Trade liberalization and its impact on tea production of India

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ABSTRACT

Tea (Camellia sinensis) serves as the most important and popular drink for two-thirds of world's population due to its aroma and health benefits. India is the largest tea producing country in the world and tea contributes 1% of the GDP of the country. Introduction of trade liberalization has influenced the marketing structures, prices received by the growers and other market players. After 2006 India lost 1st position, now China is leading country in tea production. In addition, percentage share of India's tea export in total world has declined drastically to 12.10% in 2009-10 from 21.91% in 1981-90. Indian tea industry is facing twine problems of reduced productivity as well loosing share in the world export market. To know the root cause of the problems in tea production during and after to trade liberalization, this paper aimed to study the instability in tea production of India during pre and post trade liberalization period. Using the data on tea production and acreage for four major tea growing states of India for the period 1951-2011instability in tea production was studied. To study the instability, four instability index were used i.e. Coefficient of variation (CV), Instability index given by Cuddy and Della (1978), Coppock's and Chand and Raju (2008) are employed. Study reveals that area under tea in West Bengal and Kerala has shown high instability during pre reform period than post reform period while rest of the states and whole India have shown higher instability during the post reform period. Instability in tea productivity in India was lower during post reform period which indirectly suggested no growth was observed during this period. Hence it can be suggest that changed WTO policies have negative impact on productivity of tea in India.

Keywords : *Instability, tea production, trade liberalization*

1. INTRODUCTION

Tea (*Camellia sinensis*) serves as the most important and popular drink for two-thirds of world's population not only because of its attractive aroma and taste, but also because of its many heath benefits (Wang *et al.* 2010). Tea belongs to genus *Camellia,* includes some 82 species which are mostly indigenous to highlands of south-east India (Sealy, 1958). Majority of the tea producing countries are located in the Asian continent where, China, India, Sri Lanka are the major producers. Amongst tea producing countries, the principal producers are China, India, Sri Lanka, Kenya and Indonesia. These five countries account for 77% of world production and 80% global exports. Globally, tea is cultivated over 3.7 million hectares of land with an annual production of 4.07 million tones and productivity of 1100 kilogram per hectare (Anonymous, 2010). Tea has occupied an important place in India's economy for the last several decades. India is the largest tea producing country in the world and tea contributes 1% of the GDP of the country (Gupta and Dey, 2010). In all aspects of tea production, consumption and export, India has emerged to be the world leader, mainly because it accounts for 31% of global production. Major tea producing states in the country are Assam, West Bengal, Tamil Nadu and Kerala. Assam and West Bengal together accounted by 75% of the total tea produced in India (Jain, 2011)

Choudhury (2006) reported that the production of tea in India has shown a declining trend in the recent years of the current decade. The production decreased from 835.6 million kg in 1997-98 to only 667 million kilogram in 2005-06. Moreover, productivity of tea is declined in Assam by 11% during 2001 to 2010 and in Kerala by 23% during 1984 to 2004. After 2006 India lost 1st position, now China is leading country in tea production (www.faostat.org.in last accessed on 15th August 2013). Moreover, the export performance over the last three decades shows that the percentage share of India's tea export in total world has declined drastically to 12.10% in 2009-10 from 21.91% in 1981-90.

Thus, the Indian tea industry is facing twine problems of reduced productivity as well loosing share in the world export market. Introduction of New Economic Policy during 1991-92 is a new paradigm shift in Indian International Trade Policy. Introduction of this policy influenced the marketing structures, prices received by the growers and other market players. Tea productivity increased to 1735.65 kg ha^{-1} from 1458 kg ha^{-1} in post liberalization, the growth rate was negative (Darvishi and Indira, 2013). Trade liberalization has also shown negative impact on tea

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export (Kaur and Bhanu, 2013). Tea production in India has been influenced not only by a substantial change in technology, weather and other factors of production but also by various policies of government and due to demand of tea in world. Hence to know the root cause of the problems in tea production during and after to trade liberalization, this paper aimed to study the instability in tea production of India during pre and post trade liberalization period.

2. MATERIAL AND METHODS

Four major tea producing states were selected based on their shares towards tea production of India during 2011; the selected states were Assam, West Bengal, Tamilnadu and Kerala which are responsible for 98% of total tea production in India. The area, production and productivity data is collected from Tea Board of India from 1951 to 2011.

Descriptive statistics are used to describe the basic features of the data in a study. Descriptive statistics can broadly be categorized into measures of central tendency (CT), measures of dispersion and measures of association ship. Among the measures arithmetic mean, standard deviation/error, skewness, kurtosis, Simple and compound growth rate are widely used to describe the given data for their obvious merits over other hosts of measures.

2.1. Instability and its measures

Introduction of New Economic Policy during 1991-92 is a new paradigm shift in Indian International Trade Policy. It facilitated greater globalization by reducing restriction on exports and imports. Liberalization of trade policies has influenced the marketing structures, prices received by the growers and other market players. Impact of trade liberalization on agriculture sector can be understood only by analyzing the changes in the relative share of various crops, changes in production, productivity and price. Hence it is importance to study the instability in tea production in India during and after trade liberalization. In this paper we tried to analyze the instability in tea production in major growing states as well as for whole India for two periods pre and post reform period. For this purpose, the whole period under study is divided into two periods *viz.*, period- I from 1951-1990 (pre reform period), period-II from 1991 to 2011 (post reform period) and whole period from 1951-2011 during the study of instability.

As such, extensive researches on measuring growth and instability for different periods are found in literature. In majority of the literature one can find extensive use of coefficient variation as measure of instability along with variance.

2.1.1. Coefficient of variation

$$\overline{Y} = \frac{1}{n} \sum_{t=1}^{n} Y_t$$

$$\text{Variance of } Y = \frac{1}{n} \sum_{t=1}^{n} \left(Y_t - \overline{Y}\right)^2$$

Standard deviation of Y_t is the positive square root of its variance.

2.1.1. Cuddy and Della (1978) instability index

For measuring the instability in area, production and productivity the index given by Cuddy and Della (1978) and used by Larson *et al.*(2004):

$$CV_t = (CV) \times \sqrt{1 - R^2} = \frac{\sigma}{\overline{X}} \times 100 \sqrt{1 - R^2}$$

Where σ = Standard Deviation

$\overline{X}$ = Mean

R^2 = Coefficient of determination of the linear trend model of the variable concerned.

CV_t = CV around trend

More general option is to use ordinary CV value but in presence of trend, ordinary CV fails to explain the inherent trend component in a time series properly (Hasan *et al.*, 2008). So Cuddy and Della (1978) method is assumed to be superior over ordinary CV.

2.1.3. Coppock's instability index (CII%)

It is trend free measure of variability which is a close approximation of the average year to year percentage variation adjusted by trend (Kaur and Singhal, 1988).

$$V \log = \frac{\sum \left(\log \frac{X_{t+1}}{X_t} - m \right)^2}{n}$$

$$CII = Anti \log \left(\sqrt{V \log} - 1 \right) X 100$$

Where, X_t = value of the phenomenon X at time 't'.

n = Number of years.

m= Mean of the difference between logs of X_{t+1}, X_t.

$V \log$ = Logarithmic variance of the series.

2.1.4. Instability index by Chand and Raju (2008)

This index is unit free and very robust, and it measures deviations from the underlying trend (log linear in this case).

Instability index = Standard deviation of natural logarithm (Y_{t+1}/Y_t)

where, Y_t is value of phenomenon at current year and, Y_{t+1} is for the next year. When there are no deviations from trend, the ratio of Y_{t+1}/Y_t is constant and thus standard deviation is zero. As the series fluctuates more, the ratio of Y_{t+1} and Y_t also fluctuates more, and standard deviation increases.

Instability index is basically uses the information on variability in data. This index can be fluctuated by the statistical measure which is used while calculation. Thus the reason behind using different instability index is to obtain the consistent results which will lead to draw valid conclusion from the analysis.

3. RESULTS AND DISCUSSION

3.1. *Per se* performance of tea production in India

Tea is the most important cash and foreign exchange earner crop of India. It plays vital role in the Indian economy. Descriptive statistics gives an idea about the data series in one numerical value, Table 1. provides *per se* performance of tea production in India**.** From the results, one can found that in India, since 1951 area under tea has increased from 316.87 thousand to 600 thousand hectare in 2011, registering a growth rate of 1.44 % per annum and area increased by 100% than initial period. Maximum growth in area is observed in Tamilnadu, followed by Assam and West Bengal whereas minimum growth was exhibited in Kerala. In Tamilnadu tea cultivation has increased from 30.34 thousand hectare to 81.28 thousand hectare while in Kerala tea cultivation shown a mere increase from 33.54 thousand hectare to 39.96 thousand hectare. Striking feature of the study was that the area under the tea in all states and India is observed to be platykurtic and positively skewed, which reveal that there has been marginal shift of area in favour of tea during the early half and remained almost same during other part of the study.

Tea production in India has increased from a mere 278.67 million kilogram to 999.18 million kilogram during study period and has registered simple growth rate of 3.85 percent per annum. Assam ranked first in average production (producing more than 50% of all India production) followed by West Bengal, Tamilnadu and Kerala. Although average production of Assam was highest (313.97 million kilogram) maximum growth in tea production has observed in Tamilnadu. Tea productivity of India varied from 875 kilogram per hectare to 1876 kilogram per hectare. On an average, in India tea productivity remained 1424 kilogram per hectare during the period under study. Tamilnadu has recorded highest productivity (1815.36 kilogram per hectare) and lowest of Kerala (1389.03 kilogram per hectare).

Table 1: *Per se* **performance of tea production in major states of India during 1951-2011**

Area ('000 ha)					
	Assam	**West Bengal**	**Tamilnadu**	**Kerala**	**India**
Maximum	322.21	115.10	81.28	39.96	600.00
Minimum	155.80	79.48	30.34	33.54	316.87
Mean	214.29	95.43	45.69	36.78	406.53
SD	50.59	11.78	17.68	1.83	80.93
CV (%)	23.61	12.34	38.70	4.97	19.91
Skewness	0.80	0.33	1.23	0.18	0.95
Kurtosis	-0.29	-1.17	-0.25	-0.75	-0.21
SGAR (%)	1.72	0.72	2.21	0.17	1.44
CGAR (%)	1.26	0.68	1.66	-0.05	1.04
Production (million kg.)					
	Assam	**West Bengal**	**Tamilnadu**	**Kerala**	**India**
Maximum	589.11	271.60	170.72	74.63	991.18
Minimum	145.90	71.96	24.80	24.52	278.67
Mean	313.97	137.30	85.88	50.72	596.16
SD	122.08	50.92	45.95	13.11	228.11
CV (%)	38.88	37.09	53.50	25.85	38.26
Skewness	0.21	0.63	0.49	-0.21	0.21
Kurtosis	-1.21	-0.35	-1.04	-0.85	-1.30
SGAR (%)	4.59	3.99	8.99	2.69	3.85
CGAR (%)	2.32	2.10	3.24	1.41	2.30
Productivity (kg ha^{-1})					
	Assam	**West Bengal**	**Tamilnadu**	**Kerala**	**India**
Maximum	1857.83	2426.59	3104.44	2065.62	1876.00
Minimum	933.79	904.27	721.72	726.92	875.00
Mean	1422.93	1414.95	1815.36	1389.03	1424.73
SD	284.04	372.28	563.2	371.98	317.41
CV (%)	19.96	26.31	31.02	26.78	22.28
Skewness	-0.24	0.59	-0.02	-0.17	-0.35
Kurtosis	-1.29	-0.02	-0.41	-1.23	-1.38
SGAR (%)	1.39	2.37	2.99	1.95	1.75
CGAR (%)	1.05	1.41	1.55	1.46	1.24

Note: SD=Standard deviation, CV= coefficient of variation, SGAR = Simple growth rate per annum, CGAR=Compound growth rate per annum

Table 2: Test of outliers and randomness for area, production and productivity of tea in India

	No. of obs.	P	E (P)	V(P)	τ_{cal}	Inference	Outlier
Assam							
Area	62	8	40.00	10.70	9.78	Trend	No
Production	62	27	40.00	10.70	3.97	Trend	No
Productivity	62	31	40.00	10.70	2.75	Trend	No
West Bengal							
Area	62	14	40.00	10.70	7.95	Trend	No
Production	62	31	40.00	10.70	2.75	Trend	No
Productivity	62	33	40.00	10.70	2.14	Trend	No
Tamilnadu							
Area	62	12	40.00	10.70	8.56	Trend	No
Production	62	38	40.00	10.70	0.61	Random	No
Productivity	62	39	40.00	10.70	0.31	Random	No
Kerala							
Area	62	17	40.00	10.70	7.03	Trend	No
Production	62	37	40.00	10.70	0.92	Random	No
Productivity	62	40	40.00	10.70	0.00	Random	No
India							
Area	62	6	40.00	10.70	10.39	Trend	No
Production	62	31	40.00	10.70	2.75	Trend	No
Productivity	62	33	40.00	10.70	2.14	Trend	No

*Note: *=5% level of significance, **=1%level of significance, Area in '000 hectare, Production inmillion kg., Productivity in kg/ha,P=No. of turning points in a series, Obs.= Observations.*

Talukdar and Sahewalla (2005) studied tea production in India during 1951 to 2000 and observed similar results of negative compound growth rate in Kerala (-0.10%) and highest growth rate of tea production in Tamilnadu (3.38 %). In Assam growth in production mainly attributed due to increase in area while in Kerala growth in production was mainly due to productivity even effect of area was negative. Tamilnadu was prosperous state in terms of tea production. As compared to north India *i.e*. Assam and West Bengal, tea productivity was higher in South India. Additionally, favorable agro-climatic conditions might have resulted to more productivity in south India. Tea production depends on age of tea bushes, soil and climatic conditions, management practices, capital expenditure incurred, working and living conditions of workers (Arya, 2013). Tea production is also influenced by tea prices in international market and WTO policies.

3.2. Test of outliers and randomness for area, production and productivity of tea

Having an idea about acreage and production scenario of tea crop in major growing states as well as for whole India, it is now our objective to study the instability in tea production. Before getting the trends in all the series, it is better to have idea about each and every series, whether the series exhibit any trend or followed a randomness nature. Before performing the test of randomness the series under consideration are subjected to test of outlier as described in materials and methods section. The results of both the test of randomness and that of outlier were presented in table 2.

Analysis of data for different series rejected the presence of outliers. From the test of randomness one can see that area under tea cultivation in all states and in whole India followed definite trends. Tea production and productivity

Table 3: Instability in area, production and productivity of tea in India during pre reform period (1951-1990), post reform period (1991-2011) and whole period (1951-2011)

State	Instability measures											
	CV			CV_t			Coppocks instability			Chand and Raju		
	1951 - 1990	1991 - 2011	1951 - 2011	1951 - 1990	1991 - 2011	1951 - 2011	1951 - 1990	1991 - 2011	1951 - 2011	1951 - 1990	1991 - 2011	1951 - 2011
Area												
Assam	13.04	13.78	23.61	1.54	3.77	4.82	10.13	10.35	10.71	0.89	3.15	6.93
West Bengal	7.81	5.52	12.34	1.95	1.25	2.37	10.17	10.13	10.71	1.61	1.14	1.45
Tamilnadu	6.01	24.73	38.70	3.18	7.11	15.21	10.28	10.84	10.83	2.76	7.40	7.41
Kerala	5.90	2.30	4.97	3.20	1.48	4.40	10.24	10.15	10.21	2.40	1.49	2.11
India	8.70	12.48	19.91	1.80	3.06	3.16	10.19	10.29	10.23	1.77	2.33	2.01
Production												
Assam	30.97	10.33	38.88	6.31	6.48	7.66	10.63	10.65	11.90	5.73	6.10	17.09
West Bengal	24.92	17.34	37.09	6.39	7.07	7.62	10.67	10.73	11.90	6.31	6.66	6.35
Tamilnadu	39.80	16.35	53.50	10.99	5.81	10.21	11.11	10.76	11.00	9.92	7.32	9.06
Kerala	24.84	7.58	25.85	15.13	7.24	13.65	11.36	10.93	11.22	12.69	9.15	11.52
India	29.69	10.10	38.26	4.64	3.63	4.23	10.45	10.34	10.41	3.73	3.16	3.54
Productivity												
Assam	18.31	6.71	38.88	6.77	4.69	7.66	10.60	10.57	11.61	5.77	5.66	14.73
West Bengal	17.84	12.59	37.09	6.57	6.91	7.62	10.64	10.70	11.61	6.17	6.52	6.21
Tamilnadu	34.43	16.00	53.50	11.10	8.18	10.21	11.03	10.89	10.98	9.26	8.48	9.27
Kerala	26.96	7.33	25.85	12.68	7.09	13.65	11.33	10.94	11.21	12.46	9.25	11.40
India	21.05	3.94	38.26	5.14	3.57	4.23	10.43	10.33	10.40	3.89	3.30	3.80

of Assam, West Bengal and India followed definite trend while Tamilnadu and Kerala have changed randomly. Although the area under tea cultivation of Kerala and Tamilnadu have shown definite trend, production and productivity were random in nature this may be because of common cause of variation *i.e.* area . Changes in cropping pattern of Kerala and Tamilnadu may be one of the reasons for randomness of data and also one can't ignore the minor fluctuation in production between the consecutive years due to the factors beyond the control of the farmers. By and large tea industry in India is developed through some policy implications and implementation before and after WTO which may attribute to noticeable changes in tea acreage and production.

3.3. Instability analysis

In this section we tried to analyze the instability in tea production in major growing states as well as for whole India using the methods described in materials and method section for three periods i.e. pre reform period (1951-1990), post reform period (1991-2011) and whole period (1951-2011). Comparing the results of instability index by four different methods, all index gives same trend during pre and post reform period for variables under study except coefficient of variation because it is very much sensitive to small changes in data.

Instability analysis of tea production is presented in table 3; which clearly indicates wide range of instability over the periods and over the states. Area under tea cultivation in Assam has shown higher instability during post reform (1991-2011) period than pre reform (1951-1990) period. This may be due to registration of small holder farmers which has started functioning during late 1980s and flourished in late 1990s. Instability in area under tea

cultivation in West Bengal has witnessed higher instability during pre reform period than post reform period. Area under tea in Tamilnadu has exhibited high index value which revealed that Tamilnadu was very unstable state as compared to other states. Increased area under tea cultivation which could lead to high instability during post reform period in Tamilnadu was mainly associated with shifting cultivation of potato and forest crop by tea cultivation (Venugopal, 2012). In Kerala, high instability has occurred during pre reform period than post reform period and whole period. Area under tea cultivation in India has shown higher instability during post reform period than pre reform period which revealed more variation in post reform period. Increased instability during post reform period may be associated with increased area under tea cultivation of Assam coupled with increase in traditional states like Karnataka and non-traditional like Orissa and Bihar. Variation in area under a crop occurs mainly in response to distribution, timeliness and variations in rainfall and other climate factors, expected price and availability of crop-specific inputs. Darvishi and Indira (2013) also observed similar results of low variation during pre reform period than post reform period for area under tea in India.

Variability in agricultural production consists of variability in area and productivity and their interaction. Instability is found higher in production than area during all three periods in all states and India which revealed that tea production was more instable than area under tea cultivation. This also clearly indicates that instability in production is not mainly by the area under cultivation which may be due to others factors. Instability has found higher during post reform period in Assam and West Bengal as compared to whole period while found lower in Tamilnadu and Kerala. During pre reform period, production of Tamilnadu has increased due to productivity not by area while in post reform period tea production has decreased although area has increased, thereby most probably indicating the saturation in production potential of the crop in the state. In Kerala evidence of change in area and productivity tea production have been seen in all three periods. Overall tea production in India has shown high instability during pre reform period than post reform period and whole period. Darvish and Indira (2012) has also observed similar results of stability in tea production during post reform period than pre reform period.

Tea productivity in all states and India has shown low instability during post reform period than pre reform period and whole period except West Bengal. Assam, West Bengal has observed maximum instability in productivity during whole period in while in Tamilnadu, Kerala and India during pre reform period. Low productivity during post reform period was may be due to falling prices of Indian tea during international market which had effect on its profitability. As Darjeeling tea fetched more prices in International market and may lead to high profitability and hence West Bengal has observed high instability during post reform period. Darvishi and Indira (2013) has also observed similar results of stability in tea productivity during post reform period than pre reform period.

Overall, area under tea in West Bengal and Kerala has shown high instability during pre reform period than post reform period while rest of the states and whole India have shown higher instability during the post reform period. Productivity of tea in West Bengal has shown high instability during pre reform period than post reform period while rest of the states and whole India have shown higher instability during the post reform period. This instability in production may be not only by area but by other factors. These factors may be changed WTO policies in trade liberalization, price realization and may be due to uncontrolled factors like weather. Instability in tea productivity in India was lower during post reform period which revealed stability which indirectly suggested no growth was observed during this period. Hence it can be suggest that changed WTO policies have negative impact on productivity of tea in India.

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