Who Benefits From Online Privacy?

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Price Discrimination

Buy.com COUPON — Redeem Coupon

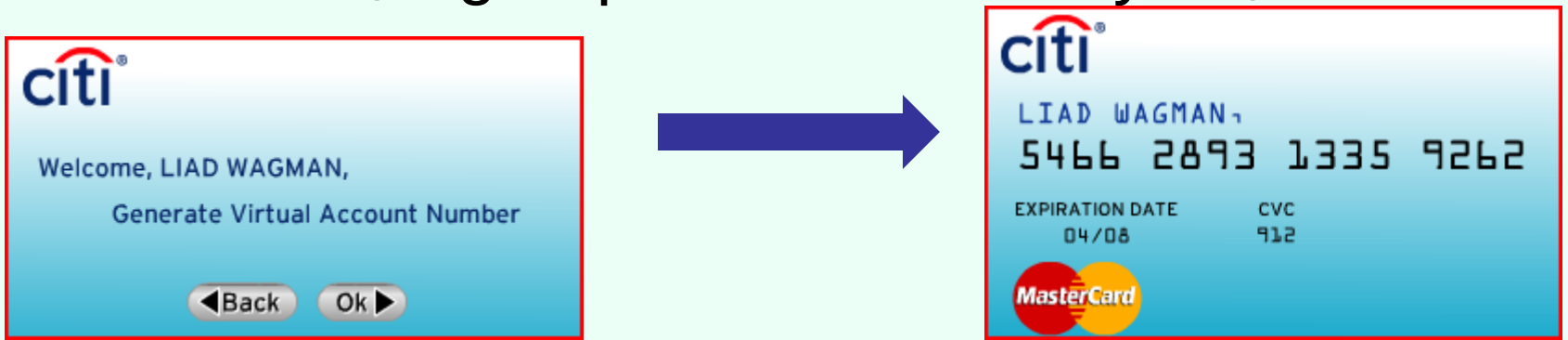
Buy.com customers take $10 OFF the purchase of $200 valid in ALL Stores! (Affiliate).*

*** Terms and Conditions:**

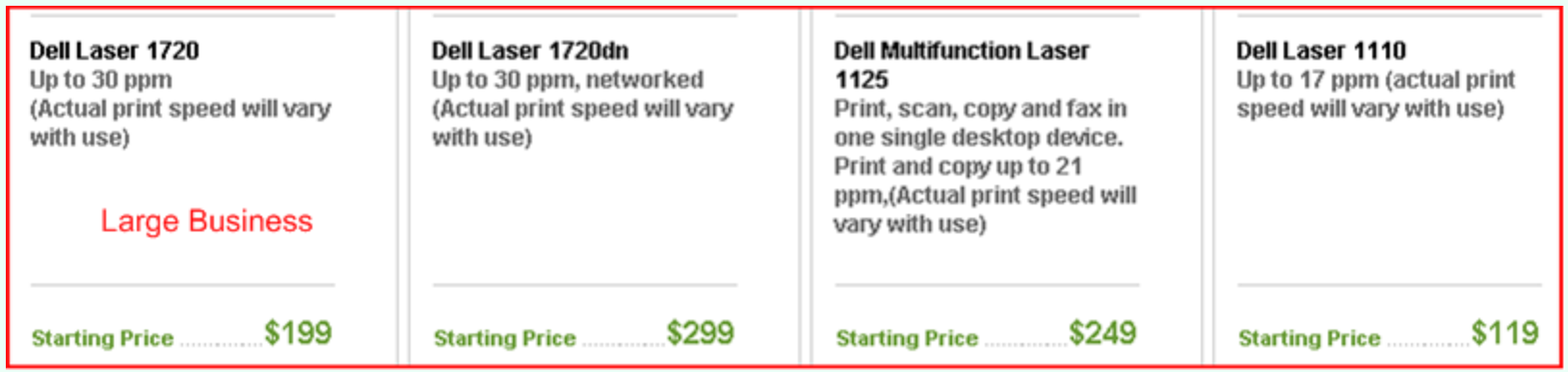
- Valid for first time Buy.com customers only.
- **Orders must be placed on or before 11/30/2009 11:59:00 PM PT.**

Google checkout

Limit one per buyer. We will apply the $10 discount to your first purchase of $10 or more (before shipping & tax). To receive the offer, sign-up before February 15, 2007.



Price Discrimination



- Common in e-commerce (Dell, Buy, Amazon)
- Consumers are not helpless – it can be circumvented
- Sellers' practices mostly follow voluntary guidelines

Towards Policy

- Transparency and Consumer Control (FTC, 07)
- Online Privacy Bill of Rights (Edward Markey)
- Customer Proprietary Network Information (CPNI)
- CAN-SPAM Act of 2003

- General direction: make it easier for consumers to maintain anonymity
- Key differences from traditional markets:
  - It is already easier for consumers to become anonymous
  - But, also easier for sellers to store and use consumer data
- Is easier-to-obtain anonymity desirable? Is it clear who benefits/loses?

Game

- Firm(s) and many consumers
- 3 parts:

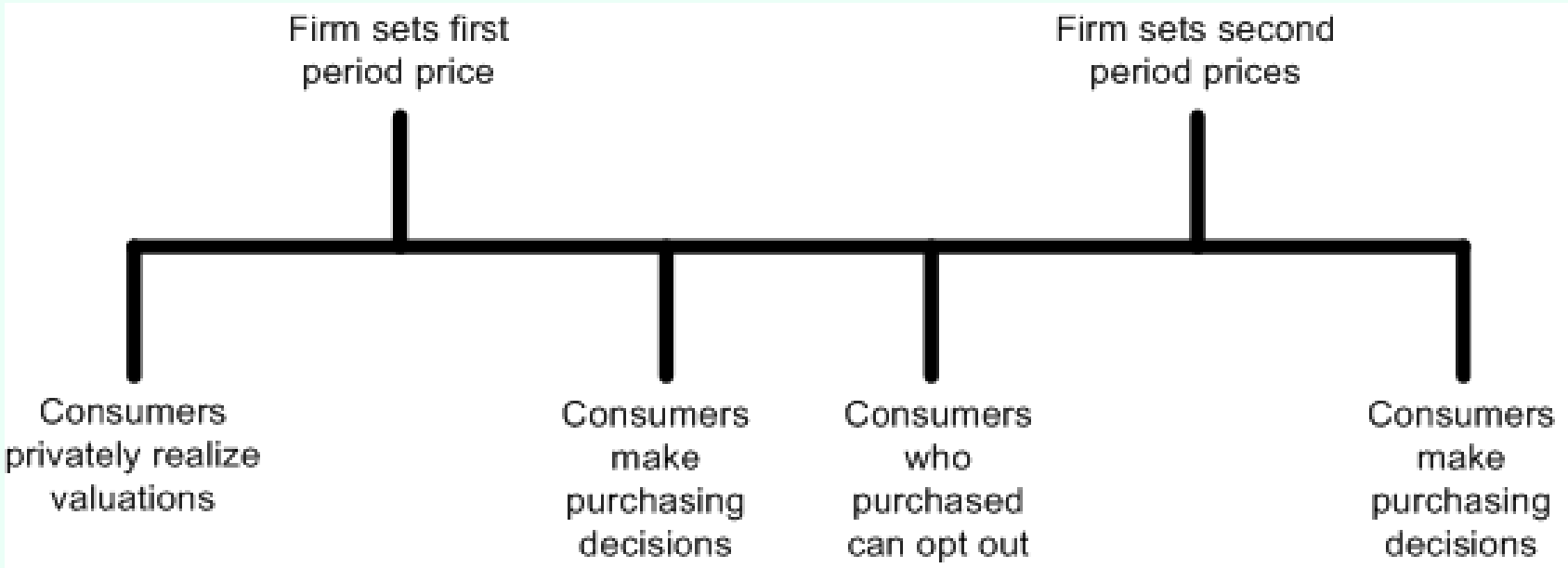
- (1) Identification:
  past purchases → disclose information
- (2) Anonymity Decisions: consumers decide whether to maintain their anonymity
- (3) Purchasing & Discrimination: firm has some information about consumers' valuations, sets prices to maximize profit

Literature

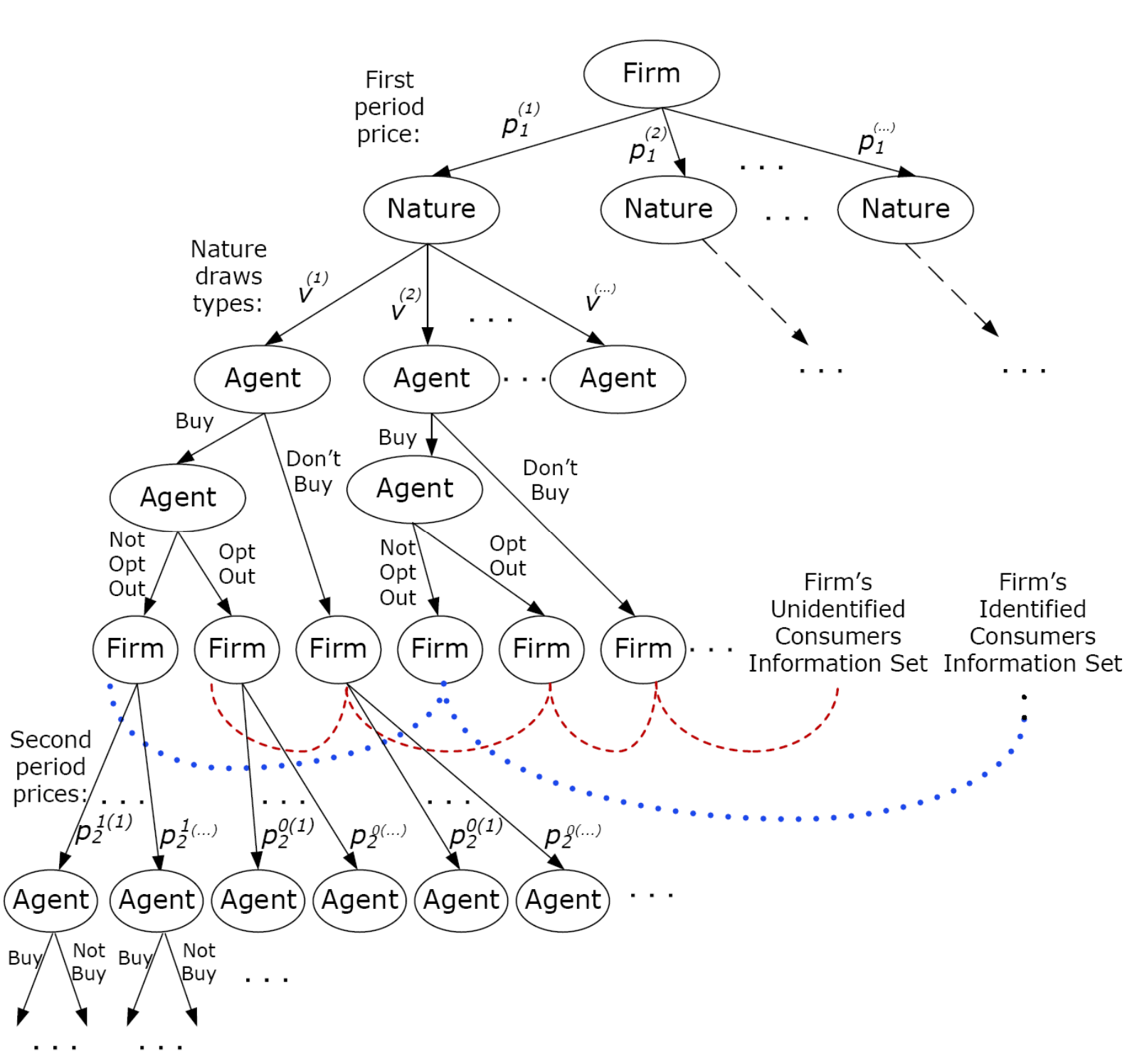
- Intertemporal Price Discrimination (Stokey 1979, Salant 1989, Riley & Zeckhauser 1983, Salant 1989);
  - Ratchet Effect (Freixas et al. 1985, Hart & Tirole 1988)
- Recognition (Chen 1997, Fudenberg & Tirole 1998 & 2000, Villas-Boas 1999 & 2004, Taylor 2003, Chen & Zhang 2008)
- Privacy policies (Taylor 2004, Acquisti & Varian 2005, Calzolari & Pavan 2006, Hann et al. 2007, Bouckaert & Degryse 2008, Johnson 2009), Survey: Fudenberg & Villas-Boas 2006
- Addressability (McCulloch et al. 1996, Rossi & Allenby 1999, Kim et al. 2001, Elsner el al. 2004, Hui & Png 2006)

Model

- Two purchasing periods
- Firm produces non-durable good, 0 marginal cost
- Continuum of strategic consumers with mass 1
- Each period: a consumer has unit demand
- Valuation *v* drawn from cdf *F* on [0,1]
  - Private info, same in both periods
- Costs *c* to opt out, expended in second period



Extensive Form Sketch



Results Overview

- Given
  - Firm cannot commit to future prices
  - Technical assumptions
- Firm's profit is non-monotonic, highest when cost of opting out is zero
- Consumer surplus may increase (with more consumers participating) in the cost of opting out, but only up to a point; then it decreases
- Social surplus, extensions

Preliminaries

- Socially optimal: all consumers purchase in each period
- If there is no consumer recognition, firm sets the monopoly price in each period
- If firm can commit to future prices + opting out is prohibitively costly (full recognition) → commits to monopoly prices
- If firm can commit to future prices + opting out → still commits to monopoly prices

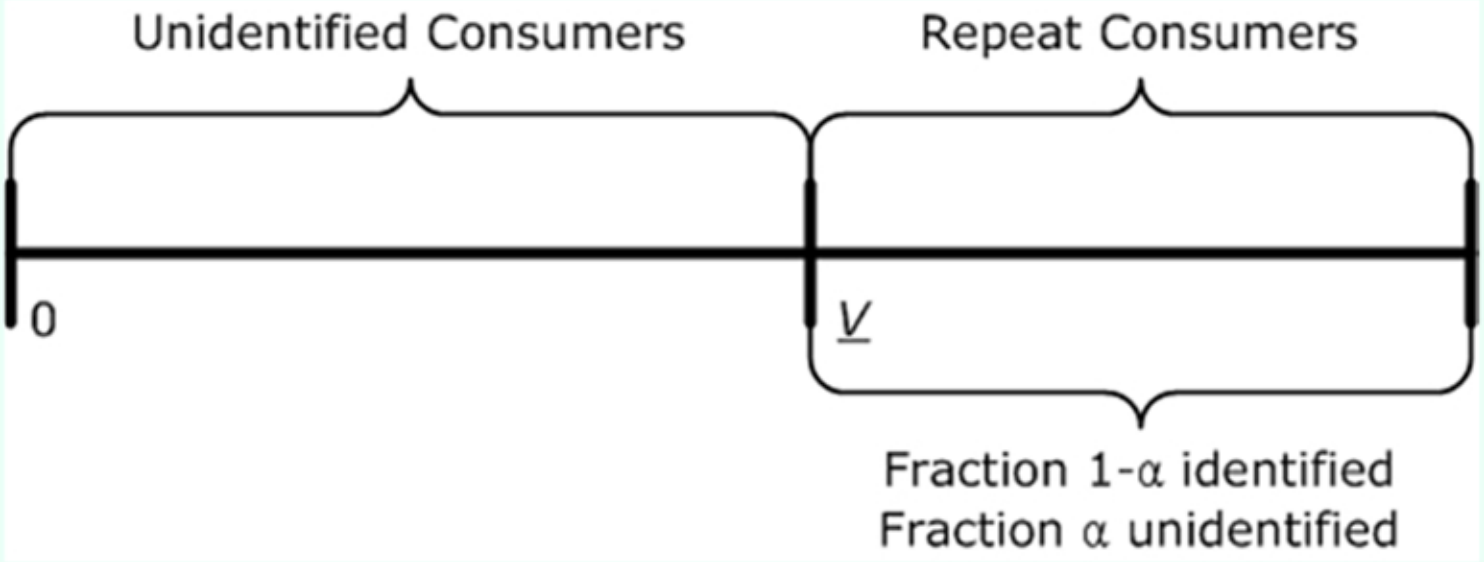
Characterization

- Consumers can opt out at a cost *c*
- Proposition: If *c=0*, all (perfect Bayesian) equilibria have the following properties:
  - (On path) prices = *monopoly prices*
  - Consumers with *valuation above price* purchase in both periods and opt out (all consumers stay anonymous)
  - No Customer Recognition outcome
  - (This is what the firm wants!)

Intuition

- Opting out is associated with a negative externality on other consumers:
  - Individually, a consumer wants to opt out to have access to cheaper prices
  - As a result, anonymous consumers pay more
    - because the firm targets more high valuation consumers in the anonymous pool
  - Prisoner's Dilemma / Tragedy of the Commons / Braess's Paradox

Stage 3: Price Discrimination, *c>0*



- Let α be the proportion of purchasing consumers maintaining anonymity
- Seller sets two prices: to anonymous consumers and to identified consumers

$$p_2^0 = \arg\max_{p \le \underline{v}} p\left(F(\underline{v}) - F(p) + \alpha(1 - F(\underline{v}))\right)$$

- Identified consumers: $p_2^1 = \arg\max_{p \ge \underline{v}} (1-\alpha)\, p\,(1 - F(p))$
- Ratchet effect

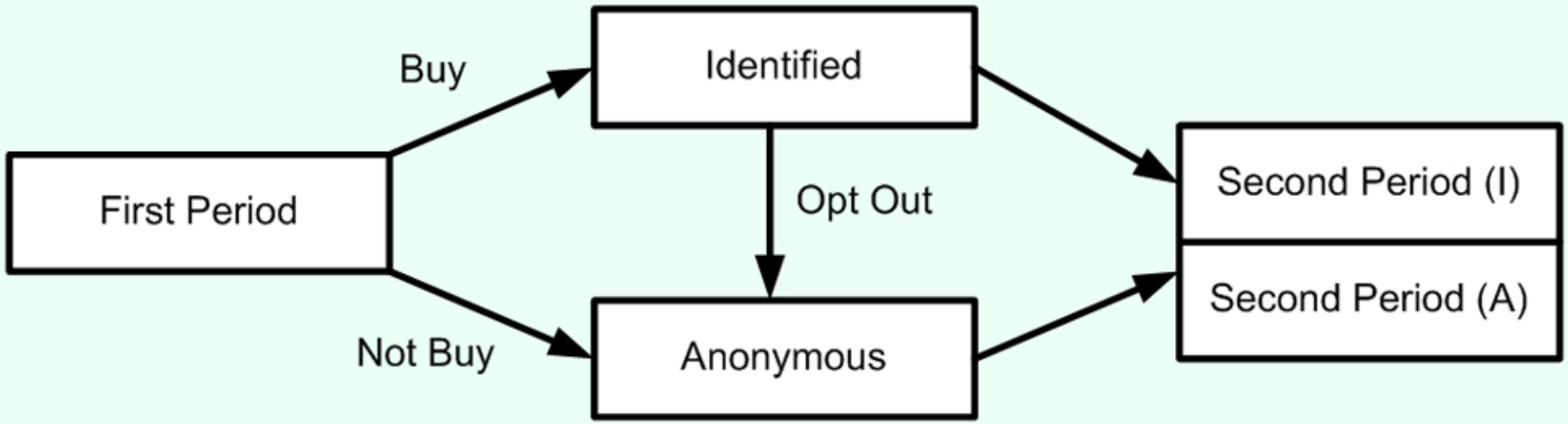
Stage 2: Choosing Anonymity

- Consumers will opt out until,

$$p_2^1 = p_2^0 + c$$

- Derive α

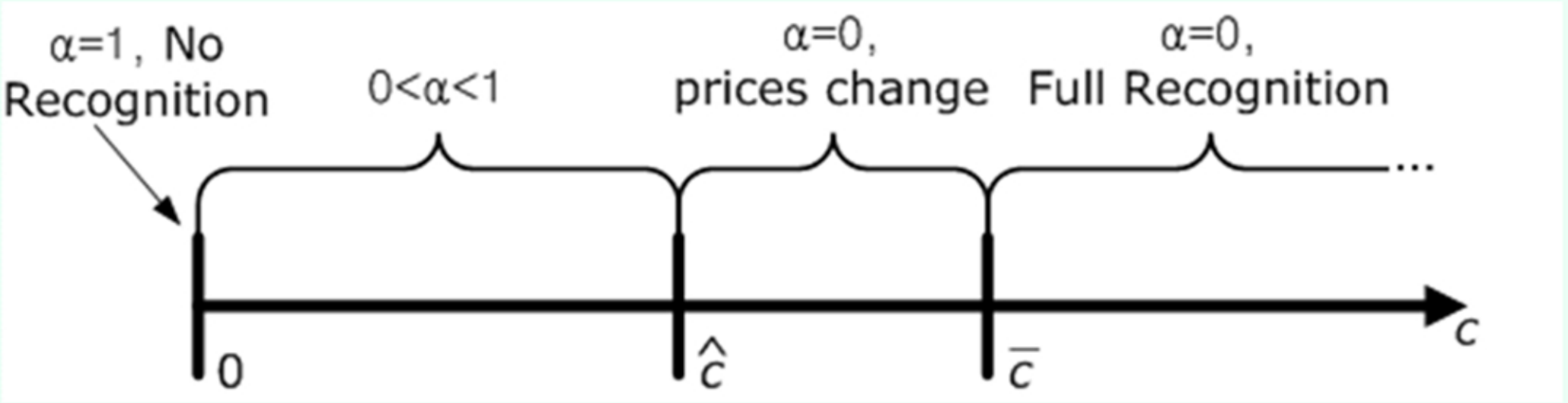
- Braess's Paradox:



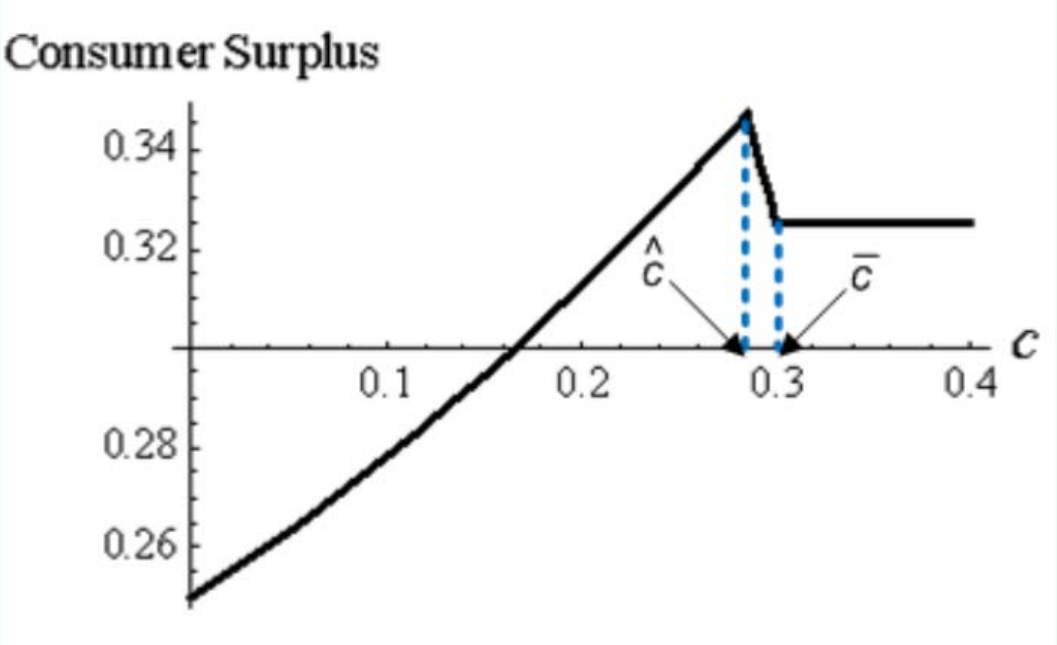
Stage 1: Pricing & Identification

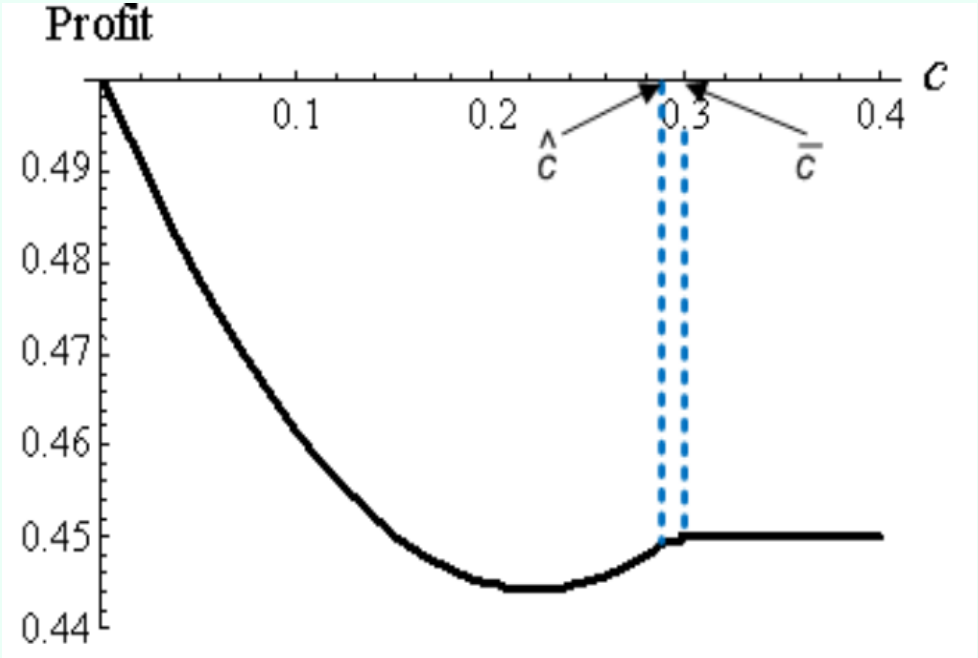
- Solve firm's first period problem

$$\max_{p_1} \underbrace{(1-F(\tilde{v}))(p_1+\delta(1-\alpha)p_2^1+\delta\alpha p_2^0)}_{\text{Repeat Consumers}} + \underbrace{\delta(F(\tilde{v})-F(p_2^0))p_2^0}_{\text{New Consumers}}$$



Comparative Statics (uniform)





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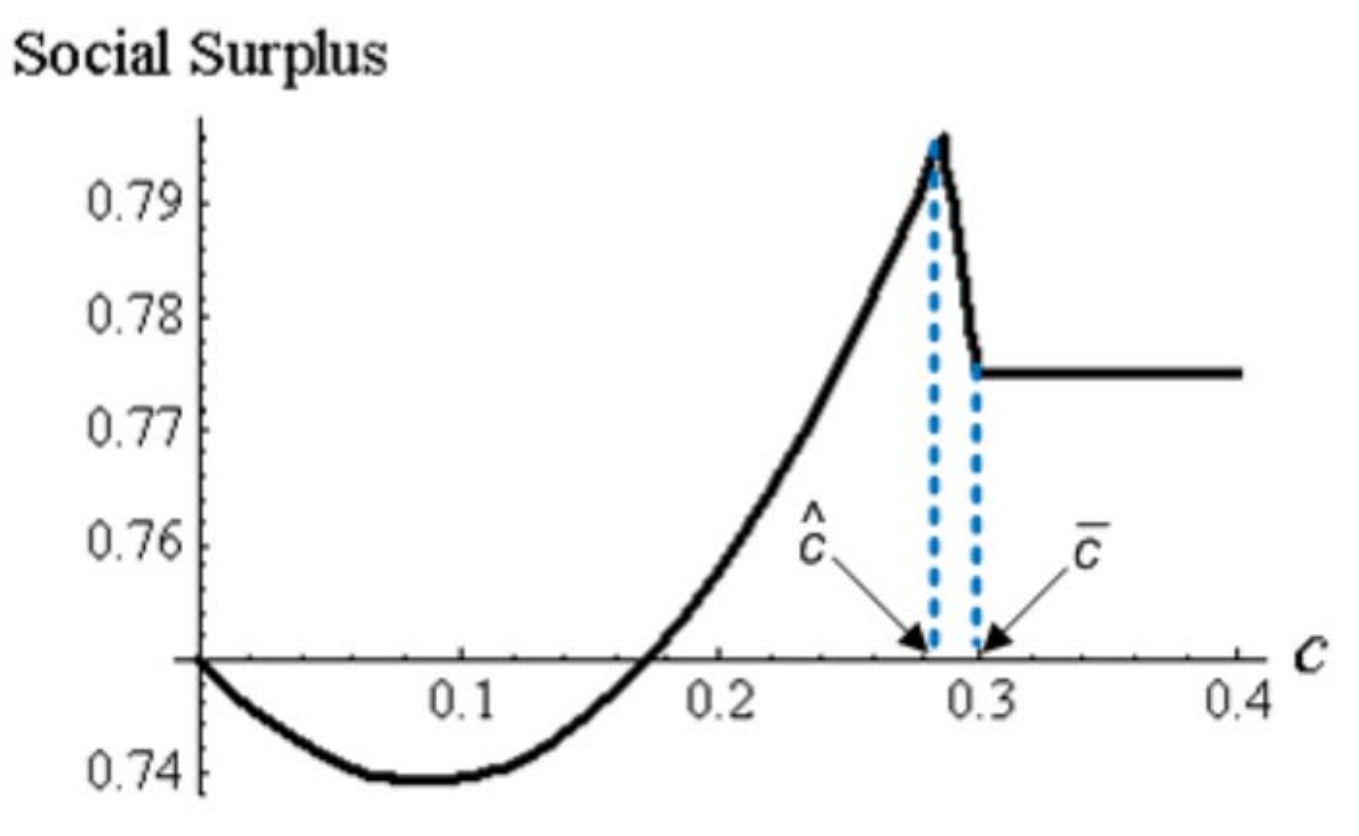


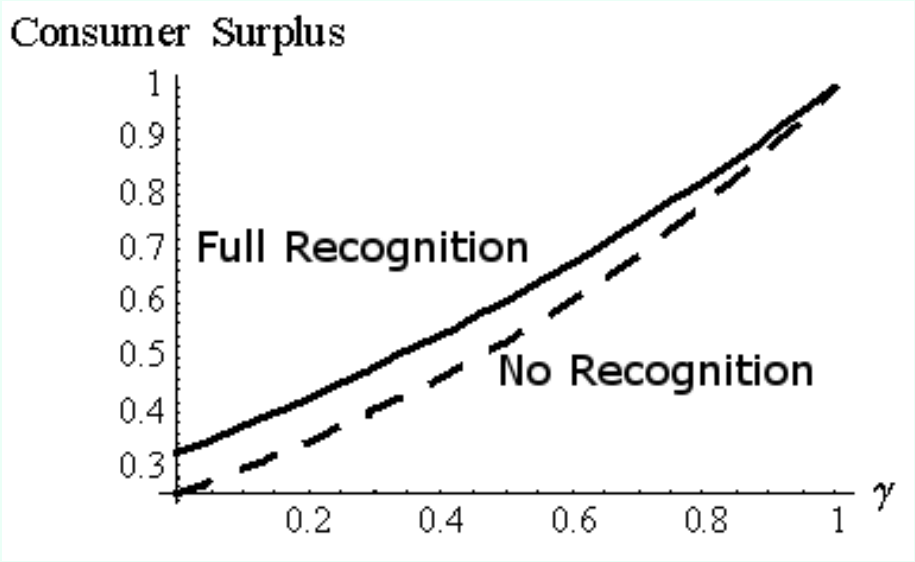
Extension: Commitment

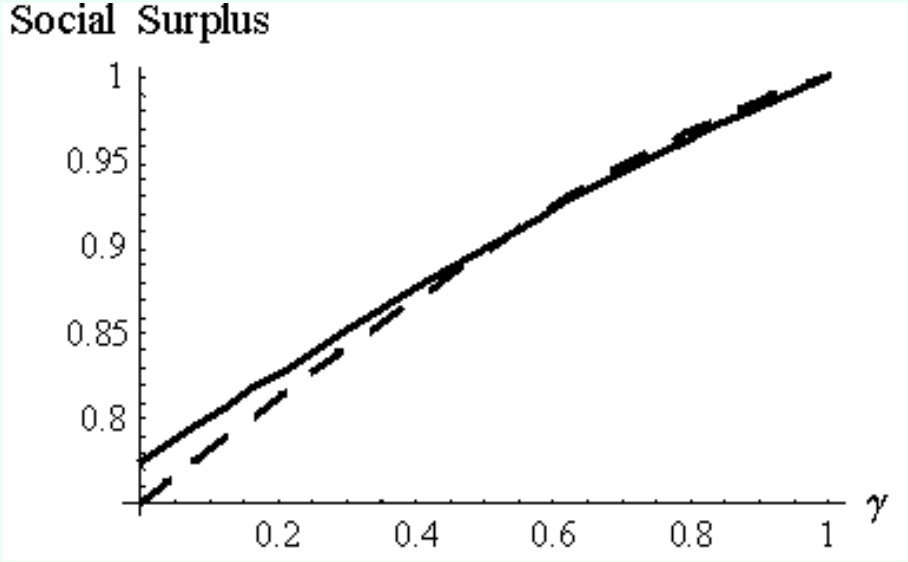
- Firm can commit not to charge identified consumers more (Amazon.com after DVD experiment)
- Consumer valuation follows a Markov process
- Process is common knowledge, but current and past valuations are private
- Firm learns about valuation through purchases
- Loyalty program: prices have to be low enough to incentivize consumers to buy (using their membership account) w/o manipulating the program

Extension: Competition

- Two firms, a market leader (*A)* selling the brand-name product and a follower (*B)* selling a generic
- Consumers with valuation v for *A*'s good have valuation γv for *B*'s good ($\gamma \leq 1$)
- Three regimes: No Recognition, Asymmetric Recognition, Full Recognition
- Firms set prices simultaneously, observe past prices, compete in price

Competition





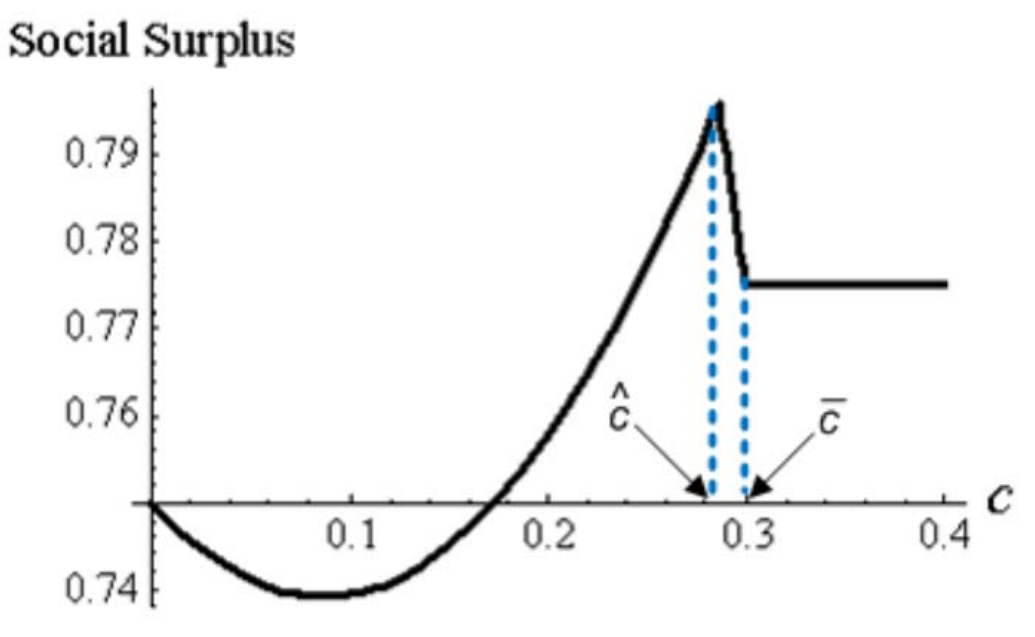
Conclusions

- Max profit for firm when 0 cost for anonymity
- Facilitating opting out can increase & also decrease welfare and consumer participation
- Non-monotonicity in surplus, profit
- Extensions: commitment, competition

Thank you for your attention!

Comparative Statics (uniform)

When *c* is deadweight loss



When *c* is collected