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Structural Change in India's Tobacco Exports : A Markov Chain Approach

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ABSTRACT. *Tobacco (Nicotiana tabacum L.) is an important commercial crop of India. Though, India grows almost all types of tobacco, except oriental, Flue cured Virginia (FCV) type is of significant commercial importance since it is an important agricultural commodity traded in the world market. Despite India being the third largest producer and fifth largest exporter of tobacco in the world, India's share in the world market is very low and stands at 0.5% of the world total. The specific objective of the study is to analyse the structural change in India's tobacco exports for the period 1980/81 to 1994/95 by using Markov chain analysis. The study has revealed that U.S.S.R., the largest market for Indian unmanufactured tobacco, showed a high degree of loyalty for Indian tobacco during 1980/81 to 1985/86, which diminished substantially during the period 1985/86 to 1994/95. The markets of Western Europe, Asia and Middle–East have taken the place of U.S.S.R.. Among the products only cigarettes had a dominant presence in the export basket. The diversification of export markets is clearly evident, necessitating efforts in the direction of brand building for Indian tobacco. The Tobacco Board of India can initiate this exercise. Measures should also be initiated to improve the export competitiveness of Indian tobacco in the world market.*

INTRODUCTION

Tobacco (*Nicotiana tabacum* L.) is one of the important commercial crops grown in India. Although tobacco is grown in an area of 0.4 million ha, which forms only 0.23% of the total cropped area, its contribution to the Indian economy is manifold. In addition to farm income and employment, it

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is an important source of revenue to the government through central excise and export earnings. Export of tobacco and tobacco products from India earned Rs. 8260 million during the year 1996/97. About Rs. 40,700 million, which forms 10% of the total excise earnings in the year 1995/96, was realised through tobacco. Despite India being the third largest producer of tobacco in the world, next only to China and U.S.A., India's share in the world export market is very low at 0.5% of the world trade in tobacco which worth US$ 30 billion. India has been exporting tobacco mainly in the unmanufactured form rather than as value added products to nearly 50 countries in the world.

The erstwhile U.S.S.R. and United Kingdom were the two largest importers of India's unmanufactured tobacco. However, the disintegration of former Soviet Union resulted in a lower intake of Indian tobacco. About 62% of India's tobacco exports are directed to West and East European countries, followed by South and South–East Asia (18%) and the rest to Middle East Asia, Africa, Australia and North and South America. The formation of the World Trade Organisation, and reduction in subsidy in developed countries are likely to help India to increase its exports since no sort of protection is given to tobacco in India (NCAER, 1994). The specific objective of the study was to analyse the structural changes in India's tobacco exports from 1980/81 to 1994/95. A knowledge of the changing direction of trade of tobacco and tobacco products is of great importance in formulating suitable policy measures to improve the export performance.

MATERIALS AND METHODS

Markov chain analysis

Markov chain analysis is an application of dynamic programming to the solution of a stochastic decision process that can be described by a definite number of states. This is a method of analysing the past behaviour of some variable in an effort to predict the future behaviour of the same variable. The transition probabilities between the current state and the future state are described by a Markov chain. A Markov process is a stochastic system for which the occurrence of the future state of any variable depends on its immediately preceding state and only on it. Thus, if $t_0, t_1, t_2, \ldots, t_n$ $(n=0,1,2 \ldots)$ represents points in time, the family of random variables, t_n, is a Markov–process if it possesses the following Markovian property.

$$P(t_n = X_n / t_{n-1} = X_{n-1}, \ldots, t_0X_0) = P\,(\,t_n = X_n / t_{n-1} = X_{n-1})$$

for all values of $t_0, t_1, \ldots, t_n$

The probability $P(X_n/X_{n-1}) = P(t_n=X_n/t_{n-1}=X_{n-1})$ is called the Transition probability. It represents the conditional probability of the system being in the state X_n at t_n, given it was X_{n-1} at t_{n-1}. This probability is also referred to as the one–step transition probability since it describes the system between t_{n-1} and t_n. An 'm' state transition probability is thus defined by;

$$PX_n, X_n\, t_m = P\,(t_nt_m = X_nt_m / t_n = X_n)$$

Let E_1, E_2,...E_J (J = 0,1,2,.....) represent the exhaustive and mutually exclusive outcome (states) of a system at any time. Initially, at time t_0, the system may be at any of these states. Let a_j (j=0,1,2,...) be the absolute probability that the system is in state E_j at t_0,... Assuming that system is Markovian, define $P_{ij} = P(t_n = j)/(t_{n-1} = i)$ as the one–step transition probability of going from state i at t_{n-1} to state j at t_n and assume that these probabilities are fixed over time. Thus, the transition probabilities from state E_i to E_j can be more conveniently arranged in a matrix form as follows;

$$P = \begin{bmatrix} P00 & P01 & P02 & \ldots \\ P10 & P11 & P12 & \ldots \\ P20 & P21 & P22 & \ldots \end{bmatrix}$$

The matrix P is called the transition probability matrix. The probabilities P_{ij} must satisfy the following conditions;

$$O \leq P_{ij} \leq 1, \text{ and}$$

$$\Sigma\, P_{ij} = 1, \text{ for } I = 1,2,\ldots$$

The states considered for the analysis are the value of exports to United Kingdom, U.S.S.R., Western Europe, Eastern Europe, Middle East, Asia, Africa and others. The transition probability matrix P together with the initial probabilities A(0) associated with the State E_j at time t_0 completely

define a Markov chain and describe the transitional behaviour of a system over equally spaced intervals of time. The probabilities (n) associated with the states E_j at time t_n is given by $A^{(n)} = A^{(0)} P^n$.

Styan and Smith (1964) demonstrated the use of stochastic Markov process to study brand loyalties and switching patterns. They indicated that the transitional probabilities could be used to explain which brand gains or loses in the market over others. They have also illustrated that Markov chain can be used to predict the future market positions. Atkin and Blandford (1982), Mellor (1984), and Wilson *et al.* (1990) have employed Markov chain analysis in studying time dependent changes of various economic phenomena.

The direction of unmanufactured tobacco exports from India to different countries/regions over a period of time was analysed. The data on values realised from exports were collected from the Tobacco Board, Guntur, India. The first period was from 1980/81 to 1984/85 (*i.e.* pre–auction period) and the second period was from 1985/86 to 1994/95 (*i.e.* auction period). Secondly, direction of exports of tobacco products was studied for the period from 1985/86 to 1994/95. Thirdly, shifts/loyalty among the tobacco products exported were analysed for the period 1985/86 to 1995/96.

RESULTS AND DISCUSSION

Unmanufactured tobacco

The transition probability matrix for shifts in export of unmanufactured tobacco from India for both the periods are presented in Tables 1 and 2. The transition probability matrix for unmanufactured tobacco exports for the first period reveals that only U.S.S.R. had retained 80% of the previous year's export share in the current period. The U.S.S.R. gained mainly from Asia (57%) and Africa (56.7%). The U.S.S.R. had also lost its previous year import share of unmanufactured tobacco to U.K. (15.7%). During this period U.S.S.R. exhibited a strong preference for unmanufactured tobacco from India.

East Europe (excluding U.S.S.R.) was next in order, retaining about 37% of the previous year's share in the current period and U.K., India's second largest importer had retained only about 23% of previous year market share in the current period. Asia retained only 17.7% of the previous year share, gaining thereby only from the Middle East (46%).

The second period, from 1985/86 to 1994/95 was of importance to the Tobacco Board and the industry as well, since it marks the entry of Tobacco Board in auction marketing of FCV tobacco, from 1984 in Karnataka and from 1985 in Andhra Pradesh. Perusal of Table 2 reveals that U.S.S.R. could retain only 25% of India's export share of the previous year in the second period as against 80% in the first period. A shift in India's export focus to West Europe (excluding U.K.), Asia and Middle East from that of Russia indicate that the country has been gradually expanding its market base, instead of heavily depending upon one or two countries. West European countries, mainly Belgium, Federal Republic of Germany, Netherlands and France showed a strong preference for India's tobacco during the second period, retained 73% of its previous year market share. It had gained 43% of export share from Middle East, 17% from East Europe and 7% from Asia. It had also lost its share to Africa (15.2%), U.S.A. and others (6.3%) and to U.K. (5.5 %).

Table 1. Transition probability matrix for shifts in export of unmanufactured tobacco from India (1980/81 to 1984/85).

Countries	U.K.	U.S.S.R.	West Europe	East Europe	Middle East	Asia	Africa	UA* and Others
U.K.	0.232	0	0.256	0	0.229	0	0.268	0.015
U.S.S.R.	0.157	0.803	0.039	0	0	0	0	0
W. Europe	0.824	0	0	0.177	0	0	0	0
E. Europe	0	0	0	0.368	0	0	0.632	0
Middle East	0	0	0	0.503	0	0.460	0	0.036
Asia	0.215	0.271	0.027	0	0	0.177	0	0.010
Africa	0.349	0.567	0	0	0.084	0	0	0
UA* and Others	0.976	0	0	0	0.023	0	0	0

UA* = U.S.A and Australia

Asia has been emerging as a potential market for Indian tobacco since it retained 63% of its previous year share in the current year in the second period as against only 17% in the first period. Asia gained primarily from Africa (42.3%). Another market of importance is the Middle East,

which had not retained any quantity in the first period, had however retained 40% of its previous year's imports from India during the second period. Eastern Europe including U.K. showed no preference for Indian tobacco during the second period.

Table 2. Transition probability matrix for shifts in export of unmanufactured tobacco from India (1985/86 to 1994/95).

Countries	U.K.	U.S.S.R.	West Europe	East Europe	Middle East	Asia	Africa	UA* and Others
U.K.	0.140	0.825	0	0	0.034	0	0	0
U.S.S.R.	0.360	0.254	0	0.108	0.106	0.038	0.133	0
W. Europe	0.055	0	0.728	0	0	0	0.153	0.063
E. Europe	0.828	0	0.172	0	0	0	0	0
Middle East	0	0.133	0.429	0	0.400	0	0	0.037
Asia	0	0	0.071	0.297	0	0.631	0	0
Africa	0.053	0.476	0	0	0	0.423	0	0.047
UA* and Others	0	0	1	0	0	0	0	0

UA* = U.S.A and Australia

Manufactured tobacco

Export of tobacco products from India, though forming a small quantity (14% of total exports), is of great significance. The transition probability matrix for export of tobacco products from India is presented in Table 3. The Middle East had retained 74% of its previous year import share of manufactured products from India. It had gained from Europe (25%) and Saudi Arabia (17%). In the meanwhile Middle East had lost 22% of its previous year's import share to Saudi Arabia and marginally to Asian countries. Europe and Saudi Arabia too had retained a little over half of its previous year's share. Russia and Africa could retain only 37 and 21%, respectively. The study revealed that only Middle East showing strong tendency for Indian tobacco products followed by Europe and Saudi Arabia.

Table 3. Transition probability matrix for shifts in export of tobacco products from India (1985/86 to 1994/95).

Countries	S. Arabia	U.S.S.R.	Middle East	Asia	Europe	Africa	U.S.A.	Others
S. Arabia	0.514	0.235	0.178	0.013	0.008	0	0.028	0.023
U.S.S.R.	0.561	0.375	0.018	0.014	0.008	0	0.004	0.019
Middle East	0.227	0	0.743	0.026	0	0.003	0	0
Asia	0	1	0	0	0	0	0	0
Europe	0	0	0.255	0	0.581	0.032	0.046	0.085
Africa	0	0.786	0	0	0	0.214	0	0
U.S.A.	0	0.365	0	0	0.635	0	0	0
Others	0	1	0	0	0	0	0	0

Atkin and Blandford (1982) studied structural changes in import market shares for apples in United Kingdom using a first order Markov model. Gemtessa (1991) analysed the direction of trade of Ethiopian Coffee using the Markov model and a structural change in exports was observed. Veena *et al.* (1994) analysed the changing direction of Indian Coffee exports for the period 1965 to 1990 through a first order Markov model. The study revealed that India could not retain its market share to the U.S.A., the Netherlands, Yugoslavia and Italy even though the actual quantity exported to these countries had increased. The above studies have upheld the validity of employing the Markov model for analysing structural changes in the export of agricultural commodities.

Shifts among tobacco products

Analysing shifts among tobacco products exported over the period 1985/86 to 1994/95 would help in identifying the product/product range in order to increase exports. The transition probability matrix for shifts among tobacco products is presented in Table 4.

The results reveal that none of the tobacco products exported from India during the study period had a stable market. Among the tobacco products only cigarettes, chewing tobacco and hookah and tobacco paste are found to be competing with each other for the market share. Cigarettes retained only 16% of its previous year market share during the present period. However, cigarettes, as an internationally exported commodity, had

Table 4. Transition probability matrix for shifts in export among tobacco products (1985/86 to 1994/95).

Products	Bidis	Cigarettes	Chewing Tobacco	Hookah & Tobacco Paste	Snuff	Others
Bidis	0	1	0	0	0	0
Cigarettes	0.180	0.160	0	0.657	0.001	0
Chewing Tobacco	0	0.773	0.227	0	0	0
Snuff	0	0.7000	0	0	0.299	0
Others	0.678	0.322	0	0	0	0

been making rapid strides over other products. It has gained considerably from chewing tobacco (77%), snuff (70%), hookah and tobacco paste (67%) and others (32%). Cigarettes were the only commodity to gain at the cost of others. This development seen in the right perspective falls in line with international demand patterns.

CONCLUSIONS

The Markov chain analysis used in this study to analyse India's unmanufactured tobacco exports to various countries/regions has revealed that the former U.S.S.R. had shown a strong preference for the Indian unmanufactured tobacco in the first period. However, the latter period witnessed a structural change in tobacco exports where West Europe, Asia and the Middle East showed a strong preference for Indian tobacco. A trend towards market diversification was noticed as far as unmanufactured tobacco exports are concerned. Although, India has not made much headway in exports of tobacco products, still the Middle East and Saudi Arabia are found to be stable markets. The shifts in exports, among the product range, indicate

the losing significance of hookah and tobacco paste, chewing tobacco and snuff. On the other hand cigarettes, though it has lost significant share to hookah and tobacco paste was able to salvage its export share by gaining substantial shares from chewing tobacco, snuff, hookah, tobacco paste and other tobacco products. The board should undertake brand building exercises for unmanufactured tobacco exports from India. India should endeavour to improve the competitiveness of tobacco exports in the world market. India should export more in the form of value added products, especially cigarettes, since consumption of tobacco is mainly in the form of cigarettes throughout the world.

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