MARKOV CHAIN ANALYSIS ON THE EXPORT PROSPECTS OF COCONUT IN INDIA

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Abstract

The study was carried out with an overall objective to analyse the export prospects of coconut in India using Markov chain model. The study relied on secondary data. The data related to coconut export performance were collected from relevant and authenticated sources for the period between 1998-99 and 2017-18. Using the data, the transitional probabilities and steady state probabilities for coconut export were estimated. The analysis revealed that the counties viz., Bahrain, Omen and United Kingdom would be the major partners in future. The results also insisted upon a fact that the present day minor importers also needs to be dealt with much care, since the import potentials with them are immense.

Keywords: Markov chain analysis, export of coconut, transitional probability

Introduction

The coconut crop is grown in about 90 countries across the World in an area of 11,906 million hectares producing 50,512,143 tonnes annually. Out of World's total area under coconut, 16 major coconut producing countries accounted for 93.75 per cent. Among the Asian and Pacific Coconut Community (APCC), mainly six countries i.e., Philippines, Indonesia, India, Sri Lanka, Papua New Guinea and Thailand together accounted for 80.65 per cent of the total area under coconut cultivation and about 82 per cent of world production (2017).

In India coconut is grown in most of the agro climate zones except subtropic and temperate zones. However, they are favorably adapted to the Indian coastal agro ecosystem, having a coastline of 8129 km and its peninsular region bounded by the Arabian sea on the west, the Bay of bengal on the east and Indian ocean on the south. Andaman and Nicobar islands in the Bay of Bengal and Lakshadweep islands in Arabian Sea are unique island eco-systems where coconut plantation is widely grown. The four southern states Kerala, Karnataka, Tamil Nadu and Andhra Pradesh are the main coconut growing areas in the Country which together account for 90 per cent of area and 93 per cent of production.

Export of Coconut

India exports coconut and its products such as fresh coconut, dry coconut, copra, coconut oil, activated carbon, coconut water, coconut fiber, desiccated coconut and shell charcoal to countries like U.A.E, U.K., Kuwait, Saudi Arabia, U.S.A, China and Germany. These products are exported through different ports. Coconut oil is exported to U.K. and Gulf nations mostly through Cochin port. Coconut shell based steam activated carbon is exported to Germany and Republic of Korea through Tuticorin and Madras port. Coconut Fiber is exported to China through Vizag port. Organic coconut is exported to U.S.A through Bangalore port. Desiccated coconut is exported to Kuwait through Nhava sheva sea port.

In the year 2017-18, the export value of coconut products stood at 1,764 crores and in the year 2019-20 it is expected to cross 2000 crores. Under this background an attempt was made to analyse the direction of trade and future prospects of coconut trade in India.

Materials and Methods

Data for Analysis

The study relied on secondary data alone. The secondary data related to the export of coconut over the years in value terms were collected from the export-import data bank of Ministry of Commerce, GOI. The data collected between the years 1998-99 and 2017-2018 were subjected to Markov chain analysis. Out of the twenty years of data collected only the values of the alternate years were considered for the analysis so as to enable the data to fit in to the excel LP format designed for Markov chain analysis.

Tool for Analysis

Markov Chain Model

The structural change in the share of export of coconut was examined by estimating the transition probability using Markov-chain model. The data on quantity of semi husked coconut exported to various countries from 1998-99 to 2017-18 were taken for Markov chain analysis. This model is stochastic process which describes the finite number of possible outcomes S_i ($i = 1,2,……r$) which is a discrete random variable X_t ($t = 1,2…..t$) and which assumes that (a) The probability of an outcome on the tth trail depends only on outcomes of the preceding trial , and (b) This probability is constant for all time periods

Central to Markov chain analysis is the estimation of the transition probability matrix, 'P'. The element 'P_{ij}' of country this matrix indicates the probability that exports will switch over from country 'i' to country 'j' with the passage of time. The diagonal element 'P_{ij}' measures the probability that the export share of a country will be retained. Hence, an examination of the diagonal element indicated the loyalty of an importing country to a particular's exports.

In the context of the current application, the transitional probability matrix of coconut trade would be estimated for the period from 1998-99 to 2017-18, with major importers of coconut, viz., UAE, UK, Bahrain, Kuwait, Saudi Arabia, Qatar, Oman and other countries.

In the present study, the average exports to a particular country was considered to be a random variable which depends only on its past exports to that country and which can be denoted algebraically as,

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

Where,

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

E_{it-1} = Exports to i^{th} 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_{ij}-1 and

R = Number of importing countries

The transitional probability matrix, which can be arranged in a (c × r) matrix, has the following properties.

$$0 \le P_{ij} \le 1$$

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

Thus, the expected export shares of each country during period 't' can be obtained by multiplying the exports to these countries in the previous period (t-1) with the transitional probability matrix. Similarly, the future export share of the importing countries are estimated.

The transitional probability matrix is estimated in the Linear Programming (LP) framework by a method referred to as minimization of Mean Absolute Deviation (MAD). The LP formula is stated as,

Min OP* + Ie

Subject to:

XP* + V = Y

GP*=1

P*>=0.

Where,

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

O is a vector of zeros

I is an appropriately dimensioned vector of area

e is the vector of absolute errors

Y is the vector of export to each country

X is a block diagonal matrix of lagged values of Y

V is a vector of errors

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

Results and Discussion

Markov Chain Analysis on the Direction of Indian Coconut Trade

An assessment on the possible changes in the country wise direction of export and probable degree of consistency of trading partners is inevitable for a country to decide at its future policy frame work. On this account, Markov-chain analysis was employed and the transition probabilities and steady state probabilities pertaining to different trading partners of coconut trade were computed and presented in Table-1.

Markov chain analysis is the way of analyzing current movement of variables in an effort to predict future movement. In the transitional probability matrix, the rows identify the current state of coconut export to different countries and the column identify the alternatives to which the export pattern could move. Here the row probabilities are associated with export retentions and shift to other countries while the column probabilities are associated with export retention and shift towards the country further adding to the share. The diagonal elements represent probability of retaining the same level of export with a specific country

The transitional and steady state probabilities computed based on the quantity of coconut export to different countries between 1998-99 and 2017-18 reveal the following inferences,

1. The probability of retention of present quantity of coconut export to Oman is estimated as 50 per cent, United Kingdom as 37 per cent and Bahrain as 29 per cent.

2. The analysis revealed that the shift of export from Bahrain to United Kingdom was 21 per cent, Saudi Arabia to Bahrain was 35 per cent, Saudi Arabia to United Kingdom was 26 per cent and United Kingdom to Oman was 25 per cent.

The steady state probabilities showed that if the trend continues like this, in future 18 per cent of Indian coconut export would go to Bahrain, 20 per cent would go to Oman, 12 per cent would go to United Kingdom and 37 percent would go to other minor countries.

Conclusion

Markov chain analysis vividly reveals that, the countries Bahrain, Omen and United Kingdom are the reliable partners as far as the Coconut export is concerned. Another salient point which the analysis reveals is that the present day minor partners of Coconut trade should also not to be ignored. The chances of a present day minor partners to become a major partner is also being indicated in the results.

Table 1 : Transitional Probabilities and Steady State Probabilities of Direction of Indian Coconut Trade

Countries	Bahrain	Oman	Qatar	Saudi Arabia	UAE	UK	Others
Bahrain	**0.29**	0.06	0.03	0.06	0.09	0.21	0.26
Oman	0.03	**0.50**	0.03	0.01	0.02	0.14	0.27
Qatar	0.19	0.01	**0.02**	0.04	0.02	0.14	0.58
Saudi Arabia	0.35	0.02	0.02	**0.05**	0.05	0.26	0.25
UAE	0.25	0.01	0.04	0.03	**0.14**	0.00	0.57
UK	0.18	0.25	0.01	0.04	0.03	**0.37**	0.13
Others	0.13	0.17	0.04	0.01	0.10	0.01	**0.54**
Steady State Probability	0.18	0.20	0.01	0.03	0.07	0.14	0.37

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Important e-source

1. Coconut Development Board, Kochi, Kerala
2. Department of Commerce (GOI)- Export and Import Data Bank