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Stability analysis of Indian cotton: An markov chain approach

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Abstract

The present study attempts to examine the trade direction of cotton export. The markov chain analysis was attempted through linear programming method to assess the transition probabilities for major cotton markets for 12 years i.e. 2004-05 to 2015-16. The major Indian cotton export markets were categorized as stable markets (China, Bangladesh) and unstable markets (Italy, Thailand, Indonesia) based on the magnitude of transition probabilities. The major export markets for Indian cotton are China (79 per cent and 77 per cent) and Bangladesh (66 per cent and 78 per cent) respectively in terms of quantity and value. 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.

Keywords: Direction of trade, markov chain, stability analysis

Introduction

Cotton is an agro-industrial crop producing in both developing and developed countries. Cotton for long has significance place in the economic and political history of the World. While around 80 countries from the globe produces cotton, India (25.5 per cent), China (21.28 per cent), and the United States (16.29 per cent) together produce over half the World's cotton. The worlds five largest cotton producing and consuming countries are China, India, the United States, Pakistan and Brazil. Together these four accounts for around 76.5 per cent of the World production. The next three largest cotton consuming countries are Australia, Uzbekistan and Turkey all of which produce cotton, but are often large importers nonetheless. India stands first in area of cotton with 10500('000' ha) in the year 2016-17. India alone contributes 35.93 per cent area to the total area. India stands first in production of cotton with 27000 million bales of 480 lb followed by china with 22500 million bales of 480 lb. In terms of productivity Australia stood first with 1781 (kg/ha) followed by China, Brazil, United States in the 2016-17. Though the share of agricultural exports has been declining over the years, there are certain commodities whose exports are increasing and one such commodity is cotton. Cotton is the only crop in which India enjoys genuine export surplus after meeting our domestic needs and the raw material availability has not been an issue for industries in the last few years. The present study is undertaken to estimate the direction of cotton export.

Objectives

To examine the structural changes in cotton export.

Highlights The dynamics in the direction of cotton trade is changing.

Materials and Methods

The study is based on the secondary data collected from various published sources such as Cotton Corporation of India (CCI) and www.indiastat.com etc. The detail information required for the study was collected from secondary sources in order to accomplish the various objectives related to export of Cotton. The time series data regarding export of cotton was collected for 12 years i.e. from 2004-05 to 2015-16.

Markov Chain Analysis was employed to analyze the dynamic nature of trade pattern specially the structural changes in any system whose progress through time can be measured in terms of single outcome variable. The gain and losses in market share of Cotton by major importing countries was examined by first order Markov process. The markov chain analysis is the estimation of the transitional probability matrix P.

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It is expressed as:

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

Where,

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

E_{it-1} = Export 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 term which is statistically independent of E_{it-1}

r = The number of importing countries

t = Number of years considered for analysis

The diagonal elements of matrix P indicate the probability that the export share of particular country will remain the same from one period to another. The off-diagonal or transfer probabilities indicate the probability that the export share of a particular country will shift to another country over time. Thus, the export share of a country during the period 't' was obtained by multiplying the actual exports in the previous period (t-1) with transition probability matrix. 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-

$XP^* + V = Y$

$GP^* = 1$

$P^* \geq 0$

Where,

P^* is a vector in which probability P are arranged,

0 is a vector of zeros,

I is an appropriately dimensioned vector of area,

e is the vector of absolute errors (IUI)

Y is the vector of export to each country

X is a block diagonal matrix of lagged values of Y and

V is a vector of errors.

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

The major cotton importing countries considered for the study were China (PRP), Bangladesh, Italy, Vietnam, Thailand, Indonesia, and Hong Kong.

Result and Discussion

The trade direction has been explored by Markov chain analysis using export quantity data from the period of (2004-05 to 2015-16). The transitional probability matrix was worked out by using triennium average which provided a broad indication of change in the direction of cotton export from India to seven major importing countries viz; China, Bangladesh, Italy, Vietnam, Thailand, Indonesia and Hong Kong and has been presented in the Table 1. The result of Markov chain analysis for quantity and value is presented in Table 1 and 2 respectively.

As could be seen from the Table 1 that the transitional probability matrix for cotton export in quantity indicated that India could not retain its previous export to Italy, Thailand and Indonesia during the study period. Nearly entire share of Italy, Thailand, and Indonesia Cotton import from India was diverted to China. However China has higher probability to gain Italy, Thailand and Indonesia import market (1). A major share of India's previous year cotton export to China market was retained to the tune of 79 per cent during the current period.

Table 1: Transitional probability matrix for cotton export in quantity from India during (2004-05 to 2015-16)

	China	Bangladesh	Italy	Vietnam	Thailand	Indonesia	Hong Kong
China	0.79	0.14	0	0.03	0.006	0.02	0.021
Bangladesh	0	0.66	0.022	0.21	0.027	0.078	0
Italy	1	0	0	0	0	0	0
Vietnam	0	0.29	0.006	0.43	0.07	0.20	0
Thailand	1	0	0	0	0	0	0
Indonesia	1	0	0	0	0	0	0
Hong kong	0.08	0	0.029	0.006	0.16	0.312	0.41

Remaining 21 per cent i.e. 14 was diverted to Bangladesh, 3 per cent was diverted to Vietnam, 0.6 per cent was diverted to Thailand, 2 per cent was diverted to Indonesia and 2.1 were diverted to Hong Kong. After China major share of India's previous year cotton export to Bangladesh market was retained to the tune of 66 per cent remaining 34 per cent i.e. 2.2 per cent was diverted to Italy, 21 per cent was diverted to Vietnam, 2.7 per cent was diverted to Thailand, and 7.8 per cent was diverted to Indonesia. Also Indonesia has the probability to gain 31 per cent of market share of Hong Kong alone. With regard to Vietnam 43 per cent of the previous period cotton import from India were retained during the current period. The remaining 57 per cent was diverted to Bangladesh with a major share of 29 per cent followed by Indonesia 20 per cent, Thailand 7 per cent, and Italy 0.6 per cent. India's previous cotton export to Hong Kong market retained to the level of 41 per cent during the current period. The remaining 59 per cent i.e. 31 per cent was diverted to Indonesia, 16 per cent was diverted to Thailand, 0.6 per cent was diverted to Vietnam, 2.9 per cent was diverted to Italy, and 8 per cent was diverted to China. Hong Kong gained only

2.1 per cent of the Indian export to China. India could not retain its previous export to Italy, Thailand and Indonesia. All three countries i.e. Italy, Thailand and Indonesia lost its entire cotton export from India to China.

From these results it could be inferred that the stability in cotton export of India was higher with China, and Bangladesh. The stability was meager with Vietnam and Hong Kong. The cotton export to Italy, Thailand and Indonesia was completely unstable. Thus India could not retain its previous year export to all the importing countries except China, Bangladesh, Vietnam and Hong Kong. The trade direction has been explored by Markov chain analysis using export value data from the period of (2004-05 to 2015-16).

It is revealed from the Table 2 that the transitional probability matrix for cotton export in value indicated that India could not retain its previous period export to Italy and Indonesia. Nearly 93% share of Italy Cotton import from India was lost to China, 6% was lost to Hong Kong and 1% was lost to Vietnam. Nearly entire share of Indonesia Cotton import from India was lost to China. However, Indonesia has a probability

to gain Vietnam import market (0.347). A major share of India's previous period cotton export to Bangladesh market was retained to the tune of 78 per cent remaining 22 per cent i.e. 0.9 per cent was diverted to Italy and 20.4 per cent was diverted to Vietnam. After Bangladesh major share of India's previous cotton export to China market was retained to the

tune of 77 per cent during the current period. Remaining 23 per cent i.e. 13 per cent was diverted to Bangladesh, 0.04 per cent was diverted to Italy, 2.8 per cent was diverted to Vietnam, 1.6 per cent was diverted to Thailand, 2.7 per cent was diverted to Indonesia and 2.6 per cent was diverted to Hong Kong.

Table 2: Transitional probability matrix for cotton export in value from India during (2004-05 to 2015-16)

	China	Bangladesh	Italy	Vietnam	Thailand	Indonesia	Hong Kong
China	0.77	0.13	0.0004	0.028	0.016	0.027	0.026
Bangladesh	0	0.78	0.009	0.204	0	0	0
Italy	0.93	0	0	0.01	0	0	0.056
Vietnam Soc Rep	0	0.12	0.032	0.42	0.083	0.347	0
Thailand	0.81	0	0	0	0.063	0.079	0.046
Indonesia	1	0	0	0	0	0	0
Hong Kong	0.77	0	0	0	0	0	0.227

Also china has the probability to gain 93 per cent of market share of Italy alone. India's previous cotton export to Vietnam market was retained to the tune of 42 per cent remaining 58 per cent i.e. 12 per cent was diverted to Bangladesh, 3.2 per cent was diverted to Italy, 8.3 per cent was diverted to Thailand and 34 per cent was diverted to Indonesia. Italy gained only 0.04 per cent of Indian export to China and 0.9 per cent to Bangladesh and 3.2 per cent to Vietnam. India's previous period cotton export to Hong Kong market was retained to the tune of 22.7 per cent remaining 77 was diverted to China alone. With regard to Thailand only 6.3 per cent of the previous period cotton imports from India were retained during the current period. The remaining 93.7 per cent i.e. 81 per cent was diverted to China alone, 8 per cent was diverted to Indonesia, and 4.6 per cent was diverted to Hong Kong. From these results it could be inferred that the stability in cotton export in terms of value of India was higher with China, Bangladesh and Vietnam. The stability was meager with Thailand and Hong Kong. The cotton export to Italy and Indonesia was completely unstable. Thus India could not retain its previous year export to all the importing countries except China, Bangladesh, Vietnam and Hong Kong. The same results were obtained by Sridevi (2017) ^[12]

Conclusion

The stability in cotton export in terms of quantity and value of India was higher with China, Bangladesh and Vietnam. The cotton export to Italy, Indonesia and Thailand was completely unstable. Thus India could not retain its previous year export to all the importing countries except China, Bangladesh, Vietnam and Hong Kong. It indicates that India retain its export in terms of quantity and value in China, Bangladesh, Vietnam and Hong Kong. Major and promising destinations for export of Indian cotton are China Bangladesh, and Vietnam.

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