

RESEARCH PAPER

Direction of Trade and Export Competitiveness of Turmeric in India

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ABSTRACT

This paper has studied the direction of trade of turmeric by Markov chain analysis and has shown that Malaysia is the most stable market of turmeric, followed by USA, Bangladesh, UAE and Iran and Morocco are the most unstable importers. The estimated NPCs have indicated that the Indian turmeric was price competitive during the study period 2009 to 2010. India had enjoyed a comparative advantage in turmeric exports during the study period i.e., 2009 to 2022.

HIGHLIGHTS

- ❶ India has been traditionally recognized as a 'land of spices', as a wide variety of spices is grown in the country.
- ❷ Turmeric is one of the oldest crops which is growing for several millennia in China and India.
- ❸ Turmeric is an erect perennial crop, but it is grown as an annual crop.

Keywords: Turmeric, export competitiveness, direction of trade, nominal protection coefficient, Markovchain analysis and factors influencing export

Indian spices are the most sought products around the globe due to their exquisite aroma, texture and taste (Chaitra and Sonnad, 2019). The world's greatest producer, consumer, and exporter of spices is India, and the country's agricultural exports also heavily rely on spices (Anusha *et al.* 2020). Indian spices hold a strong place in the world spice market (Chaitra and Sonnad, 2020). Turmeric (*Curcuma longa* L.) is called as Indian saffron and it is one among the important commercial crop grown in India. India is the largest producer, consumer and exporter of turmeric in the world. The primary tuber at the base of the aerial stem bears rhizome which is the economic portion called as bulb and fingers. The turmeric is traditionally well known for its culinary and medicinal properties. It is one of the multiuse products which have many valuable properties and uses. It is extensively used in food, textile, medicine and cosmetic industries. In the year

2022-23, India produced over 75 per cent of the global turmeric production and a major supplier of turmeric to the world with more than 60 per cent share in turmeric trade. During 2022-23, turmeric export from India to different nations in terms of quantity and value was 170085 tonne and 166699 in lakhs respectively (www.Indiastat.com). Turmeric was cultivated over an area of 333 thousand hectare. It is widely cultivated in different countries such as India, China, Myanmar, Nigeria, Bangladesh, Pakistan, Sri Lanka, Taiwan, Burma, Indonesia, etc. Among these countries, India occupies an area of 320.78 of thousand hectare with production of 1169.98 thousand metric tonne during 2022-23 (Spice Board of India).

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In India, turmeric is grown in its 18 states. The states like Andhra Pradesh, Tamil Nadu, Karnataka, Orissa and West Bengal are the major turmeric-producing states in India. The major countries that export turmeric is: India, Myanmar, Netherlands and Fiji. Indian turmeric fetches a premium price due to its superior quality in the international market. India has occupied around 60 per cent of the world trade in turmeric. The leading export markets for Indian Turmeric are Bangladesh, USA, UAE, Morocco, Iran and Malaysia.

The specific objectives to study the extent of price integration of turmeric in domestic and international markets and to analyze the direction of trade of turmeric in India.

MATERIALS AND METHODS

To study export performance of turmeric, the data on export pertaining to the period 2009 to 2022 were used and to work out trade direction, data from 2008 to 2022 were used. The statistical techniques used were Markov chain analysis to study direction of trade, nominal protection co-efficient (NPC) and Revealed Comparative Advantage (RCA) analysis to assess export competitiveness. Multiple linear regression analysis was used to examine the factors influencing on export of turmeric from India.

Markov chain analysis

Markov chain analysis is primarily based on the estimation of the transitional probability matrix P . The element P_{ij} of this matrix indicates the probability that exports will switch from the country i to the country j with time. The diagonal element P_{ii} measures the probability that the export share of a country will be retained. Hence, examination of diagonal element indicates the loyalty of an importing country to a particular country's exports. In the context of the current application, the average exports to a particular country were considered to be a random variable which depended only on its past exports to that country and which can be denoted as;

$$E_{jt} = \sum_{i=1}^r E_{it} - 1P_{ij} + e_{jt}$$

Where,

E_{jt} = Exports from India to the j^{th} country during the

year t ; E_{it-1} = Exports to the i^{th} country during the year $t-1$; e_{jt} = The error-term which is statistically independent of E_{it-1} and; r = Number of importing countries.

The transitional probabilities P_{ij} , which can be arranged in a $(c \times r)$ matrix, have the following properties;

$$\sum_{i=1}^r P_{ij} = 1 \text{ for all } i$$

Thus, the expected export shares of each country during period t were obtained by multiplying the exports to these countries in the previous period ($t-1$) with the transition probability matrix. The transition probability matrix was estimated in the linear programming (LP) framework by the method referred to as Minimization of Mean Absolute Deviation (MAD), the LP formulation is stated as:

$$\text{Min } O'P^* + Ie$$

Subject to, $XP^* + V = Y$

$$GP^* = 1$$

$$P^* > 0$$

where, P^* is a vector of the probabilities P_{ij} , O is a vector of zeros, I is an appropriately dimensional vector of areas, e is the vector of absolute errors ($|U|$), Y is the vector of exports to each country, X is a block diagonal matrix of lagged values of Y , V is the vector of errors, and G is a grouping matrix to add the row elements of P arranged in P^* , to unity. Analysis was done by using LINGO software.

EXPORT COMPETITIVENESS

The global competitiveness of turmeric was evaluated using nominal protection co-efficient (NPC) and Revealed Comparative Advantage (RCA). Competitiveness is the ability of a nation to grow successfully and to maintain its share in world trade.

Nominal Protection Co-Efficient (NPC)

Nominal Protection Coefficient is a straight forward measure of the export competitiveness. It is calculated as a ratio between domestic prices to the

international price of the comparable grades of the commodity. The nominal protection coefficient was calculated by using the formula:

$$NPC = Pd/Pb$$

Where, NPC = Nominal Protection Coefficient

Pd = Domestic price of the commodity

Pb = International reference price of the commodity

If the NPC is less than 1 indicated that the commodity is competitive and the NPC value more than 1 indicated that the export of the commodity is non-competitive.

Revealed Comparative Advantage (RCA) Analysis

The performance of turmeric done using the RCA analysis. Revealed Comparative Advantage (RCA) was first introduced by Bela Balassa (1965). It is an economist's tool that uses the trade pattern to identify the business sectors in which an economy has a comparative advantage, when comparing the country of interests' trade profile with the world average. The objective of using RCA is to analyze a competitive advantage of each business section in the country of interest. The study uses information related to an export value. RCA had been transformed several times by Balassa (1986). The original RCA measures export performance by country and its industry or commodity. Its formula defined as a country's share of world exports of a commodity divided by its share of total world exports. The index for country *i* and commodity *j* is calculated as follows:

$$RCA_{ij} = (X_{ij} / X_{ik}) / (X_{nj} / X_{nk})$$

Where,

X_{ij} = Exports of country 'I' of commodity 'j'

X_{ik} = Exports of country 'I' of a total agricultural commodity's 'k'

X_{nj} = Exports of a world 'n' of commodity 'j', and

X_{nk} = Exports of a world 'n' of a total agricultural commodity's 'k'

In the present study, country 'I' refers to India, commodity 'j' refers to any of the selected agricultural commodities, set of commodities 'k' refers to the

total agricultural commodities and 'n' refers to world. When RCA assumed the value greater than unity for a given country in a given commodity, the country is said to have a revealed comparative advantage in that commodity. However, RCA suffers from the problem of asymmetry as pure 'RCA is basically not comparable on both-sides of unity. If the index ranged from zero to one, a country is said not to be specialized in a given sector and if the value of the index ranged from one to infinity, the country is said to be specialized. The index is made symmetric, following the methodology suggested by Dalum *et al.* (1998) and the resultant index is called as 'Revealed Symmetric Comparative Advantage' (RSCA). Mathematically, it can be expressed by the following equation;

$$RSCA = (RCA - 1) / (RCA + 1)$$

This measure ranges between -1 and +1 and is free from the problem of skewness. A commodity is said to have comparative advantage in its exports if the corresponding RSCA value is positive and vice versa. In the present study, the RSCA was used to look into the comparative advantage of the selected commodities.

Regression Analysis

Multiple linear regression was employed to identify the factors influencing the export of turmeric. The model used was of the type;

$$Y = a + b_i X_i + e \dots\dots$$

Where,

Y = Export (Tonnes)

a = Constant or intercept

b_i = Regression coefficients

X1 = Price in domestic market (₹/Kg)

X2 = Export price of the spice (₹/Kg)

X3 = Production (Tonnes)

e = Disturbance term

To identify the factors influencing the export of turmeric, multiple linear regression was made use of by placing export quantity as dependent variable (Y) and price in domestic market (X1), export price of turmeric (X2) and production (X3) as independent variables (Xi) in the above model.

RESULTS AND DISCUSSION

Table 1 presents transitional probabilities depicting broad changes in the direction of trade. The period considered for analysis was 2008 to 2022. The major countries considered for the analysis were Bangladesh, USA, UAE, Morocco, Iran and Malaysia and the remaining turmeric importing countries were grouped as 'others'.

The transitional probability matrix in Table 1 indicated that Bangladesh lost its share to USA, UAE, Malaysia and others to the extent of 30.3 per cent, 19.4 per cent, 3.2 per cent and 4.1 per cent respectively. It gained 14.3 per cent, 13.4 per cent and 33.1 per cent from USA, UAE and Morocco. USA retained its original share to the extent of 46.7 per cent and lost its share to Bangladesh (14.3 %), Morocco (12.1%) and others (26.9 %). UAE also able to retained its original share of 35.0 per cent and lost its share to Malaysia (2.5 %) and others (49.1%).

The turmeric exports to Morocco are the most unstable importer of turmeric from India since it could not retain even its original share. Lost its major share to Bangladesh (33.1 %), USA (30.9%) and UAE (36.0 %). However, it gained from the shares of USA (12.1 %), Iran (0.5 %) and others (2.2 %). Iran USA retained its original share to the extent of 33.0 per cent and lost its share from USA (48.8 %). Morocco (0.5 %), Malaysia (9.9 %) and followed by others (7.8%). Malaysia is the most stable importer of turmeric, as it retained its original share of 63.4 per cent and only lost its share from UAE (36.6 %). The group of countries pooled under 'others' retained 86.0 per cent of its original share, it lost its share to Morocco (2.2 %), Iran (10%) and Malaysia (1.9%) and it gained from Bangladesh (4.1 %), USA (26.9%), UAE (49.1 %) and Iran (7.8 %)

Thus, it was clear that Morocco were the most unstable importers of turmeric as they could not retain their original shares. Bangladesh, USA, UAE, Iran and Malaysia, USA, and UAE could be termed as stable importers and potential destinations for the Indian turmeric in future.

Projection of Indian turmeric Exports to Major Destinations

The export share of Indian turmeric in export to different countries were computed using transitional probability matrix. The future market shares of Indian turmeric to the major importing countries were projected to 2027. A close look at the actual and predicted shares of turmeric exported from India to different countries during the study period (Table 2) revealed that the observed proportions of exports shares are inconsistent with the predicted share of exports, which were derived from the Markov chain process. The actual share of Bangladesh in turmeric export had fluctuations over the study period 2008 to 2022, it increased from 4.86 to 13.12 per cent, with respect to prediction share, it also increased from 5.65 to 10.32 per cent. The projections for 2027 (Table 3) suggested a decrease from 8.46 to 6.73 per cent. The actual and prediction share of USA also showed slight fluctuations during the study period increased from 7.41 to 11.33 per cent and 9.82 to 13.38 per cent. Table 3 depict projections share decrease from 13.45 to 13.15 per cent.

With respect to Morocco the actual proportion of exports showed an increasing trend, i.e. it increased from 3.15 per cent in 2008 to 5.48 per cent in 2022. The predicted proportion also showed gradual increased from 2.19 to 2.50 per cent. The projections share has also an increasing trend. The actual export to Iran and Malaysia increased in absolute and

Table 1: Transitional probability matrix for export of turmeric from India to major importing countries (2009 to 2022)

Country	Bangladesh	USA	UAE	Morocco	Iran	Malaysia	Others
Bangladesh	0.431	0.303	0.194	0.000	0.000	0.032	0.041
USA	0.143	0.467	0.000	0.121	0.000	0.000	0.269
UAE	0.134	0.000	0.350	0.000	0.000	0.025	0.491
Morocco	0.331	0.309	0.360	0.000	0.000	0.000	0.000
Iran	0.000	0.488	0.000	0.005	0.330	0.099	0.078
Malaysia	0.000	0.000	0.366	0.000	0.000	0.634	0.000
Others	0.000	0.000	0.000	0.022	0.100	0.019	0.860

Table 2: Actual and estimated share of turmeric export from India to different nations, 2008-2022 (in lakhs)

Year	Bangladesh		USA		UAE		Morocco		Iran		Malaysia		Others	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
2008	2748 (4.86)	3190 (5.65)	4189 (7.41)	5550 (9.82)	6115 (10.82)	4932 (8.73)	1779 (3.15)	1238 (2.19)	4532 (8.02)	4770 (8.44)	4420 (7.82)	4100 (7.26)	32724 (57.91)	32727 (57.92)
2009	3094 (4.42)	3484 (4.98)	4280 (6.12)	6819 (9.74)	6717 (9.60)	5660 (8.09)	1934 (2.76)	1455 (2.08)	6732 (9.62)	6397 (9.14)	5496 (7.85)	5193 (7.42)	41735 (59.63)	40980 (58.55)
2010	7774 (5.35)	8286 (5.70)	7755 (5.34)	11521 (7.93)	21510 (14.80)	14719 (10.13)	2869 (1.97)	2788 (1.92)	9549 (6.57)	11474 (7.90)	12700 (8.74)	11331 (7.80)	83168 (57.23)	85206 (58.63)
2011	13629 (7.01)	14655 (7.54)	15463 (7.95)	16954 (8.72)	34662 (17.83)	21576 (11.10)	5842 (3.01)	4168 (2.14)	7798 (4.01)	12999 (6.69)	12832 (6.60)	12151 (6.25)	104174 (53.59)	111895 (57.56)
2012	8220 (7.54)	7187 (6.60)	9505 (8.72)	11256 (10.33)	12097 (11.10)	9047 (8.30)	2015 (1.85)	2546 (2.34)	7597 (6.97)	8782 (8.06)	6810 (6.25)	6801 (6.24)	62707 (57.56)	63332 (58.13)
2013	1345 (1.18)	4079 (3.58)	10023 (8.79)	13663 (11.98)	8902 (7.80)	7393 (6.48)	2634 (2.31)	2737 (2.40)	15899 (13.94)	11937 (10.47)	8378 (7.34)	8392 (7.36)	66884 (58.64)	65863 (57.74)
2014	3988 (3.53)	5025 (4.45)	10122 (8.96)	12293 (10.88)	7183 (6.36)	7368 (6.52)	2709 (2.40)	2778 (2.46)	11314 (10.01)	10655 (9.43)	8480 (7.51)	8087 (7.16)	69179 (61.23)	66768 (59.10)
2015	3560 (2.65)	5672 (4.22)	14615 (10.88)	16593 (12.36)	7943 (5.91)	8058 (6.00)	2964 (2.21)	3570 (2.66)	15929 (11.86)	13227 (9.85)	9614 (7.16)	9462 (7.05)	79665 (59.32)	77708 (57.87)
2016	7064 (3.93)	9557 (5.32)	22519 (12.54)	23836 (13.28)	10774 (6.00)	10935 (6.09)	5580 (3.11)	5066 (2.82)	19380 (10.80)	16787 (9.35)	10337 (5.76)	10895 (6.07)	103868 (57.86)	102444 (57.07)
2017	4465 (2.45)	10322 (5.65)	34791 (19.05)	27204 (14.90)	11191 (6.13)	10473 (5.74)	5786 (3.17)	6460 (3.54)	16028 (8.78)	15342 (8.40)	9851 (5.40)	10119 (5.54)	100473 (55.03)	102663 (56.23)
2018	2622 (1.10)	16734 (7.03)	75455 (31.70)	50175 (21.08)	9004 (3.78)	11144 (4.68)	10826 (4.55)	11568 (4.86)	22154 (9.31)	18134 (7.62)	9791 (4.11)	10716 (4.50)	108187 (45.45)	119567 (50.23)
2019	13667 (7.03)	16063 (8.27)	40725 (20.95)	33405 (17.19)	9096 (4.68)	12440 (6.40)	9442 (4.86)	7110 (3.66)	15038 (7.74)	14731 (7.58)	8755 (4.50)	9516 (4.90)	97625 (50.23)	101083 (52.01)
2020	42555 (18.31)	29724 (12.79)	51620 (22.21)	45721 (19.68)	11111 (4.78)	18161 (7.82)	7604 (3.27)	8413 (3.62)	13116 (5.64)	14076 (6.06)	8964 (3.86)	10431 (4.49)	97411 (41.92)	105852 (45.55)
2021	28856 (12.79)	25000 (11.08)	45832 (20.32)	35150 (15.58)	24701 (10.95)	20884 (9.26)	8164 (3.62)	7793 (3.46)	5131 (2.28)	11976 (5.31)	10116 (4.49)	10375 (4.60)	102736 (45.55)	114355 (50.70)
2022	28178 (13.12)	22179 (10.32)	24345 (11.33)	28742 (13.38)	19888 (9.26)	20310 (9.45)	11782 (5.48)	5380 (2.50)	10674 (4.97)	14531 (6.76)	9948 (4.63)	10808 (5.03)	110001 (51.21)	112864 (52.54)

Note: The figures within the parentheses indicate percentages to total exports of turmeric.

Table 3: Projected export of Indian turmeric to major importing countries 2008-2022 (in lakhs)

Year/Country	Bangladesh	USA	UAE	Morocco	Iran	Malaysia	Others
2023	18167.05 (8.46)	28883.18 (13.45)	17303.69 (8.06)	5991.52 (2.79)	16088.83 (7.49)	11606.33 (5.40)	116771.29 (54.36)
2024	16259.87 (7.57)	28685.27 (13.35)	15986.21 (7.44)	6100.59 (2.84)	16993.73 (7.91)	12134.12 (5.65)	118650.61 (55.23)
2025	15270.16 (7.11)	28491.60 (13.26)	15387.91 (7.16)	6121.66 (2.85)	17480.20 (8.14)	12498.50 (5.82)	119559.05 (55.66)
2026	14743.20 (6.86)	28345.89 (13.20)	15127.65 (7.04)	6120.22 (2.85)	17731.54 (8.35)	12747.54 (5.93)	119991.80 (55.86)
2027	14460.13 (6.73)	28240.77 (13.15)	15025.08 (6.99)	6113.18 (2.85)	17857.72 (8.31)	12914.79 (6.01)	120194.97 (55.95)

Note: The figures within the parentheses indicate percentages to total exports.

relative percentages to the total export from India during 2008 to 2022 and projections for 2023 to 2027 have suggested a decreasing trend.

With respect to 'others', the actual and predicted export shares showed a decrease from 57.91 to 51.21 per cent and from 57.92 to 52.54 per cent between 2008 to 2022 and the estimation for 2027 suggested an increase to 55.95 per cent.

In light of the previous conversations, more stress has to be given on the countries such as Malaysia, USA, Bangladesh, Iran and other countries category for maintaining present status of export and the government has to give more importance to the countries such as Morocco to maintain the market share in the future. The policies have to be drawn based on the problems faced by the importing countries, so that the export of turmeric would increase in future and India may earn more foreign exchange through turmeric export (Angles *et al.* 2011).

Revealed Symmetric Comparative Advantage of Turmeric

The RSCA values were displayed in Table 4. It was found that India has a comparative advantage in exporting turmeric during the study period. It also strengthened its position in the global markets and assumed to be more comfortable exporting due to a growing demand among the international consumers.

Table 4: Revealed Symmetric Comparative Advantage of Turmeric, 2009-2022

Year	RSCA
2009	0.96
2010	0.96
2011	0.96
2012	0.95
2013	0.95
2014	0.95
2015	0.96
2016	0.95
2017	0.95
2018	0.95
2019	0.95
2020	0.95
2021	0.94
2022	0.94

Nominal protection coefficient is found to be the best measure to assess the price competitiveness of commodity exported. The nominal protection coefficient was calculated for the years 2009 to 2022. The results of the nominal protection coefficient are presented in the table. During the year 2009 and 2010 the NPC was 0.74 and 0.61 respectively which is less than unity was observed due to more domestic price compared to the international reference price. This shows that Indian turmeric was competitive at international market. But from the year 2011 to 2022, the NPC was found to be more than unity indicated that the export of the commodity is non-competitive market.

Table 5: National protection Coefficient (NPC)

Year	Domestic price	World price	NPC
2009	63.84	47.35	0.74
2010	122.16	75.12	0.61
2011	72.20	142.71	1.98
2012	46.86	92.37	1.97
2013	63.82	62.69	0.98
2014	61.52	86.03	1.40
2015	74.34	86.55	1.16
2016	79.62	104.14	1.31
2017	66.34	106.60	1.61
2018	63.50	96.52	1.52
2019	60.52	106.00	1.75
2020	54.89	93.49	1.70
2021	64.10	93.69	1.46
2022	63.80	116.51	1.83

Factors influencing export of turmeric during 2009 to 2022

In Table 6 as shown that the coefficient of multiple determination indicated that 75 per cent of the variations in the export of turmeric were explained by the variables included in the function. Variables such as production, domestic price and export price influenced the turmeric export significantly. The export of turmeric depended upon the turmeric production in India. All three variables positively influenced the quantity export of turmeric production in India. The growing demand in the global market was the primary cause of the amazing expansion in the quantity and value of turmeric exported.

Table 6: Factors influencing export of turmeric, 2009 to 2022

Explanatory Variable	b	P	t	R ²	F
Intercept	1.610	0.488	0.720		
Domestic price (₹/Kg) X1	0.396	0.153	1.546	0.75***	10.40
Export price (₹/Kg) X2	0.281	0.199	1.375		
Production ('000 MT) X3	1.297	0.002**	4.017		

Note: ***indicates significance at 1 and 5 per cent level.

** indicates significance at 5 per cent level.

CONCLUSION

The direction of trade in Indian turmeric, studied by Markov chain analysis, has shown Malaysia to be the most stable market, followed by USA, Bangladesh and Iran. The countries Morocco have been found highly unstable importers of Indian turmeric. A higher demand of turmeric in the overseas markets help to fetch a better price, thereby providing more profits to farmers. India had enjoyed a comparative advantage in turmeric as RSCA values were found to be positive throughout the study period. The computation of nominal protection coefficients has indicated turmeric is less than one during the first two years which clearly indicated that Indian turmeric is competitive in the international market but later became non-competitive market.

REFERENCES

- Angles, S., Sundar, A. and Chinnadurai, M. 2011. Impact of globalization on production and export of turmeric in India—An economic analysis. *Agril. Econ. Res. Rev.*, **24**: 301-308
- Chaitra, G.B. and Sonnad, J.S. 2019. Export performance of chilli and cumin from India: An empirical analysis. *J. of Pharmacognosy and Phytochem.*, **8**: 2014-2020.
- Anusha, S., Kumar, B.S. and Kumar, D.S. 2020. Time series analysis of Indian spices export and prices. *Ind. J. Agril. Res.*, **54**: 65-70
- Chaitra, G.B. and Sonnad, J.S. 2020. Export performance of Pepper from India. *Res. J. Agril. Sci.*, **11**: 355-360.
- Spice Board of India, Ministry of Commerce, Government of India, Cochin.
- www.Indiastat.com
- www.trademap.org

