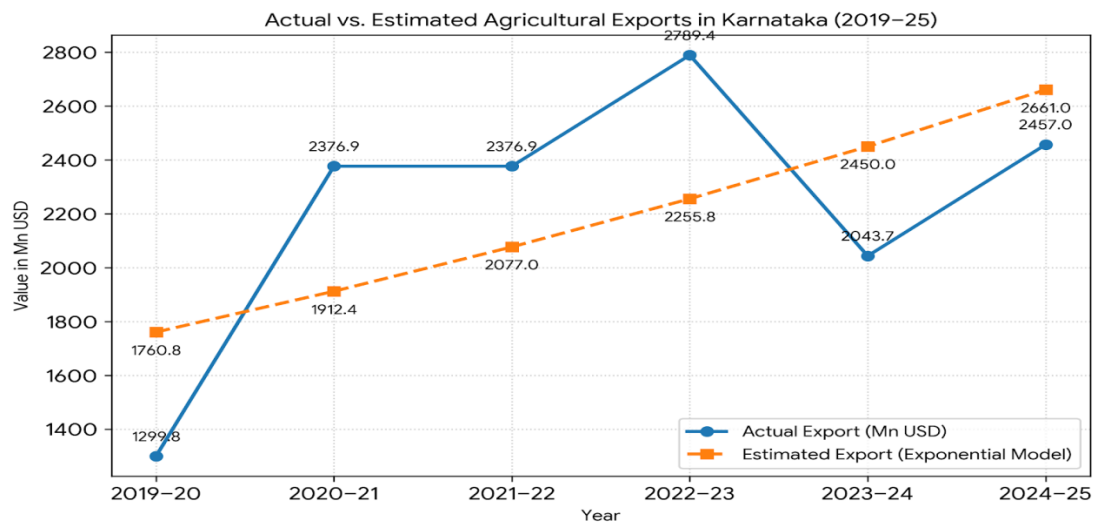
The several other commodity groups also recorded positive growth. Preparations of Vegetables, Fruits & Nuts increased by USD 22.05 million, followed by Miscellaneous Edible Preparations with an increase of USD 18.67 million and Lac, Gums and Resins with an increase of USD 16.42 million. Edible Fruits & Nuts also showed a notable increase of USD 11.63 million. Dairy products, edible vegetables, cocoa preparations, cereals, and beverages recorded relatively moderate increases. In contrast, some commodity groups experienced a decline in export value. Sugar and Confectionery registered the largest decline, falling by USD 87.93 million, from USD 190.88 million to USD 102.95 million. This was followed by Animal or Vegetable Fats and Oils, which declined by USD 23.93 million. Flour (Milling) Products and Oil Seeds, Grains & Medicinal Plants decreased by USD 14.19 million and USD 11.92 million, respectively.

Table 2: Actual and Estimated Agricultural Commodity Exports in Karnataka Based on the Exponential Growth Model (2019 to 2025)

(Value in Mn USD)

Year	Actual Export	Estimated Export	Difference
2019–20	1,299.84	1,760.79	-460.95
2020–21	2,376.87	1,912.38	464.49
2021–22	2,376.92	2,077.02	299.90
2022–23	2,789.36	2,255.83	533.53
2023–24	2,043.70	2,450.04	-406.34
2024–25	2,457.02	2,660.96	-203.94
CAGR (%)	13.58	8.61	

Source: Government of Karnataka (2025), Karnataka Economic Survey and Annual Progress Reports of Karnataka State Agricultural Produce Processing & Export Corporation Limited – 2019 to 2024



The above table 4 and graph present the actual and estimated values of agricultural commodity exports from Karnataka based on the exponential growth model for the period 2019–20 to 2024–25. The estimated values provide a measure of the underlying long-term growth trend in agricultural exports. The exponential model assumes a smooth, constant annual expansion rate of 8.61% per annum ($Y_t = 1760.79 \times e^{0.0826t}$). The actual export value increased substantially from US\$1,299.84 million in 2019–20 to US\$2,457.02 million in 2024–25. However, the actual values exhibited considerable year-to-year fluctuations compared with the estimated exponential trend. In 2019–20, actual exports were US\$1,299.84 million, which was substantially lower than the estimated value of US\$1,760.79 million. From 2020–21 onwards, actual exports exceeded the estimated trend value.

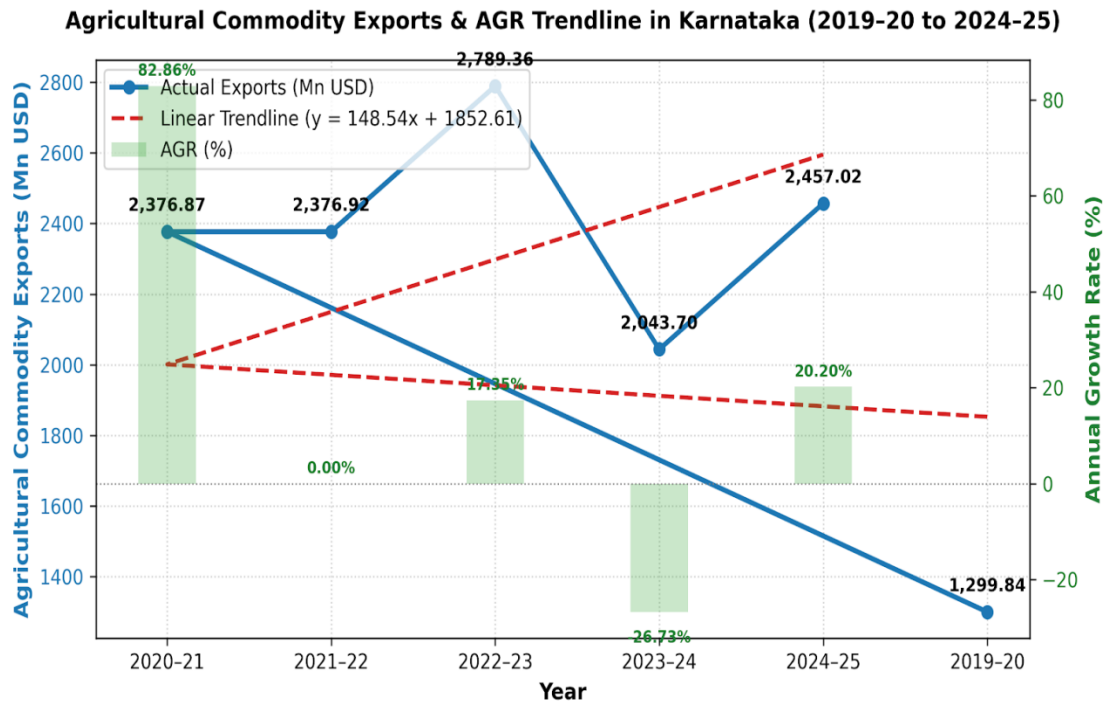
The largest positive deviation occurred in 2022–23, when actual exports reached US\$2,789.36 million, compared with the estimated value of US\$2,255.83 million, resulting in a positive difference of US\$533.53 million. This indicates that export performance was considerably stronger than the long-term trend during that year. In 2023–24, actual exports declined to US\$2,043.70 million, falling below the estimated value of US\$2,450.04 million. In 2024–25, exports recovered to US\$2,457.02 million, although this remained below the estimated value of US\$2,660.96 million. Thus, the recent export performance suggests a recovery from the previous year's decline, but actual exports had not yet reached the level indicated by the estimated exponential trend. Despite high short-term volatility, actual export growth (13.58% CAGR) comfortably surpassed the fitted exponential baseline (8.61% CAGR) over the entire 2019–2025 period, expanding from USD 1,299.84 Mn to USD 2,457.02 Mn.

Table 3: AGR of Agricultural Commodity Exports in Karnataka (2019–20 to 2024–25)

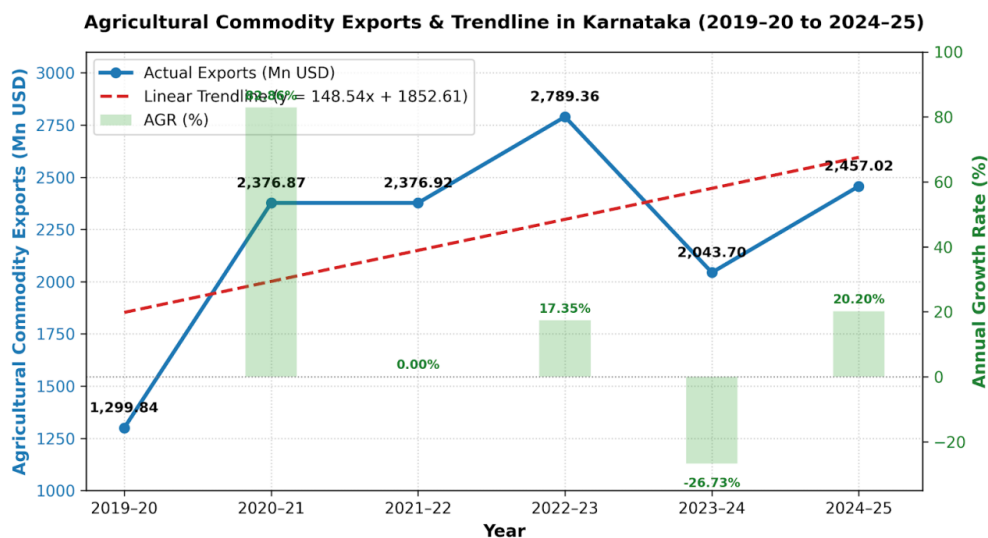
(Value in Mn USD)

Year	Agricultural Commodity Exports	Annual Growth (%)
2019-20	1,299.84	-
2020-21	2,376.87	82.86
2021-22	2,376.92	0.00
2022-23	2,789.36	17.35
2023-24	2,043.70	-26.73
2024-25	2,457.02	20.20

Source: Government of Karnataka (2025), Karnataka Economic Survey and Annual Progress Reports of Karnataka State Agricultural Produce Processing & Export Corporation Limited – 2019 to 2024



The table shows considerable fluctuations in Karnataka's agricultural commodity exports during 2019-20 to 2024-25. Exports increased sharply from US\$1,299.84 million in 2019-20 to US\$2,376.87 million in 2020-21, registering the highest annual growth rate of 82.86% during the study period. During 2021-22, exports remained almost unchanged at US\$2,376.92 million, resulting in a negligible growth rate of 0.002%, which may be reported as approximately 0.00%. Exports subsequently increased to US\$2,789.36 million in 2022-23, recording a growth rate of 17.35%. This was the highest export value observed during the study period.



However, agricultural commodity exports declined substantially in 2023–24, falling to US\$2,043.70 million. Consequently, the annual growth rate became negative at –26.73%, indicating a significant contraction in export performance. A recovery was observed in 2024–25, when exports increased to US\$2,457.02 million, representing a growth rate of 20.20% over the previous year. Although exports recovered considerably, the 2024–25 value remained below the peak recorded in 2022–23.

5.2. Testing Hypothesis

H₀: Agricultural commodity exports in Karnataka have not increased significantly over the study period.

H₁: Agricultural commodity exports in Karnataka have increased significantly over the study period.

Table 4: Exponential Growth Model Results for Agricultural Commodity Exports in Karnataka (2019 to 2024)

S. No	Particulars	Estimated Value
1	Constant (A)	1,621.22
2	Exponential coefficient (B)	0.0826
3	Estimated growth rate	8.61%
4	R ²	0.330
5	Correlation coefficient (r)	0.575

Source: Compiled Result by the Researcher

The exponential growth model indicates that agricultural commodity exports in Karnataka recorded a positive AGR of approximately 8.61% from 2019 to 2024. The estimated exponential coefficient ($B = 0.0826$) is positive, indicating an overall upward trend in agricultural commodity exports over time. The coefficient of determination ($R^2 = 0.330$) indicates that about 33.0% of the variation in agricultural commodity exports is explained by the time trend included in the exponential growth model. The remaining variation may be associated with other factors, including international commodity prices, climatic conditions, agricultural production, exchange-rate movements, export policies, and changes in global demand. The correlation coefficient ($r = 0.575$) indicates a moderate positive relationship between time and agricultural commodity exports, suggesting that exports generally increased over the study period.

Thus, the model provides evidence of a positive and increasing trend in Karnataka's agricultural commodity exports. Based on the estimated annual growth rate of 8.61%, the study finds evidence in favour of hypothesis, which states that agricultural commodity exports in Karnataka have increased significantly during the study period. However, the term statistically significant should be used only if the regression output shows that the estimated growth coefficient is statistically significant at the 5% level ($p < 0.05$). Therefore, the hypothesis is supported in terms of the direction and magnitude of growth, while its statistical significance depends on the reported p-value of the exponential regression coefficient. Finally, the research paper found that the exponential growth model demonstrates that Karnataka's agricultural commodity exports followed a positive long-term growth trajectory, with an estimated annual growth rate of 8.61%. The positive coefficient ($B = 0.0826$) and moderate positive correlation ($r = 0.575$) further reinforce the existence of an upward trend in agricultural commodity exports during the study period.

6. Conclusion

The study concludes that Karnataka has substantial potential for agricultural commodity exports. The state's diverse agro-climatic conditions support the production of a wide range of exportable agricultural commodities. Coffee, spices, cereals, fruits, vegetables, sugar, and processed food products are key components of the export basket. The study reveals that agricultural commodity exports have shown an overall positive growth tendency during the study period, although considerable year-to-year fluctuations were observed. The exponential growth model indicates an estimated annual growth rate of approximately 8.61 per cent, suggesting a positive long-term trend in agricultural commodity exports. The positive exponential coefficient further confirms the increasing direction of exports. The commodity-wise analysis shows that coffee, tea, mate and spices constitute an important component of Karnataka's agricultural export basket. The growth of processed fruits and vegetables also indicates increasing opportunities for value addition and diversification of agricultural exports. At the same time, fluctuations in commodities such as sugar, oilseeds and other agricultural products demonstrate the vulnerability of agricultural exports to changes in international prices, production conditions, climatic factors and trade policies.

The hypothesis testing framework indicates that the positive growth coefficient supports the alternative hypothesis that agricultural commodity exports have increased over the study period. However, statistical confirmation of significance should be based on the p-value of the estimated exponential regression coefficient. If the p-value is less than 0.05, the null hypothesis is rejected and the alternative hypothesis is accepted at the 5 per cent level of significance. Finally, the findings suggest that Karnataka has significant scope to strengthen its position in international agricultural markets. Greater emphasis should be placed on value addition, quality certification, modern storage and cold-chain facilities, export-oriented infrastructure, farmer-producer organisations, market diversification and international branding. Strengthening these areas can improve the competitiveness of Karnataka's agricultural commodities, increase export earnings, enhance farmers' incomes and contribute to sustainable agricultural and rural development in the state.

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