Trend Analysis of Tea Import in Pakistan

By Irum Raza, Sobia Naheed, Muhammad Zubair Anwar & Muhammad Asif Masood

Abstract- Study was carried out to check past trends as well as future estimates of tea import in Pakistan. A time series data from 1984-85 to 2012-13 were collected from various secondary sources. Three models namely linear trend, quadratic trend and exponential growth curve were compared and the best fitting model was chosen on the basis of three accuracy measures (MAPE, MAD, MSD). Quadratic trend model was found suitable for estimating the quantity of tea import in '000' tones due to the lower values of the accuracy measures whereas for estimating the value of tea in million rupees the errors were minimized more by the exponential growth model and so it was chosen to be pertinent for predicting the future estimates of tea value. Forecasts were made from the year 2013-14 to 2022-23. The forecast values for the quantity of tea import show an increasing trend and the value of forecast in the year 2013-14 was 131.7 '000' tone, it implies that if present growth rate remains the same then the quantity of tea import will be 146.9 '000' tones in the year 2022-23.

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I. Introduction

Tea is commonly used as beverage at all levels in the society. The use of tea and its annual demand is increasing over the years lavishly. Presently, Pakistan is importing about 140-150 tones of tea amounting Rs. 22.329 million rupees (7). The import bill for tea during 2011-12 also increased by 4.8 percent on the back of higher import prices during the period (Pakistan Economic Survey 2011-12). The import of tea is mainly from Kenya, Indonesia, Srilanka and Bangladesh (16). The demand for tea is further multiplying due to ever increasing trend of population. If current tea import trends persist, Pakistan would overtake the United Kingdom as the leading tea importer (6).

Loads of work at national and international level has been done regarding tea imports and its trends in Pakistan. The import volumes and its trends can be explained by demand and supply factors through trade policy, linearization of trade and globalization. Studies show the effects of macroeconomic variables on imports at the aggregate level (18; 19; 2). The main factors affecting tea import are import, domestic consumption, population, economic growth and volume of import of tea (16). (20) suggested that for analysis of imports, theories of international trade, are very important. Consumer preferences and consumption patterns are also the key factors that drive the demand of tea. (21) estimated the export elasticities of tea. (9) conducted two sample surveys of consumer preferences and consumption patterns for determining the factors that drive demand of tea in China.

Forecasting techniques in agriculture include forecasting of production/yield, area of crops and forewarning of incidence of crop pests and diseases (15). Reliable and timely forecast provide important and useful input for proper, foresighted and informed planning in agriculture which is full of uncertainties. Forecast of crop production before harvest are required for various policy decisions relating to storage, distribution, pricing, marketing, import-export etc. (17).

Keeping in the view the importance of forecasting techniques in agriculture the present study is designed to determine the past trends as well as the future prospects of tea import in Pakistan using Trend analysis. The objective of study was to identify the best method for estimating tea import in Pakistan.

II. Materials and Method

The study was conducted using time series data of quantity of Tea import (000 tones), Value (Rs. million), tea consumption (000 tones) and population (million) in Pakistan from 1984-85 to 2012-13. Data were collected from various issues of Economic Survey of Pakistan. Data were analyzed in MINITAB software version 15.

III. Analytic Techniques

In this study Linear trend, quadratic trend and exponential smoothing models have been employed to forecast tea import and its consumption in Pakistan for the period 2013-14 to 2022-23.

1. Trend Analysis.

Trend analysis was used to fit a general trend model to data and provide forecast. Trend analysis includes linear trend, quadratic trend and growth trend models. The general forms of these models as given in the (12) are described below:

- Linear trend
\[ Y = \beta_0 + \beta_1 t + \epsilon_t \]

Where:
- \( Y \): Quantity of Tea in (000' tones)
- \( \beta_0 \): Constant
- \( \beta_1 \): Regression coefficient (measures the effect of independent variable on the dependent variable)
- \( t \): Trend which determines the tendency of time series data to increase or decrease over time
- \( \epsilon \): Error term

- Quadratic trend
  The quadratic trend model accounts for simple curvature in the data
  \[ t Y = \beta_0 + \beta_1 t + \beta_2 t^2 + \epsilon_t \]

- Exponential Growth model
  The exponential growth trend model accounts for exponential growth or decay
  \[ Y_t = \beta_0 \cdot \beta_1^t \cdot \epsilon_t \]

\section{Accuracy Measures}

Reliability of the forecasting methods was based on three accuracy measures also termed as forecasting errors. These measures include Mean Absolute Percentage error (MAPE), Mean Absolute Deviation (MAD) and Mean Squared Deviation (MSD).

Smaller values of all these measures indicate a better fitting model and a better model yields minimum forecasting error (11). The best model is therefore selected to forecast Tea import and its consumption in Pakistan for the year 2013-14 to 2022-23.

\section{Original Series}

The trends of quantity of tea import are depicted in (figure 1). In 1984-85 the quantity of tea was 84.25 '000' tones and it showed increasing trend until 1996-96 then a sudden decline in the quantity of tea import was observed in 1996 to 1998. An improvement in tea import was found in the 1998 to 1998 and it continued to improve till the year 2001. There was again decrease in tea import in the 2002. The quantity of tea raised from the year 2002 to 2013. In the same way some fluctuations were found for the variables value, consumption and population and they showed increasing trend until the year 2013.

\section{Selection of the model}

The values of the accuracy measures for the selection of best forecasting method for value of tea import in Pakistan are summarized in Table 1. The values for value of tea import, MAPE for quadratic trend model (12.06) was lowest as compared to the values of MAPE for linear (12.49), and exponential (13.194) respectively. Similarly the values of MAD and MSD for exponential growth model (1.96, 6.30) was smallest as compared to the values of MAD and MSD for linear (2.69, 9.52) and quadratic (2.13, 6.60) respectively. These values recommended that exponential growth model give better fit to data and is appropriate for predicting upcoming value of population in Pakistan.
Table 1: Diagnostic Measures for the selection of best forecasting method for Tea Import, value, consumption and population in Pakistan.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAPE</td>
</tr>
<tr>
<td>Linear Trend Model</td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>13.137</td>
</tr>
<tr>
<td>Value</td>
<td>12.49</td>
</tr>
<tr>
<td>Consumption</td>
<td>139.1</td>
</tr>
<tr>
<td>Population</td>
<td>1.86</td>
</tr>
<tr>
<td>Quadratic Trend Model</td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>14.69</td>
</tr>
<tr>
<td>Value</td>
<td>12.06</td>
</tr>
<tr>
<td>Consumption</td>
<td>136.1</td>
</tr>
<tr>
<td>Population</td>
<td>1.56</td>
</tr>
<tr>
<td>Exponential Growth Model</td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>12.11</td>
</tr>
<tr>
<td>Value</td>
<td>13.19</td>
</tr>
<tr>
<td>Consumption</td>
<td>68</td>
</tr>
<tr>
<td>Population</td>
<td>1.47</td>
</tr>
</tbody>
</table>

d) Forecasting Tea value of import (million Rs) using quadratic trend model

The forecasted values of tea import for ten years are presented in Table 3. The estimated import of tea in the year 2013-14 was 131.73 '000' tones. It shows that if the present growth remains the same then the import of tea will be 146.96 '000' tones in the year 2022-23. It is obvious from the analysis that the import of tea quantity will increase in the coming years Quadratic trend model (figure 5) shows that quantity of tea import is climbing till the forecast values.

e) Forecasting Tea Quantity, Consumption and Population using exponential growth model

The estimated values for the value (Rs. million) of tea import are summarized in Table 2. In 2012-13 the value of tea was 28989.0 million rupees it implies that if the present growth rate remains the same then the value of tea will be 44089.3 million rupees in the year 2022-23. An upward or increasing trend is visible from the figure which makes it even more certain that in the coming years value of tea will increase. Likewise, the forecasting value for consumption('000' tones) and population(million) will be 237.84 & 186.62 in 2012-13 and consumption('000' tones) and population(million) will be 290.36 & 227.87 in 2022-23 respectively.
### Table 2: Forecast values of Tea value of import (million Rs), Tea Quantity('000' tones), Consumption('000' tones) and Population(million)

<table>
<thead>
<tr>
<th>Years</th>
<th>Quantity('000' tones)</th>
<th>Value (million Rs)</th>
<th>Consumption('000' tones)</th>
<th>Population (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>131.73</td>
<td>28989.0</td>
<td>237.84</td>
<td>186.62</td>
</tr>
<tr>
<td>2014-15</td>
<td>133.34</td>
<td>30526.7</td>
<td>243.17</td>
<td>190.80</td>
</tr>
<tr>
<td>2015-16</td>
<td>134.97</td>
<td>32099.4</td>
<td>248.62</td>
<td>195.09</td>
</tr>
<tr>
<td>2016-17</td>
<td>136.62</td>
<td>33707.1</td>
<td>254.19</td>
<td>199.46</td>
</tr>
<tr>
<td>2017-18</td>
<td>138.29</td>
<td>35349.9</td>
<td>259.89</td>
<td>203.94</td>
</tr>
<tr>
<td>2018-19</td>
<td>139.98</td>
<td>37027.7</td>
<td>265.72</td>
<td>208.52</td>
</tr>
<tr>
<td>2019-20</td>
<td>141.70</td>
<td>38740.5</td>
<td>271.67</td>
<td>213.19</td>
</tr>
<tr>
<td>2020-21</td>
<td>143.43</td>
<td>40488.4</td>
<td>277.76</td>
<td>217.98</td>
</tr>
<tr>
<td>2021-22</td>
<td>145.18</td>
<td>42271.4</td>
<td>283.99</td>
<td>222.87</td>
</tr>
<tr>
<td>2022-23</td>
<td>146.96</td>
<td>44089.3</td>
<td>290.36</td>
<td>227.87</td>
</tr>
</tbody>
</table>

### IV. Conclusion

The study results showed that quadratic trend model was the best for forecasting value of tea import in Pakistan due to the smaller values of the accuracy measures and exponential growth model was found suitable for estimating quantity of tea import, consumption and population in Pakistan because errors were minimized by this model. Tea is enjoyed as a beverage at all levels in the country. Unfortunately the import of tea over the years is decreasing at an alarming rate and its price is rising. To get the better of this problem the government should take wiser steps to promote tea production in Pakistan as demand of tea is constantly increasing. Proper use of agricultural inputs can definitely play an active role in supporting tea production in the country.

### References


Figure 1: Time series plot showing quantity of tea import in Pakistan during 1984-85 to 2012-2013

Figure 2: Time series plot showing import Value of tea in million rupees in Pakistan
Figure 3: Time series plot of quantity and consumption of tea

Figure 4: Time series plot of Population, quantity and consumption of tea