Great Wall Automobile H6 Sales Forecast based on Exponential Smoothing Method

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Abstract

Based on the research of demand, demand forecasting and demand forecasting methods, this paper takes the sales data of Great Wall Auto Harvard H6 for 20 months as an example, and combines exponential smoothing method (one-time index Smoothing method and quadratic exponential smoothing method) are used to forecast its sales volume. The reason of the existence of errors in the two forecasts is analyzed, and the production and marketing can be used to control the production cost and manpower cost of the Great Wall Automobile. Which in the Great Wall to expand the market share of the process to provide some help.

Keywords

Demand forecasting; exponential smoothing; automobile production and sales.

1. The Theoretical Analysis

1.1 Demand Forecasting and Influencing Factors

Demand forecasting is very important for any activity. Accurate forecasting can effectively reduce costs and improve economic benefits, and also provide information for enterprises to make decisions. Demand forecast is based on the historical data of the past and present, fully consider the various factors affecting the future, at that time, the local and the actual situation of this enterprise, estimated that within a certain time in the future, the enterprise product or a particular resource demand and the amount of demand. There are many factors that can influence demand, such as the price of the product, consumers' income, the prices of related products (complements, substitutes), consumer preferences, and advertising are from different extent influence the demand. At the same time, these factors for enterprises, also affect their sales.

1.2 Demand Forecasting Method

1.2.1 First exponential Smoothing

The theory is that future demand forecasts are based on weighted averages of previous demand and forecast levels. The new predicted value is the sum of the difference between the weighted predicted value of the previous period and the weighted predicted value of the previous period and the actual weighted demand. This adjustment factor (or weight) is called the smoothing index.

The calculation formula is as follows:

$S_t=\alpha Y_t+ (1-\alpha)S_{t-1}$

Where, Ft is the predicted value of period t;St is the smoothness of period t;Yt is the actual value of period t;St-1 is the smoothness of period t-1;Q is the smoothing coefficient, whose value range is [0,1].

It should be noted that the smoothness of period t is equal to the predicted value of period t+1, i.e

$F_{t+1}=S_t=\alpha Y_t+(1-\alpha)F_t$

1.2.2 Quadratic Exponential Smoothing

The quadratic exponential smoothing method is to make another exponential smoothing on the basis of the first exponential smoothing method, that is, an exponential smoothing model considering the trend change factors in the time series. When using the first exponential smoothing method to predict, the time series data trend shows a trend of increasing or decreasing over time, and the prediction tends to be delayed. Quadratic exponential smoothing can effectively solve the problem of time series data trend.

The calculation formula is as follows:

$F_{t+T}=a_t+b_t*T$

$a_t=2S_t(1)-S_t(2)$

$b_t=\alpha/(1-\alpha)*(S_t(1)-S_t(2))$

$S_t(1)=\alpha Y_t+(1-\alpha)S_{t-1}(1)$

$S_t(2)=\alpha S_t(1)+(1-\alpha)S_{t-1}(2)$

Where, T is the period of advance prediction, and Ft+T is the predicted value of the period of T +T. St(1) is the first smoothing value of period t; St(2) is the second smoothing value of period t; Yt is the actual value of period t; Q is the smoothing coefficient, whose value range is[0, 1].

2. Status Quo Analysis and Problem Solving

2.1 Analysis of the Situation

As people living standard unceasing enhancement, the economic strength also had the more promotion than before, people pursue the quality of life more convenient, high quality, and car has gradually become the essentials of families. For Great Wall, this is both an opportunity and a challenge. Great Wall motors in recent years, the main market is concentrated in the SUV sales market, and is the industry leading position, since August 25, 2011, "urban intelligent positioning SUV" Harvard H6 in Great Wall was listed after the new factory in Tianjin, but also secure the situation. In September of the same year, have H6 sales ranked among the top five SUV sales per month in China's passenger car sales ranking. Since November of the same year, the H6 sales volume has been ranking the first place in China's passenger car sales ranking. Enough to show people's recognition of the H6 model and its greater demand prospects.

However, as far as the current market situation and the enterprise itself are concerned, there are still some problems in expanding the market more rapidly, mainly in the following aspects.

First, the car market is very competitive. In the last five years, the market share of cars has been leading, but it is decreasing year by year. SUV market share continued to grow, especially from 2014 to 2015, up 9 percent. Of course, in addition to the fierce competition in the automobile market, many brands also form competition.

Second, production is high and supply exceeds demand.2016 years ago, 11 months and 11 in 2015 years ago, the Great Wall automobile overall yield is much higher than sales, at the same time, the growth rate of output is higher than the growth rate of sales, this kind of situation separately on each model has different degree of embodiment.

Third, component costs are high and depreciation, red and labor costs are rising. For Great Wall, "over-development" is a strategy to focus on developing subs. Meanwhile, engines, gearboxes, car bodies, interior decoration and electronic systems have long been the main costs of cars, accounting for

more than 60% of the total cost. For the automotive industry, the loss and depreciation of large machines and equipment is also a part of many.

2.2 Cause Analysis

At present, the Great Wall is mainly occupied in the field of auto production SUV sales market, and has 13 consecutive years among the top SUV sales, at Harvard H6 listed after, more to consolidate a position. For all the problems of its enterprises, it can take have H6 as the representative and analyze the production and marketing of have H6 as the main starting point.

First, intense market competition. Competition in China's car industry is fierce. High exit barriers, exit barriers is mainly influenced by sunk costs, auto production requires a large amount of investment, with strong specificity and machine equipment, the high sunk costs lead to high exit barriers of the automotive industry.

Second, car production is greater than sales, mostly because car companies are too optimistic about the market. Traditionally, companies have made demand forecasts based on sales over the previous month and the same period of previous years, without taking into account multiple factors.

Finally, cost is another factor that affects the expansion of automobile enterprises. The cost of automobiles includes the cost of automobile production, the cost of automobile sales and the cost of automobile storage and transportation, as well as the hidden cost of related industrial costs.

3. Sales Forecast Analysis

The prediction is made by using the first-order exponential smoothing method. The steps are as follows:

The first step: use the test algorithm to select the prunes value, which is taken as the cause =0.3, q =0.6, and q =0.9.

Step 2: select the initial value and replace the average value of the actual value before the initial value S0.

Step 3: use the excel editing formula to calculate the smoothing value and predicted value of the index in period t+1. The results are as follows:

Table 1. Experimental data of primary exponential smoothing method

t	sales	Exponential smoothing St			Predictive value Ft		
		α=0.3	α=0.6	α=0.9	α=0.3	α=0.6	α=0.9
1	31400						
2	36100						
3	20200	29233	29233	29233			
4	31400	29883	30533	31183	29233	29233	29233
5	30800	30158	30693	30838	29883	30533	31183
6	30000	30111	30277	30084	30158	30693	30838
7	23500	28128	26211	24158	30111	30277	30084
8	23100	26619	24344	23206	28128	26211	24158
9	27200	26794	26058	26801	26619	24344	23206
10	30500	27905	28723	30130	26794	26058	26801
11	37500	30784	33989	36763	27905	28723	30130
12	40300	33639	37776	39946	30784	33989	36763
13	42600	36327	40670	42335	33639	37776	39946
14	42200	38089	41588	42213	36327	40670	42335
15	33100	36592	36495	34011	38089	41588	42213
16	46100	39445	42258	44891	36592	36495	34011
17	43900	40781	43243	43999	39445	42258	44891

18	37400	39767	39737	38060	40781	43243	43999
19	37500	39087	38395	37556	39767	39737	38060
20	39100	39091	38818	38946	39087	38395	37556
21	40600	39544	39887	40435	39091	38818	38946
22	53300	43670	47935	52013	39544	39887	40435
23	56700	47579	53194	56231	43670	47935	52013
24	70300	54396	63458	68893	47579	53194	56231

Step 4: calculate the root mean square error (RMSE) under different values using excel, as shown in table2.

Table 2. Trial calculation error evaluation table of primary exponential smoothing method

Error categories	α=0.3	α=0.6	α=0.9
Root mean square error n=21	37619.79151	31470.35254	28602.50055

In terms of the type of error, the q =0.9 error is small, so the q =0.9 is used for the prediction analysis.

Step 5: make predictions. The first exponential smoothing method can only be used to predict the first prediction in one step), that is, the sales volume of the haverh6 in the 25th month -- December 2016 F22=S21= 68,893 vehicles

All the above calculations are performed in excel. By using excel, the calculation amount can be effectively reduced and the accuracy can be guaranteed.

Based on the prediction results of the first exponential smoothing method, the second exponential smoothing method was used for the prediction.

Table 3. Prediction data of quadratic exponential smoothing method

t	sales	One exponential smoothing value	Quadratic exponential smoothing value	at	bt	Predictive value
1	31400					
2	36100					
3	20200	29233	29233	29233	0	29233
4	31400	31183	30988	31378	1755	33133
5	30800	30838	30853	30823	-135	30688
6	30000	30084	30161	30007	-693	29314
7	23500	24158	24759	23558	-5402	18156
8	23100	23206	23361	23051	-1398	21653
9	27200	26801	26457	27145	3096	30240
10	30500	30130	29763	30497	3306	33803
11	37500	36763	36063	37463	6300	43763
12	40300	39946	39558	40335	3495	43830
13	42600	42335	42057	42612	2499	45111
14	42200	42213	42198	42229	141	42370
15	33100	34011	34830	33193	-7368	25825
16	46100	44891	43885	45897	9055	54952
17	43900	43999	43988	44011	103	44113
18	37400	38060	38653	37467	-5335	32132
19	37500	37556	37666	37446	-987	36459
20	39100	38946	38818	39074	1152	40226
21	40600	40435	40273	40596	1455	42052
22	53300	52013	50839	53188	10567	63754
23	56700	56231	55692	56771	4853	61623
24	70300	68893	67573	70213	11881	82094

By predicting, 25 months, that is, in December 2016 the Harvard H6 sales of 82094 units. The results and there are many differences between an exponential smoothing, but because the results can be in a certain extent, eliminate lag an exponential smoothing results, thus is more reliable.

4. Conclusion

Based on the demand, the demand forecasting of the related theories and methods as well as the factors affecting the demand as the foundation, to the Great Wall automobile Harvard H6 nearly 20 months of sales data, for example, will demand forecasting of relevant methods applied to the sales forecast, in the hope for Great Wall in expanding market share in the process of provide certain help.

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