Breakeven Analysis

This module covers the concepts of variable, fixed, average and marginal costs, contribution, contribution margin, unit and dollar breakeven analysis.

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Marketing Metrics Reference: Chapter 3

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Fixed and Variable Costs

Definition

**Fixed Costs (FC):** Costs that remain unchanged with volume sold. Examples include rent for facilities, management salaries, and most advertising media.

**Variable Costs (VC):** Costs that change with volume sold. Examples include material used to construct a product, commissions paid to salespeople, and packaging costs. Variable costs are usually assumed to be relatively constant on a per-unit basis.

By definition, those costs that are not fixed are variable!
Distinguish Variable Costs from Fixed Costs

**Definition**

**Total Costs** = Total Fixed Costs + Total Variable Costs

Note visually how variable costs as well as total costs increase with units sold while fixed costs remain constant.
## Fixed or Variable?

<table>
<thead>
<tr>
<th>Item</th>
<th>Fixed</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent for office space</td>
<td><img src="true" alt="Check" /></td>
<td><img src="false" alt=" " /></td>
</tr>
<tr>
<td>Packaging Material</td>
<td><img src="false" alt=" " /></td>
<td><img src="true" alt="Check" /></td>
</tr>
<tr>
<td>Sales Force Salaries</td>
<td><img src="true" alt="Check" /></td>
<td><img src="false" alt=" " /></td>
</tr>
<tr>
<td>Sales Force Commission</td>
<td><img src="true" alt="Check" /></td>
<td><img src="false" alt=" " /></td>
</tr>
<tr>
<td>TV Advertisement</td>
<td><img src="true" alt="Check" /></td>
<td><img src="false" alt=" " /></td>
</tr>
<tr>
<td>Amazon.com shipping charges</td>
<td><img src="true" alt="Check" /></td>
<td><img src="false" alt=" " /></td>
</tr>
<tr>
<td>CEO’s limo lease payment</td>
<td><img src="true" alt="Check" /></td>
<td><img src="false" alt=" " /></td>
</tr>
<tr>
<td>Mfg warranty expenses</td>
<td><img src="true" alt="Check" /></td>
<td><img src="false" alt=" " /></td>
</tr>
</tbody>
</table>

*Fixed OR Variable?*
Definitions

**Unit Variable Cost** = Total Variable Costs for 1 Unit of Production

**Total Variable Costs** = Unit Variable Costs * Units Sold

<table>
<thead>
<tr>
<th>Units Sold</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable Mfg. Costs</td>
<td>2</td>
<td>20</td>
<td>200</td>
<td>2,000</td>
</tr>
<tr>
<td>Packaging Material</td>
<td>3</td>
<td>30</td>
<td>300</td>
<td>3,000</td>
</tr>
<tr>
<td>Unit Variable Cost</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total Variable Costs</td>
<td>5</td>
<td>50</td>
<td>500</td>
<td>5,000</td>
</tr>
</tbody>
</table>

In this example, the unit variable cost equals the variable mfg cost ($2) plus the packaging material ($3). The **unit** variable cost remain constant at $5 as volume increases, while **total** variable costs increase with volume sold.

**Insight**

Often, variable costs will decrease with volume. This might occur due to impacts such as volume discounts or economies of scale.
## Average Costs

### Definitions

**Total Costs** = \( FC + VC = \text{Fixed Costs} + (\text{Unit Var. Cost} \times \text{Units Sold}) \)

**Average Costs** = \( \frac{\text{Total Costs}}{\text{Units Sold}} \)

<table>
<thead>
<tr>
<th>Units Sold</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Costs</strong></td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td><strong>Variable Mfg. Costs</strong></td>
<td>2</td>
<td>20</td>
<td>200</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Packaging Material</strong></td>
<td>3</td>
<td>30</td>
<td>300</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Total Variable Costs</strong></td>
<td>5</td>
<td>50</td>
<td>500</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td>505</td>
<td>550</td>
<td>1,000</td>
<td>5,500</td>
</tr>
<tr>
<td><strong>Average Cost</strong></td>
<td>505</td>
<td>55</td>
<td>10</td>
<td>5.50</td>
</tr>
</tbody>
</table>

Now let’s add fixed costs to our example. As the number of units sold increases, fixed costs stay fixed at $500, unit variable costs remain constant at $5, total variable costs increase with each additional unit sold, and the average cost per unit decreases as more units are sold.
Insight

A brief digression for those remembering Economics 101

Marginal Costs vs. Variable Costs

• Almost the same concept: Marginal cost refers to what it costs to produce an additional unit; variable cost analysis usually assumes constant marginal cost.

• Over a wide range of output, the unit variable costs may not change. Therefore the marginal cost of producing an additional unit and the variable cost for that range will be the same.

• Over some range, variable costs might change (discounts from suppliers for a larger order of packaging materials, for example) but still would not be considered fixed costs.
Revenues and Profits

Up to now, we’ve been discussing costs. Let’s add revenues to the equation. **Total Revenues** equals the selling price x unit sales. **Total Contribution** is the difference between revenues and variable costs. The **Profit** (or loss if negative) is the difference between total revenues and total costs.

### Definitions

**Total Revenues** = Selling Price * Units Sold  
**Total Contribution** = Total Revenues – Total Variable Costs  
**Profit (or Loss if negative)** = Total Revenues – Total Costs  

or **Profit** = Total Contribution – Fixed Costs

<table>
<thead>
<tr>
<th>Units Sold @ $12</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenues</td>
<td>12</td>
<td>120</td>
<td>1,200</td>
<td>12,000</td>
</tr>
<tr>
<td>Total Variable Costs</td>
<td>5</td>
<td>50</td>
<td>500</td>
<td>5,000</td>
</tr>
<tr>
<td>Total Contribution</td>
<td>7</td>
<td>70</td>
<td>700</td>
<td>7,000</td>
</tr>
<tr>
<td>Fixed Costs</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Profit (Loss)</td>
<td>-493</td>
<td>-430</td>
<td>200</td>
<td>6,500</td>
</tr>
</tbody>
</table>
Revenues and Profits

Adding revenues and profits to our total cost / units graph, visually, might look something like this:

- The firm becomes profitable where total revenues crosses total costs
- Since fixed costs don’t change over the short-term, they may be “sunk” costs
Contribution

Definitions

Unit Contribution = Selling Price per unit – Variable Cost per unit

Contribution Margin % = Unit Contribution / Selling Price per unit

Take a moment to consider why unit contribution might be meaningful…
Unit Contribution is significant because it measures a net inflow of funds to a company as additional units are sold.

Let’s try a few contribution calculations:

**Question 1:** If a firm receives $12 revenue from each unit it sells, and pays $5 per unit in variable costs, then what is the contribution of each unit?

**Answer:**

We know that \( \text{Unit Contribution} = \text{SP per unit} - \text{VC per unit} \)

Therefore, substituting in our values:
Unit Contribution = $12 - $5
Unit Contribution = $7
Question 2: If a firm realizes $50 in total contribution by selling 10 units of a product at a selling price of $20, what is the unit variable cost per unit?

Answer:

We know that Total Contribution = Unit Contribution * Units Sold
And that Unit Contrib. = Selling Price per unit - Variable Cost per unit

Therefore, substituting in our values:
$50 = Unit Contribution * 10
Unit Contribution = $50 / 10
Unit Contribution = $5

$5 = $20 - Unit Variable Cost
Unit Variable Cost = $20 - $5
Unit Variable Cost = $15
Question 3: If a firm receives $100 revenue from selling 5 units of a product, and pays $25 in total variable costs, then what is the contribution and contribution margin (%) of each unit?

Answer:
We know that **Total Revenues = Selling Price per unit * Units Sold**
$100 = SP * 5; Selling Price = $20

and **Total Variable Costs = Unit Variable Costs * Units Sold**
$25 = Unit Variable Costs * 5; Unit Variable Costs = $5

and **Unit Contribution = SP per unit – VC per unit**
Unit Contribution = $20 - $5 = $15

and **Contribution Margin % = Contribution / Selling Price**
Contribution Margin % = $15 / $20 = 75%
Some of the types of questions that contribution analysis can help answer include:

Will our unit prices cover unit variable costs?

Target unit volumes:
- Will the additional contribution cover our fixed costs and make a “profit”?
- We want to sell 10,000 units. Will the contribution cover our fixed costs?

How much can we afford to pay marketing to sell an additional unit?
- If an advertisement cost $1,000, how many units will we need to sell to make it worthwhile?
- What kinds of commission programs are feasible for our salespeople?
Breakeven is where total revenues = total costs

Breakeven Point:
(Total Costs = Total Revenues)

Profit!

Break-even Volume in Units

Breakeven Volume in Dollars

Total Revenues
Total Costs
Total Variable Costs
Total Fixed Costs
Breakeven

• Not a loss, but zero
• Selling enough to just cover fixed costs
• Where a business becomes profitable
• Each sale contributes to covering a portion of fixed costs
• The amount each sales contributes to covering fixed costs is the difference between unit price (revenue) and unit variable costs (e.g. unit contribution)
• Marketers (and CFOs) like to know how high sales have to be to “breakeven” (e.g. where do we become profitable?)
Breakeven Formulas

Two types of breakeven analysis:

**Unit Breakeven** = How many unit sales need to be made to cover fixed costs?
**Revenue Breakeven** = What level of sales are needed to cover fixed costs?

**Definitions**

**Unit Breakeven** = Fixed Costs / Unit Contribution

**Unit Breakeven** = Fixed Costs / (Selling Price – Variable Cost)

**Revenue Breakeven** = Fixed Costs / Contribution Margin %

**Revenue Breakeven** = Fixed Costs / (Unit Contribution / Selling Price)

With either measure it is simple to calculate the other, using price to convert.

**Revenue Breakeven** = Breakeven in units * Unit Price

**Breakeven in Units** = Dollar Breakeven / Unit Price

Also **Target Profit Breakeven** = (Fixed Costs+Target Profit) / Contrib Margin %
Question 1: Mickey’s Mousetraps wants to know how many of its “Magic Mouse Trappers” it needs to sell in order to breakeven. The product sells for $20, it costs $5 per unit to make, and the company’s fixed costs are $30,000.

Answer:

We know that Breakeven (units) = Fixed Costs / (Selling Price – Var. Cost)

Therefore, substituting in our values:
Breakeven (units) = $30,000 / ($20 - $5)
Breakeven (units) = 2,000 mousetraps
Question 2: Mickey’s Mousetraps wants to know how many dollars worth of its “Deluxe Mighty Mouse Trappers” it needs to sell in order to break-even on costs. Again, the product sells for $20, it costs $5 per unit to make, and the company’s fixed costs are $30,000.

Answer:

We know that Breakeven (units) = Fixed Costs / (Selling Price – Var. Cost) and that Breakeven (revenues) = Breakeven units * price

Therefore, substituting in our values:
Breakeven (units) = $30,000 / ($20 - $5)
Breakeven (units) = 2,000 mousetraps
Breakeven (revenues) = 2,000 * $20 = $40,000
Breakeven: Sample Problems

**Question 3:** Swiss entrepreneur Herr Zeitgeist buys watch faces from Italy for 5 Euros, buys watch mechanisms for 15 Euros from Spain, and hires assembly in Portugal for 10 Euros per watch. His only other expense is 100,000 Euros he pays the Zuricher Flughafen ad agency to place ads in inflight magazines to build the Zeitgeist brand.

Herr Zeitgeist sells each watch for 50 Euros to airport duty-free shops, earning the retailer an 80% margin. What is his breakeven volume?

**Answer:**

We know that **Breakeven (units) = Fixed Costs / (Selling Price – Var. Cost)**

Therefore, substituting in our values:

By reading the information provided, we see that fixed costs are 100,000 Euros, and variable costs are 5+15+10 = 30 Euros per watch.

BE (units) = 100,000 / (50 – 30) = 100,000 / 20 = 5,000 watches.
Breakeven - Further Reference


- And -

Profit Dynamics (core MBTN module). This module builds on the breakeven analysis to volume – price interactions and their impact on profits.