STUDENT SOLUTION MANUAL

Business Statistics in Practice, Third Canadian Edition

by

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CHAPTER 16: Time Series Forecasting

16.1 [LO 1]

No long-run growth or decline in the time series over time.

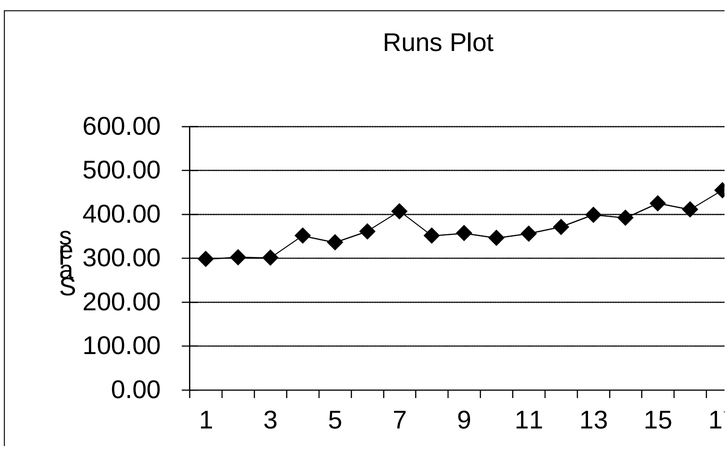
Straight-line long-run growth or decline over time.

16.3 [LO 2]

In general, the purpose of the dummy variables is to ensure that an appropriate seasonal parameter is included in the regression model in each time period. The number of dummy variables that we use is, in general, the number of seasons minus 1.

16.5 [LO 2]

a. The data plot suggests that there is a long-run straight line growth. Therefore, the linear trend model $y_t = \beta_0 + \beta_1 t + \varepsilon_t$ is reasonable.



b. $\hat{y} = 290.089474 + 8.667669(21) = 472.1$

Using the MegaStat output:

Predicted values for: Sales

		95% Confidence Interval		95% Prediction Interval		
Month	*Predicted*	*lower*	*upper*	*lower*	*upper*	*Leverage*
21	472.111	450.796	493.425	421.519	522.703	0.216

Hence, 95% prediction intervals are for y_{21}: [421.5 to 522.7]

16.7 [LO 2]

MegaStat Output:

Predicted values for: Y

		95% Confidence Intervals		95% Prediction Intervals		
t	*Predicted*	*lower*	*upper*	*lower*	*upper*	*Leverage*
2,012	653,143.8	643,011.6	663,276.0	639,144.1	667,143.5	1.100
2,013	662,385.8	649,424.6	675,347.0	646,220.3	678,551.3	1.800

16.9 [LO 2]

It is quite common for time series data to violate the assumption of independence in the error terms. Hence, autoregressive error term model allows us to test for the type of autocorrelation present.

16.11 [LO 2]

Durbin–Watson statistic, $d = 0.43$. Appendix table only goes to $k = 5$, but d is very small. Hence, positive correlation exists.

16.13 [LO 3]

TR is estimated by fitting a straight line to deseasonalized observations.

16.15 [LO 3]

The seasonal factors for quarters 1, 2, 3, and 4 are $sn_1 = 1.192$, $sn_2 = 1.521$, $sn_3 = 0.804$, and $sn_4 = 0.484$.

16.17 [LO 3]

$tr_t = 220.54 + 19.95t$

16.19 [LO 3]

95% Prediction Intervals

Quarter 1 1997: $\left[666.6 \pm 14\right] = \left[652.6,\ 680.6\right]$

Quarter 2 1997: $\left[881.6 \pm 14.4\right] = \left[867.2,\ 896.0\right]$

Quarter 3 1997: $\left[482.1 \pm 14.6\right] = \left[467.5,\ 496.7\right]$

Quarter 4 1997: $\left[299.9 \pm 15\right] = \left[284.9,\ 314.9\right]$

16.21 [LO 3]

When the equation $y_t = \beta_0 + \varepsilon_t$ describes the time series and when β_0 may be changing slowly over time.

16.23 [LO 3]

The variable "t" is included in the double smoothing model as a separate independent variable.

16.25 [LO 3]

Forecast = 35,438

16.27 [LO 4]

MAD = mean absolute deviation

MSD = mean squared deviation

MAPE = mean absolute percentage error

These quantities are used to compare forecasting methods.

16.29 [LO 4]

Method A: forecast errors: 3, 3, –3. MAD = 3; MSD = 9; MAPE = 4.72

Method B: forecast errors: 1, –1, –6. MAD = 2.67; MSD = 12.67; MAPE = 4.06

16.31 [S 16.7]

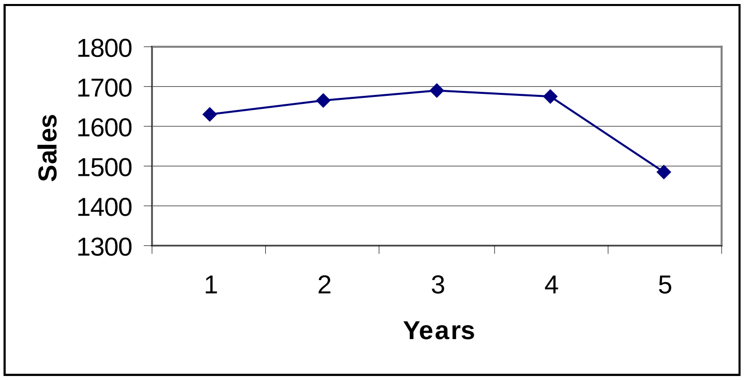
A simple index is computed by using the values of one time series; an aggregate index is based on a "market basket" consisting of more than one time series.

16.33 [S 16.7]

a.

Year	Sales (1,000s)	Simple price index
2005	1,630 (Base)	100
2006	1,666	(1666/1630)×100 = 102.21
2007	1,690	103.68
2008	1,674	102.70
2009	1,485	91.10

b. For 2008: 1674/1630 × 100 = 102.70; for 2009: 91.10; Sales were up 11.6% in 2008 when compared to 2009.



c.

Huge drop in sales in 2009 (year 5).

16.35 **[S 16.7]**

a.

Simple Index:

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
gold	100.00	87.44	87.90	82.88	78.77	82.42	87.90	84.02	89.04
silver	100.00	84.23	73.81	61.87	60.34	65.85	81.01	78.87	81.16
platin	100.00	96.94	89.29	70.94	68.83	71.51	78.59	81.26	78.39

b. Prices of the precious metals are lower than the base year of 1988

c.

Aggregate price index:

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
index	100	92.56	88.56	76.28	73.27	76.41	82.82	82.49	83.23

Prices of the precious metals are lower than from the base year of 1988

d.

Aggregate price index: (base=1990)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
index	112.92	104.51	100.00	86.14	82.74	86.28	93.52	93.15	93.99

16.37 **[LO 2]**

a. Yes, in fact, below is the Megastat output:

Regression Analysis

r^2	0.636	n	18
r	-0.798	k	1
Std. Error	3.356	Dep. Var.	**%dead**

ANOVA table

Source	*SS*	*df*	*MS*	*F*	*p-value*
Regression	315.5439	1	315.5439	28.01	.0001
Residual	180.2339	16	11.2646		
Total	495.7778	17			

Regression output

variables	*coefficients*	*std. error*	*t (df=16)*	*p-value*	*confidence interval 95% lower*	*95% upper*
Intercept	1,639.5205	304.8837	5.378	.0001	993.196	2,285.85
t	-0.8070	0.1525	-5.293	.0001	-1.1303	-0.4838

b.

Predicted values for: %dead

		95% Confidence Intervals		95% Prediction Intervals		
t	*Predicted*	*lower*	*upper*	*lower*	*upper*	*Leverage*
2,009	18.2	14.7	21.7	10.3	26.2	0.242
2,010	17.4	13.6	21.2	9.4	25.5	0.283
2,011	16.6	12.5	20.7	8.4	24.8	0.329
2,012	15.8	11.4	20.2	7.4	24.2	0.378
2,013	15.0	10.3	19.7	6.5	23.5	0.432

Assess predicted values against actual values.

16.39 [LO 1,2]

a. increasing trend

b. Output:

Predicted values for:
Amount

		95% Confidence Intervals		95% Prediction Intervals		
t	*Predicted*	*lower*	*upper*	*lower*	*upper*	*Leverage*
2,010	7,721,399.7	5,785,089.0	9,657,710.4	5,046,002.0	10,396,797.4	1.100