

## Class 2 Break-Even Analysis and Customer Lifetime Value

Dr. Wei Miao

UCL School of Management

October 4, 2023

## Section 1

### Overview

# Learning Objectives

- How to conduct break-even analyses for marketing campaigns
  - Break-even quantity
  - Net present value
- Concept of customer life cycle
- Concept of and how to compute customer acquisition cost (CAC)
- Concept of and how to compute customer lifetime value (CLV)
- Practice R basic calculations and vector operations in the case study

## Section 2

### Break-Even Analysis

# Decisions for Marketing Managers

- Ultimate goal in the marketing process: create value and improve profitability for firms
- As any marketing activity comes with a cost, marketers need to correctly evaluate whether a campaign creates or destroys value to the company. Such analyses are called **break-even analyses (BEA)**.
- In this class, we will learn how to conduct BEA from the following 2-by-2 perspectives:
  - 1 Campaign-centric or customer-centric
  - 2 Static or dynamic

	Static View	Dynamic View
Campaign-centric	Break-Even Quantity	Net Present Value
Customer-centric	-	Customer Lifetime Value

# Break-Even Quantity

- We often use **break-even analyses** to evaluate the financial feasibility of marketing investments. One commonly used way is to compute the **break-even quantity**.

## Definition

The **break-even quantity (BEQ)** calculates the number of *incremental* units the firm needs to sell to cover the cost of the marketing campaign.

# Break-Even Quantity: Steps and Decision Rule

- Steps to conduct break-even analysis
  - *Step 1:* Compute the BEQ based on the company's product demand and production cost structure
  - *Step 2:* Evaluate whether the campaign can guarantee incremental sales to that quantity
- The decision rule
  - if incremental quantity sales  $>$  BEQ, the company makes money, so accept the campaign; otherwise, reject the campaign

## Compute BEQ

Marketers often refer to the difference between the **price per unit** and **variable costs per unit** as the **contribution margin per unit**. That is,

$$\text{ContributionMarginPerUnit} = \text{PricePerUnit} - \text{VariableCostsPerUnit}$$

- **Price per unit:** retail price
- **Variable costs per unit:** Costs of goods sold (COGS)<sup>1</sup> + any other variable costs
- **Marketing expenditure:** total costs of marketing investment

This gives the second formula for computing BEQ:

$$\text{BEQ} = \text{MarketingExpenditure} / \text{ContributionMarginPerUnit}$$

---

<sup>1</sup>Material and production labor costs for producing a unit of product; often represented in **percentage terms**, e.g., COGS of 60% means the costs are 60% of retail prices.



# Pineapple Inc: Background



Tom Cooper, is looking to launch a series of marketing campaigns to promote its new product PinePhone 15 Pro against its competitor iPhone 15 Pro. Tom was a proud graduate from UCL MSc BA program in 2020, and he remembered learning from Marketing Analytics module that, marketers often use break-even analysis to help evaluate different types of marketing decisions.

## Case objectives:

- Learn an example of situation analysis for the 1st assignment
- Practice how to compute BEQ for break-even analyses
- Practice R basic computations and vector operations

## Pineapple Inc: Key Information

**From the case:** The marketing analytics team at Pineapple Inc had applied predictive analytics models on historical sales data and predicted that the sales this year will reach **10** million units at the retail price of **£600**, without any additional marketing activities. The team had also collected the information on the Cost of Goods Sold of Pineapple 15, which is **60%**. The Research and Development (R&D) costs for PinePhone 15 is **100** million pounds.

- Open the .qmd answer sheet downloaded from Moodle. And let's solve this case using the R basics we learned last week!

## Pineapple Inc: BEA

- **Question 1:** Compute the contribution margin
  - Do we need to consider R&D costs?
- **Question 2:** Based on the information at hand, should Tom approve the influencer marketing plan?

## Section 3

# Net Present Value

# Definition of NPV

- When the effect of the marketing campaign is expected to have a long-term effect or **when time value of money is important** to the question at hand, we need to take the future into account.

## Definition

Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

# Formula of NPV

$$NPV = -I_0 + \frac{CF_1}{(1+k)} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n}$$

- $I_0$  is the initial marketing expense
- $CF_n$  is the **incremental** sales in period  $n$ : it must be the additional sales due to the marketing campaign
- $k$  is the discount rate: reflects the value of time: the same £1 today is more valuable than £1 tomorrow
- The decision rule
  - if  $NPV > 0$ , then the marketing campaign can bring in more values to the company, accept
  - if  $NPV < 0$ , then the marketing campaign will decrease the company's value, reject

# Pineapple Inc: NPV Influencer Marketing I

**Question 3:** Based on the information at hand, should Tom approve the influencer marketing plan based on Net Present Value method?

- 1 Compute the sequence of monthly cash flows
  - Generate a sequence of incremental sales for 12 months (a vector with 12 elements)
    - Hint: use `rep()`, `c()`, and vector element-wise multiplication

The resulting monthly CFs are: 7.2, 4.8, 4.8, 4.8, 4.8, 4.8, 4.8, 4.8, 4.8, 4.8, 4.8, 4.8

# Pineapple Inc: NPV Influencer Marketing II

- 2 Compute the sequence of discount factors
  - Generate a sequence of WACC for 12 months (a vector with 12 elements)
  - Generate a sequence of discount factor for 12 months (a vector with 12 elements)
    - Hint: use `seq()` to generate geometric sequence with patterns

The resulting monthly discount factors are: 0.9917355, 0.9835394, 0.975411, 0.9673497, 0.9593551, 0.9514265, 0.9435635, 0.9357654, 0.9280319, 0.9203622, 0.9127559, 0.9052124



## Pineapple Inc: NPV Influencer Marketing III

- ④ Compute the NPV
  - Generate a sequence of discounted CFs for 12 months
  - Sum up all discounted CFs across the 12 months using `sum()`
  - Subtract endorsement fee from the sum to get NPV
- The NPV is 6.9778057

## Section 4

# Customer Lifetime Value

# From Campaign-Centric to Customer-Centric Marketing



Figure 1: Customer Life Cycle

# Customer Acquisition Cost

## Definition

**Customer Acquisition Cost (CAC)** is the cost of winning a customer to purchase a product or service.

- Why should we care about CAC? Having a new customer may not always be a good thing. For example, no company would spend £500 to acquire a new customer worth £300

# How to Acquire New Customers

- Free sampling/trials



Hear sound  
all around.

Try it free

# How to Acquire New Customers

- Referral Programs: Customer Lifetime Social Value (CLSV, week 2)

## Give the gift of food to friends

You both get a promo when your friend makes their first order.

[See details](#)



**You get £10 off**

£30 minimum order



**They get £10 off**

For the first order • £30 minimum order

eats-weim42ue

Copy



Share



Share



Email



Get free food



## Share Deliveroo with a friend

Refer a friend and get £10 off across your next 4 orders. They'll get £10 off across their first 4 orders!

Just share your personal link. Your credit will be available for 30 days. Minimum order value of £20.00 to use this credit.

[roo.it/harrym-scgh](https://roo.it/harrym-scgh)

 Share

# Customer Acquisition Cost: Calculation

## Definition

When the marketing cost can be attributed to each individual customer

- $CAC = (\# \text{ of offers needed to acquire 1 customer}) * (\text{cost of making a marketing offer})$
  - $CAC = (\text{cost of making a marketing offer}) / (\text{customer response rate})$
- After we study predictive analytics later in this module, we will be able to predict response rate for each individual customer and compute individual-specific CAC.

## Customer Acquisition Cost: An Example

A new Bubble Tea shop in Canary Wharf is contemplating whether or not to attract new customers by sending ads leaflets to nearby residents.

The cost of sending a leaflet, which includes production and labor costs, is **£0.5**.

- ① randomly sending out leaflets
  - expected response rate of **1%**
- ② using names purchased from a marketing agency
  - each name costs **£0.2**
  - expected response rate of **4%** by analyzing the buying behavior and demographics of current customers

Compute the CAC for each choice.



# Customer Lifetime Value (CLV)

## Definition

Customer lifetime value (CLV or LTV) is the total worth to a business of a customer over the whole period of their relationship.

- The underlying idea of CLV is essentially NPV, but at the customer level.
  - Think of acquiring a new customer as an investment in an “asset” that can generate future cash flows

# CLV: Calculation

$$CLV = -CAC + \sum_{t=1}^N \frac{CF_t * r^{(t-1)}}{(1+k)^t}, \text{ where } CF_t = M_t - c_t$$

- $r$  is the average annual retention rate;  $r^{(t-1)}$  is the cumulative retention rate in year  $t$
- $N$  is the number of years over which the relationship is calculated
- $M_t$  is the margin the customer generates in year  $t$
- $c_t$  is the expected cost of marketing communications or promotions targeted to the customer in year  $t$
- $k$  is the rate for discounting future cash flows

# Retention Rate

## Definition

The churn rate, also known as the rate of attrition or customer churn, is the rate at which customers stop doing business with an entity.

- retention rate =  $1 - \text{churn rate}$
- **How to compute *individual* churn rate:** machine learning models to predict the churn rate of an individual customer (Week 4)

## Number of Years of Customer Relationship

- If we assume **infinite** customer economic life, we can simplify the formula into the following using the property of geometric sequence.

$$CLV_N = \sum_{t=1}^N \frac{gr^{(t-1)}}{(1+k)^t} \Rightarrow CLV_N = g \cdot \frac{1 - \left(\frac{r}{1+k}\right)^N}{1+k-r} \Rightarrow CLV_{\infty} = \frac{g}{(1+k-r)}$$

- However, most of the time, we are more comfortable to assume **finite** customer economic life; we need to decide on a cutoff date for CLV calculation
  - Rule 1: until the year when the  $g = M - c$  becomes negative
  - Rule 2: industry's average customer lifespan

## After-class

- Review the coding practice in today's class.
- We will solve Harvard Business Case: **Customer Lifetime Social Value**.  
Remember to read the case background before next week's class.
  - You can try to solve the case on your own using what we've covered today.
- Optional readings are for alternative ways to compute CLV in the industry.