Break-Even Analysis and Decision Making

Session 5
4th April 2019
A PRODUCT (OR ANY OTHER COST OBJECT) CAN BE SAIYED TO BE PROFITABLE (ECONOMICALLY AFFORDABLE) WHEN……

• It has a positive first contribution margin

• It creates volumes that cover any traceable fixed costs and offer a further contribution to covering common fixed costs (a positive second contribution margin)

The first law of profitability: the variable cost is the maximum limit of the sale price [Unit Price > Unit Variable Cost and then 1st CM > 0]

The second law of profitability: the 1st Contribution Margin must cover any traceable fixed costs [2nd MdC > 0]
### Bellavista Gourmet Hotel & Restaurant Case Study

#### HOTEL

<table>
<thead>
<tr>
<th>Revenues</th>
<th>€ 3.822.000,00</th>
<th>100,00%</th>
<th>€ 1.794.000,00</th>
<th>100,00%</th>
<th>€ 394.000,00</th>
<th>100,00%</th>
<th>€ 6.010.000,00</th>
<th>100,00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumptions</td>
<td>€ 146.000,00</td>
<td>3,82%</td>
<td>€ 975.000,00</td>
<td>54,35%</td>
<td>€ 36.000,00</td>
<td>9,14%</td>
<td>€ 1.157.000,00</td>
<td>19,25%</td>
</tr>
<tr>
<td>Rentals</td>
<td>€ 182.000,00</td>
<td>4,76%</td>
<td>€ 76.000,00</td>
<td>4,24%</td>
<td>€ 6.000,00</td>
<td>1,52%</td>
<td>€ 264.000,00</td>
<td>4,39%</td>
</tr>
<tr>
<td>First Contribution Margin</td>
<td>€ 3.494.000,00</td>
<td>91,42%</td>
<td>€ 743.000,00</td>
<td>41,42%</td>
<td>€ 352.000,00</td>
<td>89,34%</td>
<td>€ 4.589.000,00</td>
<td>76,36%</td>
</tr>
</tbody>
</table>

| Employees (annual) | € 1.710.000,00 | 44,74%  | € 640.000,00   | 35,67%  | € 80.000,00 | 20,30%  | € 2.430.000,00 | 40,43%  |
| Employees (seasonal) | € 720.000,00 | 18,84%  | -              | 0,00%   | € 72.000,00 | 18,27%  | € 792.000,00   | 13,18%  |
| External Services | € 24.000,00    | 0,63%   | € 42.000,00    | 2,34%   | € 4.000,00  | 1,02%   | € 70.000,00    | 1,16%   |
| Maintenance       | € 165.000,00   | 4,32%   | € 24.000,00    | 1,34%   | € 88.000,00 | 22,34%  | € 307.000,00   | 5,11%   |
| Depreciations     | € 155.000,00   | 4,06%   | € 64.000,00    | 3,57%   | € 88.000,00 | 22,34%  | € 307.000,00   | 5,11%   |

| Second Contribution Margin | € 720.000,00 | 18,84%  | € 27.000,00    | -1,51%  | € 70.000,00 | 17,77%  | € 763.000,00   | 12,70%  |

| Employees (annual) | € 240.000,00  | 4,27%   | -              | 0,00%   | € 240.000,00 | 3,99%   |

| Third Contribution Margin | € 453.000,00 | 8,07%   | € 70.000,00    | 0,00%   | € 523.000,00 | 1,09%   |
## The Profitability Laws

### Food Products for Childrens Case Study

<table>
<thead>
<tr>
<th>Unit sales price</th>
<th>4,00</th>
<th>3,00</th>
<th>2,00</th>
<th>1,25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>20.000,00</td>
<td>30.000,00</td>
<td>60.000,00</td>
<td>62.500,00</td>
</tr>
<tr>
<td>Variables Costs</td>
<td>4.350,00</td>
<td>7.900,00</td>
<td>21.300,00</td>
<td>32.500,00</td>
</tr>
<tr>
<td><strong>First Contribution Margin</strong></td>
<td><strong>15.650,00</strong></td>
<td><strong>22.100,00</strong></td>
<td><strong>38.700,00</strong></td>
<td><strong>30.000,00</strong></td>
</tr>
<tr>
<td>Traceable Fixed costs</td>
<td>33.000,00</td>
<td>33.000,00</td>
<td>33.000,00</td>
<td>33.000,00</td>
</tr>
<tr>
<td><strong>Second Contribution Margin</strong></td>
<td><strong>- 17.350,00</strong></td>
<td><strong>- 10.900,00</strong></td>
<td><strong>5.700,00</strong></td>
<td><strong>- 3.000,00</strong></td>
</tr>
</tbody>
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</thead>
<tbody>
<tr>
<td>Unit Variable Cost</td>
<td>0,87</td>
<td>0,79</td>
<td>0,71</td>
<td>0,65</td>
</tr>
<tr>
<td>First Contribution Margin per unit</td>
<td>3,13</td>
<td>2,21</td>
<td>1,29</td>
<td>0,60</td>
</tr>
<tr>
<td><strong>Break-Even volume</strong></td>
<td><strong>10.543,13</strong></td>
<td><strong>14.932,13</strong></td>
<td><strong>25.581,40</strong></td>
<td><strong>55.000,00</strong></td>
</tr>
</tbody>
</table>
Break-even Analysis Defined

Breakeven analysis examines the short run relationship between changes in volume and changes in total sales revenue, expenses and net profit.

Also known as C-V-P analysis (Cost Volume Profit Analysis)
Study of interrelationships among a firm’s sales, costs, and operating profit at various levels of output.

Break-even point is the $Q$ (Quantity or Volume) where Total Revenues = Total Costs ($Q_1$ to $Q_2$ on graph).
Linear Break-Even Analysis

- Over small enough range of output levels TR and TC may be linear, assuming:
  - Constant selling price
  - Constant variable cost
  - Firm produces only one product (no mix effect)
  - No time lags between investment and resulting revenue stream
Graphic Solution Method

- Draw a line through origin with a slope of $P$ (product price) to represent TR function.
- Draw a line that intersects vertical axis at level of fixed cost and has a slope of $MC$.
- Intersection of $TC$ and $TR$ is break-even point.
Breakeven Chart
The Break-even point occurs where total revenue equals total costs.

The firm, in this example would have to sell Q1 to generate sufficient revenue (income) to cover its total costs.
If the firm chose to set price higher than €2 (say €3) the TR curve would be steeper – they would not have to sell as many units to break even.

At present, this firm sells each unit for €2 – Break Even point is at Q1.
Breakeven Chart - simulation

If the firm chose to set prices lower (say € 1) it would need to sell more units before covering its costs.
Breakeven Chart - simulation

Costs/Revenue vs. Output/Sales

TC (Total Cost) - VC (Variable Cost) - FC (Fixed Cost)

TR (p = € 2) - Q1

BEP (Break Even Point)

Loss - Profit

Any units sold above Break Even Point represents a Profit
Equate total revenue and total cost functions and solve for Q

\[ TR = P \times Q \]
\[ TC = FC + (VC \times Q) \]
\[ TR = TC \]
\[ P \times Q_B = FC + VC \times Q_B \]
\[ (P \times Q_B) - (VC \times Q_B) = FC \]
\[ Q_B \times (P - VC) = FC \]
\[ Q_B = FC/(P - VC) \]
Example (1)

Bannerman Trading Company opens a flower shop.

Fixed Costs:
- Rent: € 400
- Helper (Wages): € 200

Variable Costs:
- Flowers: € 0.50 per bunch

Selling Price:
- Flowers: € 2 per bunch

So we know that:
- Total **Fixed Costs** = € 600
- **Variable Cost** per Unit = € 0.50
- **Selling Price** per Unit = € 2.00
We must firstly calculate how much income from each bunch of flowers can go towards covering the **Fixed Costs**.

This is called the **Unit Contribution Margin**

\[
\text{Selling Price} - \text{Unit Variable Costs} = \text{Unit Contribution Margin}
\]

\[
€2.00 - €0.50 = €1.50
\]

For every bunch of flowers sold €1.50 can go towards covering **Fixed Costs**
Now to calculate how many units must be sold to cover Total Costs (FC + VC)

This is called the Break Even Point

Break Even Point = Fixed Costs ÷ Unit Contribution Margin

€ 600 ÷ € 1.50 = 400 Units

Therefore 400 bunches of flowers must be sold to Break Even – at this the point the business is not making a Profit nor incurring a Loss – it is merely covering its Total Costs.
Uses of Breakeven Analysis

- C-V-P analysis is an important tool in terms of **short-term planning** and **decision making**

- It looks at the relationship between costs, revenue, output levels and profit

- Short run decisions where C-V-P is used include **choice of sales mix, pricing policy** etc.
Decision Making and Break-Even Analysis: Exemples

- How many units must be sold to breakeven?

- How many units must be sold to achieve a target profit?

- Should a special order be accepted?

- How will profits be affected if we introduce a new product or service?
Key Terminology: Break-even Analysis

- **Break even point**: the quantity (or volume) at which a company makes neither a profit or a loss.

- **Contribution Margin per unit**: the sales price minus the variable cost per unit. It measures the contribution made by each item of output to the fixed costs and profit of the organisation.
Key Terminology: Break-even Analysis

- **Margin of safety**: a measure in which the budgeted volume of sales is compared with the volume of sales required to break even. The margin of safety may be expressed in units or revenue terms and it shows the amount by which sales can drop before a loss will be incurred.

- **Marginal Cost**: cost of producing one extra unit of output.
Example: Margin of safety

Using the following data, calculate the breakeven point and margin of safety in units:

Selling Price = €50
Variable Cost = €40
Fixed Cost = €70,000
Budgeted Sales = 7,500 units

Solution

Contribution Margin = €50 - €40 = €10 per unit
Breakeven point = €70,000/€10 = 7,000 units
Margin of safety = 7,500 - 7,000 = 500 units
Example: Margin of safety

A higher price would lower the break even point and the margin of safety would widen.

Margin of safety shows how far sales can fall before losses are made. If Q1 = 1000 units sold and Q2 = 1800, sales could fall by 800 units before a loss would be made.
Target profits

- What if a firm doesn’t just want to breakeven – it requires a target profit
- Contribution per unit will need to cover profit as well as fixed costs
- Required profit is treated as an addition to Fixed Costs
Using the following data, calculate the level of sales required to generate a profit of €10,000:

- Selling Price = €35
- Variable Cost = €20
- Fixed Costs = €50,000

Unit Contribution Margin = €35 – €20 = €15

Level of sales required to generate profit of €10,000:

$$\frac{€50,000 + €10,000}{€15} = 4000 \text{ units}$$
Assumptions of Break Even Analysis (1)

- All fixed and variable costs can be easily identified over the whole range of output.
- Variable costs are assumed to vary directly with output (Efficiency remains unchanged).
- Fixed costs will remain constant.
- Selling prices are assumed to remain constant for all levels of output (no price promotional activities).
THERE ARE SOME COSTS THAT ARE DIFFICULT TO CLASSIFY:
FOR THESE YOU MUST USE THE CONCEPT OF

**RELEVANT LEVEL OF ACTIVITY**

(*RELEVANT RANGE*)
The sales mix of products will remain constant – break even charts cannot handle multi-product situations.

It is assumed that all production will be sold (non inventory effect).

The volume of activity is the only relevant factor which will affect costs.
Limitations of Break-even analysis (1)

- Some costs cannot be identified as precisely Fixed or Variable
- Semi-variable costs cannot be easily accommodated in break-even analysis
- Costs and revenues tend not to be constant
- With Fixed costs the assumption that they are constant over the whole range of output from zero to maximum capacity is unrealistic
Limitations of Break-even analysis (2)

- Price reduction may be necessary to protect sales in the face of increased competition

- The sales mix may change with changes in tastes and fashions

- Productivity may be affected by strikes and absenteeism

- The balance between Fixed and Variable costs may be altered by new technology