Trade dynamics and export supply function of Indian groundnut

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(Received: May 13, 2020; Revised: July 29, 2020; Accepted: July 31, 2020)

ABSTRACT

India is the leading groundnut exporter to world market. Direction of trade has changed over the period. Sphere of groundnut export has narrowed down from European nations during 1995-96 to Asian markets during 2014-15, with lost shares in UK, Netherland, Egypt, USA and Russia to Vietnam, Thailand, Pakistan, China, Ukraine and UAE. Indonesia was identified as highest loyal market followed by Malaysia. To identify the factors influencing groundnut export, Cointegration and Vector Error Correction Model were used. Export was found to increase significantly with export price and exchange rate and decrease significantly with increase in domestic price and increase in population. Speed of adjustment indicates the adjustment to the long-run equilibrium from short run shocks. Result highlights to target European market, the largest importer of groundnut in world.

Keywords: Cointegration, Direction of trade, Groundnut export, Markov chain analysis, Vector Error Correction Model

India exports groundnut in different forms namely, shelled, in-shell and prepared groundnut but more than 90 per cent of total is exported in shelled or kernel form (http://agriexchange.apeda.gov.in). During 2017-18, India ranked second in groundnut export to world market with 5.22 lakh tonnes export (20.58%) next only to Argentina (5.66 lakh tonnes; 22.33%) followed by USA (4.41 lakh tonnes; 17.39%) and China (3.12 lakh tonnes; 12.31%). On the other hand, Netherlands, Indonesia, Germany, Mexico and Russia are the leading importers with 3.45, 2.87, 1.27, 1.65 and 1.32 lakh tonnes groundnut imports, respectively (APEDA, 2019). India exports groundnut to more than hundred countries in one or other years. But sphere of her export has narrowed down from European to Asian markets consequently direction has changed over the period. The export of an agricultural commodity depends on available surplus of that commodity along with other price and non-price factors. High and increasing domestic demand due to large and rising population and increasing income adversely affects India's agricultural exports (Ansari and Khan, 2015; Murlidhar Meena et al., 2018). Understanding how area, production, domestic prices, international prices, exchange rates along with other socio-economic factors like GDP, personal disposable income, exchange rate and human population was collected from Reserve Bank of India website (http://dbie.rbi.org.in). The information on area, production and productivity was collected from Directorate of Economics & Statistics, DAC&FW website (http://eands.dacnet.nic.in). The information on Macro-Economic aggregates like GDP, personal disposable income, exchange rate and human population was collected from Reserve Bank of India website (http://dbie.rbi.org.in). The domestic and international price for groundnut was also taken from APEDA website and other published sources.

MATERIALS AND METHODS

Data: Data on groundnut export from India (in quantity term) country-wise, Harmonized System code wise and the total, were collected from 1996-97 to 2014-15 from Directorate General of Commercial Intelligence and Statistics (DGCI&S, Kolkata), available at APEDA website (http://agriexchange.apeda.gov.in). The information on area, production and productivity was collected from Directorate of Economics & Statistics, DAC&FW website (http://eands.dacnet.nic.in). The information on Macro-Economic aggregates like GDP, personal disposable income, exchange rate and human population was collected from Reserve Bank of India website (http://dbie.rbi.org.in). The domestic and international price for groundnut was also taken from APEDA website and other published sources.

Analytical framework: To study change in direction of trade Markov Chain Analysis was employed and to study export supply function OLS regression followed by time series analysis was used to take care of spurious results obtained in OLS regression. For comparison whole study period was equally divided in two sub-period, period 1 (1996-97 to 2004-05) and period 2 (2005-06 to 2014-15).

Markov chain analysis: Major destinations were identified based on the average quantity exported to each country in respective periods. The Markov chain approach was employed to estimate transitional probability matrix (TPM). The element $P_{ij}$ of this matrix indicates the probability that exports will switch from country $i$ to country $j$ with the passage of time. The diagonal $P_{ii}$ measures the probability that the export share of a country will be retained. Therefore, diagonal element of the TPM pointed out the retention of an importing country to Indian groundnut export in respective
period. In Markov Chain analysis average export to a particular country is considered to be a random variable which depended only on its past exports to that country (For details refer Mahadevaiah et al., 2005).

### Export supply function analysis:

The export supply function points out the influence of price and non-price factors on export of a commodity (Sato, 1977; Onkon and Sunday, 2014). The export of an agricultural commodity from a country mainly depends on its production, domestic demand, domestic and international prices along with socio-economic factors like GDP, exchange rate and personal disposable income. It can be written as:

$$\ln Q_{Et} = b_0 + b_1 \ln P_{t-1} + b_2 \ln DP_t + b_3 \ln EP_t + b_4 \ln ER_t + b_5 \ln GDP_t + b_6 \ln POP_t + b_7 \ln PDI_t + \mu_t$$

Where,

- $\ln Q_{Et}$ = Groundnut export from India (in tonnes)
- $b_0$ = Intercept
- $\ln P_{t-1}$ = Previous year domestic production (in tonnes)
- $\ln DP_t$ = Domestic price (₹/qtl)
- $\ln EP_t$ = Export price (Dollar/tonnes)
- $\ln ER_t$ = Rupee exchange rate (₹/$)
- $\ln GDP_t$ = GDP in billion rupees at factor cost (base year : 2004-05)
- $\ln POP_t$ = Population in million
- $\ln PDI_t$ = Personal disposable income in rupees
- $b_1$ to $b_7$ = Regression coefficients
- $\mu_t$ = Stochastic error term

### Time series analysis:

The recent developments in time series econometrics suggest that most time series are non-stationary. In case of non-stationary time series data, the common statistical tools are not appropriate and gives spurious results. In this study economic time series like GDP, exchange rate, domestic and export prices etc. trended over time. The regressions between trending series may produce significant results with high R2, but may be spurious or meaningless (Granger and Newbold, 1974). Therefore, it became necessary to check into the time series properties of the variables used in present study and to use the appropriate method of estimation based on the time series properties of the variables. Therefore, Engle and Granger (1987) two-step procedure was used in here. In first step, the order of integration between the data series was found out using ADF and Phillips-Peron stationarity test was followed by cointegration test using Johansen cointegration test. In the second step, vector error correction model (VECM) was employed to estimate cointegration equation and to specify the dynamic error correction mechanism or speed of adjustment to long run equilibrium.

### RESULTS AND DISCUSSION

**Scenario of groundnut trade:** International trade in groundnut is very thin (less than 5-6% of global production) and concentrated due to high domestic consumption in major producing countries like India and China (Diop et al., 2004). During study period 3.72 per cent of the world production was traded in international markets. From 1996-97 to 2014-15, global trade in groundnut increased at significantly higher rate (2.20%) than production (1.77%; Table 1). In above period, top five groundnut exporting countries in the world are China (22.66%), India (18.64%), Argentina (13.59%), USA (14.30%) and Netherland (5.99%), jointly accounted for more than three fourth of the world's total export. Export from India registered significantly high compound growth rate (CGR) of 18.33 and 11.25 per cent per annum during period 2 and overall period respectively. The volume of export from India has increased more than five times from 1.07 lakh tonnes in TE 1996-97 to 5.85 lakh tonnes in TE 2014-15. During 2005-06 to 2014-15, export increased at significantly higher rate making India the leading exporter to the world with 26.19 per cent share to world export. From figure 1, it can be seen that India's share to world export exhibited increasing trend since 2003-04 on regular basis with a maximum of 42 per cent share during 2011-12 made her top exporter to the world. During study period, the groundnut export from India increased by fourteen times in value terms. This confirmed the tremendous performance by Indian as of increased price groundnut from 2005-06 and onward. During period 2, the groundnut export from India increased in consistent way indicates optimistic future of Indian groundnut in world market in years to come (Table 2). Increase in value of Indian agricultural exports during 2010-11 was primarily because of higher exports of groundnut, sugar, molasses, cotton, guar gum meal, spices, maize, coffee, oil meal, castor oil, tea and jute etc (Sharma, 2013). During TE 2015-16, India exported 5.85 lakh tonnes groundnut, accounting at 3.96 lakh crore rupees to more than hundred countries, mainly shipped to Indonesia (33.32%), Vietnam (13.82%), Malaysia (11.41%), Philippines (10.10%) and Thailand (6.87%), jointly accounted for almost three fourth of total export from India in terms of quantity (Table 3).

Groundnut export from India exhibited significant growth and decreasing instability over the period indicates that India has emerged as reliable groundnut supplier to world market in study period (Table 2). Instability in groundnut export from India has decreased from 80 to 28 per cent in quantity and from 81 to 35 per cent in value from period 1 to period 2, respectively. Export value was more volatile than quantity.
as it depends on so many others factors along with quantity exported. The decrease in instability in second period indicated that India became more regular exporter in period 2 than in period 1. Results indicated that during first five years after WTO the export from India showed decreasing trend followed by a revival subsequently as reported earlier by Sharma (2013) and Shah (2013). Similarly, during period 1, groundnut export to production share varied from 3.33 to 0.65 per cent. In period 2, India exported more than 6 per cent of her total production, with maximum of more than 11 per cent during 2011-12 and 12-13. As a result India became top exporter to world market in recent years with increased share in world's export (Table 3). Surge in export to production share in recent years depicts decreasing domestic consumption in India, because of shifting consumption pattern of edible oils in the country from traditional groundnut and rapeseed & mustard towards cheap imported palm and soya oils. From 2001-02 to 13-14, groundnut oil consumption increased from 29 to 42 per cent whereas palm oil consumption increased from 12 to 2.13 per cent whereas palm oil consumption increased from 29 to 42 per cent (Meena et al., 2015; Mehta, 2015).

Change in pattern of groundnut export from India: It is mostly traded as shelled (kernel), in-shell (pod) and prepared groundnut like, salted, blanched, preserved and peanut butter etc. During study period, 89 per cent in quantity and 92 per cent in value terms of the total groundnut export from the country was merchandised in shelled form (including both Hand Picked Selected (HPS) and Not Specified Elsewhere (NES), shelled groundnut). In-shell groundnut constituted 8 and 6 per cent share in quantity and value term respectively. Prepared groundnut contributed only 3 and 2 per cent in volume and value term, respectively during the study period. Peanut butter, a new product form of groundnut export basket since 2008-09 is gaining importance in recent years. Kernel export decelerated in period 1, but recorded tremendous recovery in period 2 with 21 and 35 per cent growth in quantity and value term respectively. Kernel export registered higher growth than in-shell export in overall period. Total groundnut export recorded higher growth in period 2 than period 1 and in overall (Table 4). Trading in kernel form is having higher export competitiveness than in-shell and prepared groundnut. It has freight advantage over in-shell groundnut as pod contains 30 per cent of shell, which has low economic value. Further kernels have more self-life compared to prepared peanut might be the reasons to export more in kernel form (Nautiyal, 2002; Meena, et al., 2019). Instability in HPS kernels export came down over the period but instability in in-shell HPS increased confirms the increasing preference towards kernel export by the traders over the export of pod.

Table 1 Performance of groundnut export in term of quantity and share to world export in major exporting countries

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Growth Instability</td>
<td>Mean</td>
</tr>
<tr>
<td>China</td>
<td>Export (Lakh tonnes)</td>
<td>3.58</td>
<td>10.14^2 0.39</td>
<td>2.23</td>
</tr>
<tr>
<td></td>
<td>Production (Lakh tonnes)</td>
<td>129.3</td>
<td>5.00^3 0.09</td>
<td>150.1</td>
</tr>
<tr>
<td></td>
<td>% Share to world export</td>
<td>29.25</td>
<td>10.35^3 0.38</td>
<td>16.06</td>
</tr>
<tr>
<td>India</td>
<td>Export (Lakh tonnes)</td>
<td>1.35</td>
<td>-1.95^3 0.89</td>
<td>4.05</td>
</tr>
<tr>
<td></td>
<td>Production (Lakh tonnes)</td>
<td>69.8</td>
<td>-3.20^3 0.39</td>
<td>72.4</td>
</tr>
<tr>
<td></td>
<td>% Share to world export</td>
<td>11.08</td>
<td>-1.76^3 0.88</td>
<td>26.19</td>
</tr>
<tr>
<td>Argentina</td>
<td>Export (Lakh tonnes)</td>
<td>1.73</td>
<td>-12.16^3 0.30</td>
<td>1.90</td>
</tr>
<tr>
<td></td>
<td>Production (Lakh tonnes)</td>
<td>3.78</td>
<td>-5.66^3 0.48</td>
<td>6.27</td>
</tr>
<tr>
<td></td>
<td>% Share to world export</td>
<td>14.30</td>
<td>-12.00^2 0.33</td>
<td>12.88</td>
</tr>
<tr>
<td>USA</td>
<td>Export (Lakh tonnes)</td>
<td>1.84</td>
<td>-3.88^3 0.38</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Production (Lakh tonnes)</td>
<td>17.3</td>
<td>1.45^8 0.17</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>% Share to world export</td>
<td>15.04</td>
<td>-3.70^8 0.33</td>
<td>13.56</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Export (Lakh tonnes)</td>
<td>0.63</td>
<td>-4.96^7 0.19</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>% Share to world export</td>
<td>5.22</td>
<td>-4.78^3 0.19</td>
<td>6.76</td>
</tr>
<tr>
<td></td>
<td>Export (Lakh tonnes)</td>
<td>3.25</td>
<td>-2.42^7 0.24</td>
<td>3.61</td>
</tr>
<tr>
<td>Others</td>
<td>Production (Lakh tonnes)</td>
<td>79.5</td>
<td>2.88^7 0.04</td>
<td>101.4</td>
</tr>
<tr>
<td></td>
<td>% Share to world export</td>
<td>26.63</td>
<td>-2.23^7 0.20</td>
<td>24.55</td>
</tr>
<tr>
<td>World</td>
<td>Export (Lakh tonnes)</td>
<td>12.18</td>
<td>-0.19^6 0.08</td>
<td>14.80</td>
</tr>
</tbody>
</table>

Note: 3, 2, 1 and NS indicate significant at less than 1.5, 10 per cent level of significance and non-significant respectively.
Source: Calculations based on data from FAO (2016).
### Table 2: Export performance of Indian groundnut in quantity ('000 Tonnes) and value (in ₹ Crore) term

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Production</th>
<th>Export</th>
<th>Value of produce</th>
<th>Export Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Period 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>6849.92</td>
<td>142.65</td>
<td>12843.03</td>
</tr>
<tr>
<td>Growth</td>
<td></td>
<td>-2.35NS</td>
<td>-0.66NS</td>
<td>-4.09NS</td>
</tr>
<tr>
<td>Instability</td>
<td></td>
<td>0.41</td>
<td>0.80</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7167.39</td>
<td>436.93</td>
<td>14023.29</td>
</tr>
<tr>
<td></td>
<td>Period 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>7017.01</td>
<td>297.53</td>
<td>13464.22</td>
</tr>
<tr>
<td>Growth</td>
<td></td>
<td>0.69NS</td>
<td>15.34 1</td>
<td>4.03NS</td>
</tr>
<tr>
<td>Instability</td>
<td></td>
<td>0.44</td>
<td>0.28</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>7017.01</td>
<td>297.53</td>
<td>13464.22</td>
</tr>
<tr>
<td>Growth</td>
<td></td>
<td>0.17NS</td>
<td>11.31 3</td>
<td>0.83NS</td>
</tr>
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<td>Instability</td>
<td></td>
<td>0.42</td>
<td>0.56</td>
<td>0.37</td>
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</tbody>
</table>


### Table 3: Groundnut export from India and its share to production and world export

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (000 tonnes)</th>
<th>Export (000 tonnes)</th>
<th>Export value (₹ Crore)</th>
<th>Export to production share (%)</th>
<th>India to world export Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-97</td>
<td>7589.41</td>
<td>151.35</td>
<td>331.59</td>
<td>1.99</td>
<td>11.43</td>
</tr>
<tr>
<td>1997-98</td>
<td>7370.40</td>
<td>245.13</td>
<td>566.28</td>
<td>3.33</td>
<td>19.87</td>
</tr>
<tr>
<td>1998-99</td>
<td>8980.00</td>
<td>137.07</td>
<td>316.41</td>
<td>2.14</td>
<td>9.97</td>
</tr>
<tr>
<td>1999-00</td>
<td>5250.00</td>
<td>112.81</td>
<td>250.93</td>
<td>1.61</td>
<td>8.12</td>
</tr>
<tr>
<td>2000-01</td>
<td>6410.00</td>
<td>78.26</td>
<td>178.19</td>
<td>1.65</td>
<td>4.75</td>
</tr>
<tr>
<td>2001-02</td>
<td>7027.50</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
</tr>
<tr>
<td>2002-03</td>
<td>4121.10</td>
<td>177.15</td>
<td>371.78</td>
<td>2.94</td>
<td>13.38</td>
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<tr>
<td>2003-04</td>
<td>8126.50</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
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<td>2004-05</td>
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<td>447.01</td>
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<td>13.59</td>
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<td>2005-06</td>
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<td>177.15</td>
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<td>2.62</td>
<td>13.59</td>
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<td>2006-07</td>
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<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
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<td>2007-08</td>
<td>9182.50</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
</tr>
<tr>
<td>2008-09</td>
<td>7168.10</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
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<tr>
<td>2009-10</td>
<td>5248.99</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
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<tr>
<td>2010-11</td>
<td>8265.78</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
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<tr>
<td>2011-12</td>
<td>6963.70</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
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<td>2012-13</td>
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<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
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<td>2013-14</td>
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<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
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<td>2014-15</td>
<td>7401.71</td>
<td>177.15</td>
<td>447.01</td>
<td>2.62</td>
<td>13.59</td>
</tr>
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</table>

Source: Data compiled from DAC & FW, DGCIS and FAO.

### Table 4: Performances of groundnut export in different forms in quantity (000 tonnes) and value (₹ Crore) term

<table>
<thead>
<tr>
<th>Forms (HS code)</th>
<th>Particulars</th>
<th>Average</th>
<th>Growth (%)</th>
<th>Instability index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Period 1</td>
<td>Period 2</td>
<td>Overall</td>
<td>Period 1</td>
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<tr>
<td>Shelled HPS</td>
<td>Quantity</td>
<td>99.91</td>
<td>402.04</td>
<td>258.93</td>
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<tr>
<td>(12022001)</td>
<td>Value</td>
<td>253.99</td>
<td>2296.58</td>
<td>1329.03</td>
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<tr>
<td>Shelled N.E.S.</td>
<td>Quantity</td>
<td>16.89</td>
<td>10.15</td>
<td>13.34</td>
</tr>
<tr>
<td>(12022009)</td>
<td>Value</td>
<td>42.43</td>
<td>42.55</td>
<td>42.66</td>
</tr>
<tr>
<td>Shelled total</td>
<td>Quantity</td>
<td>116.80</td>
<td>412.19</td>
<td>272.27</td>
</tr>
<tr>
<td>(HPS+N.E.S.)</td>
<td>Value</td>
<td>296.41</td>
<td>2339.24</td>
<td>1371.58</td>
</tr>
<tr>
<td>In-shell HPS</td>
<td>Quantity</td>
<td>21.35</td>
<td>14.21</td>
<td>17.59</td>
</tr>
<tr>
<td>(12021001)</td>
<td>Value</td>
<td>52.98</td>
<td>54.10</td>
<td>53.57</td>
</tr>
<tr>
<td>In-shell N.E.S.</td>
<td>Quantity</td>
<td>4.50</td>
<td>10.53</td>
<td>7.67</td>
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<td>(12021009)</td>
<td>Value</td>
<td>11.29</td>
<td>45.11</td>
<td>29.09</td>
</tr>
<tr>
<td>In-shell Total</td>
<td>Quantity</td>
<td>25.85</td>
<td>24.74</td>
<td>25.26</td>
</tr>
<tr>
<td>(HPS+N.E.S.)</td>
<td>Value</td>
<td>64.27</td>
<td>99.21</td>
<td>82.66</td>
</tr>
<tr>
<td>Prepared/Preserved</td>
<td>Quantity</td>
<td>11.21</td>
<td>8.74</td>
<td>9.91</td>
</tr>
<tr>
<td>(20081100)</td>
<td>Value</td>
<td>26.41</td>
<td>47.03</td>
<td>37.26</td>
</tr>
<tr>
<td>Gross</td>
<td>Quantity</td>
<td>142.65</td>
<td>436.93</td>
<td>297.53</td>
</tr>
<tr>
<td></td>
<td>Value</td>
<td>360.68</td>
<td>2438.44</td>
<td>1454.24</td>
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</table>

Source: Computed from DGCIS, Ministry of Commerce and Industry, Govt. of India data.
TRADE DYNAMICS AND EXPORT SUPPLY FUNCTION OF INDIAN GROUNDNUT

Fig. 1. Proportionate shares (%) of major exporting countries to world groundnut export (in quantity term)

Fig. 2. Production and export of groundnut from India in quantity (primary axis) and value term (secondary axis)
### Table 5 Change in Indian groundnut export destinations during 1995-96 to 2014-15

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Average</td>
<td>Growth</td>
</tr>
<tr>
<td>Indonesia</td>
<td>61.39</td>
<td>0.57</td>
<td>0.83</td>
</tr>
<tr>
<td>% Share</td>
<td>44.79</td>
<td>0.53</td>
<td>0.37</td>
</tr>
<tr>
<td>Malaysia</td>
<td>19.29</td>
<td>21.29</td>
<td>0.52</td>
</tr>
<tr>
<td>% Share</td>
<td>14.34</td>
<td>21.25</td>
<td>0.36</td>
</tr>
<tr>
<td>Philippines</td>
<td>8.26</td>
<td>-0.33</td>
<td>1.29</td>
</tr>
<tr>
<td>% Share</td>
<td>5.56</td>
<td>-0.37</td>
<td>0.75</td>
</tr>
<tr>
<td>Singapore</td>
<td>5.20</td>
<td>-7.65</td>
<td>0.82</td>
</tr>
<tr>
<td>% Share</td>
<td>3.77</td>
<td>-7.68</td>
<td>0.34</td>
</tr>
<tr>
<td>UK</td>
<td>13.76</td>
<td>-10.94</td>
<td>1.14</td>
</tr>
<tr>
<td>% Share</td>
<td>9.02</td>
<td>-10.98</td>
<td>0.49</td>
</tr>
<tr>
<td>Netherland</td>
<td>3.84</td>
<td>-12.77</td>
<td>1.92</td>
</tr>
<tr>
<td>% Share</td>
<td>2.08</td>
<td>-12.80</td>
<td>1.36</td>
</tr>
<tr>
<td>Egypt</td>
<td>2.38</td>
<td>-25.74</td>
<td>1.55</td>
</tr>
<tr>
<td>% Share</td>
<td>1.96</td>
<td>-25.25</td>
<td>1.68</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>2.37</td>
<td>9.28</td>
<td>0.69</td>
</tr>
<tr>
<td>% Share</td>
<td>2.15</td>
<td>9.23</td>
<td>1.13</td>
</tr>
<tr>
<td>USA</td>
<td>2.36</td>
<td>-26.35</td>
<td>8.89</td>
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<tr>
<td>% Share</td>
<td>1.41</td>
<td>-16.35</td>
<td>5.64</td>
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<tr>
<td>Russia</td>
<td>2.35</td>
<td>-59.26</td>
<td>8.20</td>
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<tr>
<td>% Share</td>
<td>1.53</td>
<td>-50.39</td>
<td>4.62</td>
</tr>
<tr>
<td>Others</td>
<td>19.30</td>
<td>-4.10</td>
<td>0.76</td>
</tr>
<tr>
<td>% Share</td>
<td>13.39</td>
<td>-4.13</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Note: Qty. indicates quantity in 000 tonnes and share indicate per cent share to total groundnut export from India.
Source: Computed from DGCIS, Ministry of Commerce and Industry, Govt. of India data

### Table 6 Transitional probability matrix of Indian groundnut export during 1995-96 to 2014-15

<table>
<thead>
<tr>
<th>Country</th>
<th>Indonesia</th>
<th>Malaysia</th>
<th>Philippines</th>
<th>Vietnam</th>
<th>UK</th>
<th>Thailand</th>
<th>Ukraine</th>
<th>Singapore</th>
<th>Pakistan</th>
<th>UAE</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>52.94</td>
<td>11.76</td>
<td>0.00</td>
<td>11.76</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>5.88</td>
<td>0.00</td>
<td>17.65</td>
</tr>
<tr>
<td>Malaysia</td>
<td>11.11</td>
<td>22.22</td>
<td>22.22</td>
<td>0.00</td>
<td>5.56</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>11.11</td>
<td>0.00</td>
<td>27.78</td>
</tr>
<tr>
<td>Philippines</td>
<td>11.11</td>
<td>11.11</td>
<td>16.67</td>
<td>0.00</td>
<td>11.11</td>
<td>5.56</td>
<td>5.56</td>
<td>0.00</td>
<td>0.00</td>
<td>16.67</td>
<td>22.22</td>
</tr>
<tr>
<td>Vietnam</td>
<td>11.11</td>
<td>0.00</td>
<td>0.00</td>
<td>11.11</td>
<td>5.56</td>
<td>27.78</td>
<td>0.00</td>
<td>5.56</td>
<td>27.78</td>
<td>11.11</td>
<td>0.00</td>
</tr>
<tr>
<td>UK</td>
<td>0.00</td>
<td>16.67</td>
<td>22.22</td>
<td>0.00</td>
<td>5.56</td>
<td>5.56</td>
<td>22.22</td>
<td>11.11</td>
<td>0.00</td>
<td>11.11</td>
<td>5.56</td>
</tr>
<tr>
<td>Thailand</td>
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<td>0.00</td>
<td>0.00</td>
<td>11.11</td>
<td>22.22</td>
<td>22.22</td>
<td>11.11</td>
<td>0.00</td>
<td>16.67</td>
<td>5.56</td>
<td>11.11</td>
</tr>
<tr>
<td>Ukraine</td>
<td>0.00</td>
<td>0.00</td>
<td>16.67</td>
<td>11.11</td>
<td>11.11</td>
<td>11.11</td>
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<td>11.11</td>
<td>5.56</td>
<td>22.22</td>
<td>0.00</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.00</td>
<td>0.00</td>
<td>11.11</td>
<td>5.56</td>
<td>5.56</td>
<td>5.56</td>
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<td>11.11</td>
<td>22.22</td>
<td>27.78</td>
<td>5.56</td>
</tr>
<tr>
<td>Pakistan</td>
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<td>6.00</td>
<td>0.00</td>
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<td>11.11</td>
<td>22.22</td>
<td>0.00</td>
<td>16.67</td>
<td>5.56</td>
<td>0.00</td>
</tr>
<tr>
<td>UAE</td>
<td>0.00</td>
<td>11.11</td>
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<td>5.56</td>
<td>11.11</td>
<td>5.56</td>
<td>22.22</td>
<td>27.78</td>
<td>5.56</td>
<td>11.11</td>
<td>0.00</td>
</tr>
<tr>
<td>Others</td>
<td>16.67</td>
<td>22.22</td>
<td>11.11</td>
<td>5.56</td>
<td>11.11</td>
<td>5.56</td>
<td>0.00</td>
<td>0.00</td>
<td>5.56</td>
<td>5.56</td>
<td>16.67</td>
</tr>
</tbody>
</table>

Source: Computed from DGCIS, Ministry of Commerce and Industry, Govt. of India data

**Change in direction of groundnut export from India:**

Direction and destinations of export are crucial to define India's export potential. A sluggish growth experienced by export partners indicates that demand for Indian exports is likely to be constrained in near future. Therefore, to find out how the share of traditional export partners has altered and how the country has succeeded in capturing new markets for its export in post WTO period was assessed. Table 5 shows that 87 and 89 per cent of the total quantity exported during period 1 and 2, respectively was concentrated in top ten importing countries viz., Indonesia (43.95%), Malaysia (15.08%), Philippines (8.85%), Vietnam (3.36%), United Kingdom (UK; 5.28%), Thailand (1.40%), Ukraine (2%), Singapore (2.46%), Pakistan (1.15%) and United Arab Emirates (UAE; 1.65%) Exports to Indonesia, Malaysia, Philippines and Singapore jointly constituted 68.46 and
TRADE DYNAMICS AND EXPORT SUPPLY FUNCTION OF INDIAN GROUNDNUT

68.71 per cent share to total export in period 1 and 2 respectively. India lost its share in the UK, Netherlands, Egypt, Sri Lanka, the USA and Russia markets in period 2, but exported to new partners like Vietnam, Thailand, Pakistan, China, Ukraine and UAE during same period. The highest growth in export during period 1 was observed in export to Malaysia whereas highest negative growth was found in export to Russia in this period. Highest instability index was observed in export to USA (8.89) followed by Russia (8.2) due to tightening of the safety measures with the clients. In period 2, Thailand, Pakistan, China, Ukraine, UAE and Singapore joined as premier customer to India. China, the largest producer of groundnut in world, also imported Indian groundnut to meet its domestic demand in period 2. It was quite noticeable that newly joined partners to India showed very high degree of instability varying from 500 per cent in Thailand, 300 per cent in case of China to 200 per cent in Vietnam. In case of old regular trading partners like, Indonesia (28%), Malaysia (19%), Philippines (36%), and Singapore (13%), instability was very low compared to new partners.

Similar to the earlier findings (Mahadevaiah et al., 2005; Savadatti, 2006; Dominic, 2008; Sharma, 2013; Varghese, 2014, Adhikari et al., 2016) present study also revealed narrowing market for Indian groundnut in terms of distance. The sphere of Indian groundnut export has shifted from European to Asian countries from period 1 to period 2. In period 1 Indian groundnut was landing into the United Kingdom, Egypt, Netherlands and USA along with major markets like Indonesia and Malaysia, whereas in second period these long distance markets were replaced by near markets namely, Vietnam, Thailand, China, UAE and Pakistan which clearly indicated the narrowing trade sphere from far distant to nearby markets, with increasing export in quantity term. It was mainly because of strict sanitary and phytosanitary measure adopted by European countries and another is higher freight charges to these far destinations like United Kingdom, Netherlands, Egypt (Jagdambe, 2016). Low retention share of USA and UK might be the result of change in trade policies in these countries in post WTO period. Aflatoxin level which was a major setback to groundnut exports from India to the European Union. To manage aflatoxin contamination at different stages in groundnut supply chain it is immensely needed to give more emphasis for good agricultural practices in groundnut production right from farmers till end consumer through proper handling of produce by industry people. High moisture content in export consignment is the root cause for aflatoxin problem (ICRISAT, 2016; Mukherjee et al. 2019). European market is the largest importer of groundnut in world but India is having very low or negligible share in their markets. It calls for India to target these markets by meeting their quality standards. It will strengthen India's groundnut competitiveness in world market.

Markov Chain Analysis was done to examine structural change in groundnut export from India. Top ten importing countries were taken to analyse the shift in direction while export to remaining countries were pooled under others category. TPM of groundnut export during period 1, 2 and overall was estimated but due to space limitations TPM for overall period is only presented here in Tables 6. It was evident from TPM for period 1 that Indonesia was the most loyal importer of Indian groundnut as reflected through high probability of retention of 78 per cent followed by Egypt and Sri Lanka. Malaysia was not a stable importer in period 1, even though quantity imported by Malaysia was high about 20 thousand tonnes in period 1. Similar case was observed in case of Indian turmeric export to USA. USA was the second top destinations for India turmeric between 1990 and 2007 but it retained zero per cent share of its previous export (Angles et al., 2011). During period 2, Singapore was identified as biggest loyal market for Indian groundnut. It retained 80 per cent share of lagged years. Indonesia continued to be a premier customer with 67 per cent retention over previous year in period 2. Vietnam and Malaysia were next loyal in this period, retained 30 and 50 per cent export share over previous year respectively. Similarly, Varghese in 2014 also identified Indonesia and Malaysia as most loyal markets for groundnut kernel HPS with high retention probabilities of 59 and 43 per cents respectively from 2001 to 2008. TPM for overall period i.e. from 1995 to 2015 found Indonesia as most loyal destination because it retained 52.94 per cent of its previous year export share. Singapore emerged as second steady market. Malaysia and Thailand also retained more than one fifth of their previous year export. Others countries retention improved from 20 per cent in period 1 to 30 per cent in period 2 indicating that non-traditional small importer retained their share in addition to gain from larger importer like Malaysia and Philippines (Table 6). Retention share of other countries improved in period second compared to period one which indicated the increasing preference of Indian groundnut in new importing countries.

Factors influencing groundnut export from India:
Agricultural export from a country is subjective to various price and non-price factors (Haleem et al. 2005; Mythili, 2007; Ranjan and Rai 2007; Kumawat and Prasad 2012; Kannan 2013; Okon and Sunday 2014; Saxena et al. 2015). It is mainly influenced by domestic demand in exporting country and the relative prices she receives for exports. The export supply function indicates the relative influence of relevant price and non-price factors and associated policies in stimulating the supply of exports (Islam and Subramanian, 1989). There is a negative link between domestic demand and exports from a country. Changes in domestic prices in relation to export prices influence an exporter's decision to
supply goods equally. The interaction between prices and the exchange rate plays a crucial role in determining India's exports because any change in exchange rate affects both the prices and the competitiveness of exports (Shah, 2013). Theoretically, a depreciating currency stimulates exports by making it cheaper abroad providing a quick boost in competitiveness.

The export function of Indian groundnut was estimated to identify the factors that determine the groundnut export from India. The results (Table 7) indicated that the factors included in the models explain 72 per cent variation in export volume. GDP at factor cost (04-05 base year) and population had a significant positive influence on the volume of groundnut exports, whereas exchange rate had a significant negative influence on the volume of export. Rest of the variables were found insignificant. The estimation suggested that with 1 per cent increase in the GDP, exports increased by 0.96 percent. There was inverse relationship between exchange rate and export and proportional relationship between population and export. Theoretically, a depreciating currency stimulates exports while with increase in population the available surplus should decrease resulting in the decrease in export. Therefore, the regression results seem to be spurious as they were found against established hypotheses. Hence, it was analysed further considering the time series properties of the variable used in model.

Regressions between trended series may produce significant results with high $R^2$, but may be spurious or meaningless (Granger and Newbold, 1974). So it became appropriate to look into the time series properties of the variables used in the estimation and to use estimation method based on the time series properties of the variables. Hence, appropriate time series techniques namely, ADF and Phillips Peron stationarity test, Johansen Cointegration test and Vector Error Correction Model were used.

Non-stationarity causes a serious inference problem therefore stationary test was employed for export, production, domestic and export prices, GDP, population and personnel income before co-integration tests. To examine the univariate time series properties of the variables and to confirm that all the series are non-stationary and integrated of the same order, ADF and Phillips Peron unit root test were used. Both the tests produced almost similar results (Table 8). Results showed that export, domestic price, export price, exchange rate and population series were non-stationary at the level, as the unit root test statistic was less than the critical value at 5% level. At first difference, the null hypothesis of unit root could be rejected for all the variables i.e. they become stationary at the first difference. But lagged year production was found stationary at level itself whereas GDP and personal disposable income did not become stationary even after second differencing. When the unit root null hypothesis ($\beta = 1$) was rejected against the alternative hypothesis ($\beta < 1$), it meant that the non-stationary variables $Y_t$ and $Z_t$ co-integrated over long run. Therefore, both the unit root test namely ADF and Phillips Peron results confirmed that export, domestic price, export price, exchange rate and population variables were integrated of the same order i.e. $I(1)$. It confirmed the precondition for cointegration i.e. non-stationarity at level and integrated of same level. It confirmed a long-run or equilibrium relationship between groundnut export, its domestic price, its export price, exchange rate and population. After establishing non-stationarity of variables at level and were integrated of same order, Johansen co-integration test was employed to check long-run relationship among these integrated variables (Johansen, 1988). Johansen cointegration test as sequential test procedure was employed to determine the number of cointegrating relations among the variables. Each row of the Tables 9 and 10 tested a different null hypothesis. The results based on Trace statistic test and Eigen value statistics, and Johansen cointegration test indicated 5 cointegrating equations/vectors at 5 per cent level of significance, and it suggested that there was high long run association between export, domestic price, export price, exchange rate and population. The Johansen test was proceeded to estimate VECM to measure the magnitude of speed of adjustment to the long-run equilibrium. VECM produced theoretically correct results against OLS estimates. The cointegration equation (Table 11) showed that export of groundnut from India increased significantly with export price and exchange rate. On the other hand export decreased significantly with increase in domestic price and increase in population (due to increased domestic consumption). Similar results were also obtained by Sengupta and Roy (2011) in case of chilli & pepper, banana and walnut export which decreased with domestic prices. In case of rice export, Adhikari et al. (2016) found that rice export from India increased with exchange rate and international price and decreased with domestic prices and population. The coefficient of the speed of adjustment for groundnut export from India was negative and statistically significant. It reflects the adjustment to the long-run equilibrium from short run shocks, implied that groundnut export tends to converge to equilibrium in long-run after short run shocks. Hence, it could be concluded that domestic and international prices, exchange rate and population played a significant role in groundnut export from India during 1995 to 2015.

This study indicated that groundnut export from India increased significantly during 1995 to 2015. India has emerged as a top, reliable and consistent supplier of groundnut to world market. The export market sphere has narrowed from European to Asian countries amid tightening of SPS measures and increasing cut-throat competition in world market. There is needs to adopt good and efficient production and manufacturing practices by all the
TRADE DYNAMICS AND EXPORT SUPPLY FUNCTION OF INDIAN GROUNDNUT

stakeholders in peanut supply chain. Export from India significantly depends on domestic and export prices, exchange rate and population. Therefore, export promotion policies should be articulated to increase groundnut export from India accordingly.

Table 7 OLS estimates of groundnut export supply function; Dependent variable-Ln export quantity

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Coefficients</th>
<th>t Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.21</td>
<td>0.03</td>
</tr>
<tr>
<td>Ln Production (t-1; Mt)</td>
<td>0.12</td>
<td>0.25</td>
</tr>
<tr>
<td>Ln Domestic price (₹/qtl)</td>
<td>0.16</td>
<td>0.29</td>
</tr>
<tr>
<td>Ln Export price ($/tonnes)</td>
<td>0.13</td>
<td>0.29</td>
</tr>
<tr>
<td>Ln Exchange rate (₹/$)</td>
<td>-2.25**</td>
<td>-2.25</td>
</tr>
<tr>
<td>Ln GDP at factor cost (₹ Billion; base year 04-05)</td>
<td>0.96*</td>
<td>2.08</td>
</tr>
<tr>
<td>Ln Population (in million)</td>
<td>1.04**</td>
<td>2.30</td>
</tr>
<tr>
<td>Ln Personal disposable income (₹)</td>
<td>-0.07</td>
<td>-0.31</td>
</tr>
<tr>
<td>Adjusted R square</td>
<td>0.72</td>
<td></td>
</tr>
</tbody>
</table>

Note: *, **, *** Indicates that the variable is significant at less than 10%, 5% and 1% level respectively

Table 8 Results of ADF and Phillips-Peron Unit Root test

<table>
<thead>
<tr>
<th>Series</th>
<th>ADF Fisher</th>
<th>Phillips-Peron Fisher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>First difference</td>
</tr>
<tr>
<td>Export</td>
<td>0.78</td>
<td>0.00</td>
</tr>
<tr>
<td>Production (t-1)</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Domestic price(₹/qtl)</td>
<td>0.77</td>
<td>0.05</td>
</tr>
<tr>
<td>Export price($/tonnes)</td>
<td>0.94</td>
<td>0.00</td>
</tr>
<tr>
<td>Exchange rate(₹/$)</td>
<td>0.92</td>
<td>0.04</td>
</tr>
<tr>
<td>GDP (₹ Billion; base year 04-05)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Population(in million)</td>
<td>0.96</td>
<td>0.00</td>
</tr>
<tr>
<td>Personal disposable income (₹)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 9 Result of Johansen Cointegration test using Trace statistics

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.95</td>
<td>125.58</td>
<td>69.82</td>
<td>0.00</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.85</td>
<td>75.88</td>
<td>47.86</td>
<td>0.00</td>
</tr>
<tr>
<td>At most 2 *</td>
<td>0.74</td>
<td>43.90</td>
<td>29.80</td>
<td>0.00</td>
</tr>
<tr>
<td>At most 3 *</td>
<td>0.54</td>
<td>20.74</td>
<td>15.49</td>
<td>0.01</td>
</tr>
<tr>
<td>At most 4 *</td>
<td>0.35</td>
<td>7.42</td>
<td>3.84</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Trace test indicates 5 cointegratingeqn(s) at the 0.05 level

Table 10 Result of Johansen Cointegration test using Eigen value statistics

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Max-Eigen Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>0.95</td>
<td>49.70</td>
<td>33.88</td>
<td>0.00</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.85</td>
<td>31.98</td>
<td>27.58</td>
<td>0.01</td>
</tr>
<tr>
<td>At most 2 *</td>
<td>0.74</td>
<td>23.16</td>
<td>21.13</td>
<td>0.03</td>
</tr>
<tr>
<td>At most 3 *</td>
<td>0.54</td>
<td>14.31</td>
<td>14.26</td>
<td>0.07</td>
</tr>
<tr>
<td>At most 4 *</td>
<td>0.35</td>
<td>7.42</td>
<td>3.84</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Max-eigenvalue test indicates 5 cointegrating eqn(s) at the 0.05 level

Table 11 Results of Vector Error Correction Model

<table>
<thead>
<tr>
<th>CointegratingEq:</th>
<th>CointEq1</th>
<th>Standard errors</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export(-1)</td>
<td>1.000000</td>
<td>-17.05</td>
<td>-1.28</td>
</tr>
<tr>
<td>Domestic price(-1)</td>
<td>-219.62***</td>
<td>-39.97</td>
<td>-1.37</td>
</tr>
<tr>
<td>Export price(-1)</td>
<td>54.74*</td>
<td>-88.83</td>
<td>-28.56</td>
</tr>
<tr>
<td>Exchange rate(-1)</td>
<td>7792.44***</td>
<td>-2535.74</td>
<td>3.07</td>
</tr>
<tr>
<td>Population(-1)</td>
<td>-2537.44***</td>
<td>0.66727</td>
<td>[-1.87904]</td>
</tr>
<tr>
<td>C</td>
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<td>Error Correction:</td>
<td>D(Export)</td>
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<td>Speed of adjustment</td>
<td>-1.253834**</td>
<td>(0.66727)</td>
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<td>R-squared</td>
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<td>Adj. R-squared</td>
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<td>Akaike AIC</td>
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<td>Schwarz SC</td>
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Note: *, **, *** Indicates variable is significant at the 10, 5 and 1% level respectively.

ACKNOWLEDGEMENT

This study is the part of Ph.D work submitted to Junagadh Agricultural University, Junagadh, Gujarat, India and the author gratefully acknowledges the support extended by Director, DGR and authorities of the JAU, Junagadh.

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TRADE DYNAMICS AND EXPORT SUPPLY FUNCTION OF INDIAN GROUNDNUT


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