Case 8 : Consolidated Foods B

In this case students are to perform descriptive analyses of the relationships between quantity and price for Brand 1 and for its competitors. This description is prepared using scatter plots, correlations, and simple regression. In this case we use simple regression only to describe the relationship -- that is to compute the constant and slope for the best linear fit given the data. The student is not expected to perform any analysis using the remainder to the regression output. A key goal is the written report and that should include features that you the Professor feel are important given your learning objectives. We do include some key ideas that we have found useful in setting objectives for students and reviewing their work.

This project uses descriptive measures of relationships between variables.

2a

In this analysis students are trying to determine if there are relationships between quantities and prices. It might be useful to note that an approximate minimum critical absolute value for correlations is 2 over the square root of the sample size, which is 0.16 for this sample of size 156. You should also encourage students to compare the correlation coeffcients with the scatter plots. This will help students learn an intuitive interpretation of the correlations.

MTB > corr c3, c4
Correlation of saleb1 and apriceb1 = -0.263

MTB > corr c7,c8
Correlation of saleb2 and apriceb2 = -0.370

MTB > corr c11,c12
Correlation of saleb3 and apriceb3 = -0.316

MTB > corr c15,c16
Correlation of saleb4 and apriceb4 = -0.158

MTB > corr c19,c20
Correlation of saleb5 and apriceb5 = 0.993
Note that this correlation does not fit the pattern of the correlations for the other brands.
Further examination indicates a large number of zeros for price and sales for brand 5. Thus brand 5 should not be used in the remaining analysis, because the large number of zeros result in a distored analysis.

Students may have problems understanding the weighted price for brands 2 through 5 and how it is calculated. You need to explain that this price represents the implicit price for all competitors. You may also wish to explain weighted average while assigning the case.

2b
MTB > corr c3 c33
Correlation of saleb1 and apric2-5 = 0.116

2c
MTB > corr c4 c8 c12 c16
    apriceb1 apriceb2 apriceb3
apriceb2 0.507
apriceb3 0.579   0.446
apriceb4 0.509   0.500   0.523

```
MTB > corr c3 c7 c11 c15
        saleb1   saleb2   saleb3
saleb2   0.136
saleb3   0.014   0.103
saleb4   0.248   0.310   0.232
```

3 Encourage students to place sales on the ordinate and price on the abscissa. This emphasizes the idea that we are interested in examining the effect of price on quantity sold. In addition there will be a direct comparison between the scatter plots and the simple regression equations derived below.
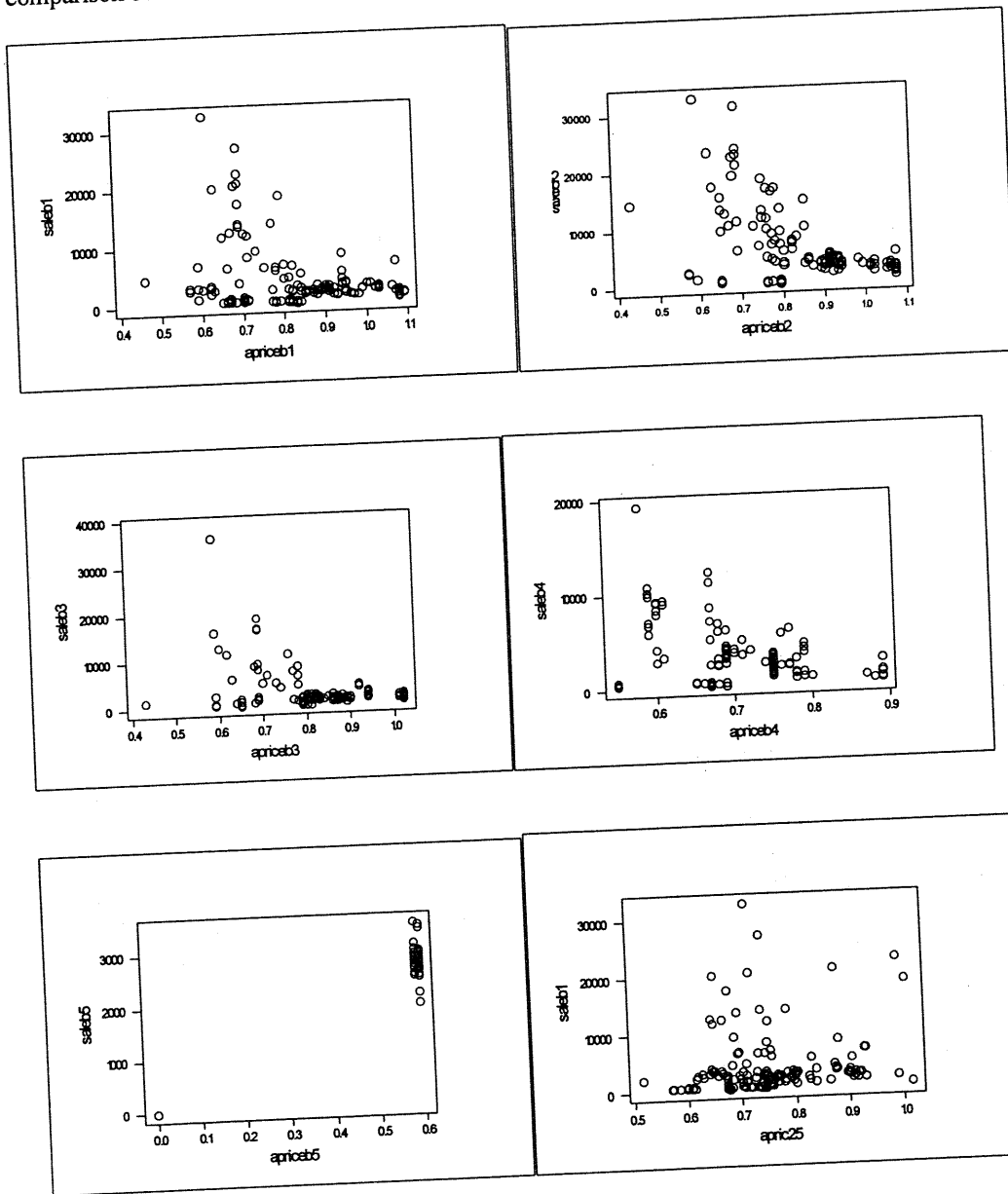
From the plots it can be seen that there are not strong relationships between price and quantity. In the Consolidated Foods D case it is shown that there are a number of variables which jointly predict quantity sold and in the resulting multiple regression model price has a strong conditional effect.

Note the strange pattern for Brand 5. This indicates that price is fixed and that a number of stores do not sell this brand and thus quantity and price are both zero. This pattern of points results in an apparent high correlation which is of course spurious. Brand 5 is likely a store brand sold at a low price.

5 The following regression indicates that price has a statistically significant effect, but that the effect is not strong. Using multiple regression in Consolidated Foods Case D it is shown that price has a strong conditional effect when included with other important predictors of quantity sold.

MTB > regr c3 on 1 c4

The regression equation is
saleb1 = 12095 - 10142 apriceb1

Predictor	Coef	Stdev	t-ratio	p
Constant	12095	2489	4.86	0.000
apriceb1	-10142	2997	-3.38	0.001

$s = 5192$ R-sq = 6.9%   R-sq(adj) = 6.3%

Analysis of Variance

SOURCE	DF	SS	MS	F	p
Regression	1	308697856	308697856	11.45	0.001
Error	154	4151047168	26954852		
Total	155	4459745280			

MTB > regr c3 on 1 c33

The regression equation is
saleb1 = - 1120 + 6570 apric2-5

Predictor	Coef	Stdev	t-ratio	p
Constant	-1120	3427	-0.33	0.744
apric2-5	6570	4549	1.44	0.151

$s = 5345$ R-sq = 1.3%   R-sq(adj) = 0.7%

Analysis of Variance

SOURCE	DF	SS	MS	F	p
Regression	1	59602240	59602240	2.09	0.151
Error	154	4400142848	28572356		
Total	155	4459745280			

6. MTB > Oneway 'saleb1' 'promotb1'.

One-Way Analysis of Variance

Analysis of Variance on saleb1
Source	DF	SS	MS	F	p
promotb1	3	2.174E+09	724641344	48.19	0.000

```
Error    152 2.286E+09  15038294
Total    155 4.460E+09
```

Individual 95% CIs For Mean
Based on Pooled StDev

Level	N	Mean	StDev				
0	82	1560	1126	(-*-)			
1	3	2953	3336	(--------*--------)			
2	52	3837	3156	(-*-)			
3	19	13425	9583			(---*--)	

```
                           ---+---------+---------+---------+---
Pooled StDev =   3878        0     5000    10000    15000
```

7. Report

The report should include the above computer output as appendicies. Specific results should be referenced and quoted in the report. The following points should be included:

1. There is an inverse relationship between quantity sold and price for brands 1 through 4, with the brand 4 relationship being the weakest. The relationship between price for all competing brands and quantity of brand 1 sold is direct but weak.

2. The prices for the various brands are correlated indicating that the different brands respond to price changes for the other brands. Quantities of goods sold are not correlated.

3. The graphical plots provide more detail concerning the relationships between prices and quantities sold for the various brands. It seems clear that there are a large number of weeks in which variables other than price are having an influence on the quantity of goods sold.

4. The regression analysis indicates that for brand 1 each one cent increases in price reduces the weekly quantity of goods sold by approximately 101 units. (Note that prices are given in dollars and thus the computed coefficient must be divided by 100 if we wish to discuss the results in terms of pennies. However, note that the relationship is not very stable. The regression of quantity of brand 1 sold on overall competitors price does not indicate any relationship.

5. The descriptive analysis reveals that higher prices do lower sales and that the selling prices for the various brands tend to increase and decrease together. However, the weak relationships clearly indicates that factors other than own price are having an important influence.

6. The one way analysis of variance using the promotional categorical variable indicates that the combination of newspaper advertising and in store promotion results in substantially higher sales compared to the sum of the effects of each strategy used by itself. This synergy is an important conclusion when designing a marketing plan.

7. Note that there are a number of additional questions that could be asked. We have limited the questions to avoid excessive student statistical work and hence less effort devoted to preparing a well written report. Students could compare the promotional strategies for Brand 1 and Brand 2 using a two way table. Students could also be asked to discuss the characteristics of Brand 5 and compare it to other brands.