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A Markov chain analysis of cardamom export from India

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Abstract

A Markova chain analysis of cardamom export from India was studied for the period of 1980-81 to 2014-15. The data was collected from www.indiastat.com and www.indianspices.com. The structural change in export of cardamom from India was examined by using the Markov chain approach. The five major importing countries selected were Saudi Arabia, Japan, Kuwait, UAE, USA and remaining countries were considered under other countries. It is evident from results that Kuwait (75.10%) was the most stable market followed by Saudi Arabia (66.53%), USA (46.42%), UAE (30.28%) and Japan (13.65%).

Keywords: Markova chain analysis, export, structural change, transitional probability matrix, retention

Introduction

India is known for spice production and export all over the world. India is rightly called as “spice bowl of the world” for its production of variety and superior quality of spices. India produces a wide range of spices and holds a prominent position in world spice production. Because of the varying climates - from tropical to temperate almost all spices grow splendidly in India. From India spices like pepper, cardamom, ginger, turmeric, chilli, tejpat, coriander, cumin, garlic *etc.* are produced and exported. Black pepper, Cardamom, Ginger, and Chillies are included in the major spices and the rest are considered as minor spices.

India is the world's largest producer, consumer and exporter of spices. The country produces about 75 varieties out of the 109 varieties listed by the International Organization for Standardization (ISO) and accounts for half of the global trading in spices.

Spices accounts for 12.98 per cent of the area and 11.5 per cent of total production of horticulture crops in India. Total spices export from India is 2, 26, 225 tonnes valued at US\$ 621.78 in 2016 registering a year-on-year growth of 3 per cent. Major importers of Indian spices in 2015-16 were US, China, Vietnam, UAE, Indonesia, Malaysia, UK, Sri Lanka, Saudi Arabia, and Germany.

Cardamom (*Elettaria cardamomum*) belongs to the family Zingiberaceae. It is known as the “Queen of Spices”. It is a perennial tropical herb plant and grows from a thick rootstalk up to around 6-10 feet. The origin of cardamom is believed to be in the rain forests of the Western Ghats in South India. It is indigenously grown in the evergreen forests of the Western Ghats in South India.

International scenario

Cardamom is generally produced in the tropical regions of the world. Guatemala is the largest cardamom producing country followed by India in the world. The total world production of this spice is around 55,000 MT per annum. Guatemala is the largest producer of cardamom followed by India and Indonesia. Nearly 41 per cent of World's Cardamom production is in India and more than 30 per cent of the cardamom produced is exported from India. Even though, Guatemala leads in the World's production it has seen production come down in the past few years due to natural disasters like flood. Besides major producers, cardamom is grown on small scale in Singapore, Netherlands, Nepal, Germany, Sweden, France, Tanzania, Srilanka, Vietnam, Thailand, Cambodia and New Guinea.

National scenario

India has been a dominant producer of cardamom. It is the second largest producer of cardamom in the world. In 2015-16, as per provisional estimates of Spices Board of India, India's production was around 22,000 MT.

Cultivation of cardamom is concentrated in the ever-green forests of Western Ghats in South India. Kerala, Karnataka and Tamil Nadu are the major cardamom producing states in India. Idukki district in Kerala is known as the major trading centre of cardamom. Kerala is the leading producer of cardamom in the country constituting 78 per cent of the total production from 56 per cent of the area under cardamom in the country.

Markov chain analysis

Indian economy is basically agrarian and hence exports of food and agricultural products assume greater significance in our economy. Growth in agro-exports not only brings additional foreign exchange for the country but also benefits a large number of people involved in the production, processing and export of such products.

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.

Markov chain is a stochastic process with the Markov property. The term "Markov chain" refers to the sequence of random variables such a process moves through, with the Markov property defining serial dependence only between adjacent periods (as in a "chain"). It can be used for describing systems that follow a chain of linked events, where what happens next depends only on the current state of the system.

Markov chain analysis helps to know the change and directions of growth i.e. Retention, gains and losses. Also helps in predicting the future values based on transitional probability matrix. The dynamic nature of trade patterns that is the gains and losses in export in major importing countries was examined using the Markov chain model.

2. Material and methods

This study was based on secondary data and the data was collected from www.indiastat.com and www.indianspices.com.

The structural change in exports cardamom from India will be examined by using the Markov chain approach. The estimation of the transitional probability matrix (P) is central to this analysis. The element P_{ij} of the matrix indicated the probability that the exports would switch from the i^{th} country to j^{th} country over a period of time.

In this study, the structural change in export of cardamom retention and switching was examined by using the Markov Chain approach. The estimation of the transitional probability matrix (P) was central to this analysis. The element P_{ij} of the matrix indicated the probability that the exports would switch from the i^{th} country to j^{th} country over a period of time. The diagonal elements P_{ij} indicates the probability that the export share of a country that would be retained in the successive time periods. The average exports to a particular country is considered to be a random variable which depended only on its past exports to that country and which is denoted algebraically by,

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

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.

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

e_{jt} = Error-term which is statistically independent of e_{jt-1} , and r = Number of importing countries.

3. Results and Discussion

Share of different countries in World's cardamom export has been presented in Table 1. India is the second largest exporter of cardamom with share of 18.4 percent after Guatemala with 67.1 per cent share in world's cardamom export. Other countries like Indonesia (4.6 %), Singapore (2.6 %), Netherlands (1.7 %), Nepal (1.11 %), Germany (0.8 %), Sweden (0.5 %) and France (0.4 %) were also contributing for world's cardamom export.

Table 1: Share of different countries in World's cardamom export

Countries	Share in world (%)
Guatemala	67.1
India	18.4
Indonesia	4.6
Singapore	2.6
Netherlands	1.7
Nepal	1.11
Germany	0.8
Sweden	0.5
France	0.4
Others	2.79

Share of Cardamom Export from India to different countries has been presented in Table 2. Among all countries, Saudi Arabia has emerged as the major export market for Indian Cardamom. Based on this result the major five countries were selected to know the shift in cardamom export. The five countries which selected were Saudi Arabia, Japan, Kuwait, UAE and USA.

Table 2: Share of Cardamom Export from India to different countries (over the years)

Sl. No.	Countries	Share (%)
1	Saudi Arabia	61.25
2	Japan	8.69
3	UAE	7.59
4	Kuwait	3.49
5	USA	1.51
6	UK	1.28
7	Malaysia	1.19
8	Pakistan	0.91
9	Oman	0.58
10	Qatar	0.57
11	Canada	0.54
12	Italy	0.53
13	South Africa	0.49
14	Australia	0.43
15	Greece	0.31
16	Baharain	0.10
17	New Zealand	0.009
18	Others	10.96

Structural change of cardamom export from India was examined by estimating the transitional probability matrix using stochastic model (Markov chain). The transitional matrix was presented in the Table 3. The major countries were Saudi Arabia, Japan, Kuwait, UAE, USA and remaining countries were considered under 'Others' category.

The diagonal elements indicate the probability that the export share of a country that would be retained in successive time

periods and the row elements indicates the probability that exports will switch from one country to other country with the passage of time.

The results presented in Table 3 depicts that the highest retention was noticed in Kuwait (75.10 %) followed by Saudi Arabia (66.53 %), USA (46.42 %), others (41.24 %), UAE (30.28 %) and Japan (02.24 %).

It is evident from results that Kuwait was the most stable market among the major importers of Indian cardamom as reflected by the probability of retention of 75.10 per cent and at the same time it has lost its share of 12.78 per cent to Saudi Arabia, 3.15 per cent to USA and 8.97 per cent to other countries. Saudi Arabia was the second most stable market for cardamom with 66.53 per cent of retention and also it has lost its share of 31 per cent to Japan and 0.97 per cent to USA. USA was the next stable market with 46.42 per cent of retention and it has lost its share of 31.71 per cent to UAE and 21.87 per cent to Kuwait. Next major importer of cardamom was found to be other countries with retention of 41.24 per cent and it lost its share of 2.24 per cent to Saudi Arabia and 56.52 per cent to UAE. UAE was found to be next stable importer with 30.28 per cent of retention and it has lost its share of 21 per cent to Saudi Arabia, 0.02 per cent to Japan, 3.90 per cent to Kuwait, 31.81 per cent to USA and 12.99 per cent to other countries. Japan was found to be most unstable market among all with very less retention of 13.65 per cent and major share of this is shifted. The Percentage shift in export of cardamom from India was expressed in figure 1.

Table 3: Transitional probability matrix of cardamom export Shift Gain

	Saudi Arabia	Japan	Kuwait	UAE	USA	Others
Saudi Arabia	0.6653	0.3100	0.0150	0.0000	0.0097	0.0000
Japan	0.3628	0.0224	0.0926	0.2133	0.1697	0.0251
Kuwait	0.1278	0.0000	0.7510	0.0000	0.0315	0.0897
UAE	0.2100	0.0002	0.0390	0.3028	0.3181	0.1299
USA	0.0000	0.0000	0.3171	0.2187	0.4642	0.0000
Others	0.0224	0.0000	0.0000	0.5652	0.0000	0.4124

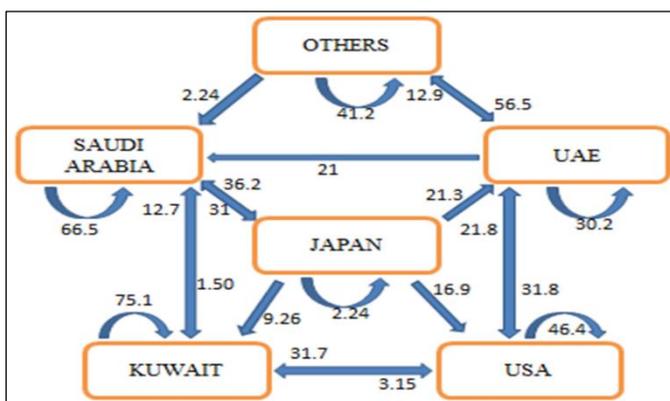


Fig 1: Percentage shift in export of cardamom from India

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