

RESEARCH ARTICLE

## Price Analysis of Coffee in India

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### ABSTRACT

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The present study is proposed with the objective to analyze the trend, seasonal and cyclical price variations of coffee in India. Secondary data collected from Coffee Board over a period of 13 years (2007-2020). Compound Annual Growth Rate Analysis, Seasonal Index, Bry - Boschan algorithm used to identify the price trend, seasonal and cyclical price variations of coffee in India. The farm gate price of coffee in the selected markets Chikmagalur and Tamil Nadu was positive and significant. In Chikmagalur market, prices prevailed lean during March, April, August, September, October and November and higher in the months of December, January and February for Arabica. Robusta parchment and cherry prices prevailed lean during January, November and December and higher in March, June and July. In Tamil Nadu market, price was higher in the months of January, February and March and lean during September, October and November.

**Keywords:** Coffee; Arabica; Robusta; Chikmagalur; Tamil Nadu; Price cycle.

### INTRODUCTION

The percentage share of Indian coffee exports to the global agricultural exports decreased from 7.48 per cent in 1995 to 2.12 per cent in 2019. The productivity of Arabica coffee in India declined to 531 kg/ha in 2018-19 from 596 kg in 2014-15 (10 per cent reduction). Coffee cultivation is exposed to high-level production risk (Hartmann and Akasha, 2009), market risk and extreme price volatility. These high fluctuations in coffee prices have also raised a red flag on the Excessive Food Price Variability Early Warning System, maintained by IFPRI's Food Security Portal, which identifies periods of unusual price variability in different commodity markets. The novel coronavirus represents an unprecedented joint supply and demand shock to the global coffee sector, constituting an enormous challenge to coffee growers, farm workers, and downstream value chain actors. The various supply and demand impacts will be felt at different points in time, further contributing to global market uncertainties and the ongoing price volatility. The pandemic may also have significant implications for poverty and food insecurity for the world's 25 million coffee producers, most of whom are smallholders in low- and middle-income countries that are unprepared to respond to a public health crisis of this proportion (Hernandez et al. 2020)

Taru et al. (2009) in their study on estimation of seasonal price variation and price decomposition of maize and guinea corn in Nigeria identified that seasonal variation existed in the price collected from the Michika and Bazza markets. The results showed insignificant values in cyclical and random variations that indicated the cyclical variation occurrence in the years and random as unpredictable. Geman and Sarfo (2012) studied the

seasonality in cocoa spot and forward markets and found that the cocoa prices exhibited a weak seasonality and moderate volatile prices, as the production was limited globally to only eight countries. This showed that the cocoa traders have an attractive opportunity for hedging and trading. Tiku et al. (2013), in their study on analyzing the palm oil prices by trend, seasonality, cyclical and irregular variations. A primary survey was conducted randomly to 160 palm oil marketers through structured questionnaire. They found that the instability was 0.097 per cent, which indicated that the oil prices were stable. They recommended that palm oil should not be stored rather they should speculate it. Mahesh et al. (2018) studied the market arrival and price behavior of cotton in Haryana and found that the arrivals were positive but insignificant. Seasonality of cotton prices indicated that the arrivals were high from October to January and lean during February to May.

The objective of this study is that to analyze the trend, seasonal and cyclical price variations of coffee in India.

### METHODOLOGY

The major Indian coffee markets for Arabica coffee are Karnataka and Tamil Nadu and for Robusta coffee are Karnataka and Kerala. Two major markets for Arabica and one major market for Robusta were selected for price analysis. Chikmagalur in Karnataka and Tamil Nadu market prices for Arabica coffee and Chikmagalur market for Robusta coffee over a period of 13 years (2007-2020) was collected from Coffee Board Database (<https://www.indiacoffee.org/>).



**TOOLS FOR ANALYSIS**

**Compound Annual Growth Rate Analysis**

Compound annual growth rate of coffee was worked out to examine the tendency of variable to increase, decrease or stagnant over a period. Compound annual growth rates of exports of coffee was estimated by using the exponential growth function of the form:

$$Y_t = a \cdot b^t U^t \tag{1}$$

Where,

$Y_t$  = Dependent variable for which growth rate of coffee was estimated

$a$  = Intercept

$b$  = Regression coefficient

$t$  = Year which takes values of (1, 2, 3, ... n)

$U^t$  = Disturbance term in year 't'.

The equation (1) will be transformed in to log-linear and written as:

$$\log Y_t = \log a + t \log b + \log U \tag{2}$$

Equation (2) will be estimated by using Ordinary Least Square (OLS) technique.

The compound growth rate ( $g$ ) will be then estimated by the identity given in equation (3)

$$g = (b-1) \times 100 \tag{3}$$

Where,

$g$  = Estimated compound growth rate per annum in percentage.

$b$  = Antilog of  $\log b$

**Construction of Seasonal Index**

The seasonal Index of a period indicates how much this period typically deviates from the annual average. Each time period's price is expressed as a percentage of the season's average and has value equal to, greater than or less than 100. Most indices of this type use a base value of 100 percent. A value of 95 for a particular period would mean that period's price was 5 percent below that year's 12-month seasonal average price. The relative movement of prices within the season (Jadhav, 2013) was focused which was supported by (Anil, 2012) who used seasonal indices in price and arrivals of wheat in major markets of Karnataka.

**Cyclical analysis - Bry - Boschan algorithm**

The BB algorithms identify turning points in the time series and give the dates of peak and trough. Alternating trough and peak together complete one cycle. The time taken to go from peak to trough or trough to peak is called as a phase and two such

phases constitute a cycle. In order to identify a turning point (peak or a trough), not every change taken as a turning point. Rather a local maxima or minima is selected based upon criteria that a certain number of points after the selected point follow the same pattern. From the identified dates, the duration spent in each state and amplitude (percentage change in each phase) could be calculated. BB algorithm was used to identify the presence of cycle and the length.

BB algorithm was used by Cashin (Cashin et al., 2002), to identify the duration and magnitude of the price cycle. He was not able to find any consistent shape in the commodity price cycle. BB algorithm to identify price cycle in selected commodities and found asymmetry in the duration spent in boom and slump and price cycle does not have a consistent shape Rahman (2012).The study did not provide any policy implications. 13 years price data was collected from Tamil Nadu and Chikmagalur markets.

**RESULTS AND DISCUSSION**

**Trend of Coffee prices across markets**

Different processing methods are used to produce different types of coffee. Parchment coffee could be obtained by using wet processing method and cherry coffee by dry processing method. The trend in farm-gate prices of Arabica coffee was analyzed for the major markets in Tamil Nadu and Chikmagalur from 2007-2020. It could be observed from Figure 1 that, the farm gate price of coffee in the selected markets Chikmagalur and Tamil Nadu was positive and significant during 2007-2020. Chikmagalur has the highest production of Arabica and Robusta coffee than Tamil Nadu. The farm gate prices of Arabica parchment and Arabica cherry were comparatively higher in Chikmagalur market than in the Tamil Nadu market. It could be observed from the Figure 2 that, the farm gate price of Robusta parchment in Chikmagalur increased from 4.37 per cent in 2007 to 7.93 per cent in 2020. The Robusta cherry prices increased from 4.56 per cent in 2007 to 8.30 per cent in 2020.

The compound annual growth rates and their significance were estimated for price of coffee by employing the exponential growth model for the given period (2007-2020. It could be concluded from Table 1 that, the increase in Robusta coffee prices was due to shift in cultivation of Arabica coffee to Robusta coffee. This directly influenced the higher production and productivity of Robusta coffee in India. The growing demand of Indian Robusta coffee led to increase in prices during the study period.



**Seasonal index**

Seasonal index used to identify the peak and lean price months of coffee in the major markets of Tamil Nadu and Karnataka. From Table 2, In Chikmagalur market, Arabica parchment prices prevailed 2 per cent higher than the average price in January and February. Arabica Cherry prices prevailed 5 per cent higher than the average price in January and 3 per cent higher in February in Chikmagalur market. Robusta parchment prices prevailed 4 per cent higher than the average price in July and 3 per cent higher in June. Robusta cherry prices prevailed 3 per cent higher in July and 2 per cent higher in March than the average price. Prices prevailed lean during the months of March, April, August, September, October and November and higher in the months of December, January and February for Arabica. Robusta parchment and cherry prices prevailed lean during January, November and December and higher in March, June and July. In Tamil Nadu market, Arabica parchment prices prevailed 3 per cent higher in January and March than the normal price. Arabica cherry prices prevailed 4 per cent in January and February. Price was higher in the months of January, February and March and lean during September, October and November.

The coffee year commenced from October and ended in September the succeeding year (Ghosal, 2021). Hence, the fresh arrivals of the market prevailed higher prices in the beginning months of the year.

**Price cycle analysis**

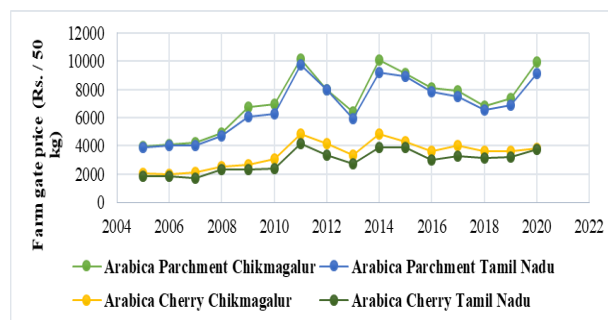
The coffee farm gate prices of Chikmagalur and Tamil Nadu during 2007-20 was analyzed by using Bry-Boschan (BB) algorithm. Price data was deflated and the series was linked with linking factor for different base years. It could be inferred from table 3 that, in Chikmagalur the Arabica parchment coffee prices observed three peak-to-peak cycles, two trough-to-trough cycles with mean cycle length of 31 months and in slump, the average price are reduced by 131 per cent where as in boom the prices get doubled (111 per cent). Arabica cherry prices observed two peak-to-peak cycles, three trough-to-trough cycles with mean cycle length of 35 months and in slump, the average price is reduced by 155 per cent where as in boom the prices get doubled (110 per cent). The time spent in slump was higher than in boom.

In Chikmagalur, Robusta parchment prices observed three peak-to-peak cycles, three trough-to-trough cycles with mean cycle length of 28 months and in slump, the average price get reduced by 240 per cent where as in boom the prices get doubled

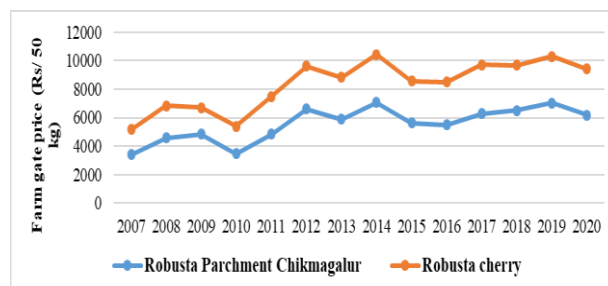
(128 per cent). The time spent in slump was higher than in boom. Robusta cherry prices observed four peak-to-peak cycles, three trough-to-trough cycles with mean cycle length of 32 months and in slump, the average price is reduced by 115 per cent where as in boom the prices get increased (73 per cent). The Arabica parchment and cherry prices spent 17 months and 19 months in peak to trough and 12 months and 17 months in trough to peak phase. The Robusta parchment and cherry prices spent 14 months and 15 months in peak to trough phase and 16 months in trough to peak phase.

In Tamil Nadu, the Arabica parchment prices observed two peak-to-peak cycles, three trough-to-trough cycles with mean cycle length of 32 months and in slump, the average price get reduced by 123 per cent where as in boom the prices get increased (97 per cent). Arabica cherry prices observed four peak-to-peak cycles, three trough-to-trough cycles with mean cycle length of 33 months and in slump, the average price is reduced by 251 per cent where as in boom the prices get doubled (210 per cent). The Arabica parchment prices spent 22 months in peak to trough and 17 months in trough to peak phase. The Arabica cherry prices spent 16 months in peak to trough and 15 months in trough to peak phase.

In all the three markets, there observed difference in number of cycles but similar pattern was observed with regard to time period spent in slump was higher than in boom for all the three markets. Hence, the commodity prices spent greater time in slump than in boom (Cashin et al., 2002).



**Figure 1, Farm gate price of Arabica coffee of Tamil Nadu and Chikmagalur markets**



**Figure 2, Farm gate price of Robusta coffee in Chikmagalur markets (2007-2020)**



**Table 1. Compound Annual Growth Rate of Coffee prices across markets (2007-2020)**

	AP		AC		RP	RC
	CHK	TN	CHK	TN	CHK	
<b>Trend</b>	4.49**	4.40**	4.26**	4.57**	3.66**	4.29***

(\*\*\*@1% level of significance, \*\* @ 5% level of significance) AP- Arabica Parchment, AC- Arabica Cherry, RP- Robusta Parchment, RC- Robusta Cherry, CHK -Chikmagalur, TN- Tamil Nadu

**Table 2. Seasonal index of Farm- gate prices of coffee of Tamil Nadu and Chikmagalur (2007-20)**

Months	AP		AC		RP	RC
	CHK	TN	CHK	TN	CHK	
January	102.4	103.3	105.8	104.3	95.2	97.6
February	102.0	102.3	103.4	104.5	99.6	100.1
March	99.1	103.6	99.6	105.3	101.4	102.0
April	99.7	99.0	98.8	98.1	99.7	97.2
May	100.4	101.2	99.7	100.2	102.6	99.7
June	101.3	101.3	98.6	100.0	103.6	101.0
July	100.1	99.4	99.3	99.0	104.4	103.4
August	99.7	98.8	97.7	98.7	101.8	101.2
September	99.4	98.9	98.5	98.1	101.6	101.2
October	98.6	97.8	99.2	98.0	99.8	100.9
November	97.1	96.3	98.0	95.2	96.7	98.5
December	100.1	98.1	101.4	98.4	93.5	97.3

**Table 3. Price cycle analysis of farm gate prices of Chikmagalur and Tamil Nadu**

Parameters	AP		AC		CHK	
	CHK	TN	CHK	TN	RP	RC
Number of peak-to-peak cycles	3	2	2	4	3	4
Number of trough-to-trough cycles	2	3	3	3	3	3
Mean cycle lengths	31.8	32.4	35.6	33.2	28.5	32.8
Standard deviation of cycle lengths	10.4	8.5	9.2	9.8	7.4	11.6
Percentage change in price during slump (Amplitude)	-131	-123	-155	-251	-240	-115
Percentage change in price during boom (Amplitude)	111.1	96.7	110.5	210.0	128.4	73.17
Mean peak-to-trough phases	17.6	22.0	19.0	16.0	14.6	15.7
Standard deviation peak-to-trough phases	12.0	9.8	5.6	9.4	4.1	3.8
Mean trough-to-peak phases	12.5	10.6	17.3	15.0	16.0	16.6
Standard deviation trough-to-peak phases	0.7	3.7	8.3	6.0	8.6	15.3

AP- Arabica Parchment, AC- Arabica Cherry, RP- Robusta Parchment, RC- Robusta Cherry, CHK - Chikmagalur, TN- Tamil Nadu



## CONCLUSION

The increase in Robusta coffee prices was due to shift in cultivation of Arabica coffee to Robusta coffee. This directly influenced the higher production and productivity of Robusta coffee in India. In Chikmagalur market, prices prevailed lean during the months of March, April, August, September, October and November and higher in the months of December, January and February for Arabica. Robusta parchment and cherry prices prevailed lean during January, November and December and higher in March, June and July. In Tamil Nadu market, Arabica parchment prices prevailed 3 per cent higher in January and March than the normal price. Arabica cherry prices prevailed 4 per cent in January and February. Price was higher in the months of January, February and March and lean during September, October and November. Regarding the cyclical behavior, in Chikmagalur and Tamil Nadu market, there observed difference in number of cycles but similar pattern was observed with regard to time period spent in slump was higher than in boom for both the markets.

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Not applicable

### Ethics statement

No specific permits were required for the described field studies because no human or animal subjects were involved in this research.

### Originality and plagiarism

Authors should ensure that they have written and submit only entirely original works, and if they have used the work and/or words of others, that this has been appropriately cited. Plagiarism in all its forms constitutes unethical publishing behavior and is unacceptable.

### Consent for publication

All the authors agreed to publish the content.

### Competing interests

There were no conflict of interest in the publication of this content

### Data availability

Enough data was generated from this study.

### Author contributions

Not applicable.

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