AN ANALYSIS ON THE SALES OF DAIRY MILK

R. Ajantha, G. Jayasree, K. Srinivas and N.Ch. Bhatra Charyulu

Department of Statistics, University College of Science, Osmania University, Hyderabad-7

Summary

In this paper an attempt is made to study on the sales of dairy milk of different sized packets of toned and diluted toned milks produced by dairy milk based on the past data of six years. The data is analyzed using some advanced statistical tools to draw valid conclusions and also made an attempt to estimate for future period by constructing a time series model.
Keywords: Dairy Milk sales, Analysis.

1. INTRODUCTION

India is one of the world's largest milk producing and consuming country. Its consumption in 2013-14 is around 140 million tons, but it produced around 132.5 million tons. Its annual milk production should increase from current 4.5 million tons per ton to 7.5 million tons, to meet the demand and to solve the nutritional challenges in the country. The National Dairy Development Board proposing to increase milk production for meeting the growing demand, which is estimated to be around 200 million tons by 2021-22. This shows the importance of milk enterprise in India and it also shows that India possesses milk yielding cattle on large-scale.

The Nalgonda-Rangareddy Districts Co-Operative Milk producers Union Limited was registered on 25-02-1986 to cater the needs of milk producers of two districts Nalgonda and Rangareddy. The union is having 14 milk-Chilling centers in Nalgonda District and three in Ranga Reddy District. The Mother Dairy was started in 1987 at Hayathnagar with the capacity of 2 lakh litres per day. The union is implementing various schemes for its members for improving milk production. Mother Dairy is one of the dairy form producing milk products over nine lakh liters and supplying to around fifty towns in the states of Telangana and Andhra Pradesh. It produces milk products like milk (toned milk (TM) with 1000ml, 500ml and 200 ml packets; and diluted toned milk in 500 ml and 200 ml packets with FAT 3% and 1.5% and SNF with 8.5 and 9 respetively), curd, butter, cheese, ghee and many other milk products as per the demand. It producing milk through 358 registered cooperative societies and 776 milk producers association centers through 61 milk routes.   Its main objective is to supply the trusted quality of milk for the healthy life to the people.

Secondary information that is available from the published sources of annual reports of the organization of NARMAC (Nalgonda-Rangareddy Mutually Aided Cooperative) Union Ltd is gathered for further analysis. The monthly consumption information about the five milk products toned milk with 1000ml, 500ml, 200ml packs with FAT 3% ; and diluted toned milk with 500ml and 200ml packs with FAT 1.5%, during the period 2005 to 2010 (six years), covering the geographical area of twin cities Hyderabad and Secunderabad is used for the analysis.

2. ELEMENTARY ANALYSIS

Primary statistical analysis is carried out and presented below with suitable graphical representation.

1. The average sales of toned and diluted toned milk packets for each year are presented in the table 2.1 and its graphical representation for toned and diluted toned milk is presented separately in fig 2.1 and 2.2.

Year	Toned Milk (TM)			Diluted TM	
	1000ml	500ml	200ml	500ml	200ml
2005	65219	899115	278723	60439	68653
2006	87482	947647	285559	90766	83050
2007	109220	1030056	245699	64395	67904
2008	86312	941576	207866	38736	44813
2009	64562	993468	210453	26337	35868
2010	74120	1071194	235206	41934	51440

Table 2.1

Fig 2.1 — Year wise TM sales

Fig 2.2 — Year wise DTM sales
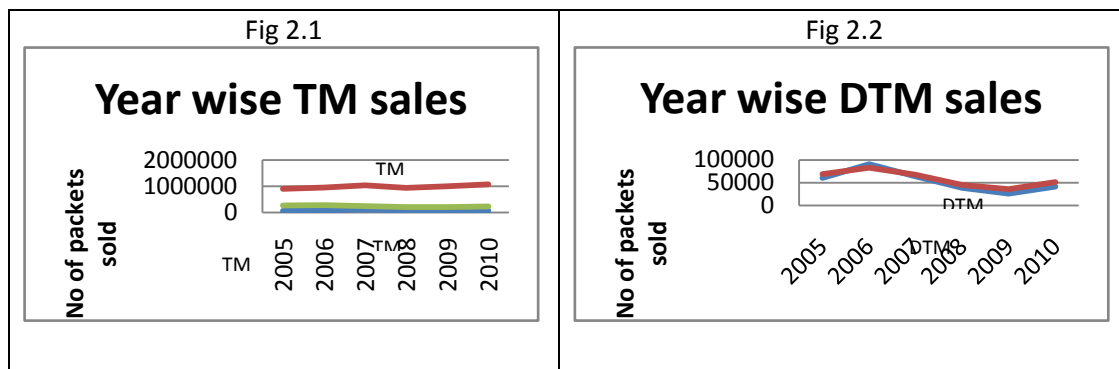
The fig 2.1, indicates the sales of toned milk 500ml packets is significantly more than 200ml and 1000ml packets throughout the period. By comparing fig 2.1 and fig 2.2 and from table 2.1, we can conclude that the sales of toned milk packets is significantly more than diluted toned milk packets. But the sales of diluted toned milk are incresed in period 2005-2006 and decreased to 30000 in 2009 and laer the sales are slowly increasing due to several reasons. There is a significant difference in the average sales of two types of milks.

2. The average sales in each month (for a period of six years) presented in table 2.2 and its graphical representation is presented in fig 2.4 and 2.5 for toned and diluted toned milk separately. The sales in each month for toned milk are very high when compared with other milk products.

Month	Toned Milk (TM)			Diluted TM	
	1000ml	500ml	200ml	500ml	200ml
January	37971	451035	118866	27378	29657
February	39225	475817	122064	26901	28608
March	38710	489638	120363	27109	29064
April	39865	474060	119467	27148	27991
May	42206	487228	114395	27645	28081
June	40764	509098	120202	27714	29524
July	43111	522431	127641	28042	31722
August	42923	501165	127353	26937	30636
September	38413	473940	124262	25474	29419
October	41708	493444	123085	25519	28748
November	40491	501705	123418	26140	29034
December	41528	503495	122390	26600	29244

Table 2.2

Fig 2.3 — Month wise TM Ssales

Fig 2.4 — Month wise DTM sales
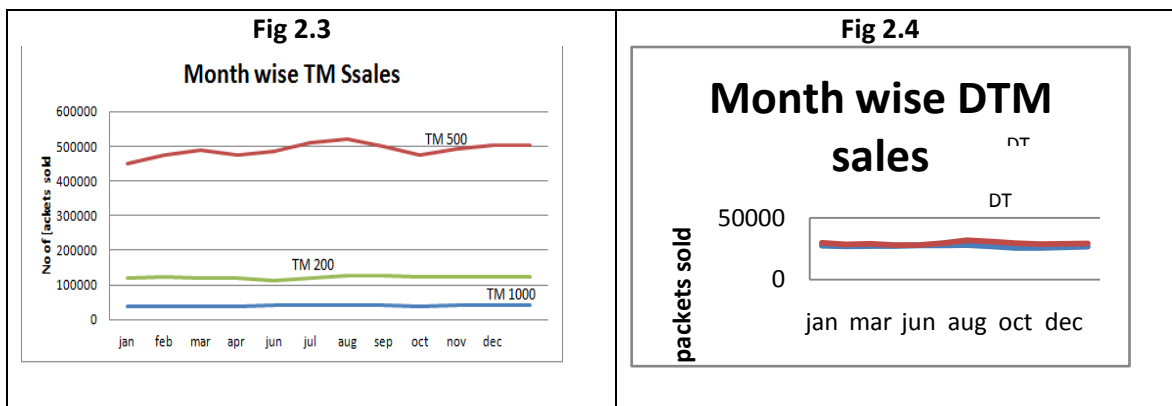
3. The average and standard deviation of sales during the period of 72 months is for toned and diluted toned milk of different sized packets is given below.

Parameter	Toned Milk (TM)			Diluted TM	
	1000ml	500ml	200ml	500ml	200ml
Mean Consumption	6762.71	20326.47	81709.11	4480.65	4885.11
Standard Deviation	1475.546	2870.177	7685.883	1894.462	1451.412

Table 2.3

4. Average sales of milk packets are equal in each year and in each month are tested and found that there is insignificant difference in the average sales in months for toned milk 1000ml, 500ml, and DTM 500ml and DTM 200ml packets. Average sales in months and in years for toned milk 200ml

packets is found to be significant. In annual sales p significance values for toned 1000ml, 500ml, 200ml and diluted 500ml, 200ml 0.0015, 0.0519, 0.0012, 0.0002, 0.00017 respectively.

5. The maximum average sales of toned milk 1lt, ½ lt and 200ml are in the years 2007, 2010 and 2006 where as for diluted milk 500ml and 200ml maximum sales are in the year 2006. The sales of toned milk packets is more than the diluted toned milk packets and specifically ½ lt packets sales are more due to several advantages like storage cost and minimization of expenditure etc.

3. CONSTRUCTION OF BOX & JENKINS MODEL:

The Box-Jenkins methodology is a four-step iterative process which includes model identification, model fitting, model diagnostics and forecasting. To construct the model, original sales data converted to stationary by removing residual and by evaluating autocorrelations. A low mean absolute percentage error value is evaluated (MAPE) to indicate stability of the market under unforeseen fluctuations. Using the constructed model sales is forecasted for future period.

1. The auto correlation function plot for residuals is evaluated using SPSS for the sales of toned milk 1000ml and constructed an autoregressive integrated moving average (ARIMA) model. The resulting is an ARIMA (1,2,1) with Z_t = $-0.391z_{t-1}+0.9807z_{t-2}-2.8147a_t$. The residuals are normal and are independent. P-P plot is nearly linear. The prediction performance of the model is 8.573 (MAPE).
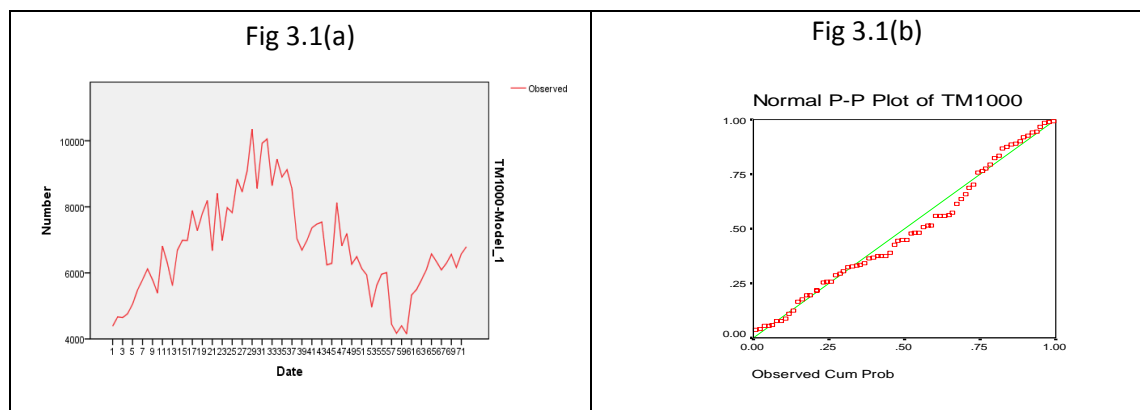

Fig 3.1(a)   Fig 3.1(b)

2. The auto correlation function plot for residuals is evaluated using SPSS for the sales of toned milk 500ml and constructed ARIMA model with parameters (3,2,1) with Z_t = $-0.0123z_{t-1}-0.2956z_{t-2}-0.0265z_{t-3}+0.99676z_{t-4}-5.1199a_t$. Residuals are independent and normal. P-P plot represents linear (see fig 3.2(b)). The prediction performance of the model is 5.191 (MAPE).   The model shows that the sales are increasing year to year with fluctuations.

Fig 3.2(a)   Fig 3.2(b)
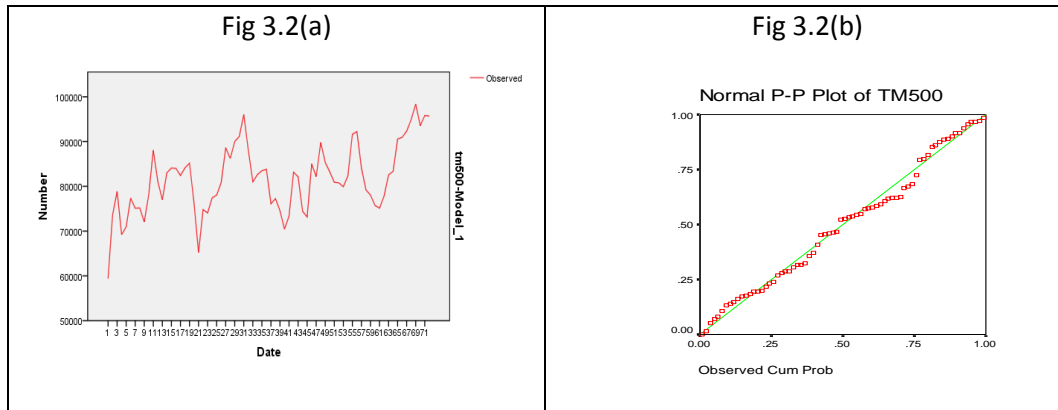
3. The sales of toned milk 200ml, autocorrelation function plot using SPSS for residuals are evaluated. The constructed ARIMA model is with parameters (0,2,1) with $Z_t = 0.9997z_{t-1}-2.5025a_t$. The residuals are independent and normal. P-P plot presented in fig 3.3(b). The prediction performance of the model is 3.616. The sales are increasing with fluctuations up to the year 2007 and decreased to 2008 then slightly increasing.

Fig 3.3(a)   Fig 3.3(b)
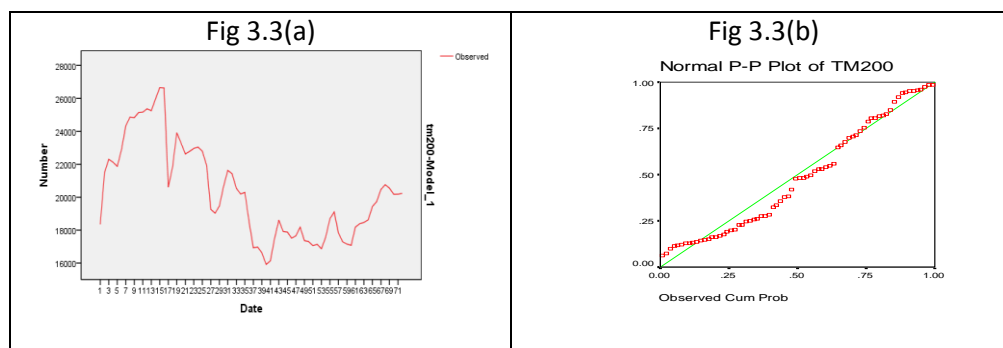
4. The sales of diluted toned milk 500ml ACF plot for residuals is evaluated using SPSS and constructed ARIMA (0,2,1) model with $Z_t = 0.81972z_{t-1} - 5.5420a_t$. The residuals are independent and normal. P-P plot presented in fig 3.4. The model prediction performance is with MAPE 6.830. The sales of diluted toned milk 500 are increased to 2006 and slightly decreased to 2009.

Fig 3.4(a)	Fig 3.4(b)
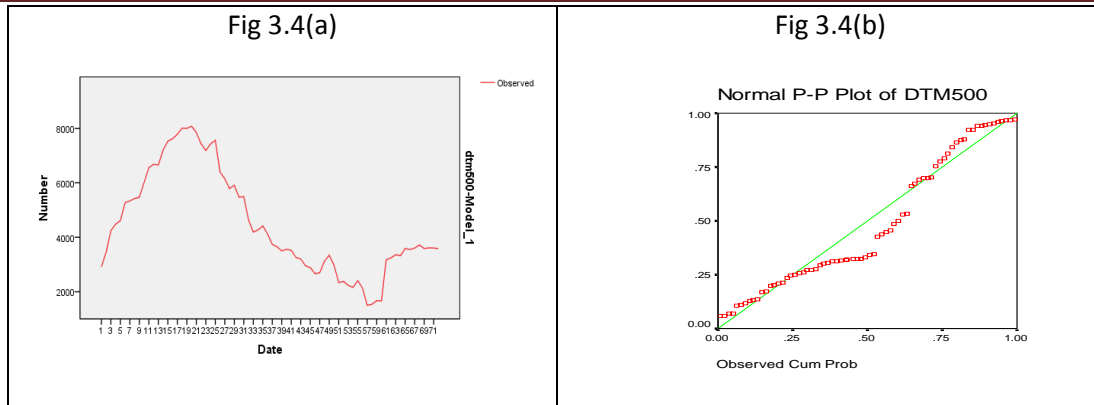
5. The sales of diluted toned milk 200ml, ACF plot for residuals is evaluated and constructed ARIMA(0,2,1) model with $Z_t=0.88514z_{t-1}-1.95985a_t$. The residuals are independent and normal. P-P plot is presented in fig 3.5(b). This model gives a prediction performance with MAPE 5.363. The sales are increasing upto 2006 and decreasing upto 2009,then found a small raise.

Fig 3.5(a)	Fig 3.5(b)
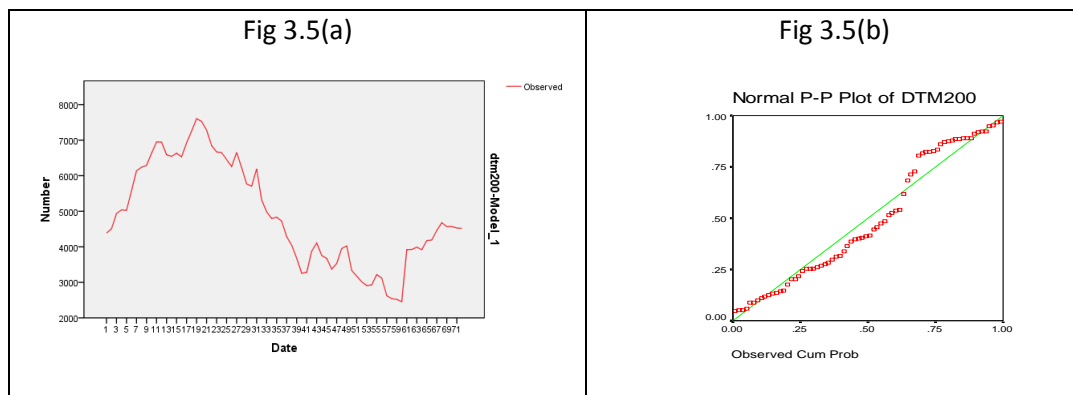
4. FORECAST ANALYSIS

The sales for toned milk of 1000ml, 500ml and 200 ml and diluted toned milk 500ml and 200ml packets for the next three years are forecasted using the corresponding constructed models and presented below in the tabular form Table 4.1. The corresponding graphical models are presented in the following Fig 4
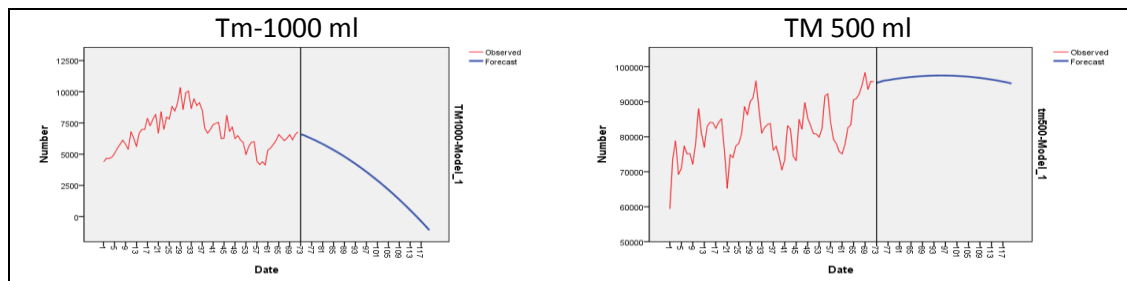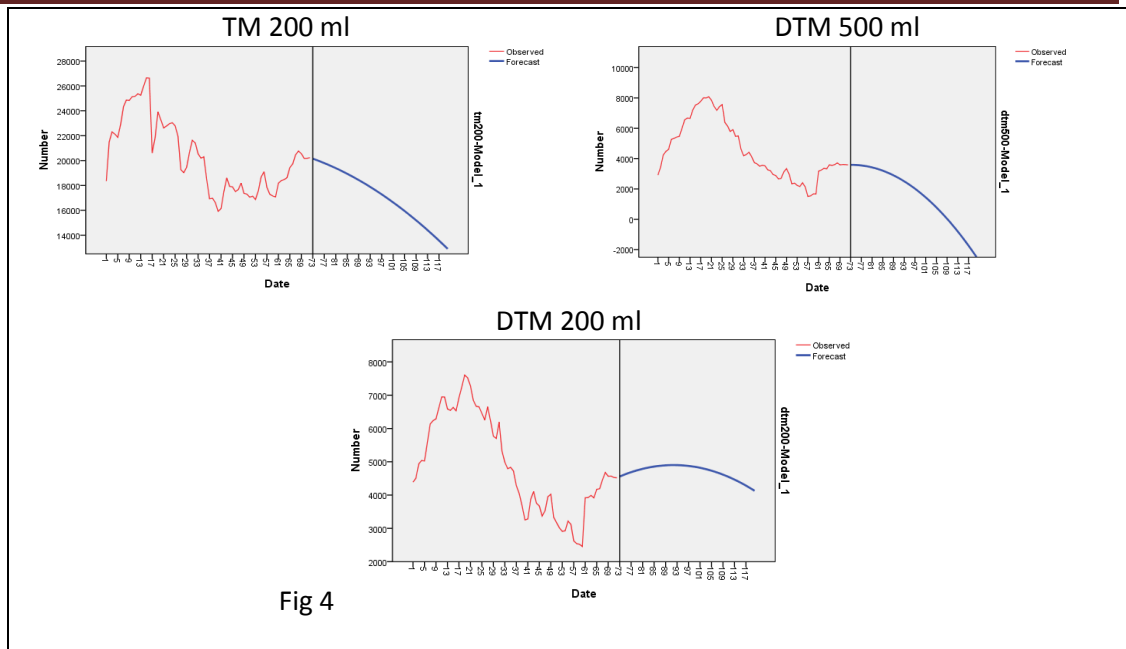
Fig 4

	Toned Milk (TM)			Diluted TM	
	1000 ml	500 ml	200 ml	500 ml	200 ml
1	6620.312	95530.94	20171.53	3587.151	4557.451
2	6596.92	95857.59	20105.56	3585.761	4592.943
3	6512.013	96255.55	20037.08	3578.828	4626.474
4	6447.246	96494.29	19966.1	3566.353	4658.046
5	6370.688	96693.29	19892.62	3548.336	4687.658
6	6294.825	96931.13	19816.64	3524.777	4715.31
7	6214.776	97177.64	19738.15	3495.676	4741.002
8	6132.448	97406.78	19657.16	3461.033	4764.735
9	6047.095	97625.71	19573.67	3420.848	4786.507
10	5959.01	97842.84	19487.68	3375.12	4806.32
11	5868.078	98056.64	19399.18	3323.851	4824.172
12	5774.344	98264.45	19308.18	3267.039	4840.065
13	5677.79	98466.54	19214.68	3204.686	4853.998
14	5578.424	98663.72	19118.68	3136.79	4865.972
15	5476.242	98855.98	19020.17	3063.352	4875.985
16	5371.245	99043.07	18919.16	2984.372	4884.039
17	5263.434	99224.98	18815.65	2899.85	4890.132
18	5152.808	99401.78	18709.63	2809.786	4894.266
19	5039.368	99573.48	18601.12	2714.18	4896.44
20	4923.112	99740.06	18490.1	2613.032	4896.654
21	4804.042	99901.52	18376.57	2506.341	4894.908
22	4682.157	100057.9	18260.55	2394.109	4891.203
23	4557.458	100209.1	18142.02	2276.334	4885.537
24	4429.944	100355.2	18020.99	2153.018	4877.912

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25	4299.615	100496.1	17897.46	2024.159	4868.327
26	4166.471	100632	17771.42	1889.758	4856.782
27	4030.513	100762.7	17642.89	1749.815	4843.277
28	3891.74	100888.4	17511.84	1604.33	4827.812
29	3750.152	101008.9	17378.3	1453.303	4810.387
30	3605.749	101124.2	17242.26	1296.734	4791.003
31	3458.532	101234.5	17103.71	1134.623	4769.659
32	3308.5	101339.6	16962.66	966.9696	4746.354
33	3155.653	101439.7	16819.1	793.7742	4721.09
34	2999.992	101534.6	16673.05	615.0367	4693.867
35	2841.516	101624.4	16524.49	430.7571	4664.683
36	2680.225	101709	16373.43	240.9354	4633.539

Table 4.1

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