Export Performance of Wheat from India: A Markov Chain Analysis

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Abstract:
India ranks second position in wheat production in the world with a contribution of roughly 13.53 percent to global wheat output. However, India was one of the top exporters in the world since its export market has historically been a significant economic driver. The main objective of present study is to showcase the export performance of wheat in India. For this, data related to export (quantity) among the countries namely Bangladesh, United Arab Emirates, Republic of Korea, Indonesia, Philippines, Yemen, Nepal, Malaysia and Vietnam are collected for the period of 20 years i.e. from 2000 to 2020 as to understand import dynamics among the countries, through Markov-chain analysis. From the results of Transition Probability matrix, the countries Nepal and Republic of Korea are identified as the most stable market for wheat export among the other major importing countries as due to highest probability of retention at 0.6697 and 0.5861, respectively. Whereas Indonesia, Yemen, Malaysia and Vietnam are recognized as the most unstable markets as they retained zero percent of wheat imports from India. Finally, it is concluded as the policies should focus on fostering positive trade links with the stable destinations in order to reap its benefits.
Keywords: Markov-chain analysis, Wheat, Export, India.

INTRODUCTION:

Wheat is a grass that is valued highly for its seed. It is a cereal grain that is a common diet all over the world and significant source of carbs. India ranks second position in wheat production in the world with a contribution of roughly 13.53 percent to global wheat output. India produces around 107.59 MT of wheat annually while a major chunk of it goes towards domestic consumption (**Ministry of commerce & Industry**). Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, and Gujarat are the main wheat-growing states in India.

India is among the fastest-growing economies in the world. Limited and concentrated resources across the world have made trade an important part of a country's economy. A big influence on the need for importing and exporting goods is the rapid evolution and growth in what people need and desire. On the other hand, trade provides employment and raises standards of living. India's export market had for long been a major contributor to its economy, which made it one of the leading exporters worldwide.

Now, as on date, our country is a major supplier of many agricultural products like spices, coffee, tea, rice, oil meals, fresh vegetables & fruits, processed meat, and marine products to the global market (**Gopalsamy and Arul kumar, 2020**). Apart from the above products, wheat is also considered as one of the stable food and exporting from India to all over the world. Though India is not among the top ten wheat exporters in the global trade, its rate of growth in exports have surpassed that of other countries, indicating the rapid strides it is taking in reaching new markets worldwide (https://pib.gov.in/PressReleasePage.aspx?PRID=1786624).

India's wheat exports are mainly to neighbouring countries i.e. Bangladesh, United Arab Emirates, Republic of Korea, Indonesia, Philippines, Yemen, Nepal, Malaysia and Vietnam. Main factor which is influencing wheat exports from India is unit price of wheat. As it plays an important role in International trade there is an adverse effect on wheat exports from India. So this study made an attempt to study the export performance of wheat from India in order to know the dynamics in direction of India's wheat exports. And it also helps to improve the export performance by formulating suitable policy.

METHODOLOGY:

Data:

The data related to export quantity for the period of 20 years i.e. from 2000 to 2020 was considered for this study. Bangladesh, United Arab Emirates, Republic of Korea, Indonesia, Philippines, Yemen, Nepal, Malaysia and Vietnam were selected as top nine importing countries of wheat from India. The trade performance was analyzed using the Markov-chain analysis.

Markov-Chain Analysis:

The trade directions of wheat export from 2000 to 2020 were analyzed using the first order Markov chain approach. Markov chain analysis is an application of dynamic programming to the solution of a stochastic decision process that can be defined by a finite number of states (**Padberg 1962**). The dynamic nature of trade patterns, direction of trade growth, and predicting the future values of growth can be measured using Markov chain analysis (**Bagalkoti et al 2019; Sheelpa shree et al 2017**).

The estimation of the transitional probability matrix (P) was central to this analysis. The element Pij of the matrix indicated the probability that the exports would switch from the ith country to jth country over a period of time. The diagonal elements Pij indicated the probability that the export share of a country would be retained in the successive time periods, which in other words, measured the loyalty of an importing country to a particular exporting country (**Deepika joshi et al 2014**).

In the context of the current application, structural changes were treated as a random process with selected importing countries. The average imports to a particular country was considered to be a random variable which depends only on the past exports to that country, which can be denoted algebraically as

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

Where,
E_{jt} = Imports to Nepal from jth country during the year t.
E_{it-1} = Imports from ith country during the period t-1.
P_{ij} = Probability that the imports will shift from ith country to jth country.
E_{jt} = The error term which is statistically independent of E_{it-1}.
t = Number of years considered for the analysis
r = Number of exporting countries
The transitional probabilities P_{ij} which can be arranged in a (c * r) matrix have the following properties.

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

$$\sum_{i=1}^{n} P_{ij} = 1 \; for \; all \; i$$

Thus, the expected import shares of each country during period't' were obtained by multiplying the import from these countries in the previous period (t-1) with the transitional probability matrix.
The value of diagonal elements indicates the probability of retention of the previous year values, while values in columns reveal probability of gain of a particular country from other countries, values in rows reveal probability that a country might lose to their countries share in respect of specific commodity imports. Similar methodology were used by **Gairhe and Reddy** (2012) to study the coffee export scenario in India, and **Shilpa Shree et al** (2017) to reveal the changing direction of export and import of dairy products in India.

RESULTS & DISCUSSION:
The trade direction of wheat exports to different destinations has been analyzed by constructing transition probability matrix for twenty years data on quantity of wheat exporting from India to other countries in the world using Markov-chain analysis. Table 1 depicts the transition probability matrix of Indian wheat export for the period from 2000 to 2020. The major wheat importers from India, i.e. Bangladesh, United Arab Emirates, Republic of Korea, Indonesia, Philippines, Yemen, Nepal, Malaysia and Vietnam were considered for analysis. There are nine major countries which import wheat from India and the rest of the countries were pooled under the category of others. In transition probability matrix row elements indicates the probability of loss on account of competing countries, while the column elements indicates the probability of gain from other competing countries and the diagonal elements indicates probability of retention of the previous year's trade by the respective country (**Kusuma and Basavaraja, 2014).** The results shown in the table.1 revealed that the Nepal and Republic of Korea are the most stable markets for India's wheat among the major importing countries as reflected by highest probability of retention at 0.6697 and 0.5861 i.e. Nepal and Republic of Korea had retained theirs original export share of 66.97 and 58.61 percent for the period from 2000 to 2020 respectively. Bangladesh, UAE and Philippines retained 57.21, 6.33 and 4.63 percent of total export from India. The remaining countries retained 83.32 percent of export from India. On the otherside, whereas Indonesia, Yemen, Malaysia and Vietnam were seen to be the most unstable markets as they retained zero percent of wheat imports from India. Nepal, in addition to its hgh retention ability it is likely to gain from the switch over from The Republic of Korea and Others countries with a high probability of 0.3450 and 0.1668 respectively. Indonesia was found to be unstable importer showing zero probability of retention, losing about 81 per cent of its share to Bangladesh and 19 per cent to Yemen. United Arab Emirates, Yemen and also Malaysia lost about 36.90 per cent, 73.53 per cent and 76.16 per cent of its previous share of wheat exports to Bangladesh. This shows that export of Indian wheat have strong preference for Bangladesh in the export market.

Table1. Transition probability matrix of India's wheat export from 2000 to 2020

	Bangladesh	United Arab Emirates	Republic of Korea	Indonesia	Philippines	Yemen	Nepal	Malaysia	Viet Nam	others
Bangladesh	**0.5721**	0.3506	0.0000	0.0000	0.0504	0.0000	0.0000	0.0000	0.0000	0.0269
United Arab Emirates	0.3690	**0.0633**	0.0000	0.0000	0.0000	0.0000	0.0867	0.1375	0.0627	0.2808
Republic of Korea	0.0000	0.0000	**0.5861**	0.0000	0.0000	0.0000	0.3450	0.0000	0.0000	0.0689
Indonesia	0.8145	0.0000	0.0000	**0.0000**	0.0000	0.1855	0.0000	0.0000	0.0000	0.0000
Philippines	0.0000	0.0000	0.0479	0.2586	**0.0463**	0.2374	0.0000	0.1468	0.0739	0.1891
Yemen	0.7353	0.0000	0.0000	0.0000	0.1884	**0.0000**	0.0000	0.0000	0.0764	0.0000
Nepal	0.1664	0.0725	0.0000	0.0000	0.0000	0.0000	**0.6697**	0.0015	0.0000	0.0899
Malaysia	0.7616	0.0000	0.0000	0.2384	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0000
Viet Nam	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000
others	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1668	0.0000	0.0000	**0.8332**

CONCLUSIONS:

Markov chain analysis was used in this study to examine the direction of India's wheat export to other countries across the world. From the results it is evident that Nepal, Republic of Korea and Bangladesh are the loyal imports of India's wheat. The transition probability matrix has indicated that India is likely to lose most of its share in its traditional markets which have come out to be the most unstable importers such as Indonesia, Yemen, Malaysia and Viet Nam for India's wheat.

Even though some of its original markets have been retained, India cannot rely too much on asmall number of them to reduce trade risk over the long term. In order to preserve the current position of export and market share in the future, new markets must be investigated and more emphasis must be placed on nations like the Nepal, United Arab Emirates, Bangladesh and, other countries. Government policy should focus on boosting productivity, minimising the cost per unit of production, enhancing trade standards, and removing all trade-related barriers that are of greater concern for the importing nations. This would help India become more competitive on the global market and restore its reputation in the wheat trade.

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