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Instability analysis of raisin exports from India

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ABSTRACT

As India strengthens its position within the international dried-fruit trade, a comprehensive examination of export instability is essential to optimize trade dynamics and enhance the global competitiveness of value-added horticultural commodities. This study evaluates the volatility of Indian raisin exports from 2005–06 to 204–25, utilizing secondary time-series data from Agricultural and Processed Food Products Export Development Authority (APEDA). The 20 year time period was divided into Period I (2005–06 to 2014–15) and Period II (2015–16 to 2024–25) for comparative assessment. With the objective to analyse export volatility, both the Coefficient of Variation (CV) and the Cuddy-Della *Valle* Instability Index (CDVI) were employed to assess market fluctuations in raisin exports from India and export destination-wise performance. The empirical findings revealed that over the 20-year period, the instability indices (CDVI) for exported raisin volume, value and unit prices were 45.88 per cent, 51.36 per cent and 18.00 per cent, respectively. Even though export volume and total value reflected high volatility, export pricing demonstrated moderate instability. In comparison with period I, period II experienced a significant decline in quantity, value and price instability for export destinations of Indian raisins. Furthermore, destination-specific evaluations identified Vietnam as the most stable market overall for quantity (CDVI of 29.17 per cent) and value CDVI of 31.70 per cent) whereas Malaysia recorded the lowest price instability with CDVI of 13.71 per cent, followed closely by Vietnam at 15.07 per cent.

Keywords: Raisins, Export, India, Coefficient of Variation, Cuddy Della *Valle* Index, Instability

1. Introduction

Raisins, derived from sound, dried grapes of *Vitis vinifera* L., constitute a commercially vital value-added commodity in the international dried-fruit market. They serve both as direct nutritional snacks and as essential ingredients across the bakery, confectionery, dairy and beverage industries. India is the world's second-largest producer of dried grapes, generating approximately 270,000 metric tons annually, about 16 per cent of global output (INC Statistical Yearbook, 2024). Domestic production is heavily concentrated in Maharashtra contributing over 75 per cent of the national total, followed by Karnataka and Andhra Pradesh.

In India, raisins are primarily produced from Thompson Seedless grapes and their clones, which are processed into diverse commercial raisin types such as golden, brown, black, green, red raisins and black Monukka, achieving a 25 per cent recovery rate with 16 per cent moisture and 22 to 23 degrees Brix (TSS). The raisin sector plays a crucial role in mitigating post-harvest losses within India's table grape industry, currently processing 20 per cent of the domestic harvest while offering a substantial scope for value addition. Compared to fresh table grape exports, raisin production requires lower capital investment and reduced labour requirement, enabling producers as well as exporters to secure superior economic returns (Sharma *et al.*, 2007) [1].

India possesses strong competitive advantages in raisin production and trade, supported by favourable agro-climatic conditions, established viticulture regions, modern cold-chain infrastructure and strategic institutional backing from APEDA. Rising consumer demand for healthy, value-added products offers significant potential for market expansion, import substitution and efficient grape utilization. Additionally, the International Trade Centre ranks dried grapes sixth among India's top export potential products within the fruit sector. Sustained adherence to international quality standards for raisins and reliable supply chains continue to strengthen India's global market presence.

Despite substantial production, India contributes only about 6 per cent of the total global exports of dried grapes as high domestic consumption absorbs the majority of the supply. India stands among major raisin exporters, ranking 8th in export quantity and 9th in export value. In 2024, the total raisin exports reached 46,738.93 metric tons valued at ₹607.83 crores, with Maharashtra supplying 80 to 95 per cent of this total. Major destination markets include Morocco, Saudi Arabia, Vietnam, Sri Lanka, Malaysia, Romania, the UAE, and Russia. In 2024–25, Morocco accounted for the largest share in both export quantity and value of Indian raisins, while the United Arab Emirates offered the highest prices for Indian raisins.

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2. Research methodology

This study evaluates India as a single geographical unit to assess the dynamics of raisin export trade over time. It is based on secondary time-series data from 2005–06 to 2024–25, obtained from the Agricultural and Processed Food Products Export Development Authority (APEDA) for raisins classified under HS Code 08062010. To facilitate a comparative assessment, the study timeline is divided into Period I (2005–06 to 2014–15), Period II (2015–16 to 2024–25), and the Overall Period (2005–06 to 2024–25). The collected data was analysed using appropriate statistical methods to derive the meaningful findings. The analysis focused on nine major and consistent importing countries of Indian raisins reflecting current market dynamics, with remaining destinations grouped under an ‘Others’ category.

3. Tools of analysis

The Coefficient of Variation and Cuddy Della *Valle* Index were employed following tabular analysis to examine the instability in the export of Indian raisins.

Instability analysis

a) Coefficient of variation (CV %)

Coefficient of Variation (CV) is defined as the ratio of sample Standard Deviation (SD) to its mean. In order to study the variability in the time series data, coefficient of variation (CV) was used as an index of instability.

$$CV (\%) = (S.D./Mean) \times 100$$

where,

CV = Coefficient of Variation

SD = Standard Deviation

$$\text{Mean} = \sum X_i / N$$

b) Cuddy Della and Valle instability index

As proposed by Cuddy and Della called the coefficient of variation (CV) is modified as de-trend CV by using coefficient of determination (R^2). Thus, it is a better measure to capture instability in agricultural production and export as it indicates the real direction of the instability.

The formula is given as

$$CDVI = CV \times \sqrt{(1 - R^2)}$$

where,

C.V. = Coefficient of variation in per cent (%)

R^2 = Coefficient of determination from time trend regression adjusted by number of degrees of freedom

If the index values are below 15 per cent, then it is categorized as low instability, if they fall between 15 to 30 per cent, then it is categorized as medium instability and values more than 30 per cent are categorized as high instability.

4. Results and discussion

4.1 Instability in raisin exports from India

An evaluation of export of Indian raisins over a 20-year period as given in the [table 1](#) demonstrated that although export levels fluctuated from year to year, the long-term trends in export quantity, value and prices have consistently remained positive and upward during the twenty year period. The physical trade volumes exhibited high instability, recording a Coefficient of Variation (CV) of 70.65 per cent and a Cuddy Della *Valle* Index (CDVI) of 45.88 per cent.

Table 1. Instability in the Raisin Exports from India, (2005-06 to 2024-25)

Year	Export Quantity (MT)	Export Value ₹. Lakhs)	Export Price (₹ per Kg)
2005-2006	73.75	34.44	46.70
2006-2007	217.92	63.59	29.18
2007-2008	100.59	46.40	46.13
2008-2009	6,142.83	3,895.94	63.42
2009-2010	13,476.17	11,169.17	82.88
2010-2011	5,232.60	3,466.79	66.25
2011-2012	9,541.99	6,092.66	63.85
2012-2013	30,041.78	26,883.85	89.49
2013-2014	31,602.27	22,311.90	70.60
2014-2015	12,325.66	10,764.29	87.33
2015-2016	26,825.12	20,418.43	76.12
2016-2017	30,859.12	26,895.72	87.16
2017-2018	25,259.52	23,904.65	94.64
2018-2019	18,926.49	25,910.57	136.90
2019-2020	24,668.17	26,975.78	109.35
2020-2021	24,406.09	21,607.87	88.53
2021-2022	19,520.68	18,136.70	92.91
2022-2023	27,640.62	26,665.25	96.47
2023-2024	47,750.60	51,196.86	107.22
2024-2025	46,738.93	60,782.87	130.05
CV (%)	70.65	83.47	32.28
CDVI	45.88	51.36	18.00

Source: DGCIS Annual Data, APEDA

Among all three export parameters, export value displayed the highest instability, registering a CV of 83.47 per cent and a CDVI of 51.36

per cent. As compared to volume and total earnings, unit prices exhibited the lowest instability, with a CV of 32.28 per cent and a CDVI of

18.00 per cent. This relative price stability underscores a strong international demand that buffers the overall export market against domestic supply variations. The similar findings were reported by T. Priyanka *et al.* (2024) [2] and Gurindapalli *et al.* (2025) [3]. Overall higher instability was noticed in the export value of Indian raisins whereas low instability was noticed in the export prices as de-

picted in the figure 1 illustrating fluctuations in Indian raisin exports during two decades. High volume instability reflects weather vulnerabilities, need to be compliant with stringent foreign phyto-sanitary protocols and changing preferences in international markets.

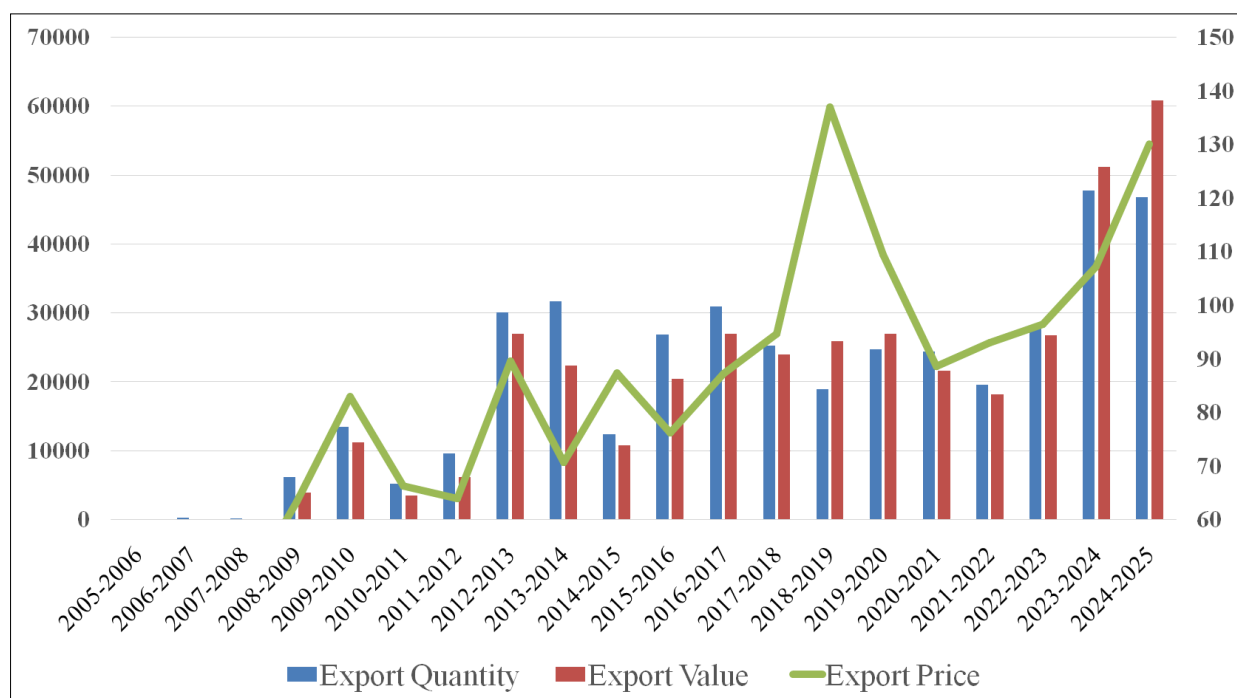


Figure 1. Instability in Export of Raisins from India (2005-06 to 2024-25)

4.2 Sub period-wise growth rate and instability in raisin exports from India

Comparative assessment of period wise trade presented in the table 2 shows overall positive yet volatile trajectory for raisin exports from India indicating that the raisin export has expanded rapidly but has also experienced substantial fluctuations. The Period I (2005-06 to 2014-15) demonstrating initial growth phase exhibited high instability, with CDVI values reaching 50.16 per cent for export volume, 51.54 per cent for revenue and 12.11 per cent for unit prices.

Minimum instability in the export prices was observed in the period I in comparison with the period II.

Period II (2014-15 to 2024-25) was characterized by a significant improvement in the trade stability, with CDVI values for export volume and total value dropping to their lowest levels at 21.34 per cent and 26.69 per cent, respectively, while unit price instability remained low at 12.26 per cent. The minimum instability in the export quantity and export value was observed in the period II relatively to period I. The observed reduction in instability highlights enhanced supply chain resilience, adoption of standardized raisin processing protocols and improving international quality compliance.

Table 2. Sub- period wise Growth Rate and Instability in Raisin Exports from India. (Period I : 2005-06 to 2014-15), (Period II : 2015-16 to 2024-25), (Overall Period : 2005-06 to 2024-25)

Particulars	Export Quantity			Export Value			Export Price		
	(MT)			(₹ Lakhs)			(₹ per Kg)		
	Period I	Period II	Overall Period	Period I	Period II	Overall Period	Period I	Period II	Overall Period
CV (per cent)	106.54	34.57	70.65	111.8	46.53	83.47	30.22	18.86	32.28
CDVI (per cent)	50.16	21.34	45.88	51.54	26.69	51.36	12.11	12.26	18.00

4.3 Country-wise instability in the export of raisins from India

An evaluation of trade stability using the Cuddy Della Valle Index (CDVI) over the 20-year period from 2005–06 to 2024–25 reveals significant volume and value fluctuations across major export destinations for Indian raisins as shown in table 3.

When assessing country specific instability in export quantity, Morocco recorded the highest CDVI at 127.23 per cent, followed by

Romania (118.07 per cent) and the United Arab Emirates (106.02 per cent) across the entire 20-year timeline. Conversely, Vietnam demonstrated the lowest quantity instability with a CDVI of 29.17 per cent, followed by Saudi Arabia (39.14 per cent) and Sri Lanka (43.96 per cent). All the importing countries exhibited high instability for the export volume except Vietnam which displayed moderate instability reflecting the role of structured supply agreements.

Evaluating export value instability, Morocco registered the maximum CDVI at 131.17 per cent, followed by Romania (111.63 per cent) and

Russia (82.59 per cent). In contrast, Vietnam recorded the lowest value instability at 31.70 per cent, followed by Sri Lanka (44.36 per cent) and Saudi Arabia (46.54 per cent). All the export destinations demonstrated high instability for export earnings resulting from unpredictable import demand shifts and growing competition from other dominant raisin exporting countries.

Analysing unit export price instability, Sri Lanka exhibited the highest CDVI at 28.90 per cent, followed by the United Arab Emirates (18.24 per cent) and Ukraine (18.12 per cent). The lowest price instability was registered in Malaysia with a CDVI of 13.71 per cent, followed by Vietnam (15.07 per cent) and Russia (16.38 per cent). All trade partners reported moderate instability in unit price realizations of Indian raisins but Malaysia exhibited low instability.

Table 3. Country wise Instability Indices of the Raisin Exports from India, (2005-06 to 2024-25)

Country	Export Quantity		Export Value		Export Price	
	CV	CDVI	CV	CDVI	CV	CDVI
Saudi Arabia	51.23	39.14	62.97	46.54	21.24	16.41
Morocco	162.05	127.23	168.55	131.17	22.11	18.12
Ukraine	79.98	77.68	78.3	74.78	20.77	18.45
Sri Lanka	63.33	43.96	74.07	44.36	36.81	28.90
Russia	92.91	79.08	101.11	82.59	20.83	16.38
Vietnam	96.21	29.17	95.31	31.70	18.6	15.07
United Arab Emirates	107.01	106.02	84.75	80.90	30.65	18.24
Malaysia	55.41	44.40	65.66	51.10	22.94	13.71
Romania	170.83	118.07	176.72	111.63	22.77	20.11
Others	65.96	43.25	80.62	48.87	33.45	17.40
Total	70.65	45.88	83.47	51.36	32.28	18.00

Note: CDVI Below 15 per cent- Low Instability, between 15 to 30 per cent- Medium

Instability and more than 30 per cent- High Instability.

4.4 Sub- period wise instability in the raisin exports to destination markets

A comparative analysis of sub-period export stability of Indian raisins across major trade partners was executed using the Cuddy Della Valle Index (CDVI) for Period I (2005–06 to 2014–15) and Period II (2015–16 to 2024–25). Evaluation of sub-period instability of Indian raisin exports reveals structural shift towards market consolidation and risk reduction between Period I to Period II.

During Period I, maximum instability in export quantity was recorded in Romania with a CDVI of 142.77 per cent, followed by the United Arab Emirates and Morocco, whereas Vietnam registered the lowest quantity instability at 31.06 per cent, followed by Malaysia and Saudi Arabia. In terms of export value, Romania again exhibited peak volatility at 139.24 per cent CDVI, followed by the United Arab Emirates and Morocco, while Vietnam maintained the lowest value

instability at 24.73 per cent, followed by Sri Lanka and Malaysia. Assessing unit export prices, the highest instability was observed in Sri Lanka at 49.62 per cent CDVI, followed by the United Arab Emirates and Romania, whereas Russia recorded the lowest price instability at 5.32 per cent CDVI, followed by Vietnam and Ukraine.

Over the course of Period II, maximum instability in export quantity shifted to Morocco with a CDVI of 81.74 per cent, followed by Russia and Ukraine, while Sri Lanka achieved the highest volume stability with a CDVI of 20.09 per cent, followed by Malaysia and Vietnam. Regarding export value, Morocco similarly registered peak volatility at 88.07 per cent CDVI, followed by Russia and Ukraine, whereas Sri Lanka registered the lowest value instability at 23.75 per cent CDVI, followed by Malaysia and Vietnam. For unit export prices, Ukraine recorded the maximum instability at 20.98 per cent CDVI, followed by Morocco and Saudi Arabia, while the United Arab Emirates registered the lowest price volatility at 10.85 per cent CDVI, followed by Malaysia and Vietnam.

Table 4. Sub-Periodwise Instability Indices of Raisin Exports from India, (Period I : 2005-06 to 2014-15), (Period II : 2015-16 to 2024-25)

Country	Export Quantity		Export Value		Export Price	
	Period I	Period II	Period I	Period II	Period I	Period II
Saudi Arabia	50.26	34.45	57.23	42.98	11.88	18.66
	(61.04)	(34.45)	(70.70)	(43.06)	(14.61)	(19.02)
Morocco	81.47	81.74	87.06	88.07	15.29	19.68
	(91.37)	(129.98)	(95.67)	(132.59)	(15.44)	(21.04)
Ukraine	57.38	46.94	59.25	44.67	10.17	20.98
	(114.07)	(64.00)	(119.19)	(57.32)	(14.10)	(23.42)
Sri Lanka	52.92	20.09	39.42	23.75	49.62	16.75
	(113.90)	(26.87)	(103.54)	(35.36)	(49.62)	(19.18)
Russia	70.77	76.89	70.60	82.52	5.32	17.86
	(78.40)	(77.19)	(85.94)	(82.53)	(18.72)	(19.36)
Vietnam	31.06	27.68	24.73	29.57	7.13	15.59
	(31.06)	(66.94)	(30.49)	(64.80)	(23.27)	(15.70)
United Arab Emirates	96.06	43.40	93.33	39.00	29.76	10.85
	(111.09)	(52.38)	(113.42)	(44.76)	(34.12)	(13.70)

(continued on next page)

Country	Export Quantity		Export Value		Export Price	
	Period I	Period II	Period I	Period II	Period I	Period II
Malaysia	50.16 (76.31)	21.34 (26.68)	51.54 (80.66)	26.69 (36.20)	12.11 (24.55)	12.26 (13.85)
Romania	142.77 (154.13)	34.45 (133.64)	139.24 (154.94)	42.98 (137.02)	17.68 (18.25)	18.66 (21.29)
Others	47.58 (99.05)	29.46 (32.57)	49.93 (108.95)	35.53 (47.17)	16.92 (30.34)	16.72 (20.31)
Total	50.16 (106.54)	21.34 (34.57)	51.54 (111.80)	26.69 (46.53)	12.11 (30.22)	12.26 (18.86)

Note: Values in parentheses indicate coefficient of variation

Conclusion

Over the 20-year period, raisin exports experienced significant volatility, with instability indices reaching 45.88 per cent for volume, 51.36 per cent for value, and 18.00 per cent for unit prices. While export volume and total value demonstrated high instability for Indian raisins, export pricing remained moderately stable. Across different destinations, high instability was observed in both export quantity and export value, meanwhile Vietnam emerged as the most stable market for Indian raisins whereas Morocco and Romania experienced extreme instability in these areas. All importing countries exhibited moderate instability in the export prices of raisins except Malaysia. Malaysia registered the lowest price instability, followed closely by Vietnam while Sri Lanka saw the high price fluctuations. The period wise assessment reflected that, export instability decreased substantially in Period II across quantity and value for most of the destinations like Sri Lanka, Malaysia and Saudi Arabia except Morocco. Export price instability remained in the low to medium range across both the periods. It is evident that period II brought considerably higher market instability.

Suggestion

The present investigation suggested that, the existing export volumes from highly unstable destinations like Romania and Russia could be strategically redirected towards the stable and consistent markets such as Vietnam, Malaysia and Saudi Arabia. Furthermore, high volatility in the export markets like Morocco and Sri Lanka suggests for structured supply chain management, and export contract models to stabilize trade volumes and reduce frequent buyer shifts.

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