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Research Article

AN ECONOMIC ANALYSIS OF GROWTH AND TRADE PERFORMANCES OF COFFEE

DHARANI S.R.*, DANIEL VISWASAM SAMUEL A., SIVASANKARI B.
Department of Agricultural Economics, Agricultural College and Research Institute, Madurai, 625104, Tamil Nadu Agricultural University, Coimbatore, 641003, India
*Corresponding Author: Email - dharani9september@gmail.com

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Abstract: The study brings to a focus, the growth and trade performances of Indian coffee. Secondary data on area, production, productivity and export of coffee were collected for the period of 1990-91 to 2017-18. Growth rate of area (2.39%) and production (2.24%) of Indian coffee has been increased over the study period. Coffee export in terms of quantity (3.91), value (9.73) and unit value (5.60) also registered a positive growth. The results of Coppock's instability index revealed the existence of stability in the area (2.54%), production (9.51) and productivity (4.32%) of Indian coffee. The instability index for quantity, value and unit value realized from Indian coffee export was found to be 13.79%, 22.63% and 18.81% respectively. The results of Markov chain model found Italy, Poland, Russia, and Jordan as the loyal and stable market for Indian coffee. With the increasing global demand per se there is a huge scope for expanding the cultivation in non-traditional regions. Adoption of new technologies and initiatives on value chain is essential.

Keywords: *Compound growth rate, Coppock's instability index, Markov chain model*

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Introduction

The etymology of *Kaffa* is thought to be from the *Arabic qahwah* meaning 'a drink from berries' and is a province of Ethiopia from where originated. There are 70 major coffee producing countries in the world among which Brazil is the leading producer. India is the seventh largest coffee producer in the world with the production of 316,000 MT [1]. In India *ipso facto* coffee is largely produced in the hill areas of the south Indian states such as Karnataka, Kerala, and Tamil Nadu. The Non-traditional coffee growing regions in India are Andhra Pradesh, Orissa and Seven sister states of India [2]. Coffee is the second most traded commodity in the world next to crude oil. In 2017-18 the export of coffee from India is 3,95,014 MT [1]. Nearly 80% of the coffee produced in India is exported. In spite of increasing global demand for coffee the overall productivity of the country was found to be less. Since foreign trade *si-ne quanon* plays an important role in the development of the economy it is essential for the country to cull out the factors that hinders the growth coffee production. Hence the overall objective of the study concerns on assessing the growth and trade performance of Indian coffee with the specific objectives i) to compute growth rate for area, production, productivity and export of Indian coffee, ii) to find out the stability in coffee production and export and iii) to analyze the direction of trade in Indian coffee export.

Materials and Methods

The study was based on the time series data on area, production, productivity, total export and country wise export of coffee from India. Secondary data for the period 1990-91 to 2017-18 were obtained from the coffee database 2018, online publication of coffee board of India. Compound growth rate analysis was done to evaluate the growth of area, production and productivity of coffee in India. It was also used to assess the performance of coffee exports from India. The instability in area, production, productivity and export of coffee were estimated through the Coppock's instability index. Markov chain model was used in analyzing the direction of trade in the export of coffee.

Tool up for the study

Compound growth rate, Coppock's instability index, Export response function, Markov chain model.

Compound growth rate

In the present study, compound growth rates in area, production, productivity and export of coffee were estimated by using the exponential growth function, Thangadurai,2017, [3] of the form

$$Yt = a + b_T + U_t$$

where,

Yt = Dependent variable for which growth rate was estimated (Area, Production, Productivity, Export quantity, export value and unit value of coffee in year't')

a = Intercept

b = Regression coefficient

T = year (which takes value 1, 2, ... n)

U_t = Error term in year't'.

The equation was transformed into log linear and was estimated by using (OLS) ordinary least square technique.

$$\ln Y = \ln a + t \ln b + \ln U_t$$

The Compound growth rate (r) was then estimated by the identity given in the below equation,

$$r = (b - 1) * 100$$

Where,

r = Estimated compound growth rate in percent per annum.

b = Antilog of (ln b)

Coppock's instability Index

Instability index for area, production, productivity and export of coffee for the period of 28 years were estimated by using Coppock's instability index, Ahmed,2013 [4]. The estimable form is given as

$$Vlog = \frac{\sum \left[\frac{log\, x_t + 1}{log\, x_t} - m\right]^2}{N - 1}$$

Coppock's instability index = Antilog $(\sqrt{V\ log} - 1)$ *100

Where, X_t = (Area, Production, Productivity, Export quantity, export value and unit value of coffee in year'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.

Export response function

To determine the effect of liberalization on coffee export, the following function was hypothesized.

$$EXQ_t = (DVL_t, U_t)$$

Where, EXQ_t = export quantity of coffee in year't' (tonnes)

DVL_t = dummy variable for liberalization (0 for the year 1978-1995 and 1 for the years 1995-2017)

U_t = error term in year't'

Direction of trade – Markov chain model

The direction of trade in export of Indian coffee was examined by estimating the transition probability matrix using first order Markov chain model, Tejaswi, 2005 [5]. The data on country wise export of coffee from India for the period of 2000-01 to 2017-18 were taken for analysis. The year wise export quantity of Indian coffee to top ten importing countries *viz*., Italy, Germany, Russia, Belgium, Spain, Slovenia, USA, Jordan, Greece and Poland were formulated into a Linear Programming [LP] problem under the method of Minimization of Mean Absolute Deviations. To obtain the transition probability matrix, LP was solved using LINGO (version 11) software Package, Thulasiram, 2018 [6]. Diagonal elements of the transition probability matrix give the export retention share of different importing countries which helps in finding the loyal and stable importer of Indian coffee.

Results and discussion

Growth rate of bearing area, production, productivity and export of Indian coffee

From [Table-1], it was found that the bearing area and production of Indian coffee has been increased for the past twenty-seven years.

Table-1 *Compound growth rate of area, production and productivity of Indian coffee for the period of (1990-91 to 2017-18) in (%).*

Category	*Arabica*	*Robusta*	Overall
Bearing Area	2.26**	2.51**	2.39**
Production	0.77**	3.39**	2.24**
Productivity	-1.83**	0.86**	0.18*

***Significant at 1 percent level, *Significant at 5 percent level*

Both the bearing area and coffee production showed a positive and significant growth rate of 2.39% and 2.24% respectively. Though the varieties Arabica and *Robusta* had almost equal share of bearing area in India, the production of Arabica showed a slower growth rate of 0.77% when compared to that of *Robusta* production which showed an increasing growth rate of 3.39% over the study period. The reason behind it was the susceptibility of Arabica to the white stem borer attack. Also, the productivity of Arabica had a significant negative growth rate of -1.83%. The overall productivity of Indian coffee also showed a slower growth of 0.18% was due to the lack of knowledgeable work force and scientific management practices.

It could be seen from [Table-2], that the total export quantity of Indian coffee showed a positive and significant growth of 3.91% over the study period. Export value and the unit value realized from coffee export also had a significant and positive growth of 9.73% and 5.60% respectively. Impact of increasing demand for Indian coffee at the international markets resulted in the positive growth of Indian coffee export.

Table-2 *Compound growth rate of export quantity, export value and unit value realized of Indian coffee for the period of (1990-91 to 2017-18) in (%).*

Category	Particulars
Export quantity	3.91**
Export value	9.73**
Unit value realized	5.60**

***Significant at 1 percent level *Significant at 5 percent level*

Coppock's instability index for area, production, productivity and export of Indian coffee

As the area, production, productivity and export of Indian coffee showed a significant growth over the study period. It was found necessary in constructing the instability index for those elements.

Table-3 *Coppock's instability index for area, production and productivity of Indian coffee for the period of (1990-91 to 2017-18) in (%)*

Category	Arabica	*Robusta*	Overall
Bearing Area	2.69	3.9	2.54
Production	12.46	9.66	9.51
Productivity	13.62	9.86	4.32

From [Table-3], it became evident that the instability index for the bearing area of coffee was less (2.54%). Hence the actual variation in the area of Indian coffee was less over the period of study. Compared to *robusta*, the instability index for the bearing area of Arabica had showed less variation (2.69%). Also, the instability index for the production and productivity of Indian coffee was 9.51% and 4.32% respectively. Overall the study revealed the existence of stability in the area, production and productivity of Indian coffee over the study period. This was mainly due to the perennial nature of coffee plantations.

It could be seen from [Table-4] that the instability index for quantity, value and unit value realized from Indian coffee export was 13.79%, 22.63% and 18.81% respectively. Actual variation in the export value of coffee was found to be higher than the quantity and unit value realized from coffee export. This was due to high price fluctuations at the international markets. Increasing demand and fall in supply due to weather extremity caused volatility in coffee prices.

Table-4 *Coppock's instability index for export quantity, export value and unit value realized of Indian coffee for the period of (1990-91 to 2017-18) in (%)*

Category	Particulars
Export quantity	13.79
Export value	22.63
Unit value realized	18.81

Liberalization effect on coffee export

In order to know the impact of trade liberalization on Indian coffee export, a study was carried out for the time period of 1979-80 to 2017-18. From the [Table 5], it became evident that the trade liberalization had a significant impact on the Indian coffee export. Trade liberalization influenced the export quantity of coffee by 150420.2 MT every year and without the liberalization effect the export of coffee increased by 98200.27 MT every year.

Direction of trade

The top ten major coffee importing countries from India were taken for the study. From [Table 6], the diagonal element of the transition probability matrix 0.787 indicated that Italy was the most stable and highly loyal market for coffee from India. It retained about 78.7 percent export share of Indian coffee. Italy gained about 69.3 percent and 21.6 percent export share of Slovenia and Jordan respectively. The result is in line with the findings of Amariza Vivine, 2011 [7]. Also, it was found that coffee export to USA and Greece could not be retained by India due to zero percent retention. Greece lost almost 100 percent of its share to Italy. Italy, Poland, Russia and Jordan were found to be the stable market with the retention capacity of about 50 percent export share among the top ten coffee importing countries from India.

Conclusion and Implications

The strength of flavors from coffee is

- The area and production of Indian coffee had a positive growth.
- Coffee export in terms of quantity, value and unit value realized also showed a positive growth rate.
- Stability in the area, production and productivity of Indian coffee.
- Instability index of Indian coffee export indicated that the export quantity and unit value realized was highly stable than the export value of coffee.
- Italy, Poland, Russia and Jordan were found to be loyal market for Indian coffee exports.

Table-5 *Results of coffee export response function*

S. N.	Variables	Coefficient	Standard error	Prob. Value
1	Intercept	98200.27**	12776.19	4.22E-09
2	Dummy variable for liberalization	150420.2**	16422.12	6.14E-11
	R^2	0.69		

***Significant at 1 percent level *Significant at 5 percent level*

Table-6 *Transition probability matrix of coffee export from India (1990-91 to 2017-18)*

Countries	Italy	Germany	Russia	Belgium	Spain	Slovenia	USA	Jordan	Greece	Poland
Italy	0.787	0.063	0	0	0	0	0.043	0.049	0.058	0
Germany	0	0.202	0.188	0.329	0	0.174	0.074	0	0.010	0.023
Russia	0.079	0.037	0.519	0.186	0.154	0.025	0	0	0	0
Belgium	0	0.723	0	0.069	0.086	0.032	0	0	0.090	0
Spain	0	0	0.533	0	0.398	0	0	0	0.069	0
Slovenia	0.693	0	0	0	0	0.307	0	0	0	0
USA	0	0.408	0.527	0	0	0.065	0	0	0	0
Jordan	0.216	0.146	0	0	0	0	0.113	0.449	0	0.076
Greece	1.000	0	0	0	0	0	0	0	0	0
Poland	0	0.338	0	0	0	0	0	0.019	0	0.643

This study helps to suggest some policy implications. In India Coffee production is mainly confined to the traditional growing states. With increasing global demand there is a scope for expanding the cultivation in the non-traditional growing states. By adopting new technologies, improving the credit facilities and educating the cultivators on scientific management practices helps in increasing the coffee production in India which in turn strengthens *tour de force* the Indian coffee export. Government should take necessary efforts in promoting the production of specialty coffee, which is highly valued and demanded in the international markets. Value addition in coffee helps in retrieving higher price for our produce at the international markets. Hence India should pay attention in this. Further, it is suggested to improve productivity in the existing coffee growing area as a short run measure and in the long run production has to be increased through the expansion under non- traditional coffee growing area. Stable growth and stability in exports are the consummating factors.

Application of Research: This study primarily concerns on the scope and export performance of Indian coffee. It helps in examining the obstacles faced by the nation in coffee production and export.

Research Category: Export performance

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Study area / Sample Collection: Coffee Board of India

Cultivar / Variety name: Coffee - *Coffea arabica, Coffea robusta*

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