

Price discrimination in a lifetime value framework: When is CLV maximization an optimal strategy?

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The information revolution is reshaping the way firms interact with their customers...

Customer intelligence



Addressability

The ability to contact consumers individually¹



Targetability

The ability to predict preferences and purchase behaviors of individual customers

for the purpose of customizing its price or product offer¹

Consumer's heterogeneity

- Brand preference
- Switching costs

How?

- Price discriminate? To whom?
- While max ST profits, or CLV?

¹ Chen, Narasimhan and Zhang (2001)



Introduction

- *“Growing a business can be framed as a matter of getting customers and keeping them so as to grow the value of the base to its fullest potential.”*

Blattberg and Deighton (HBR, 1996)
- *“Customer equity is the sum of the lifetime value of all the customers of a firm. Maximizing customer equity will lead to enhanced profits.”*

Rust, Lemon, Zeithaml (MSI, 2001)
- *“All firms need to direct attention to customer acquisition because once the customers make a commitment, they want to stay. Therefore the firms should focus on long run revenue stream.”*

Thomas (JMR 2001)

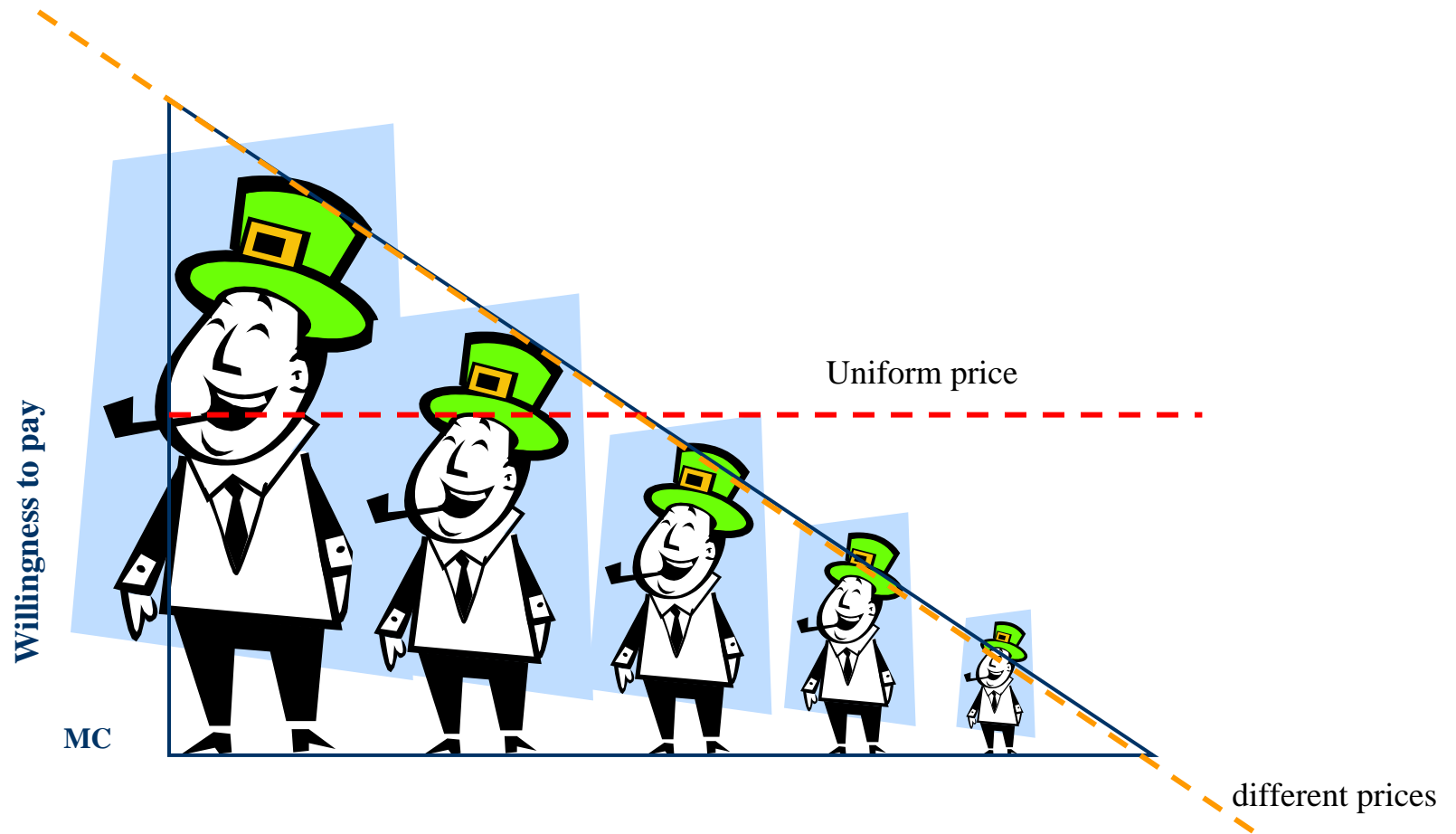


But....

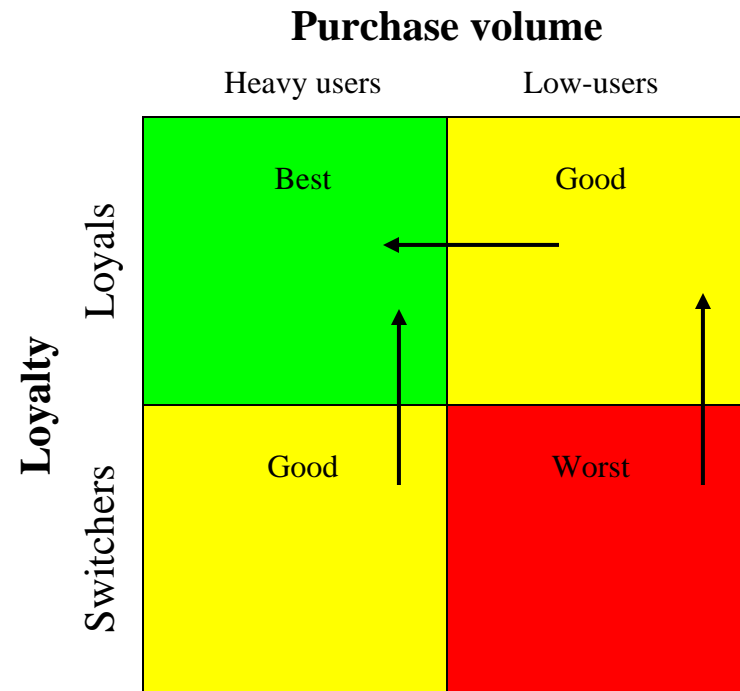
- Managers make decisions in firms

They follow market share data more than CLV

Willingness to pay and price discrimination



Loyalty and CLV





Price discrimination models

- Heterogeneity
 - Switching costs (e.g. Narasimhan, 1988; McGahan and Ghemawat, 1994; Chen, Narasimhan and Zhang, 2001)
 - Brand preference (e.g. Hotelling, 1929; Shaffer and Zhang, 1995; Fudenberg and Tirole, 2000)
- Concepts of PD
 - First, Second and Third-degree (Pigou, 1920; Tirole, 1988)
 - Behavior-based (Villas-Boas, 1998; Shaffer and Zhang, 2000)
- Strategic customers and jealousy effects (Villas-Boas, 1998; Chen and Zhang, 2001)
- Asymmetries (Shaffer and Zhang, 2000)
- Imperfect targetability (Chen, Narasimhan and Zhang, 2001)
- Cost of targeting (Shaffer and Zhang, 1995)
- Discrimination in prices, coupons, service



Building a behavior-based price discrimination model that integrates:

- *the concept of CLV maximization*
- *the higher profitability of long-life customers*

in order to answer the following two research questions:

- Should the company penalize loyal customers relative to switchers?
- Is it always optimal for a firm to set prices that maximize CLV? If not, when should it maximize ST profits instead?



Model

- 2 periods, homogeneous products, duopoly model
- Customers are heterogeneous in their switching costs. Firms know the distribution of switching costs.
- Fixed pool of customers
- Long-life customers may be more (or less) profitable over time
- There is perfect addressability, although not individual targetability.
- Each company maximizes retention and acquisition
- Offering different prices to different pools of customers, considering:
 - Whether they are current customers or prospects
 - Their switching costs
- Example: credit cards

Model

- Consumers are heterogeneous in their SC $\theta_i^h \square U(0,1)$, $h = \{1,2\}$
- Firms decide at t=0 whether to maximize CLV or ST

	CLV	ST
First period (p_{h1})	$\pi_{h1}(p_{11}, p_{21}) + \pi_{h2}(p_{12}^*(p_{11}, p_{21}), p_{22}^*(p_{11}, p_{21}))$	$\pi_{h1}(p_{11}, p_{21})$
Second period (p_{h2})	$\pi_{h2}(p_{12}(p_{11}^*, p_{21}^*), p_{22}(p_{11}^*, p_{21}^*))$	$\pi_{h2}(p_{12}(p_{11}^*, p_{21}^*), p_{22}(p_{11}^*, p_{21}^*))$

- Pairs of strategies: LVLV, STST, Asymmetry
- At t=1,2 firms offer an acquisition discount (a) and a retention discount (r) to each pool of customers
- Consumers decide to switch or repeat based on their SC (θ) and the discounts offered, e.g.

$$R_h = \Pr(\theta_h \geq a_{3-h} - r_h),$$

- Profits are a function of the number of customers retained and acquired and the discounts offered

$$\pi = \pi_R + p_A = R(1-r) + A(1-a)$$

The profitability of long-life customers: Two models

We develop and test two models depending on two different effects predicted by the CRM literature, that are included by an exogenous parameter δ in the profits equations

CASE A
VOLUME MODEL $\pi = \pi_R + p_A = \overbrace{(1+d)R(1-r)}^{\pi_R} + \overbrace{A(1-a)}^{\pi_A}$

δ : long-life customers are likely to buy more

CASE B
REVENUE MODEL $\pi = \pi_R + p_A = \overbrace{R((1+d)-r)}^{\pi_R} + \overbrace{A(1-a)}^{\pi_A}$

δ : long-life customers are cheaper to serve



Model equations

$$\theta_i^h \square U(0,1), \quad h = \{1,2\}$$

$$R_h = \Pr(\theta_h \geq a_{3-h} - r_h) = 1 - a_{3-h} + r_h$$

$$A_h = \Pr(\theta_{3-h} + r_{3-h} \leq a_h) = a_h - r_{3-h}$$

$$AA_h = aa_h - ra_j$$

$$RA_h = a_h - r_j + ra_h - aa_j$$

$$AR_h = ar_h - rr_j + r_j - a_h$$

$$RR_h = 1 + rr_h - ar_j$$

$$h = \{1,2\}, j = 3 - h$$

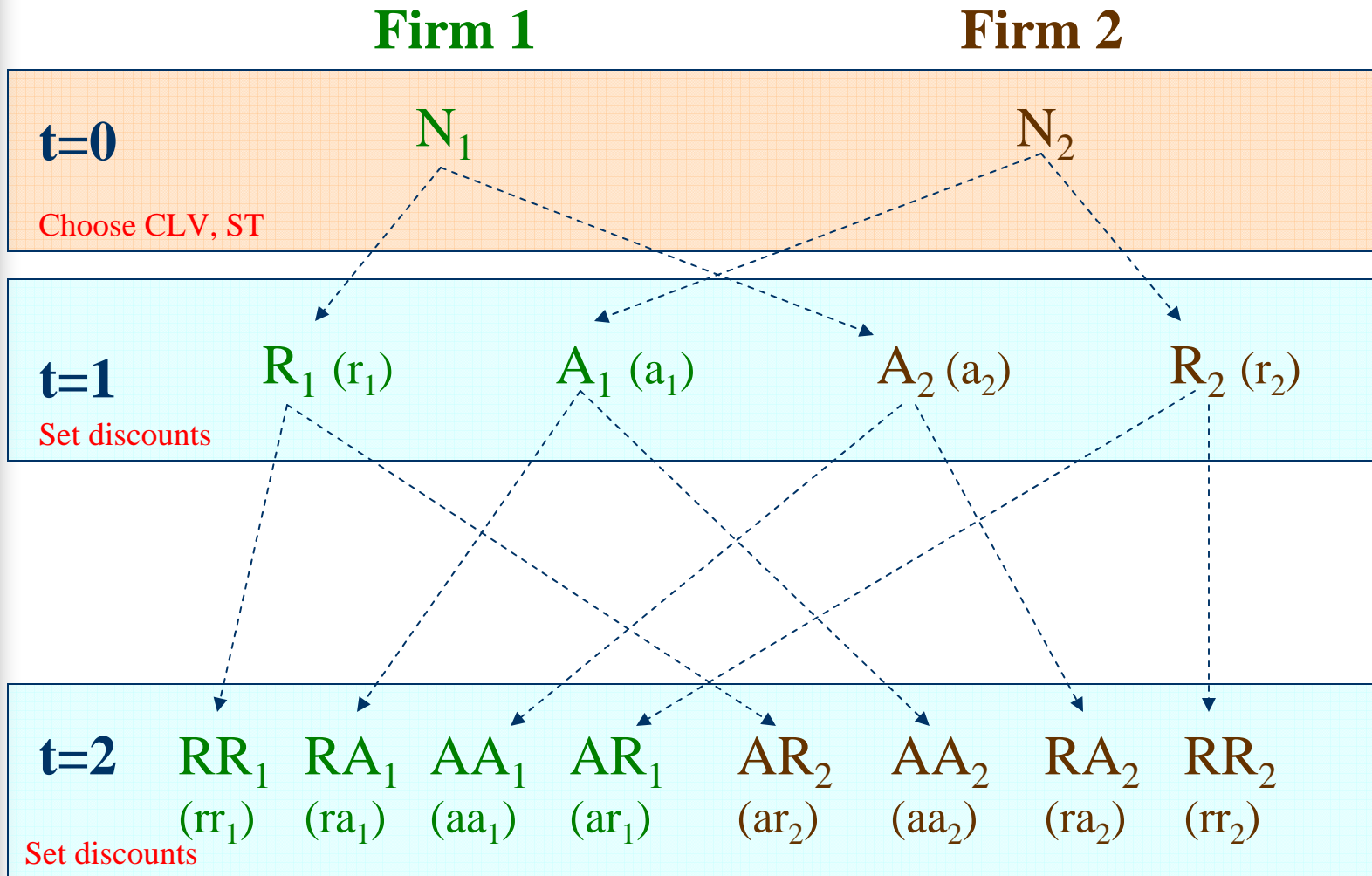
$$\rho_{h1} = (1 + d)R_h(1 - r_h) + A_h(1 - a_h)$$

$$\rho_{h2} = (1 + 2d)RR_h(1 - rr_h) + (1 + d)RA_h(1 - ra_h) + AA_h(1 - aa_h) + AR_h(1 - ar_h)$$

$$\rho_{h1} = R_h((1 + d) - r_h) + A_h(1 - a_h)$$

$$\rho_{h2} = RR_h((1 + 2d) - rr_h) + RA_h((1 + d) - ra_h) + AA_h(1 - aa_h) + AR_h(1 - ar_h)$$

The game

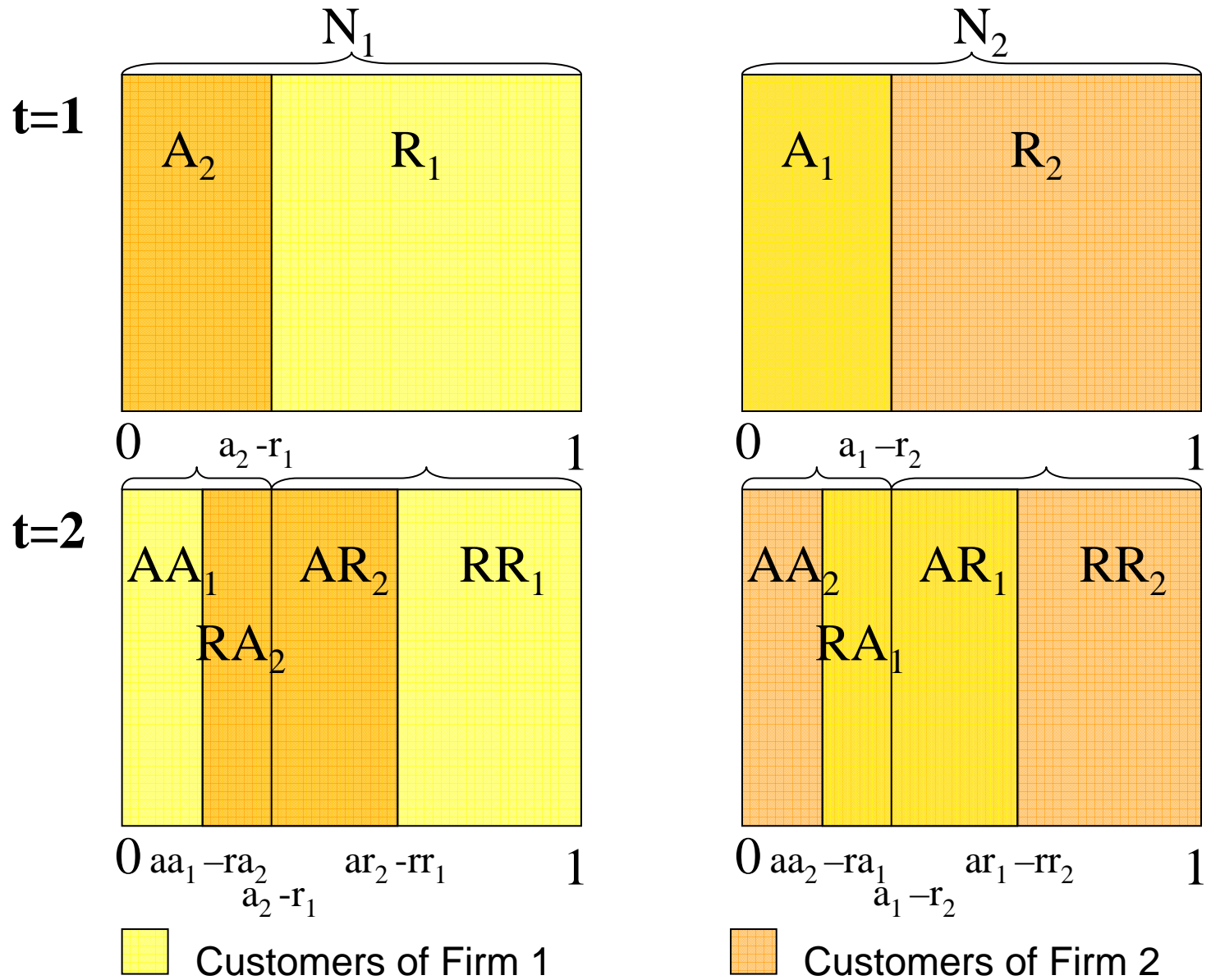


Each of these segments represents a history of purchases.
Firms price discriminate based on past behavior.

Segments' sizes are in caps letters

Discounts are in parenthesis

Observed switching costs' distributions



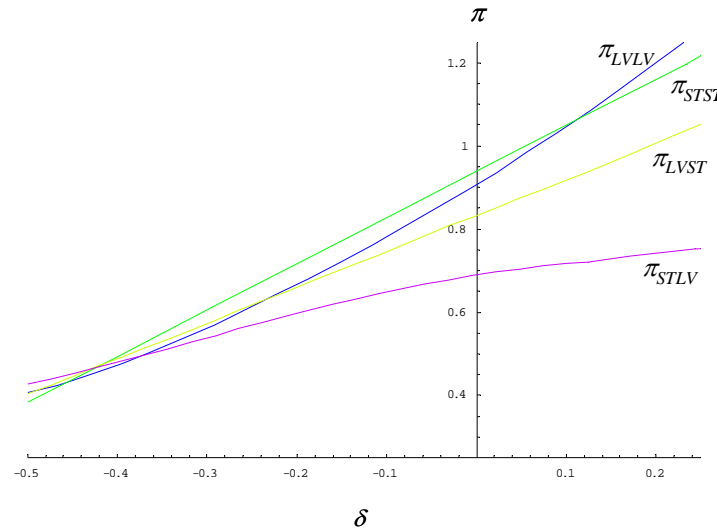
Results Volume Model

$$\pi = \pi_R + p_A \Rightarrow (1+d)R(1-r) + A(1-a)$$

δ : long-life customers are likely to buy more

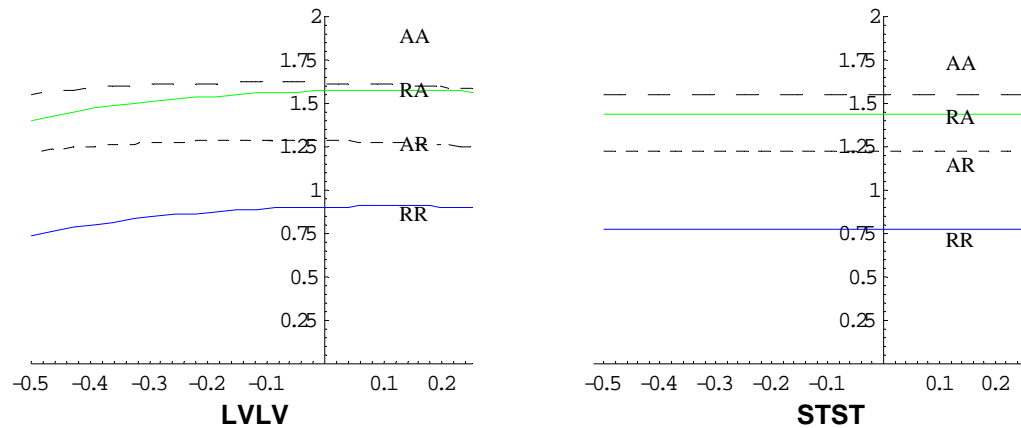
LVLV is PO for $\delta > 0.112$, and both LVLV and STST are NE for most values of δ

profits



Consumer welfare is higher the lower are the SC of a consumer segment

consumer welfare



Results Revenue Model

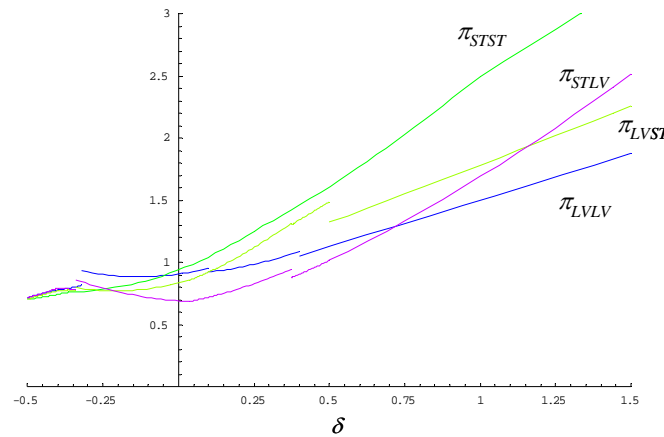
$$\pi = \pi_R + p_A = R \left[\overbrace{(1+d)}^{\delta} - r \right] + A(1-a)$$

δ : long-life customers are cheaper to serve

For all positive values of δ STST is the PO and for $\delta > 0.717$ STST is the unique NE.

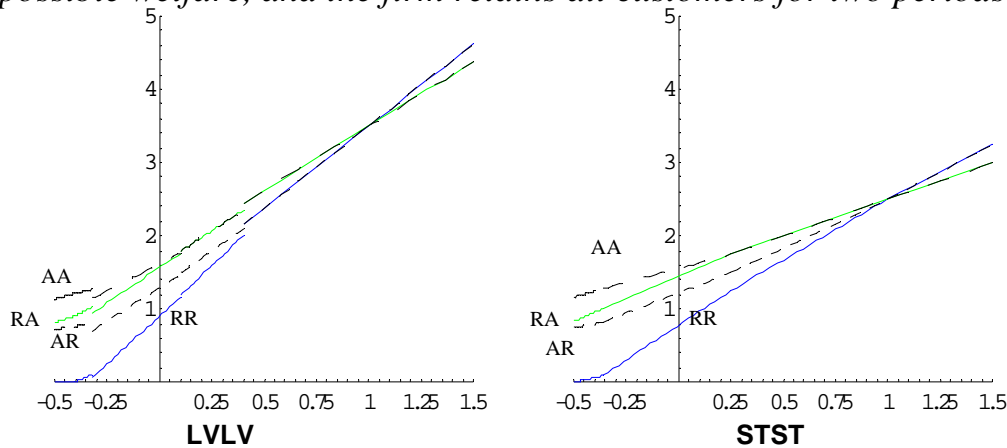
For most other values of δ both LVLV and STST are NE

profits



When δ is sufficiently high, the group of customers with the highest SC get the max possible welfare, and the firm retains all customers for two periods

consumer welfare





Conclusions

- Setting prices that max CLV is optimal only under some conditions:
 - The extent to which long-life customers are more (less) profitable than first-time customers
 - Whether this effect is specified as a volume or a revenue effect
- When loyal customers exhibit a sufficiently high revenue effect, the firm should retain all customers and loyal customers get the max possible welfare.



Further Work (Experiment)

- <http://iesedti.com/Equity/Equity.htm>

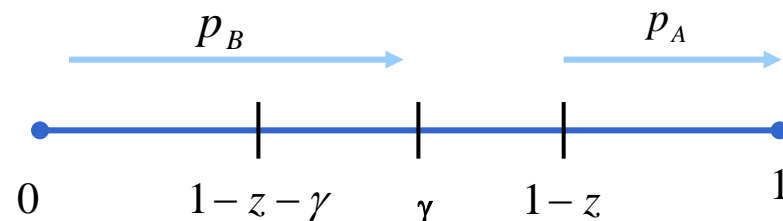


Related work (Villanueva et al. 07)

- Duopoly model
- Each firm owns a customer at the start of period 1
- Reservation utility of customer is 1
- Each customer is a potential switcher with probability z
- Switching cost is γ
- Firms choose two prices in each period - one directed to its own customer and the other to competitor's customer
- Revenue expansion effect
- Strategic customers

Related work (Villanueva et al. 07), continued

- Always a positive likelihood of customer “churn” in equilibrium, i.e., $p_A > p_B + \gamma$
- Benchmark case - one period model
 - Long term (CLV) same as short term (ST)
 - Lower limit of firm 1’s price is $(1-z)$ and firm 2’s 0
 - Condition for positive likelihood of customer churn is, $(1 - z) > \gamma$
 - There is only mixed strategy equilibrium





Further Research

- Asymmetries in the size of the players
- Heterogeneity in brand preference
- SC endogenized (e.g. as a function of discounts offered in the past)
- “jealousy” effects or customers behaving “strategically”
- Mix revenue and volume model
- New customers into the market