

## Assessing the Trade Performance of Poultry Products in India - An Application of Markov Chain Analysis

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### ABSTRACT

*Poultry is one of the fastest growing segments of the agricultural sector in India today. India is now the world's fifth largest egg producer and the eighteenth largest producer of broilers. In this study, tabular analysis was used to analyse the pattern of export, import and balance of trade of Poultry products in India. From the study, it is observed that between 2004-2007 imports & exports kept edging each other out & after 2007, it started falling down in export and increase in imports. This may be due to rising urban population, expanding middle class, changing lifestyles and also growing penetration of restaurants. The export of poultry meat is increased drastically after 2010. The present study was also undertaken to find out the direction of trade of poultry products using Markov Chain Analysis indicated that India's previous export to the Afghanistan market was retained to the level of 36 per cent and the remaining 64 per cent was diverted to Germany (10 per cent) and other countries (54 per cent) whereas in case of imports, India's previous import from the Brazil market was retained to the level of 46 per cent and the remaining 54 per cent was diverted to Netherland. India could not retain its previous import of poultry products to Netherland, Japan and Australia. India lacks access to developed country markets due to their stringent food safety and quality standards. To give a boost to livestock exports, compliance with various SPS measures should be taken up vigorously to ensure international hygiene standards and to harness the untapped potential of exporting to developed countries.*

**Key words:** India, Trade, Poultry Products, Markov Chain

### INTRODUCTION

Poultry is one of the fastest growing segments of the agricultural sector in India today. India is now the world's fifth largest egg producer and the eighteenth largest producer of broilers. The potential in this sector is due to a combination of factors like growth in per capita income, a growing urban population and

falling real poultry prices. Poultry meat is the fastest growing component of global meat demand and India, the world's second largest developing country, is experiencing rapid growth in its poultry sector. India has been in the egg export business for nearly two decades and the export turnover swelled to around 450 crore six years ago.

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Since the first outbreak of avian flu in India in 2006, egg exports have been showing a downward trend. Namakkal in Tamil Nadu is the egg export hub of India. Although some efforts have been made to increase Poultry exports from India, the trade is very small in comparison to the global trade. At present the exports are mainly in table eggs, hatching eggs, frozen eggs, egg powder and to a small extent for live poultry. India exports about 800 reefer containers of table eggs (0.413 million eggs per container) to the gulf market. Eggs come to Gulf market from India, Holland and USA. Dubai is the major market with a preference for white shelled eggs. Muscat is another market but the imports are seasonal (6 to 7 months). Oman, Baharen and Qatar are other small markets. Saudi Arabia, Yemen Syria and Iran are almost self sufficient in requirement of table eggs. In Dubai, our major sales are in the institutional market i.e. hotels, restaurants and caterers. Indian eggs are perceived as of lower quality and are quoted for USD 3 less per carton (360 eggs) than the eggs from Europe and USA. The poultry sector is growing at a compounded annual growth rate (CAGR) of about 10% with demand growing at over 15% due to the rising population, expanding middle class and growing penetration of restaurants. Keeping these in mind, the present study was undertaken to find out the trade performance of poultry sector in India.

#### MATERIALS AND METHODS

The data used in this study were collected from various secondary sources. Time series data for twenty year (1991 – 2011) on export and imports (quantity as well as in value terms) of dairy products for the world and India were collected from Food and Agricultural Organization (FAO)<sup>3</sup> of the United Nations, FAO<sup>3</sup> trade statistics and FAO<sup>3</sup> commodity Review and outlook. The data on top exporting and importing countries were collected from Agricultural and Processed food products Export Development

Authority (APEDA)<sup>1</sup>, Ministry of Commerce and Industry, Government of India. The reference period for the analysis is from 2007-08 to 2012-13.

The study is divided into two sections. The first section examines the pattern of export, import and net trade for poultry products during the last two decades by tabular analysis. The second section finds out the direction of trade of poultry products from 2007-08 to 2012-13 using Markov Chain Analysis.

#### Markov Chain Analysis – Transitional Probability Matrix

For finding out the changes in the structure of the trade in dairy products of India, Markov chain analysis was used. Markov analysis is an application of dynamic programming to the solution of a stochastic decision process that can be described by a finite number of states<sup>2</sup>. Any sequence of trials (experiments) that can be subjected to probabilistic analysis is called as stochastic process. For a stochastic process, it is assumed that the movements (transitions) of objects from one state (possible outcome) to another are governed by a probabilistic mechanism or system. A finite markov process is a stochastic process whereby the outcome of a given trial  $t$  ( $t = 1, 2, \dots, T$ ) depends only on the outcome of the preceding trial ( $t-1$ ) and this dependence is the same at all stages in the sequence of trials.

Consistent with this definition, the structural change in the trade in dairy products of India was examined by using the Markov chain approach. 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 export will switch from category  $i$  to category  $j$  with the passage of time. The diagonal element  $P_{ii}$  measures the probability that the export share of  $i^{\text{th}}$  country will be retained<sup>6,7</sup>. The value of export of particular country was considered to be a random variable which depends only on its previous exports and this dependence is the same among all periods. A process satisfying

these conditions is called a first order stationary Markov chain.

## RESULTS AND DISCUSSION

### Pattern of export, import and balance of trade of poultry products in India.

In India, pattern of export, import and balance of trade of eggs and Poultry meat are shown in table 1. From the table 1, the trend for export of eggs continued till 2002 and then it increased drastically in 2003. The imports of eggs decreased in 2003 and then it started increasing. However, between 2004-2007 imports & exports kept edging each other out & after 2007, it started falling down in export and increase in imports. This may be due to rising urban population, expanding middle class, changing lifestyles and also growing

penetration of restaurants. The results also revealed that the trend for export of poultry meat continued till 2001 and then it increased drastically in 2003. The trend for imports of poultry meat continued till 2009 and then it started increasing. However, between 2004-2009 observed slight fluctuations in the export trend for exports of poultry meat whereas in 2010, export of poultry meat was increased drastically. India can emerge as a significant exporter by subsidizing its exports to compete with other world exporters or should negotiate in the WTO for substantial reduction in subsidies by their major exporters<sup>5</sup>. Afghanistan, Saudi Arabia, Indonesia, Germany and Netherland are the major export destinations.

**Table: 1 Pattern of export, import and balance of trade of poultry products in India**

Year	Eggs			Poultry Meat		
	Export	Import	Net trade	Export	Import	Net trade
1991	5794	0	5794	215	0	215
1992	8188	0	8188	139	0	139
1993	3595	0	3595	212	0	212
1994	6200	0	6200	101	0	101
1995	13175	0	13175	407	0	407
1996	13064	14	13050	520	1	519
1997	9382	11	9371	344	0	344
1998	10885	5	10880	351	0	351
1999	9950	69	9881	259	0	259
2000	11344	23	11321	259	1	258
2001	10486	8	10478	58	65	-7
2002	15128	387	14741	1041	17	1024
2003	42319	43	42276	6918	18	6900
2004	48582	300	48282	1822	9	1813
2005	58744	366	58378	890	44	846
2006	49070	239	48831	1072	25	1047
2007	67259	294	66965	1887	54	1833
2008	52409	119	52290	1589	63	1526
2009	44180	66	44114	1656	61	1595
2010	34861	144	34717	4313	148	4165
2011	33915	315	33600	10548	124	10424

The NPCs for poultry meat indicate that India has protected poultry sub-sector heavily or the international prices have been depressed due to price distortion in the world market. These results suggest that India does not have enough potential to increase poultry export under the existing scenario<sup>4</sup>.

#### **Direction of Trade and Changing Pattern of both Exports and Imports of poultry Products in India:**

The transitional probability matrices were presented in table 2 depicts a broad indication of the changes in the direction of trade of poultry products in India.

The four major exporting countries for poultry products taken for this analysis were Afghanistan, Saudi Arab, Indonesia, Germany with the remaining exporting countries grouped as others. As could be seen from the table 2, the transition probability matrix indicated that India's previous poultry products export to the Afghanistan market was retained to the level of 36 per cent during the current period. The remaining 64 per cent was diverted to Germany (10 per cent) and other countries (54 per cent). However, Afghanistan has higher probability to gain 62 per cent of the market share of Indonesia alone.

India could not retain its previous export of poultry products to Saudi Arab during the study period. The entire share of Saudi Arab was directed to Germany and other countries alone. Nearly 11 per cent of the

Saudi Arab's share of poultry products imports from India was lost to Germany and the remaining 89 per cent was lost to others. However, Saudi Arab has higher probability to gain Germany's import market (0.233) followed by Indonesia's import market (0.13) and of other countries (0.03).

India's previous poultry products export to the Indonesia market was retained to the level of 18 per cent during the current period. The remaining 82 per cent was diverted to Afghanistan (62 per cent), Saudi Arab (13 per cent) and Germany (7 per cent). However, Indonesia has probability to gain 7 per cent of the other countries import market alone.

India could not retain its previous export of poultry products to Germany during the study period except U Arab Emis. The entire share of Germany was diverted to Saudi Arab (23 per cent) and other countries (77 per cent). However, Germany has higher probability to gain Saudi Arab's import market (0.11) followed by Afghanistan's import market (0.10) and of Indonesia's (0.07).

India's previous poultry products export to the other countries was retained to the level of only 10 per cent during the current period. However, other countries has higher probability to gain Saudi Arab's import market (0.89) followed by Germany's import market (0.77) and of Afghanistan's (0.54).

**Table 2: Transitional Probability Matrix for India's Export of Poultry Products**

	Afghanistan Tis	Saudi Arab	Indonesia	Germany	Others
Afghanistan Tis	<b>0.364449</b>	0	0	0.097707	0.537844
Saudi Arab	0	<b>0</b>	0	0.110061	0.889939
Indonesia	0.622036	0.126122	<b>0.183702</b>	0.068139	0
Germany	0	0.233104	0	<b>0</b>	0.766896
Others	0	0.260019	0.063908	0	<b>0.097667</b>

The four major importing countries for poultry products taken for this analysis were Brazil, Netherland, Japan, Australia with the remaining importing countries grouped as  
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others. As could be seen from the table 3, the transition probability matrix indicated that India's previous poultry products import from the Brazil market was retained to the level of

46 per cent during the current period. The remaining 54 per cent was diverted to Netherland. However, Brazil has higher probability to gain Netherland's export market (1.00), Japan's export market (1.00), Australia's export market (0.10) and of other countries (0.15). India could not retain its previous import of poultry products to

Netherland, Japan and Australia during the study period.

India's previous poultry products import to the other countries was retained to the level of only 73 per cent during the current period. The remaining percent was directed to Brazil (0.15), Japan (0.11) and Australia (1.00).

**Table 3: Transitional Probability Matrix for India's Import of Poultry Products**

	Brazil	Netherland	Japan	Australia	Others
Brazil	<b>0.459757</b>	0.544702	0	0	0
Netherland	1	<b>0</b>	0.695381	0.151423	0.144235
Japan	1	0.223678	<b>0</b>	0	0.766354
Australia	0.101245	1	0	<b>0</b>	0.898367
Others	0.151325	0	0.112367	1	<b>0.727624</b>

### CONCLUSION

The present study was undertaken to find out the pattern of trade of poultry products using tabular analysis indicated that between 2004-2007 imports & exports kept edging each other out & after 2007, it started falling down in export and increase in imports. India's previous export to the Afghanistan market was retained to the level of 36 per cent and the remaining 64 per cent was diverted to Germany (10 per cent) and other countries (54 per cent) whereas in case of imports, India's previous import from the Brazil market was retained to the level of 46 per cent and the remaining 54 per cent was diverted to Netherland. Indian meat export has undergone expansion in the last two decades driven mainly by increased meat production, institutional interventions in meat processing and policy initiatives to bring down tariffs. The growth of export of meat and meat products are very higher compared to other livestock products. The constraints affecting meat exports as livestock disease situation, abattoir facilities, slaughter house conditions, some social groups against meat exports, lack of grading and inspection system in meat trade and lack of pragmatic slaughter policies. India lacks access to developed country markets due to their stringent food safety and quality standards. To give a boost to livestock exports,

compliance with various SPS measures should be taken up vigorously to ensure international hygiene standards and to harness the untapped potential of exporting to developed countries like USA, EU and Japan. Compliance with food safety measures (FSM) has become an important issue in the trading of livestock products. To reduce the negative externalities of international trade in livestock products, incentives and support services should be structured to allow subsistence farmers and landless livestock farmers to participate in the livestock trade and reap the benefits of emerging opportunities.

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