Game Theory
for
Strategic Advantage

15.025

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Last 2 Classes

1. The **shadow of the future** helps sustain **cooperation**

2. This requires a **long and important** future, with **variable outcomes** (i.e. must depend on the past)!

3. Threats, rewards and **punishments** must be **credible**

Today's Class

You ate your broccoli, now here's your cake!

- Cooperation = softer (price) competition
- General Electric vs. Westinghouse

1. Is Large Turbine Generators an **attractive market**?
2. Should GE make Westinghouse **exit the market**?
3. What **specific steps** would you recommend to GE?

The Five Forces That Shape Industry Competition

Michael Porter's Five Forces

- Threat of entry
  - cost structure: economies of scale & scope, learning
  - access to physical or intellectual inputs
- Substitute and complement products
  - outside industry
- Suppliers
  - price sensitivity, switching costs, concentration of suppliers
- Buyers
  - price sensitivity, switching costs, concentration of buyers
- Rivalry
  - number of players, product differentiation (inside industry), cost structure, collusion

Market Attractiveness

- Large barriers to entry
  - Cost structure: fixed costs, learning curves
  - Requires specialized labor and equipment
  - Political protection against foreign entry?
- Substitute products
  - None really
- Suppliers
  - Highly skilled labor, sophisticated machine tools
  - Competitive input markets

Market Attractiveness

- Buyers
  - Private utilities: price book with discount after closed-doors negotiations.
  - Public utilities: auctions with public bids.
  - Regulated markets with cost-plus rules
  - Generators are expensive
  - Volatile demand + risk aversion
- Internal competition
  - Duopoly (Allis Chalmers just left)
  - Nearly 40% of utilities sole sourced.
  - Partial differentiation / market division

Market Strategy

- Looks pretty good on a number of dimensions
- But… GE & Westinghouse are having trouble avoiding low prices

- So what should GE do? Drive W out of business?
  - Core business for W ➔ will fight!
  - DOJ + foreign entry concerns
  - W is the ideal rival! (2nd place)

- What about restrained competition?

Restraining Competition

- What is the most harmful rivalry dimension?
- Overlapping market segments?
- Focus on largest-generator end of the market?
- Must frame it as “cooperative”
- Too little growth potential for W?
- GE didn’t go this way

- What are the sources of pricing trouble?

Restraining Competition

- What is the most harmful rivalry dimension?
- Product differentiation? Number of firms? What then?
- Who pays the highest prices?
  - government utilities
  - private utilities
- Price opacity vs. price transparency

Game Theory Interlude

Price Competition

- Quarterly perspective (easier than order-by order)
- 4 total orders in each period (e.g. 4mln kW)
- GE and W choose High price (p=3) or Low price (p=2)
- Products are differentiated ➔ demand may split
- If prices are equal:
  - 2 orders each with 50% probability
  - All 4 orders to GE with 25% probability
  - All 4 orders to W with 25% probability
- Different prices:
  - Low-price firm gets all 4 orders

Expected Stage-Game Profits

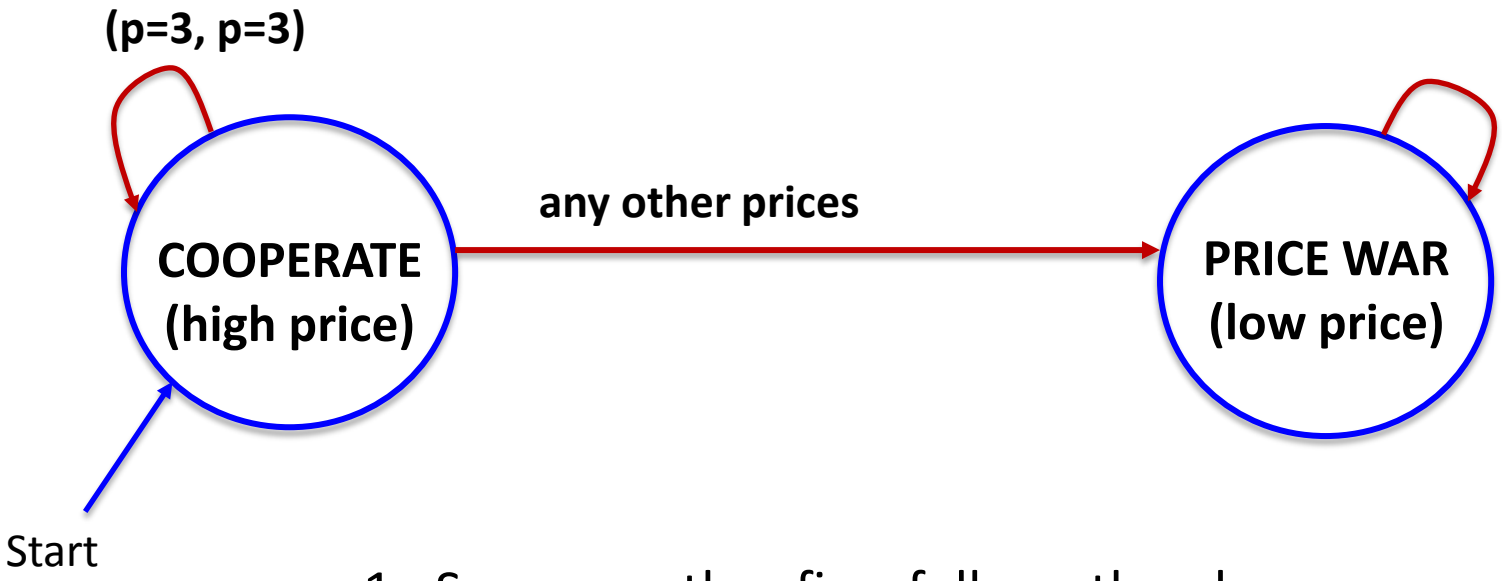
GE \ W	p = 2	p = 3
p = 2	(4 , 4)	(8 , 0)
p = 3	(0 , 8)	(6 , 6)

(p=$2, p=$2) ➔ Profits = 0.5*(2*$2) + 0.25*(4*$2) = $4
(p=$2, p=$3) ➔ Profits = 4*$2 = $8 , Profits = 0
(p=$3, p=$3) ➔ Profits = 0.5*(2*$3) + 0.25*(4*$3) = $6

Observable Prices

If prices are publicly known, play a trigger strategy

Interest rate = *r*



1. Suppose other firm follows the plan
2. Do you want to take the prescribed action?
3. Check in every state

Observable Prices

- NPV of following the strategy = ***6 + 6/r***
- Deviate to "p = 2" ➔ total payoff = ***8 + 4/r***
- Trigger strategies work if the future matters "enough"
- In this case,

$$6 + 6 / r > 8 + 4 / r$$

true if $r < 1$ → How often does a price war start?

reward – punishment > temptation

tomorrow **today**

Unobservable Prices

If prices are not observed, the strategies can only depend on the number of orders received by each firm

How often does a price war start?

- Remember: history-independent play can't work
- Future play must be sensitive to past outcomes
- Must punish (both firms) if all 4 orders go to one firm only (suppose not…)

Unobservable Prices

- Follow strategy ➔ NPV of cooperation = V_C

$$V_C = 0.5^*(6 + V_C/(1+r)) + 0.25^*(12 + 4 / r) + 0.25^*(0 + 4 / r)$$

- Solve for V_C ➔ $\mathbf{V_C} = 6 + 4/r + 2/(1+2*r)$
- Deviate to "p = 2" ➔ total payoff = V_D *(value of deviation)*
- Calculate V_D ➔ $\mathbf{V_D} = 8 + 4/r$
- Value of deviation > Value of cooperation **FOR ALL r**

Unobservable Prices: Conclusion

- Prices unobservable ➔

reward – punishment < temptation
tomorrow today

- Why? Because the NPV cooperation is very low
- 50% chance of starting a price war at each stage!
- Temptation looms large…

Unobservable Prices: Lessons

1. History-independent play can't work
2. Play differently tomorrow to provide incentives today
3. Without observable prices, we must punish

   extreme market shares
4. Value of cooperation is NECESSARILY LOW
5. Temptation is relatively much stronger!

How to get to restrained competition?

- A clear understanding of what "the deal" is.
- The players have to monitor each other.
- They must be willing to carry out punishments
- Punishments must be severe ➔ deterrent.

- If GE and Westinghouse succeed in increasing prices, how would they keep entrants out?

What happened….

GE Response: New Price Policy

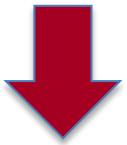
- New GE price book with simplified formulas, standard features, and examples
- GE publishes the price book
- Lowered book prices significantly
- Prices calculated by multiplying book price by a standard multiplier, initially set at 0.76
- Announce: GE will sell to all customers at this published price without exception!

GE Response: Continued

- "Price protection clause" promising buyer that, if prices were lowered within six months of purchase, GE would give the price break
- Hired Peat, Marwick, Mitchell to audit compliance with the price protection policy
- Published list of all orders and quotations for several months prior to announcement.
- Announced policy with letters to clients, press releases

Game-Changers

- Price book reduces strategy complexity – now comparable across customized orders
- Price book changes the monitoring structure
- Price protection changes the payoffs!

reward – punishment vs. **temptation** 

- Matching guarantee lowers temptation!
  (price cut ➔ pay back old buyers)

New Game

- Need Westinghouse to come along…

- W began to use the GE book: **coordination game**
- Adopted the 0.76 multiplier

- In this new game, what if you saw your market share decline?

Westinghouse Response

- Began to use the GE book: **coordination game**
- Adopted the 0.76 multiplier
- In June 1964, GE reduced its multiplier in response to suspected price cutting by W.
- In July 1964 Westinghouse
  - Announced a price increase
  - Published outstanding orders and quotations
  - Instituted a price protection clause
- In September 1964, prices are back at pre-June level

Consent Decree

- Forbid price protection policy
- No distribution of price books
- No communication permitted outside company of
  - Negotiation strategies
  - Formula or system for pricing
  - Percentage of book price
- No publication of outstanding bids

A New Era for Anti-Trust

"The prototype price-fixing deal calls for competitors to gather in a smoke-filled room. But last week the Justice Department chalked up its first significant victory against a pricing arrangement so indirect that the supposed conspirators never even met."

– Business Week, December 1976

Collusion: Takeaways

Elements facilitating collusion

- Few, similar competitors
- Homogeneous products
- Transparent actions
- Low short-run gains (e.g. capacity constraints)

Examples

- Car parts
- Lysine
- OPEC (?)
- LCD panels

How to Avoid Collusion

- Coordination is harder if more players are involved:
  - harder to coordinate
  - temptation to steal market share is higher
- Suppliers try to cooperate at a cost to you?
  - Make the dealings less transparent!
  - Destabilize their coordination by creating a suspicion of opportunistic behavior!
  - Negotiate over fewer, larger contracts!

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