

## Export of Rice from India: Performance and Determinants<sup>§</sup>

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### Abstract

The study has examined the growth performance and identified determinants of rice exports from India with special reference to basmati rice during the period 1980-81 to 2012-13. Compound growth rate, instability index and Markov chain analysis, were applied to estimate trend, and instability and the project export to different countries. The time series data were made stationary before estimating the determinants of Indian rice export. The study has observed that rice contributed substantially to the national income during the study period. The higher growth observed in value of basmati rice export (15.87%) was due to higher growth in unit value than quantity of export (7.55%) during 1980-81 to 2012-13. The growth rate of unit value of rice export was higher in period I (13.48%) than period II (5.06%). The growth rates in export of non-basmati rice in terms of quantity, export earnings and unit value were 10.87 per cent, 17.74 per cent and 6.20 per cent, respectively during the study period. The instability index has been found highest for quantity (43.37 %) in case of basmati rice and value (141.36%) in case of total rice during the entire period. The UAE has been found to be a highly preferred market for Indian basmati rice and Nigeria for Indian non-basmati rice, as indicated by the probability of retention of their previous shares. The study has projected that during 2013-14 the major markets for Indian basmati rice would be Iran and Saudi Arabia, whereas for Indian non-basmati rice, the major markets would be Nigeria and South Africa. The estimated regression model has shown that export price, international price, lagged production, domestic consumption, and exchange rate are the major determinants of rice export from India. In order to sustain in the international market, Indian export price needs to be competitive besides improvement in quality and sanitary standards.

**Key words:** Rice, export destinations, performance, instability index, Markov Chain Analysis, export determinants

**JEL Classification:** F17, Q17

### Introduction

International trade plays an important role in the economic development of a country. The participation of India in international trade is largely confined to primary products, especially of the agricultural sector. Indian trade policy for agricultural commodities is guided by the twin objectives of ensuring national food

security and building export markets for enhancing the farmer's income. In 2011, India was on the tenth position in agriculture and food exports in the world and had 2.07 per cent share in global export of agricultural and food products. Rice is one of the most important exportable agricultural commodities from India. The steady increase in production, availability of buffer stock and rising demand for basmati rice in the international market has helped India in increasing rice export. In 1990-91, India was able to export only 505 thousand tonnes rice with a total values of ₹ 459.63 crore and this amount increased to ₹ 33858.19 crore in

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2012-13. The major markets for export of Indian rice were: United Arab Emeritus, Saudi Arabia, Iran, Kuwait and Iraq (for basmati rice).

The new multilateral trade regime coupled with the policy changes adopted by the most nations aiming towards globalization, provided new opportunities as well as posed several challenges for expanding trade in agricultural products. India too has been able to derive significant benefits from the changed global environment. Since global trade environment is highly dynamic and export is influenced by both micro and macro policies, it is important to understand the product-specific dynamics to improve export performance of agricultural commodities. The global markets for Indian rice are highly dynamic and the barriers to trade are being lowered gradually all around the world (Singh, 2001). The export of rice is also related with the buffer stock of rice held by the government. Because of comfortable buffer stock, India became a major exporter of rice in 2012. There is a strong demand for Indian rice in the international markets. The increasing consumer demand for rice and India's strength for production of basmati as well as non-basmati rice, coupled with liberal export policy, and large public stock have created ample scope for rice export. In recent years, the African countries have also shifted to Indian non-basmati rice because of price competitiveness (Chandrashekhar, 2013).

The future performance of any product in international markets can be judged in the light of its past performance. Therefore, evaluation of past performance of rice is necessary to work out its export potential, challenges and opportunities. The present study has analysed major markets for Indian rice, in terms of its future share. Rice export from India is determined by various factors and therefore, reliable estimates of determinants of export are essential for the formulation of appropriate policies. The present study has examined the growth performance and instability of rice, important destinations, with projections for export in future and has identified the factors affecting export of rice.

## Data and Methodology

The study is based on the time series data on export quantity, value and unit value which were compiled from various sources for a period of 33 years (1980-

81 to 2012-13). For analysis, the total period was sub-divided into two periods, viz. Period-I: Pre-WTO period (1980-81 to 1994-95); and Period-II: Post-WTO period (1995-96 to 2012-13). The division of period was based on the assumption that liberalization as well as formation of WTO helped in boosting up rice export. The data on export quantity and value were collected from Agricultural Statistical Compendium, and APEDA. Similarly, data on production, import, stock, and international price of rice were collected from various sources like *indiastat.com* website, hand book of Indian Economy, pink sheet of World Bank, etc. The global data on exports and imports were collected from various issues of *Rice Year Book*, USDA websites. To analyze trend, the compound growth rates for export of basmati rice and total rice in terms of quantity, value and unit value realizations were worked out for the both sub-periods and the overall period. The Instability Index was computed using Cuddy-Della Valle Index,  $I = CV * (1-R^2)^{0.5}$  (Singh and Byerlee, 1990), where, CV is the coefficient of variation and  $R^2$  is the corrected coefficient of determination of the log linear function.

The trade directions of export were analyzed using the first order Markov chain approach. Central to the Markov chain analysis is the estimation of transitional probability matrix  $P_{ij}$ . The elements  $P_{ij}$  of the matrix  $P$  indicates the probability that export will switch from the  $i^{\text{th}}$  country to the  $j^{\text{th}}$  country with passage of time (Dent, 1967; Lee *et al.*, 1970; Gillet, 1976). The diagonal elements of the matrix measure the probability that the export share of a country will be retained. Hence, the examination of the diagonal elements will indicate the preference of an importing country for a particular country's exports.

In the context of the present study, the structural changes were treated as a random process with selected importing countries. The average export to a particular country was considered to be a random variable which depended only on the past exports to that country, and can be denoted algebraically by Equation (1):

$$E_{jt} = \sum_{i=1}^r E_{it-t} P_{ij} + e \quad \dots(1)$$

where,  $E_{jt}$  denotes exports from India to the  $j^{\text{th}}$  country during the year  $t$ ,  $E_{it-t}$  denotes exports from India to the  $i^{\text{th}}$  country during the period  $t-1$ ,  $P_{ij}$  is the probability that exports will shift from the  $i^{\text{th}}$  country to the  $j^{\text{th}}$

country,  $e_{jt}$  is the error- term which is statistically independent of  $E_{it-1}$ ,  $t$  is the number of years considered for the analysis, and  $r$  is the number of importing countries. The transitional probabilities  $P_{ij}$  which can be arranged in a  $(c \times r)$  matrix have the following properties:

$$0 \leq P_{ij} \leq 1$$

$$\sum_{j=1}^r P_{ij} = 1 \text{ for all } i$$

The minimum absolute deviation (MAD) estimation procedure was employed to estimate the transitional probability, which minimizes the sum of absolute deviations (Fisher, 1967; Wagner, 1959). The conventional linear programming technique was used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation. The linear programming formulation is stated as:

$$\text{Min OP}^* + Ie$$

$$\text{Subject to, } XP^* + V = Y, \quad GP^* = 1, \quad P^*e \geq 0$$

where,

$0$  = Vector of zeroes,

$P^*$  = Vector in which probability  $P_{ij}$  is arranged,

$I$  = Appropriate dimensioned column vector of unit,

$e$  = Vector of absolute error ( $|U|$ ),

$Y$  = Vector of export to each country,

$X$  = Block diagonal matrix of lagged values of  $Y$ ,

$V$  = Vector of errors, and

$G$  = Grouping matrix to add the row elements of  $P$  arranged in  $P^*$  to unity.

After calculating the transitional probability matrix, the expected shares of export were calculated by Equation (2):

$$Y_{jt} = \sum_{i=1}^r y_{it-1} \times P_{ij} \quad (j=1,2,3,\dots, r) \quad \dots(2)$$

where,  $Y_{jt}$  is the predicted proportions of the  $j$ th country's share at time 't',  $Y_{t-1}$  is the observed proportion of the  $i$ th country's share at time 't-1', and  $P_{ij}$  is the estimated transitional probability matrix.

Thus, the expected export shares of each country during period 't' were obtained by multiplying the

export to these countries in the previous period (t-1) with the transitional probability matrix. Multiple regression was carried out, using ordinary least square (OLS) estimation procedure, in the statistical software E-Views.

### Determinants of Rice Exports

The factors affecting the export of rice were identified using log-log linear type of function:

$$\ln QT = b_0 + b_1 \ln EXP + b_2 \ln INT + b_3 \ln LGP + b_4 \ln DMC + b_5 \ln EXC + \mu \quad \dots(3)$$

where,  $QT$ = Total rice export from India ('000 t),  $EXP$  = Export prices ( $\text{₹}/t$ ),  $INT$ = International price (Thai 5%  $\text{\$/t}$ ),  $LGP$ = Lagged production of rice (million tonnes),  $DMC$  = Domestic consumption of rice ('000 tonnes),  $EXC$  = Exchange rate with dollar ( $\text{₹}/\text{\$}$ ),  $\mu$  = Error-term, and  $b_1, \dots, b_5$  are the regression coefficients and  $b_0$  is a constant.

The export prices and international prices for rice have been represented by their respective unit values. The monthly unit value of international price of rice was derived from the international price given by pink sheet of World Bank and was converted according to the fiscal year. The international price of rice is generally represented by the Thai rice, fob Bangkok. Due to non- availability of data on domestic consumption, it was computed as per expression (4):

$$\text{Domestic consumption} = \text{Production} + \text{Import} + \text{Stock change} - \text{Export} \quad \dots (4)$$

While dealing with time series data, the first step is to check whether the underlying time series is stationary or not. In a time series, the set of possible values at a particular point of time 't' is denoted by  $Y_t$ , and a time series is denoted by  $\{Y(t), t \in T\}$ . For stationary,  $Y_t$  must fulfill the following three characteristics:

- (i)  $E(Y_t) = \mu$  ( i.e. Mean is constant)
- (ii)  $\text{Var}(Y_t) = E(Y_t - \mu)^2 = \sigma^2$  (i.e. Variance is constant)
- (iii)  $\rho_k = E[(Y_t - \mu)(Y_{t+k} - \mu)]$  (i.e. Covariance is constant)

To check unit root in the data, augmented Dickey-Fuller (ADF) test was used adopting the regression Equation (5):

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^m a_i \Delta Y_{t-i} + \varepsilon_t \quad \dots(5)$$

where,  $\varepsilon_t$  is the white noise error,  $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ , where  $\Delta$  represents the first difference,  $m$  represents the number of lagged difference. These lags are included to make error- term white noise in above equation.  $\beta_1$  is the intercept and 't' represents time trend. The null hypothesis of ADF is  $H_0: \delta=0$ ; There is unit root, and the alternative hypothesis is  $H_1: \delta<0$ ; There is no unit root.

### CUSUM Test and CUSUM of Squares Test

The CUSUM test is based on the cumulative sum of the equation errors in regression. The E-Views represent graphically the cumulative sum of errors together with critical lines of 5 per cent. The equation parameters are not considered stable if the whole sum of recursive errors gets outside the two critical lines. CUSUM of Squares test is calculated similarly and interpreted as CUSUM test, with the difference that instead of recursive errors, we use recursive doubled errors.

## Results and Discussion

### Scenario of World Rice Trade

India ranks second in the production of rice after China, and accounted for 22.12 per cent of global rice production in 2012-13. The international rice market is characterized by high volatility with inelastic supply and demand. The global trade of rice is very low in comparison to its production. Only seven per cent rice production is traded and global rice exports are highly concentrated with the top five exporters accounting for 85 per cent of global net trade (Wailes and Chavez, 2012).

The global export of rice increased from 11.70 Mt in 1990 to 38.66 Mt in 2013. Although, China and India together accounts for half of the world rice production, Thailand was a major player till 2011 on rice export front. When the Government of India removed ban on export of non-basmati rice in September, 2011, India emerged as a leading exporter of rice with market share of 25.73 per cent, followed by Vietnam (19.38 %) and Thailand (17.45 %) in 2012. India's share in world export of rice has increased from 25.73 per cent in 2012 to 27.16 per cent in 2013. The other exporters such as

Vietnam and Thailand shared 17.59 per cent and 17.33 per cent, respectively in the world export of rice. The country-wise rice export and imports, given in Annexure I, show that India was a major exporter and China was the largest importer of rice in the world, followed by Nigeria and Iran during the year 2013.

The international rice market is quite thin and oligopolistic in nature. The entry of a big player like India can affect the world price significantly (Bhattacharyya and Pal, 2000). Protectionist measures taken by the Indian government during 2008 like ban on export of non-basmati rice and imposition of export tariff on basmati rice to increase domestic supply and lower domestic price reduced the rice supply in world markets. The period from mid-2007 to mid-2008 is referred to as world rice crisis period, which resulted in rise in world price of rice. Deliberated trade policy based on scientific facts and figures will retain India's market share in the global rice trade.

### India's Production and Exports of Rice during 1980-81 to 2012-13

India has been exporting substantial quantities of rice to various parts of the world since 1980-81. In 2012-13, the total production of rice was around 104 Mt, of which around 10.1 Mt was exported (Figure 1).

In 1980-81, the total quantity of rice (basmati + non-basmati) exported from India to different countries was 7.27 lakh tonnes, which rose to 49.1 lakh tonnes in 1995-96. After a lot of fluctuations, the export of total rice started increasing again from 2009-10 and it reached 101.5 lakh tonnes in 2012-13. There was not much earning from exports of rice during 1980s and 1990s but it increased gradually during the past five years. In terms of value, the rice export was of ₹ 223.86 crore in 1980-81 which increased to ₹ 1164.40 crore in 2008-09 ( Table 1). But in between 1980-81 and 2008-09, it showed a fluctuating pattern in export earnings which may be due to fluctuating domestic production, inconsistent export policies, frequent bans on export of non-basmati rice, currency devaluation, and volatility in the international market. In the year 2000-01, the earning from rice exports recorded the lowest value due to the fall in international prices of rice. The exports of rice gradually increased from 2008-09 and reached ₹ 33,858.19 crore in 2012-13. The

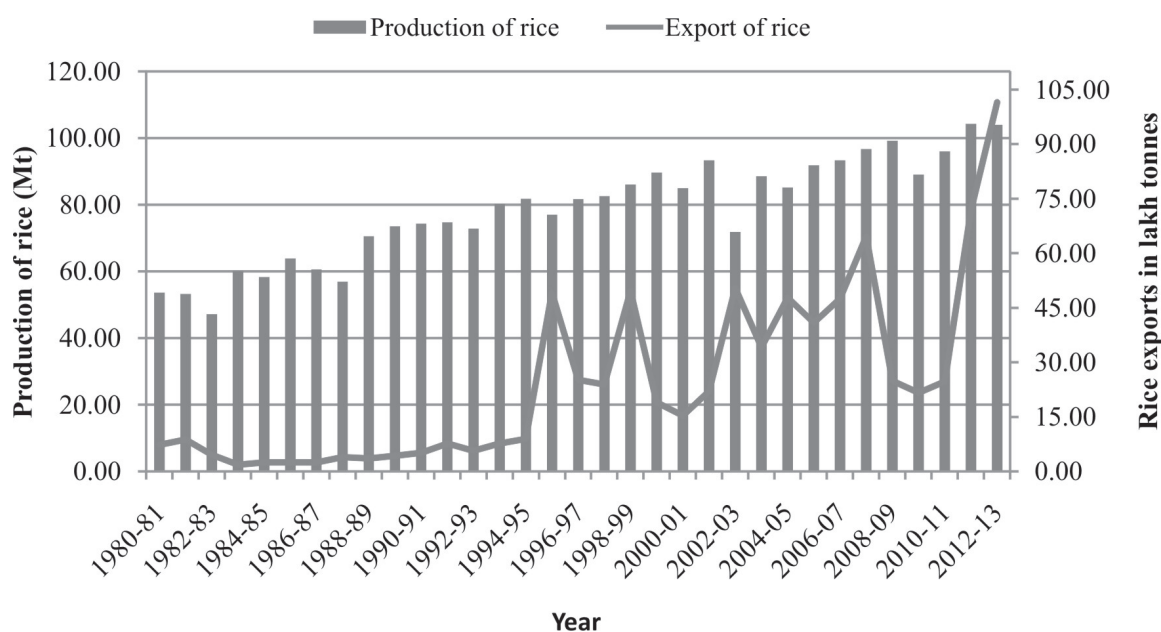


Figure 1. India's production and export of rice during 1980-81 to 2012-13

Table 1. Share of Indian rice export to total agricultural exports: 1980-81 to 2012-13

Year	Total rice export (Quantity, '000 tonnes)	Total rice export (value, in crore ₹)	Unit value (₹/tonne)	Agricultural export (in crore ₹)	Per cent share of total rice export in agricultural export
1980-81	727.35	223.86	3077.71	2375.70	9.42
1985-86	245.01	196.32	8012.61	3271.50	6.00
1990-91	505.11	459.63	9099.60	6012.76	7.64
1995-96	4914.01	4568.12	9296.11	20397.74	22.40
2000-01	1534.47	2943.39	19181.80	28657.37	10.27
2005-06	4088.16	6221.25	15217.73	49216.96	12.64
2006-07	4747.92	7035.88	14818.87	62411.42	11.27
2007-08	6469.28	11754.39	18169.55	79039.72	14.87
2008-09	2488.29	11164.4	44867.76	85951.67	12.99
2009-10	2156.32	11254.42	52192.72	89341.50	12.60
2010-11	2471.35	11585.92	46880.94	117483.60	9.86
2011-12	7175.89	24108.74	33596.86	187609.30	12.85
2012-13	10147.89	33858.19	33364.77	230141.13	14.71

Source: GoI (2013a); GoI (2013b); indiastat.com; Bansil (1992)

percentage share of total rice export in total agricultural export had increased from 9.42 per cent in 1980-81 to 12.60 per cent in 2009-10, but decreased to 9.86 per cent in 2010-11. The decrease in percentage terms was due to higher export of agricultural products, other than rice. In the year 2012-13, the share of rice export in total agricultural export was 14.71 per cent.

### Growth of Rice Export from India

The annual compound growth rates (ACGR) for export of basmati rice and total rice in terms of quantity, value and unit value during the period 1980-81 to 2012-13 are presented in Table 2. During period 1980-1994, the quantity of rice export recorded a positive but non-

**Table 2. Compound growth rates of quantity, value and unit value of basmati rice and total rice export from India, 1980-81 to 2012-13**

(in per cent)

Period	Basmati rice			Total rice (basmati and non-basmati)		
	Quantity	Value	Unit value	Quantity	Value	Unit value
I (1980-81 to 1994-95)	0.22 <sup>ns</sup> (2.06)	13.74 <sup>**</sup> (1.93)	13.48 <sup>**</sup> (0.84)	4.07 <sup>ns</sup> (3.17)	14.96 <sup>**</sup> (2.84)	10.46 <sup>**</sup> (1.05)
II (1995-96 to 2012-13)	12.11 <sup>**</sup> (0.93)	17.78 <sup>**</sup> (1.72)	5.06 <sup>**</sup> (0.99)	3.72 <sup>ns</sup> (2.34)	12.34 <sup>**</sup> (1.85)	8.31 <sup>**</sup> (1.65)
Overall (1980-81 to 2012-13)	7.55 <sup>**</sup> (0.73)	15.87 <sup>**</sup> (0.69)	7.74 <sup>**</sup> (0.49)	10.87 <sup>**</sup> (1.25)	17.74 <sup>**</sup> (0.94)	6.20 <sup>**</sup> (0.60)

*Note:* Figures within the parentheses indicate standard error in respective values

\*\* and \* denote significance at 1 per cent, and 5 per cent levels, respectively.

significant compound growth due to lower domestic production and restriction of minimum export price till 1991. In contrast, the export value and unit value registered a positive growth rate of 13.74 per cent and 13.48 per cent per annum. The export of basmati rice in quantity grew at the rate of 12.11 per cent per annum during the period 1995-2012. The increase in quantity of rice export was due to a strong demand for basmati rice in the international markets and comfortable production in the country. The value of export of basmati rice also increased at a compound growth rate of 17.74 per cent per annum. The export performance of basmati rice in terms of quantity and value was better in period II.

During the overall period 1980-2012, the total rice export in terms of quantity, value, and unit value grew at a positive and significant growth rate of 10.87 per cent, 17.74 per cent, and 6.20 per cent per annum, respectively, which may be due to higher demand of basmati rice in the international market, consistent policies for export of basmati rice, higher international price, and increased domestic production making comfortable stock of rice in the central pool (Gangwar and Rai, 1995; Shende *et al.*, 1998).

### Instability in Rice Export from India

The higher export instability in terms of quantity of rice during period I may be due to more variability in quantum exported than during period II. The consistent export policy, international demand for and

domestic production of basmati rice during period II may be the other factors. Similarly, variability in quantum of export and unit price were the dominant factors for the variability in export earnings. The export earnings showed a higher stability during period I than period II. The unit value realization exhibited more instability during period II than period I and overall period, may be due to the impact of devaluation of Indian rupee after 1991.

The instability index of basmati rice and total rice exports in terms of quantity, value and unit value is presented in Table 3. The quantity exported registered instability of 46.23 per cent, 53.23 per cent and 50.68 per cent during period I, period II and overall period. The export value recorded instability of 41.22 per cent, 43.53 per cent, and 37.40 per cent during period I, period II and overall period, respectively. The quantity exported has been more stability during period I than period II and overall period. However, the export value was found more unstable during period II than period I and overall period, while unit value realization was more stable during period I as compared to period II and overall period.

The variability in rice exports was due to the changes in the composition of rice varieties. The export instability of rice in terms of quantity as well as value may be due to increasing domestic and international rice demand, volatility in world prices, changes in export policy of India and political situation in international markets.

**Table 3. Instability index of rice export from India: 1980-81 to 2012-13**

Period	Basmati rice		Total rice	
	CV(%)	Instability index	CV(%)	Instability index
	<b>Quantity</b>			
I (1980-81 to 1994-95)	33.16	33.16	46.23	46.23
II (1995-96 to 2012-13)	69.77	19.49	53.23	53.23
Overall (1980-81 to 2012-13)	95.91	43.37	97.71	50.68
	<b>Value</b>			
I (1980-81 to 1994-95)	71.92	34.49	76.41	41.22
II (1995-96 to 2012-13)	101.98	34.43	88.40	43.53
Overall (1980-81 to 2012-13)	152.98	33.52	141.36	37.40
	<b>Unit Value</b>			
I (1980-81 to 1994-95)	55.09	11.42	42.61	13.87
II (1995-96 to 2012-13)	35.60	21.60	60.52	36.56
Overall (1980-81 to 2012-13)	63.00	20.41	74.91	34.57

### Major Export Destinations of Indian Basmati Rice

The major export destinations of Indian rice vary according to variety of rice. Basmati rice is mainly exported to Iran, Saudi Arabia, Kuwait, Iran, UK, USA, UAE and Iraq. The major destinations of Indian basmati rice and their shares illustrated in Table 4 show that nearly 75 per cent of the total export of basmati rice from India was concentrated in countries like Saudi Arabia, UK, Kuwait, UAE, Iran and Iraq. Among the major importing countries, Iran accounted for the highest share (33.3%) in total export of basmati rice from India, followed by Saudi Arabia (18.85%), UAE (6.76%), Kuwait (5.46%) and Iraq (5.55%) in the year 2012-13. Since 2008, when a new rice variety, 'Pusa 1121' was notified as basmati rice, Iran has been a major buyer of this rice variety (Sidhu *et al.*, 2014). The preference of Iran for this variety of basmati rice was due to its lower cost vis-à-vis of other varieties making it affordable for every class of consumer in Iran.

Rice is not produced in Saudi Arabia and the country imports a substantial quantity of basmati rice from India to meet its strong consumer demand. Also, the Government of Saudi Arabia does not impose any tariff on rice import providing Saudi traders the opportunity to re-export the imported rice to the nearby countries. There has been a shift in export destinations of Indian basmati rice over the period of six years (2007-2012).

### Trade Directions of Basmati Rice Export from India

The directions of trade of basmati rice export to different destinations was examined by estimating the transitional probability matrix using Markov chain analysis and the values of transitional probability matrix (TPM) are presented in Table 5. There are six major countries that imported Indian basmati rice in large quantities and rest of the countries were pooled under 'others' category. The diagonal elements in the TPM provide information on the probability of retention of trade, while row elements indicate the probability of loss in trade on account of competing countries. The column elements indicate the probability of gain in trade from the competing countries.

A close look at Table 5 indicated that UAE was the most stable market among the major importers of Indian basmati rice, as exhibited by the highest probability of retention at 0.8226, which means that UAE had retained its original export share of 82.26 per cent during the period 2000-01 to 2012-13. Iran and Saudi Arabia imported larger quantities of basmati rice than UAE; but UAE was the most stable market. Saudi Arabia had the probability of retention 0.7517, and it retained its original export share of 75 per cent. Similarly, Iran had retained its original export share of 72 per cent. This implies that Saudi Arabia and Iran were also the stable importers of Indian basmati rice. Kuwait, UK and other countries have shown lower

**Table 4. Share of basmati rice exported from India to major countries: 2007-08 to 2012-13**

(Value in crore ₹)

Year	Saudi Arabia	Kuwait	UK	USA	UAE	Iran	Iraq	Others	Total
2007-08	2038.35 (46.92)	401.68 (9.25)	291.08 (6.70)	142.10 (3.27)	689.83 (15.88)	20.33 (0.47)	16.81 (0.39)	744.39 (17.13)	4344.57 (100.00)
2008-09	3102.81 (32.74)	733.94 (7.74)	431.04 (4.55)	272.60 (2.88)	2786.20 (29.40)	980.76 (10.35)	34.48 (0.36)	1135.22 (11.98)	9477.05 (100.00)
2009-10	3295.47 (30.26)	1030.14 (9.46)	195.89 (1.80)	153.50 (1.41)	3094.65 (28.42)	2053.09 (18.85)	35.90 (0.33)	1030.46 (9.46)	10889.10 (100.00)
2010-11	3132.94 (27.59)	1091.64 (9.61)	351.77 (3.10)	250.32 (2.20)	2839.76 (25.01)	2033.96 (17.91)	165.31 (1.46)	1488.93 (13.11)	11354.63 (100.00)
2011-12	3380.88 (21.88)	1362.92 (8.82)	629.46 (4.07)	503.88 (3.26)	3432.79 (22.22)	2843.21 (18.40)	672.87 (4.36)	2623.60 (16.98)	15449.61 (100.00)
2012-13	3659.08 (18.85)	1059.68 (5.46)	849.98 (4.38)	561.69 (2.89)	1311.20 (6.76)	6463.50 (33.30)	1076.67 (5.55)	4427.58 (22.81)	19409.38 (100.00)

Note: Figures within the parentheses indicate per cent share of each importing country.

Source: GoI (2013b)

**Table 5. Transitional probability matrix of Indian basmati rice export, 2000-01 to 2012-13**

Country	Saudi Arabia	Kuwait	UK	UAE	Iran	Iraq	Others
Saudi Arabia	<b>0.7517</b>	0.1055	0.0498	0.0000	0.0000	0.0000	0.0930
Kuwait	0.0000	<b>0.3831</b>	0.0015	0.1156	0.0000	0.0018	0.4980
UK	0.5327	0.0000	<b>0.4673</b>	0.0000	0.0000	0.0000	0.0000
UAE	0.0000	0.0171	0.0000	<b>0.8226</b>	0.1603	0.0000	0.0000
Iran	0.0000	0.1005	0.0000	0.0000	<b>0.7209</b>	0.0766	0.1021
Iraq	0.0000	0.0000	0.0000	0.0000	1.0000	<b>0.0000</b>	0.0000
Others	0.3570	0.0000	0.0680	0.0350	0.0000	0.0000	<b>0.5400</b>

probability of retention, viz. 0.3831, 0.4673 and 0.5400, respectively. On the contrary, Iraq has shown 'zero' probability of retention, indicating that Iraq was an unstable importer of Indian Basmati rice. The major gainer among the importers of Indian basmati rice over the study period was Iran which had a transfer probability of 1.000 from Iraq and 0.1603 from UAE. In a similar manner, Saudi Arabia gained 53.27 per cent market share from UK and 35.70 per cent from others.

In addition to having high probability of retention, UAE was also likely to gain 11.56 per cent market share from Kuwait. On the other hand, UAE was likely to lose 16.03 per cent market share to Iran and 1.71 per cent to Kuwait. Iraq, which is an unstable market

for Indian basmati rice, is likely to gain 7.66 per cent market share from Iran.

#### Actual and Estimated Shares of Indian Basmati Rice Export to Importing Countries

The actual and estimated shares of basmati rice exported from India to different countries (in percentage term) were shown in Table 6. A comparison of this proportion during the study period revealed that the observed proportions of export shares were consistent with the estimated shares of export, which were derived from the Markov chain process. However, differences have been observed in some years, which could be due to limitation of the model that the present estimates depend only on the previous year



**Table 6. Actual and estimated shares of Indian basmati rice export from India, 2000-01 to 2012-13** (in crore ₹)

Year	Saudi Arabia		Kuwait		UK		UAE		Iran		Iraq		Others		Total	
	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated
2000-01	1098.78 (50.73)	-	227.35 (10.50)	-	303.70 (14.02)	-	90.53 (4.18)	-	0.00 (0.00)	-	0.00 (0.00)	-	445.58 (20.57)	-	2165.94 (100.00)	-
2001-02	1058.81 (57.49)	1146.86 (52.95)	196.11 (10.65)	204.55 (9.44)	193.26 (10.49)	227.23 (10.49)	49.97 (2.71)	116.35 (5.37)	12.32 (0.67)	14.51 (0.67)	0.00 (0.00)	0.40 (0.02)	331.29 (17.99)	456.04 (21.06)	1841.76 (100.00)	-
2002-03	1052.21 (51.03)	1017.18 (55.23)	172.79 (8.38)	188.91 (10.26)	205.16 (9.95)	165.81 (9.00)	84.33 (4.09)	75.37 (4.09)	0.11 (0.01)	16.89 (0.92)	1.51 (0.07)	1.29 (0.07)	546.00 (26.48)	376.31 (20.43)	2062.11 (100.00)	-
2003-04	1067.96 (53.58)	1095.22 (53.11)	137.69 (6.91)	178.64 (8.66)	219.39 (11.01)	185.61 (9.00)	104.88 (5.26)	108.46 (5.26)	0.26 (0.01)	15.11 (0.73)	0.00 (0.00)	0.31 (0.02)	462.85 (23.22)	478.77 (23.22)	1993.03 (100.00)	-
2004-05	1587.43 (56.22)	1084.95 (54.44)	237.00 (8.39)	167.22 (8.39)	265.40 (9.40)	187.33 (9.40)	143.97 (5.10)	118.39 (5.94)	2.44 (0.09)	17.00 (0.85)	0.05 (0.00)	0.26 (0.01)	587.56 (20.81)	417.87 (20.97)	2823.85 (100.00)	-
2005-06	1664.42 (54.70)	1544.49 (54.69)	237.93 (7.82)	260.95 (9.24)	222.66 (7.32)	243.31 (8.62)	159.57 (5.24)	166.39 (5.89)	13.98 (0.46)	24.89 (0.88)	0.98 (0.03)	0.60 (0.02)	743.52 (24.43)	583.22 (20.65)	3043.06 (100.00)	-
2006-07	1240.96 (44.43)	1635.28 (53.74)	306.87 (10.99)	270.85 (8.90)	196.23 (7.03)	237.77 (7.81)	305.21 (10.93)	184.79 (6.07)	46.17 (1.65)	36.63 (1.20)	0.65 (0.02)	1.49 (0.05)	696.71 (24.95)	676.24 (22.22)	2792.80 (100.00)	-
2007-08	2038.35 (46.92)	1286.16 (46.05)	401.68 (9.25)	258.33 (9.25)	291.08 (6.70)	201.27 (7.21)	689.83 (15.88)	310.92 (11.13)	20.33 (0.47)	82.85 (2.97)	16.81 (0.39)	4.07 (0.15)	886.49 (20.40)	649.18 (23.24)	4344.57 (100.00)	-
2008-09	3102.81 (32.74)	2003.87 (46.12)	733.94 (7.74)	382.75 (8.81)	431.04 (4.55)	298.32 (6.87)	2786.20 (29.40)	644.91 (14.84)	980.76 (10.35)	142.04 (3.27)	34.48 (0.36)	2.26 (0.05)	1407.82 (14.86)	870.42 (20.03)	9477.05 (100.00)	-
2009-10	3295.47 (30.26)	3064.76 (32.34)	1030.14 (9.46)	754.74 (7.96)	195.89 (1.80)	452.63 (4.78)	3094.65 (28.42)	2426.01 (25.60)	2053.09 (18.85)	1188.07 (12.54)	35.90 (0.33)	76.39 (0.81)	1183.96 (10.87)	1514.46 (15.98)	10889.10 (100.00)	-
2010-11	3132.94 (27.59)	3004.40 (27.59)	1091.64 (9.61)	1001.58 (9.20)	351.77 (3.10)	337.55 (3.10)	2839.76 (25.01)	2706.14 (24.85)	2033.96 (17.91)	2011.93 (18.48)	165.31 (1.46)	159.02 (1.46)	1739.25 (15.32)	1668.49 (15.32)	11354.63 (100.00)	-
2011-12	3380.88 (21.88)	3163.51 (27.86)	1362.92 (8.82)	1001.71 (8.82)	629.46 (4.07)	440.16 (3.88)	3432.79 (22.22)	2523.02 (22.22)	2843.21 (18.40)	2086.70 (18.38)	672.87 (4.36)	157.66 (1.39)	3127.48 (20.24)	1981.87 (17.45)	15449.61 (100.00)	-
2012-13	3659.08 (18.85)	3993.47 (25.85)	1059.68 (5.46)	1223.27 (7.92)	849.98 (4.38)	677.06 (4.38)	1311.20 (6.76)	3090.79 (20.01)	6463.50 (33.30)	3272.67 (21.18)	1076.67 (5.55)	220.10 (1.42)	4989.27 (25.71)	2972.24 (19.24)	19409.38 (100.00)	-

Note: Figures within the parentheses indicate percentage to total export of basmati rice.

**Table 7. Projected exports of Indian basmati rice to major importing countries: 2013-14 to 2017-18**

(Value in crore ₹)

Year	Saudi Arabia	Kuwait	UK	UAE	Iran	Iraq	Other countries
2013-14	4984.81 (25.68)	1463.86 (7.54)	920.09 (4.74)	1375.72 (7.09)	5946.15 (30.64)	496.79 (2.56)	4221.97 (21.75)
2014-15	5744.79 (29.60)	1707.68 (8.80)	967.24 (4.98)	1448.66 (7.46)	5003.67 (25.78)	457.88 (2.36)	4079.46 (21.02)
2015-16	6290.35 (32.41)	1787.80 (9.21)	1017.77 (5.24)	1531.84 (7.89)	4297.05 (22.14)	386.14 (1.99)	4098.43 (21.12)
2016-17	6734.15 (34.70)	1806.46 (9.31)	1069.93 (5.51)	1610.20 (8.30)	3729.27 (19.21)	332.17 (1.71)	4127.20 (21.26)
2017-18	7105.83 (36.61)	1804.72 (9.30)	1118.37 (5.76)	1677.81 (8.64)	3278.57 (16.89)	288.73 (1.49)	4135.36 (21.30)

Note: Figures within the parentheses indicate per cent to respective values

Source: GoI (2013b)

observations and the exports also depend on sudden policy changes, leading to abrupt increase or decrease in exports to a country.

### Projection of Indian Basmati Rice Export to Major Importing Countries

Table 7 shows the export of Indian basmati rice to different countries which was computed using the transitional probability matrix. It was projected that during 2013-14, the major markets for Indian basmati rice would be Iran (30.64 %), Saudi Arabia (25.68 %) and others (21.75 %). The projected exports to Saudi Arabia have exhibited an increasing trend in both absolute value and percentage to total export. The reason behind increasing projected exports to Saudi Arabia is that it is likely to gain 53.27 per cent market share from UK and 35.70 per cent from 'others'. Similarly, the projected value of basmati export to Kuwait has shown an increasing trend. The projected market share is likely to increase marginally from 7.54 per cent to 9.30 per cent from 2013-14 to 2017-18. In the case of Iran and Iraq, the projected value has shown a decreasing trend, in both absolute and relative to total export from India. The reason for showing a decreasing trend by Iraq was that it had totally lost its market share to Iran, although it had gained small market shares from Iran and Kuwait. The projected exports to Iran have shown a decline from ₹ 5946 crore in 2013-14 to ₹ 3278 crore in 2017-18, i.e. 30.64 per cent to 16.89 per cent during the foresaid period.

### Determinants of Rice Export from India

Difference in comparative advantage, geographical and political proximity and degree of trade barriers are the major determinants of destinations for exports of any food commodity (Kumar *et al.*, 2008). The factors determining rice export from India were studied by using multiple regression of log-log form where quantity exported was regressed against export price, exchange rate, international price, domestic consumption and lagged production. The data used for regression analysis were for 33 years (1980-81 to 2012-13). Since all variables are stationary at I (1), as shown in Annexure II, OLS estimation was employed and coefficients are given in Table 8.

**Table 8. Estimates of determinants of rice export from India**

Variable	Coefficient	Standard error
Constant	0.15**	0.06
D (Export price)	-2.00***	0.21
D (Exchange rate)	1.08 <sup>ns</sup>	0.64
D (International price)	1.20***	0.25
D (Domestic consumption)	-0.95 <sup>ns</sup>	0.64
D (Lagged production)	0.53 <sup>ns</sup>	0.64

R-squared=0.8153, Adjusted R-squared=0.7798, D-W=2.44, F-statistics=22.958, Prob(F-statistics)=0.0000

Note: D=Difference; \*\* and \*\*\* indicate significance at 5 per cent and 1 per cent levels, respectively. ns= Non-significant

**Table 9. Estimates of determinants of rice export from India by model I and model II**

Dependent variable: D (Quantity)	Model I		Model II	
	Coefficient	Std. error	Coefficient	Std. error
Constant	0.16**	0.06	0.13**	0.06
D (Export price)	-2.02***	0.20	-1.98***	0.21
D (Exchange rate)	1.21*	0.62	1.02 <sup>ns</sup>	0.66
D (International price)	1.23***	0.24	1.15***	0.25
D (Domestic consumption)	-1.30**	0.47	-	-
D (Lagged production)	-	-	1.16**	0.49
	R-squared=0.8104		R-squared=0.7994	
	Adjusted R-squared=0.7823		Adjusted R-squared=0.7697	
	D-W=2.37		D-W=2.55	
	F-statistics=28.854		F-statistics=26.9033	
			Prob (F-statistics) = 0.0000	

Note: D=Difference ; \*, \*\*, and \*\*\* indicate level of significance at 10 per cent, 5 per cent and 1 per cent level respectively.

Table 8 shows that export price and international price are significant at 1 per cent level of significance. However, other three variables, viz. exchange rate, domestic production, and lagged production, are non-significant. So, domestic consumption and lagged production were treated separately and two models were formulated.

In model I, quantity exported was the dependent variable and export price, exchange rate, international price and domestic consumption were independent variables. In model II, export price, exchange rate, international price and lagged production were independent variables and the results are shown in Table 9.

#### CUSUM Test and CUSUM of Square Test

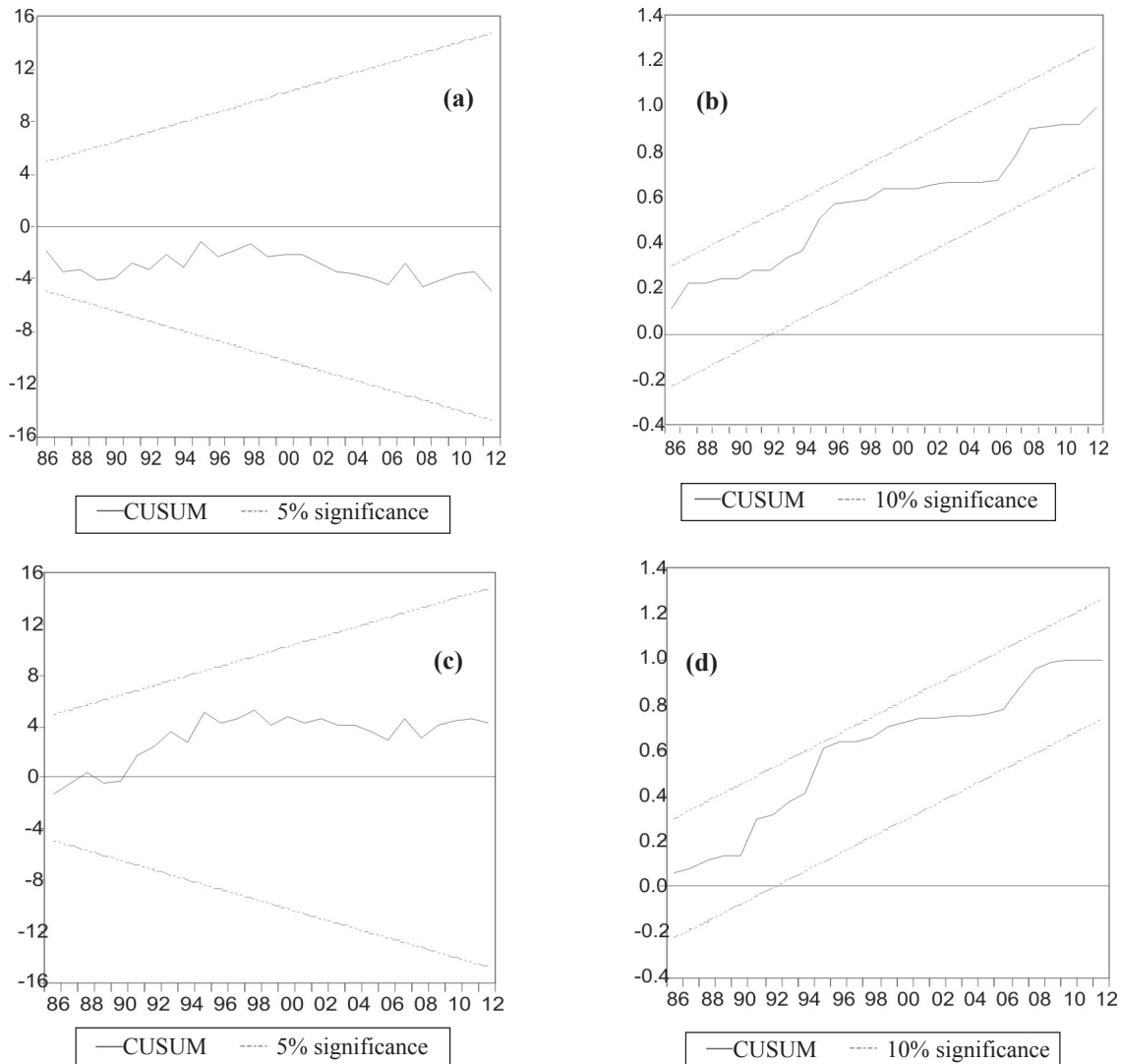
The CUSUM test is based on the cumulative sum of the recursive residuals. The test finds parameter instability, if the cumulative sum goes outside the area between the two critical lines. Both these tests have suggested stability of parameters, as revealed by Figure 2 (a-d).

Finally, both the functions were tested by various econometric tests to achieve best, linear and unbiased coefficient. The results of various tests are depicted in Table 10.

Both the models have shown that export of rice from India is highly price sensitive. The negative and significant coefficient of Indian export price indicates

that it has a negative impact on exports of rice. In order to grab international markets, Indian export price has to be competitive. Increase in export price means that exports become expensive in the world market. Other empirical studies drawing similar results were of Abolagba *et al.* (2010), Bilal and Rizvi, (2013) and Shende *et al.* (1999). However, Kumar *et al.* (2008) have found a positive relationship between Indian export price on export of cucumber and gherkin products from India, but the result was non-significant, indicating that export price has not played any significant role in its export.

The international price of rice is significant with high positive elasticity, which indicates that international price has a positive impact on exports of rice from India. This may be due to the fact that when price of Thai rice increases, the importer shifts towards Indian rice due to price advantage, indicating the role of government to set price just below Thai 5%, in such a way that price becomes competitive in the international markets. The exchange rate has a positive impact on rice export from India and is significant at 10 per cent level (model I). When the exchange rate of rupee with dollar increases (devaluation of rupee occurs), then exports from India become cheaper for the importing countries, and hence export increases. Thus, a positive impact of exchange rate is assumed on rice exports from India. Haleem *et al.* (2005), Kumar *et al.* (2008) and Shende *et al.* (1999) have also revealed the positive and significant effect of exchange rate.



**Figure 2. CUSUM test and CUSUM of square test, (a) CUSUM 5% significance model I, (b) CUSUM 10% significance Model II, (c) CUSUM 5% significance, and (d) CUSUM 10% significance**

The domestic consumption of rice shows a negative and significant effect on its export from India. When domestic consumption increases, smaller surpluses are available for exports, and ultimately its export decreases. Abolagba *et al.* (2010) and Bilal and Rizvi (2013) have endorsed the same view. But, in recent years, a drastic change has been seen in the food habits of people. The consumption of cereals is decreasing in India because of increasing preferences for processed foods, vegetables and high protein food items (Chopra *et al.*, 2014). The coefficient of lagged production has been found positive and statistically significant at 5 per cent level of significance. This means that rice

export is more influenced by the previous year's production. The positive and significant influence of lagged production has been seen not only on export of rice (Gangwar and Rai, 1995 ; Sekhar, 2003) but also on export of onion, banana and black pepper ( Hema and Kumar, 2007), indicating increase in export earnings with increase in production.

## Conclusions

Rice contributes substantially to the national income through exports of its basmati as well as non-basmati rice varieties. The study has revealed that Indian rice exports had a fabulous performance during

**Table 10. Econometric test for assumptions of Model I and Model II**

Hypothesis	Name of test	F-statistics	Observed R-squared R-square	Prob. chi-square for observed	Decision
<b>Model I</b>					
H <sub>0</sub> = The variance of error-terms are constant H <sub>1</sub> = The variance of error terms are not constant	Breusch-Pagan-Godfrey	0.3733 <sup>ns</sup>	1.677	0.7948	The variance of error-terms are constant
H <sub>0</sub> = There is no serial correlation H <sub>1</sub> = There is a serial correlation	Breusch-Godfrey Serial Correlation LM Test	1.538 <sup>ns</sup>	3.5066	0.1732	No serial correlation
H <sub>0</sub> = The error-term are normally distributed. H <sub>1</sub> = The error-terms are not normally distributed.	Jarque-Bera		1.5847 <sup>ns</sup>	0.457	Error-terms are normally distributed
<b>Model II</b>					
H <sub>0</sub> = The variance of error-terms are constant H <sub>1</sub> = The variance of error-terms are not constant	Breusch-Pagan-Godfrey	0.2439 <sup>ns</sup>	1.116	0.8917	The variance of error-terms is constant
H <sub>0</sub> = There is no serial correlation H <sub>1</sub> = There is a serial correlation	Breusch-Godfrey Serial Correlation LM Test	1.657 <sup>ns</sup>	3.746	0.1536	No serial correlation
H <sub>0</sub> = The error-term are normally distributed. H <sub>1</sub> = The error-terms are not normally distributed.	Jarque-Bera		1.038 <sup>ns</sup>	0.595	Error-terms are normally distributed

Note: NS=Non-significant

the study period 1980-81 to 2012-13. It has registered positive growth rates in terms of quantity, value and unit value for basmati rice and total rice. The instability index has been found higher for export quantity (43.37 %) of basmati rice than its value (33.52 %) and unit value (20.41 %). India faces competition in export of non-basmati rice from Thailand and Vietnam in international market due to better quality of rice from these countries, and from Pakistan for basmati rice. The study has also revealed that export of rice from India is highly price sensitive. Export price, international price, lagged production, domestic consumption, and exchange rate are the major determinants of rice export from India. In order to sustain in the international market, Indian export price needs to be competitive besides meeting quality and sanitary and phyto-sanitary standards.

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**Annexure 1. World rice trade showing major exporters and importers: 1990-2013**

('000 tonnes)

Country	1990	1995	2000	2005	2010	2011	2012	2013
<b>Exporters</b>								
India	0.51 (4.36)	4.18 (20.10)	1.45 (6.37)	4.69 (16.20)	2.23 (7.01)	4.64 (12.70)	10.25 (25.73)	10.50 (27.16)
Vietnam	1.67 (14.27)	2.32 (11.15)	3.37 (14.79)	5.17 (17.86)	6.73 (21.17)	7.00 (19.16)	7.72 (19.38)	6.80 (17.59)
Thailand	3.94 (33.68)	5.89 (28.32)	6.55 (28.75)	7.27 (25.11)	9.05 (28.47)	10.65 (29.15)	6.95 (17.45)	6.70 (17.33)
Pakistan	0.90 (7.69)	1.59 (7.64)	2.03 (8.91)	3.03 (10.47)	4.00 (12.58)	3.41 (9.33)	3.50 (8.79)	3.50 (9.05)
USA	2.42 (20.68)	2.99 (14.38)	2.85 (12.51)	3.86 (13.33)	3.87 (12.17)	3.25 (8.89)	3.33 (8.36)	3.27 (8.46)
Others	2.25 (19.23)	3.83 (18.41)	6.54 (28.71)	4.92 (16.99)	5.91 (18.59)	7.59 (20.77)	8.09 (20.31)	7.89 (20.41)
World Total	11.70 (100.00)	20.80 (100.00)	22.78 (100.00)	28.95 (100.00)	31.79 (100.00)	36.54 (100.00)	39.83 (100.00)	38.66 (100.00)
<b>Importers</b>								
China	0.06 (0.51)	1.96 (9.42)	0.28 (1.23)	0.61 (2.11)	0.37 (1.16)	0.58 (1.59)	2.90 (7.28)	3.20 (8.28)
Nigeria	0.22 (1.88)	0.45 (2.16)	1.25 (5.49)	1.78 (6.15)	2.00 (6.29)	2.55 (6.98)	3.40 (8.54)	2.60 (6.73)
Iran	0.87 (7.44)	1.58 (7.60)	1.10 (4.83)	1.20 (4.15)	1.52 (4.78)	1.87 (5.12)	1.75 (4.39)	2.15 (5.56)
Phillipines	0.54 (4.62)	0.28 (1.35)	0.90 (3.95)	1.89 (6.53)	2.40 (7.55)	1.20 (3.28)	1.50 (3.77)	1.10 (2.85)
Indonesia	0.08 (0.68)	3.01 (14.47)	1.50 (6.58)	0.50 (1.73)	1.15 (3.62)	3.10 (8.48)	1.96 (4.92)	0.65 (1.68)
Others	9.94 (84.96)	13.52 (65.00)	17.75 (77.92)	22.98 (79.38)	24.35 (76.60)	27.25 (74.58)	28.32 (71.10)	28.96 (74.91)
World Total	11.70 (100.00)	20.80 (100.00)	22.78 (100.00)	28.95 (100.00)	31.79 (100.00)	36.54 (100.00)	39.83 (100.00)	38.66 (100.00)

*Note:* Figures within the parentheses are percentage of the total.

*Source:* USDA (2013)

**Annexure II. Stationary (unit root) test for variables**

Variable	Linear graph	At level			At first difference			Decision
		Test statistic	Critical values		Test statistic	Critical values		
			(99%)	(95%)		(99%)	(95%)	
QT	Intercept	-0.91	-3.65	-2.95	-6.20**	-3.66	-2.96	I(1) at 1%
	Trend and intercept	-3.21	-4.28	-3.56	-6.24**	-4.28	-3.56	I(1) at 1%
EXC	Intercept	-2.44	-3.65	-2.96	-3.94**	-3.66	-2.96	I(1) at 1%
	Trend and intercept	-0.93	-4.27	-3.56	-4.20**	-4.28	-3.56	I(1) at 1%
EXP	Intercept	-1.80	-3.66	-2.96	-4.91**	-3.67	-2.96	I(1) at 1%
	Trend and intercept	-3.36	-4.28	-3.56	-4.83**	-4.29	-3.57	I(1) at 1%
INT	Intercept	-1.27	-3.65	-2.96	-4.75**	-3.66	-2.96	I(1) at 1%
	Trend and intercept	-2.01	-4.27	-3.56	-5.12**	-4.28	-3.56	I(1) at 1%
DC	Intercept	-3.91**	-3.67	-2.96	-6.85**	-3.67	-2.96	I(1) at 1%
	Trend and intercept	-3.30	-4.27	-3.56	-5.12**	-4.29	-3.57	I(1) at 1%
LGP	Intercept	-1.53	-3.66	-2.96	-9.92**	-3.66	-2.96	I(1) at 1%
	Trend and intercept	-4.85**	-4.27	-3.55	-9.81**	4.28	3.56	I(1) at 1%

*Notes:* Critical values have been taken from Mackinnon (1996)

All variables are in log form

Optimum lag selection is 8 on basis of Schwartz Information Criterion (SIC) default set by E-Views.

\*\* denotes significance at 1 per cent level.