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Price Behaviour of Cassava in Kerala: An Econometric Analysis

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Abstract

The study analyzed the price behaviour of cassava in Kerala during the period from January 1999 to June 2011. The growth in cassava prices was slow, but with high instability of 36.97%. Time series decomposition analysis was carried out to isolate the different components present in the price series. The single exponential smoothening model was found to capture the underlying trend in cassava prices with a low Mean Absolute Percentage Error (MAPE) value of 1.67. The seasonal decomposition analysis revealed that the months of March and April was typically characterized by a peak phase for cassava prices in Kerala. The period from September to November was also marked by a buoyant phase for cassava due to lean market arrival during this period. Even though no pronounced long term cycles were evident, three short cycles were identified during the study period. There were random effects in the price-but it oscillated more or less evenly around the mean value of 100, indicating that random factors were evenly occurring in cassava trading. As the shelf life of cassava tubers are too short, product development and diversification through processing and value addition is suggested to overcome the adverse seasonal and cyclical price movements.

Key words: Cassava, price behaviour, price instability, trend component, seasonal index, cyclical variation, random fluctuation

Introduction

Cassava (syn. tapioca) is a major starchy root crop of the tropics. Cassava grows best under warm humid tropical conditions where rainfall is well distributed and fairly abundant. It has the ability to withstand fairly prolonged periods of drought (KAU, 2011). The crop thrives best on light sandy loams or loamy sands which are moist, fertile and deep. But in practice, it is grown on a wide range of soils, provided the soil texture is friable enough to allow the development of the tubers. In India, during 2010-11, 80.59 lakh tonnes of cassava was produced from 2.32 lakh ha, with a productivity of 34.756 t ha^{-1} (Directorate of Economics and Statistics, 2012). Kerala and Tamil Nadu are the two major cassava growing states in India. However, it is grown widely as a food crop in Kerala, while it is grown mainly for industrial purposes in Tamil Nadu. Kerala and Tamil Nadu together accounts for 88.65% of cassava growing area in India (Department of Economics and Statistics, 2012). Andhra Pradesh, Assam, Meghalaya, Nagaland, Pondicherry, Karnataka and Andaman and Nicobar Islands are the other cassava growing states in India.

It may be noted that the area under cassava cultivation in Kerala has been continuously on the decline from 1995-96 (Table 1). The gains in productivity were negated by the shrinking area, with the result that cassava production has been stagnant in the state since the nineties. The picture becomes more clear when we analyze the acreage ratio (expressed as the area under a crop as a percentage to the total cropped area during the same year) of the major crops (Table 2). A perusal of the Table indicates that rice, coconut, cassava, rubber, pepper, banana and cashew together accounted for more than two third of the total cropped area in Kerala at the

Table1. Area, production and productivity of cassava in India and Kerala from 1995-96 to 2010-11

Year	India			Kerala		
	Area ('000 ha)	Production ('000 t)	Productivity (t ha^{-1})	Area ('000 ha)	Production ('000 t)	Productivity (t ha^{-1})
1995-96	231.70	5856.80	25.278	113.60	2500.11	22.008
1996-97	228.20	5443.20	23.853	120.39	2691.11	22.354
1997-98	256.10	5662.80	22.112	121.39	2741.69	22.586
1998-99	264.30	6681.90	25.282	112.77	2630.16	23.322
1999-00	243.40	5830.00	23.952	109.26	2563.51	23.463
2000-01	223.50	6014.10	26.909	111.18	2512.15	22.595
2001-02	253.50	6768.40	26.700	111.19	2455.88	22.087
2002-03	238.90	6515.90	27.275	104.18	2413.22	23.164
2003-04	207.00	5426.20	26.214	111.35	2503.56	22.484
2004-05	220.00	5949.60	27.044	88.49	2400.04	27.123
2005-06	244.70	7462.80	30.498	90.54	2568.28	28.367
2006-07	244.60	7854.90	32.113	87.13	2518.99	28.911
2007-08	255.50	8232.30	32.220	83.99	2556.46	30.438
2008-09	270.00	9056.00	33.541	87.28	2712.11	31.074
2009-10	280.20	9623.00	34.343	74.86	2525.38	33.737
2010-11	231.90	8059.80	34.756	72.28	2360.08	32.650

Source: Directorate of Economics and Statistics (2012) and Department of Economics and Statistics (2012)

Table 2. Acreage ratio of important crops in Kerala (%)

Year	Rice	Cassava	Coconut	Banana	Pepper	Cashew	Rubber
1980-81	27.79	8.49	22.58	1.71	3.75	4.90	8.24
1985-86	23.67	7.08	24.59	1.85	4.24	4.81	11.53
1990-91	18.52	4.85	28.81	2.17	5.58	3.83	13.50
1995-96	16.36	3.70	29.80	2.38	6.26	3.37	14.64
2000-01	11.50	3.79	30.64	3.29	6.69	3.05	15.70
2005-06	9.24	3.03	30.07	3.91	7.97	2.62	16.56
2009-10	8.77	2.80	29.18	3.71	6.43	1.84	19.69

Source: Estimated by the authors

beginning of eighties. The acreage ratio of rice, cassava and cashew has been declining continuously during the reference period, while that of coconut, rubber, black pepper and banana are on the rise. This trend is truly indicative of the changing relative profitability of these crops brought about by changing cost of cultivation scenario and output price changes. A previous study by Srinivas and Anantharaman (2005) reported that farmers neither have any say on the price of raw tubers nor do they get any remunerative prices in cassava. It is against this background that the price behaviour of cassava in Kerala has been studied in this paper.

Materials and Methods

The data on area, production and productivity of cassava in India was collected from the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. The data on area, production and productivity of cassava in Kerala was compiled from various issues of Economic Review, State Planning Board, Government of Kerala. The Compound Annual Growth Rates (CAGR) of cassava area, production, productivity and price were estimated by fitting an exponential function of the type: $Y = AB^t$

where, Y = monthly state average farm gate price of cassava, A = intercept, B = regression coefficient of the equation assumed to be (1 + r) and t = time variable. The logarithmic transformation of the function was carried out as:

$$\ln Y = \ln A + t \ln B$$
$$\acute{Y} = a + bt$$

where, Ý = ln Y, a = ln A and b = ln B

The Compound Annual Growth Rate (CAGR) was found from (antilog b – 1)*100.

The instability of cassava price was determined using the coefficient of variation. It was arrived by the formula:

$$CV = \frac{\sigma}{\bar{y}} 100$$

where, CV = coefficient of variation in %, ó = standard deviation and $\bar{y}$ = arithmetic mean of the time series.

The monthly state average farm gate price of cassava was collected from the Directorate of Economics and Statistics, Thiruvananthapuram, Kerala, for the period from January 1999 to June 2011, covering a time span of 13 years. The classical time series decomposition analysis was performed (Anderson, 1971; Croxton et al., 1979 and Enders, 1995). This approach essentially tries to decompose any time series to identify four basic components, viz., the trend, seasonal, cyclic and irregular variations.

A multiplicative model of the following form was used for the decomposition:

$$Y(P) = T \times C \times S \times I$$

where, Y (P) = state average farm prices of cassava, T = trend, C = cyclical variation, S = seasonal variation and I = irregular movements.

A "trend" denotes a long run tendency in the price behavior without considering the seasonal, cyclical or random effects. Trend analysis was carried out using the method of least squares and different functional forms like linear, quadratic, cubic, compound, growth, logarithmic, sigmoid, exponential, inverse, power and logistic models. Fitted trend lines were plotted along the actual data to examine the goodness of fit.

Seasonal variations are the variations which occur within the span of a year with regular periodicity. Generally, seasonal effects of prices are attributed to the mismatch between the seasonal nature of production and the perennial nature of consumption. It would be very pronounced in seasonal and annual crops, where the growth seasons are marked. Seasonal indices were worked out to capture the seasonal patterns in the price data. The ratio to moving average method was used to estimate the seasonal index.

Cyclical variations are of longer duration, usually extending to a few years and are of different periodicity. The residue method was employed for determining the cyclical effects in the data. Accordingly, the secular trend was removed from the time series data by dividing each of the original values by the corresponding trend values and expressing the same in percentage. The trend value for each month was divided by the corresponding seasonal index, which left a residue of cyclical and irregular components. The irregular movements were eliminated by using 12-month moving averages. The index thus obtained was expressed in percentage to facilitate easy interpretation.

The irregular components are the "residuals" that remain in a time series after the removal of the trend, seasonal and cyclical effects. It will represent the random or irregular variations in a time series. They are short term fluctuations, attributable to supply shocks on account of climatic deviations or demand shocks or high speculative factors. Irregular movements were obtained by dividing the cyclical versus irregular indices by the cyclical movement. It was then converted in percentage to obtain the irregular index. The estimations were carried out using SPSS version 16.0 and Mini Tab 11.0 version.

Results and Discussion

Growth rates

The growth rates in area, production, and productivity of cassava are presented in Table 3. It may be noted that the production of cassava in India grew annually at 3.26% during the period under reference. This was largely due to the contribution of growth in productivity and to a lesser extent by growth in acreage.

The situation in Kerala during the corresponding period was entirely different. It may be noted that the gains in productivity were negated by the shrinking area, with the result that cassava production has been stagnant in the State since the nineties.

Table 3. Compound growth rate (%) of cassava in India and Kerala from 1995-96 to 2010-11

Particulars	India	Kerala
Area	0.42	-3.24
Production	3.26	-0.29
Productivity	2.83	3.05

The growth in monthly state average farm gate price of cassava was just 0.60%, indicating the slow growth in the output price, not compensating the changes in the cultivation costs that had accrued to the farmers during this period by way of increased fertilizer cost, labour wages and other farm inputs. The fluctuation in cassava price measured using the coefficient of variation during the same period was 36.97%. It is evident from the above analysis that the slow growth in output price coupled with price instability was a major disincentive for cassava cultivation in Kerala. This explained why the farmers abandoned cassava in favour of more remunerative crops like rubber.

Trend analysis

Trend lines were fitted to the monthly state average farm gate price of cassava using the linear, quadratic, cubic, compound, growth, logarithmic, sigmoid, exponential, inverse, power and logistic models. As none of the geometric models could capture the trend present in the time series accurately in terms of R^2 value, standard error and Mean Absolute Percentage Error (MAPE), the trend line was depicted using the single exponential smoothening model (Fig. 1), which could capture the trend correctly with a low MAPE value of 1.67. It indicated that the fitted trend line could predict the variations in cassava price in Kerala with 98.33% accuracy. Cassava prices were devoid of wide fluctuations during the period from January 1999 to December 2009. The trend analysis also confirmed that cassava prices grew more or less steady within a small range.

Seasonal price movements

The mismatch between round the year consumption and seasonality in the production of crops leads to seasonal variations in the price of agricultural commodities. The degree of seasonal fluctuations in prices is directly related to the degree of perishability of the commodity, the availability of storage and other market infrastructure facilities also. The seasonal index for cassava farm gate prices were worked out and are given in Fig. 2. The main planting seasons for cassava are April, May and June with the onset of South-West monsoon and September-October with the onset of North-East monsoon. The improved and local varieties

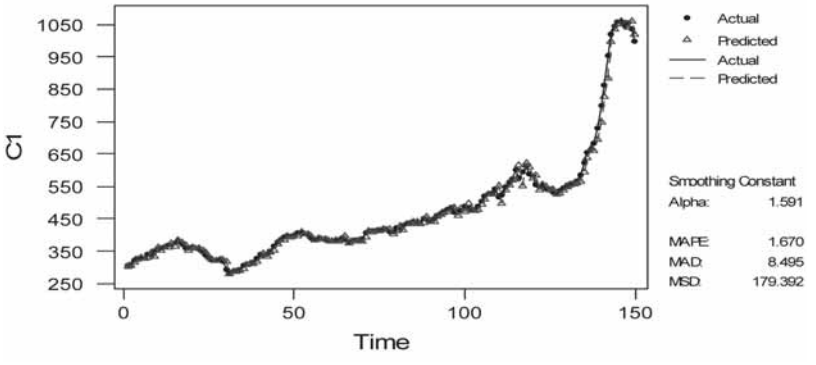

Fig.1. Single exponential smoothening model for cassava farm gate prices

are more cultivated during the April-May planting. This crop will be harvested during the period from December to January. The seasonal index showed a declining trend for prices during this period when market arrivals were maximum. Farmers prefer a short duration variety for September-October planting since most of the crop is cultivated in rice fallows. It is generally harvested in six months, preferably in the months of March or April before the onset of South-West monsoon for good quality tubers. As there are no starch industries in Kerala, a portion of the marketable surplus moves to the starch industries in the neighbouring state of Tamil Nadu. There are reports that the demand from the starch industries in Tamil Nadu was maximum during this period because quality starch manufacturing required dry summer days (Graffam et al., 2012). So this period is typically characterized by a peak phase for cassava prices in Kerala. This explains as regards to why cassava prices were peaking during March- April months. However, the prices softened by May-June when the market arrivals were maximum. The period from September to November was marked by a buoyant phase for cassava due to lean market arrival during this period. Earlier, Srinivas and Anantharaman (2005) had reported price troughs from January to June quarters coinciding with the harvest of cassava in Tamil Nadu and price peaks during the lean arrival period from July to September quarter. Thus, the cassava growers at large were faced with a distorted market on account of intra-year price fluctuations in the main cassava planting season in Kerala (April-May planting) as the peak production season was characterized by trough prices and the lean production period was characterized by buoyant prices.

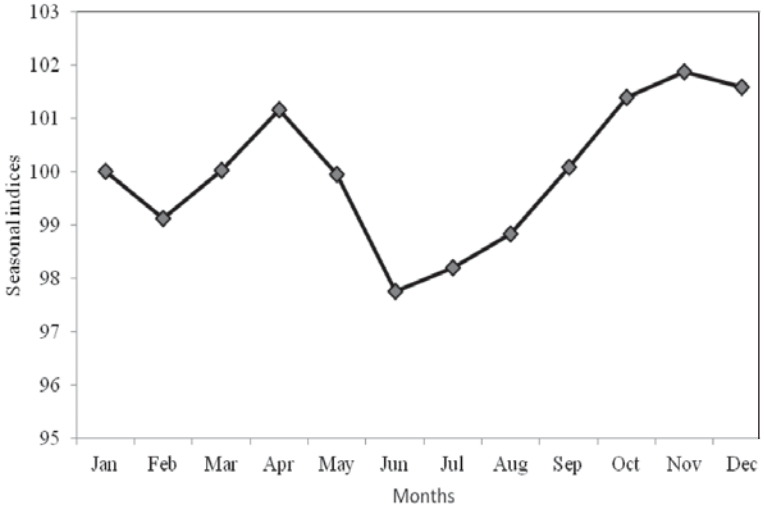

Fig. 2. Seasonal variations of monthly state average cassava prices

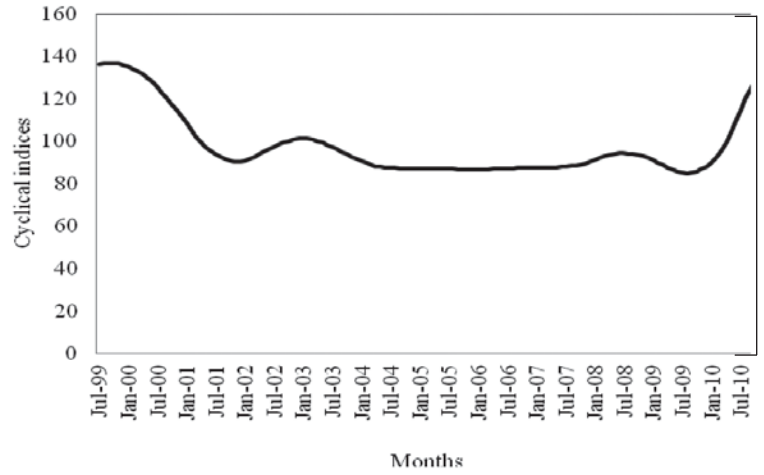

Fig.3. Cyclical variations in the monthly state average prices of cassava

However, the farmers were better off during the second season (September-October planting).

Cyclical price movements

Cyclical variations in cassava prices were analyzed in order to know the variation in prices over the years and is presented in Fig. 3. It may be noted that short cycles were visible during the period from July 1999 to June 2001; from December 2001 to March 2004; from September 2007 to August 2009. The data period is insufficient to capture the end of the present price cycle.

Agricultural commodities are characterized by inter-year price fluctuations, manifested in the form of price cycles. These price cycles are driven by demand-supply mismatches, differences in production and consumption cycles, etc. For example, Jayasree et al. (2011) has identified a price cycle of six years for black pepper during 1995 to 2010, while a price cycle of five years have been reported for coconut by Babu et al. (2011) during 2000 to 2011. Varghese (2011) on the other hand noted cycles of short spells for natural rubber during 1995 to 2011. It implies that though the booms and depressions in the economy may affect the macro economic variables, price cycles are influenced more by production cycles, consumption and trade patterns and sector wise policies also.

Random price movements

The random component is an unpredictable component as a result of unforeseen situations like weather related production problems or demand or supply uncertainties due to a host of factors or due to speculative activities. The indices of irregular variations have been worked out to capture the random effect (Fig. 4). It can be noted that the prices of cassava were subjected to considerable fluctuations over time.

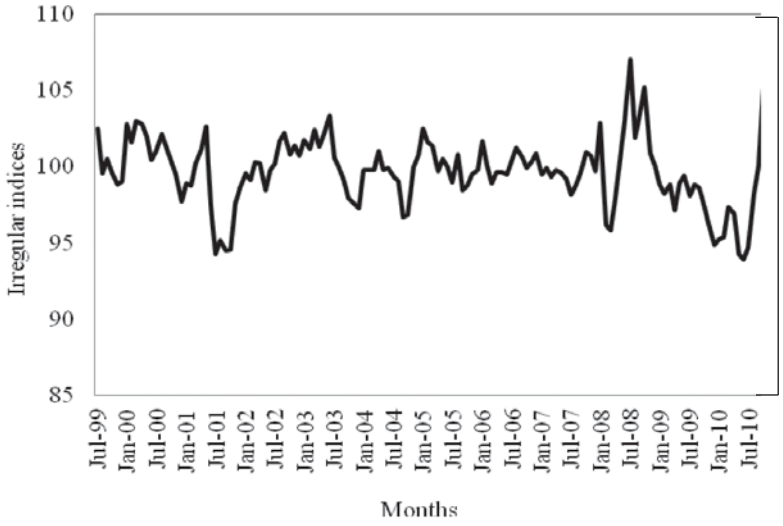

Fig. 4. Irregular variations in the monthly state average prices of cassava

There were random effects in the price but it oscillated more or less evenly around the mean value of 100, indicating random factors were evenly occurring in cassava trading.

Conclusion

Being a food as well as an industrial crop, understanding the causes and consequences of cassava commodity price will be helpful in understanding the market dynamics better. The analysis conducted on cassava prices showed that the growth in price was very slow. The price contained the trend effects, seasonal effects, cyclical effects and irregular or random effects. This information can be of immense value to farmers as well as traders in guiding farm level sale, stocking/outsourcing and contract phasing decisions to their advantage. As cassava prices are subjected to high instability, institutional mechanisms to protect the cassava growers from the adverse effects are needed to sustain their interest in its cultivation. Price risk reduction measures such as providing adequate, timely, dependable and farmer centric market intelligence through the collective efforts of all stake holders like farmers, traders, promotional agencies and R and D institutions assume importance in this context.

The cassava growers were facing a distorted market on account of intra-year price fluctuations because the peak production season was characterized by trough prices, and the lean production phase was characterized by buoyant prices. Naturally, the benefit of this trade equation would go to the traders and market intermediaries as the commodity under consideration could not be stored due to its perishability and low shelf life. Nor the farmers could delay the harvest as it would affect the quality of the tubers, thereby fetching a still lower price. This drives home the need for processing, value addition and product diversification in cassava that may help to reduce the price instability in the primary commodity through forward and backward linkages.

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