An economic analysis of export performance of processed vegetables in India

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ABSTRACT

Indian processed vegetables in International markets accelerate the growth of Indian economy. Studying the changes in share of processed vegetables to different countries, improve the welfare of farmers, processors and exporters. In this regard, an attempt was made to quantify the changing structure of Indian processed vegetables exports. The main objective of the present study was to analysis the growth and the direction of trade in processed vegetables export. In this regard, secondary data, mainly quantity of processed vegetables exports from India was collected from APEDA, for a period of 1995-96 to 2017-18. Growth rates was estimated by using the exponential growth model and the Markov chain analysis model was computed through linear programming method to assess the transition probabilities for the major Indian processed vegetables export markets using Lingo Programming computer package. Accordingly, processed vegetables export market have positive double digit growth rate, UK retained 22.5 per cent, countries pooled under ‘others category’ retained 32.4 percent of share of Indian processed vegetables export. That the countries pooled under ‘others category’ and UK would be the more stable importers of the processed vegetables from India in future and country like Germany and Netherland was not found as the stable importer.

KEYWORDS

Export, Processed Vegetables, Markov Chain

The agriculture sector is vital for any nation. In India, it is the principal source of livelihood for more than 58 percent of the population, and it is the second-largest country in the world as far as farm production is concerned. Annually, India produces about 245 million tonne of food grain, 205 million tonme of fruits and vegetables. However, it processes just 4.6 percent of its output. The fact that a large volume of India’s agricultural output is wasted an alarming signal for the country. About 35 percent of the fruits and vegetables are wasted annually, due to poor storage facility amounting to a revenue loss of about Rs. 500 billion.

Approximately 80 percent of the vegetables rotted due to their high water content and the lack of processing facility, it resulting in a revenue loss of Rs. 125 billion. India aims to increase the processing level up to 20 percent by 2015 (MoFPI, 2011). The food processing industry is one of the largest industries in India and is divided into several segments, including fruit and vegetables; meat and poultry; dairy; marine products, and grains and consumer foods (which includes packaged foods, beverages and packaged drinking water). The food processing industry is growing at the rate of 13 per cent.
The growth of food processing industry is very important, as it takes care of farmers and employment for skilled and unskilled labour.

**Objective**
- To estimate the export growth rate
- To analyse the direction of trade in processed vegetables and processed fruits, juices and nuts to export.

**Methodology**

**Compound Growth Rate Analysis**

Growth rates in export of Processed Vegetables for 23 years in India were estimated by using the exponential growth model.

\[ Y_t = A B^t V_t \]  

Where,
- \( Y_t \) = export under consideration in the year \( t \)
- \( A \) = intercept indicating \( Y \) in the base
- \( B = 1 + g \), \( t \) = time period
- \( V_t \) = random disturbance term

Equation (1) was converted into the logarithmic form as follows to make it in a linear form:

\[ \ln Y_t = \ln A + t \ln B + \ln V_t \]

This is of the following form

\[ Q_t = a + b t + U_t \]

Where,
- \( Q_t = \ln Y_t \)
- \( a = \ln A \)
- \( b = \ln B \)
- \( U_t = \ln V_t \)

The values of ‘\( a \)’ and ‘\( b \)’ were estimated by using Ordinary Least Squares estimation technique. Later, the original ‘\( A \)’ and ‘\( B \)’ parameters in equation (1) were obtained by taking antilogarithms of ‘\( a \)’ and ‘\( b \)’ values as;

\( A = \text{Antilog (a)} \) and \( B = \text{Antilog (b)} \)

Average annual compound growth rate (%) was calculated as follows:

\[ g = \frac{(B - 1) \times 100}{100} \]

**Direction of Trade - Markov Chain Model**

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 (Dent, 1967). In the context of current application, structural change was treated as a random process with six importing countries for processed vegetables. The assumption was that the average export of processed vegetables from India amongst importing countries in any period depends only on the export in the previous period and this dependence was same among all the periods. This was algebraically expressed as

\[ E_{jt} = \sum_{i=1}^{n} E_{it-1} \cdot P_{ij} + e_{jt} \]

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 \( t-1 \), \( P_{ij} \) = the probability that exports will shift from \( i \)th country to \( j \)th country, \( e_{jt} \) = the error term which was statistically independent of \( E_{it-1} \), \( n \) = the number of importing countries. The transitional probabilities \( P_{ij} \), which could be arranged in \( a(c \times n) \) matrix, have the following properties.

\[ \sum_{i=1}^{n} P_{ij} = 1 \]

Where \( 0 \leq P_{ij} \leq 1 \)

Thus, the expected export share of each country during period ‘\( t \)’ was obtained by multiplying the exports to these countries in the previous period (\( t-1 \)) with the transitional probability matrix. Thus transitional probability matrix \( T \) was estimated using linear programming (LP) framework by a method referred to as minimization of Mean Absolute Deviation (MAD).

\[ \text{Min } Op^* + Ie \]

Subject to

\[ X P^* + V = Y, \quad GP^* = 1, \quad P^* > 0 \]

Where,
- \( P^* \) - Vector of the probabilities \( P_{ij} \)
- \( O \) - Vector of zeros
- \( i \) - Appropriately dimensional vectors of areas
- \( e \) - Vector of absolute errors
- \( Y \) - Proportion 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**

Compound growth rates for export of processed vegetables were analyzed for a period of 23 years \( i.e. \) from 1995-96 to 2017-18 and have been presented in Table 1.

**Table 1. CAGR of export of Processed Vegetables (1995-95 to 2017-18)**

<table>
<thead>
<tr>
<th>Quantity (In MT)</th>
<th>Value (In Rs. Crore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAGR (%)</td>
<td>11.14 ***</td>
</tr>
<tr>
<td>Value</td>
<td>16.92 ***</td>
</tr>
</tbody>
</table>

Note: *** indicates significance at 1 percent level of probability
The results revealed that quantity and value exhibits significant positive growth rate 11.14 per cent, 16.92 per cent for processed vegetables.

**Direction of Trade of Processed Vegetables Export from India**

Markov chain analysis was used to study the direction of trade by estimating the transitional probability matrix. The probability of retaining the previous period market (gain or loss) was interpreted by studying the diagonal and off diagonal element of transitional matrix. The transitional probability matrix for processed vegetable export from India to major countries was presented in Table 2. A broad indication of the change in the direction of trade of Processed Vegetables in India was indicated for the study period.

**Table 2. Transitional probability matrix of Indian processed vegetables export (1995-95 to 2017-18)**

<table>
<thead>
<tr>
<th></th>
<th>UK</th>
<th>UAE</th>
<th>USA</th>
<th>S. Arabia</th>
<th>Sri Lanka</th>
<th>Germany</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.225</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.095</td>
<td>0.176</td>
<td>0.504</td>
<td></td>
</tr>
<tr>
<td>0.444</td>
<td>0.014</td>
<td>0.087</td>
<td>0.140</td>
<td>0.123</td>
<td>0.193</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>0.000</td>
<td>0.995</td>
<td>0.001</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>0.041</td>
<td>0.008</td>
<td>0.942</td>
<td>0.003</td>
<td>0.002</td>
<td>0.004</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>0.000</td>
<td>0.018</td>
<td>0.010</td>
<td>0.904</td>
<td>0.012</td>
<td>0.055</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.002</td>
<td>0.000</td>
<td>0.997</td>
<td><strong>0.000</strong></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>0.670</td>
<td>0.005</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.324</td>
<td></td>
</tr>
</tbody>
</table>

The six major countries imported processed vegetable from India were UK, UAE, USA, S. Arabia, Sri Lanka, and Germany. Further the processed vegetable export to remaining countries was pooled under the category of others. It was inferred from the probability matrix from in for Indian processed vegetable exported to the major countries. It was found that UK retain 22.5 percent share of Indian processed vegetable export for the period. Whereas UK would lose its share of 50.4 percent to others countries, 17.6 percent share to Germany, and 9.5 percent share to Sri Lanka. Beside UK gained considerable save from others countries (67 %), UAE (44.4 %), and S. Arabia (4.1 %)

The UAE was found to be another stable importer of India processed vegetable, it retained original share 1.4 percent over the period. It lost it major share of 44.4 percent to UK 19.3 percent to Germany, 14 percent to S. Arabia, 12.3 percent to Sri Lanka and 8.7 percent to USA. USA and S. Arabia both have low probability of retention of its own share likely 0.01 per cent, 0.03 percent respectively. USA lost its major share of 99.5 percent to UAE; S. Arabia lost nearly it 94 percent share to USA and 4 percent to UK. Sri Lanka have low retention probability of 1.2 percent is likely to lost it 90.4 percent to S. Arabia, 5 percent to Germany, 1.8 percent to UAE.

Germany having zero probability of retention of its own share likely to earns 19 percent from UAE, 17.6 percent from UK and 5 percent from Sri Lanka. It lost 99.7 percent of its share to Sri Lanka and. Compare to major importing countries at present, the countries pooled under others category retain 32.4 percent and it lost major share of 67 percent to UK and little amount to UAE.

**Conclusion**

From the above analysis the countries pooled under ‘others category’ and UK would be the more stable importers of the processed vegetables from India in future and country like Germany and Netherland was not found as the stable importer.

**References**
