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COMPARATIVE STUDY OF LINEAR TREND REGRESSION, HOLT AND WINTER MODELS, WITH APPLICATION TO PRODUCTION OF INDIAN AUTOMOBILES

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ABSTRACT

There are a number of methods available to study time-series data. In this study, an attempt has been made to examine the Linear Trend Regression, Holt and Winter Models and compare their forecast quality by using times series data of the production of Indian Automobiles during 1996-97 to 2007-08. Forecasts using these methods are presented and Comparison Statistics and Statistics of Errors for the methods were examined. It is found that Winter's Model Forecasting produced better results than the rest of the methods, as seen on the Mean Absolute Percentage Error (MAPE).

Introduction

The need for quick, reliable, simple and medium term forecasts of various time series is often encountered in economies and business environments. Linear Trend Regression, Holt and Winter Models Trend provide a comprehensive, simple, accurate and applicable solution to this question. Though their computational techniques differ, their accuracy, simplicity and stability on any time series data can be compared via the behaviour of their forecasts, statistics of forecast error and comparision statistics as shown on **Table 2-4.** It is observed that the Holt and Winter parameter estimates are recursively obtained while the Linear Trend Regression Model obtains its parameters via the Least Square Method. Their accuracy and stability can be deducted from their forecast errors and other forecast criteria, referred to as Comparison Statistics.

But the choice of method to use on any time series data depends on factors such as simplicity, accuracy and stability on the series data. The importance of the Automobile Industry in India cannot be underestimated as it contributes arround 5 per cent of GDP at present, offering employment to a large number of people in our country as well as contributing significantly to the country's export. Keeping in view the importance of this Sector to the Indian Economy, it becomes a matter of immense importance to forecast the production of automobiles. In this study, three forecasting methods are used to forecast the production of Indian Automobile and forecasts are compared by using forecast criteria.

Literature Review

There is hardly any literature available on forecasting the production of Indian Automobiles. However, a lot of work has been done on forecasting by using various techniques. **Umar (2007)**[1] examined the Holt and Winter, double exponential and the linear regression trend parameter estimation techniques and compared their forecast quality via the criteria of forecast. **Gilchrist**[2] and **Fields**[3] used time series data of exchange rates of the Naira to the Dollar forecasts by using certain methods which are presented and Comparison Statistics and Statistics of Errors for these methods are examined. It is found that the Holt and Winter forecasting method, with the choice of smoothening constant α = 0.2 and β = 0.5, produced better results than the rest of the methods.

Amar etal. (2006)[4] forecasted the demand for the cardiac PTCA procedure using simple exponential smoothing and Holt's method. A sample of 21 out of 80 hospitals were taken and based on volumes of procedures performed, the hospitals were divided into eight segments. Forecasting exercise was carried out for each segment using data for 18 months from January 2003 to June 2004. The results were combined to provide an overall forecast for the next month. **Deepak Chawla and Vidhu Shekhar Jha (2009)**[5] forecasted the production of Natural Rubber in India by using monthly data for the period from January 1991 to December 2005 using Linear Trend Equation, Semi – Log Trend Equation, Holt's Method, Winter's Method and ARIMA Model. It was found that Winter's Method gives the best results, followed by Holt's Method and Semi-Log Trend Equation.

Panda (2007)[6] used Vector – Auto – Regression (VAR) Model to forecast nominal exchange rate of Indian Rupee against US Dollar. The forecasting performance of sticky price monetary model and flexible price monetary model was evaluated using the criteria of root mean square, mean absolute error and mean absolute percentage error. It was found that forecasting accuracy of sticky price monetary model was better than that of flexible price monetary model. The subject of forecasting volatility of a variable like stock market indices, etc., has been handled very well with GARCH Model. **Selvam et.al. (2007)**[7] find evidence of time – varying volatility of ten market indices from Asian countries using symmetric GARCH, (1,1) Model for a period of one year from January 2006 to December 2006.

Thomako and Bhattacharya (2005)[8] have conducted a forecasting study for inflation, industrial output, and exchange rate for India. The analysis was based on linear models, ARIMA, and bivariate transfer functions and restricted VAR. On the basis of root mean square error as a measure of forecasting accuracy, it is found that bivariate models do better than ARIMA for weekly data, while for monthly data, ARIMA does a better job. **Naresh Kumar and Balraj Singh (2003)**[9] forecasted the production of Indian Automobile Industry with the help of non-linear innovation diffusion and substitution models. Findings showed that India has a growing market for passenger cars and commercial vehicles, reaching the saturation phase whereas three wheelers are growing marginally.

Chawla and Behi (2002)[10] built an ARIMA Model to forecast exports of Indian Readymade Garments. The monthly data for the period, April 1991 to December 2000 were used to develop the model whereas forecasts were obtained for the period January 2001 to December 2001. The accuracy of ex-post forecast was measured through Mean Absolute Percentage Error (MAPE) and Thiel's U-Statistic. **Gupta (1993)**[11]estimated ARIMA Model for tea production using monthly data for India from January 1979 through July 1991 and used the same Model to forecast tea production in India for the next twelve months.

Statement of the Problem

Transport **S**ector is the backbone of any country's economic growth and development. Transportation has made possible unprecedented level of mobility across the geographical space. Mobility has broadened access of business to new markets and more choices by increasing the available pool of resources. From the economic point of view, transportation is a vital factor for steady economic growth and development. Transport Sector is equally important for both industrialzed and developing economies. Transport Sector, including water transport, aviation and surface transport are major contributors to the Gross Domestic Product (GDP), which includes the value of all goods and services.

The Automobile Industry in India has been subject to substantial policy changes over the last two decades. The policy changes were in two phases, and took the form of partial de-regulations introduced in 1985 and liberalization measures launched since 1991. As a result of these policy changes, the Automobile Industry in India, witnessed a number of new entrants during the mid-1980s and early 1990s. The main motivation for the analysis of forecasting of automobile production was provided by two major developments in the Indian Automobile Sector during the last decade. (a) liberalization in Government policy measures resulting in entry of firms with expanded capacity to produce vehicles involving technological upgradation: (b) massive inflow of Foreign Direct Investment into the Automobile Sector. Both these developments have important implications for the performance of individual firms. Therefore, an attempt has been made in this paper to discuss the growth of production of Indian Automobile Industry using Trend Models.

Objectives

The objectives of this study are

(1) To forecast the production of Indian Automobiles using various forecasting techniques.

(2) To choose the best forecasting technique based on the forecasting accuracy of various techniques as judged by hold – out sample performance.

Data

The above said objectives were pursued with the help of data on production of Automobiles for the period 1996-97 to 2007-08. The data for the study were collected from the PROWESS database of CMIE (Centre for Monitoring Indian Economy), various journals and from the website www.Indiastat.com. To estimate model parameters, QSB package was used.

Automobiles Production in India

The production data pertaining to commercial vehicles, passenger cars and multi-utility vehicles, two and three wheelers and total automobiles during the period, 1995-96 to 2007-08, are listed in **Table -1.** The total Indian automobiles production has increased from 3504.2 thousands in 1995-96 to 10685.5 thousands in 2007-08 which accounts for three times rise during the study period. The production of Automobiles in India had registered an increasing trend except in the year 2000-01 and 2007-08. The Compound Annual Growth Rate of Indian Automobiles is 9.74 per cent during the study period. It is also evident from the table that the production of commercial vehicles, passenger cars and multi-utility vehicles and two and three wheelers registered fluctuating trend upto 2000-01 and afterwards registered an increasing trend.

The commercial vehicles have increased from 217.5 thousands in 1995-96 to 549.2 thousands in 2007-08 i.e., 2.52 times. Passenger cars and multi-utility vehicles during the same period rose from 454.4 thousands to 1646.2 thousands and the rise was 3.62 times. Two wheelers production have increased from 2655.9 thousands to 7995.1 thousands during the same period i.e, 3.01 times. The three wheelers during the study period rose from 176.4 thousands to 495 thousands and the rise was 2.80 times. On comparing the changes that have taken place in the production of various sectors of Automobiles, it is observed that increases in production are more in passenger cars and multi-utility vehicles, followed by two wheelers, three wheelers and commercial vehicles. The Compound Annual Growth Rate of commercial vehicles, passenger cars and multi-utility vehicles, two wheelers and three wheelers were 8.04 per cent, 11.32 per cent, 9.62 per cent, 8.99 per cent respectively during the study period. The Co-Efficient of Variation (CV) also confirms that the production of Indian Automobiles registered high fluctuation during the study period.

Estimation of Forecasting Models and Analysis

Before choosing a technique for forecasting, it is essential to analyse the data pattern to determine the appropriateness of the technique for forecasting. A simple plot of data indicates that there is both seasonality and trend in the data as evident from Figure 1 and 2. In this paper, the following methods would be briefly explained and used for forecasting.

1. Trend Method
2. Holt's Method
3. Winter's Method

1. Trend Method

In the Trend Method of forecasting, the Linear Trend Model is a hypothetical curve that shows the direction of movement of a time series over a period of time. It is simply a linear function of time.

$X_t = B_0 + B_1 t + R_t$

Where B_0, B_1 are constants and R_t is an error term. The Mean Square Error of Forecast, MSE is defined by.

$$\text{MSE} = \sum_{r=1}^{t} R_t^2 = \sum_{r=1}^{t} (X_r - \hat{B}_0 - \hat{B}_1 r)^2$$

Where R_t is the forecast error for period t, with the associated normal equation as:

$$\sum_{r=1}^{t} X_r - \hat{B}_0 t - \hat{B}_1 \sum_{r=1}^{t} r = 0 \sum_{r=1}^{t} X_r - \hat{B}_0 \sum_{r=1}^{t} r - \hat{B}_1 \sum_{r=1}^{t} r^2 = 0$$

The estimates of the trend parameters are obtained as

$$\hat{B}_0 = \frac{1}{t}\sum_{r=1}^{t} X_r \quad \text{and} \quad \hat{B}_1 = \sum_{r=1}^{t} r x_r / \sum_{r=1}^{t} r^2$$

The estimates of the forecasts are obtained as

$$\hat{X}_{t,h} = \hat{B}_0 + \hat{B}_1 h.$$

Where h is the lead time into the future.

The linear trend equation for the production of Indian Automobiles were estimated by using Ordinary Least Square Method, as shown below.

Linear Trend Equation } **Y =2114.04 + 709.27 t**
tvalue (4.376) (10.81)*

R^2=0.91

*** - Significant at 0.01 level**

The above trend equation showed that t – variable is statistically significant at 0.01 level of significance as indicated by t – statistic. Using linear trend equation, forecast for 2009-10, 2010-11, and so on are obtained by substituting t = 14, t = 15 …… and t = 18 respectively and the results are presented in Table 2. An estimate of the Mean Absolute Percentage Error (MAPE) was found to be 9.955 per cent. This was done to examine the accuracy of the forecast for those periods for which actual production was available. The forecast were extended for the period 2009-10 to 2013-14. The results are reported in Table 2. The results indicate that absolute percentage errors for the years 1996-97, 1997-98, 2000-01 to 2002-03 and 2006-07, varied from 10.78 per cent to 29.19 per cent. Further, forecast exhibits an increasing trend, with the estimated forecast for the year 2013-14 being 14880.9 thousands.

2. Holt's Method

Holt's Method is used when there is a trend in the time series. It has already obtained time series (Y) on production of Indian Automobiles which has a trend. Therefore, Holt's Method is used. The technique smoothes the level and slope directly by using smoothing constants. These smoothing constants provide estimates of level and slope that adopt over time as new observations become available. The equations of Holt's Method (Hanke et al 2003)[16] are:

1. The exponentially smoothed series or current level estimate.

$$L_t = \alpha Y_t + (1-\alpha)(L_{t-1} + T_{t-1})$$

2. The trend estimate

$$T_t = \beta(L_t - L_{t-1}) + (1-\beta)T_{t-1}$$

3. Forecast m periods into future

$$\hat{Y}_{t+m} = L_t + mT_t$$

Where

L_t = New smoothed value

α = Soothing constant for data ($0 \le \alpha \le 1$)

Y_t = New observation or actual value of series in period t.

β = Smoothing constant for trend estimate ($0 \le \beta \le 1$)

T_t = Trend estimate

m = Periods to be forecasted in future

$\hat{Y}_{t+m}$ = Forecast for m periods into future.

To use this method the values of L_t and T_t are initialized. The value of L_t is taken as equal to Y_t and the value of T_t is taken as $Y_2 - Y_1$. The values of α and β are so chosen as to minimize the error sum of squares. In our case, α (=0.10) and β (=0.10) minimized the error sum of square which was obtained through QSB package. The seasonalised forecast upto 2013-14 and the actual production of Indian Automobiles, the last period for which actual data were available, and estimate of forecast error from 1996-97 to 2007-08 are presented in Table 3.

It is observed by examining the data in Table 3 that the forecast error is high during the period, 1997-98 to 2002-03, 2005-06 and 2006-07 and varying between 11.091 per cent to 33.323 per cent. It is also seen that there is an increase in the forecasted trend of Indian Automobiles production, estimated for 2013-14 being 14,920.1 thousands. It is seen that Holt's Method gives a MAPE of 16.015 per cent which is higher than what is obtained by using linear trend equation method.

3. Winter's Method

Winter's Method is used when there is not only trend but also seasonality in the data. The Holt's Model could be modified as given below to take into account the effect of seasonality. The equations of Winter's Model are given below.

1. The exponentially smoothed series:

$$L_t = \alpha \frac{x_t}{s_t - s} + (1-\alpha)(L_{t-1} + T_{t-1})$$

2. The trend estimate

$$T_t = \beta(L_t - L_{t-1}) + (1-\beta)T_{t-1}$$

3. The seasonal estimate

$$S_t = \gamma \frac{x_t}{L_t} + (1-\gamma)S_{t-s}$$

4. Forecast p periods into future:

$$\hat{X}_{t+p} = (L_t + P^t_t)\ S_{t-s+p}$$

Where

L_t = New smoothed value or current level estimate

α = Soothing constant for the level ($0 \le \alpha \le 1$)

X_t = New observation or actual value in period t.

β = Smoothing constant for trend estimate ($0 \le \beta \le 1$)

T_t = Trend estimate

γ_t = Smoothing constant for seasonality estimate ($0 \le \gamma \le 1$)

S_t = Seasonal estimate

P = Periods to be forecast into the future

S = Length of seasonality

$\hat{X}_{t+p}$ = Forecast for m periods into future.

To use this method, it is necessary to initialize the values of L_t, T_t and S_t. The parameters α, β and γ, can be chosen to minimize Mean Square Error, (MSE). Using this method, the values of α, β and γ which minimize the mean square error, were obtained, by using QSB packages, as 0.8, 0.2 and 0.5 respectively.

The forecast upto 2013-14, on the basis of actual production from 1996-97 to 2007-08 and the error estimates are reported in the **Table -4.** The forecast errors were high during the year 1999-2000, 2002-03, 2004-05 to 2007-08 varying from 6.638 per cent to 13.519 per cent. It is also observed that forecast exhibits an increasing trend with production for 2013-14 being estimated at 14631 thousands. It is estimated that the MAPE using this method is 7.49 per cent which is the least among all the methods discussed so far.

Comparison of Various Forecasting Methods

The accuracy of forecasts of production of Indian Automobiles as obtained by various methods are shown in Table 2 to 4 by presenting the absolute percentage error for the period 1996-97 to 2007-08. The mean absolute percentage error, as obtained by various methods, is also presented. The mean absolute percentage errors are 9.955 per cent, 16.015 per cent and 7.49 per cent respectively for Linear Trend Equation, Holt's Model and Winter's Model. On the basis of MAPE, it could be concluded that Winter's Model is the best, followed by Linear Trend Equation and Holt's Model.

Findings and Suggesstions

The forecasting and trend analysis of production are very important for industrial and infrastructure performance. Automobile Industry is the strength of surface transport which is the largest network in the country. Therefore, analysis of production and its forecast is helpful not only for the industry but also to the policy maker. Appropriate forecasting method is more important for future strategies of a firm.

Production trends of Indian Automobiles were analysed by using trends models. From the analysis it can be noticed that one could recommend Winter's Model for forecasting the production of Indian Automobiles. This is because the MAPE for this method was the minimum. This is followed by Linear Trend Equation and Holt's Model where the mean absolute percentage error are 9.955 per cent and 16.015 per cent respectively. It is very essential that the forecast needs to be updated as and when more data become available as the difference in the accuracy of the three methods is not much. These forecasts could be very useful for the producers and users of automobiles while deciding the price. These are also useful for the policy makers engaged in the welfare of the Indian Automobile Industry. It could always happen that the method, which has given good forecast for the current sample period, may not do so in future, if there are structural changes with respect to the production of Automobiles in the Indian Economy. Further, no forecasting method can be best under all situations and no method is useless.

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Table – 1

Indian Automobiles Production Trends (in 000's)

Category	95-96	96-97	97-98	98-99	99-2k	2k-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	Mean	CV	CAGR
Ms HCVs	129.7	155.7	95.9	80.5	112.3	88.2	96.7	120.0	166.1	214.8	219.3	294.3	304.4	159.8	0.477	7.38
	-	(20.05)	(-38.4)	(-16.05)	(39.5)	(-21.4)	(9.6)	(24.1)	(38.4)	(29.3)	(2.1)	(34.2)	(3.4)			
LCVs	87.8	84.9	65.0	55.3	61.2	63.8	65.7	82.9	108.9	138.9	171.7	275.7	244.8	115.9	0.626	8.93
	-	(-3.3)	(-23.4)	(-14.9)	(10.7)	(4.2)	(3.0)	(26.2)	(31.4)	(27.5)	(23.6)	(60.6)	(-11.2)			
CVs	**217.5**	**240.6**	**160.9**	**135.8**	**173.5**	**152**	**162.4**	**202.9**	**275**	**353.7**	**391**	**570**	**549.2**	**275.7**	**0.536**	**8.04**
	-	**(10.6)**	**(-33.1)**	**(-15.6)**	**(27.8)**	**(-12.4)**	**(6.8)**	**(24.9)**	**(35.5)**	**(28.6)**	**(10.5)**	**(45.8)**	**(-3.6)**			
Passenger Cars	348.2	411.1	104.0	390.7	577.2	504.6	500.3	557.7	782.6	960.4	1046.1	1238.0	1401.5	701.5	0.51	12.29
	-	(18.1)	(-2.5)	(-2.6)	(47.7)	(-12.6)	(-0.9)	(11.5)	(40.3)	(22.7)	(8.9)	(18.3)	(13.2)			
MPUVs	106.2	134.6	134.6	113.3	124.3	125.9	169.3	163.2	206.9	249.4	263.2	306.8	244.7	180.2	0.369	7.19
	-	(26.7)	-	(-15.8)	(9.7)	(1.3)	(34.5)	(-3.6)	(26.8)	(20.5)	(5.5)	(16.6)	(-20.2)			
PVs	**454.4**	**545.7**	**535.6**	**504**	**701.5**	**630.5**	**669.6**	**720.9**	**989.5**	**1209.8**	**1309.3**	**1544.8**	**1646.2**	**881.7**	**0.469**	**11.32**
	-	**(20.1)**	**(-1.9)**	**(-5.9)**	**(39.2)**	**(-10.1)**	**(6.2)**	**(7.7)**	**(37.3)**	**(22.3)**	**(8.2)**	**(18)**	**(6.6)**			
Scooters	1224.8	1312.9	1279.5	1315.0	1259.4	879.7	937.5	850.1	935.3	987.4	1021.0	943.9	1091.4	1079.8	0.162	-0.97
	-	(7.2)	(-2.5)	(2.8)	(-4.2)	(-30.1)	(6.6)	(-9.3)	(10.0)	(5.6)	(3.4)	(-7.6)	(15.6)			
Motorcycle	809.1	988.2	1125.9	1387.3	1794.1	2183.8	2906.3	3914.6	4355.1	5193.9	6207.7	7112.2	6465.1	3418.7	0.662	18.91
	-	(22.1)	(13.9)	(23.2)	(29.3)	(21.7)	(33.1)	(34.7)	(11.3)	(19.3)	(19.5)	(14.6)	(-9.1)			
Mopeds	622	678.1	667.2	672.2	724.5	694.9	427.5	344.6	332.3	348.4	379.9	379.9	420.3	514.8	0.310	-3.16
	-	(9.0)	(-1.6)	(0.7)	(7.8)	(-4.1)	(-38.5)	(-19.4)	(-3.6)	(4.8)	(9.0)	-	(10.6)			
Ele. Two Wheelers												7.9	18.3	13.1	0.561	
												-	(131.6)			
Two Wheelers	**2655.9**	**2979.2**	**3072.6**	**3374.5**	**3778**	**3758.4**	**4271.3**	**5109.3**	**5622.7**	**6529.7**	**7608.6**	**8443.9**	**7995.1**	**5015.3**	**0.406**	**9.62**
	-	**(12.2)**	**(3.1)**	**(9.8)**	**(12)**	**(-0.5)**	**(13.6)**	**(19.6)**	**(10.0)**	**(16.1)**	**(16.5)**	**(11.0)**	**(-5.3)**			
Three Wheelers	**176.4**	**221.6**	**234.8**	**209.0**	**205.5**	**203.2**	**212.7**	**271.2**	**356.2**	**374.4**	**434.4**	**556.1**	**495.0**	**303.9**	**0.415**	**8.99**
	-	**(25.6)**	**(6)**	**(-11)**	**(-1.7)**	**(-1.1)**	**(4.7)**	**(27.5)**	**(31.3)**	**(5.1)**	**(16.0)**	**(28.0)**	**(-11.0)**			
Grand total	**3504.2**	**3987.1**	**4003.9**	**4223.3**	**4858.5**	**4744.1**	**5316**	**6304.3**	**7243.4**	**8467.6**	**9743.3**	**11,114.8**	**10685.5**	**6476.6**	**0.417**	**9.74**

Source : Society of Indian Automobile manufacturers (SIAM)

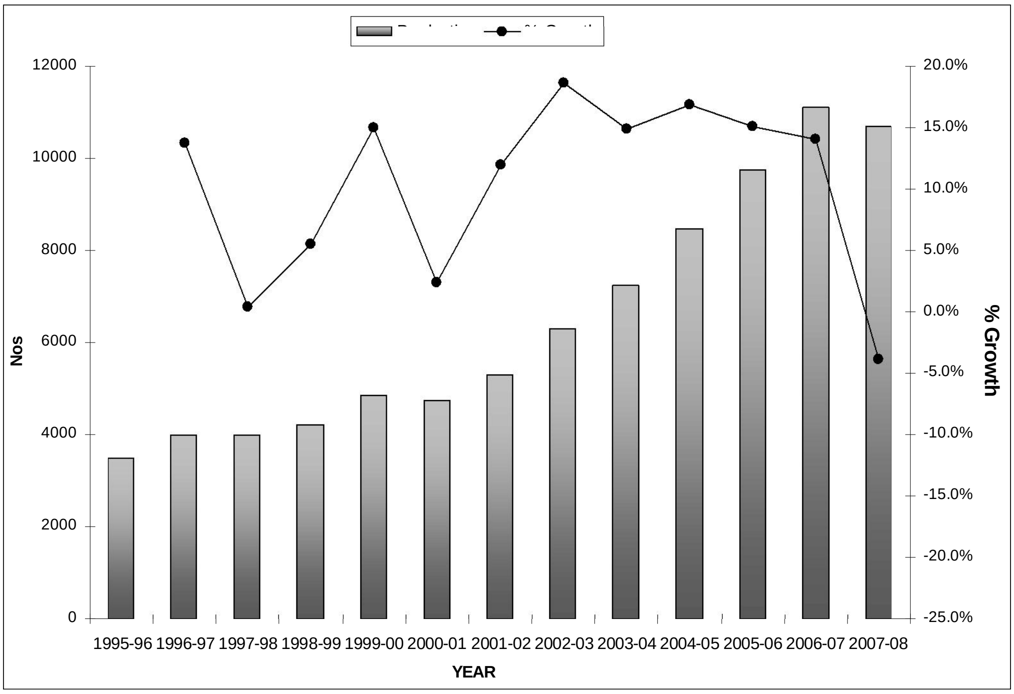

Figure 1 : Total production of Indian Automobiles (1995 - 96 to 2007 - 08)

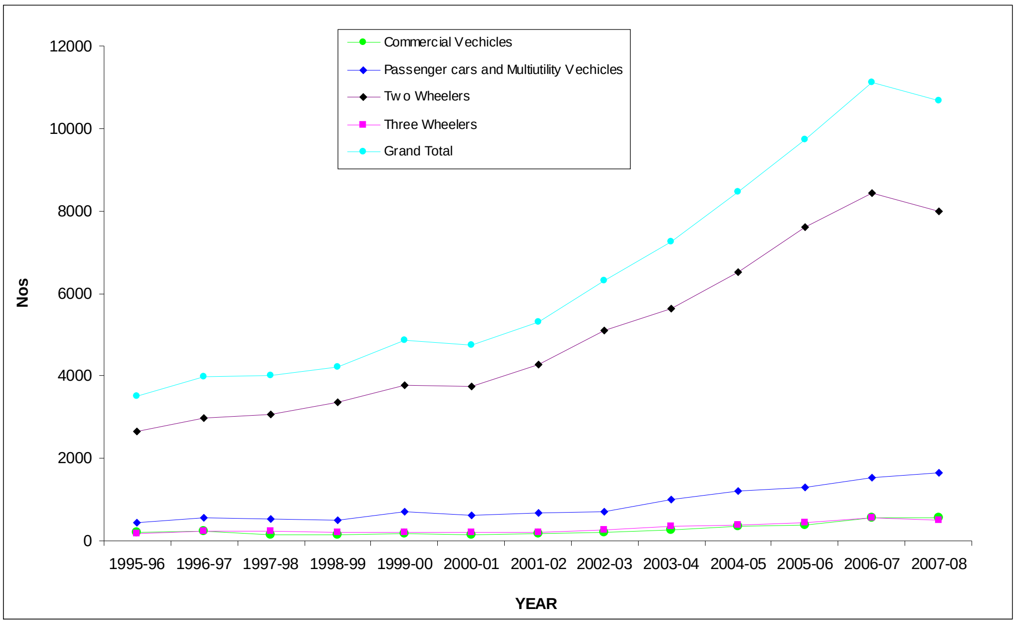

Figure 2 : Total production of different sectors of Indian Automobiles (1995 - 96 to 2007 - 08)

Table – 2
Actual Production, Seasonalized Forecast and Errors of Forecast using Linear Trend Equation

Period	Actual Production (000[1])	Seasonalized Forecast	Error	Error (%)	Absolute Error %
1996-97	3987.1	2823.3	1163.8	29.189	29.189
1997-98	4003.9	3532.6	471.3	11.771	11.771
1998-99	4223.3	4241.9	-18.6	-0.440	0.440
1999-00	4858.5	4951.1	-92.6	-1.906	1.906
2000-01	4744.1	5660.4	-916.3	-19.315	19.315
2001-02	5316.0	6369.7	-1053.7	-19.821	19.821
2002-03	6304.3	7078.9	-774.7	-12.289	12.289
2003-04	7243.4	7788.2	-544.8	-7.521	7.521
2004-05	8467.6	8497.5	-29.9	-0.353	0.353
2005-06	9743.3	9206.8	536.5	5.506	5.506
2006-07	11.114.8	9916.0	1198.8	10.786	10.786
2007-08	10685.5	10.625.3	60.2	0.563	0.563
2009-10		**12043.9**			**MAPE=9.955%**
2010-11		**12753.1**			
2011-12		**13462.4**			
2012-13		**14171.7**			
2013-14		**14880.9**			

Source: Computed

Table – 3

Actual Production, Seasonalized Forecast and Errors of Forecast using Holt's Methods

Period	Actual Production (000[1])	Seasonalized Forecast	Error	Error (%)	Absolute Error %
1996-97	3987.1	4291.6	-304.5	-7.637	7.637
1997-98	4003.9	4867.0	-863.1	-21.556	21.556
1998-99	4223.3	5377.9	-1154.7	-27.341	27.341
1999-00	4858.5	5848.2	-989.7	-20.370	20.370
2000-01	4744.1	6325.1	-1580.9	-33.323	33.323
2001-02	5316.0	6727.0	-1411.0	-26.543	26.543
2002-03	6304.3	7131.8	-827.5	-13.126	13.126
2003-04	7243.4	7586.7	-343.3	-4.739	4.739
2004-05	8467.6	8086.6	381.0	4.500	4.500
2005-06	9743.3	8662.7	1080.6	11.091	11.091
2006-07	11114.8	9319.5	1795.3	16.152	16.152
2007-08	10685.5	10065.8	619.7	5.799	5.799
2009-10		**12245.2**			**MAPE = 16.015%**
2010-11		**12816.4**			
2011-12		**13486.6**			
2012-13		**14148.3**			
2013-14		**14920.1**			

Source: Computed

Table – 4
Actual Production, Seasonalized Forecast and Errors of Forecast using Winter Model

Period	Actual Production (000[1])	Seasonalized Forecast	Error	Error (%)	Absolute Error %
1996-97	3987.1	3987.0	-	-	-
1997-98	4003.9	3987.0	16.9	0.422	0.422
1998-99	4223.3	4005.0	218.3	5.169	5.169
1999-00	4858.5	4239.0	619.0	12.741	15.741
2000-01	4744.1	4935.0	-190.9	-4.023	4.023
2001-02	5316.0	4871.0	445.0	8.371	8.371
2002-03	6304.3	5452.0	852.3	13.519	13.519
2003-04	7243.4	6540.0	703.4	9.711	9.711
2004-05	8467.6	7611.0	856.6	10.116	10.116
2005-06	9743.3	8963.0	780.3	8.008	8.008
2006-07	11114.8	10377.0	737.8	6.638	6.638
2007-08	10685.5	11876.0	-1190.5	-11.141	11.141
2009-10		**12080.0**			**MAPE = 7.490%**
2010-11		**12718.0**			
2011-12		**13355.0**			
2012-13		**13993.0**			
2013-14		**14631.0**			

Source: Computed