Session 4: Customer Lifetime Value

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Contents

The problem

- **Problem**: we don't understand our customer. We don't know if a specific customer is relevant for our organization.
- **Goals**:
    - We want to know how much value a customer is generating for the organization.
    - We want to know how the generated value is going to evolve.
    - We want to segment customers based on value.
- **Why?** To perform specific actions for different customer groups

How we solve the problem

- We need to measure the value a customer generates for a company
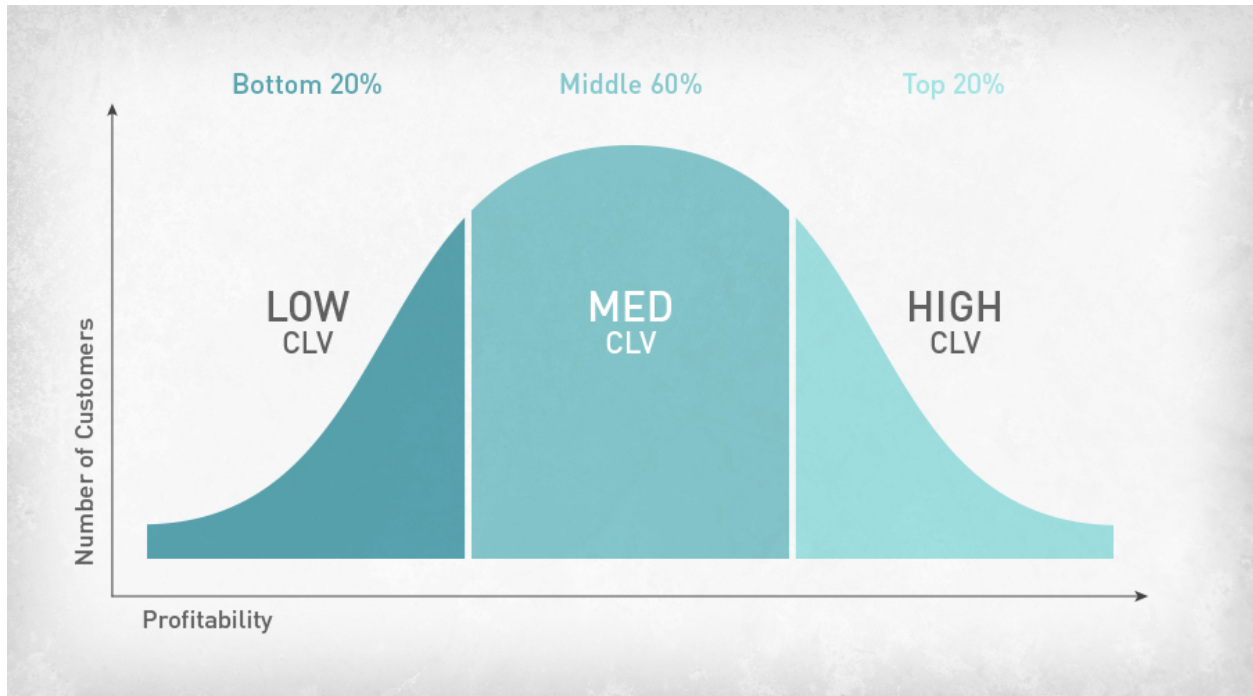- We have many ways to measure value: CLV, RFM, ARPU, ARPA, ARMU, ARMA,...

Figure 1: Using CLV to segment your customers - pareto -

What is CLV

CLV is the acronym of **Customer Lifetime Value**

> CLV is a prediction of all the value a business will derive from their entire relationship with a customer.

There is a tough part in this definition: how to estimate future customer interactions. The value generated by all our customers is called **Customer Equity** and is used to evaluate companies (with no significant income yet).

Main Concepts in CLV

In order to measure CLV we need:

- **Cash flow**: the net present value of the income generated by the customer to the organization throughout their relationship with the organization
- **Lifecycle**: the duration of the relationship with the organization
- **Maintenance costs**: associated costs to ensure that the flow of revenue per customer is achieved
- **Risk costs**: risk associated with a client
- **Acquisition costs**: costs and effort required to acquire a new customer.
- **Retention costs**: costs and effort required to retain a new customer.
- **Recommendation value**: impact of the recommendations of a customer in its sphere of influence on company revenue
- **Segmentation improvements**: value of customer information in improving customer segmentation models
- **Discount rate**: expresses the amount of interest paid/earned as a percentage of the balance at the end of the (annual) period.

How to measure the value

The calculation of CLV can be based on:

- ARPU/ARPA (Historic CLV)
- AMPU/AMPA (Historic CLV)
- RFM (only applicable to the next period)
- CLV Formula (Historic CLV)
- Probability/Econometrics/ Persistence Models/Machine Learning/Growth and dissemination models such as:
  - Moving Averages
  - Regressions
  - Bayesian Inference
  - Pareto/NBD (Negative Binomial Distribution)

Depending if our customers are contractual or not, we use different approaches:

- **Contractual**:
  - Basic Structural Model of CLV (Jain and Singh 2002; Berger and Nasr 1998)
  - Regression/Recency, Frequency, and Monetary (RFM) Models (e.g., Donkers, Verhoef, and de Jong 2007)
  - Hazard Rate Models (Borle, Singh, and Jain 2008)
- **Non-contractual**:
  - Pareto/NBD (Schmittlein, Morrison, and Colombo 1987)
  - Beta-Geometric/NBD or BG/NBD (Fader, Hardie, and Lee 2005 b)
  - Markov Chain Models (Pfeifer and Carraway 2000; Rust, Lemon, and Zeithaml 2004)
  - Markov Chain Monte Carlo (MCMC) Data Augmentation Based Estimation Framework (Singh, Borle, and Jain 2008)

CLV Formula

The traditional CLV formula is:

$$CLV = \sum_{n=1}^{T} \frac{(p_t - c_t)r_t}{(1+i)^t} - AC$$

where

$p_t =$ price paid by the customer in time t,

$c_t =$ direct costs for customer service in time t,

$i =$ discount rate or cost of money for the firm,

$r_t =$ probability that the client returns to buy or is alive in time t,

$AC =$ acquisition cost, and

$T =$ time horizon to estimate CLV.

A simplification

Let's consider that p y c are constant values and r is a decresing function in time (r^t), then the formula becomes:

$$CLV = \sum_{n=1}^{\infty} \frac{(p-c)r^t}{(1+i)^t} = (p-c)\sum_{n=1}^{\infty} \frac{r^t}{(1+i)^t} = \frac{(p-c)r}{1+i-r}$$

Proof. Let's consider:

$$S_N = \sum_{n=1}^{N} \frac{r^t}{(1+i)^t} = \sum_{n=0}^{N} \left(\frac{r}{(1+i)}\right)^t$$

That means

$$S_N = \frac{r}{(1+i)} + ... + \left(\frac{r}{(1+i)}\right)^N$$

As a result,

$$\left(\frac{r}{(1+i)}\right) * S_N = \left(\frac{r}{(1+i)}\right)^2 + ... + \left(\frac{r}{(1+i)}\right)^{N+1}$$

Combining both of them:

$$S_N - \left(\frac{r}{(1+i)}\right) S_N = \frac{r}{(1+i)} - \left(\frac{r}{(1+i)}\right)^{N+1}$$

Then,

$$S_N = \frac{\frac{r}{(1+i)} - \left(\frac{r}{(1+i)}\right)^{N+1}}{1 - \left(\frac{r}{(1+i)}\right)}$$

And applying limits and simplyfing the fraction, we obtain the desired outcome.

General formula

$$E(CLV) = \int_0^{\infty} E[v(t)]S(t)d(t)dt$$

where

- $E[v(t)]$ is the expected value (or net cashflow) of the customer at time t (if active)
- $S(t)$ = the probability that the customer has remained active to at least time t
- $d(t)$ = discount factor that reflects the present value of money received at time t

CLV limitations

- It can not be used if we don't have costs.
- There are many ways to allocate costs.
- We need to estimate the future behaviour of the customer and there are many different forecasting techniques.
- Therefore, it is important to remember that:

Our ability to predict the future is limited by the fact that to some extent is contained in the past.

- What mathematically means we are under some continuity conditions (or the hyphotesis are true)

Steps to consider CLV

- [**BU**] Discuss whether CLV fits as a metric in our business
- [**DP**] Identification and understanding of sources and metadata
- [**DP**] Extract, transform, clean and load data
- [**M**] Choose CLV method
- [**M/E**] Analyze results and adjust parameters
- [**D**] Present and explain the results

Benefits

- Ability to create business objectives
- Better understanding of customers
- Having a common numerical analysis criteria
- Ability to have an alert system
- Improved management of the sales force

Use Cases

- Create market strategies based on CLV
- Customer segmentation based on CLV
- Forecasting and customer evolution per segment
- Create different communication, services and loyalty programs based on CLV
- Awake "non-active" customers
- Estimated the value of a company (startup, in the context of acquisition)

ARPU as CLV aproximation

Average Revenue per User (ARPU) can be used to calculate historical CLV. Process:

- calculate the average revenue per customer per month, add them up
- and then multiply by 12 or 24 to get a one- or two-year CLV.

Suppose:

Customer Name	Purchase Date	Amount
Josep	January 1, 2015	$150
Josep	May 15, 2015	$50
Josep	June 15, 2015	$100
Laura	May 1, 2015	$45
Laura	June 15, 2015	$75
Laura	June 30, 2015	$100

Josep's ARPU is

$$(150 + 50 + 100)/6 = 50$$

Laura's ARPU is

$$(45 + 75 + 100)/2 = 110$$

.

Adding these two numbers gives you an average monthly revenue per customer of $160/2 = $80. To find a 12-month or 24-month CLV, multiply that number by 12 or 24.

The benefit of an ARPU approach is that it is simple to calculate, but it does not take into account changes in your customers' behaviors.

Note: ARPA is when we consider **accounts** instead of user. AMPU is when we consider average margin instead of average revenue. AMPA is when we consider average margin and accounts instead of average revenue and users.

How does ARPU relate to CLV?

$$CLV = \sum_{n=1}^{\infty} \frac{(ARPU_n - CCPU_n)r_n}{(1 + WACC)^t} - AC$$

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