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Destinations and diversification in export of meat from India: Markov chain analysis

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Abstract
The present study entitled "Export of meat from India – An Economic Analysis" For this study time series data on country wise exports for the period 1987 to 2013 were collected from annual publications of APEDA and website, FAO year books. The collected data were evaluated for two different periods *viz.* pre-WTO period: 1987-88 to 1994-95, post-WTO period 1995-96 to 2013-14 and overall period 1987-88 to 2013-14, in order to observe the effect of the WTO on export of meat. Markov chain analysis was used to analyze the market share and direction of trade of Indian meat.

The market share and direction of trade analysis showed that Malaysia, UAE, Oman, Mauritius were most loyal and stable importers of buffalo meat during study period. The most unstable markets were Kuwait and Jordan as their retention probabilities were almost zero in pre-WTO and overall period. In case of sheep and goat meat UAE and Saudi Arabia were most loyal and stable importers during study period. The most unstable markets for sheep and goat meat were Bahrain, Oman, Kuwait and USA Portugal was most loyal and stable importer of Animal casings during study period. The most unstable markets were Italy, Germany, Japan, UAE, France as their retention probabilities were almost zero during study period. For processed meat and Oman was most loyal and stable importer during study period. The most unstable markets for processed meat were Qatar, Malaysia, Jordan, Seychelles, Kuwait, and Bahrain. Bahrain, Bhutan and Nepal were most loyal and stable importers of other meat during study period. It could be concluded from the foregoing analysis that in order to reap benefit from international it is necessary to concentrate on markets for meat the most loyal countries and at the same time divise the policy to increase share of Indian meat in international market.

Keywords: Destinations, diversification, meat, Markov chain

Introduction
Livestock sector contributed important share in Indian export trade. India ranks first in the world in animal and cattle population. India ranks eighth in the world meat production; present meat production in India is estimated at 6.27 million tones which is 2.21 percent of the world's meat production. Buffalo in India contributes about 30 percent of total meat production. The contribution by meat, cattle, sheep, goats and poultry is 30 percent, 5 percent, 10 percent, 10.2 percent and 11.5 percent, respectively.

The meat production has registered a healthy growth from 2.3 million tones at the end of 10th Five Year Plan (2006-07) to 5.5 million tones at the end of 11th Five Year Plan (2011-12). The growth rate for production of meat in 2011-12 was about 13 percent. In spite of big potential because of large livestock population, the meat industry in India has not taken its due share. There is a scope to increase meat production in India.

The present study on 'Export of meat from India: An economic analysis' has been taken with the following specific objectives:
1. To study diversification in meat export.
2. To identify major destinations of meat export.

Methodology
The present study is based on secondary data. The detail information required for the study was collected from secondary sources in order to accomplish the various objectives related to export of meat. Five types of meat were selected for the study namely buffalo meat, sheep and goat meat, animal casings, processed meat and other meat. The country wise time series data on export of meat in terms of value and quantity from 1987-88 to 2013-14 were collected from annual publication of APEDA (Agricultural and Processed Foods Export Development Authority, India) and its website www.apeda.com. The collected data were grouped into three periods.

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Pre-WTO period from 1987-1994, Post-WTO period from 1995-2013 and overall period from 1987-88 to 2013-14.

The trade direction of Indian meat exports was analyzed using the first order Markov chain approach. Central to Markov chain analysis is the estimation of the transitional probability matrix P. The elements P_{ij} of the matrix P indicate the probability that exports will switch from country i to country j with the passage of time. The diagonal elements of the matrix measure the probability that the export share of a country will be retained. Hence, an examination of the diagonal elements indicates the loyalty of an importing country to a particular country's exports.

In the present study six major importing countries of meat were considered, the rest of countries were grouped as 'others'. The average exports 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;

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

Where,

E_{jt}: Exports to j[th] country from India during the year t

E_{it}-1: Exports to i[th] country during the year t-1

P_{ij}: The probability that export will shift from i[th] country to j[th] country.

E_{jt}: The error term which is statistically independent of E_{it}-1

r: The number of importing countries

Considering the limitations of software Lindo for estimating transition probability matrix for pre and post WTO period triannum averages and for overall period quinquinal averages were used.

Results

1. Transitional Probability Matrix of buffalo meat export from India

Table 1.a: Pre-WTO Period

Country	Malaysia	U.A.E	Oman	Yamen Arab Republic	Kuwait	Mauritius	Others
Malaysia	0.13261	0.29360	0.004015	0.053586	0.0556	0.0595	0.4009
U.A.E	1	0	0	0	0	0	0
Oman	0	0	1	0	0	0	0
Yamen Arab Republic	0	0	0	0	0	0	1
Kuwait	0	1	0	0	0	0	0
Mauritius	1	0	0	0	0	0	0
Others	0.76937	0.14378	0	0.081716	0.0051	0	0

Table 1.b: Post-WTO period

	Malaysia	U.A.E	Philippines	Jordan	Kuwait	Iran	Others
Malaysia	0.4973	0	0.37524	0	0	0.127382	0
U.A.E	0.2328	0.5528	0.185152	0.029124	0	0	0
Philippines	0.2602	0.38906	0.00637	0.162642	0.071746	0	0.109888
Jordan	0	0	0	0	0	0	1
Kuwait	0	0	0	0	0.3586	0	0.64133
Iran	0	1	0	0	0	0	0
Other	0	0	0	0.0526	0.0073	0	0.9399

Table 1.c: Overall Period

Country	Malaysia	U.A.E	Kuwait	Oman	Jordan	Mauritius	Others
Malaysia	0.62351	0.33467	0	0.02185	0	0.019953	0
U.A.E	0	0.44186	0.02599	0	0.12169	0	0.410452
Kuwait	0.493888	0	0	0.06958	0.43653	0	0
Oman	0.553712	0	0	0.4462	0	0	0
Jordan	0	0	0.40244	0	0	0	0.597552
Mauritius	0.09113	0.24505	0	0	0.52060	0.143218	0
Others	0	0	0.01164	0	0.00285	0	0.985504

Table 1.a, 1.b, and 1.c showed that, Malaysia, UAE, Oman, Mauritius were most loyal and stable importers of Buffalo meat during study period. Malaysia had retention probability of 0.13 percent of its previous period import in pre-WTO period, this increased to 0.49 percent in post-WTO period. This country showed highest retention probability during overall period i.e. 0.62 percent. UAE had probability retention 0 percent in pre-WTO period but it increased to 0.55 percent in post-WTO period. At overall level retention probability of UAE was 0.44 percent of previous period. The most unstable markets were Kuwait and Jordan as their retention probabilities were almost zero in pre-WTO and overall period.

2. Transitional Probability Matrix of sheep and goat meat export from India

Table 2.a: Pre-WTO Period

Country	U.A.E	Saudi Arabia	Oman	Bahrain	U.S.A	Kuwait	Other
U.A.E	0.55081	0.360445	0.088735	0	0	0	0
Saudi Arabia	0.40013	0.49050	0.054935	0.041658	0.00466	0	0.00809
Oman	1	0	0	0	0	0	0
Bahrain	0	0	0.092043	0.59492	0	0	0.31303
U.S.A	0	0	0	0.28373	0.71627	0	0
Kuwait	0	0	0	0	0	0	1
Other	0	0	0.427885	0	0	0.572115	0

Table 2.b: Post-WTO Period

Country	U.A.E	Saudi Arabia	Kuwait	Oman	Bahrain	U.S.A	Other
U.A.E	0.732312	0.033046	0.019293	0.16005	0	0.0018	0.0534
Saudi Arabia	0.354699	0.620793	0	0	0.022379	0.0021	0
Kuwait	1	0	0	0	0	0	0
Oman	0	0.922569	0	0	0.077431	0	0
Bahrain	0	1	0	0	0	0	0
U.S.A	0	0.694822	0	0	0	0.3051	0
Other	0	0.073549	0.000004	0.047213	0.003656	0	0.875

Table 2.c: Overall Period

Country	U.A.E	Oman	Saudi Arabia	Bahrain	Kuwait	U.S.A	Others
U.A.E	0.329388	0.08785	0.538094	0.035014	0.00542	0.004234	0
Oman	0.960503	0	0	0	0.039497	0	0
Saudi Arabia	0.29521	0	0.170206	0.001365	0.012043	0	0.5211
Bahrain	1	0	0	0	0	0	0
Kuwait	0	0	0	0	0	0	1
U.S.A	0	1	0	0	0	0	0
Others	0	0	0	0	0	0	1

The transition probability matrix for sheep and goat meat is depicted in Table 2.a, b and c for pre- WTO, post-WTO and overall period respectively.

It could be seen from Table 2 that retention probability of UAE and Saudi Arabia increased from 0.55 and 0.49 percent during pre-WTO period to 0.73 and 0.62 percent during post-WTO period. This revealed that UAE and Saudi Arabia were the most loyal importers of sheep and goat meat from India.

The increase in retention probability for other countries during post-WTO period indicated that there was increase in number of countries importing sheep and goat meat from India. This could be attributed to the effect of globalization. Similar results were observed for the total study period.

3. Transitional Probability Matrix of Animal casings export from India

Table 3.a: Pre-WTO Period

Country	Netherland	Spain	Portugal	Japan	Italy	Germany	Others
Netherland	0	0.3586	0.2963	0	0	0.34501	0
Spain	0.452787	0.3987	0	0.028	0	0	0.11985
Portugal	0	0.10637	0.5946	0	0.2989	0	0
Japan	0.234078	0.1451	0	0.0671	0.371	0	0.1825
Italy	0	0	1	0	0	0	0
Germany	0	0	0.9274	0	0	0.07250	0
Others	1	0	0	0	0	0	0

Table 3.b: Post-WTO Period

Country	Spain	Germany	France	UAE	Portugal	Italy	Other
Spain	0.593	0.0878	0	0.189626	0	0	0.1292
Germany	0.0718	0	0	0	0	0	0.9281
France	0	0.1569	0	0	0.27093	0.5720	0
U.A.E.	0.0981	0	0	0	0.90189	0	0
Portugal	0	0.2682	0.131241	0	0.0521	0	0.5483
Italy	0	0	0	0	0	0	1
Other	0	0.1319	0.0017	0.0145	0	0	0.8517

Table 3.c: Overall Period

Country	Germany	Spain	France	Portugal	Italy	UAE	Others
Germany	0	0	0	0	0	0	1
Spain	0	0	0	0	0	0	1
France	0.650136	0	0	0.0205	0.3293	0	0
Portugal	0.184386	0.054912	0.255475	0.4012	0.0703	0	0.0336
Italy	0	0	0	0	0	0	1
U.A.E.	0	0	0	0	0	0	1
Others	0.065834	0.09629	0	0	0	0.034474	0.8034

The transition probability matrix of animal casing depicted in Table 3.a, b and c indicated that there was a mixed trend in import of animal casings from India. At overall level only Portugal seems to be a loyal importer of animal casings from India with 0.40 percent retention probability. Whereas, the retention probability for countries which are not regular importer was to the tune of 0.80 percent.

During pre-WTO period retention probability of Spain was 0.39 percent which increased to 0.59 percent during post-WTO period. In case of Portugal reverse trend was observed which may be because of diversification of 0.27, 0.13 and 0.55 percent of its previous period import to Germany, France and Other countries.

4. Transitional Probability Matrix of Processed meat export from India

Table 4.a: Pre-WTO Period

Country	Australia	U.A.E.	Saudi Arab	Qatar	Malaysia	Vietnam Soc Rep	Other
Australia	0.3212	0.5137	0	0	0.0470	0	0.1179
U.A.E.	0	0	0	0.015949	0	0.3572	0.6268
Saudi Arab	0.674576	0	0.32542	0	0	0	0
Qatar	0	0	0	0	0	0	1
Malaysia	0	0	0	0.199753	0	0.8002	0
Vietnam Soc Rep	0	0	0	0	0	1	0
Other	0	0	0	0	0.1946	0.1236	0.6816

Table 4.b: Post-WTO Period

Country	U.A.E.	Seychelles	Oman	Jordan	Kuwait	Baharain	Other
U.A.E.	0.373776	0	0.446194	0	0	0	0.1800
Seychelles	0	0.022184	0.977816	0	0	0	0
Oman	0.642529	0	0.306085	0	0	0.051387	0
Jordan	0.014504	0	0	0	0	0.092846	0.892
Kuwait	0	0	0	0.27252	0	0	0.727
Baharain	1	0	0	0	0	0	0
Other	0.181198	0.163825	0.019896	0.023612	0.056178	0	0.5552

Table 4.c: Overall Period

Country	U.A.E.	Seychelles	Oman	Saudi Arab	Malaysia	Qatar	Other
U.A.E.	0	0.04387	0.9116	0	0	0.044	0
Seychelles	1	0	0	0	0	0	0
Oman	0.223834	0.09708	0.459	0	0	0.2191	0
Saudi Arab	0.266194	0.73380	0	0	0	0	0
Malaysia	0.40185	0	0.5981	0	0	0	0
Qatar	0	0	0	0	1	0	0
Other	0.0066	0.040193	0.0151	0.0265	0.1091	0	0.802

The transition probability matrix for export of processed meat from India revealed most diversified picture during the study period. It was observed that, Oman was the only loyal importer of processed meat with retention probability of 0.46 percent for the overall period. The countries which were irregular importers retained maximum (0.80 percent) share. Though there was addition of new countries *viz.* Seychelles, Jordan and Kuwait during post-WTO period, there retention probability was very meager. This could be attributed to wide diversification in export destinations for processed meat from India.

5. Transitional Probability Matrix of Other meat export from India

Table 5: Overall Period

Country	Vietnam	Bahrain	Bhutan	Nepal	Maldives	Italy	Other
Vietnam	0	0.0157	0.9533	0.0308	0	0	0
Bahrain	0	0.6121	0	0.3878	0	0	0
Bhutan	0	0	1	0	0	0	0
Nepal	0	0	0	1	0	0	0
Maldives	0	1	0	0	0	0	0
Italy	0	0.2698	0	0	0	0	0.7301
Other	0.2866	0	0	0	0.0020	0.0244	0.6869

Table 5. Showed, that Bahrain, Bhutan and Nepal were most loyal and stable importers of other meat during study period. In that Bhutan and Nepal had cent percent retention probability of its previous period import in overall period, Bahrain had 0.61 percent retention probability. The most unstable markets were Vietnam, Maldives, Italy and their probability retentions were almost zero.

The loyal importers of buffalo meat during study period were Vietnam, Malaysia, Congo, U.A.E, Philippines, Egypt, Jordan, Saudi Arabia, Angola, Kuwait. Sheep and goat meat was regularly imported by U.A.E, Saudi Arabia, Oman, Egypt, Kuwait, Angola, Qatar, Iraq, Malaysia. Animal casings are mainly exported to Vietnam, Germany, Portugal, Spain, Bangladesh, Netherland, Sweden, South Africa, Hong Kong, Myanmar, France. In case of processed meat the major export destinations were U.A.E., Australia, Vietnam, Seychellus, Jordan, Saudi Arabia, Malaysia, Oman, Hong Kong, Kuwait. Other meats were mainly exported to Vietnam, Myanmar, Egypt, Jordan, Bhutan, Iraq, Yamen Arab Republic, Portugal, Angola.

Conclusion
- This study showed that the impact of World Trade Organization on meat export was positive and beneficial to the meat industry.
- Among the importing countries UAE, Saudi Arabia, Malaysia, Kuwait, Angola, Egypt, Oman Hong Kong, Iraq and Portugal were the most stable and loyal importers of Indian meat.
- As observed that meat have tangible share in export earnings and it is a remunerative industry, so Government should provide necessary facilities including medium and long term loans for those who are engaged in meat industry, thereby to expand this industry and create more and more job opportunities and finally to promote economic welfare for the nation as a whole.
- There is a need to set up schemes for diversification and preparations of value added meat products depending upon market demand, suitable processing and manufacturing units can be set up.

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