

# Book VII

# Making Savvy Business Decisions

Note receivable	20,000	
Accumulated depreciation	1,000	
Discount on note receivable	(\$20,000 – \$17,000)	3,000
Equipment		14,000
Gain on disposal of equipment		4,000



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## ***In this book...***

- ✔ Estimate production cost by using job costing and process costing and use either of those values to ballpark a profitable price to charge for a product. Set the right price from the get-go.
- ✔ Calculate the product cost based on activities that go into manufacturing and selling the product, so your cost per product and pricing are more accurate. Find out what peanut-butter costing is and why and how to avoid it.
- ✔ Analyze a product's break-even point, target profit, and margin of safety. Savvy business owners use these tools to plan production and sales levels.
- ✔ Calculate variance into the pricing equation to avoid any nasty surprises. Variance analysis compares budgeting plans with actual results.
- ✔ Survey various pricing models to make smart pricing decisions. Decide which pricing method will cover all your costs and generate a reasonable profit.
- ✔ Size up the financial condition of your business and recognize the most common early warning signs of financial trouble. Use the results to improve your business.

# Chapter 1

## Estimating Costs with Job Costing

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### *In This Chapter*

- ▶ Going over how job costing works
  - ▶ Identifying cost objects
  - ▶ Using job costs to price a product or service
  - ▶ Reviewing the flow of costs through a manufacturing system
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*J*ob costing is a methodology you use when the costs to manufacture a product or provide a service vary according to each customer's unique needs. Job costing allows you to provide detailed price estimates based on the product or service provided. A roofing business, for example, uses job costing, because the cost varies according to the customer's needs. The amount of material depends on the type of roof and the square footage. Labor time varies, depending on the roof's size, pitch, and unique angles.

A cost object is the product, activity, or process that causes your company to incur costs. In this chapter, you see how to assign costs to the cost object. You also find out how to follow the flow of manufacturing costs as a product moves through the production process.

### *Understanding How Job Costing Works*

For some businesses, nearly every customer job has different costs, and that's where job costing asserts its value. You need a job costing estimate in order to get the customer's business, and you need to track costs accurately so you generate a reasonable profit.

The different costs for different jobs are often self-evident. Material costs, labor hours, mileage cost, and type of equipment used are likely to vary. For example, a tree trimming company incurs more costs to remove a 30-foot tree than to remove a small stump. The big tree takes more labor and different equipment.

Some factors could lower costs and make a business more competitive in price (or improve its bottom line). For example, a tree trimming company working on a job in a certain neighborhood may distribute a flyer offering free estimates to other homes in the neighborhood. It's a smart business move. If the tree-trimming services already stands to incur the cost to locate its employees and equipment in a certain area, why not perform as much work as possible while it's there? The business can spread some costs (mileage, for example) over several jobs. As a result, its cost per job in that neighborhood is lower, boosting its profit.

The business lesson is that a little bit of flyer can go a long way.

## ***Cost objects: The sponges that absorb money***

A *cost object* is anything that causes you to incur costs. Think about a cost object as a sponge that absorbs your money. The object can be a customer, job, product line, or company division. Carefully identifying cost objects helps you cost your product or service accurately.

Assume you manage a group of plumbers. You're reviewing the month's mileage expense (the equivalent of gasoline) for your staff and notice a 20 percent increase from the prior month. Why? You start asking questions. As it turns out, the customer demand for plumbing work required your staff to drive more miles. The average customer lived farther away.

You grumble, "That driving ran up a lot of costs!" Yes, it did, and you do the driving to meet the needs of your customers. In this example, the cost object was the group of customers for the month. Without any customers, you wouldn't have paid for all the gas. (Well, you wouldn't have had any income either, but never mind that.) No cost object means no costs incurred.

Direct costs are *traced* to the cost object, and indirect costs are *allocated* to the cost object.

Indirect costs can be fixed or variable. Insurance costs on vehicles are a fixed indirect cost. The premiums are fixed, and the cost is indirect to the job because you can't trace the vehicle insurance cost directly to a specific job. Utility costs for the office (such as heating and cooling) are variable indirect costs. Costs vary with the weather, but as with the insurance premiums, you can't trace them directly to any one job.

Here's how fixed and variable costs are assigned to cost objects:

✓ Direct costs

Variable direct costs, such as denim material, where denim jeans are the cost object

Fixed direct costs, such as a supervisor salary at an auto plant, where an automobile produced is the cost object

✓ Indirect costs

Variable indirect costs, such as utility costs for a television plant, where a television produced is the cost object

Fixed indirect costs, such as insurance for a plumbing vehicle, where a plumbing job is the cost object

## *Charging customers for direct and indirect costs*

To bill a customer and calculate a profit, you add up all the costs for that customer, whether they're direct or indirect costs.

If, for example, you manufacture kitchen countertops, you include all direct and indirect costs of a custom countertop installation in order to bill the customer. A direct cost may be marble (for material). To find the total cost of material for the job, you compute direct material cost as  $\text{Marble} \times \text{Square footage used} \times \text{Cost per square foot}$ .

Indirect costs are different. If your kitchen countertop business makes lease payments on an office building, the cost is indirect. You can't know the exact amount of indirect costs for the client. You also can't trace the cost directly to a specific customer, but you can allocate it by using a cost allocation base.



For job costs to be accurate, you need to collect information before you bill the client. You also need to consider the difference between your cost estimate and the final bill. Your client needs to understand how costs higher than the estimate will be handled. Should the customer expect to pay it, or will you absorb the cost (and lower your profit)? If this isn't handled correctly, the customer may be upset. Unforeseen things happen, of course, and you should explain when you hand the customer the estimate that the final bill may be different. A customer is likely to accept additional labor costs. That's because the exact cost of labor is probably hard for you to predict.

### ***Allocating indirect costs***

Think about allocating indirect costs this way: You need to allocate a dollar amount of cost (say, \$100). You spread that cost over a group of customers, a level of production, or some other activity level. In this section, you see how that may work.

A carpenter owns trucks that require repair and maintenance expense. That cost can't be traced to specific customers; instead, these indirect costs are allocated to a cost object. You find a "best" method to assign repair and maintenance expense to clients, perhaps labor hours worked for the customer.

The logic is that if you work more hours for a specific customer, you probably use your truck more. If you use the truck more, that customer should absorb more of your truck's repair and maintenance cost.

Tracing the repair and maintenance cost of the truck back to a specific customer is virtually impossible. So you make your best educated guess to distribute the cost.

### ***Defining cost allocation***

*Cost allocation* is the process of connecting an indirect cost to a cost object. A *cost pool* is a grouping of similar costs. You can think of a cost pool as a bunch of similar cost objects thrown together. In this case, the cost object is a specific job.



A *cost driver* is an item that changes the total costs. If you drive the trucks more, they require more repair and maintenance. An activity (driving to see customers) drives up your costs (repair and maintenance).

Just to clarify: The cost object is the "sponge" that absorbs the cost. The cost driver adds to the size of the sponge. A bigger sponge absorbs more cost.

Assume the total repair and maintenance expense for three carpentry trucks is \$3,000. During the month, your workers provide service to 300 clients. Each customer is allocated \$10 of repair and maintenance expense ( $\$3,000 \div 300$  clients).

If the cost driver increases to 400 clients per month, the carpenters drive more miles. As a result, the trucks require more maintenance and possibly repairs. Your monthly repair and maintenance expense is higher.

At 400 customers for the month, assume total repair and maintenance expense for three carpentry trucks is \$3,600. Now each customer is allocated repair expense of \$9 ( $\$3,600 \div 400$  clients). The cost driver increase

(number of customers) changes your total cost to \$3,600. Because you also have an increase in total customers (400), the \$3,600 is spread over a larger group. The total cost increases, but the cost allocated per customer declines.

You can see how the cost allocation process can get complicated.

Grouping similar costs into the same cost pool is often beneficial when the cost driver is the same. Consider a cost pool for the indirect costs for the carpentry trucks. In addition to repair and maintenance expense, the company pays for insurance and depreciation on the three trucks. None of these costs can be traced to a specific customer; instead, you need to allocate these costs. A good cost pool includes depreciation, insurance, and repair costs on the trucks. This cost pool can be allocated in the same way as the repair and maintenance costs in the previous example.

## *Implementing job costing in manufacturing: An example*

To implement job costing in a manufacturing company, first think about dividing your costs into two piles: direct costs and indirect costs. In a manufacturing setting, you have direct materials and direct labor you can trace directly to any given job. So far, so good. Next, think about what's driving indirect costs. You spread those indirect costs to the work you perform.

As an example, Reliable Fencing manufactures and installs wooden fences for the residential market. Reliable has a manufacturing component and a service component.

Reliable provides the customer a cost estimate. The estimate is based on the type of fence, fence height and length, and labor hours needed for installation. Because nearly every job has a different set of costs, Reliable Fencing uses job costing. This system allows Reliable to compute costs accurately. And from that, Reliable can calculate a selling price that generates a reasonable profit.

Imagine that you're the manager of Reliable Fencing. The Johnsons have requested an estimate for a fence in their backyard. To provide the estimate, you discuss the fence models and types with them. You measure the length needed for the fence and the height requested. Finally, you consider any extra labor costs you may incur. For example, the Johnsons want the fence to jog around several trees so the fence doesn't damage the tree trunks.

The Johnsons' fence is the cost object. Reliable will incur costs if the client orders a fence and work starts on the project. But before getting an order, you have to provide a cost estimate.

***Figuring out direct costs***

Reliable combines the cost of wood, paint, and a waterproofing treatment for the wood. That combined cost represents direct materials. As the manager, you compute direct material costs:

$$\text{Direct materials} = \text{Quantity of materials} \times \text{Unit price paid for material}$$

You buy material measured in square feet. The unit cost is the price per square foot. Here's the amount of material needed and the cost:

$$\text{Direct materials} = 600 \text{ square feet of material needed} \times \$5 \text{ per square foot}$$

$$\text{Direct materials} = \$3,000$$

Your other direct cost is direct labor. Your staff must cut the wood, paint it, waterproof it, and build the fence. Thinking through it further, your staff must measure and dig postholes. They then fill the area around the posts and nail the fence boards onto the posts, all while keeping everything level. Not easy! It takes real skill and planning. As a result, the owners of Reliable Fencing know it's best to hire skilled people and pay them a reasonable hourly rate.

Your experience as Reliable's manager allows you to estimate the labor time needed based on several factors. You consider the square footage of material needed; the length and height of the fence; and any extra work, such as going around those tree trunks. Here's your formula for direct labor costs:

$$\text{Direct labor} = \text{Hours of labor} \times \text{Rate paid for labor}$$

Note a difference in terms: *Price* is used for materials, and *rate* is the term used for labor. That distinction comes up in the world of cost variances.

You estimate that 2 people working 20 hours can complete the job. Using these numbers, you determine the labor cost:

$$\text{Direct labor} = \text{Number of workers} \times \text{Hours of labor per worker} \times \text{Hourly rate paid for labor}$$

$$\text{Direct labor} = 2 \text{ workers} \times 20 \text{ hours} \times \$20 \text{ per hour}$$

$$\text{Direct labor} = \$800$$

Consider one more direct cost. You see a discussion of mileage expense earlier in chapter. That formula is also used here:

$$\text{Cost per mile} = \text{Cost per gallon of gas} \div \text{Miles per gallon for the vehicle}$$

$$\text{Mileage costs} = \text{Miles needed for client} \times \text{Cost per mile}$$





You calculate 15 miles (round trip) from your office to the job site. However, the work will be completed over several days, so you estimate 45 total miles.

Your trucks get 20 miles to the gallon, and your fuel cost is \$4 per gallon. It's not much, but here is the direct cost for mileage:

$$\text{Cost per mile} = \$4 \text{ gallon of gas} \div 20 \text{ miles per gallon}$$

$$\text{Cost per mile} = \$0.20 \text{ per mile}$$

$$\text{Mileage costs} = 45 \text{ miles needed for client} \times \$0.20 \text{ per mile}$$

$$\text{Mileage costs} = \$9.00$$

So you have three direct costs: materials, labor, and mileage. They're direct costs because they can be traced to the cost object: the Johnsons' fence.

### *Calculating indirect costs*

To allocate indirect costs, you decide on two cost pools. One pool is your vehicle and equipment costs, which includes depreciation, maintenance, repair, and insurance costs. The other pool is office cost, which includes salary, benefits, accounting costs, and legal costs for your company. The cost object for allocating these indirect costs is the customer base:

Vehicle and equipment costs	\$4,000
Office cost	\$7,000
Customers serviced	200

After you resolve how to allocate costs, try to keep it simple. You combine the indirect costs into one amount:  $\$4,000 + \$7,000 = \$11,000$ . You then divide the indirect cost total by the number of clients for the month:

$$\text{Indirect cost allocation rate} = \$11,000 \div 200 \text{ customers} = \$55 \text{ per customer}$$

$$\text{Indirect cost allocation rate} = \$55 \text{ per customer}$$

Your office assistant asks a question: "Is that really fair? What if one client has a \$3,000 job, and another's project is only \$500? Should we be charging the same amount of costs to both?" You think about the issue over lunch.

After lunch, you stop by your office assistant's desk and say: "You know, a client should expect that if we show up for a job of any size we're going to incur some office and vehicle costs. I don't think a client will be surprised by those fees."

The assistant thinks for a minute. “Yeah, that’s fair. If they showed up at my house for a job, those indirect costs seem okay. I guess I’d expect to pay for it somehow. As long as the cost charged to a small job isn’t huge, I think charging a rate per customer is reasonable.”



The discussion with your office assistant may convince you that your indirect cost allocation should be more specific. If you could show the client how the specific job generates indirect costs, he or she would be more inclined to agree with your billing.

You need to weigh the cost and time needed to allocate costs with the benefit of knowing more specific information. If customers generally accept the \$55 allocation rate as reasonable, great. Probably no reason to dig further into your indirect costs.

If the majority of your customers have a problem with the rate, you should consider more detailed analysis and present a more detailed indirect cost billing. If not, you may lose the opportunity to do more work with the same group of clients.

### *Presenting total job costs*

Table 1-1 shows the total costs for the Johnsons’ fence job.

<i>Cost Type</i>	<i>Amount or Quantity</i>	<i>Price or Rate</i>	<i>Total Cost</i>
Direct material	600 square feet	\$5 per square foot	\$3,000
Direct labor	40 hours	\$20 per hour	\$800
Mileage	45 miles	\$0.20 per mile	\$9
Indirect costs	1 customer	\$55 allocation	\$55
Total job costs			\$3,864

## *Taking a Closer Look at Indirect Costs by Using Normal Costing*

In this section, you apply indirect costs to your product or service. You also plan direct and indirect costs by using a normal costing system. Actual costs represent what comes out of your checkbook. You determine actual costs after the work is completed. *Normal costing* instead uses budgeted data, which is generated before the work is completed. Normal costing uses a budgeted price or rate multiplied by the actual quantity used.

Planning your work without some budgeted rates of cost is difficult. Normal costing creates budgeted rates that you can use to plan your work. Although normal costs may not equal your actual costs, they do give you a basis for planning your spending each period.

Suppose you operate a landscaping company. Changes in costs can make planning difficult. Maybe the costs you pay for materials, labor, and other costs change as the year progresses. The cost of grass seed may go up, increasing your material costs. Or your labor costs decline because the economy slows. More people with the needed skills are looking for landscaping work, so you can offer a lower pay rate.

If you use actual costs, which change over time, pricing your product to generate a reasonable profit is difficult. For example, if you had a 15 percent profit above costs, a cost increase would eat away at your profit. Maybe higher costs lower your profit to 10 percent.

Planning your cash needs is also more challenging. If you need to buy \$10,000 of grass seed in the next 30 days, what if the price goes up? Maybe a shortage increases your grass seed cost to \$12,000. That means that the check you need to write will be \$12,000, not \$10,000. Now you need to have \$2,000 more cash available.



Budgeting and cash management is similar to planning a vacation. First, you determine the costs (airline, car rental, hotel, gas). Next, you plan your cash flow to pay for the vacation cost. If the prices are constantly fluctuating, planning is difficult. Many people try to book a vacation trip well in advance, so at least airfare and lodging costs are fixed for the trip!

## *Budgeting for indirect costs*

When you budget for indirect costs, you spread those costs to cost objects based on a cost driver (refer to the section “Cost objects: The sponges that absorb money”). Before you spread the indirect cost, you come up with a rate to allocate the costs to the product or service. The indirect cost rate allows you to price your product to produce a reasonable profit.

As the manager for the landscaping company, you decide on a cost pool for indirect costs. Your only indirect cost is for vehicles and equipment (depreciation, insurance, and repair costs). Your company is new, with virtually no office costs to consider yet.

Many companies have planning meetings around the end of their fiscal (business) year. In the meetings, they make assumptions about many issues, including next year’s costs. This is when a company plans *predetermined* or

*budgeted indirect cost rate.* The predetermined overhead rate depends on total indirect costs and the cost driver you select. Indirect costs are also referred to as *overhead costs*.

During a planning session, you consider the prices and rates you paid last year. You think about how prices and rates have changed and consider your estimates of miles driven each month. Based on that analysis, here is your budgeted indirect cost rate:

$$\begin{aligned}\text{Predetermined or budgeted indirect cost rate} &= \$7,500 \div 1,400 \text{ miles} \\ &= \$5.36 \text{ per mile}\end{aligned}$$

Not until the end of the year does the company know what the actual total indirect costs and the actual miles driven will be. Here's the actual indirect cost rate for the vehicles and equipment (using miles driven for the month as the cost object). The formula is explained in the section "Computing direct costs and indirect costs":

$$\text{Indirect cost allocation rate} = \$8,000 \div 1,300 \text{ miles} = \$6.15 \text{ per mile}$$



*Predetermined or budgeted* means planned in advance. Your budgeted monthly rate has a lower monthly cost level (\$7,500 versus \$8,000) but more monthly miles (1,400 versus 1,300). As a result, the budgeted overhead rate is lower. You use this rate to apply indirect costs to every job during the year.

At the end of the year, you realize that you didn't allocate enough costs to your jobs. As a result, your actual profit will be lower than what you budgeted. Because actual costs aren't known until the end of the year, you almost always have a difference between budgeted and actual results.

## ***Following a normal job costing system***

Put together your budgeting process for indirect costs with a plan for direct costs. Think of the combined process as *normal costing*. This chapter keeps hammering away at this point, but it's important: You trace direct costs and allocate indirect costs.

Normal costing combines indirect cost rate with actual production. The process gets you closer to actual total costs for your product.

**Computing direct costs and indirect costs**

To implement normal costing, you compute direct and indirect costs:

- ✓ **Direct costs:** Traced to the cost object by multiplying actual prices and/or rates  $\times$  actual quantity for a specific job object
- ✓ **Indirect costs:** Allocated to the cost object by multiplying predetermined or budgeted indirect cost rate  $\times$  actual quantity for a specific job object

Note that both direct and indirect costs use actual quantity in the formula. While you come up with an indirect cost rate in planning, the rate is multiplied by actual quantities. In this case, the quantity is jobs for the month.

**Introducing the job cost sheet**

A *job cost sheet* lists every cost incurred for a particular job, including direct material, direct labor, and all indirect costs. The job cost sheet is your basis for computing your sale price and your profit. You use this document to prepare a cost estimate for a client. Table 1-2 shows a job cost sheet using normal costing for a landscaping job. Because some job costs are based on budgets and estimates, many businesses round the calculations. You see that total costs are rounded in Table 1-2.

<i>Cost Type</i>	<i>Amount or Quantity</i>	<i>Price or Rate</i>	<i>Total Cost (Rounded)</i>
Direct material	100 square feet of grass seed	\$12 per square foot	\$1,200
Direct labor	15 hours of labor	\$15 per hour	\$225
Mileage	30 miles driven	\$0.18 per mile	\$5
Indirect costs	30 miles driven	\$5.36 per mile	\$161
<b>Total job costs</b>			<b>\$1,591</b>

The indirect cost calculation (vehicle and equipment costs) uses the actual quantity (miles driven) and the estimated rate per mile. The other direct costs on the job sheet use actual quantities and actual prices/rates.

## *Following the Flow of Costs through a Manufacturing System*

Costs flow through a manufacturing system, from buying materials for a product all the way to the customer sale. When you envision the flow of costs, you find it easier to collect all the product costs you need to price a product. When you know all the steps, you remember all the costs related to those steps!

The manufacturing process described in the following sections assumes the company uses *process costing*. Process costing assumes that each product manufactured is similar to the others, maybe even identical. As a result, you can track costs as they move from one production department to another. You don't need to track costs by each customer or each customer job.

### *Control starts with control accounts*

*Control accounts* are temporary holding places for costs. Managing costs has to start somewhere, and in accounting, that process most often starts with control accounts.

Labor, materials, and indirect costs start off in control accounts. It may sound strange, but these accounts and their balances don't appear in the financial statements. That's because the balances are eventually moved to other accounts. All the checks you write for manufacturing costs are posted first to control accounts.

For many manufacturers and retailers, inventory is the biggest investment; more cash is spent on inventory than any other asset. Because of that, a big part of operating a profitable business is to control the costs of inventory.

*Inventory* is an asset you eventually sell to someone. (That's a little different, of course, from buildings and equipment.) For manufacturers, inventory has three components: *raw materials*, *work-in-process*, and *finished goods*, whereas retailers just have finished goods. Raw materials inventory is, broadly, products not yet started; work-in-process inventory is partially completed products; and finished goods inventory is completed products.

The three kinds of inventory are assets, because you eventually sell the goods to a customer. When you do, the inventory asset becomes an expense — cost of goods sold. Managing inventory starts in a control account.

Following are the three major categories of control accounts. The amounts in each of these accounts are eventually moved into production.

- ✔ **Materials:** You buy materials (such as wood for making kitchen cabinets) in advance of making your products. *Materials control* is the term for the control account for material costs.
- ✔ **Labor:** Consider labor costs. Employees report the hours they work on *time cards* each week. Those cards list hours worked on various projects. For custom cabinets, the time cards list customer jobs that employees completed, and the hours worked. *Wages payable control* is the term for the control account for labor.
- ✔ **Indirect costs:** A business (such as the kitchen cabinet business) has indirect costs (for example, machine repair and maintenance). Your firm has some method to allocate those costs to clients (see “Budgeting for indirect costs”). However, you may not get to the allocation until after you write checks for the cost. *Overhead control* is the term for the control account for indirect costs.



Control accounts (materials, labor, and overhead), work-in-process, and finished goods are inventory accounts, which are assets. Cost of goods sold (COGS) is an expense account. When you make a sale to a customer, you “use up” the asset. The asset becomes an expense. Debiting increases all these accounts, and crediting decreases all these accounts. The balance for any of these accounts is equal to debit balance less credit balance. For more about debits and credits, see Book I, Chapter 2.

## *Walking through a manufacturing cost example*

Say you’re the manager of Homewood Custom Cabinets. You order \$20,000 in lumber. You then take \$5,000 of the lumber and start making cabinets for a customer.

When you buy the lumber, cash (an asset) goes down, but the material control account (as asset) goes up. The material control account is increased (debited) when you buy the lumber.

The material control account balance is decreased (credited) when you take \$5,000 in lumber to start using the material for a customer. Now how does your material control account look?

**Material control account**

<i>Debit</i>	<i>Credit</i>
\$20,000	
	\$5,000

If the month ends with no other activity, the ending material control balance is \$15,000 (\$20,000 – \$5,000).

But the \$5,000 doesn't just vanish. When you put materials into production, you reduce (credit) the material control account and increase (debit) the work-in-process control account.

**Work-in-process control account**

<i>Debit</i>	<i>Credit</i>
\$5,000	

You reduce one asset (material control account) and increase another asset (work-in-process control account).

Now assume that the people on the shop floor finish some cabinets and move \$2,000 of the \$5,000 work-in-process to finished goods.

**Work-in-process control account**

<i>Debit</i>	<i>Credit</i>
\$5,000	
	\$2,000

You reduce one asset (work-in-process control account) and increase another asset (finished good control account). If the month ends with no other activity, the ending balance in work-in-process is \$3,000 (\$5,000 – \$2,000).

Again, no money disappears. The “other side” of the transaction hits the finished goods control account.

**Finished goods control account**

<i>Debit</i>	<i>Credit</i>
\$2,000	

So one more time, you reduce one asset (work-in-process control account) and increase another asset (finished goods control account).



At some point, you sell what you made. You have \$2,000 in finished goods. Because you make custom cabinets, you have one customer identified as the buyer. That customer “raised her hand” and placed an order. The finished goods control account shows this:

**Finished goods control account**

<i>Debit</i>	<i>Credit</i>
\$2,000	\$2,000

You’re almost home. When goods are sold, you reduce (credit) the finished goods account and increase (debit) cost of goods sold. And *that’s* an expense account. At last!

**Cost of goods sold**

<i>Debit</i>	<i>Credit</i>
\$2,000	

The difference between your sale price and the cost of goods sold is your profit.

The reason you do this exercise is to fully track where your inventory money is. For custom cabinets, it can be a big deal if you’re building for, say, 20 customers at once. For off-the-shelf cabinets, it can be a very big deal. You may be delivering 2,000 cabinets per month.



The flow lets you see where the inventory money is and spot production logjams. Too much in the material control account suggests that you’re overbuying or not producing at the rate you expected. Too much in the work-in-process control account suggests that you’re not producing completed product as planned. Too much in the finished goods control account suggests that you’re not selling and you have “dead inventory.”

## *Applying the methodology to other control accounts*

Use the same flow process for labor and indirect costs. Labor costs accumulate in the control account until they’re traced to a customer or product line. At that point, the cost moves to work-in-process. When the goods are

completed, the costs move to finished goods. When goods are sold, the cost moves to cost of goods sold. The labor cost process mirrors the system for material costs described in the previous section.

For more about cost allocation see the “Budgeting for indirect costs” section earlier in this chapter. For example, you’re recognizing depreciation expense and repair costs on vehicles. Those costs are in an overhead account. You plan a budgeted rate to apply indirect costs to products. As those costs are incurred, the overhead control account is increased (debited).

When you allocate indirect costs to a customer or product line, you reduce (credit) the overhead account and increase (debit) work-in-process control account. After that, the process is the same as with the other control accounts. Costs move from work-in-process to finished goods to cost of sales.

## Chapter 2

# Performing Activity-Based Costing

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### *In This Chapter*

- ▶ Understanding peanut butter costing
  - ▶ Designing and implementing an activity-based costing system
  - ▶ Using activity-based costing to increase profits in the budgeting process
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**A**s a business owner or manager, you can always use more useful information — information that helps you make informed decisions. Chapter 1 introduces two widely used costing methods: job costing and process costing. Now dig deeper for better information on costs. Pull apart your product or service and find out more about the activities that create cost. The result is an activity-based costing system.

With *activity-based costing (ABC)* you incur costs when production and sales happen. When you take an order over the phone, manufacture a product, or place a box on a delivery truck, the activities generate costs. The *activity* becomes the focus to assign costs. Because you're connecting cost to the activity that creates the cost, your cost per product is more accurate, and so is your pricing.

## *Avoiding the Slippery Slope of Peanut Butter Costing*

Despite the benefits of ABC costing, many business managers use *cost smoothing*, or *peanut butter costing*, instead, which spreads costs over a broad range of cost objects. When you spread peanut butter, you smooth it over the entire slice of bread. You don't pay much attention to how much cost is assigned to any particular part of the bread. Likewise, cost smoothing spreads the cost without paying too much attention to how much cost is assigned to any particular cost object. The trouble is, costs aren't assigned as accurately as they should be.



Cost allocation is the process of allocating indirect costs to products and services. The cost allocation base is the level of activity you use to assign costs. Maybe you use 1,000 machine hours or 200 labor hours. Also, keep in mind that direct costs are *traced* to products and services, not *allocated*. Stroll over to Chapter 1 for more.

To understand the benefits of ABC, you need to see the slippery slope of peanut butter costing. Here's the setup: Say you're a food distributor. You have five restaurant clients that order meat, fish, and poultry every day. You take orders, package them, and deliver the food to these businesses every day. Your restaurant clients have high expectations; they expect high-quality, fresh food to be delivered quickly so they can prepare their meals.

Your order manager handles the details of order processing. Her salary, benefits, and other costs total \$5,000 per month, an indirect cost. The cost must be charged to the restaurant clients. You can't *trace* the cost of the order manager to your service. Instead, you need to *allocate* it.

The following sections explain how to allocate indirect costs by using one type of activity. You can see that using single indirect cost allocation can lead to errors in assigning costs.

## ***Recognizing a single indirect cost allocation***

A *single indirect cost allocation* uses one cost pool. (Chapter 1 defines cost pools.) The food distribution setup uses one pool of costs — order manager costs. With ABC, you end up dividing the costs of order management into more cost pools, and you're better off for it.

Everybody pretty much starts by creating a predetermined or budgeted overhead rate (described in Chapter 1). When you plan at the beginning of the year, using a single indirect cost pool, you come up with an overhead rate for the order manager's cost, such as the following:

$$\begin{aligned}\text{Annual budgeted indirect cost rate} &= \text{Cost} \div \text{orders} \\ &= \$60,000 \div 1,250 = \$48 \text{ per order}\end{aligned}$$

The order manager's cost of \$5,000 per month amounts to \$60,000 per year. The five restaurants order nearly every business day of the year. You figure that total orders will be 1,250 — 250 orders per year from five customers. (Isn't it great that in samples all customers order exactly the same number of times?)

The single indirect cost allocation spreads the cost (order manager) uniformly over the cost object (orders). That's \$48 dollars per order. This is an example of peanut butter costing, where all services receive the same or similar amounts of cost.

## *A fly in the peanut butter: Dealing with different levels of client activity*

If some customers or activities eat up more costs than others, peanut butter costing isn't a true reflection of the costs. A customer or activity that demands more effort should get a larger cost allocation. So companies that use peanut butter costing miss the chance to allocate costs more precisely.

You no doubt know from experience that some customer orders are usually smooth as glass. Other orders, from problem customers, often require your staff to jump through extra hoops. For example, say you notice that your order manager is spending a lot of time with two customers in particular. The Steak Place and Riverside Fishery are making big demands.

They change their orders at the last minute at least once a week. When they make this change, the order manager has to cancel the original invoice (the bill), make a new one, and e-mail it. Then she has to change the shipping instructions document; you don't want the wrong goods put on the truck and sent to the restaurant. So the order manager cancels the original shipping instructions and makes new instructions.

"It's really frustrating," the manager says. "Sometimes they call so late that I have to call the driver and tell him not to leave the dock. We unload the truck and start over." Well, no doubt you want to be known for your high level of customer service, but this is getting ridiculous.

Another issue is that when the invoice and shipping orders change, the goods coming out of inventory also change. Your pickers are taking products off the shelf, putting them back, and then taking different products. These constant changes eventually lead to mistakes in inventory. A picker may move a product in or out and not record it in the accounting records.

And here's another point to consider: Your business supplies meat, fish, and poultry — items that aren't known for having a long shelf life. The excesses of The Steak Place and Riverside Fishery may leave you with heaps of spoiled product.



You decide to take another run at allocating the office-manager cost. “Why don’t we track the time spent on each client? Let’s try that for three months and see how your time shakes out. It sounds like we should assign more costs to the two customers you mentioned.” You change the cost allocation from orders placed to time spent per customer.

After three months, you review the time spent per customer. Fortunately, you’ve been tracking time carefully, and you’re using an excellent spreadsheet program.

The office manager works 24 days per month, 8 hours per day. Her total monthly hours are 192 hours (24 days × 8 hours). Table 2-1 shows the breakdown.

<i>Restaurant Customer</i>	<i>Hours for Month</i>	<i>Percent of Total</i>
Apple Core Diner	30	15.6
Blue Lantern	30	15.6
Meadowbrook Grill	30	15.6
Riverside Fishery	56	29.2
The Steak Place	46	24.0
<b>Total hours</b>	<b>192</b>	<b>100.0</b>

Aha! The situation is just as the order manager described, but now you have some metrics. Half the costing battle is measuring reality to confirm your instincts.

With peanut butter costing, you spread the cost evenly. You assigned 20 percent of order-manager costs to each customer. Now you see that two customers account for more than 50 percent (!!!) of the order manager’s effort. The time to reallocate the cost has arrived.

## *Undercosting and overcosting*

If you use cost smoothing, you’re likely to incur product undercosting or product overcosting.

- ✓ *Product undercosting* occurs when a product or service uses more resources (costs) than you assign.
- ✓ *Product overcosting* occurs when a product or service uses fewer resources (costs) than you assign.

If either of these costing errors occurs, the cost of the product isn't accurate, and your profit calculation is incorrect.

### ***Discussing product-cost cross-subsidization***

Undercosting or overcosting creates *product-cost cross-subsidization*, meaning that if you undercost one product, you will overcost another. It's common sense and simple math. You have a fixed amount of cost to assign. If you're "over" in one product, you'll be "under" in another. That situation throws off your cost and profit calculations.

Say you have two products, A and B. (Obviously, your marketing department needs to come up with better product names.) The total cost to be allocated is \$100. You allocate \$50 of costs to product A and \$50 to product B. If you overcost product A by \$10, you allocate \$10 too much. That means you undercost product B by \$10. In other words, the actual costs should be \$40 for product A and \$60 for product B. You start with \$100 in your "bucket" of costs. When you allocate too much for product A, too little remains to allocate to product B.

Undercosting or overcosting direct costs is relatively easy to figure out and fix. How do you catch mistakes? You *trace* direct costs, so you can determine the exact cost of material used in production. Undercosting or overcosting of indirect costs is harder to catch. *Allocating* indirect costs is less precise than *tracing* direct costs.

For example, allocating utility costs in a factory is a bit difficult, but you can do it. The cost accounting "secret" is to invest time investigating the activities that result in utility costs. For example, if one of the manufacturing machines runs twice as long as another, that activity is probably consuming twice as much electricity. The higher machine activity should result in twice as much utility expense.

Table 2-1 shows that investigation pays off. Two customers are chewing up more than 50 percent of the order manager's effort by requiring more hours of her time. The investigation of the activity produces metrics, which form the basis of a better cost allocation plan. For the tools and techniques, see the section "Designing an Activity-Based Costing System," later in this chapter.

### ***Underallocating or overallocating messes up pricing***

Underallocating or overallocating costs impacts your product price and your profit. If your product costs aren't accurate, you can't price your product correctly.

Say you overallocate costs for retailing a men's dress shirt. You think total shirt cost is \$31 in direct and indirect costs, and you want a \$10 profit per shirt. You therefore price your shirts at \$41. But that may not be correct! If the true cost of the shirt is only \$30, \$1 is overallocated. As a result, your profit is \$11 ( $\$41 - \$30$ ).

Well, what's wrong with that? You'd prefer to make \$11 a shirt instead of \$10. But with that higher price, you may lose some sales. Most people have a *price point* — a maximum price they're willing to pay based on the value they perceive. Because the apparel industry is highly price-driven, you could be losing sales, which would hurt your bottom line.

If a lot of customers say to themselves, "The most I would pay for that shirt is \$40," you may lose sales by charging \$41. Although you make another dollar per shirt at \$41, your sales may decline to the point where you make less total profit.

A bigger pricing problem may be when a product's cost is underallocated. Assume that you underallocate another men's dress shirt by \$5. You think the total cost is \$50. To make a \$10 profit per shirt, you set the sale price at \$60, so everything's fine, right? Wrong! If costs are allocated correctly, the real profit is \$5 ( $\$60 - \$55$ ). Underallocation has resulted in a sale price that's too low, and that reduces profit.



You can't make up this deficiency through volume sales. Usually, shirts selling for \$60 don't go flying off the display table.

## *Designing an Activity-Based Costing System*

If your ABC system is well designed, you allocate costs more precisely. This section helps you carefully separate costs between direct costs and indirect costs. You also consider the specific activities that drive the indirect costs higher. Finally, the indirect costs are allocated to the activities that cause those costs to be incurred.

### *Refining your approach*

ABC is a *refined costing system*, or a more specific way to assign costs to cost objects. The system avoids using big, generic categories, such as splitting a cost evenly between divisions. Instead, it allocates indirect costs to the



activities that generate those costs. The result is likely to be more accurate costing and product pricing.

The refined costing system requires you to perform the following three tasks:

- ✔ **Direct cost tracing:** Review your direct costs and categorize more costs as direct costs, if possible.
- ✔ **Cost pools:** Review cost pools and create more pools, if necessary.
- ✔ **Cost-allocation bases:** Decide on cost-allocation bases by using cause-and-effect criteria.

Direct costs are traced to cost objects. As a result, the amount of cost is fairly easy to determine. For example, determining the amount of leather used to make the leather handbags is easy.

Cost pools should be *homogeneous*; that is, each of the costs has the same cost allocation base. The costs have a similar cause-and-effect relationship. Therefore, if you have more than one allocation base, you should have more than one cost pool. A good example is a cost pool combining vehicle depreciation, repair and maintenance, and fuel costs. The costs all increase when your vehicles drive more miles. The cost allocation base should be mileage, and you simply allocate a dollar amount of indirect cost per mile driven.

## *Grouping costs by using a cost hierarchy*

A *cost hierarchy* groups costs into cost pools based on cost drivers or cost allocation bases. A cost hierarchy has levels, which explain how broadly you look at costs and activities. Here are levels you may use in a cost hierarchy:

- ✔ **Unit-level costs** are cost activities performed on an individual unit, whether a product or service. If you make blue jeans, your unit is one pair of jeans. An individual tax return is a unit, if you prepare tax returns for clients.
- ✔ **Batch-level costs** are cost activities that generate costs at the batch level. For example, when an automobile plant changes from one car model to another, it's changing batches and incurring setup costs. The plant is "retooling," which may include moving machinery, and certainly includes changing out the dies and reprogramming the welding robots.
- ✔ **Customer-level costs** are cost activities generated for one customer. If you're remodeling a kitchen, your labor costs, materials used, and overhead costs incurred for a specific customer are all customer-level costs. Customer-level costs may include multiple orders from the same client.

- ✔ **Product-sustaining costs** are cost activities that support a particular product or service line, regardless of the number of units produced. A product-sustaining cost extends the life of a product; technology products are good examples. To stay relevant with customers, software companies come out with endless new versions of software. Extending a product's life is supposed to keep customers buying it. Design costs can be product-sustaining costs. To keep the technology product current, you change the design. You can allocate product-sustaining costs to a product or to an entire product line (sometime called a "product family" in high tech).
- ✔ **Facility-sustaining costs** are cost activities that support the overall company, such as legal and accounting activities. The rent, insurance, and maintenance on the company's building are facility-sustaining costs, because the building is essential to keeping the entire company running. The costs should be allocated over the entire company. Companies with multiple buildings sometimes cost allocate for each building to see whether a building is too expensive to occupy.



If you use a fine-enough granularity, you can get really precise costing. On the other hand, too much granularity will make you crazy. The financial benefit of precise costing should be greater than the time and expense to track the cost information. The financial benefit is more accurate product costs and more precise profit calculations.

## *Testing your ABC design*

The following example begins by separating direct and indirect costs. You also see descriptions of the activities that generate indirect costs. This example allocates indirect costs and calculates the full cost of the product.

For this example, assume you manage a company that makes and installs automobile windshields. You have a forward-looking product called a smart windshield, which uses lasers, infrared sensors, and a camera to help drivers with vision problems drive well. You sell two products: sedan windshields and van windshields. The company wants to implement activity-based costing for indirect costs. Ready, set, go!

### *Dealing with direct costs*

You begin by sitting down with the production manager to get a handle on direct costs. You produce 1,500 windshields each year (750 for sedans and 750 for vans). You trace \$300 of direct materials per windshield and \$500 in direct labor per unit. Table 2-2 shows direct costs.

**Table 2-2** Windshield Direct Costs

<i>Type of Cost</i>	<i>Units × Cost</i>	<i>Total</i>
Direct material	1,500 units × \$300	\$450,000 (\$225,000 per type)
Direct labor	1,500 units × \$500	\$750,000 (\$375,000 per type)

***Diving into the cost pools***

Next, you and the production manager list the indirect cost activities to manufacture and install windshields. Your goal is to pull apart the cost pools. In other words, you make sure that each cost pool is based on a specific activity. The more specific the cost pool, the more likely you're allocating costs to products correctly. Table 2-3 shows the indirect costs for producing and installing windshields.

**Table 2-3** Indirect Cost Activities — Windshield Production and Installation

<i>Activity</i>	<i>Description</i>
Molding setup	Install mold in machine to create a windshield
Machine operation	Run machine to convert material in mold to a windshield
Quality inspection	Review product for defects
Packaging and delivery	Pack windshield; load into truck for delivery to client
Installation	Install windshield at client location

You review to see whether any of these costs are direct costs. That would be good, because it gets you out of the cost allocation business. Using a direct cost *traced* to a product results in greater precision than using an indirect cost *allocated* to a product.

***Applying indirect costs by using a cost allocation base***

The next step is to link the indirect costs to the cost pools (the activities) by using a cost allocation base. At the start, you agree that labor hours should be used to allocate indirect costs for each activity, except for machine operation. The machine cost is allocated based on machine hours. Table 2-4 allocates each cost pool (activity) based on the total hours required to complete each activity. You perform this analysis for all products.

<i>Activity</i>	<i>Allocation Base</i>	<i>Total Cost</i>	<i>Total Hours</i>	<i>Allocation Rate/Hour</i>
Molding setup	Labor hours	\$20,000	150	\$133/hour
Machine operation	Machine hours	\$500,000	5,700	\$88/hour
Quality inspection	Labor hours	\$100,000	1,050	\$95/hour
Packaging and delivery	Labor hours	\$50,000	525	\$95/hour
Installation	Labor hours	\$30,000	900	\$33/hour

***Allocate and celebrate: Assigning the cost allocation rates to the products***

You have the allocation rate per hour (either machine hours or labor hours). Now decide how many hours to use to apply the rate. The goal is to tie the cost allocation to the activity as closely as possible.

Each product has a different mold. Your company changes the windshield being produced by changing the mold. Because of the sedan windshield's curve, more labor hours are required to set up the sedan's mold.

More machine hours are required to produce the van windshield, simply because the van windshield is bigger. The van's larger windshield also requires more time to inspect, package, and deliver.

Installation costs are the same for both products. Table 2-5 lists the cost allocation for each product and the percentage of the total hours for each activity.

<i>Activity</i>	<i>Allocation Rate/Hour</i>	<i>Sedan Cost and (Percent Hours)</i>	<i>Van Cost and (Percent Hours)</i>
Molding setup	\$133	\$13,333 (67%)	\$6,667 (33%)
Machine operation	\$88	\$236,842 (47%)	\$263,158 (53%)
Quality inspection	\$95	\$42,857 (43%)	\$57,143 (57%)

<i>Activity</i>	<i>Allocation Rate/Hour</i>	<i>Sedan Cost and (Percent Hours)</i>	<i>Van Cost and (Percent Hours)</i>
Packaging and delivery	\$95	\$21,429 (43%)	\$28,571 (57%)
Installation	\$33	\$15,000 (50%)	\$15,000 (50%)

At long last, you review the total product costs for sedan and van windshields (see Table 2-6).

<i>Type of Costs</i>	<i>Sedan (750 Units)</i>	<i>Van (750 Units)</i>	<i>Total (1,500 Units)</i>
Direct material	\$225,000	\$225,000	\$450,000
Direct labor	\$375,000	\$375,000	\$750,000
Molding setup	\$13,333	\$6,667	\$20,000
Machine operation	\$236,842	\$263,158	\$500,000
Quality inspection	\$42,857	\$57,143	\$100,000
Packaging and delivery	\$21,429	\$28,571	\$50,000
Installation	\$15,000	\$15,000	\$30,000
Total costs	\$929,461	\$970,539	\$1,900,000
Cost per windshield	\$1,239.28	\$1,294.05	

The cost per van windshield (\$1,294.05) is slightly higher than the cost per sedan windshield. The higher cost for vans makes sense. You can use the total costs in Table 2-4 and the percentages in Table 2-5 to assign costs. You get the same cost allocation that's calculated by using the rates per hour in Table 2-5. You need the cost allocation rates to easily assign costs to all of your production. That's why the rates per hour are important.

Take a look at indirect costs. Installation costs are evenly split, so disregard that cost pool. Consider the other indirect costs. Other than molding setup, all the remaining indirect cost pools have a larger allocation to the van. That's reasonable, because the van windshield is bigger than the sedan windshield. It costs more to run it through a machine, to inspect it, and to package it.

## Using Activity-Based Costing to Compute Total Cost, Profit, and Sale Price



The only constant is change. Demand for your product is probably always changing. Material costs may increase (they rarely go down). Increased competition may force you to lower your prices to prevent sales from slipping. Luckily for you, activity-based costing is a tool to manage indirect cost allocations effectively as conditions change.

Take a look at the following example, which shows how to use cost allocation to compute total cost, profit, and a sale price. Say you operate a lawn care business that provides two services: flower bed planting and care, and lawn planting and care. You plan and price your work based on a 25-square-foot area. One unit for your business is 25 square feet, whether it's a lawn or flower bed. You refer to one unit as one customer yard. Table 2-7 shows a summary of the cost objects for the business.

<i>Type of Costs</i>	<i>Flower Bed</i>	<i>Lawn Care</i>
Direct materials	Mulch and fertilizer	Sod, grass seed, and fertilizer
Direct labor	Clear area, plant, or install material	Clear area, plant, or install material
Estimator cost (indirect cost)	Flower bed inspection and analysis	Lawn inspection and analysis
Transportation cost (indirect cost)	Depreciation, insurance for vehicles, and mileage	Depreciation, insurance for vehicles, and mileage
Office cost (indirect cost)	Costs for dispatcher/accountant	Costs for dispatcher/accountant

In planning, you determine that your business will service 500 units in the upcoming year. Assume that the sales will be evenly split between the two services (250 yards each).

## *Allocating indirect costs evenly by product*

Initially, you allocate indirect costs by splitting the indirect costs between the product types. Table 2-8 shows an even allocation of indirect costs. The direct costs are traced to each service you provide, either flower bed work or lawn care.

**Table 2-8 Costs and Profit by Product — Flower Bed and Lawn Care**

<i>Cost (250 Units of Each Product)</i>	<i>Flower Bed</i>	<i>Lawn Care</i>	<i>Total</i>
Direct material	\$25,000	\$30,000	\$55,000
Direct labor	\$37,500	\$25,000	\$62,500
Estimator cost (indirect cost)	\$15,000	\$15,000	\$30,000
Transportation cost (indirect cost)	\$7,500	\$7,500	\$15,000
Office cost (indirect cost)	\$12,500	\$12,500	\$25,000
Total costs	\$97,500	\$90,000	\$187,500
Add: Profit (10 percent of cost)	\$9,750	\$9,000	\$18,750
Total sales	\$107,250	\$99,000	\$206,250
Cost per unit (yard)	\$390	\$360	
Sale price per unit	\$429	\$396	

Estimator cost, transportation cost, and office cost are evenly split. Now think about profit as a percentage of total costs. In Table 2-8, the flower bed profit calculation is \$9,750, or 10 percent of costs ( $\$97,500 \times 0.10$ ). To compute your sale price for flower beds, add the total cost to profit. That's \$107,250. Finally, divide both the total cost and total sales by 250 yards. That provides cost per unit of \$390 and sale price per unit of \$429 for flower beds.

## *Analyzing and reallocating cost activities*

A key point of activity-based costing is basing each cost pool on a specific activity. This puts you on the road to more accurate costing of your product. To find out more, ask your staff in detail about their activities.

The estimator's job is to discuss each project with the client. She assesses the current condition of the yard and the labor and materials needed for the project. Finally, she supervises the work to completion. You ask your estimator to track the amount of time she spends on each type of product. It's simple: She will post her time to a flower bed column or a lawn column on a spreadsheet.

After a few months, you find that the estimator spends 70 percent of her time on flower bed projects. “Flower beds take more time to discuss with the client,” she says. “Most of time, we’re dealing with an existing flower bed. The customer decides what to keep and what to throw out. Lawns are easier. You don’t have much to discuss, other than the current condition of the grass.” Based on this discussion, clearly you should assign 70 percent of the estimator’s cost to the flower bed product.

At the same time, the estimator tracks mileage on the trucks and vehicles. “If you look at this map, you’ll see that most of our flower bed work is in the wealthier area of town. That’s farther from our office than most of the lawn work.” She looks through her mileage log. “I calculated that 60 percent of our drive time and mileage is spent on flower bed work.” Okay, more progress! You probably should allocate 60 percent of the transportation costs (vehicle depreciation, insurance, and fuel) to the flower bed product.

Your last stop is your office assistant’s desk. “You know we get a lot of cancellations and rescheduled work for lawn care.” He pauses for a minute. “I think because the work isn’t complicated, and we have a lot of competitors, people don’t take it as seriously. They change and cancel without much thought.”

Well, a cancellation or rescheduling fee would reduce the problem, but that’s a cost story for another day. For now, just consider the activities that generate office costs. The office assistant’s cost (salary, office supplies, and computer) can be allocated based on his time. When a customer cancels or reschedules, the office assistant spends time on the phone with customers, the estimator, and employees. In addition, the paperwork for the project has to be changed. After more analysis, the two of you decide that 60 percent of the office assistant cost should be allocated to lawn work.

## *Changing allocations to cost pools*

You investigate indirect costs and make some changes. Table 2-9 shows the cost allocation changes to the three indirect cost pools. The direct costs don’t change, because they’re *traced* directly, not *allocated*. Total costs are still \$187,500. That makes sense, because activity-based costing changes cost allocations, not cost totals. Costs change by product but not in total for the company. Sales are still \$206,250.

Because the per unit sale prices stay the same, the profit calculations change. Profit for flower beds is now \$4,750 (\$107,250 – \$102,500). Profit for lawn care is now \$14,000 (\$99,000 – \$85,000).



**Table 2-9 Activity-Based Costing by Product — Flower Bed and Lawn Care**

<i>Cost (250 Units of Each Product)</i>	<i>Flower Bed</i>	<i>Lawn Care</i>	<i>Total</i>
Direct material	\$25,000	\$30,000	\$55,000
Direct labor	\$37,500	\$25,000	\$62,500
Estimator cost (indirect cost)	\$21,000	\$9,000	\$30,000
Transportation cost (indirect cost)	\$9,000	\$6,000	\$15,000
Office cost (indirect cost)	\$10,000	\$15,000	\$25,000
Total costs	\$102,500	\$85,000	\$187,500
Profit (total sales less total costs)	\$4,750	\$14,000	\$18,750
Total sales	\$107,250	\$99,000	\$206,250
Cost per unit (yard)	\$410	\$340	
Sale price per unit	\$429	\$396	

In Table 2-9, the flower bed total cost increases by \$5,000 (from \$97,500 to \$102,500). As a result, profit for flower beds declines by \$5,000 (from \$9,750 to \$4,750). ABC has the opposite effect on the lawn care business. Lawn care costs go down by \$5,000 (from \$90,000 to \$85,000). Profit increases by \$5,000 (from \$9,000 to \$14,000).

## *Changing prices after ABC*

You overcosted lawn care and undercosted flower beds. When you reallocate that from lawn care to flower beds, the change throws off your profit calculation! You want a profit of 10 percent for each product, but flower beds are producing only a 4.6 percent profit ( $\$4,750 \text{ profit} \div \$102,500 \text{ in sales}$ ). The lawn care profit produces a 16.5 percent profit ( $\$14,000 \div \$85,000$ ). See the explanation for the profit and sales numbers earlier in the chapter.

Here's the problem: 4.6 percent may be too small a profit margin. You're spinning your wheels for a bunch of petunias. Calculate the new sale price for flower beds, based on the ABC and a 10 percent profit, as shown in Table 2-10.

**Table 2-10**      **Calculating a New Sale Price for Flower Beds**

<i>Cost (250 Units of Each Product)</i>	<i>Flower Beds</i>
Total costs in Table 2-9	\$102,500
Profit (10 percent of total cost)	\$10,250
Total sales	\$112,750
Cost per unit (yard)	\$410
Sale price per unit	\$451

The original price per unit for flower beds was \$429. The new flower bed unit price is \$451, which is \$22 higher than before (\$451 to \$429). To make a 10 percent profit, change the flower bed sale price to \$451 per unit.

At the old price, you weren't making your desired profit. Now you will. And *that's* the value of using ABC. You could make up for the lower profit on flower beds by earning more on lawn care. But really, you should assess each product on its own and price each one to produce the correct profit.

## Chapter 3

# Examining Contribution Margin

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### *In This Chapter*

- ▶ Figuring contribution margin
  - ▶ Meeting income goals with cost-volume-profit analysis
  - ▶ Analyzing your break-even point, target profit, and margin of safety
  - ▶ Exploring operating leverage
- 

**W**hen you have to make a business decision about what to sell, how much of it to sell, or how much to charge, you first need to understand how your decision is likely to affect net income — your profit. Suppose you sell one refrigerator for \$999.95. How does that sale affect your net income? Now suppose you sell 1,000 of the same make and model at this price. How does that sales volume affect net income?

Contribution margin simplifies these decisions. In this chapter, you find out how to calculate contribution margin and how to apply it to different business decisions, using both graphs and formulas. You also find out how to prepare something called a *cost-volume-profit analysis*, which explains how the number of products sold affects profits. And you discover how to prepare a *break-even analysis*, which indicates exactly how many products you must sell in order to break even and start earning a profit.

Suppose you set a *target profit* — a goal for net income this period. This chapter shows you how to estimate the number of units you need to sell in order to meet your target profit. It also explains how to measure something called *margin of safety*, or how many sales you can afford to lose before your profitability drops to zero. Finally, this chapter explains and demonstrates *operating leverage*, which measures a company's riskiness.

## Computing Contribution Margin



*Contribution margin* measures how sales affects net income or profits. To compute contribution margin, subtract variable costs of a sale from the amount of the sale itself:

$$\text{Contribution margin} = \text{Sales} - \text{Variable costs}$$

For example, if you sell a gadget for \$10 and its variable cost is \$6, the contribution margin for the sale is  $\$10 - \$6 = \$4$ . Selling this gadget increases your profit by \$4, before considering fixed costs. Your contribution margin less fixed costs equals your profit.



When computing contribution margin, subtract all variable costs, including variable manufacturing costs and variable selling, general, and administrative costs. Don't subtract any fixed costs. You compute *gross profit* by subtracting cost of goods sold from sales. Because cost of goods sold usually includes a mix of fixed and variable costs, gross profit doesn't equal contribution margin.

You can calculate contribution margin in three forms, as discussed in the following sections: in total, per unit, or as a ratio.

Contribution margin, in any of its forms, explains how different factors in the company — sales price, sales volume, variable costs, and fixed costs — interact. This understanding helps you make better decisions when planning sales and costs.

## Figuring total contribution margin

*Total contribution margin* measures the amount of contribution margin earned by the company as a whole. You calculate it by using this formula:

$$\text{Total contribution margin} = \text{Total sales} - \text{Total variable costs}$$

To determine overall profitability, subtract total fixed costs from total contribution margin. Net income equals the excess of contribution margin over fixed costs.

You can use total contribution margin to create something called a *contribution margin income statement*. This document differs from a multi-step income statement (shown in Figure 3-1), where you first subtract cost of goods sold from sales and then subtract selling, general, and administrative costs.

<b>Figure 3-1:</b> Multi-step income statement.	Assets:		
	<i>Current assets:</i>		
	Cash and bank deposits:		
	Restricted deposit	\$ 300,000	
	Unrestricted	<u>475,800</u>	\$ 775,800

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A contribution margin income statement first subtracts the variable costs and then subtracts fixed costs, as shown in Figure 3-2. Here, variable costs include variable costs of both manufacturing and selling. Likewise, fixed costs include more manufacturing and selling costs.

<b>Figure 3-2:</b> Contribution margin income statement.	To record estimate of uncollectable:		
	Bad debt expense	5,000	
	Allowance for doubtful accounts		<u>5,000</u>

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The contribution margin income statement makes understanding cost behavior and the way sales will affect profitability easier. In Figure 3-2, the company earns \$1,000 in sales, \$400 of which goes toward variable costs. This scenario results in \$600 of contribution margin.

These amounts — sales, variable costs, and contribution margin — change in proportion to each other. If sales increase by 10 percent, then variable costs and contribution margin also increase by 10 percent; \$1,100 in sales increases variable costs to \$440 and contribution margin to \$660. On the other hand, fixed costs always remain the same: The \$300 in fixed costs is \$300 regardless of any increase or decrease in sales and contribution margin.



The contribution margin income statement presents the same net income figure as a traditional income statement. However, the contribution margin income statement isn't in accordance with generally accepted accounting principles (GAAP). (See Book IV, Chapter 1 for more about GAAP.) Managers can internally use a contribution margin income statement to better understand their own companies' operations.

## Calculating contribution margin per unit



*Contribution margin per unit* measures how the sale of one additional unit affects net income. You calculate it by subtracting variable costs per unit from sales price per unit, as in this formula:

$$\text{Contribution margin per unit} = \text{Sales price per unit} - \text{Variable costs per unit}$$

Say a company sells a single gadget for \$100, and the variable cost of making the gadget is \$40. Contribution margin per unit on this gadget equals  $\$100 - \$40 = \$60$ . Therefore, selling the gadget increases net income by \$60, assuming no change in fixed costs.

Increasing the sales price doesn't affect variable costs because the number of units manufactured, not the sales price, is what usually drives variable manufacturing costs. Therefore, if the gadget company raises its sales price to \$105, the variable cost of making the gadget remains at \$40, and the contribution per unit increases to  $\$105 - \$40 = \$65$  per unit. The \$5 increase in sales price goes straight to the bottom line as net income. Again, this assumes that fixed costs don't change.

## Working out contribution margin ratio



*Contribution margin ratio* measures the percentage of each sales dollar that represents net income. To calculate it, divide contribution margin by sales, either in total or per unit:

$$\text{Contribution margin ratio} = \text{Total contribution margin} \div \text{Total sales}$$

or

$$\text{Contribution margin ratio} = \frac{\text{Contribution margin per unit}}{\text{Sales price per unit}}$$

Suppose a gadget selling for \$100 per unit brings in \$40 per unit of contribution margin. Its contribution margin ratio is 40 percent:

$$\text{Contribution margin ratio} = \$40 \div \$100 = 0.40 \text{ or } 40\%$$

To find out how sales affect net income, multiply the contribution margin ratio by the amount of sales. In this example, \$1,000 in gadget sales increases net income by  $\$1,000 \times 0.40 = \$400$  (before considering fixed costs).

## Preparing a Cost-Volume-Profit Analysis

Contribution margin indicates how sales affects profitability. When running a business, a decision-maker needs to consider how four different factors affect net income:

- ✓ Sales price
- ✓ Sales volume
- ✓ Variable cost
- ✓ Fixed cost

*Cost-volume-profit analysis* helps you understand different ways to meet your net income goals. The following sections explain cost-volume-profit analysis by using graphical and formula techniques. These sections pay special attention to computing net income based on different measures of contribution margin: total contribution margin, contribution margin per unit, and the contribution margin ratio.



The graphs provide a helpful way to visualize the relationship among cost, volume, and profit. However, when solving problems, you'll find that plugging numbers into formulas is much quicker and easier.

### Drafting a cost-volume-profit graph

Figure 3-3 visually describes the relationship among cost, volume, and profit for a company called Pemulis Basketballs. It sells its basketballs for \$15 per basketball. The variable cost of the basketballs is \$6. Pemulis has total fixed costs of \$300 per year.

In this figure, the fixed costs of \$300 are represented by a horizontal line because regardless of the sales volume, fixed costs stay the same. Total variable costs are a diagonal line, starting at the origin (the point in the lower-left corner of the graph where sales are zero). Total costs (the sum of total variable costs and total fixed costs) are a diagonal line starting at the \$300 mark because when the company makes and sells zero units, total costs equal the fixed costs of \$300. Total costs then increase with volume. Finally, total sales forms a diagonal line starting at the origin and increasing with sales volume.

Figure 3-4 shows when the company will earn net income or incur a loss. When the sales curve exceeds total costs, the company earns net income (represented by the shaded right side of the *X* in Figure 3-4). However, if total

Assets:		
<i>Current assets:</i>		
Cash and bank deposits:		
Restricted deposit	\$ 300,000	
Unrestricted	<u>475,800</u>	\$ 775,800
Accounts receivable	75,500	
Less: Allowance for doubtful accounts	(5,000)	<u>70,500</u>
Total current assets		<u>\$ 846,300</u>

**Figure 3-3:**  
Cost-  
volume-  
profit graph.

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sales are too low to exceed total costs, then the company incurs a net loss (the shaded left side of the *X*). The higher the sales volume — that is, the more sales volume moves to the right of the graph — the higher the company's net income.

**Figure 3-4:**  
Identifying  
net income  
and loss  
in a cost-  
volume-  
profit graph.

Notes receivable	20,000
Discounts on notes receivable	6,388
Cash	13,612

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Dropping numbers into the chart shows exactly how much income can be earned at different sales levels. Assuming Pemulis has a sales price of \$15 per unit, a variable cost per unit of \$6, and total fixed costs of \$300, what happens if Pemulis sells 60 basketballs? Total sales come to 60 units  $\times$  \$15 = \$900. Total variable costs multiply to 60 units  $\times$  \$6 = \$360. Add these total variable costs to total fixed costs of \$300 to get total costs of \$660.

Figure 3-5 illustrates these amounts. Total sales of \$900 sits on the Total sales line. Total costs of \$660 sits on the Total cost line. The difference between these amounts of \$240 represents the net income from selling 60 units.



Schedule of Note Discount Amortization			
Effective Interest Method at 8%			
	Interest <u>Revenue</u>	Discount <u>Amortized</u>	Carrying <u>Amount</u>
Date of Issue			\$13,612
End of year 1	\$1,089**	\$1,089	14,701
End of year 2	1,176	1,176	15,877
End of year 3	1,270	1,270	17,147
End of year 4	1,372	1,372	18,519
End of year 5	<u>1,481</u>	<u>1,481</u>	20,000
	<u>\$6,388</u>	<u>\$6,388</u>	

\*\*  $\$13,612 \times .08 = \$1,089$ .  $\$13,612 + \$1,089 = \$14,701$ .

**Figure 3-5:**  
Applying  
a cost-  
volume-  
profit graph  
to a specific  
case.

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## Trying out the total contribution margin formula



The following formula, based on total contribution margin, follows the same structure as the contribution margin income statement. (Flip to the earlier section “Figuring total contribution margin” for details on total contribution margin and its related income statement.)

$$\text{Net income} = \text{Total contribution margin} - \text{Fixed costs}$$

Assume that Pemulis Basketballs sells 60 units for \$15 each for total sales of \$900 (see the preceding section for more on the origins of this example). The variable cost of each unit is \$6 (so total variable costs come to  $\$6 \times 60 = \$360$ ), and total fixed costs are \$300. Using the contribution margin approach, you can find the net income in two easy steps:

### 1. Calculate total contribution margin.

Use the formula provided earlier in the chapter to compute total contribution margin, subtracting total variable costs from total sales:

$$\begin{aligned} \text{Total contribution margin} &= \text{Total sales} - \text{Total variable costs} \\ &= (60 \times \$15) - (60 \times \$6) = \$900 - \$360 = \$540 \end{aligned}$$

This total contribution margin figure indicates that selling 60 units increases net income by \$540 (before considering fixed costs).

**2. To calculate net income, subtract the fixed costs from the total contribution margin.**

Just plug in the numbers from Step 1:

$$\text{Net income} = \text{Total contribution margin} - \text{Fixed costs} = \$540 - \$300 = \$240$$

Subtracting fixed costs of \$300 from total contribution margin of \$540 gives you net income of \$240.

## *Practicing the contribution margin per unit formula*

If you know the contribution margin per unit (see “Calculating contribution margin per unit” earlier in this chapter), the following approach lets you use that information to compute net income. Here’s the basic formula equating net income with contribution margin per unit:

$$\text{Net income} = (\text{Sales volume} \times \text{Contribution margin per unit}) - \text{Fixed costs}$$

Say Pemulis Basketballs now wants to use this formula. It can simply plug in the numbers — 60 units sold for \$15 each, variable cost of \$6 per unit, fixed costs of \$300 — and solve. First compute the contribution margin per unit:

$$\begin{aligned} \text{Contribution margin per unit} &= \text{Sales price per unit} - \text{Variable costs per unit} \\ &= \$15 - \$6 = \$9 \end{aligned}$$

Next, plug contribution margin per unit into the net income formula to figure out net income:

$$\begin{aligned} \text{Net income} &= (\text{Sales volume} \times \text{Contribution margin per unit}) - \text{Fixed costs} \\ &= (60 \times \$9) - \$300 = \$540 - \$300 = \$240 \end{aligned}$$

## *Eyeing the contribution margin ratio formula*

If you want to estimate net income but don’t know total contribution margin and can’t find out the contribution margin per unit, you can use the contribution margin ratio to compute net income.



As noted in the earlier section “Working out contribution margin ratio,” you can compute contribution margin ratio by dividing total contribution margin by total sales. So if your contribution margin is \$540 and your sales is \$900, your contribution margin ratio is 60 percent:

$$\begin{aligned}\text{Contribution margin ratio} &= \text{Total contribution margin} \div \text{Total sales} \\ &= \text{Contribution margin per unit} \div \text{Sales price per unit} = \$540 \div \$900 \\ &= 0.60 = 60\%\end{aligned}$$

This means that 60 cents of every sales dollar increases net income, after considering fixed costs. After you know the contribution margin ratio, you’re ready for the net income formula:

$$\begin{aligned}\text{Net income} &= (\text{Sales volume in units} \times \text{Contribution margin per unit}) \\ &\quad - \text{Fixed costs}\end{aligned}$$

To calculate net income for the earlier example company, plug the contribution margin ratio of 60 percent into the formula:

$$\begin{aligned}\text{Net income} &= (\text{Sales volume in units} \times \text{Contribution margin per unit}) \\ &\quad - \text{Fixed costs} = (\$900 \times 0.60) - \$300 = \$540 - \$300 = \$240\end{aligned}$$

## Generating a Break-Even Analysis

How much do you need to sell in order to break even? The *break-even point* (BE) is the amount of sales needed to earn zero profit — enough sales to avoid a loss, but insufficient sales to earn a profit. This section shows you a couple of different ways — graphs and formulas — to locate your break-even point.

### Plotting the break-even point

In a cost-volume-profit graph, the break-even point is the sales volume where the total sales line intersects with the total costs line. This sales volume is the point at which total sales equals total costs.

Suppose that, as with the basketball example earlier in the chapter, a company sells its products for \$15 each, with variable costs of \$6 per unit and total fixed costs of \$300. The graph in Figure 3-6 indicates that the company’s break-even point occurs when the company sells 34 units.

	<u>Cash</u>	<u>Interest Revenue</u>	<u>Discount Amortized</u>	<u>Carrying Amount</u>
Date of Issue				\$18,403
End of year 1	\$1,200	\$1,472**	\$272	18,675
End of year 2	1,200	1,494	294	18,969
End of year 3	1,200	1,518	318	19,287
End of year 4	1,200	1,542	342	19,630
End of year 5	<u>1,200</u>	<u>1,570</u>	<u>370</u>	20,000
	<u>\$6,000</u>	<u>\$7,597</u>	<u>\$1,596</u>	

\*\*  $\$18,403 \times .08 = \$1,472$ .  $\$1,472 - \$1,200 = 272$ .  $\$18,403 + \$272 = \$18,675$ .

**Figure 3-6:**  
Plotting the  
break-even  
point.

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For many products (such as basketballs), you can sell only whole units. Therefore, if you sell whole units, the break-even point must always be a whole number. If break-even analysis results in some fractional volume of sales (such as 33.33333 units), always round *up* (in this case, to 34 units), even if the fraction is closer to the lower whole number than the higher number. If your break-even point equals 33.0001, round it up to 34. If you round down (to 33 units), then the actual sales volume is below the break-even point, and at this volume level, your company reports a net loss.

## Using the formula approach

When you need to solve actual problems, drawing graphs isn't always practical. For a quicker approach, you want to rely on the three formulas that use contribution margin to measure net income. (See "Preparing a Cost-Volume-Profit Analysis" earlier in the chapter.)

The break-even point is where net income is zero, so just set net income equal to zero, plug whatever given information you have into one of the equations, and then solve for sales or sales volume. Better yet: At the break-even point, total contribution margin equals fixed costs.

Suppose a company has \$30,000 in fixed costs. How much total contribution margin does it have to generate in order to break even?

Net income = Total contribution margin – Fixed costs

$$0 = \text{Total contribution margin}_{\text{BE}} - \text{Fixed costs}$$

$$0 = \text{Total contribution margin}_{\text{BE}} - \$30,000$$

$$\$30,000 = \text{Total contribution margin}_{\text{BE}}$$

Here, too, at the break-even point, total contribution margin equals fixed costs of \$30,000. Now suppose a company has contribution margin per unit of \$6 and fixed costs of \$600. What's the break-even point in units?

Net income = (Sales volume × Contribution margin per unit) – Fixed costs

$$0 = (\text{Sales volume}_{\text{BE}} \times \text{Contribution margin per unit}) - \text{Fixed costs}$$

$$0 = (\text{Sales volume}_{\text{BE}} \times \$6) - \$600$$

$$\$600 = \text{Sales volume}_{\text{BE}} \times \$6$$

$$\$600 \div \$6 = 100 \text{ units}$$

Another company has a contribution margin ratio of 40 percent and fixed costs of \$1,000. Sales price is \$1 per unit. What's the break-even point in dollars?

Net income = (Sales × Contribution margin ratio) – Fixed costs

$$0 = (\text{Sales}_{\text{BE}} \times \text{Contribution margin ratio}) - \text{Fixed costs}$$

$$0 = (\text{Sales}_{\text{BE}} \times 0.40) - \$1,000$$

$$\$1,000 = \text{Sales}_{\text{BE}} \times 0.40$$

$$\$1,000 \div 0.40 = \text{Sales}_{\text{BE}}$$

$$\$2,500 = \text{Sales}_{\text{BE}}$$



You can express break-even point in units or dollars. If your formula gives you units and you want dollars, multiply the number of units by the sales price. If your formula gives you dollars and you want units, just divide by the sales price.

## Shooting for Target Profit

If you've set a specific goal for net income, contribution margin analysis can help you figure out the needed sales. This goal for net income is called *target profit*.



To compute target profit, just adapt one of the three net income formulas. (Head to the earlier section “Preparing a Cost-Volume-Profit Analysis” to see these formulas.) Then plug target profit into one of these formulas as net income. For example, say a company is pushing to earn \$20,000 in profit and has to pay \$10,000 in fixed costs. How much total contribution margin does the company need to generate in order to make its target profit of \$20,000?

$$\text{Net income} = \text{Total contribution margin} - \text{Fixed costs}$$

$$\$20,000 = \text{Total contribution margin}_{\text{Target}} - \$10,000$$

$$\$30,000 = \text{Total contribution margin}_{\text{Target}}$$

Total contribution margin of \$30,000 will result in \$20,000 worth of net income. Now suppose a company has set its target profit for \$2,000, earns contribution margin per unit of \$5, and incurs fixed costs of \$500. How many units must the company sell?

$$\text{Net income} = (\text{Sales volume} \times \text{Contribution margin per unit}) - \text{Fixed costs}$$

$$\$2,000 = (\text{Sales volume}_{\text{Target}} \times \text{Contribution margin per unit}) - \text{Fixed costs}$$

$$\$2,000 = (\text{Sales volume}_{\text{Target}} \times \$5) - \$500$$

$$\$2,500 = \text{Sales volume}_{\text{Target}} \times \$5$$

$$\$2,500 \div \$5 = \text{Sales volume}_{\text{Target}}$$

$$500 \text{ units} = \text{Sales volume}_{\text{Target}}$$

If the company wants to earn \$2,000 in profit, it needs to sell 500 units. Consider another company with a contribution margin ratio of 40 percent and fixed costs of \$1,000. The company is looking to earn \$600 in net income. How much does that company need in sales?

$$\text{Net income} = (\text{Sales} \times \text{Contribution margin ratio}) - \text{Fixed costs}$$

$$\$600 = (\text{Sales}_{\text{Target}} \times \text{Contribution margin ratio}) - \text{Fixed costs}$$

$$\$600 = (\text{Sales}_{\text{Target}} \times 0.40) - \$1,000$$

$$\$1,600 = \text{Sales}_{\text{Target}} \times 0.40$$

$$\$1,600 \div 0.40 = \text{Sales}_{\text{Target}}$$

$$\$4,000 = \text{Sales}_{\text{Target}}$$



Don't confuse dollars with units. The formula that uses contribution margin per unit gives you sales in units. However, the formula that uses contribution margin ratio gives you sales in dollars. To translate between these units, just multiply or divide by the sales price as described at the end of the previous section. Also be sure to label the numbers in your analysis, so you don't confuse terms. For example, use a dollar sign for dollars and the word “units” when dealing with units.

## Observing Margin of Safety

*Margin of safety* is the difference between your actual or expected profitability and the break-even point. It measures how much breathing room you have — how much you can afford to lose in sales before your net income drops to zero. When budgeting, compute the margin of safety as the difference between budgeted sales and the break-even point. Doing so will help you understand the likelihood of incurring a loss. Turn to Book VI, Chapters 4 and 5 for more about budgeting.

### Using a graph to depict margin of safety

Figure 3-7 shows you how to visualize margin of safety with a graph. In this example, margin of safety is the difference between current or projected sales volume of 60 units and break-even sales volume of 34 units, which is 26 units. Sales would have to drop by 26 units for existing net income of \$240 to completely dry up.

**Figure 3-7:**  
Graphing  
margin of  
safety.

Note receivable	20,000	
Accumulated depreciation	1,000	
Discount on note receivable	(\$20,000 – \$17,000)	3,000
Equipment		14,000
Gain on disposal of equipment		4,000

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Book VII  
Making  
Savvy  
Business  
Decisions

### Calculating the margin of safety

To compute margin of safety directly, without drawing pictures, first calculate the break-even point and then subtract it from actual or projected sales. You can use dollars or units:

$$\text{Margin of safety (in dollars)} = \text{Sales}_{\text{Actual}} - \text{Sales}_{\text{BE}}$$

$$\text{Margin of safety (in units)} = \text{Unit sales}_{\text{Actual}} - \text{Unit sales}_{\text{BE}}$$

For guidance on finding the break-even point, check out the earlier section “Generating a Break-Even Analysis.”



You can compute margin of safety either in sales dollars or in units, but be consistent. Don't subtract break-even sales in units from actual sales in dollars!

## Taking Advantage of Operating Leverage



*Operating leverage* measures how changes in sales can affect net income. For a company with high operating leverage, a relatively small increase in sales can have a fairly significant impact on net income. Likewise, a relatively small decrease in sales for that same company will have a devastating effect on earnings.

Operating leverage is typically driven by a company's blend of fixed and variable costs. The larger the proportion of fixed costs to variable costs, the greater the operating leverage. For example, airlines are notorious for their high fixed costs. Airlines' highest costs are typically depreciation, jet fuel, and labor — all costs that are fixed with respect to the number of passengers on each flight. Their most significant variable cost is probably just the cost of the airline food, which, judging from some recent flights couldn't possibly be very much. Therefore, airlines have ridiculously high operating leverage and unspeakably low variable costs. A small drop in the number of passenger-miles can have a dreadful effect on an airline's profitability.

### Graphing operating leverage

In a cost-volume-profit graph (see Figure 3-3 earlier in the chapter), operating leverage corresponds to the slope of the total costs line. The more horizontal the slope of this line, the greater the operating leverage. Figure 3-8 compares the operating leverage for two different entities, Safe Co., which has lower operating leverage, and Risky Co., which has higher operating leverage.

<b>Figure 3-8:</b> How operating leverage increases risk.	Note receivable		20,000
	Accumulated depreciation		1,000
	Discount on note receivable	(\$20,000 – \$17,000)	3,000
	Equipment		14,000
	Gain on disposal of equipment		4,000



In this example, Risky Co. has higher fixed costs and lower variable costs per unit than Safe Co. Therefore Risky's total cost line is more horizontal than Safe's total cost line. Accordingly, Risky has the potential to earn much higher income with the same sales volume than Safe does. Because its fixed costs are so high, Risky also has the potential to incur greater losses than Safe does.

## *Looking at the operating leverage formula*

The formula for operating leverage is

$$\text{Operating leverage} = \text{Total contribution margin} \div \text{Net income}$$

Suppose that Safe Co. and Risky Co. each earn sales of \$400 on 50 units. Assume that on these sales, Safe Co. has \$150 in contribution margin and Risky has \$300 in contribution margin. Safe Co. has fixed costs of \$50, while Risky Co. has fixed costs of \$200. Safe's net income comes to \$100 (\$150 – \$50). At this volume level, Risky's net income also works out to be \$100. Here's the math:

$$\text{Operating leverage} = \text{Total contribution margin} \div \text{Net income}$$

$$\text{Operating leverage}_{\text{Safe Co.}} = \$150 \div \$100 = 1.5$$

$$\text{Operating leverage}_{\text{Risky}} = \$300 \div \$100 = 3.0$$

According to these measures, Risky Co. has twice the operating leverage of Safe Co. Although a 10-percent increase in sales boosts Safe Co.'s net income by 15 percent, a similar 10-percent increase in sales for Risky Co. increases that company's net income by 30 percent!

That said, high operating leverage can work against you. For Safe Co., a 10-percent decrease in sales cuts income by 15 percent; for Risky, a 10-percent decrease in sales reduces net income by 30 percent.



Because automation replaces labor with machines, it usually replaces the variable costs (from direct labor) with fixed overhead (associated with running equipment). As such, automation tends to increase operating leverage. However, outsourcing usually has the opposite effect. Companies that close factories and pay other companies to make goods for them replace fixed costs (needed to run factories) with variable costs (used to pay other companies to make the goods).



## Chapter 4

# Accounting for Change with Variance Analysis

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### *In This Chapter*

- ▶ Understanding and setting standard costs
  - ▶ Figuring out direct materials prices and direct labor rates
  - ▶ Using formulas to compute variances
  - ▶ Exploiting a shortcut for calculating direct material and direct labor variances
  - ▶ Identifying variances that require further investigation
- 

**W**hen things don't go according to plan, inevitably you're left asking "Why?" To find the answer, examine the factors under your control. For example, suppose you don't like to diet. As an accountant, you should enjoy counting calories. But maybe you don't. Maybe you don't like to exercise either. That said, if you weigh yourself only to find that you're gaining rather than losing weight, you may ask "Why?" You thought you were being so careful this week. Why did you gain three pounds? It all comes down to three factors under your control: what you eat and drink, how much you eat and drink, and how much you exercise. Examining each of these factors helps you change your routine so that you can more successfully manage your weight in the future.

Variance analysis plays a similar role for business. When things go wrong, or even when they go more right than expected, variance analysis explains why. What caused higher-than-expected profits? What about unexpected losses? You can use all this information to improve future operations.

## *Setting Up Standard Costs*

You can't measure variances without first setting *standard costs* or *standards* — predetermined unit costs of materials, labor, and overhead. Standards are really the building blocks of budgets; budgets predict total costs (as explained in

Book VI, Chapters 4 and 5), but standards predict the cost of each unit of direct materials, direct labor, and overhead. Standard costs provide a number of important benefits for managers. For example, they

- ✔ Help managers budget for the future.
- ✔ Help employees focus on keeping costs down.
- ✔ Help set sales prices.
- ✔ Give managers a benchmark for measuring variances and identifying related problems.
- ✔ Simplify collecting and managing the cost of inventory.
- ✔ Provide useful information for variance analysis (as explained in this chapter).

Implementing standards often forces managers to face a critical dilemma: Should standards be aspirational or realistic?

- ✔ **Ideal or aspirational standards** can encourage employees to work hard to achieve rigorous goals. However, overly aggressive standards can unduly pressure employees, causing them to report false information or to just give up on the standards out of frustration, deeming them unattainable.
- ✔ **Realistic standards** provide more accurate cost information and are less likely to lead to the kind of unfavorable variances that result in lower-than-expected income. However, realistic standards don't always encourage employees to "go the extra mile" to improve cost control and productivity.

Therefore, the first step in variance analysis is to set up expectations: your standards. These standards must include both the cost and the quantity needed of direct materials and direct labor, as well as the amount of overhead required.



After you establish standards, you can use them to compute variances. Whenever actual performance strays from expectations, variances help you identify the reasons why.

## *Establishing direct materials standards*

*Direct materials* are raw materials traceable to the manufactured product, such as the amount of flour used to make a cake. To compute the direct materials standard price (SP), consider all the costs that go into a single unit of direct materials. Because several different kinds of direct materials are often necessary for any given product, you need to establish separate direct materials standard prices and quantities for every kind of direct materials needed.

Suppose that the Band Book Company usually pays \$10 per pound for paper. It typically pays \$0.25 per pound for freight and another \$0.10 per pound for receiving and handling. Therefore, as shown in Figure 4-1, total cost per pound equals \$10.35.

**Figure 4-1:**  
Adding  
up direct  
materials  
standard  
price (SP).

Cost	Per Pound
Purchase price	\$10.00
Freight-in	0.25
Receiving and handling	0.10
Direct materials standard price (SP)	<u>\$10.35</u>

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Another standard to consider is the *direct materials standard quantity* (SQ) per unit. This number is the amount of direct materials needed to make a single unit of finished product. It includes not only the direct materials actually used but also any direct materials likely to get scrapped or spoiled in the production process.



Variance costing involves juggling many different figures and terms. To simplify matters, use abbreviations such as SP (for direct materials *standard price*) and SQ (for direct materials *standard quantity*). Doing so makes remembering how to calculate variances easier later in this chapter. For example, assume that Band Book Company needs 25 pounds of paper to make a case of books. For every case, three pounds of paper are deemed unusable because of waste and spoilage. Therefore, the direct materials standard quantity per unit equals 28 pounds, as shown in Figure 4-2.

**Figure 4-2:**  
Computing  
direct  
materials  
standard  
quantity  
(SQ) per  
unit.

Cost	Quantity (Pounds)
Required materials per unit	25
Waste and spoilage	3
Direct materials standard quantity (SQ)	<u>28</u>

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## Determining direct labor standards

*Direct labor* is the cost of paying your employees to make products. Proper planning requires setting standards with respect to two factors: the direct labor standard rate and the direct labor standard hours per unit.

To compute the *direct labor standard rate* or SR (the cost of direct labor), consider all the costs required for a single hour of direct labor. For example, suppose Band Book usually pays employees \$9 per hour. Furthermore, it pays an additional \$1 per hour for payroll taxes and, on average, \$2 per hour for fringe benefits. As shown in Figure 4-3, the direct labor standard rate equals \$12 per hour.

**Figure 4-3:**  
Computing  
the direct  
labor  
standard  
rate (SR).

Cost	Per Hour
Average hourly wage	\$9.00
Payroll taxes	1.00
Fringe benefits	2.00
Direct labor standard rate (SR)	<u>\$12.00</u>

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You also need to estimate the amount of direct labor time needed to make a single unit, the *direct labor standard hours* (SH) per unit. This measurement estimates how long employees take, on average, to produce a single unit. Include in this rate the time needed for employee breaks, cleanups, and setups.

For example, employees at Band Book Company need three hours to produce a single case of books, plus an average of 30 minutes of setup time and 30 minutes of break time. Therefore, the direct materials standard quantity equals four hours, as shown in Figure 4-4.

**Figure 4-4:**  
Computing  
direct labor  
standard  
hours (SH).

Cost	Hours
Average production time	3.00
Break time	0.50
Setup time	0.50
Direct labor standard hours (SH)	<u>4.00</u>

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## Calculating the overhead rate

Standard costs also need to account for *overhead* (the miscellaneous costs of running a business) in addition to direct materials and direct labor. Overhead is much more difficult to measure than direct materials or direct labor standards because overhead consists of indirect materials, indirect labor, and other costs not easily traced to units produced. Therefore, measuring how much overhead should be applied to different units produced is very challenging. To assign overhead costs to individual units, you need to compute an *overhead allocation rate*.

Remember that overhead allocation entails three steps:

### 1. Add up total overhead.

Add up estimated indirect materials, indirect labor, and all other product costs not included in direct materials and direct labor. This amount includes both fixed and variable overhead.

For example, assume that total overhead for Band Book Company is estimated to cost \$100,000.

### 2. Compute the overhead allocation rate.

The allocation rate calculation requires an activity level. You choose an activity that closely relates to the cost incurred. The most common activity levels used are direct labor hours or machine hours. Divide total overhead (calculated in Step 1) by the number of direct labor hours.

Assume that Band Book plans to utilize 4,000 direct labor hours:

$$\begin{aligned}\text{Overhead allocation rate} &= \text{Total overhead} \div \text{Total direct labor hours} \\ &= \$100,000 \div 4,000 \text{ hours} = \$25.00\end{aligned}$$

Therefore, for every hour of direct labor needed to make books, Band Book applies \$25 worth of overhead to the product.

### 3. Apply overhead.

Multiply the overhead allocation rate by the number of direct labor hours needed to make each product.

Suppose a department at Band Book actually worked 20 hours on a product. Apply 20 hours  $\times$  \$25 = \$500 worth of overhead to this product.

## Adding up standard cost per unit

To find the standard cost, you first compute the cost of direct materials, direct labor, and overhead per unit, as explained in the previous sections. Then you add up these amounts.

Figure 4-5 applies this approach to Band Book Company. To calculate the standard cost of direct materials, multiply the direct materials standard price of \$10.35 by the direct materials standard quantity of 28 pounds per unit. The result is a direct materials standard cost of \$289.80 per case. To compute direct labor standard cost per unit, multiply the direct labor standard rate of \$12 per unit by the direct labor standard hours per unit of 4 hours. The standard cost per unit is \$48 for direct labor. Now multiply the overhead allocation rate of \$10 per hour by the direct labor standard hours of 4 hours per unit to come to a standard cost of overhead per unit of \$40.

Figure 4-5: Summing up standard cost per unit.	Type of Cost	Price or Rate	X	Quantity or Hours	=	Standard Cost
	Direct materials	\$10.35	X	28 lbs.	=	\$289.80
	Direct labor	\$12.00	X	4 hours	=	48.00
	Overhead	\$10.00	X	4 hours	=	40.00
						\$377.80

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Add together direct materials, direct labor, and overhead to arrive at the standard cost per unit of  $\$289.80 + \$48 + \$40 = \$377.80$ . Making a single case of books costs Band Book \$377.80.

## Understanding Variances

A *variance* is the difference between the actual cost and the standard cost that you expected to pay. (Standard costs are covered earlier in this chapter.) When actual cost exceeds the standard, then the resulting variance is considered *unfavorable* because it reduces net income. On the other hand, when actual costs come in under standard costs, then the resulting variance is considered *favorable* because it increases net income.

Variances can arise from direct materials, direct labor, and overhead. In fact, the variances arising from each of these three areas, when added together, should equal the total variance:

$$\begin{aligned} \text{Total variance} &= \text{Direct materials variance} + \text{Direct labor variance} \\ &\quad + \text{Overhead variance} \end{aligned}$$



In turn, you can further break down direct materials and direct labor variances into additional price and quantity variances to understand how changes in materials prices, materials quantities used, direct labor rates, and direct labor hours affect overall profitability.



Generally, you incur a variance for one of two reasons: Either you *used* more or less than you planned (a quantity variance), or you *paid* more or less than you planned (a price or rate variance).

## *Computing direct materials variances*

A direct materials variance results from one of two conditions: differences in the prices paid for materials or discrepancies in the quantities used in production. To find these variances, you can use formulas or a simple diagram approach.

### *Using formulas to calculate direct materials variances*

The total direct materials variance is comprised of two components: the direct materials price variance and the direct materials quantity variance.

To compute the direct materials price variance, take the difference between the standard price (SP) and the actual price (AP), and then multiply that result by the actual quantity (AQ):

$$\text{Direct materials price variance} = (\text{SP} - \text{AP}) \times \text{AQ}$$

To get the direct materials quantity variance, multiply the standard price by the difference between the standard quantity (SQ) and the actual quantity:

$$\text{Direct materials quantity variance} = \text{SP} \times (\text{SQ} - \text{AQ})$$

The total direct materials variance equals the difference between total actual cost of materials (AP  $\times$  AQ) and the budgeted cost of materials, based on standard costs (SP  $\times$  SQ):

$$\text{Total direct materials variance} = (\text{SP} \times \text{SQ}) - (\text{AP} \times \text{AQ})$$

Consider the Band Book Company example described in “Setting Up Standard Costs” earlier in the chapter. Band Book’s standard price is \$10.35 per pound. The standard quantity per unit is 28 pounds of paper

per case. This year, Band Book made 1,000 cases of books, so the company should have used 28,000 pounds of paper, the total standard quantity (1,000 cases  $\times$  28 pounds per case). However, the company purchased 30,000 pounds of paper (the actual quantity), paying \$9.90 per case (the actual price).

Based on the given formula, the direct materials price variance comes to a positive \$13,500, a favorable variance:

$$\begin{aligned}\text{Direct materials price variance} &= (\text{SP} - \text{AP}) \times \text{AQ} = (\$10.35 - \$9.90) \times 30,000 \\ &= \$13,500 \text{ favorable}\end{aligned}$$

This variance means that savings in direct materials prices cut the company's costs by \$13,500.

The direct materials quantity variance focuses on the difference between the standard quantity and the actual quantity, arriving at a negative \$20,700, an unfavorable variance:

$$\begin{aligned}\text{Direct materials quantity variance} &= \text{SP} \times (\text{SQ} - \text{AQ}) \\ &= \$10.35 \times (28,000 - 30,000) = -\$20,700 \text{ unfavorable}\end{aligned}$$

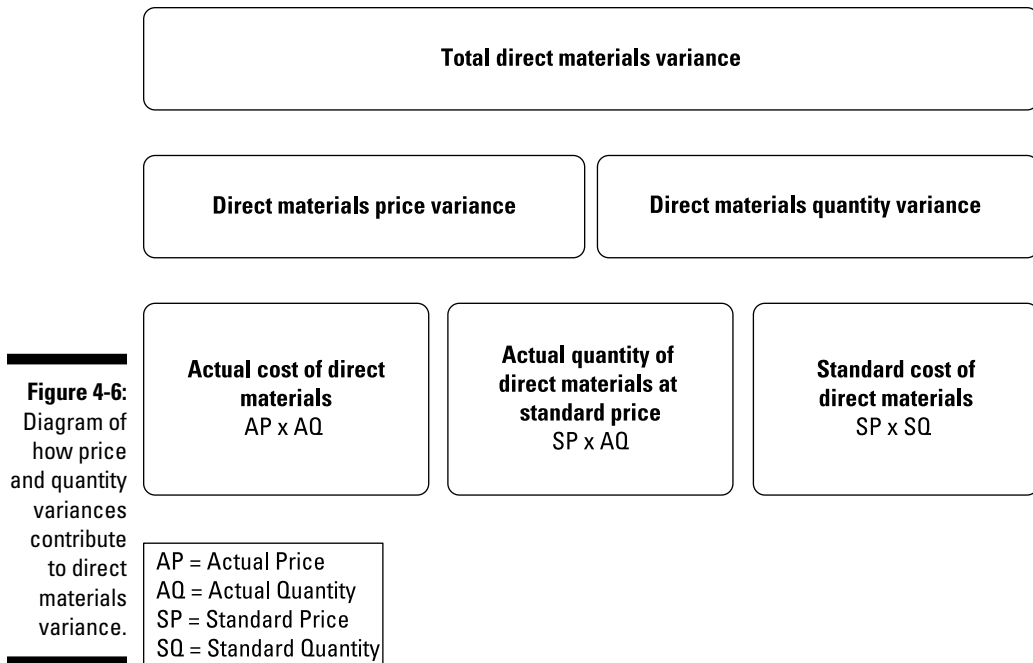
This result means that the 2,000 additional pounds of paper used by the company increased total costs \$20,700. Now, you can plug both parts in to find the total direct materials variance. (You could just plug in the final results, but I show you the longer math here.) Compute the total direct materials variance as follows:

$$\begin{aligned}\text{Total direct materials variance} &= (\text{SP} \times \text{SQ}) - (\text{AP} \times \text{AQ}) = (\$10.35 \times 28,000) \\ &\quad - (\$9.90 \times 30,000) = \$289,800 - \$297,000 = -7,200 \text{ unfavorable}\end{aligned}$$

### ***Diagramming direct materials variances***

Figure 4-6 provides an easier way to compute price and quantity variances. To use this diagram approach, just compute the totals in the third row: actual cost, actual quantity at standard price, and the standard cost. The actual cost less the actual quantity at standard price equals the direct materials price variance. The difference between the actual quantity at standard price and the standard cost is the direct materials quantity variance. The total of both variances equals the total direct materials variance.

To apply this method to the Band Book example, take a look at Figure 4-7. Start at the bottom. Direct materials actually cost \$297,000, even though the standard cost of the direct materials is only \$289,800. The actual quantity of direct materials at standard price equals \$310,500.



**Figure 4-6:** Diagram of how price and quantity variances contribute to direct materials variance.

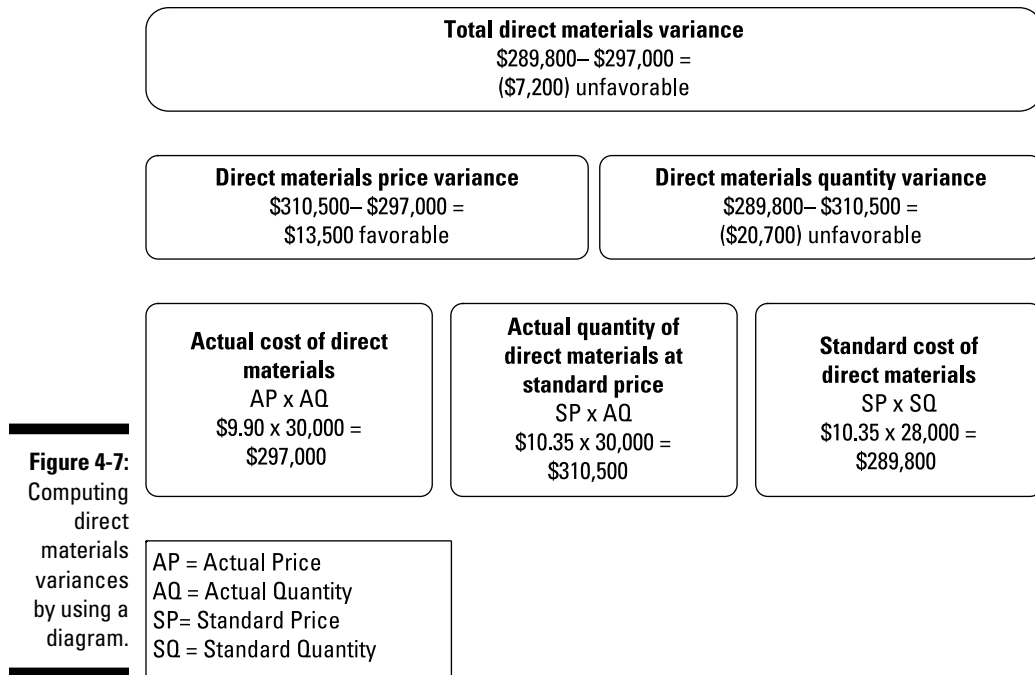
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To compute the direct materials price variance, subtract the actual cost of direct materials (\$297,000) from the actual quantity of direct materials at standard price (\$310,500). This difference comes to a \$13,500 favorable variance, meaning that the company saves \$13,500 by buying direct materials for \$9.90 rather than the original standard price of \$10.35.

To compute the direct materials quantity variance, subtract the actual quantity of direct materials at standard price (\$310,500) from the standard cost of direct materials (\$289,800), resulting in an unfavorable direct materials quantity variance of \$20,700. Because the company uses 30,000 pounds of paper rather than the 28,000-pound standard, it loses an additional \$20,700.

This setup explains the unfavorable total direct materials variance of \$7,200 — the company gains \$13,500 by paying less for direct materials, but loses \$20,700 by using more direct materials.



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## Calculating direct labor variances

A direct labor variance is caused by differences in either wage rates or hours worked. As with direct materials variances, you can use either formulas or a diagram to compute direct labor variances.

### Utilizing formulas to figure out direct labor variances

To estimate how the combination of wages and hours affects total costs, compute the total direct labor variance. As with direct materials, the price and quantity variances add up to the total direct labor variance. To compute the direct labor price variance (also known as the *direct labor rate variance*), take the difference between the standard rate (SR) and the actual rate (AR), and then multiply the result by the actual hours worked (AH):

$$\text{Direct labor price variance} = (SR - AR) \times AH$$

To get the direct labor quantity variance (also known as the *direct labor efficiency variance*), multiply the standard rate (SR) by the difference between total standard hours (SH) and the actual hours worked (AH):

$$\text{Direct labor quantity variance} = SR \times (SH - AH)$$

The direct labor variance equals the difference between the total budgeted cost of labor ( $SR \times SH$ ) and the actual cost of labor, based on actual hours worked ( $AR \times AH$ ):

$$\text{Total direct labor variance} = (SR \times SH) - (AR \times AH)$$

Now you can plug in the numbers for the Band Book Company example from earlier in the chapter. Band Book's direct labor standard rate (SR) is \$12 per hour. The standard hours (SH) come to 4 hours per case. Because Band made 1,000 cases of books this year, employees should have worked 4,000 hours (1,000 cases  $\times$  4 hours per case). However, employees actually worked 3,600 hours, for which they were paid an average of \$13 per hour.

With these numbers in hand, you can apply the formula to compute the direct labor price variance:

$$\begin{aligned} \text{Direct labor price variance} &= (SR - AR) \times AH = (\$12.00 - \$13.00) \times 3,600 \\ &= -\$1.00 \times 3,600 = -\$3,600 \text{ unfavorable} \end{aligned}$$

According to the direct labor price variance, the increase in average wages from \$12 to \$13 causes costs to increase by \$3,600. Now plug the numbers into the formula for the direct labor quantity variance:

$$\begin{aligned} \text{Direct labor quantity variance} &= SR \times (SH - AH) = \$12.00 \times (4,000 - 3,600) \\ &= \$12.00 \times 400 = \$4,800 \text{ favorable} \end{aligned}$$

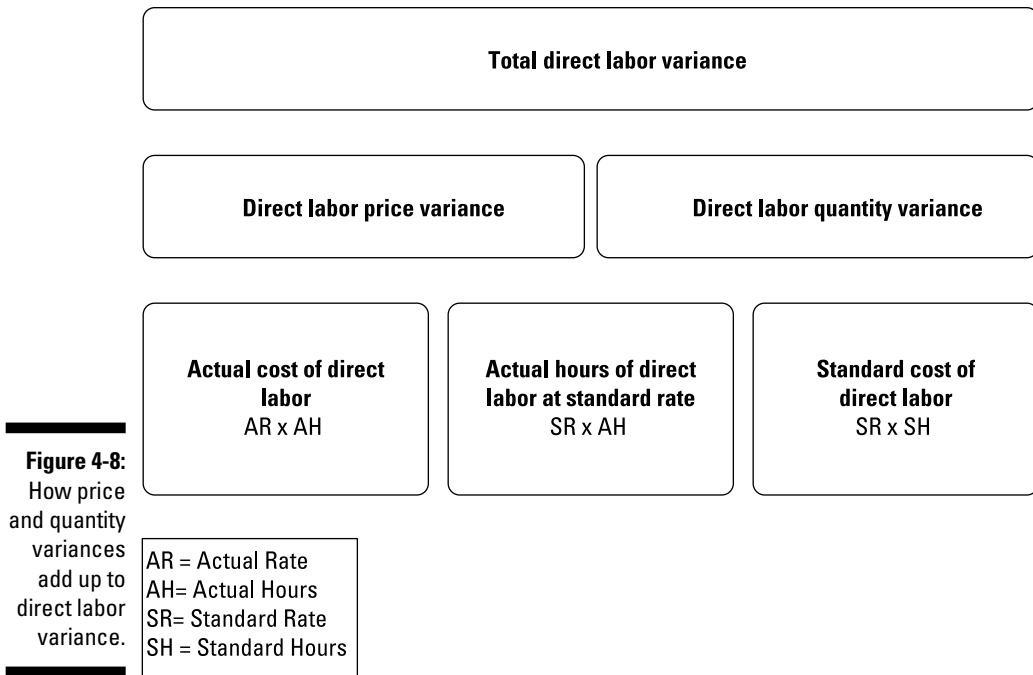
Employees worked fewer hours than expected to produce the same amount of output. This change saves the company \$4,800 — a favorable variance. To compute the total direct labor variance, use the following formula:

$$\begin{aligned} \text{Total direct labor variance} &= (SR \times SH) - (AR \times AH) = (\$12.00 \times 4,000) \\ &\quad - (\$13.00 \times 3,600) = \$48,000 - \$46,800 = \$1,200 \text{ favorable} \end{aligned}$$

According to the total direct labor variance, direct labor costs were \$1,200 lower than expected, a favorable variance.

### ***Employing diagrams to work out direct labor variances***

Figure 4-8 shows you how to use a diagram to compute price and quantity variances quickly and easily. First, compute the totals in the third row: actual cost, actual hours at standard rate, and the standard cost. To get the direct labor price variance, subtract the actual cost from the actual hours at standard. The difference between the standard cost of direct labor and the actual hours of direct labor at standard rate equals the direct labor quantity variance. The total of both variances equals the total direct labor variance.



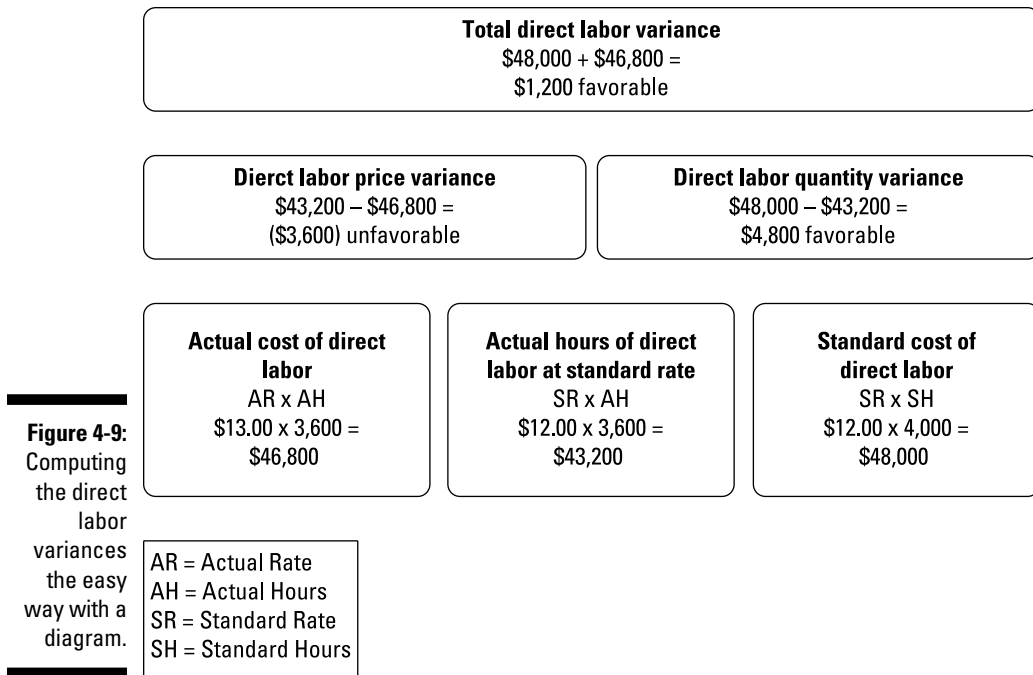
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Take a look at Figure 4-9 to see this diagram in action for Band Book: Starting from the bottom, the actual cost of direct labor amounts to \$46,800. The actual hours of direct labor at standard rate equals \$43,200. The standard cost of direct labors comes to \$48,000.

To compute the direct labor price variance, subtract the actual hours of direct labor at standard rate (\$43,200) from the actual cost of direct labor (\$46,800) to get a \$3,600 unfavorable variance. This result means the company incurs an additional \$3,600 in expense by paying its employees an average of \$13 per hour rather than \$12.

To compute the direct labor quantity variance, subtract the standard cost of direct labor (\$48,000) from the actual hours of direct labor at standard rate (\$43,200). This math results in a favorable variance of \$4,800, indicating that the company saves \$4,800 in expenses because its employees work 400 fewer hours than expected.

The \$1,200 favorable variance arises because of two factors: the company saves \$4,800 from fewer hours worked but incurs an additional \$3,600 expense by paying its employees more money per hour than planned. This scenario begs the question “Are higher-paid workers more productive?” But that’s a discussion for the human resources experts.



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## Computing overhead variances

Whenever you see direct labor and direct materials, overhead can't be far behind. To compute overhead applied, multiply the overhead application rate by the standard number of hours allowed:

$$\text{Overhead applied} = \text{Overhead application rate} \times \text{SH}$$

So you can determine overhead variance by subtracting actual overhead from applied overhead:

$$\text{Overhead variance} = \text{Overhead applied} - \text{Actual overhead}$$

Band Book Company incurs actual overhead costs of \$95,000. The company's overhead application rate is \$25 per hour. (You can find the math for that calculation in the earlier section "Calculating the overhead rate.") In that prior section, you use direct labor hours as the activity level for applying overhead. In order for Band Book's workers to produce 1,000 cases, you can expect them to work standard hours of 4 direct labor hours per case.

SH equals 1,000 cases produced  $\times$  4 direct labor hours per case, or 4,000 direct labor hours. This amount results in overhead applied of \$100,000:

$$\begin{aligned}\text{Overhead applied} &= \text{Overhead application rate} \times \text{SH} = \$25.00 \times 4,000 \\ &= \$100,000\end{aligned}$$

To compute the variance, subtract actual overhead from the overhead applied:

$$\begin{aligned}\text{Overhead variance} &= \text{Overhead applied} - \text{Actual overhead} \\ &= \$100,000 - \$95,000 = \$5,000\end{aligned}$$

Because actual overhead is less than overhead applied, the \$5,000 variance is favorable.

Spending too much or too little on overhead — or using overhead inefficiently — often causes overhead variance.

Like direct labor and direct materials, overhead, too, can have price and quantity variables. However, fixed and variable cost behaviors considerably complicate the calculation of overhead variances. These complexities are outside the scope of this book.

## *Looking past the favorable/ unfavorable label*



The *unfavorable* and *favorable* labels describe variances only in terms of how they affect income; favorable variances aren't necessarily always good, and unfavorable variances aren't necessarily always bad. For example, a favorable variance may result because a company purchases cheaper direct materials of poorer quality. These materials lower costs, but they also hurt the quality of finished goods, damaging the company's reputation with customers. This kind of favorable variance can work against a company. On the other hand, an unfavorable variance may occur because a department chooses to scrap poor-quality goods. In the long run, the company benefits from incurring a short-term unfavorable variance to provide better-quality goods to its customers.



## Teasing Out Variances

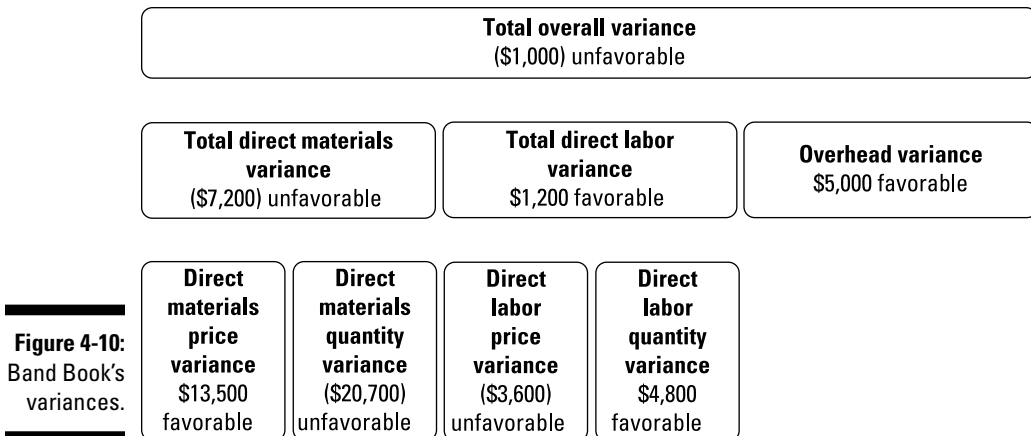
In your business, variance analysis helps you identify problem areas that require attention, such as

- ✓ Poor productivity
- ✓ Poor quality
- ✓ Excessive costs
- ✓ Excessive spoilage or waste of materials

Identifying and working on these problems helps managers improve production flow and profitability. Managers and accountants often talk about *management by exception* — using variance analysis to identify *exceptions*, or problems, where actual results significantly vary from standards. By paying careful attention to these exceptions, managers can root out and rectify manufacturing problems and inefficiencies, thereby improving productivity, efficiency, and quality.

## Interpreting variances in action

The previous sections in this chapter lay out what happens to the costs of the Band Book Company over the course of a year. Figure 4-10 summarizes Band Book’s variances.



**Figure 4-10:**  
Band Book’s  
variances.

A complete analysis of Band Book's variances provides an interesting story to explain why the company has a \$1,000 unfavorable variance. The following events transpire:

- ✔ The company pays less than expected for direct materials, leading to a favorable \$13,500 direct materials price variance.
- ✔ Perhaps because of the cheaper, lower-quality direct materials, the company uses an excessive amount of direct materials. This overage results in a \$20,700 unfavorable direct materials quantity variance.
- ✔ The company pays its employees a higher wage rate, resulting in an unfavorable direct labor price variance of \$3,600.
- ✔ The company saves money because employees work fewer hours than expected, perhaps because they're more productive, higher-paid workers. The favorable direct labor quantity variance is \$4,800.
- ✔ The company saves \$5,000 in reduced overhead costs.

### *Focusing on the big numbers*

Management by exception directs managers to closely investigate the largest variances. For example, the two largest variances in Figure 4-10 are the direct materials quantity variance (\$20,700 unfavorable) and the direct materials price variance (\$13,500 favorable). Band Book's managers should focus on how the company buys and uses its direct materials.

Here, the direct materials quantity variance resulted because the company should have used 28,000 pounds of paper but actually used 30,000 pounds of paper. Why? Here are a few possibilities:

- ✔ The paper was poor quality, and much of it needed to be scrapped.
- ✔ The company underestimated the amount of paper needed (the standard quantity needs to be changed).
- ✔ Someone miscounted the amount of paper used; 2,000 pounds of paper are sitting in the back of the warehouse (oops).
- ✔ A new employee misused the machine, shredding several thousand pounds of paper.

Management by exception directs managers to where the problem may have occurred so that they can investigate what happened and take corrective action.

Now take a look at the favorable direct materials price variance of \$13,500. How did the purchasing department come to purchase direct materials for only \$9.90 a pound, rather than the \$10.35 standard? Did the purchased materials meet all of the company's quality standards? Should the company reduce its standard price in the future?



Consider setting *control limits* to determine which items are sufficiently large to investigate. A variance exceeding its control limit takes priority over less significant variances.

## Tracing little numbers back to big problems



Be careful! Don't focus exclusively on the big numbers and ignore the little numbers. Big problems can also hide in the small numbers. For example, although many frauds (such as stealing raw materials) may trigger large variances, a well-planned fraud may be designed to manipulate variances so that they stay low, below the radar, where managers won't notice them.

For example, knowing the standard price of a raw material is \$100 per unit, a crooked purchasing manager may arrange to purchase the units for exactly that price — \$100 per unit — while receiving \$10 per unit as a kick-back gratuity from the supplier. This scheme results in a direct materials price variance of zero, but it doesn't reflect what should be the company's actual cost of doing business. A more scrupulous purchasing manager would have arranged a purchase price of \$90, resulting in a large positive direct materials price variance.



To avoid these problems, managers should still investigate all variances, even while focusing most of their time on the largest figures.



## Chapter 5

# Making Smart Pricing Decisions

### *In This Chapter*

- ▶ Understanding the importance of product differentiation
- ▶ Addressing absorption costing
- ▶ Using cost-plus pricing
- ▶ Taking risks with variable-cost pricing
- ▶ Aiming for target costing

**H**ave you ever seen the game show *The Price Is Right*? The host challenges contestants to guess the prices of different merchandise. Guessing the right price can win you cash and all sorts of valuable prizes. Even if you get the price wrong, you still walk away with your novelty nametag and maybe a chance to spin a giant wheel.

The stakes get a lot higher when you're naming prices in the real business world. Prices that are too high scare away customers. Too low, and losses may wipe out your business. Prices must be low enough to lure customers but high enough to cover your costs and help you earn a profit. Therefore, before setting a price, you must understand both market forces and the cost structure of your business.

This chapter explains how to use your knowledge of cost behavior to make savvy pricing decisions.

## *Differentiating Products*

*Product differentiation* allows consumers to see differences among different companies' products, which makes them willing to spend more money for some brands than for others. Hence, a company that successfully differentiates its products can charge a higher price than its competitors, making it a *price maker*. Companies that don't differentiate their products need to use low prices to get a leg up on the competition. Marketers call these companies *price takers*.

Customers usually have trouble seeing any difference among the products offered by different mainstream supermarkets. Therefore, all supermarkets — price takers — need to price their products competitively in line with each other. On the other hand, premium supermarkets such as Whole Foods have done a brilliant job of differentiating themselves from competitors, so much so that customers often pay significantly more money to shop there. Whole Foods is a price maker.



Regardless of how well a company differentiates its products, its prices must take into account both market forces and the company's own cost behavior.

## *Taking All Costs into Account with Absorption Costing*

*Absorption costing* (sometimes also called *full costing*) is the predominant method for costing goods that companies manufacture and sell. Generally accepted accounting principles (GAAP) require all U.S. companies to use absorption costing in their financial statements. International accounting standards have similar requirements worldwide.

Absorption costs include all *product costs* — the costs of making products. Product costs include a variable component that increases and decreases with volume and a fixed component that doesn't change regardless of how much or how little you produce.

The costs of *direct materials*, raw materials that you can directly trace to the manufactured product, are variable. After all, the more units you make, the more direct materials you need to make them. The same goes for *direct labor*, the cost of paying employees to make your products.

*Overhead* costs, such as the miscellaneous costs of running a factory, usually consist of a mixture of fixed and variable costs. Absorption costing requires you to spread out the fixed costs over all units produced. (Flip to Chapter 4 for details on direct and overhead costs.)

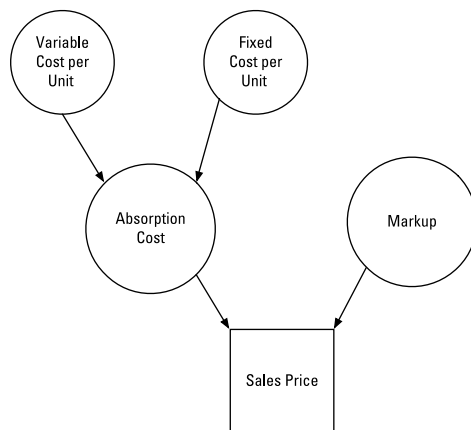
Suppose your factory makes T-shirts. Each T-shirt requires \$8 worth of variable costs (direct materials, direct labor, and variable overhead), and your factory pays \$100,000 for fixed costs each year for rent and utilities. This year, you plan to make 50,000 T-shirts. How much will each T-shirt cost?

According to absorption costing, the cost of a T-shirt includes both variable and fixed components. You know that the variable component per shirt is \$8.

The fixed component of \$100,000 applies to all the shirts, however, so you need to spread it out among them. Divide the total fixed costs of \$100,000 by the number of units you plan to produce (50,000) to get a fixed cost per unit of \$2. Therefore, each T-shirt includes \$8 worth of variable costs and \$2 worth of fixed costs, resulting in total cost per unit of \$10.

## Pricing at Cost-Plus

Many retailers and manufacturers set their prices at *cost-plus* by adding a fixed markup to their absorption cost. Cost-plus pricing ensures that prices are high enough to meet profit goals. Figure 5-1 illustrates how cost-plus pricing computes the sales price by adding markup to a product's fixed and variable costs.



**Figure 5-1:**  
Cost-plus pricing includes absorption cost of the product plus a markup.

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## Computing fixed markups

To figure out the markup for cost-plus pricing, divide total desired profit by the number of units produced.

For example, suppose that Saint Company wants to earn \$100,000 on the production of 100 Model 51 Robots:

$$\text{Desired profit} \div \text{Units produced} = \text{Markup} = \$100,000 \div 100 = \$1,000$$

Dividing the desired profit by units produced results in a planned markup of \$1,000 per unit. To set the price, add this planned markup to the cost. Assume that Saint's cost to produce each robot is \$4,000:

$$\text{Cost} + \text{Markup} = \text{Sales price} = \$4,000 + \$1,000 = \$5,000$$

If Saint Company wants to earn a total of \$100,000, it should set the price at \$5,000 per unit.

## *Setting a cost-plus percentage*

Because companies often sell many different products at different prices, they commonly use a *cost-plus percentage* or *percentage markup on cost* that applies to all their products. To figure this percentage, you divide the markup, in dollars, by the total product cost. Then, to determine the products' sales prices, you apply this percentage to all products, or to different categories of products.

For example, Saint Company's Model 51 Robot has a \$1,000 markup on a cost of \$5,000.

$$\text{Markup} \div \text{Product cost} = \$1,000 \div \$4,000 = 0.25 \text{ or } 25\%$$

Here, Saint earns a 25-percent cost-plus percentage. The company can then apply the same cost-plus percentage to set the prices of other products. For example, another robot, Model 6, costs Saint Company \$6,000 to produce. The markup on this robot amounts to  $\$6,000 \times 0.25$  percent = \$1,500, pricing it at  $\$6,000 + \$1,500 = \$7,500$ .

## *Considering problems with cost-plus pricing*

Cost-plus pricing works because it's easy to use. However, it carries a few drawbacks. First, it ignores market factors. Just because you like to mark up your merchandise 20 percent doesn't necessarily mean your customers are willing to pay this price or that your competitors will cooperate with you by setting their prices even higher.

Second, because cost-plus pricing relies on absorption costing, it treats fixed costs as though they were variable. Saint Company wants to sell 100 Model 51 Robots, which means it can distribute its fixed costs over 100 units.



However, the fixed costs remain the same regardless of how many units Saint actually sells; if the company sells only 50 robots, the fixed costs are spread over fewer units (50 robots rather than 100), and the cost per unit rises. Check out Figure 5-2. If production drops to 50 robots, then the cost per unit increases to \$6,000 per unit. This change puts Saint into a tight bind. Figure 5-2 shows how this miscalculation causes Saint's profits to vaporize into a \$50,000 loss.

	The Plan	What Actually Happened
Number of units sold	100	50
Sales price	\$5,000	\$5,000
Cost per unit	4,000	6,000
Total sales	500,000	250,000
Cost of sales	400,000	300,000
Gross profit (loss)	100,000	(50,000)

**Figure 5-2:**  
Cost-plus  
pricing gone  
wild.

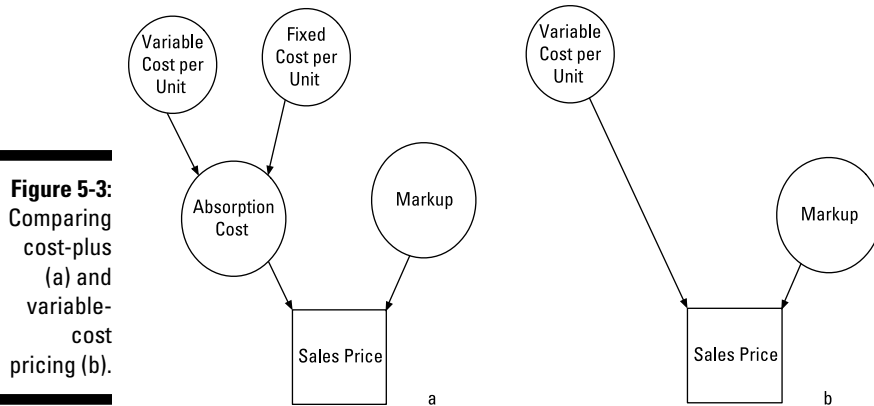
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Look on the bright side: If your sales volume is higher than you expected, then spreading fixed costs will have a disproportionately *positive* effect on income — delivering profits way beyond your wildest dreams. That's because you'll spread the fixed costs over more units, which lowers the total cost per unit sold.

## Extreme Accounting: Trying Variable-Cost Pricing

Variable-cost pricing offers an adventurous variation on cost-plus pricing (refer to the earlier section “Pricing at Cost-Plus”). Instead of adding a markup on total cost, *variable-cost pricing* adds a markup on just the variable cost. It disregards fixed costs altogether. Figure 5-3 compares variable-cost pricing with boring old cost-plus pricing. The following sections show you how variable-cost pricing works and point out the drawbacks of using this system.



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## Working out variable-cost pricing

When you use variable-cost pricing, your markup must cover both the desired profit and the expected fixed costs. Therefore, to figure out your markup, divide the total desired profit plus expected fixed costs by the number of units produced.

Suppose that Sparl Industries makes the Red Rover model. The entire production run of Red Rover requires \$900,000 worth of fixed costs. Each unit costs another \$90,000 in variable costs. Sparl wants to earn \$400,000 in profit on the production and sale of 20 units of this model.

First, figure out how much markup you need on each unit to cover both the desired profit and the fixed costs:

$$\begin{aligned} (\text{Desired profit} + \text{Fixed costs}) \div \text{Units produced} &= \text{Markup} \\ = (\$400,000 + \$900,000) \div 20 &= (\$1,300,000) \div 20 = \$65,000 \end{aligned}$$

The markup is \$65,000 per unit. Now set the price at this planned markup plus the variable cost:

$$\text{Variable cost} + \text{Markup} = \$90,000 + \$65,000 = \$155,000$$

According to this analysis, if Sparl Industries wants to earn \$400,000 in profit and cover \$900,000 worth of fixed costs by selling 20 units, it should set the sales price at \$155,000.

## *Spotting the hazards of variable-cost pricing*

Variable-cost pricing is especially useful for companies pricing special orders when they have excess capacity, meaning they have sufficient resources to produce more goods. However, when operating at full capacity, variable-cost pricing may be hazardous to the health of your business.

Suppose that you operate a hotel with vacant rooms. Each room has a variable cost of \$10/night, and a fixed cost of \$90/night. Cost-plus pricing requires you to base your price on a total cost of \$100/night. However, variable-cost pricing allows you to base your price on a variable cost of just \$10/night.

If your hotel has vacancies (read: excess capacity) and a customer walks in without a reservation, offering to pay \$52 for a room for the night, variable-cost pricing indicates you should take the guy in. After all, \$52 exceeds the variable cost of \$10, increasing your profits by \$42. (Cost-plus pricing tells you to refuse the offer. Each room costs \$100/night. Why would you willingly lose \$48?) But if your hotel is completely booked, the only way to house the \$52 customer would be to turn away a full-price-paying customer, reducing revenue.

Variable-cost pricing poses another severe danger: To earn a profit, your sales must exceed costs. Because variable-cost pricing doesn't fully account for fixed costs, it can trick managers into setting prices so low that they hurt profits, or worse yet, cause net losses. As explained in the preceding example, occasionally selling a room for \$52 may increase your profits. However, selling too many rooms at such low prices (even if you're never at full capacity) causes you to lose a lot of money.

## *Bull's-Eye: Hitting Your Target Cost*

Many industries use *price points* — special “magic” price levels that customers expect to pay. You've probably seen these prices in the store: \$99.99, \$26.99, \$19.95, and so on. Understanding customer expectations and competitor pricing, manufacturers design products specifically so that the products can be produced and sold at the magic price points.

Although traditionally you first design the product and then set the price, target costing requires you to set the price before you design the product. After you know the price, you can engineer the product so that its cost is

low enough to ensure that you earn the expected profit margin. Done right, target costing avoids problems caused by products that are priced too high for consumers or are too expensive to make. It engineers the price, the profit margin, and the cost right into the product.

## Calculating your target cost

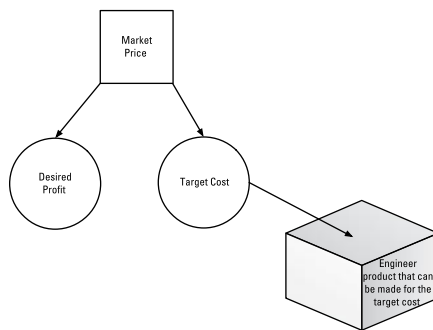
With target costing, the company starts with market price and markup and uses that information to figure out the product's cost and specifications. (In contrast, cost-plus pricing starts with the product cost and desired profit and uses that information to set the price. You can read about cost-plus pricing earlier in the chapter.)

To figure out the target cost, subtract the desired profit from the market price:

$$\text{Market price} - \text{Desired profit} = \text{Target cost}$$

Figure 5-4 illustrates how this process works.

**Figure 5-4:**  
In target costing, the market price determines the product's cost.



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For example, suppose you head to a big-box store to buy a new desktop computer, and you're determined to pay no more than \$750 plus tax. You discover four different desktop models, priced at \$599.99, \$749.99, \$999.99, and \$1,299.99. You take the \$749.99 model, because you want the best computer you can get for \$750 or less.

Assume that the store sets prices so that gross profit equals 10.51 percent of the company's sales price. An inventory item that sells for \$100 typically includes gross profit worth  $\$100 \times 0.1051 = \$10.51$ , costing the company  $\$100.00 - \$10.51 = \$89.49$ . Gross profit is defined as sales less cost of sales. Check out Chapter 3 for more detail.

The company's desired profit on your computer model equals  $\$749.99 \times 0.1051 = \$78.82$ . Plug it into the formula:

$$\text{Market price} - \text{Desired profit} = \$749.99 - \$78.82 = \$671.17$$

The math indicates that the store should pay \$671.17 for computers that it can sell for \$749.99.

Target costing works both for retailers (like that big-box store) and for manufacturers (such as the maker of your new computer). Therefore, after the store determines that it's willing to pay \$671.17 for these computers, the maker needs to figure out how to make computers with all the right bells and whistles that it can sell for \$671.17.

The computer maker works to earn a 22.7-percent profit margin on sales. Therefore, the company's desired profit equals  $\$671.17 \times 22.7 \text{ percent} = \$152.36$ :

$$\text{Market price} - \text{Desired profit} = \$671.17 - \$152.36 = \$518.81$$

After subtracting desired profit of \$152.36 from its expected sales price of \$671.17, the computer maker works out that it needs to engineer and produce computers that cost \$518.81. Armed with this knowledge, the engineers pick and choose various specifications and features to cook up a computer that costs exactly this amount.

## *Knowing when to use target costing*



Target costing works especially well for companies whose products aren't well differentiated (such as electronic accessories and economy automobiles), where price is often a key consideration for customers selecting which brand to buy. This technique ensures that the company can sell a competitive product with all the features — and the price — that customers expect.

