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Export performance and direction of trade of major Agricultural commodities exported from India with special reference to Nepal

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Abstract

The current study intended to study the growth rate of export of agricultural commodities from India to Nepal from the period 1992-93 to 2021-22 and to know the direction of trade of Non-Basmati Rice, Maze, Wheat, Cereal Preparations which are major commodities imported by Nepal. The secondary data required for the study was obtained from APEDA. The growth rate was calculated using Compound Annual Growth Rate technique. The growth rate was observed the growth at a growth rate of 9.31 per cent it has variations within the selected study period but shows positive growth rate. The dynamic nature of trade pattern of the selected commodities was analyzed by employing the first order Markov process by examining gains and losses in respect of export shares of major Indian agricultural commodities to different countries. For major five selected products for the period from 2012-13 to 2021-22. Through the TPM we noticed that the major agricultural commodities which were imported by Nepal are also imported to many other countries in the same manner where Nepal retains its majority of share with and also loses part of its share to few new export destinations of India. Efforts should be taken to promote export of selected products from India to explore and exploit potential of other markets and to avoid overdependency on few countries.

Keywords: Exports, growth rate, direction of trade, markov chain analysis

Introduction

Agriculture is the ultimate profession for human kind to survive since the evolution of *Homo sapiens*, but the geographical variations across the globe varies very adversely for every human habitat making difficult to cultivate crops and also the burning issue global warming contributes more to starve people for food.

The global harmony and sustainable agriculture only can help human race to survive and existence on earth. The movement of food and agricultural products including all other goods will help to make it happen.

The international trade plays major role in achieving this. The movement of agricultural and allied products from majorly grown countries to non-cultivable countries will help the population to feed with nutritious food and also it helps to develop international harmony. The trade facilitates farmers to get better prices for their produced, the concept of export will also bring the better-quality produce and higher productivity consciousness among the farmers.

India being leading producer and consumer of most of the agricultural and allied produces it will also feed the world through the export of agricultural products to different countries in the world which have limitations to produce certain commodities in their native because of geographical barriers, making the availability of food the importing countries. Nepal is one of those countries, which is geographically difficult for cultivation of certain products. Here, the difficulty is squashed by means of importing the agricultural and allied products from other countries. Nepal imports about 105 products (APEDA, 2021-22) from India, which includes Non-Basmati Rice, Maze, Wheat, Cereal Preparations, other fresh vegetables and etc., with total export recorded 3,371,058.57 million tone (MT). During the year 2021-22, among the total import of Agricultural products these five major products contribute around 79.69 percent (2686240.75 MT) during the year 2021-22.

The selected five major products are most staple food around the globe, hence Nepal imports most of the its staple food products from India and other countries.

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Major part of the import of these commodities will be for consumption and part of it will also be diverted towards the processing and value addition. There are limited restrictions in trade and commerce between India and Nepal which helps for these trade activities very smooth and compatible for both countries.

Need for the study

It has been argued that India with its integrated into the global market through WTO could benefit substantially from international trade in agricultural commodities. The relationship between India and Nepal is good in all aspects including trade and commerce. In order to take advantage of these opportunities, it is essential to analyze current export performance of total agricultural and processed food products and the direction of trade of the selected major five agricultural products with respect to Nepal.

Objectives

1. Estimation of Growth rate in export of Agricultural and processed food products to Nepal from India.
2. Analysis of Distribution of Major commodities exported to Nepal and with other countries.

Research Methodology

Sources of data

The secondary data of export of agricultural and processed food products from India to Nepal is obtained from Agricultural and Processed food Export Development Authority (APEDA) for the period from 1992-93 to 2021-22. Non-Basmati Rice, Maize, Wheat, Cereal Preparations and other fresh vegetables are the five major commodities exported to Nepal which are higher in volume and are selected to study the direction of trade. Secondary data on country – wise export of major agricultural commodities from India to Nepal for the period 2012-13 to 2021-22 were obtained from agri exchange portal of APEDA.

Analysis of data

Growth model

To examine the compound growth rate of exports (Agricultural and processed food products to Nepal from India) in terms of volume for the period of twenty years from 1992 to 2022 and also for quinquennial period from India. Compound growth rates were estimated with the help of exponential function.

$$Y = a b^t \quad (1)$$

Where,

Y = Dependent variable for which growth rate is estimated (export volume Mt.)

a = Constant

b = Regression coefficient

t = Time variable in year (1991 to 2022)

In the logarithmic form of the above equation estimated the compound growth rate

$$\log Y = \log a + t \log b$$

The value of antilog of 'b' was estimated by using LOGEST function in MS-Excel given below

Antilog of $\log b = \text{LOGEST}(Y_1: Y_n)$

The per cent compound growth rate (r) was derived using relationship

$$r (\text{per cent}) = [\text{antilog of } (b) - 1] \times 100$$

The compound growth rate was tested for their significance by using the following formula:

$$t = \frac{r}{S.E.(r)}$$

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 wheat, maize, non-basmati rice, other fresh vegetables and cereal preparations from India 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_{ii} 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 India 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.

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

$$= 1 \text{ for all } i$$

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 2021-12 to 2021-22.

Thus, transitional probability matrix (T) was estimated using linear programming (LP) framework by a method

referred to as minimizing of Mean Absolute Deviation (MAD).

Min, $O P^* + I e$

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.

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

To estimate of growth in export of agricultural products to Nepal from India

To estimate of growth in export of agricultural and processed food products to Nepal from India during the period 1992-93 to 2021-22 were estimated by using exponential growth function. The data regarding the exports are being obtained from APEDA, the export details and processed food products during the year 1992-93 to 2021-22 are presented in the Table 1.

The growth rate of export of agricultural and processed food products from India to Nepal is presented in the Table 2.

The volume of exports registered a positive growth rate of 3.50 per cent and are highly significant during the period 1992-93 to 1996-97. During the period 1997-98 to 2001-02, volume of exports noticed higher growth rate of 59.66 per cent per annum. The growth rate for the period 2002-03 to 2006-07 observed that 40.02 percent which is significant at 10 per cent level of significance, the lowest growth rate was observed during the period 2007-08 to 2011-12 that is 7.12 per cent. We can notice that the growth rate increased to 21.52 per cent during the period 2012-13 to 2016-17 which was significant at 1 per cent level of significance. During the period 2017-18 to 2021-22 the observed growth rate was 15.29 per cent which was Significant at 10 per cent level of significance. The overall period 1992-93 to 2021-22 depicted the growth rate of 9.31 per cent which was again significant at 1 per cent level of significance.

It is evident from the table 3 that the volume of agricultural and processed food products from India to Nepal exported increased annually at a growth rate of 9.31 per cent. Here the export of agricultural commodities are increasing year after year with positive growth rate.

Table 1: Indices of volume of export of agricultural and processed food products from India to Nepal (1990-91 to 2021-22)

Sl. No.	Year	Export Quantity (Mt.)
1	1992-93	24238.6
2	1993-94	21441.57
3	1994-95	9399.43
4	1995-96	41773.21
5	1996-97	20621.29
6	1997-98	9932.83
7	1998-99	3723.82
8	1999-00	32692.73
9	2000-01	37206.39
10	2001-02	32605.56
11	2002-03	84282.11
12	2003-04	260463.39
13	2004-05	203914.83
14	2005-06	414142.81
15	2006-07	359733.33
16	2007-08	483026.69
17	2008-09	267814.83
18	2009-10	316319.32
19	2010-11	415955.73
20	2011-12	546784.11
21	2012-13	873046.61
22	2013-14	1045405.4
23	2014-15	1429686.95
24	2015-16	1514149.45
25	2016-17	1922612.75
26	2017-18	1943461.44
27	2018-19	2205113.12
28	2019-20	1897935.18
29	2020-21	3040239.07
30	2021-22	3371058.57

Source: APEDA (2022)

Table 2: Compound growth rates for volume of Export of Agricultural and processes food products from India to Nepal in the period 1992-93 to 2021-22.

Sl. No	Growth rates in different quinquennial periods	Volume	R square value
1	Quinquennial period-I (1992-93 to 1996-97)	3.5	0.0104
2	Quinquennial period-II (1997-98 to 2001-02)	59.66	0.0104
3	Quinquennial period-III (2002-03 to 2006-07)	40.02*	0.7156
4	Quinquennial period-IV (2007-08 to 2011-12)	7.12	0.1357
5	Quinquennial period-V (2012-13 to 2016-17)	21.52***	0.9710
6	Quinquennial period-VI (2017-18 to 2021-22)	15.29*	0.7288
7	Over all period (1992-93 to 2021-22)	9.31***	0.8911

*Significant at 10 per cent level of significance

**significant at 1 per cent probability

***significant at 1 per cent level of significance

To analyze direction of trade of major agricultural commodities

Change in direction of trade is studied with the help of Markov chain analysis for the period of 2012-2022, where Transitional Probability Matrix (TPM) is estimated for studying the direction of trade. As in transitional probability matrix diagonal elements provide information about an importing country's loyalty towards our export that is probability of retention of their trade with us. While the row elements show probability of loss of share of export of a country to their competing countries, elements in column shows the probability of gain of share of export of a particular country over their competing countries. By analyzing the TPM table we can analyze the direction in which our export is moving or should move to undertake appropriate policy frame work in order to help exporters to help exporting their products with minimum uncertainty in export.

Wheat

Indian wheat is mainly destined to countries like Nepal, Sri

Lanka Bangladesh, UAE, Malaysia, Jordan, UK, Kuwait. In 2021 India exported 3.2 MT tons of wheat valued to \$ 872 million (PIB, 2021) to various countries. To study the direction of trade in wheat Markov chain analysis is used by estimating transitional probability matrix for which nine major importing countries of Indian wheat are chosen and rest all was grouped under the heading others. Data on export to these countries were taken from the period of 2012-2022 from APEDA, the top nine countries were selected and remaining are grouped under others and then analyzed as (10x10) matrix of TPM. Result of the analysis is shown in Table 3.

TPM of wheat exports revealed that most stable importer of wheat from India is shri Lanka as it retained 96.41 percent of its export followed by Nepal Bangladesh UAE Malaysia, UK, Oman Kuwait and others. Nepal is being constant importer of wheat from India. Nepal retains 79.45 percent and lost remaining 21.55 percent among Bangladesh, Shri Lank and other countries.

Table 3: Transitional probability matrix of wheat from India in terms of export quantity

Loss / Gain	Nepal	Sri Lanka	Bangladesh	UAE	Malaysia	Jordan	UK	Oman	Kuwait	Others
Nepal	0.7945	0.0120	0.0606	0.0180	0.0027	0.0027	0.0000	0.0000	0.0000	0.1095
Sri Lanka	0.0000	0.0000	0.0000	0.0000	0.1083	0.0000	0.0000	0.0000	0.0000	0.8917
Bangladesh	0.0000	0.0075	0.9641	0.0000	0.0035	0.0000	0.0000	0.0000	0.0000	0.0249
U Arab Emts	0.2236	0.0000	0.0000	0.4495	0.0000	0.0049	0.0334	0.0000	0.0007	0.2880
Malaysia	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Jordan	0.9735	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0265	0.0000
UK	0.0000	0.0000	0.0000	0.0000	0.0000	0.4108	0.4864	0.0000	0.1028	0.0000
Oman	0.0000	0.0000	0.0291	0.9709	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kuwait	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Others	0.0000	0.0108	0.1471	0.0717	0.0245	0.0000	0.0000	0.0535	0.0000	0.6922

(Raw Data Source: APEDA)

Maize

The total export of maize during the period 2021-22 was the major importing countries taken for the analysis of trade in maize exports during period 2012-13 to 2021-22 were Bangladesh, Malaysia, Nepal, Shri Lanka, Vietnam, Japan, UAE, Vietnam, Thailand and along with the remaining importing countries grouped under others. That is, there are nine major countries importing maize from India in large

quantity and rest of countries are pooled under 'others' category.

TPM of maize exports (Table 4) revealed that Bangladesh is the most stable importer of Indian maize, as it retained its original share of around 100 per cent, which was the highest among the importing countries. Nepal retained 74.07 per cent of its imports It lost its remaining share of 25.93 per cent to Bangladesh Indonesia, Shri Lanka, Japan, Oman and other countries.

Table 4: Transitional probability matrix of maize from India in terms of export quantity

Loss / Gain	Nepal	Bangladesh	Vietnam	Malaysia	Sri Lanka	Oman	Japan	UAE	Thailand	Others
Nepal	0.7407	0.0761	0.0000	0.0000	0.0146	0.0069	0.0195	0.0000	0.0038	0.1386
Bangladesh	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vietnam	0.0000	0.0000	0.3700	0.5216	0.0000	0.0000	0.0000	0.0000	0.0005	0.1079
Malaysia	0.0000	0.0000	0.0000	0.0003	0.0795	0.0164	0.0000	0.0321	0.0000	0.8717
Sri Lanka	0.0000	0.3593	0.0000	0.0000	0.5978	0.0000	0.0000	0.0429	0.0000	0.0000
Oman	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Japan	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
UAE	0.0000	0.0000	0.0000	0.0000	0.3953	0.0000	0.0000	0.6047	0.0000	0.0000
Thailand	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Others	0.0000	0.3496	0.1580	0.1453	0.0000	0.0282	0.0022	0.0000	0.0000	0.3166

(Raw Data Source: APEDA)

Other Fresh Vegetables

The major importers of other fresh vegetable from India during the period 2012-13 to 2021-22 were Nepal, UAE, UK, Bangladesh, Qatar, Oman, Kuwait, Sri Lanka, Malaysia and remaining are grouped as others. The TPM is represented in the Table 5.

From the TPM analysis we can notice that Nepal has major share in the export market. It retains 70 per cent of its import share and ramming 30 per cent is being lost to UAE, Kuwait, UK, Oman, Qatar and other countries.

Table 5: Transitional probability matrix of Other Fresh Vegetables from India in terms of export quantity

Loss / Gain	Nepal	UAE	UK	Bangladesh	Qatar	Oman	Kuwait	Sri Lanka	Malaysia	Others
Nepal	0.7008	0.1667	0.0014	0.0000	0.0428	0.0807	0.0075	0.0000	0.0000	0.0000
UAE	0.0748	0.2178	0.0000	0.2822	0.0000	0.0000	0.0000	0.0000	0.0000	0.4251
UK	0.0000	0.2087	0.7913	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bangladesh	0.7015	0.0000	0.0000	0.0000	0.0000	0.0948	0.0000	0.0913	0.1124	0.0000
Qatar	0.5101	0.0000	0.0000	0.3077	0.0000	0.0000	0.1823	0.0000	0.0000	0.0000
Oman	0.0693	0.0000	0.0000	0.3583	0.3699	0.0000	0.2025	0.0000	0.0000	0.0000
Kuwait	0.2656	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1447	0.5897	0.0000
Sri Lanka	0.5656	0.0000	0.0110	0.0000	0.1528	0.0000	0.0135	0.0798	0.1774	0.0000
Malaysia	0.8807	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1193	0.0000	0.0000
Others	0.0591	0.0617	0.0017	0.0000	0.0000	0.0000	0.0236	0.0626	0.0000	0.7914

(Raw Data Source: APEDA)

Cereal Preparations

Cereal preparations include the processed products of cereals which farther used for consumption and value addition. The major importing countries are Nepal, UAS, UAE, Bangladesh, Canada, Australia, Angola, Malaysia and remaining are grouped under others. TPM of export of

cereal preparation from India to various countries during the period 2012-13 to 2021-22 is represented in Table 6.

The TPM show that the UAS is leading importer and has retained the most of its share. Nepal being the loyal importer lost part of its import to UAE and Malaysia.

Table 6: Transitional probability matrix of Cereal Preparations from India in terms of export quantity

Loss / Gain	Nepal	USA	UAE	Bangladesh	UK	Canada	Australia	Angola	Malaysia	Others
Nepal	0.0000	0.0000	0.2101	0.0000	0.0000	0.0000	0.0880	0.0000	0.0421	0.6597
USA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
UAE	0.0000	0.3062	0.1606	0.0000	0.0000	0.1428	0.1784	0.0000	0.2121	0.0000
Bangladesh	0.0000	0.0000	0.1732	0.3076	0.0000	0.0000	0.0000	0.0236	0.0000	0.4956
UK	0.0000	0.0000	0.0000	0.0000	0.5497	0.0000	0.0000	0.0024	0.0000	0.4479
Canada	0.0000	0.0000	0.0000	0.6219	0.0280	0.0000	0.0000	0.3501	0.0000	0.0000
Australia	0.0000	0.0000	0.0000	0.1904	0.2429	0.1135	0.0000	0.0000	0.0000	0.4532
Angola	0.0125	0.3022	0.1262	0.0026	0.1365	0.1273	0.0087	0.1978	0.0000	0.0863
Malaysia	0.0000	0.0000	0.0000	0.1690	0.0000	0.3142	0.0497	0.0000	0.4670	0.0000
Others	0.1048	0.1822	0.0494	0.0000	0.0059	0.0112	0.0098	0.0559	0.0000	0.5807

(Raw Data Source: APEDA)

Non-basmati rice

Non-basmati rice category includes all the rice formats except basmati rice. The non-basmati rice will be imported throughout the globe where ever people consume rice and rice preparations. The leading importers of this commodities are Bangladesh, Benin, Nepal, Cote D' Ivor, Sri Lanka, Senegal, Guinea, UAE, south Africa and remaining are grouped under others. TPM of export of non-basmati rice

from India to various countries during the period 2012-13 to 2021-22 is represented in Table 7.

From the TPM analysis we can notice Bangladesh is leading importer of non-basmati rice from India and also the new destinations added ang they didn't affect the share of the Bangladesh. Nepal is also one of the leading importers it retains its share and also losses art of its share to Ivory Coast.

Table 7: Transitional probability matrix of non-basmati rice from India in terms of export quantity

Loss / Gain	Nepal	Benin	Bangladesh	Ivory Coast	Senegal	Guinea	Sri Lanka	UAE	South Africa	Others
Nepal	0.0000	0.0000	0.0000	0.2956	0.0000	0.0000	0.0000	0.0000	0.0000	0.7044
Benin	0.0539	0.0000	0.6229	0.0000	0.2030	0.0000	0.1202	0.0000	0.0000	0.0000
Bangladesh	0.1932	0.0000	0.0000	0.0934	0.0000	0.0124	0.0000	0.0379	0.0016	0.6616
Ivory coast	0.0000	0.8697	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1303
Senegal	0.0000	0.0539	0.0000	0.0755	0.3099	0.2779	0.0000	0.1789	0.1038	0.0000
Guinea	0.5727	0.0000	0.0000	0.0095	0.0370	0.0443	0.0000	0.0159	0.0000	0.3205
Sri Lanka	0.0000	0.3627	0.0000	0.0143	0.3980	0.1617	0.0000	0.0633	0.0000	0.0000
UAE	0.1285	0.0000	0.0000	0.0000	0.0000	0.6367	0.0000	0.2348	0.0000	0.0000
South Africa	0.0000	0.0000	0.4328	0.0000	0.0000	0.0000	0.0000	0.0000	0.5672	0.0000
Others	0.0629	0.0796	0.0000	0.0235	0.0668	0.0000	0.0000	0.0030	0.0000	0.7642

(Raw Data Source: APEDA)

Conclusion

Nepal is the stable market who imports agricultural products from India, the growth rate implies that the imports are constantly increasing every year and its likely to keep increasing in future. Through the TPM we noticed that the major agricultural commodities which are imported by Nepal are also imported to many other countries in the same manner but Nepal retains its majority of share with it. Efforts should be taken to promote export of selected products from India to explore and exploit potential of other markets and to avoid overdependency on few countries.

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