Sales Forecasting of Milk and Milk Products by Quantitative Techniques-A Case Study

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ABSTRACT:

Sales forecast is generally studied for making decision on working capital, the size of facilities, the amount of advertising and sales promotion, the need to change prices and many other problems. The study was conducted with the objective to forecast the net sales of Shyam Dairy products, Allahabad by using different quantitative methods of forecasting and use of different models such as naïve model, moving average model , exponential smoothing, casual forecasting methods(linear regression and Ab exponential regression) to recommend an optimal sales model for sales forecasting of each products. The study reviled that naïve model is recommended for forecasting of sales of full cream milk (1lit) polypack. Naïve model and exponential smoothing method recommended for full cream milk loose,skim milk, skim milk powder, ghee(15 kg) tin, casual forecasting method(linear regression) and (exponential regression) recommended for ghee(1/2 kg) case. Exponential regression and naïve model are recommended for toned milk(lit),casual forecasting method (linear regression) is recommended for paneer(kg), khoa(kg).

Key words: Sales forecasting, optimal sales model, Naïve model, Exponential smoothing, Casual forecasting method, Exponential regression.

INTRODUCTION

Sales forecasting is a key input to firm's financial planning process. Sales forecast are based on historical experience, statistical analysis and consideration of various macroeconomic factors. Generally forecast is made to one year in the future in support of marketing and financial objectives. Sales forecasting, budgeting, and business planning are vital management activities regardless of the size of business or the level of uncertainty. Sales forecast are not just for the benefit of business plan readers, but are mean to help managers to make informed decisions. These forecasts are revised frequently, typically, monthly, but for some business weekly. The purpose of forecast is to provide business with an evaluation of past and current sales levels and annual growth and allow comparing company to industry norms. It also establishes company's policies so that one easily can monitor prices and operating cost to guarantee profits and make aware of minor problems. Forecasting can be done by different methods such as quantitative forecasting, qualitative forecasting, time series model, moving average exponential smoothing, and regression models.

The present study pertains to sales forecasting of milk and milk products of Shyam dairy. Shyam dairy is the largest dairy in eastern U.P with processing capacity of four lakh (4 lakh) liters of milk per day. The dairy produces arrange of milk and milk products under brand name Shyam which includes liquid milk, ghee, butter, skimmed powder and khoa. The

market presence is in the states of Uttar Pradesh, Uttaranchal, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, west Bengal and Assam. The vast network involves over 30,000 farmer 5000 milk suppliers more than 100,000 retailers and wholesalers that all cater to more than six lakh end users.

The objective of this analysis is to forecast the sales of Shyam Dairy product using different quantitative methods and to determine an optimal sales model for forecasting of sales of Shyam Dairy and to identify the trend of sales.

MATERIALS AND METHODS

Milk and milk products viz., liquid full cream milk, ghee, butter, skimmed milk powder, khoa and paneer were selected for sales forecasting of products of Shyam industry. Multistage stratified sampling procedure was adapted for selection of ultimate industry (Shyam dairy). Followed by taking into account demographic features and then selection of dairy and then looking over the industrial profile. This forecast was carried out for a period of 3months(February 2009 to may 2009).Primary Data of sales of milk and milk product was collected from enquiry of balance sheet of previous years (April 2006-March 2009). Secondary data was collected from journals, magazines, news paper, internet and published materials. Quantative forecasting method was used to make detailed analysis of past demands and pattern forward into future.

Different models of forecast such as naïve model, moving average model, exponential smoothing (Gardner, 1989),casual forecasting(linear regression and Ab exponential regression (Tashman*et al*,2000)),trend adjusted exponential smoothing were used for calculation of forecast. The error in forecasting methods were calculated by cumulative forecast error(CFE), mean square error(MSE),mean absolute deviation(MAD), mean average percentage error(MAPE). Forecasting methods were compared on the basis of four; error computed viz., CFE, MSE, MAD and MAPE method in which lowest error found was recommended.

RESULTS AND DISCUSSION

4.1 Sales and Forecasting of Full Cream Milk Polypack
Data was forecasted by different quantitative methods and tabulated as below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	109468	207134	207.5	146484.331	-816957.6589	204701.5057
MSE	476,513,516.04	77,298,870.73	719,882,120.67	772,900,415.57	448408705.06	589787242.76
MAD	12945.11429	18455.0996	20103.79167	18851.74669	34437.83399	15713.53031
MAPE	0.108616357	14.51210072	17.69886319	15.4088327	38.02435953	12.67513119

It has been observed that maximum error is in trend adjusted exponential smoothing and minimum error is in naïve model. It is clear that minimum error gives the better forecasting of full cream milk(500ml) polypack.

4.2 Sales Forecasting of Full Cream Milk Loose
Data was forecasted by different quantitative methods and tabulated as below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	54427	108548.3333	11	102964.8853	-112434.6258	104820.66
MSE	121,127662.89	229,194,381.69	259,456,501.19	321,914,931.48	303,143,001.35	172,377,863.84
MAD	6205.628571	10040.49404	11825.97222	12513.99067	12982.46935	8268.59888
MAPE	14.85321344	21.22260449	31.23740052	29.357081	31.47079394	18.13950384

It has been observed that maximum error is in trend adjusted exponential smoothing and minimum error is in naïve model but Exponential smoothing method can also be applied as difference between error of naïve model and exponential smoothing is very less. It is clear that minimum error gives the better forecasting of full cream milk lose(lit).

4.3 Sales Forecasting of Skim Milk
Data for demand of skim milk powder (25 kg) bag was forecasted by different quantitative methods and tabulated as below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	710	1113.3333333	-6304.84	5924	-334136.653	1003.487316
MSE	5777,642.17	5862742.14	3672,351.24	3,661,483.00	122,299,446.42	4606,757.63
MAD	1383.828571	1295.756778	892.3322222	943.5	9281.575972	1132.874341
MAPE	9.037618615	8.770560937	6.085628678	6.278637551	58.82353219	7.595621365

It has been observed that maximum error is in trend adjusted exponential smoothing and minimum error is in naïve model but Exponential smoothing method can also be applied as difference between error of naïve model and exponential smoothing is very less. It is clear that minimum error gives better forecasting of skim milk powder(25kg) bag.

4.5 Sales Forecasting Of Ghee Tin
Data was forecasted for demand of ghee(15kg) tin by quantitative methods and tabulated below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	6510	15890.78	56.12	23117.92689	14948.99798	15617.77861
MSE	2095,751.43	5718,180.29	5546,062.19	6065,997.43	6609750.69	4079,758.38
MAD	1136.857143	1804.121212	1842.762222	1901.024331	1976.914092	1493.838689
MAPE	35.41122587	50.61621497	77.80769768	67.44758989	70.97533222	45.51780526

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It has been observed that maximum error is in trend adjusted exponential smoothing and minimum error is in naïve model but Exponential smoothing method can also be applied as difference between error of naïve model and exponential smoothing is very less. It is clear that minimum error gives the better forecasting of ghee(15kg) tin.

4.6 Sales Forecasting of Ghee Case
Data was forecasted for demand of ghee(1/2 kg) case by quantitative methods and tabulated below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	-2285	-283.61	25.356	7463.690373	-99343.06254	-2770.595556
MSE	1946,875.11	1,446,637.89	1,251,972.76	1299,039.45	11,463,689.19	1,480,060.26
MAD	1083.285714	830.330303	767.4561111	749.8915163	2845.61274	849.5545922
MAPE	47.88545956	38.63819423	34.14748007	30.44201087	151.1419124	41.71711676

It has been observed that maximum error is in trend adjusted exponential smoothing and minimum error is in casual forecasting methods(linear regression) and (exponential regression) as two errors of both methods are lowest for forecasting the sales of ghee(1/2kg) case.

4.7 Sales Forecasting of Toned Milk
Data for demand of toned milk was forecasted by quantitative methods and tabulated below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	6000	11333.7	-7.6	1123.496299	-310001.4227	11243.83545
MSE	2941,176.47	3,348,122.08	1,592,860.32	1,640,327.51	350,225,544.48	2,545,391.93
MAD	941.1764706	1199.978667	948.8666667	970.9236924	17222.30278	984.3987415
MAPE	3.28004086	4.091101484	3.375880369	3.440201708	58.77060835	3.368822843

It has been observed that maximum error is in moving average and minimum error is in casual forecasting methods (Ab exponential regression) and naïve model both are recommended for forecasting of sales of toned milk(lit) as two errors of both methods are lowest.

4.8 Sales Forecasting of Paneer
Data for demand of paneer(kg) was forecasted by quantitative methods and tabulated as below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	10028.4	33580.15	25.4	11559.32365	41743.1573	23763.66719
MSE	101,337,802.85	176,966,901.46	70,374,873.97	85,157,183.86	109,241,067.22	103,144,076.71
MAD	7407.942857	11548.688	6951.675	7229.369655	7004.836267	8179.754844
MAPE	37.57517448	46.4043006	38.98024506	35.49167626	27.56426587	39.63641011

It has been observed that maximum error is in moving average and minimum error is in casual forecasting method (linear regression). It is clear that minimum error gives better forecasting of paneer(kg).

4.9 Sales Forecasting of Khoa

Data for demand of khoa(kg) was forecasted by quantitative methods and tabulated as below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	11000	22000.01	0	3083.311959	-12934.95739	23890.625
MSE	38,028,571.43	62,812,477.69	18,376,875.00	21,574,446.24	24,989,199.24	35,974,605.71
MAD	4400	7040.002	3506.25	3730.472967	3916.810165	4404.2975
MAPE	15.30532213	23.20000663	13.16503268	13.57402613	14.7699096	15.12653414

It has been observed that maximum error is in moving average and minimum error is in casual forecasting method (linear regression). It is clear that minimum error gives better forecasting of khoa(kg).

4.10 Sales Forecasting of Full Cream Milk One Lit Polypack

Data for demand of Full Cream Milk One Lit Polypack was forecasted by quantitative methods and tabulated as below.

Error	Naïve-model	Moving average	Linear regression	Exponential regression	Trend adjusted	Exponential smoothing
CFE	7987	-25569.97	4872	49811.6853	-347396.8159	-14564.75697
MSE	160,551,691.12	232,134,632.22	234,954,813.89	243,283,374.93	942,275,900.60	190,879,889.47
MAD	8906.529412	11338.08667	14051.55556	13866.3251	26749.15042	10787.1671
MAPE	27.01817956	46.2796825	57.53507201	51.82962818	139.059829	40.04737744

It has been observed that maximum error is in Trend Adjusted Exponential smoothing and minimum error is in Naïve Model. It is clear that minimum error gives the better forecasting of full cream milk one lit polypack.

CONCLUSION:

Milk and milk product namely full cream milk(loose and polypack), skim milk, skim milk powder, ghee(tin and case), khoa and paneer was subjected for analysis. Its sales forecasting showed that there is good scope of increasing of milk of sales. The production of millk often rises during winter season. Since the production totally depends upon demand of local area, the study recommended that naïve model for the sales forecasting of full cream milk(500ml) and (1lit) polypack. Naïve model and exponential smoothing method for full cream milk loose, skim milk, skim milk powder and ghee(tin), casual forecasting methods (linear regression) and (exponential smoothing) for ghee(case). Exponential regression and Naïve model for toned milk and casual forecasting methods (linear regression) for paneer and khoa because the error calculated is least in recommended methods.

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