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LITIGATION SUPPORT

Choosing a Sales Forecasting Model: A Trial and Error Process

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When determining "but for" sales in a commercial damages case, regression analysis can be a very powerful forecasting tool in the hands of a skilled valuation analyst. But like all tools, if not handled properly it can cause unanticipated harm to both the client's case and the analyst's reputation. One specific "rule" of regression analysis that is repeatedly violated by both novice and experienced users is that of not extrapolating a result beyond the relevant range of data. This article presents such a problem and offers a solution.

The XYZ Motel suffered economic damages when it lost its office and manager's quarters in a traffic accident on May 31, the beginning of its busiest four months. We were hired by the tortfeasor's insurance carrier to assess the damages claim presented by the motel. Having determined that there was minimal upward trend in the monthly data over the past three years due to the fact that occupancy rates exceed 95 percent in July, August, and September, we needed to choose a forecasting model that would produce a result that not only approximated last year's sales for the same four-month period, but that also accounted for a 4.9 percent increase in lodging sales in the Economic Summary Area (ESA) during the loss period. While a seasonally adjusted time series model will probably do the job very nicely, in this article I demonstrate a cross-sectional, or causal, model.

First some facts about the case. Table 1 indicates selected data from the three years previous to the year of loss.

Note the responsiveness of the occupancy rate to the average room rate, the variable pattern in the occupancy rate versus the upward trend in room sales, and most especially, the relative volatility of the percentage change in room sales during the off-season when compared to the room sales in the ESA. This presents us with some possibly contradictory data—an increase in ESA sales during the summer months of 1996 offset by a downward trend in room sales in the period preceding those summer months.

The first problem we encountered was contained in the XYZ Motel's claim for lost cash receipts, rather than for lost room sales. As cash receipts included a 7 percent sales tax, the initial claim was overstated by $15,191. After correcting for this error, the subsequent claim took room sales for the 1996 summer season and increased it by 9.9 percent, the calendar year increase of 1995 over 1994, rather than just the 3.7 percent increase of the 1995 summer season over the 1994 summer season. That calculation (195,968 x 1.099) produced expected sales of $215,368, which, with an average room rate in the 1996 summer season of $60.74, produced an occupancy rate of 100.2 percent. This result too was rejected by the insurance company, along

TABLE 1: SELECTED DATA 1993–1995

	Period	1993	1994	1995
Occupancy Rate	June-Sept	89.6%	93.1%	89.4%
Avg. Room Rate	June-Sept	$58.60	$57.31	$61.90
Room Sales	June-Sept	$185,945	$188,954	$195,968
Change in Sales–XYZ	Oct–May 1996	NA	25.0%	-13.5%
Change in Sales–ESA	Oct–May 1996	NA	11.8%	-3.8%

with the results of multiplying $195,968 by either 1.049 or 1.037, as each produced an occupancy rate greater than that of the 1994 summer season, and were therefore considered speculative by the insurance carrier. Neither would the insurance company pay the claim based simply on the highest occupancy rate of the three-year period without further proof that that rate was achievable in 1996.

CAUSAL MODEL

While the differences among all these lost sales forecasts were not substantial given the potential range of sales, they were significant to both the claimant and the insurance company. Given the overstated initial claim, the insurance company asked us to be not only accurate but precise in our calculation of lost profits. With that request in mind, we turned to a cross-sectional, or causal, model. Since the period of interruption was closed, i.e., the period of interruption was over, we made a search for an independent variable that would correlate closely with the motel's sales. We found and downloaded the gross sales for lodging places for the Brunswick ESA from the State Planning Office that coincided with the 36 months prior to the incident date, and the four months of the period of interruption. Since the monthly sales of the XYZ Motel are included in the monthly ESA data, they were subtracted from the monthly ESA data so as not to distort comparability between the two sets of data.

Visually comparing the monthly percentage of total sales and the cumulative monthly percentage of sales for the motel versus the Brunswick ESA during the subject four months, as shown on Figure 1.1 (page 11), indicates a high degree of correlation that we thought might carry over into the whole year. We graphed the 36 months of comparative sales on a log scale so that the same visual weight would be given to comparable percentage changes in both sets of numbers. The result is Figure 1.2 (page 12), which on a visual basis indicates a high degree of correlation. Knowing that quarterly data are often easier to forecast than monthly data, because aggregating the data into quarters usually eliminates a great deal of noise or randomness in the data, we converted months into quarters. The resulting log scale graph is shown on Figure 1.3 (page 12). Visually, the lines are almost identical, further indicating the higher degree of correlation between the XYZ Motel sales and the Brunswick ESA sales that can be obtained with quarterly data.

LOG SCALE DECEPTION

Figures 1.2 and 1.3 seem to indicate a liner relationship between XYZ Motel sales and the ESA sales. However, looks can be deceiving, as log scale graphs are not designed to demonstrate linearity. Instead, we created the scatter plot shown on Figure 1.4 (page 13) which visually indicates the correlative and curvilinear relationship between the XYZ Motel and ESA sales. Therefore the data was fit with a quadratic (second-degree polynomial) trend-line, a form of transformation that allows us to account for the curvilinearity of the relationship that is caused by the phenomenon of room sales increasing relative to ESA sales but at an ever decreasing rate. The reasons for the slowdown in the rate of sales increases in the quarter comprising June, July, and August could be two-fold:

- There is more competition in the summer months than the rest of the year, as most motels shut down for the winter.
- Occupancy rates are above 95 percent in July and August, thereby putting a cap on sales increases.

CURVILINEAR METHODOLOGY

To mathematically account for the curvilinearity, we ran a quadratic[1] regression analysis on the quarterly data. This required a second independent variable that was created by raising ESA quarterly sales to the power of 2. This second variable will cause the trend-line to curve downward as the value of ESA sales increases, accounting for the slowdown in the rate of increase in XYZ Motel sales during the summer season. The setup sheet for this regression is shown on Figure 1.5 (page 13), and the regression output results are shown on Figure 1.6[2] (page 14). A coefficient of correlation of .992 and a coefficient of determination of .985 indicate an extremely high level of strength in the curved but still linear relationship between ESA sales and XYZ Motel sales, as well as implying that 98.5 percent of the variation in XYZ Motel sales are accounted for, or explained by, the variation in ESA sales. Applying the intercept and the coefficients of the regression output to ESA sales and ESA sales squared for the quarters composed of June, July, August and September, October, November of 1996 produces a predicted sales volume for those four months of $186,163, as shown on Figure 1.6.[3] We removed October and November 1996 sales by subtracting the historical average proportion of 53.4 percent that those two months represent of that quarter's sales from the predicted value for that quarter.

(Continued on page 15)

1 A quadratic model takes the form: $y = a + bx + cx^2$.
2 The cell values in the Forecasted and Predicted columns were created using Excel's TREND function whose syntax is TREND (*known-y's, known-x's, new-x's, constant*). This returns the y values of given input values (*new-x's*) based on the regression of *known-y's* on *known-x's*. If constant = true, the constant, or intercept, value is computed.
3 For example, the forecasted sales for June are computed as follows: -49,641 + .069 * 6,453,000 – 6.114E-.09 * 7,398,400,000,000 = 142,644.

Figure 1.1
XYZ MOTEL
HISTORICAL SALES

	1993–1994			1994–1995			1995–1996			1996–97	3 YEAR AVERAGE	
	$	%	CUM %	$	%	CUM %	$	%	CUM %	$	MONTH	CUM %
JUNE	27,241	9.5%	9.5%	31,249	9.9%	9.9%	32,038	10.5%	10.5%	25,346	9.96%	9.96%
JULY	55,473	19.3%	28.8%	57,299	18.2%	28.1%	57,112	18.7%	29.2%	43,217	18.73%	28.70%
AUGUST	58,073	20.2%	49.0%	56,579	17.9%	46.0%	59,838	19.6%	48.8%	55,136	19.26%	47.95%
SEPTEMBER	45,159	15.7%	64.8%	43,827	13.9%	59.9%	46,981	15.4%	64.2%	41,151	15.01%	62.96%
OCTOBER	37,917	13.2%		35,490	11.3%		41,902	13.7%		164,850	-15.88%	
NOVEMBER	11,902	4.1%		13,967	4.4%		15,232	5.0%			Change from Prior Year	
DECEMBER	5,268	1.8%		10,362	3.3%		7,642	2.5%				
JANUARY	4,995	1.7%		6,788	2.2%		5,015	1.6%				
FEBRUARY	6,816	2.4%		14,940	4.7%		5,378	1.8%				
MARCH	6,073	2.1%		14,490	4.6%		7,332	2.4%				
APRIL	9,152	3.2%		11,951	3.8%		9,540	3.1%				
MAY	18,966	6.6%		18,409	5.8%		17,338	5.7%				
	287,035	100.0%		315,352	100.0%		305,347	100.0%				
% CHANGE FROM PRIOR YEAR				9.9%			-3.2%					
OCT–NOV %	53.4%	52.5%			53.0%			54.9%				
TOTAL, JUNE SEPTEMBER	185,945			188,954			195,968					
%CHANGE FROM PRIOR YEAR				1.6%			3.7%					
THREE YEAR AVERAGE								190,289				
TOTAL, OCT TO MAY	101,090			126,398			109,379					
%CHANGE FROM PRIOR YEAR				25.0%			-13.5%					
TOTAL, DEC TO MAY	51,271			76,941			52,244					
%CHANGE FROM PRIOR YEAR				50.1%			-32.1%					

Sales During Period of Interruption

BRUNSWICK ECONOMIC SUMMARY AREA
HISTORICAL SALES

	1993–1994			1994–1995			1995–1996			1996–97	3 YEAR AVERAGE	
	$	%	CUM %	$	%	CUM %	$	%	CUM %	$	MONTH	CUM %
JUNE	1,073,000	9.3%	9.3%	1,147,000	10.4%	10.4%	1,302,000	11.4%	11.4%	1,428,000	10.37%	10.37%
JULY	2,278,000	19.8%	29.1%	1,844,000	16.7%	27.1%	2,426,000	21.2%	32.6%	2,601,000	19.24%	29.61%
AUGUST	2,959,000	25.7%	54.8%	2,381,000	21.6%	48.6%	2,306,000	20.2%	52.8%	2,424,000	22.49%	52.10%
SEPTEMBER	1,354,000	11.8%	66.6%	1,374,000	12.4%	61.1%	1,253,000	11.0%	63.8%	1,191,000	11.73%	63.83%
OCTOBER	811,000	7.0%		916,000	8.3%		941,000	8.2%		7,644,000	4.90%	
NOVEMBER	488,000	4.2%		542,000	4.9%		578,000	5.1%			Change from Prior Year	
DECEMBER	380,000	3.3%		352,000	3.2%		433,000	3.8%				
JANUARY	289,000	2.5%		368,000	3.3%		244,000	2.1%				
FEBRUARY	242,000	2.1%		537,000	4.9%		432,000	3.8%				
MARCH	364,000	3.2%		489,000	4.4%		289,000	2.5%				
APRIL	662,000	5.8%		489,000	4.4%		600,000	5.3%				
MAY	608,000	5.3%		605,000	5.5%		618,000	5.4%				
	11,508,000	100.0%		11,044,000	100.0%		11,422,000	100.0%				
%CHANGE FROM PRIOR YEAR				-4.0%			3.4%					
TOTAL, JUNE SEPTEMBER	7,664,000			6,746,000			7,287,000					
%CHANGE FROM PRIOR YEAR				-12.0%			8.0%					
TOTAL, OCT TO MAY	3,844,000			4,298,000			4,135,000					
%CHANGE FROM PRIOR YEAR				11.8%			-3.8%					
TOTAL, DEC TO MAY	2,545,000			2,840,000			2,616,000					
%CHANGE FROM PRIOR YEAR				11.6%			-7.9%					

Sales During Period of Interruption

Figure 1.2
COMPARATIVE SALES
BY MONTH
JUNE 1993 - MAY

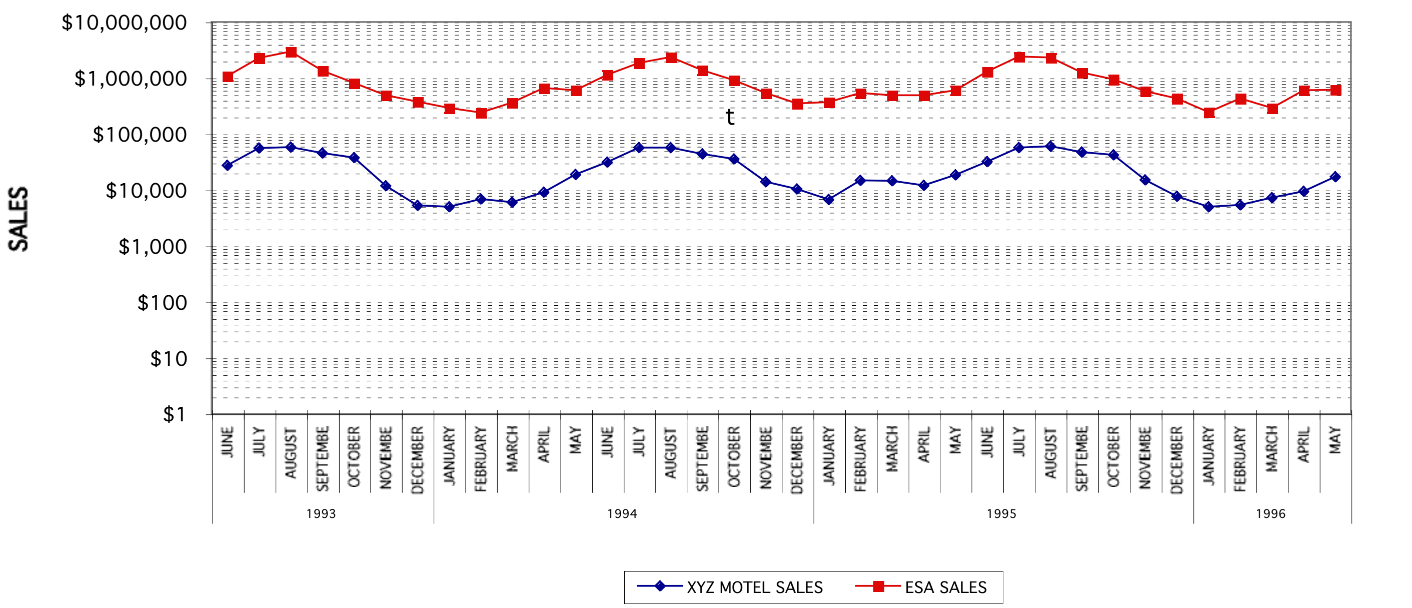
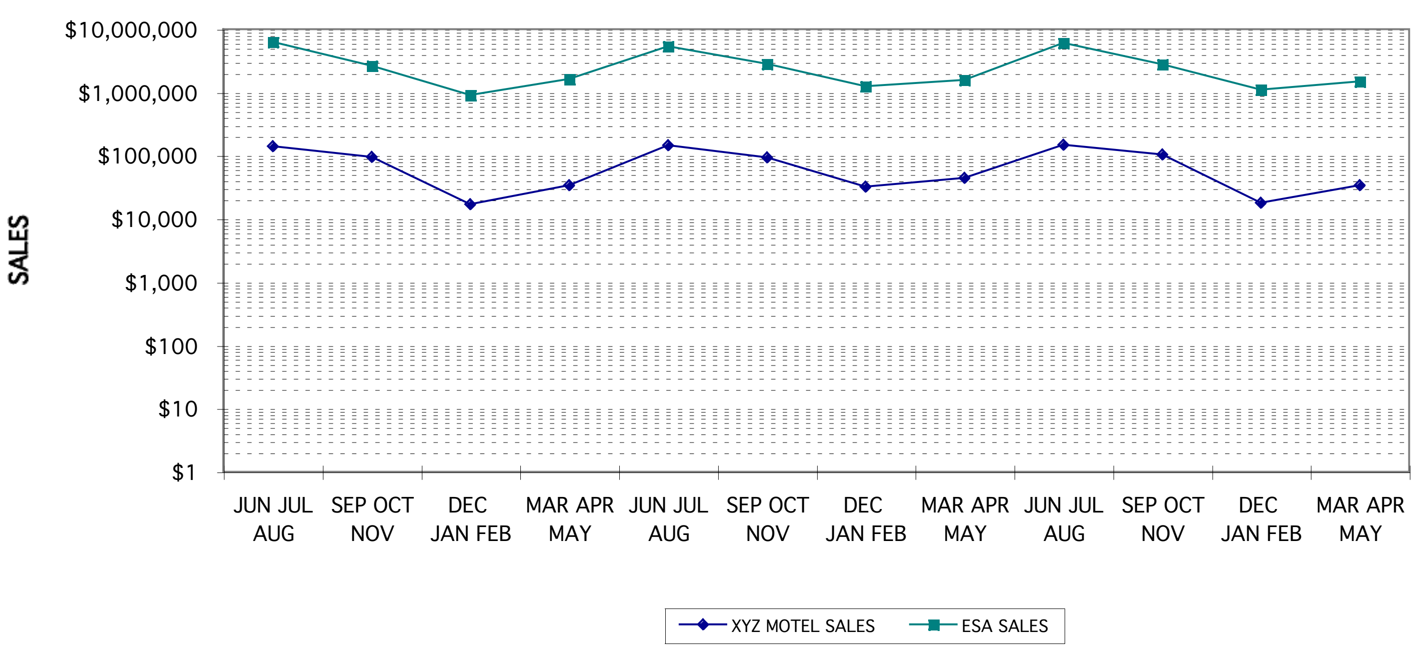


Figure 1.3
COMPARATIVE SALES
BY QUARTER
JUNE 1993 - MAY



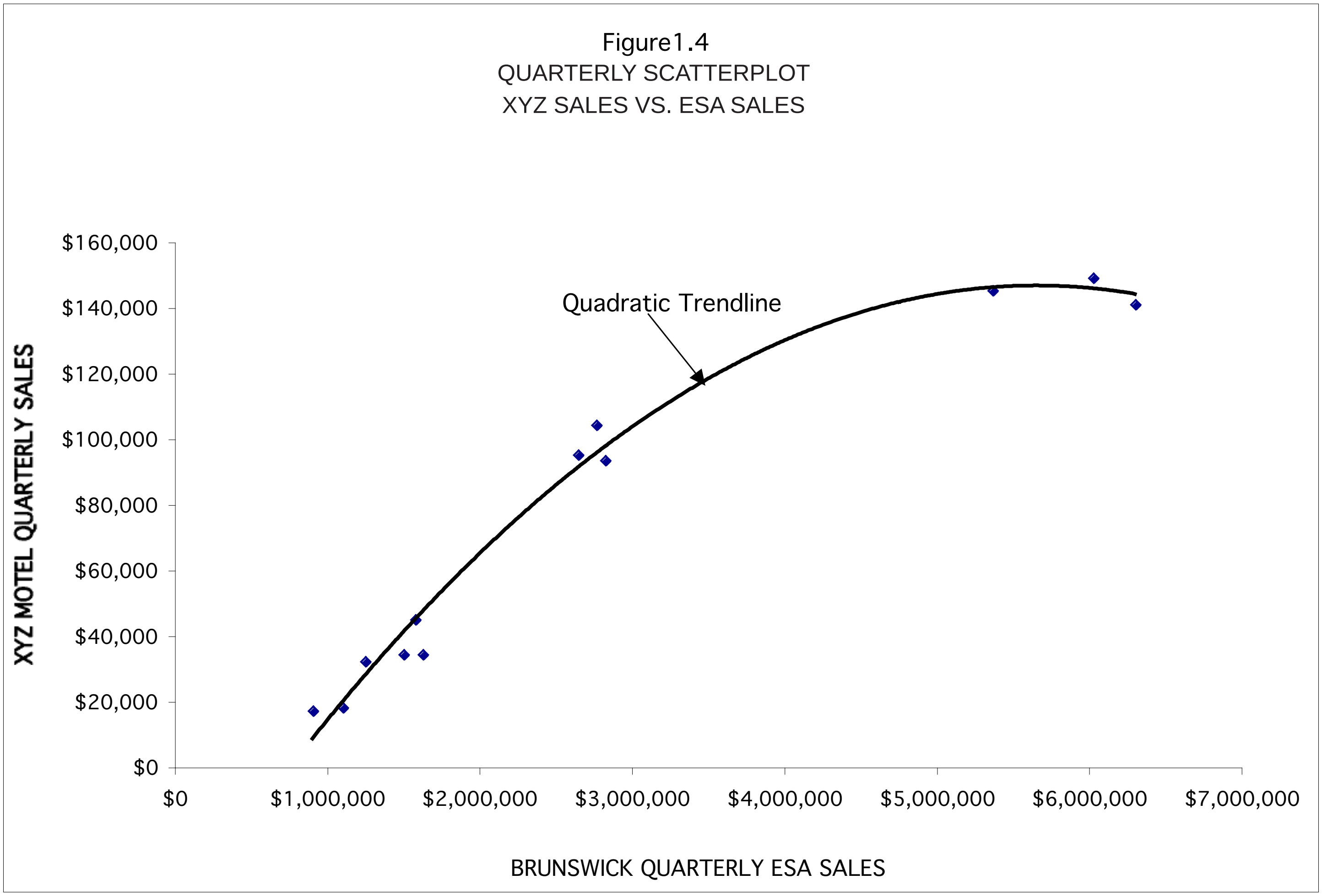


FIGURE 1.5

XYZ MOTEL
SET-UP SHEET FOR QUADRATIC REGRESSION MODEL

Year	Quarter	XYZ Motel Sales	ESA Sales	ESA Sales2
1993	JUN, JUL, AUG	140,787	6,310,000	39,816,100,000,000
1993	SEP, OCT, NOV	94,978	2,653,000	7,038,409,000,000
1993–1994	DEC, JAN, FEB	17,080	911,000	829,921,000,000
1994	MAR, APR, MAY	34,191	1,634,000	2,669,956,000,000
1994	JUN, JUL, AUG	145,127	5,372,000	28,858,384,000,000
1994	SEP, OCT, NOV	93,284	2,832,000	8,020,224,000,000
1994–1995	DEC, JAN, FEB	32,090	1,257,000	1,580,049,000,000
1995	MAR, APR, MAY	44,850	1,583,000	2,505,889,000,000
1995	JUN, JUL, AUG	148,988	6,034,000	36,409,156,000,000
1995	SEP, OCT, NOV	104,115	2,772,000	7,683,984,000,000
1995–1996	DEC, JAN, FEB	18,034	1,109,000	1,229,881,000,000
1996	MAR, APR, MAY	34,211	1,507,000	2,271,049,000,000

FIGURE 1.6

XYZ MOTEL

QUADRATIC REGRESSION OF QUARTERLY SALES AGAINST QUARTERLY ESA SALES

YEAR	QUARTER	(X) ESA SALES	(X2) ESA SALES2	(Y) XYZ MOTEL SALES	FORECASTED SALES	PREDICTED SALES
1993	JUN, JUL, AUG	6,310,000	39,816,100,000,000	140,787	143,899	
	SEP, OCT, NOV	2,653,000	7,038,409,000,000	94,978	91,049	
1994	DEC, JAN, FEB	911,000	829,921,000,000	17,080	8,373	
	MAR, APR, MAY	1,634,000	2,669,956,000,000	34,191	47,191	
	JUN, JUL, AUG	5,372,000	28,858,384,000,000	145,127	145,937	
	SEP, OCT, NOV	2,832,000	8,020,224,000,000	93,284	97,443	
1995	DEC, JAN, FEB	1,257,000	1,580,049,000,000	32,090	27,747	
	MAR, APR, MAY	1,583,000	2,505,889,000,000	44,850	44,662	
	JUN, JUL, AUG	6,034,000	36,409,156,000,000	148,988	145,616	
	SEP, OCT, NOV	2,772,000	7,683,984,000,000	104,115	95,343	
1996	DEC, JAN, FEB	1,109,000	1,229,881,000,000	18,034	19,639	
	MAR, APR, MAY	1,507,000	2,271,049,000,000	34,211	40,835	
	JUN, JUL, AUG	6,453,000	41,641,209,000,000			142,644
	SEP, OCT, NOV	2,720,000	7,398,400,000,000			93,488
	LESS: OCT & NOV @ 53.4% OF THAT QUARTER'S SALES					(49,969)

SUMMARY:	
JUNE, JULY, AUGUST	142,644
SEPTEMBER	43,520
TOTAL	186,163

SUMMARY OUTPUT - QUARTERLY DATA

Regression Statistics	
Multiple R	0.992
R Square	0.985
Adjusted R Square	0.981
Standard Error	7,005
Coefficient of Variation	9.3%
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	28,533,702,428	14,266,851,214	290.8	0.000
Residual	9	441,568,858	49,063,206		
Total	11	28,975,271,285			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	(49,641.041)	8664.630	-5.729	0.000	-69241.812	-30040.271
ESA Sales	0.069	0.006	10.788	0.000	0.055	0.084
ESA Sales2	-6.114E-9	0.000	-7.036	0.000	-0.000	-0.000

While at first blush this result appears to be satisfactory, there are two issues we need to address. First, the predicted amount of $186,163 is about $10,000 less than the same period the year before. This doesn't seem reasonable, as ESA sales for the 1996 season are 4.9 percent higher than the 1995 season. Second, we have an extrapolation problem: ESA sales for the quarter consisting of June, July, and August are outside the relevant range for the independent variable, which range is bracketed by the lowest and highest values of ESA sales in the 12 quarters leading up to the date of the incident. In this case the relevant range is bracketed between ESA quarterly sales of $911,000 and $6,310,000, which means that the quarterly ESA sales for June, July, and August 1996 of $6,453,000 are outside the range.

Extrapolating beyond the relevant range takes us into unchartered territory, as we do not know how sales actually behave outside the range, and consequently our estimate of forecasted sales will be unreliable. In fact, since we have a quadratic, curvilinear relationship that will eventually become a parabola (an inverted U), if we extend the forecast upper range any further, forecasted sales will get smaller and smaller. This explains why the predicted sales amount of $186,163 is less than we would have expected—we are predicting outside the relevant range with a quadratic model that diminishes predicted sales even as the independent variable gets larger.

A SECOND CURVILINEAR METHODOLOGY

This outcome is a disappointment, as we had very high goodness of-fit-metrics with the quarterly model, especially a low coefficient of variation of 9.3 percent. This measure of accuracy is calculated by dividing the standard error of the estimate by the average of the dependent variable, and gives the average percentage deviation about the trend-line. But discard it we must, and so a new model is called for. Since the relationship between XYZ sales and ESA sales remains curvilinear, we tried a monthly quadratic model. A preliminary look at Figure 1.7 indicates that this model ought to work very well, even though there is more variation, or dispersion, about the

Figure 1.7
MONTHLY SCATTERPLOT
XYZ SALES VS. ESA SALES

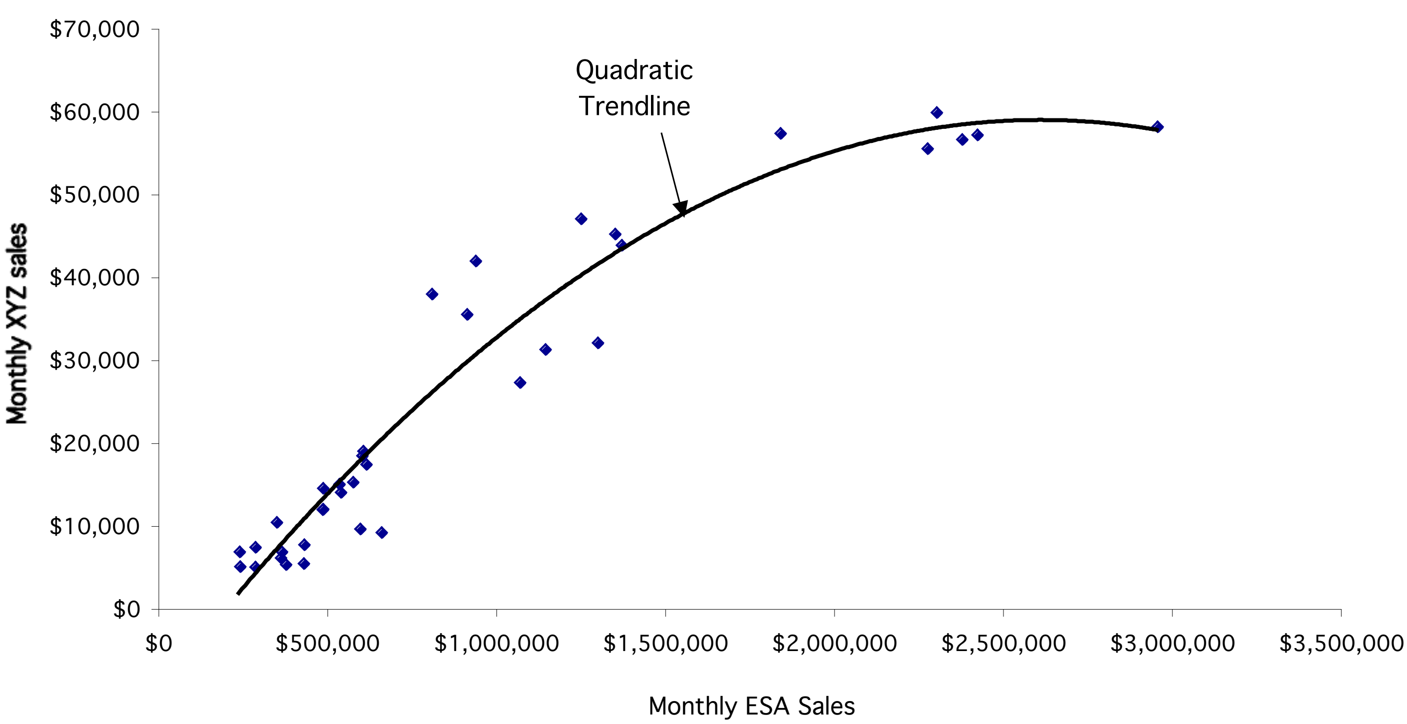


FIGURE 1.8
XYZ MOTEL
SET-UP SHEET FOR QUADRATIC REGRESSION MODEL

Year	Month	XYZ Motel Sales	ESA Sales	ESA Sales2
1993	JUNE	27,241	1,073,000	1,151,329,000,000
	JULY	55,473	2,278,000	5,189,284,000,000
	AUGUST	58,073	2,959,000	8,755,681,000,000
	SEPTEMBER	45,159	1,354,000	1,833,316,000,000
	OCTOBER	37,917	811,000	657,721,000,000
	NOVEMBER	11,902	488,000	238,144,000,000
	DECEMBER	5,268	380,000	144,400,000,000
1994	JANUARY	4,995	289,000	83,521,000,000
	FEBRUARY	6,816	242,000	58,564,000,000
	MARCH	6,073	364,000	132,496,000,000
	APRIL	9,152	662,000	438,244,000,000
	MAY	18,966	608,000	369,664,000,000
	JUNE	31,249	1,147,000	1,315,609,000,000
	JULY	57,299	1,844,000	3,400,336,000,000
	AUGUST	56,579	2,381,000	5,669,161,000,000
	SEPTEMBER	43,827	1,374,000	1,887,876,000,000
	OCTOBER	35,490	916,000	839,056,000,000
	NOVEMBER	13,967	542,000	293,764,000,000
1995	DECEMBER	10,362	352,000	123,904,000,000
	JANUARY	6,788	368,000	135,424,000,000
	FEBRUARY	14,940	537,000	288,369,000,000
	MARCH	14,490	489,000	239,121,000,000
	APRIL	11,951	489,000	239,121,000,000
	MAY	18,409	605,000	366,025,000,000
	JUNE	32,038	1,302,000	1,695,204,000,000
	JULY	57,112	2,426,000	5,885,476,000,000
	AUGUST	59,838	2,306,000	5,317,636,000,000
	SEPTEMBER	46,981	1,253,000	1,570,009,000,000
	OCTOBER	41,902	941,000	885,481,000,000
	NOVEMBER	15,232	578,000	334,084,000,000
	DECEMBER	7,642	433,000	187,489,000,000
1996	JANUARY	5,015	244,000	59,536,000,000
	FEBRUARY	5,378	432,000	186,624,000,000
	MARCH	7,332	289,000	83,521,000,000
	APRIL	9,540	600,000	360,000,000,000
	MAY	17,338	618,000	381,924,000,000

trend-line than in the quarterly scatter-plot. The setup sheet for this regression is shown on Figure 1.8 (page 16), the regression output results are shown on Figure 1.9 (below), and the forecasted and predicted sales are shown on Figure 1.10 (page 18).

The results of this model are quite good, and all four months of ESA sales in the prediction period are within the relevant range, so our predicted sales are made by interpolating and not by extrapolating. However, the regression statistics are not as good as those of the quarterly data. Multiple R and R-square are lower, and while the standard error is lower, as a percentage of average monthly sales it is more than double the quarterly model at 20.5 percent. Figure 1.11 (page 19) is a line chart that presents the reasonably good fit between actual and forecasted motel sales, with predicted sales appearing to be very much in line with expectations.

At $200,000, predicted sales during the period of interruption are higher than last year's for the same period. However, this could happen, because, since the room rate for the period of interruption is given at $60.74, it would only require that this year's occupancy rate be equal to that of 1994. This seems feasible, as comparative-period ESA sales are 4.9 percent higher this year than last year. In fact, the occupancy rate produced at $200,000 of room sales using an average room rate of $60.74 is 93.1 percent, an amount equal to that of the 1994 summer season.

While neither the independent nor the dependent variable was normally distributed, tests of the residuals (not shown), i.e., the difference between the forecasted values and the actual monthly sales amounts, indicated that they were normally distributed, had equal variances along the trend-line (homoscedasticity), and were without serial correlation (one residual's value did not depend on

FIGURE 1.9
XYZ MOTEL
QUADRATIC REGRESSION OF MONTHLY SALES AGAINST MONTHLY ESA SALES

SUMMARY OUTPUT
MONTHLY DATA

Regression Statistics	
Multiple R	0.966
R Square	0.932
Adjusted R Square	0.928
Standard Error	5,168
Coefficient of Variation	20.50%
Observations	36

ANOVA

	df	SS	MS	F	Significance F
Regression	2	12,146,437,216.26	6,073,218,608.13	227.39	0.0
Residual	33	881,391,163.83	26,708,823.15		
Total	35	13,027,828,380.09			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-10507.850	2587.859	-4.060	0.000	-15772.894	-5242.807
ESA Sales	0.053	0.005	10.520	0.000	0.043	0.063
ESA Sales2	-0.000	0.000	-5.824	0.000	-0.000	-0.000

FIGURE 1.10

XYZ MOTEL

FORECASTED AND PREDICTED SALES FROM MONTHLY QUADRATIC REGRESSION

YEAR	MONTH	(X) ESA SALES	(X2) ESA SALES2	(Y) XYZ MOTEL SALES	FORECASTED SALES	PREDICTED SALES
1993	JUNE	1,073,000	1,151,329,000,000	27,241	34,699	
	JULY	2,278,000	5,189,284,000,000	55,473	57,651	
	AUGUST	2,959,000	8,755,681,000,000	58,073	57,608	
	SEPTEMBER	1,354,000	1,833,316,000,000	45,159	42,682	
	OCTOBER	811,000	657,721,000,000	37,917	25,813	
	NOVEMBER	488,000	238,144,000,000	11,902	12,945	
	DECEMBER	380,000	144,400,000,000	5,268	8,170	
1994	JANUARY	289,000	83,521,000,000	4,995	3,964	
	FEBRUARY	242,000	58,564,000,000	6,816	1,726	
	MARCH	364,000	132,496,000,000	6,073	7,443	
	APRIL	662,000	438,244,000,000	9,152	20,140	
	MAY	608,000	369,664,000,000	18,966	17,973	
	JUNE	1,147,000	1,315,609,000,000	31,249	36,956	
	JULY	1,844,000	3,400,336,000,000	57,299	52,775	
	AUGUST	2,381,000	5,669,161,000,000	56,579	58,248	
	SEPTEMBER	1,374,000	1,887,876,000,000	43,827	43,189	
	OCTOBER	916,000	839,056,000,000	35,490	29,541	
	NOVEMBER	542,000	293,764,000,000	13,967	15,243	
1995	DECEMBER	352,000	123,904,000,000	10,362	6,894	
	JANUARY	368,000	135,424,000,000	6,788	7,625	
	FEBRUARY	537,000	288,369,000,000	14,940	15,033	
	MARCH	489,000	239,121,000,000	14,490	12,988	
	APRIL	489,000	239,121,000,000	11,951	12,988	
	MAY	605,000	366,025,000,000	18,409	17,850	
	JUNE	1,302,000	1,695,204,000,000	32,038	41,325	
	JULY	2,426,000	5,885,476,000,000	57,112	58,441	
	AUGUST	2,306,000	5,317,636,000,000	59,838	57,835	
	SEPTEMBER	1,253,000	1,570,009,000,000	46,981	39,997	
	OCTOBER	941,000	885,481,000,000	41,902	30,396	
	NOVEMBER	578,000	334,084,000,000	15,232	16,743	
	DECEMBER	433,000	187,489,000,000	7,642	10,543	
1996	JANUARY	244,000	59,536,000,000	5,015	1,822	
	FEBRUARY	432,000	186,624,000,000	5,378	10,499	
	MARCH	289,000	83,521,000,000	7,332	3,964	
	APRIL	600,000	360,000,000,000	9,540	17,647	
	MAY	618,000	381,924,000,000	17,338	18,378	18,378
	JUNE	1,428,000	2,039,184,000,000			44,518
	JULY	2,601,000	6,765,201,000,000			58,802
	AUGUST	2,424,000	5,875,776,000,000			58,433
	SEPTEMBER	1,191,000	1,418,481,000,000			38,246
	Total Predicted Value					200,000

the preceding residual's value)—all good things that validate the regression results. Through trial and error, we found we had to trade a less accurate result (more variance about the trend-line) for a more precise point estimate of loss ($200,000 better reflects expected sales than $186,163).

While this difference may seem trivial as it is only about 7 percent, relative to the range of reasonable forecasts available to us, it is highly significant. That range is very narrowly defined as being between an amount that approximates 1995's sales and those sales that produce an occupancy rate no higher than the highest rate obtained over the past three years. Through the use of common sense, reasonableness, and informed judgment we have rejected unsupported, back-of-the-envelope, *a priori* calculations submitted by the claimant in favor of a more rigorous, analytical approach that produces a forecasted sales amount that falls at the upper end of our reasonable range. VE

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Figure 1.11
XYZ MOTEL