3 Break-Even and Target Income

CVP analysis is imperative for management. It is used to build an understanding of the relationship between costs, business volume, and profitability. The analysis focuses on the interplay of pricing, volume, variable and fixed costs, and product mix. This analysis will drive decisions about what products to offer, how to price them, and how to manage an organization's cost structure. CVP is at the heart of techniques that are useful for calculating the break-even point, volume levels necessary to achieve targeted income levels, and similar computations. The starting point for these calculations is to consider the contribution margin.

3.1 Contribution Margin

The contribution margin is revenues minus variable expenses. Do not confuse the contribution margin with gross profit as discussed in the previous chapter (revenues minus cost of sales). Gross profit would be calculated after deducting all manufacturing costs associated with sold units, whether fixed or variable. Instead, the contribution margin is a conceptual number reflecting the amount available from each sale, after deducting all variable costs associated with the units sold. Some of these variable costs are product costs, and some are selling and administrative in nature. The contribution margin is generally a number calculated for internal use and analysis; it does not ordinarily become a part of the externally reported data set.

3.2 Contribution Margin: Aggregated, per Unit, or Ratio?

When speaking of the contribution margin, one might be referring to aggregated data, per unit data, or ratios. This point is illustrated below for Leyland Sports, a manufacturer of score board signs. The production cost is $500 per sign, and Leyland pays its sales representatives $300 per sign sold. Thus, variable costs are $800 per sign. Each sign sells for $2,000. Leyland's contribution margin is $1,200 ($2,000 – ($500 + $300)) per sign. In addition, assume that Leyland incurs $1,200,000 of fixed costs, regardless of the level of activity. Below is a schedule with contribution margin information, assuming 1,000 units are produced and sold:

	Total	Per Unit	Ratio
Sales (1,000 X $2,000)	$2,000,000	$2,000	100%
Variable costs (1,000 X $800)	800,000	800	40%
Contribution margin	$1,200,000	$1,200	60%
Fixed costs	1,200,000		
Net income	-		

What would happen if Leyland sold 2,000 units?

	Total	Per Unit	Ratio
Sales (2,000 X $2,000)	$4,000,000	$2,000	100%
Variable costs (2,000 X $800)	1,600,000	800	40%
Contribution margin	$2,400,000	$1,200	60%
Fixed costs	1,200,000		
Net income	$1,200,000		

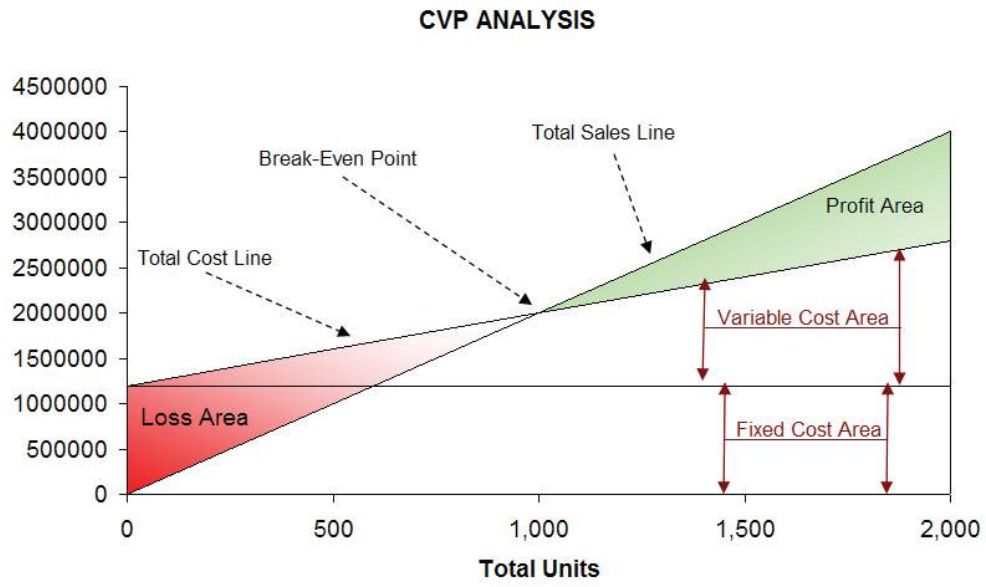
What would happen if Leyland sold only 500 units?

	Total	Per Unit	Ratio
Sales (500 X $2,000)	$1,000,000	$2,000	100%
Variable costs (500 X $800)	400,000	800	40%
Contribution margin	$ 600,000	$1,200	60%
Fixed costs	1,200,000		
Net income	$ (600,000)		

Notice that changes in volume only impact certain amounts within the "total column." Volume changes did not impact fixed costs, or change the per unit or ratio calculations. By reviewing the data on the previous page, also note that 1,000 units achieved breakeven net income. At 2,000 units, Leyland managed to achieve a $1,200,000 net income. Conversely, 500 units resulted in a $600,000 loss.

3.3 Graphic Presentation

Leyland's management would probably find the following chart very handy. Dollars are represented on the vertical axis and units on the horizontal:



Be sure to examine this chart, taking note of the following items: The total sales line starts at "0" and rises $2,000 for each additional unit. The total cost line starts at $1,200,000 (reflecting the fixed cost), and rises $800 for each additional unit (reflecting the addition of variable cost). "Break-even" results where sales equal total costs. At any given point, the width of the loss area (in red) or profit area (in green) is the difference between sales and total costs.

3.4 Break-Even Calculations

As they say, a picture is worth a thousand words, and that is certainly true for the CVP graphic just presented. However, everyone is not an artist, and you may find it more precise to do a little algebra to calculate the break-even point. Consider that:

Break-even results when:
Sales = Total Variable Costs + Total Fixed Costs

For Leyland, the math turns out this way:

$$(\text{Units} \times \$2{,}000) = (\text{Units} \times \$800) + \$1{,}200{,}000$$

Solving:

$$\text{Step a: } (\text{Units} \times \$2{,}000) = (\text{Units} \times \$800) + \$1{,}200{,}000$$
$$\text{Step b: } (\text{Units} \times \$1{,}200) = \$1{,}200{,}000$$
$$\text{Step c: Units} = 1{,}000$$

Now, it is possible to "jump to step b" above by dividing the fixed costs by the contribution margin per unit. Thus, a break-even short cut is:

$$\text{Break-Even Point in Units} = \text{Total Fixed Costs} / \text{Contribution Margin Per Unit}$$
$$1{,}000 \text{ Units} = \$1{,}200{,}000 / \$1{,}200$$

Sometimes, you may want to know the break-even point in dollars of sales (rather than units). This approach is especially useful for companies with more than one product, where those products all have a similar contribution margin ratio:

$$\text{Break-Even Point in Sales} = \text{Total Fixed Costs} / \text{Contribution Margin Ratio}$$
$$\$2{,}000{,}000 = \$1{,}200{,}000 / 0.60$$

3.5 Target Income Calculations

Breaking even is not a bad thing, but hardly a satisfactory outcome for most businesses. Instead, a manager may be more interested in learning the necessary sales level to achieve a targeted profit. The approach to solving this problem is to treat the "target income" like an added increment of fixed costs. In other words, the margin must cover the fixed costs and the desired profit:

Target Income results when:

$$\text{Sales} = \text{Total Variable Costs} + \text{Total Fixed Costs} + \text{Target Income}$$

Assume Leyland wants to know the level of sales to reach a $600,000 income:

$$(\text{Units} \times \$2{,}000) = (\text{Units} \times \$800) + \$1{,}200{,}000 + \$600{,}000$$

Solving:

Step a: (Units × $2,000) = (Units × $800) + $1,200,000 + $600,000
Step b: (Units × $1,200) = $1,800,000
Step c: Units = 1,500

Again, it is possible to "jump to step b" by dividing the fixed costs and target income by the per unit contribution margin:

Units to Achieve a Target Income
=
(Total Fixed Costs + Target Income) / Contribution Margin Per Unit
1,500 Units = $1,800,000 / $1,200

If you want to know the dollar level of sales to achieve a target net income:

Sales to Achieve a Target Income
=
(Total Fixed Costs + Target Income) / Contribution Margin Ratio
$3,000,000 = $1,800,000 / 0.60

3.6 Critical Thinking About CVP

CVP is more than just a mathematical tool to calculate values like the break-even point. It can be used for critical evaluations about business viability.

For instance, a manager should be aware of the "margin of safety." The margin of safety is the degree to which sales exceed the break-even point. For Leyland, the degree to which sales exceed $2,000,000 (its break-even point) is the margin of safety. This will give a manager valuable information as they plan for inevitable business cycles.

A manager should also understand the scalability of the business. This refers to the ability to grow profits with increases in volume. Compare the income analysis for Leaping Lemming Corporation and Leaping Leopard Corporation:

LEAPING LEMMING CORPORATION Contribution-based Income Analysis for 20X1			LEAPING LEOPARD CORPORATION Contribution-based Income Analysis for 20X1		
Sales (5000 X $1,000)	$5,000,000	100%	Sales (5000 X $1,000)	$5,000,000	100%
Variable costs (5,000 X $900)	4,500,000	90%	Variable costs (5,000 X $400)	2,000,000	40%
Contribution margin	$ 500,000	10%	Contribution margin	$3,000,000	60%
Fixed costs	500,000		Fixed costs	3,000,000	
Net income	$ -		Net income	$ -	

Both companies "broke even" in 20X1. Which company would you rather own? If you knew that each company was growing rapidly and expected to double sales each year (without any change in cost structure), which company would you prefer? With the added information, you would expect the following outcomes for 20X2:

LEAPING LEMMING CORPORATION Contribution-based Income Analysis for 20X2			LEAPING LEOPARD CORPORATION Contribution-based Income Analysis for 20X2		
Sales (10,000 X $1,000)	$10,000,000	100%	Sales (10,000 X $1,000)	$10,000,000	100%
Variable costs (10,000 X $900)	9,000,000	90%	Variable costs (10,000 X $400)	4,000,000	40%
Contribution margin	$ 1,000,000	10%	Contribution margin	6,000,000	60%
Fixed costs	500,000		Fixed costs	3,000,000	
Net income	$ 500,000		Net income	$ 3,000,000	

This analysis reveals that Leopard has a more scalable business model. Its contribution margin is high and once it clears its fixed cost hurdle, it will turn very profitable. Lemming is fighting a never ending battle; sales increases are met with significant increases in variable costs. Be aware that scalability can be a double-edged sword. Pull backs in volume can be devastating to companies like Leopard because the fixed cost burden can be consuming. Whatever the situation, managers need to be fully cognizant of the effects of changes in scale on the bottom-line performance.