CHAPTER **2**

# Cost Behavior and Cost Estimation

# Unit Summaries

**Unit 2.1 – Cost Behavior Patterns**

This unit examines four cost behavior types – variable, fixed, mixed, and step.

**Unit 2.2 – Cost Estimation**

This unit focuses on using knowledge of cost behaviors to develop cost functions and estimate total costs. The high-low method and the EXCEL functions for regression are illustrated as a means for analyzing mixed costs.

**Unit 2.3 – Contribution Margin Analysis**

The contribution margin and the contribution format income statement are introduced.

# Continuing Case Recap

This is the first chapter in the text that uses the running case. In this chapter students are introduced to Universal Sports Exchange, one of C&C Sports’ customers.

# Motivating the Chapter with The Business Decision and Context

Martin Keck, Universal Sports’ vice president of sales, wonders why a 10% decrease in sales volume did not result in a 10% decrease in net income. The 10% decrease in sales volume also resulted in a larger than expected ending inventory of baseball jerseys. Martin needs to know how to predict the changes in income when sales volume changes.

# Assignment Classification by Learning Objective

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Objective** | **Exercises** | **Problems** | **Cases** |
| 1. Identify basic cost behavior patterns and explain how changes in activity level affect total cost and unit cost. (Unit 2.1) | 1, 2, 3, 4, 5, 6, 7 | 19, 24 | 27, 29 |
| 1. Estimate a cost equation from a set of cost data and predict future total cost from that equation. (Unit 2.2) | 8, 9, 10, 11, 12 | 20, 21, 22, 23, 25 | 28, 31, 32 |
| 1. Prepare a contribution format income statement. (Unit 2.3) | 13, 14, 15, 16, 17, 18 | 24, 25, 26 | 28 |

# Assignment Characteristics

**\* Revised problem in 4th edition + Lightboard video solution available n New problem**

**Difficulty:** E = Easy, M = Moderate, D = Difficult

**Bloom’s:** K = Knowledge, C = Comprehension, AP = Application, AN = Analysis, S = Synthesis, E = Evaluation

**IMA:** S = Strategy, planning & performance, R = Reporting and control, T = Technology and analytics, B = Business acumen & operations, L = Leadership, E = Professional ethics & values

**AICPA ACC:** RA = Risk assessment, M = Measurement, R = Reporting, RS = Research, S = System/process management, T = Technology

**AICPA BUS:** S = Strategic, G = Global, P = Process management, GV = Governance, C = Customer

**AICPA PRO:** E = Ethics, P = Professional behavior, D = Decision making, CO = Collaboration, L = Leadership, C = Communication, PM = Project Management

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Item | Description | L. O. | Difficulty Level | Minutes to Complete | Bloom’s Taxonomy | IMA | AICPA ACC | AICPA BUS | AICPA PRO | Ethics  Coverage |
| EXERCISES | | | | | | | | | | |
| 2.1\* | Identify cost behaviors | 1 | M | 12 | C | S | R | S, P | D |  |
| 2.2 | Identify cost behaviors | 1 | M | 15 | C | S | R | S, P | D |  |
| 2.3\* | Identify cost behaviors | 1 | M | 12 | AP | S | M | S, P | D |  |
| 2.4\* | Identify cost behaviors | 1 | M | 15 | AP, C | S | M | S, P | D |  |
| 2.5\* | Identify cost behaviors | 1 | M | 15-20 | AP, AN | S | M | S, P | D |  |
| 2.6 | Explain use of fixed costs in calculating unit cost | 1 | D | 5-7 | AN | S | M | S, P | D |  |
| 2.7\* | Understand the effect of changes in volume on costs | 1 | D | 8 | AP, AN | S | M | S, P | D |  |
| 2.8 | Use a scattergraph to estimate a cost function | 2 | M | 15-20 | AP, AN | S | M | S, P | D |  |
| 2.9 | Use the high-low method to estimate a cost function | 2 | M | 20 | AP, AN | S | M | S, P | D |  |
| 2.10\*+ | Use the high-low method to estimate a cost function | 2 | M | 12 | AP, AN | S | M | S, P | D |  |
| 2.11\* | Develop cost functions | 2 | D | 20 | AP | S | M | S, P | D |  |
| 2.12\* | Develop cost function and estimate total cost | 2 | D | 10-15 | AP | S | M | S, P | D |  |
| 2.13\*+ | Prepare a contribution format income statement | 3 | M | 10-15 | AP | S | M | S, P | D |  |
| 2.14 | Find missing amounts in a contribution format income statement | 3 | E | 10-15 | AN | S | M | S, P | D |  |
| 2.15\* | Prepare a contribution format income statement | 3 | D | 10-15 | AP | S | M | S, P | D |  |
| 2.16\*+ | Prepare a contribution format income statement | 3 | M | 15 | AP | S | M | S, P | D |  |
| 2.17 | Prepare a contribution format income statement | 3 | E | 15 | AP | S | M | S, P | D |  |
| Item | **Description** | **L. O.** | **Difficulty Level** | **Minutes to Complete** | **Bloom’s Taxonomy** | **IMA** | **AICPA ACC** | **AICPA BUS** | **AICPA PRO** | **Ethics**  **Coverage** |
| 2.18\* | Interpret contribution format income statement | 3 | E | 10 | AP | S | M | S, P | D |  |
| PROBLEMS | | | | | | | | | | |
| 2.19 | Identify cost behavior using unit cost information | 1 | E | 20-25 | AP, AN | S | M | S, P | D |  |
| 2.20\* | Develop cost function using scattergraph and high-low method, estimate total cost | 2 | M | 20-25 | AP, AN | S | M | S, P | D |  |
| 2.21\* | Develop cost function using high-low method, estimate total cost | 2 | D | 15-20 | AP, AN | S | M | S, P | D |  |
| 2.22\* | Develop cost function using high-low method, identify cost outliers | 2 | M | 20-25 | AP, AN | S | M | S, P | D |  |
| 2.23 | Develop and evaluate cost function using high-low method | 2 | D | 30-35 | AP, AN | S | M | S, P | D |  |
| 2.24 | Identify cost behavior, prepare contribution format income statement | 1, 3 | D | 20-25 | AP | S | M | S, P | D |  |
| 2.25\* | Prepare a contribution format income statement, estimate total cost | 2, 3 | D | 20 | AP | S | M | S, P | D |  |
| 2.26\* | Prepare a contribution format income statement, evaluate changes in cost behavior | 3 | D | 20-25 | AP | S | M | S, P | D |  |
| C&C CONTINUING CASE | | | | | | | | | | |
| 2.27\* | Identify cost behavior | 1 | E | 5-7 | C | S | M | S, P | D |  |
| 2.28\* | Determine operating profit equation, prepare contribution format income statement | 2, 3 | M | 10 | AP, AN | S | M | S, P | D |  |
| CASES | | | | | | | | | | |
| 2.29\* | Identify cost behavior, estimate total cost | 1 | D | 20-25 | AP | S | M | S, P | D |  |
| 2.30 | Evaluate ethical issues |  | M | 10-15 | AN | E | R | S, P | E | ✔ |
| DATA ANALYTICS PROBLEMS | | | | | | | | | | |
| 2.31 | Identify cost behavior, estimate total cost | 2 | M | 30-40 | AP, AN, E | T, S | T, M | S, P | D |  |
| 2.32 n | Identify cost behavior, estimate total cost | 2 | M | 30-40 | AP, AN, S, E | T, S | T, M | S, P | D |  |

# Learning Objective Summary by Unit

## **Unit 2.1**

**LO 1 *Identify basic cost behavior patterns and explain how changes in activity level affect total cost and unit cost.***

The two basic cost behavior patterns are variable and fixed. Costs that are a combination of these two basic patterns are referred to as mixed. The following table shows how these costs change with changes in activity:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **AS ACTIVITY INCREASES** | | **AS ACTIVITY DECREASES** | |
| **Cost Behavior** | **Total Cost** | **Cost per Unit** | **Total Cost** | **Cost per unit** |
| Variable | increases | remains constant | decreases | remains constant |
| Fixed | remains constant | decreases | remains constant | increases |
| Mixed | increases | decreases | decreases | increases |

## **Unit 2.2**

**LO 2 *Estimate a cost equation from a set of cost data and predict future total cost from that equation.***

Total cost can be expressed in the form *y = mx + b*, where *y* is the total cost, *m* is the variable cost per unit, *x* is the number of units, and *b* is the total fixed cost. Given a set of costs and activity levels, you can estimate a cost equation using one of the following methods: scattergraph, high-low, or regression.

## **Unit 2.3**

**LO 3 *Prepare a contribution format income statement.***

A contribution format income statement is an income statement that categorizes expenses by their behavior. It follows the structure:

|  |  |
| --- | --- |
|  | Sales revenue |
| - | Variable expenses |
| = | Contribution margin |
| - | Fixed expenses |
| = | Operating income |

Besides showing total sales revenue and expenses, the contribution format statement should also show per unit amounts for sales revenue, variable expenses, and contribution margin.

# Related Reading

##### Douglas MacMillan, “Turning Smartphones Into Cash Registers,” Bloomberg Businessweek, February 14 – February 20, 2011, 44-45.

This article, while a little dated, provides information about the costs incurred to use Square, a mobile payment system that plugs into smartphones. The cost information in the article provides an example of a mixed cost, with a fixed monthly base charge and a variable charge per transaction. One interesting twist on this mixed cost is that there are two variable components – one based on the number of transactions and one based on the sales revenue.

# Alex Colon, “New iPad 4G Data Plans: AT&T Vs. Verizon,” PCMag.com, March 15, 2012, <http://www.pcmag.com/article2/0,2817,2401618,00.asp>

The data plans discussed in this article provide a good example of a step-variable cost.

##### David E. Stout, “Using Excel 2013 for Regression-Based Cost Estimation: Part 1,” Management Accounting Quarterly, Winter 2017, 12-22.

This article provides information about using Excel to develop cost estimates using Excel’s regression function.

# Additional Cases

##### Thomas L. Albright, Paul Juras, and Russ Elrod, “Over-land Trucking and Freight: Relevant Costs for Decision Making,” *IMA Educational Case Journal,* June 2014 (Vol. 7, No. 2, Art. 2).

This case provides an opportunity to use one case across several chapters to help students see connections between topics. For Chapter 2, concentrate on assignments 1, 2, and 3. Since the case refers to relevant costs, a topic not covered until Chapter 8, you may need to supplement the discussion with a brief explanation of this concept or give students enough information to complete the assignment. An additional assignment to consider for Chapter 2 is to have students prepare a contribution format income statement for the company.

##### Thomas Calderon, James W. Hesford, Nicolas Mangin, and Mina Pizzini, “Sunrise Hotels: An Integrated Managerial Accounting Teaching Case,” *Journal of Accounting Education,* 2018, 60-72.

This case can be used across Chapters 2, 3, 5, 6, 8, and 10. It provides students an opportunity to see how these topics are related, rather than isolated, by examining them in one company setting. Part (A) requires students to classify costs by behavior and identify cost drivers. Once this has been decided, students develop a cost estimate function.

##### Susan P. Convery and Amy M. Swaney, “Analyzing Business Issues – With EXCEL: The Case of Superior Log Cabins, Inc.,” *Issues in Accounting Education,* February 2012, 141-156.

This case provides an opportunity to practice cost estimation using scattergraphs, the high-low method, and regression. It also provides the opportunity to practice and improve EXCEL skills. The assignment contains several components, some of which have not been covered at this point in the text, so you will need to provide revised instructions to students about which components to complete.

##### Shane S. Dikolli and Karen L. Sedatole, “Delta’s New Song: A Case on Cost Estimation in the Airline Industry,” *Issues in Accounting Education,* August 2004, 345-358.

This case provides an opportunity for students to make and test hypotheses about cost drivers and cost behavior. Using quarterly operating data from Delta Airlines, students are asked to identify possible cost drivers for salary costs and to establish a salary cost formula using high-low, single regression and multiple regression. The data, which covers 1993 – 2002, may appear a bit old, but the exercise does not depend on the newness of the data. The case also offers limited data for the first years of Jet Blue Airlines’ operations, allowing a comparison of the cost functions of two airlines with different operating strategies. If you have an alumnus with experience in the airline industry, the case offers an excellent chance for team teaching.

##### Robert Rankin and Martin Stuebs, “The Chicken or the Egg: Hatching a New and Innovative Product,” *IMA Educational Case Journal*, June 2017 (Vol. 10, No. 2, Art. 3).

While this case is set in a manufacturing environment, cost behaviors are described in a way that students should be able to complete the contribution format income statement without knowing details about product costs. The case can also be used with Chapter 3 and Chapter 4.

##### Martin Stuebs, Scott M. Bryant, Cari Edison, and Kate Reese, “Brittney’s Boutique: Tailoring a Budget for Function as well as Fashion,” *Journal of Accounting Education,* 2017 (Vol. 39), 32-47.

Students are asked to prepare a contribution format income statement in a retail setting (part 1). Parts 2 and 3 can be assigned with Chapters 3 and 5, respectively, to provide integration across the three chapters. Part 2 requires students to conduct CVP analysis and Part 3 requires preparation of a cash budget.

##### Wendy Tietz, Indrarini Laksmana, and John Rose, “Snowie’s Shaved Ice Business: Planning and Decision Making,” *IMA Educational Case Journal*, September 2018 (Vol. 11, No. 3, Art. 3).

This is a case that illustrates cost behaviors in a simple retail setting. After studying Chapter 2, students will be able to complete questions 1-5 in Part 1. You can return to the case after Chapter 3 to complete questions 6-8. The case can also be used with Chapters 5 (Part 3) and 8 (Part 2) to provide a single case that integrates across four chapters.

##### L. Melissa Waters and Teresa M. Pergola, “An Instructional Case: Cost Concepts and Managerial Analysis,” *Issues in Accounting Education*, November 2009, 531-538.

This case illustrates basis cost concepts using a library setting. Students must identify cost drivers, identify the relevant range of activity, identify can classify costs by behavior, and calculate unit cost. One of the case requirements does require knowledge of cost traceability, which is not covered in the text until Chapter 3. However, the case can be used at this point by omitting that requirement.

# Critical Thinking Exercise

##### Read Alison Sider, “Pricier Fuel to Test Airline Profits,” *The Wall Street Journal*, July 9, 2018 (<https://www.wsj.com/articles/pricier-fuel-to-test-airline-profits-1531058400>) and Susan Carey, “American Airlines to Raise Pay for Pilots, Flight Attendants,” *The Wall Street Journal*, April 26, 2017 (<https://www.wsj.com/articles/american-airlines-to-raise-pay-for-pilots-flight-attendants-1493245909>)

###### Questions

* Fuel and crew salaries are two of an airline’s largest expenses. Using the number of passengers on a flight as the cost driver, how would you classify the behavior of these two costs?

*Crew sizes are determined by the size of the aircraft and the length of the flight (long flights will require additional crew to provide adequate rest periods). Therefore, few salaries would be fixed with regard to the number of passengers on a particular flight. Fuel cost will be a function of the type of aircraft engine and the length of time the engines are running. Again, this cost would be fixed with regard to the number of passengers on a particular flight. However, weight is also a contributor to fuel efficiency, so there would be a very small component of fuel cost that would be attributable to the number of passengers on the flight.*

* If an airline were to consider crew salaries as variable, what would be a reasonable cost driver?

*Many airlines use flight time as the driver for crew payroll costs.*

* A standard cost metric used by airlines is “cost per available seat mile”. This metric is calculated by dividing the total operating costs by the available seat miles flown. How would you classify this metric’s cost behavior?

*While at first glance a metric that is expressed per available seat mile appears to be variable, this metric is actually a mixed cost. Total operating costs include fixed and variable costs.*

# PowerPoint Slide Notes

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| --- | --- |
|  |  |
|  | The Business Decision and Context is based on Universal Sports Exchange’s (a C&C customer) vice president of sales wondering what net income would have been if the company had reached its planned jersey sales. Ask students to use this income statement to come up with an answer for Universal. After getting some answers, point out that some of the costs won’t change in total. For example, selling more jerseys wouldn’t increase the amount that the company pays for factory rent. Set the stage by telling students they will learn how to identify which costs will change with additional sales volume and how to prepare a different format of an income statement to help answer this type of question. |
|  |  |
|  |  |
|  | Inform students that there are four general types of cost behavior that will be studied in Chapter 2. |
|  | Use this and the following slides of familiar scenarios to illustrate cost behaviors. |
|  | Point out that each can of soda costs $0.75 and that doesn’t change as more friends show up and drink a can of soda. This is a variable cost because the cost per unit of $0.75 remains the same, and the total cost of soda increases as more cans of soda are consumed. |
|  | Define variable cost. Point out that the graph shows the same information as the table in the previous slide. Review the concept of the slope of a line and how the slope of the cost line is the cost per unit. |
|  | Ask students to identify variable costs for each of these industries. The hotel chain is a good example to use to talk about activity drivers. For instance, the cost of laundry is driven by the number of guests registered. However, the cost of maid service is driven by the number of rooms rented and cleaned. A room with four people will require more laundry than a room with one person. However, each of the rooms will require approximately the same amount of cleaning. |
|  | Continue the study break example. |
|  | Point out that one pizza was ordered, and the total cost of the pizza will not change as more friends drop in, causing this to be a fixed cost. |
|  | Define fixed cost. Point out that the graph illustrates the data from the table in the previous slide. Discuss the concept of relevant range. |
|  | Emphasize that if students will always work with the “constant” form of the costs, they will be less likely to adjust costs incorrectly for changes in volume or activity. For variable costs, this is the cost per unit; for fixed costs, it is the total cost. |
|  | Discuss the concepts of committed and discretionary costs. Relate the concepts to students’ lives by using apartment rent and movie tickets to illustrate committed and discretionary costs, respectively. |
|  | Discuss step-variable costs. This illustration assumes an academic support person for online courses is paid $70,000 per year and can handle 500 students. Make sure students understand that while step variable costs appear fixed, they steps are relatively small compared to the relevant range over which fixed costs are fixed. |
|  | Make sure students understand that while step costs appear fixed, the steps are relatively small compared to the relevant range over which fixed costs are fixed. Inform students that these are sometimes referred to as step-variable costs. |
|  | Discuss this scenario about an event that has a room rental fee and a cost per person for food. Relate back to the pizza example, point out how total cost increases and the cost per person decreases as more people are added to the pizza party. Ask students why the overall cost per guest declines – it’s because the total fixed costs are spread over the higher number of guests attending the event. |
|  | Discuss mixed costs and present the definition. The graph shows the total cost of a banquet that requires a $200 charge for the room plus a $10 per person charge for food. |
|  |  |
|  |  |
|  | This graph illustrates the fixed and variable components of a mixed cost. Point out the line intercepts the y-axis at the level of the fixed component of the mixed cost and that the slope of the total cost line represents the variable cost per unit. |
|  | This is a scattergraph of the delivery cost example in the textbook. Ask students how they would use this data to find the fixed and variable delivery cost. Then show the next slide. |
|  | Discuss the pros and cons of each of these possible lines drawn through the delivery cost data points. Ask students which is the best line and what makes that line the best. |
|  | This shows one potential total cost line that could be used to define the cost function. Once again, point out the y-intercept and the slope of the line. |
|  | This is the basic linear cost function definition. Remind students that this is the same line equation they learned in high school algebra, where x is the number of units, m is the variable cost per unit, and b is total fixed costs. |
|  | Point out the steps for developing the equation of a line. 1. Select two points from the data. 2. Draw the line through the two points. 3. Find the y-intercept. 4. Calculate the slope of the line using the two points. 5. Write the equation of the line. Have students compute the equation of the line before you reveal the answer. |
|  | Discuss the usefulness of the high-low method as a quick way to estimate the fixed and variable components of a mixed cost. Point out that the change in the total cost is a result of a change in volume (the cost per unit or slope of the cost line). Be sure to emphasize the WATCH OUT! reminder that activity is always based on level of activity, not the total costs. |
|  | Verbally walk students through the steps of the high-low calculation. Many students will stop after step 2, so remind students that they are not done until they complete the last step to calculate fixed costs. |
|  | Have students identify the high and low points in this data set. Remind them that the high and low points are based on activity level, not total cost. Once students have tried the problem, walk through the calculations with them. |
|  | Have students calculate the estimated cost, then work through the calculation with them. Ask why their answer differs from the actual cost when 1,500 deliveries were made. |
|  | Tie back to the calculation from the previous slide and point out the actual March data point. Emphasize that the high-low method of cost estimation is just that – an estimate. Point out how many actual points fail to fall on the high-low line. But remind students that this doesn’t mean it isn’t a good tool to use. |
|  | If students have completed a statistics course, they should be familiar with regression. Talk about using regression to determine the intercept (total fixed cost) and slope (variable cost per unit) of a set of cost data points. You may want to create a spreadsheet with the delivery data points and show the students how to use a spreadsheet program such as Excel to compute the regression analysis. |
|  | This slide shows how to calculate the variable cost per unit using EXCEL’s SLOPE function. Inform students that they can also use the LINEST function or the REGRESSION tool in the Data Analysis Tool Pack to find both the slope and intercept. |
|  | This slide shows how to calculate the total fixed costs using EXCEL’s INTERCEPT function. Inform students that they can also use the LINEST function or the REGRESSION tool in the Data Analysis Tool Pack to find both the slope and intercept. |
|  | Have students work Problem 2.20 or work it as a class. |
|  | Answers for part A will differ depending on what line the student draws through the data points. |
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|  | Define contribution margin and point out how it differs from the term gross margin that the students are familiar with. |
|  | Walk through the contribution margin income statement. Point out that expenses are classified by behavior rather than function. Illustrate how a mixed cost will appear in both variable and fixed sections of the income statement. Emphasize that operating income will not change when recasting a functional income statement into a contribution format income statement. Expenses are not changing, they are just being rearranged. |
|  | Have students recast Universal Sports Exchange’s functional income statement (Exhibit 2.9) into a contribution format income statement using Exhibit 2.9 and the information on page 2-19. |
|  | Work through Universal’s contribution format income statement. |
|  | Emphasize that including the per unit amounts for sales, variable expenses, and contribution margin, along with their percentages, will create a more useful income statement to support decision-making efforts. |