Component 1: Cooperation

Many Bases For Cooperation
- AMD/American Austin/San Jose flights
- Complements
  - Wintel (MS/Intel)
  - Intel/Rambus
- No negative advertisements
- Major Elements of cooperation
  - Shared interest
  - Punishment for misbehavior
  - Recovery

Basic Theory
- Cooperate on a variety of matters, not just price,
- Identify the basis for cooperation,
- Share the proceeds of cooperation sufficiently that the relevant parties participate,
- Identify punishments for misbehavior that are an adequate deterrent,
Basic Theory, Cont’d

- Identify punishments that will credibly be used,
- Set a trigger to start a punishment,
- Fix a method for recovering from punishment and returning to cooperation,
- A fixed length punishment is often a good choice – if it is credible.

Grim Trigger Strategy

- Cooperate if \( \pi^m + \pi^c \frac{\delta}{1-\delta} \leq \frac{\pi^m}{n} \frac{1}{1-\delta} \)
- or \( \pi^c \leq \frac{\pi^m (1 - n (1-\delta))}{n} \frac{1}{\delta} \)
- True if \( \delta \) near 1, false if \( n(1-\delta)>1 \).

Problems of Price Cooperation

- Confessions
- Too many firms
- Product differentiation
- Reaction time
- Random demand
- Motivating managers
Problems, Continued

- Efficient allocation and bargaining
- Unenforceable contracts
- Communication is risky
- Small or failing firms
- Entry, substitutes
- Quality competition

Phases of the Moon

Solutions

- Industry association
- Published price lists
- Exclusive territories
- Pre-announced price increases
- Incrementalism
Solutions, Continued

• Multi-market contact
• Multi-level contact
• Excess capacity
• Grow (or crush) small or bankrupt firms

Cooperation Summary

• Cooperate on a variety of matters, not just price,
• Identify the basis for cooperation,
• Share the proceeds of cooperation sufficiently that the relevant parties participate,
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Cooperation Summary, Cont’d

• Identify punishments that will credibly be used,
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• A fixed length punishment is often a good choice – if it is credible.
Component 2: Organization Theory and Incentives

Make or Buy

- Centralization
  - Economies of scale
  - Coordination of distant operations
- Decentralization
  - Incorporation of local information
  - Incentives

Make

- Holdup
- Coordination in Production and Design
- Double Marginalization
- Foreclosure
- Information Leakage
- Input suppliers as a source of future competition
- Low marginal costs (price war)
Simple Theory of Holdup

- Contracts exogenously incomplete
- Holdup takes 50% (Nash bargaining) of marginal proceeds to investment
- Ownership of assets limits holdup
- Asset ownership determined by maximizing efficiency of investments

Example

- Coal costs $10/ton at mineshaft
- Transport is $10/ton
- Electric utility at mineshaft viable needs $14 coal to be viable
- Absent long-term contract or merger, utility is not viable

Multiple Marginalization: The Silk Road

Figure 6.2: The Silk Road
Coordination and Complements

- Complements (synergies) are a reason for integration
- Double marginalization (successive monopoly) is an extreme version
- Complements have useful property of reducing bargaining power of suppliers
- Example: Disney animation

Buy

- Lowest price
  - Competitive markets!
- Competitive incentives to innovate
- Elimination of overhead & fixed costs
- Distinct corporate cultures
  - Sony/Columbia Pictures
  - GM/EDS

Fragmented Industries

- Dry cleaners, hardware stores, furniture makers, restaurants, hair cutting, gas stations, taxis
- Mixed or defragmenting: bookstores, accounting, attorneys, software, motels
- De-fragmented: PC, video retailing, office supply
Reasons for Fragmentation

• Need for owner-operators
  – Maximal incentives
  – Personalized service
  – Important unmonitorable characteristics
• Absence of important scale economies

Defragmenters

• A&P
• Home Depot
• Blockbuster Video
• Staples, OfficeMax, Office Depot
• Best Buy, Circuit City

Tradeoffs of Defragmentation

+ Scale economies
+ Investments that increase value
  – Advertising, R&D
  – Incentives
    – Local manager with autonomy
  – Disorganization
    – Failure to account for local circumstances
Agency Theory

• Firm sets commission $s$, salary $y$.
• Agent obtains
  
  \[ u = sx + y - \frac{x^2}{2a} - s\lambda\sigma^2 \]
• Where $x$ is the effort in output units, $1/a$ measures the disutility of effort, $\sigma^2$ is the risk, and $\lambda$ is the risk premium.

Agent Maximization

• A working agent maximizes $u$ over effort $x$, which yields $x = sa$.
• Increasing shares increase effort.
• Salary $y$ is set to insure the agent accepts the job ($u_0$ is the reservation utility level):
  
  \[ u_0 = s^2a + y - \frac{(sa)^2}{2a} - s\lambda\sigma^2 = y + \frac{1}{2}s^2a - s\lambda\sigma^2 \]

Salary Determination

• This gives:
  
  \[ y = u_0 - \frac{1}{2}s^2a + s\lambda\sigma^2 \]
• The salary must be higher to compensate for increased risk.
Firm Profits

• The firm earns

\[ \pi = (1-s)x - y \]
\[ = (1-s)sa - (u_0 - \frac{1}{2}s^2a + s\lambda\sigma^2) \]
\[ = sa - u_0 - \frac{1}{2}s^2a - s\lambda\sigma^2 \]

• This provides the firm with the output, minus the cost of effort, the cost of the agent, and the cost of risk.

Firm Maximization

• The firm chooses the agent's share \( s \)

\[ s = 1 - \frac{\lambda}{\sigma^2} \]

• The share increases in the ability \( 1/a \) of the agent, and decreases in the riskiness or cost of risk.

Selection of Agent

• Agent paid with a combination of salary and commission
• With a fixed salary, more able agents obtain a higher return.
• Thus, offering a higher commission, lower salary will attract more able agents.
• RE/MAX
• Incentives aren’t just about effort, but about agent selection as well
Multidivisional Firm

- First: General Motors, Du Pont, Sears, Exxon
- Product Divisions
  - appliances, consumer electronics
- Customer Divisions
  - military and civilian aircraft
- Technological Divisions
  - aircraft, electronics,
- Geographical Divisions
  - by state, by nation, by region

Multi-Tasking

- Incentives on one task spill over to others
- Increased incentives on one task will reduce effort on others
- Increasing one incentive generally makes increasing others optimal
- When important job is unmeasurable, incentives on measurable jobs produce poor performance

Organization of Bread Delivery

<table>
<thead>
<tr>
<th></th>
<th>Independent Contractor</th>
<th>Employee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route</td>
<td>Sets own route</td>
<td>Company sets route</td>
</tr>
<tr>
<td>Truck ownership</td>
<td>Owns truck</td>
<td>Company owns truck</td>
</tr>
<tr>
<td>Compensation</td>
<td>Incentive</td>
<td>Salary or Hourly</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Contractor controls</td>
<td>Set by company</td>
</tr>
<tr>
<td>Carry other items</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Examples

- Teacher rewarded for students’ performance on standardized tests “teaches to the test.”
- Medicare doctors maximize throughput
- CEO rewarded for near-term stock performance sacrifices investment
- Independent contractors choose most aspects of their job
- High quality workers paid based on skills, not based on job

Correlation of Incentives

- Incentives are complementary
- Strong incentives in one dimension require strong incentives in other dimensions
- Being “in the middle” is often the worst place – salaries or incentive pay dominate the mix

Common Agency

- Several firms represented by same agent
  - Grocery retailing
  - Travel agents
  - Insurance brokers
- The incentives offered by other firms matter to the outcomes obtained by any one firm.
Common Agency Conclusions

- The firm offering the strongest incentives tends to get the most out of the agent.
- Incentives tend to be complements, so that each firm responds to an increase in incentives by one with increases of their own.
- Firms which can most easily monitor the agent’s performance have a striking advantage, because they can provide strong incentives to perform.
- Consequently, it may pay to invest in increased monitoring as a means of offering strong incentives.

Transaction Costs Theory

- Minimize total costs of transactions and production.
- Production methods and organization affect transactions costs:
  - Markets increase search, enforcement, measurement, coordination costs.
  - Internal increases incentive, bargaining, influence costs.

Transaction Costs Approach

- Specialized Investments and Holdup Costs
- Motivation and Incentive Costs
- Information Acquisition Costs
- Information Processing Costs
- Influence and Lobbying Costs
- Coordination Costs
- Contracting Costs
- Search Costs
  - Enforcement Costs
  - Bargaining Costs
  - Measurement Costs
Ratchet Effect

- Success met with increased expectations, reduced future payments
- Ratchet effect reduces incentives to work
- Chicago GSB set a 5 year, $175 million fund-raising goal
  - raised $100 million in 8 months

Prices Versus Quantities

- Trade-off on errors
- Prices give incentives to equate marginal value to price
- When demand is elastic, price is nearly fixed, so better to use prices
- When demand is inelastic, quantity is nearly fixed, so better to use quantities

Component 3:

Pricing
Softening Price Competition
- Reward the sales force on revenue, or net profits, not quantity
- Encourage non-price deal sweeteners rather than price cuts
- Reduce quality to justify price cuts
- Create complex, difficult to compare, pricing
- Create loyalty of existing customers rather than attract competitors’ customers
- Reward loyalty

Pricing Strategy
- Don’t offer discounts to rivals’ customers
- Business stealing invites like response
  - bad for industry
  - cell phone companies
- Instead reward loyalty
  - Makes best customers hard to poach
  - Encourages rivals to increase prices
  - Airlines

Can You Hear Me Now?
“All phone prices are offered only with activation of a new line of service with Verizon Wireless, under the terms and conditions of selected service plan.”

“Prices exclusive to T-Mobile.com and valid only with new service activation.”
Reminder: Monopoly Pricing

Formula

\[
\frac{p - mc}{p} = \frac{1}{\varepsilon}
\]

\[
\varepsilon = -\frac{\%\Delta Q}{\%\Delta p}
\]

is the elasticity of demand

• Price higher when demand is less elastic

Percentage Markup

• Rewrite to say

\[
p = \frac{\varepsilon}{\varepsilon - 1} mc
\]

• Does not justify a constant markup!

Basic Price Discrimination

• Charge more to the less elastic demanders
  – “Value-based Pricing”

• Creates a problem of arbitrage
  – Consumers charged high prices attempt to buy at lower price
Direct Price Discrimination

- AKA value-based pricing
- Charge based on customer characteristics
  - Student, elderly
  - Location
  - Other purchases
- Problem: Arbitrage

Indirect Price Discrimination

- Coupons
- Quantity discounts
- Other good purchases
- Solves arbitrage by "self-selection"
- Multiple versions offered to all

Dell 512 MB Memory Module

- Part Number A 019 3405

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Business</td>
<td>$289.99</td>
</tr>
<tr>
<td>GSA/DOD</td>
<td>$266.21</td>
</tr>
<tr>
<td>Home</td>
<td>$275.49</td>
</tr>
<tr>
<td>Small Business</td>
<td>$246.49</td>
</tr>
</tbody>
</table>
Dell’s Spokesperson

• Each Segment sets its own pricing
• Customer is free to pick the one that’s cheapest

Examples: Damaged Goods

• Pharmaceutical pricing
  – Brand price rises when generics available
• 486SX, 487SX
  – disabled math co-processor
• IBM LaserPrinter E
  – Added chips to slow processing
• Sony 74, 60 minute mini-discs
  – differ by instructions on disc

Means of Preventing Arbitrage

• Transportation costs
• Legal impediments to resale
• Personalized products or services
• Thin markets and matching problem
• Informational problems
Two Ways of Booking

Two Roundtrips

<table>
<thead>
<tr>
<th>Day</th>
<th>Origin</th>
<th>Destination</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon</td>
<td>AUS</td>
<td>LA</td>
<td>$2200.00</td>
</tr>
<tr>
<td>Thu</td>
<td>AUS</td>
<td>LA</td>
<td>$420.00</td>
</tr>
</tbody>
</table>

(Jan 2004)

Yield Management

- Reserve some seats for late arriving business passengers
- Tradeoff
  - Gain when plane fills and full fare passengers otherwise turned away
  - Cost of tourists turned away and plane doesn’t fill
  - Gain of business passengers not permitted to pay tourist fare
- Worth $500M/yr to American Airlines

Yield Management Formula

- $P_D$, $P_F$ are discount, full fares
- Prob next person won’t pay full fare = $n$
- Prob plane doesn’t sell out = $s$
- Sell discount seat to next request if
  \[ P_D > P_F \times (1 - n + n \times (1-s)) = P_F \times (1 - n \times s) \]
Yield Management Summary

\[ P_D > P_F \times (1 - n s) \]

- Sell more discount seats
  - As prob plane doesn’t fill increases \((s^{\uparrow})\)
  - Release more discount seats on empty flights
  - As prob next customer won’t pay \(P_F\) rises \((n^{\uparrow})\)

- But what prices?

Selling Ten Seats

Peak-load Pricing

- At capacity, marginal costs include
  - Costs of expanding capacity
  - Value of un-served customers
- For electricity, airlines, hotels, marginal costs could fluctuate dramatically
- Pricing should reflect probability of reaching capacity
- Small effects (1%) for large sales
Airline Pricing

- Airlines are a vision of the future of pricing
- Most complex scheme
- Principles straightforward but overall scheme very complex

AA6825, AL101, 9/23

AA6825, AL101, 9/25
How to Buy Airline Tickets

- Prices vary a lot
  - Large gains to search
  - Check back frequently
- Rise $70 last fortnight
- Flexibility on time of day, airport worth as much as 50%
- **Searching worth 25%**

Wednesday Advertisements
Price Dispersion

- Some customers loyal to a store
- Some shop around for low price
- This forces prices to be unpredictable
  - if firm knows rivals’ price, wants to undercut it slightly
  - at low prices, would rather have high price sold only to loyal customers
  - leads to randomization

Equilibrium Price Dispersion

- \( s \) is the share of shoppers
- \( n \) is the number of firms
- \( p_m \) is the maximum price consumers pay
- Distribution of prices is predicted

\[
F(p) = \left(1 - \frac{(p_m - p)(1 - s)}{s(p - c)n}\right)^{n-1}.
\]
Effect of Competition

Effect of Shoppers

Want to Know More?

• This discussion taken from Introduction to Economic Analysis
• Free, open source intro to microeconomics
• http://www.introecon.com/
Predictions

- Unpredictable prices
  - Grocery prices vary week to week
  - 50% price changes common
- Closed form for price distribution
  - Readily tested
- Negative correlation over time
  - Low prices build up consumer inventories
  - High consumer inventories induce high prices

Hedonic Pricing

- Mechanism for valuing individual components of complex devices
- Technical tool, underused
- Estimate synthetic values

<table>
<thead>
<tr>
<th>Camcorder Hedonic Price Regression Results</th>
<th>Variable Name</th>
<th>Price Effect</th>
<th>Variable Name</th>
<th>Price Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Price (VHS-C)</td>
<td>$347.26</td>
<td>95.9%</td>
<td>Non-Sony Mini DV</td>
<td>141.2%</td>
</tr>
<tr>
<td>On Sale</td>
<td>-7.5%</td>
<td>Sony Mini DV</td>
<td>141.2%</td>
<td></td>
</tr>
<tr>
<td>Non-Sony 8mm</td>
<td>-15.3%</td>
<td>Monitor Size</td>
<td>12.9% / inch</td>
<td></td>
</tr>
<tr>
<td>VHS</td>
<td>-8.4%</td>
<td>Color Viewfinder</td>
<td>9.8%</td>
<td></td>
</tr>
<tr>
<td>Non-Sony Hi 8mm</td>
<td>8.9%</td>
<td>Image Stabilization</td>
<td>7.4%</td>
<td></td>
</tr>
<tr>
<td>Sony Hi 8 mm</td>
<td>46.2%</td>
<td>Low weight</td>
<td>33.7%</td>
<td></td>
</tr>
<tr>
<td>Sony Digital 8</td>
<td>79.8%</td>
<td>JPEG format</td>
<td>65.6%</td>
<td></td>
</tr>
</tbody>
</table>

JVC mini-DV camcorder with a 3 inch monitor, color viewfinder, image stabilization, low weight, JPEG format and not on sale is worth:

\[
\text{Value} = \$347.26 \times 1.959 \times 1.129 \times 1.129 \times 1.098 \times 1.074 \times 1.337 \times 1.656 = \$2,556.05.
\]
Strategy Conclusions

• Reward loyalty
• Produce multiple qualities to justify multiple prices
  – Damaged goods
• Quantity discounts
  – includes bundling of dissimilar items
• Yield management adds several percent

Search Conclusions

• Returns to search are often significant
• Competition may naturally give rise to price volatility
  – Justifying search
  – Challenging environment for pricing

Research Conclusions

• Pricing is central to business profitability
  – Often ignored in favor of marketing and product promotion
• Pricing has useful mathematical theories
  – Readily tested
• Pricing contains many mysteries
First-Class on USAir