STATISTICAL EVALUATION OF PRICE BEHAVIOR OF SILK COCOON IN SELECTED MARKETS OF KARNATAKA

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CERTIFICATE

This is to certify that the thesis entitled **"Statistical evaluation of price behavior of silk cocoon in selected markets of Karnataka"** submitted in partial fulfillment of the requirements of **MASTER OF SCIENCE (Agriculture)** in **AGRICULTURAL STATISTICS** of the University of Agricultural Sciences; Bengaluru is a bonafide record of research work carried out by **Ms. CHAITHRA. R. PALB 2162 ,** during the period of her study in the University, under my guidance and supervision and no part of the thesis has been submitted for the award of any degree, diploma, associate ship, fellowship or other similar titles.

Place: Bengaluru
Date: 18th, Feb 2015

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Above all, I thank thee for the blessings showered on me in my life.

Bangalore **(Chaithra. R)**
Feb, 2015

STATISTICAL EVALUATION OF PRICE BEHAVIOR OF SILK COCOON IN SELECTED MARKETS OF KARNATAKA

Chaithra, R.

Abstract

Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen, inherent affinity for dyes, soft touch and high durability and known as the "Queen of Textiles" the world over.

This study is an attempt to analyze the pricing behavior and market co-integration of silk cocoons in Ramanagaram, Shidlaghatta and Vijayapura Markets of Karnataka for the period of 2010-2014. This study uses the descriptive statistics, Box-Jenkins ARIMA model, Vector Error Correction Model (VECM) and Granger causality test. The results of descriptive statistics revealed that mean prices of all the three markets is in the range of Rs 200-350 Per Kg for the year 2013 whereas arrivals showed seasonal variation. Mean and other measures indicated that Shidlaghatta market prices and arrivals were higher than other two markets and results showed increasing trend within the market for prices and arrivals in all the three markets. Analysis showed that model (0 1 4) (1 0 1) was most appropriate for Shidlaghatta and Ramanagara, and model (0 1 0) (1 0 1) for Vijayapura market. Forecasting was made for the period Jan 2014 – Mar 2014, using ARIMA models and forecasting showed upward trend in all the market. Vector correction model showed the Speed of adjustment of price signals among the selected markets is Co-integrated with unidirectional feedback mechanism. Future researchers can study the price behaviour using the quality parameter.

Student Signature   Major Advisor

ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಆಯ್ದ ರೇಷ್ಮೆ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ರೇಷ್ಮೆ ಗೂಡುಗಳ ಬೆಲೆ ವರ್ತನೆಯ ಕುರಿತು ಅಂಕಿ ಅಂಶಗಳ ಮೌಲ್ಯಮಾಪನ

ಚೈತ್ರ, ಆರ್

ಪ್ರಬಂಧದ ಸಾರಾಂಶ

ವಿಶ್ವದ ಒಂದು ಅತ್ಯಂತ ಸೊಗಸಾದ ಜವಳಿಯೆಂದರೆ ರೇಷ್ಮೆ ಎನ್ನಬಹುದು. ಇದು ಸಾಟಿಯಿಲ್ಲದ ಹಾಗೂ ಹೆಚ್ಚಿನ ಬಾಳಿಕೆಯನ್ನು ಹೊಂದಿರುವ ಜವಳಿಯಾಗಿದೆ, ಆದುದರಿಂದ ಪ್ರಪಂಚದಾದ್ಯಂತ ಇದನ್ನು "ಜವಳಿ ರಾಣಿ" ಎಂದು ಕರೆಯುತ್ತಾರೆ.

2010–2014ರಲ್ಲಿ ಕರ್ನಾಟಕ ರಾಜ್ಯದ ರಾಮನಗರ, ಶಿಡ್ಲಘಟ್ಟ ಮತ್ತು ವಿಜಯಪುರ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ರೇಷ್ಮೆ ಗೂಡುಗಳ ಬೆಲೆ ವರ್ತನೆಯ ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸಿ ಈ ಅಧ್ಯಯನವನ್ನು ಕೈಗೊಳ್ಳಲಾಗಿದೆ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ರೇಷ್ಮೆ ಗೂಡುಗಳ ಬೆಲೆ ಪರಿವರ್ತನೆ ಮತ್ತು ಮಾರುಕಟ್ಟೆಗಳ ಸಹ ಏಕೀಕರಣ ಬಗ್ಗೆ ವಿಶ್ಲೇಷಿಸಲು ಪ್ರಯತ್ನಿಸಲಾಗಿದೆ. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಲ್ಲಿ ವಿವರಣಾತ್ಮಕ ಅಂಕಿ–ಅಂಶ, ಬಾಕ್ಸ್ ಜೆಂಕಿನ್ಸ್ ಅರಿಮ (ARIMA), ವೆಕ್ಟರ್ ದೋಷ ತಿದ್ದುಪಡಿ ಮಾದರಿ ಹಾಗೂ ಗ್ರ್ಯಾಂಗನರ್ ಶಾರಣ ತತ್ವಗಳ ಸಾಧನಗಳ ಮೂಲಕ ಅಂಕಿ ಅಂಶಗಳನ್ನು ವಿಶ್ಲೇಷಿಸಲಾಗಿದೆ. ವಿವರಣಾತ್ಮಕ ಅಂಕಿ ಅಂಶಗಳ ಫಲಿತಾಂಶಗಳ ಪ್ರಕಾರ 2013ರಲ್ಲಿ ಮೂರು ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ರೇಷ್ಮೆ ಗೂಡಿನ ಸರಾಸರಿ ಬೆಲೆ ಒಂದು ಕೆ.ಜಿ. ಗೆ 200–350 ರೂಪಾಯಿಗಳು ಎಂದು ಕಂಡುಬಂದಿದೆ. ಸರಾಸರಿ ಮತ್ತು ಇತರೆ ಮಾಪನಗಳ ಪ್ರಕಾರ ಉಳಿದ ಎರಡು ಮಾರುಕಟ್ಟೆಗಳಿಗೆ ಹೋಲಿಸಿದರೆ ಶಿಡ್ಲಘಟ್ಟ ಮಾರುಕಟ್ಟೆಯಲ್ಲಿ ರೇಷ್ಮೆ ಗೂಡಿನ ಸರಬರಾಜು ಮತ್ತು ರೇಷ್ಮೆ ಗೂಡಿನ ಬೆಲೆ ಅಧಿಕವಾಗಿರುವುದು ಕಂಡುಬಂದಿದೆ. ರೇಷ್ಮೆ ಗೂಡಿನ ಸರಬರಾಜು ಮತ್ತು ಬೆಲೆಗಳ ಅಂದಾಜನ್ನು ಬಾಕ್ಸ್ ಜೆಂಕಿನ್ಸ್ ಅರಿಮಾದಿಂದ ವಿಶ್ಲೇಷಿಸಿದ್ದು, ಇದರ ಪ್ರಕಾರ ಅರಿಯ ಮಾದರಿಯು (014) (101), ಶಿಡ್ಲಘಟ್ಟ ಹಾಗೂ ರಾಮನಗರ ಮಾರುಕಟ್ಟೆಗೆ ಮತ್ತು (010) (101) ಮಾದರಿಯು ವಿಜಯಪುರ ಮಾರುಕಟ್ಟೆಗೆ ಸೂಕ್ತವಾಗಿರುತ್ತದೆ ಎಂದು ತಿಳಿದು ಬಂದಿದೆ. ಅರಿಮ ಮಾದರಿ ಬಳಸಿ ಜನವರಿ 2014ರಿಂದ ಮಾರ್ಚ್ 2014 ಅವಧಿಗೆ ಬೆಲೆ ಸರಬರಾಜು ಅಂದಾಜು ಮಾಡಲಾಗಿದೆ, ಇದರ ಪ್ರಕಾರ ಎಲ್ಲಾ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ಬೆಲೆ ಮತ್ತು ಸರಬರಾಜಿನಲ್ಲಿ ಏರಿಕೆಯನ್ನು ಗಮನಿಸಬಹುದು. ಗ್ರ್ಯಾಂಗನರ್ ಶಾರಣ ಮತ್ತು ವೆಕ್ಟರ್ ತಿದ್ದುಪಡಿ ಮಾದರಿಯು ಮಾರುಕಟ್ಟೆಗಳ ಪೈಕಿ ಬೆಲೆ ಸಂಕೇತಫಳ ಹೊಂದಾಣಿಕೆಯ ವೇಗದ ಜೊತೆಗೆ ದಿಕ್ಕಿನ ಪ್ರತಿಕ್ರಿಯೆಯನ್ನು ಯಾಂತ್ರಿಕ ಕೋ–ಅಂತರ್ಗರವಾಗಿರುವುದನ್ನು ತೋರಿಸುತ್ತದೆ. ಗುಣಾತ್ಮಕಾಂಶಗಳ ಬೆಲೆ ವರ್ತನೆಯ ಮೇಲಿನ ಪ್ರಭಾವವನ್ನು ಮುಂದಿನ ಸಂಶೊಧಕರು ಅಧ್ಯಯನ ಮಾಡಬಹುದು.

ವಿದ್ಯಾರ್ಥಿಯ ಸಹಿ
(ಚೈತ್ರ, ಆರ್)

ಮುಖ್ಯ ಸಲಹೆಗಾರರು
(ಡಾ. ಎಂ. ಗೋಪಿನಾಥ್ ರಾವ್)
ಕೃಷಿ ಸಂಖ್ಯಾಶಾಸ್ತ್ರ ವಿಭಾಗ
ಕೃ.ವಿ.ವಿ., ಜಿ.ಕೆ.ವಿ.ಕೆ.
ಬೆಂಗಳೂರು–560 065

Study of Variation of Prices of Silk Cocoon in Major Markets of Karnataka

Chaithra. R and Dr. M. Gopinath Rao

Department of Agricultural Statistics, Applied Mathematics and Computer Sciences

INTRODUCTION: India is 2nd largest producer of Silk in the world contributing to 18% of world raw silk production. Market share in global silk trade is about 4-5 %.

- Cocoons find usage in various preparations for medicine, beauty enhancement, value added decorative crafts etc has provoked the farmers to involve in sericulture.
- India, despite being 2nd in global production of silk and the only country to produce all the five different varieties of silk. India is importing substantial quantities of silk from China.
- Among all the major silk producing states, Karnataka ranks 3rd In terms of production of both Bivoltine and Multivoltine silk cocoons.
- Hence, the present study is concentrated to know the major variety, markets and its contribution to production and productivity in Karnataka. This study will help the Govt in policy decision making.

OBJECTIVES

- To Study the spatial and temporal variation in the pricing of silk cocoon.
- To know the market co-integration of silk cocoon at selected markets of Karnataka.
- To Forecast the prices of the silk cocoon in selected markets of Karnataka

MATERIAL AND METHODS

Study area: - The study was carried out in major 3 markets from 2 districts of Karnataka, viz., Ramanagaram, Shidlaghatta and Vijayapura from Chikkaballapura district. These areas were selected based on major arrivals and transactions respectively.

Data type: - Secondary data was used in the study, daily data was available for the arrivals and prices for the period of October 2010 till February 2014.

Statistical tools: - Vector error correction model for market co-integration. Seasonal index is represented by Graph and analyzed by Moving Average method(Harmonic analysis).

Results: Cocoon production is influenced by climatic condition, the ideal climatic condition is adequate sunshine coupled with dry weather (summer). The extent of variation in arrivals is studied with the help of seasonal index and Harmonic analysis. The interdependence of markets is studied through co-integration method to capture long term and short term price movements

▪Market co-integration is an alternative approach to stabilize prices, allocate resources and rectify market imperfections. If markets are well integrated then government can stabilize price in one key market and rely on commercialization to produce a similar outcome in other markets. This reduces the cost of stabilization considerably. Further, farmers will not be constrained by local demand conditions.

▪To carry out the vector error correction analysis there is a need to test the stationarity of data using Augmented Dickey Fuller test and the results for the price data reveals that they are stationary only after 1st differencing. Granger Causality test was carried out to know the co-integration and results are shown in table(1). There is bi-directional co-integration between all the markets.

▪Vector error correction results are shown in table(2) above test indicate that Ramanagaram and Vijayapura market prices are integrated and are adjusted within 2 lag period. Where as Shidlaghatta market is corrected on its own.

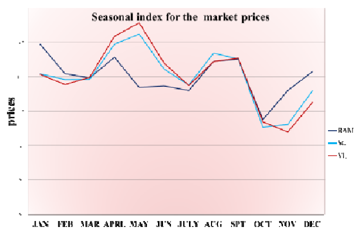
Granger causality test. In table 1 and Vector error correction model in table 2.

Null hypothesis	observation	Probability	Reject H_0
Ramnagaram prices does not Granger Cause Shidlaghatta prices	1245	1.E-20	YES
Shidlaghatta prices does not Granger Cause Ramnagaram prices	1245	2.E-15	YES
Vijayapura prices does not Granger Cause Shidlaghatta prices	1245	3.E-49	YES
Shidlaghatta prices does not Granger Cause Vijayapura prices	1245	9.E-15	YES
Vijayapura prices does not Granger Cause Ramnagaram prices	1245	7.E-24	YES
Ramnagaram prices does not Granger Cause Vijayapura prices	1245	9.E-13	YES

Sl.No	Error Correction		Table 2		
			Shidlaghatta	Ramnagaram	Vijyapura
1	**Co- integration Equation 1**	t- statistics	-12.7663	1.49985	2.54767
2	**Shidlaghatta(-1)**	t- statistics	-1.23948	0.31910	**3.28034**
3	**Shidlaghatta(-2)**	t- statistics	-1.12577	-0.55637	0.77739
4	**Ramnagaram(-1)**	t- statistics	1.87665	**4.40313**	**2.41089**
5	**Ramnagaram(-2)**	t- statistics	0.00646	**-5.00770**	0.84986
6	**Vijayapura(-1)**	t- statistics	1.89355	**6.08807**	-1.67090
7	**Vijayapura(-2)**	t- statistics	-0.68845	**3.91748**	-1.16460

Seasonal indices for prices in selected markets and graphical representation

months	RAM(P)	SG(P)	VIJ(P)
Jan	104.716	100.378	100.324
Feb	100.431	99.574	98.856
Mar	99.823	99.631	99.917
Apri	102.802	104.703	105.866
May	98.433	106.184	107.826
Jun	98.642	101.072	101.954
July	97.972	98.771	98.731
Aug	102.202	103.405	102.187
Sept	102.515	102.606	102.684
Oct	93.749	92.663	93.434
Nov	97.978	93.047	91.978
Dec	100.737	97.965	96.243



Discussion

Seasonal variation.

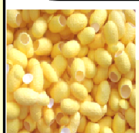
Seasonal indices shows that lower prices prevail during the months of October to March, while April to June are high price months.

Vector error correction model.

Is used to know the speed of adjustment of price signals among important cocoon markets. It is clear from the table that Ramanagara market price is influenced by its own previous days prices and it also influences today's Vijayapura market prices and visa versa with error correction, Shidlaghatta previous day prices influence today's Vijyapura prices, with error correction.

Summary

Cocoon prices exhibit seasonality in price behaviour. The three leading cocoon markets are co-integrated with unidirectional feedback mechanism. Shidlaghatta prices correct on its own to the extent of 12.76 %, while rest of the price adjustments happen due to price movements in other markets. Vijayapura market prices are influenced by one day lag prices of itself and Ramanagara prices. Whereas Ramanagara prices are influenced by one day lag price of itself and previous two days prices of Vijayapura market.



Advisory committee

•Dr M. Gopinath Rao (Chair person)
•Mr. G.B. Mallikarjuna.
• Dr T. K Narayanaswamy.
•Dr Chandrashekar.

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I. INTRODUCTION

Agriculture is the largest sector in Indian economy. It is providing not only food and raw materials but also employment to the vast population in India. Since agriculture has reached a stage, where it cannot absorb any increased number of labor force because of large-scale unemployment and under-employment there is a need to develop agro-based industries to divert the surplus population from agriculture. Thus, sericulture is best suited to a country like India, where there is surplus work force and land resources beside its remunerative nature. By creating more employment opportunities to the rural population, sericulture prevents rural migration and promotes handlooms sector.

Silk is nature's gift to humankind and a commercial fibre of animal origin other than wool. Being an eco-friendly, biodegradable and self-sustaining material, silk has assumed special relevance in present age. Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen, and inherent affinity for dyes, high absorbance, lightweight, soft touch and high durability and known as the "Queen of Textiles" the world over. Silk the queen of all fabrics is historically one of India's most important industries. Sericulture is the cultivation of silk through rearing of silkworm. It is an agro-based industry. It involves the raising of food plants for silkworm, rearing of silkworm for production of cocoons, reeling and spinning of cocoon for production of yarn etc. for value added benefits.

The contribution of sericulture to the rural development is reflected by its growth potential, which has increased by 7.2 per cent per annum in the last 36 years. Sericulture is an important agro based rural industry that helps our economy and generates higher income and employment. Sericulture industry provides employment to approximately 7.65 million persons in rural and semi-urban areas in India, which is mostly concentrated in Karnataka, Tamil Nadu and Andhra Pradesh and to some extent in Assam and West Bengal. Karnataka accounts for more than 70% of the country's total silk production. Sericulture industry is rated as the second largest employer and manufacturer contributing to 18% of the total world raw silk production, increased silk production by 23, 800 MT, and has increased exports by 15% (2012-13). India's traditional and culture bound domestic market and an amazing diversity of silk garments that reflects geographic specificity and has helped the country to achieve a leading position in silk industry. India has the unique distinction of being the only country producing all the five known commercial silks, viz., mulberry, tropical tasar, oak tasar, eri and muga, of which muga with its golden yellow glitter is unique and prerogative of India.

PRODUCTION AND CONSUMPTION OF RAW SILK:

The origin of Sericulture and Silk production are closely associated with the emergence of China as one of the great civilization. World raw silk production was 1,52,868 MT in 2011. China leads the world with silk production of 1,26,000 MT or 82.41% of the produce. India is the second largest producer of silk in the world, and it has

15.49 % share in global raw silk production, around Rs. 1000 crores worth of silk is produced in India annually.

Indian Scenario: - Production of raw silk in India was 23,679 MT in 2012-13 of which, mulberry raw silk output aggregated to 18,715 MT (79.04%). The remaining 4,964 MT (20.96%) was *Vanya* silks. Mulberry sericulture is mainly practised in five states viz., Karnataka, Andhra Pradesh, West Bengal, Tamil-Nadu and Jammu & Kashmir which jointly account for about 97% of the total mulberry silk production in the country.

As the consumption of raw silk (around 28,630 MT) exceeds the production, the additional requirement of around 5,000 MT of silk (particularly Bivoltine mulberry silk of international quality) is imported mainly from China.

Need for the Study

The biggest problem of world silk economy is prevailing price instability in cocoon and raw silk markets. The 21st congress of the International Sericulture Commission (ISC), devised a policy to safeguard the interests of developing countries against the influx of low priced silk and silk commodities. Though sericulture plays an important role in Indian economy, there exists a serious problem of fluctuation in silk cocoon prices in markets. Hence, the study is carried out to see the price fluctuation in Major markets of Karnataka.

The specific objectives of the study are as follows

- Studying the spatial and temporal variation in the pricing of silk cocoon
- Forecasting the prices of the silk cocoon in selected markets of Karnataka
- Know the market co-integration of silk cocoon at selected markets of Karnataka

LIMITATIONS OF THE STUDY

This study is limited to three major silk markets of Karnataka, which are Ramanagaram, Shidlaghatta and Vijayapura. Daily data on arrivals and prices of the cocoon was available for 3 years and few months (2010-2014). Using this daily data on silk cocoon co-integration between three markets and forecasting of silk cocoon prices has been attempted.

II. REVIEW OF LITERATURE

The purpose of this chapter is to report the findings and reviews undertaken by previous investigators on different aspects of the study in the light of the models or tools set forth. In accordance with the tools of the study, the review of literature have been chronologically organized and presented under different heads as given below.

2.1 Descriptive statistics

2.2 ARIMA model

2.3 Error correction model and Market co-integration

2.1 Descriptive Statistics

Rodolfo G. Nillo and Antonio E. Madrid (2002) conducted a study to develop a set of strategies to optimize returns from the use of cocoons at the Sericulture Research and Development Institute, and they mainly aimed at determination of the cocoon production constraints optimized returns and best utilized combination which would optimize the returns hence for the study they utilized the descriptive and developmental research design. The descriptive research design was used to describe the procedures that are on-going; practices and beliefs that are prevailing, conditions of relationships that exist; effects that are being felt; and trends that are developing. There were 15 cocoon producer respondents that were surveyed providing information on their cocoon production and economic profits. Frequency counts, mean and percentage were applied in the analysis of data were keyed in to generate the best cocoon utilization option or combination that would yield maximum economic returns for farmers and cocoon produce. Results showed that the best cocoon utilization option was the selling of cocoons after harvest, drying and sorting them. For the Sericulture Industry to generate maximum net income, it should focus on the production of cocoon for marketing and less attention to be given to silk fabric production.

Khatiwada *et al*. (2002) made a study on ground water contamination assessment. By using descriptive statistics of the water quality parameters, the parameters are grouped by comparing to the World Health organization (WHO) drinking water quality guideline values. The arsenic (AS) content was found to exceed the guideline value in four wells from the central region where extremely high value of some other parameters such as DOC, NH_3 and phosphate ($PO4_3$) were observed. Deep wells were also found to have Fe, Mn and Hg concentrations exceeding the guideline values.

D'Emden (2006) carried out a study in Australia on the adoption and diffusion of conservation tillage practices. No-till and zero-tillage could be seen as representing the current technological end-point of the conservation tillage movement. This study uses descriptive statistics and both logit and duration regressions to analyse the influence of cross-sectional and time-dependent factors on the probability of no-till adoption by growers in Australia's southern grain growing regions. Descriptive statistics suggest that weed management and herbicide resistance are important considerations for growers in their tillage decisions, predominantly due to the substitution of herbicides for the physical weed control provided by cultivation. The results suggest that research and development of integrated weed management practices that are compatible with no-till systems is highly important if no-till systems are to be sustained in Australia's southern wheat belt. Such research and development should acknowledge the high value which growers place on locally generated information and the channels used to acquire such information.

Ladele and Kuponiyi (2006) conducted a study on Comparative analysis of the role of for-profit and non-profit private organizations in agricultural extension. They investigated and compared the roles of for-profit in the British American Tobacco Company and non-profit private organizations of the Farmers Development Union and the Diocesan Agricultural Development Programme in agricultural extension service delivery in South-western Nigeria. Data was collected using interview schedule from 218 for-profit and 304 non-profit organizations clients selected by multistage random sampling technique, totalling 522 respondents. Data was analysed using both descriptive and inferential statistics. The results revealed that Mean ages of respondents varied between 47.1 years and 49.6 years for profit-oriented and non-profit private organizations, respectively. At least 95% for-profit participants were married compared with 74.6% of the non-profit private organizations clients. In the case of non-profit organizations there were significant relationships between the level of achievement and gender.

Asif Mahmood *et al.* (2011) reported that descriptive statistics of the 16 parameters were determined during the study and large standard deviation of most of the parameters revealed their randomly fluctuating concentration levels in the ground water. Correlation matrix is used to account for the degree of mutually shared variables between pairs of water quality variables.

SS Nupa et al (2011) conducted a study with a aim of to assess the Dietary Diversity Score (DDS) and nutritional status of breast feeding mothers living in rural villages in Ogun state, Nigeria. Data was collected by One hundred breastfeeding mothers using simple random sampling method. Information on Dietary Diversity Score (DDS) representing the number of food groups consumed over a 24 hour period was obtained using Food and Nutrition on Technical Assistance project. A daily nutrient intake was obtained by converting the food intakes into nutrient using food composition table. Anthropometric data such as weight, height, mid upper arm circumference (MUAC) was collected by using standard procedures. Data was analyzed using descriptive statistics; SPSS software package version 15.0, Chicago. Results revealed that more than half of the respondents were within the age group of 15-25years.The energy and protein intake of the respondents were above the recommended allowances. Anthropometric results showed that 75% of the respondents had normal body mass index, 20% were overweight while 5% were underweight. The MUAC showed that 80% had normal body fat while the rest were below standard. The DDS of breast feeding mothers were 13.32; the meat group received the highest (1.84) within the food groups, while cereal group received the lowest DDS (1.51) and the Conclusion of the study is, the breast feeding mothers had a good nutritional status and dietary diversity score.

Narendra kumar Bhatia *et al* (2013) conducted a study on yield Gap Analysis of Mulberry Sericulture in Northwest India, for analysis purposes they employed descriptive statistics and frequency analysis to analyze most of the data. The results reveal that, in 11^{th} plan period (2007-2012), there was an addition of 6196 ha (217.09 %) of mulberry acreage at annual linear growth rate of 33.44%, and total silk production could increase only by 54.64 MT (78.57%) at annual linear growth rate of 15.59 %, due to 43.93% (10.82 kg/ha) reduction in silk productivity at negative growth rate of -13.46%, annually. And now, average raw silk productivity in north-western states of India remains at 13.81 kg/ha, which is lower by 452.93 % (87.09 kg) in comparison to the national average of 100.90 kg/ha. A discussion is given on increasing the raw silk productivity to improve livelihood delivery of mulberry sericulture in northwest India in their study.

Oyekale and Abayomi Samuel (2014) carried out the study to analyzed the impacts of gender role in agriculture and climate and food security in the Sahel Belt of West Africa. The data was collected by the Climate Change, Agriculture and Food Security (CCAFS) Department and from 281 farmers from Mali and Burkina Faso Region, using multi-stage sampling procedures. Tools used in the study are Descriptive statistics, Poisson regression and Negative Binomial regression for the analysis. The results showed that average food crop land owned were 9.0227 and 2.8266 hectares in Mali and Burkina Faso respectively while 58.87 percent and 24.29 percent of the farmers indicated that men did most of the works in raw food production. Also, 24.11 percent and 43.57 percent of the households noticed more erratic rainfall in Mali and Burkina Faso, respectively, while 16.31 percent and 36.43 percent reported less overall rainfall. It was concluded that recognition of the contributions of women to food production in the Sahel can facilitate a process for understanding and devising livelihood strategies to mitigate the impacts of climate change.

2.2 Forecasting (ARIMA Model)

Protharo and Wallis (1976) examined the extent to which variations in a series could be explained first by a dynamic econometric model and then by ARIMA model. Econometric model clearly indicated that they provided a closer estimate of behaviour of the series during the sample periods.

Achoth (1985) fitted the time series models, to price data of tea at Calcutta and cochin auctions, production data of Northern and Southern regions of the country and quantity of tea exports. He identified that the moving average model was most suitable. The forecasts from these models yielded reasonably good ex-post and ex-ante forecasts judging from the test of their efficiency. The forecast of prices were superior to the forecasts of quantities which may be due to the predictable pattern of price behaviour. Further, some of the models fitted to the quantity series did reveal a certain degree of inadequacy which was not considered as serious, probably because certain cyclic pattern may not have been captured by the model.

Devaiah *et al.* (1988) attempted forecasting the prices of cocoons at Ramnagaram market by using ARIMA models. The forecasts were made for 13 months from April 1987 to April 1988. The forecasted values were observed to be close to the actual prices.

Lanciotti (1990) presented a analysing of time series data of monthly prices for a group of dairy products with the aim of obtaining reliable forecasts. The method of analysis employed is ARIMA as put forward by Box-Jenkins. The time series data covers both wholesale and retail prices for butter, Gorgonzola, Provolone, Grana Padano and Pasmigiano Reggiano. To estimate the reliability of the forecast obtained, a comparison is made with those resulting from naïve models do not require any estimates. Indicators on the accuracy of the forecasts show that except for Grana Padana, ARIMA forecasts are better.

Zapata and Garcia (1990) studied forecasting performance of various multivariate as well as univariate ARIMA models and evaluated for the presence of non stationarity in the data. Specifically, the accuracy of these approaches for forecasting monthly US prices of slaughter steers was examined. Results indicated that the importance of identifying characteristics of the time series by testing types of non stationarity procedures that permits model specifications consistent with system's dynamics provide the most accurate forecasts.

Borah and Bora (1995) model the monthly rainfall of Guwahati using seasonal ARIMA series, the model parameters are estimated using Marquard algorithm for non linear optimization. The various stages of model building are presented in a simple algorithm form. The model is used to predict rainfall for the month ahead and month wise rainfall for the year ahead.

Harinath (2001) conducted a study to examine the influence of quality and non-quality factors on the prices of cocoon, raw silk in Karnataka and to see the problems faced by cocoon rearing farmers and reelers. The result of the study revealed that the qualitative and non-qualitative characteristics influencing prices of cocoon are found to be highly significant, and problems were encountered in producing and marketing of silk cocoons, as pest and diseases attach is a common scenario, scarcity of rearing equipments, price instability, financial creases, and shortage of skilled workers.

Mastny (2001) used Box- Jenkins model for the analysis of time series for agricultural commodities. The paper contains a basic mathematical explanation of ARIMA models together with a practical illustration of prices development forecasting for the selected agricultural commodities.

Gangadharappa (2005) fitted ARIMA model to study the variation in arrivals and prices of potato in Bangalore, Belgaum, Kolar, Hassan and Hubli markets of Karnataka during 1996-97 to 2003-04. Box-Jenkins method was applied for precise forecasting of arrivals and prices of potato for the monthly data to all the selected markets. Of all the ten series, he found only two series, which yielded Box –Pierce 'Q' statistic which was significant and AIC was minimum.

Punitha (2007) attempted to fit ARIMA model to forecast the values of arrivals and prices of maize and ground nut for Davengere market and Hubli market. The forecasted values of groundnut arrivals and prices showed an increasing trend in Davangere market, but in Hubli market prices showed decreasing trend. The forecasted values of arrivals and prices of maize showed an increasing trend in both the markets

Satya pal *et al*. (2007) made an attempt to forecast milk production using statistical time series modelling techniques such as double exponential smoothing and Auto- Regression Moving Average(ARIMA) for the study period of twenty five years (1980-81 to 2004-05). On validation of the forecast from these models, ARIMA model performed better than the other one.

Badmus and Ariyo (2011) used ARIMA models to time series data on maize yield for the period of 1970-2005. The results shows that maize production forecast for the year 2020 to be about 9952.72 tons with upper and lower limits of 6479.8 and 13425.64 thousand tons respectively. The model also shows that the maize area would be 9229.74 thousand hectares with lower and upper limit of 7087.67 and 11371.81 thousand hectares respectively by 2020. This projection is important as it helps to inform good policies with respect to relative production, prices structure as well as consumption of maize in the country.

2.3 ERROR CORRECTION MODEL

Basu and Dinda (2003) conducted a study to analyse the issue of market integration of potato markets in Hooghly district, West Bengal by using the method of bivariate price series correlation, Engle- Granger and Error correction. The correlation matrix revealed that the wholesale and retail prices were strongly correlated but the co integrations setup did not support it. Thus, potato markets in Hooghly district are shown to be integrated. This is mainly attributed to close proximity, good communication facilities and good infrastructure availabilities among the market centres in Hooghly district of the state. The high degree of market integration showed that potato markets in the state are competitive and efficient at the wholesale level.

Edmund (2005) conducted a study on Induced Technological Change in Canadian Agriculture Field Crops, based on two-stage constant elasticity of substitution production function to disaggregate western Canadian wheat and canola data from 1926-2003 to investigate the induced innovation hypothesis. Analysis was carried out using co integration and error correction to assess causality in differentiating between technological change and factor substitution. The results provide empirical support for the hypothesis with respect to prairie wheat and cano la production.

Fadli Fizari Abu Hassan Asari *et al* (2011) made an attempt to analyze the relationship between interest rate, inflation rate and exchange rate volatility in Malaysia covering the period between 1999-2009. In this study they have used time-series Vector Error Correction Model (VECM) approach of stationarity test, co integration test, stability test and Granger causality test. The results showed that the inflation rate impacts the interest rate as indicated by Granger-cause. Subsequently the interest rate influences the exchange rate as shown by the Granger cause test. Taking into account a long term relationship, interest rate moves positively while inflation rate goes negatively towards exchange rate volatility in Malaysia. The implication of this study is that increasing the interest rate can be efficient in restraining exchange rate volatility.

Jenifer piesse et al (2011) applied co integration techniques to induced innovation based on the two- stage constant Elasticity of Substitution production function. This approach results in direct tests of the inducement hypothesis, which are applied to agricultural data of the United Kingdom from 1953 to 2000. The time series properties of the variables are checked, co integration is established and an Error Correction Model (ECM) constructed, which attempts to separate factor substitution from technological change. Finally, the ECM formulation is subjected to causality tests, which showed that the factor price ratio for chemicals and land is Granger-prior to the factor-saving bias of technological change. However, long-run relative prices are not causally prior to the machinery/labour ratio. The results from perturbations are the user cost of machinery, caused by oil price shocks. Thus, the Induced Innovation Hypothesis (IIH) may explain long-run transformations like the mechanical and fertilizer revolutions that dominated the twentieth century, but not reflect short-run price volatility.

Elham Gholampour et al (2012) conducted a study to examine the relationship between prices on linear causality relationship and vector error correction model(VECM) that show an unidirectional causality from the price of crude oil to that of gasoline. They have investigated asymmetric relationship between Iran's crude oil and imported gasoline prices for the period 1987-2008 using threshold nonlinear model. The results of estimated ECM-TAR suggest the short run unidirectional causality from the price of crude oil towards the imported gasoline price and bidirectional causality between these variables in the long-run.

NICHOLAS APERGIS *et al* (2014) carried out the study on the causal relationship between income inequality and economic freedom using data from U.S. states over the period 1981 to 2004 for analysis purposes they used panel error correction model. The results indicate bidirectional causality between income inequality and economic freedom in both the short and the long run. These results suggest that high income inequality may cause states to implement redistributive policies causing economic freedom to decline as economic freedom declines, income inequality rises even more. In other words, it is quite possible for a state to get caught in a vicious circle of high income inequality and heavy redistribution.

Rongping Li *et al* (2014) conducted a study to analyzes the fixed assest's and total investment in the Hebei Province industry for the period 1990-2011, using co-integration test and error correction models. The results showed, that the investment efficiency of Hebei Province was low in 1990-2011, the large fluctuation of the primary industrial investment efficiency, low investment efficiency and unreasonable structure of the tertiary industry are the important factors which were restricting economic growth of Hebei Province, and Hebei should increase the scale of investment and optimize investment structure based on the characteristics of each industry to improve the industrial investment efficiency and achieve sustained and stable economic growth in Hebei province.

Market Co Integration

Jayesh (2001) studied market integration for spices using correlation coefficient. The zero order correlation matrix of prices showed a strong integration among the selected markets of Kerala, Karnataka and Tamil nadu for both pepper and cardamom.

Balappa Shivaraya (2002) has made an attempt to examine the extent of price integration of onion and potato in the selected markets of North Karnataka comprising Belgaum, Bijapur, Dharwad, Gulburga, Raichur and Hubli. Zero-order correlation matrix between average wholesale prices of onion clearly indicated the integration among the selected markets, except Bijapur with other markets. However, the magnitude of integration was found to be higher between Belgaum and Raichur (0.9447), between Belgaum and Hubli (0.9253), Raichur and Gulburga (0.8669) and Belgaum and Gulburga (0.8393).

Amitkar *et al.* (2004) studied marketing infrastructure in Himachal Pradesh and integration of the Indian apple markets. The data was collected from various secondary sources. Exponential growth model and cuddy Delia valls method and co-integrated methods were employed. The study revealed that Chennai, Delhi and Mumbai markets were well integrated indicating existence of price diplomacy among various market were well integrated indicating existence of price dependency among various markets.

Gangadharappa (2005) employed a study in Bangalore, Belgaum, Kolar, Hassan and Hubli market during 1996-97 to 2003-04. The correlation coefficients were calculated between the arrivals and prices of all the selected markets, which indicated that the coefficients are significant except Bangalore market. All the selected markets for vegetables are integrated with zero order of integration.

Kerur (2007) employed correlation analysis for market integration of regulated markets in Karnataka. The results showed that before the improvement in Market Information System (MIS), there was integration between Ranebennur and Raichur market. Strong market integration was observed between Gulbarga and Raichur markets for jowar may be due to nearness of the markets.

III. METHODOLOGY

This chapter explains the comprehensive view of methodology adopted for the investigation viz., the study area, source of the data and the statistical tools and techniques employed for analyzing the data, under the following headings:

The methodology is presented under the following heads:

3.1 Selection of markets

3.2 Nature and sources of data

3.3 Analytical tools and techniques applied

3.1 Selection of markets

Study was conducted on the silk cocoon markets. According to the Central Silk Board, the major regulated markets for silk cocoon are Ramanagara, Shidlaghatta and Vijayapura markets. Markets were selected depending on the major arrivals and transactions.

Ramanagara market is situated beside the Bangalore-Mysore highway and it is in Ramanagara district, Shidlaghatta and Vijayapura markets are situated in Chikkaballapura district and they are situated on main road to Chikkaballapura.

3.2 Nature and source of data

This study is carried out using secondary data. Data on arrivals and prices was required for the study, and it was extracted from the registers maintained in respective silk cocoon markets for the period October 2010- February 2014. These markets maintain data on daily arrivals and prices of silk cocoon.

3.3 Methods of Statistical Analysis

In this section, a brief description of statistical tools employed are presented

a. Descriptive statistics

b. Time series analysis

c. Moving Average

d. Box- Jenkins model

e. Unit root Test

f. Johansen's Co- integrated test

g. Granger causality test

h. Vector Error Correction Estimation

3.3.1 Descriptive Statistics

The statistical information or data that are summarized and presented in the form, which is easy to read and understand, which may be tabular, graphical, or numerical, are referred as descriptive statistics. The mean, model, minimum value, maximum value, Standard Deviation (SD), skewness and kurtosis were computed for both price and arrivals, and were used to study the year wise variability for both the variables. Through this, we can observe the variation in the value of variables from year to year.

These analyses were carried out in SAS software, SAS provides a procedure function to compute descriptive statistics for the data set. These functions can be used to compute the different statistics of interest

3.3.1.1 Analysis of Time Series

Time series analysis was employed for studying the long- term, short- term and periodic fluctuations in price and arrivals of silk cocoons in the selected markets.

Database for time series analysis of price and arrivals of silk cocoon are in chronological order. Behavior of the data in a time series involves several components, viz., trend (T_t), cyclical variation (C_t), seasonal variation (S_t) and Irregular variation (I_t).

Trend component

Time series data generally exhibit random fluctuation, the series which show gradual shifts or movements to relatively higher or lower values over a longer period of time is known as trend. Trend is usually the result of long term factors such as population, change in taste of people, the count of bacteria and many more.

There are different types of trends; some of them are linear and non- linear in their form. Often, it may be possible to describe such movements by structural mathematical model. In the absence of such a definite format, approximately a polynomial or a smooth curve could describe the movement.

Cyclical variation

Any time series data often showing the recurring sequence of points above and below the trend line lasting more than one year can be attributed to the cyclical variation.

Seasonal variation

The time series data that usually shows the variation in regular pattern within a year and which represents the variability in the data due to seasonal fluctuation are known as seasonal variation. This variation usually can be analyzed using moving average method.

Irregular variation

Here, the effect could be completely unpredictable, changing in a random manner. These are also known as causal series and are affected by the unknown causes. The irregular variations are caused by the short- term, unanticipated, and nonrecurring factors that affect the time series. Like earthquakes, accidents and many more.

3.3.2: Time series model

For analysis of the time series data, a model is essential. Generally, two broad approaches are used. One is a multiplicative model and the other is an additive model. There could be other approaches too resulting in a hybrid model of these two. We employ only a multiplicative model, since agricultural data in many cases admit such a model as more appropriate one.

Let original observation at the time point be denoted by Y_t and the four components of time series viz., trend, seasonal, cyclical and irregular variations by T_t, S_t, C_t and I_t respectively, for a time period t (where t = 1, 2, 3..........n).

Then the multiplicative model is expressed as;

$Y_t = T_t * S_t * C_t * I_{t,}$ t = 0, 1, 2, 3...n.

3.3.3 Estimation of Seasonal Indices of monthly data

The multiplicative model permits to estimate each of the four components.

As a first step, to estimate the seasonal index at 12 months centered moving average is as follows.

$$M_1 = (Y_1 + 2Y_2 + ... + 2Y_{12} + Y_{13})/24$$

$$M_2 = (Y_2 + 2Y_3 + ... + 2Y_{13} + Y_{14})/24$$

$$M_3 = (Y_3 + 2Y_4 + ... + 2Y_{14} + Y_{15})/24 \text{........etc.} \qquad .....(1)$$

This is in the sequential manner for each points of time t. In this fashion a 12 month centered moving average removes a large part fluctuation due to seasonal effects, so that what remains is mainly attributable to other source viz., long term affects (T_t), cyclical effect(C_t); the irregular variation (I_t). Thus, this affords a means of not only estimating trend component effect but also estimating seasonal components.

In the next step of computing the seasonal index, the original series Y_t is divided by the centered moving average. This gives the first estimate of seasonal variations (S_t).

$$S_t = \frac{Y_t}{(TC)_t} = \frac{T_t C_t S_t I_t}{T_t C_t} \qquad \text{...... (2)}$$

It is expressed in terms of percentages. In this process, we do not have moving average for the first six and last six observations. The estimation procedure of seasonal indices is presented in Table 3.1 and Table 3.2.

Table 3.1 Computation of centered 12 months moving average

Year/month	Observation	Centered 12 month moving average	Per cent 12 month moving average
2010			
October	Y_1	-	-
November	Y_2	-	-
December	Y_3	-	-
2011			
January	Y_4	-	-
February	Y_5	-	-
March	Y_6	-	-
April	Y_7	M_1	S1
May	Y_8	M_2	S2
June	Y_9	M_3	S3
July	Y_{10}	M_4	S4
August	Y_{11}	M_5	S5
September	Y_{12}	M_6	S6
October	Y_{13}	M_7	S7
November	Y_{14}	*	*
December	Y_{15}	*	*
		*	*

2012			
January	Y_{16}	*	*
February	Y_{17}	*	*
March	Y_{18}	*	*
April	*	*	*
May	*	*	*
June	*	*	*
July	*	*	*
August	*	*	*
September	*	*	*
October	*	*	*
November	*	*	*
December	*	*	*
	*	*	*
2013			
January	Y_{29}	*	*
February	*	*	*
March	*	*	*
April	*	*	*
May	*	*	*
June	*	*	*
July	*	*	*
August	*	*	*
September	*	*	*
October	*	*	*
November	*	*	*
December	*	*	*
2014	*	*	*
January	*	*	*
February	Y	M	S

Table 3.2: Average of percentage centered 12 month moving average and computation of seasonal index for observation

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept
2010												
2011	-	-	-	-	-	-	S	S	S	S	S	S
2012	S	S	S	S	S	S	S	S	S	S	S	S
2013	S	S	S	S	S	S	S	S	S	S	S	S
2014	S	S	S	S	S	S	S	S	-	-	-	-
Mean	-	-										
Adj.	*	*	*	*	*	*	*	*	*	*	*	1200
Seasonal index	*	*	*	*	*	*	*	*	*	*	*	100

The original observation (Y_t) is divided by corresponding (S_t) value to obtain the residual $(TCI)_t$ corresponding to time point t.

$$(TCI)_t = \frac{Y_t}{S_t} = \frac{(TCSI)_t}{S_t}$$

The residual series $(TCI)_t$ thus obtained is subjected to the same process of determining 12 months centered average as done earlier to obtain better estimates for trend cycle and irregular effects $(TCI)_t$. These revised estimates are next employed as above to generate a revised set of seasonal indices by dividing each observation (Y_t) by the corresponding $(TCI)_t$ value. This will lead to revised estimates of seasonal indices (St) as second interactive ones. This interactive process is separately employed until stabilized seasonal indices are obtained that is, two successive seasonal indices do not differ by more than five per cent that is,

$$(TCI)_t = \frac{S_{i+j} - S_i}{S_i} x\,100 \leq 5 \qquad \ldots\ldots (3)$$

i=j=1, 2…..12.

3.3.5 Box-Jenkins (BJ) Methodology

This study uses Box-Jenkins ARIMA model technique to find an appropriate model for the time series. This model is then assessed, to determine how well it fits the data. Finally, price values for the next ninety days are estimated using this model.

Box and Jenkins's (1970) suggested that great parsimony could be obtained by combining the autoregressive (AR) and moving-average (MA) models. Differencing a time series *d* times to make data stationary and then by applying the ARMA model for it, we can obtain ARIMA (auto regressive integrated moving average) time series model.

Originally ARIMA model was studied extensively by George Box and Gwilym Jenkins's and their names have been frequently used synonymously with general ARIMA process.

To use this Box-Jenkins's methodology, we need either stationary time series or a time series that is stationary after one or more differencing.

3.3.5.1 Stationarity test

The basic assumption of, most of the time series technique is stationarity. Stationary data has constant mean and covariance and it is time invariant, but most of the time series data are non-stationary.

The methods to test stationarity are (1) Graphical method (2) Autocorrelation and Correlogram method and unit root test. Most popularly used method is unit root test i.e. it is done by differencing a time series data *d* times to make it stationary.

3.3.5.2 Establishing Seasonality

The need for autoregressive (AR) and moving average (MA) parameters are established by examining the autocorrelation and partial autocorrelation patterns of a stationary series at lags that are multiples of the number of periods per season. These parameters are required if the values at lags s, 2s, etc. are nonzero and display patterns associated with the theoretical patterns for such models, differencing the data is required if the autocorrelations at the lags do not decrease rapidly.

3.3.5.3 Autoregressive (AR) process (p 0 0)

Let y_t represent the model.

$$(y_t - \delta) = (y_{t-1} - \delta) + u_t \quad \text{...... (4)}$$

Where, δ is the mean of y and u_t is an uncorrelated random error term with mean zero and variance σ^2 then we can say y_t is an autoregressive or AR (1) stochastic process. In other words, this model says that the forecast value of y at time t is simply some proportion of y at time (t-1) plus a random disturbance at time t.

In general, we can have

$$(y_t - \delta) = \alpha_1 \left(y_{t-1} - \delta\right) + \alpha_2 \left(y_{t-2} - \delta\right) + ... + \alpha_p \left(y_{t-p} - \delta\right) + u_t \qquad ...... (5)$$

In which case y_t is a p^{th}-order autoregressive, or AR (p), process. Model involving current and previous y values along with error term are known as Autoregressive process. Its coefficient value lies between -1 and +1.

3.3.5.4 Moving Average (MA) process (0 0 q)

Along with AR, process consider the other mechanism that may have generated y

Suppose we have model y as follows,

$$y_t = \mu + \beta_o u_t + \beta_1 u_{t-1} \qquad ...... (6)$$

where μ is a constant and u_t, is the white noise stochastic error term. Here y at time t is equal to a constant plus a moving average of the current and past error terms. Thus, in the present case we say that y follows first order moving average, MA (1) process

In general,

$$y_t = \mu + \beta_o u_t + \beta_1 u_{t-1} + ... + \beta_q u_{t-q} \qquad .... (7)$$

is a MA (q) process. Moving average process is a linear combination of white noise error terms. Its coefficient value lies between -1 and +1.

3.3.5.5: Mixture: (ARIMA) process

With a stationary series in place, a basic model can now be identified. Three basic models exist; AR (autoregressive), MA (moving average) and a combined ARMA in addition to the previously specified RD (regular differencing) combine to provide the available tools. When regular differencing is applied together with AR and MA, they are referred to as ARIMA, with I indicating as "integrated" and referencing the differencing procedure.

If the non-stationarity is added to a mixture ARMA process, then the general ARIMA (p d q) is implied. Here the word integrating is confusing to many and refers to the differencing of the data series.

$$(1 - B)^d (1 - \phi_p B^p) y_t = c + \left(1 + \theta_q B^q\right) u_t \qquad ...... (8)$$

Steps involved in this Box-Jenkins's methodology are:

1. Identification of the model (choosing tentative *p, d, q*)

2. Parameter estimation of the chosen model

3. Diagnostic checking; whether the estimated residuals are white noise are not

4. If there is white noise, go for Forecasting, if not return to the step 1

1. Identification of model

To find out the appropriate values of p, d and q, Differencing method, graphical plot and correlogram methods can be used.

For estimation of parameter (p, q) (P Q) of model, data should be examined to decide about the model which best suits to explain the data. This is done by examining the sample ACF and PACF of differenced series y_t. Usually ACF and PACF are calculated up to maximum of 25 lags (k).

The sample auto correlations for k time lags can be found and denoted by r_k as follows.

$$p_k(Y_t) = r_k(Y_t) \qquad \ldots\ldots (9)$$

$$= \frac{e_k(Y_t)}{e_0(Y_t)}$$

where,

$$e_k(Y_t) = \frac{1}{n}\sum_{t=1}^{n}(Y_t - \overline{Y})(Y_{t+k} - \overline{Y})$$

k = 0, 1, 2…..24 t =1, 2…… n-k n = time period

The chief tools in identification are the autocorrelation function (ACF), the partial autocorrelation function (PACF). There are several ways of determining the order of process, but still there is no exact procedure for identifying the model.

Identification of order of an AR process can be done by examining partial autocorrelations. The order will simply be equal to the number of partial autocorrelations significantly different from zero. The partial autocorrelations up to p time lags will be significant while the remaining will be closer to zero. This cut off p will be the order of the AR process. On the other hand, the order of MA can be identified, by examining the autocorrelations function/graph. When the first q autocorrelations are significantly different from zero and if the other is not, then q is the order of the MA process. However, in the mixed ARIMA model, the identification process is very difficult.

2. Estimation of Parameters

After tentatively identifying the suitable model, next step is to obtain least square estimates of the parameters such that the error sum of squares is minimum.

To estimate ϕ and θ, it is first necessary to work out the moving average process to estimate θ and then perform analytical least squares to estimate the autoregressive parameters,

The sum of the squares are obtained as,

$$S(\phi, \theta) = \sum_{t=1}^{n} e_t^2 (\phi, \theta) \qquad \text{........ (10)}$$

where, t = 1, 2, 3……n

The sum of the squares can be then plotted for a grid value of θ and ϕ the final value that minimize S (θ). Then preliminary value of the tentatively identified model are obtained by using the sample ACF as proxy for Y (k) and solved for ϕ and θ. Then, by an iterative process, we obtained the maximum likelihood estimate of ϕ and θ by minimizing the sum of square.

There are fundamentally two ways of getting estimates for such parameters:

Trial and error: Examine many different values and choose set of values that minimizes the sum of the square of residual

Iterative method: choose a preliminary estimate and let a computer program refine the estimate iteratively

Both methods are used in our analysis for estimating the parameters.

3. Diagnostic checking of the model

After having estimated the parameters of a tentatively identified ARIMA model, it is necessary to do diagnostic checking to verify that the model is adequate or not.

Examining ACF and PACF of residuals may show up an adequacy or inadequacy of the model. If it shows random residuals, then it indicates that the tentatively identified model was adequate. When an inadequacy is detected, the checks should give an indication of how the model need to be modified, after which further fitting and checking takes place.

One of the procedures for diagnostic checking mentioned by Box-Jenkins is called over-fitting i.e., using more parameters than necessary. Over-fitting involves fitting a more elaborate model than indicated by the identification. However, main difficulty in correcting the identification is, not getting enough clues from the ACF because of inappropriate level of differencing. The residuals of ACF and PACF are considered randomly when all their ACF's were within the limits

$$\pm 1.96\sqrt{\frac{1}{(n)}-12} \quad \text{........ (11)}$$

Hence, the randomness of the ACF satisfies the condition of diagnostic checking.

The minimum Akaike's Information Criterion (AIC) and Schwartz Bayesian Information Criterion (SBIC) were used to determine the differencing order (d, D) required for attaining Stationarity and the appropriate number of AR and MA parameters, it can be computed as follows.

$$AIC_{(p+q)} = \{(1 + \log 2\pi) + n \log \sigma^2 + 2n\} \quad \text{........ (12)}$$

where,

σ^2 = Estimated MSE

n= Number of observations

m=P+D+Q

This diagnostic checking helps us to identify the differences in the models, so that the model could be subjected to modification, if needed.

4. Forecasting

The principal objective of developing ARIMA model was, to generate post sample period forecast for the variable. The ultimate test for any model is whether it is capable of predicting future events accurately or not. If the model is

$$(1 - \phi B)Y_t = (1 - \theta B)e_t \qquad \text{……. (13)}$$

It can be used to compute 3 months data point. The above model gives the forecasting equation as

$$Y_t - \phi Y_{t-1} = e_t - \theta e_{t-1} \qquad \text{…….. (14)}$$

Given, the data up to time 't' and the optional forecast of Y (also called Ex- Ante forecast) model at the t is the conditional expectation of Y $_{t-1}$.

It follows, in particular, that,

$$e_t = Y_t - Y_{t-1} \qquad \text{…….. (15)}$$

The error e_t in the above model are in fact the forecast errors for unit lead time. That for an optimal forecast these 'one step ahead' forecast error ought to form an uncorrelated series is otherwise obvious. Suppose, if these forecast errors were auto correlated, then it would be possible to forecast the next forecast error in which case it could both be optimal.

However, using these methods, Ex-post forecast can also be compared with the values actually realized.

The accuracy of forecast for both Ex-ante and Ex-post is tested using the following tests (Makridakis and Hibbon, 1979).

5. Mean square error (MSE)

The formula for MSE

$$MSE = \frac{1}{n}\sum_{t=1}^{n}\left(Y_t - \hat{Y}_t\right)^2 \qquad \text{……… (16)}$$

where,

Y_t = Actual values

$\hat{Y}_t$ = Predicted values

6. Mean absolute percentage error (MAPE)

The formula for this is

$$MAPE = \frac{1}{n}\sum_{t=1}^{n}\left|\frac{Y_t - \hat{Y}_t}{Y_t}\right| * 100 \qquad \text{........ (17)}$$

where,

Y_t = Actual values

$\hat{Y}_t$ = Predicted values

3.3.6 Market Co-integration

Market integration is an alternative approach to stabilize prices, allocate resources and rectify market imperfections like entrenched monopolies or monopsonies and inadequate and costly information transmission. The rectification of the market imperfection smoothens the way of attaining market efficiency, which in turn facilitates the attainment of agricultural development and equity in income distribution. If markets are well integrated then government can stabilize price in one key market and rely on commercialization to produce a similar outcome in other markets. This reduces the cost of stabilization considerably. Further, farmers will not be constrained by local conditions.

Co-integration is a method of defining the long- term relationship among a group of time series variables. The presence of co-integration among relevant variables implies that a linear combination of non-stationary time series variables is stationary. Co-integration refers to a linear combination of non-stationary time series that result in a stationary time series that represent the co-integration among the variables (Granger, 1986).

The Johansen maximum likelihood co-integration test helps in establishing any long-term stochastic relationships. Can be conducted using the following steps

Suppose that two variables say y_t and z_t are believed to be integrated of order 1 and we want to determine whether there exists an equilibrium relationship between the two

Granger (1987) proposed a four step procedure to determine the co-integration of order CI (1, 1) for two I (1) variable.

STEP 1. Pre testing the variables for their order of integration. By definition, co-integration necessitates that two variables be integrated of the same order. Augmented Dickey Fuller test can be used to infer the number of unit root in each of the variables. If both variables are stationary, it is not necessary to proceed for the next steps

STEP 2. Estimate the long–run equilibrium relationship. In order to determine if the variables are actually co-integrated, denote the residuals sequence by (u_t). These series are the estimated values of the deviations from the long–run relationship. If these deviations are found to be stationary, then y_t and z_t sequences are said to be co-integrated of order (1, 1). Dickey-Fuller test on these residuals are performed to determine their order of integration.

STEP 3. Estimate the error- correction model. If the variables are co-integrated then the residuals from the equilibrium regression equation can be used to estimate the error correction model (ECM). If y_t and z_t are co-integrated of order (1, 1) then variables have the error correction form of

$$\Delta y_t = \alpha_1 + \alpha_y \left[y_{t-1} - \beta_1 z_{t-1} \right] + \sum_{i-1} \alpha_{11}(i) \Delta y_{t-i} + \sum_{i-1} \alpha_{12}(i) \Delta z_{t-i} + u_{y_t} \quad \ldots\ldots(18)$$

$$\Delta z_t = \alpha_2 + \alpha_z \left[y_{t-1} - \beta_1 z_{t-1} \right] + \sum_{i-1} \alpha_{21}(i) \Delta y_{t-i} + \sum_{i-1} \alpha_{22}(i) \Delta z_{t-i} + u_{z_t} \quad \ldots\ldots (19)$$

where,

β_i = the parameters of the co-integrating vector.

u_{y_t} and u_{z_t} = white noise disturbances

α_1, α_2, α_y , α_z , α_{11} (i) α_{21} (i) α_{12} (i) α_{22} (i)= parameters.

STEP 4. Assess the model adequacy by performing diagnostic checks to determine whether the residual of ECM equation approximate to white noise. If residuals are serially correlated lag length may be too short. Re-estimate the model using lag length that yield serially uncorrelated errors.

1. The speed of adjustment co-efficient α_y and α_z are of particular interest in that they are important implications for the dynamics of the system

3.3.7 Unit Root Test

The first step of this analysis is to determine whether the data is stationary or not, which can be done by using Augmented Dickey-Fuller (ADF) test.

3.3.7.1: Basic unit root Theory

The following discussion outlines the basic features of unit root test. Considering a simple AR (1) process.

$$Y_t = \rho Y_{t-1} + u_t \qquad -1 \leq \rho \leq +1 \quad \text{............ (20)}$$

Where,

Y_{t-1} Y_t are the values of y, observed at time t-1 and t

u_t = white noise.

ρ = parameter to be estimated

If null hypothesis is ρ =1 then above equation becomes random walk without drift i.e. the equation will be non stationary with no constant or intercept term. This, is also known as the unit root problem. The alternative hypothesis of $|\rho|<1$ corresponds to stationarity in the time series of Y_t . The test can be carried out by simply regressing Y_t on Y_{t-1} and estimating ρ .

The unit root test was carried out using E-*views* software; it has an option that automatically select the lag length based on Akaike's, Schwarz, and other information criteria. In ADF we still test whether ρ =1 and the ADF follows the same asymptotic distribution as the DF statistic, so the same critical values can be used.

3.3.7.2 Augmented Dickey- Fuller (ADF) Test

In conducting Dickey-Fuller test we assume error term is uncorrelated. But in case if error is correlated, Dickey- Fuller has developed another test, known as the Augmented Dickey- Fuller (ADF) test. This test is conducted by "augmenting" the equations by adding the lagged values to the dependent variable. By modifying the above equation (21)

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + u_t \quad \text{............ (21)}$$

$$= (\rho - 1)Y_{t-1} + u_t$$

This can be alternatively written as.

$$\Delta Y_t = \delta Y_{t-1} + u_t \quad .... (22)$$

where, $\delta = (\rho - 1)$ and Δ is first difference operator.

When estimating the equation (23) and testing the H_0: $\delta = 0$ against the alternative H_1: $\delta < 1$, if $\delta = 0$, then we have unit root i.e., $\rho = 1$. Unfortunately, under the null hypothesis that $\delta = 0$, the t value of the estimated coefficient of Y_{t-1} does not follow the t distribution even in large samples; i.e. it does not have an asymptotic normal distribution. Hence Dickey-Fuller have shown null hypothesis estimated co-efficient of Y_{t-1}, τ statistic. The critical values of tau statistics are available for comparision

3.3.8 Johansen and Juselius Cointegration Test:

Johansen test is a procedure for testing co-integration of several I (1) time series this test permits more than one co-integrating relationship

There are two type of Johansen's test, either with trace or with eigen value methodology developed by Johansen (1991) performing using a group object or an estimated vector Auto regressive(VAR) object.

Consider a VAR of order p:

$$\mathbf{y}_t = A_1 \mathbf{y}_{t-1} + ... + A_p \mathbf{y}_{t-p} + \mathbf{B}\mathbf{x}_t + \mathbf{u_t} \quad ...... (23)$$

where $\mathbf{y}_t$ is a k- vector of non- stationary I(211) variable, X_t is a d-vector of deterministic variable, and $\mathbf{u}_t$ is a vector of innovations. We can rewrite this VAR as,

$$\Delta \mathbf{y}_t = \Pi \mathbf{y}_{t-1} + \sum_{i-1}^{p-1} \Gamma_i \Delta \mathbf{y}_{t-p} + \mathbf{B}\mathbf{x}_t + \mathbf{u_t} \quad .... (24)$$

where

$$\Pi = \sum_{i-1}^{p} A_i - I \qquad \Gamma_i = -\sum_{j=i+1}^{p} A_j$$

Granger's representation theorem asserts that if the co-efficient matrix Π has reduced rank r<k, then there exists k x r matrices and each □ and $\boldsymbol{\beta}$ with rank r such that $\Pi = \alpha \boldsymbol{\beta}'$ and $\boldsymbol{\beta}' \mathbf{y}_n$ is I(0) is the number of co-integration relations and each column of β is the co-integration vector. As explained below, the elements of α are known as adjustment

parameters in the VEC model. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π.

Maximum eigen statistic test the null hypothesis of r co-integration against the alternative of r+1 co-integration relations for r = 0, 1, 2… n-1. These test statistics are computed as;

$$LR_{\max}(r/n+1) = T * \log(1-\hat{\lambda}) \quad \text{….. (25)}$$

where, λ is the Maximum eigen value and T is the sample size Trace statistics investigated the null hypothesis of r co-integration relations against the alternative n co-integration relations, where n is the number of variables in the system for r = 0,1,2…..n-1. Its equation is computed according to the following formula

$$LR_{tr}(r/n) = T * \sum_{i=r+1}^{n} \log(1-\hat{\lambda}_i) \quad \text{….. (26)}$$

3.3.8 Granger Causality Test

Correlation does not necessarily imply causation in any meaningful sense of the word. The econometric graveyard is full of magnificent correlation, which is simply spurious or meaningless.

The Granger approach to question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation. Y is said to be Granger caused by x if x helps in the prediction of Y, or equivalently if the coefficient on the lagged x's are statistically significant. Note that two- way causation is frequently the case: x Granger causes y and y Granger causes x.

It is important to note that the statement "x Granger causes y" does not imply that y is the effect or the result of x. Granger Causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

The test for the absence of Granger causality by estimating the following vector auto regressive model:

$$y_t = \alpha_1 y_{t-1} + \ldots.. + \alpha_n y_{t-n} + \beta_1 x_{t-1} + \ldots… + \beta_n x_{t-n} + e_t$$
$$x_t = \alpha_1 x_{t-1} + \ldots.. + \alpha_n x_{t-n} + \beta_1 y_{t-1} + \ldots… + \beta_n y_{t-n} + u_t \quad \text{…… (27)}$$

For all the possible pairs of (x, y) series in the group

The steps involved in implementing the Granger Causality test are as follows.

1. Regress current y variable on all lagged y and other variables, if any, but don't include the lagged m variables which are restrictions in this regression. From this regression obtain the restricted residual sum of square, RSS_R.

2. Now run the regression including the lagged m terms. From this obtain the unrestricted sum of squares, RSS_{UR}.

3. The null hypothesis is H_0: $\sum \alpha_i$ =0, 1, 2,..., n, that is, lagged m terms do not belong in the regression.

4. To test this H_0 we apply F test

$$F = \frac{RSS_R - RSS_{UR}/m}{RSS_{UR}/(n-k)} \approx F_{(m,(n-k))} \quad \ldots\ldots\ldots (28)$$

Where, m = number of lagged terms

k = number of parameters estimated in the unrestricted regression.

5. If the computed F value exceeds the critical F value at the chosen level of significance, we reject H_0, in which case the lagged m terms belong in the regression.

<u>3.3.9: Vector Error Correction Model</u>

A vector error correction model is a restricted VAR designed for use with non-stationary series that are known to be co-integrated. Tests co-integrated using an estimated VAR objective; equation object estimated using non- stationary regression methods, or using a group object.

The error correction model is the preferred method for estimation when two integrated time series are statistically related or co-integrated, since the error correction model can be formally derived from the properties of integrated time series.

According to this theorem, two or more integrated time series that are co-integrated have an error correction representation, and two or more time series that are error correction (VEC) is useful for non-stationary series that are known to be integrated. This has the advantage of the co-integration relations built into the specifications so that it restricts the long run behavior of the endogenous variables to converge to their co-integration relationships while allowing for short-run dynamics. The co-integration term is known as the error correction term since the deviation from long run equilibrium is corrected gradually through a series of partial adjustments.

Consider a two variable system with one co-integrating equation and no lagged difference terms. The co-integrating equation is:

$$y_{2,t} = \beta y_{1,2,3....n} \qquad .... (29)$$

The corresponding VEC model is:

$$\Delta y_{1,t} = \alpha_1 \lfloor y_{2,t-1} - \beta y_{1,\ t-1} \rfloor + u_{1,t}$$

$$\Delta y_{2,t} = \alpha_2 \lfloor y_{2,t-1} - \beta y_{1,\ t-1} \rfloor + u_{2,t} \qquad ...... (30)$$

In this simple model, the only right-hand side variable is the error correction term. In the long run equilibrium,, this term is zero. However, if y_1 and y_2 deviate from the long run equilibrium, the error correction term will be non zero and each variable adjusts to partially restore the equilibrium relation. The coefficient α_1 measures the speed of adjustment of the i^{th} endogenous variable towards the equilibrium.

IV. RESULTS

The results chapter deals with the systematic presentation of the results of the study. The results on various aspects according to the objectives were presented under the following headings.

4.1 Spatial and temporal variation of silk cocoon

4.2 Forecasting of prices

4.3 Market co-integration

4.1 DESCRIPTIVE STATISTICS

In this section, descriptive statistics such as mean, maximum, and minimum value, standard deviation, skewness, and kurtosis were used for measure the variability in the arrivals and prices between three markets over the years. Descriptive statistics for each market for 3 years are presented separately in the following sections.

4.1.1 Descriptive Statistics for the silk cocoon arrivals and prices for Shidlaghatta markets

Data presented in Table 4.1 for Shidlaghatta market indicates that the cocoon prices over the year shows an upward trend and arrivals for the same period are fluctuating. The highest mean prices were noticed in the year 2013, which is Rs 331 with SD of Rs 38. The modal price of Rs 365 is also noticed for the year 2013. The distribution of the price is nearly symmetric and it is platykurtic.

The highest mean arrivals of cocoon were in the year 2011, which was 40785 kg’s with SD of 9181 kg’s. The range for cocoon arrivals in the year 2013 was from a minimum of 40900 kg’s to maximum of 76405 kg’s. The distribution of arrivals showed departure from symmetry and it is platykurtic

4.1.2 Descriptive Statistics for the silk cocoon arrivals and prices for Ramanagara markets

Table 4.2 gives the details of prices and arrivals for Ramanagara market: highest mean prices of Rs 311 was observed in 2013 with a SD of Rs 31 and modal price of Rs 310 is in close agreement with mean price for the same year.

The arrivals of cocoons have shown a decreasing trend in this market. The mean arrival was 25095 kg’s in 2013 and maximum arrivals was 42539 kg’s. The distribution of arrivals was left skewed and platykurtic in 2013.

Table 4.1: Descriptive Statistics for Silk cocoon arrivals and prices for Shidlaghatta market area

Variables	Year	Mean	SD	Maximum	Minimum	Modal Price /arrivals	Kurtosis	Skewness
Prices in Rupees per Kg	2011	218	50	340	260	188	0.34	0.73
	2012	248	30	345	189	242	-0.62	0.04
	2013	331	38	409	194	365	-0.26	-0.40
Arrivals in Kg's	2011	40785	7819	61690	12526	40570	0.18	-0.13
	2012	39565	7728	62771	13851	41148	0.01	0.08
	2013	40900	9181	76405	40068	39528	1.854	0.70

Table 4.2: Descriptive Statistics for Silk cocoon arrivals and prices for Ramanagara market area

Variables	Year	Mean	SD	Maximum	Minimum	Modal Price /arrivals	Kurtosis	Skewness
Prices in Rupees per Kg	2011	205	54	364	98	182	0.38	1.15
	2012	234	31	350	179	246	-0.27	0.38
	2013	311	31	399	219	310	-0.26	-0.06
Arrivals in Kg's	2011	31968	7351	57409	31844	28870	1.95	-0.26
	2012	26310	5867	44450	26212	22760	1.99	-0.47
	2013	25095	6168	42539	24915	16074	1.70	-0.51

4.1.3: Descriptive Statistics for the silk cocoon arrivals and prices for Vijayapura markets

In the Table 4.3, the details of the prices and arrivals in Vijayapura market are presented. The mean highest price was Rs 321 with SD of Rs 38. There is an increasing trend in the prices of cocoon over the year. However, the modal price of cocoon is Rs 298 which is lower than mean prices in the year2013. The distribution of prices is left skewed and is platykurtic

There is a decreasing trend in arrivals of cocoon in this market. It has decreased from a mean of 10795 kg's in 2011 to 9308 kg's in 2013. The variation as shown by SD is more in 2013 in than the year 2011. The distribution of arrivals is positively skewed and platykurtic.

Seasonal indices of silk cocoon prices and arrivals in selected markets of Karnataka

Seasonal indices of market price and arrivals of silk cocoon in major markets are presented in Table 4.4 and Fig 4.1

This procedure was carried out to see the fluctuation both in arrivals and prices within the year among the three selected markets. As we know cocoon rearing need dry and warm weather there is variation in both the parameters.

For Shidlaghatta market, seasonal indices presented in the Table 4.4 and 4.5, Fig 4.1 and 4.2 indicates that price for the month of May(106) is high and for the month of October (92) is very low. Seasonal indices for arrivals for the month of July (110), September (109) and October (109) is high whereas seasonal indices for April month is lowest.

Seasonal indices presented in Table 4.4 and 4.4 figure 4.1 and 4.2 show the arrivals and prices for Ramanagara market. Arrivals are very high during the month of May (108) and June (108), lowest arrivals are seen in January(91). Prices are highest during January(104), August (102) and September(102) and for Oct it is the lowest.

Seasonal indices of prices for May (107) is the highest in Vijayapura market which is followed by the month of April (105). Seasonal indices for arrivals was highest for July (119) followed by the month of September (113) and October (113).

4.2 BOX- JENKINS ARIMA MODEL

As Box-Jenkins model is preferred to the multiplicative time series model for forecasting purposes, it's used for forecasting prices of silk cocoon. The result is presented below.

Table 4.3: Descriptive Statistics for Silk cocoon arrivals and prices for Vijayapura market area

Variables	Year	Mean	SD	Maximum	Minimum	Modal Price /arrivals	Kurtosis	Skewness
Prices in Rupees per Kg	2011	211	48	328	115	183	-0.14	0.95
	2012	239	30	342	178	248	-0.30	0.068
	2013	321	38	395	205	298	-0.75	-0.30
Arrivals in Kg's	2011	10795	2516	20126	3429	9264	0.14	0.17
	2012	9297	2594	16635	1214	6923	-0.04	0.27
	2013	9308	2895	20259	1251	9496	1.13	0.80

Table 4.4: Seasonal price variation of silk cocoon in selected markets of Karnataka

Month	PRICES (Rs)		
	SHIDLAGHATTA	RAMANAGARA	VIJAYAPURA
JAN	100.37	104.71	100.32
FEB	99.57	100.43	98.85
MAR	99.63	99.82	99.91
APRL	104.70	102.8	105.87
MAY	106.18	98.43	107.82
JUN	101.07	98.64	101.95
JULY	98.77	97.97	98.73
AUG	103.42	102.22	102.18
SEPT	102.61	102.52	102.68
OCT	92.66	93.75	93.43
NOV	93.04	97.99	91.97
DEC	97.96	100.74	96.24

Table 4.5: Seasonal variation for the arrivals in the major markets of Karnataka

Month	ARRIVALS		
	SHIDLAGHATTA	RAMANAGARA	VIJAYAPURA
JAN	93.25	91.07	88.33
FEB	97.28	103.41	91.01
MAR	90.61	104.83	90.99
APRL	88.87	94.63	89.17
MAY	93.02	108.41	85.38
JUN	106.40	108.96	102.72
JULY	110.15	96.98	119.52
AUG	95.58	81.53	98.86
SEPT	109.99	101.54	113.65
OCT	109.81	104.72	113.94
NOV	101.44	101.49	113.00
DEC	103.57	102.37	102.25

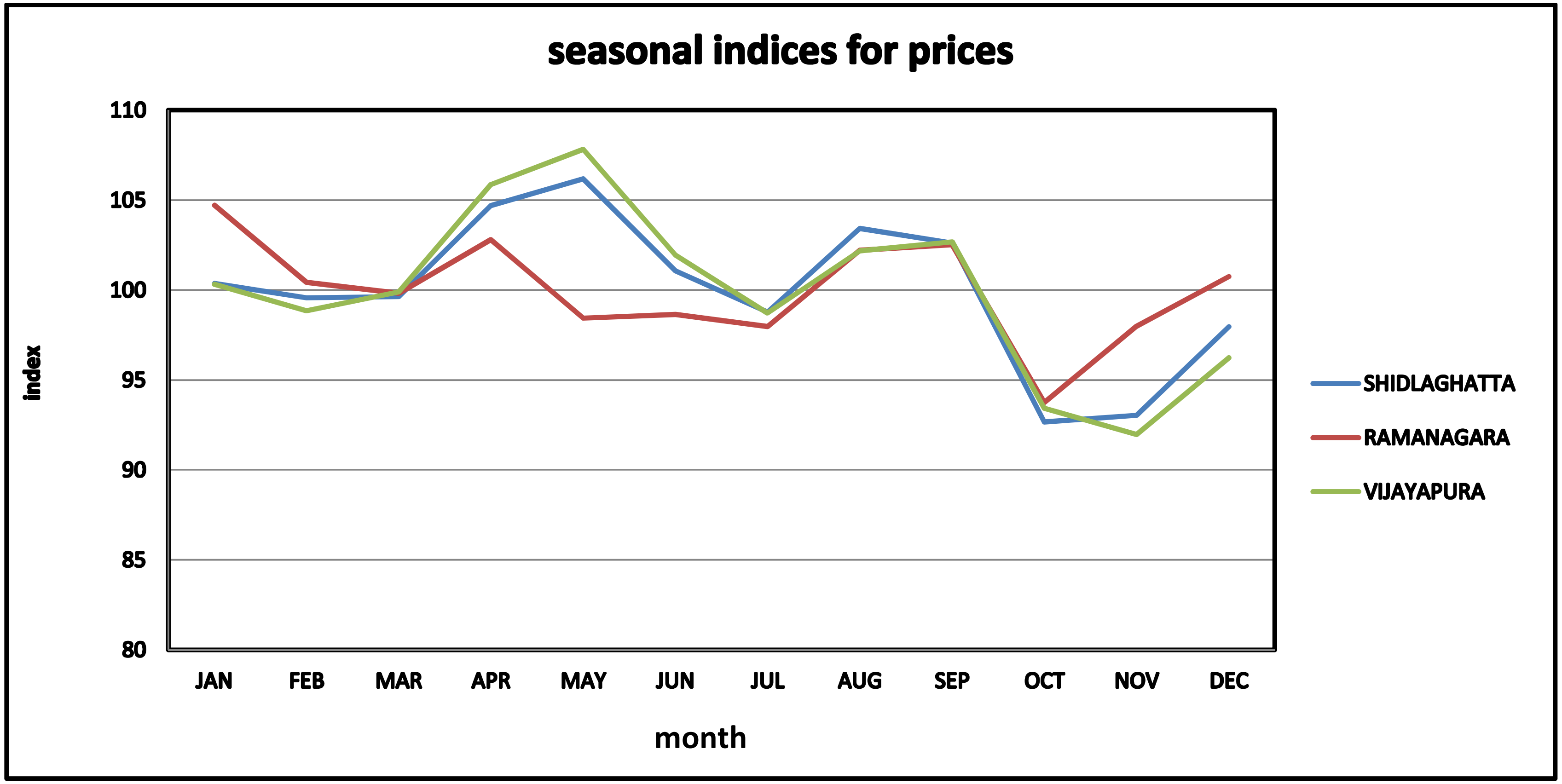


Fig 4.1. Seasonal variation for the prices in the major markets of Karnataka

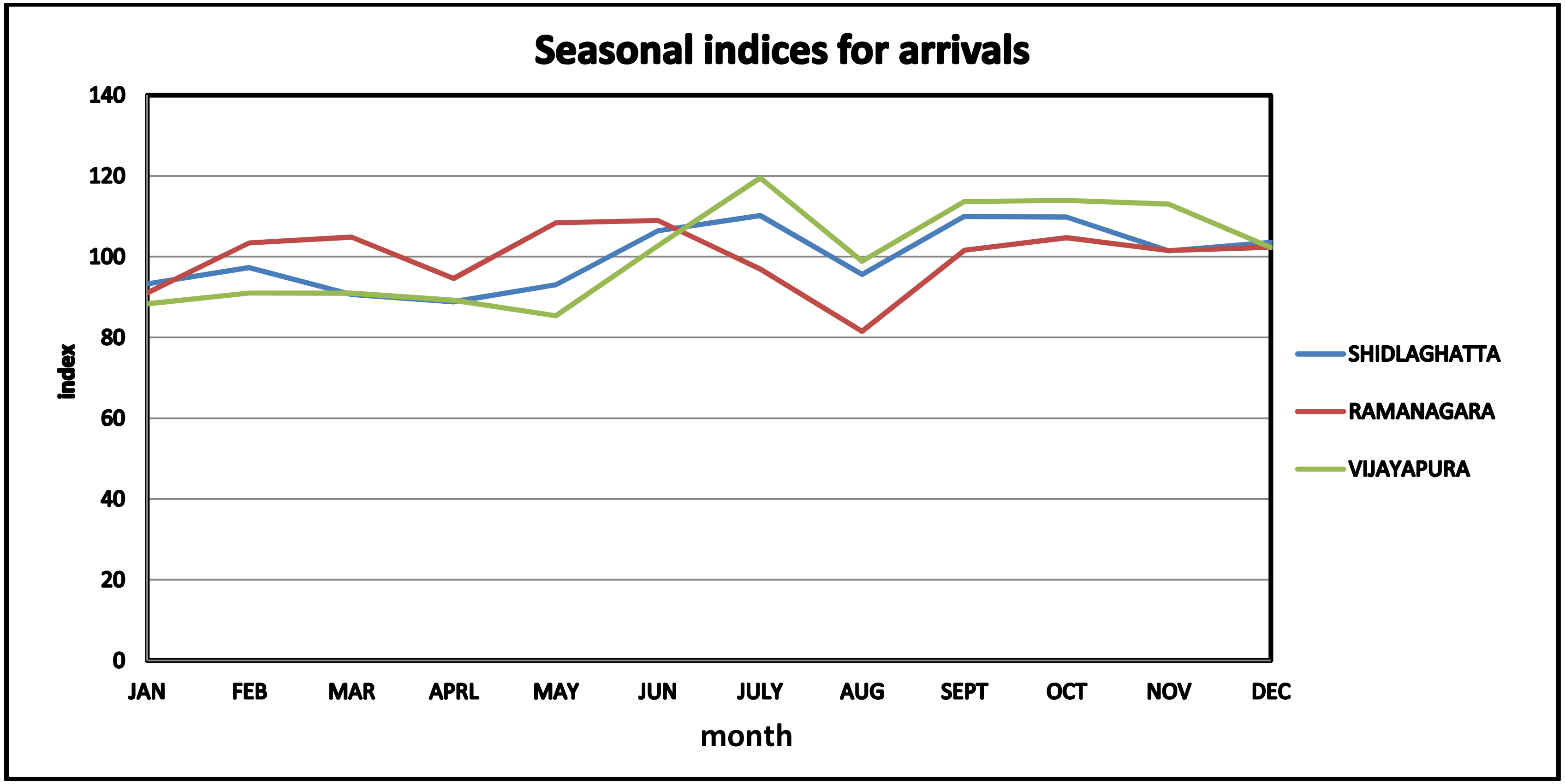


Fig 4.2: Seasonal variation for arrivals in the major markets

4.2.1 Identification of the model:-

The tentative models are first identified based on the Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) for the different series Y_t for selected markets. The computed value of ACF and PACF are shown in Table (4.7) for the three markets with maximum lagged values up to 24 lags. An examination of the ACF and PACF revealed seasonality. However, the series were found to be stationary, since the coefficient dropped to zero after the first or second lag. Each individual coefficient of ACF and PACF are tested for their significance using 't' test. Further, the absence of peak at first values clearly indicate suitability of the choice of non-seasonal difference d=1, to accomplish stationarity series. Hence, based on ACF and PACF many models are tried, finally model (0 1 4) (1 0 1) is tentatively identified for Shidlaghatta and Ramanagara market prices and model (0 1 0) (1 0 1) is identified for prices of cocoon in Vijayapura market.

4.2.2 Estimation of parameter

After identifying the models tentatively the next step is to obtain the estimates by the method of Least Squares Estimates of the parameters θ and ϕ for selected the markets. Such that the error sum of square is to be minimum i.e.,

$$S(\phi,\theta)=\sum_{t=1}^{n}e_t^2(\phi,\theta)$$

The parameters of the tentatively identified models, are estimated by an iterative process and then the residual of each of the models is to be estimated

4.2.3 Diagnostic Checking

Residual analysis is carried out to check the adequacy of the models. The residuals of ACF and PACF are obtained from the tentatively identified model. The adequacy of the model is judged based on the values of Box-Pierce Q statistics and AIC (Beenstock and Bansali, 1981). The values of the statistics are shown in Table 4.7. The model (0,1,4) (1,0,1) is found to be the best model for Shidlaghatta and Ramanagara market and for Vijayapura market the model (0,1,0) (1,0,1) is found to be the best as it had the lowest estimate for AIC and Q statistics.

4.2.4: Forecasting prices

The method of forecasting are explained in detail in chapter III, both Ex- ante and Ex- post forecast has been attempted and compared with actual values of observations.

The forecast has been made up to March 2014 for the period of three months (90 days). The results of Ex-post and Ex- ante Forecast of silk cocoon for major markets of Karnataka is shown in the Tables 4.8, 4.9 and 4.10 respectively. The forecast is also shown in the Figs from 4.9 to 4.15 respectively. The accuracy of forecasts for both Ex-post and Ex- ante are tested using MAPE test. The values of MAPE are presented in the Table.4.8 which were found to be least and significant, indicating the accuracy of the forecast.

Table 4.6: ACF's and PACF's of Silk cocoon prices for Major markets of Karnataka

Lags	Shidlaghatta		Ramanagara		Vijayapura	
	ACF	PACF	ACF	PACF	ACF	PACF
Lag 1	.024	.024	-.002	-0.002	-.009	-.009
Lag 2	-.053	-.053	.000	0	.010	.010
Lag 3	-.044	-.044	-.001	-0.001	-.038	-.038
Lag 4	.002	.002	.005	0.005	.001	-.002
Lag 5	-.052	-.052	.020	0.02	-.080	-.079
Lag 6	.014	.014	.001	0.001	-.039	-.045
Lag 7	.023	.023	.015	0.015	-.017	-.019
Lag 8	.017	.017	-.033	-0.033	-.030	-.037
Lag 9	-.019	-.019	-.014	-0.014	.004	-.002
Lag 10	-.030	-.030	-.057	-0.058	.015	.007
Lag 11	-.053	-.053	.015	0.015	-.027	-.036
Lag 12	-.010	-.010	-.032	-0.033	.025	.018
Lag 13	.011	.011	.013	0.015	-.021	-.026
Lag 14	.035	.035	-.030	-0.029	-.002	-.010
Lag 15	-.026	-.026	-.022	-0.018	.046	.049
Lag 16	-.002	-.002	-.022	-0.023	-.005	-.009
Lag 17	-.061	-.061	-.012	-0.01	-.056	-.057
Lag 18	-.052	-.052	-.022	-0.027	-.029	-.032
Lag 19	-.015	-.015	.016	0.018	-.040	-.048
Lag 20	-.010	-.010	-.006	-0.011	.002	.002
Lag 21	-.022	-.022	-.017	-0.013	-.005	-.005
Lag 22	-.018	-.018	.000	-0.004	-.010	-.025
Lag 23	-.007	-.007	.001	0.003	-.064	-.072
Lag 24	-.015	-.015	-.005	-0.012	-.004	-.025

Table 4.7: **Best models and least Q-Statistics, AIC and SBC values for the Models of silk cocoon**

Market	Model	Q-statistics	AIC	SBC
Shidlaghatta	(0,1,4)(1,0,1)	27.44	9824.93	9850.33
Ramanagara	(0,1,4)(1,0,1)	11.49	8699.81	8725.20
Vijayapura	(0,1,0)(1,0,1)	24.72	8778.34	8773.42

Table 4.8: **Error measures of ARIMA model**

Markets	MAPE	R-Square
Shidlaghatta	3.70	0.94
Ramanagara	2.64	0.97
Vijayapura	2.73	0.97

Table 4.9: Actual and Forecasted values for Shidlaghatta market prices of silk cocoons

Date	Actual	Forecast
01-Jan-14	387	385
02-Jan-14	379	387
03-Jan-14	387	378
04-Jan-14	379	382
05-Jan-14	374	379
06-Jan-14	381	379
07-Jan-14	377	383
08-Jan-14	372	380
09-Jan-14	369	376

10-Jan-14	368	368
11-Jan-14	377	366
12-Jan-14	371	373
13-Jan-14	381	375
14-Jan-14	378	382
15-Jan-14	381	379
16-Jan-14	373	382
17-Jan-14	370	372
18-Jan-14	366	368
19-Jan-14	361	366
20-Jan-14	365	366
21-Jan-14	370	368
22-Jan-14	365	371
23-Jan-14	367	368
24-Jan-14	364	364
25-Jan-14	362	361
26-Jan-14	362	361
27-Jan-14	367	364
28-Jan-14	370	369
29-Jan-14	374	371
30-Jan-14	370	374
31-Jan-14	370	368
01-Feb-14	374	367
02-Feb-14	372	370
03-Feb-14	378	374
04-Feb-14	376	380
05-Feb-14	385	377

06-Feb-14	377	383
07-Feb-14	370	376
08-Feb-14	362	369
09-Feb-14	356	363
10-Feb-14	358	361
11-Feb-14	367	363
12-Feb-14	365	367
13-Feb-14	367	367
14-Feb-14	372	364
15-Feb-14	375	366
16-Feb-14	372	371
17-Feb-14	381	374
18-Feb-14	376	381
19-Feb-14	380	378
20-Feb-14	382	380
21-Feb-14	376	378
22-Feb-14	380	374
23-Feb-14	380	377
24-Feb-14	380	381
25-Feb-14	379	384
26-Feb-14	381	381
27-Feb-14	382	382
28-Feb-14	384	379
01-Mar-14		380
02-Mar-14		379
03-Mar-14		382
04-Mar-14		384

05-Mar-14		385
06-Mar-14		386
07-Mar-14		383
08-Mar-14		380
09-Mar-14		379
10-Mar-14		382
11-Mar-14		385
12-Mar-14		386
13-Mar-14		387
14-Mar-14		384
15-Mar-14		381
16-Mar-14		380
17-Mar-14		383
18-Mar-14		386
19-Mar-14		387
20-Mar-14		388
21-Mar-14		384
22-Mar-14		382
23-Mar-14		381
24-Mar-14		383
25-Mar-14		386
26-Mar-14		387
27-Mar-14		388
28-Mar-14		385
29-Mar-14		382
30-Mar-14		382
31-Mar-14		384

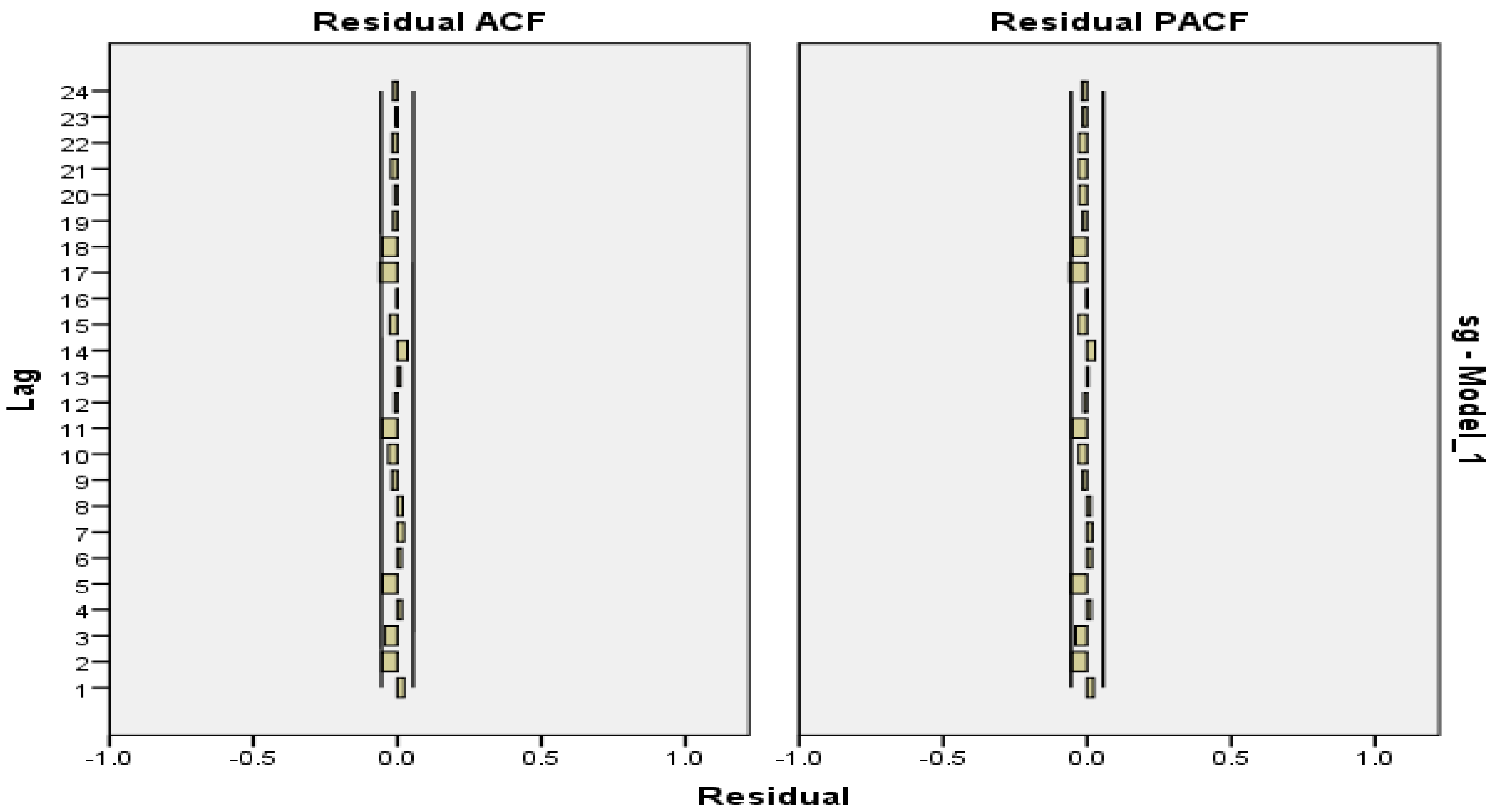


Fig 4.3: Autocorrelation and Partial autocorrelation plots for residuals series of silk cocoons prices of Shidlaghatta Market for (0 1 4) (1 0 1) ARIMA model

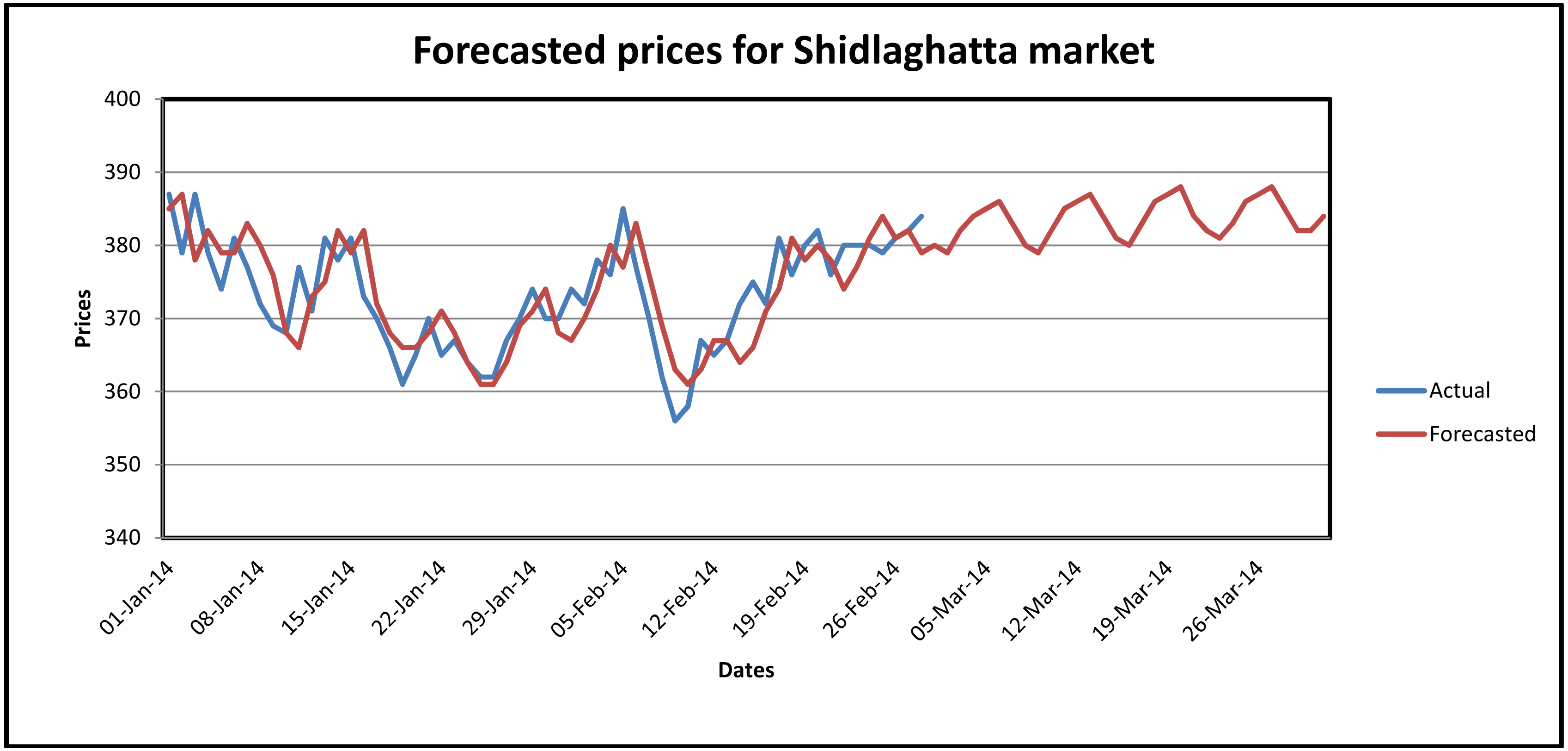


Fig 4.4: Forecasted prices for Shidlaghatta market for three months of 2014

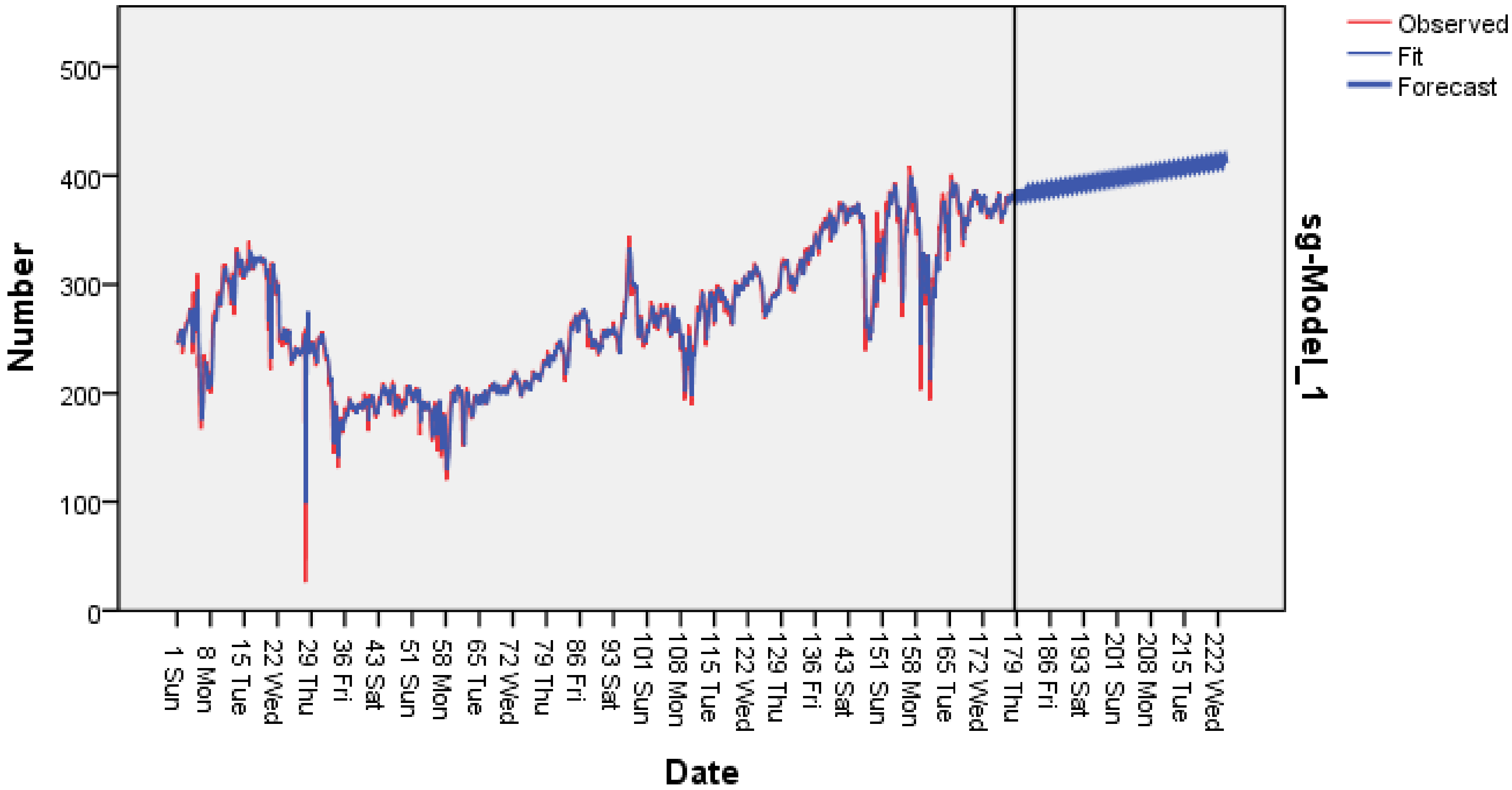


Fig 4.5: Overall forecasted and actual prices for Shidlaghatta Market area

Table 4.10: Actual and Forecasted values for Ramanagaram market prices of silk cocoons

Date	Actual	Forecast
01-Jan-14	343	343
02-Jan-14	349	352
03-Jan-14	360	362
04-Jan-14	374	375
05-Jan-14	368	364
06-Jan-14	364	362
07-Jan-14	361	361
08-Jan-14	365	367
09-Jan-14	370	370
10-Jan-14	365	363
11-Jan-14	359	358
12-Jan-14	346	345
13-Jan-14	352	355
14-Jan-14	346	346
15-Jan-14	354	356
16-Jan-14	349	348
17-Jan-14	344	344
18-Jan-14	347	348
19-Jan-14	336	335
20-Jan-14	339	341
21-Jan-14	330	330
22-Jan-14	344	348
23-Jan-14	344	343
24-Jan-14	353	354
25-Jan-14	360	359
26-Jan-14	360	359
27-Jan-14	362	360
28-Jan-14	369	369

29-Jan-14	375	375
30-Jan-14	374	372
31-Jan-14	368	365
01-Feb-14	366	366
02-Feb-14	369	370
03-Feb-14	378	380
04-Feb-14	373	371
05-Feb-14	372	371
06-Feb-14	370	369
07-Feb-14	360	359
08-Feb-14	340	338
09-Feb-14	344	348
10-Feb-14	350	353
11-Feb-14	352	352
12-Feb-14	354	353
13-Feb-14	359	360
14-Feb-14	358	357
15-Feb-14	357	356
16-Feb-14	359	359
17-Feb-14	364	365
18-Feb-14	366	366
19-Feb-14	364	363
20-Feb-14	363	362
21-Feb-14	358	358
22-Feb-14	359	360
23-Feb-14	347	345
24-Feb-14	358	361
25-Feb-14	352	351
26-Feb-14	342	341
27-Feb-14	358	361
28-Feb-14	355	355

01-Mar-14		354
02-Mar-14		353
03-Mar-14		354
04-Mar-14		355
05-Mar-14		355
06-Mar-14		354
07-Mar-14		354
08-Mar-14		355
09-Mar-14		355
10-Mar-14		354
11-Mar-14		354
12-Mar-14		353
13-Mar-14		354
14-Mar-14		354
15-Mar-14		353
16-Mar-14		354
17-Mar-14		354
18-Mar-14		355
19-Mar-14		355
20-Mar-14		354
21-Mar-14		354
22-Mar-14		355
23-Mar-14		355
24-Mar-14		354
25-Mar-14		354
26-Mar-14		353
27-Mar-14		354
28-Mar-14		354
29-Mar-14		354
30-Mar-14		354
31-Mar-14		354

Table 4.11: Actual and Forecasted values for Vijayapura market prices of silk cocoons

Date	Actual	Forecast
01-Jan-14	366	368
02-Jan-14	373	367
03-Jan-14	371	372
04-Jan-14	373	368
05-Jan-14	380	373
06-Jan-14	377	382
07-Jan-14	385	378
08-Jan-14	376	386
09-Jan-14	380	377
10-Jan-14	359	379
11-Jan-14	428	356
12-Jan-14	370	428
13-Jan-14	373	371
14-Jan-14	376	374
15-Jan-14	374	377
16-Jan-14	372	375
17-Jan-14	368	370
18-Jan-14	364	366
19-Jan-14	364	364
20-Jan-14	361	366
21-Jan-14	365	362
22-Jan-14	364	366
23-Jan-14	357	365
24-Jan-14	362	355
25-Jan-14	354	360
26-Jan-14	354	354
27-Jan-14	359	355
28-Jan-14	360	360
29-Jan-14	366	361

30-Jan-14	357	367
31-Jan-14	353	355
01-Feb-14	363	351
02-Feb-14	375	363
03-Feb-14	368	376
04-Feb-14	373	369
05-Feb-14	371	374
06-Feb-14	357	372
07-Feb-14	362	355
08-Feb-14	353	360
09-Feb-14	346	353
10-Feb-14	350	347
11-Feb-14	355	351
12-Feb-14	355	356
13-Feb-14	355	355
14-Feb-14	355	353
15-Feb-14	367	353
16-Feb-14	363	367
17-Feb-14	372	364
18-Feb-14	372	373
19-Feb-14	375	373
20-Feb-14	373	375
21-Feb-14	376	372
22-Feb-14	394	374
23-Feb-14	377	394
24-Feb-14	383	379
25-Feb-14	322	384
26-Feb-14	381	323
27-Feb-14	385	381
28-Feb-14	384	384
01-Mar-14		382
02-Mar-14		382

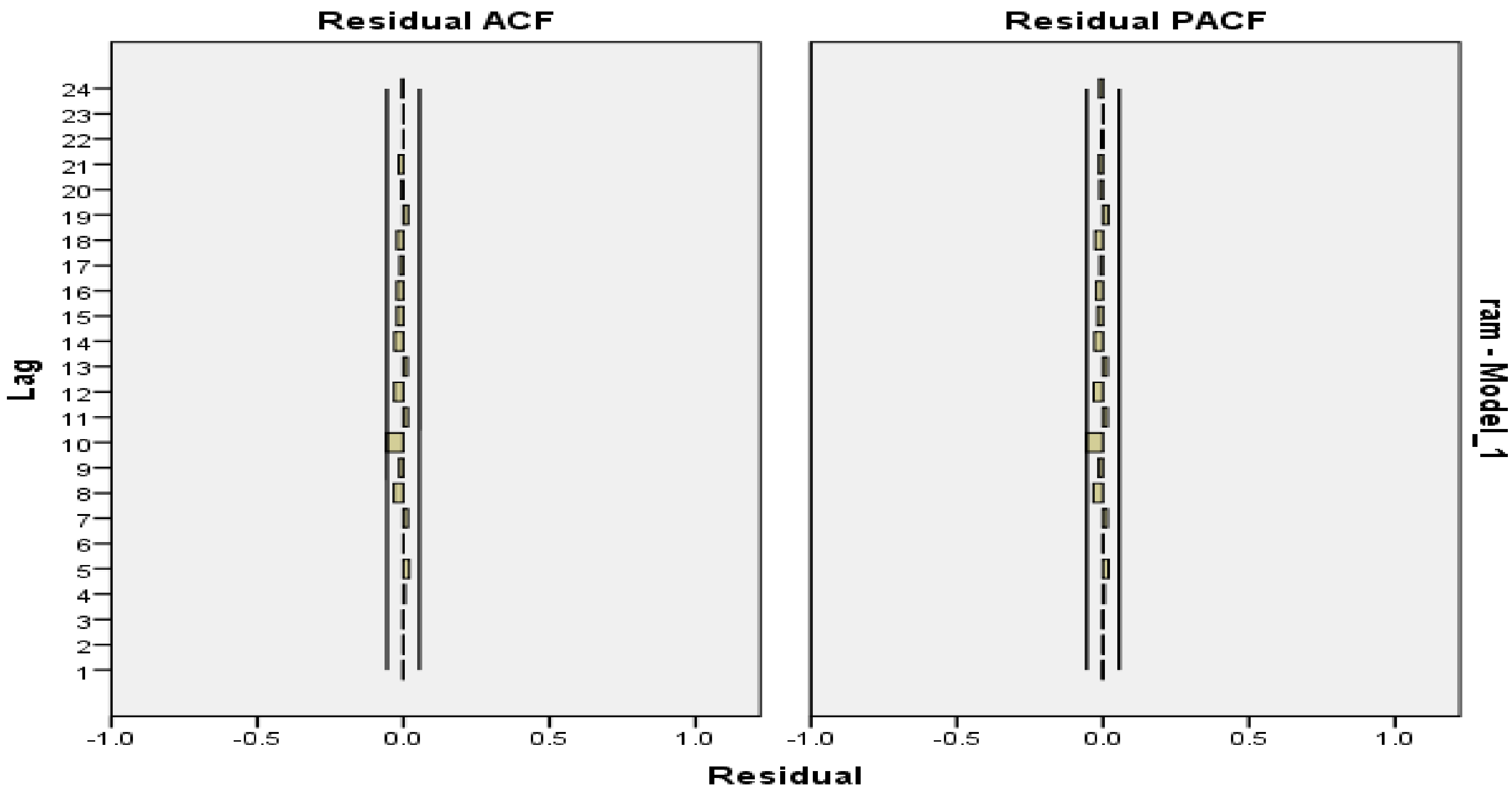


Fig 4.6: Autocorrelation and Partial autocorrelation plots for residuals series of silk cocoons prices of Ramanagara Market for (0 1 4)(1 0 1) ARIMA model

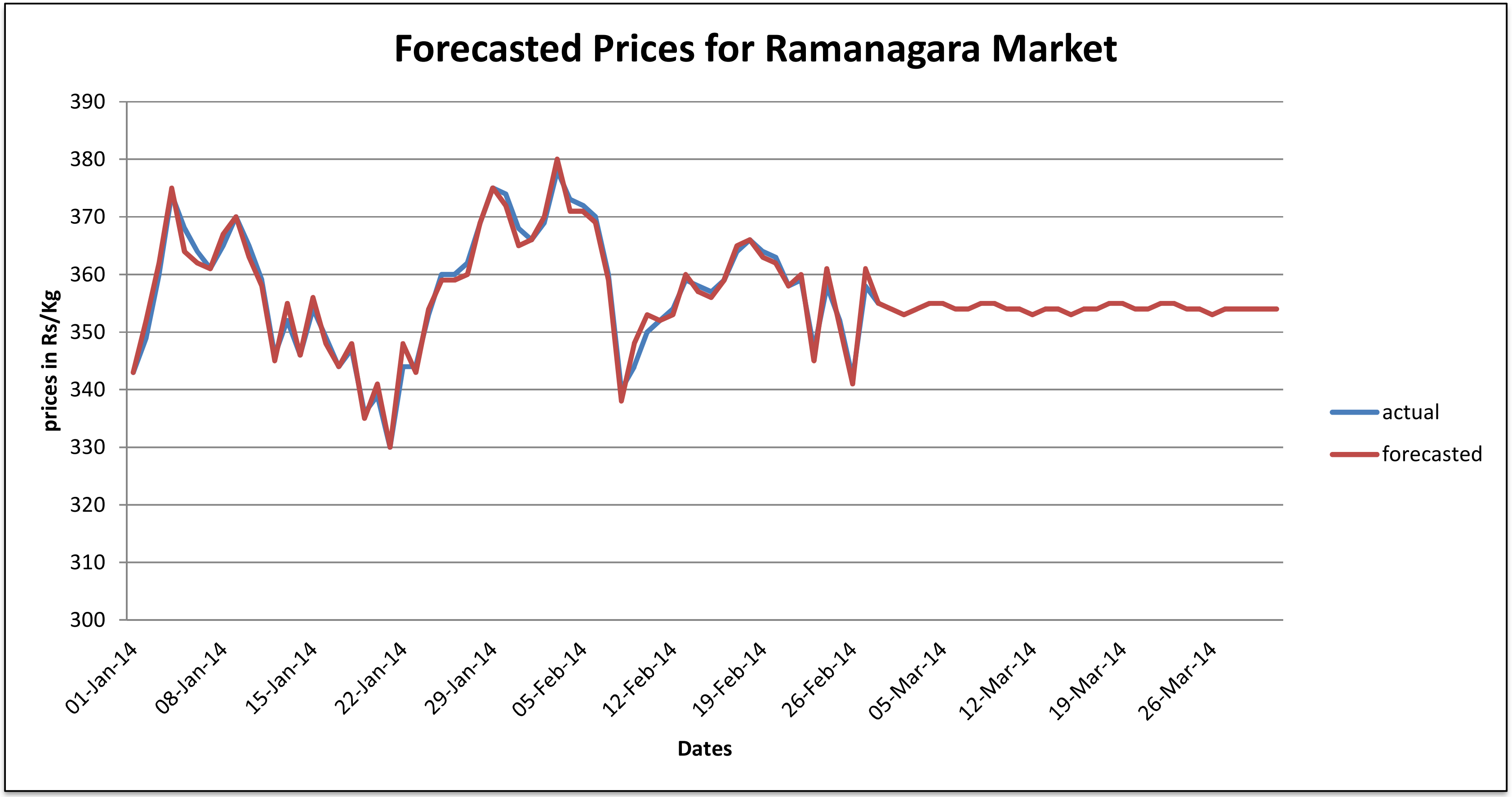


Fig 4.7: Forecasted prices for Ramanagara market for three months of 2014

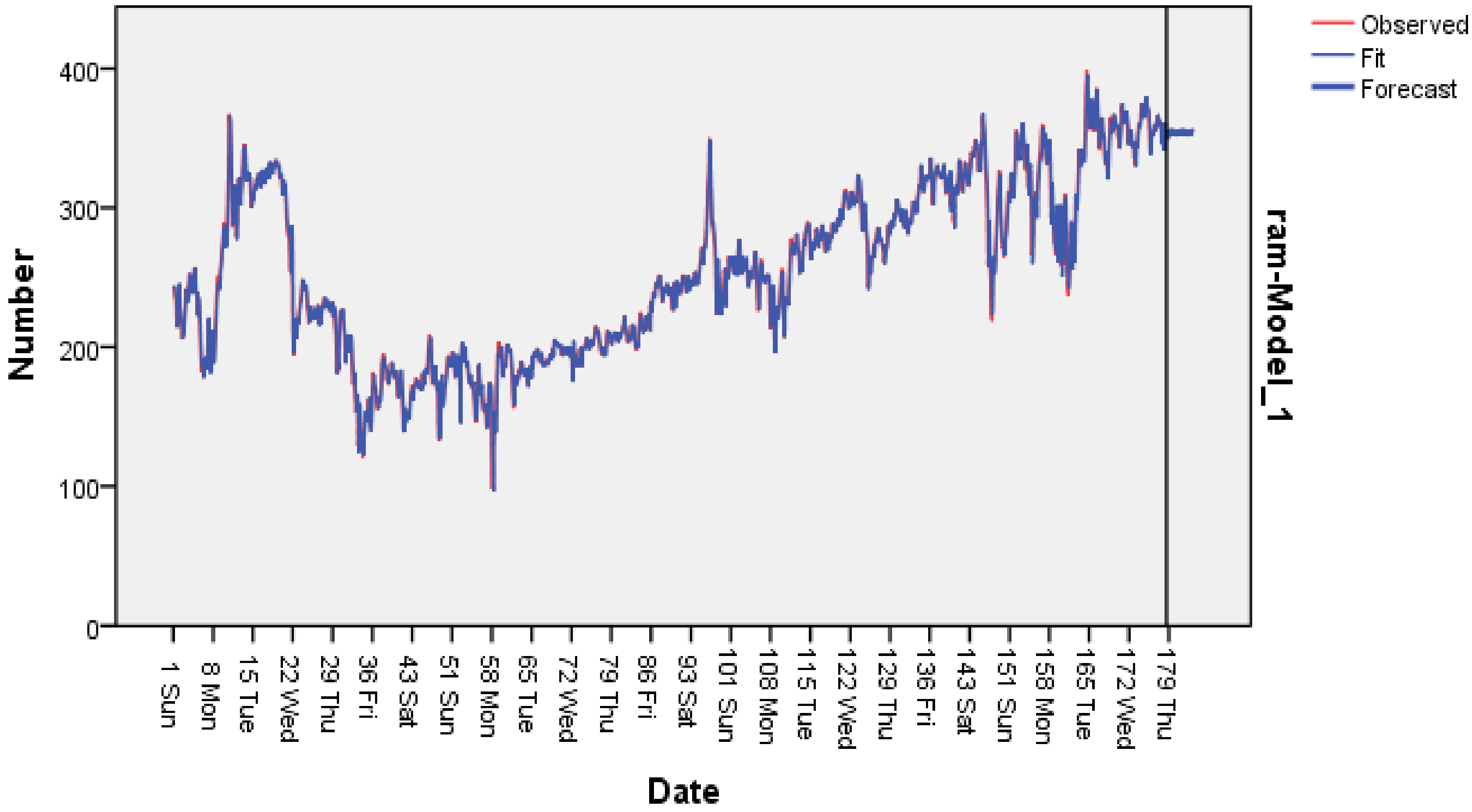


Fig 4.8: Overall Forecasted and Actual prices for Ramanagaram Market area

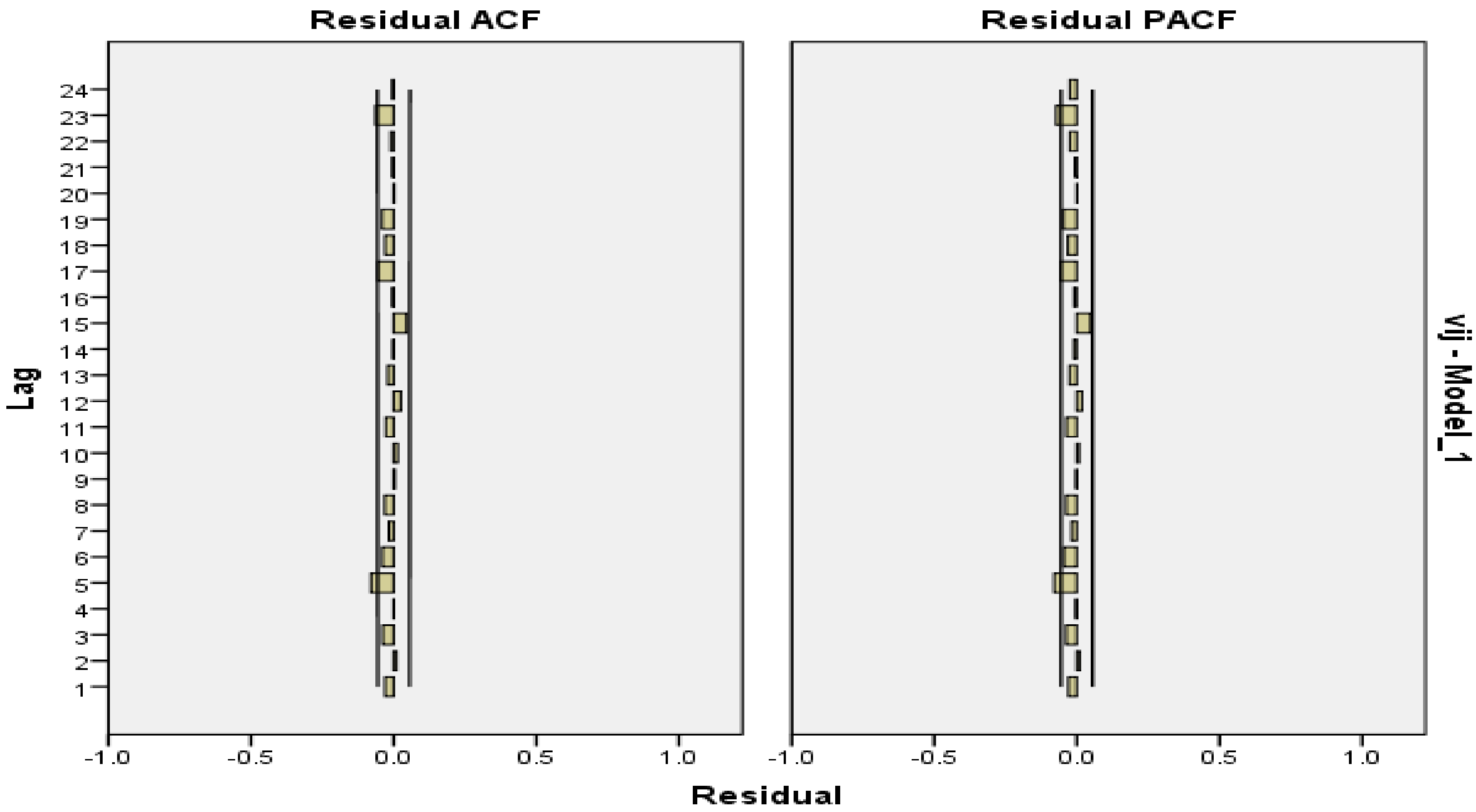


Fig 4.9: Autocorrelation and Partial autocorrelation plots for residuals series of silk cocoons prices of Vijayapura Market for (0 1 0) (1 0 1)ARIMA model

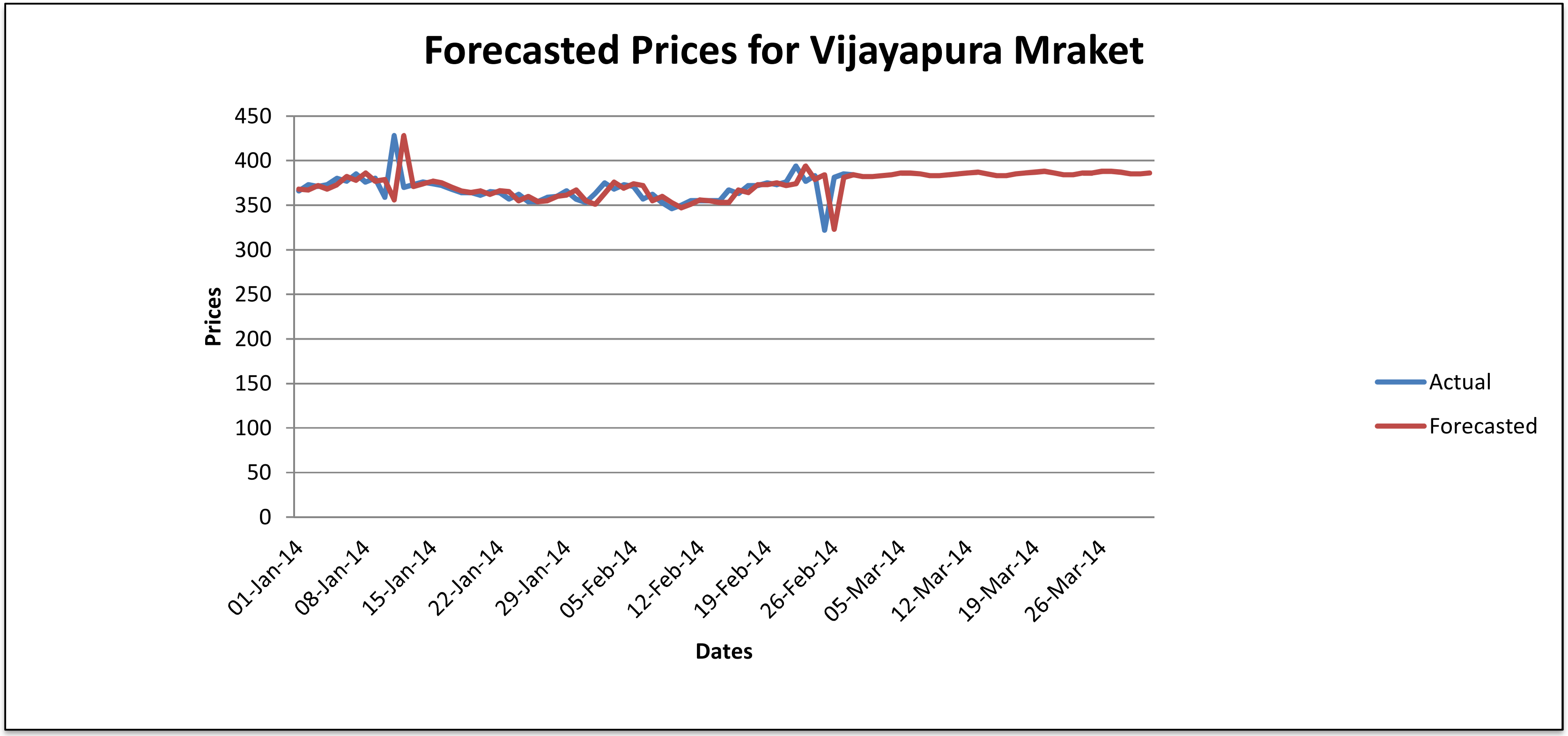


Fig 4.10: Forecasted prices for Vijayapura market for three months of 2014

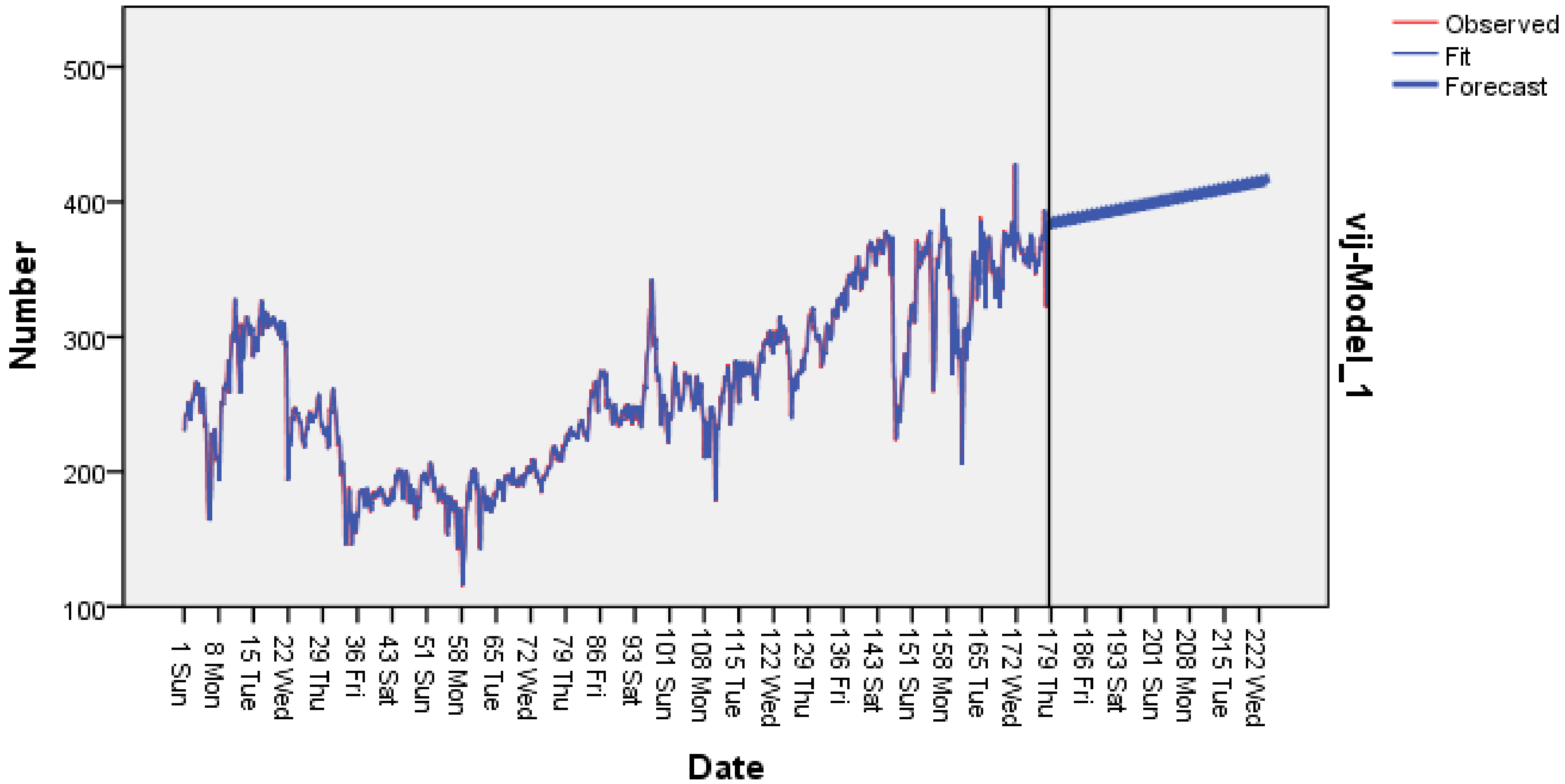


Fig 4.11: Overall Forecasted and Actual prices for Vijayapura Market area

03-Mar-14		383
04-Mar-14		384
05-Mar-14		386
06-Mar-14		386
07-Mar-14		385
08-Mar-14		383
09-Mar-14		383
10-Mar-14		384
11-Mar-14		385
12-Mar-14		386
13-Mar-14		387
14-Mar-14		385
15-Mar-14		383
16-Mar-14		383
17-Mar-14		385
18-Mar-14		386
19-Mar-14		387
20-Mar-14		388
21-Mar-14		386
22-Mar-14		384
23-Mar-14		384
24-Mar-14		386
25-Mar-14		386
26-Mar-14		388
27-Mar-14		388
28-Mar-14		387
29-Mar-14		385
30-Mar-14		385
31-Mar-14		386

4.3 : Market Co-integration.

Market co-integration is an alternative approach to stabilize prices, allocate resources and rectify market imperfections like entrenched monopolies or monopsonies and inadequate and costly information transmission. The rectification of market imperfections smoothens the way to attain market efficiency, which in turn facilitates the attainment of agricultural development and equity in income distribution. If markets are well integrated then government can stabilize price in one key market and rely on commercialization to produce a similar outcome in other markets. This reduces the cost of stabilization considerably. Further, farmers will not be constrained by local demand conditions.

4.3.1: Unit root test (ADF test).

The Augmented Dickey Fuller based unit root test is carried out to check the stationarity of the time series price data from three selected cocoon markets are presented in Table 4.12. The ADF test was carried out for the period (Oct 2010 to Feb 2014). It could be inferred that Augmented Dickey Fuller test values are above the critical value (at 1% level) given by ManKinnon statistical tables implying that the series are stationary at their levels confirming the existence of stationarity. Calculated values are less than the critical value(at 1% level) and are free from consequence of unit root.

This shows that all the three major markets have unit root at 1 % level of significance and the data is non- stationary

This shows that the arrivals of the markets are not stationary because there is no unit root at 1% level of significance. Co-integration test for arrivals is not attempted.

As the price data is stationary we can go for testing the co-integration between the markets. Hence we carry out the “Johansen’s co-integration test” for selected cocoon markets of Karnataka.

4.3.2: JOHANSEN’S CO-INTEGRATION TEST

The Johansen’s multiple co-integration procedure was applied to study the integration between the markets by using E-views software. The results are presented in Table 4.13 and 4.14. Both Trace and maximum Eigen value indicated the presence of at least two integration equation at 5 percent level of significance. Hence, it is concluded that markets are having long run equilibrium relationship.

Table 4.14 and 4.15 shows there are at most three major markets between which Granger co-integration test can be carried out

Table 4.12 Results Of unit root test for prices (Adf Test)

Market	Level	Difference	Critical Value(1% level)
Shidlaghatta	-1.98**	-21.25	-3.44
Ramnagaram	-2.22**	-23.66	-3.44
Vijyapura	-2.59**	-35.94	-3.44

**Significant at 1 per cent level.

Table 4.13 Results of unit root test for arrivals (ADF test).

Market	Level	Difference	Critical Value(1% level)
Shidlaghatta	-7.03**	-23.71	-3.44
Ramnagaram	-6.37**	-2.22	-3.44
Vijyapura	-7.80**	-8.95	-3.44

**Significant at 1 per cent level

Table 4.14 Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.131	250.951	29.797	0.0001
At most 1 *	0.056	76.435	15.494	0.0000
At most 2 *	0.003	4.141	3.841	0.0418

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 4.15 Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.131	174.515	21.131	0.0001
At most 1 *	0.0565	72.294	14.264	0.0000
At most 2 *	0.003	4.141	3.841	0.0418

Table 4.16 Pair wise Granger Causality tests for prices

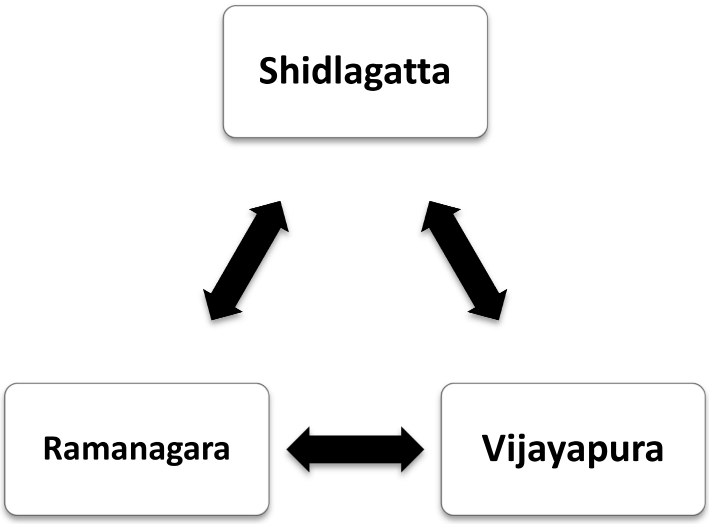
Null Hypothesis:	Number of Observation	F-Statistic	Prob.	Rejection of H_0
Ramanagara prices does not Granger Cause Shidlaghatta prices	1245	47.71	1.E-20	YES
Shidlaghatta prices does not Granger Cause Ramanagara prices	1245	34.83	2.E-15	YES
Vijayapura prices does not Granger Cause Shidlaghatta prices	1245	122.28	3.E-49	YES
Shidlaghatta prices does not Granger Cause Vijayapura prices	1245	33.19	9.E-15	YES
Vijayapura prices does not Granger Cause Ramanagara prices	1245	55.64	7.E-24	YES
Ramanagara prices does not Granger Cause Vijayapura prices	1245	28.39	9.E-13	YES

4.3.3: GRANGER CAUSALITY TESTS.

Granger causality test was conducted to analyse the influence of markets on other market prices. The results are presented in tables.

The Granger causality results reveal that Ramnagaram market prices are influenced by other market prices i.e. Shidlaghatta and Vijayapura markets. Shidlaghatta and Vijyapura market prices influence each other and are also influenced by Ramnagaram market prices. Hence the result show there is an bi directional integration between all the major three markets of Karnataka.

There is a co-integration and interdependence between all the major three markets.



4.3.4 Vector Error Correction Estimates

The error correction model is preferred method for estimation when two integrated time series data are statistically related or co-integrated, since the error correction model can be formally derived from the properties of integrated time series. Error correction component of the model, measures the speed at which prior deviation from equilibrium is corrected, the results are presented in the table 4.17.

The vector error correction estimation reveals that if the t-statistics is greater than 2 or less than -2, the decision is that the markets are co-integrated. On the other hand if it is less than 2 the decision is that markets are not co-integrated

The co-integration equation reveals that -0.52 per cent error corrections were made in Shidlaghatta market itself with standard error of 0.05. While 0.04 per cent error corrections were made in Ramnagaram market, with 0.03 standard error and Vijyapura market has 0.08 per cent correction with standard error 0.03.

The three leading cocoon markets were co-integrating with unidirectional feedback mechanism. Shidlaghatta market prices correct on its own to the extent of 12.76 % and Vijyapura market prices correct on its own to the extent of 2.54 %, while rest of the price adjustments happen due to price movements in other markets. Shidlaghatta market prices was influenced by one-day lag prices of Vijayapura market prices and Vijayapura market prices are influenced by one day and two-day lag prices of its own market and Ramanagara market prices respectively. Whereas Ramanagara prices were influenced by one-day lag price of its own market and previous two days prices of Vijayapura market of Karnataka

Table 4.17 Vector error correction estimation

Error Correction:		**Shidlaghatta**	**Ramanagara**	**Vijayapura**
Co-integration Equation1	Error correction	-0.52	0.04	0.08
	Standard Error	-0.04	-0.03	-0.03
	t- Statistics	[-12.76]	[1.49]	[2.54]
(Shidlaghatta(-1))	Error correction	-0.05	0.01	0.09
	Standard Error	-0.04	-0.03	-0.03
	t- Statistics	[-1.24]	[0.32]	[3.32]
(Shidlaghatta(-2))	Error correction	-0.04	-0.01	0.01
	Standard Error	-0.03	-0.02	-0.02
	t- Statistics	[-1.13]	[-0.55]	[0.77]
(Ramanagara(-1))	Error correction	0.08	0.13	0.07
	Standard Error	-0.04	-0.03	-0.03
	t- Statistics	[1.87]	[4.41]	[2.42]
(Ramanagara(-2))	Error correction	0.00	-0.14	0.03
	Standard Error	-0.04	-0.03	-0.03
	t- Statistics	[0.02]	[-5.01]	[0.86]

(Vijayapura(-1))	Error correction	0.09	0.20	-0.06
	Standard Error	-0.05	-0.03	-0.04
	t- Statistics	[1.89]	[6.09]	[-1.67]
(Vijayapura(-2))	Error correction	-0.03	0.11	-0.04
	Standard Error	-0.04	-0.03	-0.03
	t- Statistics	[-0.68]	[3.98]	[-1.16]
C	Error correction	0.10	0.06	0.10
	Standard Error	-0.38	-0.26	-0.28
	t- Statistics	[0.26]	[0.23]	[0.37]

VI. DISCUSSION

The discussion of the present study ispresented under following sub-headings. The findings of the related studies are made use to substantiate the results wherever possible

5.1 Spatial and temporal variation of silk cocoon

5.2 Forecasting of prices

5.3 Market co-integration

5.1 : Descriptive statistics

5.1.1 Descriptive Statistics for the arrivals and prices of silk cocoon in all the major markets of Karnataka

On close observation of the figures in Table 4.1. 4.2 and 4.3 for Shidlaghatta, Ramanagara and Vijayapura markets we notice that Shidlaghatta is emerging as a leading market and this is followed by Ramanagara and Vijayapura. Though, the market area in Ramanagara is comparatively larger than the other two markets, and till recent days it was the leader, the factor's like ideal conditions for silk worm rearing, transportation and other facilities created have made Shidlaghatta market overtake Ramanagara and become the leader

5.1.2 Seasonal indices of arrivals and prices on silk cocoon in selected markets of Karnataka

Seasonal indices were compute adopting 12-month moving averages. The seasonal variation in prices and arrivals of silk cocoon in the study market are presented as follows.

The seasonal indices of monthly prices and arrivals of silk cocoon in selected markets of Karnataka are presented in the Table4.4 and 4.5 respectively.

Silkworm requires a dry and less humid climate for cocoon rearing. During rainy season due to high humidity in the environment, there are chances of cocoon being contaminated and there is greater risk of contaminating diseases. The quantity of arrivals during the monsoon months decline considerably and there is pre capital reduction in the quality of cocoons. In summer, the quantity of arrivals is much higher and better quality cocoons are seen

The prices of cocoon is much better during summer whereas in the remaining months cocoon don't attract the same prices, the movement of price in different months demonstrates the influence of the season on this variables

5.2Box- Jenkins's ARIMA Methodology

As explained earlier (chapter III), fitting ARIMA model, involves a four stage procedure. The discussion is presented in the same order.

Box Jenkins approaches primarily uses three type of filters: autoregressive, the integration and the moving average. Box-Jenkins model provides a most appropriate filter for the series being analyzed, for diagnosing the accuracy and reliability of the models that have been estimated and finally forecasting is obtained

5.2.1 Identification of the model

Identification is concerned with deciding the appropriate values of p, q and d. It is done based on the conjunction of auto-correlation function (ACF) and partial auto correlation function (PACF)the number of nonzero coefficient in ACF, order of MA terms and a number of non zero coefficient in PACF determine order of AR terms.ACF and PACF of all the major markets of Karnataka are presented in the Table. Since the method of identification does not lay down any hard and fast rule, several possible models are tentatively identified and the following model yields the best results.

5.2.2 Estimation

Having tentatively identified the model, next the parameters, which minimize the sum of square of error, are estimated. The estimated model for prices of silk cocoon is

1. Price of silk cocoon in Shidlaghatta market: (0 1 4)(1 0 1) is the model identified and this model has the lowest AIC and Q-statistic value

2. Price of silk cocoon in Ramanagara market: (0 1 4)(1 0 1)is the model fitted for prices of cocoon, which has the lowest AIC and Q-Statistics value

3. Price of silk cocoon in Vijayapura market: (0 1 0)(1 0 1) is the model found to fit for prices of cocoon, as determined by the estimates AIC and Q- statistics

5.2.3 Diagnostic/ checking

Model verification is concerned with checking of the residual of estimated models to see if they contain any systematic pattern, which can still be removed to improve the chosen ARIMA models. The residuals of the estimated model are depicted and presented in Table(4.7)

The residuals of the estimated models were found to be random (white noise) in all the cases as none of the co-efficient was significantly different from zero, which is supported by the significance of minimum Q-statistic value for prices of silk cocoon. Seasonality is found and forecasting consideration is the best. So these models are chosen.

5.2.4 Forecasting

The principle objective of developing ARIMA model for a variable is to generate post sample period forecasting for the same variable. The Ex-ante and Ex-post forecast obtained by the Box-Jenkins models are provided in Tables 4.9-4.11. The actual and estimated values of the series are also displayed in Fig 4.3- 4.11.

The predictive performance of the models were tested by test statistics like MAPE, the computed values for silk cocoon prices was low for all the three markets; ultimately implying that forecasting ability of the models in prices is good.

Shidlaghatta price:

The Ex-ante and Ex-post forecast done using the best model are presented in Table 4.9. The forecasted values show a bit of fluctuations of values over the 90days.the model (0 1 4) (1 0 1) has lowMAPE hence this model was selected.

Ramanagara prices:

The Ex-ante and Ex-post forecast done using the best model are presented in the Table 4.10.The forecasted values show normalityof values over the 90days.The model (0 1 4) (1 0 1) has low MAPE hence this model was selected.

Vijayapura prices:

The Ex-ante and Ex-post forecast done using the best model are presented in the Table 4.11. The forecasted values show normalityof values over the 90days.The model (0 1 0) (1 0 1) has low MAPE hence this model was selected.

5.3 Market co-integration

Co- integration is a method of defining the long- term relationship among a group of time series variables. The presence of co-integration among relevant variables implies that a linear combination of non- stationary time series variables is stationary (Granger, 1986).

5.3.1 Unit root test (ADF test)

Augmented Dickey fuller (ADF) test is carried out to test the stationarity of the time series price and arrivals data from the three major markets of Karnataka (Table4.12). It is clear from Table 4.12 that the null hypothesis of unit roots for all the time series are accepted at their level of differencing, since the ADF test statistic values are less than the critical values at 1% level of significances and free from the consequence of unit root (Dickey fuller 1979). Thus, the variables are stationary and integrated of same order, i.e., I (0). However, the application of the ADF tests for the prices revealed that this variable is stationary in its levels where as the ADF test for arrivals didn't become stationary even after 2nd differencing hence for the variable arrivals co-integration test was not carried out.

5.3.2Johansen's Co-Integration Test

The Johansen's multiple co-integration procedure is applied to study the integration between the markets. In the present investigation, trace and maximum Eigen value indicated the presence of at least two integration equations at 5 percent level of significance. Hence, it's concluded that markets are having long run equilibrium relationship (Granger 1987).

5.3.3 Granger Causality Test

In the present study the Granger causality test results reveals that Ramanagara market prices were influenced by Vijayapura and Shidlaghatta markets and vice versa, Vijayapura market prices was influenced by Shidlaghatta market prices and vice versa. Hence, all the three markets influence each other market prices and hence there was a bi directional influence. This tests result reveals and confirm that major markets of silk cocoon in Karnataka are integrated (Granger 1987).

5.3.4 Vector Error Correction Estimates (VEC).

The presence of co-integration between variables suggests a long term relationship among the variables under consideration. Then, the VEC model can be applied

In the present examination, the results of VEC showed that Shidlaghatta market make speed adjustments at a rate of 12.76% on its own and Vijayapura markets also make its own speed adjustment at a rate of 2.54%. Shidlaghatta market prices are influenced by Vijayapura market prices, Ramanagara market also make speed adjustments within one or two lagged periods with its own market prices and Vijayapura market prices.

VI. SUMMARY

Sericulture is best suited to a country like India, where there is surplus manpower and land resources beside its remunerative nature. By creating more employment opportunities to the rural population, sericulture prevents rural migration and also promotes handlooms sector.

India is second largest producer of Silk in the world contributing to 18% of world raw silk production. Market share in global silk trade is about 4-5 %.

Cocoons find usage in various preparations for medicine, beauty enhancement, and value added decorative crafts etc has provoked the farmers to involve in sericulture.

India, despite being second in global production of silk, and the only country to produce all the five different varieties of silk. India is importing substantial quantities of silk from China.

Among all the major silk producing states, Karnataka ranks 3rdIn terms of production of both Bivoltine and Multivoltine silk cocoons.

Hence, the present study is concentrated to know the major variety, markets, and its contribution to production and productivity in Karnataka. This study will help the Govt in policy decision making sericulture is best suited to a country like India, where there is surplus manpower and land resources beside its remunerative nature. By creating more employment opportunities to the rural population, sericulture prevents rural migration and also promotes handlooms sector.

In this context, the study is conducted with the following specific objectives.

1. Studying the spatial and temporal variation in the pricing of silk cocoon
2. Forecasting the prices of the silk cocoon in selected markets of Karnataka
3. To Know the market co-integration of silk cocoon at selected markets of Karnataka

Data source

The study was carried out in major three markets from two districts of Karnataka, viz., Ramanagara from Ramanagara district, Shidlaghatta and Vijayapura from Chikkaballapura district. These areas were selected based on major arrivals and transactions respectively.

Data type:

Secondary data which was used in the study is daily data for the arrivals and prices for the period of October 2010 till February 2014.

Statistical tools used for the analysis

Following statistical tools were used to analyze the data to fulfill the objectives:

- To study the spatial and temporal variation in the data in selected markets, descriptive statistics are used. Using the mean, modal, standard error, variation in the data within the year between the markets and over the year within the selected market is studied; normality of the data was checked using skewness and kurtosis. Seasonal index and trend are also analyzed in this objective and it was carried out using moving average method.

- To know the market co-integration between the selected markets Vector error correction analysis was carried out

- Box-Jenkins's ARIMA model was used for forecasting the prices

Study of spatial and temporal variation in selected markets of Karnataka

In the present study, descriptive statistics was used to compare the mean modal values and arrivals of silk cocoon between the major markets of Karnataka.

The descriptive statistics analysis revealed that between the markets the mean prices of silk cocoon was around the same price i.e., Rs 320 per kg and mean arrivals showed a variation. Between the selected markets mean and other measures indicated, Shidlaghatta market's transaction was significantly higher than other two markets, in terms of both arrivals and prices. Shidlaghatta market is followed by Ramanagara market and Vijayapura market. Within a market, there is an increasing trend.

Seasonal variation

Seasonal indices for the selected markets showed that there is some amount of variation in Shidlaghatta and Ramanagara market but major variation was recorded in Vijayapura market

Seasonal indices for price showed that lower prices prevail during the months of October and November for the selected markets of Karnataka and higher prices prevailed for the month of January in Ramanagara and May for other two markets. Whereas for arrivals maximum quantity was recorded during the months of June for Ramanagara and July for Shidlaghatta and Vijayapura market respectively

Co-integration of silk cocoon at selected markets of Karnataka

Vector error correction model

The speed of adjustment of price signals among important cocoon markets is showed by Vector correction model. The three leading cocoon markets are co-integrated with unidirectional feedback mechanism. Shidlaghatta prices correct on its own to the extent of 12.76 %, while rest of the price adjustments happen due to price movements in other markets. Vijayapura market prices are influenced by one-day lag prices of its own market price and Ramanagara prices. Whereas Ramanagara prices are influenced by one-day, lag price of itself and previous two days prices of Vijayapura market

Box-Jenkins model.

The aim of this analysis was to determine an appropriate ARIMA model for the daily silk cocoon data for the selected markets of Karnataka. In particular, we were interested in forecasting future prices or values using this Box-Jenkins model.

The analysis has shown that the daily prices data was non-stationary. In particular, it was found that the original data is I (1). Overall it was determined that the ARIMA (0 1 4) (1 0 1) was the most appropriate model for the Shidlaghatta market data and for ARIMA (0 1 4)(1 0 1) and (0 1 0)(1 0 1) for Ramanagara and Vijayapura market data was appropriate, with low AIC and SBIC values. Future price values for the next three months period i.e. (Jan 2014 – Mar 2014), were estimated using this model. The forecasted values showed an upward trend.

Future line of work

- The study can be extended to other markets of Karnataka.

- The study can be carried to know the quality parameter influence on cocoon pricing pattern.

- Karnataka's cocoon prices and quality can be compared with other major cocoon producing states.

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