Changing direction and magnitude of Indian Mango export

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ABSTRACT

India is native to Mango and is also the largest producer of mangoes with 44.14 per cent of the total world production. The export of fresh mangoes has increased from ₹ 35.2 crores in 1991-92 to ₹ 162 crores in 2012-13. The paper attempts to quantify the changing structure of Indian mango exports. Data for analysis was taken for a period of 12 years from 2001-02 to 2012-13. The markov chain analysis was attempted through linear programming method to assess the transition probabilities for the major mango markets. The major export markets for Indian mangoes are Bangladesh, U.A.E, Nepal, Saudi Arabia and UK. The major Indian mango export markets were categorized as stable market (Bangladesh, U.K, U.A.E) and unstable markets (Nepal, Saudi Arabia) based on the magnitude of transition probabilities. The increasing share of other countries clearly shows the need to explore and exploit the market potential of other countries. Efforts are also needed to improve the efficiency of production and quality in order to stabilize the markets and also to make the product acceptable and price competitive in other importing countries.

Introduction

Mango (*Mangifera indica*) is the main fruit of Asia and has developed its own importance all over the world. Being an useful and del¹icious fruit, it was the part of culture and religion since long time. Besides a fine taste, it has many good qualities thus making it to be called as "King of Fruits". Mango continues to dominate the Indian fruit basket contributing 36 per cent to total fruit area and 20.3 per cent to total fruit production. It is grown over an area of 2.2 million ha with a production of 15.5 million tonnes in the country (Indian Horticulture database, 2011). India is the largest producer of mangoes with 44.14 per cent of the total world production. Thus India has immense potential to assert a strong presence in the global mango market, which is still under-developed. The export value of fresh mangoes has increased from ₹ 35.2 crores in 1991-92 to ₹162 crores in 2012-13. The major export markets for Indian mangoes are Bangladesh, U.A.E, Nepal, Saudi Arabia and UK. This is made possible due to increased export and due to diversification of geographical concentration. Even though export of mangoes is increasing, the share of quantity exported out of total production is meagre (0.38 %) of total production is exported. Therefore an attempt is made to quantify the changing structure of Indian mango exports. The main objective of the paper was to study the direction of export and structural change in mango exports.

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Material and Methods

The study is based on time series data on quantity and value of mango export from India obtained from various published issues of APEDA for a period of 2001-02 to 2012-13. Markov chain analysis was employed to analyze the structural change in any system whose progress through time can be measured in terms of single outcome variable (Dent, 1967). In the present study, the dynamic nature of trade patterns that is the gains and losses in export of Indian mango in major importing countries was examined using the Markov chain model. Markov chain analysis involves developing a transitional probability matrix 'P', whose elements, P_{ij} indicate the probability of exports switching from country 'i' to country 'j' over time. The diagonal element P_{ij} where i=j, measures the probability of a country retaining its market share or in other words, the loyalty of an importing country to a particular country's exports.

In the context of current application, structural change was treated as a random process with seven importing countries for mango the assumption was that the average export of mango from India amongst importing countries in any period depends only on the export in the previous period and this dependence was same among all the periods. This was algebraically expressed as

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

Where,

E_{jt} = exports from India to the jth country in the year t

E_{it-1} = exports of ith country during the year t-1

P_{ij} = the probability that exports will shift from i^{th} country to j^{th} country

e_{jt} = the error term which is statistically independent of E_{it-1}

n = the number of importing countries

The transitional probabilities P_{ij}, which can be arranged in a (c x n) matrix, have the following properties.

$$\sum_{i=1}^{n} P_{ij} = 1 \text{ Where } 0 \pounds P_{ij} \pounds 1$$

Thus, the expected export share of each country during period 't' is obtained by multiplying the exports to these countries in the previous period (t-1) with the transitional probability matrix. The probability matrix was estimated for the period 2000-01 to 2010-11.

Thus transitional probability matrix (T) was estimated using linear programming (LP) framework by a method referred to as minimization of Mean Absolute Deviation (MAD).

Min, OP* + I e

Subject to

X P* + V = Y

GP* = 1

P* ³ 0

Where,

P* is a vector of the probabilities P_{ij}

O is the vector of zeros

i is an appropriately dimensional vectors of areas

e is the vector of absolute errors

Y is the proportion of exports to each country.

X is a block diagonal matrix of lagged values of Y

V is the vector of errors

G is a grouping matrix to add the row elements of P arranged in P* to unity.

Prediction of quantity of fresh mango export were made by using the Transitional Probability Matrix.

$B_t = B_0 * T$

$B_{t+i} = B_{t+i-1} * T$

Where,

B_0 = Quantity exported in Base years

B_{t+i} = Quantity exported in next year (prediction)

T = Transitional probability matrix

Table 1. Transitional probability matrix of Indian mango export (2001-02 to 2012-13)

	U.A.E	Bangladesh	Nepal	Saudi Arabia	UK	Others
U.A.E	0.2576	0.5787	0.0779	0.0164	0.0000	0.0695
Bangladesh	0.4739	0.3732	0.0705	0.0000	0.0398	0.0425
Nepal	0.0000	0.9816	0.0184	0.0000	0.0000	0.0000
Saudi Arabia	0.3296	0.6704	0.0000	0.0000	0.0000	0.0000
UK	0.5645	0.0000	0.0000	0.0000	0.4355	0.0000
Others	0.2263	0.0000	0.0000	0.3192	0.0000	0.4544

Table 2. Actual and predicted quantity of mango export from India to selected countries

	U.A.E		Bangladesh		Nepal		Saudi Arabia		UK		Others	
	A	E	A	E	A	E	A	E	A	E	A	E
2001-02	12809.55	16409.35	21033.74	17333.79	101.40	2483.11	2942.88	2179.85	1372.87	1435.10	6168.88	4588.12
	(28.83)	(36.93)	(47.34)	(39.01)	(0.23)	(5.59)	(6.62)	(4.91)	(3.09)	(3.23)	(13.88)	(10.33)
2002-03	14033.56	12889.66	13392.85	14934.50	426.19	2045.38	2085.02	2413.17	1227.57	1067.69	6836.74	4651.53
	(36.93)	(33.92)	(35.24)	(39.30)	(1.12)	(5.38)	(5.49)	(6.35)	(3.23)	(2.81)	(17.99)	(12.24)
2003-04	21056.16	20500.02	23797.13	26518.83	2930.11	3372.30	3845.72	2711.83	1511.63	1605.53	7410.57	5842.80
	(34.77)	(33.86)	(39.30)	(43.80)	(4.84)	(5.57)	(6.35)	(4.48)	(2.50)	(2.65)	(12.24)	(9.65)
2004-05	10338.61	20385.74	32503.22	22991.97	3400.94	3160.60	2300.53	1328.18	1308.56	1863.62	3628.16	3749.91
	(19.33)	(38.12)	(60.78)	(42.99)	(6.36)	(5.91)	(4.30)	(2.48)	(2.45)	(3.48)	(6.78)	(7.01)
2005-06	26533.76	24211.48	32770.90	32671.57	4116.01	4453.72	1564.15	1643.55	839.97	1670.20	3781.81	4956.09
	(38.12)	(34.78)	(47.08)	(46.94)	(5.91)	(6.40)	(2.25)	(2.36)	(1.21)	(2.40)	(5.43)	(7.12)
2006-07	22045.51	28152.35	42887.52	37555.32	8055.73	4890.48	1323.56	1277.20	1883.19	2527.20	2865.37	4658.32
	(27.88)	(35.61)	(54.25)	(47.50)	(10.19)	(6.19)	(1.67)	(1.62)	(2.38)	(3.20)	(3.62)	(5.89)
2007-08	22469.62	16543.96	17063.60	27779.70	7550.89	3092.49	1488.95	1391.75	2575.37	1800.78	3202.37	3742.12
	(41.34)	(30.44)	(31.40)	(51.11)	(13.89)	(5.69)	(2.74)	(2.56)	(4.74)	(3.31)	(5.89)	(6.89)
2008-09	24570.90	30877.98	45104.50	37162.08	4765.00	5182.89	2141.30	1870.56	2527.40	2896.00	4594.07	5713.65
	(29.35)	(36.89)	(53.89)	(44.40)	(5.69)	(6.19)	(2.56)	(2.23)	(3.02)	(3.46)	(5.49)	(6.83)
2009-10	25608.20	26367.08	33549.90	33431.18	4058.20	4435.53	3147.10	2061.41	2958.70	2623.93	5138.51	5541.48
	(34.39)	(35.41)	(45.06)	(44.90)	(5.45)	(5.96)	(4.23)	(2.77)	(3.97)	(3.52)	(6.90)	(7.44)
2010-11	25725.00	20549.19	23049.70	26509.28	1991.30	3665.82	1592.20	1744.29	2723.50	2103.56	4139.07	4648.63
	(43.44)	(34.70)	(38.92)	(44.76)	(3.36)	(6.19)	(2.69)	(2.95)	(4.60)	(3.55)	(6.99)	(7.85)
2011-12	22013.88	22094.91	27599.48	28492.33	3925.74	3733.45	2388.63	1952.07	2532.42	2201.44	4981.13	4967.10
	(34.70)	(34.83)	(43.50)	(44.91)	(6.19)	(5.88)	(3.77)	(3.08)	(3.99)	(3.47)	(7.85)	(7.83)
2012-13	37598.65	15689.48	4650.21	26805.07	2237.62	3296.95	1665.44	2574.63	3304.48	1624.23	6128.58	5594.62
	(67.64)	(28.23)	(8.37)	(48.22)	(4.03)	(5.93)	(3.00)	(4.63)	(5.94)	(2.92)	(11.03)	(10.06)
2013-14		19776.95		24043.70		3173.37		2043.90		1774.29		4772.77
		(35.58)		(43.26)		(5.71)		(3.68)		(3.19)		(8.59)
2014-15		19244.77		24901.41		3294.57		1848.77		1729.73		4565.73
		(34.62)		(44.80)		(5.93)		(3.33)		(3.11)		(8.21)
2015-16		19377.88		24901.67		3315.87		1773.93		1744.47		4471.17
		(34.86)		(44.80)		(5.97)		(3.19)		(3.14)		(8.04)

Note: A-Actual exports in tons. P- Predicted exports in tons. Figures in parenthesis indicate exports share in percent

Results and Discussion

The transitional probability matrix presented in Table 1 depicts a broad idea of change in the direction of trade of Indian mango from 2001-02 to 2012-13. The five major countries which imported Indian mango were UAE, Bangladesh, Nepal, Saudi Arabia and UK. The export to remaining countries was pooled under the category of 'other countries'. It could be seen from the Table 4.29 that, during the study period, 'other countries' were the most stable importers of Indian mango as they retained their original share of about 45.44 per cent from the previous year. They lost their share of about 31.92 per cent to Saudi Arabia and 22.63 per cent to UAE. Other countries gained 6.95 per cent from UAE and 4.25 per cent from Bangladesh. UK is another stable importer of Indian mango as it retained 43.55 per cent of its share from previous year by losing 56.45 per cent to UAE and gained 3.98 per cent from Bangladesh. Nepal is unstable importer of Indian mango because it retained only 1.84 per cent of its share from the previous year by losing 98.16 per cent to Bangladesh. Saudi Arabia was the most unstable importers of Indian mango during the study period as the country did not retain any amount of its share from the previous year. Similar results were found in study conducted by Promod Kumar *et al* (2007).

The projection of the Indian mango export to different countries was computed using the transitional probability matrix and the results of actual and projected exports of Indian mango have been presented in Table 2. The market share projections of mango exports to different countries have been computed upto 2015-16. In the case of UAE, the actual export had increased from 28.83 per cent to 67.64 per cent during 2001-02 to 2012-13 and the estimated value showed that the share of UAE has decreased for the same period and the projected market share is expected to increase from 28.23 per cent to 34.86 per cent during 2012-13 to 2015-16. But, in case of Bangladesh, the actual export had decreased during 2001-02 to 2012-13 from 47.34 per cent to 8.37 per cent and the estimated value showed increase dur-

ing the same period and the projected market share is expected to decrease during 2012-13 to 2015-16 from 48.22 per cent to 44.80 per cent. In the case of Nepal, the percentage share of actual and estimated export of mango increased from 0.23 per cent to 4.03 per cent and from 5.59 per cent to 5.93 per cent respectively from 2001-02 to 2011-12. However, the projected value suggested that the percentage of quantity would slightly increase from 5.93 per cent in 2011-12 to 5.97 in 2015-16. The actual and estimated share of mango to Saudi Arabia decreased from 6.62 per cent to 3 per cent and from 4.91 per cent to 4.63 per cent. The projected market share is also expected to decrease from 4.63 per cent in 2011-12 to 3.19 per cent in 2015-16. In the case of UK, the actual export had increased from 3.09 per cent to 5.94 per cent and the estimated value showed that the share of UK decreased and the projected market share is expected to increase. The actual and estimated share of mango to other countries decreased from 13.88 per cent to 11.033 per cent and from 10.33 per cent to 10.06 per cent. The projected market share is also expected to decrease from 10.06 per cent in 2011-12 to 8.04 per cent in 2015-16. Similar results were found in study conducted by Yeledhalli *et al.* (2012).

Though India is the largest producer of mango in the world, it export's less than one per cent of its total production. India has a good potential for export of mango and it needs to strive hard to improve its export by improving upon the quality of mango exports and also by improving the yield levels.

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