

Vertical Integration: Firm Strategies

*Competitive Solutions:
A Strategist's Toolkit,*
Princeton U Press, 2003

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Plan for Today

- Business strategy view
 - Make or buy
 - Fragmented industries
 - Agency theory
 - Multidivisional firms
 - Multitasking
 - Common agency
 - Transaction costs view

Plan for Today, Continued

- Antitrust
 - Sherman Act
 - Clayton Act
 - Vertical Restraints
 - Chicago School critique
 - Modern developments
- Pricing
 - Price discrimination
 - Yield Management

Make or Buy

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

VBS Worm Generator

“This, as far as I know, is the first (and only) on-line virus creation tool. NO DOWNLOAD, NO WASTED TIME, NO PROGRAMING SKILL NEEDED!!!” says MI_pirat, the site's author. "Choose from the options (few, I know, but it's the first edition) and then copy/paste the generated code into a Word (97...2000 etc.) module named after the virus. Enjoy!!!”

Civil War Inside Sony

- Sony Music wants to entertain you
- Sony Electronics wants to equip you
- Sony produces CDs that can't play on Sony PCs
- Sony sued Launch Radio, which it partly owns

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

- GHM
- 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

Holdup Example

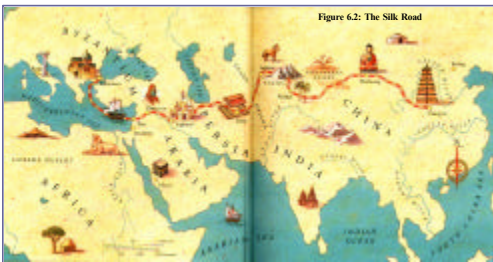
- Coal costs \$10/ton at mineshaft
- Transport is \$10/ton
- Electric utility at mineshaft viable needs \$14 coal to be viable
- Absent long-term contract or merger, utility is not viable

Two Views of Holdup

- GHM emphasizes ownership rights to maximize *ex ante* investment incentives
- Williamson emphasizes design of contracts, ownership to mitigate *ex post* opportunism
- Whinston finds empirical work supports Williamson, not GHM

Coordination in Manufacturing	Mass Production	Modern Manufacturing
Batch Size	Very Large	Small
Number of Varieties	Small	Very Large
Machines	Specialized, High Volume	Flexible,
Product Upgrades	Rare	Frequent
Worker Skills	Specialized	Multiple Tasks
Inventories	Large	Just-in-time
Compensation	Piece-rate, hourly	Based on skills, not job
Decision Centralization	Centralized	More authority at factory floor
Communications	Top down, infrequent	Fast, bidirectional
Subcontracting	Unimportant	Large

Multiple Marginalization: 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, σ^2 is the risk, and λ 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

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

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

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.

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

Transfer Pricing

- Internal price = market price
 - Incentive to invest
 - Price exceeds MC
 - Input underused
 - Shoddy quality
- Internal price = MC
 - Efficient use
 - Underinvestment

Bellcore Transfer Pricing

- Typing pool a profit center
- Price = Average Cost
- Too much equipment, so quantity fell

Transfer Pricing Intractability

- When a market exists for an input, usually best to use the market
- Thus, the very circumstances (market failure) that lead to internal production make transfer prices problematic

Tapered Integration

- Use both market and internal production
- Use each to discipline the other
- GM
- Infineon
 - Advantage in learning as well

Divisionalization

- Create autonomous business units as a commitment to higher quantity
- Prisoner's dilemma with fixed set of firms
- May serve as an entry barrier

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

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

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 •Enforcement Costs
- Contracting Costs •Bargaining Costs
- Search Costs •Measurement Costs

	Mass Production	Modern Manufacturing
Specialized Investments	High	Low
Coordination	Medium	Very High
Incentive	Low	Medium
Information Extraction	Low	High
Information Processing	Low	Very High
Contracting	Medium	High
Search	Low	High
Enforcement	High	Medium
Bargaining	High	Medium
Measurement	High	Medium or High
Influence	High	Low

Michael Whinston, "The Transactions Cost Determinants of Vertical Integration," mimeo 2002.

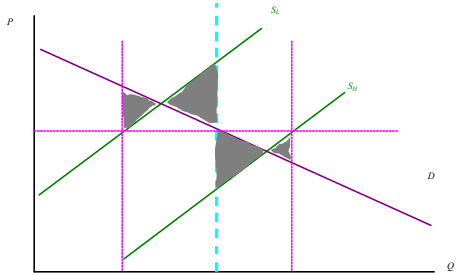
- Transaction cost economics (Williamson etc) distinct from property rights theory (Grossman/Hart)
- TCE has (i) incomplete contracts, (ii) relationship specific assets/Lock-in. PRT has these elements, but focuses on distortions of ex ante incentives rather than ex post haggling.
- PRT assumes that transactions problems remain once transaction is brought inside firm, with only residual claimancy changed.
- Marginal returns to investment need not be correlated to level of quasi-rents
- Empirical studies tend to confirm TCE but NOT PRT

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



A Graphical Analysis of Prices versus Quantities

Prices Versus Quantities

- When demand is inelastic, use quantities through internal transactions
- Still leaves transfer pricing problem

Antitrust Issues

Sherman Act (1890)

- Attempt to monopolize illegal
- Conspiracy to restraint trade illegal
- Standard Oil broken into 33 companies
- Fines and imprisonment for violations
- Rule of Reason
 - Do you have a pro-competitive reason?

Violation

- Two part test
- Did firm have monopoly power in a market?
- Did firm engage in illegal activity to extend or maintain that power?
- Legal to obtain monopoly through “a superior product, business acumen or historic accident”

Alcoa

- Violated law by
 - Contracts prohibiting utilities from selling power to rival smelters
 - Price-fixing with foreign producers
 - Increasing price of ingot to sheet fabricators
 - Expanding capacity to eliminate rivals
- US created competitors Reynolds, Kaiser using WWII assets

Clayton Act (1914)

- Adds detail to Sherman
- No criminal penalties
- Treble damages
- Section 2 (Robinson Patman) prohibits price discrimination which lessens competition
- Morton salt volume discounts illegal (1948)
- Section 7 bans mergers that lessen competition

Section 3

- Forbids exclusionary tactics that lessen competition, including:
 - Tying (must buy one good to get another)
 - Requirements Tying (buyer agrees to buy all its needs from the seller)
 - Exclusive Dealing (buyer agrees to deal only with seller)
 - Exclusive Territories (Buyer agrees to operate only in specified region)
 - Resale Price Maintenance (Buyer agrees to a minimum resale price)
 - Predatory Pricing (pricing below cost to eliminate a competitor)

FTC Act

- Permits FTC commissioners to prevent unfair and deceptive practices
- Commission is quasi-judicial
 - Issues restraining orders
- Pizza, oil treatments, and shakes

Vertical Restraints

- Refusal to deal
 - If access to an essential facility denied, firm cannot compete and competition harmed
- Predation
 - Price below MC, AVC
 - Ability to recoup lost profits

Vertical Restraints, Cont'd

- Once sold, good cannot be further constrained
 - Coors east of Mississippi
 - Mercedes car parts
 - Resale Price Maintenance
- Tying purchase of one good to use or non-use of another in order to lessen competition is illegal
 - Tying Kodak film to Kodak development
 - Carry 3M equipment, can't carry rivals

Vertical Mergers

- Raising rival's costs
- Foreclosure
- Microsoft's proposed merger of Intuit
 - Use OS to eliminate rivals to Quicken?
- Time Warner/TBS (owns CNN)
 - FTC required equal access

Chicago School Critique

- Vertical mergers have pro-competitive reasons
 - e.g. Avoid double marginalization
- Don't necessarily reduce supply to rivals
 - Total upstream capacity unchanged
- There is only one monopoly rent
 - If downstream monopolized, there are no additional profits to be had

Chicago Example

- Monopoly supplier of operating system
- Buys Dell, monopolizes PCs
- Is there competitive harm?
- No, because consumers buy PC + OS
 - Prior to merger, could already charge monopoly price

Chicago School Assumptions

- Monopoly has high entry barriers
 - Otherwise substitutes are relevant
 - Buying Dell increases entry barriers
- Monopoly is unregulated
 - vertical integration can be used to evade price controls

Chicago School Assumptions, Cont'd

- Arbitrage is easy
 - use inputs to price discriminate
- Input market competitive
 - e.g. monopolist affect market structure of input market and increase prices to other users

Post-Chicago

- Benefits to vertical integration
 - Pricing coordination
 - Improved quality
 - Design and production coordination
 - Efficient use of inputs
- Costs
 - Exclusionary behavior
 - Collusion
 - Pricing changes (regulation & discrimination)

Vertical Coordination

- Avoid double-marginalization
- Reduce hold-up risk
- Internalize quality and design values
- Internalize warranty and support values

McAfee, R. Preston, "The Effects of Vertical Integration on Competing Input Suppliers," *Federal Reserve Bank of Cleveland Economic Review* 35, no. 1, Quarter 1, 1999.

- Vertical integration may be beneficial
- It is strictly beneficial when raising rivals' costs/foreclosure is not an issue.
- Integration reduces double marginalization for the integrated firm
- Causing rival upstream firms to reduce prices
- Causing integrated firm to reduce price charged to outsiders relative to pre-integration.
- Banks and ATMs

Chen, Yongmin, "On Vertical Mergers and Their Competitive Effects" *RAND Journal of Economics* v32, n4 (Winter 2001): 667-85

- Literature focused on upstream behavior, but downstream behavior changes as well
- Incentive to lower price balanced by desire to raise price (foreclosure incentive).
- Incentive to lower price identical to my Cleveland Fed article

Design and Production Coordination

- May need to merger to align incentives
- Without merger, technology sharing may create a competitor
- Stealthy Cruise Missile
- Light Beer
- Inscrutable one-handle shower faucets

Exclusionary Behavior

- Raising rival's costs
- Exclusion of one upstream/downstream pair reduces the competitiveness of the market
- Leads to increased input prices
- e.g. 2 upstream, three downstream
- merger + refusal to deal leads to upstream monopoly, benefiting the vertical firm

Raising Rival's Costs

Salop & Scheffman (1987)

- Vertical Integration could increase rival's costs in a simple model

Ordover, Saloner & Salop (1990)

- Vertical Integration could increase rival's costs in an impenetrable and incoherent game-theoretical model.

Church, Jeffrey ; Gandal, Neil, "Systems Competition, Vertical Merger, and Foreclosure," Journal of Economics and Management Strategy v9, n1 (Spring 2000): 25-51

- Designing software product to be incompatible with rival's hardware as a mechanism for monopolizing hardware market.
- Also known as "technological tying"
- Example: FTC agreement with Silicon Graphics (competing workstations foreclosed), Time Warner/TBS -CNN
- Need not completely eliminate rival for tying to be effective
- Arises when hardware differentiated and software not much (in which case rival persists because important for software delivery to customer) or hardware undifferentiated and software differentiated (in which case rival foreclosed)

Collusion

- Exchange of information
 - Silicon Graphics
 - Barnes & Noble / Ingram
- Punish with the low cost/high injury market

Bernheim, B. Douglas; Whinston, Michael D., "Multimarket Contact and Collusive Behavior," Rand Journal of Economics v21, n1 (Spring 1990): 1-26.

- Sharing market is easier when there are multiple markets
- Can be geographical, product, vertical markets
- Quid pro quo

Missing from Bernheim Whinston

- Punish “cheaply”
- Multi-market contact provides alternative punishments, choose one with highest damage/cost ratio
- Makes punishments more credible
- California gasoline retail/wholesale

Pricing

- Price discriminate
- If MS monopolized PC market, could charge more for OS to people with higher performance machines
- Ambiguous welfare implications

Chen, Yongmin, "Vertical Disintegration", working paper, 2001

- Downstream firms may choose to avoid an integrated competitor to avoid the ill-effects of this firm in the presence of economies of scale, which creates lock-in.
- An unintegrated downstream firm buying from a vertically integrated upstream firm with scale economies makes that firm stronger, with lower input cost, thereby strengthening its downstream division. Downstream rivals will require a discount to buy from vertically integrated firm.
- NOTE same will be true for any form of lock-in.
- This effect can cause the integrated firm to spin off divisions.

Chen, Yongmin, "Strategic Bidding by Potential Competitors: Will Monopoly Persist?" Journal of Industrial Economics, Vol. XLVIII, pp. 161-175, 2000

- Classic result that a monopoly outbids a potential entrant for a new technology, since value to monopoly is continued monopoly, which exceeds the value of oligopoly.
- Does the same apply to an oligopoly?
- No. Strategic substitutes encourage entry purchase (ceteris paribus) while incumbents buy strategic complements.

Strategic Substitutes Example

- Standard differentiated products hotelling line
- Firms located at 0, 1, and a “transportation cost” of t per unit.
- Firm 0 offers value v_0 , while firm 1 offers value v_1 .
- Price of firm i is p_i .
- It is straightforward to show that firm i charges

Equilibrium Prices and Profits

$$p_i = t \left(1 + \frac{v_i - v_{1-i}}{3t} \right)$$

$$p_i = \frac{t}{2} \left(1 + \frac{v_i - v_{1-i}}{3t} \right)^2$$

Value-enhancing Innovation

- Willingness to pay for a value-enhancing innovation which is sold to one firm:

$$\frac{t}{2} \left(1 + \frac{v_i + \Delta - v_{1-i}}{3t} \right)^2 - \frac{t}{2} \left(1 + \frac{v_i - \Delta - v_{1-i}}{3t} \right)^2 = \frac{t\Delta}{3} \left(1 + \frac{v_i - v_{1-i}}{3t} \right)$$

- “Larger” firm wins the bidding
- Concentration rises
- This is efficient sale

If Offered to Both Firms

- Sells to i for up to

$$\frac{t}{2} \left(1 + \frac{v_i + \Delta - v_{1-i} - \Delta}{3t} \right)^2 - \frac{t}{2} \left(1 + \frac{v_i - \Delta - v_{1-i}}{3t} \right)^2$$
$$= \frac{t}{2} \left(1 + \frac{v_i - v_{1-i}}{3t} \right)^2 - \frac{t}{2} \left(1 + \frac{v_i - \Delta - v_{1-i}}{3t} \right)^2 = \frac{t\Delta}{3} \left(1 + \frac{v_i - v_{1-i} - \Delta/2}{3t} \right)$$

- Thus, sells to both firms

If Innovation Owned by Larger Firm

- Suppose larger firm is 0
- 1 willing to pay $\frac{t\Delta}{3} \left(1 + \frac{v_1 - v_0 - \Delta/2}{3t} \right)$

- Profits lost by sale are

$$\frac{t}{2} \left(1 + \frac{v_0 + \Delta - v_1}{3t} \right)^2 - \frac{t}{2} \left(1 + \frac{v_0 - v_1}{3t} \right)^2 = \frac{t\Delta}{3} \left(1 + \frac{v_0 - v_1 + \Delta/2}{3t} \right)$$

- Thus 0 would NOT sell

Example: Conclusions

- Strategic complements tend to increase concentration when exclusive
- Independent sellers of value-enhancing innovations will tend to sell to all parties
- May require price discrimination to encourage sale
- Vertically integrated firm won't want to sell to rival

Example: Application

- Hughes-DirecTV-News Corp
- News Corp has incentive to deny Fox, other content to rival Echostar
- Independent Fox has incentive to sell to all

Chen, Yongmin, and Michael Riordan, "Vertical Integration, Exclusive Dealing, and ex post Cartelization", working paper, 2002.

- Vertical integration + exclusive contracts results in exclusion of equally efficient upstream competitor and increase in downstream price.
- Many examples of vertical integration plus exclusive dealing, e.g. Standard Oil company outlets + franchisees. CRS + airline is current example
- The integrated firm raises input price to downstream, increasing downstream price toward monopoly/cartel level; downstream unintegrated firm goes along with this because of shared profits through fixed fees.
- Exclusive contracts are needed because the increase in the downstream price makes the unintegrated downstream firm want to buy more inputs and something is needed to restrain this desire.

Pricing

Pricing gives a basis for vertical relationships, due to the desire to price discriminate or coordinate complementary goods

Monopoly Pricing Formula

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

$e = - \frac{\% \Delta Q}{\% \Delta p}$ is the elasticity of demand

- Price higher when demand is less elastic

Pricing

- If demand inelastic, increase price
- Charge more to the less elastic demanders
- 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”

Examples

- Pharmaceutical pricing
- Armani’s brands
- 486SX, 487SX
- IBM LaserPrinter E
- Sony 74, 60 minute mini-discs

Means of Preventing Arbitrage

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

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

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

Yield Management Summary

$$P_D > P_F \times (1 - ns)$$

- 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 ($n \uparrow$)
- Adds 2-4% in revenue for airlines
- \$500 million per year to American

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

Peak-load Pricing

- At capacity, marginal costs include
 - Costs of expanding capacity
 - Value of unserved customers
- For electricity, airlines, hotels, marginal costs fluctuate dramatically
- Pricing should reflect likelihood of sellout or reaching capacity

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:
 Value = $\$347.26 \times 1.959 \times 1.129 \times 1.129 \times 1.129 \times 1.098 \times 1.074 \times 1.337 \times 1.656 = \$2,556.05$.
