



## Time Series Analysis of Retail Milk Prices in Tamil Nadu State of India

## KEYWORDS

Milk price, Trend, Seasonal Variation

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**ABSTRACT**

A study was carried out to analyze the trend and seasonal variation of retail milk prices in major consumption centres of Tamil Nadu, India. The data on monthly retail milk prices for the period from April 1990 to March 2012 were collected from various secondary sources. The retail milk price trend equation fitted for selected four major consumption centers of Tamil Nadu revealed that the milk price had increased at the rate of 0.058 (Chennai), 0.071 (Madurai), 0.072 (Coimbatore), and 0.059 (Nagercoil), paise per litre of milk on every month. The intercept of trend equations was fitted for four consumption centers of Tamil Nadu were found to be around 4.159 (Chennai), 3.865 (Madurai), 3.065 (Coimbatore) and 4.093 (Nagercoil). The monthly milk price index was observed to be the maximum and minimum variations seen on subsequent months. The seasonal retail milk price index was found to be the highest during the month of June, July and November and the lowest during the month of August and November.

**INTRODUCTION**

Indian Dairy sector play a significant role in supplementing family income and generating gainful employment in the rural areas besides providing cheap nutritional food to millions of people. The growth of dairy sector during the last three decades has been impressive. So that's way the Growth of Dairy industry placed India at first position in world's milk production with a production of 127.92MT of milk per year (Economic Survey of India, 2011-12). The milk production in India is growing at the rate of 4 percent whereas the world growth rate is only one percent. India occupies the largest milk producing country in the world and as compared with 1998-99 figures, milk production in India has increased by about 40 percent in 2011-12, the per capita availability of milk is 291 gm per day which is much below the figure of the world average. Tamil Nadu ranks seven in the country's milk production (Integrated sample survey, 2011. Directorate of Animal Husbandry and Veterinary Services, Chennai). The state Government decides the procurement and sales retail price of milk. Price of milk increases rapidly due to increase in demand, driven by growing population pressure, increase in income status of the consumers and awareness on nutritional quality of milk. For forecasting demand and supply, the time series analysis of retail milk prices in major consumption centers of Tamil Nadu will be useful, which in turn would aid in suggesting suitable policy implications for the betterment of milk consumers and producers. For the present study, four major consumption centers of Tamil Nadu namely Chennai, Madurai, Coimbatore and Nagercoil were selected by simple random sampling to analyze the trend, seasonal and spatial variations in monthly retail milk prices.

**DATA AND METHODOLOGY**

The data on monthly retail prices of milk for four major consumption centres of Tamil Nadu viz., Chennai, Ma-

durai, Coimbatore and Nagercoil for the period from April 1990 to March 2012 were collected from various secondary sources.

**Price trend**

To identify the price trend, scatter diagram was examined taking time period in X-axis and monthly retail milk price in Y-axis. Since, the scatter diagram exhibited linear relationship, the following form of linear trend equation was fitted for the present study similar to previous studies by Serma saravana Pandian *et al.* (2011) and Rajendran *et al.* (1991)

$$P = a + bt + \mu$$

Where,

- P - Monthly retail milk price in paise
- a - Intercept to be estimated
- b - Slope / Regression parameter to be estimated
- t - Time in months (t = 1 for April 1990, t = 2 for May 1990....., t = 264 for March 2012) and
- $\mu$  - Error term.

**Seasonal variation in Milk prices**

For the present study, to find out the seasonality in retail milk prices using multiplicative model, classical decomposition through centered moving average method was used because of its accuracy and forecasting ability. Similar methodology has been adopted in the previous studies of Mani *et al.* (1995) and Mondal *et al.* (1995).

$$\text{Multiplicative model} : X_t = T_t * S_t * C_t * I_t$$

Where,

- $X_t$  - Retail price of milk at time 't'

- $T_t$  - Trend component
- $S_t$  - Seasonal component
- $C_t$  - Cyclical component and
- $I_t$  - Irregular component.

**Classical Decomposition method :**

$$S_t = \frac{T_t * S_t * C_t * I_t}{T_t * C_t * I_t}$$

By calculating the moving average, ' $T_t * C_t$ ' was separated and by taking average, centered moving average was constructed, thereby ' $I_t$ ' was also separated and finally the seasonal index ' $S_t$ ' was obtained.

**RESULTS AND DISCUSSION**

**Price trend**

The result of the trend analysis using a linear trend equation of retail milk prices for four major consumption centers of Tamil Nadu namely Chennai, Madurai, Coimbatore and Nagercoil are portrayed in Table 1. The Adjusted  $R^2$  for the retail price trend equations fitted for four major consumption centers of Tamil Nadu were found to be 0.992 (Chennai), 0.909 (Madurai), 0.854 (Coimbatore) and 0.928 (Nagercoil), which indicated that about for Chennai, Madurai, Coimbatore and Nagercoil, 99.2, 90.9, 85.4 and 92.8 per cent of the variations in retail milk prices in different consumption centres of Tamil Nadu were due to the trend component of time series. The F value of retail price trend equations was fitted for four major consumption centers of Tamil Nadu were found to be 3098.118 (Chennai), 2619.699 (Madurai), 1537.302 (Coimbatore) and 3405.512 (Nagercoil). The slope of linear trend equations of retail milk price revealed that the milk price had increased at the rate of 0.058 (Chennai), 0.071 (Madurai), 0.072 (Coimbatore) and 0.059 (Nagercoil) paise per litre of milk on every month in all the four selected major consumption centers of Tamil Nadu.

**Table: 1 Retail milk prices in Tamil Nadu**

Place	Trend equation	F value	Adjusted $R^2$
Chennai	$P = 4.159 + 0.058^{**}t + \mu$	3098.118**	0.992
Madurai	$P = 3.865 + 0.071^{**}t + \mu$	2619.699**	0.909
Coimbatore	$P = 3.065 + 0.072^{**}t + \mu$	1537.302**	0.854
Nagercoil	$P = 4.093 + 0.059^{**}t + \mu$	3405.512**	0.928

The positive slope of linear trend equation indicates steady raise in milk price which might be due to either increasing demand, driven by growing population pressure or due to decline in supply caused by factors like failure in proper management of dairy stock, anomalous price fluctuations of dairy feeds, failure in control of disease outbreaks and environmental factors etc. The intercept of trend equations was fitted for four major consumption centers of Tamil Nadu were found to be 4.159 (Chennai), 3.865 (Madurai), 3.065 (Coimbatore) and 4.093 (Nagercoil).

**Seasonal variations in milk price**

The monthly price index of retail milk price for four major consumption centers of Tamil Nadu was depicted in table 2. It could be inferred from the table that the price index of all the major consumption centers coincides with each other over months. This clearly indicated that the seasonal variations in the milk price index were almost similar irrespective of the location of market. The reason for uniform-

ity in price behaviour might be due to the organized milk marketing method and uniform price fixation procedures by state government. Thus the variations in the price index during various months solely depend upon the changes in demand surpassing all the other related factors. The milk price index showed fluctuation on subsequent months. The reason could be the supply of milk. When the milk supply was high price also increased vice versa and then demand of these economic goods is stable in all over the months of the year so price fluctuation is not too much.

**Table: 2 Seasonal indices for retail milk prices in Tamil Nadu**

Month	Chennai	Madurai	Coimbatore	Nagercoil
Jan	100.142	100.140	99.993	99.990
Feb	99.857	99.860*	99.991	99.990
Mar	100.142	100.140	99.997	100.000
Apr	99.867	99.870	100.001	100.000
May	100.142	100.140	100.006	100.010
June	99.871	99.870	100.009	100.020**
July	100.142	100.140	100.015**	100.010
Aug	99.847*	99.850	100.013	100.000
Sep	100.144	100.150	100.009	100.010
Oct	99.851	98.150	100.014	100.010
Nov	100.146**	100.151**	99.981*	99.970*
Dec	99.848	99.150	99.987	99.990

\*\* Highest price index & \*Lowest price index

Among different months, milk price indices were seemed to be the highest during the month of November in Chennai (100.146) and Madurai (100.151). However the milk price indices was the highest during the month of June in Nagercoil (100.020) and July in Coimbatore (100.15). The milk price indices showed fluctuation on subsequent months.

**CONCLUSION**

The study of analyzing the trend, seasonal variations in retail milk prices in Tamil Nadu state of India, revealed that the milk price had increased constantly by at the rate of 0.058 (Chennai), 0.071 (Madurai), 0.072 (Coimbatore) and 0.059 (Nagercoil) paise per litre of milk on every month. The Adjusted  $R^2$  and F value of trend equations was fitted for four major consumption centers of Tamil Nadu were found to be around 0.992 (Chennai), 0.909 (Madurai), 0.854 (Coimbatore), 0.928 (Nagercoil) and 3098.118 (Chennai), 2619.699 (Madurai), 1537.302 (Coimbatore) and 3405.512 (Nagercoil) respectively. The intercept of trend equations was fitted for four major consumption centers of Tamil Nadu were found to be around 4.159 (Chennai), 3.865 (Madurai), 3.065 (Coimbatore) and 4.093 (Nagercoil). The milk price indices were showed fluctuation on subsequent months. The reason could be supply of milk. When the milk supply was high price also increased vice versa and then demand of these economic goods is stable in all over the months of the year so price fluctuation is not too much.

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