ACCY 121

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Chapter 05
Cost Estimation

1. The following manufacturing costs were incurred by the RST Company in 2011:

Direct materials	$112,500
Direct labor	175,000
Manufacturing overhead	235,000

These costs were incurred to produce 25,000 units of product. Variable manufacturing overhead was 80% of the direct materials cost.
In 2012, the direct material and variable overhead costs per unit will increase by 15%, but the direct labor costs per unit are not expected to change. Fixed manufacturing costs are expected to increase by 7.5%.
Required:
(a) Prepare a cost estimate for an activity level of 20,000 units of product in 2012.
(b) Determine the total product costs per unit for 2011 and 2012.

1		2011 @ 25,000 units
4.50	DM	112,500
7.00	DL	175,000
3.60	VMOH	90,000 (80% x 112,500)
	FMOH	145,000 (235,000 MOH − 90,000 VMOH)
	Total	$ 522,500
		÷ 25,000
		$ 20.90 per unit

	2012 @ 20,000 units	1
DM	103,500	(4.5 x 1.15 = 5.175)
DL	140,000	7.00
VMOH	82,800	(3.6 x 1.15 = 4.14)
FMOH	155,875 (145,000 x 1.075)	
Total	$ 482,175	
	÷ 20,000	
	$ 24.11 per unit	

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In 2012, the direct material and variable overhead costs per unit will increase by 15%, but the direct labor costs per unit are not expected to change. Fixed manufacturing costs are expected to increase by 7.5%.
Required:
(a) Prepare a cost estimate for an activity level of 20,000 units of product in 2012.
(b) Determine the total product costs per unit for 2011 and 2012.

(a) $482,175
(b) 2011 unit cost: $522,500/25,000 = $20.90; 2012 unit cost: $482,175/20,000 = $24.11

Feedback: (a) Variable overhead costs (2011) = .80($112,500) = $90,000
Fixed overhead costs (2011) = $235,000 - $90,000 = $145,000

	2011	2012	
Direct materials	$112,500	$103,500	(1)
Direct labor	175,000	140,000	(2)
Variable overhead costs	90,000	82,800	(3)
Fixed overhead costs	145,000	155,875	(4)
Total	$522,500	$482,175	

(1) [($112,500)/25,000)(1.15)](20,000) = $103,500
(2) ($175,000/25,000)(20,000) = $140,000
(3) [($90,000)/25,000)(1.15)](20,000) = $82,800
(4) ($145,000)(1.075) = $155,875

AACSB: Analytic
AICPA: FN-Decision Making
Bloom's: Analysis
Difficulty: Medium
Learning Objective: 3
Topic Area: Account Analysis Method

$Y = a + bx$

2. Hagler's Toupees has the following machine hours and production costs for the last six months of last year:

$b = \frac{\text{rise}}{\text{run}} = \text{slope}$

Month	X Machine Hours	Y Production Cost
July	~~15,000~~	~~$12,075~~
August	~~13,500~~	~~10,800~~
September (Low)	11,500	9,580
October (High)	15,500	12,080
November	~~14,800~~	~~11,692~~
December	~~12,100~~	~~9,922~~

If Hagler expects to incur 14,000 machine hours in January, what will be the estimated total production cost using the high-low method?

A. $8,750.00
B. $11,142.50
C. $22,400.00
D. $10,889.10

$b = \frac{12,080 - 9,580}{15,500 - 11,500} = \frac{2500}{4000} = 0.625$

$Y = a + \frac{0.625}{\text{per MH}}(x)$

Sept Low: $9580 = a + \frac{0.625}{MH}(11,500)$

$9580 = a + 7,187.5$

$a = 2,392.5$

$Y = 2,392.5 + \frac{0.625}{MH}(x)$

Est. January $Y = 2,392.5 + \frac{0.625}{MH}(14,000)$

$Y = \$11,142.50$

2. Hagler's Toupees has the following machine hours and production costs for the last six months of last year:

Month	Machine Hours	Production Cost
July	15,000	$12,075
August	13,500	10,800
September	11,500	9,580
October	15,500	12,080
November	14,800	11,692
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If Hagler expects to incur 14,000 machine hours in January, what will be the estimated total production cost using the high-low method?
A. $8,750.00
B. $11,142.50
C. $22,400.00
D. $10,889.10

VC per unit = ($12,080 - 9,580)/(15,500 - 11,500) = $.625; FC = $12,080 - $.625(15,500) = $2,392.50; TC = $2,392.50 + $.625(14,000) = $11,142.50

AACSB: Analytic
AICPA: FN-Decision Making
Bloom's: Application
Difficulty: Hard
Learning Objective: 4
Topic Area: High-Low Cost Estimation

3. The Teal Company's total overhead costs at various levels of activity are presented below:

Month		Direct Labor Hours	Total Overhead	(V) Util	(F) Sup Sal	(M) Maint
July		~~7,500~~	~~$272,000~~			
August	Low	6,000	234,000	$-\left(\begin{smallmatrix}15.3\\ \times 6000\end{smallmatrix}\right) - 80{,}000 =$		62,200
September		9,000	319,000			101,300
October	High	10,500	340,500	$-\left(\begin{smallmatrix}15.3\\ \times 10{,}500\end{smallmatrix}\right) - 80{,}000 =$		99,850
				[160,650]		

Assume that the overhead costs above consist of utilities, supervisory salaries, and maintenance. The breakdown of these costs at the 9,000 direct labor hour level of activity is as follows:

	1 DLH	9000 DLH
Utilities (V)	15.3	$137,700
Supervisory Salaries (F)		80,000
Maintenance (M)		101,300
		319,000

$Y_{maint} = a + b(X_{DLH})$

Required:

(a) Using the high-low method, determine the cost formula for maintenance.

(b) Express the company's total overhead costs in linear equation form.

(a) $b = \frac{rise}{run} = \frac{99,850 - 62,200}{10,500 - 6,000} = \frac{37,650}{4,500} = \$8.36667$ per DLH

Low → $Y_{maint} = 62,200 = a + 8.36667 \text{ per DLH}\,(6000 \text{ DLHs})$

$62,200 = a + 50,200$

$a = 12,000$

$Y_{maint} = 12,000 + 8.36667\,(X \text{ DLHs})$

b) $Y_{Total\ OH} = a + bX$

FC + VC

$Y = [80,000 + 12,000] + [\$15.3 \times \text{DLHs}] + [\$8.36667 \times \text{DLHs}]$

$Y_{OH} = \$92,000 + 23.66667 \text{ per DLH}\,(\text{DLHs})$

3. The Teal Company's total overhead costs at various levels of activity are presented below:

Month	Direct Labor Hours	Total Overhead
July	7,500	$272,000
August	6,000	234,000
September	9,000	319,000
October	10,500	340,500

Assume that the overhead costs above consist of utilities, supervisory salaries, and maintenance. The breakdown of these costs at the 9,000 direct labor hour level of activity is as follows:

Utilities (V)	$137,700
Supervisory Salaries (F)	80,000
Maintenance (M)	101,300
	319,000

Required:
(a) Using the high-low method, determine the cost formula for maintenance.
(b) Express the company's total overhead costs in linear equation form.

(a) $12,000 + 8.36667 × Direct Labor Hour
(b) $92,000 + 23.6667 × Direct Labor Hour

Feedback: (A) Utilities per hour = $137,700/9,000 = $15.30 per direct labor hour
Utility cost at the high point = $15.30(10,500) = $160,650
Utility cost at the low point = $15.30(6,000) = $91,800
Maintenance cost at the high point = $340,500 - 80,000 - 160,650 = $99,850
Maintenance cost at the low point = $234,000 - 80,000 - 91,800 = $62,200
Maintenance cost per hour = ($99,850 - 62,200)/(10,500 - 6,000) = $8.36667
Fixed Maintenance costs per month = $99,850 - ($8.36667) × (10,500) = $12,000
Total maintenance costs = $12,000 + $8.36667 per Direct Labor Hour
(B) Total overhead costs = ($80,000 + 12,000) + ($15.30 + 8.36667) × Direct Labor Hours = $92,000 + $23.66667 × Direct Labor Hours

AACSB: Analytic
AICPA: FN-Decision Making
Bloom's: Analysis
Difficulty: Medium
Learning Objective: 4
Topic Area: High-Low Cost Estimation

4. A company ran a regression analysis using direct labor hours as the independent variable and manufacturing overhead costs as the dependent variable. The results are summarized below:

Intercept	$14,600
Slope	$ 12.55
Correlation coefficient	.931
R-squared	.867

The company is planning on operating at a level that would require 12,000 direct labor hours per month in the upcoming year.

Required:

(a) Use the information from the regression analysis to write the cost estimation equation for the manufacturing overhead costs.

(b) Compute the estimated manufacturing overhead costs per month for the upcoming year.

$Y = a + bX$

a) $Y_{MOH} = \$14,600 + \$12.55_{\text{per DLH}} (DLHs)$

b) $Y_{MOH} = \$14,600 + (\$12.55_{\text{per DLH}} \times 12,000_{DLHs})$

$Y_{MOH} = \$165,200$

4. A company ran a regression analysis using direct labor hours as the independent variable and manufacturing overhead costs as the dependent variable. The results are summarized below:

Intercept	$14,600
Slope	$ 12.55
Correlation coefficient	.931
R-squared	.867

The company is planning on operating at a level that would require 12,000 direct labor hours per month in the upcoming year.
Required:
(a) Use the information from the regression analysis to write the cost estimation equation for the manufacturing overhead costs.
(b) Compute the estimated manufacturing overhead costs per month for the upcoming year.

(a) Total manufacturing overhead costs = $14,600 + ($12.55 × Direct Labor Hours)
(b) $165,200

Feedback: (b) Total manufacturing overhead costs = $14,600 + ($12.55)(12,000) = $165,200

AACSB: Analytic
AICPA: FN-Decision Making
Bloom's: Analysis
Difficulty: Easy
Learning Objective: 5
Topic Area: Obtaining Regression Estimates

5. The Grind Company has been having some difficulties estimating their manufacturing overhead costs. In the past, manufacturing overhead costs have been related to production levels. However, some production managers have indicated that the size of their production lots might also be having an impact on the amount of their monthly manufacturing overhead costs. In order to investigate this possibility, the company collected information on their monthly manufacturing overhead costs, production in units, and average production lot size for 2011.

Month	Production (Units)	Manufacturing Overhead Cost	Average Monthly Production Lot Size
1	75,000	$ 925,800	20
2	90,000	843,875	19
3	65,000	910,125	24
4	80,000	946,000	19
5	55,000	879,000	24
6	50,000	825,000	18
7	85,000	960,000	22
8	105,000	1,053,500	25
9	102,000	1,020,000	23
10	68,000	905,000	20
11	75,000	938,000	22
12	95,000	995,000	24

Regression analysis results of the information presented above are as follows:

Ordinary regression:
Equation: $691,741 + $3.0692 x units
r-square: .628 worse

Multiple regression:
Equation: $482,171 + $2.4918 x units + $11,770.939 x lot size
r-square: .777 better

(a) $Y = 691,741 + 3.0692(92,000 \text{ units})$
$Y = \$974,107$

Required:

(a) Use the results from the ordinary regression and estimate next month's manufacturing overhead costs, assuming the company is planning to produce 92,000 units.

(b) Use the results from the multiple regression and estimate the next month's manufacturing costs, assuming the company is planning to produce 92,000 units with an average lot size of 21.

(c) Comment on which regression seems to be more appropriate under these circumstances. What additional information would you like to see? Be specific.

(b) $Y_{MoH} = 482,171 + (2.4918 \times 92000) + (11,770.939 \times 21)$

$Y_{MoH} = \$958,606$

(c) R^2 increases from 0.628 to 0.777.

5. The Grind Company has been having some difficulties estimating their manufacturing overhead costs. In the past, manufacturing overhead costs have been related to production levels. However, some production managers have indicated that the size of their production lots might also be having an impact on the amount of their monthly manufacturing overhead costs. In order to investigate this possibility, the company collected information on their monthly manufacturing overhead costs, production in units, and average production lot size for 2011.

Month	Production (Units)	Manufacturing Overhead Cost	Average Monthly Production Lot Size
1	75,000	$ 925,800	20
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6	50,000	825,000	18
7	85,000	960,000	22
8	105,000	1,053,500	25
9	102,000	1,020,000	23
10	68,000	905,000	20
11	75,000	938,000	22
12	95,000	995,000	24

Regression analysis results of the information presented above are as follows:
Ordinary regression:
Equation: $691,741 + $3.0692 x units
r-square: .628

Multiple regression:
Equation: $482,171 + $2.4918 x units + $11,770.939 x lot size
r-square: .777

Required:
(a) Use the results from the ordinary regression and estimate next month's manufacturing overhead costs, assuming the company is planning to produce 92,000 units.
(b) Use the results from the multiple regression and estimate the next month's manufacturing costs, assuming the company is planning to produce 92,000 units with an average lot size of 21.
(c) Comment on which regression seems to be more appropriate under these circumstances. What additional information would you like to see? Be specific.

(a) $974,107
(b) $958,606
(c) The multiple regression improves the fit over the ordinary regression. The r-square improves from .628 to .777. Additional information may include tests to determine the significance of the coefficients.

Feedback: (a) Total manufacturing costs = $691,741 + ($3.0692 × 92,000) = $974,107
(b) Total manufacturing costs = [$482,171 + ($2.4918 × 92,000) + ($11,770.939 × 21)] = $958,606

AACSB: Analytic
AICPA: FN-Decision Making
Bloom's: Analysis
Difficulty: Medium
Learning Objective: 5
Topic Area: Obtaining Regression Estimates

6. Cameron Company is interested in establishing the relationship between utility costs and machine hours. Data has been collected and a regression analysis prepared using Excel. The monthly data and the regression output follow:

Month	Machine Hours	Electricity Costs				
January	3,250	22,080				
February	3,770	25,200				
March	2,470	16,200				
April	4,030	27,600				
May	4,940	33,900				
June	4,290	26,400				
July	5,330	29,700				
August	4,550	27,300				
September	2,600	18,600				
October	4,810	31,200				
November	6,110	37,200				
December	5,460	33,300				
SUMMARY OUTPUT						
Regression Statistics						
Multiple R	96.5%					
R Square	93.2%					
Adjusted R-Square	92.5%					
Standard Error	1,710.21					
Observations	12.00					
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	4,472.26	2,019.39	2.21	0.051	-27.23	8971.74
Machine Hours	5.329	0.455	11.70	3.69E-07	4.314	6.343

exceeds 2.0

Required:

a. What is the equation for utility costs using the regression analysis?

b. Does the variable "machine hours" have statistically significance? Explain.

c. Prepare an estimate of utility costs for a month when 3,000 machine hours are worked.

(a) $4,472.26 + (\$5.329 \times MH)$

(b) $11.70 > 2.0 \Rightarrow$ MH significant

$Y_{util} = 4,472.26 + \left(5.329 \frac{\$}{MH} \times 3000\ MH\right) = \$20,459.26$

(a) $4,472.26 + $5.329 × machine hours
(b) yes, the t-stat of 11.70 exceeds the rough rule of thumb of 2
(c) $20,459.26

Feedback: (c) $4,472.26 + $5.329 × 3,000 = $20,459.26

AACSB: Analytic
AICPA: FN-Decision Making
Bloom's: Analysis
Difficulty: Medium
Learning Objective: 5
Topic Area: Obtaining Regression Estimates

7. The Ottawa Company has traditionally estimated manufacturing overhead costs using production volume. Some of the production managers believe that the number of set ups may also have an impact on monthly manufacturing overhead costs. In order to investigate this possibility, the company collected information on their monthly manufacturing overhead costs, production in units, and number of setups for 2011.

Month	Production (Units)	Manufacturing Overhead Cost	Number of Setups
1	50,000	$800,100	17
2	65,000	752,500	16
3	40,000	795,100	21
4	55,000	822,750	16
5	30,000	771,225	21
6	25,000	706,200	15
7	60,000	843,000	19
8	80,000	935,200	22
9	77,000	901,750	20
10	43,000	786,400	17
11	50,000	819,600	19
12	70,000	880,900	21

Regression analysis results of the information presented above are as follows:
Ordinary regression:
Equation:$650,398 + $3.1061 × units
r-square:.707
Multiple regression:
Equation:$464,481 + $2.5356 × units + $11,631.6048 × lot size
r-square:.867
Required:
(a) Use the results from the ordinary regression and estimate next month's manufacturing overhead costs, assuming the company is planning to produce 75,000 units.
(b) Use the results from the multiple regression and estimate the next month's manufacturing costs, assuming the company is planning to produce 75,000 units with an average lot size of 18.
(c) Comment on which regression seems to be more appropriate under these circumstances. What additional information would you like to see? Be specific.

(a) $883,356
(b) $864,020
(c) The multiple regression improves the fit over the ordinary regression. The r-square improves from .707 to .867. Additional information may include tests to determine the significance of the coefficients.

Feedback: (a) Total manufacturing costs = $650,398 + ($3.1061 × 75,000) = $883,356
(b) Total manufacturing costs = [$464,481 + ($2.5356 × 75,000) + ($11,631.6048 × 18)] = $864,020

AACSB: Analytic
AICPA: FN-Decision Making
Bloom's: Analysis
Difficulty: Medium
Learning Objective: 5
Topic Area: Obtaining Regression Estimates