Full Length Articles

Changing Pattern of Livestock Products Trade in India

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ABSTRACT

Data on Indian import and export of livestock products from 2010-11 to 2016-17 were collected from the reports of FAO and APEDA and used for forecasting the future direction of international trade using Markov Chain analysis. The transition probability matrix indicated that India could not retain its previous export of dairy products to Afghanistan and Oman. India's previous export of dairy products to the UAE market was retained at 23.70%. The remaining 58.70% was diverted to other countries. The probability of retention of the present quantity of dairy products imported was the highest for other countries (96.40%), followed by import from Denmark (44.20%). India could not retain its previous import of dairy products from France, Turkey and Italy during the period. The probability of retention of the present quantity of processed meat export was the highest for UAE (39.70%), followed by other countries (36.9%). India could not retain its previous export of processed meat to Qatar and Maldives. There was 100% probability of shifting of export to India from Sri Lanka to other countries, and from Spain to Sri Lanka. There were 93.50% and 69.70% probabilities to shift India's import from Belgium to Sri Lanka and from Thailand to Sri Lanka, respectively. India's previous buffalo meat export to Iraq market was retained at 59.60%. The remaining 40.40% was diverted to other countries (33.70%) and Indonesia (6.60%). Malaysia showed only 7.90% probability to retain its export market from India and its remaining 92.00% share was found directed to Vietnam. India was having 100% probability to retain the import of buffalo meat from Belgium, followed by New Zealand (70.50%) and Australia (26.80%). The probability of retention of export of poultry products to the Maldives was at 65.10%. India could not retain its previous export of poultry products to Japan and Vietnam. Vietnam's share of poultry products imports from India was diverted to other countries (86.10%). India's previous poultry products import from France market was retained at 52.00% and 48% was diverted to others (39.30%).

Key Words: Livestock products, Trade, Pattern, Markov Chain, India

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INTRODUCTION

Livestock sector has become one of the fastest growing agricultural subsectors in India. Its share of agricultural GDP was 25.6% in 2016-2017. This phenomenal growth is driven by the rapidly increasing local demand for livestock products, owing to the population growth, urbanization and increasing incomes in the country and also the increasing export opportunities for livestock products. As a result, livestock sector in India has undergone perceptible changes in its size, composition and productivity in the last few decades, transforming itself from a low-profile backyard venture to the status of a promising industry.

However, at the current level of productivity and the need to comply with the emerging standards across the world, the export competitiveness of Indian livestock products is not encouraging. Hence, this study attempts to unravel the future state of livestock export and import of livestock products in the country.

MATERIALS AND METHODS

Data on import and export of livestock and dairy products (annual trade data) from 2010-11 to 2016-17 were collected from FAO and APEDA. Livestock products considered for the analysis were dairy products, poultry products, processed meat and cara beef. Five major export destinations and five major importers were considered in this study. Markov chain analysis was employed for data analysis. The structural changes in nation wise share of trade in livestock products were analyzed by estimating the transitional probability using the Markov chain model. This model is a stochastic process which describes the finite number of possible outcomes S_i (i=1, 2…, r) of a discrete random variable X_t (t=1, 2…, t) and this assumes that the probability of an outcome on the t^{th} trial depends only on the outcome of the proceeding trial and this possibility is constant for all time periods (Lee *et al.,* 1965).

Central to Markov chain analysis is the estimation of the transitional probability matrix, 'P'. The element 'P_{ij}' of this matrix indicates the probability that trade will switch over from country 'i' to country 'j' over time. The diagonal element 'P_{ij}' measures the probability that the trade share of a country will be retained. An examination of this matrix will indicate the loyalty of an importing country to a particular country's exports (Dent, 1967).

In the study, the average export to a particular country would be considered as a random variable which depends only on its past export to that country and following a first order Markov model. It can be denoted algebraically as,

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

where,

E_{ij} = 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}= Probability that export will shift from i^{th} country to j^{th} country

e_{ij}= Error term, which is statistically independent of E_{it-1}

r = number of importing countries.

The transitional probabilities P_{ij}, which can be arranged in a [c × r] matrix, have the following properties.

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

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

Thus, the expected export shares of each country during the period 't' can be obtained by multiplying the exports to these countries in the previous period (t-1) with the transitional probability matrix. Similarly, the future export share of the importing countries is estimated. 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 formulation is stated as:

Min $OP^* + I_e$

Subject to

$XP^* + V = Y$

$GP^* = 1$

$P^* \geq 0$

where

P* - vector of the probability P_{ij}

O - vector of zero

I_e - dimensional vector of areas and e - vector of absolute errors

Y - vector of exports to each country

X - block diagonal matrix of lagged values of Y

V - vector of errors

G - grouping matrix to add the row elements of P arranged in P*, to unity

RESULTS AND DISCUSSION

Markov analysis is the way of analyzing the current movement of trade to predict its future movement. The results of the analysis were expected to identify the reliable trading partners and to assess the probability of retention of old partners in livestock products trade. In the transition probability matrix, the rows identify the current state of trade to different countries and the column identifies the alternatives to which the trade pattern could move. The transition probabilities computed based on the quantity of trade of livestock products are prescribed in this section.

The transitional probability matrix constructed for India's export of dairy products trade is presented in Table 1, which depicts a broad indication of changes in the direction of the export of dairy products from India. The period considered for this analysis was seven years from 2010-11 to 2017-18. The four major countries to which India exported dairy products which were considered for the analysis were USA, UAE, Afghanistan, Oman and with the remaining importing countries grouped as others. As could be seen from the table, the transition probability matrix indicated that India could not retain its previous export of dairy products to Afghanistan and Oman during the study period. The entire share of Afghanistan was directed to USA (71.10%), followed by other countries (16.10%) and Oman (12.80%). Again, the whole share of Oman was directed to UAE (100.00%), followed by other countries (16.10%) and Oman (12.80%).

Table - 1. Transitional probability matrix for India's export of dairy products

Country	USA	UAE	Afghanistan	Oman	Others
USA	**0.042**	0.958	0.000	0.000	0.000
UAE	0.000	**0.237**	0.076	0.100	0.587
Afghanistan	0.711	0.000	**0.000**	0.128	0.161
Oman	0.000	1.000	0.000	**0.000**	0.000
Others	0.000	0.000	0.000	0.000	**1.000**

India's previous export dairy products to the UAE market were retained to the level of 23.70% during the current period. The remaining 58.70% was diverted to other countries, followed by Oman (10.00%) and Afghanistan (7.60%). However, UAE has a higher probability to gain Oman's market (100%), as already stated. India's previous export to other countries market was retained at the same level (100%) during the current period and the other countries have a higher probability to gain UAE's export market (58.70%), followed by Afghanistan's market (16.10%).

Table 2 presents the transitional probability matrix for India's import of dairy products. The four major exporting countries analyzed were France, Turkey, Denmark, Italy and with the remaining countries being grouped as others. The transitional probability matrix for imports of dairy products reveals that the probability of retention of the present quantity of dairy products imported is the highest in other countries (96.40%), followed by import from Denmark (44.20%). India could not retain its previous import of dairy products from France, Turkey and Italy during the period.

Table - 2. Transitional probability matrix for India's import of dairy products

Countries	France	Turkey	Denmark	Italy	Others
France	**0.000**	0.000	0.000	0.000	1.000
Turkey	0.000	**0.000**	0.385	0.000	0.615
Denmark	0.000	0.000	**0.442**	0.000	0.558
Italy	0.000	0.000	0.000	**0.000**	1.000
Others	0.021	0.000	0.008	0.007	**0.964**

The entire share (100%) of France was directed to other countries. Turkey's import share was directed to Denmark (38.50%) and to other countries (61.50%). However, 55.80% of India's import would be now from other countries.

The transitional probability matrix constructed for India's export of poultry products trade is presented in Table 3, which depicts a broad indication of changes in the direction of the export of poultry products from India. The period considered for this analysis was seven years from 2010-11 to 2017-18. The four major countries to which India exported poultry products which were considered for the analysis were Oman, Maldives, Japan, and Vietnam and with the remaining importing countries grouped as others. The probability of retention of

the quantity of export of poultry products to the Maldives was at a level of 65.10% during the study period. The remaining was diverted to Oman (32.90%) and Vietnam (1.90%).

India could not retain its previous export of poultry products to Japan and Vietnam during the study period 2010-11 to 2017-18. The entire export share of Japan was directed to other countries. Vietnam's share of poultry products imports from India was diverted to the other countries (86.10%), with 13.90% going to Oman. Probability of retention of the present quantity of export of poultry products to Oman was at the level of 32.70% and remaining was diverted to other countries (56.80%), Vietnam (8.50%) and Maldives (2.00%). Oman has a higher probability to get the export market of other counties (75.70%), Maldives (32.90%) and Vietnam (13.90%).

Table - 3. Transitional probability matrix for India's export of poultry products

Countries	Oman	Maldives	Japan	Vietnam	Others
Oman	**0.327**	0.020	0.000	0.085	0.568
Maldives	0.329	**0.651**	0.000	0.019	0.000
Japan	0.000	0.000	**0.000**	0.000	1.000
Vietnam	0.139	0.000	0.000	**0.000**	0.861
Others	0.757	0.025	0.046	0.022	**0.150**

The four major importing countries for poultry products taken for this analysis were Poland, France, Germany, Brazil with the remaining importing countries grouped as others. As could be seen from Table 4, the transition probability matrix indicated that India's previous poultry products import from the France market was retained to the level of 52.00% and the remaining 48% was diverted to others (39.30%), Brazil (8.50%) and Poland (0.20%). However, France had a higher probability to gain other countries' share (57.90%) and Poland's export market (25.00%). India could not retain its previous import of poultry products from Brazil and other countries. The entire share of Brazil was diverted to Poland (64.70%) and Germany (35.30%).

Table - 4. Transitional probability matrix for India's import of poultry products

Countries	Poland	France	Germany	Brazil	Other
Poland	**0.125**	0.250	0.203	0.423	0.000
France	0.002	**0.520**	0.000	0.085	0.393
Germany	0.346	0.000	**0.431**	0.000	0.223
Brazil	0.647	0.000	0.353	**0.000**	0.000
Other	0.309	0.579	0.000	0.111	**0.000**

The transitional probability matrix constructed for India's export of processed meat trade is presented in Table 5, which depicts a broad indication of changes in the direction of export of processed meat from India. The period considered for this analysis was seven years from 2010-11 to 2017-18.

Table - 5. Transitional probability matrix for India's export of processed meat

Countries	UAE	Qatar	Maldives	Myanmar	Others
UAE	**0.397**	0.000	0.000	0.000	0.603
Qatar	0.000	**0.000**	0.000	0.000	1.000
Maldives	0.000	0.000	**0.000**	0.000	1.000
Myanmar	0.002	0.825	0.000	**0.173**	0.000
Others	0.048	0.486	0.000	0.096	**0.369**

The four major countries to which India exported poultry products which were considered for the analysis were UAE, Qatar, Maldives, Myanmar and with the remaining importing countries grouped as others. The computed probabilities revealed that the probability of retention of present quantity of processed meat export is highest in UAE (39.70%), followed by other countries (36.9%) and Myanmar (17.30%). In the case of UAE, the remaining 60.30% of the export market share will be shifted to other countries. India could not retain its previous export of processed meat to Qatar and Maldives during the study period. However, Qatar having higher probability to gain 82.50% market shares of Myanmar, and from other countries, it was of 48.60%. Qatar and Maldives had 100% probability and UAE having 60.30% probability of shifting of export market to other countries.

The direction of import from the different countries like Sri Lanka, Spain, Thailand, Belgium and other countries were assessed from the computed transitional probability matrix, given in Table 6. It can be understood from the matrix that all the four main countries are not able to retain its export to India during the study period of 2010-11 to 2017-18. There was 100% probability of shifting of export to India from Sri Lanka to other countries, and from Spain to Sri Lanka. It was also noticed that there was 93.50% probability to shift India's import from Belgium to Sri Lanka and 69.70% probability to shift from Thailand to Sri Lanka. Other countries had a higher probability of 88.80% to retain their present levels of imports to India in future years.

The transitional probability matrix constructed for India's export of buffalo meat trade is presented in Table 7, which depicts a broad indication of changes in the direction of export of buffalo meat from India. The period considered for this analysis was seven years from 2010 – 11 to 2017 – 18. The four major countries to which India exported poultry products which were considered for the analysis were Vietnam, Malaysia, Indonesia, Iraq and with the remaining importing countries grouped as others. As could be seen from the table, the transition probability matrix indicated that India's previous buffalo meat export to the Iraq market was retained to the level of 59.60% during the current period. The remaining 40.40% was diverted to other countries (33.70%) and Indonesia (6.60%).

Table - 6. Transitional probability matrix for India's import of processed meat

Countries	Sri Lanka	Spain	Thailand	Belgium	Others
Sri Lanka	**0.000**	0.000	0.000	0.000	1.000
Spain	1.000	**0.000**	0.000	0.000	0.000
Thailand	0.697	0.199	**0.000**	0.103	0.000
Belgium	0.935	0.062	0.003	**0.000**	0.000
Others	0.052	0.026	0.008	0.027	**0.888**

Table - 7. Transitional probability matrix for India's export of buffalo meat

Countries	Vietnam	Malaysia	Indonesia	Iraq	Others
Vietnam	**0.359**	0.118	0.000	0.000	0.522
Malaysia	0.920	**0.079**	0.000	0.000	0.000
Indonesia	0.313	0.127	**0.378**	0.181	0.000
Iraq	0.000	0.000	0.066	**0.596**	0.337
Others	0.429	0.048	0.003	0.025	**0.493**

However, Iraq had a probability to gain 18.10% of the market share of Indonesia and 2.50% of other countries. Malaysia showed only 7.90% probability to retain in the export market from India and its remaining 92.00% share was found to be directed to Vietnam. India's previous Buffalo meat export to the other countries market was retained to the level of 49.3% during the current period. The remaining share was directed to Vietnam (42.90%), Malaysia (4.80%), Iraq (2.50%) and Indonesia (0.30%). However, other countries had a higher probability to gain Vietnam's export market (52.20%), followed by Iraq's export market (33.70%).

Table 8 depicts the transitional probability matrix of India's previous buffalo meat import from various countries. From the matrix, it was observed that India having 100% probability to retain the import market from Belgium, followed by New Zealand (70.50%) and Australia (26.80%). The remaining 29.50 per cent of New Zealand was directed to other countries (29.40%) and Belgium (0.10%). However, New Zealand had 100% probability to gain the import market share of other countries and 21.90% market share of Australia. Australia's import market shares were found to be diverted to other countries (51.10%) and New Zealand (21.90%). Netherland was found to be failed 100% in retaining its current state of import market and the whole market is found to be shifted to other countries.

Table - 8. Transitional probability matrix for India's import of buffalo meat

Countries	New Zealand	Belgium	Australia	Netherland	Others
New Zealand	**0.705**	0.001	0.000	0.000	0.294
Belgium	0.000	**1.000**	0.000	0.000	0.000
Australia	0.219	0.000	**0.268**	0.000	0.511
Netherland	0.000	0.000	0.000	**0.000**	1.000
Others	1.000	0.000	0.000	0.000	**0.000**

On examination of the temporal and compositional changes in livestock exports and assessment of export competitiveness and factors affecting the growth of livestock export, it was reported that India was competitive in export of bovine meat (Kumar, 2010). The export of buffalo meat was found to have increased consistently, fuelled by poor domestic demand. However, the export of mutton did not have any prospects in the short-run, as even the domestic demand was not met. Also, India was not competitive in the export of milk and milk products. He identified domestic policy initiatives and increased production and productivity as the key factors for increasing the export of livestock products.

On examining India's meat exports, structure, composition and future prospects, it was found that since 1981, India made impressive strides in export of meat items, both in quantity and value terms (Suresh *et al.,* 2012). Buffalo meat exports increased heavily from 7.6 million tons in TE 1992–93 to 56 million tons in TE 2010-11 (Kumar *et al.*, 2012). Studying the changing direction of trade of sheep and goat meat in India, by analyzing the data of 20 years (1991 – 2011), using Markov Chain analysis, it was also found that India's previous export to the United Arab Emirates was retained at the level of 17% and import from Thailand retained at 100% during the period (Shilpashree *et al.,* 2017).

In spite of the promising trends in both population and production of livestock and poultry in the country, the export potentials of livestock and poultry products from India to other countries only look gloomy if the trends are analysed. This points to the fact that the country has to effectively tackle challenges it faces in food safety issues. With the surplus production of milk and egg being the remarkable feature of Indian livestock and poultry industry, unless food safety issues are strictly considered and addressed, the country will not be able to fully exploit the export potentials in the near future. Also, exploring all possible avenues for further processing and value addition of livestock and poultry products will help to achieve the desired results. Necessary focus to retain the existing target countries for export of livestock products and to persuade the other potential importing countries would require formulation and following up of globally acceptable food safety standards.

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