https://selldocx.com/products/solution-manual-management-accounting-2e-eldenburg

Solutions Manual

to accompany

Management Accounting 2e

Prepared by

Albie Brooks, Judy Oliver and Gillian Vesty

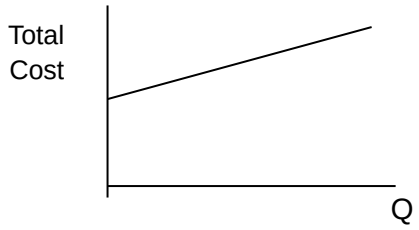
John Wiley & Sons Australia, Ltd 2011

Chapter 2
Cost concepts, behaviour and estimation

QUESTIONS

2.1 'As volume increases, total cost increases and per-unit cost decreases.' What type of linear cost function does this describe? Draw a simple graph of this type of cost function.

This function has both fixed costs and variable costs. If at least part of the cost is variable; total cost increases as production volumes increase. If at least part of the cost is fixed, the average total per-unit cost decreases because the average fixed cost decreases as volume increases.



2.2 A motor vehicle assembly plant closes every August to retool for the next year's model. How should August's cost data be used in estimating the overhead cost function?

Several years' worth of data for August would be helpful for estimating the overhead cost function for subsequent Augusts, but the August data should not be used for estimating the overhead cost function for other months during the year. It is highly unlikely that the August data would be representative of the data during normal operations. However, August's costs are probably a good estimate of the fixed costs for other months. When zero production occurs, only fixed costs are incurred.

2.3 You have been asked to provide the managing director with an approximate cost function for the entity's activities, and it must be done by this afternoon. Some members of the board of directors want to understand why performance varies so much across store locations. They have asked for a quick analysis today and want a more detailed analysis next week. Which cost estimation technique(s) should you consider using? Explain.

Since time appears to be of the essence, one of several cost estimation techniques might be employed. First, account analysis will provide a rough estimate. Second, the two most recent income statements could be used to approximate fixed and variable costs using the two-point method, but the president would need to understand that the quality of information could be low using this method. Third, if enough observations of cost data are readily available, regression analysis can be run. However, usually it takes more time to collect the data necessary to use regression analysis.

© John Wiley & Sons Australia, Ltd 2011

2.4 At two levels of activity within the relevant range, average costs are $192 and $188, respectively. Assuming the cost function is linear, what can be said about the existence of fixed and variable costs?

The information leads to a conclusion that fixed costs exist because cost per unit changes between two levels of activity within the relevant range. The information is not sufficient to determine the amount of fixed costs or whether variable costs exist.

2.5 You are about to start a coffee shop business. Identify the likely key costs and classify each as a fixed or variable.

Likely key costs might include:
- Rent/lease of premises - Fixed
- Purchase/rental of equipment such as coffee machine, table and chairs etc - Fixed
- Salaries to staff/employees - Variable
- Utilities' costs - Fixed
- Stock of coffee and any related food and beverage items - Variable

2.6 Explain how information from a scatter plot helps in categorising a cost as fixed, variable, or mixed.

Analysis of a scatter plot provided general information about whether a cost appears to be variable, fixed, or mixed. If there is a linear pattern in the scatter plot and the trend appears to go to zero, the cost could be variable. If a scatter plot with a linear trend intersects the vertical axis at a nonzero value, it could be mixed. If the scatter plot has no discernable pattern, the cost could be fixed. And if the pattern is linear with little or no slope, the cost could be fixed.

2.7 Explain the analysis at the account level approach to developing a cost function.

The pattern of a cost over time in the accounting system, together with knowledge of operations, is used to classify costs as variable, fixed, or mixed. Costs such as managers' salaries are usually fixed; they are often directly associated in the general ledger with a particular department or product. Costs for variable materials used in the production process are usually available in the general ledger or in production records. Costs such as manufacturing overhead are often mixed; they tend to include fixed costs such as insurance and property taxes for the plant and variable costs such as indirect supplies used in manufacturing. For costs identified as mixed, another cost estimation technique such as the two-point method or regression analysis must be used to determine the fixed and variable components.

2.8 List two examples of non-linear cost functions and describe a method of developing a cost function for each one.

Learning curves are nonlinear representations of direct labour cost. The cumulative average time approach can be used to determine an approximation of total cost when

© John Wiley and Sons Australia, Ltd 2011

labour experiences a learning rate. Economies of scale are a non-linear function. Information about past experience with economies of scale can be used to help estimate future costs. For example, volume discounts are examples of economies of scale. The required volumes needed to reach discounted prices are generally known, so these can be estimated using several different ranges to reflect the changes in price.

2.9 Why might some have trouble classifying costs as fixed or variable?

It can be difficult to classify some costs as fixed or variable as:

- A particular cost may possess characteristics of both
- It may be difficult to identify what the cost items actually varies with i.e. identifying the true cost driver

2.10 The trend line developed using regression analysis provides a more accurate representation of a mixed cost function than the two-point or high-low methods. Explain why.

The trend line developed using regression analysis incorporates all of the cost observations, while the two-point method uses only two observations. Because there is fluctuation in cost over time, better estimates are developed using more observations, because they better reflect the past fluctuations and therefore should better estimate future fluctuations.

© John Wiley and Sons Australia, Ltd 2011

EXERCISES

2.11 Linear, stepwise linear, and piecewise linear cost functions

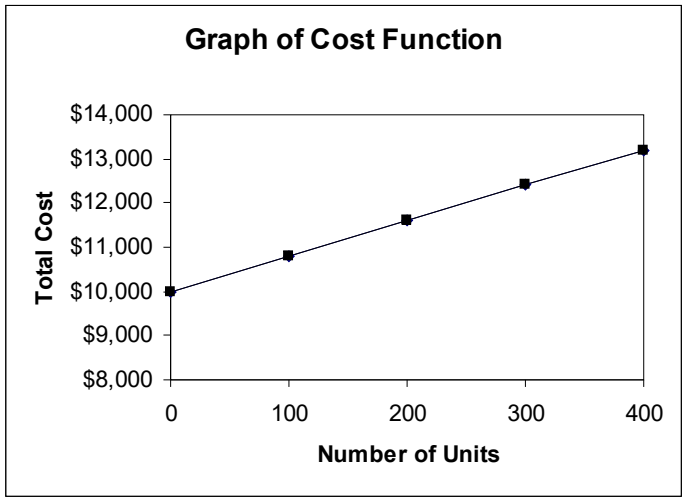
(a) Total fixed costs are \$10 000 per week and the variable cost per unit is \$8. Write the algebraic expression for the cost function and graph it. What are the assumptions of the cost function?

(b) Total fixed costs are \$25 000 per week up to 2000 units a week and then jump up to \$35 000 per week. The variable cost per unit is \$8. Write the algebraic expression for the cost function and graph it.

(c) The average cost to produce 10,000 units is \$45 and the average cost to produce 12 000 units is \$44. Estimate the average cost to produce 15 000 units.

(d) The total cost function for Hot Dog Days, a hot dog cart business in Centennial Park, is TC = \$5000 + 45% × total revenues. Estimate the total cost for a month when total revenues are \$10 000.

(a) TC = \$10 000 + \$8.00×Q

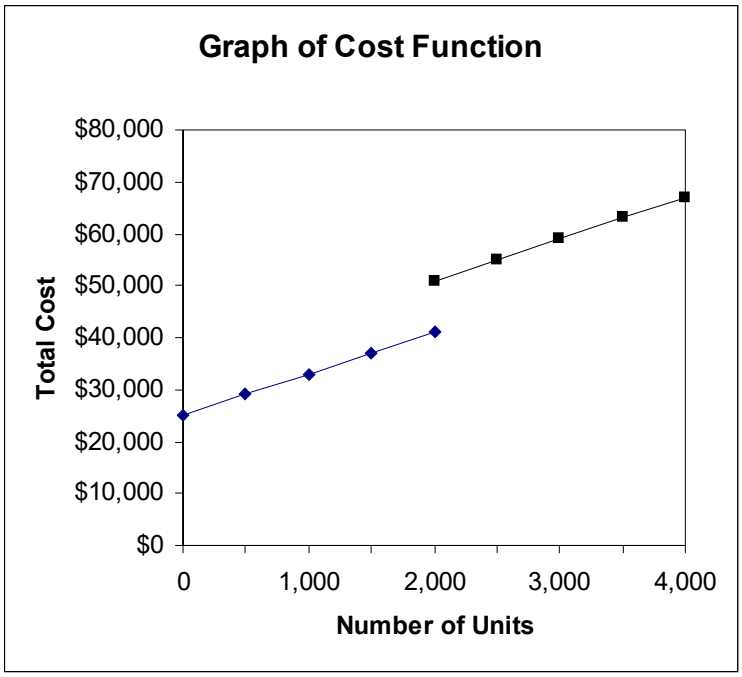


The cost function includes the following assumptions:

- Operations are within a relevant range of activity
- Within the relevant range of activity:
  - Fixed costs will remain fixed
  - Variable cost per unit will remain constant

(b) TC = \$25 000 + \$8.00×Q, for Q ≤ 2000
TC = \$35 000 + \$8.00×Q, for Q > 2000

© John Wiley and Sons Australia, Ltd 2011



(c) To estimate the costs at another production level, it is first necessary to estimate the cost function.

Convert the average costs to total costs for each production level:

Total cost at 10 000 units = 10 000 × $45 = $450 000
Total cost at 12 000 units = 12 000 × $44 = $528 000

Calculate the variable cost per unit using the Two-Point method:

$$\frac{\text{Change in cost}}{\text{Change in volume}} = (\$528\,000 - \$450\,000)/(12\,000 - 10\,000)$$
= $78 000/2 000 = $39 per unit

Use one data point in the total cost function and solve for F:

Using the data for 10 000 units:
$450 000 = F + $39×10 000
F = $450 000 – $390 000 = $60 000

Combining the fixed and variable costs to create the cost function:
TC = $60 000 + $39×Q

Estimated total cost at 15 000 units:
TC = $60 000 + $39×15 000 = $60 000 + $585 000 = $645 000

Estimated cost per unit = $645 000/15 000 = $43

(d) Inserting $10 000 in revenues into the cost function total cost is estimated as:
TC = $5000 + 45%×$10 000 = $9500

© John Wiley and Sons Australia, Ltd 2011

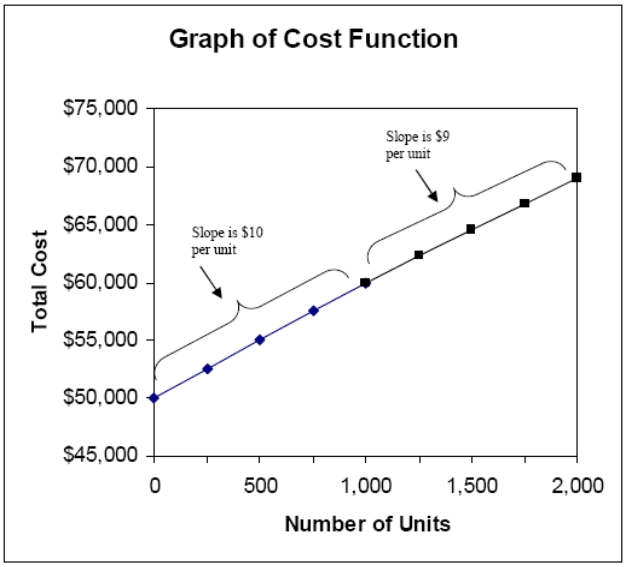
2.12 Piecewise linear cost function; regression measurement error

The following is the description of a cost: Total fixed costs are $50 000 per month and the variable cost per unit is $10.00 when production is under 1000 units. The variable cost drops to $9.00 per unit after the first 1000 units are produced.

Required

(a) Write the algebraic expression of the cost function and graph it.

(b) Assume that the cost function just described is a reasonable representation of total costs. If the accountant performed regression analysis on weekly observations of this cost and did not realise that there were two relevant ranges, what problems would arise in the cost function that was produced? In other words, how would the cost function be mismeasured?



(a) TC = $50 000 + $10.00×Q for Q ≤ 1 000
For Q > 1 000:
TC = $50 000 + (1000 × $10.00) + $9.00×(Q – 1000)
TC = $50 000 + $10 000 + $9.00×Q – $9000
TC = $51 000 + $9.00×Q

(b) If the accountant did not detect that there were two different relevant ranges, the cost function mismeasurement depends on the values of Q. There are three general situations:

1. If all of the data estimation points occurred when Q was ≤ 1000 units, then the cost function would appear to be: TC = $50 000 + $10.00×Q. This cost function would provide reasonable estimates for Q ≤ 1000 units but would overestimate total cost for Q > 1 000 units.

2. If all of the data estimation points occurred when Q was > 1000 units, then the cost function would appear to be: TC = $51 000 + $9.00×Q. This cost function would provide reasonable estimates for Q > 1000 units but would underestimate total cost for Q ≤ 1000 units.

© John Wiley and Sons Australia, Ltd 2011

3. If the data estimation points occurred across the two relevant ranges, then the cost function would be some mixture of the functions for the two relevant ranges. This cost function will either overestimate or underestimate costs for almost any level of Q (see figure 2.3)

2.13 Cost function and assumptions

Bison Sandwiches is a small restaurant that sells a variety of sandwiches and beverages. Total fixed costs are $20 000 per month. Last month total variable costs were $8000 when total sales were $32 000.

Required

(a) Write out the algebraic expression for the cost function.
(b) What assumptions do we make when we develop this cost function?

(a) If total variable costs were $8,000 on total sales of $32,000, then variable cost per dollar of revenue is calculated as follows:

$8,000/$32,000 = 0.25, or 25% of sales

Combining fixed and variable costs, the cost function is:

TC = $20,000 + 25%×Total sales

(b) Assumptions: Fixed costs remain fixed within the relevant range, and variable costs remain constant within the relevant range. In addition, this particular cost function assumes that variable costs are driven by sales. Chapter 3 will point out another assumption for this cost function: the sales mix (the proportion of sales of different products) remains constant within the relevant range.

© John Wiley and Sons Australia, Ltd 2011

2.14 Cost function; opportunity cost; relevant costs

Yummy Yoghurt sells yogurt cones in a variety of natural flavours. Data for a recent month follow:

Revenue		$9 000
Cost of ingredients	$4 500	
Rent	1 000	
Store attendant salary	2 300	
		7 800
Profit		$1 200

Required

(a) Categorise each cost as fixed or variable.

(b) Create a cost function.

(a)

	Fixed	Variable
Cost of ingredients		$4500
Rent	$1000	
Store attendant (salaried)	2300	
Total Costs at $9,000 in sales	$3300	$4500

(b) In many organisations, costs vary with dollars of revenue. In this type of situation, total revenue (TR) instead of quantity (Q) can be used in the cost function:
Total variable cost/Total revenue = $4500/$9000 = 0.50, or 50% of revenue

Combining fixed and variable costs, the cost function is:
TC = $3300 + 50%×Total revenue

© John Wiley and Sons Australia, Ltd 2011

2.15 Fixed, variable, and mixed costs

Spencer and Church is a CPA entity engaged in local practice. Some selected items from its chart of accounts are listed here.

Required

For each account, indicate whether the account represents a fixed, variable, or mixed cost for the operations of the local practice office. If mixed, indicate whether it is predominantly fixed or variable. Explain your answers.

(a) Staff wages	(f) Office supplies
(b) Clerical wages	(g) Professional dues
(c) Rent	(h) Professinal subscriptions
(d) Licences	(i) Property taxes
(e) Insurance	(j) Advertising

[*Note about problem complexity:* These are difficult questions because students will need to first visualise the costs (with very little information) and then apply chapter concepts. The Step 2 questions (A, B, and F) are the ones requiring significant assumptions to generate an answer.]

(a) Staff wages – Could be variable or mixed (salary + overtime) for regular staff. If there is part time help, that cost would be variable; However staff are often salaried, in which case the total cost would be primarily fixed.
(b) Clerical wages – Fixed unless overtime is regularly scheduled, and then mixed
(c) Rent - Fixed
(d) Licenses- Fixed
(e) Insurance- Fixed
(f) Office supplies - Mixed, mostly variable
(g) Professional dues- Mostly fixed and discretionary
(h) Professional subscriptions- Fixed and discretionary
(i) Property taxes- Fixed
(j) Advertising – Fixed and discretionary

© John Wiley and Sons Australia, Ltd 2011

2.16 Cost function using regression; other potential cost drivers

The new cost analyst in your accounting department just received a computer-generated report that contains the results of a simple regression analysis. The analyst was estimating the costs of the marketing department using units sold as the cost driver. Summary results of the report are shown below.

Variable	Coefficient	*t*-statistic	*p*-value
Intercept	12.44	1.39	0.25
Units sold	222.35	2.48	0.001
Adjusted *R*-square = 0.61			

Required

(a) Write an equation for the cost function based on the regression analysis.
(b) What does the adjusted *R*-square tell you?
(c) What other cost drivers could potentially explain marketing costs? Explain.

(a) TC = \$222.35×units sold. (Notice that the T-statistics on the fixed costs indicate that it is not likely to be different from zero. Therefore, the fixed cost is set at zero.)

(b) The adjusted R-Square indicates how much of the variation in the marketing department cost can be explained by variation in units sold. In this problem, the variation in units sold explains about 61% of the variation in marketing department cost.

(c) Other possible cost drivers for marketing department costs could be revenue, number of advertisements placed, or profits. In addition, it is possible that marketing costs are discretionary. The cost analyst needs to gather information about how marketing costs are set each year. For example, the analyst could ask the CFO whether the marketing department budgets its costs through a negotiation process with top management. If this is the case, the cost is discretionary and will be set through the negotiating process.

© John Wiley and Sons Australia, Ltd 2011

PROBLEMS

2.17 Cost function using high-low and regression; quality of cost estimates

Following are sales and administrative cost data for Big Jack Burgers for the last four months:

	Sales	Administrative costs
September	$ 632 100	$43 333
October	842 500	57 770
November	1 087 900	62 800
December	1 132 100	68 333

Administrative cost is a mixed cost, and sales is a potential cost driver.

Required

(a) Using the high-low method, create a cost function for administrative costs.

(b) In your own words, explain why the high-low method might not be a good method for estimating the cost function.

(c) Create a scatter plot and add a trend line. After examining the plot, use your judgement to determine whether the cost is fixed, variable, or mixed.

(d) Perform regression analysis to create a cost function for administrative costs.

(e) Can we know for certain that the cost function from part (d) provides a good estimate for next month's administrative costs? Why or why not?

(f) Discuss whether sales are an economically plausible driver for administration costs for Big Jack Burgers.

(a) Total revenue (TR) instead of quantity (Q) in the cost function because sales is a potential cost driver. Under the high-low method, the cost function is calculated using the highest and lowest values of the cost driver. First, the variable cost is calculated:

($68 333 – $43 333)/($1 132 100 – $632 100)
= $25 000/$500 000
= 0.05 or 5% of sales

The fixed cost is determined by substituting the variable cost into one of the high-low data points:

$68 333 = F + 5%×$1 132 100
F = $68 333 – $56 605 = $11 728

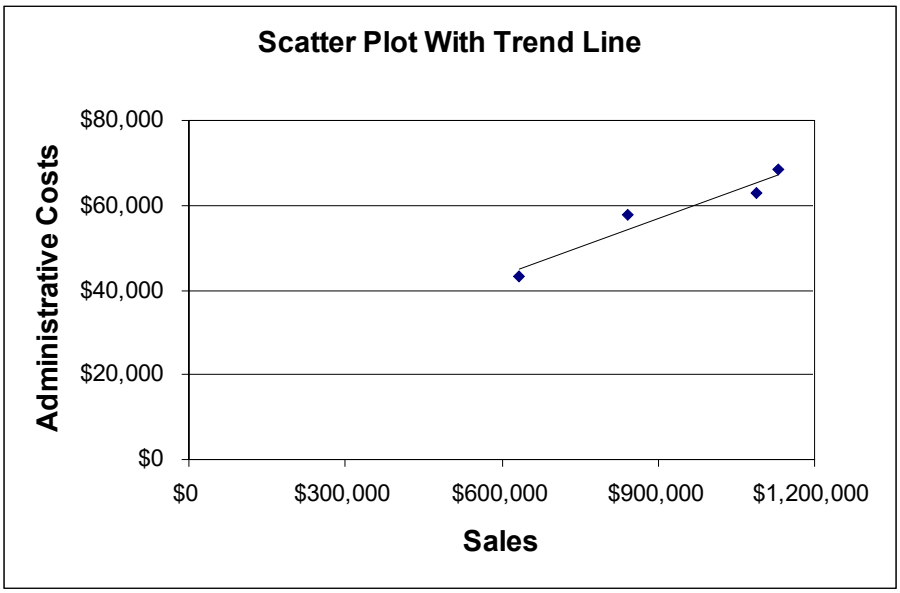
Thus, the total cost function is:

TC = $11 728 + 5%×Sales

(b) The high-low method uses the most extreme cost driver values, which could be outliers, that is, not represent the cost most of the time. That means that the cost function might not represent the actual cost, on average. Therefore, this cost function might provide poor estimates of future costs.

(c) Chart of data with trend line added by Excel; trend line extended to Y-axis (dashed line) using Word:

© John Wiley and Sons Australia, Ltd 2011



It appears that the cost is most likely mixed. There is a general downward slope (variable cost) that appears to meet the intercept enough above zero to suggest a fixed cost. The upward slope of the line indicates that there are variable costs.

(d) Following is the regression output. A t-statistic greater than 2 is often interpreted as meaning that the coefficient is significantly different from zero. Notice that the t-statistic for the intercept coefficient is 2.172, but the p-value is greater than 10% at 0.162. Based on the p-value, there is a 16% probability that the intercept (fixed cost) is not different from zero. Because this regression has few observations, the p-value result for the t-statistic is atypical. Additional judgement is required to decide whether it is appropriate to include a fixed cost in the cost function.

Analysis at the account level can be used to increase the understanding of this cost. If this cost pool includes items such as salaries and other fixed costs (insurance, etc), the regression intercept can be used as an estimate of the fixed costs. Then, the cost function would be **TC = $16 800 + 4.5% × sales**. Alternatively, analysis at the account level might indicate that there are few fixed costs. In that case, fixed costs are likely to be zero and would be excluded from the cost function. Then, the cost function would be: **TC = 4.5% × sales**

Regression Statistics	
Multiple R	0.9680477
R Square	0.93711636
Adjusted R Square	0.90567454
Standard Error	3293.4038
Observations	4

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	16800.2444	7734.73545	2.17205158	0.16197623
X Variable 1	0.04466925	0.00818212	5.45937486	0.0319523

© John Wiley and Sons Australia, Ltd 2011

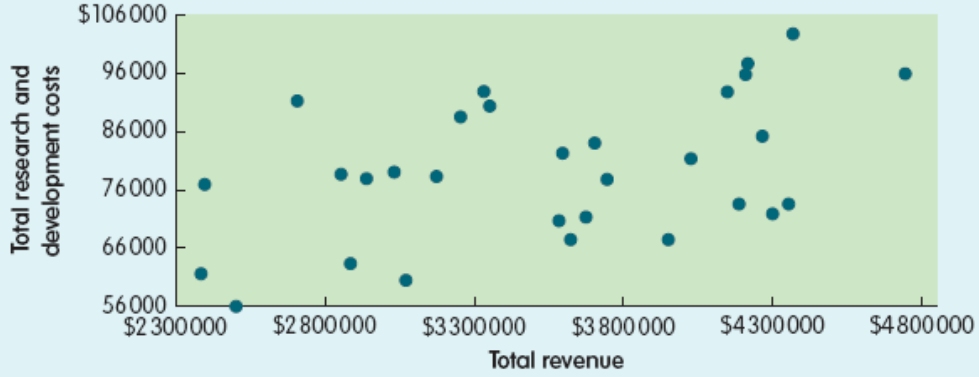
(e) Because of unforeseen changes in cost behaviour, a cost function may not provide a good estimate for the next month's costs. The past costs used for estimation might not be representative, especially because so few observations were used in the estimation. Sales might not be the activity that drives administrative costs. There might be a change in business operations or in the economy that would cause future costs to be different than in the past. There might be a large discretionary component in administrative costs, causing fluctuations in cost that are unrelated to any cost driver.

(f) The cons of the high-low method as an estimation technique were discussed in Part B above. If there are only two or three data points, however, the high-low method may be the best option available. This method can be used in cases where there is not enough data to perform regression, and it can be further improved by adopting more representative data points than the highest and lowest values of the cost driver. If there are more data points, regression analysis incorporates all of the observations into the analysis. Therefore, the results rely on more complete information and provide a better estimate, on average. Both methods assume that the cost function is linear and that all data points come from a single relevant range. If these assumptions do not hold, then both methods may be unsuitable for estimating future costs. In addition, both of these methods assume that the data points are representative of future costs. Unusual cost items are assumed to continue in the future, and possible changes in costs such as those described in Part E are ignored.

© John Wiley and Sons Australia, Ltd 2011

2.18 Scatter plot; cost function using regression

The following scatter plot and simple regression results used revenue as a potential cost driver for research and development costs.



Summary Output Regression statistics				
Multiple *R*	0.462332038			
R-square	0.213750914			
Adjusted *R*-square	0.185670589			
Standard error	10894.44062			
Observations	30			
	Coefficients	**Standard error**	***t*-statistic**	***p*-value**
Intercept	50364.97682	10834.0628	4.648761758	7.2426E-05
Revenue	0.008179276	0.002964572	2.759007802	0.01010244

Required

(a) Discuss whether the scatter plot suggests that revenue is a cost driver for research and development costs.

(b) Using the regression results, write the cost function for research and development costs.

(c) Based on the regression results, discuss whether it would be appropriate to use total revenue as a cost driver for research and development costs.

(d) If you use the cost function from part (b) to estimate next month's research and development costs, what assumptions are you making? Identify at least three assumptions and discuss their reasonableness.

(a) The plot shows costs that are widely scattered. However, there does appear to be a general upward trend. Sales does not appear to explain much of the variation in research and development costs.

(b) Using the regression results, the cost function is:

i. TC = $50 365 + 0.82%×Sales

(c) The adjusted R-Square statistic is very low at 0.186. This means that variation in sales explains only about 18% of the variation in research and development cost. Future costs are not likely to be estimated accurately if the cost driver explains only a small part of the variation in the cost.

© John Wiley and Sons Australia, Ltd 2011

(d) Several very general assumptions apply to a linear cost function. First, the cost is assumed to be linear within the relevant range. Therefore, fixed costs would remain fixed and variable costs would remain constant within that range. When regression analysis is used to specify a cost function, the underlying cost function is assumed to be linear and that the cost driver is assumed to be economically plausible as a cost driver, that is, the relation makes sense from an economic standpoint. In this problem, assuming that the cost function is linear may not be appropriate. The scatter plot shows little evidence of linearity. In addition, research and development cost is often discretionary. These costs are set by decision, usually annually. Managers set the costs depending on the organisation's strategies and funds available for research and development. Better cost estimates for discretionary costs can be obtained by gathering information about planned expenditures from the department head or from the managers who are responsible for costs.

© John Wiley and Sons Australia, Ltd 2011

2.19 Cost driver; cost categories; appropriateness of regression; relevant information

Susan looked at her long-distance telephone bill with dismay. After leaving her job last year to become a self-employed consultant, her long-distance charges had grown considerably. She had not changed long-distance plans for years, partly because she hated taking the time to review the range of service providers and plans. However, the size of her long-distance bill made it clear that it was time to make a change. She had recently seen numerous advertisements by telephone companies offering much lower rates than she was currently paying, but she was sure that at least some of those plans offered low rates only for night and weekend calls.

Susan called her current long-distance service provider and asked how she could obtain a lower rate. She mentioned hearing that a competitor was currently offering long distance at 5c per minute. In responding to the service representative's questions, Susan verified that most of her long-distance calls are weekday and out of state. She also agreed that her activity over the past two months—approximately 500 minutes of long distance per month—was her best estimate for future calling activity. Given this information, the service representative suggested that Susan buy the following long-distance service plan:

(i) Up to 500 minutes of long distance for a flat fee of $20 per month.
(ii) No refunds would be provided for usage less than 500 minutes per month.
(iii) Any minutes over 500 per month would be billed at 10c per minute.
(iv) No service change fee or cancellation fee would apply.

Required

(a) What is the cost driver for Susan's long-distance telephone costs, assuming that the cost object is her consulting business?
(b) In the proposed service plan, which of the costs are fixed and which are variable? Explain.
(c) Would regression analysis be an appropriate tool for Susan to use in deciding whether to buy the new service plan? Why?
(d) Is the cost of Susan's current long-distance service plan relevant to this decision? Why?
(e) Explain why Susan cannot be certain whether the new service plan will reduce her long-distance costs.
(f) List additional information that might be relevant to Susan in deciding whether to buy the new service plan.
(g) Are Susan's long-distance services most likely a discretionary cost? Explain.
(h) Are Susan's long-distance services most likely a direct or indirect cost, assuming that the cost object is an individual consulting job? Explain.
(i) Describe the pros and cons of the new service plan.

(a) The cost driver for long distance calls is the number of minutes on the telephone.

(b) The fixed cost is the $20 flat fee. The variable cost is 10 cents per minute for those minutes over 500 per month.

(c) Regression is useful for estimating a cost function when fixed and variable costs are unknown. In this problem, Susan already knows the cost function, so she

© John Wiley and Sons Australia, Ltd 2011

does not need to estimate the cost function using regression or any other estimation technique.

(d) Yes, to make a decision she needs to compare her costs under the old plan to what costs would be under the new plan.

(e) She cannot be certain that she will use the same amount of time, on average, as she has in the past. Since her consulting work varies, the number of calls and whether they are long distance or local calls will vary.

(f) Additional information could include the location of Susan's future consulting work, the amount of travelling she will be doing since she cannot call from home when she is travelling, the cost of alternatives such as cellular service or any other types of telephone or communication service.

(g) It is likely that Susan has to call people to conduct business, although she could use email. Since she probably can cut back on calls when her consulting work is not providing enough income, a portion of the cost is likely to be discretionary. Since she has to have telephone service to stay in business, part of the cost is committed and cannot be reduced.

(h) The classification as direct or indirect depends on whether Susan's calls are directly related to specific projects she works on or are indirect activities such as business promotion. It also depends on whether she can trace telephone calls to individual consulting jobs. Many cellular telephone bills do not list the calls made, so Susan may need to maintain her own records if she wishes to trace telephone usage. In most businesses, telephone costs are viewed as an indirect cost.

(i) Pros:

- Susan might prefer the convenience of not switching telephone companies
- If Susan is happy with her current quality of service she might prefer to stay with the same company and not investigate other companies' plans
- Susan may be able to predict her cost better, especially if she usually calls less than 500 minutes a month
- Below is Susan's average cost per minute at different levels of calls per month.

Minutes	Total Cost	Average Cost
300	\$20.00	\$0.067
400	\$20.00	\$0.05
500	\$20.00	\$0.04
600	\$20.00 + (600-500)×\$0.10 = \$30.00	\$0.05
700	\$20.00 + (700-500)×\$0.10 = \$40.00	\$0.057

The average cost is lowest at exactly 500 minutes per month. If her calls are over 400 minutes or under 600 minutes, her phone bill will be less than it would be at a rate 5 cents per minute, which appears to be the other alternative (although the 5 cents per minute rate might not be available for daytime week day calls).

© John Wiley and Sons Australia, Ltd 2011

Cons

- If Susan has a number of projects in her local area or will be travelling a lot, she may be paying for 500 minutes of service that she does not use
- If Susan's calling volume exceeds 500 minutes per month, she will pay a very high rate of 10 cents per minute

2.20 Cost categories; cost function

The University Lounge has been reporting losses in past months. In July, for example, the loss was $5000.

Revenue		$70 000
Expenses		
Purchases of prepared food	$ 21 000	
Serving personnel	30 000	
Cashier	5 500	
Administration	10 000	
University surcharge	7 000	
Utilities	1 500	75 000
Loss		$ (5 000)

The Lounge purchases prepared food directly from University Food Services. This charge varies proportionately with the number and kind of meals served. Personnel who are paid by the Lounge serve the food, tend the cash register, waiting and clean tables, and wash dishes. The staffing levels in the Lounge rarely change; the existing staff can usually handle daily fluctuations in volume. Administrative costs are primarily the salaries of the Lounge manager and her office staff. The university charges the Lounge a surcharge of 10 per cent of its revenue. Utility costs are the costs of cooling, heating, and lighting the Lounge during its normal operating hours.
The university's management is considering shutting the Lounge down because it has been operating at a loss.

Required

(a) List the fixed expenses of the Lounge.
(b) List the variable expenses of the Lounge and the most likely cost driver for each expense.
(c) Write out the cost function for running the Lounge.
(d) Estimate the profit or loss for August if the revenues of the Lounge increase to $80 000.
(e) Explain why the original data show a loss but part (d) shows a profit. Be specific.

© John Wiley and Sons Australia, Ltd 2011

(a) and (b)

Wildcat Lounge costs:	Fixed	Variable
Purchases of prepared food		$21 000
Serving personnel	$30 000	
Cashier	5 500	
Administration	10 000	
University surcharge		7 000
Utilities	1 500	
Totals	$47 000	$28 000

Total revenue is the most likely cost driver for both variable costs. Food costs are likely to vary proportionately with sales, and the University surcharge is specifically based on sales.

(c) Because revenue is the cost driver for both variable costs, total revenue (TR) instead of quantity (Q) can be used in the cost function:

Variable cost = $28 000/$70 000 = 0.40, or 40% or revenue

Combining fixed and variable costs, the cost function is:

TC = $47 000 + 40%×Total revenue

(d) The estimate of total costs given revenues of $80 000 using the cost function is:

TC = $47 000 + 40%×80 000 = $79 000

Profit = Revenues – Total costs = $80 000 – $79 000 = $1000

(e) Lounge's fixed costs are assumed to be unchanged with the $10,000 increase in revenues. Only total variable costs are expected to increase, and the increase is estimated to be 40% of the increase in revenues. So, total variable costs are expected to increase by $4000 ($10 000×40%). So, the additional profit from a $10 000 increase in revenues is expected to be $6000 ($10 000 – $4000). In July there was a loss of $5000, so the estimated profit in August is $1000 (–$5000 + $6000).

(f) If the university were to close the Lounge, it would lose the revenues, less the fixed costs and the variable food costs. Because the university surcharge is an allocation within the university, this surcharge should be ignored when computing the university's opportunity cost (assuming that the charge does not relate to any variable costs for the university that arise because of the Lounge). Thus, for July the opportunity cost would have been $2000 — the operating loss of $(5000) + the university surcharge of $7000.

To estimate the opportunity cost for August, the variable cost part of the cost function can be adjusted. Variable food costs are estimated to be 30% ($21 000/$70 000) of revenues. (This is the same as the previous 40% variable cost rate less the university surcharge of 10% of revenues.) The adjusted cost function is:

TC = $47 000 + 30%×Total revenue

© John Wiley and Sons Australia, Ltd 2011

During August, the opportunity cost is estimated to be:

Revenue	$80 000
Fixed costs	(47 000)
Variable costs (30%×$80 000)	(24 000)
Net	$ 9 000

2.21 Cost behaviour; scatter plot

Polar Bear Ski Wear is a shop that sells skiwear at a ski resort. Its cost accountant developed the following scatter plot for the cost of electricity for lights, heating, and cooling against retail sales revenue.

Required

(a) In a business such as retail sales, what usually causes the cost of electricity to vary?

(b) In what time of year would most skiwear be sold at a ski resort?

(c) In the scatter plot, the cost of electricity appears to be related to volume of retail sales. If this shop specialised in selling swimwear, would the scatter plot look different? Explain what would change.

(d) Identify and explain another cost that is similar in nature to the cost of electricity. When you plot the cost against a cost driver, a relationship becomes apparent. However, the cost varies with something other than the cost driver. (Think of other situations where this type of relationship might occur.)

(a) In a retail business, electricity usually varies with hours of operation and possibly with the season (because of heating and air conditioning). A shop located near a ski area is likely to incur high heating costs during the winter. Electricity costs also vary with changes in electricity rates, but this is not considered a *cost driver* (a business activity that causes variations in total variable cost).

(b) The shop is most likely a seasonal business, generating most its sales around the ski season (fall and winter). During the spring and summer months, the shop might experience very little business activity; it might even close when the ski area shuts down.

© John Wiley and Sons Australia, Ltd 2011

(c) Assuming the highest electricity cost is during the winter when fewest bathing suits are sold, costs would be higher when there were fewer sales, so the trend would be the opposite of this plot. However, if the bathing suit shop is located in a geographic region where the highest electricity costs occur during the summer because of air conditioning, then the highest sales might coincide with the highest electricity costs.

(d) Many costs can be related to volume of activity. For example, higher profits generally occur during periods when activity is high. Higher profits, in turn, generally mean there is more money available to spend on administrative travel, special promotions, employee training, and new office furniture or equipment. Although these expenditures are made because more money is available, they are discretionary expenditures and not *caused* by the level of activity. A correlation may appear in a scatter plot or regression analysis. However, correlation does not necessarily mean causation.

© John Wiley and Sons Australia, Ltd 2011

2.22 Cost function using regression; scatter plots; three potential cost drivers
Laura Mills is the controller of Peer Jets International, a manufacturer of small corporate jets. She has undertaken a project to study the behaviour of overhead cost. She has assembled factory overhead data for the last 30 months from the company's manufacturing facility. Laura has asked you to develop a model to predict the level of manufacturing overhead.
The following categories of information are available to Laura. Manufacturing overhead includes all of the overhead costs associated with the manufacturing plant. Labour hours are the number of hours manufacturing employees worked. Machine hours are the total hours that machinery was used for the period. Tons of raw materials are all of the raw materials that were used for that particular month.

Required
(a) Create a scatter plot of manufacturing overhead for each of the potential cost drivers.
(b) Would you eliminate any of the potential cost drivers based on the scatter plots? Why?
(c) Explain why you create a scatter plot of the data before you perform regression analysis.
(d) To practice your regression analysis skills, perform a simple regression analysis of manufacturing overhead for each of the three potential cost drivers. Write the cost function from each regression.
(e) Based on the simple regression results, which cost driver does the best job of explaining manufacturing overhead costs? Explain.
(f) Do your regression results support your answer to part (b)? Explain.

Factory Overhead	Labour Hours	Machine Hours	Raw Materials
137896	2092	959	414
174342	1617	1227	623
168896	2215	1351	437
178059	1584	1480	479
166605	1930	952	678
165320	1717	986	666
157585	2319	931	585
165667	2312	1439	479
155657	1880	945	619
144605	1723	869	489
157608	1992	1171	445
171700	2476	1228	581
140686	2087	928	446
171982	2256	950	688
155252	2179	1016	580
140793	1806	902	464
154377	1671	948	610
150886	2019	1130	532
159198	1585	1335	415

© John Wiley and Sons Australia, Ltd 2011

145379	1747	1052	517
152614	1618	860	640
159450	2122	1188	548
160983	1697	1254	425
175393	2406	1187	695
153031	1917	948	468
166110	1658	1015	660
150041	2042	971	478
170419	1757	1111	652
169062	1952	1326	619
157149	1536	1017	513
137896	1536	860	414
178059	2476	1480	695

(b) None of the plots show a definite trend, but the plot for labour hours appears to have the least trend. Based only on the cost plots, labour hours could be deleted as a potential cost driver.

(c) Costs and potential cost driver data are plotted to determine whether further analysis is necessary. Analysis of the plots involves looking for a linear or football-shaped positive slope or trend. If the observations are widely scattered, the cost driver does not explain the variation in cost; either the driver is wrong or the cost is mostly fixed. Sometimes a cost that is mostly variable. The plots help determine whether regression analysis should be performed using any of the potential drivers.

© John Wiley and Sons Australia, Ltd 2011

(d) Labour Hours Regression:

Regression Statistics	
Multiple R	0.11279932
R Square	0.01272369
Adjusted R Square	-0.02253618
Standard Error	11114.8173
Observations	30

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	150410.682	14812.50852	10.1543	6.86E-11
Labour Hours	4.56597156	7.600936029	0.600712	0.552864

Only the intercept term is significantly different from zero, so the cost function is estimated as:

TC = $150 411

Machine Hours Regression:

Regression Statistics	
Multiple R	0.612063
R Square	0.3746211
Adjusted R Square	0.3522862
Standard Error	8846.1555
Observations	30

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	117598.67	10291.47803	11.4268	4.68E-12
Machine Hours	38.217192	9.331580777	4.095468	0.000325

Both the intercept and slope coefficients are significant, so the cost function is estimated as:

TC = $117 599 + $38.22*Machine hours

© John Wiley and Sons Australia, Ltd 2011

Raw Materials Regression:

Regression Statistics	
Multiple R	0.5033241
R Square	0.2533351
Adjusted R Square	0.2266685
Standard Error	9665.9786
Observations	30

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	126216.91	10853.56778	11.62907	3.11E-12
Raw Materials	60.215128	19.53627459	3.082222	0.004579

Both the intercept and slope coefficients are significant, so the cost function is estimated as:

TC = \$126 217 + \$60.22* Raw materials

(e) Labour hours can be eliminated as a potential driver because its coefficient is not significantly different from zero (see Part D). The coefficients for each of the other potential cost drivers are significantly different from zero, and the adjusted R-Squares from the regressions are:

Machine Hours	0.352
Raw Materials	0.226

Based on the simple regression results, machine hours appears to do the best job of explaining manufacturing overhead costs; however, this driver explains only 35% of the variation in cost.

(f) Yes, the direct labour hours was not significantly related to manufacturing overhead costs using simple regression.

© John Wiley and Sons Australia, Ltd 2011

2.23 Cost function using multiple regression (appendix 2A)

Refer to the data and requirements of Problem 2.22.

Required

(a) Perform multiple regression using all three cost drivers. Compare the adjusted *R*-squares and cost functions for the multiple regression with the results of simple regressions for each potential cost driver.

(b) Which cost drivers do the best job of explaining manufacturing overhead costs? Explain.

(c) Select only the cost drivers that do the best job of explaining manufacturing overhead costs. Perform multiple regression analysis for those cost drivers and write the cost function.

(d) Explain why more than one cost driver is plausible for manufacturing overhead costs.

(a) Multiple regression with all three potential cost drivers:

Regression Statistics	
Multiple R	0.9092294
R Square	0.8266982
Adjusted R Square	0.8067018
Standard Error	4832.5558
Observations	30

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	60988.489	10361.2349	5.886218	3.3E-06
Labour Hours	-0.1959303	3.333162437	-0.05878	0.953575
Machine Hours	48.778501	5.291558412	9.218173	1.12E-09
Raw Materials	82.976635	10.10654585	8.210187	1.08E-08

Comparison of simple and multiple regression results:

	Adj. R^2	Intercept t-stat (p-value)	Independent Variables t-stat (p-value)		
			Labour Hours	Machine Hours	Raw Materials
Simple Regressions:					
Labour Hours	0.022	$150,411 (<0.001)	$4.57 (0.55)		
Machine Hours	0.352	$117,599 (<0.001)		$38.22 (<0.001)	
Raw Materials	0.226	$126,217 (<0.001)			$60.22 (0.005)
Multiple Regression	0.806	$60,988 (<0,001)	$-0.20 (0.954)	$48.78 (<0.001)	$82.98 (<0.001)

© John Wiley and Sons Australia, Ltd 2011

(b) Labour hours does not appear to be a cost driver when using either simple regression or multiple regression; its coefficient is not significantly different from zero in either regression. Also, its coefficient is negative rather than positive in the multiple regression. Thus, labour hours can be eliminated as a potential cost driver.

Both machine hours and raw materials are positive and significantly different from zero when using simple regression and also when using multiple regression. The adjusted R-Square is far higher in the multiple regression (0.806) than in either of the simple regressions (0.352 and 0.226) for these two cost drivers. A combination of cost drivers does a much better job of explaining the variation in manufacturing overhead costs than either cost driver alone.

(c) Multiple regression using machine hours and raw materials as cost drivers:

Regression Statistics	
Multiple R	0.90921678
R Square	0.82667515
Adjusted R Square	0.81383627
Standard Error	4742.5348
Observations	30

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	60677.5902	8743.664851	6.939606	1.86E-07
Machine Hours	48.7422519	5.157604083	9.450561	4.71E-10
Raw Materials	82.925842	9.881964042	8.391636	5.29E-09

The cost function is: TC = \$60 678 + \$48.74×Machine hours + \$82.93×Raw materials

(d) Manufacturing can be a complex activity requiring a number of different tasks. Each task includes different activities. Costs for these activities are likely related to specific cost drivers. In this example, machine hours and raw materials explain different activity costs, such as machining work on units, and materials handling for the units. A better understanding of the manufacturing process improves the ability to determine the types and number of cost drivers that can be used in a more complete cost function.

© John Wiley and Sons Australia, Ltd 2011

2.24 Use of prior year costs; quality of information

Software Solutions is a family-owned business that has been in operation for more than 15 years. The board of directors is comprised of mainly family members, plus a few professionals such as an accountant and lawyer. Regina is a staff accountant who has been working on the budget for the last several weeks. The chief financial officer (CFO) needs to present the budget at the next board meeting and wants a preliminary copy in two days. Regina is certain that she will not be able to finish the budget within two days. Several department heads have not turned in their preliminary figures, and two departments have budgeted large increases in fixed costs for replacing computer equipment. Regina knows she should have alerted the CFO about these budgeted increases, but she has not had time.

One of her co-workers knows that Regina is behind and suggests that she use last year's budgets for those departments that have not provided information and also for the departments that increased their budgets by large amounts. The co-worker says that the budget can be straightened out later because the board does not pay attention to the details.

Required

(a) Is this an ethical dilemma for Regina? Why?

(b) Why might it be important for the board of directors to have as much updated information as possible about the budget?

(c) What should Regina do, given that not enough time is available to gather high-quality information? Explain your thinking.

(a) Regina has at least two choices in this situation. She can tell the CFO that she cannot produce a very accurate budget within two days or she can pull together something that may not be very accurate. She may believe that her reputation as a diligent employee would suffer if she cannot produce something. However, if she submits a budget based on last year's budget and she knows that this is likely to be inaccurate, her reputation would also suffer. This is a potential ethical dilemma for Regina because the CFO believes that he can rely on Regina's work when he presents the budget to the board. If Regina uses last period's budget, the department amounts and total budget may be quite inaccurate, and the CFO will present the board with information that is unreliable. When the budget is complete the board will likely see it again and notice the discrepancies between the preliminary and actual budgets and wonder why the first budget was so inaccurate, and that could reflect negatively on the CFO. More importantly, the board may make inappropriate decisions based on faulty data.

(b) The board of directors monitors the performance of the CEO and top management. If they have outdated information and inaccurate information, they will draw erroneous conclusions about the performance of the organisation and the top management. They may either praise or criticise top management when the situation may not warrant it. They may also use the inaccurate information to help them approve decisions, such as a business expansion.

(c) Although the board is not directly involved in day-to-day operations, in their role of oversight, they need the most current information available and explanations for information that is not available. The relationship between the CEO and the board should be one of trust and confidence. If Regina submits unrealistically low budgets this month and then more accurate budgets next

© John Wiley and Sons Australia, Ltd 2011

month, but with large increases in department costs, the board may begin to lose trust in the CEO's ability to manage operations. Regina should submit the most current information she has, and use last year's budgets for departments that have not turned theirs in, with a flag indicating that the information quality is low for the budgets in those departments and an explanation that the budget is currently based on last year's information.

2.25 Scatter plots, cost function using regression, two potential cost drivers
Suppose we need to predict the cost of maintenance for Brush Valley High School for the upcoming school year. From the school district records we gather weekly data about costs and volumes for two potential cost drivers: labour hours used in the maintenance department and number of enrolled students.

		Potential cost drivers	
Week	Total maintenance cost	Number of maintenance hours worked	Number of students
1	$16 690	238	534
2	13 560	194	532
3	13 540	108	534
4	16 060	229	530
5	12 430	101	533
6	20 860	298	537
7	18 420	244	540
8	12 310	98	540
9	13 770	108	541
10	16 990	225	538
11	20 650	289	540
12	14 770	118	539

Required

(a) Identify and explain two potential cost drivers for total maintenance cost, in addition to number of students and maintenance hours worked.

(b) Create a scatter plot, first for maintenance cost against hours worked and then maintenance cost against students.

(c) Would you eliminate either cost driver based on the plots? Explain.

(d) Perform regression analysis using each cost driver. Use your judgement to determine the most appropriate cost driver and write out the cost function for maintenance cost.

(e) Can we know for certain that the cost driver chosen in part (d) is the best cost driver? Why?

(a) Other cost drivers for total maintenance cost could be number of rooms cleaned, square feet cleaned, number of hours students attend school, number of hours the building is open, or number of classes and activities per period. Students

© John Wiley and Sons Australia, Ltd 2011

may have thought of other drivers that could be logically related to cleaning maintenance costs.

(b)

(c) I would eliminate number of students because there does not seem to be a positive linear relationship between maintenance cost and number of students.

(d) Regression results for maintenance cost and number of maintenance hours worked:

Regression Statistics	
Multiple R	0.920565237
R Square	0.847440356
Adjusted R Square	0.832184392
Standard Error	1217.06772
Observations	12

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	9134.875134	965.5045837	9.461245	2.63E-06
X Variable 1	35.74733262	4.796328319	7.453062	2.18E-05

Regression output for maintenance cost and number of students:

Regression Statistics	
Multiple R	0.247329
R Square	0.061172
Adjusted R Square	-0.03271
Standard Error	3019.173
Observations	12

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-89867	130954.9	-0.68624	0.508157
X Variable 1	197.0261	244.0857	0.807201	0.438328

© John Wiley and Sons Australia, Ltd 2011

According to the R Square statistics, changes in maintenance hours worked explains more than 80% of the changes in maintenance cost while number of students explains none. Therefore, maintenance hours is a reasonable cost driver. The p-values on the T-statistics are very small, providing high confidence that both the intercept and slope are different from zero. The total cost function is:

TC = \$9135 + \$35.74×maintenance hours worked.

(e) It cannot be known for certain whether the number of maintenance hours is the best cost driver because every single possible cost driver cannot be identified. An unidentified cost driver could have a higher R-Square. However, it is logical to expect a strong relation between hours worked and cost. From the analyses performed, it is rational to conclude that hours worked will provide a reasonable estimate of future costs.

© John Wiley and Sons Australia, Ltd 2011

2.26 Cost function using account analysis and high-low method

The Elder Clinic, a not-for-profit entity, provides limited medical services to low-income elderly patients. The manager's summary report for the past four months of operations is reproduced here.

	March	April	May	June	Total
Number of patient visits	849	821	778	842	3 290
Patient fees	$ 4 230	$ 4 180	$ 3 875	$ 4 260	$ 16 545
Medical staff salaries	13 254	13 256	13 254	14 115	53 879
Medical supplies used	3 182	3 077	2 934	3 175	12 368
Administrative salaries	3 197	3 198	3 197	3 412	13 004
Rent	1 000	1 000	1 000	1 100	4 100
Utilities	532	378	321	226	1 457
Other expenses	2 854	2 776	2 671	2 828	11 129
Total expenses	24 019	23 685	23 377	24 856	95 937
Operating surplus (loss)	$(19 789)	$(19 505)	$(19 502)	$(20 596)	$(79 392)

The clinic receives an operating subsidy from the city, but unfortunately, the operating loss that has been incurred through June $(79 392) is larger than anticipated. Part of the problem is the salary increase that went into effect in June, which had been overlooked when the budget was submitted to the city last year. To compound the problem, the cold winter months traditionally bring with them an increase in cold-related health problems. Thus, the clinic is likely to experience an increase in patient visits during July.

The clinic's managers are considering an increase in patient fees to reduce losses. However, they are reluctant to raise fees because the patients have low incomes. They will raise fees only if it is necessary.

Required

(a) Use your judgement to classify costs as fixed, variable, or mixed. Explain how you classified each item.

(b) Create a cost function for the Elder Clinic. Use the high-low method to estimate the function for any mixed costs.

(c) Use the cost function to estimate July expenses based on a projection of 940 patient visits.

(d) List reasons why management of the Elder Clinic cannot know with certainty what the expenses will be during July. List as many reasons as you can.

(e) Describe the pros and cons of using your cost estimate from part (C) to decide whether to raise patient fees.

(f) The managers need your July cost estimate to decide whether to raise patient fees. Use the information you learned from parts (a) and (b) to write a memo to the director of the Elder Clinic presenting your estimate of July costs. Provide the director with appropriate information for understanding your methodology and evaluating the reliability of your cost estimate.

© John Wiley and Sons Australia, Ltd 2011

(a) and (b)
Salaries are always fixed, and rent for this type of facility is usually fixed. Utilities cost varies with season not visits, it is considered fixed. The most current value is used to predict next period's utilities. Medical supplies vary with number of patient-visits; each patient requires a certain number of supplies, such as tongue depressors, gloves, and so on. These would be variable. Some supplies, such as snake anti-venom, must be kept on hand whether or not they are used. These would be fixed. Therefore, medical supplies is a mixed cost. Other expenses appear to increase and decrease with number of patient-visits, but not proportionately. This analysis suggests that there are some of the other expenses are variable costs and some fixed, so this cost is classified as a mixed cost.

Category	Fixed	Variable	Cost Driver	Mixed
Medical staff salaries*	$14 115			
Medical supplies used**	219	$3.49	Patient-visits	X
Administrative salaries	3 412			
Rent	1 100			
Utilities	226			
Other expenses	664	2.58	Patient-visits	X
Total Expenses	$19 736	$6.07		

* The value in June is used for fixed costs because the increase in salaries will hold into the future.
**Using high-low, variable cost is $3.49 ($3182 – $2934)/(849 – 778).
Use March, high point of medical supplies cost and patient data, to find fixed: $3182 = F + $3.49×849.

Use the same method for other expenses.
Given the preceding computations and cost summary, the cost function is:

$$TC = \$19\,736 + \$6.07 \times \text{patient-visits}$$

(c) At 940 patient-visits, July expenses are estimated to be:

$$TC = \$19\,736 + \$6.07 \times 940 = \$25\,441.80$$

(d) There are many possible reasons that could be listed. Here are some of the reasons:
- The managers will not know how many visits they will receive, and costs go up as patient-visits increase. Visits are affected by season, weather, current illnesses that are circulating in the area, and so on. Also, other facilities may open or close, affecting the number of visits at this clinic.
- Prices of all inputs could change (usually increase).
- Treatments and related costs may change as new drugs are available, new equipment is acquired, or there are changes in treatment procedures for certain illnesses.

(e) There is no one answer to this part.

© John Wiley and Sons Australia, Ltd 2011

2.27 Cost function judgement and methodology

Suppose you have the responsibility of creating a cost function for the costs of an Internet service provider's help line.

Required

(a) What is the cost object? Identify where you might obtain information about past costs for the cost object.

(b) Identify at least two potential cost drivers. Explain where you might obtain information about past volumes for each cost driver.

(c) What other information would you like to obtain before estimating the cost function? How might you obtain that information?

(d) Identify the techniques introduced in this chapter that you would be most likely to use in creating the cost function. Explain why.

(a) The cost object is the help line. Accounting records could be accessed to determine the wage rates and time worked for help support staff and supervisors. Analysis of general ledger entries could be used to determine past costs for phone service, supplies, and other miscellaneous costs. If the help line is housed in its own building, depreciation schedules, prepaid insurance schedules, etc. could be used to identify costs for building and occupancy costs. If the service is housed in a common building, cost allocation records could be used to identify past costs. The choice of information sources depends on how the past cost information is to be used.

(b) Possible cost drivers include number of calls handled, number of hours worked, number of work stations, number of employees, or total number of Internet customers. Information about number of employees and hours worked is found in the payroll accounting system. Number of calls might have to be tracked by employees or by the telephone system. Number of customers is part of the revenue accounting records. Number of work stations might come from the department head.

(c) It would be useful to obtain several years of monthly data from which to prepare scatter plots and run regression analysis. This data could be found in the accounting system, or it might need to be estimated if it has not been tracked in the past. Vendors, department heads, and others could be interviewed to identify any potential cost increases or other expected changes in cost behaviour from prior periods.

(d) If enough data points are available, regression analysis would probably be the best choice. Regression analysis makes use of all data points and is more accurate than two-point methods, assuming a linear cost function. If not, a two point method might be best, with representative points selected from a scatter plot. Alternatively, analysis at the account level could be used to develop a cost function using information from the general ledger.

© John Wiley and Sons Australia, Ltd 2011

2.28 Adjusting data for use with regression; outlier

Smeyer Industries is a large entity with more than 40 departments, each employing 35 to 100 persons. Recent experience suggests that the cost function used to estimate overhead in Department IP-14 is no longer appropriate. The current function was developed three years ago. Since then, a number of changes occurred in the facilities and processes used in Department IP-14. The changes happened one at a time. Each time a change was made, the cost accountant felt the change was not major enough to justify calculating a new overhead cost function. Now it is clear that the cumulative effect of the changes has been large.

You have been assigned the task to develop a new cost function for overhead in Department IP-14. Initial analysis suggests that the number of direct labour hours is an appropriate cost driver. Departmental records are available for nine months. The records reveal the following information.

Month	Actual Overhead	Direct Labour Hours
March	$68 200	8812
April	71 250	8538
May	68 150	8740
June	73 500	9176
July	38 310	2123
August	70 790	9218
September	80 350	8943
October	68 750	8821
November	68 200	8794

An assistant has analysed the data for March through July and made the appropriate adjustments except for the following items (for which the assistant was unsure of the proper treatment).

(i) The semi-annual property tax bill for Department IP-14 was paid on June 30. The entire amount of $3,000 was charged to overhead for June.

(ii) The costs to install a new piece of equipment with a life of 10 years in the department were charged to overhead in April. The installation costs were $4,300.

(iii) Factory depreciation is allocated to Department IP-14 every month. The department's share, $8,000, is included in overhead.

(iv) A strike closed the plant for three weeks in July. Several non-union employees were kept on payroll during the strike. Their duties were general housekeeping and 'busy work' These costs were charged to overhead.

You also have the details for the overhead account for the months of August and September. They are presented in the following table. You were hired on October 1 and have been keeping the department accounts since then. Therefore, you know that the data for October and November are correct, except for any adjustments needed for the preceding items.

© John Wiley and Sons Australia, Ltd 2011

Department IP-14 Overhead control

August	Explanation	Amount
4	Miscellaneous supplies	$ 10 450
5	Payroll for indirect labour	5 500
15	Power costs: department IP-14	12 250
19	Payroll for indirect labour	6 000
19	Overtime premium	890
24	Factory depreciation	8 000
26	Miscellaneous supplies	27 700
	Total for August	$ 70 790

September	Explanation	Amount
2	Payroll for indirect labour	$ 6 000
7	Miscellaneous supplies	12 100
15	Power costs: department IP-14	11 100
15	Power costs: department IB-4	10 850
16	Payroll for indirect labour	6 500
16	Overtime premium	950
21	Miscellaneous supplies	19 350
28	Factory depreciation	8 000
30	Payroll for indirect labour	5 500
	Total for September	$ 80 350

August has 31 days and September has 30 days.

Required

(a) Using the information provided, adjust the monthly cost data to more accurately reflect the overhead costs incurred during each month.

(b) Discuss whether the data for July should be included in the estimate of future costs. Use a scatter plot to help you answer this question.

(c) Develop a cost function by regressing overhead costs in Department IP-14 on direct labour hours. Discuss whether your cost function would be reasonable for estimating future overhead costs. Ignore any items you will discuss in part (d).

(d) Identify and discuss any additional adjustments that might be needed to more accurately measure overhead costs for the regression in part (c).

(e) Explain why adjustments probably need to be made to information from accounting records when estimating a cost function.

© John Wiley and Sons Australia, Ltd 2011

(a) Adjustments to more accurately reflect overhead costs incurred:

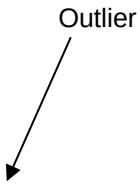
	Unadjusted Overhead	Property Tax(a)	Depreci-ation(b)	Other	Payroll[3]	Adjusted Cost
Mar	$68 200	+$500	+$36[1]			$68 736
Apr	71 250	+ 500	+ 36			
			–4300			67 486
May	68 150	+ 500	+ 36			68 686
June	73 500	+ 500	+ 36			
		–3000				71 036
July	38 310	+ 500	+ 36		+$2750	41 596
Aug	70 790	+ 500	+ 36		–2750	
					+ 4800	73 376
Sept	80 350	+ 500	+ 36	–10 850[2]	–4800	65 236
Oct	68 750	+ 500	+ 36			69 286
Nov	68 200	+ 500	+ 36			68 736

[1] To predict future overhead, the first month is adjusted even though it is not an actual cost: 4300/10 × 12 = 35.83/mo. (rounded to $36)
[2] Note IB-4's power added to Dept. IP-14
[3] Payroll paid every two weeks; 1/2 of August 5 payroll goes to July: 5500 × 1/2 = 2750. Similarly, 80% of September 2 payroll to August: .8 × 6000 = 4800.

No adjustments are needed for items (c) and (d); these are correctly handled. The miscellaneous supplies account also looks suspicious, but there is insufficient information to make an adjustment.

(b) Operations in the month of July are not typical of the rest of the time period, as shown in the scatter plot below. If these observations are included in the regression analysis, the trend line is likely to distort costs. Because of the large difference between these values and the values in other months, July's result is an outlier and should be removed from the data.

© John Wiley and Sons Australia, Ltd 2011



(c) Here are the regression results:

Regression Statistics	
Multiple R	0.641981
R Square	0.412139
Adjusted R Square	0.314163
Standard Error	1980.47
Observations	8

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	8777.818	29406.26	0.298502	0.775388
X Variable 1	6.789722	3.310484	2.050976	0.086126

Based on the t-statistic and p-value for the intercept, the fixed cost does not appear to be different from zero. Therefore, the cost function is estimated as:

Overhead cost = \$6.79 × direct labour hours

This cost function might not provide a very accurate estimate for future costs because the direct labour hours explain only about 31% of the variation in overhead costs (based on the adjusted R-square). Thus, considerable future variation in overhead costs is likely to occur due to factors other than changes in direct labour hours.

(d) According to the details provided for August and September, supplies were a large proportion of overhead cost. Based on the variation in dates at which supplies are recorded, they are most likely recorded at the time of purchase rather than at the time of use. Monthly overhead costs for supplies may be significantly overstated or understated if the amount of supplies inventory varies significantly from month to month. Thus, adjustments could be made to adjust the balance in supplies inventory each month. In addition, there could be seasonal variation in costs such as overtime pay and utilities. If the cost function

© John Wiley and Sons Australia, Ltd 2011

is for annual costs, this may not be a problem, but if the company would like information about predicted monthly costs, these variations would need to be considered. Additional adjustments include any expected changes in costs from prior periods. For example, power costs could be adjusted upward if utility rates in the future are expected to be higher than in the past.

(e) Following are three reasons for making adjustments when estimating cost functions. First, the accounting records might not accurately reflect the costs incurred during each time period. The process of preparing financial statements often includes adjustments so that costs are recorded in the correct time period. However, financial statements may be prepared less frequently than data is collected for cost estimation. Second, small adjustments that may be material when estimating a cost might not be sufficiently material to the financial statements for adjustments in the accounting records. Third, sometimes known changes have occurred in prices or cost behaviour. Prior cost data should be adjusted for these changes before the data are used to estimate future costs.

© John Wiley and Sons Australia, Ltd 2011