FORECAST OF PHARMACY SALES WITH BROWN'S **EXPONENTIAL SMOOTHING**

OLIMPIA DUMITRIU BUZIA¹, NELA MARDARE², CAMELIA DIACONU³

^{1,2,3}Dunarea de Jos University Galați

Keywords: pharmaceutical products, anterior forecast. WinQSB forecast, software

sales

ulterior

Abstract: The present paper aims at improving the sale of pharmaceutical products, taking into account the fact that Romania is and will continue to be a market of high potential in selling pharmaceutical goods. We have used a mathematical pattern, i.e. Brown's exponential smoothing method. Brown's exponential smoothing method consists in correcting predictions proportional to the deviation noted between previous predictions and their accomplishment, each deviation being downward weighted as it departs from the present. The prediction following the reference period is based on the algebraic sum of the previous forecast and a percentage associated with adjustment error. This problem is solved with the help of the WinOSB software; applying the Solve and Analyze function in the menu of the Forecasting application of the WinQSB software leads to acquiring the outcomes of the predictions. The managers of health care institutions should use the new information and communication technologies in order to plan the activities that will contribute in reaching their proposed objectives, based on accurate forecasting patterns.

INTRODUCTION

The managers in the field of pharmaceutical services are frequently confronted with the necessity of making operational decisions without knowing their medium-term and impact.(1) Making methodologically long-term and scientifically thorough predictions allows them to anticipate the future and plan the activities which will contribute in attaining their objectives.

PURPOSE

Optimisation of sales of pharmaceuticals products of a pharmacy from Galați using the WinQSB software.

MATERIALS AND METHODS

In order to present the foundation method of a prediction in the field of pharmaceutical services, we have considered appropriate to apply Brown's Single Exponential Smoothing method for the forecast of the sale of Pharmacy "A" from Galați, under contract with the National Health Insurance Fund, based on the sales reports provided by the pharmacy manager.

The sales recorded last year exceeded the estimations of Cegedim. In Euro, the drug sales increased last year (2014) by 6.2%. In 2013, the value of the pharmaceutical market was of 11.75 billion according to the studies conducted by Cegedim.(2)

During the focus period, the retail sales decreased by 3.9%, to 580.6 million Euros, and hospital sales by 4.9%, to 88.2 million Euros. In RON, the drop was of 1.3% for pharmacies and 2.3% for hospitals.

Prescription drugs (Rx) in pharmacies reached the value of de 2.12 billion RON (471.7 million Euros), on the decrease by 2.2%, and over-the-counter drugs (OTC) reached 490 million RON (109 million Euros), one the increase by 2.4%.

At the level of the last 12 months (April 2013 – March 2014), the total value on the market was of 11.7 billion RON lei, on the decrease by 1.2%, compared to the corresponding period of the previous year (April 2012 - March 2013). In Euro, the market decreased by 0.8%, to 2.63 billion Euros.

The retail sales decreased by 0.7%, to 2.27 billion Euros, whereas sales to hospitals reduced by 2.6%, to 353.1 million Euros. Prescription drugs recorded a decrease by 1.6%, to 1.87 billion Euros, and OTC sales increased by 4.5%, to 402.7 million Euros.

On long term, Romania is still a high-potential market in the field of pharmaceutical products sale, as its average longterm (10 years) increase rate is of 12.5%.(2,3,4)

Brown's exponential smoothing method

Brown's exponential smoothing method consists in correcting predictions proportional to the deviation noted between previous predictions and their accomplishment, each deviation being downward weighted as it departs from the present.

According to this method, each forecast subsequent to the reference period is based on the algebraic sum of the previous prediction and a percentage associated to adjustment error.

The mathematical equation of Brown's method is:

$$F_{t+1} = F_t + \alpha \mathbf{x} \ e_t$$
 (1), where:

 F_{t} and F_{t+1} represent predictions of a phenomenon studied in two successive periods;

 α – levelling constant, which represents a percentage of the prediction error; $0 \le \alpha \le 1$ (for unseasonal and trendless phenomena)

 e_{i} - adjustment error which underlines the difference between the real and the forecasted level of the phenomenon under focus: $e_t = Y_t - F_t$

$$F_{t+1} = F_t + \alpha \mathbf{x} (Y_t - F_t) \implies F_{t+1} = \alpha \mathbf{x} Y_t + (1 - \alpha) \mathbf{x} F_t \quad (2)$$

Equation (2) underlines the relation between the prediction for the "t+1" period according to the real and predicted levels of the phenomenon studied in the t period.

AMT, vol. 21, no. 1, 2016, p. 127

²Corresponding author: Olimpia Dumitriu Buzia, Str. Tecuci, Nr. 40, Galați, România, E-mail: buzia_olimpia@yahoo.com, Phone: +40746 222264 Article received on 08.02.2016 and accepted for publication on 10.03.2016 ACTA MEDICA TRANSILVANICA March 2016;21(1):127-129

RESULTS AND DISCUSSIONS

The sales of Galenus Pharmacy, where we conducted a study case on the applicability of the exponential smoothing method, had the following trend in the period March-August 2014 (table no. 1):

Table no. 1. The sales of "A" Pharmacy during the March – August 2014 period

	- RON -				
Month	Actual sales (Y_t)	Predicted sales (F_t)			
March	23,512	24,120			
April	24,645				
May	22,872				
June	23,317				
July	21,810				
August	22,724				
September	-	??			

Knowing that the initial prediction of the March 2014 sales was of 24.120 RON, the manager of "A" Pharmacy wants to determine the forecast of the September sales, on condition that there is no trend or seasonality of the sales. The value of the levelling constant, as established by the decision-maker, is $\alpha = 0.3$

According to the data recorded in table no. 1, the actual sales and the predicted sales in March can be transcribed as follows: $F_1 = 24.120$ RON and $Y_1 = 23.512$ RON. Applying the second formula (2), one may determine the value of prediction for April (F_2):

$$\begin{split} F_2 &= 0.3 \ge Y_1 + (1 - 0.3) \ge F_1 \\ F_2 &= 0.3 \ge 23.512 + 0.7 \ge 24.120 \implies F_2 = 23.937.6 \ \text{RON} \\ F_3 &= 0.3 \ge Y_2 + (1 - 0.3) \ge F_2 \\ F_3 &= 0.3 \ge 24.645 + 0.7 \ge 23.937.6 \implies F_3 = 24.149.82 \ \text{RON} \\ F_4 &= 0.3 \ge 22.872 + 0.7 \ge 24.149.82 \implies F_4 = 23.766.47 \ \text{RON} \\ F_5 &= 0.3 \ge 23.317 + 0.7 \ge 23.766.47 \implies F_5 = 23.631.63 \ \text{RON} \\ F_6 &= 0.3 \ge 21.810 + 0.7 \ge 23.631.63 \implies F_6 = 23.085.14 \ \text{RON} \\ F_7 &= 0.3 \ge 22.724 + 0.7 \ge 23.085.14 \implies F_7 = 22.976.8 \ \text{RON} \end{split}$$

The results obtained after the successive application of the mathematical formula specific to Brown's exponential smoothing method determine the prediction for September (table no. 2).

Table no. 2. Predicted sales of "A" Pharmacy from March to September

	- RON -			
Month	Actual sales (Y_t)	Predicted sales (F_t)		
March	23.512	24.120		
April	24.645	23.937.6		
May	22.872	24.149.82		
June	23.317	23.766.47		
July	21.810	23.631.63		
August	22.724	23.085.14		
September	_	22.976.8		

Solving this problem with the help of the WinQSB application software (5) is pursued by taking the following steps:(3)

- access the Forecasting & Linear Regression module;
- choose the prognosis problem type Time Series Forecasting and fill in the fields: title of the problem, unit of time (calendar months) and the length of the dynamic series (6 months);

• select Single Exponential Smoothing (SES) method, insert the values of the actual sales of the pharmacy from March to August, the value of the forecast for the first month (March) and the value of levelling constant ($\alpha = 0.3$). (figure no. 1).

Figure no. 1. Entry data of the problem of determining the

forecast of the sales of a pharmacy based on exponential

smoothing method				
🐱 Focusating (Presiziones worsarilar on	i fanneil] 👘			
Sate of the break shows a second	are the design	webber 16		
표당님 🖂 📲 지 환변 🚥 소 티	* = 1	i 😹 🔤	🔜 💷 🖬 🐼 😵	
8. Historical Data	20224			
		Line	The Internal II also	1
		I.	23512	
		2	2025	
		2	32%72	
		+	2359.7	
		5	2100.0	
		Б	22(24	
Larecasting Setup		ь	22124	×
Forecasting Setup	N	6 adhan P.n. andara	22124 Kaunik Calmine	×
For an analysis of the second se	N	6 allen Proseden R Assign valuer	Saunh Gilminn Ruanh Gilminn Ruanh O DFE	×
Formating Satup Formating Kotsol C: Single average (SA) C: Powng are age (PG)	N.	6 Alex Prosident 8 Assign values 7: Search the Devi	Example Coloring Records Coloring Records Colore Colore Colore	×
For accessfung Sectory For accessing National C: Single average (SA) C: Husting average (HK) C: Manyhar average (HK)	N	b allen Proceeder 9 Aarige valuer 7 Search Joe Devi	Konsk Gibnins Robert Official Official Official	×
Larscarding Sotup For meeting Kotwol C. Single average (SA) C. Huseng are age (HA) C. Monghan may ng aseraga (MNA) C. Koning awaran wik Tanan unod (NAT)		B athen Proceedian R Assign values T Search the book athen of periods to 1	22124 Receive Colorian Revelop Coloria Revelop Coloria Revelop Coloria	×
For according Settip For according Kathwall C: Single average (SA) C: Hawing average (HA) C: Hawing average static Taxor and (NAT) (F: Single expressed al second (NAT) (F: Single expressed al second (in) (SES)		B Adam Proceedings Analysis values Search the level alose of periods to 1 ending constant of	20124 Second Falm inn Er Holl O EFE Er Halt Er Hollon Innend I pha Uty	×

If the approximation of the most adequate value for the levelling constant α is needed, a comparison criterion is selected. It may be one of the following: mean of absolute deviation (MAD), cumulative forecast error (CFE), mean square error (MSE) or mean absolute percentage error (MAPE).

The use of the Solve and Analyze function in the menu of the Forecasting application of the WinQSB software provides the forecasts on the successive months of the period in focus and, implicitly, the determination of the forecast of the September sales, data available in the Forecast by SES field: (figure no. 2).

Figure no. 2. Results of forecasting the sales of a pharmacy with the help of the Single Exponential Smoothing module of the WinQSB application software

of Famoacaley								
For Farwar You al Laborar Mindow Note								
🖬 🕿 🤫	cao A		Cie	- 10		<mark></mark>	62	
a Funccriffered, he Providence cone the and ferneed!								
	BRUCK STEP Lans	Anton Dista	Francation 310	Financial Ling:	.12	MAC .	MK.F	MVEB (2)
	1	040						
	,	2010	2002.5	π 2 1324	272 1024	707 4884	500×157	2.070.361
	1	55F\.S	26165.52	12///22	271.033	387 B. H	108882	1222/06
	1	202.2	20011,47	-145,1246	-10.10.0022	011,565	7702225	1461621
	3	:11.1	2011.33	1111.553	1101/227	10046882	1410460	0.04300
	•		24 P. (1	01,18.8		ALCON	1114308	0.004
	7		22011					
	Cas		2010,97					
	H/D		522,4348					
	NSE.							
	MARE -		4,15521					
	Int.Signal		2.67112					
	Hospital		10,6244.015					
			Alphe F 1					
			100-20123					

CONCLUSIONS

To conclude, the managers in the field of health care services should use the new information and communication technologies in order to plan their activities which will contribute to attaining their objectives, based on adequate prediction patterns.

AMT, vol. 21, no. 1, 2016, p. 128

The field of information technology has had an exceptional development lately. Regardless of the activity field in which software applications and innovations are used, the information-technology field is characterised both by dependability and by swift adaptation to the demands of the market of health care services in Romania.

The research studies undertaken in the field of health care services have proved that the managers of the organisations (4) involved in providing pharmaceutical services often make decisions based on experience, by analysing the information available in databases constantly updated by their administrators.

REFERENCES

- Gourdin K. Global Logistics Management A Competitive Advantage for the 21st Century, John Willey and Sons, New York; 2006. p. 66.
- 2. http://www.mediafax.ro/economic/cegedim-piatafarmaceutica.
- 3. Schneller E. Strategic Management of the Health Care Supply Chain, Jossey Bass, San Francisco; 2003.
- 4. Young S. Multiple Productivity Approaches to Health Care Management, Health Care Management Review. 2008;17.
- 5. A free trial version of the WinQSB software has been downloaded from http://www.asecib.ase.ro/soft.htm.