Effect of Annual National Coconut (*Cocos nucifera*) Production on the Prices of Fresh Nut, Desiccated Coconut and Coconut Oil.

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ABSTRACT

Coconut is the largest plantation crop in Sri Lanka and the second largest after rice and the coconut palm plays an important role in the economy of Sri Lanka. Desiccated coconut (DC) and coconut oil (CNO) are the major kernel product of coconut. Annual data on wholesale prices of fresh nut (WP-NUT), DC free on board (f.o.b) price (P-DC), wholesale price of CNO (WP-CNO) and annual national coconut production (ANCP) in Sri Lanka from 1973-2003 were analysed in this study. The correlation analysis showed a significant negative correlation (p<0.05) for WP-NUT, P-DC, and WP-CNO with the ANCP in the same year. Further these three price indicators are highly inter-correlated and there is a very strong significant linear relationship between the WP-NUT and WP-CNO (r =0.91, p<.0001). Of these three types of prices P-DC is least effected by the ANCP. The influence of current year production on both WP-NUT and WP-CNO is almost same. Further, ANCP one year prior is also a significant influential factor (p<0.05) only on the current year P-DC. ANCP two years prior has no any significant effect on WP-NUT, WP-CNO or P-DC. Using ordinary Least Square method a simple linear regression model was developed to predict the current year P-DC using previous year ANCP (R^2=12.6 percent, p<0.03), but the percentage error varies between -40 percent to 85 percent.

KEY WORDS: Coconut Nut, DC, CNO, Temporal Variability Analysis, Correlation, Simple Linear regression

INTRODUCTION

Coconut belongs to the family palmae. It is an important export commodity, which has a broad spectrum of industrial uses. It is a primary source of food, drink, shelter and medicines. The major part of the production 70 percent is used for local consumption; the balance is used for export as kernel products (24 percent) and husked nuts (1 percent). Two main groups can be recognized within the cocos genus, the tall palms *Cocos nucifera typica*, the dwarf palms *Cocos nucifera nana* (Shivashankar, 1991).

Coconut is a high value commercial crop grown in 92 countries within the humid tropical regions in the world. As every part of the coconut palm is utilized to make different kinds of products, the coconut palm is popularly known as "tree - of - life". During 1999-2003, the total coconut extent in the world was about 11.5 million hectares and mean annual production of coconut was around 54 billion nuts. (APCC, 2003).

Coconut is a traditional plantation crop that has been grown in Sri Lanka for last two hundred centuries. The crop plays a significant role in the national economy, besides its influence on the social and cultural lives of about 700,000 families, which form the coconut production ranging from 2600-3000 million nuts, Sri Lanka is in the forefront as a major exporter of DC and brown fiber among coconut growing countries in the world. The crop contributes Rs19 108 million to the GDP (the GDP contribution by the coconut sector was 2 percent in year 2003) and earns foreign exchange to the extent of RS. 8 926 million by way of exporting a range of kernel and non-kernel coconut products in the year 2003 (Central Bank, 2003).

Though coconut is widespread throughout the country covering a total extend of about 442 000

ha, the crop is mainly confined to the coconut triangle (including the districts of Kurunegala, Puttlam and Gampaha). Low productivity of the coconut palm is the main problem affecting the coconut industry in Sri Lanka with an average national production of only 5 550nuts/ha/year (Central Bank, 2003).

Generally, coconut palms show a wide tolerance of climatic and weather factors. Among the climatic factor rainfall, minimum temperature and relative humidity (afternoon) are the most influential climatic parameters in determining the crop yield (Peiris and Thattil, 1996).

However, the annual national coconut production is determined by the three-monthly seasonal rainfall in seven different agro-ecological regions within the coconut triangle (Peiris, 2004). By considering the three-monthly seasonal rainfall (January-March, April-June, July-September, and October-December) in the above agro-ecological regions (AER), he has shown that rainfall during the first quarter of the year in each AER is the most significant determinant factor of the national coconut production.

Coconut provides about 22 percent of the daily calorie intake of the Sri Lankan population, being second only to rice. The annual per capita consumption of coconut is the highest in Sri Lanka compare to the other countries, which was around 113±7 nuts during 1983-2002 (CDA, 2002). The inter and intra annual variability of national coconut production poses many problems in sharing coconut among domestic consumption and other industrial uses.

Although it can be hypothesized that the prices of coconut nut, and some kernel products of fresh such as desiccated coconut and coconut oil are dependent on annual national coconut production and the temporal variability of the prices over the year has not been thoroughly investigated. Therefore this study was conducted to achieve following objectives.

1. To investigate annual variability of, (a) annual average wholesale price of fresh nut (WP-NUT), (b) annual average f.o.b. price of DC (P-DC) and (c) annual average wholesale price of CNO (WP-CNO), (d) annual national coconut production (ANCP).
2. To identify the association between the above prices with annual national coconut production at different lag years.
3. To predict the f.o.b price of DC (P-DC) using ANCP of the previous year.

METHODOLOGY

The vagaries of market arising from disequilibrium of supply and demand bear serious implications on the net income of the producers of perennial crops compared to annual crops. An important factor contributing to price fluctuations of perennial crops is borne out of its relatively inelastic supply in the short run. Studies on the price behavior of perennial crops assumed added significance due to higher investment, gestation period, span of economic life and secular trend in prices.

1). Data collection

The study was carried out at the Biometry Division of the Coconut Research Institute of Sri Lanka, Lunuwila. The secondary data about yearly coconut production and yearly prices of fresh nut (CN) (wholesale), f.o.b price of desiccated coconut and wholesale price of coconut oil from past statistics reports (1973-2003) of the Coconut Development Authority. All the price values were deflated by Colombo Consumer Price Index (CCPI) number to remove the inflation effect.

2) Statistical Analysis
A. Analysis of temporal annual variability

The plots were drawn for the data on the ANCP and the three price variables from 1974-2003 using Excel package and the descriptive statistic were computed using the Minitab package.

B. Correlation analysis

The correlation anlysis for the current year ANCP, previous year ANCP, and two year lag ANCP with the current year annual average prices of WP-NUT, P-DC and PW-CNO were carried out by using Statistical Analysis Software (SAS) package.

C. Simple Linear Regressions

The regression model was fitted for current year P-DC using previous year ANCP as a dependent variable from the period of 1973-2002.

CP-DC = f (PANCP)

Where;

CP-DC = Current year annual average f.o.b

prices of DC in Rs/Kg
PANCP = Previous year annual national coconut production in million nuts

RESULTS AND DISCUSSION

A. Analysis of descriptive statistics of the variables

The descriptive statistics of the four variables are shown in Table 1.

Table 1. Descriptive Statistic of the four variables (1974- 2003)

| Variable	Mean	Std Dev	CV	Minimum	Maximum
ANCP	2434	326.05	13.4	1821 (1977)	3096 (2000)
WP-NUT	292.9	87.24	29.78	105 (1975)	578 (1984)
P-DC	3.68	1.61	43.75	2.02 (2001)	7.57 (1979)
WP-CNO	2596	814.73	31.38	1030 (1975)	5276 (1984)

Parenthesis refers the year of which maximum and minimum occurs

The wholesale price of coconut oil (WP-CNO) and that of coconut nut (WP-NUT) were highest in 1984. These two prices were lowest in 1975. The annual variation of the prices was very high for the DC and the CV is 44 percent. The inter-annual variability of the prices was the lowest for CNO and the CV is around 30 percent. The annual variability of ANCP was significantly lower than the annual variability of the prices of nut and kernel products.

B. Temporal variation of ANCP and annual prices.

a. Annual National Coconut Production (ANCP)

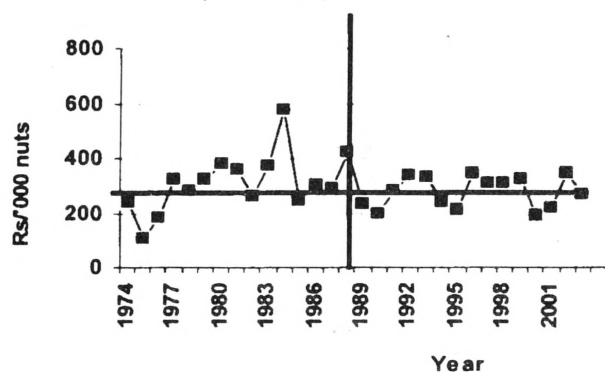Figure 1: Temporal variability of ANCP (1974-2003)
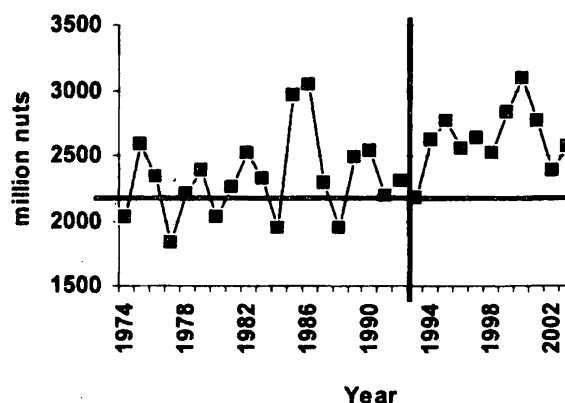
The Figure 1 clearly indicated that there is no-cyclic pattern. During the last 30 years period from 1974 to 2003 the mean value was 2434 million nuts. It can be seen that the ANCP after 1993 was above the long-term mean. The production in year 1978, 1991 and 1993 were closure to 2200 million nuts but it was closure to 3000 million nuts in year 1986 and 2000 (Figure 1).

During the last 30 years the fresh nut wholesale price was fluctuated over the year between 1974 and

150

2003. The mean wholesale price of fresh nut during 1976, 1990, and 2000 was approximate to 200 Rs/'000 nuts but in year 1988 it was 421 Rs/'000 nuts (Figure 2). The highest price was obtained in 1984 and it was 578 Rs/'000 nuts (Table 1).
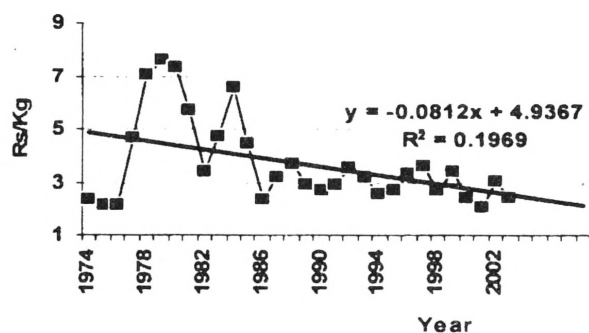
b. Annual Wholesale Price of Nut (WP-NUT)

Figure 2: Temporal variability of WP-NUT (1974-2003)


c. Annual f.o.b. Price of DC (P-DC)

Figure 3: Temporal variability of P-DC (1974-2003)

$y = -0.0812x + 4.9367$
$R^2 = 0.1969$

The annual f.o.b price of DC had shown the decreasing trend pattern over the time. However the trend line was able to explained only about 20 percent of the variability of the DC price (Figure 3). The lowest price of 2.02 Rs/Kg was obtained in year 2001(Table -1)

d. Annual Wholesale Price of Coconut oil (WP-CNO)

Figure 4: Temporal variability of WP-CNO (1974-2003)
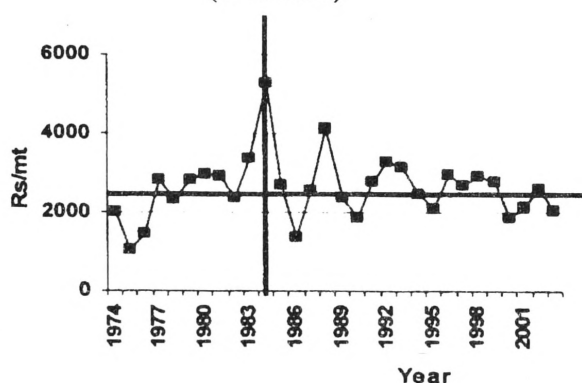
The coconut oil price also fluctuated over the time during last 30 years from the period 1974-2003. the CV is 31.38. The highest price of 5276 Rs/MT was obtained in 1984 that was two time of mean price of coconut oil.

C. *Association between prices and yield (with lagged)*

The result of the correlation matrix of the above variables is given in Table 2

According to the probability values shown in parenthesis (Table-2), there were no significant relationship between current year annual national coconut production (CANCP), and pervious year annual national coconut production (Lag1 ANCP); as same as among previous year ANCP, current year wholesale price of fresh nut (CWP-NUT) and current year wholesale price of CNO (CWP-CNO). But there were significant negative correlation (p<0.05) among CANCP, CWP-NUT, CP-DC, and CWP-CNO and quantified to 52.53 percent, 45.11 percent, and 54.16 percent respectively. As well as between Lag1 ANCP and CP-DC it is quantified to 38.99 percent. Further it can be all these three current year correlation coefficients were almost same and the correlation coefficient between Lag1 ANCP and CP-DC was low compare to other significant coefficients. However these correlations were not strong enough to claim that there is a linear relationship between CANCP and the current year prices of CN, DC and CNO as well as between Lag1 ANCP and CP-DC. And there were no significant correlation for the current year price variables with the two year lag period coconut production (Lag2 ANCP) at 5 percent significant level (Table-2)

D. *Prediction of P-DC*

In order to develop a simple linear regression model to predict the current year f.o.b price of DC using previous year ANCP, a model of CP-DC = f (PANCP) was investigated.

Different types of models such as linear, log linear, linear log, log-log and Quadratic functions were tested. The stability of the models was judged based on coefficient of determination (R^2), significant of the parameter estimates. Also residual sums of squares were compared.

A log-linear model was selected as the best model for the CP-DC variable based on coefficient of variation. The regression results given below in Table 3 are for the current year DC price variable.

Table 3: Regression results for current year P- DC for previous year ANCP

Variables	Estimated coefficient	t-value	p-value
Intercept	2.315 (0.482)	4.80	<0.0001*
PANCP	-0.00045 (0.0002)	-2.28	0.0303*

Significant at 5 percent, Model R2=15.66 percent, Adjusted R2 = 12.66 percent, CV=29.33

151

Table 2: Pearson Correlation matrix for ANCP and current year price variable

|	CANCP	Lag1 ANCP	Lag2 ANCP	CWP-NUT	CP-DC	CWP-CNO
CANCP	1.0000					
Lag1 ANCP	0.3480 (0.0595)	1.0000				
Lag2 ANCP	-0.2069 (0.2727)	0.2742 (0.1426)	1.0000			
CWP-NUT	-0.5236 (0.0029)	-0.0075 (0.9688)	0.3097 (0.0989)	1.0000		
CP-DC	-0.4511 (0.0123)	-0.3899 (0.0332)	0.1828 (0.3335)	0.5950 (0.0005)	1.0000	
CWP-CNO	-0.5416 (0.0020)	-0.1229 (0.5174)	0.3384 (0.0674)	0.9138 (<.0001)	0.5344 (0.0024)	1.0000

Parenthesis refers the probability values of correlation coefficient

The predicted model can be written as log (P-DC) = 2.315-0.00045 PANCP ----- (1)

The regression model explained 12.6 percent of the variation in the previous year ANCP by the specified explanatory variable (Table-3). It further indicated that the previous year ANCP was significant at the 5 percent probability level and showed a negative significant relationship with current year price of DC (CP-DC).

The comparison between actual and predicted DC price using the model (1) shown in the figure 5. The correlation between actual and predicted DC was 0.39 (p <0.05). The percentage error of predicted values with the respect to actual prices varied between -40 percent and 85 percent.

Figure 5: Comparison of actual and predicted DC price

Time (Year)

—■— Actual   —▲— Predicted
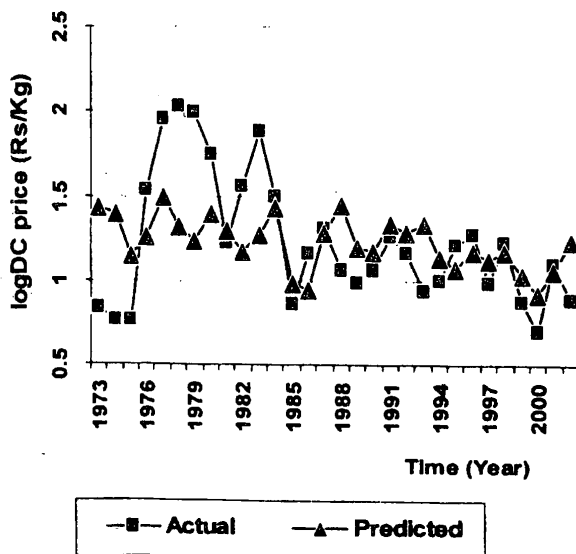
CONCLUSION

The result revealed that the variability of annual national coconut production (ANCP) is significantly low compared with the annual variability of wholesale price of coconut nut, coconut oil (CNO) or f.o.b price of DC (DC). The current year prices of fresh nut, DC and CNO are significantly affected by the ANCP of the same year. The ANCP for a given year effects only on the following year f.o.b price of DC. The f.o.b. price of DC can be estimated by using previous year ANCP.

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