Class 3 Workshop: Break-Even Analyses and Customer Lifetime Value

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Thu, Oct 13 2022

Section 1

Recap of BEA

Objective of Marketing Process

- Marketing activities need to create value for the company

Break-Even Analyses

- Any marketing activity (in fact, any business activity)
  - incurs some marketing expense/investment costs
  - generates benefits for the company (e.g., incremental sales; higher customer retention rate)
- The core idea of a break-even analysis is to compare the benefit with the cost
  - BEA is sometimes called cost-benefit analysis.

Break-Even Quantity

- For a marketing campaign with **fixed marketing expenditure** with **short-term impacts**, we can compute **BEQ** to evaluate its feasibility
- **BEQ** calculates the number of **incremental** units the firm needs to sell to cover the cost of the marketing campaign.
  - Incremental because we are comparing with status quo

Break-Even Quantity Formula

- Contribution Margin Per Unit = Price Per Unit - Variable Costs Per Unit
  - Measures how much money each additional sale "contributes" to the company's total profits.
  - **contribution margin rate**[1] = contribution margin per unit / price per unit
- Break-Even Quantity = Marketing Expenditure / Contribution Margin Per Unit
- Compare BEQ with estimated **incremental** sales to finish break-even analyses
  - Marketing costs are usually easy to obtain through budgeting
  - Incremental sales will need to be estimated through causal inference tools (i.e., the causal impact of influencer marketing on sales)
- If the estimated incremental sales can exceed BEQ, approve the marketing campaign

[1] It's important to **infer** percentage/absolute terms from the context.

PineApple BEQ

- Assign values to R objects based on case background information

```
price <- 600 # retail price
quantity <- 10 # sales; it's 10 million, bear this unit in mind
COGS <- 0.6 # cost of goods sold in percentage terms
RD_costs <- 100 # R&D Costs
endorsement_fee <- 50 # fixed marketing expenditure
```

- `quantity` is 10 million; we use 10 for brevity
  - **Sales** refers to **quantity sales** by industry practice
  - **Revenue** or **revenue sales** refers to monetary sales
- `COGS` is the variable costs per unit in the BEQ formula
  - Used in both percentage or value terms interchangeably.
- R&D costs are sunk costs
  - Should sunk costs be considered in a BEA for a marketing campaign?

PineApple BEQ Step 1

- Compute the contribution margin per unit

```
# Following the definition
# contribution margin per unit = price - variable cost
contribution_margin_per_unit <- price - price * COGS
contribution_margin_per_unit
```

```
[1] 240
```

```
# equivalently, contribution margin rate = 1 - COGS
# contribution margin per unit = price * contribution margin rate
contribution_margin_per_unit <- price * (1 - COGS)
contribution_margin_per_unit
```

```
[1] 240
```

PineApple BEQ Step 2

- Compute the break-even quantity

```
# numerator is the marketing expense
# denominator is the the contribution margin per unit

BEQ <- endorsement_fee / contribution_margin_per_unit
BEQ
```

```
[1] 0.2083333
```

- The marketing costs, i.e., the endorsement fee, is 50 million pounds
- Each incremental sale makes profit by 240 pounds

  => This means, the influencer marketing campaign needs to increase sales by at least BEQ (0.2083333 million) units, in order for the company not to lose any money

PineApple BEQ Step 3

- Compare BEQ with estimated **incremental** sales to finish break-even analyses
- In the case study, "the team estimates that such an influencer campaign can increase the total sales within the next financial year by 2.5%."
  - The comparison base is the original estimated sales without any marketing campaign, so the incremental units of sales would be `quantity * 0.025`

```
quantity * 0.025
```

```
[1] 0.25
```

- We need to sell `0.2083333` million units to break-even (not earn or lose money), but we can in fact sell 0.25 million, which is more than the BEQ.
- The influencer marketing campaign is profitable and should be approved.

NPV

- If the benefits of the marketing campaign come in longer periods, we need to consider the **time value of money** and **use NPV** to evaluate the profitability

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

Discount Rate and Discount Factor

- k is called **discount rate**, which reflects the time value of money
  - The same £1 today is more valuable than £1 tomorrow
  - e.g., if interest rate is 10% annually, then £1 today is worth £1.1 a year later
- $\frac{1}{1+k}$ is called **discount factor,** which is a factor to discount the future CFs to **today**
  - In each period, we discount the future CF by multiplying it with the discount factor
  - CF received 1 month later CF_1 is worth $\frac{1}{1+k} * CF_1$ today
  - CF received 2 months later CF_2 is worth $\frac{1}{(1+k)^2} * CF_2$ today
- For a company, k is often estimated by the finance department, which is usually the Weighted Average Cost of Capital, or WACC

PineApple NPV: Step 1

1. Compute the sequence of monthly cash flows

- First, we compute the incremental sales percentage for each month, relative to the 10 million.
- This is a 12-element vector, each element representing the incremental sales percentage.

```r
incremental.sales.percentage_1stmonth <- 0.003
incremental.sales.percentage_next11months <- rep(0.002,11)

# incremental profit each month
vector_incremental.sales.percentage_12months <-
  c(incremental.sales.percentage_1stmonth,
    incremental.sales.percentage_next11months)

vector_incremental.sales.percentage_12months
```

```
[1] 0.003 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002
```

- **Interpretation**: 0.003 means that, the first month incremental sales units would be 0.3% of the baseline quantity.

PineApple NPV: Step 1

- Next, we multiply the incremental sales **percentage** with **quantity**, to get the **incremental sales in terms of units** for each month.

```
vector_incremental.sales.units_12months <-
  vector_incremental.sales.percentage_12months *
  quantity

vector_incremental.sales.units_12months
```

```
[1] 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02
```

- **Interpretation**: 0.03 means that, the first month incremental sales units would be 0.03 million units.

PineApple NPV: Step 1

- Lastly, we multiply the **incremental quantity sales** with the **contribution margin per unit**, to get the total contribution margins (incremental profits) for each month, i.e., the CF

```
vector_CF <- vector_incremental.sales.units_12months *
  contribution_margin_per_unit

vector_CF
```

```
[1] 7.2 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8
```

- **Interpretation**: 7.2 means that, the first month incremental net profits would be 7.2 million pounds.

PineApple NPV: Step 2

2. Compute the sequence of discount factors

```r
# divide annual wacc to get monthly wacc
monthly_WACC <- 0.1/12
# monthly wacc is the k in the NPV formula
k <- monthly_WACC
k
```

```
[1] 0.008333333
```

```r
# discount factor is 1/(1+k)
discount_factor <- 1/ (1+k)
discount_factor
```

```
[1] 0.9917355
```

```r
# Generate a geometric sequence vector of discounted CFs for 12 months
vector_discount_factor <- discount_factor^c(1:12)
vector_discount_factor
```

```
 [1] 0.9917355 0.9835394 0.9754110 0.9673497 0.9593551 0.9514265 0.9435635
 [8] 0.9357654 0.9280319 0.9203622 0.9127559 0.9052124
```

- **Interpretation**: 0.9917355 means that, £1 1 month later is worth £0.992 today; 0.9052124 means that, £1 12 month later is worth £0.905 today.

PineApple NPV: Step 3

3. Compute the NPV
   - Multiply CF vector with discount factor vector, to get the discounted CF vector

```
# this will do element-by-element multiplication
vector_discounted.CF <- vector_CF * vector_discount_factor
vector_discounted.CF
```

```
[1] 7.140496 4.720989 4.681973 4.643279 4.604904 4.566847 4.529105 4.4
[9] 4.454553 4.417738 4.381228 4.345020
```

PineApple NPV: Step 3

- use function sum() to get the sum of all elements in a vector. That is, the sum of discounted cash flows in all 12 months.

```
sum(vector_CF * vector_discount_factor)
```

```
[1] 56.97781
```

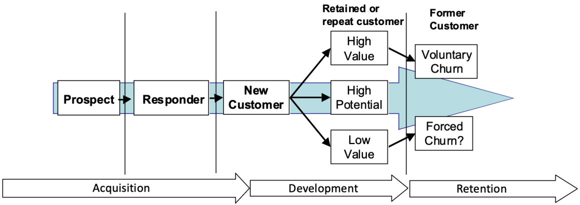
- We need to subtract the endorsement fee, which is the marketing expense, to get the net present value

```
NPV <- sum(vector_CF * vector_discount_factor) - endorsement_fee
NPV
```

```
[1] 6.977806
```

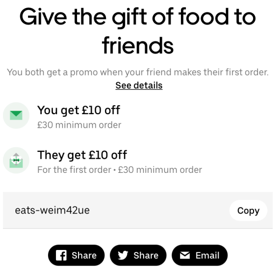
Customer Lifetime Value

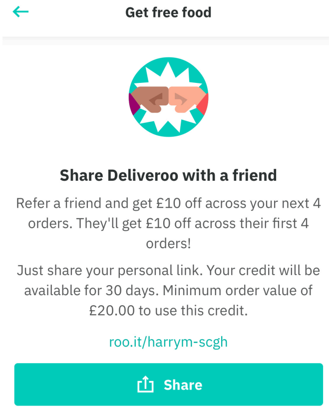
- CLV is a break-even analysis from the perspective of **a single customer**, which considers a customer as an asset to the company that generates future cashflows
  - incurs customer acquisition costs (CAC)
  - customer generates profits for the company in each period
  - customer churns at some point in time



Customer Acquisition Costs

- The total marketing costs to acquire a new customer





CLV: Formula

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

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

Section 2

Case Study: i-basket CLV

Situation Analyses: i-basket

- Company
- Customer
- Collaborators
- Competitors
- Context/Climate

Step 1: Determine time unit of analysis

- Time unit of analysis
  - *[...] (find info in the case study)*
    - When should we use monthly analysis?

Step 2: Determine number of years

- N: the number of years over which the customer relationship is assessed
  - *[...] (find info in the case study)*

```
N <-
```

Step 3: Compute profit margin for each period

$CF = M - c$: **gross profit each year**

- *most customers paid the $99 annual membership fee*

```
membership <-
```

- *40 times each year; each time $100*

```
n_visit <-
revenue_each_visit <-
```

Step 3: Compute profit margin for each period

- *profit margin 7% (COGS 93%)*

```
profit_margin <- 0.07
## think carefully about how M is calculated, it's tricky ~~~~
M <-
```

- *variable delivery costs each order*

```
deliverycost_each_visit <- 5 + 100 * 0.035
c <- deliverycost_each_visit * n_visit
```

Step 3: Compute profit margin for each period

- the annual CF from customers CF

```
# CF is the cash flow for one year
CF <-

# create a sequence of CF for N years
profit_seq <- rep(CF,N)
```

Step 4: Compute sequence of retention rate

4. r: retention rate
   - *[...] (find info in the case study)*

```
# retention_rate is the probability of customer staying with us after 1 year
retention_rate <-

# create a geometric sequence of accumulative retention rate for N years
retention_seq <-
```

Step 5: Compute sequence of discount factors

5. k: the discount rate
   - *[...] A yearly discount rate of 10%*

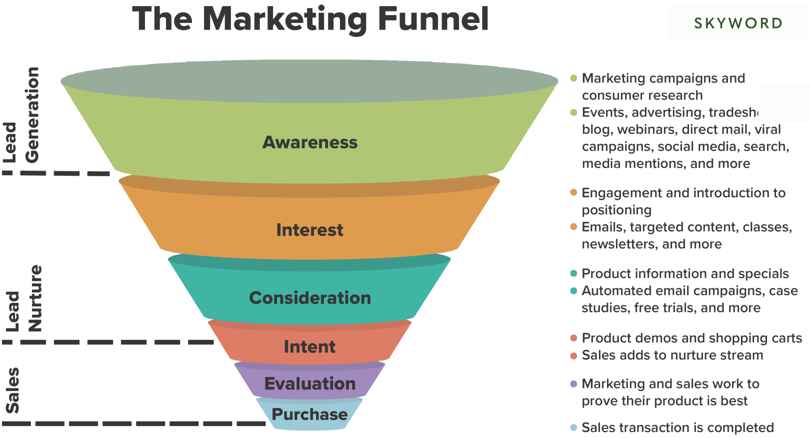
```
discount_rate <- 0.1
discount_factor_seq <-
```

- *[...] The team decided to take a conservative approach whereby all profits are booked at the end of year.*
  - All profits earned per customer in year 1 need to be discounted once, the profits earned in year 2 need to be discounted twice, and so on

Step 6: Compute customer acquisition costs

6. CAC = **total costs for customer ad clicks** + total costs of $15 promo + total costs of free deliveries

- How the Marketing Funnel Works From Top to Bottom



Step 6: Compute customer acquisition costs

6.1 Total costs for customer clicks

- [...] *a fifth of those who clicked on an ad were willing to give the service a try*
- *[...] 20% of those that signed up for the free trial ended up becoming members*

```
# click_to_trier_rate is the % of trier customers from clickers
click_to_trier_rate <- 0.2

# trier_to_buyer_rate is the % of final customer from trier customers
trier_to_buyer_rate <- 0.2
```

- How many customers need to click the ad to get 1 new customer?

```
n_clicks_1newcustomer <- 1/click_to_trier_rate/trier_to_buyer_rate
```

- Total costs for customer clicks

```
total_cost_clicks <- 0.4 * n_clicks_1newcustomer
```

Step 6: Compute customer acquisition costs

6. CAC = total costs for customer ad clicks + **total costs of $15 promo** + total costs of free deliveries

6.2 total costs of $15 promo for first order each trier customer

- How many customers need to try the service to get 1 new customer?

```
n_triers <- 1/conversion_rate
```

- What is the total promo cost for these “trier” customers’ first order?

```
promo_first_order_each_trier <- 15

total_cost_promo <- promo_first_order_each_trier * (1 - profit_margin) * n_triers
total_cost_promo
```

Step 6: Compute customer acquisition costs

6. CAC = total costs for customer ad clicks + total costs of $15 promo + **total costs of free deliveries**

6.3 total costs from free deliveries

- Assume two visits, the delivery costs for each visit

```
deliverycost_1st <- 5 + 115 * 0.035
deliverycost_2nd <- 5 + 100 * 0.035
deliverycost_each_trier <- deliverycost_1st + deliverycost_2nd
```

- We also make a profit from each trier

```
profit_each_trier <-  revenue_each_visit * profit_margin * 2
```

- Net delivery costs for each trier

```
NetDeliveryCost_each_trier<- deliverycost_each_trier - profit_each_trier
total_cost_delivery <- NetDeliveryCost_each_trier * n_triers
```

Step 6: Compute customer acquisition costs

6. CAC $=$ total costs for customer ad clicks $+$ total costs of \$15 promo $+$ total costs of free deliveries

```
CAC <- total_cost_clicks + total_cost_promo + total_cost_delivery
CAC
```

Step 7: Compute CLV

7. Compute the CLV based on the CLV formula (Table A)

- 7.1 Revenues, variables costs, and profit for the next 5 years

```
profit_seq
```

- 7.2 Apply retention rate

```
profit_seq_after_churn <- profit_seq * retention_seq
```

- 7.3 Apply discount factor

```
profit_seq_after_churn_discount<- profit_seq_after_churn * discount_factor_seq
```

- 7.4 Compute CLV by summing up future expected profits

```
CLV <- sum(profit_seq_after_churn_discount) - CAC
```

Section 3

CLV for Marketing Decisions

CLV as a Key Management Tool

Acquisition →

- Only offer $15 off for first time purchase
- Only waive first time delivery fee
- Reduce annual membership fee to increase conversion rate

Development →

- Develop personalized recommendation system to increase customers’ shopping basket

Retention

- Offer regular vouchers to customers to increase retention rate
- Provide better after-sale service to increase retention rate

We can use CLV as the key managerial tool for evaluating different marketing initiatives!

Discussion

1. How important is it for i-basket to measure CLV? Can you think of other companies or industries where CLV is particularly relevant?
2. Conduct sensitivity analyses
    - what assumptions have we made here? Are these assumptions sensitive to different values?
3. From our analyses, what suggestions would you offer to i-basket in order to improve its customer profitability? How are you going to evaluate the feasibility of your proposal?
    - acquisition/development/retention

Exercise

1. How much annual membership fee should the company charge to break even?
2. The company is looking to develop a personalized recommendation system that can increase the average shopping basket to \$150. Compute the upper bound for the company's investment in developing the algorithm in order to break even? Assume the company has 10,000 customers at this moment.