BEHAVIOUR OF SILK COCOON PRICES IN KARNATAKA – AN ECONOMETRIC ANALYSIS

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1. INTRODUCTION

In recent years sericulture has emerged as one of the potential enterprises for generating income at short intervals and employment opportunities in rural areas and semi urban areas. It is an important agro based rural cottage industry, which covers the gamut of sericulture activities like mulberry cultivation, silkworm rearing and cocoon production, silk reeling and other post cocoon production stages. Superiority of the end product, silk has been recognized as a natural textile fiber and as one of the high-value, low volume commodities to trade between the continents from time immemorial. Even today no other fabric can match its luster, durability, lightness, elegance and luxury.

Sericulture is not new to India as references have been made in the epics of the Ramayana and Mahabharata. For more than 4000 years this silk cloth considered the ''Queen of textiles''.

Silk is the most elegant among textiles in the world, as it remains most loved fiber throughout the world. It is literally just a continuous protein filament secreted by specific types of caterpillars commonly known as silk worms. The endearing qualities of silk are natural sheen, inherent affinity for rich colours, high absorbance and light weight with high durability. Hence it is acclaimed as the queen of textiles and also Aristocrat good. Silk is associated with human happiness i.e on festivals, marriages, functions, *etc*., all people from children to adults would like silk clothes.

Mulberry silkworm (*Bombyx mori* L.) is a domesticated and commercially exploited species reared in over 30 countries. In India, there are 200 breeds maintained but only few have been exploited. Mulberry silk is produced from silk worm (*Bombyx mori.L*) which feeds on mulberry leaves. Silk worm rearing is location specific, a temperature ranging from 70^{o} F to 85^{o} F, humidity in the range of 60 to 80 per cent and the rainfall of about 600 mm found suitable. Multivoltine Silkworms produce the cocoon in 22-23 days and bivoltine silk worm produces silk cocoon in 26-27days, after which worms spin cocoons. These cocoons are sold to the reelers at the regulated cocoon markets. The reelers convert them into silk yarn. In the major silk producing states, there are well established cocoon markets for the sale of cocoons.

In recent years sericulture has emerged as one of the most potential enterprises for generating income at short intervals and employment opportunities in the rural areas. As cottage and agro based industry sericulture fits well into India's rural areas. This agriculture continues to be the main rearing silk worms and raising silk cocoon crops is essentially a village based, labour intensive industry.

In tropical countries like India multivoltine races are predominant. Although they are hardy and have tremendous ability to survive and reproduce under extreme climatic conditions, yet there other economic characters are poor. The size of larvae and cocoons is small. An average pure multivoltine cocoon weighs 0.9 gram with a filament length of 350 meters and a raw silk yield of 6 per cent. Pure Mysore is the predominant multivoltine race of Karnataka which spins greenish yellow to yellow cocoons. The poor yielding multivoltine races have been improved through hybridization and selection. An average cocoon of an improved multivoltine race weighs 1.24 grams with a filament length of 550 meters and a raw silk yield of 7.5 per cent. The bivoltine silkworm races are native to Japan and china. Most of the bivoltine races in our country are imported and improved through inbreeding and selection. An average Indian bivoltine weighs 2 grams with a filament length ranging from 800-1000 meters and a raw silk yield of 12 per cent. The common races in Karnataka are NB18, NB4D2, NB7, and KA which yield white cocoon(Jayaswal and Datta,1993). In south Indian commercial sericulture, the hybrids between Multivoltine Pure Mysore x Bivoltine viz., NB4D2, NB18 NB7 and KA dominated in last two decades and at present Pure Mysore x CSR2 is the most popular hybrid. The other hybrids are CSR2XCSR5 and CSR2 X CSR4. The popular breeds in north India are J112, J122 and all bivoltines reared in South India, and the multivoltine is Nistari. The mulberry silk worm may be classified based on number of moults, voltanism, place of origin, commercial breeds, etc.

Popular bivoltine breeds reared in South India are Kalimpong-A, NB7, NB4D2, NB18, Nandi, CSR2, CSR4, CSR5, CSR6, NP2 and popular Multivoltine breeds reared in South India are C-nichi, Pure Mysore, Hosa Mysore, MY1, MH1, Nistari, BL24, SLKSPM, etc.

Silk scenario in India

In global market, silk accounts for only 0.2 per cent of the total world production of all textile fibers. India is the second largest producer of silk in the world, next to China and has a 12 per cent share in the global raw silk production. The annual silk production in the country is about 16,000 million tonnes with annual consumption of silk is around 26,000 million tonnes and foreign exchange earnings from silk goods export is over ₹ 300 crores. Silk production has increased from about 4,000 tonnes in 1980 to about 16,245 million tonnes in 2008, (Kshama *et al*, 2008). Silk production in small quantities has been widespread but it flourished only in China, Japan, Korea, India and more recently in Brazil and USSR.

Karnataka ranks first in production followed by Andhra Pradesh and West Bengal with 8,240.00, 4,485.32 and 1,660.36 metric tonnes respectively. Out of the total production, about 55 per cent is accounted by Karnataka, it was followed by Andhra Pradesh, West Bengal and Tamil Nadu. The five traditional states where sericulture is practiced are Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal, Jammu and Kashmir. These states accounts for most of the mulberry silk production in the country.

India has the unique distinction of producing all the four types of silk *viz*., mulberry, tasar, muga and eri. Among them, mulberry silk is predominant and accounts for 88 per cent of the total natural silk produced in India. Around 53,000 villages of India are involved in growing silk cocoons. The area under mulberry cultivation in India is 1,81,893 hectares with raw silk production of 16,322 metric tonnes in 2010-11,(Centre for Industrial and Economic Research, 2010).

The government decided to introduce futures trading in mulberry cocoons and raw silk to boost domestic production of raw silk and to allow producers to hedge their risk due to price fluctuation in international markets. To boost production, National Silkworm Seed Project (NSSP) initiated by the government set up a network of Basic Seed Farms (BSF) to produce and supply basic seed for production of commercial silkworm seed in the seed production centers under the Central Silk Board and the State Departments. Besides, there are the silkworm seed production centers (SSPCs) functioning under NSSP in different states to support the industry.

Export scenario

Karnataka accounts for 25 per cent of the country's silk export. Silk knit fabrics could contribute 5-10 per cent to the total export of silk materials, currently worth 1,500 crores from the country. Japan, China and India are the leading countries in the production of silk and other materials. There is demand for the Indian silk items from America, Spain, Germany, Italy and East Europe. 75 per cent of the Indian production was used domestically and only 25 per cent is exported.

USA, UK, UAE, Italy and German were the top five countries imported Indian silk goods in value terms during the year 2007-08 and accounted for the 23.2 per cent, 14.2 per cent, 7.9 per cent, 6.4 per cent and 5 per cent respectively of the total export earnings.

Importance of sericulture

Sericulture being a small scale enterprise provides ample opportunity to reach target groups especially small and marginal farmers. It has the advantage of addressing simultaneously and rapidly towards several development priorities. Sericulture provides 1) employment and income generation in rural areas 2) high participation of low income and target social groups 3) good comparative advantage and growth prospects 4) potential for export earnings 5) providing a greater role for development 6) good downstream employment impact of raw silk production on the industrial sector. All these combined features make sericulture an attractive sector for further development.

The biggest problem in world silk economy is the prevailing price instability in cocoon and raw silk markets. The 21st congress of the International Sericultural Commission (ISC), devised a policy to safeguard the interests of developing countries against the influx of low priced silk and silk commodities.

Need for the present study

Our problem in the world silk economy is the prevailing price instability in the cocoon and raw silk markets. This is accentuated by the seasonal production of cocoons, which means that there are periods when farmers and reelers have no work at all in some areas of the country. If price instability is reduced, the gains could be increased to considerable extent and it has a very high degree of backward and forward linkages as it encompass both agriculture and industry. Though sericulture plays an important role in Indian economy, there exists a serious problem of fluctuation in silk cocoon prices in markets. Hence, the present study is conducted with the following specific objectives.

1. To study the temporal movement of prices and arrivals of silk cocoon in selected markets of Karnataka.
2. To analyse the impact of arrivals on prices in the different races of silk cocoon.
3. To forecast the prices of silk cocoons in selected markets.
4. To examine the market integration among the different races of silk cocoon in selected markets.

Hypothesis

- There is a temporal variation in arrivals and prices of multivoltine and bivoltine silk.
- Market arrivals determine the prices of multivoltine and bivoltine silk cocoon in a market.
- The prices prevailing in one market are in co-ordination with the other markets.

Presentation of the study

The entire study has been presented in six chapters, Chapter I highlights the introduction to the topic, importance of silk cocoon in Indian economy, specific objectives of study and hypothesis of the study. Chapter II includes the review of earlier studies connected with present investigation. Chapter III explains the methodology i.e., description of the study area, nature and sources of data, and the tools and techniques of analysis adopted for evaluating the objectives of the study. In the next Chapter, the results obtained in consistent with the objectives of the study are presented and these results have been discussed in detail under Chapter V. The last Chapter summaries the entire study and brings about the major policy implications to improve and evolve a measure to stabilize the prices and arrivals of multivoltine and bivoltine silk cocoon.

2. REVIEW OF LITERATURE

Review of literature helps the researchers in knowing the previous works done in their field of research and thereby helps them in indentifying a proper analytical and methodological issue relevant to the study. It enables the researchers to carry out their research work in a proper direction and enables them to draw conclusions. Therefore, the past studies were reviewed and are presented under the following headings.

2.1 Temporal movements of arrivals and prices

2.2 Impact of arrivals on prices

2.3 Price forecasting

2.4 Market integration

2.1 Temporal movements of arrivals and prices

Kunnal *et al.* (1990) analyzed the long-term and short-term variations in prices and arrivals of groundnut in Gadag and Ranebennur markets. Monthly data on arrivals and prices were collected for the period of 1965 to 1981 for Gadag market and for the period 1966 to 1982 for Ranebennur market. The study revealed that, seasonal variability of price was less when compared to variability in arrivals of groundnut in both the markets. Both the markets are subjected to severe fluctuations from year to year. Both the markets have shown an increasing trend for both arrivals and prices. The farm harvest prices were mostly determined by the current year price rather than from the previous year. No prefect relationship between arrivals and price was ascertained as the coefficient of correlation between arrivals and prices was negative and non-significant in both the markets.

Mitrannavar and Gummagolmath (1998) attempted to analyze the seasonal indices of arrivals and prices of potato in regulated markets of north Karnataka. The data on monthly arrivals and prices for the period of 1984-85 to 1994-95 were collected from Belgaum and Hubli markets. The long-run trends in arrivals and prices of potato for the selected markets were analyzed using three years moving average method. The study concluded that arrivals were highest in the month of November in both the markets indicating glut during harvesting season. However, price did not decrease during glut season as majority of the traders purchased potato at that time in Belgaum market while there was a negative relationship between arrivals and prices in Hubli market.

Nahatkar *et al.* (1998) analysed price variation of cotton in Kukshi regulated market of Dhar district of Madhya Pradesh by considering secondary data for a period of 11 years from 1986-87 to 1996-97. The study revealed that seasonal index of cotton prices was lowest in the second quarter (January to March) and maximum in the third quarter (April to June). The coefficient of price variation shows that price rise was higher during first quarter (October to December), as buyers tend to attract more cotton growers to sell their produce at lower prices. The data on cyclical variations indicated that, after every three years the cycle of cotton prices changes, irrespective of the variations in price in the three quarterly periods, revealing that within a year there is no sudden short fall or boom of cotton arrivals in the market. The variation in arrivals of cotton was found to be higher than that of variations in prices.

Pagire (1998) made analysis on arrivals and prices of grapes in Maharashtra state. The data on arrivals and prices of grapes were collected from the Agricultural Produce Market Committees for a period of 12 years from 1980-81 to 1991-92 and were analyzed to know the seasonal fluctuations in arrivals and prices with the help of indices. The study noticed that the arrivals of grapes in Pune market were observed at its peak in March and lowest in June. The arrivals were observed to drastically increase from December to March. In Nasik market, the arrivals were highest in February. In case of prices, declining trend was noticed from January till March and thereafter began to increase from April onwards in Pune market. In Nasik market, the prices were observed to be stable. Variations were observed in arrivals and prices during the period of twelve years. Definite trends in prices and arrivals were noticed but for limited periods, during the period of twelve years in both the markets.

Malli (1999) analysed the trend in arrivals and prices of vegetables (Tomato and Lady's finger) in Pune regulated market during the period from 1978-79 to 1996-97. The coefficient of variation of arrivals (56–80%) and prices (40–80%) of Tomato were higher than the variation in arrivals (27–60%) and prices (49–75%) of lady's finger. The compound growth rate of arrivals (2.11% per annum) and prices (1.02% per annum) for both the vegetables were significant during the same period and prices of both vegetables showed increasing trend indicating good integration of Pune regulated vegetable market.

Shiyaini *et al.* (1999) in their study on time series analysis of arrivals and prices of Garlic in regulated markets of Saurashtra region of Gujarat for a period of 1988 to1998, revealed that the prices of garlic was found relatively higher in mid and lean marketing period than in the peak period.

Patel (2000) in his study used time series data on prices for a period of 1975-76 to 1992-93 obtained from six *khet bazaar utpan samitis*, Directorate of Economics and Statistics, Gujarat Agricultural Produce Marketing Board and Directorate of Agriculture. The study revealed that all markets have around 40 to 75 per cent of the total market arrivals of rapeseed-mustard in peak marketing season. Whereas prices were lower by ₹.20 to ₹ 60 per quintal over mid and lean marketing season in Mehasana district of Gujarat.

Singh *et al.* (2000) adopted linear equation and moving average methods to examine the trend as well as seasonal variation of arrivals and price of rapeseed-mustard in Haryana from 1985-86 to 1995-96. The findings of the study showed general tendency of rising, while the arrivals indicated greater fluctuations from year to year in all markets.

Mehta (2000) analyzed the seasonality in prices of Groundnut and Maize. The results showed linear trend in maize prices. The oscillatory movements affecting the prices were found to be regular in period and amplitude. There existed a crop production periodicity of 12 months seasonality. Seasonality index ranged between 5.0-5.9 implying that its supply and consumption were nearly equi- spread throughout the year. Steep price fall after September synchronized with crop attaining maturity in three months after sowing. In case of Groundnut, the results showed moderately increasing trend, the periodic variations were of non-uniform cycle and amplitude. The long-term price behaviour was approximately linear and the cyclical trend was less pronounced.

Birukal (2001) collected data on monthly arrivals and prices of Cotton for the period from 1984-85 to 1999-2000 from the Agricultural Produce Marketing Committees and indicated a continuous decreasing trend in both price and arrivals of Laxmi cotton. This may be due to the introduction of DCH-32 around the area and the results showed that the trend values of market arrivals and prices of Varalaxmi cotton in Dharwad market showed an increasing trend.

Ravikumar *et al.* (2001) analysed the data for the study collected for the period from 1981-82 to 1995-96. The study concluded that, in general, arrivals showed mixed trend, whereas, prices showed an increasing trend for the selected commodities in Anakapalle regulated market of Andhra Pradesh. There existed an inverse relationship between seasonal indices of arrivals and prices of selected commodities. Therefore, the policy implication lies in encouraging the farmers to dispose off their produce at the opportune time to get good remunerative prices.

Sanjaykumar (2003) studied relationship between arrivals and prices of Onion in selected markets of India from 1994-2000. The results revealed that the arrivals fluctuated to a great extent and prices had a tendency to rise in all the markets during the study period. The correlation coefficients between yearly arrivals and prices of onion were found to be negative and significant over the years in most of the markets. This indicated inverse relationship between market arrivals and prices.

Wadhwani and Bhogal (2003) observed price behaviour of Cauliflower and Cabbage in Western Uttar Pradesh (1988-1997). The results showed that, the prices of these two vegetables were found to be higher in September and started declining from October onwards. The prices were again found increasing from May. The lowest prices were found to be in March and also that the prices of cauliflower and cabbage responded negatively to their arrivals.

Hiremath (2004) collected the data on monthly prices and arrivals of Cotton for a period of 1985-86 to 2002-03 in Hubli market (Karnataka). The study revealed that for DCH-32 cotton kapas, the seasonal indices were the lowest in the month of September and highest in the month of December. The seasonal index was below 100 during the months from April to August.

Sangeeta (2004) analyzed the arrivals and prices of Onion in Lasalgaon and Pune markets (Maharashtra) from 1999-2002. She observed that in Lasalgaon market the arrivals were more in January and February, where as in Pune market the arrivals began increasing in February and March. The prices showed an upward trend from the month of June and continued to rise up to November, after which price decline was observed.

Pawar *et al.* (2004) studied the behaviour of prices and arrivals of Pomegranate in Solapur (Maharashtra) market from 1991 to 2000 and found that the arrivals were maximum during July to September and December and the lowest arrivals in the month of April. The correlation coefficient between arrivals and prices exhibited negative relationship. Trends in arrivals showed increase at 9.80 per cent per annum while prices increased at 8.20 per cent annually during the study period.

Lavleen *et al.* (2005) analyzed the cyclical variation of arrivals and prices of Tomato in Punjab from 1981-2001 by employing Fourier analysis followed by periodogram analysis to estimate the hidden periodicity along with amplitude in the cycles. The periodogram analysis of time series of supply and prices of tomato showed that it followed regular cycles, seasonal within 12 months and cycles of longer duration viz, Kitchin cycles for arrivals with periodicity of 3 years and Jugar cycles for prices with a periodicity of 5 years.

Navadkar *et al.* (2005) in their study on seasonal indices of monthly arrivals and prices of vegetables in Pune (1990-2000) observed lowest coefficient of variation of arrivals for Tomato and it was more than 50 per cent during remaining months. On the other hand, the price was highest during March and below 50 per cent during April to June. In case of Bhendi, the coefficient of variation of arrivals was far below 50 per cent for the period from April to October, while it was more than 50 per cent in all the months except in November and May. It was noticed that the coefficient of variation ranged from 22-79 per cent for arrivals and for prices these were in the range of 31-69 per cent for cabbage. While for cauliflower the same were 31 to 69 per cent and 24 to 54 per cent, respectively. Furthermore, it was indicated that when the arrivals of vegetables were at the higher side, the prices are at the lower side.

Virenderkumar *et al.* (2005) studied the behaviour of market arrivals and prices of major vegetable crops in four metropolitan markets of Delhi, Mumbai, Bangalore and Kolkata from 1990-2001. The results showed that in cabbage, the extent of variability in arrivals was lower in Bangalore and higher in Mumbai. Prices were relatively stable in Mumbai but were volatile in Bangalore. There was broadly a similar pattern in the price across different months in Kolkata and Delhi markets. The authors also found relationship between market arrivals and prices over the years in all the four metropolitan markets. Across different months, there have been several instances of positive relationship between arrivals and prices in all the four markets.

Khunt *et al.* (2006) made a study on the price behaviour of major vegetables in Gujarat state, and the major vegetables considered for the study were Onion, Brinjal, Potato, Chillies, Tomato and Cluster bean. A number of regulated markets were selected by considering the major vegetable growing areas and data availability about the prices and arrivals of vegetables. The study revealed that there is seasonality in arrivals and prices of all the major vegetables produced in the state which indicates the need for storage facilities. The inverse relationship was observed between prices and arrivals of most of the vegetables. Arrivals and prices of major vegetables have increased over the period in most of the regulated markets showing the scope for expansion of vegetable cultivation.

Yogisha *et al.* (2007) in their study concluded that, there was a mixed trend in arrivals and prices of Potato in all selected markets. The data pertaining to the study was collected for a period from 1994-95 to 2004-05. The monthly seasonal indices for arrivals of Potato, Onion, Ragi and Groundnut were found higher immediately after the harvest in all the markets and the price indices were found to be maximum during lean period and minimum during harvesting period.

Hence, the dissemination of information on market arrivals, prices prevailing in the market, crops to be grown to the season, etc. will result in maintaining uniformity in supply and demand of the produce.

Manasa (2009) analysed the long term and short term variations in prices and arrivals of Pigeon pea in Bidar, Bellary, Gulbarga and Sedam markets in Karnataka. Monthly data on arrivals and prices were collected for the period of 1987-88 to 2007-08. All markets were showed fluctuations from year to year and showed an increasing trend for both arrivals and prices.

Srivastava(2010) Conducted a study on economic analysis of marketing of Soybean in Mandsaur district of MP. They collected the information by multistage stratified random sampling method. 120 Soybean growers were selected from six village of the MP. Primary data collated by interview method for the analysis marketing costs, producers share in consumers rupee, marketing efficiency where used for study. The producers share rupee varied from 54.1 per cent to 59.6 per cent and marketing efficiency was estimated to be 2.18, 2.47 and 2.44 per cent.

Singh and Kataria (2010) Study conducted on behavior of arrivals and prices of green Chillies, colleted the information on the secondary data pertaining to the arrivals and prices. The data were collected from Punjab state i.e in Amritsar and Patila districts. The data collected by time series method for the analysing trend, seasonal variations, cyclical variation and Fourier analysis were used for study. The arrivals and prices of major green Chillies have increased over the period in most of the regulated market showing the scope for expansion of green chillies cultivation.

Govind pal (2010) Study conducted on behavior of arrivals and prices of Lac at different levels of market in West Bengal. They collected the information on secondary data on monthly average prices, where collected from the Ranchi for a period of 16 year spanning from 1990-91 to 2005-06. The data collected by time series method for the analysis trend, seasonal variations, cyclical variation and Fourier analysis were used for study.

Singh et.al (2010) conducted a study on behavior of arrivals and prices of green chillies in Punjab. The objectives of study were to examine the growth in area under vegetables and chillies in Punjab, to estimate the trend in arrivals and prices variation in the arrivals and prices of chillies. The arrivals and prices from related data were from secondary source market committees of selected markets. The analysis of data was done by cyclical variation, Fourier analysis and period gram analysis. The finding of the study indicated that the call for development of market infrastructure which would streamline the supply of the produce there by, keeping a check on the falling prices is generally higher. This will ensure remunerative prices to the farmers of their produce. It can be achieved though marketing, cooperative marketing and contract farming.

2.2 Impact of arrivals on prices

Awasthi *et al.* (1985) studied the relationship between arrivals and prices of Groundnut in three markets of Western region of Madhya Pradesh. The study was based on secondary data collected from Indore, Khargone and Sanwad market records for the period of 1972-73 to 1981-82. The authors observed abrupt and sudden decline in the price of Groundnut, after the harvest period and subsequent moderate price increase up to February. The prices after this period increased substantially till August. However, researchers reported a positive association between prices and arrivals of the produce during the study period.

Dinakar (1990) analyzed the relationship between arrivals and prices of Groundnut in three markets of Raichur district of Karnataka state computing monthly index numbers of market arrivals and prices for the years 1979-80 to 1985-86. It was reported that, the prices ruled high in May to June in all the markets. The correlation coefficient of arrivals and market price was negative in Kukanoor and Koppal markets confirming that high arrivals in the markets have depressed the prices there by putting the farmers into disadvantageous position. However, in Raichur market, the correlation coefficient was found to be positive. This revealed that arrival pattern may not influence the price and forces not taken into account in the analysis may determine the price.

Chitra (2000) studied the market arrivals and prices of groundnut in Challakere market for the period 1990-99. The results showed that, the estimated trend in arrivals of groundnut was statistically non significant, while prices of groundnut showed a steady increase, which was significant. The correlation coefficient estimated for the monthly market arrivals and prices was not significant. Therefore, it was concluded that there was no definite relationship between the arrivals and prices of groundnut. The nature of association between arrivals and prices was negative for the lean periods and was positive for the peak periods and for overall period.

Nadaf (2002) studied the behaviour of price and arrivals of Maize in Belgaum district in general and in Gokak (1985-2001), Ramdurga (1987-2001) and Soundatti markets (1986-2001) in particular. The results indicated that the arrivals were higher during December to March in Gokak and November to February in Ramdurga and Soundatti markets. Whereas, the lowest arrivals were seen in Gokak market during August to November; Ramdurga and Soudatti markets recorded the lowest arrivals in April and June. The highest prices were seen in May to September and remaining months a moderate price in Gokak market. In Ramdurga market, increased price was seen from April to September whereas, in Soundatti market the price was the highest during June to October.

Navadkar *et al.* (2002) in their study on arrivals and prices of vegetables in Gultekadi regulated market, Pune (1978-97) observed inverse relationship between arrivals and mean prices. The correlation coefficients for all the selected vegetables were highly significant at one per cent level of probability. The magnitude of correlation coefficient was the lowest to the extent of 0.61 for Cauliflower and it was the highest to the tune of 0.90 in the case of Bitter guard.

Kollar (2002) studied price behaviour of Maize in Haveri, Ranebennur (1990-91 to 2000-2001), Gokak and Soundatti markets (1985-86 to 2000-2001). The results indicated that there was a significant and positive relationship between arrivals and prices in all the selected markets. The pattern of relationship was high in Soundatti market.

Ramesh (2003) studied the price behaviour of Groundnut in Gujarat from 1987-88 to 2001-2002. The results indicated that, higher indices of market arrivals of groundnut were found immediately after harvesting. Since groundnut is mainly grown under rainfed condition, the higher indices were noticed during October to January. Indices of prices were found to be low during peak arrival months and vice versa.

Chahal *et al.* (2004) studied the price behaviour of Green peas in Hoshiarpur and Ludhiana (Punjab) markets from 1994 to 2002 and found that correlation coefficient of arrivals of green peas in Ludhiana market was positive; were as in Hoshiarpur market it was negative. The authors also found that, correlation coefficient of prices of both the markets were positive.

Verma *et al.* (2004) in their study on relationship between market arrivals and prices of Onion in Indore market (1996-2002) observed positive correlation between arrivals and prices from 1999 to 2002, and negative correlation from 1996 to 1999, which indicated that increase in arrivals lead to reduction in price and decrease in arrivals of Onion lead to increase in prices. Price of onion was the lowest in the month of April followed by May.

Virenderkumar (2006) studied the market arrival and price behaviour of Potato in four metropolitan markets (Delhi, Bangalore, Mumbai and Kolkata) for the period 1990-2001. The results showed a positive correlation coefficient for Delhi market for nine years out of total eleven years. However, these were statistically non significant. In Mumbai market, the relationship turned out to be negative for seven year out of eleven years. The coefficients were negative for Bangalore and Kolkata markets. The negative relationship between market arrivals and potato prices in these markets of Mumbai, Bangalore and Kolkata were statistically significant for a single year only keeping a check on the falling prices is generally higher. This will ensure remunerative prices to the farmers of their produce. It can be achieved though marketing, cooperative marketing and contract farming.

Punitha (2007) studied the seasonal indices and trend in arrivals and prices of Maize and Ground nut in Davengere market and Hubli market. In case of maize, Davangere market showed increasing trend in arrivals but Hubli market showed stagnant trend and both the markets showed an increasing trend in prices.

In Davangere market significant and positive relationship between arrivals and prices was observed for maize. Whereas, in Hubli market non-significant and negative relationship was observed.

Yogisha (2007) computed trend in arrivals and prices of Potato in Chikkaballapur, Chintamani, kolar and Srinivaspur during 1994-95 to 2004-05. The results shows that in the initial years potato arrivals was increasing and in the mid period it started decreasing while in the later period the arrivals again increased in all markets except Srinivaspur. In case of price trend pattern, decreasing trend in prices of potato in later period except Bangalore and Chintamani may be because of increased arrivals of potato to these markets.

2.3 Price forecasting

The Box Jenkins models include a class of ARIMA (Auto Regressive Integrated Moving Average) models. Though these models have been in use for several years, it was popularized by Box and Jenkins during the late sixties. Some of the studies relating to broad objective of the present study are reviewed below.

Leuthold *et al*. (1970) forecasted hog prices and daily quantities supplied by means of several alternative forecasting techniques. The distinction between econometric and the Box Jenkins models, they stated, lies in that the former identifies and measures both economic and non-economic variables affecting price and quantity, while the later identifies the stochastic components. The models were tested using the Theils U coefficient and the authors concluded that the econometric models yielded slightly superior forecasts. Finally, the authors concluded that although better forecasts are obtained by econometric models, stochastic models were less prone to error and were less expensive.

Schmitz and Walts (1970) estimated and forecasted wheat yield changes in four largest wheat exporting countries namely the United States (US), Canada, Australia and Argentina using Box Jenkins models. They compared these forecasts with those obtained by exponential smoothing using Theils inequality coefficient and concluded that forecasts with parametric modeling gave better forecasts for the US but not for the others. Thus, the authors concluded that the method of forecasting should be judged based on the ability to give good forecasts.

Chatfield and Prothero (1973) averred that, the Box Jenkins procedure was unsuitable for sale forecasts with a multiplicative seasonal component. They used monthly data of sales of a company and fitted a seasonal moving average model. The Box Pierce test testified to the adequacy of the model. The authors tried alternative formulations introducing additional terms, but they were not found satisfactory.

Govindan (1974) used Box Jenkins models to wholesale price indices of rice, wheat, jowar and gram. While short-term forecasts were found to give good forecasts, the same was not true of long term forecasts. Janus quotients of the forecasts showed that the model gave good forecasts.

Newbold and Granger (1974) compared the forecast performance of the Box Jenkins, Holt Winters and stepwise regression models. The results indicated that each method possessed useful features absent in the others. The authors were of the view that the Box-Jenkins gave better forecasts in the short-run, but the method required time and skill to compute. The results further indicated that, for time series data with less than 30 observations, the Holt Winters method was better suited, but for data with more than 30 observations, step-wise regression was better. For data between 40-50 observations, a combination of Holt Winters and step-wise regression was suited. For series of 50 observations the Box-Jenkins model performed well. The authors cautioned that, for data with strong seasonal fluctuation and long fluctuations, the Holt Winters Model should not be used.

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

Lakshminarayan *et al.* (1977) used Box-Jenkins model for the broiler chicken production in Quebec, and found that the model was adequate in explaining variation in the series. The forecasts too were accurate and the mean absolute percentage error was under 5 per cent in the production series.

Makridakis and Hibbon (1979) averred that accuracy of forecasts are negatively associated with the error term. Several tests to arrive at the accuracy of forecasts like mean square error (MSE), Theils 'U' coefficient and Mean Absolute Percentage Error (MAPE) were suggested.

Chengappa (1980) used Box-Jenkins model to forecast pool coffee prices and export auction prices. Monthly data were used and due to the distinct seasonal variation of prices, ARIMA seasonal model was used. While pool sale price forecasts were accurate but the export price forecasts were not. This, the author attributed to a possible lack of stationarity of the data, and suggested a better method for making the export price series stationary. Due to wide confidence interval for distant forecasts it was observed that the method was not suited for long term forecasts.

Larson (1983) argued that information about the structure of the error term is essential to accurately evaluate any model and its summary statistics. He found that such information is neither generally requested not provided by most economic journals. In this opinion an effective methods' for evaluating a model and its forecasting abilities was to compare the net-of-the sample forecasts of complicated models with out-of-the sample forecasts of simple models. Auto Regressive Integrated Moving Average (ARIMA) and Vector Auto Regression (VAR) models were two such models, which provide relatively good forecasts.

Achoth (1985) analyzed the supply, price and trade of Indian Tea by fitting ARIMA models to data on prices and production. The moving average models were found to be most suitable. Among the price series a particular month's price was not related to the price of the immediate previous month but significantly related to the price of same month in previous years. However, the production in a particular month was related both to production of the previous month as well as to the production of same month in previous years. The forecasts yielded reasonably good results as judged from the tests of their efficiency. The forecasts of prices were superior when compared to the forecasts of quantities, which was attributed to the highly structured pattern of price behaviour.

Achoth (1985) fitted the seasonal ARIMA model to price data of tea at Calcutta and Cochin auctions to production data of Northern and Southern regions of the country and quantity of tea exports and their prices. 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. By for 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 serious probably because certain cyclic pattern may not have been captured by the model.

Shanmugam (1985) studied the temporal and spatial performance of groundnut price and concluded that there was no significant difference in wholesale market prices of groundnut kernel between different markets because of the presence of necessary communication network and integrated prices intelligence service.

Abdul (1988) dealt with the inherent problem of price expectations by comparing the methods utilizing future prices *i.e.* ARIMA forecasting and two other methods for combining the two individual forecasts. ARIMA model performed better in forecasting broiler prices in the shorter forecast ranges. When all the range was considered, the combined simple average method performed best. For corn prices, the individual forecasts based on future prices performed best and for soyabean - meal prices, the combined - linear regression method was the best.

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.

Bogahawatte (1988) employed Box-Jenkins Auto Regressive Integrated Moving Average (ARIMA) approach to study the seasonal variations in retail and wholesale prices of rice in markets of Colombo and found that, seasonality in retail prices was more prominent than the wholesale prices. He also reported that the interaction between retail and wholesale prices and the influence of current retail price on wholesale prices of periods t+1, t+2, t+3 were significant. Findings of the study implied that any increase in the supply of rice due to retail price in period 't' will arrive in the market at period t+3, thus, preventing any further increase in price.

Paul and Ashtekar (1990) forecasted some major exchange rate using structural and time series models and found that ARIMA models were able to capture the turning points better than the other structural regression models.

Lanciotti (1990) presented a paper that analysis of time series data of monthly prices for a group of diary 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, Le ARIMA forecasts are better.

Gupta (1993) forecasted the values for monthly tea production in India using ARIMA. The researcher used monthly tea production in India from 1979 to 1991. By fitting ARIMA model the author forecasted for next 12 months. In this study MA (1, 12, 13, 24) and AR (1, 2, 3, 23) lags were found significant and time series data achieved stationary at first order of difference.

Venugopalan and Prajnesha (1996) compared polynomial function fitting approach, non-linear mechanistic growth modeling procedure and Autoregressive Integrated moving average time series methodology for analyzing the fishery export data. They found that ARIMA model was the best for describing fishery products exports data.

Srivastava (1998) used ARIMA for forecasting sugarcane productivity based on the time series data of fifty years (1940-41 to 1989-90) in Bihar. The major phases involved in model building are identification of the order of model, estimation of the parameters and diagnostic checking for adequacy of the model. ARIMA model is characterized by the order (p,d,q) where 'd' denotes the degree of differencing and it was assumed that d^{th} of original data Z_t is stationary. The constant 'p' and 'q' denote the orders of autoregressive and moving average operators, respectively of appropriately differenced series. The findings, therefore ascertained that the time series data on sugarcane productivity for the state of Bihar was described by an ARIMA (0,1,1) model. Forecast of sugarcane at origin 't' for the state of Bihar are computed with the help of equation Zt [1]= Zt - 0.85at (1-step ahead forecast) and Zt = Zt [L-1], L-step ahead forecast [L>1].

Yin and Mins (1999) studied the timber price forecasts with univariate Autoregressive Integrated Moving Average model, employing standard Box-Jenkins modeling strategy. Using quarterly price series from timber Mart-South, results showed that most of the selected pine pulpwood and saw timber markets in six southern US states can be evaluated using ARIMA model and that short term forecasts, especially those of one-lead forecasts, were fairly accurate. It was suggested that forecasting future prices could aid timber producers and consumers alike in timing harvests, reducing uncertainty and enhancing efficiency.

Gill and Kumar (2000) indicated that univariate ARIMA model could not be better than multivariate vector Autoregressive and bivariate vector Autoregressive time series models, which allow multivariate interaction among the variables.

Amin and Razzaque (2000) stated ARIMA model is a way of describing how a time series variable is related to its own past value. Mainly an ARIMA model is used to produce the best weighted average forecast for a single time series. Producing forecast from an ARIMA model is straight forward. The Autoregressive (AR) operator φ (B) is assumed to be stationary and the Moving Average operator θ (B) is assumed to be invertible, $\{a_t\}$ is a sequence of independent and identically distributed random variables (iid) with mean zero and variance σ^2, B is the back shift operator such that $B^i Z_t = Z_t - 1$ for any integer i, d is the differencing, necessary to induce stationary in the data and a is a constant.

The data pertaining to the years 1956-57 to 1994-1995 were used for the modeling and forecasting was done for 1995-96 to 1999-2000 for all crops chosen. And they found that the crops taken for study showed less increasing trend.

Ansari and Ahmed (2001) applied ARIMA modeling for time series analysis of world tea prices and export prices in industrialized countries. The results of the estimated ARIMA equation implied that the information on the current period's tea price is sufficient to forecast the next periods and the industrialized countries' export prices can be forecasted from information on the prices of the previous two periods. The authors concluded from the fitted ARIMA models that, the autoregressive process generated both price series and there was no influence of external factors.

Mastny (2001) used ARIMA models, also called Box and Jenkins models after their developers, is a group of models allowing the analysis of the time series with various features. The article demonstrates the possible usage of the Box-Jenkins methodology 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 a price development forecast for a selected agricultural commodity.

Amera (2002) applied ARIMA modeling for price data of potato in Belgaum and Hassan markets. A stochastic seasonal ARIMA was found to be appropriate model for Belgaum and Hassan markets, as well as the state. The forecasted values of potato prices using ARIMA model showed an increasing trend up to year 2003 in the selected districts and state in general.

Selvakumar (2002) forecasted the future demand for agriculture manpower In Government and Private sectors using ARIMA models. He revealed that the supply of agricultural graduates exceeds the demand and could lead to unemployment for agriculture manpower. By creating new jobs in agriculture by Government sector and investment in agriculture business by private sectors would be beneficial to boost the Indian agriculture sector.

Rajaraman and Datta (2003) forecasted the Agriculture production of five states of India namely Punjab, Rajasthan, Karnataka, Andhra Pradesh and Uttar Pradesh using ARIMA models. They have used Index of Agricultural Production (IAP) rather than Gross State Domestic Product (GSDP) of the states. Models were fitted for the data from 1950-51 to 2000-2001 and forecasted for next three years. The forecast for 2002-2003 showed negative growth for Rajasthan (-1.7%) and Andhra Pradesh (-3.5%). The forecast for Punjab and Karnataka were positive 1.8 and 5.0 per cent, respectively.

Farmer *et al.* (2004) studied monthly unemployment of three G-7 countries, which displayed explosive behavior in recessionary periods, with stationary behavior in expansions. In this paper, the authors put forward a new autoregressive time series model with time-varying parameters, where this variation depended on a linear indicator variable. When the value of this variable exceeds a stochastic threshold level, the parameters change. The authors discussed representation, estimation and interpretation of the model.

Conejo *et al.* (2005) in their article considered forecasting techniques to predict the 24 market-clearing prices of a day-ahead electric energy market. The techniques considered include time series analysis, neural networks and wavelets. Within the time series procedures, the techniques considered comprise of ARIMA, dynamic regression and transfer function. Relevant conclusions were drawn on the effectiveness and flexibility of any one of the considered techniques. Furthermore, results of different models were exhaustively compared among themselves.

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.Batchelor *et al.* (2007) identified the model that provided the most accurate short-term forecasts of spot and forward prices in the international freight market.

Four time series models were considered, namely, the Box-Jenkins ARIMA model, the Vector Auto-regression (VAR) model on price changes, a general Vector Equilibrium Correction model (VECM) suggested for co-integrated variables and a restricted VECM model. The VAR model was considered as a restricted version of the VECM in which the equilibrium correction term was dropped. For evaluation purposes, the data were split into an in-sample estimation set and an out-of-sample forecast set. The various time-series models were initially estimated over the period 16 January 1997 to 30 June 1998 for all routes. The period from 1 July 1998 to 31 July 2000 for the Atlantic routes and the period from 1 July 1998 to 30 April 2001 for the Pacific routes were then used to evaluate independent out-of-sample N-days ahead forecasts.

Cheluvarangappa (2007) applied ARIMA model in his study to forecast the monthly prices of copra in Tiptur market of Karnataka. He considered monthly time series data of copra prices from 1975 to 2005. Post period forecasted values depicted the same pattern of actual prices of copra. The fitted model for these monthly prices of copra was (4, 1, 5).

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 *et al*. (2007) made an attempt to forecast milk production using statistical time series modeling techniques such as double exponential smoothing and Auto- Regressive 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.

Nikhil (2008) in his study on “Arecanut marketing and prices under economic liberalization in Karnataka” fitted an interactive Auto Regressive Integrated Moving Average (ARIMA) Process to monthly average prices of two varieties of areca nut. The ACF and PACF showed autoregressive and moving average process with seasonality component in the selected markets. The auto correlation coefficients were significant in both the varieties, which implied that there was a strong seasonality component in the error terms. Using the model, the prices of both types of areca nut were ex-post forecasted. Accordingly, prices of both varieties reached a peak in the month of August and declined thereafter.

2.4 Market integration

Krishnaswamy (1975) studied the behaviour of market arrivals of groundnut prices of Rajasthan. He observed that the six out of eight cases studied the market arrivals were positively related to prices.

Bhat (1980) studied the movement of paddy and groundnut prices in the selected market of Karnataka. He employed zero order correlation coefficient analysis for analysing market integration. Further, he suggested a strong integration of markets in price formation indicating the influence of price in one market over the prices in other markets. The “r” values were higher in the cases of bigger markets compared to smaller markets indicating the influence of trader’s participation in determining the degree of market integration.

Ejiga and Robinson (1981) analysed the market integration in terms of storage cost of cowpea in Nigeria and showed that on an average, the stock had to be held for about eight months to secure maximum gains. Significantly, there was high degree of variability from year to year in both price and arrivals. Suggesting that, a farmer or a trader could not be assured of profit from storage every year.

Mundinamani (1985) analysed the market concentrations by commission agents in the selected market of groundnut in Dharwad district. The author found that the top commission agents controlled about two thirds of the total quantity of groundnut handled in Hubli market and one third in Gadag market indicated a high degree of concentration in purchase in Hubli market compared to Gadag market.

Singhal (1986) studied five primary and one terminal markets in Uttar Pradesh to analyse spatially and temporally, the rape-seed mustard price structure using correlation coefficients technique for spatial analysis.

He found that almost every year there were periods of attack 6 to 8 weeks at strength when the terminal market (Kanpur) price was considerably in excel of the primary market price (after taking transport costs etc. into account). It was concluded that while the primary and terminal markets were spatially disintegrated.

Nagaraj *et al.* (1987) studied spatial integration of silk cocoon markets in Karnataka. The Haugh's test based on cross correlation coefficient was employed to examine the dependence of prices in various silk cocoon markets with that of Ramnagaram prices. Results revealed that the silk cocoon markets in Karnataka were spatially integrated and there by price efficient.

Deviah *et al.* (1988) studied spatial integration and price leadership of Ramnagaram cocoon market over other markets through Granger's causality test. This test was performed on the price series of fourteen markets, which were filtered using an ARIMA model. The cross correlation coefficient of the residuals of the Ramnagaram silk cocoon prices with other markets was relatively high at lag 0. Hence it was concluded that prices were determined spontaneously in all the markets and no specific lead- lag relations existed between them. The markets were observed to be spatially integrated and price efficient.

Prabhakara (1988) studied the market integration of two major cocoon markets in Karnataka *viz*. Ramnagaram and Vijayapura. It was found that both the markets were highly integrated as indicated by a very high correlation coefficient of 0.947 between the seasonal indices of prices (0.601) in different markets was also significant at one per cent level. This confirmed the observations made earlier that the two markets being closely integrated and spatially efficient.

Prabhakara (1988) analyzed price transmission between silk prices at Bangalore silk exchange and cocoon markets. The estimated price transmission elasticities for Vijayapura and Ramnagaram markets were observed to be close to unity. This kind of elasticity of price transmission between two stages of marketing is ideal, provided the price spread is realistic and markets being price efficient.

Arya (1991) analysed spatial integration of four markets in Gujart using zero order price series correlation analyses. The result revealed a significant and high correlation in price movement between markets and concluded that the markets under consideration were integrated in terms of price movement.

Goodwin and Schroeder (1991) empirically evaluated spatial linkages in regional cattle markets using co integration tests of regional price series. Several markets were not co integrated over the period 1980 through 1987 period. However, significant increases in co integration of several regional livestock markets were observed through the 1980s. The increased co integration parallels significant structural changes in the livestock industry. Further, a formal analysis of market characteristics revealed that distances between markets, industry concentration ratios, market volumes and market types showed significant influences on co integration relationships among the markets.

Naik and Babu (1993) analyzed the prices of domestic and imported silk in important markets of India. The high correlation coefficients of prices between different markets suggested that prices of imported raw silk and domestic silk were moving together irrespective of the location of the markets and source of imports. The results indicated higher correlation between maximum price of filature silk of Bangalore silk exchange and imported silk. To examine lead lag relationship between different markets Granger causality test was conducted. The results showed that Bangalore silk exchange prices for raw silk influenced the Varanasi market China raw silk prices within two weeks. In turn, Varanasi market china raw silk prices influenced the Bangalore market china raw silk prices within a week. It was concluded that there was a definite relationship between the raw silk prices at different markets and it was not instaneous.

Baharumshah and Habibullah (1994) employed the co integration method developed by Engle-Granger to analyse the long-run relationship between pepper prices in different markets in Malaysia. The results suggested that these markets were highly co integrated, which implied that commodity arbitrage was working. The results also showed that the prices of pepper moved uniformly across spatial markets.

Importantly, the distance between markets was not an impediment to efficient adjustment of price to new information. Thus, the price changes were fully and immediately passed on to the other markets.

Parameshwarappa (1997) employed co integration analysis to examine whether the prices of Indian silk are integrated with the world indicator prices of silk yarn. It was observed that co-integration proves that in the long run there is no relationship between Indian silk yarn and world indicator prices. This is an indication of the domestic prices from that of world prices.

Vani and Krishnaiah (1998) in Guntur district of Andhra Pradesh, to assess the price integration existing between two regulated markets. Guntur and Tadikonda as central and local markets respectively. The index of market connection was 0.82, indicating a high degree of short-run market integration. The influence of change in central market price over local market price was 0.30, which implied that one rupee change in Guntur market prices between the current and the last years price brought about 0.30 increase in Tadikonda market price during the same time period. Guntur market prices influenced Tadikonda market price with an increase of 0.63 during the same period, while it would increase the difference by 0.63 in Tadikonda market price during last year. Dynamic marketing is necessary for maintaining proper price structure in chilies so as to remunerative prices to Chilli growers.

Samarajeeva and Gunatilake (1999), the results of Dickey fuller and augmented Dickey fuller tests revealed that the quantity consumed and prices of Palm oil are integrated to the order zero while prices of Coconut oil and Soya oil and income are integrated to the order one.

Arvind Kumar (2000) in his study on performance of India's Rice exports used cointegration approach to test the extent of integration between Indian Domestic Rice Market (New Delhi) and the major world rice markets (Bangkok and Houston). The results clearly indicated that the domestic rice market was not integrated, in the long-run with the major rice markets of the world i.e., Bangkok and Houston. This was inferred from the fact that 'b' coefficient of the price series integration was less than their respective Dickey Fuller critical values.

Ashalatha (2000) employed the co-integration technique to analyze the theoretical long-run equilibrium relation between economic time series. She used the model to examine whether the domestic market was integrated with the international market for cashew kernel. The results amply proved that there was a long-run equilibrium of the prices of cashew kernel. This explained the tendency of domestic cashew prices to move in unison with the international market prices in the long-run, confirming the law of one price (LOP).

Balappa Shivaraya and Hugar (2000) 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, Gulbarga, Raichur and Hubli. Zero order correlation and coefficient of variation techniques were used. The correlation matrix of prices of different markets was worked out to know their integration. The results for 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 Hubli and Raichur (0.9439), between Belgaum and Hubli (0.9253), Raichur and Gulbarga (0.8669) and Belgaum and Gulbarga (0.8393).

Ghosh (2000) investigated intra-state and inter-state spatial integration of rice markets in India and found that the Indian rice markets were spatially linked in the long-run. Even though the regional markets were geographically dispersed, spatial pricing relationships indicated that the prices were linked together and hence all exchange locations were in the same economic market.

Patel (2000) used SND test (Standard Normal Distribution) to judge the existence of perfect market integration. The test revealed that all rapeseed-mustard market pairs were well integrated in Mehasana district of Gujarat with respect to price movement.

Birukal (2001) employed zero order correlation coefficient technique to ascertain the integration of markets between Dharwad, Raichur and Soundatti regulated markets in north Karnataka for the unadjusted and adjusted price series of cotton.

The study revealed that all the three markets were well integrated in case of unadjusted price series. For adjusted price series also, there was a good integration among the selected markets, but extent of integration was low as compared to unadjusted price data. Adjusted price data indicated that Soundatti and Dharwad markets were well integrated.

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).

Jyotish and Dinda (2003) observed that the highest values of 'r' for wholesale as well as retail prices have been found strongly correlated. It was found that the test statistic obtained from all the pair-wise markets were seen to be greater than the critical value at one per cent level of significance. All the market pairs in Hooghly district, in terms of both wholesale and retail price, were observed to be co integrated. This was mainly attributed to close proximity, good communication facilities and good infrastructure availabilities among the market centre in Hooghly district. The high degree of market integration shows that potato markets in the states are competitive and efficient at the wholesale level.

Amit Kar *et al.* (2004) indicated that Chennai, Delhi and Bombay markets were well integrated indicating the existence of price dependency among various markets. It was pointed out that the values of ADF test were all significant at 10 per cent level of significance.

Dalawai *et al*. (2004) analyzed the relationship between the prices in major six domestic cotton markets and also at international market (New York) using the co integration technique. The results clearly indicated that, all the price series in major four DCH cotton markets and two Jayadhar cotton markets in the state were assumed to be stationary at order of integration one. The Dickey Fuller test statistic obtained for all the markets, including international market, were found to be more than the asymptotic critical value even at 10 per cent level. Thus, the major cotton markets in the state were found to be integrated and hence quite competitive pricing behaviour was observed.

Yogisha *et al.* (2006), market integration for major agricultural commodities was studied by employing distributed lag model, which was superior over correlation analysis. Distributed lag model of potato prices revealed that, Chickballpur market took less than a day to transfer the prices signals from Bangalore followed by Srinivaspur (3.48 days), Chintamani (13.03 days) and Kolar (16.18 days). In case of onion, Chickballpur took 1.38 days followed by Chintamani (4.38 days), Kolar (7.45 days) and Srinivaspur (7.93 days) to reflect Bangalore onion prices. Kolar took 8.34 days to reflect Bangalore ragi prices. In case of groundnut prices, Kolar took less than 6 days and it was highest (16.01 days) for Srinivaspur market.

Chebbi and Lachaal (2007) in their study on agriculture sector and economic growth in Tunisia using time series co-integration techniques indicated that in the long-run all econometric sectors tend to move together (co-integration). But, in the short-run, the agricultural sector seems to have a limited role as a driving force for the growth of the other sectors of the economy. In addition, growth of the agricultural output may not be conducive directly to non-agricultural economic sector in the short-run.

Pushpa (2007) studied the Indain export performance of Basmati rice revealed that, although the trend was positive, it was not smooth and steady. Therefore, there was a need to diversify the geographical concentration. In this context, it was emerged from the study that there was ample scope for export to USA, which is one of the important importer of Indian basmati rice. The estimated NPC with respect to USA indicated that basmati rice export competitive and enjoys advantages in exports. The study also revealed that domestic and export market (USA) prices for basmati rice were well integrated. case of shrimp. The spatial integration between major shrimp markets in the country appeared to be least, possibly because of its greater market share outside the country.

Henrik *et al.* (2008) studied the existence of spatial integration between and within paddy markets in the north and south of Vietnam. The empirical model used estimates of transfer costs to generalize Ravallion's model of spatial market integration to allow for threshold effects. A sequential testing strategy was used for market segmentation, the number of threshold, long-run integration, informational efficiency and law of one price within an error-correction framework. Whenever price spreads exceed their threshold, at least 60 per cent of price changes were transmitted between regional markets within a month. The results suggested that national level policies cannot be relied upon to stabilize or support paddy prices in Vietnam. Instead policies need to be designed with the specific production, consumption and marketing characteristics of northern and southern Vietnam in mind.

Saran and Gangwar (2008) analysed the spatial co integration amongst major wholesale egg markets in India through measurement of oneness in the egg markets for which, the Engle-Granger cointegration test procedure was applied to egg price series for major wholesale egg markets in the country. The study indicated that, the major markets studied were co integrated apparently due to performance of market intelligence functions by National Egg Coordination Committee (NECC), which helped in transmitting price signals across length and breadth of the country through print media on day-to-day basis. The high degree of co integration amongst various markets indicated that the markets were competitive and efficient at the wholesale levels.

Vasisht *et al.* (2008) studied the price behaviour in fruits and vegetable markets using Co-integration and Error Correction Analysis techniques. The empirical results on the price behaviour provided evidence of high volatility in the prices of fruits and vegetables in major markets. There was a presence of long-run relationship across some of the state level markets for less perishable commodities like apple. The findings clearly indicated that the horticulture sector in India can thrive for greater benefit of both producers and consumers only if better infrastructural facilities like storage, modern marketing infrastructure, as well as timely availability of market information and better market intelligence are developed fast across all states.

Yadav (2008) in his study on "Co-integration, Causality, Money and Income in India" using annual data over 1950-51 to 2006-07 established that money supply and national income (both real and nominal) were found to be co-integrated, which suggested the existence of long-run relationship.

3. METHODOLOGY

The aim of this chapter is to provide a brief description of the materials which provide the necessary data-base for this study and to highlight the important statistical tools employed in the analysis.

The methodology is presented under the following heads

3.1. Selection of markets

3.2. Description of the selected markets

3.3. Nature and sources of data

3.4. Analytical tools and techniques applied

3.1 Selection of markets

Keeping in the view of the objectives of the study three Government silk cocoon markets have been selected one each from the two selected districts namely in Chikkaballapur and Ramanagara districts, namely Government silk cocoon market Ramanagara district, Government silk cocoon market Shidlagatta, and Government silk cocoon market Chintamani from Chikkaballapur district. This is because of the following reasons.

1. Sericulture is an important commercial activity and is being grown extensively in and around these areas.
2. Large quantity of silk cocoon produces comes to these markets.
3. These places have got silk cocoon market established more than twenty years ago with maintenance of Government records on arrivals and prices of silk cocoon.
4. All these markets are connected by better road ways.

3.2 Description of the selected markets

In Karnataka, there are 56 working cocoon markets, out of these 14 are seed cocoon markets and remaining 42 are reeling cocoon markets. Among the reeling cocoon markets, Ramanagara, Shidlagatta and Chintamani market are class one markets which have been selected for the present study in view of the above said reasons. A brief description of the selected markets is presented below.

Ramanagara market

The Ramanagara cocoon market is the largest and oldest cocoon market in India. It was strengthened in the year 1984 under World Bank assistance. The market is located 50 km away from Bangalore on Bangalore-Mysore highway. The cocoon supply to this market is from Ramanagara, Mandya, Chitradurga, Tumkur and Bellary. In addition, some quantities of cocoons are brought from the neighboring states like Andhra Pradesh, Tamil Nadu, Kerala and Maharashtra for transaction. The cocoon transaction is by open auction method.

Shidlagatta market

The Shidlagatta cocoon market is second largest cocoon market in Karnataka and it was strengthened in the year 1983 under World Bank assistance. The market is located in Chikkaballapur district which is 50 KM away from Bangalore. The cocoon supply is from Chikbalapur, Kolar, Bangalore rural, Chitradurga, Davanagere, Haveri, Gadag, Gulburga, Bijapur and also from Andhra Pradesh and Tamil nadu.

Chintamani market

The Chintamani cocoon market is third largest cocoon market in Karnataka. This market is located in Chikkaballapur district which is 75 KM Bangalore. The cocoon supply is from Chintamani, Srinivaspur, and also from Andhra Pradesh.

Transaction of cocoons

Silk cocoons are being a perishable commodity they should be sold soon after harvesting. The farmer who is a commercial silk cocoon producer will take the produce to the market and display the cocoons in the market yard on the metal bin platform in thin layer. The

reelers who are the buyers assemble around the cocoon lots and assess the quality of cocoons. Transaction of cocoon is by open auction. The market officer will arrange for auctioning of cocoons and auctioning will be done in his presence. Reelers quote their price and when the price gets stable auctioneer gives three calls and closes the bidding with the third and final call in favour of the highest bidder. If the farmer is agreeable to the price, the cocoons will be sold to the highest bidder. Then the cocoons are filled in pre-weighted plastic crates and taken to trolleys to weighing platform for electronic weighment. After weighment the buyer take the possession of cocoons and make the payment at the counter, then the market officer will arrange the payment to the farmer on the same day.

3.3 Nature and sources of data

For the study of temporal and seasonal fluctuations in arrivals and prices, monthly secondary data on arrivals in tonnes and prices (₹/Kg) were collected from each of the above markets for varying periods stretching from April 1998 to September 2010 depending up on the data availability. The price data refers to model price which is the wholesale at which most of the transaction takes place during the peak marketing period on each day. This price was thought to be a better representative price than an average price.

Information on arrivals and prices was collected for the period i.e from April 1998 to October 2010 for Ramanagara market, from April 1998 to September 2010 for Shidlagatta market and from April 1998 to September 2010 for Chintamani market.

3.4 Analytical tools and techniques

3.4.1 Time series analysis

Time series analysis was conducted to study the variations in monthly prices and arrivals of Silk cocoon. That is Trend (T), Seasonal (S), Cyclical (C) and Irregular (I) variations. These four types of movements are frequently found either separately or in combination in a time series. The relationship among these components is assumed to be additive or multiplicative, but the multiplicative model is the most commonly used method in economic analysis, which can be represented as

$$O_t = T \times C \times S \times I$$

Where,

O_t = Original observation at time 't'

T = Trend component

S = Seasonal variations

C = Cyclical element

I = Irregular fluctuations

Linear trend (T): Over a long period of time, time series is very likely to show a tendency to increase or decrease over time. The factors responsible for such changes in time series are mainly the growth of population, change in the taste of people, technological advances in the field, etc.

There are different types of trends, some of them are linear and some are nonlinear in their form. For shorter period of time, in most of the situations the straight line provides the best description of trend and for longer period of time, the non-linear form generally provides a good description of the trend. Often, it may be possible to describe such movements with a structured mathematical model. In the absence of such a definite format, approximately a polynomial or a free hand curve describes the movements.

Seasonal variation (S): The variation within a year is called as seasonal variation. The main causes of seasonal variations are production periods, customs, climates, etc. Such seasonal components can be analyzed through harmonic analysis.

Cyclical movements (C): Cyclical movements are fluctuations which differ from periodic movements. Cyclical movements have longer duration than a year and are periodicity of several years as in business cycles.

Irregular variations (I): Here the effects could be completely unpredictable, changing in a random manner. A given observation is affected by episodic and accidental factors. These are also known as causal series and are affected by the unknown causes. These unknown causes act in an unpredictable manner

3.4.1.1 Estimation of seasonal indices of monthly data

To measure the seasonal variations in prices and arrivals, seasonal indices were calculated employing twelve months ratio to moving average method. The seasonal indices were calculated by adopting the following steps

In the first step, 12 months moving total were generated. These totals were divided by 12 to compute 12 months moving average. Then a series of centered moving averages were worked out.

3.4.1.2 Estimation of cyclical indices

The most commonly used method for estimating cyclical movement of time series is the residual method by eliminating the seasonal variation and trend. This is accomplished by dividing (Yt) by corresponding (S) for time't'. Symbolically,

T. C. I. = T. C. S. I. / S

C. I. = T. C. I/T

These deseasonalized data contain trend, cyclical and irregular components. This trend cycle components were plotted against time for examining cyclical behaviour. If there is any existence of cycle, periodicity of cycle was noted. Again, moving average of length equal to periodicity of cycle was computed for eliminating cyclical behaviour.

These moving averages were arranged cycle wise and were adjusted for cyclical indices, as in the case of seasonal indices. Then trend cycle values (TC) were divided by adjusted components cyclical and irregular. On examination of both the graphs of trend component, one will get a clear idea of the presence of cycle.

If there is similarity in these two graphs, it is an indication of non-existence of the cycles. However, the non-similarity in the two graphs is an indication of the presence of the cycles. If, ultimately, a cycle is reflected, then the cyclical effect was removed from T-C components. If no cycle is detected, then the trend cycle values were treated as pure trend values. The Friedman's two way analysis of variance was employed to know the significant difference among months within a cycle and also between cycles; A significant difference indicating the presence of changing cyclical behaviour and non-significant difference indicating the consistency of cyclical pattern.

3.4.1.3 Analysis of long-term movements (trend)

For estimating the long-run trend of arrivals and prices, the method of least squares estimate was employed. This method of ascertaining the trend in a series of annual arrivals and prices involves estimating the coefficient of intercept (a) and slope (b) in the linear functional form. The equation adopted for this purpose was specified as follows.

The linear, quadratic and sixth degree polynomial trend equations fitted to the data were of the following form.

Linear trend : $Y_t = a + bt + e$

Quadratic trend : $Yt = a + bt + bt^2 + e$

6^{th} degree polynomial: $Yt = a+bt+bt^2+bt^3+bt^4+bt^5+bt^6+e$

Where,

Y_t = Arrivals/prices at time t

t = Period

a = intercept parameter

b = slope parameter

e = Error

Annual trends of prices and arrivals for the selected markets were computed and compared. The goodness of fit of trend line to the data was tested by computing the coefficient of multiple determinations which is denoted by R^2.

3.4.2 Regression analysis

This analysis was carried out to ascertain the impact of arrivals on prices. The observation X and Y were converted to logarithmic form. The equation fitted for the purpose was specified as follows.

$$Y = a + bX + e$$

where,

Y = Prices

a = Intercept

b = Slope or regression coefficient

X = Arrivals

e = Error

As shown in the equation, Y was assumed to be the dependent variable while, X was taken as an independent variable.

3.4.3 Box-Jenkins models

The Box-Jenkins procedure is concerned with fitting a mixed Auto Regressive Integrated Moving Average (ARIMA) model to a given set of data. The main objective in fitting ARIMA model is to identify the stochastic process of the time series and predict the future values accurately. These methods have also been useful in many types of situation which involve the building of models for discrete time series and dynamic systems. But, this method was not good for lead times or for seasonal series with a large random component (Granger and Newbold, 1970).

Originally ARIMA models have been studied extensively by George Box and Gwilym Jenkins (1968) and their names have frequently been used synonymously with general ARIMA process applied to time series analysis, forecasting and control. However, the optimal forecast of future values of a time-series are determined by the stochastic model for that series. A stochastic process is either stationary or non-stationary. The first thing to note is that most time series data are in non-stationary and the ARIMA model refer only to a stationary time series. Therefore, it is necessary to have a distinction between the original non-stationarity time series and its stationarity counterpart.

3.4.3.1 Stationarity and non-stationarity

The term stationarity meaning that the process generating the data is in equilibrium around a constant value and that the variance around the mean remains constant over time. The data must be roughly horizontal along time axis.

If mean changes over time (with some trend cycle pattern) and variance is not reasonably constant then series is non-stationary in both mean and variance.

If a time series is not stationary, then it can be made more nearly stationary by taking the first difference of the series. Conversely, a stationary process may be summed or integrated to give a non-stationary process.

Let Xt be a random variable and xt (where t=1, 2, . . . n) be the observations on Xt with density function f (xt). If the observations are independent, then

f (X1, X2 .. . . . Xn) = f1 (x1), f2 (x2), . . . ,fn (xn)

This implies that joint distribution is independent of historical time. The assumption of stationarity reduces the number of parameters in the joint probability density function of a random variable Xt in the series.

Since the ARIMA model refers only to a stationary time series, the first stage of Box-Jenkins model is reducing non-stationary series X_t to a stationary series Y_t by taking first differences as follows.

$Yt = \Delta Xt$

$= Xt - Xt\text{-}1$

$= Xt - BXt$

$= (1\text{-}B)\, Xt$ . . . . . (3.1)

Where,

B = Backward shift operator

The backward shift operator is convenient for describing the process of differencing. To define B, such that,

$BiXt = Xt\text{-}1$ i= 1, 2, . . .n

Suppose the first difference of the series doesn't become stationary then second order differencing is done as follows.

$Yt = \Delta (\Delta Xt)$ . . . . . (3.2)

$= \Delta (Xt - Xt\text{-}1)$

$= (Xt - Xt\text{-}1) - (Xt\text{-}1 - Xt\text{-}2)$

$= Xt - 2Xt\text{-}1 + Xt\text{-}2$

$= Xt - 2BXt + B^2Xt$

$= (1 - 2B + B^2)\, Xt$

$= (1 - B)^2\, Xt$

In general, if it takes a d^{th} order difference to achieve stationarity, it is written as,

d^{th} order difference $= (1\text{-}B)d\, Xt$ . . . . . (3.3)

The general ARIMA (o, d, o) model will be

$(1 - B)^2\, Xt = e_t$ . . . . . (3.4)

Where e_t is error term distributed normally with

$E(e_t) = 0$, $V(e_t) = e_t^2$ and

Cov (ei, ej) = θ for all t ($i \neq j$)

In order to test the stationarity, auto-correlation functions (ACF) of difference series (Yt) up to 50 lags should be computed. If the ACF for first and higher differences (after 2-3 lags) drop abruptly to zero then it indicates the series is stationary.

3.4.3.2 Stationary time series model

(a) Auto regressive process (p, o, o)

If the observation Yt depends on previous observation and error term et is called auto regressive process (AR process).

$$Yt = \mu + \varnothing tYt\text{-}1 + \varnothing 2Yt\text{-}2 + \varnothing pYt\text{-}p + e$$

$$= \varnothing p\,(B)\,(Yt\text{-}\mu) + e_t \qquad \ldots\ldots\ldots (3.5)$$

Note the term μ in equation (3.5) is not quite the same as the "Mean" of the Y series. Rather, the development is as follows.

$$(Yt\text{-}\mu) = \varphi p\,(Yt - \mu) + et$$

$$= \varphi 1\,(Yt\text{-}1 - \mu) + \varphi 2\,(Yt\text{-}2 - \mu) + \ldots . \varphi p\,(Yt\text{-}p - \mu) + e_t \qquad \ldots . (3.6)$$

$$= \varphi 1\,(Yt\text{-}1 - \varphi 1\mu) + \varphi 2\,(Yt\text{-}2 - \varphi 2\mu) + \ldots . \varphi p\,(Yt\text{-}p - \varphi\mu) + e_t$$

$$Yt = (\mu - \varphi 1\mu - \ldots . . \varphi\mu) + \varphi 1\ Yt\text{-}1 + \ldots . . + \varphi p\ Yt\text{-}p + e_t$$

$$= \mu 1 + \varphi 1Yt\text{-}1 + \ldots ... + \varphi pYt\text{-}p + e_t$$

and the values of auto regressive coefficient restricted to lie between-1and+1.

(b) Moving average process (o, o, q)

If the observation Yt depends on the error term et and also on one or more previous error terms (e_t 's) then we have moving average (MA) process.

$$Yt = \mu + et - \theta 1e(t\text{-}1) - \theta 2e(t\text{-}2) - \ldots . \theta qe(t\text{-}q) \qquad \ldots . . (3.7)$$

Where,

Θi = ith moving average parameter

i = 1, 2, ... q

q = Order moving average

The values of the coefficient are restricted to lie between -1 to +1.

(c) Mixtures: ARIMA process

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

$$(1\text{-}B)d\ (1\text{-}\varphi pBp)\ Yt = u = (1\text{-}\varphi pBq)\ e_t \qquad \ldots .. \ldots . (3.8)$$

(d) Seasonality and ARIMA models

Some time series exhibit perceptible periodic pattern for instance price and arrivals of Agricultural commodities usually have a seasonal pattern process then the general.

The ARIMA notation can be extended readily to handle seasonal aspects and the general shorthand rotation is ARIMA

(p.d.q.) (P.D.Q.)

(non-seasonal part of the model) (Seasonal part of the model)

s = number of periods per season

The mixture of AR and MA seasonal model is

$$\varnothing p\ (B)\ \Delta d\ \varnothing p(Bs)\ \Delta D\ xt = \theta q\ (B)\ .\ (H)Q\ (Bs)\ e_t \qquad \ldots . . . . . (3.9)$$

If Yt = Δd Δd xt – the model becomes an integrated model.

The main stages in setting up a Box-Jenkins forecasting model are as follows.

1. Identification
2. Estimating the parameters
3. Diagnostic checking and
4. Forecasting

(1) Identification of models

A good starting point for time series analysis is a graphical plot of the data. It helps to identify the presence of trends.

Before estimating the parameter p and q of model, the data are not examined to decide about the model which best explains the data. This is done by examining the sample ACF (Autocorrelation function) and PACF (Partial Autocorrelation function) of differenced series Yt.

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

$$\hat{\rho}k\,(Yt) = rk\,(Yt) \qquad \ldots\ldots\ldots (3.10)$$

$$= C_k\,(Yt)/\,C_0\,(Yt)$$

where,

n-k

t-1

$C_k\,(Yt) = 1/n\ \Sigma\ (Yt - Y)\ (Yt+k - Y)$

K = 0, 1, 2, ... n

t = 1, 2, . . . n-k

$Y_t = 1/n\ \Sigma\ Y_t$

n = Length of time period

Both ACF and PACF are used as the aid in the identification of appropriate models. There are several ways of determining the order type of process, but still there was no exact procedure for identifying the model.

(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.

$$S\,(\theta, \varnothing) = \Sigma\ et^2\,(\theta, \varnothing) \qquad \ldots\ldots (3.11)$$

where,

t = 1, 2, 3, . . . n

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

i) Trail and error: Examine many different values and choose set of values that minimizes the sum of squares residual

ii) Interactive method: Choose a preliminary estimate and let a computer programme refine the estimate interactively.

The latter method is used in our analysis for estimating the parameters

(3) Diagnostic checking

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.

Examining ACF and PACF of residuals may show an adequacy or inadequacy of the model. If it shows random residuals, then it indicates that the tentatively identified model is adequate. When an inadequacy is detected, the checks should give an indication of how the model need 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. But the main difficulty in the correct identification is not getting enough clues from the ACF because of inappropriate level of differencing. The residuals of ACF and PACF considered random when all their ACF were within the limits.

$$\pm 1.96 \sqrt{1/(n-12)} \qquad \ldots\ldots\ldots (3.12)$$

We also used Box and Pierce (1970) 'Q' statistic for whether the auto correlations for these residuals are significantly different from zero. It can be computed as follows.

$$Q = n \sum_{k=1}^{m} rk^2 \qquad \ldots\ldots\ldots (3.13)$$

where,

m = Maximum lag considered

n = N – D

N = Total number of observations

rk = ACF for lag k

D = Differencing

And Q is distributed approximately as a Chi-square statistic with (m-p-q) degree of freedom.

The minimum Akike Information Coefficient (AIC) criteria is used to determine both the differencing order (d, D) required to attain stationarity and the appropriate number of AR and MA parameters, it can be computed as follows.

$$AIC(p+q) = N \ln \sigma^2 + 2 (p + q) \qquad \ldots\ldots\ldots (3.14)$$

Where,

σ^2 = Estimated MSE

N = Number of observations

(p+q) = Number of parameters to be estimated.

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

(4) Forecasting

After satisfying about the adequacy of the fitted model, it can be used for forecasting. Forecasts based on the model.

$$(1-\varnothing B)\ (1-\varphi B)s\ Yt = (1-\theta B)\ (1-(H)sB)\ e_t \qquad \ldots\ldots\ldots (3.15)$$

were computed for upto 26 months ahead. The above model (3.15) gives the forecasting equation is

$$Yt = \varnothing Yt\text{-}1 + \varphi Yt\text{-}12 - \varnothing\varphi Yt\text{-}13 + e_t\text{-}\theta e_t\text{-}1 - (H)\ e_t\text{-}12 + \theta(H)\ e_t\text{-}13 \qquad \ldots (3.16)$$

Given data upto time't' 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

$$e_t = Y_t - Y_{t-1} \qquad \ldots\ldots\ldots (3.17)$$

The errors e_t in model (3.17) are in fact that forecast errors for unit lead time. That for an optimal forecast these 'one step ahead' forecast errors ought to form an uncorrelated series is otherwise obvious. Suppose, if these forecast errors were autocorrelated, then it could be possible to forecast the next forecast error in which case it could not be optimal.

The required expectations are easily found because

$$E(Y_{t+m}) = Y_t(m),\ E(e_{t+m}) = 0 \qquad \ldots\ldots\ldots (3.18)$$

Where,

$m = 1, 2, 3 \ldots\ldots n$

$E(Y_{t-m}) = Y_{t-m}\ E(e_{t-m}) = a_{t-m} = Y_{t-m} - Y_{t-m-1}$

Where, $m = 0, 1, 2, \ldots\ldots n \ldots\ldots\ldots (3.19)$

For instance, to determine the three month ahead (1-3) forecast for series Yt (use equation 3.16).

$Y_{t+1} = Y_{t+3}$

$= \varnothing Yt+2 + \varphi Yt-9 - \varnothing\varphi Yt-10 + e_t+13 - \theta e_t-2 - (H)\ e_t-9 + \theta\ (H)\ e_t-10$

taking conditional expectations at time t,

$Y_t(1) = Y_t(3)$

$= \varnothing\ Yt(2) + \varphi yt-9 - \varnothing\ \varphi Yt-10 + 0-\theta\ (0)-(H)\ (Yt-9-Yt-10) + \theta(H)\ (Yt-10-Yt-11)$

Because, $E(e_{t+1}) = 0$, $E(e_{t-1}) = Y_{t-1} - \hat{Y}_{t-1} = e_{t-1}$

i.e. $Y_t(3) = 0\ Y_t(2)$.

The forecast Yt(2) can be obtained in a similar way in terms of Yt(1) from E (Yt+2). Similarly Yt (1) can be obtained from E (Y_{t+1}). In practice it is very easy to compute the forecast Yt (1), Yt (2), Yt (3) etc. recursively using the forecast function (3.18).

E (Y_{t+1}) = E($0Y_{t+1}$-1 + Q_{t+1}-0 e_{t+1}-1) - θ e_{t+1}-1 – (H) e_{t+1}-12 + θ(H) e_{t+1}-13 and using 3.18 and 3.19.

However, using these methods, Ex-post forecasts can also be calculated for comparing with the value actually realized.

The accuracy of forecasts for both Ex-ante and Ex-post were tested using the following tests.

1) Mean square error (MSE); the formula for computing MSE is

$$MSE = \frac{1}{n} \sum_{t=1}^{n} \sqrt{(X_t - \hat{X}_t)^2}$$

Where,

Xt = Actual values

X^t = Predicted values

2) Mean average percentage error (MAPE): The formula for this is

$$MAPE = \frac{1}{n} \sum_{t=1}^{n} \sqrt{\frac{(Xt - \bar{X}t)^2}{Xt}} \times 100$$

Where,

Xt = Actual values

$\bar{X}t$ = Predicted values.

3.4.4 Zero order Correlation Matrix

On the basis of the availability of modal price data on Silk cocoon in major markets of Karnataka, three markets *viz.,* Ramanagara, Shidlagatta and Chintamani markets were selected for detailed analysis of market integration.

Spatial price relationships have been widely used to indicate overall market performance. The usual definition is that integrated markets are those where prices are determined interdependently. This has generally been assumed to mean that the price changes in one market will be fully transmitted to the other markets.

In the present study Zero order correlation coefficient matrix for prices in the selected markets were computed to study the integration of the markets.

$$r = \frac{\Sigma X_i Y_i - \frac{\Sigma X_i \Sigma Y_i}{n}}{\sqrt{\left[\Sigma X_i^2 - \frac{(\Sigma X)^2}{n}\right]\left[\Sigma Y_i^2 - \frac{(\Sigma Y)^2}{n}\right]}}$$

Where,

r = Correlation coefficient between X and Y markets.

x = Monthly modal price of Silk cocoon in market X.

y = Monthly modal price of Silk cocoon in market Y.

n = Number of data period (i.e., 13*12=156).

4. RESULTS

Keeping in view of the specific objectives of the present study, the data collected on the arrivals and prices of cocoon in Ramanagara, Shidlagatta and Chintamani market have been subjected to various statistical methods as outlined in the materials and methods. The results were reported in this chapter under the following headings.

4.1 Behaviour of arrivals and prices of cocoon

4.2 Impact of silk cocoon arrivals on prices in selected markets

4.3 Forecasting of arrivals and prices

4.4 Market integration among selected silk cocoon markets

4.1 Behaviour of arrivals and prices of cocoon

4.1.1 Seasonal indices of cocoon arrivals and prices in selected markets

Seasonal indices of market arrivals and prices of Multivoltine and Bivoltine cocoon in Ramanagara, Shidlagatta and Chintamani markets were presented in Table 4.1and Table 4.2.

4.1.1.1 Seasonal indices of Multivoltine silk cocoon arrivals and prices in Ramanagara, Shidlagatta and Chintamani markets

The seasonal indices of arrivals and prices of Multivoltine silk cocoon of Ramanagara, Shidlagatta and Chintamani markets were presented in the Table 4.1 and Fig 4.1, Fig 4.2 and Fig 4.3 respectively. In the case of Ramanagara market the highest arrivals indices were noticed in the month of June (135.52) and October (103.70). The lowest arrivals were noticed in the month of November (86.53) and April (93.52). As far as the price indices of cocoon were concerned, the highest price indices were observed in the month of May (107.09) and March (105.92). The lowest price indices were recorded in the month of January (95.34) and October (95.93) respectively.

In the case of Shidlagatta market, the highest arrivals indices were noticed in the month of June (119.34) and October (109.31). The lowest arrivals were obtained in the month of July (83.68) and September (90.86). As far as the price indices of cocoon were concerned, the highest price indices were observed in the month of September (103.94) and May (103.65). The lowest indices were recorded in the month of January (91.32) and February (91.91) respectively, and for Chintamani market the highest seasonal indices were noticed in the month of June (112.82) and January (107.42). The lowest arrivals were obtained in the month of April (91.53) and July (92.38). As far as the price indices of cocoon were concerned, the highest price indices were observed in the month of April (103.28) and September (102.29). The lowest indices were recorded in the month of February (94.77) and January (96.38) respectively.

4.1.1.2 Seasonal indices of Bivoltine silk cocoon arrivals and prices in Ramanagara, Shidlagatta and Chintamani markets

The seasonal indices of arrivals and prices of Bivoltine silk cocoon in Ramanagara, Shidlagatta and Chintamani markets have been presented in Table 4.2 and Fig 4.4, Fig 4.5 and Fig 4.6 respectively The highest arrivals indices for Ramaanagara were observed in the month of January (109.99) and March (107.97). The lowest arrivals were recorded in the month of August (82.63) and July (84.45). As far as the price indices of cocoon were concerned, the highest price indices were noticed in the month of April (103.94) and May (103.48). The lowest indices were obtained in the month of February (96.19) and January (97.02) respectively.

In the case of Shidlagatta market, the highest arrivals indices were noticed in the month of June (113.08) and October (107.60). The lowest arrivals were obtained in the month of July (86.21) and September (91.15). As far as the price indices of cocoon were concerned, the highest price indices were observed in the month of May (103.45) and July (103.25). The lowest indices were recorded in the month of January (91.30) and February (95.90) respectively.

Table 4.1 Seasonal indices of arrivals and prices of Multivoltine silk cocoon

(Per cent)

Months	Markets					
	Ramanagara		Shidlagatta		Chintamani	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
April	93.53	106.29	99.27	103.07	91.53	103.28
May	97.13	107.09	95.92	103.65	97.52	101.46
June	135.51	98.02	119.34	99.72	112.82	99.510
July	94.78	99.46	83.68	102.78	92.38	100.92
August	96.73	97.89	95.19	102.62	100.90	101.97
September	96.12	99.34	90.86	103.94	100.34	102.29
October	103.70	95.93	109.31	100.31	102.43	100.04
November	86.53	100.78	100.39	101.66	96.36	101.75
December	100.30	97.48	102.09	100.61	102.16	99.27
January	98.20	95.34	107.00	91.32	107.42	96.38
February	101.71	96.40	103.29	91.91	99.83	94.77
March	95.70	105.92	93.61	98.34	96.26	98.30

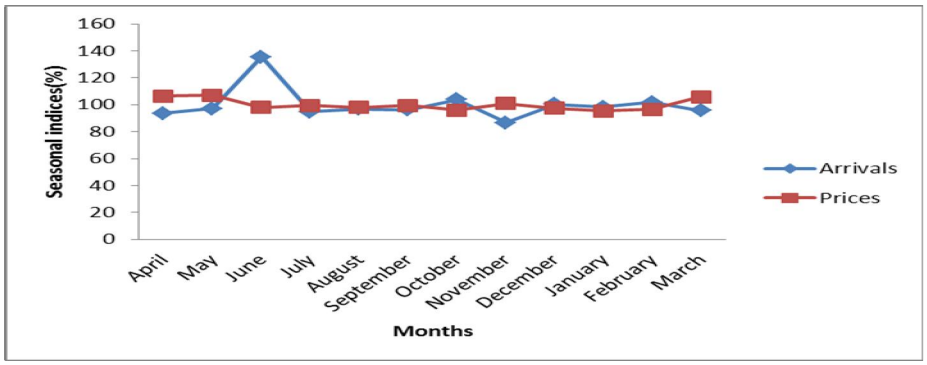

Fig 4.1: Seasonal indices of arrivals and prices of Multivoltine silk cocoon in Ramanagara market

Fig.4.1: Seasonal indices of arrivals and prices of Multivoltine silk cocoon in Ramanagara market

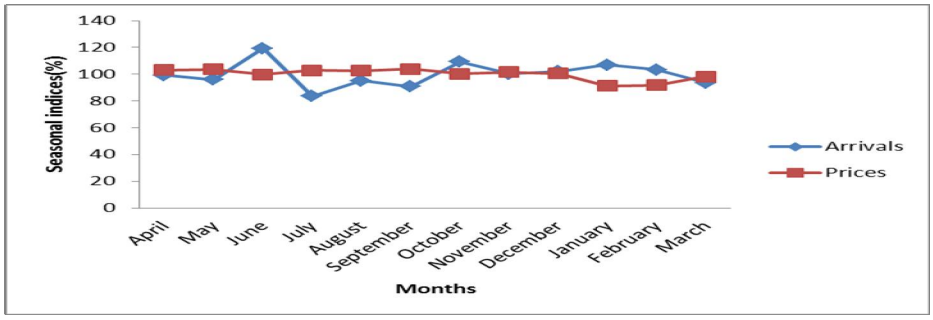

Fig 4.2: Seasonal indices of arrivals and prices of Multivoltine silk cocoon in Shidlagatta market

Fig.4.2: Seasonal indices of arrivals and prices of Multivoltine silk cocoon in Shidlagatta market

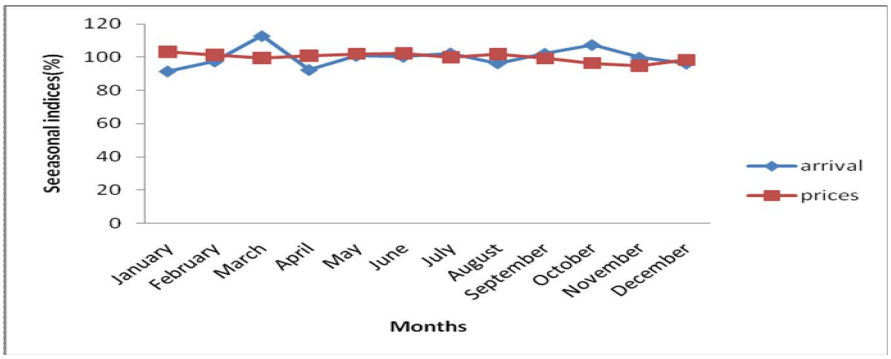

Fig 4.3: Seasonal indices of arrivals and prices of Multivoltine silk cocoon in Chintamani market

Fig.4.3: Seasonal indices of arrivals and prices of Multivoltine silk cocoon in Chintamani market

Table 4.2 Seasonal indices of arrivals and prices of Bivoltine silk cocoon

(Per cent)

Months	Markets					
	Ramanagara		Siddlagatta		Chintamani	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
April	103.93	103.94	95.92	103.20	89.79	104.76
May	104.46	103.48	95.18	103.45	93.18	103.02
June	107.27	97.14	113.08	98.60	114.82	97.28
July	84.45	100.73	86.21	103.25	93.78	101.01
August	82.63	100.34	95.13	102.69	96.04	101.20
September	89.45	99.65	91.15	103.25	96.39	102.15
October	104.78	97.52	107.60	99.69	104.29	99.45
November	95.03	102.58	101.41	100.39	99.58	100.77
December	102.40	98.81	103.88	98.72	104.28	98.41
January	109.99	97.02	109.35	91.30	106.26	95.76
February	107.59	96.19	104.16	95.90	102.29	96.04
March	107.97	102.54	96.87	99.50	96.56	100.10

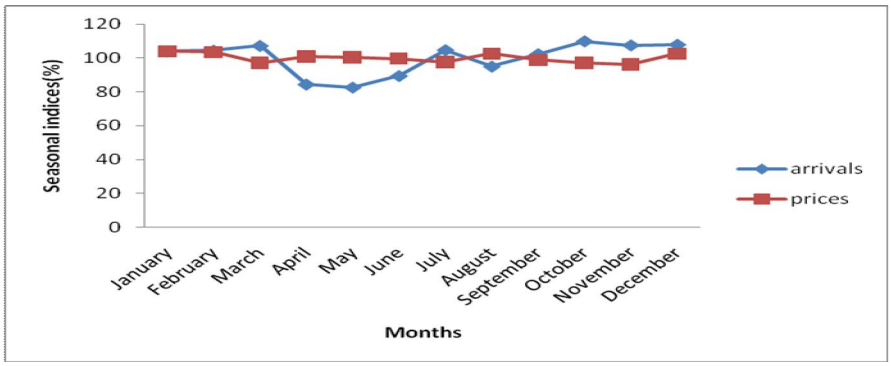

Fig 4.4: Seasonal indices of arrivals and prices of Bivoltine silk cocoon in Ramanagara market

Fig.4.4: Seasonal indices of arrivals and prices of Bivoltine silk cocoon in Ramanagara market

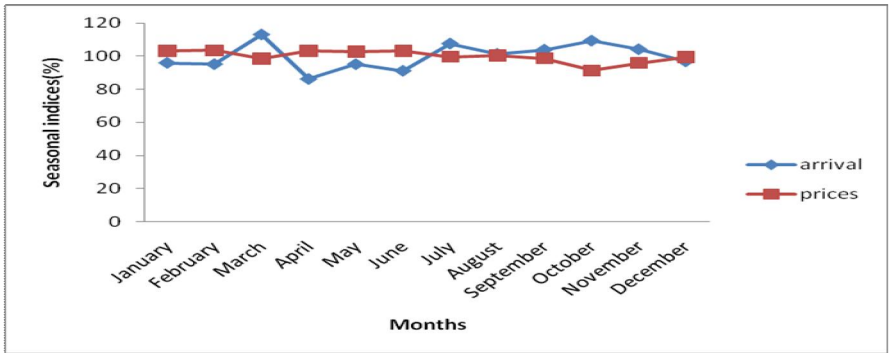

Fig 4.5: Seasonal indices of arrivals and prices of Bivoltine silk cocoon in Shidlagatta market

Fig.4.5: Seasonal indices of arrivals and prices of Bivoltine silk cocoon in Shidlagatta market

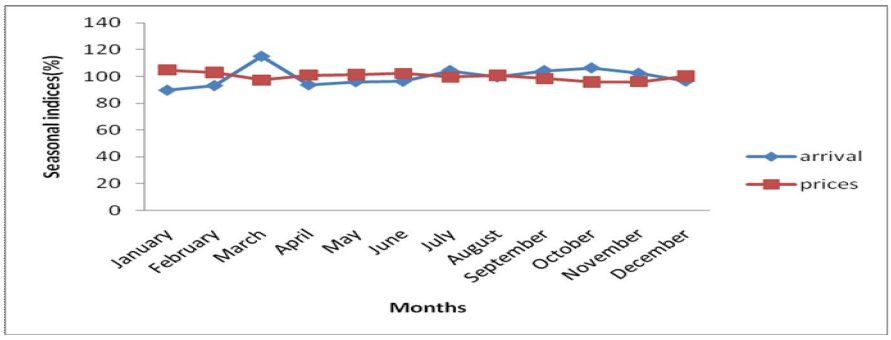

Fig 4.6: Seasonal indices of arrivals and prices of Bivoltine silk cocoon in Chintamani market

Fig.4.6: Seasonal indices of arrivals and prices of Bivoltine silk cocoon in Chintamani market

In the case of Chintamani market the highest seasonal indices were noticed in the month of June (114.82) and January (106.26). The lowest arrivals were obtained in the month of January (89.79) and May (93.18). As far as the price indices of cocoon were concerned, the highest price indices were observed in the month of April (104.76) and May (103.02). The lowest indices were recorded in the month of January (95.76) and February (96.04) respectively.

4.1.2 Estimated trend equation for arrivals and prices of Multivoltine and Bivoltine silk cocoon in the selected markets

4.1.2.1 Estimated trend equation for arrivals and prices of Multivoltine silk cocoon in the selected markets

Table 4.3 indicates the results of trend analysis for arrivals and prices of Multivoltine silk cocoon in selected markets.

In Ramanagara market, sixth degree polynomial trend equation was found to be best fit, for arrivals of Multivoltine silk cocoon, compared to other functional forms, as indicated by R^2 value. The sixth degree polynomial trend equation had a fairly good R^2 value of 0.44, which was statistically in-significant as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Multivoltine silk cocoon over years. In the case of prices of Multivoltine silk cocoon linear trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.35, which was statistically significant (at 5% level) as indicated by F value. The estimated trend equation indicated a positive trend in the prices of Multivoltine silk cocoon over years. Figure 4.7 depicts the sixth degree polynomial trend for arrivals of Multivoltine silk cocoon and Figure 4.8 indicates the linear trend equation for prices of Multivoltine silk cocoon in Ramanagara market.

In Shidlagatta market, the linear trend equation was found to be best fit, for arrivals of Multivoltine silk cocoon, compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.55, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Multivoltine silk cocoon over years. In the case of prices of Multivoltine silk cocoon, quadratic trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.83, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a positive trend in the prices of Multivoltine silk cocoon over years. Figure 4.9 depicts the linear trend for arrivals of Multivoltine silk cocoon and Figure 4.10 indicates the quadratic trend equation for prices of Multivoltine silk cocoon in Shidlagatta market.

In Chintamani market, linear trend equation was found to be best fit, for arrivals of Multivoltine silk cocoon, compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.54, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a negative trend in arrivals of Multivoltine silk cocoon over years. In the case of prices of Multivoltine silk cocoon, quadratic trend equation was found to be best fit, as indicated by R^2 value that is 0.78, which was statistically significant(at 1% level) as indicated by F value. The estimated trend equation indicated a positive trend in the prices of Multivoltine silk cocoon over years. Figure 4.11 depicts the linear trend for arrivals of Multivoltine silk cocoon and Figure 4.12 indicates the quadratic trend equation for prices of Multivoltine silk cocoon in Chintamani market.

4.1.2.1 Estimated trend equation for arrivals and prices of Bivoltine silk cocoon in selected markets

Table 4.4 indicates the results of trend analysis for arrivals and prices of Bivoltine silk cocoon in selected markets.

In Ramanagara market, sixth degree polynomial trend equation was found to be best fit for arrivals of Bivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The sixth degree polynomial trend equation had a fairly good R^2 value of 0.77, which was statistically in-significant as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Bivoltine silk cocoon over years. In the case of prices of Bivoltine silk cocoon linear trend equation was found to be best fit, as indicated by R^2 value.

Table 4.3: Estimated trend equation for in arrivals and prices of Multivoltine silk cocoon

Markets		Estimated parameters							R^2	F value
		Intercept	T	T^2	T^3	T^4	T^5	T^6		
Ramanagara	Arrivals	1171.30^{NS} (687.78)	-620.90^{NS} (1088.9)	427.33^{NS} (587.46)	-129.51^{NS} (145.97)	18.80^{NS} (18.26)	-1.28^{NS} (1.11)	0.03^{NS} (0.02)	0.44^{NS}	0.81
	Prices	104.31* (12.72)	3.90* (1.60)						0.35*	5.94
Shidlagatta	Arrivals	799.19** (62.84)	29.38* (7.91)						0.55**	13.77
	Prices	173.81** (12.73)	-19.90** (4.18)	1.69** (0.29)					0.83**	24.92
Chintamani	Arrivals	197.08* (8.53)	-3.90** (1.07)						0.54**	13.18
	Prices	175.51** (14.13)	-20.79** (4.64)	1.69** (0.32)					0.78**	17.76

Note: **Significant at 1 percent level
*Significant at 5 percent level
NS- Non significant
Figures in the parentheses indicate the standard errors of the corresponding co-efficient

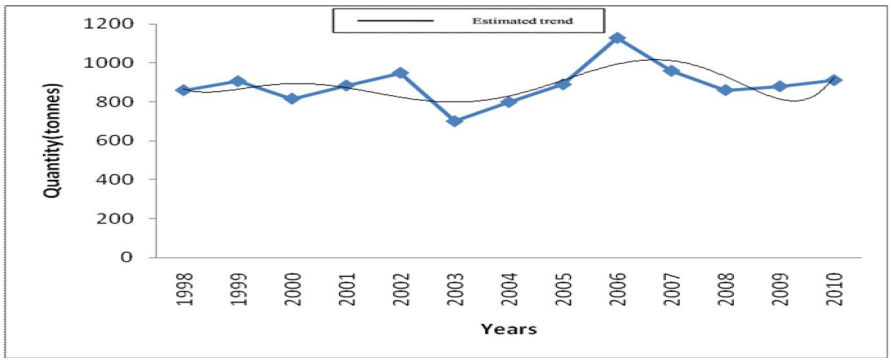

Fig 4.7: Trend component of arrivals of Multivoltine silk cocoon in Ramanagara market

Fig.4.7: Trend component of arrivals of Multivoltine silk cocoon in Ramanagara market

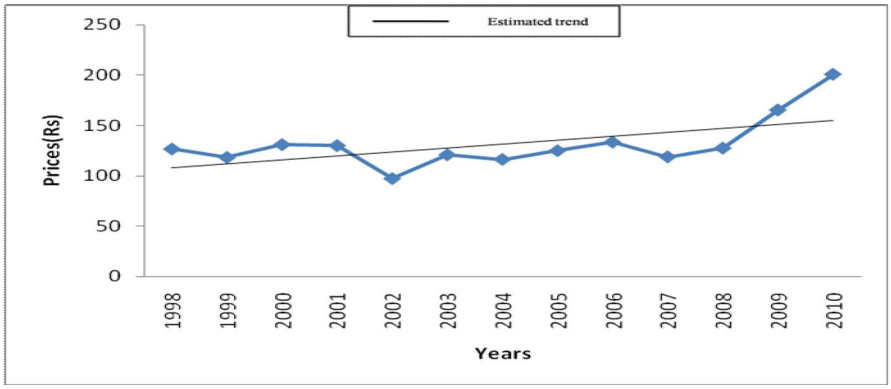

Fig 4.8: Trend component of prices of Multivoltine silk cocoon in Ramanagara market

Fig.4.8: Trend component of prices of Multivoltine silk cocoon in Ramanagara market

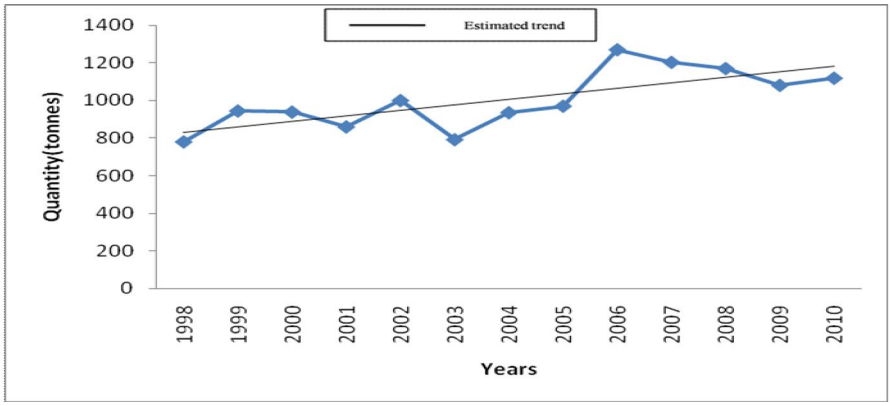

Fig 4.9: Trend component of arrivals of Multivoltine silk cocoon in Shidlagatta market

Fig.4.9: Trend component of arrivals of Multivoltine silk cocoon in Shidlagatta market

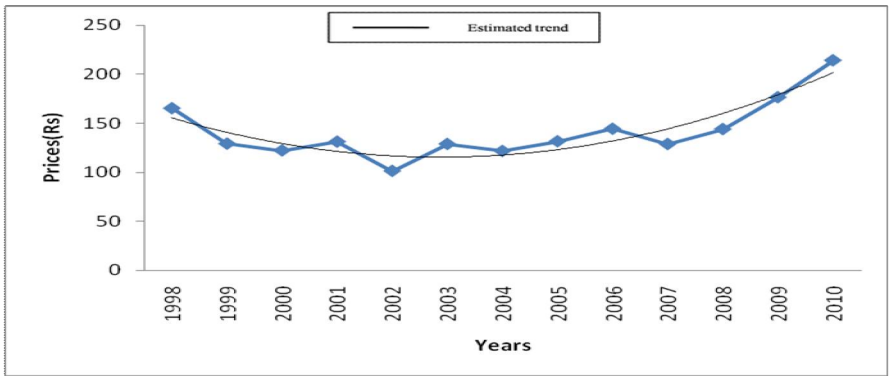

Fig 4.10: Trend component of prices of Multivoltine silk cocoon in Shidlagatta market

Fig.4.10: Trend component of prices of Multivoltine silk cocoon in Shidlagatta market

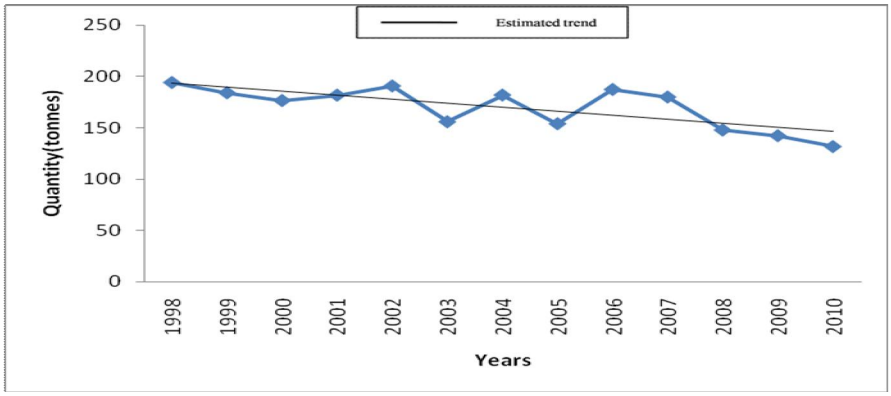

Fig 4.11: Trend component of arrivals of Multivoltine silk cocoon in Chintamani market

Fig.4.11: Trend component of arrivals of Multivoltine silk cocoon in Chintamani market

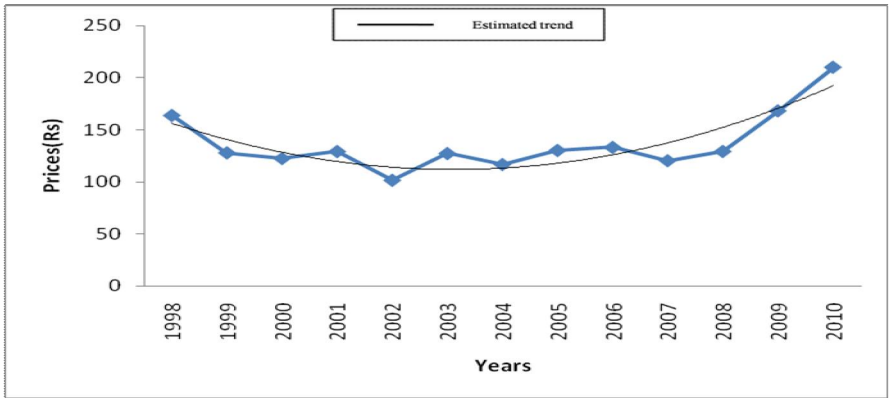

Fig 4.12: Trend component of prices of Multivoltine silk cocoon in Chintamani market

Fig.4.12: Trend component of prices of Multivoltine silk cocoon in Chintamani market

Table 4.4: Estimated trend equation for in arrivals and prices of Bivoltine silk cocoon

Markets		Estimated parameters							R^2	F value
		Intercept	T	T^2	T^3	T^4	T^5	T^6		
Ramanagara	Arrivals	240.37* (78.60)	217.53^{NS} (124.44)	129.19^{NS} (67.13)	-13.61^{NS} (16.68)	4.53^{NS} (2.08)	-0.28^{NS} (0.12)	0.006^{NS} (0.003)	0.77^{NS}	3.55
	Prices	121.54* (15.62)	121.54* (15.62)	5.31* (1.96)					0.39*	7.27
Shidlagatta	Arrivals	20.42** (1.57)	0.49* (0.49)						0.36*	6.28
	Prices	202.15** (14.09)	-20.04** (4.63)	1.69** (0.32)					0.79**	19.90
Chintamani	Arrivals	9.33** (0.48)	-0.19** (0.06)						0.47**	9.80
	Prices	207.46** (15.59)	-22.99** (5.12)	1.86** (0.35)					0.77**	17.28

Note: **Significant at 1 percent level
*Significant at 5 percent level
NS- Non significant
Figures in the parentheses indicate the standard errors of the corresponding co-efficient

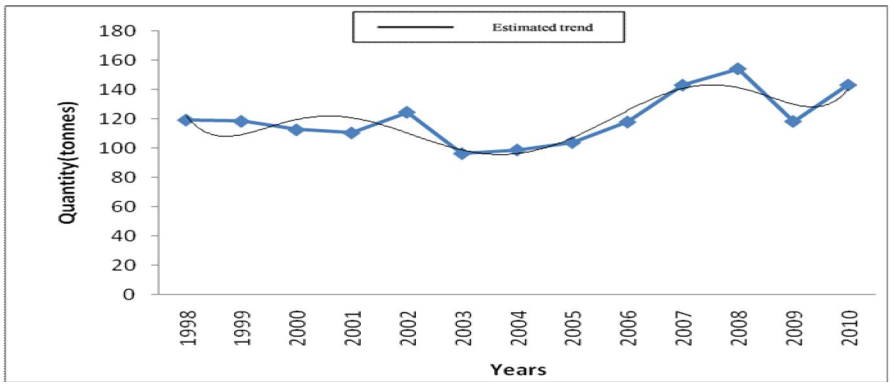

Fig 4.13: Trend component of arrivals of Bivoltine silk cocoon in Ramanagara market

Fig.4.13: Trend component of arrivals of Bivoltine silk cocoon in Ramanagara market

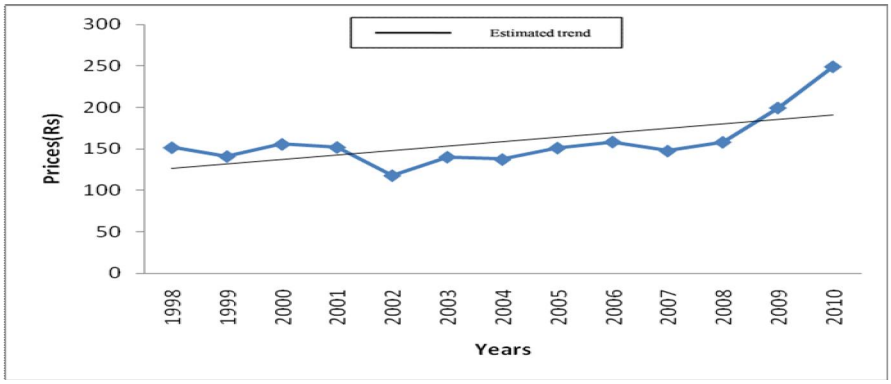

Fig 4.14: Trend component of prices of Bivoltine silk cocoon in Ramanagara market

Fig.4.14: Trend component of prices of Bivoltine silk cocoon in Ramanagara market

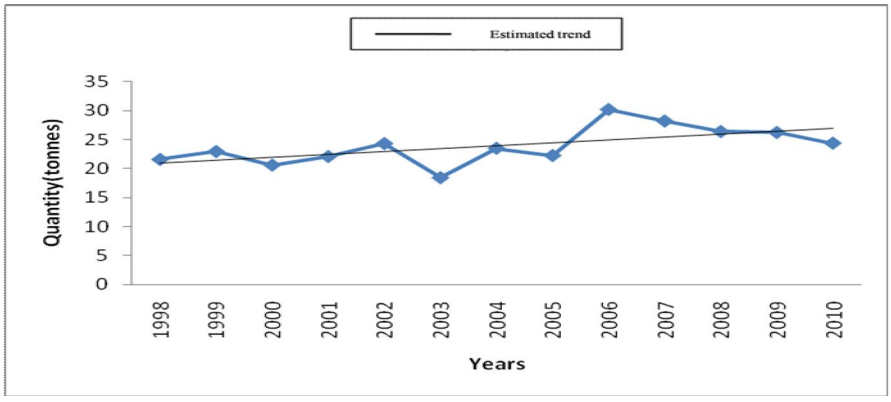

Fig 4.15: Trend component of arrivals of Bivoltine silk cocoon in Shidlagatta market

Fig.4.15: Trend component of arrivals of Bivoltine silk cocoon in Shidlagatta market

The equation had a high R^2 value of 0.39, which was statistically significant (at 5% level) as indicated by F value. The estimated trend equation indicated a positive trend in the prices of Bivoltine silk cocoon over years. Figure 4.13 depicts the sixth degree polynomial trend for arrivals of Bivoltine silk cocoon and Figure 4.14 indicates the linear trend equation for prices of Bivoltine silk cocoon in Ramanagara market.

In Shidlagatta market, linear trend equation was found to be best fit for arrivals of Bivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.36, which was statistically significant (at 5% level) as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Bivoltine silk cocoon over years. In the case of prices of Bivoltine silk cocoon quadratic trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.79, which was statistically significant (at 1% level) as indicated by F value. The estimated tend equation indicated a positive trend in the prices of Bivoltine silk cocoon over years. Figure 4.15 depicts the linear trend for arrivals of Bivoltine silk cocoon and Figure 4.16. Indicate the quadratic trend equation for prices of Bivoltine silk cocoon in Shidlagatta market.

In Chintamani market, linear trend equation was found to be best fit for arrivals of Bivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.47, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a negative trend in arrivals of Bivoltine silk cocoon over years. In the case of prices of Bivoltine silk cocoon quadratic trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.77, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a positive trend in the prices of Bivoltine silk cocoon over years. Figure 4.17 depicts the linear for arrivals of Bivoltine silk cocoon and Figure 4.18 indicates the quadratic trend equation for prices of Bivoltine silk cocoon in Chintamani market.

4.1.3 Cyclical variations in arrivals and prices of Multivoltine and Bivoltine silk cocoon in selected markets

As it could be seen from the table 4.5, in the case of Ramanagara market, average cycle was found to be once in 3.66 years in arrivals and 3.33 years prices for Multivoltine silk cocoon. It could also seen from Fig 4.19. Similarly in case of Bivoltine silk cocoon, as shown in Table 4.6, the arrivals and prices, average cycle was obtained once in 4 years and 3.33 years respectively. (The average cycles in the range between 2.33 years to 4 years.). It was indicated in Fig 4.22. The cyclical in arrivals and prices of Multivoltine and Bivoltine silk cocoon were presented in Table 4.5 and Table 4.6 respectively.

With regard to Shidlagatta market, the average cycle was found to be once in 3.66 years for arrivals and 3 years for prices in Multivoltine silk cocoon. It was indicated in Fig 4.20. Similarly in Bivoltine arrivals and prices, average cycle was found to be once in 2.33 years and 3 years respectively. It was indicated in Fig 4.23.

In respect of Chintamani market, the average cycle was found to be once in 2.5 years for Multivoltine arrivals and 3 years for prices. It was indicated in Fig 4.21. With respect to Bivoltine arrivals, average cycle was found to be once in 2.33 years and for prices it was once in 3 years. It could be seen from Fig 4.24.

4.2 Impact of silk cocoon arrivals on prices in the selected markets

To ascertain the impact of silk cocoon arrivals on prices, logarithmic regression was employed.

4.2.1 The impact of Multivoltine silk cocoon arrivals on prices in the selected markets

To ascertain the response of arrivals on prices of Multivoltine silk cocoon in the selected markets, logarithmic regression was computed by taking into account the total monthly arrivals and average prices of Multivoltine silk cocoon for a period of 13 years (1998-2011).

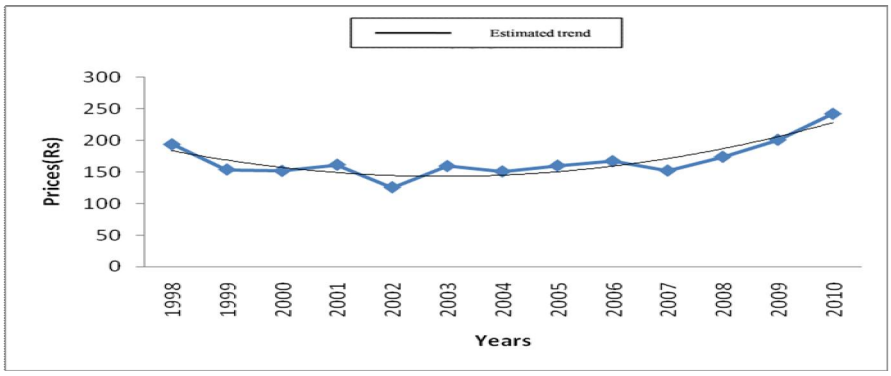

Fig 4.16: Trend component of prices of Bivoltine silk cocoon in Shidlagatta market

Fig.4.16: Trend component of prices of Bivoltine silk cocoon in Shidlagatta market

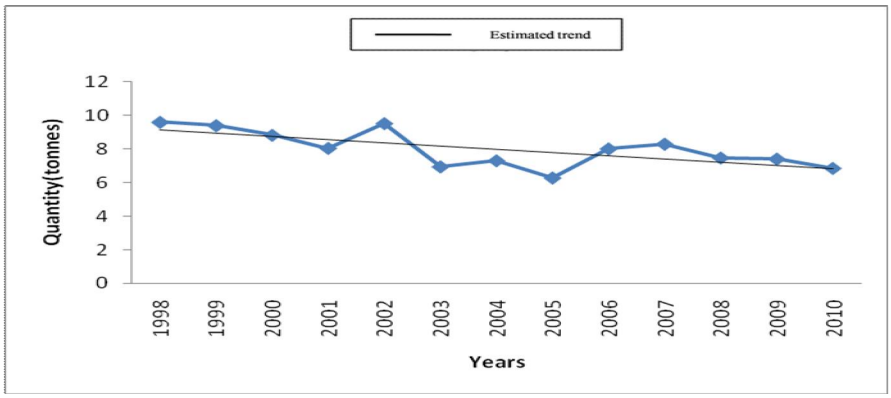

Fig 4.17: Trend component of arrivals of Bivoltine silk cocoon in Chintamani market

Fig.4.17: Trend component of arrivals of Bivoltine silk cocoon in Chintamani market

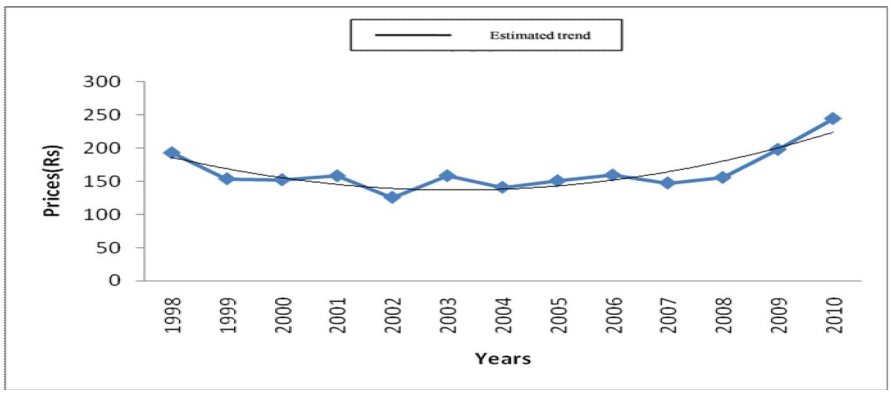

Fig 4.18: Trend component of prices of Bivoltine silk cocoon in Chintamani market

Fig.4.18: Trend component of prices of Bivoltine silk cocoon in Chintamani market

Table 4.5: Cyclical indices of variations in Multivoltine silk cocoon arrivals and prices

(Per cent)

Years	Markets					
	Ramanagara		Siddlagatta		Chintamani	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
1998	101.04	116.89	94.36	139.38	100.40	137.44
1999	105.72	105.32	110.15	105.48	97.22	104.78
2000	94.61	112.75	105.83	96.78	95.20	97.95
2001	101.64	108.24	93.91	100.78	100.11	100.86
2002	108.34	78.41	105.67	75.66	107.36	77.59
2003	79.49	94.52	81.31	93.47	89.73	94.93
2004	90.01	88.23	93.17	85.86	107.09	85.18
2005	99.54	92.07	93.80	90.42	92.80	92.98
2006	125.26	95.58	119.24	96.64	115.61	93.07
2007	105.79	82.76	109.95	84.03	113.79	82.46
2008	94.25	86.48	104.14	91.69	95.91	86.76
2009	95.74	109.28	93.77	109.72	94.71	110.58
2010	98.51	129.41	94.65	130.02	90.03	135.35
Average duration of cycle (years)	3.66	3.33	3.66	3.00	2.50	3.00

Table 4.6: Cyclical indices of variations in Bivoltine silk cocoon arrivals and prices

(Per cent)

Years	Markets					
	Ramanagara		Siddlagatta		Chintamani	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
1998	111.56	119.53	102.98	132.18	104.96	132.46
1999	108.49	106.69	107.00	102.34	104.94	103.30
2000	101.17	113.22	93.84	98.47	100.71	100.17
2001	97.36	106.38	98.38	102.34	93.85	102.01
2002	107.62	79.71	106.01	77.79	113.66	79.41
2003	81.79	91.43	78.61	96.48	84.72	98.08
2004	82.32	86.58	98.20	89.28	91.30	85.60
2005	84.98	92.20	91.08	92.72	80.35	89.87
2006	94.67	93.58	121.17	94.83	105.20	93.25
2007	112.84	84.50	110.94	84.54	111.74	84.69
2008	119.55	87.88	101.83	94.77	103.33	87.90
2009	90.24	107.63	99.30	107.35	105.16	109.80
2010	107.33	130.62	90.59	126.86	100.01	133.38
Average duration of cycle (years)	4.00	3.33	2.33	3.00	2.33	3.00

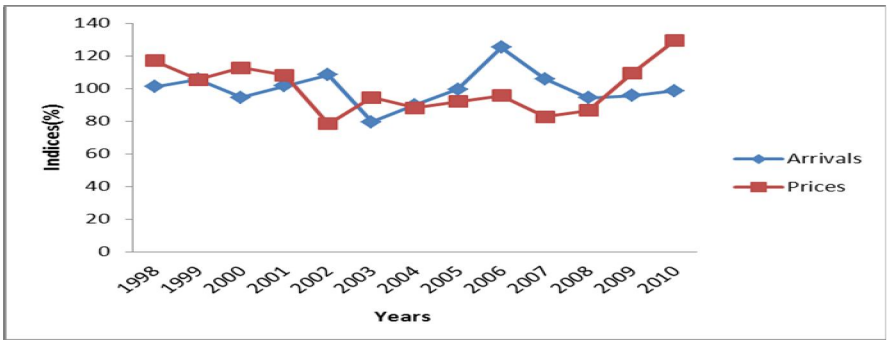

Fig 4.19: Cyclical indices of variations in Multivoltine silk cocoon arrivals and prices in Ramanagara markets

Fig.4.19: Cyclical indices of variations in Multivoltine silk cocoon arrivals and prices in Ramanagara markets

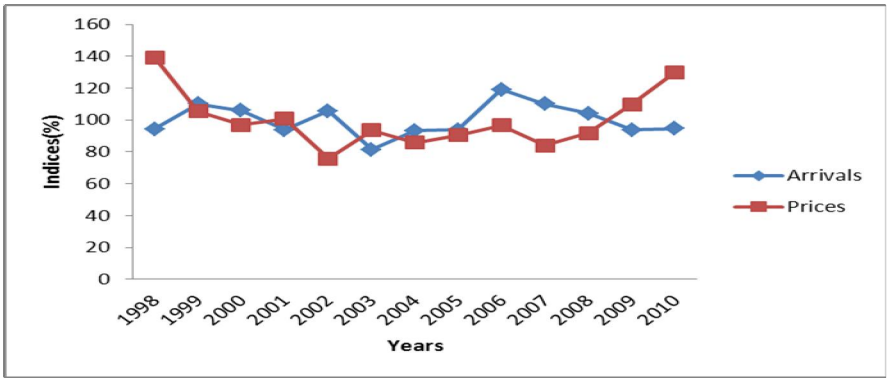

Fig 4.20: Cyclical indices of variations in Multivoltine silk cocoon arrivals and prices in Shidlagatta markets

Fig.4.20: Cyclical indices of variations in Multivoltine silk cocoon arrivals and prices in Shidlagatta markets

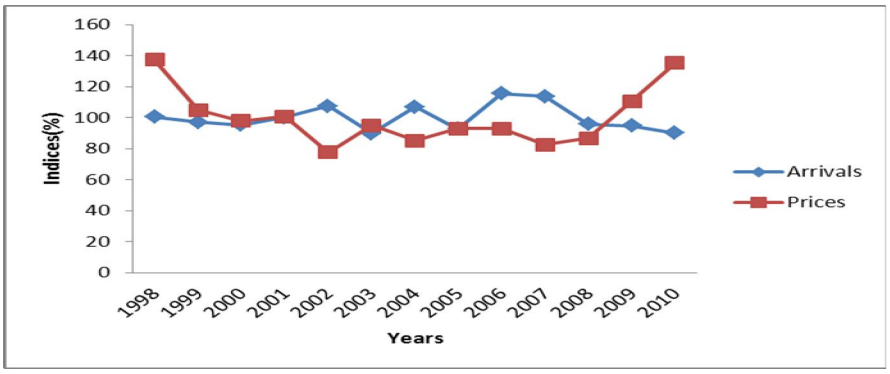

Fig 4.21: Cyclical indices of variations in Multivoltine silk cocoon arrivals and prices in Chintamani markets

Fig.4.21: Cyclical indices of variations in Multivoltine silk cocoon arrivals and prices in Chintamani markets

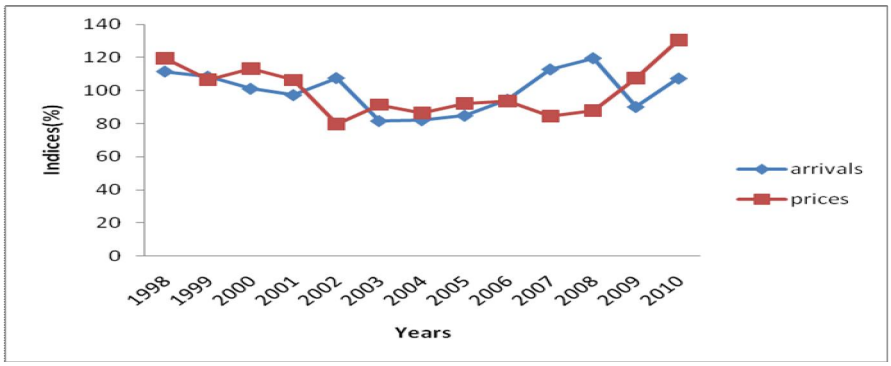

Fig 4.22: Cyclical indices of variations in Bivoltine silk cocoon arrivals and prices in Ramanagara markets

Fig.4.22: Cyclical indices of variations in Bivoltine silk cocoon arrivals and prices in Ramanagara markets

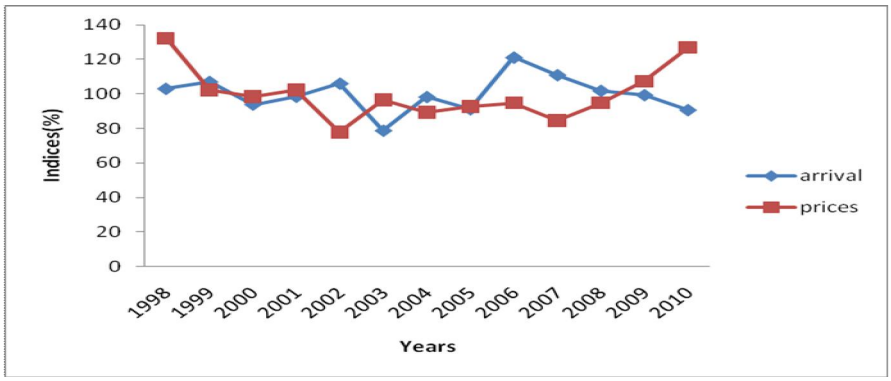

Fig 4.23: Cyclical indices of variations in Bivoltine silk cocoon arrivals and prices in Shidlagatta markets

Fig.4.23: Cyclical indices of variations in Bivoltine silk cocoon arrivals and prices in Shidlagatta markets

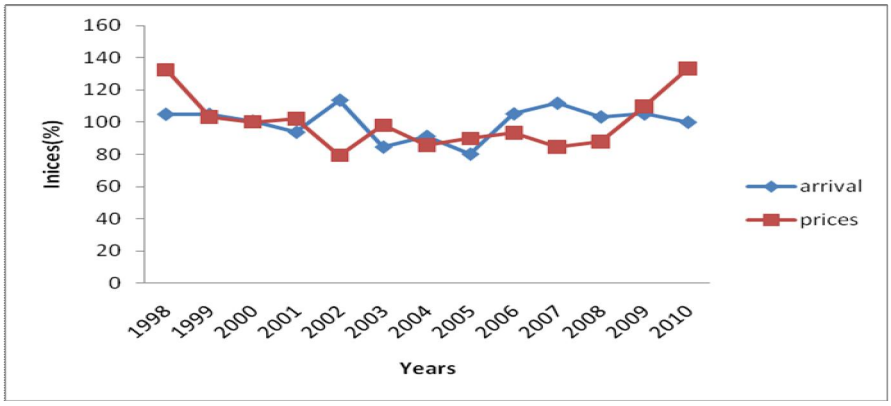

Fig 4.24: Cyclical indices of variations in Bivoltine silk cocoon arrivals and prices in Chintamani markets

Fig.4.24: Cyclical indices of variations in Bivoltine silk cocoon arrivals and prices in Chintamani markets

Table 4.7: Impact of Multivoltine silk cocoon arrivals on prices

Markets	Intercept	Regression coefficient	R^2	t -value
Ramanagara	-0.79	0.98** (0.02)	0.91**	41.29
Shidlagatta	-0.47	0.87** (0.02)	0.93**	45.82
Chintamani	-0.12	1.01** (0.02)	0.91**	40.89

Note: **Significant at 1 percent level
*Significant at 5 percent level
NS- Non significant
Figures in the parentheses indicate the standard errors of the corresponding coefficients

Table 4.8: Impact of Bivoltine silk cocoon arrivals on prices

Markets	Intercept	Regression coefficient	R^2	t-value
Ramanagara	0.47	0.82** (0.016)	0.94**	49.51
Shidlagatta	1.05	0.85** (0.01)	0.97**	76.57
Chintamani	1.35	0.95** (0.016)	0.95**	58.25

Note: **Significant at 1 percent level
*Significant at 5 percent level
NS- Non significant
Figures in the parentheses indicate the standard errors of the corresponding coefficients

Table 4.7 reveals that the impact of arrivals on prices of Multivoltine silk cocoon found to be positive in all the selected markets. In the case of Ramanagara, Shidlagatta and Chintamani markets, it was observed that for one unit increase in the prices of a Multivoltine silk cocoon, the arrivals would increase to an extent of 0.98 units, 0.87units and 1.01units respectively. However it was found to be significant in all the selected markets.

4.2.2 The impact of Bivoltine silk cocoon arrivals on prices in the selected markets

In order to ascertain the impact of arrivals on prices of Bivoltine silk cocoon in the selected markets, logarithmic regression was computed by taking into account the total arrivals and average prices of Bivoltine silk cocoon for a period of 13 years (1998-2011).

Table 4.8 reveals that the impact of arrivals on prices of Bivoltine silk cocoon found to be positive in all the selected markets. In the case of Ramanagara, Shidlagatta and Chintamani markets, it was observed that for one unit increase in the prices of a Bivoltine silk cocoon, the arrivals would increase to an extent of 0.82units, 0.85units and 0.95units respectively. However it was found to be significant in all the selected markets.

4.3 Forecasting of arrivals and prices

The Box-Jenkins model was preferred to the multiplicative time series model for forecasting purposes. It was used for forecasting of arrivals and prices of silk cocoon in the selected markets of Karnataka. The results are presented under following heads.

4.3.1 Arrivals and prices of Multivoltine and Bivoltine silk cocoon in Ramanagara market

The detailed analysis of forecasting of arrivals and prices of Multivoltine and Bivoltine silk cocoon in Ramanagara market has been presented as under.

4.3.1.1 Identification of the model

The tentative models were first identified based on the Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) for the different series Y_t for selected markets and varieties of cocoon. The computed value of ACF and PACF of Ramanagara market were shown in Table 4.9 for Multivoltine and Bivoltine silk cocoon was up to 50 lags. An examination of the ACF and PACF revealed seasonality. However, the series was found to be stationary, since the coefficient dropped nearer to zero after the first or second lag. Each individual coefficient of ACF and PACF were 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 were tried, finally model (2,1,1) (2,1,1) was tentatively identified for arrivals and model (0,1,0) (1,1,1) was identified for prices of Multivoltine silk cocoon in Ramanagara market. In the same way, model(2,1,2) (1,1,1) was identified for arrivals and model (0,1,0) (1,1,1) was identified for prices of Bivoltine silk cocoon in Ramanagara market. It could be seen from Table 4.10.

4.3.1.2 Diagnostic checking

Residual analysis was carried out to check the adequacy of the models. The residuals of ACF and PACF were obtained from the tentatively identified model. The adequacy of the model was judged based on the values of AIC and SBC (Beenstock and Bansali, 1981). The values of the statistics are shown in Table 4.9. The model (2,1,1) (2,1,1) was found to be the best model for arrivals of Multivoltine silk cocoon in Ramanagara market. Also for prices of Multivoltine silk cocoon the model (0,1,0) (1,1,1) was identified. Similarly for Bivoltine silk cocoon, (2,1,2) (1,1,1) and model (0,1,0) (1,1,1) was identified as the best model for arrivals and prices in Ramanagara market respectively. These models were identified on the basis of lowest AIC and SBC estimates. The estimation of arrivals and prices, conditional least square estimates are presented in Appendix I, II, III, IV.

4.3.1.3 Forecasting the arrivals and prices of cocoon in Ramanagara market

The method of forecasting has been explained in detail in chapter three. Both Ex-ante and Ex-post forecast were done and it was compared with actual values of observations.

Table 4.9: Residual analysis of monthly arrivals and prices of Bivoltine and Multivoltine silk cocoon

Markets			Models	AIC	SBC	Standard error
Ramanagara	Bivoltine	Arrivals	(2,1,2)(1,1,1)	1247.75	1268.24	0.81-0.84
		Prices	(0,1,0)(1,1,1)	1075.78	1084.56	0.80-0.82
	Multivoltine	Arrivals	(2,1,1)(2,1,1,)	1791.57	1812.06	0.79-0.81
		Prices	(0,1,0)(1,1,1)	1073.05	1081.83	0.78-0.80
Suddlagatta	Bivoltine	Arrivals	(1,1,1)(1,1,1)	792.45	807.05	0.80-0.81
		Prices	(1,1,1,)(2,1,1)	1108.65	1126.17	0.81-0.82
	Multivoltine	Arrivals	(2,1,1)(1,1,1)	1803.31	1820.83	0.83-0.84
		Prices	(0,1,0)(2,1,1)	1101.94	1113.62	0.82-0.84
Chintamani	Bivoltine	Arrivals	(1,1,1,)(1,1,1)	484.84	499.48	0.81-0.83
		Prices	(0,1,0)(1,1,1)	1093.44	1102.22	0.83-0.85
	Multivoltine	Arrivals	(1,1,1)(2,1,1)	1331.65	1349.22	0.81-0.83
		Prices	(0,1,0)(2,1,1)	1103.59	1115.30	0.83-0.84

AIC- Akaike's Information Criterion
SBC- Schwartz's Bayesian Criterion

Table 4.10: ACF and PACF of monthly arrivals and prices of Bivoltine and Multivoltine silk cocoon in Ramanagara market

	Bivoltine				Multivoltine			
	Arrivals		Prices		Arrivals		Prices	
Lags	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF
1	-0.25	-0.25	-0.15	-0.15	-0.38	-0.38	-0.06	-0.06
2	-0.20	-0.29	0.06	0.04	-0.01	-0.18	0.03	0.03
3	0.07	-0.08	0.02	0.04	0.06	-0.01	-0.07	-0.06
4	-0.09	-0.19	-0.11	-0.11	-0.30	-0.34	-0.08	-0.09
5	0.15	0.07	-0.05	-0.09	0.29	0.04	-0.01	-0.01
6	-0.02	-0.01	-0.006	-0.01	-0.07	0.002	0.03	0.03
7	-0.12	-0.08	0.01	0.03	-0.26	-0.34	-0.04	-0.05
8	0.09	0.01	0.05	0.05	0.37	0.10	0.13	0.12
9	-0.09	-0.10	-0.002	-0.007	-0.17	0.06	0.005	0.02
10	0.19	0.18	-0.007	-0.02	0.11	0.04	-0.02	-0.03
11	0.06	0.15	0	-0.002	0.09	0.11	-0.10	-0.10
12	-0.48	-0.37	-0.40	-0.40	-0.44	-0.25	-0.43	-0.44
13	0.27	0.07	0.11	0.007	0.32	-0.009	0.09	0.03
14	-0.03	-0.17	-0.09	-0.03	-0.14	-0.11	-0.02	-0.02
15	-0.05	-0.06	-0.07	-0.09	-0.03	-0.05	0.006	-0.08
16	0.14	0.01	0.17	0.08	0.17	-0.08	0.10	0.05
17	-0.15	-0.02	-0.09	-0.12	-0.21	-0.04	-0.12	-0.14
18	0.04	-0.01	-0.00	-0.07	0.18	0.01	-0.009	-0.009
19	0.03	-0.04	0.08	0.08	0.02	-0.10	-0.008	-0.03
20	-0.12	-0.11	-0.08	-0.04	-0.28	-0.16	-0.14	-0.08
21	0.10	-0.07	0.06	0.06	0.34	0.16	0.08	0.07
22	-0.05	0.08	-0.02	-0.02	-0.20	0.02	0.02	-0.02
23	0.05	0.09	0.09	0.07	0.11	0.12	0.11	0.02
24	0.06	-0.14	-0.04	-0.23	-0.02	-0.21	-0.004	-0.27
25	-0.22	-0.07	-0.13	-0.17	-0.17	0.002	-0.09	-0.06
26	0.14	-0.09	0.08	0.004	0.18	-0.09	-0.006	-0.02
27	0.008	-0.06	-0.06	-0.11	-0.05	-0.10	-0.008	-0.08
28	-0.09	-0.008	-0.01	0.07	-0.06	-0.03	-0.07	-0.03
29	0.10	-0.01	0.13	0.001	0.14	-0.03	0.16	-0.02
30	-0.08	-0.008	-0.006	-0.03	-0.18	-0.04	-0.04	-0.04
31	0.04	0.01	0.03	0.12	0.11	-0.14	0.15	0.09
32	0.12	0.03	0.04	-0.06	0.08	-0.004	0.04	-0.04
33	-0.15	-0.09	-0.03	0.11	-0.21	0.01	-0.02	0.12
34	0.004	-0.03	-0.06	-0.08	0.18	-0.02	-0.03	-0.03
35	-0.08	-0.10	0.003	0.03	-0.10	0.11	0.05	0.11
36	0.09	-0.01	0.02	-0.05	0.09	0.03	0	-0.08
37	0.08	-0.08	0.11	-0.03	-0.02	-0.14	-0.001	-0.18
38	-0.03	0.12	-0.06	-0.01	-0.08	-0.007	-0.004	0.04
39	0.03	0.03	0.12	-0.03	0.12	0.04	0.07	-0.005
40	-0.06	-0.07	-0.05	0.03	-0.05	-0.10	0.02	0.05
41	-0.02	0.001	-0.09	-0.02	-0.05	-0.05	-0.06	-0.008
42	0.11	-0.004	0.07	0.01	0.09	-0.01	0.004	-0.05
43	-0.05	0.05	-0.13	0.02	-0.08	0	-0.16	-0.01
44	-0.06	0.01	-0.01	-0.10	0.07	-0.14	0.02	-0.05
45	0.01	-0.13	-0.01	0.01	-0.04	-0.02	-0.03	0.02
46	-0.02	-0.10	0.09	0.09	-0.08	-0.05	0.07	0.14
47	0.19	0.10	0.10	0.21	0.09	-0.01	0.06	0.21
48	-0.08	0.02	-0.06	-0.07	-0.04	0.02	-0.08	-0.15
49	-0.01	0.05	-0.06	-0.16	0.06	0.02	0.01	-0.09
50	-0.06	0.01	-0.02	-0.07	-0.01	-0.04	-0.04	-0.03

ACF – Autocorrection Function
PACF – Partial Autocorrection Function

The forecast was done for 2011 to 2012. The results of Ex-ante and Ex-post forecast of arrivals and prices of Multivoltine silk cocoon in Ramanagara market is shown in Tables 4.11 and Table 4.12. The forecasts were also depicted in the Fig. 4.25 and Fig 4.26. The forecasted values of Multivoltine silk cocoon arrivals showed a decreasing trend, where as prices showed increasing trend in the future years. The arrivals of Multivoltine silk cocoon during 2010-2011 will be as high as 1006.53 tonnes in March 2010 and as less as 824.62 tonnes during the month September 2010. By 2012 the arrivals will be high in the month of March (985.9tonnes) and less during the month of December (626.6tonnes) for Multivoltine silk cocoon. In the case of prices of Multivoltine during 2010-2011the prices will be high around ₹217 per Kg and less around ₹174 per Kg during the months of August and November respectively, Similarly prices will be high in the month of December that is ₹ 338 per Kg and less during the months May and July that is ₹ 291per Kg in Ramanagara market in 2012.

Similarly the results of Ex-ante and Ex-post forecast of arrivals and prices of Bivoltine silk cocoon in Ramanagara market is shown in Tables 4.13 and Table 4.14. The forecasts were also depicted in the Fig. 4.27 and Fig 4.28. Forecasted values of arrivals showed an ups and downs over the years and prices showed increasing trend. The arrivals of Bivoltine silk cocoon in the market during 2009-2010 will be as high as 198.367 tonnes and as less as 78.932tonnes during the month of March and April respectively. By 2012 the arrivals will be high in the month March (187.63tonnes) and less during the month of May (93.46tonnes) for Bivoltine silk cocoon. In the case of prices of Bivoltine during 2010-2011, the prices will be high around ₹ 275 per Kg and less around ₹208 per Kg during the month of October and November respectively. Similarly the prices will be high in the month of December that is ₹ 407 per Kg and less in the month of March that is ₹ 352 per Kg in Ramanagara market in 2012.

4.3.2 Arrivals and Prices of Multivoltine and Bivoltine silk cocoon in Shidlagatta market

The detailed analysis of forecasting of arrivals and prices of Multivoltine and Bivoltine silk cocoon in Shidlagatta market has been presented as under.

4.3.2.1 Identification of the model

The tentative models were first identified based on the Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) for the different series Y_t for selected markets and varieties of cocoons. The computed value of ACF and PACF of Shidlagatta market was shown in Table 4.15 for Multivoltine and Bivoltine silk cocoon was up to 50 lags. An examination of the ACF and PACF revealed seasonality. However, the series was found to be stationary, since the coefficient dropped to zero after the first or second lag. Each individual coefficient of ACF and PACF were 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 stationary series. Hence, based on ACF and PACF many models were tried, finally model (2,1,1) (1,1,1) was tentatively identified for arrivals and model (0,1,0) (2,1,1) was identified for prices of Multivoltine silk cocoon in Shidlagatta market. In the same way model(1,1,1) (1,1,1) was identified for arrivals and model (1,1,1) (2,1,1) was identified for prices of Bivoltine silk cocoon in Shidlagatta market. It was presented in Table 4.9.

4.3.2.2 Diagnostic checking

Residual analysis was carried out to check the adequacy of the models. The residuals of ACF and PACF were obtained from the tentatively identified model. The adequacy of the model was judged based on the values of AIC and SBC. The values of the statistics are shown in Table 4.9. The model (2,1,1) (1,1,1) was found to be the best model for arrivals of Multivoltine silk cocoon in Shidlagatta market. Also for prices of Multivoltine silk cocoon the model (0,1,0) (2,1,1) was identified. Similarly for Bivoltine silk cocoon, found (1,1,1) (1,1,1) and model (1,1,1) (2,1,1)was identified as the best model for arrivals and prices in Shidlagatta market respectively. These models were identified on the basis of lowest AIC and SBC estimates. The estimation of arrivals and prices in Shidlagatta market, conditional least square estimates are presented in Appendix V, VI, VII, VIII.

Table 4.11: Actual and Forecast values for arrivals of Multivoltine silk cocoon in Ramanagara market

(Values in tonnes)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	644.94	.	Apr-01	766.36	952.5	Apr-04	551.08	479.8
May-98	675.06	.	May-01	847.21	814.6	May-04	756.18	505.9
Jun-98	685.52	.	Jun-01	894.59	935.3	Jun-04	833.9	623.6
Jul-98	1135.58	.	Jul-01	786.07	935.5	Jul-04	806.48	798.1
Aug-98	863.24	.	Aug-01	751.31	643.2	Aug-04	798.33	717.1
Sep-98	957.81	.	Sep-01	833.47	887.5	Sep-04	905.75	936.9
Oct-98	909.7	.	Oct-01	791.67	789.3	Oct-04	887.03	858.9
Nov-98	837.74	.	Nov-01	935.57	829.4	Nov-04	959.72	1007.0
Dec-98	1021.71	.	Dec-01	597.48	1018.8	Dec-04	746.86	874.8
Jan-99	974.3	.	Jan-02	926.39	667.8	Jan-05	770.59	797.4
Feb-99	941.03	.	Feb-02	1149.1	913.2	Feb-05	754.53	834.1
Mar-99	1667.57	.	Mar-02	1597.09	1498.6	Mar-05	1036.32	1145.1
Apr-99	755.23	.	Apr-02	1012.88	979.8	Apr-05	867.38	590.8
May-99	770.94	784.6	May-02	902.08	1009.9	May-05	856.79	795.2
Jun-99	1056.97	785.2	Jun-02	818.26	1033.3	Jun-05	879.54	792.7
Jul-99	797.06	1398.5	Jul-02	917.59	872.5	Jul-05	1013.95	937.9
Aug-99	609.16	740.9	Aug-02	633.46	706.5	Aug-05	903.11	831.5
Sep-99	801.3	827.5	Sep-02	729.71	800.4	Sep-05	995.86	1033.1
Oct-99	647.73	608.6	Oct-02	752.66	732.9	Oct-05	948.46	987.0
Nov-99	828.03	660.9	Nov-02	959.41	781.6	Nov-05	838.69	1080.4
Dec-99	1015.48	911.5	Dec-02	976.03	923.8	Dec-05	807.57	824.3
Jan-00	664.35	916.2	Jan-03	562.06	933.0	Jan-06	819.47	736.4
Feb-00	889.43	786.5	Feb-03	665.07	844.0	Feb-06	871.96	792.1
Mar-00	1149.27	1522.4	Mar-03	866.48	1200.4	Mar-06	1368.22	1183.7
Apr-00	822.02	374.0	Apr-03	561.5	335.7	Apr-06	1146.19	928.9
May-00	879.31	778.7	May-03	593.49	528.9	May-06	1112.06	1089.0
Jun-00	806.11	893.8	Jun-03	416.41	500.1	Jun-06	1068.6	1085.7
Jul-00	729.3	1021.7	Jul-03	604.11	514.4	Jul-06	1343.43	1173.5
Aug-00	501.94	555.0	Aug-03	696.02	326.7	Aug-06	1036.39	1200.5
Sep-00	788.92	673.3	Sep-03	890.6	711.3	Sep-06	1137.98	1225.0
Oct-00	860.11	615.7	Oct-03	802.6	838.0	Oct-06	1190.04	1166.4
Nov-00	779.88	846.5	Nov-03	923.1	920.5	Nov-06	1291.21	1180.1
Dec-00	922.28	991.5	Dec-03	824.16	952.0	Dec-06	1138.29	1191.3
Jan-01	944.77	760.1	Jan-04	769.18	745.1	Jan-07	1084.69	1101.6
Feb-01	922.96	966.0	Feb-04	650.95	870.3	Feb-07	930.3	1113.1
Mar-01	1524.93	1378.6	Mar-04	918.81	1114.5	Mar-07	1184.28	1330.3

Table 4.11: Contd…..

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	964.39	928.3	Apr-10	866.99	913.8
May-07	935.83	969.6	May-10	976.83	824.6
Jun-07	849.89	928.6	Jun-10	963.18	887.2
Jul-07	1140.16	1012.8	Jul-10	959.44	1049.5
Aug-07	887.49	954.5	Aug-10	794.51	827.9
Sep-07	1065.54	1019.6	Sep-10	824.62	919.4
Oct-07	861.06	1072.4	Oct-10	926.13	812.2
Nov-07	803.56	960.4	Nov-10		867.5
Dec-07	792.69	775.4	Dec-10		733.6
Jan-08	763.98	703.6	Jan-11		828.2
Feb-08	835.15	704.9	Feb-11		805.2
Mar-08	1135.21	1115.2	Mar-11		1046.8
Apr-08	996.88	850.1	Apr-11		899.8
May-08	983.73	980.2	May-11		898.7
Jun-08	865.11	931.5	Jun-11		860.0
Jul-08	826.09	1088.6	Jul-11		905.3
Aug-08	783.00	744.6	Aug-11		754.4
Sep-08	780.94	904.6	Sep-11		822.7
Oct-08	798.22	713.0	Oct-11		838.3
Nov-08	874.19	810.3	Nov-11		817.5
Dec-08	673.14	722.9	Dec-11		683.2
Jan-09	769.55	702.1	Jan-12		761.2
Feb-09	889.75	748.2	Feb-12		777.9
Mar-09	1001.38	1161.9	Mar-12		985.9
Apr-09	997.35	861.1	Apr-12		866.7
May-09	889.14	957.4	May-12		846.7
Jun-09	970.03	802.0	Jun-12		830.6
Jul-09	925.06	1112.5	Jul-12		855.8
Aug-09	742.63	770.1	Aug-12		697.0
Sep-09	878.53	904.0	Sep-12		777.4
Oct-09	973.76	800.5	Oct-12		810.5
Nov-09	819.31	978.8	Nov-12		759.8
Dec-09	692.90	733.0	Dec-12		626.2
Jan-10	927.45	744.8			
Feb-10	861.21	816.5			
Mar-10	1006.53	1121.7			

Table 4.12: Actual and Forecast values for prices of Multivoltine silk cocoon in Ramanagara market

(Value in ₹/kg)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	132	.	Apr-01	126	116	Apr-04	134	138
May-98	136	.	May-01	132	131	May-04	120	137
Jun-98	142	.	Jun-01	136	131	Jun-04	111	126
Jul-98	123	.	Jul-01	140	134	Jul-04	104	114
Aug-98	110	.	Aug-01	140	145	Aug-04	112	103
Sep-98	123	.	Sep-01	123	143	Sep-04	99	110
Oct-98	112	.	Oct-01	108	112	Oct-04	103	92
Nov-98	125	.	Nov-01	122	128	Nov-04	100	114
Dec-98	137	.	Dec-01	139	123	Dec-04	121	100
Jan-99	131	.	Jan-02	127	136	Jan-05	123	123
Feb-99	131	.	Feb-02	116	128	Feb-05	132	127
Mar-99	118	.	Mar-02	108	99	Mar-05	128	123
Apr-99	119	.	Apr-02	108	115	Apr-05	124	133
May-99	117	123	May-02	95	113	May-05	125	123
Jun-99	107	123	Jun-02	90	96	Jun-05	121	127
Jul-99	115	88	Jul-02	95	90	Jul-05	112	122
Aug-99	124	102	Aug-02	91	98	Aug-05	123	114
Sep-99	120	137	Sep-02	88	88	Sep-05	111	119
Oct-99	107	109	Oct-02	86	76	Oct-05	109	107
Nov-99	116	120	Nov-02	85	104	Nov-05	128	117
Dec-99	114	128	Dec-02	78	92	Dec-05	164	134
Jan-00	122	108	Jan-03	100	72	Jan-06	175	167
Feb-00	122	122	Feb-03	108	97	Feb-06	186	180
Mar-00	114	109	Mar-03	100	95	Mar-06	140	179
Apr-00	118	115	Apr-03	107	105	Apr-06	137	143
May-00	127	119	May-03	113	107	May-06	119	137
Jun-00	125	125	Jun-03	135	112	Jun-06	125	120
Jul-00	126	121	Jul-03	142	137	Jul-06	111	124
Aug-00	140	125	Aug-03	133	144	Aug-06	124	116
Sep-00	139	144	Sep-03	131	131	Sep-06	126	118
Oct-00	127	127	Oct-03	128	122	Oct-06	117	123
Nov-00	160	138	Nov-03	131	141	Nov-06	107	129
Dec-00	152	165	Dec-03	123	134	Dec-06	135	121
Jan-01	140	154	Jan-04	125	126	Jan-07	128	140
Feb-01	141	141	Feb-04	135	126	Feb-07	135	135
Mar-01	113	131	Mar-04	132	124	Mar-07	131	118

Table 4.12: Contd…..

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	128	133	Apr-10	197	185
May-07	122	124	May-10	195	196
Jun-07	129	125	Jun-10	198	199
Jul-07	111	125	Jul-10	193	192
Aug-07	114	118	Aug-10	217	203
Sep-07	104	111	Sep-10	208	214
Oct-07	92	99	Oct-10	224	210
Nov-07	109	98	Nov-10		234
Dec-07	123	126	Dec-10		254
Jan-08	122	125	Jan-11		255
Feb-08	124	129	Feb-11		256
Mar-08	106	112	Mar-11		247
Apr-08	105	107	Apr-11		250
May-08	110	101	May-11		249
Jun-08	118	114	Jun-11		253
Jul-08	118	111	Jul-11		248
Aug-08	126	124	Aug-11		262
Sep-08	133	121	Sep-11		258
Oct-08	137	127	Oct-11		263
Nov-08	158	147	Nov-11		274
Dec-08	173	174	Dec-11		294
Jan-09	180	175	Jan-12		296
Feb-09	159	186	Feb-12		297
Mar-09	165	145	Mar-12		288
Apr-09	158	166	Apr-12		292
May-09	156	157	May-12		291
Jun-09	154	161	Jun-12		295
Jul-09	143	150	Jul-12		291
Aug-09	162	150	Aug-12		304
Sep-09	155	161	Sep-12		301
Oct-09	173	152	Oct-12		307
Nov-09	174	186	Nov-12		317
Dec-09	206	190	Dec-12		338
Jan-10	198	210			
Feb-10	194	198			
Mar-10	185	186			

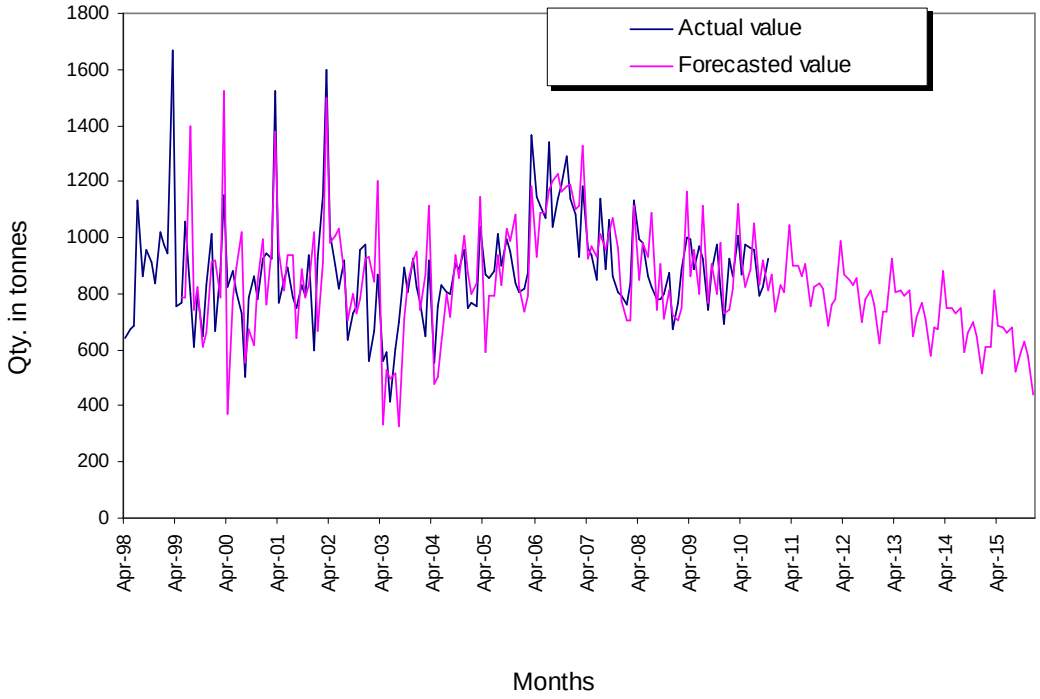

Fig.4.25: Ex-ante and ex-post forecast of arrivals of Multivoltine silk cocoon in Ramanagara market

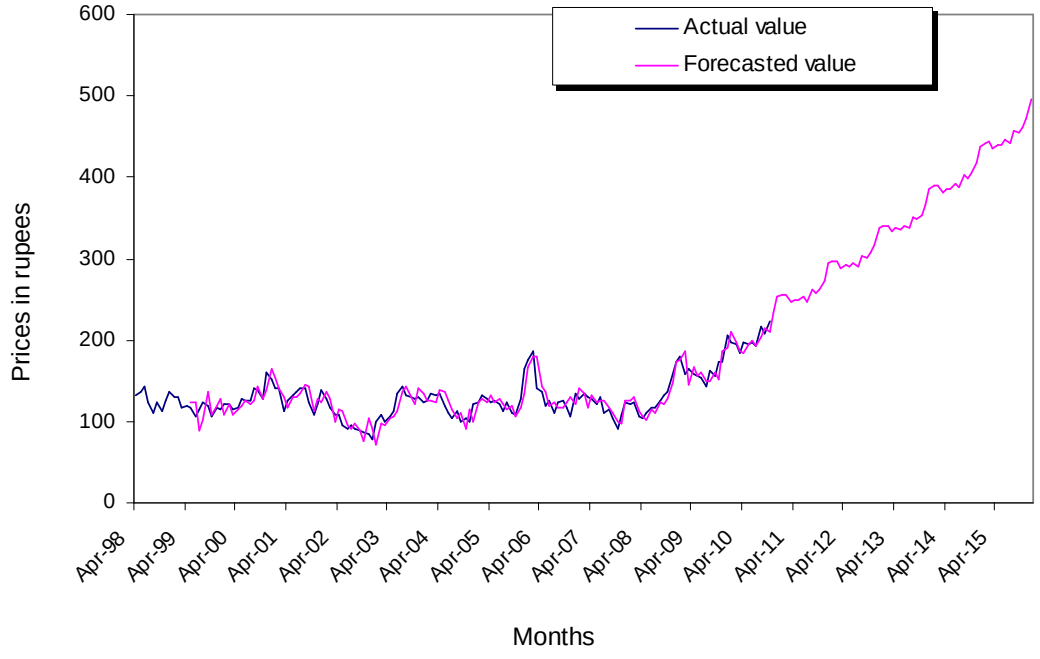

Fig. 4.26. Ex-ante and ex-post forecast of prices of Multivoltine silk cocoon in Ramanagara market

Table 4.13: Actual and Forecast values for arrivals of Bivoltine silk cocoon in Ramanagara market

(Value in tonnes)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	98.108	.	Apr-01	97.638	96.30	Apr-04	88.452	89.01
May-98	98.246	.	May-01	98.543	100.64	May-04	95.281	99.59
Jun-98	109.763	.	Jun-01	125.898	123.23	Jun-04	98.652	97.61
Jul-98	145.376	.	Jul-01	105.863	125.24	Jul-04	99.246	103.00
Aug-98	115.468	.	Aug-01	99.563	91.61	Aug-04	97.548	84.21
Sep-98	104.538	.	Sep-01	105.472	112.02	Sep-04	125.483	105.57
Oct-98	135.461	.	Oct-01	105.831	106.73	Oct-04	102.468	110.85
Nov-98	125.473	.	Nov-01	123.782	112.93	Nov-04	102.489	118.58
Dec-98	139.897	.	Dec-01	98.657	134.94	Dec-04	97.456	105.20
Jan-99	116.379	.	Jan-02	102.487	90.07	Jan-05	99.568	80.94
Feb-99	102.498	.	Feb-02	126.843	100.85	Feb-05	97.685	99.67
Mar-99	124.568	.	Mar-02	102.568	129.19	Mar-05	102.467	93.43
Apr-99	99.426	.	Apr-02	112.672	82.84	Apr-05	98.547	92.80
May-99	109.834	99.61	May-02	148.937	109.15	May-05	99.874	99.30
Jun-99	142.931	119.19	Jun-02	124.586	151.50	Jun-05	102.493	99.89
Jul-99	115.763	170.89	Jul-02	142.483	121.03	Jul-05	125.876	102.32
Aug-99	105.971	97.50	Aug-02	105.769	118.40	Aug-05	103.579	110.52
Sep-99	129.731	100.88	Sep-02	125.763	112.64	Sep-05	112.459	113.08
Oct-99	98.357	151.86	Oct-02	102.687	129.20	Oct-05	102.489	106.77
Nov-99	126.873	102.51	Nov-02	145.762	108.58	Nov-05	98.728	110.38
Dec-99	146.782	141.59	Dec-02	152.472	143.98	Dec-05	102.472	100.40
Jan-00	102.483	119.43	Jan-03	99.654	133.71	Jan-06	124.593	92.05
Feb-00	115.768	94.19	Feb-03	99.358	111.32	Feb-06	110.284	117.10
Mar-00	125.762	132.29	Mar-03	102.547	105.48	Mar-06	102.569	104.35
Apr-00	99.458	100.07	Apr-03	89.576	98.70	Apr-06	99.528	99.35
May-00	100.143	104.67	May-03	86.421	104.04	May-06	115.472	100.75
Jun-00	115.831	122.70	Jun-03	85.426	109.26	Jun-06	125.761	115.82
Jul-00	129.672	126.23	Jul-03	90.368	95.46	Jul-06	102.173	123.98
Aug-00	98.437	109.42	Aug-03	92.453	81.98	Aug-06	98.324	98.10
Sep-00	109.751	107.05	Sep-03	99.925	102.46	Sep-06	112.473	116.18
Oct-00	126.397	114.10	Oct-03	105.379	98.39	Oct-06	154.273	104.05
Nov-00	109.673	129.89	Nov-03	108.762	120.50	Nov-06	142.432	142.57
Dec-00	116.739	131.40	Dec-03	96.428	109.32	Dec-06	125.431	127.26
Jan-01	134.876	92.36	Jan-04	92.682	85.95	Jan-07	98.147	126.31
Feb-01	109.378	123.11	Feb-04	91.248	100.27	Feb-07	115.793	98.22
Mar-01	119.379	122.72	Mar-04	94.528	88.79	Mar-07	125.748	119.19

Table 4.13: Contd…..

Months	Actual value	Forecasted value	Months	Actual value	Forecasted value
Apr-07	110.957	112.27	Apr-10	78.932	144.63
May-07	78.493	121.63	May-10	69.992	68.28
Jun-07	90.275	91.96	Jun-10	81.31	86.76
Jul-07	170.562	109.07	Jul-10	140.253	122.07
Aug-07	175.542	137.73	Aug-10	137.653	138.10
Sep-07	181.291	168.80	Sep-10	160.405	126.59
Oct-07	188.464	164.88	Oct-10	191.099	179.90
Nov-07	185.454	172.39	Nov-10		163.38
Dec-07	193.578	162.46	Dec-10		165.25
Jan-08	200.528	177.88	Jan-11		167.96
Feb-08	190.592	178.03	Feb-11		177.62
Mar-08	188.566	181.28	Mar-11		176.03
Apr-08	152.135	167.98	Apr-11		112.71
May-08	107.288	152.95	May-11		91.97
Jun-08	100.429	128.96	Jun-11		103.50
Jul-08	148.715	143.14	Jul-11		141.85
Aug-08	159.235	150.33	Aug-11		136.49
Sep-08	150.824	174.02	Sep-11		135.27
Oct-08	161.356	170.16	Oct-11		173.95
Nov-08	141.758	168.06	Nov-11		158.14
Dec-08	146.39	147.19	Dec-11		161.98
Jan-09	141.26	153.66	Jan-12		176.71
Feb-09	155.241	145.86	Feb-12		185.76
Mar-09	156.739	164.04	Mar-12		187.63
Apr-09	91.226	136.53	Apr-12		110.92
May-09	79.797	91.03	May-12		93.46
Jun-09	91.352	96.38	Jun-12		104.73
Jul-09	117.227	144.67	Jul-12		148.31
Aug-09	92.092	130.83	Aug-12		143.41
Sep-09	78.356	120.42	Sep-12		148.17
Oct-09	140.573	114.35	Oct-12		184.79
Nov-09	137.227	141.71	Nov-12		166.44
Dec-09	137.55	136.39	Dec-12		169.69
Jan-10	183.014	142.28			
Feb-10	188.704	168.09			
Mar-10	198.367	176.99			

Table 4.14: Actual and Forecast values for prices of Bivoltine silk cocoon in Ramanagara market

(Value in ₹/kg)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	166	.	Apr-01	151	155	Apr-04	153	157
May-98	167	.	May-01	154	151	May-04	148	153
Jun-98	164	.	Jun-01	156	149	Jun-04	132	152
Jul-98	142	.	Jul-01	160	157	Jul-04	127	135
Aug-98	136	.	Aug-01	163	167	Aug-04	131	129
Sep-98	147	.	Sep-01	146	161	Sep-04	116	126
Oct-98	138	.	Oct-01	136	141	Oct-04	125	113
Nov-98	151	.	Nov-01	147	155	Nov-04	127	134
Dec-98	156	.	Dec-01	156	143	Dec-04	148	128
Jan-99	143	.	Jan-02	143	149	Jan-05	151	150
Feb-99	146	.	Feb-02	137	143	Feb-05	158	153
Mar-99	137	.	Mar-02	132	127	Mar-05	153	153
Apr-99	147	.	Apr-02	131	144	Apr-05	154	161
May-99	139	148	May-02	114	132	May-05	152	153
Jun-99	127	136	Jun-02	111	112	Jun-05	143	151
Jul-99	143	105	Jul-02	118	113	Jul-05	140	145
Aug-99	151	137	Aug-02	112	124	Aug-05	145	143
Sep-99	138	162	Sep-02	104	106	Sep-05	136	138
Oct-99	142	129	Oct-02	110	98	Oct-05	140	136
Nov-99	143	155	Nov-02	105	126	Nov-05	159	148
Dec-99	139	148	Dec-02	102	106	Dec-05	187	165
Jan-00	146	126	Jan-03	126	94	Jan-06	192	190
Feb-00	142	149	Feb-03	128	125	Feb-06	204	195
Mar-00	134	133	Mar-03	123	120	Mar-06	164	199
Apr-00	149	144	Apr-03	131	131	Apr-06	161	171
May-00	153	146	May-03	137	128	May-06	144	160
Jun-00	150	146	Jun-03	156	135	Jun-06	142	142
Jul-00	154	149	Jul-03	157	160	Jul-06	148	143
Aug-00	168	156	Aug-03	154	160	Aug-06	159	152
Sep-00	163	167	Sep-03	149	148	Sep-06	154	152
Oct-00	152	162	Oct-03	142	147	Oct-06	136	155
Nov-00	187	159	Nov-03	141	153	Nov-06	141	147
Dec-00	173	188	Dec-03	142	141	Dec-06	160	152
Jan-01	158	171	Jan-04	146	143	Jan-07	162	164
Feb-01	157	158	Feb-04	151	146	Feb-07	160	168
Mar-01	142	149	Mar-04	148	144	Mar-07	155	147

Table 4.14: Contd……

Months	Actual value	Forecasted value	Months	Actual value	Forecasted value
Apr-07	159	160	Apr-10	247	225
May-07	161	155	May-10	247	251
Jun-07	168	160	Jun-10	248	249
Jul-07	140	171	Jul-10	244	243
Aug-07	148	146	Aug-10	271	257
Sep-07	137	142	Sep-10	274	267
Oct-07	118	134	Oct-10	275	275
Nov-07	129	128	Nov-10		285
Dec-07	138	142	Dec-10		303
Jan-08	151	142	Jan-11		309
Feb-08	152	155	Feb-11		308
Mar-08	134	142	Mar-11		300
Apr-08	132	140	Apr-11		308
May-08	150	130	May-11		311
Jun-08	154	151	Jun-11		313
Jul-08	150	150	Jul-11		309
Aug-08	164	157	Aug-11		325
Sep-08	169	157	Sep-11		323
Oct-08	165	164	Oct-11		324
Nov-08	183	176	Nov-11		335
Dec-08	197	195	Dec-11		353
Jan-09	216	203	Jan-12		359
Feb-09	193	220	Feb-12		359
Mar-09	193	182	Mar-12		352
Apr-09	184	198	Apr-12		359
May-09	191	187	May-12		363
Jun-09	191	193	Jun-12		366
Jul-09	175	188	Jul-12		362
Aug-09	201	184	Aug-12		378
Sep-09	193	198	Sep-12		376
Oct-09	209	189	Oct-12		377
Nov-09	208	222	Nov-12		389
Dec-09	243	221	Dec-12		407
Jan-10	234	252			
Feb-10	229	233			
Mar-10	223	221			

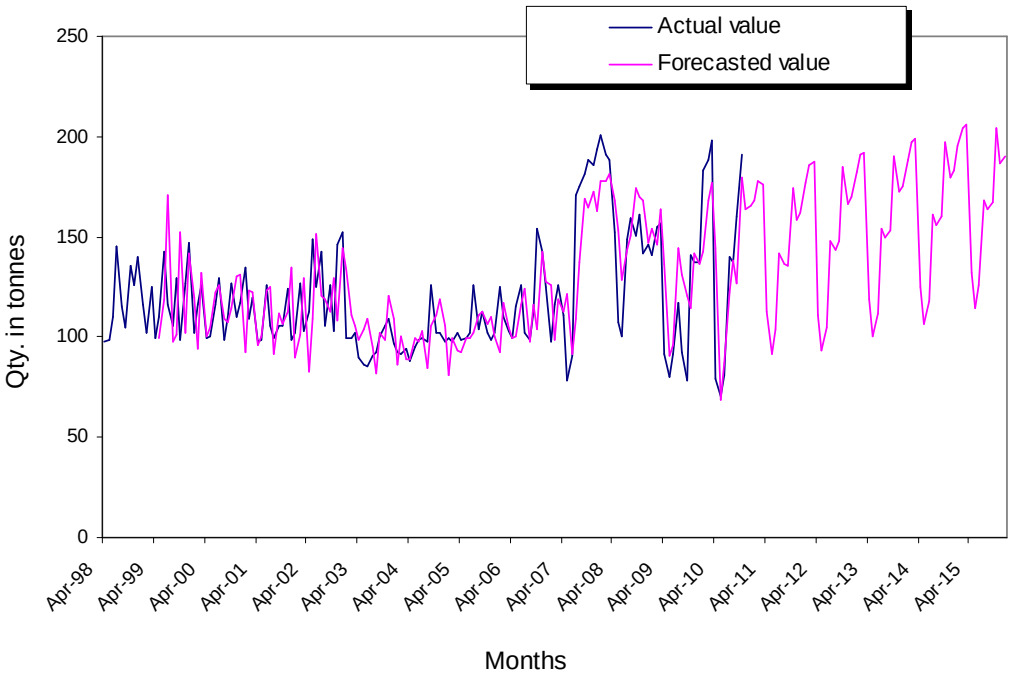

Fig. 4.27. Ex-ante and ex-post forecast of arrivals of Bivoltine silk cocoon in Ramanagara market

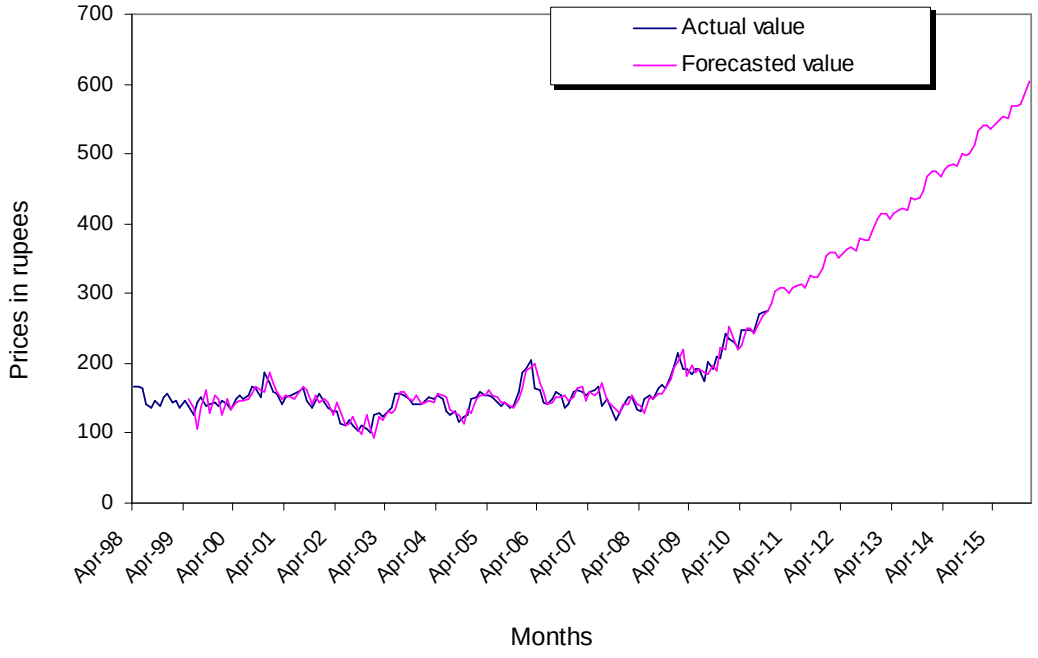

Fig. 4.28. Ex-ante and ex-post forecast of prices of Bivoltine silk cocoon in Ramanagara market

Table 4.15: ACF and PACF of monthly arrivals and prices of Bivoltine and Multivoltine silk cocoon in Shidlagatta market

	Bivoltine				Multivoltine			
	Arrivals		Prices		Arrivals		Prices	
Lags	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF
1	-0.36	-0.36	-0.17	-0.17	-0.38	-0.38	-0.15	-0.15
2	-0.007	-0.16	0.01	-0.02	-0.06	-0.24	-0.004	-0.03
3	-0.15	-0.25	-0.04	-0.05	0.05	-0.09	-0.09	-0.10
4	0.11	-0.06	0.12	0.11	-0.14	-0.21	0.09	0.06
5	0.04	0.03	-0.02	0.01	0.13	-0.01	0.01	0.03
6	-0.07	-0.06	-0.04	-0.04	-0.11	-0.13	-0.04	-0.04
7	0.06	0.05	0.03	0.03	-0.04	-0.16	0.03	0.03
8	-0.09	-0.05	-0.06	-0.06	0.12	-0.02	-0.11	-0.11
9	0.01	-0.08	0.06	0.04	-0.03	-0.008	0.13	0.09
10	0.02	-0.01	-0.02	0.01	0.03	0.01	-0.03	0.006
11	0.24	0.28	-0.01	-0.02	0.20	0.31	-0.02	-0.04
12	-0.45	-0.33	-0.46	-0.47	-0.41	-0.21	-0.51	-0.52
13	0.10	-0.16	0.16	-0.01	0.10	-0.15	0.19	0.02
14	-0.08	-0.20	-0.03	-0.02	-0.02	-0.18	0.01	0.005
15	0.26	0.01	-0.04	-0.08	0.08	0.05	-0.03	-0.09
16	-0.10	0.01	-0.06	0.02	-0.01	-0.08	-0.01	0.04
17	-0.08	-0.04	-0.08	-0.16	-0.12	-0.08	-0.10	-0.13
18	0.01	-0.11	0.04	-0.05	0.11	-0.09	0.05	-0.06
19	0.001	-0.01	0.01	0.07	-0.01	-0.12	0.00	0.04
20	0.06	-0.03	-0.09	-0.17	0.04	0.02	-0.01	-0.17
21	0.01	0.01	-0.04	-0.03	-0.04	0.02	-0.07	0.02
22	0.03	0.05	0.05	0.02	0.02	0.09	0.06	0.03
23	-0.16	0.02	0.06	-0.02	-0.01	0.19	0.08	-0.03
24	0.13	-0.05	0.02	-0.18	-0.04	-0.10	0.07	-0.20
25	-0.09	-0.18	-0.15	-0.16	-0.003	-0.15	-0.19	-0.17

ACF- Autocorrection Function
PACF-Partial Autocorrection Function

Table 4.15: Contd…..

Bivoltine					Multivoltine			
Arrivals			Prices		Arrivals		Prices	
Lags	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF
26	-0.09	-0.18	0.12	-0.15	0.10	-0.01	0.07	0.02
27	0.19	-0.04	0.07	-0.01	-0.14	-0.03	0.07	0.02
28	-0.22	-0.06	0.06	-0.03	0.12	0.10	-0.02	-0.05
29	0.10	0.05	0.001	0.10	-0.01	-0.005	0.07	-0.04
30	-0.03	-0.04	0.06	-0.005	0.00	-0.003	0.01	0.04
31	0.13	0.07	-0.01	-0.003	0.08	0.02	0.02	0.03
32	-0.03	0.01	0.10	0.02	-0.14	0.07	0.08	-0.01
33	-0.04	0.04	0.02	0.07	0.008	-0.04	0.01	0.02
34	-0.06	-0.07	-0.01	-0.04	0.03	0.10	-0.03	0.05
35	0.03	0.05	0.002	0.10	-0.04	0.11	-0.04	-0.01
36	0.12	0.10	0.04	0.11	0.03	-0.07	0.06	-0.04
37	-0.08	0.02	0.13	-0.07	0.08	0.02	0.11	-0.04
38	0.05	-0.08	-0.14	0.02	-0.13	-0.07	-0.09	0.03
39	-0.16	-0.07	-0.04	-0.07	0.06	-0.13	-0.07	-0.01
40	0.12	-0.07	0.04	-0.13	-0.01	0.02	0.11	0.11
41	-0.06	0.01	0.03	0.02	-0.02	-0.06	0.00	0.09
42	0.10	0.02	-0.03	-0.06	0.01	-0.05	0.02	0.11
43	-0.11	0.04	-0.05	-0.05	-0.06	0.01	-0.10	-0.03
44	0.005	0.04	-0.08	0.01	-0.02	-0.16	-0.05	-0.01
45	-0.07	-0.12	0.00	-0.16	0.10	-0.08	-0.001	-0.02
46	0.14	-0.02	-0.03	-0.08	-0.06	-0.04	-0.01	-0.01
47	-0.006	0.05	-0.01	-0.04	0.04	0.09	0.06	0.13
48	-0.07	0.11	-0.06	0.09	0.03	0.02	-0.10	-0.01
49	0.005	0.04	-0.04	0.02	-0.02	0.16	-0.02	-0.02
50	0.02	0.07	0.01	0.16	0.02	-0.08	-0.01	-0.10

ACF- Autocorrection Function
PACF-Partial Autocorrection Function

4.3.2.3 Forecasting the arrivals and prices of cocoon in Shidlagatta market

The method of forecasting has been explained in detail in chapter three. Both Ex-ante and Ex-post forecast were done and it was compared with actual values of observations. The forecast was done up to 2012. The results of Ex-ante and Ex-post forecast of arrivals and prices of Multivoltine silk cocoon in Shidlagatta market is shown in Tables 4.16 and Table 4.17. The forecasts were also depicted in the Fig. 4.29 and Fig 4.30. The forecasted values of Multivoltine silk cocoon arrivals showed a decreasing trend, where as prices showed increasing trend in the future years. The arrivals of Multivoltine silk cocoon during 2010-2011 will be as high as 1240.04 tonnes and as less as 843.89 tonnes during the month of October and April respectively. By 2012 the arrivals will be high in the month of July (1253.3 tonnes) and less during the month of April(922.4 tonnes) for Multivoltine silk cocoon. In the case of prices of Multivoltine during 2010-2011the prices will be high around ₹239 per Kg and less around ₹171 per Kg during the months of September and November respectively. Similarly the prices will be high in the month of December ₹344 per Kg and low in the month of March that is ₹296 per Kg in Shidlagatta market in 2012.

Similarly the results of Ex-ante and Ex-post forecast of arrivals and prices of Bivoltine silk cocoon in Shidlagatta market is shown in Tables 4.18 and Table 4.19. The forecasts were also depicted in the Fig. 4.31 and Fig 4.32. The forecasted values of Bivoltine silk cocoon arrivals showed a decreasing trend where as prices showed increasing trend in the future years. The arrivals of Bivoltine silk cocoon during 2010-2011 will be as high as 30.149 tonnes and as less as 20.579 tonnes during the month of October and September respectively. By 2012 the arrivals will be high in the month of March (24.89tonnes) and less during the month of April (18.74tonnes) for Bivoltine silk cocoon. In the case of prices of Bivoltine during 2010-2011, the prices will be high around ₹267 per Kg and less around ₹198 per Kg during the months of December and October respectively, similarly prices will be high in the month of December ₹374 per Kg and less in the month of March that is ₹ 326 per Kg for Bivoltine silk cocoon in Shidlagatta market in 2012.

4.3.3 Arrivals and Prices of Multivoltine and Bivoltine silk cocoon in Chintamani market

The detailed analysis of forecasting of arrivals and prices of Multivoltine silk cocoon and Bivoltine silk cocoon in Chintamani market has been presented as under.

4.3.3.1 Identification of the model

The tentative models were first identified based on the Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) for the different series Y_t for selected markets and varieties of cocoons. The computed value of ACF and PACF of Chintamani market was shown in Table 4.20 for Multivoltine and Bivoltine silk cocoon was up to 50 lags. An examination of the ACF and PACF revealed seasonality. However, the series was found to be stationary, since the coefficient dropped to zero after the first or second lag. Each individual coefficient of ACF and PACF were 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 were tried, finally model (1,1,1) (2,1,1) was tentatively identified for arrivals and model (0,1,0) (2,1,1) was identified for prices of Multivoltine silk cocoon in Ramanagara market. In the same way and model(1,1,1) (1,1,1) was identified for arrivals and model (0,1,0) (1,1,1) was identified for prices of Bivoltine silk cocoon in Chintamani market. It was showed in Table 4.9.

4.3.3.2 Diagnostic checking

Residual analysis was carried out to check the adequacy of the models. The residuals of ACF and PACF were obtained from the tentatively identified model. The adequacy of the model was judged based on the values of AIC and SBC. The values of the statistics are shown in Table 4.9.The model (1,1,1) (2,1,1) was found to be the best model for arrivals of Multivoltine silk cocoon in Chintamani market. Also for prices of Multivoltine silk cocoon the model (0,1,0) (2,1,1) was identified.

Table 4.16: Actual and Forecast values for arrivals of Multivoltine silk cocoon in Siddlagatta market

(Value in tonnes)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	517.13	.	Apr-01	702.79	664.2	Apr-04	602.85	596.1
May-98	633.75	.	May-01	967.24	868.7	May-04	892.19	699.5
Jun-98	635.54	.	Jun-01	759.72	777.8	Jun-04	1063.32	621.7
Jul-98	893.47	.	Jul-01	715.43	891.4	Jul-04	1050.51	989.8
Aug-98	954.24	.	Aug-01	921.33	880.5	Aug-04	960.13	988.9
Sep-98	668.51	.	Sep-01	950.14	786.8	Sep-04	1022.99	983.5
Oct-98	981.72	.	Oct-01	761.76	1051.2	Oct-04	904.16	982.6
Nov-98	827.15	.	Nov-01	941.84	900.2	Nov-04	1129.96	1019.6
Dec-98	925.12	.	Dec-01	544.28	834.1	Dec-04	887.56	958.2
Jan-99	754.19	.	Jan-02	1036.63	788.1	Jan-05	988.02	941.1
Feb-99	787.8	.	Feb-02	1093.06	901.5	Feb-05	782.66	956.6
Mar-99	1319	.	Mar-02	1273.86	1337.1	Mar-05	1090.27	1128.9
Apr-99	934.57	.	Apr-02	1010.07	730.8	Apr-05	835.18	686.3
May-99	955.46	1050.7	May-02	922.16	1028.3	May-05	985.52	901.6
Jun-99	761.14	994.2	Jun-02	702.89	796.1	Jun-05	952.13	861.4
Jul-99	889.9	1136.9	Jul-02	1024.92	825.7	Jul-05	1091.55	1019.6
Aug-99	960.24	1100.7	Aug-02	713.94	1025.0	Aug-05	1078.2	1019.8
Sep-99	784.29	782.1	Sep-02	1021.38	810.9	Sep-05	1083.39	1071.6
Oct-99	1028.51	1121.4	Oct-02	1006.69	978.7	Oct-05	1098.86	1028.3
Nov-99	1237.25	938.4	Nov-02	1127.18	1033.5	Nov-05	729.93	1167.9
Dec-99	928.07	1168.3	Dec-02	1064.91	851.5	Dec-05	925.74	835.0
Jan-00	1004	876.0	Jan-03	653.86	1126.5	Jan-06	1021.31	951.7
Feb-00	1038.51	963.7	Feb-03	880.99	930.5	Feb-06	858.81	931.2
Mar-00	1508.8	1505.2	Mar-03	1035.94	1255.3	Mar-06	1406.48	1162.7
Apr-00	689.6	1041.4	Apr-03	541.57	733.8	Apr-06	1284.39	871.2
May-00	984.11	931.6	May-03	560.04	784.1	May-06	1147.87	1149.6
Jun-00	784.21	876.6	Jun-03	433.97	550.1	Jun-06	1060.41	1031.8
Jul-00	822.13	1034.9	Jul-03	796.73	698.5	Jul-06	1635.69	1162.6
Aug-00	877.29	1024.2	Aug-03	917.54	732.9	Aug-06	1169.81	1324.3
Sep-00	900.02	764.0	Sep-03	980.94	848.4	Sep-06	1311.63	1243.6
Oct-00	981.88	1119.0	Oct-03	841.23	929.1	Oct-06	1461.18	1242.2
Nov-00	884.65	1105.3	Nov-03	936.37	940.6	Nov-06	1415.83	1286.4
Dec-00	793.86	904.8	Dec-03	939.25	785.0	Dec-06	1446.32	1264.1
Jan-01	1003.15	850.9	Jan-04	963.11	836.3	Jan-07	1267.42	1364.3
Feb-01	930.82	964.1	Feb-04	790.64	951.4	Feb-07	1063.17	1214.1
Mar-01	1132.9	1435.6	Mar-04	968	1133.6	Mar-07	1274.4	1499.6

Table 4.16: Contd…..

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	939.99	1112.3	Apr-10	843.84	947.0
May-07	1070.45	1132.8	May-10	1061.58	997.9
Jun-07	1199.14	1066.6	Jun-10	1189.71	1053.0
Jul-07	1438.51	1409.5	Jul-10	1238.56	1306.3
Aug-07	1242.85	1269.3	Aug-10	1187.98	1047.2
Sep-07	1203.08	1316.4	Sep-10	1175.64	1157.9
Oct-07	1377.16	1303.0	Oct-10		1240.4
Nov-07	1168.65	1321.1	Nov-10		1104.8
Dec-07	1177.23	1226.2	Dec-10		990.6
Jan-08	1084.91	1204.0	Jan-11		1099.5
Feb-08	1186.86	1053.4	Feb-11		1055.2
Mar-08	1301.01	1418.6	Mar-11		1181.3
Apr-08	1045.3	1037.1	Apr-11		935.2
May-08	1237.15	1134.5	May-11		1063.6
Jun-08	1151.31	1164.7	Jun-11		1107.8
Jul-08	1462.2	1398.9	Jul-11		1270.2
Aug-08	1271.25	1272.9	Aug-11		1107.5
Sep-08	1194.57	1294.6	Sep-11		1138.1
Oct-08	1264.37	1319.7	Oct-11		1216.3
Nov-08	1014.57	1230.5	Nov-11		1087.6
Dec-08	813.41	1132.3	Dec-11		979.2
Jan-09	1097.79	1003.0	Jan-12		1081.9
Feb-09	1096.22	1035.1	Feb-12		1037.3
Mar-09	999.58	1315.7	Mar-12		1167.2
Apr-09	1022.11	881.0	Apr-12		922.4
May-09	1060.12	1080.1	May-12		1046.4
Jun-09	1216.78	1032.2	Jun-12		1086.3
Jul-09	1269.29	1369.9	Jul-12		1253.3
Aug-09	904.90	1155.1	Aug-12		1085.1
Sep-09	1086.77	1060.2	Sep-12		1117.1
Oct-09	1240.04	1160.2	Oct-12		1195.4
Nov-09	1085.60	1079.0	Nov-12		1066.6
Dec-09	881.39	997.3	Dec-12		958.0
Jan-10	1137.65	1012.6			
Feb-10	1096.77	1029.1			
Mar-10	1130.12	1198.5			

Table 4.17: Actual and Forecast values for prices of Multivoltine silk cocoon in Siddlagatta market

(Value in ₹/kg)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	151	.	Apr-01	135	111	Apr-04	143	137
May-98	175	.	May-01	140	143	May-04	131	142
Jun-98	162	.	Jun-01	143	140	Jun-04	119	139
Jul-98	171	.	Jul-01	149	146	Jul-04	110	123
Aug-98	168	.	Aug-01	142	142	Aug-04	122	105
Sep-98	161	.	Sep-01	127	142	Sep-04	105	118
Oct-98	161	.	Oct-01	109	129	Oct-04	111	99
Nov-98	172	.	Nov-01	126	107	Nov-04	98	117
Dec-98	165	.	Dec-01	136	128	Dec-04	123	95
Jan-99	174	.	Jan-02	125	152	Jan-05	121	134
Feb-99	168	.	Feb-02	115	119	Feb-05	135	121
Mar-99	161	.	Mar-02	110	111	Mar-05	133	133
Apr-99	121	.	Apr-02	111	102	Apr-05	137	140
May-99	116	145	May-02	92	117	May-05	137	136
Jun-99	122	103	Jun-02	98	94	Jun-05	131	148
Jul-99	120	131	Jul-02	101	101	Jul-05	127	132
Aug-99	116	117	Aug-02	103	91	Aug-05	132	123
Sep-99	119	109	Sep-02	98	101	Sep-05	122	129
Oct-99	118	119	Oct-02	92	98	Oct-05	116	116
Nov-99	98	129	Nov-02	90	95	Nov-05	129	120
Dec-99	115	91	Dec-02	80	89	Dec-05	157	127
Jan-00	136	124	Jan-03	104	93	Jan-06	171	165
Feb-00	128	130	Feb-03	111	98	Feb-06	187	176
Mar-00	116	121	Mar-03	102	112	Mar-06	157	185
Apr-00	125	76	Apr-03	118	101	Apr-06	149	165
May-00	130	138	May-03	126	121	May-06	138	146
Jun-00	133	125	Jun-03	153	129	Jun-06	147	142
Jul-00	132	138	Jul-03	151	157	Jul-06	126	145
Aug-00	110	129	Aug-03	139	143	Aug-06	139	127
Sep-00	109	108	Sep-03	144	134	Sep-06	144	133
Oct-00	115	109	Oct-03	132	140	Oct-06	126	141
Nov-00	126	114	Nov-03	138	139	Nov-06	111	127
Dec-00	105	130	Dec-03	126	138	Dec-06	135	120
Jan-01	120	120	Jan-04	127	135	Jan-07	130	141
Feb-01	115	114	Feb-04	135	122	Feb-07	142	140
Mar-01	130	107	Mar-04	134	135	Mar-07	142	137

Table 4.17: Contd……

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	142	148	Apr-10	221	209
May-07	141	139	May-10	222	220
Jun-07	134	143	Jun-10	219	228
Jul-07	122	129	Jul-10	209	209
Aug-07	123	127	Aug-10	214	219
Sep-07	124	117	Sep-10	239	216
Oct-07	109	120	Oct-10		234
Nov-07	113	111	Nov-10		236
Dec-07	121	130	Dec-10		254
Jan-08	133	128	Jan-11		259
Feb-08	130	145	Feb-11		258
Mar-08	106	120	Mar-11		254
Apr-08	130	108	Apr-11		265
May-08	128	126	May-11		266
Jun-08	147	130	Jun-11		268
Jul-08	140	138	Jul-11		257
Aug-08	152	147	Aug-11		271
Sep-08	160	150	Sep-11		273
Oct-08	158	151	Oct-11		273
Nov-08	164	157	Nov-11		273
Dec-08	178	183	Dec-11		295
Jan-09	179	183	Jan-12		299
Feb-09	167	190	Feb-12		297
Mar-09	176	157	Mar-12		296
Apr-09	178	180	Apr-12		309
May-09	182	175	May-12		311
Jun-09	174	185	Jun-12		312
Jul-09	158	164	Jul-12		301
Aug-09	180	165	Aug-12		314
Sep-09	169	181	Sep-12		322
Oct-09	179	159	Oct-12		321
Nov-09	171	180	Nov-12		322
Dec-09	203	188	Dec-12		344
Jan-10	202	209			
Feb-10	199	207			
Mar-10	200	189			

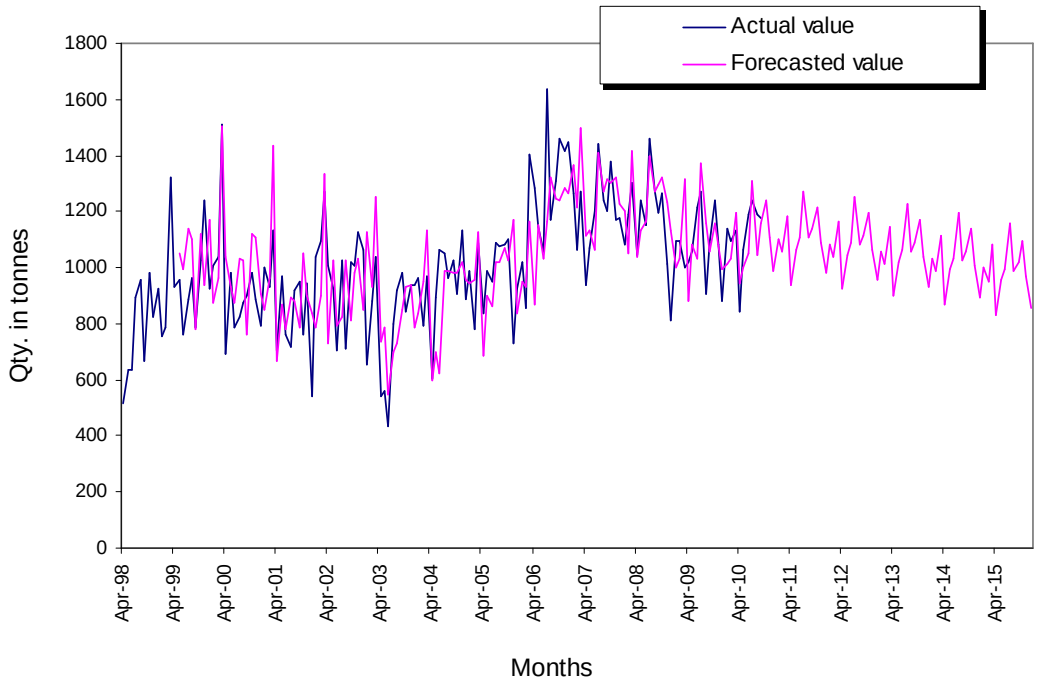

Fig. 4.29. Ex-ante and ex-post forecast of arrivals of Multivoltine silk cocoon in Siddlagatta market

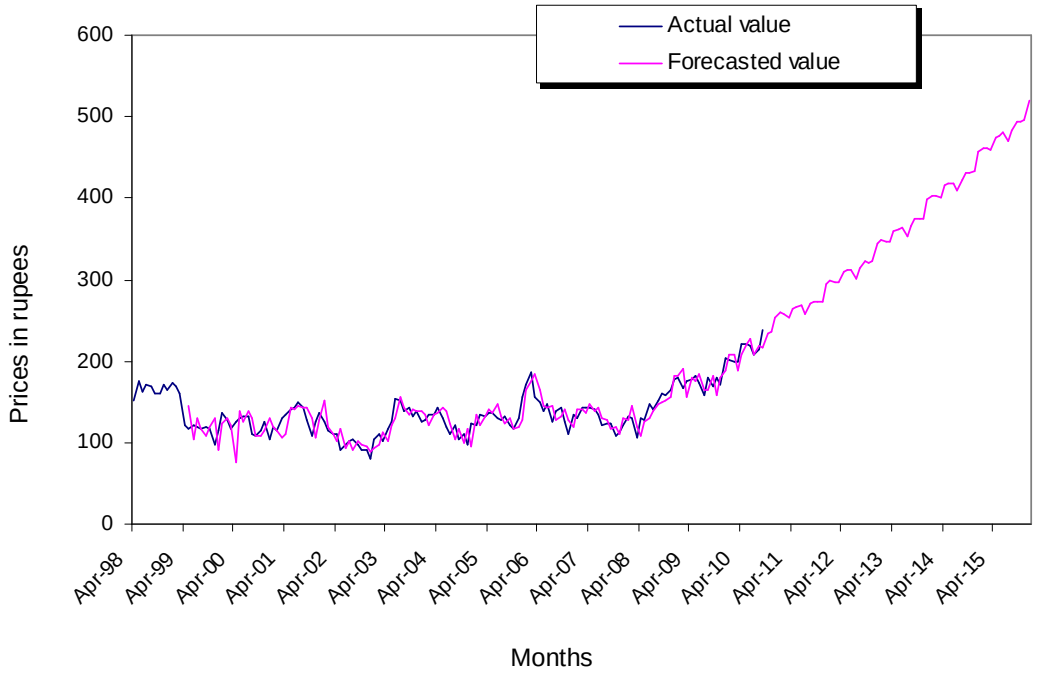

Fig. 4.30. Ex-ante and ex-post forecast of prices of Multivoltine silk cocoon in Siddlagatta market

Table 4.18: Actual and Forecast values for arrivals of Bivoltine silk cocoon in Shidlagatta market

(Value in tonnes)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	14.283	.	Apr-01	19.273	19.41	Apr-04	17.246	18.21
May-98	18.421	.	May-01	21.349	22.82	May-04	20.387	18.56
Jun-98	17.649	.	Jun-01	18.957	17.31	Jun-04	26.149	16.05
Jul-98	20.149	.	Jul-01	18.271	20.61	Jul-04	30.476	23.64
Aug-98	27.614	.	Aug-01	22.647	22.03	Aug-04	22.692	26.29
Sep-98	20.176	.	Sep-01	25.379	19.90	Sep-04	24.673	24.55
Oct-98	28.348	.	Oct-01	19.873	28.09	Oct-04	22.149	25.01
Nov-98	20.149	.	Nov-01	24.938	19.33	Nov-04	26.748	24.12
Dec-98	27.168	.	Dec-01	16.214	22.84	Dec-04	23.467	23.93
Jan-99	19.247	.	Jan-02	25.463	19.09	Jan-05	24.318	23.34
Feb-99	18.279	.	Feb-02	24.398	23.67	Feb-05	18.614	23.53
Mar-99	29.384	.	Mar-02	27.609	28.70	Mar-05	24.372	25.91
Apr-99	25.317	.	Apr-02	23.921	19.74	Apr-05	19.739	19.30
May-99	24.387	29.44	May-02	23.58	24.44	May-05	22.476	21.47
Jun-99	18.243	25.47	Jun-02	19.927	19.67	Jun-05	21.437	20.41
Jul-99	22.347	24.50	Jul-02	27.314	21.27	Jul-05	20.713	24.21
Aug-99	21.438	31.73	Aug-02	18.347	27.08	Aug-05	25.437	21.53
Sep-99	19.901	19.94	Sep-02	25.917	21.42	Sep-05	26.571	24.55
Oct-99	27.346	29.39	Oct-02	24.938	26.67	Oct-05	23.479	25.16
Nov-99	27.698	20.57	Nov-02	26.473	24.17	Nov-05	17.246	24.90
Dec-99	21.483	30.97	Dec-02	23.627	22.65	Dec-05	22.347	19.63
Jan-00	20.741	18.11	Jan-03	15.347	24.98	Jan-06	21.437	21.73
Feb-00	21.462	19.14	Feb-03	18.248	20.95	Feb-06	19.914	20.28
Mar-00	27.624	30.55	Mar-03	20.491	26.01	Mar-06	31.573	24.98
Apr-00	18.248	22.37	Apr-03	17.398	17.43	Apr-06	27.134	21.72
May-00	24.386	21.88	May-03	13.949	20.16	May-06	26.346	24.97
Jun-00	17.243	19.83	Jun-03	12.429	13.70	Jun-06	24.376	22.65
Jul-00	18.431	21.83	Jul-03	17.924	17.29	Jul-06	38.246	25.54
Aug-00	19.768	23.51	Aug-03	20.098	17.63	Aug-06	28.146	31.36
Sep-00	20.146	18.12	Sep-03	23.471	19.59	Sep-06	34.721	29.22
Oct-00	23.176	27.31	Oct-03	16.849	23.05	Oct-06	36.789	31.28
Nov-00	17.986	21.84	Nov-03	22.469	18.71	Nov-06	37.648	31.90
Dec-00	17.648	20.50	Dec-03	22.176	18.78	Dec-06	35.768	32.92
Jan-01	23.418	15.83	Jan-04	23.431	18.52	Jan-07	29.273	32.89
Feb-01	26.731	19.40	Feb-04	19.928	21.17	Feb-07	26.732	29.90
Mar-01	27.614	29.75	Mar-04	24.389	24.29	Mar-07	30.539	35.08

Table 4.18: Contd…..

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	20.973	27.78	Apr-10	21.037	20.33
May-07	22.137	26.70	May-10	26.437	23.17
Jun-07	24.673	23.64	Jun-10	25.389	24.31
Jul-07	33.591	29.89	Jul-10	26.374	27.96
Aug-07	29.739	29.75	Aug-10	25.279	25.19
Sep-07	30.146	31.26	Sep-10	20.579	26.09
Oct-07	34.716	31.07	Oct-10		25.12
Nov-07	28.437	32.52	Nov-10		24.31
Dec-07	27.199	29.03	Dec-10		22.28
Jan-08	22.319	27.18	Jan-11		22.39
Feb-08	27.394	24.27	Feb-11		21.97
Mar-08	33.417	31.52	Mar-11		25.67
Apr-08	22.387	25.37	Apr-11		19.82
May-08	27.913	25.12	May-11		22.19
Jun-08	26.317	25.32	Jun-11		21.16
Jul-08	31.291	30.43	Jul-11		24.72
Aug-08	29.347	29.16	Aug-11		23.20
Sep-08	27.341	30.37	Sep-11		23.14
Oct-08	26.734	30.03	Oct-11		24.63
Nov-08	22.134	27.56	Nov-11		23.30
Dec-08	19.872	24.49	Dec-11		21.46
Jan-09	24.721	21.63	Jan-12		21.14
Feb-09	27.682	23.78	Feb-12		20.81
Mar-09	24.679	30.70	Mar-12		24.89
Apr-09	21.689	20.35	Apr-12		18.74
May-09	24.675	23.61	May-12		20.83
Jun-09	31.247	22.35	Jun-12		19.79
Jul-09	30.157	30.59	Jul-12		23.56
Aug-09	25.467	27.91	Aug-12		21.99
Sep-09	24.678	27.43	Sep-12		22.31
Oct-09	30.149	26.93	Oct-12		23.53
Nov-09	27.689	27.09	Nov-12		22.14
Dec-09	21.679	25.56	Dec-12		20.30
Jan-10	26.197	23.48			
Feb-10	24.395	25.25			
Mar-10	23.579	28.58			

Table 4.19: Actual and Forecast values for prices of Bivoltine silk cocoon in Shidlagatta market

(Value in ₹/kg)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	183	.	Apr-01	172	141	Apr-04	173	164
May-98	195	.	May-01	175	172	May-04	167	174
Jun-98	192	.	Jun-01	178	181	Jun-04	145	177
Jul-98	205	.	Jul-01	181	174	Jul-04	139	152
Aug-98	189	.	Aug-01	164	170	Aug-04	148	135
Sep-98	197	.	Sep-01	150	170	Sep-04	130	142
Oct-98	186	.	Oct-01	134	151	Oct-04	135	129
Nov-98	208	.	Nov-01	152	147	Nov-04	127	140
Dec-98	189	.	Dec-01	166	145	Dec-04	154	128
Jan-99	204	.	Jan-02	148	179	Jan-05	152	160
Feb-99	197	.	Feb-02	139	150	Feb-05	167	153
Mar-99	182	.	Mar-02	131	138	Mar-05	156	160
Apr-99	144	.	Apr-02	135	126	Apr-05	163	164
May-99	144	156	May-02	120	139	May-05	160	165
Jun-99	158	144	Jun-02	124	131	Jun-05	152	166
Jul-99	135	169	Jul-02	127	124	Jul-05	154	154
Aug-99	136	126	Aug-02	129	115	Aug-05	162	151
Sep-99	140	143	Sep-02	121	127	Sep-05	149	153
Oct-99	136	130	Oct-02	115	117	Oct-05	148	149
Nov-99	129	157	Nov-02	113	127	Nov-05	173	151
Dec-99	141	116	Dec-02	105	113	Dec-05	184	172
Jan-00	160	152	Jan-03	136	116	Jan-06	197	189
Feb-00	157	151	Feb-03	136	128	Feb-06	211	199
Mar-00	144	141	Mar-03	133	131	Mar-06	172	203
Apr-00	151	104	Apr-03	151	130	Apr-06	165	187
May-00	156	151	May-03	164	148	May-06	166	171
Jun-00	163	159	Jun-03	184	166	Jun-06	172	168
Jul-00	161	159	Jul-03	179	180	Jul-06	150	171
Aug-00	142	153	Aug-03	171	169	Aug-06	166	154
Sep-00	143	151	Sep-03	163	168	Sep-06	160	156
Oct-00	146	138	Oct-03	170	158	Oct-06	142	160
Nov-00	159	154	Nov-03	164	178	Nov-06	149	151
Dec-00	138	154	Dec-03	161	165	Dec-06	156	158
Jan-01	152	159	Jan-04	160	173	Jan-07	161	165
Feb-01	149	149	Feb-04	171	159	Feb-07	165	170
Mar-01	164	136	Mar-04	160	166	Mar-07	160	154

Table 4.19: Contd…..

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	167	165	Apr-10	256	245
May-07	162	167	May-10	247	252
Jun-07	158	163	Jun-10	242	249
Jul-07	136	155	Jul-10	236	235
Aug-07	140	145	Aug-10	243	246
Sep-07	143	133	Sep-10	267	241
Oct-07	132	139	Oct-10		260
Nov-07	149	142	Nov-10		269
Dec-07	153	157	Dec-10		284
Jan-08	165	162	Jan-11		287
Feb-08	157	173	Feb-11		288
Mar-08	138	147	Mar-11		283
Apr-08	173	146	Apr-11		298
May-08	163	168	May-11		296
Jun-08	178	164	Jun-11		295
Jul-08	172	166	Jul-11		288
Aug-08	179	177	Aug-11		299
Sep-08	182	173	Sep-11		300
Oct-08	184	175	Oct-11		299
Nov-08	191	192	Nov-11		309
Dec-08	207	199	Dec-11		326
Jan-09	202	215	Jan-12		328
Feb-09	190	210	Feb-12		329
Mar-09	198	181	Mar-12		326
Apr-09	204	206	Apr-12		342
May-09	206	202	May-12		340
Jun-09	191	208	Jun-12		339
Jul-09	185	185	Jul-12		332
Aug-09	206	192	Aug-12		344
Sep-09	194	201	Sep-12		348
Oct-09	198	191	Oct-12		346
Nov-09	204	208	Nov-12		357
Dec-09	236	214	Dec-12		374
Jan-10	227	239			
Feb-10	230	230			
Mar-10	234	221			

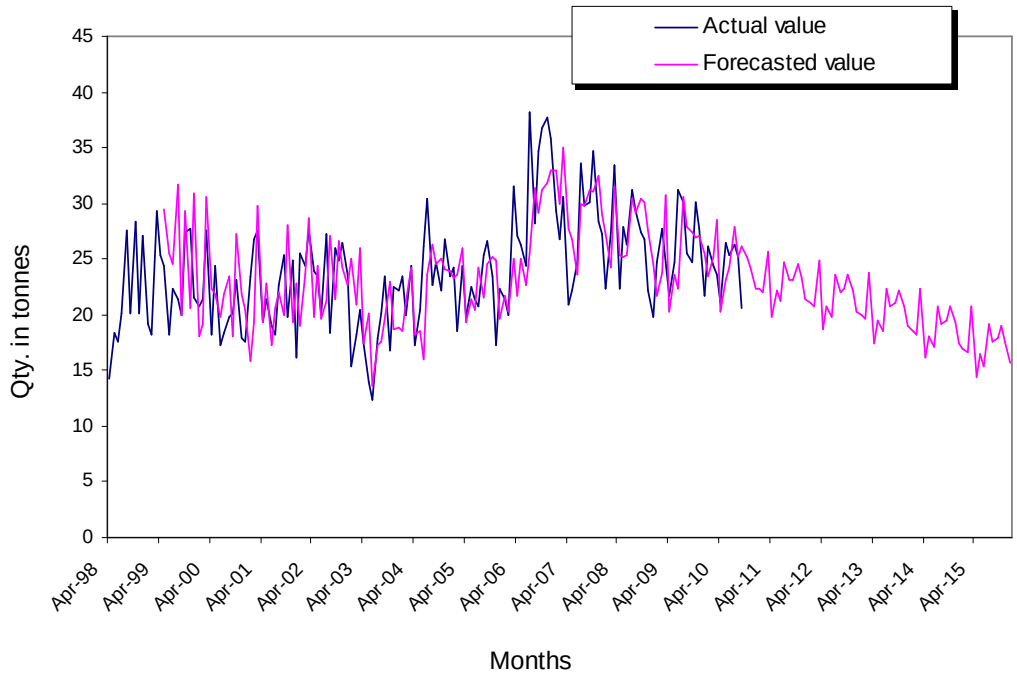

Fig. 4.31. Ex-ante and ex-post forecast of arrivals of Bivoltine silk cocoon in Siddlagatta market

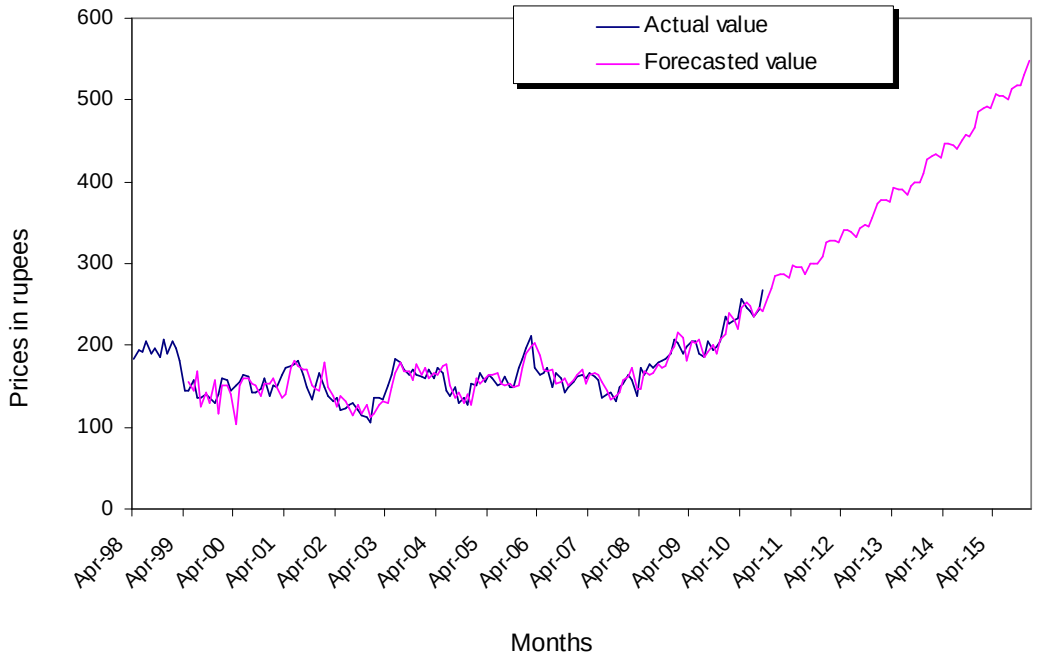

Fig. 4.32. Ex-ante and ex-post forecast of prices of Bivoltine silk cocoon in Siddlagatta market

Table 4.20: ACF and PACF of monthly arrivals and prices of Bivoltine and Multivoltine silk cocoon in Chintamani market

Bivoltine					Multivoltine			
Arrivals			Prices		Arrivals		Prices	
Lags	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF
1	-0.38	-0.38	-0.10	-0.10	-0.36	-0.36	-0.04	-0.04
2	0.01	-0.15	0.10	0.09	-0.01	-0.16	-0.12	-0.12
3	-0.06	-0.14	-0.20	-0.19	-0.02	-0.11	-0.09	-0.10
4	-0.02	-0.13	0.28	0.25	-0.10	-0.19	0.09	0.07
5	0.11	0.05	-0.09	-0.03	0.09	-0.04	-0.03	-0.04
6	-0.07	-0.02	-0.04	-0.14	-0.08	-0.11	-0.07	-0.07
7	-0.13	-0.20	-0.05	0.05	-0.01	-0.13	0.07	0.07
8	0.12	-0.01	-0.03	-0.13	0.07	-0.02	-0.11	-0.14
9	-0.003	0.02	0.13	0.15	0.09	0.12	0.19	0.20
10	0.08	0.08	-0.11	-0.05	-0.05	0.02	0.007	0.01
11	0.07	0.21	-0.03	-0.12	0.13	0.19	-0.11	-0.12
12	-0.49	-0.43	-0.49	-0.47	-0.45	-0.38	-0.48	-0.47
13	0.23	-0.21	0.17	0.04	0.17	-0.16	0.02	-0.11
14	-0.01	-0.0	-0.07	0.02	0.07	-0.01	0.21	0.10
15	-0.01	-0.12	0.01	-0.17	-0.17	-0.23	-0.13	-0.17
16	0.04	-0.004	-0.23	0.04	0.19	-0.05	-0.04	-0.02
17	-0.16	-0.11	0.07	-0.14	-0.19	-0.23	-0.01	-0.05
18	0.16	-0.07	0.04	-0.05	0.21	-0.02	0.10	-0.05
19	0.08	0.005	0.09	0.18	-0.03	-0.04	-0.05	0.02
20	-0.13	-0.03	-0.12	-0.19	-0.08	-0.05	-0.001	-0.06
21	0.05	0.04	-0.05	-0.01	0.03	0.06	-0.02	0.11
22	-0.07	0.06	0.11	0.07	-0.02	-0.01	-0.03	-0.02
23	0.06	0.10	0.06	-0.15	0.08	0.19	0.17	-0.01
24	0.16	-0.02	0.07	-0.09	-0.05	-0.18	-0.01	-0.26
25	-0.23	-0.15	-0.23	-0.16	-0.04	-0.15	-0.005	-0.05

ACF- Autocorrection Function
PACF-Partial Autocorrection Function

Table 4.20: Contd…..

Bivoltine					Multivoltine			
Arrivals			Prices		Arrivals		Prices	
Lags	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF
26	0.12	0.02	0.13	0.01	0.02	0.005	-0.09	0.04
27	-0.05	-0.05	0.05	-0.03	0.11	-0.16	0.12	-0.07
28	0.05	0.06	0.12	-0.01	-0.09	-0.02	0.09	0.07
29	0.07	0.04	-0.07	0.07	0.09	-0.08	-0.06	-0.04
30	-0.13	-0.01	0.02	-0.10	-0.08	0.01	0.01	0.004
31	0.002	0.03	0.001	0.09	-0.03	-0.02	0.00	0.03
32	0.01	-0.12	0.06	-0.13	0.04	-0.16	0.10	0.04
33	-0.02	-0.02	0.03	0.07	-0.07	0.07	-0.14	-0.03
34	0.06	0.06	-0.10	0.05	0.11	0.03	0.05	0.05
35	-0.06	0.10	0.05	-0.07	-0.14	0.006	-0.09	-0.08
36	-0.06	-0.01	-0.03	-0.03	0.07	-0.16	0.08	-0.05
37	0.16	-0.07	0.18	-0.08	0.11	-0.02	0.02	-0.05
38	-0.11	-0.05	-0.12	0.10	-0.11	0.05	0.02	0.13
39	0.07	-0.01	0.05	0.10	0.09	0.05	0.02	0.08
40	-0.14	-0.08	0.02	0.10	-0.11	-0.01	-0.09	0.02
41	0.01	0.004	0.03	-0.02	0.01	-0.01	0.10	0.06
42	0.09	-0.03	0.02	0.10	-0.03	-0.05	-0.02	0.08
43	-0.01	0.02	-0.12	-0.06	0.04	-0.006	-0.02	0.04
44	0.05	0.04	0.01	-0.01	0.05	0.04	-0.09	-0.01
45	-0.03	-0.04	-0.09	0.01	-0.03	-0.02	0.07	-0.04
46	-0.005	0.07	0.13	0.06	-0.03	0.01	0.02	0.05
47	0.11	0.18	-0.12	0.04	0.14	0.16	0.01	0.05
48	-0.06	0.05	0.09	0.05	-0.09	-0.07	0.01	-0.01
49	-0.06	-0.01	-0.14	-0.03	-0.13	-0.07	-0.04	0.02
50	0.03	-0.06	0.06	-0.09	0.11	0.03	-0.09	-0.11

ACF- Autocorrection Function
PACF-Partial Autocorrection Function

Similarly for Bivoltine silk cocoon, found (1,1,1) (1,1,1) and model (0,1,0) (1,1,1)was identified as the best model for arrivals and prices in Chintamani market respectively. These models were identified on the basis of lowest AIC and SBC estimates. The estimation of arrivals and prices, conditional least square estimates are presented in Appendix IX, X XI XII.

4.3.3.4 Forecasting the arrivals and prices of cocoon in Chintamani market

The method of forecasting has been explained in detail in chapter 3. Both Ex-ante and Ex-post forecast were done and it was compared with actual values of observations. The forecast was done up to 2012. The results of Ex-ante and Ex-post forecast of arrivals and prices of Multivoltine silk cocoon in Chintamani market is shown in Tables 4.21 and Table 4.22. The forecasts were also depicted in the Fig. 4.33 and Fig 4.34. The forecasted values of Multivoltine silk cocoon arrivals showed a decreasing trend, where as prices showed increasing trend in the future years. The arrivals of Multivoltine silk cocoon during 2010-2011 will be as high as 179.267 tonnes and as less as 89.629 tonnes during the month of July and April respectively. By 2012 the arrivals will be high in the month of March (134.26 tonnes) and less during the month of December (94.15 tonnes) for Multivoltine silk cocoon. In the case of prices of Multivoltine during 2010-2011, the prices will be high around ₹247 per Kg and less around ₹160 per Kg during the month of October and November respectively. Similarly the prices will be high in the month of December ₹366 per Kg and low in the month of January that is 317 per Kg in Chintamani market in 2011-12.

Similarly the results of Ex-ante and Ex-post forecast of arrivals and prices of Bivoltine silk cocoon in Chintamani market is shown in Tables 4.23 and Table 4.24. The forecasts were also depicted in the Fig. 4.35 and Fig 4.36. The forecasted values of Bivoltine silk cocoon arrivals showed a decreasing trend, where as prices showed increasing trend in the future years. The arrivals of Bivoltine silk cocoon in the market during 2010-2011 will be as high as 8.954 tonnes and as less as 5.91 tonnes during the month of July and January respectively. By 2012 the arrivals will be high in the month March (7.23 tonnes) and less during the month of December (4.94 tonnes) for Bivoltine silk cocoon. In the case of prices of Bivoltine during 2010-2011, the prices will be high around ₹273 per Kg and less around ₹208 per Kg during the months of December and November respectively. Similarly the prices will be high in the month of December ₹415 per Kg and less in the month of March that is ₹349 per Kg for Bivoltine silk cocoon in Chintamani market in 2012.

4.4 Market integration among the selected silk cocoon markets

4.4.1 Zero order correlation of prices for Multivoltine and Bivoltine silk cocoon in selected markets

The Zero order correlation coefficients were computed to ascertain the degree of association of prices of silk cocoon in selected markets in order to find the market integration of selected markets.

The correlation coefficient of prices for Multivoltine silk cocoon in Ramanagara, Shidlagatta and Chintamani market during the study period is presented in Table 4.25. It indicates that there was a positive correlation between all markets considered in the study. It shows that there was a positive and significant relationship between prices of cocoon in Ramanagara, Shidlagatta and Chintamani markets. The positive correlation coefficient which is found to be significant and indicated that an increasing in prices of Multivoltine silk cocoon in one market results in increasing in the prices of silk cocoon in other markets.

The Zero order correlation coefficient of prices for Bivoltine silk cocoon in Ramanagara, Shidlagatta and Chintamani market during the study period is presented in Table 4.26. It indicates that there was a positive correlation between all markets considered in the study. It showed that there was a positive and significant relationship between prices of Bivoltine silk cocoon in Ramanagara, Shidlagatta and Chintamani market. The positive correlation coefficient indicated that an increase in prices of Bivoltine silk cocoon in one market results in increase in the prices of cocoon in other markets.

Table 4.21: Actual and Forecast values for arrivals of Multivoltine silk cocoon in Chintamani market

(Value in tonnes)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	167.564	.	Apr-01	169.984	165.74	Apr-04	132.858	133.54
May-98	180.012	.	May-01	197.613	179.00	May-04	200.894	154.54
Jun-98	187.631	.	Jun-01	186.489	166.80	Jun-04	218.836	153.17
Jul-98	186.989	.	Jul-01	162.897	173.09	Jul-04	214.466	171.89
Aug-98	198.689	.	Aug-01	181.276	176.88	Aug-04	181.61	183.49
Sep-98	194.638	.	Sep-01	190.013	174.73	Sep-04	240.768	171.84
Oct-98	226.457	.	Oct-01	198.624	198.63	Oct-04	220.203	206.82
Nov-98	186.784	.	Nov-01	173.568	189.18	Nov-04	135.955	192.22
Dec-98	216.452	.	Dec-01	146.732	175.44	Dec-04	186.44	152.88
Jan-99	175.438	.	Jan-02	179.964	152.88	Jan-05	147.186	167.81
Feb-99	167.891	.	Feb-02	182.346	174.22	Feb-05	188.256	160.27
Mar-99	195.461	.	Mar-02	198.762	206.30	Mar-05	164.564	198.81
Apr-99	186.43	.	Apr-02	181.235	160.61	Apr-05	160.836	149.30
May-99	199.943	198.80	May-02	182.138	187.68	May-05	150.301	176.86
Jun-99	167.534	207.08	Jun-02	168.437	164.12	Jun-05	173.063	146.58
Jul-99	170.034	183.86	Jul-02	197.689	162.81	Jul-05	154.758	163.23
Aug-99	181.679	193.53	Aug-02	175.39	189.48	Aug-05	170.795	162.81
Sep-99	169.943	187.29	Sep-02	200.427	175.65	Sep-05	174.503	172.41
Oct-99	186.795	214.02	Oct-02	200.167	201.65	Oct-05	113.433	180.95
Nov-99	216.64	165.96	Nov-02	214.53	187.43	Nov-05	103.69	143.04
Dec-99	189.957	222.98	Dec-02	206.143	184.52	Dec-05	145.196	135.29
Jan-00	175.431	160.73	Jan-03	153.789	184.17	Jan-06	132.803	140.70
Feb-00	186.486	162.06	Feb-03	182.342	171.68	Feb-06	184.996	145.14
Mar-00	223.468	195.65	Mar-03	201.354	209.01	Mar-06	234.185	182.37
Apr-00	164.832	184.97	Apr-03	170.546	168.76	Apr-06	155.687	165.60
May-00	186.786	182.60	May-03	176.421	186.59	May-06	151.485	168.06
Jun-00	154.623	174.37	Jun-03	120.064	165.18	Jun-06	233.21	143.88
Jul-00	159.876	166.04	Jul-03	122.642	150.42	Jul-06	156.638	180.44
Aug-00	175.341	178.15	Aug-03	153.894	157.40	Aug-06	183.573	161.28
Sep-00	180.068	171.14	Sep-03	135.467	166.63	Sep-06	178.239	176.77
Oct-00	184.679	200.47	Oct-03	150.034	170.51	Oct-06	229.692	176.18
Nov-00	176.458	186.28	Nov-03	149.213	162.82	Nov-06	217.52	180.32
Dec-00	149.276	187.29	Dec-03	153.842	150.65	Dec-06	188.429	184.15
Jan-01	170.052	146.08	Jan-04	169.737	148.11	Jan-07	165.929	165.15
Feb-01	183.759	164.05	Feb-04	132.499	165.19	Feb-07	149.577	170.75
Mar-01	218.642	200.33	Mar-04	146.833	175.95	Mar-07	197.548	181.57

Table 4.21: Contd…..

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	162.087	160.45	Apr-10	89.629	120.58
May-07	155.381	176.04	May-10	113.656	124.60
Jun-07	204.575	159.00	Jun-10	136.378	125.14
Jul-07	246.719	174.81	Jul-10	179.267	131.60
Aug-07	178.036	200.70	Aug-10	135.756	143.15
Sep-07	166.508	184.30	Sep-10	136.612	139.27
Oct-07	206.334	179.23	Oct-10	118.703	146.50
Nov-07	163.729	176.41	Nov-10		116.84
Dec-07	161.255	169.48	Dec-10		118.14
Jan-08	125.754	155.49	Jan-11		108.50
Feb-08	156.052	156.81	Feb-11		120.24
Mar-08	225.672	184.29	Mar-11		146.96
Apr-08	157.599	169.54	Apr-11		110.84
May-08	199.666	171.90	May-11		124.43
Jun-08	107.193	181.41	Jun-11		121.60
Jul-08	138.002	141.60	Jul-11		122.42
Aug-08	101.556	156.76	Aug-11		112.58
Sep-08	143.524	146.78	Sep-11		122.66
Oct-08	167.171	161.38	Oct-11		132.61
Nov-08	144.907	150.65	Nov-11		113.63
Dec-08	106.586	150.15	Dec-11		107.09
Jan-09	135.443	121.30	Jan-12		98.45
Feb-09	147.594	146.56	Feb-12		108.79
Mar-09	142.5	172.35	Mar-12		134.26
Apr-09	139.55	125.34	Apr-12		97.94
May-09	132.54	149.76	May-12		111.29
Jun-09	156.389	142.49	Jun-12		110.26
Jul-09	170.5	145.42	Jul-12		113.23
Aug-09	108.968	153.14	Aug-12		100.32
Sep-09	143.904	137.66	Sep-12		110.62
Oct-09	168.373	154.37	Oct-12		119.68
Nov-09	150.782	142.14	Nov-12		101.41
Dec-09	110.634	141.92	Dec-12		94.15
Jan-10	133.155	114.39			
Feb-10	124.803	137.96			
Mar-10	149.258	157.93			

Table 4.22: Actual and Forecast values for prices of Multivoltine silk cocoon in Chintamani market

(Value in ₹/kg)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	149	.	Apr-01	131	113	Apr-04	135	134
May-98	170	.	May-01	137	141	May-04	124	137
Jun-98	162	.	Jun-01	142	135	Jun-04	113	129
Jul-98	172	.	Jul-01	146	149	Jul-04	104	118
Aug-98	166	.	Aug-01	141	138	Aug-04	115	99
Sep-98	157	.	Sep-01	125	136	Sep-04	102	109
Oct-98	160	.	Oct-01	105	128	Oct-04	89	96
Nov-98	174	.	Nov-01	127	109	Nov-04	116	99
Dec-98	164	.	Dec-01	133	128	Dec-04	114	115
Jan-99	170	.	Jan-02	126	146	Jan-05	125	122
Feb-99	166	.	Feb-02	112	122	Feb-05	127	123
Mar-99	156	.	Mar-02	108	107	Mar-05	132	126
Apr-99	119	.	Apr-02	114	97	Apr-05	129	137
May-99	118	140	May-02	93	121	May-05	128	128
Jun-99	120	110	Jun-02	94	94	Jun-05	138	135
Jul-99	123	130	Jul-02	99	100	Jul-05	127	142
Aug-99	118	117	Aug-02	105	90	Aug-05	117	125
Sep-99	114	109	Sep-02	101	100	Sep-05	111	114
Oct-99	114	117	Oct-02	94	102	Oct-05	124	104
Nov-99	99	128	Nov-02	93	98	Nov-05	142	133
Dec-99	119	89	Dec-02	82	96	Dec-05	165	138
Jan-00	139	125	Jan-03	101	95	Jan-06	177	174
Feb-00	130	135	Feb-03	108	96	Feb-06	147	180
Mar-00	118	120	Mar-03	103	105	Mar-06	141	146
Apr-00	127	81	Apr-03	115	101	Apr-06	132	147
May-00	129	139	May-03	127	119	May-06	136	132
Jun-00	130	126	Jun-03	150	129	Jun-06	118	144
Jul-00	134	138	Jul-03	147	156	Jul-06	131	118
Aug-00	112	129	Aug-03	136	138	Aug-06	137	130
Sep-00	110	106	Sep-03	142	131	Sep-06	137	134
Oct-00	113	112	Oct-03	134	140	Oct-06	116	131
Nov-00	122	115	Nov-03	139	142	Nov-06	104	128
Dec-00	107	126	Dec-03	126	139	Dec-06	122	101
Jan-01	118	120	Jan-04	124	136	Jan-07	122	130
Feb-01	117	112	Feb-04	134	120	Feb-07	133	124
Mar-01	129	107	Mar-04	132	134	Mar-07	135	133

Table 4.22: Contd……

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	135	139	Apr-10	211	194
May-07	135	134	May-10	215	212
Jun-07	130	138	Jun-10	214	216
Jul-07	112	128	Jul-10	195	208
Aug-07	111	113	Aug-10	216	203
Sep-07	116	107	Sep-10	231	216
Oct-07	100	112	Oct-10	247	223
Nov-07	108	115	Nov-10		257
Dec-07	110	112	Dec-10		268
Jan-08	121	120	Jan-11		276
Feb-08	123	119	Feb-11		277
Mar-08	105	124	Mar-11		274
Apr-08	116	106	Apr-11		279
May-08	110	117	May-11		281
Jun-08	126	111	Jun-11		283
Jul-08	119	124	Jul-11		276
Aug-08	141	119	Aug-11		291
Sep-08	139	138	Sep-11		290
Oct-08	130	135	Oct-11		287
Nov-08	156	141	Nov-11		297
Dec-08	166	166	Dec-11		312
Jan-09	166	175	Jan-12		317
Feb-09	162	162	Feb-12		318
Mar-09	168	161	Mar-12		318
Apr-09	167	168	Apr-12		325
May-09	175	168	May-12		329
Jun-09	165	173	Jun-12		330
Jul-09	152	164	Jul-12		320
Aug-09	177	155	Aug-12		339
Sep-09	164	177	Sep-12		339
Oct-09	172	155	Oct-12		342
Nov-09	160	180	Nov-12		348
Dec-09	190	171	Dec-12		366
Jan-10	190	198			
Feb-10	191	191			
Mar-10	191	189			

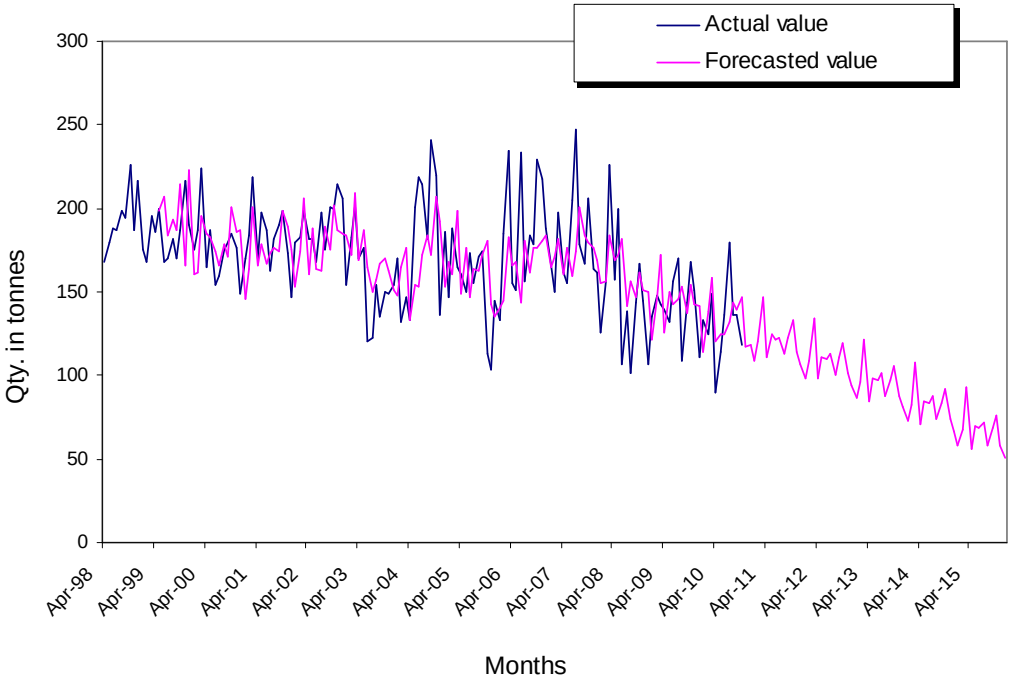

Fig. 4.33. Ex-ante and ex-post forecast of arrivals of Multivoltine silk cocoon in Chintamani market

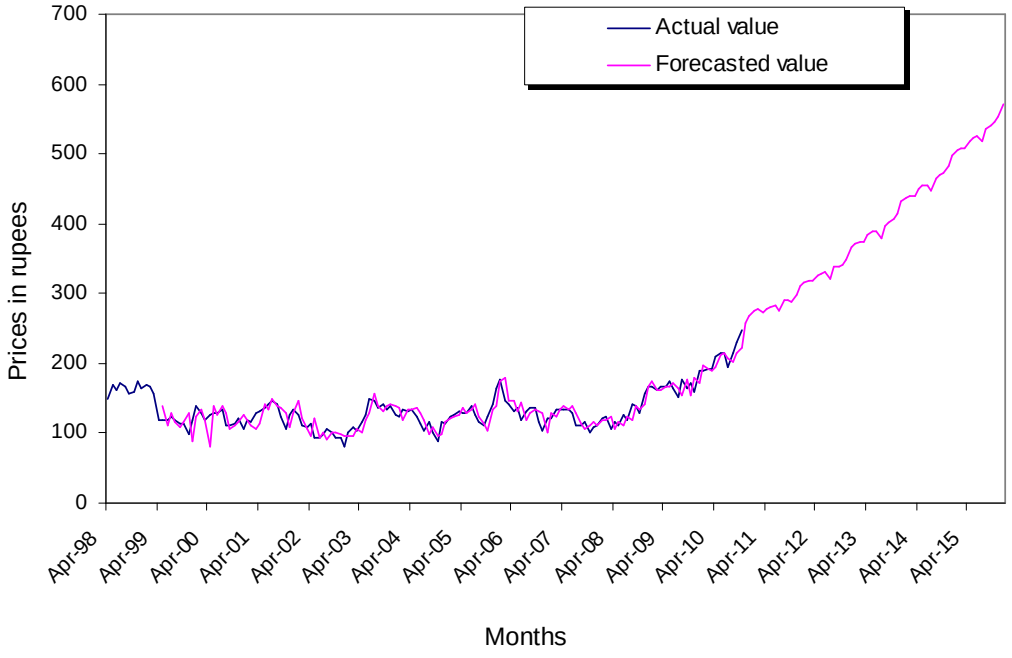

Fig. 4.34. Ex-ante and ex-post forecast of prices of Multivoltine silk cocoon in Chintamani market

Table 4.23: Actual and Forecast values for arrivals of Bivoltine silk cocoon in Chintamani market

(Value in tonnes)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	7.429	.	Apr-01	7.006	8.33	Apr-04	6.354	5.43
May-98	8.386	.	May-01	7.034	8.72	May-04	6.438	6.31
Jun-98	8.438	.	Jun-01	6.429	6.92	Jun-04	8.427	5.36
Jul-98	8.648	.	Jul-01	6.381	7.73	Jul-04	8.034	7.32
Aug-98	11.689	.	Aug-01	7.352	8.52	Aug-04	7.359	7.60
Sep-98	9.467	.	Sep-01	8.864	7.40	Sep-04	9.167	7.83
Oct-98	12.463	.	Oct-01	7.946	9.58	Oct-04	8.527	8.31
Nov-98	8.342	.	Nov-01	8.629	7.49	Nov-04	6.724	8.01
Dec-98	11.564	.	Dec-01	7.642	8.14	Dec-04	6.891	7.15
Jan-99	8.576	.	Jan-02	8.927	6.64	Jan-05	5.867	6.57
Feb-99	8.679	.	Feb-02	9.124	7.97	Feb-05	6.421	6.49
Mar-99	10.328	.	Mar-02	11.213	9.77	Mar-05	6.283	7.81
Apr-99	9.429	.	Apr-02	8.821	7.97	Apr-05	6.439	5.52
May-99	9.786	10.38	May-02	9.126	8.92	May-05	5.724	6.13
Jun-99	8.039	10.07	Jun-02	8.754	7.57	Jun-05	6.498	5.36
Jul-99	9.621	9.29	Jul-02	10.597	8.52	Jul-05	6.624	6.46
Aug-99	9.681	12.68	Aug-02	8.742	10.27	Aug-05	7.534	6.79
Sep-99	9.423	9.18	Sep-02	10.057	9.11	Sep-05	7.012	7.75
Oct-99	10.003	12.61	Oct-02	9.624	10.51	Oct-05	5.247	6.98
Nov-99	10.769	7.48	Nov-02	9.867	9.18	Nov-05	4.786	6.10
Dec-99	8.467	12.30	Dec-02	9.469	9.33	Dec-05	6.837	5.62
Jan-00	7.237	7.49	Jan-03	7.061	8.91	Jan-06	6.483	5.76
Feb-00	7.924	7.86	Feb-03	7.642	8.55	Feb-06	6.31	5.85
Mar-00	10.846	9.49	Mar-03	8.421	9.88	Mar-06	11.679	6.92
Apr-00	8.643	8.36	Apr-03	7.267	7.19	Apr-06	7.862	7.38
May-00	10.231	9.08	May-03	6.034	8.04	May-06	8.089	6.95
Jun-00	8.007	8.79	Jun-03	5.215	6.25	Jun-06	10.21	7.19
Jul-00	8.234	9.15	Jul-03	5.829	6.75	Jul-06	6.738	8.59
Aug-00	8.967	10.55	Aug-03	7.267	7.20	Aug-06	7.389	7.80
Sep-00	8.937	8.69	Sep-03	8.267	7.58	Sep-06	7.241	8.51
Oct-00	9.764	10.91	Oct-03	6.246	8.30	Oct-06	8.671	7.51
Nov-00	8.721	8.53	Nov-03	7.008	6.93	Nov-06	8.964	7.59
Dec-00	8.427	9.51	Dec-03	7.013	6.85	Dec-06	6.492	8.13
Jan-01	9.546	6.89	Jan-04	7.428	6.48	Jan-07	6.069	6.74
Feb-01	9.967	8.38	Feb-04	5.764	7.20	Feb-07	5.871	6.65
Mar-01	9.764	10.83	Mar-04	6.521	7.98	Mar-07	9.428	7.83

Table 4.23: Contd…..

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	6.837	7.18	Apr-10	6.137	6.48
May-07	6.869	6.78	May-10	6.739	6.60
Jun-07	8.649	7.17	Jun-10	7.431	7.00
Jul-07	12.561	7.64	Jul-10	8.954	7.83
Aug-07	8.639	9.76	Aug-10	6.237	7.20
Sep-07	8.831	9.15	Sep-10	6.714	7.16
Oct-07	9.104	8.52	Oct-10	5.481	7.53
Nov-07	8.246	8.36	Nov-10		6.33
Dec-07	8.431	8.34	Dec-10		5.62
Jan-08	6.389	7.85	Jan-11		5.29
Feb-08	7.064	7.23	Feb-11		5.80
Mar-08	9.721	9.55	Mar-11		7.64
Apr-08	7.631	7.79	Apr-11		5.98
May-08	8.643	7.69	May-11		6.00
Jun-08	7.068	8.84	Jun-11		6.33
Jul-08	7.692	7.95	Jul-11		7.21
Aug-08	6.439	7.99	Aug-11		5.83
Sep-08	7.026	7.79	Sep-11		6.40
Oct-08	8.461	7.55	Oct-11		6.81
Nov-08	8.037	7.66	Nov-11		6.41
Dec-08	5.492	7.45	Dec-11		5.31
Jan-09	6.237	5.95	Jan-12		5.05
Feb-09	7.824	6.30	Feb-12		5.54
Mar-09	8.346	9.34	Mar-12		7.23
Apr-09	7.628	6.77	Apr-12		5.59
May-09	6.735	7.28	May-12		5.70
Jun-09	7.038	7.62	Jun-12		6.08
Jul-09	8.496	8.01	Jul-12		7.05
Aug-09	6.218	7.52	Aug-12		5.47
Sep-09	7.394	7.32	Sep-12		6.03
Oct-09	8.927	7.59	Oct-12		6.20
Nov-09	8.061	7.67	Nov-12		5.98
Dec-09	5.934	7.19	Dec-12		4.94
Jan-10	6.342	5.91			
Feb-10	6.823	6.50			
Mar-10	7.629	8.85			

Table 4.24: Actual and Forecast values for prices of Bivoltine silk cocoon in Chintamani market

(Value in ₹/kg)

Months	Actual value	Forecast value	Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-98	182	.	Apr-01	166	147	Apr-04	158	164
May-98	193	.	May-01	169	170	May-04	150	157
Jun-98	194	.	Jun-01	173	176	Jun-04	141	158
Jul-98	208	.	Jul-01	176	169	Jul-04	134	142
Aug-98	188	.	Aug-01	167	169	Aug-04	128	131
Sep-98	194	.	Sep-01	149	171	Sep-04	116	125
Oct-98	184	.	Oct-01	131	145	Oct-04	111	110
Nov-98	206	.	Nov-01	150	138	Nov-04	134	119
Dec-98	184	.	Dec-01	162	147	Dec-04	137	133
Jan-99	206	.	Jan-02	150	180	Jan-05	144	149
Feb-99	197	.	Feb-02	138	147	Feb-05	142	142
Mar-99	178	.	Mar-02	128	128	Mar-05	150	137
Apr-99	145	.	Apr-02	138	126	Apr-05	151	159
May-99	142	156	May-02	115	143	May-05	156	154
Jun-99	154	143	Jun-02	120	121	Jun-05	150	164
Jul-99	135	168	Jul-02	124	118	Jul-05	143	149
Aug-99	138	115	Aug-02	127	116	Aug-05	140	139
Sep-99	140	144	Sep-02	124	127	Sep-05	141	137
Oct-99	137	130	Oct-02	116	119	Oct-05	146	138
Nov-99	127	159	Nov-02	115	127	Nov-05	158	154
Dec-99	142	105	Dec-02	110	112	Dec-05	184	156
Jan-00	161	164	Jan-03	137	122	Jan-06	190	192
Feb-00	160	152	Feb-03	134	133	Feb-06	201	192
Mar-00	141	141	Mar-03	129	130	Mar-06	164	197
Apr-00	154	108	Apr-03	147	131	Apr-06	168	171
May-00	159	160	May-03	166	148	May-06	146	169
Jun-00	161	165	Jun-03	182	172	Jun-06	142	149
Jul-00	157	162	Jul-03	175	182	Jul-06	150	139
Aug-00	145	147	Aug-03	168	169	Aug-06	156	146
Sep-00	144	150	Sep-03	166	164	Sep-06	152	152
Oct-00	144	138	Oct-03	168	159	Oct-06	134	150
Nov-00	157	153	Nov-03	166	179	Nov-06	143	146
Dec-00	140	151	Dec-03	158	167	Dec-06	162	146
Jan-01	148	162	Jan-04	154	167	Jan-07	164	170
Feb-01	144	143	Feb-04	167	149	Feb-07	162	167
Mar-01	160	126	Mar-04	157	162	Mar-07	152	157

Table 4.24. Contd…….

Months	Actual value	Forecast value	Months	Actual value	Forecast value
Apr-07	161	158	Apr-10	241	226
May-07	160	161	May-10	243	244
Jun-07	159	161	Jun-10	243	245
Jul-07	142	157	Jul-10	239	238
Aug-07	148	140	Aug-10	266	249
Sep-07	136	146	Sep-10	264	264
Oct-07	116	134	Oct-10	273	259
Nov-07	130	128	Nov-10		288
Dec-07	135	141	Dec-10		305
Jan-08	150	143	Jan-11		314
Feb-08	147	155	Feb-11		310
Mar-08	131	135	Mar-11		301
Apr-08	134	137	Apr-11		309
May-08	146	130	May-11		312
Jun-08	150	146	Jun-11		313
Jul-08	146	149	Jul-11		306
Aug-08	159	147	Aug-11		322
Sep-08	163	156	Sep-11		319
Oct-08	159	156	Oct-11		321
Nov-08	179	171	Nov-11		334
Dec-08	201	192	Dec-11		355
Jan-09	210	209	Jan-12		360
Feb-09	193	213	Feb-12		356
Mar-09	187	182	Mar-12		349
Apr-09	189	194	Apr-12		360
May-09	193	188	May-12		364
Jun-09	189	194	Jun-12		366
Jul-09	172	185	Jul-12		360
Aug-09	199	176	Aug-12		379
Sep-09	190	195	Sep-12		377
Oct-09	204	181	Oct-12		381
Nov-09	208	218	Nov-12		395
Dec-09	237	221	Dec-12		415
Jan-10	229	247			
Feb-10	224	229			
Mar-10	220	213			

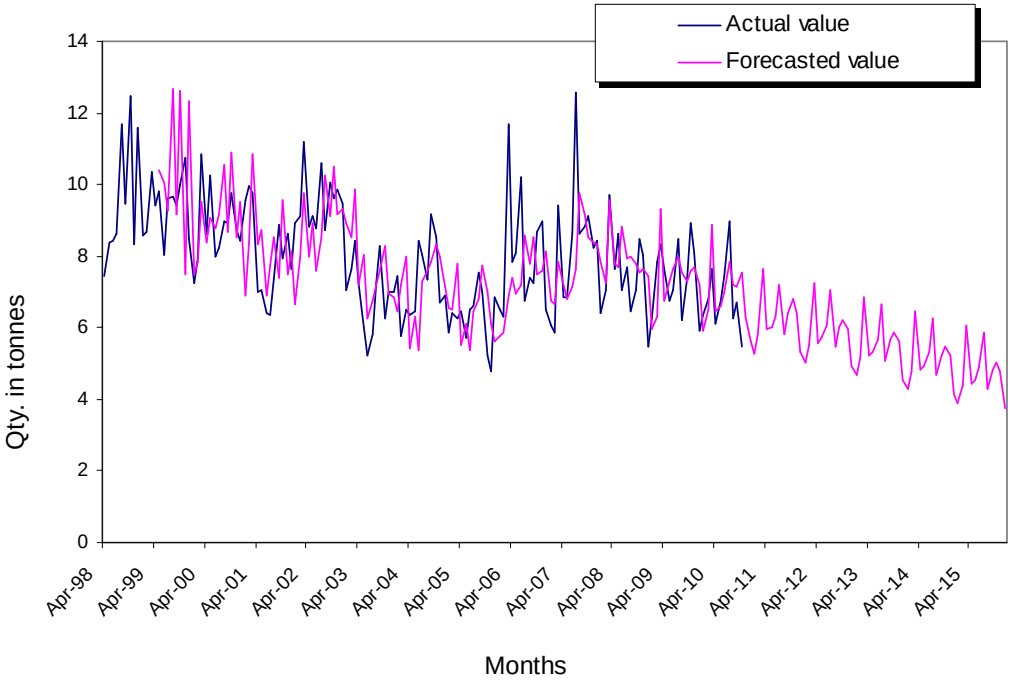

Fig. 4.35. Ex-ante and ex-post forecast of arrivals of Bivoltine silk cocoon in Chintamani market

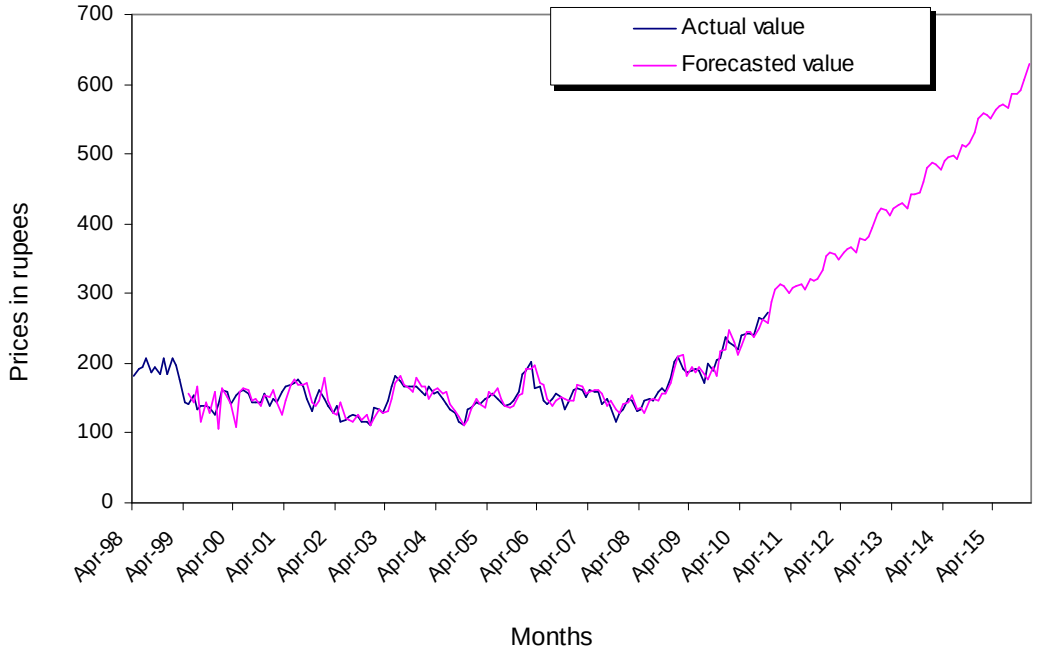

Fig. 4.36. Ex-ante and ex-post forecast of prices of Bivoltine silk cocoon in Chintamani market

Table 4.25: Zero order correlation of Multivoltine prices in selected markets

Markets	Ramanagara	Shidlagatta	Chintamani
Ramanagara	1	0.88**	0.86**
Siddlagatta		1	0.97**
Chintamani			1

Note: ** Correlation is significant at 1 per cent level (2-tailed)
* Correlation is significant at 5 per cent level (2-tailed)
NS- Non significant

Table 4.26: Zero order correlation of Bivoltine prices in selected markets

Markets	Ramanagara	Shidlagatta	Chintamani
Ramanagara	1	0.87**	0.88**
Siddlagatta		1	0.96**
Chintamani			1

Note: ** Correlation is significant at 1 per cent level (2-tailed)
* Correlation is significant at 5 per cent level (2-tailed)
NS- Non significant

5. DISCUSSION

Ramanagara, Shidlagatta and Chintamani markets were selected to study the fluctuation in silk cocoon arrivals and prices. The secondary data on monthly arrivals and prices of silk cocoons was collected for the study period from 1998 to 2010 from the respective markets. The data was subjected to different statistical tools and the results presented in the previous chapter are discussed under the following heads.

5.1 Behaviour of arrivals and prices of silk cocoon

5.2 Impact of silk cocoon arrivals on prices in the selected markets

5.3 Forecasting of arrivals and prices

5.4 Market integration among various silk cocoon markets

5.1 Behaviour of Arrivals and Prices of silk cocoon

5.1.1 Seasonal indices of Multivoltine silk cocoon arrivals and prices in selected markets

To analyze the arrival pattern of silk cocoon during different months of the year and their impact on price, seasonal indices are computed adopting 12 months centred moving averages. The seasonal variation in arrivals and prices of cocoon in the study markets are presented as follows.

The seasonal indices of monthly arrivals and prices of cocoon in Ramanagara, Shidlagatta and Chintamani markets are presented in Table 4.1 and Fig 4.1, 4.2, and 4.3 respectively.

Silk worm feeds on mulberry leaves, which is a perennial plant. From mulberry, around five to six harvests can be obtained in a year. The life cycle of silk worm would be around 22-24 days for Multivoltine silk worm depending upon climatic conditions like room temperature, humidity etc. then it stops feeding and starts spinning the cocoon. That cocoon is used for reeling silk.

The present study reveals that June and October months have accounted for maximum arrivals of Multivoltine cocoon in both Ramanagara and Shidlagatta markets. Here two peaks of arrival are observed, the first peak is in the month of June and second peak is in the month of October. In the case of Chintamani market, also two peaks were observed. First peak in June, and second peak was in January.

Similarly as it could be seen in Table 4.2 with regard to the Bivoltine silk cocoon arrivals in Ramanagara market the two peaks are obtained that is in January and March. In the case of Shidlagatta market two peaks of arrivals were noticed, first peak has in the month of June and second peak was in the month of October. In the case of Chintamani market, first peak was observed in June and second peak observed in January.

If Silk worm reared in hotter months, produce was less due to their susceptibility to diseases. Cocoon production will be more, when it has favourable conditions like low temperature accompanied by high humidity (Siddiqui *et al.,* 2001). Hence peak arrivals generally found in June, October and January in Multivoltine cocoon.

Since Ramanagara, Shidlagatta and Chintamani cocoon markets it is grown in irrigated region, hence the cocoon production will be more during that season. Hence the peak season of arrivals of all selected market coincides with the ideal months having favourable condition for cocoon production. With regard to the price of Multivoltine silk cocoon indices, it is higher during May and March in Ramanagara market, the reason might be the high quality and lower quantity of silk cocoon arrival. In Shidlagatta market, the highest price is in September and May which has lowest arrivals. In Chintamani market highest price indices was observed in April and September. Hence, arrivals were low in this market during those months in which prices are high. The price of cocoon is fixed by the reelers based on cocoon colour, weight, luster and quality and quantity.

In the case of prices of Bivoltine silk cocoon indices, in Ramanagara market highest price indices was observed in April and May. In Shidlagatta market highest price indices were observed in May and July. With regard to Chintamani market April and May months have highest price indices. This is because of lowest arrivals and highest quality of silk cocoon. Similar seasonal indices are obtained by Prabhakara (1988) while studying the behaviour of major cocoon markets in Karnataka *viz*. Ramanagara and Vijayapura.

5.1.2 Estimated trend equation for arrivals and prices of Multivoltine and Bivoltine silk cocoon in the selected markets

5.1.2.1 Estimated trend equation for arrivals and prices of Multivoltine silk cocoon in selected markets

As seen from the Table 4.3, in Ramanagara market, sixth degree polynomial trend equation was found to be best fit for arrivals of Multivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The sixth degree polynomial trend equation had a fairly good R^2 value of 0.44, which was statistically in-significant as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Multivoltine silk cocoon over years. In the case of prices of Multivoltine silk cocoon linear trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.35, which was statistically significant (at 5% level) as indicated by F value. The estimated equation indicated a positive trend in the prices of Multivoltine silk cocoon over years.

In Shidlagatta market, linear trend equation was found to be best fit for arrivals of Multivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.55, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Multivoltine silk cocoon over years. In the case of prices of Multivoltine silk cocoon quadratic trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.83, which was statistically significant (at 1% level) as indicated by F value. The estimated equation indicated a positive trend in the prices of Multivoltine silk cocoon over years.

In Chintamani market, linear trend equation was found to be best fit for arrivals of Multivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.54, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a negative trend in arrivals of Multivoltine silk cocoon over years. In the case of prices of Multivoltine silk cocoon qudratic trend equation was found to be best fit, as indicated by R^2 value that is 0.78, the trend was found to be statistically significant (at 1% level). The estimated equation indicated a positive trend in the prices of Multivoltine silk cocoon over years.

5.1.2.2 Estimated trend equation for in arrivals and prices of Bivoltine silk cocoon in selected markets

As seen from the Table 4.4, in Ramanagara market, sixth degree polynomial trend equation was found to be best fit for arrivals of Bivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The sixth degree polynomial trend equation had a fairly good R^2 value of 0.77, which was statistically in-significant as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Bivoltine silk cocoon over years. In the case of prices of Bivoltine silk cocoon linear trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.39, which was statistically significant (at 5% level) as indicated by F value. The estimated trend equation indicated a positive trend in the prices of Bivoltine silk cocoon over years.

In Shidlagatta market, linear trend equation was found to be best fit for arrivals of Bivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.36, which was statistically significant (at 5% level) as indicated by F value. The estimated trend equation indicated a positive trend in arrivals of Bivoltine silk cocoon over years. In the case of prices of Bivoltine silk cocoon qudratic trend equation was found to be best fit, as indicated by R^2 value.

The equation had a high R^2 value of 0.79, which was statistically significant (at 1% level) as indicated by F value. The estimated equation indicated a positive trend in the prices of Bivoltine silk cocoon over years.

In Chintamani market, linear trend equation was found to be best fit for arrivals of Bivoltine silk cocoon as compared to other functional forms, as indicated by R^2 value. The linear trend equation had a fairly good R^2 value of 0.47, which was statistically significant (at 1% level) as indicated by F value. The estimated trend equation indicated a negative trend in arrivals of Bivoltine silk cocoon over years. In the case of prices of Bivoltine silk cocoon qudratic trend equation was found to be best fit, as indicated by R^2 value. The equation had a high R^2 value of 0.77, which was statistically significant (at 1% level) as indicated by F value. The estimated equation indicated a positive trend in the prices of Bivoltine silk cocoon over years.

5.1.3 Cyclical variations in arrivals and prices of Multivoltine and Bivoltine silk cocoon in the selected markets

Cyclical trend in arrivals and prices of Multivoltine and Bivoltine silk cocoon in Ramanagara, Shidlagatta and Chintamani markets is presented in Table 4.5 and 4.6 and Fig. 4.19 to Fig 4.24.

In all the selected markets, in case of Multivoltine silk cocoon arrivals the average duration of cycles obtained for every 2.5 year to 3.66 years in the period of 13 years. Similarly in the case of prices it is found to be the cycles for every 2.5 years to 3.33 years. This is almost in accordance with cycles found in arrivals. This variation in the average duration of cycles is mainly because of weather and climatic conditions, pest and disease situations, market impact factors and such other parameters which are vary at regular intervals.

In all the selected markets, for Bivoltine silk cocoon arrivals the average duration of cycles obtained for once in every 3 years to 4 years in a period of 13 years. This variation in the average duration of cycles is mainly because of weather and climatic conditions, pest and disease situations, market impact factors and such other parameters which vary at regular intervals. In the case of prices also nearer to above cycles observed owing to the similar reasons.

Similar results were observed in George and Govindan (1975). It could be observed that there was a regular cycle in arrivals and prices of potato in Ahmadabad market.

5.2 Impact of Multivoltine and Bivoltine silk cocoon arrivals on prices in the selected markets

In order to ascertain the response of arrivals on prices of Multivoltine and Bivoltine silk cocoon in the selected markets, logarithmic regression was computed by taking into account the monthly total arrivals and average prices of Bivoltine silk cocoon for a period of 13 years (1998-2011).

5.2.1 The impact of Multivoltine silk cocoon arrivals on prices in the selected markets.

As could be seen from Table 4.7, the impact of arrivals on prices in the selected markets showed that, in all the markets the regression coefficient found to be positive. This indicated the positive impact of arrivals on prices. The R^2 value and regression co-efficient found to be significant. This positive may be because of heavy competition in the markets and also the government policies.

5.2.2 The impact of Bivoltine silk cocoon arrivals on prices in the selected markets.

As could be seen from Table 4.8, the impact of arrivals on prices in the selected markets showed that, in all the markets the regression coefficient found to be positive. This indicated the positive impact of arrivals on prices. The R^2 value and regression co-efficient found to be significant. This positive may be because of heavy competition in the markets and also the government policies.

5.3 Forecasts of arrivals and prices of silk cocoon in selected markets.

ARIMA model is an extrapolation method that requires only historical time series data on the variable under study. The Box-Jenkins approach primarily makes use of three types of filters, namely, the autoregressive, the integration and the moving average. The Box-Jenkins model provides a verified approach for identifying which filter are most appropriate for the series being analyzed, for diagnosing the accuracy and the reliability of the models that have been estimated and lastly, for forecasting.

ARIMA models are extensively used to study market fluctuations particularly of agricultural commodities. The main advantage of this class of models lies in its ability to quantify random variations present in many economic time series. Hence the data on prices of both Multivoltine and Bivoltine silk cocoon in the selected markets were subjected to ARIMA analysis to quantify the variation and also to predict the future prices of both Multivoltine and Bivoltine silk cocoon.

Since ARIMA model used only stationary series, there was a need to change the non-stationary series into stationary series by applying appropriate order of differencing to the series. Thereafter, the autocorrelation and partial autocorrelation coefficient of the working series were computed and confirmed the absence of trend component in the series. An examination of such tables revealed that this is justified by the autocorrelation function of the series dropping to zero after second or third lag.

5.3.1 Identification of the model

Identification of the model is the first step which involves a greater deal of skill. It is done based on conjunction of the sample Auto Correlation Function with the Partial Auto Correlation Function. Since the identification does not lay down any hard and fast principles, several possible models were tentatively identified and the model which yielded the best results was adopted.

Identification of the model is concerned with deciding the appropriate values of p, d, q, P, D and Q. It is done by observing Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) values. The Auto Correlation Function helps in choosing the appropriate values for ordering of moving average terms (MA) and Partial Auto-Correlation Function for those autoregressive terms (AR). The number of non-zero coefficients in ACF determines order of MA terms and the number of non-zero coefficients in PACF plots determines order of AR terms.

A perusal of the analysis of ACF and PACF revealed that, in all the price series of the selected markets, there was non-seasonal and seasonal moving average (MA) and Auto regressive (AR) terms of different orders.

5.3.2 Estimation of parameters

Having tentatively identified the model, next the parameters which minimize the sum of squares of error were estimated through iteration process. The estimated models for arrivals and prices of Multivoltine and Bivoltine silk cocoon in the selected markets are presented below.

1. Multivoltine arrivals in Ramanagara market:	(2, 1, 1) (2, 1, 1)
2. Multivoltine prices in Ramanagara market:	(0, 1, 0) (1, 1, 1)
3 Bivoltine arrivals in Ramanagara market:	(2, 1, 2) (1, 1, 1)
4. Bivoltine prices in Ramanagara market:	(0, 1, 0) (1, 1, 1)
5. Multivoltine arrivals in Shidlagatta market:	(2, 1, 1) (1, 1,1)
6. Multivoltine prices in Shidlagatta market:	(0, 1, 0) (2, 1, 1)
7. Bivoltine arrivals in Shidlagatta market:	(1, 1, 1)(1, 1, 1)
8. Bivoltine prices in Shidlagatta market:	(1, 1, 1) (2, 1, 1)

9. Multivoltine arrivals in Chintamani market: (1, 1, 1) (2, 1, 1)

10. Multivoltine prices in Chintamani market: (0, 1,0) (2, 1, 1)

11. Bivoltine arrivals in Chintamani market: (1, 1, 1) (1, 1, 1)

12. Bivoltine prices in Chintamani market: (0, 1, 0) (1, 1, 1)

The coefficients of estimated models were subjected to tests of significance. It could be observed that in all the selected markets non-seasonal MA and AR process were present. Thus, it could be concluded that all the price series under study are linearly related to both the previous year's error term and previous year values. Seasonal moving averages (MA) were found to be significant at 1 per cent probability level in Shidlagatta and Chintamani markets for both Multivoltine and Bivoltine silk cocoon arrivals. While seasonal term Auto Regressive (AR) in Ramanagara market was significant at one per cent for both Multivoltine and Bivoltine silk cocoon arrivals. Seasonal Moving Average (SMA) was found to be significant 1 per cent probability level for prices of both Multivoltine and Bivoltine silk cocoon in the selected markets. The estimated models are then subjected to diagnostic checking to validate the adequacy of the estimated model prior to carrying out forecasting. The results can be seen from the Annexure.

5.3.3 Diagnostic checking

The residual of estimated models were examined for testing the randomness of series and analyzed to determine the adequacy of the estimated models. Model verification is concerned with checking of the residuals of the model to see if they contain any systematic pattern, which can still be removed to improve the chosen ARIMA model. Seasonality was found and the forecast consideration was best. So these models were chosen.

The residual of the estimated models were found to be random in all cases as none of the coefficients were significantly different from zero which is also supported by the non-significance of Box-Pierce 'Q' statistics. These entire joint statistics approved that, all the tentatively identified and estimated models were found to be appropriate for forecasting the cocoon prices of the selected market. Ansari and Ahmed (2001) arrived at similar conclusions with the present study regarding validation of ARIMA modelling in their study on the world tea price.

5.3.4 Forecasting

The principal objective of ARIMA model for a variable is to generate post sample period forecast for the variable arrivals and price. Both the ex-ante and ex-post forecasted values obtained by the Box-Jenkins method. In Ramanagara market for Multivoltine arrivals and prices are presented in the Tables 4.11 and 4.12 respectively. Similarly for Bivoltine arrivals and prices, it could be seen from Table 4.13 and 4.14 respectively. In the case Shidlagatta market Multivoltine arrivals and prices are presented in Table 4.16 and 4.17 respectively. Similarly for Bivoltine silk cocoon arrivals and prices are presented in Table 4.18 and 4.19. In the same way for Chintamani market Multivoltine arrivals and prices are presented in Table 4.21 and 4.22 and for Bivoltine silk cocoon are presented in Table 4.23 and 4.24 respectively. The forecasts obtained from the various models were checked for their efficacy by comparing the forecasted values with the actual price values.

In all the markets the forecasted prices showed that, there would be increase in the prices in the future years. This would be due to the reason that there is an increase in the demand for the silk cocoon and decrease in production/arrivals of silk cocoon in the selected markets.

Similar model was used by Almemaychu Amera (2002), Punitha (2007) to forecast the prices and arrivals of agricultural commodities.

5.3.4.1 Forecasts of arrivals and prices of Multivoltine silk cocoon in Ramanagara market

The results of the ARIMA fitted to arrivals and prices in time series data yielded up to 50 lags (Table 4.11 and 4.12 for arrivals and prices respectively) and for each corresponding value of error autocorrelation coefficients, standard error were derived. Corresponding to each error autocorrelation coefficient, the standard error computed was varying from 0.81 to

0.84 for arrivals and.0.80 to 0.82 for prices. The overall significance was tested by using Box-Jenkins test statistics which showed that none of the error terms fell in the rejection region. Therefore it was concluded that error term was non-significant, implying that it is only random and hence the ARIMA model (2, 1, 1) (2, 1, 1) was found to be the best fit arrivals and model (0, 1, 0) (1, 1, 1) for prices of Multivoltine silk cocoon in Ramanagara market as could be seen in Table 4.9.

For the present study, ARIMA model was employed to forecast the arrivals and prices up to December 2012. Table 4.11 shows the actual and forecast values of monthly arrivals of Multivoltine silk cocoon. Table 4.12 shows the ex-ante and ex-post forecast of monthly prices of Multivoltine silk cocoon in Ramanagara market. In this market, it was observed that there was sudden decrease in arrivals and increase in both actual and predicted prices during 2008, because severe incidence of pest and diseases like Uzi fly, Flacherie and Muscardine diseases in this region. The month-wise arrivals showed a decreasing trend but in case of prices both actual and predicted prices shows an increasing trend for coming years. Due to Industrialisation in this region, the maximum land is used to industrial purposes, labour problem in this region, heat problem during summer, due to these problems the mulberry cultivation decreases in turn the arrivals of silk cocoon in this market decreases. The decrease in arrivals on one hand and increase in demand for silk cocoon on the other has resulted in decrease in arrivals, which leads to increase in prices.

5.3.4.2 Forecasts of arrivals and prices of Bivoltine silk cocoon in Ramanagara market.

The results of the ARIMA fitted to arrivals and prices time series data which yielded up to 50 lags (Table 4.13 and 4.14 for arrivals and prices respectively) and for each corresponding value of error autocorrelation coefficients, standard error were derived. Corresponding to each error autocorrelation coefficient, the standard error computed was varying from 0.79 to 0.81 for arrivals and 0.78 to 0.80 for prices. The overall significance was tested by using Box-Jenkins test statistics which showed that none of the error terms fell in the rejection region. Therefore it was concluded that error term was non-significant, implying that it is only random and hence the ARIMA model (2, 1, 2) (1, 1, 1) was found to be the best fit arrivals and model (0, 1, 0) (1, 1, 1) for prices of Bivoltine silk cocoon in Ramanagara market as could be seen in Table 4.9.

For the present study, ARIMA model was employed to forecast the arrivals and prices up to December 2012. Table 4.13 shows the actual and forecast values of monthly arrivals of Bivoltine silk cocoon. Table 4.14 shows the ex-ante and ex-post forecast of monthly prices of Bivoltine silk cocoon in Ramanagara market. In this market, it was observed that there was sudden decrease in arrivals and increase in prices during 2008, because the severe incidence of pest and diseases like Uzi fly, Flacherie and Muscardine diseases in this region. The month-wise the arrivals shows an ups and downs but in case of prices increasing both actual and predicted price for coming years due to the Industrialisation in this region, the maximum land is used for the industrial purposes, labour problem in this region, heat problem during summer, non availability of DFL's, leads to decrease in arrivals to this market. The decrease in arrivals leads to the increase in demand for silk cocoon, it finally leads to increase in prices of silk cocoon.

5.3.4.3 Forecasts of arrivals and prices of Multivoltine silk cocoon in Shidlagatta market

The results of the ARIMA fitted to arrivals and prices time series data which yielded up to 50 lags (Table 4.16 and 4.17 for arrivals and prices respectively) and for each corresponding value of error autocorrelation coefficients, standard error were derived. Corresponding to each error autocorrelation coefficient, the standard error computed was varying from 0.80 to 0.81 for arrivals and 0.81 to 0.82 for prices. The overall significance was tested by using Box-Jenkins test statistics which showed that none of the error terms fell in the rejection region. Therefore it was concluded that error term was non-significant, implying that it is only random and hence the ARIMA model (2, 1, 1) (1, 1, 1) was found to be the best fit arrivals and model (0, 1, 0)(2, 1, 1) for prices of Multivoltine silk cocoon in Shidlagatta market as could be seen in Table 4.9.

For the present study, ARIMA model was employed to forecast the arrivals and prices up to December 2012. Table 4.16 shows the actual and forecast values of monthly arrivals of Multivoltine silk cocoon. Table 4.17 shows the actual and forecast values of monthly prices of Multivoltine silk cocoon in Shidlagatta market. In this market, it was observed that there was sudden increase in arrivals and prices during 2006, because of the government policies and good crop conditions. The month-wise arrivals shows an decreasing but in case of prices both actual and predicted prices shows increasing for coming years, because this region recently becoming industrial area due to the establishment of Industrial Airport in Devanahalli, and also labour problem , shortage of irrigation water, heat problem during summer season, and frequent pest and disease problems like Uzi fly, Grassierie, Flacherie, and Muscardine diseases due to these problems, the silk cocoon arrivals decreases, it leads to the increase demand for silk cocoon in market increase, as a result prices of cocoon increases.

5.3.4.4 Forecasts of arrivals and prices of Bivoltine silk cocoon in Shidlagatta market

The results of the ARIMA fitted to arrivals and prices time series data which yielded up to 50 lags (Table 4.18 and 4.19 for arrivals and prices respectively) and for each corresponding value of error autocorrelation coefficients, standard error were derived. Corresponding to each error autocorrelation coefficient, the standard error computed was varying from 0.83 to 0.84 for arrivals and 0.82 to 0.84 for prices. The overall significance was tested by using Box-Jenkins test statistics which showed that none of the error terms fell in the rejection region. Therefore it was concluded that error term was non-significant, implying that it is only random and hence the ARIMA model (1, 1, 1) (1, 1, 1) was found to be the best fit arrivals and model (1, 1, 1)(2, 1, 1) for prices of Bivoltine silk cocoon in Shidlagatta market as could be seen from Table 4.9.

For the present study, ARIMA model was employed to forecast the arrivals and prices up to December 2012. Table 4.18 shows the ex-ante and ex-post forecast values of monthly arrivals of Bivoltine silk cocoon. Table 4.19 shows the ex-ante and ex-post forecast of monthly prices of Bivoltine silk cocoon in Shidlagatta market. In this market, it was observed that there was sudden increase in arrivals and also prices during 2006, because of the government policies and good crop conditions. The month-wise the arrivals shows an decreasing but in case of prices increasing both actual and predicted price for coming years because this region recently becoming industrial are due to the establishment of International Airport in Devanahalli. Other problems are, labour problem, shortage of irrigation water, heat problem during summer season, frequent attack of pest and diseases, lack of separate rearing room, shortage of rearing equipments due these problems the arrivals of silk cocoon to this market decrease, it leads to increase in demand for cocoon in the market, as the demand increases, the prices of cocoon increases.

5.3.4.5 Forecasts of arrivals and prices of Multivoltine silk cocoon in Chintamani market

The results of the ARIMA fitted to arrivals and prices time series data which yielded up to 50 lags (Table 4.21 and 4.22 for arrivals and prices respectively) and for each corresponding value of error autocorrelation coefficients, standard error were derived. Corresponding to each error autocorrelation coefficient, the standard error computed was varying from 0.82 to 0.84 for arrivals and 0.81 to 0.83 for prices. The overall significance was tested by using Box-Jenkins test statistics which showed that none of the error terms fell in the rejection region. Therefore it was concluded that error term was non-significant, implying that it is only random and hence the ARIMA model (1, 1, 1) (2, 1, 1) was found to be the best fit arrivals and model (0, 1, 0) (2, 1, 1) for prices of Multivoltine silk cocoon in Chintamani market as could be seen from Table 4.9.

For the present study, ARIMA model was employed to forecast the arrivals and prices up to December 2012. Table 4.21 shows the ex-ante and ex-post forecast values of monthly arrivals of Multivoltine silk cocoon. Table 4.22 shows the ex-ante and ex-post forecast values of monthly prices of Multivoltine silk cocoon in Chintamani market. In this market, it was observed that there was decreasing in arrivals and increase in both actual and predicted the prices. The month-wise arrivals shows an decreasing but in case of prices both actual and predicted prices shows increasing for coming years because in this region the main problem is the shortage of irrigation water, non availability of labour, heat problem during summer, season, lack of separate rearing room, frequent attack of pest and diseases such as Uzi fly,

Grasseri, Flachri and Muscardine diseases due to these problems the arrivals of cocoon to this market decreases, it leads to the increase in demand for cocoon in this market, as the demand for cocoon increases the prices of cocoon increases.

5.3.4.6 Forecasts of arrivals and prices of Bivoltine silk cocoon in Chintamani market

The results of the ARIMA fitted to arrivals and prices time series data which yielded up to 50 lags (Table 4.23 and 4.24 for arrivals and prices respectively) and for each corresponding value of error autocorrelation coefficients, standard error were derived. Corresponding to each error autocorrelation coefficient, the standard error computed was varying from 0.83 to 0.85 for arrivals and 0.81 to 0.83 for prices. The overall significance was tested by using Box-Jenkins test statistics which showed that none of the error terms fell in the rejection region. Therefore it was concluded that error term was non-significant, implying that it is only random and hence the ARIMA model (1, 1, 1) (1, 1, 1) was found to be the best fit arrivals and model (0, 1, 0) (1, 1, 1) for prices of Bivoltine silk cocoon in Chintamani market as could be seen from Table 4.9.

For the present study, ARIMA model was employed to forecast the arrivals and prices up to December 2012. Table 4.23 shows the ex-ante and ex-post forecast values of monthly arrivals of Bivoltine silk cocoon. Table 4.24 shows the ex-ante and ex-post forecast of monthly prices of Bivoltine silk cocoon in Chintamani market. In this market, it was observed that there was decrease in arrivals and increases in prices. The month-wise the arrivals shows an decreasing but in case of prices increasing both actual and predicted price for coming years, Because in this region the main problem is the shortage of irrigation water, non availability of labour, heat problem during summer season, lack of separate rearing room, frequent attack of pest and diseases such as Uzi fly, Grasserie, Flacherie and Muscardine diseases, due to these problems the arrivals of silk cocoon to this market decrease, it leads to increase in demand for cocoon in this market, as the demand increases the prices also increases.

5.4 Market integration among selected silk cocoon markets

5.4.1 Zero order correlation of Multivoltine and Bivoltine silk cocoon prices in selected markets

Market integration is a very useful concept which shows to what extent two markets are integrated in terms of the variations in prices. It also measures the inter-relationship between the prices in different markets. Since price is the major parameter which influences the quantity of arrivals at different markets and thereby helps in integration of markets.

To ascertain the integration of markets for the present study, zero order correlation matrix was computed considering the selected three selected silk cocoon markets. Table 4.25 and Table 4.26 clearly signifies that the prices of Multivoltine and Bivoltine silk cocoon in Shidlagatta market were influenced by the price in Chintamani market to a very high degree.

Ramanagara is the major market for silk cocoon in Karnataka. It can be considered as price leader for the silk cocoon in the state. Shidlagatta is very nearby market to Chintamani. Hence price signal of Shidlagatta market easily travels to Chintamani market. Hence there is high degree of co-integration between these markets. These two markets are highly co-integrated with Ramanagara market. Ramanagara market is the leader market.

Ramanagara market price influenced the Shidlagatta and Chintamani market prices almost to the same degree. This might be due to the price competition occurring between these markets. Low degree of association was found between Ramanagara and Chintamani markets, this may be attributed to lack of dissemination of market information between these markets and the distance between these two markets is high.

This clearly indicated that, the prices of silk cocoon were governed not only based on arrivals but also of factors like prices prevailing in other major markets, transportation and communication network in the given market. This might be due to the movement of produce from one market to another, depending upon price prevailed in different markets. The competitive conditions prevailing in the selected markets might have also influenced the movement of prices in the same direction.

6. SUMMARY AND POLICY IMPLICATIONS

In recent years sericulture has emerged as one of the potential enterprises for generating continues income and employment opportunities in rural areas and semi urban masses. It is an important agro based rural cottage industry, which covers the gamut of sericulture activities like mulberry cultivation, silkworm rearing and cocoon production, silk reeling and other post cocoon production stages. Sericulture is not new to India as references have been made in the epics of the Ramayana and Mahabharata. Silk cloth is considered as the ''Queen of textiles''.

India has the unique distinction of producing all the four types of silk *viz.*, mulberry, tasar, muga and eri. Among them, mulberry silk is predominant and accounts for 88 % of the total natural silk produced in India. Mulberry silkworm (*Bombyx mori* L.) is a domesticated and commercially exploited species reared in over 30 countries. Mulberry silk is produced from silk worm (*Bombyx mori.L*) which feeds on mulberry leaves. Silk worm rearing is location specific, a temperature ranging from 70^0 F to 85^0 F, humidity in the range of 60 to 80 per cent and the rainfall of about 600 mm found suitable. Based on voltanism silk cocoon is divided in to Bivoltine and Multivoltine silk cocoon. Multivoltine Silkworms produce the cocoon in 22-23 days and Bivoltine silk worm produces silk cocoon in 26-27days, after which worms spin cocoons. Popular Bivoltine breeds reared in South India are Kalimpong-A, NB7, NB4D2, NB18, Nandi, CSR2, CSR4, CSR5, CSR6, NP2 and popular Multivoltine breeds reared in South India are C-nichi, Pure Mysore, Hosa Mysore, MY1, MH1, Nistari, BL24, SLKSPM, etc.

In global market, silk accounts for only 0.2 per cent of the total world production of all textile fibres. India is the second largest producer of silk in the world, next to China and has a 12per cent share in the global raw silk production. Silk production has increased from about 4,000 tonnes in 1980 to about 16,322 metric tonnes in 2010-11, (Centre for Industrial and Economic Research, 2010).

Karnataka ranks first in production followed by Andhra Pradesh and West Bengal with 8,240.00, 4,485.32 and 1,660.36 metric tonnes respectively. Out of the total production, about 55 per cent is accounted by Karnataka.

Karnataka accounts for 25per cent of the country's silk export. Silk knit fabrics could contribute 5-10 per cent to the total export of silk materials, currently worth ₹ 1,500 crores from the country. There is demand for the Indian silk items from America, Spain, Germany, Italy and East Europe. 75 per cent of the Indian production was used domestically and only 25per cent is exported. The major destinations of Indian silk cocoon are USA, UK, UAE, Italy and Germany which accounted for the 23.2 per cent, 14.2 per cent, 7.9 per cent , 6.4 per cent and 5 per cent respectively of the total export earnings.

Sericulture being a small scale enterprise provides ample opportunity to reach target groups especially small and marginal farmers. It has the advantage of addressing simultaneously and rapidly towards several development priorities. Sericulture provides, employment and income generation in rural areas , high participation of low income and target social groups, good comparative advantage and growth prospects, potential for export earnings, providing a greater role for development, and good downstream employment impact of raw silk production on the industrial sector. All these combined features make sericulture an attractive sector for further development.

The major problem faced by the silk industry is price instability in the cocoon and raw silk markets. This is accentuated by the seasonal production of cocoons, which means that there are periods when farmers and reelers have no work at all in some seasons. If price instability is reduced, the gains could be increased to considerable extent and it has a very high degree of backward and forward linkages as it encompass both agriculture and industry. Though sericulture plays an important role in Indian economy, there exists a serious problem of fluctuation in silk cocoon prices in markets.

Large fluctuations in the prices of a commodity may result in switching over of the farmers to some other remunerative crops. On the other hand, stable price level of the commodity provides incentives to the producers to increase the production of that commodity.

The present study was conducted to study the behaviour of arrivals and prices of silk cocoon by selected three major markets of silk cocoon in Karnataka with the following objectives.

- To study the temporal movement of prices and arrivals of silk cocoon in selected markets of Karnataka.
- To analyse the impact of arrivals on prices in the different races of silk cocoon.
- To forecast the prices of silk cocoon in selected markets.
- To examine the market integration among the different races of silk cocoon in the selected markets.

Methodology

For the present study, selection of major markets for silk cocoon was done on the basis of maximum quantity of arrivals for the markets. Later looking into the average arrivals in different markets, the top three major silk cocoon markets were selected. The three major silk cocoon markets were namely Ramanagara, Shidlagatta and Chintamani markets. The secondary data on time series for monthly arrivals and prices of silk cocoon were collected from the register maintained in the respective Government silk cocoon markets for a period of 13 years from 1998-99 to 2010-11. And later these data was subjected various statistical analysis.

A multiplicative model of time series was used to analyze the behaviour of arrivals and prices for selected markets. To study the trend, the method of linear, different degree polynomial trend line method was employed. Twelve months ratio to moving average method was used for the purpose of estimating seasonal indices and residual method was employed to study the cyclical changes. Logarithmic regression analysis was carried out to ascertain the response of prices to given changes in the arrivals of silk cocoon. And to forecast the future prices of silk cocoon in the selected markets, ARIMA also called Box-Jenkins model was applied. To analyze the spatial integration of prices and arrivals between the selected markets, zero order correlation matrix was employed.

Findings of the study

Seasonal indices

In silk cocoon arrivals, the presence of seasonality was observed within a year in the selected markets. The seasonal indices of arrivals of Multivoltine silk cocoon in Ramanagara and Shidlagatta markets revealed that arrivals were at their peak during June and October, in Chintamani market it was in the month of June and January. In all the markets highest Multivoltine silk cocoon arrivals were observed to be in month of June. Lowest arrivals were observed in the month of November in Ramanagara market, July in Shidlagatta market, April for Chintamani market. With respect to prices of Multivoltine silk cocoon in Ramanagara market it is observed in May and March, for Shidlagatta market it was noticed in September and may, for Chintamani market it was observed in April and September, where the seasonal indices of arrivals is low.

In the same way seasonal indices of arrivals of Bivoltine silk cocoon in Ramanagara market revealed that arrivals were at their peak during January and March, for Shidlagatta market it was June and October and for Chintamani market it was in the month of June and January. Lowest arrivals were observed in the month of August in Ramanagara market, July in Shidlagatta market, April for Chintamani market. With respect to prices of Bivoltine silk cocoon in Ramanagara market it is noticed peak in April and May, for Shidlagatta market it was noticed in May and July, for Chintamani market it was observed in April and May, where the seasonal indices of arrivals is low.

Trend

The pattern of trend in arrivals and prices of silk cocoon was similar in all the markets. The results revealed that in the long run all the markets showed an increasing trend in arrivals and prices of both Bivoltine and Multivoltine silk cocoon over the years. The fluctuations in arrivals and low increase in prices of both Bivoltine and Multivoltine silk cocoon was observed in all selected markets. The extent of fluctuations in arrivals and increasing prices of silk cocoon varied from one market to another market.

Cyclical trend

In the case of Multivoltine silk cocoon, the average cycles was found to be once in 2.5 to 3.66 years per cycle for 13 years in selected markets. In Ramanagara market the cycle was observed for every 3.66 and 3.33 years for Multivoltine arrival and prices respectively. For every 3.66 and 3 years the cycle for Multivoltine arrivals and prices in Shidlagatta market, in the same way for every 2.5 and 3 years every cycle observed for Multivoltine silk cocoon arrivals and prices in Chintamani market.

In the case of Bivoltine silk cocoon, the average cycles was found to be once in 3 to 4 years per cycle for 13 years in selected markets. In Ramanagara market the cycle was observed for every 4 and 3.33 years for Bivoltine arrival and prices respectively. For every 2.33 and 3 years the cycle for Bivoltine arrivals and prices in Shidlagatta market, in the same way for every 2.33 and 3 years for every cycle observed for Bivoltine silk cocoon arrivals and prices in Chintamani market.

Regression analysis

To ascertain the impact of arrivals on prices of silk cocoon in the selected markets a logarithmic regression was computed. This was done for analyzing the arrivals impact on prices for the logarithmic regression method is used.

In the logarithmic regression analysis there was a positivee impact of arrivals on prices of both Multivoltine and Bivoltine silk cocoon in all the selected markets *i.e.* for every one unit change in arrivals, there was substantial increase in the prices of Multivoltine silk cocoon in all the selected markets. The R^2 value and regression co-efficient found to be significant. This is because of high demand for silk cocoon, high competition in the selected markets and also the government policies.

Forecasting

ARIMA: Auto Regressive Integrated Moving Average model

ARIMA (Box Jenkins model) model was employed to predict the future arrivals and prices of both Multivoltine and Bivoltine silk cocoon in the selected markets.

In Ramanagara market, the arrivals of Multivoltine silk cocoon during 2010-2011 will be as high as 1006.53 tonnes and as less as 824.62 tonnes. By 2012, the arrivals may go to be as high as 985.9tonnes and as less as 626.2 tonnes for Multivoltine silk cocoon, owing to the existing unfavorable policies which will be decreased. In the case of prices of Multivoltine during 2010-2011the prices will be high around ₹217 per Kg and less around ₹174 per Kg. In 2012 prices will be high that is ₹ 338 per Kg and as less as ₹ 291 per Kg. This indicated an increase in price due to decrease in arrivals in the coming years.

The arrivals of Bivoltine silk cocoon in the market during 2010-2011 will be as high as 198.367 tonnes and as less as 78.932tonnes. By 2012, the arrivals will be increased as high as 187.63tonnes and as less as 93.46tonnes of Bivoltine silk cocoon. In the case of prices of Bivoltine during 2010-2011, the prices will be high around ₹275 per Kg and less around ₹208 per Kg. Similarly the forecast prices will be as high as ₹ 407 per Kg and as less as ₹ 352 per Kg in Ramanagara market during 2012.

In Shidlagatta market, the arrivals of Multivoltine silk cocoon during 2010-2011 will be as high as 1240.04 tonnes and as less as 843.89 tonnes. By 2012 the arrivals will be high as 1253.3 tonnes and less as 922.4tonnes for Multivoltine silk cocoon which showed significance. In the case of prices of Multivoltine during 2010-2011the prices is high around ₹239 per Kg and less around ₹171 per Kg. Similarly the prices will be as high as ₹344 per Kg and as low as ₹296 per Kg in Shidlagatta market during 2012.

The arrivals of Bivoltine silk cocoon during 2010-2011 will be as high as 30.149 tonnes and as less as 20.579 tonnes. By 2012, the arrivals will be as high as 24.89tonnes and as less as 18.74tonnes for Bivoltine silk cocoon. In the case of prices of Bivoltine during 2010-2011, the prices will be high around ₹267 per Kg and less around ₹198 per Kg, similarly prices will be as high as ₹374 per Kg and as less as ₹ 326 per Kg for Bivoltine silk cocoon in Shidlagatta market during 2012.

The arrivals of Multivoltine silk cocoon during 2010-2011 will be as high as 179.267 tonnes and as less as 89.629 tonnes. By 2012, the arrivals will be as high as 134.26tonnes and as less as 93.15tonnes for Multivoltine silk cocoon. In the case of prices of Multivoltine during 2010-2011, the prices will be high around ₹247 per Kg and less around ₹160 per Kg. Similarly the prices will be as high as ₹366 per Kg and as low as ₹ 317 per Kg in Chintamani market during 2012.

The arrivals of Bivoltine silk cocoon in the market during 2010-2011 will be as high as 8.954 tonnes and as less as 5.91 tonnes. By 2012, the arrivals will be as high as 7.23tonnes and as less as 4.94tonnes for Bivoltine silk cocoon. In the case of prices of Bivoltine during 2010-2011, the prices will be high around ₹273 per Kg and less around ₹208 per Kg. Similarly the prices will be as high as ₹415 per Kg and as less as ₹349 per Kg for Bivoltine silk cocoon in Chintamani market during 2012.

Market Integration

Integration of markets with respect to prices in the major market was also analyzed and the results revealed that Shidlagatta market would influence the prices in Chintamani market to a greater extent. This would be due to the fact that Shidlagatta market is nearest market to Chintamani, due to this price signals are easily transferred to Chintamani market. Ramanagara market is the major referral market to both Shidlagatta and Chintamani market. Hence the price signals are easily transferred from Ramanagara market to Shidlagatta and Chintamani market.

POLICY IMPLICATIONS

- Seasonal indices of prices as well as forecast prices indicated that, the prices were high during the month of April and May. Hence producers may be advised to plan to rear more silk worm in these months by adopting controlled temperature and humidity.
- Cyclical fluctuations in market arrivals and prices were found to be every three or four years in case of Bivoltine silk cocoon. Hence, farmers need to have considered the cycles while making decisions for production and marketing.
- The trend in arrivals of silk cocoon is very low over the last ten years in some markets and increasing in some markets. Therefore stable import and export policy towards silk yarn needs to be undertaken by the government.
- ARIMA model results revealed that generally the arrivals will be going to be higher in the month of March in Ramanagara market for Multivoltine. However prices predicted to be higher in October to December. Hence farmers are advised to sell the Multivoltine cocoon in Ramanagara market. However arrivals in Shidlagatta market predicted to be higher during July and November. However prices are higher during November and December. Similarly in Chintamani market it is same as Ramanagara market. Therefore farmers are advised to consider these months for better prices.

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APPENDIX I

Conditional least square estimates of arrivals of Multivoltine silk cocoon in Ramanagara market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
AR1	-0.93	0 .21	-4.25	0 .00003
AR2	-0.39	0 .085	-4.59	0 .000009
MA1	-0.57	0.23	-2.50	0 .013
SAR1	-0.22	0.17	-1.29	0 .19
SAR2	-0.20	0.12	-1.64	0.10
SMA1	0.50	0 .17	2.79	0 .005
CONSTANT	-0.72	3.48	-0.20	0.83

AR- Autoregressive
MA- Moving Average
SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX II

Conditional least square estimates of Prices of Multivoltine silk cocoon in Ramanagara market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
SAR1	0.03	0.12	0.27	0 .78
SMA1	0.79	0.11	6.59	0.000
CONSTANT	0.35	0 .31	1.10	0.27

SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX III

Conditional least square estimates of arrivals of Bivoltine silk cocoon in Ramanagara market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
AR1	-0.42	0 .11	-3.53	0.0005
AR2	0 .46	0.11	3.85	0.0001
MA1	-0.11	0.34	-0.33	0 .74
MA2	0.88	0 .31	2.82	0.005
SAR1	-0.23	0 .15	-1.51	0.13
SMA1	0.47	0.15	2.97	0.003
CONSTANT	0.049	0 .21	0.22	0.82

AR- Autoregressive
MA- Moving Average
SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX IV

Conditional least square estimates of prices of Bivoltine silk cocoon in Ramanagara market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
SAR1	0.03	0.12	0.23	0.81
SMA1	0.81	0.12	6.53	0.000
CONSTANT	0.44	0.30	1.45	0.14

SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX V

Conditional least square estimates of arrivals of Multivoltine silk cocoon in Shidlagatta market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>Itl
AR1	0.23	-0 .11	2.04	0.04
AR2	0.04	0.10	0.43	0.66
MA1	0.84	0.07	10.87	0.000
SAR1	0.04	0.13	0.33	0.74
SMA1	0.74	0.12	6.19	0.00
CONSTANT	-0.50	1.14	-0.44	0.65

AR- Autoregressive
MA- Moving Average
SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX VI

Conditional least square estimates of prices of Multivoltine silk cocoon in Shidlagatta market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>Itl
SAR1	-0.32	0.19	-1.66	0.09
SAR2	-0.07	0.15	-0.45	0.64
SMA1	0.54	0.18	2.86	0.004
CONSTANT	0.39	0.41	0.93	0.35

SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX VII

Conditional least square estimates of arrivals Bivoltine silk cocoon in Shidlagatta market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>Itl
AR1	0.22	0.11	1.92	0.05
MA1	0.79	0.07	11.01	0.00
SAR1	0.08	0.11	0.77	0.44
SMA1	0.97	0.57	1.69	0.09
CONSTANT	-0.01	0.02	-0.58	0.56

AR- Autoregressive
MA- Moving Average
SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX VIII

Conditional least square estimates of prices of Bivoltine silk cocoon in Shidlagatta market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>Itl
AR1	0.13	0.38	0.35	0.72
MA1	0.35	0.37	0.94	0.34
SAR1	-0.14	0.171	-0.81	0.41
SAR2	-0.02	0.13	-0.14	0.88
SMA1	0.68	0.16	4.12	0.00006
CONSTANT	0.40	0.29	1.38	0.16

AR- Autoregressive
MA- Moving Average
SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX IX

Conditional least square estimates of arrivals of Multivoltine silk cocoon in Chintamani market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
AR1	0.30	0.09	3.32	0.001
MA1	0.92	0.04	21.13	0.00
SAR1	-0.07	0.12	-0.57	0.56
SAR2	-0.02	0.10	-0.26	0.79
SMA1	0.93	0.28	3.27	0.001
CONSTANT	-0.08	.075	-1.07	0.28

AR- Autoregressive
MA- Moving Average
SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX X

Conditional least square estimates of prices of Multivoltine silk cocoon in Chintamani market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
SAR1	-0.36	0.16	-2.26	0.025
SAR2	-0.19	0.13	-1.51	0.13
SMA1	0.56	0.16	3.41	0.0008
CONSTANT	0.44	0.35	1.26	0.20

SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX XI

Conditional least square estimates of arrivals of Bivoltine silk cocoon in Chintamani market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
AR1	0.19	0.11	1.70	0.08
MA1	0.81	0.07	11.62	0.00
SAR1	-0.14	0.11	-1.26	0.20
SMA1	0.74	0.10	7.14	0.00
CONSTANT	-0.001	0.008	-0.14	0.88

AR- Autoregressive
MA- Moving Average
SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

APPENDIX XII

Conditional least square estimates of prices of Bivoltine silk cocoon in Chintamani market

Parameter	Estimater	Std.Error	t-value	Approximate Pr>ltl
SAR1	-0.22	0.11	-1.89	0.06
SMA1	0.65	0.11	5.62	0.00
CONSTANT	0.48	0.36	1.33	0.18

SAR- Seasonal Autoregressive
SMA- Seasonal Moving Average

BEHAVIOUR OF SILK COCOON PRICES IN KARNATAKA-AN ECONOMETRIC ANALYSIS

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ABSTRACT

Silk is the queen of textiles, have endearing qualities such as natural sheen, light weight with high durability. India is the second largest producer of silk cocoon next to China. Analysis of price and market arrivals over time is important for formulating a sound price policy. Fluctuation in arrivals largely contributes to price instability. Such an analysis is also use full to farmers in order to rear silkworm and produce cocoon in the months in which they obtain best price advantages. Therefore the study under taken to assess the dynamics of market arrivals and prices. The monthly prices and arrivals of bivoltine and multivoltine silk cocoon in three major Government silk cocoon markets (i.e Ramanagara, Shidlagatta and Chintamani) were collected for period of 13 years (April 1998 to September 2010). An decreasing trend in arrivals and increasing trend in prices was observed in the selected markets, but the quantum of decrease in arrivals and increase in prices varied from one market to another. The higher seasonal indices of prices were observed during May, during which the arrivals were found to be low. In the case of Multivoltine and Bivoltine silk cocoon arrivals and prices, the average duration of cycle was found to be once in 2.33 to 4.00 years and 3.00 to 3.33 years respectively. Response of silk cocoon arrivals on prices in all the markets showed positive relationship, which implied that, as a arrivals of silk cocoon increased the prices also to a small extent. ARIMA analysis was employed to quantify the variation in prices and also forecast the prices for the next 24 months. The forecasted prices in all the markets showed an increasing value. Analysis of zero order correlation showed that there is an existence of a strong integration among all the selected markets. Finally it was forecasted prices which serve as input in taking the marketing and production decisions.