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Finance & Pricing Strategy

3. Break-even analysis - Tutorial

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3. Break-even analysis

When introducing a new product/service:

- Determine the necessary sales units (or more generally the necessary revenue) to cover the fixed and variable production costs of this new product.
  $\longrightarrow$ **Break-even point**.
- At what point a company, or a new product or service, becomes profitable?
- What should happen (i.e. which sales/revenue amount we should get) for the NPV of the project being equal to 0?
- Also, we should take into account potential product-line/cross-product effects derived from the introduction of this new product/service (alienation and cannibalisation effects).

Break-even formula:

✓ When looking at the necessary revenue/cash-flows & for a project involving multiple periods:

$$\sum_{t=0}^{T} CF_{BE}(t) \times \frac{1}{(1+R)^t} = 0$$

$\longrightarrow CF_{BE}(t)$?

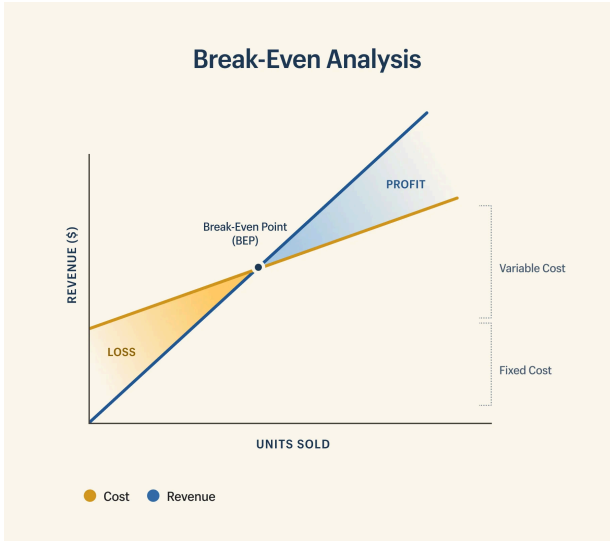
✓ When looking at the necessary sales units and just one period ahead:

$$(p_{\text{new product}} - c_{\text{new product}}) \times Q_{BE} - FC = 0$$

$\longrightarrow Q_{BE}$?

And if:

- $CF_{BE}(t) < \mathbb{E}[CF(t)]$ or $Q_{BE} < \mathbb{E}[Q]$: accept the project.
- $CF_{BE}(t) > \mathbb{E}[CF(t)]$ or $Q_{BE} > \mathbb{E}[Q]$: reject the project.


Break-Even Analysis
PROFIT
Break-Even Point
(BEP)
REVENUE ($)
LOSS
Variable Cost
Fixed Cost
UNITS SOLD
Cost
Revenue

3.2. Break-even analysis - example

ABC is considering an investment project

- £15mn investment will be needed before the projects starts running
- ABC's planning horizon is 5 years
  - By the way, what will affect the planning horizon?
- Returns from the investment are expected to increase at 5% annually and discount rate is 3%.
- What is the project's break-even point?

3.3. Incremental break-even analysis

We are considering the price reduction of a particular product.
$\longrightarrow$ Incremental break-even analysis shows how much the product's sales need to increase to fully compensate the income reduction deriving from the price reduction of the product.

Incremental break-even formula

$$\underbrace{\Delta Q \times (p_1 - c)}_{\text{Gains}} - \underbrace{Q_0 \times (p_1 - p_0)}_{\text{Loss}} = 0$$

where,

- p_0 is the current price;
- p_1 is the new lower price;
- c is the marginal cost;
- Q_0 is unit sales when price is p_0.

3.3. Incremental break-even analysis - example

C-Turtle is an apparel brand popular for its t-shirts

- Last year it sold 1.5m t-shirts
- Expected to stay the same this year if nothing changes
- An average t-shirt is priced at £49.99
- The following cost information is available

Cost type	Estimate
Overhead	£1.25m
Depreciation	£2m
Cost per t-shirt	£13.49

- C-Turtle is considering a £5 reduction in prices
- How many extra sales will need to be made to justify this?

3.4. Alienation effect

alienation noun

1. a withdrawing or separation of a person or a person's affections from an object or position of former attachment: ESTRANGEMENT

alienation … from the values of one's society and family
— S. L. Halleck

- The new product is inconsistent with the company's core values or customer expectations.
- This misalignment can create a sense of disconnect or dissatisfaction among loyal customers, leading them to feel "alienated" from the brand.

Product line effects/Cross-product effects.

Break-even formula with alienation

$$(p_{\text{new product}} - c_{\text{new product}}) \times \mathbf{Q_{BE}} - FC - \underbrace{a \times (1-t) \times Q_{\text{old product}} \times (p_{\text{old product}} - c_{\text{old product}})}_{\text{alienation effect}} = 0$$

where,

- FC: fixed costs associated with the new product;
- a: the strength of alienation effect;
- t: tax rate;
- $Q_{\text{old product}}$: sales of the original product if new product is not introduced;
- $p_{\text{old product}} - c_{\text{old product}}$: markup from the original product;
- $p_{\text{new product}} - c_{\text{new product}}$: markup from the new product.

3.4. Alienation effect - example

- CGC is an electronics producer;
- One of its key values proposition is the use of recycled plastic;
- CGC is thinking about producing a line of kettles made of plastic;
- Recycled plastic was found inappropriate for kettles
  $\longrightarrow$ will have to use new, high-quality plastic.
- Cost estimates for the new product line:

Cost type	Estimate
R&D	£0.75m
Marketing	£5m
Unit production cost	£35

- CGC anticipates to charge £80 for each kettle
- Using non-recycled plastic may alienate some costumers and reduce the sales of overall CGC products; Alienation effect is estimated to be 15%.
- Here is information about CGC prior to the introduction of new kettles:

Revenue	£11,500,000
Cost of Sales	- £5,250,000
Gross Profit	£6,250,000
Overhead	- £1,350,000
Operating Income	£4,900,000
Tax	- £490,000
Net Income	£4,410,000

- Estimate the break-even volume accounting for 15% alienation effect.

3.5. Cannibalisation effect

- Market cannibalization is a sales loss caused by a company's introduction of a new product that displaces one of its own older products.
- This phenomenon can occur when a new product is similar to an existing product and both share the same customer base.

Product line effects/Cross-product effects.

Break-even formula with cannibalisation

$$(p_{\text{new product}} - c_{\text{new product}}) \times \mathbf{Q_{BE}} - FC - \underbrace{b \times (1 - t) \times \mathbf{Q_{BE}} \times (p_{\text{old product}} - c_{\text{old product}})}_{\text{cannibalisation effect}} = 0$$

where,

- FC: fixed costs associated with the new product;
- b: the strength of cannibalisation effect;
- t: tax rate;
- $Q_{\text{old product}}$: sales of the original product if new product is not introduced;
- $p_{\text{old product}} - c_{\text{old product}}$: markup from the original product;
- $p_{\text{new product}} - c_{\text{new product}}$: markup from the new product.

3.5. Cannibalisation effect - example

1. Flybus is a manufacturer of commercial passenger planes. It specialises in medium-haul planes, but considers producing its first long-haul plane to target a new market segment. The price for each long-haul plane is expected to be around 105m. The following table provides information about relevant costs:

Cost type	Estimate
New plant	£1.25 bn
R&D	£1.5 bn
Marketing	£25m
Unit production cost	£65m

What is the break-even number of sales of the new long-haul planes?
$\longrightarrow$ For simplicity consider a tax rate of 0%.

2. Assume that introducing a long-haul aircraft will cannibalise the sales of the medium-haul aircrafts. Cannibalisation rate is 10%. Flybus receives gross profit of £55m from each medium-haul plane.
   What is the break-even sales volume of long-haul planes?
   $\longrightarrow$ For simplicity consider a tax rate of 0%.

Comment about Alienation/Cannibalisation effects

- Unless otherwise specified, whenever we refer to alienation/cannibalisation effects, we are considering them at the Gross Profit level.
- That is, whenever we say “alienation/cannibalisation effect is 15%” we are saying that sales were reduced 15%.
- Note that the alienation effect formula is directly derived from balance sheet analysis:

$$\text{Alienation Effect} = \underbrace{\big((1-a)\times \text{Gross Profit} - \text{OPEX}\big)\times(1-t)}_{\text{Net Profit}_0 \text{ with alienation}} - \underbrace{\big(\text{Gross Profit} - \text{OPEX}\big)\times(1-t)}_{\text{Net Profit}_0} =$$

$$= \big((1-a)\times \text{Gross Profit} - \text{OPEX} - (\text{Gross Profit} - \text{OPEX})\big)\times(1-t) =$$

$$= -a \times \underbrace{\text{Gross Profit}}_{Q_0(p_0-c_0)} \times (1-t)$$

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Thank you.
Questions?

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