Reconnoitering the Impact of Economic Variables on Fruit Pulp Export from Tamil Nadu

M. Amthul Thawab, S. Thowseaf, M. Ayisha Millath, K. Malik Ali

Abstract: The objective of the was to determine the impact of the Price of the commodity, Purchasing Power Parity of the host country, Population of the importing country and Distance between the trading countries with respect to the quantity of fruit pulp export from Tamil Nadu. The researchers adopted analytical research data, wherein during the time frame of 2017 was used. The analysis conducted on data indicates that there is a long run relationship between the Price, Purchasing Power Parity, Population and Distance with respect to the quantity of fruit pulp export. Furthermore, the VECM (Vector Error Correction Model) indicates error estimates can be estimated effectively for the model framed using study variables considered.

Keywords: Export, Economic contribution, Fruit Pulp – Tamil Nadu, Fruit Pulp – Tamil Nadu Export.

I. INTRODUCTION

According to a report from the Government of India about 56% of the population in Tamil Nadu are engaged in agricultural product production either directly or indirectly. 13% of the N.D.P. (Net Domestic Product) of the state depends on agriculture. It is estimated that there exist nearly 82 lakh land holdings for agriculture. Among 82 lakh landholding, 91% of the landholding belongs to marginal and small farmers (Agriculture Department, 2012). Unlike many other states in India, Tamil Nadu is the only state having surplus produce available for export in specific commodities. And, those commodities were products of agriculture; they are banana, eggs, Chicken meat, maize, and tapioca. Total production of banana from Tamil Nadu was calculated to be 5650 thousand tons during the year 2014; it was found that only 0.2% are exported, still, Tamil Nadu holds 1st place in the export production of banana. Similarly, the total egg production form Tamil Nadu was calculated to be approximately 12,43,70,00,000 numbers per year. It is not only in the production of chicken eggs but also chicken meats are produced in surplus in Tamil Nadu for consumption and production to be exported. It was estimated that around 328188 thousand tons of chicken meat were produced during the year 2014. Likewise, the production of maize and tapioca was 1829.9 and 4975.56 thousand tons respectively during 2014 (Indiastat, 2014).

On one side, Tamil Nadu has the potential to produce a surplus of agricultural products and on the other side, it has great potential for the production of many other types of fruits and vegetables for the purpose of export. Tamil Nadu holds an indispensable position in exporting various fruit commodities such as banana, grapes, papaya, pomegranate, mango, and guava. Another end, Tamil Nadu possesses the best infrastructure to produce, process, store and export its production. Tamil Nadu has 57 warehouses (9-Chennai, 2-Coimbatore, 8-Cuddalore, 9-Mudarai, 7-Salem, 9-Tirunelveli, and 10-Trichy), 136 cold storage units and 67 ICD (Inland Container Depots) and CFS (Container Freight Stations) to handle fruits and the processed products. This kind of infrastructural support, especially for fruit commodities, is nowhere available in India other than Tamil Nadu. Despite, Tamil Nadu being positioned as one among the top 5 states in India regarding export, it hasn't fully realized its true hidden potential concerning the production and export of fruit commodities. Hence the study focuses on finding the problems faced by the exporters of fruits and its products of Tamil Nadu to provide valuable suggestions and find the prospectus of fruit commodities concerning various markets around the world. The most noteworthy aspect of Tamil Nadu with regard to fruit production is that 69% of different varieties of fruits exported from India are contributed by Tamil Nadu i.e. Tamil Nadu produces nearly 20 different varieties of fruits out of 29 varieties that are exported from India. Tamil Nadu not only produces 20 different varieties of fruits, but it also holds a significant position in producing them in large quantities. The details are given in Table I.

Table I - Rank of Tamil Nadu among Indian States in Fruits Production for Export

<table>
<thead>
<tr>
<th>Major Fruits Exported</th>
<th>Rank of Tamil Nadu Among Indian States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td>-</td>
</tr>
<tr>
<td>Amla/ Gooseberry</td>
<td>3</td>
</tr>
<tr>
<td>Apple</td>
<td>6</td>
</tr>
<tr>
<td>Bael</td>
<td>-</td>
</tr>
<tr>
<td>Banana</td>
<td>2</td>
</tr>
<tr>
<td>Ber</td>
<td>-</td>
</tr>
<tr>
<td>Custard Apple</td>
<td>-</td>
</tr>
<tr>
<td>Grapes</td>
<td>3</td>
</tr>
</tbody>
</table>

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II. FRUIT PULP PRODUCTION AND EXPORT POTENTIAL OF TAMIL NADU

The pulp is extracted by crushing membranes of the fruits in large quantities. The pulp is preserved by the freezing process but for long-time preservation, they are treated either by sorbic acid or formic acid. The pulp is used in the production of jelly, marmalades, sweets, jams, drinks, filler for baked goods, baby food products, and even cosmetics. The major factor for the increasing demand for fruit pulp globally is because of their longer shelf life than raw fruits. Moreover, the fruit pulp retains the taste, texture, flavor, and color without compensating the nutrients. This is a major factor fueling the revenue growth of fruit pulp globally. It was forecasted by the NPC’s research agency that fruit pulp would have 5.8% CAGR (Compounded Annual Growth Rate) during 2017–2025. The fruit pulp exported from India includes mango, pomegranate, apple, guava, strawberry, berries, citrus, grape, pear, pineapple, custard apple, kiwi, passion fruits and other drupes fruits. Fruit pulp was segmented into liquid and power based on the form. On the basis of the application, it was segmented into food and beverages.

India is one of the largest exporters of fruit pulp commodities; it was estimated by APEDA that during the year 2017–18 approximately 130738.32 MT of mango pulp were exported to other countries for the price of 755.95 crore Rs. Out of which Tamil Nadu had contributed 75258.58 MT of Mango pulp worth 390.27 crores Rs., which is more than half of the total contribution of other Indian States. The Tamil Nadu holds a significant position in exporting other fruit pulp commodities, it was estimated that approximately 35% in terms of quantity was contributed by Tamil Nadu. Along with the fruit commodities listed in APEDA such as fresh grapes, mango, fruits seeds, mango pulp, other fresh fruits, and processed fruits, it is mango pulp and processed fruit (including pulp of fruits other than mango) holding top 1st and 2nd position among highly exported commodities in terms of price and quantity. Tamil Nadu’s contribution to pulp export is increasing exponentially. During 2005-06 the contribution of Tamil Nadu for fruit pulp was estimated to be 1.97% while during 2017-18 it was estimated to be 42.58%, which is expected to increase further in the future. The majority of the pulp exporters are concentrated in Tamil Nadu and Maharashtra. It is important to mention that among the top 5 pulp exporters 2 are from Tamil Nadu and furthermore the Indian top fruit pulp exporter Capricorn and ABC fruits are present in Tamil Nadu. Hereby, among many fruit commodities, it would be apt to study fruit pulp rather than any other commodities considering its feasibility. It would be apt if the study was conducted in Tamil Nadu rather than in any other state in India with regard to fruit pulp. Hence in-order to narrow down the topic the researcher considered and choose fruit pulp among fruit products line and Tamil Nadu as the study area.

III. REVIEW OF LITERATURES

(Sachdeva, Sachdev, & Sachdeva, 2015) – Titled: ‘Increasing Fruit and Vegetable Consumption: Challenges and Opportunities’. The objective of the study was to identify whether the fruits and vegetable consumption decreases the mortality rate and to identify the challenges and opportunists associated with it in the Indian scenario. The study is conceptual. According to author Non-communicable diseases (NCD), including cardiovascular diseases (CVDs), diabetes, cancers, and chronic respiratory diseases, accounted for at least 50% of all deaths worldwide in 2005 and projected to increase to more than 60% by 2015 with major brunt being borne by low and developing countries. Through the evidential report, the author illustrated that the usage of fruits and vegetables in the less processed form is reducing the mortality rate and increasing the health of the patient’s substantially.

(Kapur, 1991) – Titled: ‘The Structure and Competitiveness of India’s Export’. This paper examined the extent of loss of India’s export competitiveness in the international market using the market-share model. The author decomposed the model into two components namely structural effect and competitive effect. The study was analytical in nature, wherein secondary data was used, which is collected from official reports. The study illustrated that nontraditional commodities such as machinery, service goods, and miscellaneous goods improved their market share significantly using competitiveness. While the traditional commodities other than agriculture commodities are significantly losing their market share and traditional agricultural commodities market share seems to remain constant.

(Marjit & Ray, 2017) – Titled: ‘Export profitability, competition, and technology’. The study investigated the influence of competition and technology on the export profitability of the firm. Hence the study variables are confined only to the level of competition, technology and profit yield of the firm.
considered for the study. The study was empirical in nature. Secondary data of price-cost margin were used for this purpose, the data was taken post-reforms in India. The result after empirical investigation demonstrated that advancement in technology will lead to competition. Also, it was proved that advancement in technology will lead to the promotion of export.

(Barua, Chakrabory, & CG, 2012) – Titled: ‘Entry, Competitiveness, and Exports: Evidence from the Indian Firm Data’. In this study, the author attempted to evaluate the effect of industrial de-licensing post-reforms and its impact on domestic competitiveness and export performance. The study was empirical for which the author utilized the oligopoly model framework. The sales of the firm from 14 sectors were considered from the year 1990-2008. From the result, it is observed that the amount of firms’ entry in each industrial sector and its competitiveness had increased significantly after liberalization. The drastic decline in the elasticity of the demand was also noted using regression analysis made. Moreover, the theoretical model performs intact with the empirical model, hence the author suggested the oligopoly model from the point of equilibrium of elasticity of demand as a prefatory condition.

(Marutani & Brown, 2014) – Titled: ‘A Small-Scale Integrated Farm System in a Tropical Insular Environment of Guam: A Case Study. In Sustainable Horticultural Systems’. The study was descriptive and conceptual. Herein the author discussed the competitiveness of India with respect to various horticulture products. The author also made a descriptive comparative study of a conventional and traditional horticulture production system. The study elucidated that India possesses major competitiveness in the production of fruit commodities among all horticulture products.

IV. OBJECTIVES

- To develop a model that integrates Quantity, Price, Purchasing Power Parity, Population and Distance with respect to fruit pulp export.
- To identify whether there exist long-run and short-run causality between the variable considered.

V. THE HYPOTHESIS OF THE STUDY

\( H_0: \) There is no significant impact of Purchasing power, price of the commodity, population of the importer country and distance between importer and exporter country on Quantity of fruit pulp exported.

![Figure: 1 – Hypothesis of the Study](Image)

The above conceptual diagram is based on the assumption that export Quantity is significantly influenced by factors such as, the price of the commodity which is exported, the population of the importing country, Purchasing Power Parity (P.P.P.) of the importing country and distance between importing and exporting country.

It is the perseverance of the exporter who prefers selling to the country where the importers buy the commodity in a larger quantity than to county where the importer buys less, therefore the quantity of export is considered a significant factor. In the case of the production capacity of the company being less, the company would focus on the countries where the particular commodity is bought at a higher price than any other country to attain more profit. Hence the price is considered another factor. The population of the country determines the level of demand; more population more the demand would be. So, it is assumed that a more populous country would buy a more quantity of goods than a less populous country; therefore the population is considered a factor. P.P.P. (Purchasing Power Parity) has a direct connection with foreign exchange and purchasing power of the importing country, which also plays a significant role in determining the price of the commodity, so P.P.P. is considered a vital factor. More distance takes more time for delivery. Agriculture commodity especially fruits being perishable products, it is very important to deliver them on time so that the quality is not lowered. So an exporter prefers selling more to nearby countries to provide a quality product, service and reduce complexity. Hence distance is also considered as a factor.

VI. VECTOR ERROR CORRECTION MODEL

A. Unit – Root Test

The regression model cannot be applied to the variables whose values are not stationary. Hence, the unit root test is applied to check whether the dataset of each variable considered for the study is stationary.

Null Hypothesis: The variables got unit root or the variables are not stationary printing.
Table II - Unit Root Test – Quantity, Price, Purchasing Power Parity, Population, and Distance

<table>
<thead>
<tr>
<th></th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-12.23201</td>
<td>0.000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.473967</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.880591</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577008</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-12.03848</td>
<td>0.000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.473967</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.880591</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577008</td>
<td></td>
</tr>
<tr>
<td>PPP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-11.24805</td>
<td>0.000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.474874</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.880987</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577219</td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-12.10014</td>
<td>0.000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.474874</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.880987</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577219</td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-12.34128</td>
<td>0.000</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.473967</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.880591</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.577008</td>
<td></td>
</tr>
</tbody>
</table>

Source: (Secondary data)

The observed probability value for considered variables i.e. Quantity, Price, Purchasing Power Parity, Population, and Distance was found to be 0.000 at the level. Hence the Null Hypothesis was rejected, thereby the data set of the considered variables are stationary. Hereby the researcher can proceed next step for VECM i.e. Johansen Cointegration test.

B. Johansen Cointegration Test

The Johansen cointegration test is conducted to identify whether the variables i.e. Quantity, Price, Purchasing Power Parity, Population, and Distance cointegrated to one another and have long-run relationships.

Table III - Johansen Cointegration Test - Quantity, Price, Purchasing Power Parity, Population, and Distance.

Unrestricted Cointegration Rank Test (Trace)

<table>
<thead>
<tr>
<th>Hypothesized</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of CE(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None *</td>
<td>0.320</td>
<td>179.003</td>
<td>69.819</td>
<td>0.000</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.282</td>
<td>124.962</td>
<td>47.856</td>
<td>0.000</td>
</tr>
<tr>
<td>At most 2 *</td>
<td>0.215</td>
<td>78.486</td>
<td>29.797</td>
<td>0.000</td>
</tr>
<tr>
<td>At most 3 *</td>
<td>0.179</td>
<td>44.509</td>
<td>15.495</td>
<td>0.000</td>
</tr>
<tr>
<td>At most 4 *</td>
<td>0.114</td>
<td>16.894</td>
<td>3.841</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

<table>
<thead>
<tr>
<th>Hypothesized</th>
<th>Max-Eigen</th>
<th>Trace Statistic</th>
<th>Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of CE(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None *</td>
<td>0.320</td>
<td>54.041</td>
<td>33.877</td>
<td>0.000</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.282</td>
<td>46.476</td>
<td>27.584</td>
<td>0.000</td>
</tr>
<tr>
<td>At most 2 *</td>
<td>0.215</td>
<td>33.977</td>
<td>21.132</td>
<td>0.001</td>
</tr>
</tbody>
</table>
From the Trace Statistics and Maximum Eigenvalue probability value, which was estimated to be 0.000 < 0.05. It can be interpreted that the considered variables i.e. Quantity, Price, Purchasing Power Parity, Population, and Distance are cointegrated and has long term relationship, whose equation is:

\[
\text{Quantity} = (-0.010) (-0.008) (\text{PPP}) + (-3.78 \times 10^6) (-1.4 \times 10^5) (\text{Population}) + (0.186) (-0.043) (\text{Distance}) + (-168.478) (-6.435) (\text{Price})
\]


<table>
<thead>
<tr>
<th>Quantity (QTY)</th>
<th>PPP</th>
<th>Population (POPULATION)</th>
<th>Distance (DISTANCE)</th>
<th>Price (PRICE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At most 3 *</td>
<td>0.179</td>
<td>27.615</td>
<td>14.265</td>
<td>0.000</td>
</tr>
<tr>
<td>At most 4 *</td>
<td>0.114</td>
<td>16.894</td>
<td>3.841</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Normalized cointegrating coefficients (standard error in parentheses)

Adjustment coefficients (standard error in parentheses)

1 Cointegrating Equation(s):

<table>
<thead>
<tr>
<th>Quantity (QTY)</th>
<th>PPP</th>
<th>Population (POPULATION)</th>
<th>Distance (DISTANCE)</th>
<th>Price (PRICE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Cointegrating Equation(s):</td>
<td>Log likelihood</td>
<td>-7503.484</td>
<td>-168.478</td>
<td></td>
</tr>
<tr>
<td>2 Cointegrating Equation(s):</td>
<td>Log likelihood</td>
<td>-7480.246</td>
<td>-6.435</td>
<td></td>
</tr>
<tr>
<td>3 Cointegrating Equation(s):</td>
<td>Log likelihood</td>
<td>-7463.257</td>
<td>-1.4E-06</td>
<td></td>
</tr>
<tr>
<td>4 Cointegrating Equation(s):</td>
<td>Log likelihood</td>
<td>-7449.450</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Source: (Secondary data)

C. VECM Estimates

Applying VECM onto the dataset of considered variables to find its VECM equations also to find whether there are long-run causality and short-run causality between variables

Table: IV - VECM Estimates – Equation, Coefficients Estimates, and Wald Statistics

Through the Johansen cointegration table value, it was also found there is high-level cointegration between the dataset of quantity, price, purchasing power parity and distance forming 4 cointegrated equation. Hereby, the dataset satisfying the second condition, the researcher is applying VECM.
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\[
D(\text{POPULATION}) = C(31)(\text{QTY}(\cdot) - 157.126073583\cdot\text{PRICE}(\cdot) - 87.8975850359) + C(32)(\text{PPP}(\cdot) - 971.069016036\cdot\text{PRICE}(\cdot) - 13354.8761539) + C(33)(\text{POPULATION}(\cdot) + 6515371.97244\cdot\text{PRICE}(\cdot) - 95143781.1412) + C(34)(\text{DISTANCE}(\cdot) + 379.310942823\cdot\text{PRICE}(\cdot) - 10503.1094138) + C(35)(\text{DISTANCE}(\cdot)) + C(36)(\text{QTY}(\cdot)) + C(37)(\text{QTY}(\cdot)) + C(38)(\text{PPP}(\cdot)) + C(39)(\text{PPP}(\cdot)) + C(40)(\text{POPULATION}(\cdot)) + C(41)(\text{QTY}(\cdot)) + C(42)(\text{QTY}(\cdot)) + C(43)(\text{QTY}(\cdot)) + C(44)(\text{QTY}(\cdot)) + C(45)
\]

\[
D(\text{DISTANCE}) = C(46)(\text{QTY}(\cdot) - 157.126073583\cdot\text{PRICE}(\cdot) - 87.8975850359) + C(47)(\text{PPP}(\cdot) - 971.069016036\cdot\text{PRICE}(\cdot) - 13354.8761539) + C(48)(\text{POPULATION}(\cdot) + 6515371.97244\cdot\text{PRICE}(\cdot) - 95143781.1412) + C(49)(\text{POPULATION}(\cdot) + 6515371.97244\cdot\text{PRICE}(\cdot) - 95143781.1412) + C(50)(\text{DISTANCE}(\cdot) + 379.310942823\cdot\text{PRICE}(\cdot) - 10503.1094138) + C(51)(\text{DISTANCE}(\cdot)) + C(52)(\text{POPULATION}(\cdot)) + C(53)(\text{POPULATION}(\cdot)) + C(54)(\text{POPULATION}(\cdot)) + C(55)(\text{POPULATION}(\cdot)) + C(56)(\text{POPULATION}(\cdot)) + C(57)(\text{POPULATION}(\cdot)) + C(58)(\text{POPULATION}(\cdot)) + C(59)(\text{POPULATION}(\cdot)) + C(60)
\]

\[
D(\text{PRICE}) = C(61)(\text{QTY}(\cdot) - 157.126073583\cdot\text{PRICE}(\cdot) - 87.8975850359) + C(62)(\text{PPP}(\cdot) - 971.069016036\cdot\text{PRICE}(\cdot) - 13354.8761539) + C(63)(\text{POPULATION}(\cdot) + 6515371.97244\cdot\text{PRICE}(\cdot) - 95143781.1412) + C(64)(\text{POPULATION}(\cdot) + 6515371.97244\cdot\text{PRICE}(\cdot) - 95143781.1412) + C(65)(\text{DISTANCE}(\cdot) + 379.310942823\cdot\text{PRICE}(\cdot) - 10503.1094138) + C(66)(\text{DISTANCE}(\cdot)) + C(67)(\text{DISTANCE}(\cdot)) + C(68)(\text{PPP}(\cdot)) + C(69)(\text{POPULATION}(\cdot)) + C(70)(\text{POPULATION}(\cdot)) + C(71)(\text{POPULATION}(\cdot)) + C(72)(\text{POPULATION}(\cdot)) + C(73)(\text{POPULATION}(\cdot)) + C(74)(\text{POPULATION}(\cdot)) + C(75)
\]

**Coefficient estimates - Long Run causality**

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>-1.151</td>
<td>0.296</td>
<td>-3.894</td>
</tr>
<tr>
<td>C(2)</td>
<td>63.096</td>
<td>34.517</td>
<td>1.828</td>
</tr>
<tr>
<td>C(3)</td>
<td>-0.079</td>
<td>0.108</td>
<td>-0.737</td>
</tr>
<tr>
<td>C(4)</td>
<td>0</td>
<td>0</td>
<td>-0.879</td>
</tr>
<tr>
<td>C(5)</td>
<td>0.471</td>
<td>0.242</td>
<td>1.944</td>
</tr>
<tr>
<td>C(6)</td>
<td>0.185</td>
<td>0.172</td>
<td>1.074</td>
</tr>
<tr>
<td>C(7)</td>
<td>-64.115</td>
<td>31.938</td>
<td>-2.007</td>
</tr>
<tr>
<td>C(8)</td>
<td>-11.864</td>
<td>23.833</td>
<td>-0.498</td>
</tr>
<tr>
<td>C(9)</td>
<td>0.041</td>
<td>0.091</td>
<td>0.447</td>
</tr>
<tr>
<td>C(10)</td>
<td>-0.029</td>
<td>0.068</td>
<td>-0.433</td>
</tr>
<tr>
<td>C(11)</td>
<td>0</td>
<td>0</td>
<td>0.561</td>
</tr>
<tr>
<td>C(12)</td>
<td>0</td>
<td>0</td>
<td>0.294</td>
</tr>
<tr>
<td>C(13)</td>
<td>-0.391</td>
<td>0.371</td>
<td>-1.052</td>
</tr>
<tr>
<td>C(14)</td>
<td>0.127</td>
<td>0.292</td>
<td>0.436</td>
</tr>
<tr>
<td>C(15)</td>
<td>-74.22</td>
<td>1281.502</td>
<td>-0.058</td>
</tr>
</tbody>
</table>

**Wald Statistics – Short run causality**

**Price**

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>2.765</td>
<td>(2, 177)</td>
<td>0.066</td>
</tr>
<tr>
<td>Chi-square</td>
<td>5.53</td>
<td>2</td>
<td>0.063</td>
</tr>
</tbody>
</table>

Null Hypothesis: C(2)=C(7)=C(8)

Null Hypothesis Summary:

Normalized Restriction (= 0)

| C(2) - C(8) | 74.96 |
| C(7) - C(8) | 52.251 |

**PPP**

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.532</td>
<td>(2, 177)</td>
<td>0.588</td>
</tr>
<tr>
<td>Chi-square</td>
<td>1.064</td>
<td>2</td>
<td>0.587</td>
</tr>
</tbody>
</table>

Null Hypothesis: C(3)=C(9)=C(10)
Null Hypothesis Summary:

<table>
<thead>
<tr>
<th>Normalized Restriction (= 0)</th>
<th>Value</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(3) - C(10)</td>
<td>-0.05</td>
<td>0.158</td>
</tr>
<tr>
<td>C(9) - C(10)</td>
<td>0.07</td>
<td>0.068</td>
</tr>
</tbody>
</table>

Population

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.299</td>
<td>(2, 177)</td>
<td>0.742</td>
</tr>
<tr>
<td>Chi-square</td>
<td>0.598</td>
<td>2</td>
<td>0.742</td>
</tr>
</tbody>
</table>

Null Hypothesis: C(4)=C(11)=C(12)

Null Hypothesis Summary:

<table>
<thead>
<tr>
<th>Normalized Restriction (= 0)</th>
<th>Value</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(4) - C(12)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C(11) - C(12)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Distance

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-statistic</td>
<td>-1.74</td>
<td>177</td>
<td>0.082</td>
</tr>
<tr>
<td>F-statistic</td>
<td>3.058</td>
<td>(1, 177)</td>
<td>0.082</td>
</tr>
<tr>
<td>Chi-square</td>
<td>3.058</td>
<td>1</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Null Hypothesis Summary:

Null Hypothesis: C(13)=C(14)

Null Hypothesis Summary:

<table>
<thead>
<tr>
<th>Normalized Restriction (= 0)</th>
<th>Value</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(13) - C(14)</td>
<td>-0.518</td>
<td>0.296</td>
</tr>
</tbody>
</table>

Source: (Secondary data)

The researcher is considering 1st equation i.e. quantity as dependent variable and price, purchasing power parity, population and quantity as independent variables as the target model. The coefficient value for the target model found to be negative and its corresponding probability value was 0.000, which is less than 0.050. Hence, it can be concluded that there is a long-run causality between the considered variables. While from the Wald statistics corresponding Chi-Square Value it can be interpreted that there is no short-run causality between the considered variables.

D. VECM – Fitness Test

In order to prove the fitness of the VECM, it had to satisfy the following three conditions, i.e. there should be [1] no heteroscedasticity in the model dataset [2] no Serial Correlation in model dataset and [3] Data should be normally distributed. Hereby the following are the Null Hypothesis.

1. H0: There is no heteroscedasticity in the model [Prob. Chi-Square > 0.05]
2. H0: There is no Serial Correlation in the model [Prob. Chi-Square > 0.05]
3. H0: The model dataset is not normally distributed [Prob. Chi-Square > 0.05]

Table: V – VECM – Fitness Test

<table>
<thead>
<tr>
<th></th>
<th>F-statistic</th>
<th>Obs*R-squared</th>
<th>Scaled explained SS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.294</td>
<td>4.690</td>
<td>68.20</td>
</tr>
</tbody>
</table>

Source: (Secondary data)

The estimated Chi-Square value analogous to observed R-Square value was estimated to be greater than 0.05 for Heteroscedasticity test, hence the Null Hypothesis is accepted. Therefore there is no Heteroscedasticity, which is desirable for the model.

The estimated Chi-Square value analogous to observed R-Square value was estimated to be greater than 0.05 for serial correlation test, hence the Null Hypothesis is accepted. Therefore there is no serial correlation, which is desirable for the model.

The estimated probability value for the calculated Jarque-Bera Statistics was estimated to be greater than 0.05 for normality test, hence the Null Hypothesis is accepted.
Therefore model dataset is normally distributed, which is desirable for the model.

VII. RESULT AND DISCUSSION

The analysis indicates that there is a significant long-run relationship between the quantity of export, the price at which the product exported, purchasing power parity of the host country and distance between the nations with respect to fruit pulp export from Tamil Nadu. Hereby, it recommended considering the quantity, price, purchasing power parity and distance as an important variable while exporting fruit pulp from Tamil Nadu. Furthermore, the analysis indicates that the price is directly proportional to the quantity of export i.e. increase in quantity results in an increase in price. Similarly, the purchasing power of the country determines the price they are ready to offer per quantity i.e. a country with more purchasing power will be ready to pay a higher price for the same commodity. Furthermore, the distance is between the country increases the trade probability decreases. As the fruits and its pulp are degradable, trading with countries that are at a very long distance will detonate the quality of the product, hereby the exporter mostly isn’t preferring distant countries for exporting fruit pulp.

VIII. CONCLUSION

To identify the long run relationship for the considered model, following equation derived through Johansen cointegration can be employed, whose equation is:

\[ \text{Quantity} = (-0.010)(-0.008)(\text{PPP}) + (-3.78 \times 10^{-6})(-1.4 \times 10^{-6})(\text{Population}) + (0.186)(-0.043)(\text{Distance}) + (-168.478)(-6.435)(\text{Price}) \]

Since the overall all conditions of VECM is satisfied, the error estimates using VECM for the following considered variables would be helpful in knowing the error term in prospects more accurately for the fruit pulp export quantity having purchasing power parity, population and price as independent variables. The equation for estimating error term is:

\[ \text{D(QTY)} = C(1)^{*}(\text{QTY}(-1)) - 157.126073583^*\text{PRICE}(-1) - 87.8975850359\ ) + C(2)^{*}(\text{PPP}(-1) - 971.069016036^*\text{PRICE}(-1) - 13354.8761539 ) + C(3)^{*}(\text{POPULATION}(-1) + 6515371.97244^*\text{PRICE}(-1) - 95143781.1412 ) + C(4)^{*}(\text{DISTANCE}(-1) + 379.310942823^*\text{PRICE}(-1) - 10503.1094138 ) + C(5)^{*}\text{D(QTY}(-1)) + C(6)^{*}\text{D(QTY}(-2)) + C(7)^{*}\text{D(PPP}(-1)) + C(8)^{*}\text{D(POPULATION}(-1)) + C(9)^{*}\text{D(PPP}(-2)) + C(10)^{*}\text{D(POPULATION}(-2)) + C(11)^{*}\text{D(DISTANCE}(-1)) + C(12)^{*}\text{D(DISTANCE}(-2)) + C(13)^{*}\text{D(PRICE}(-1)) + C(14)^{*}\text{D(PRICE}(-2)) + C(15) \]

REFERENCES


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