

## Component 1: Cooperation

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## 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

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## 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,

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### 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.

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### Grim Trigger Strategy

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

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### Problems of Price Cooperation

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

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## Problems, Continued

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

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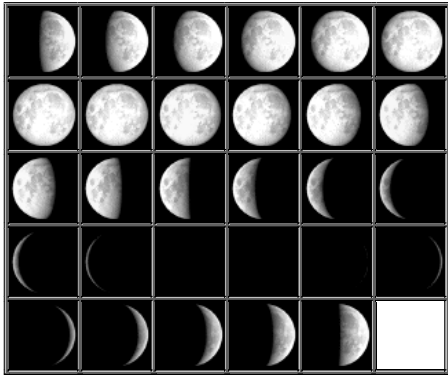
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## Phases of the Moon



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## Solutions

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

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## Solutions, Continued

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

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Component 2:  
Organization Theory  
and Incentives

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Make or Buy

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

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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)

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## 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

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## 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

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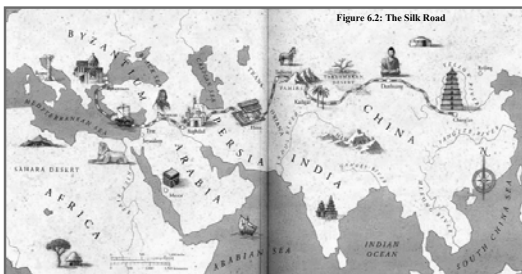
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## Multiple Marginalization: The Silk Road



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## 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

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## Buy

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

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## 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

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## Reasons for Fragmentation

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

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## Defragmenters

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

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## Tradeoffs of Defragmentation

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

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## 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.

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## 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):

$$u_0 = s^2a + y - \frac{(sa)^2}{2a} - s\lambda\sigma^2 = y + \frac{1}{2}s^2a - s\lambda\sigma^2$$

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## 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.

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## Firm Profits

- The firm earns

$$\begin{aligned}\pi &= (1-s)x - y \\ &= (1-s)sa - (u_0 - \frac{1}{2}s^2a + s\lambda\sigma^2) \\ &= sa - u_0 - \frac{1}{2}s^2a - s\lambda\sigma^2\end{aligned}$$

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

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## Firm Maximization

- The firm chooses the agent's share  $s$

$$s = 1 - \frac{\lambda}{a}\sigma^2$$

- The share increases in the ability  $1/a$  of the agent, and decreases in the riskiness or cost of risk.

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## 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

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## 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

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## 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

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## Organization of Bread Delivery

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

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## 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

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## 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

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## 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.

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## 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

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## 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

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## 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
  - Enforcement Costs
- Search Costs
  - Bargaining Costs
  - Measurement Costs

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### 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

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### 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

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### Component 3: Pricing

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## 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

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## 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

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## 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.”

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### 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

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### Percentage Markup

- Rewrite to say

$$p = \frac{\varepsilon}{\varepsilon - 1} mc$$

- Does *not* justify a constant markup!

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### 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

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## Direct Price Discrimination

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

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## Indirect Price Discrimination

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

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## Dell 512 MB Memory Module

- Part Number A 019 3405

Large Business	\$289.99
GSA/DOD	\$266.21
Home	\$275.49
Small Business	\$246.49

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### Dell's Spokesperson

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

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### 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

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### Means of Preventing Arbitrage

- Transportation costs
- Legal impediments to resale
- Personalized products or services
- Thin markets and matching problem
- Informational problems

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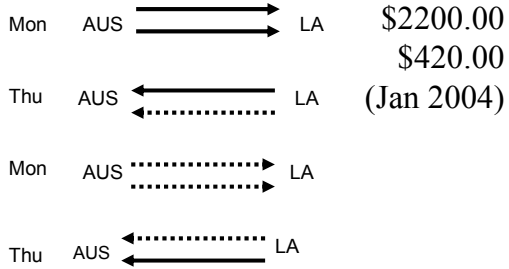
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### Two Ways of Booking Two Roundtrips




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### 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

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### 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  

$$P_D > P_F \times (1 - n + n(1-s)) = P_F \times (1 - ns)$$

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## 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?

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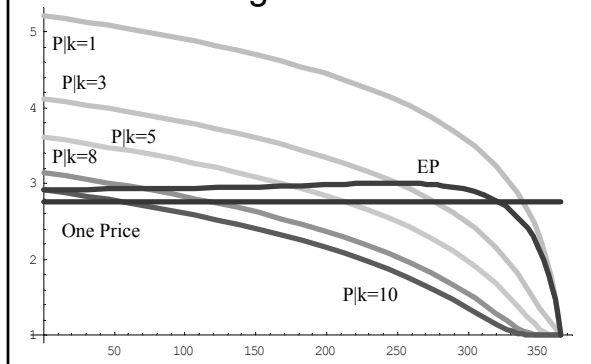
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## Selling Ten Seats




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## 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

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## Airline Pricing

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

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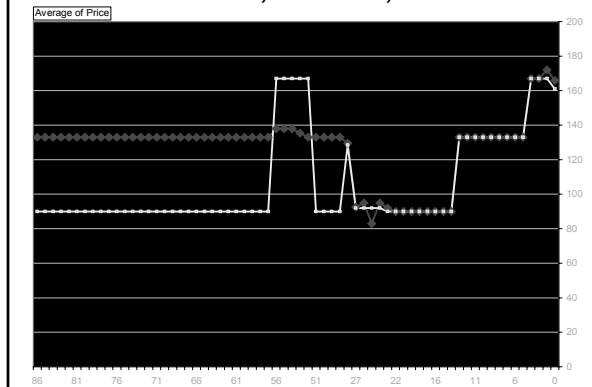
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### AA6825, AL101, 9/23



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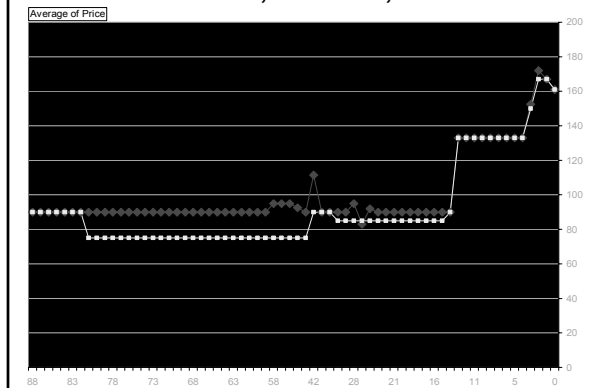
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### AA6825, AL101, 9/25



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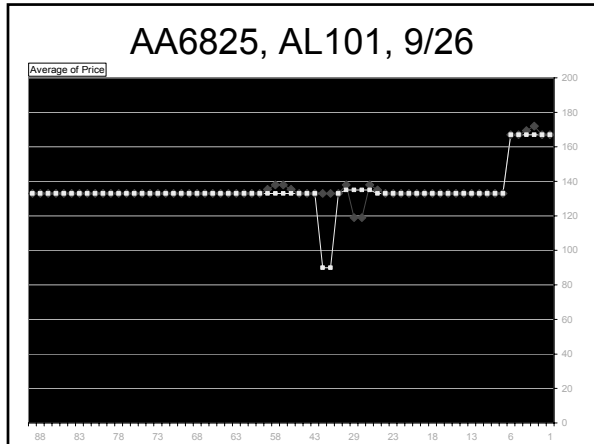
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### How to Buy Airline Tickets

- 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%**

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### Wednesday Advertisements

Item	Price
Chairman's Reserve Premium Quality Bottom Sirloin Steaks	2.98
Chairman's Reserve Premium Quality Whole Pork Fillet of Tenderloin	3.48
Chairman's Reserve Premium Quality Sirloin Tip Roast	3.68
Chairman's Reserve Premium Quality Lobster Tails	8.48
Chairman's Reserve Premium Quality Cooked Shrimp	6.48
Chairman's Reserve Premium Quality Salmon Fillets	1.78
Chairman's Reserve Premium Quality Tilapia Fillets	2.68
Chairman's Reserve Premium Quality Crab Cakes	1.28
Chairman's Reserve Premium Quality Ocean Cod Fillets	4.28
Chairman's Reserve Premium Quality Cooked Shrimp	3.98
Chairman's Reserve Premium Quality Beef Cakes	4.38
Chairman's Reserve Premium Quality Pork Chops	2.98
Chairman's Reserve Premium Quality Lamb Steaks	10.10
Chairman's Reserve Premium Quality Beef Steaks	7.88
Chairman's Reserve Premium Quality Chicken Breast	2.98
Chairman's Reserve Premium Quality Chicken Breast	12.98
Chairman's Reserve Premium Quality Chicken Breast	2.98
Chairman's Reserve Premium Quality Chicken Breast	3.48

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### 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

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### 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

$$F(p) = \left( 1 - \frac{(p_m - p)(1 - s)}{s(p - c)n} \right)^{n-1}$$

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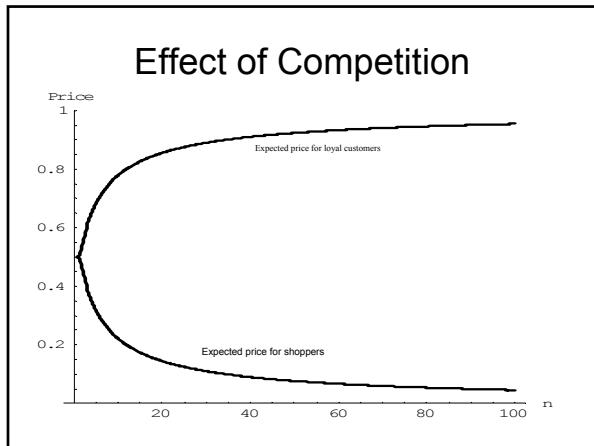
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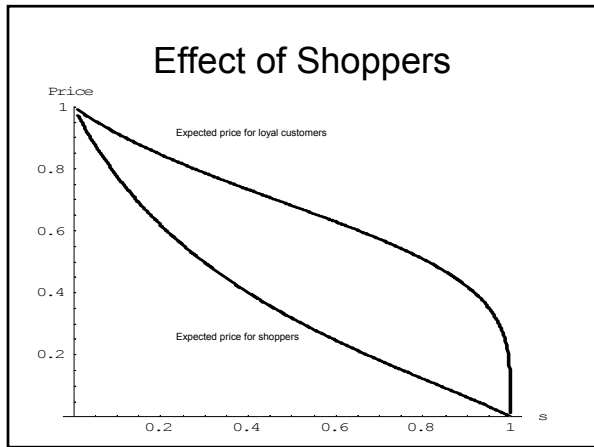
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### Want to Know More?

- This discussion taken from  
*Introduction to Economic Analysis*
- Free, open source intro to microeconomics
- <http://www.introecon.com/>

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## 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

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## Hedonic Pricing

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

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Camcorder Hedonic Price Regression Results			
Variable Name	Price Effect	Variable Name	Price Effect
Base Price (VHS-C) B&W viewfinder	\$347.26	Non-Sony Mini DVI	95.9%
On Sale	-7.5%	Sony Mini DV	141.2%
Non-Sony 8mm	-15.3%	Monitor Size	12.9% / inch
VHS	-8.4%	Color Viewfinder	9.8%
Non-Sony Hi 8mm	8.9%	Image Stabilization	7.4%
Sony Hi 8 mm	46.2%	Low weight	33.7%
Sony Digital 8	79.8%	JPEG format	65.6%

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

$$\text{Value} = \$347.26 \diamond 1.959 \diamond 1.129 \diamond 1.129 \diamond 1.129 \diamond 1.098 \diamond 1.074 \diamond 1.337 \diamond 1.656 = \$2,556.05.$$

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## 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

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## Search Conclusions

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

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## 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

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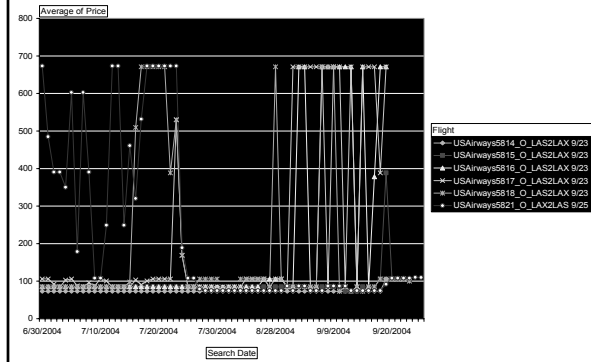
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# First-Class on USAir



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