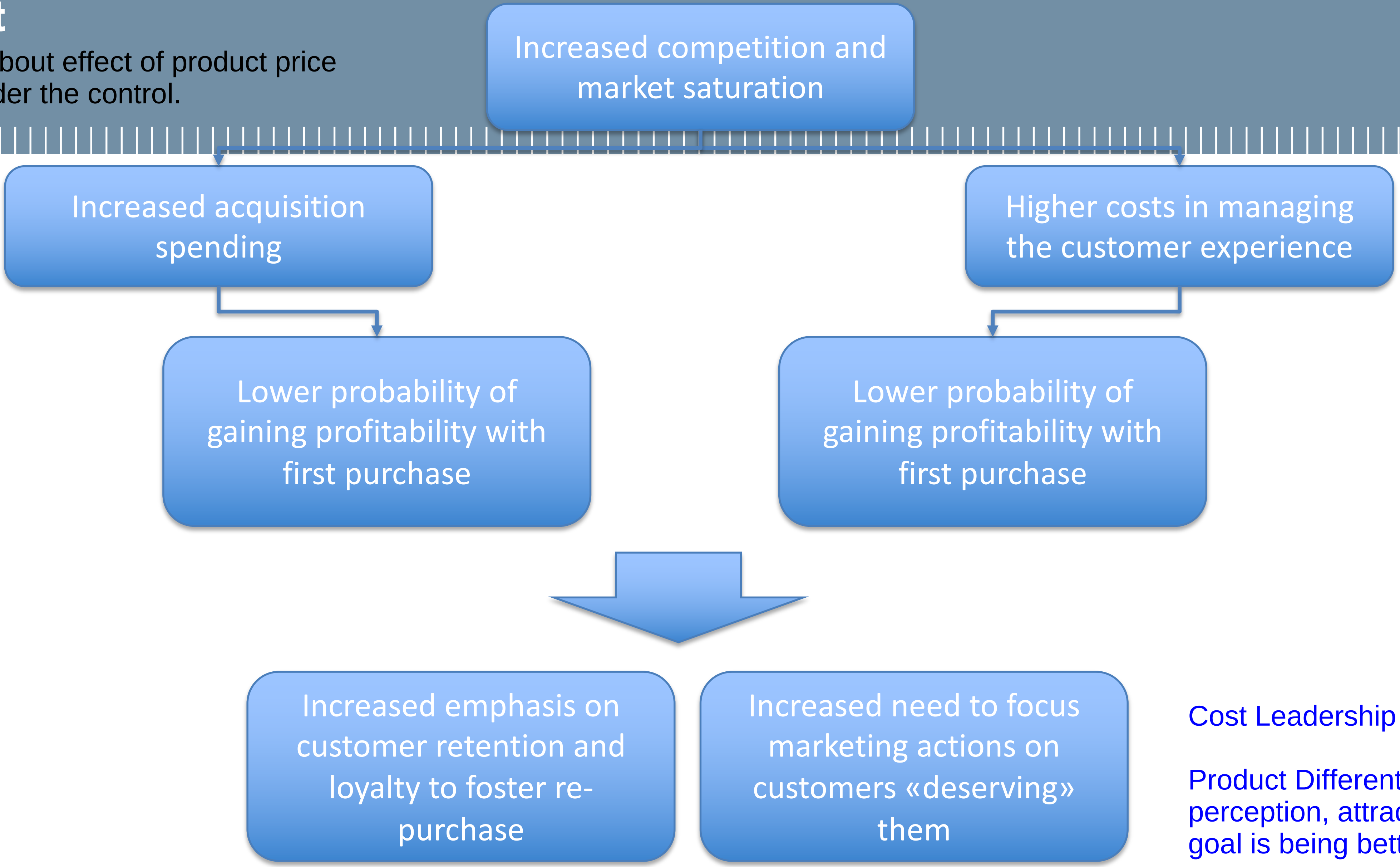
Customer (e)valuation

Marketing Analytics – Lucio Lamberti

Context

Chattering about effect of product price and cost under the control.



Cost Leadership

Product Differentiation -> value perception, attractiveness (our goal is being better than others)

value is a perception

Context

Investing in customer relationships means committing resources to provide specific services (e.g., customer service, «extra-miles», loyalty programs, etc.)

Fundamental questions:

1. What is the expected value I can create through a specific customer relationship?
2. Is it worthwhile to invest in acquiring a new customer?
3. A customer threatens to churn. How much should I invest in trying to retain her?
4. What is the overall situation of my customer base?

cornerstione issue : CAC is grown drastically.

people mean differently... so it means different marketing plans and it means extra CAC. like t-shirts

high CAC and customer are high cont... are stimulated by others ... losing customer is easier.

technology favor: also returning cost are free, switching cost is so low

high CAC => long time to return the value

Example of SEM

Customer evaluation: conceptual background

$$Economic\ value = \sum_{t=0}^{\infty} \frac{NCG_t}{(1+WACC)^t}$$

$$NPV = \sum_{t=0}^{T-1} \frac{NCG_t}{(1+WACC)^t} + TV(T)$$

Where does value come from?
What is the «real» investment which may pay off?

CLV: operational definition

CLV of an individual customer is the Net Present Value of the relationship a company foresees developing with her.

$$\text{Economic Value} = \Sigma_N * CLV_i$$

$$CLV = \Sigma_n \; P_i$$

Value drivers:

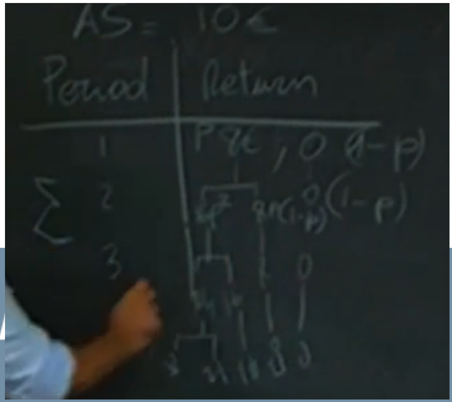
N: number of customers

P: Profitability of individual customer

n: no. relations per individual customer

in general we shouldn't use deterministic formula for CLV,
we need stochastic NPV for embracing the complexity

CLV as expression of current and future profitability of individual customer



NPV = I0 + sigma binahayat NCF / (1 + Wacc)^t
if it's > 0 it's a good investment.

Applicability

- Contexts in which CLV and customer valuation are particularly useful:
  - Subscription-based models
  - Repetitive purchase (better if frequent, but not necessarily)

- Contexts in which CLV and customer valuation are less precise:
  - Infrequent purchases (e.g., real estate, car dealers, etc.)

Theoretical underpinnings of CLV

1. Discounted cash-flow: CLV analyzes long-termed effects (generally, years), so a DCF approach is required (hence, a financial and not economic approach is necessary → relevant in case of installments, long payment terms, etc.; in general, in frequent purchases these phenomena tend to be less relevant)

2. Stochastic modelling: a customer is an exogenous variable which has a contractual/natural probability of churning at every transaction. So the first and foremost stochastic phenomenon to model is **customer retention**

Assuming the probablity

Retention rate and churn rate

problem of calculating CLV

Retention rate (RR)

RR(t) is the probability that a customer who was active in (t-1) will in (t)

t is duration of relationship with customer.

it's not calendar year.

Churn rate

The label is applied in different ways that are conceptually very diverse:

- Churn rate (t) = 1 – RR(t) = $\frac{\#\, churned\ customers(t)}{active\ customers(t-1)}$
- Churn rate (t) = $\frac{\#\, churned\ customers(t)}{active\ customers(0)}$
- Churn rate (t) = $\frac{\#\, churned\ customers(t)}{average\ customer\ base\ (t)}$

churned customers (t) = Active customers (t-1) – Active customers (t)

An example

	12/31/2020	12/31/2021	12/31/2022	12/31/2023
Active customers	3500	3600	3800	3700
Lost customers (churned)		300	400	200
Baby churn (t < 12 months)		140	100	50
Churn rate		?	?	?

	12/31/2020	12/31/21	12/31/22	12/31/23
Active customers	3500	3600	3800	3700
Lost customers		300	400	200
Baby churn(t<12months)		140	100	50
NEW		540	700	150
Churn Rate در سال		12.57%	13.89%	6.58%
CR 1		9%	11%	5%
CR 0		26%	14%	33%

Retention rate and churn rate

A t = 0 the company acquires 10.000 customers. RR(t) is constant and equal to 0.9. How many customers are going to be active in the first 3 periods?

t = 0
Active customers = 10.000

t = 1
Active customers = 10.000 * RR(1) = 9.000
Churned customers = 1.000

t = 2
Active customers = 9.000 * RR(2) = 8.100
Churned customers = 900

RR(t) may be considered independent from RR(t-1), so the probability that a customer who is active in period 1 (A1) is still active in period 2 (A2) is:

$$P(A2 \cap A1) = RR(1) * RR(2) = \text{cumulated RR}$$

Retention rate and churn rate

A t = 0 the company acquires 10.000 customers. RR(t) is constant and equal to 0.9. How many customers are going to be active in the first 3 periods?

t = 0
Active customers = 10.000

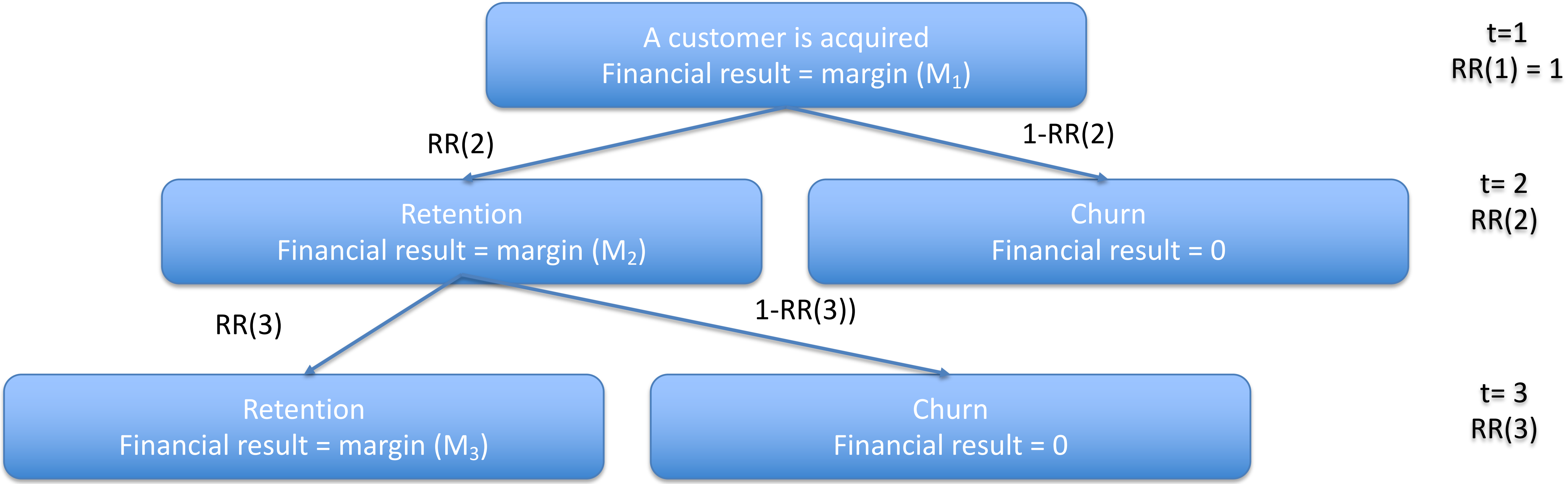
t = 1
Cumulated RR(1) = RR(0)*RR(1) = 1*0.9 = 0.9
Active customers (1) = Active customers(0)*cumulated RR(1)

t = 2
Cumulated RR(2) = RR(0)*RR(1)*RR(2) = 1*0.9*0.9 = 0.81
Active customers (2) = Active customers(0)*cumulated RR(2)

If a customer is acquired in 0, her probability of being active over time (cumulated Retention Rate) is:

$$CumulatedRR(T) = \prod_{t=0}^{T} RR(t)$$

Modelling CLV



$CLV(3) = CLV(1) + CLV(2) + CLV(3) = M_1 * RR(1) + RR(1) * RR(2) * M_2 + RR(1) * RR(2) * RR(3) * (M_3)$ Period-wise

$CLV(3) = (M_1 + M_2 + M_3) * RR(3) * RR(2) * RR(1) + (M_1 + M_2) * (1\text{-}RR(3)) * RR(2) * RR(1) + M_1 * (1\text{-}RR(2)) =$ Path-wise

$= M_1 * RR(1) + RR(1) * RR(2) * M_2 + RR(1) * RR(2) * RR(3) * (M_3)$ (obviously)

The CLV formula

$$CLV = \sum_{t=1}^{\infty} \frac{M_t * \prod_{t=0}^{T} RR(t)}{(1 + DR)^t}$$

Transactions over time can be irregular, making DCF imprecise. We need to generalize

Where:
M_t = margin in the t-th transaction
RR(t) = retention rate in t-th transaction
DR = Weighted Average Cost of Capital

The CLV formula

The most general formula

$$CLV = \sum_{t=0}^{\infty} \sum_{k=1}^{\infty} \frac{M_{k,t} * \prod_{i=0}^{t} RR(k,i)}{(1 + DR)^t}$$

Where:

k = transtaction

t = period

$M_{k,t}$ = margin of the k-th transaction in t-th period

RR(k,t) = retention rate estimated for the k-th transaction in t-th period

DR = Weighted Average Cost of Capital

The CLV formula

If we model 1 transaction per year

$$CLV = \sum_{t=0}^{\infty} \frac{M_t * \prod_{i=0}^{t} RR(i)}{(1 + DR)^t}$$

first term is devided by 1 because it's taken and is for granted

Where:
t = period
M_t = margin t-th period
RR(t) = retention rate estimated for the k-th transaction in t-th period
DR = Weighted Average Cost of Capital

The CLV formula

If we model constant RR

$$CLV = \sum_{t=0}^{\infty} \frac{M_t * RR^t}{(1 + DR)^t}$$

اگر ام ثابت باشه بیاد بیرون و
بقیش هم ثابته برای همین
میشه یک تصاعد هندسی که
باید جمعش کنیم.

$$\sum_{n=1}^{\infty} ar^{n-1} = \frac{a}{1-r}$$

Where:
k = transtaction
t = period
$M_{k,t}$ = margin of the k-th transaction in t-th period
RR(k,t) = retention rate estimated for the k-th transaction in t-th period
DR = Weighted Average Cost of Capital

Modelling CLV

So, an analytical approach to CLV modelling (period-wise) consists of:

1. Estimating Margin scenarios
2. Estimating RR
3. Calculating Cumulated RR
4. Applying the discount factor
5. Calculating the period-CLV
6. Summing up the period-CLVs to obtain the total CLV
7. Managing terminal value

Exercise

The following are the data about customer activation and de-activation of a Telco.
What retention rate can we expect for the future?

	acquired	Deactivated										
Activation year	Activated	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2010	286.817	20.196	83.687	43.608	31.103	24.680	16.494	11.013	8.809	7.635	5.889	2.858
2011	320.027		17.394	65.835	60.169	42.256	27.603	18.945	14.710	12.424	9.504	4.534
2012	433.831			24.974	94.561	87.625	53.861	33.018	25.450	20.364	15.981	7.600
2013	517.446				31.834	115.054	97.513	63.607	44.397	31.993	24.080	11.368
2014	512.668					26.925	97.469	99.288	74.460	47.816	33.142	15.093
2015	545.200						31.469	94.644	108.201	79.935	50.668	22.145
2016	545.186							30.168	82.861	103.144	82.012	32.860
2017	512.244								28.095	69.060	88.841	45.107
2018	551.194									27.208	72.073	48.106
2019	520.805										25.814	37.983
2020	322.258											6.240

Exercise

A Telco operator is launching a new wireline offer for its customers.

The offer is a 35€/month flat fee paid by the customer with direct debit at the end of the period.

The average margin (ARPU) on the offer is the 20% of the full price

The offer foresees a 24.5€ special price for the first 12 months.

Retention rate is expected to be 0.99 in months 1-3, 0.995 per month in the first 12 months and 75% per year from month 13 on.

Assuming WACC = 1% per month, what is the customer lifetime value of an acquired customer?

What is the average and the median lifetime of a customer?

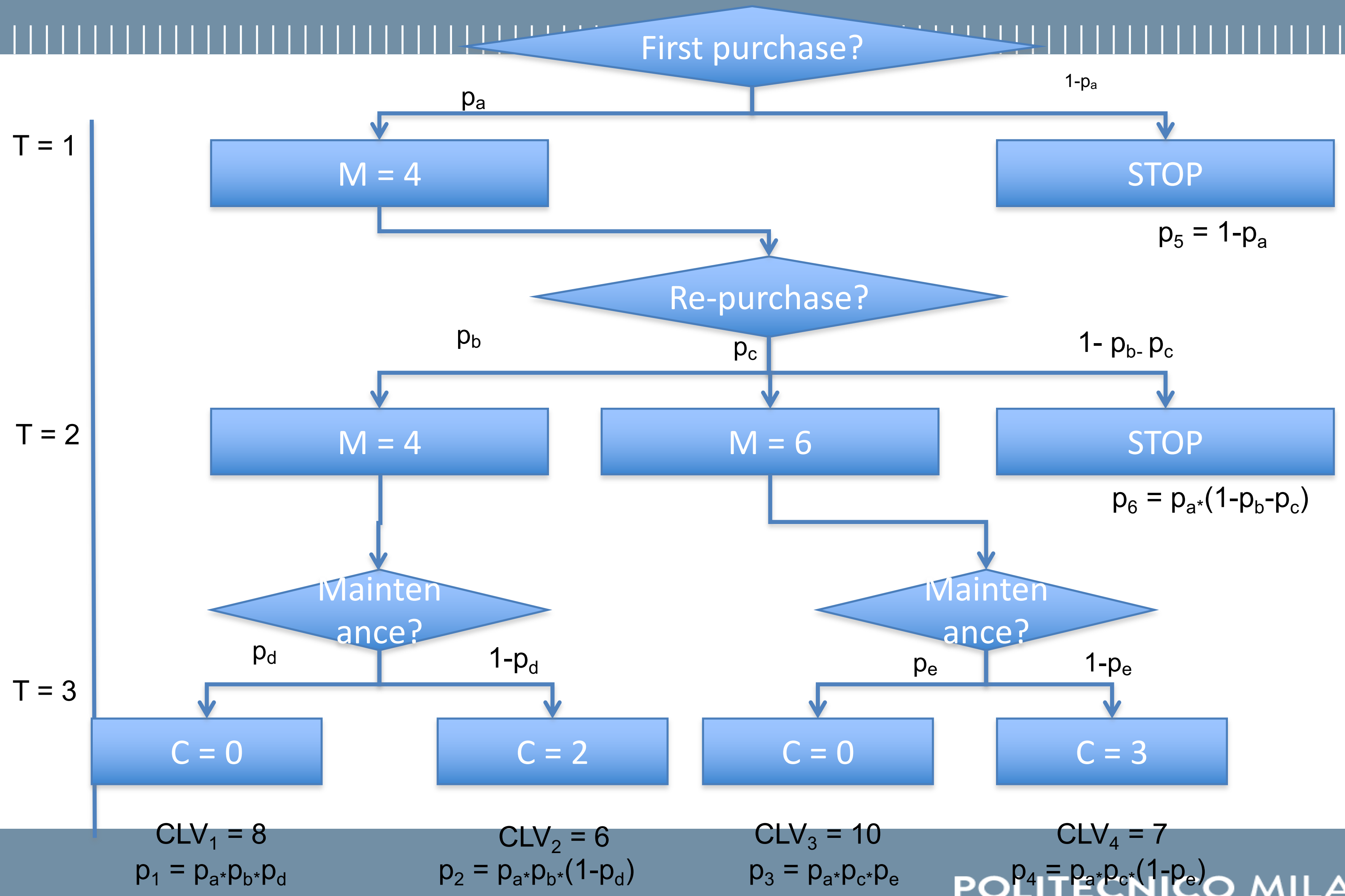
In order to predict future CLV in response to uncertain events (e.g., possible upselling/cross-selling, possible maintenance costs, etc.) a stochastic approach may be adopted

General principle:

$$\overline{CLV} = P_1 * CLV_1 + P_2 * CLV_2 + P_3 * CLV_3 + \dots$$

Where p_i are the probability of occurence of the different scenarios

Building scenarios



Special cases of CLV

Let:

M = margin (discounted at the end of the first period)
RR = retention rate
DR = discount rate

$$CLV = \sum_{t=1}^{\infty} \frac{M_t * RR^t}{(1+DR_t)^t}$$

Please note: t = 1 because t is the number of transactions
DR_t is the discount rate between t and t-1

Special cases of CLV

Be M, RR and the time interval constant

$$CLV = \sum_{t=1}^{\infty} \frac{M * RR^t}{(1+DR)^t} = M * \sum_{t=1}^{\infty} \frac{RR^t}{(1+DR)^t} =$$

$$= M * \sum_{t=1}^{\infty} \left(\frac{RR}{(1+DR)} \right)^t$$

Geometrical series

$$\sum_{n=0}^{\infty} x^n = 1 + x + x^2 + x^3 + \cdots = S$$

And $\sum_{n=0}^{N} x^n = 1 + x + x^2 + x^3 + \cdots + x^N = S_N$

In our case x is greater than 0

$$if\ x \geq 1, then\ S_{N+1} > S_N \rightarrow S = \infty$$

If 0<x<1, then:

$$xS \quad = x + x^2 + x^3 + \cdots = S \quad - 1$$

$$S \;\; = \frac{1}{1-x}$$

Special cases of CLV

Be M, RR and the time interval constant

$$M * \sum_{t=1}^{\infty} \left(\frac{RR}{(1+DR)} \right)^t = M * \sum_{t=0}^{\infty} \left(\frac{RR}{(1+DR)} \right)^t - M$$

as

$$0 < \left(\frac{RR}{(1+DR)} \right) < 1$$

then

$$\sum_{t=0}^{\infty} \left(\frac{RR}{(1+DR)} \right)^t = \frac{1}{1 - \frac{RR}{1+DR}} = \frac{1+DR}{1+DR-RR}$$

so

$$M * \sum_{t=0}^{\infty} \left(\frac{RR}{(1+DR)} \right)^t - M = M * \frac{1+DR}{1+DR-RR} - M = \frac{M * RR}{1+DR-RR}$$

Special cases of CLV

So:

$$CLV = \frac{M * RR}{(1+DR-RR)}$$

Under the following assumptions:

- Constant margins
- Constant retention
- T = ∞

Spotify Reveneue: 180 euro a year
Cost = 165

Example

An ISP charges 19,95€/month

Variable costs = 18€/Y*account

Marketing spending = 6€/Y*account

RR = 99% per month

DR = 1%

CLV = ?

2	Charges	19,95	month		
3					
4	Costs	18	year	1,5	month
5	Marketing	6	year	0,5	month
6	RR	99%	month	89,5%	year
7	DR	1%	month	11,6%	year
8					
9	M	215,4			
10	CLV	875,30 €			
11					

it's ok to pay less than 875.30 for acquiring this customer.

Special cases of CLV

Relaxing the hypotheses:

–Existence of a margin in 0 (or margin discounted at the beginning of the period) → CLV with Initial Margin

initial margin (

$$CLV = IM + M * \frac{RR}{(1 + DR - RR)}$$

– Relaxing T = ∞ → in general, T = 4-5 years, even if, when yearly RR < 0,8 (roughly, 0.98 per month) and DR > 10% per year, the first five years account for more than the 80% of the total CLV

$$CLV_{approx} = IM + AC * \left(M * \frac{RR}{(1+DR-RR)}\right)$$

!!! اینجارو ببین

AC = approximation coefficient

Approximation coefficient

AC		RR				
		0,8	0,85	0,9	0,95	0,99
DR	5%	80%	70%	60%	45%	25%
	7%	80%	75%	60%	50%	35%
	9%	80%	75%	65%	55%	40%
	10%	85%	75%	70%	55%	45%
	15%	85%	80%	75%	65%	55%

Objective: to account for the lifetime value of a newly aquired customer

Use: prospecting decisions

$$PLV = AR * [IM + CLV] - AS$$

prospect lv => cost of a yet not acquired customer!

we use it for campaing performance assessment

AR = Acquisition Rate

IM = Initial Margin

AS = Acquisition Spending (per capita)

capaing paysoff

It is possible to invert the formula to get a break-even AR

$$BEAR = AS / [IM + CLV]$$

Example

claculating break even for marketing campaign.

Total budget = 60.000€

Target = 75.000

AR = 1,2%

IM = 10€

CLV = 100€

Is the campaign economically attractive?

BEAR?

Sensetivity Analysis?

what would happen if I change some factors

Solution

$$BEAR = AS/[IM + CLV]$$

Here:
AS = budget/target = 60.000€ / 75.000 = 0,8€
IM = 10
CLV = 100
BEAR = 0,8/110 = 0,73%
Since AR > BEAR, the campaign is economically attractive
ROI = ((AR-BEAR)*Target*(CLV+IM))/budget = 65%

Exercise

- A music streaming service monthly fee for premium customers is priced 14,95€
- Let's set direct costs per user (both free and premium) at 84€/year
- A free user generates direct revenues at € 6,5 per month
- Let's set
  - DR = 10% per year
  - RR(free) = 99% per year
  - RR(premium) = 95% per year
- and upselling marketing investments (from free to premium) at € 750.000 per year

1. What is the CLV of free and premium customers?
2. If, on Jan 1st, we have 1.500.000 free users, is the marketing investment likely to payback?

Solution

- R = 14,95€ per month (prmium), 6,5€ (free)
- direct costs per user (both free and premium) = 84€/year
- DR = 10% per year
- RR(free) = 99%
- RR(premium) = 95%
- upselling marketing budget = € 750.000 per year
- Customer Base (CB) at 01/01 = 1.500.000 free users

$$CLV_{approx} = \text{IM} + \text{AC} * (\text{M} * \frac{RR}{(1+DR-RR)})$$

Let's turn everything in yearly terms:

R (free) = 78 €; R (premium) = 179,4 €

M (free) = -6 €; M (premium) = 95,4 €

In this case:

- IM = 0
- AC =

Approximation coefficient

Premium

Free

AC		RR				
		0,8	0,85	0,9	0,95	0,99
DR	5%	80%	70%	60%	45%	25%
	7%	80%	75%	60%	50%	35%
	9%	80%	75%	65%	55%	40%
	10%	85%	75%	70%	55%	45%
	15%	85%	80%	75%	65%	55%

Solution

$$CLV_{approx} = \text{IM} + \text{AC} * (\text{M} * \frac{RR}{(1+DR-RR)})$$

Let’s turn everything in yearly terms:

R (free) = 78 €; R (premium) = 179,4 €

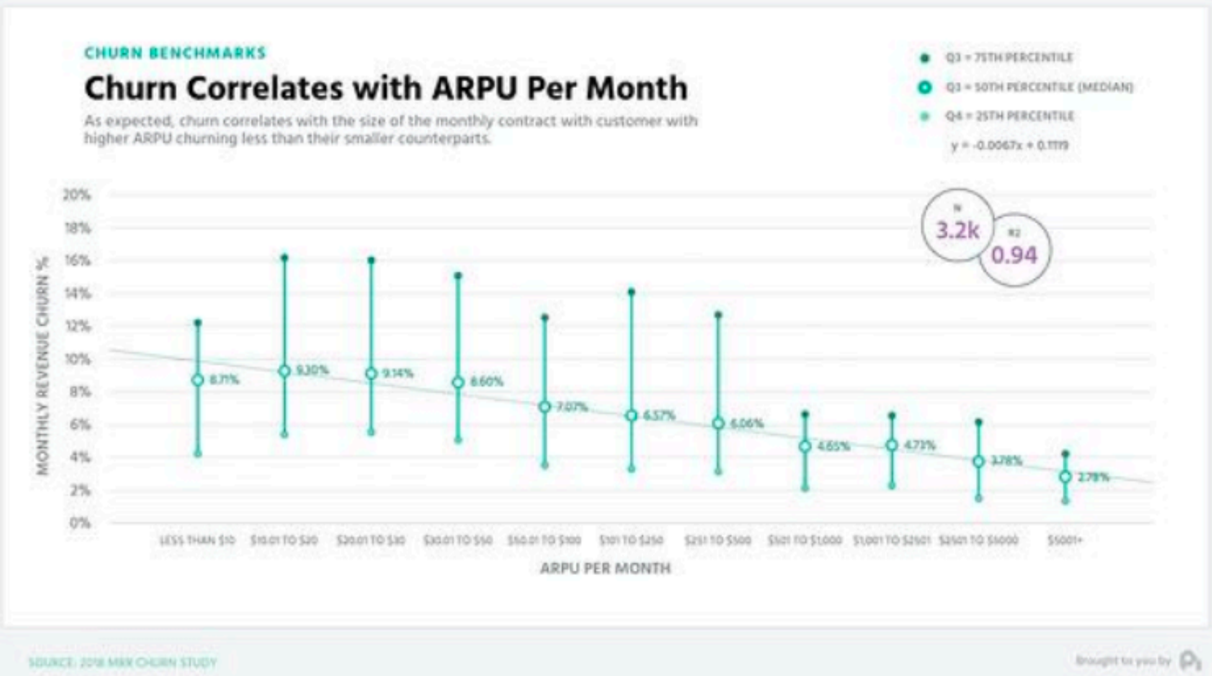
M (free) = -6 €; M (premium) = 95,4 €

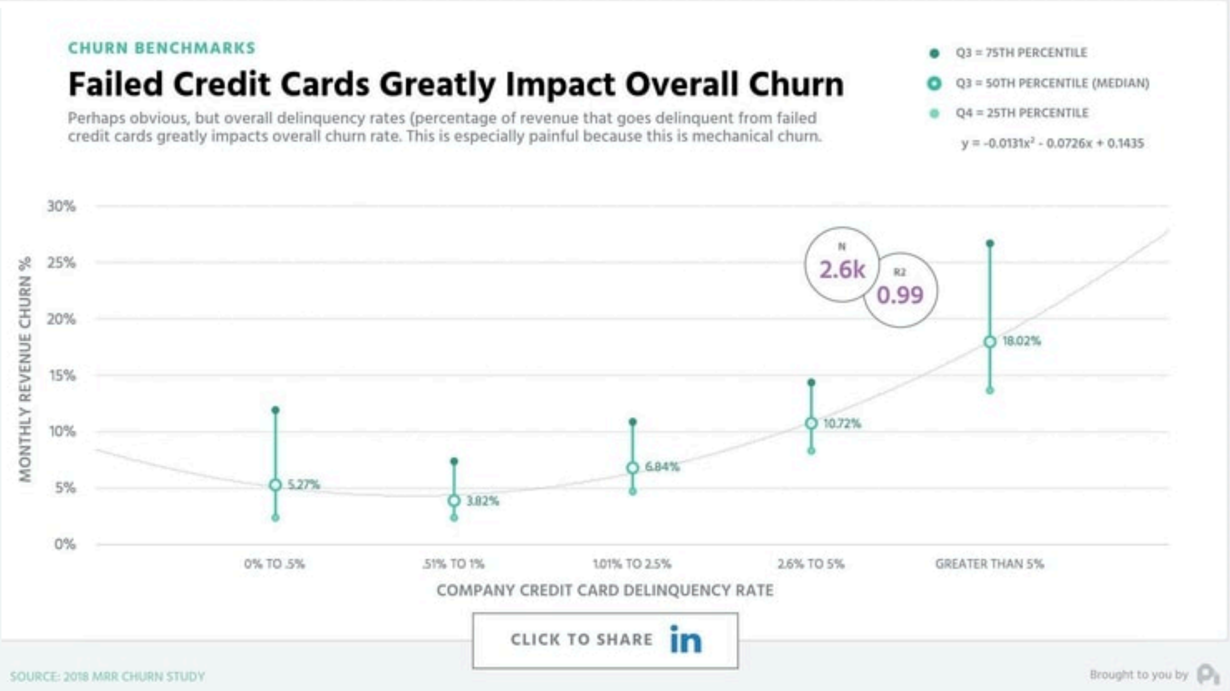
In this case:

- IM = 0
- AC =
- Free customer: 0,45 * (-6) * (0,99/(1+0,1-0,99)) = - 24,3
- Premium customer = 0,55 * (95,4) * (0,95/(1+0,1-0,95)) = 332,31
- CLV increase in case of upselling = 356,61
- AS = 750.000 € / 1.500.000 = 0,5€
- BEAR = AS/CLVincr = 0,14%

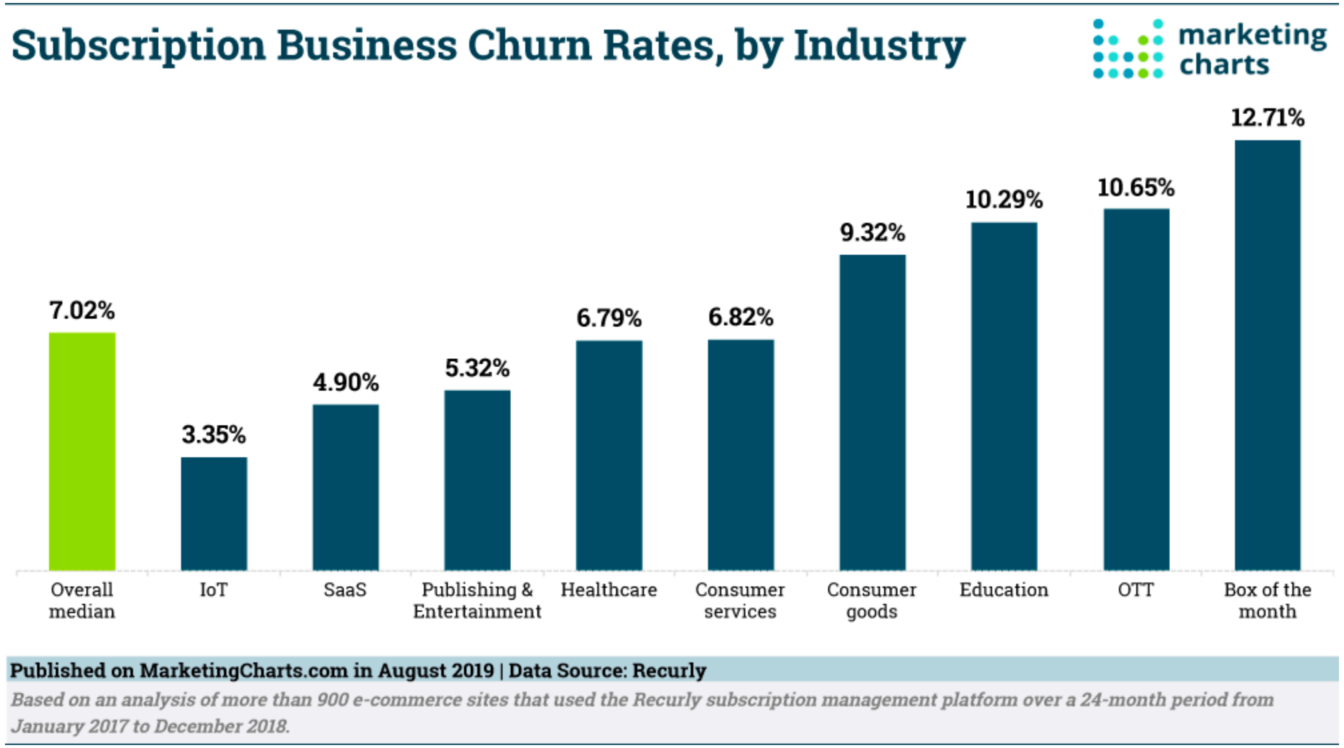
- The campaign seems highly profitable

Churn rate and retention rate: a subscription-based markets benchmark





Churn rate in subscription-based business models



Making CLV formula more complete

- Whatever cost/margin-revenue related to the lifetime, until associated with a probability of occurrence may be added to the analytical CLV formula to make it more comprehensive

$$CLV = \sum_{t=0}^{\infty} \sum_{k=1}^{\infty} \frac{(M_{k,t}) * \prod_{i=0}^{t} RR(k,i) + x_t * p(x_t)}{(1+DR)^t}$$

Where
x_t is the further cost/margin
$p(x_t)$ is the probability of occurrence of x_t

Final remarks

- CLV calculated upon RR represents the **average stochastic CLV** for a population
- If we know in advance the lifetime of a customer, her CLV will just be the discounted sum of the margins
- If cumulated $RR_t = 0.5$ it means that, by t, we will lose 50% of the customers, hence t will be the **median lifetime**
- **Average lifetime** is calculated as a weighted average of the lifetimes of churners

$$AVG(Lifetime) = \sum_{t=0}^{\infty} CR_t * CLT_t$$

Where
CR_t is the probability of churn in t
CLT(t) is the lifetime of the churners churning exactly in t

- **Median lifetime = average lifetime** if and only if CR(t) is symmetrical in t