

Direction of Trade of Cereals from Australia

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ABSTRACT

Australia supplies a wide variety of cereals to the rest of the world. The grain (predominantly wheat and barley) markets around the world are dominated by Australian exports. This paper has studied the direction of trade of cereals by Markov chain analysis using the time series data from 2009 to 2018. The study showed that China and Philippines are the most stable markets and Japan, Indonesia, Vietnam, Republic of Korea, Malaysia and Yemen are least stable markets for export of cereals from Australia. Projections of exports were made from 2019 to 2023. The paper has found that during 2019, the major market for cereals is China (21.99%) followed by Indonesia (13.58%). The increasing share of other countries clearly showed the need to explore and exploit the market potential of other countries.

Key words: Cereals, Exports, Direction of trade, Markov chain analysis.

INTRODUCTION

Crop production in Australia is vital in providing food for its local population as well as for livestock feed. The main cereals grown in Australia are wheat, coarse grains (barley, oats, sorghum, maize, and triticale) and rice. Australia supplies a wide variety of cereals to the rest of the world. Wheat accounts for the greatest contribution to the production value of cereals. Exports account for nearly 80 percent of wheat and over 50 percent of barley and rice. During 2018, Australia exported 23.21 million metric tonnes of cereals. There is still scope for increase in export of cereals by Australia. Improved seasonal conditions have

resulted in significantly higher production and lower domestic feed use. This will drive up exports and lower prices in the domestic market. The considerable expanses of arable land have helped Australia to become a leading world exporter of grains. The grain (predominantly wheat and barley) markets around the world are dominated by Australian exports. The present study has analysed direction of cereals export from Australia.

MATERIALS AND METHODS

The research study completely based upon the secondary sources of data.

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The required data was procured from UNCOMTRADE data accessed through the World Bank's World Integrated Trade Solution (WITS) software. Data related to composition of trade were based on Harmonized System coding (HS 1992) and HS two-digit level of classification has been considered for a period of 10 years i.e., from 2009 to 2018. As data on weight is not available for two-digit level classification, sum of all the four-digit level categories under that two-digit level are considered for the study.

Markov chain analysis

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. In the present study, the dynamic nature of trade patterns of cereals from Australia studied using the Markov chain model.

Markov chain analysis involving developing a transitional probability matrix 'P', whose elements, P_{ij} indicate the probability of exports switching from country 'i' to country 'j' over time. The diagonal element P_{ij} where $i=j$, measure the probability of a country retaining its market share or in other words, the loyalty of an importing country to a particular country's exports.

In the context of current application, structural change was treated as a random process with eight importing countries for cereals. The assumption was that the average export of cereals from a country amongst importing countries in any period depends only on the export in the previous period and this dependence is same for all the periods. This was algebraically expressed as

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

Where,

E_{jt} = Exports from Australia to the j^{th} country in the year t

E_{it-1} = Exports of i^{th} country during the year $t-1$

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

e_{jt} = the error term which is statistically independent of E_{it-1}

n = the number of importing countries

The transitional probabilities P_{ij} , which can be arranged in a $(c \times r)$ matrix, have the following properties.

$$0 < P_{ij} < 1$$

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

Thus, the expected share of each importing country during period 't' is obtained by multiplying the exports of cereals to these countries in the previous period (t-1) with the transitional probability matrix. The probability matrices were estimated for the period from

2009 to 2018. Projections are made from 2019 to 2023.

Thus, transitional probability matrix (T) was estimated using linear programming (LP) frame work by a method referred to as minimizing of Mean Absolute Deviation (MAD).

$$\text{Min, } O P^* + I e$$

$$\text{Subject to } X P^* + V = Y$$

$$GP^* = 1$$

$$P^* > 0$$

Where,

P^* is a vector of the probabilities P_{ij}

O is the vector of zeros

i is an appropriately dimensional vectors of areas

e is the vector of absolute errors

Y is the proportion of exports to each country

X is a block diagonal matrix of lagged values of Y

V is the vector of errors

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

Prediction of quantity of cereals exports were made by using the Transitional Probability Matrix.

$$B_t = B_0 \times T$$

$$B_{t+i} = B_{t+i-1} \times T$$

Where,

B_0 = Quantity exported in Base years

B_t = Quantity exported in next year (prediction)

T = Transitional probability matrix

The values in the transition probability matrix will have different interpretations. The value of diagonal elements indicates the probability of retention of the previous year's share, while values in the columns reveal probability of gain by a particular country from other countries, values in rows reveal probability that a country might lose to other countries in respect of a specific commodity exports.

RESULTS AND DISCUSSION

The results have been discussed under the following heads.

Transitional probability matrix of cereals exported from Australia

Transitional probability matrix for quantity of Cereals exported from Australia during the period 2009 to 2018 is presented in Table 1. The major importing countries are China, Indonesia, Japan, Vietnam, Philippines, Republic of Korea, Malaysia, Yemen and the remaining importing countries are grouped under the category others.

China and Philippines retained 54.88 and 48.32 per cent of their original share respectively. Where as other countries retained 43.24 per cent of its original share. Indonesia and Vietnam lost 70.99 and 44.48 per cent of their share to other countries respectively. Whereas Republic of Korea lost all of its share to other countries. Japan lost 42.32 per cent of its share to Republic of Korea. Philippines lost 51.68 per cent of its share to China. Malaysia lost 76.86 per cent of its share to Indonesia.

The most stable markets are China and Philippines and least stable markets are Japan, Indonesia, Vietnam, Republic of Korea, Malaysia and Yemen for export of Cereals from Australia.

Projections for export of Cereals from Australia

Projections for export of Cereals to major importing countries from Australia for the period from 2019 to 2023 are presented in Table 2. The results suggest that the category "others" import major quantity of Cereals from Australia followed by China whereas quantity imported by others increased from 73.52 to 84.68 lakh tonnes and quantity imported by China decreased from 51.03 to 42.02 lakh tonnes for the years from 2019 to 2023.

The share of import increased from 2019 to 2023 for the countries Indonesia, Japan Malaysia and Yemen whereas as the share decreased for Vietnam, Philippines and Republic of Korea.

In conclusion, though Australia is one of the leading exporters in the world in case of cereals, the major importing country, China is posing threat by imposing 80.5 % tariff on barley imports from Australia. In order to maintain its export share there is a need to explore new markets for cereals. As the category Others have major share, there is scope for new countries emerging as new markets. This can be done by studying sanitary and phytosanitary measures of these countries.

Table 1: Transition probability matrix for export of Cereals (HS Code:10) from Australia for the period from 2009 to 2018

GAIN	LOSS									
	Country	China	Indonesia	Japan	Vietnam	Philippines	Republic of Korea	Malaysia	Yemen	Others
	China	0.5488	0.1249	0.0000	0.0002	0.1103	0.0205	0.0339	0.0215	0.1398
	Indonesia	0.0000	0.0000	0.0774	0.0000	0.0000	0.1472	0.0654	0.0000	0.7099
	Japan	0.0000	0.0000	0.2242	0.3526	0.0000	0.4232	0.0000	0.0000	0.0000
	Vietnam	0.0000	0.2811	0.0000	0.0000	0.2360	0.0381	0.0000	0.0000	0.4448
	Philippines	0.5168	0.0000	0.0000	0.0000	0.4832	0.0000	0.0000	0.0000	0.0000
	Republic of Korea	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
	Malaysia	0.0000	0.7686	0.0000	0.2314	0.0000	0.0000	0.0000	0.0000	0.0000
	Yemen	0.0000	0.0000	0.0000	0.9354	0.0000	0.0000	0.0646	0.0000	0.0000
Others	0.1193	0.2241	0.0967	0.0044	0.0000	0.0000	0.0481	0.0750	0.4324	

Table 2: Projected export of Cereals (HS Code: 10) to major importing countries from Australia: 2019 to 2023 (in lakh tonnes)

Year/Country	China	Indonesia	Japan	Vietnam	Philippines	Republic of Korea	Malaysia	Yemen	Others
2019	51.03 (21.99)	31.53 (13.58)	13.11 (5.65)	15.70 (6.76)	18.46 (7.95)	15.76 (6.79)	7.16 (3.08)	5.84 (2.52)	73.52 (31.67)
2020	46.33 (19.96)	32.77 (14.12)	12.49 (5.38)	12.07 (5.20)	18.26 (7.87)	11.83 (5.10)	7.71 (3.32)	6.61 (2.85)	84.05 (36.21)
2021	44.89 (19.34)	33.94 (14.62)	13.46 (5.80)	12.75 (5.49)	16.78 (7.23)	11.52 (4.96)	8.18 (3.52)	7.30 (3.15)	83.28 (35.88)
2022	43.25 (18.63)	34.15 (14.71)	13.70 (5.90)	13.84 (5.96)	16.07 (6.92)	12.10 (5.21)	8.22 (3.54)	7.21 (3.11)	83.57 (36.00)
2023	42.02 (18.10)	34.34 (14.79)	13.79 (5.94)	13.85 (5.96)	15.81 (6.81)	12.24 (5.27)	8.19 (3.53)	7.20 (3.10)	84.68 (36.48)

Note: The figures within the parentheses indicate percentages to total exports

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