

Non- Cooperative Strategic Behavior
Predatory Pricing
Limit Pricing (detering Entry)
Investment in R&D (low cost tech)

Notes: on General Game theory view of Strategic Behavior: P

Strategic Modes: designed to alter the beliefs and actions of others in a direction favorable to yourself.

Strategic moves may violate your intuition on reason, by being moves that go against ones immediate rational.

One feature of Stragegic moves is that they may have the effect of limiting your freedom of action.

In game theory having options is not allways the best strategy, sometimes lack of freedom has a strategic value

this is the case if limiting your own freedom changes other players expectations about your future responses, you can turn this to your advantage. Others know when you have the freedom to act you also have the freedom to capitulat.

Often to behavie Strategically you must commit NOT to follow your equilibrium Strategy of the simultaneous move game. (R&D example Below)

Strategic behavior may

Drive rivals out.

prevent rivals from entry (Barriers to Entry)

reduce rivals size.

Two conditions must be met for a non-cooperative strategy to be successful

1. Advantage: must be had over rival in some way. This asymmetry of power could come in the form of a cost advantage or the ability to choose first.
2. Commitment: be able to demonstrate that a non-cooperative strategy may be committed to.

Together these conditions basically make a non-cooperative strategy a **credible threat**.

Predatory Pricing:

“a dead man can't bite” -Plutarch

Predatory pricing: lowering your price in order to drive the rival out of business and scare of potential entrants.

Firm is hoping to have a **credible threat** of driving the price below cost and holding it there until rival leaves.

A firm may pursue this strategy if it thinks it can incur short run losses in order to capture long term gains. Since, one the rival is eliminated, monopoly power may become the case.

The rival, will likely respond by reducing their output in order to minimize losses.

As a consequence the predatory firm must satisfy most of the increased demand at the new lower price.

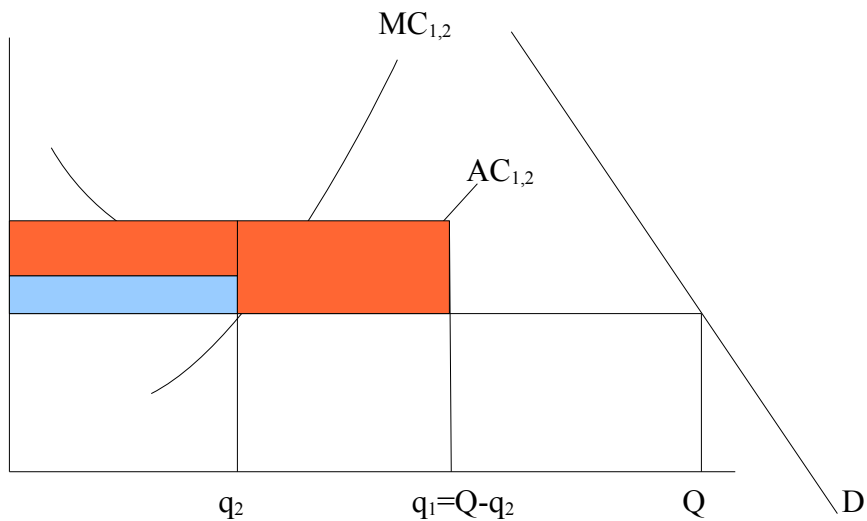
Successful predation will require that the firm can survive low prices longer than the rival.

But, since even if one firm is driven out another might enter for the predation to be successful incumbents must believe the entrenched firm is willing and able to pursue an aggressive predation strategy anytime. Creating this belief, via maintaining a credible threat then may prevent rivals from entering.

Predation with identical firms

when firms cost structures are identical, predation will not succeed.

- incumbent lowers price below Average cost
- rival reduces output to minimize losses ($P=MC$ above AVC)
- since as P falls quantity demanded increases the incumbent must meet increasing quantity demanded.



- Let 1 be incumbent firm, 2 be rival
- is the rival's losses profit = $(p-AC)q$
- is the incumbent's losses.
- Since the incumbent incurs greater losses than the rival so long as predation is the non-cooperative strategy it will not be able to outlast the rival.
- It would be irrational for a firm to practice predatory pricing under these conditions.
- Thus, for identical firms, predation is NOT a *credible strategy*

Strategies to avoid Predation:

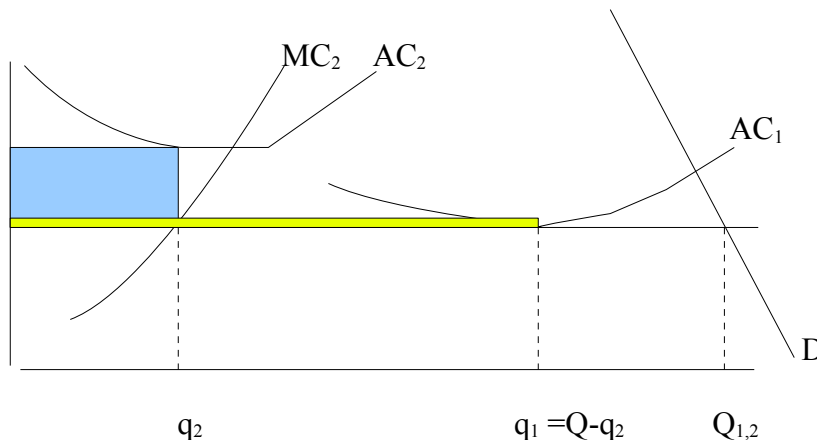
1. Merge: avoiding predations the entrant talks to the incumbent and suggests collusion. This is a sort of unofficial merger into duopoly. The offer may threaten the incumbent less as the entrant of the rival will not mean competition, price power will be maintained and expected loss of profit is smaller.
2. Long-Term contracts: entrant signs contracts with buyers prior to entry to set the price above the predation level. Buyers may be willing to sign long term contracts at prices below the existing monopoly levels. With these long term contracts, predatory pricing strategies will have no effect on the rivals losses, or survivability.
3. Reduce output or exit during predation: If a rival has low sunk costs or can quickly deploy its assets in the production of some other good then it can flexibly enter and exit without incurring additional costs. Thus when predation takes place they exit, when it abates they enter. When there are low sunk costs the market is said to be a *contestable market*.
(example manufactures entering the market for desks, and when predation occurs switches to making tables)

Predation with advantage:

- Thus a advantage must exist for the incumbent to successfully pursue a predation strategy.

(this is really a bitch to draw. For it to be obvious the rivals AC must be much higher than the incumbents and the incumbents AC curve lower and longer (Increasing returns over more q. start with rivale, then draw in predation price, follow it through to the demand curve and once that is done, draw min of incumbents AC curve wherever q1 seems to be)

- let 2 denote rival
- let 1 denote incumbent



- In this example the rival earns losses equal to the blue box. While the incumbents cost advantage allows them to sustain predation price levels and incur losses lower than the rivals.

(once must be carefull, if you draw the min of AC at the predation price level, then you are not drawing a real predation story, but competition with a lower costs firm. (see notes on Legal))

- signals of low cost advantage such as surviving a period of low prices and successfully surviving a rival's departure from the market may help an incumbent gain a reputation for being a low cost firm who would be able to successfully pursue predation if rivals entered.
- This creates a credible threat that discourages rivals from attempting to enter the market.

Legal

- Areeda and Turner (1975) develop an indicator of Predation pricing policy
 - a firm is predatory pricing if its $P < MC_{\text{short run}}$
 - since if a firm prices below short run marginal costs it is not acting in the logic of profit maximization and must be pursuing some other strategy. Such as driving a rival out and securing long term profits.
- $P < AC$ is not a good criterion, since these conditions may occur in many highly competitive markets during various market fluctuations.

Problems:

- data on SR MC is hard to come obtain
- Other strategies, which are not Predatory, involve pricing below SR MC. Such as giving away goods for free, (definitely below SR MC) but these strategies may be just promotional, to enter a market, to educate consumers about the product etc.. and may not represent an aggressive anti-competitive strategy.
- thus it's tough to tell, by legally actionable terms, when a firm is predatory pricing.
(tobacco in 1881, Standard Oil (debatable) Airlines (predation in services?, banking/credit cards (deposit rates? Interest rates?))

Legislation:

- Often a legislation regarding predation is brought against business rivals. But often these lawsuits are strategic in themselves. A firm may not really be complaining about $P < \text{Cost}$ but about price competition from a more efficient firm. (your graph above, if $AC_{\text{min}} = \text{Pred } P$ is just a more efficient firm) and thus a lawsuit may be a strategy by a less efficient firm to protect its strategy.
- some suggest that the courts take this into account and not even consider a Predatory price lawsuit until after a rival has been driven out from the market. Only then could one tell if it was lack of efficiency and rigorous competition, or predatory pricing that drove the firm out of business.

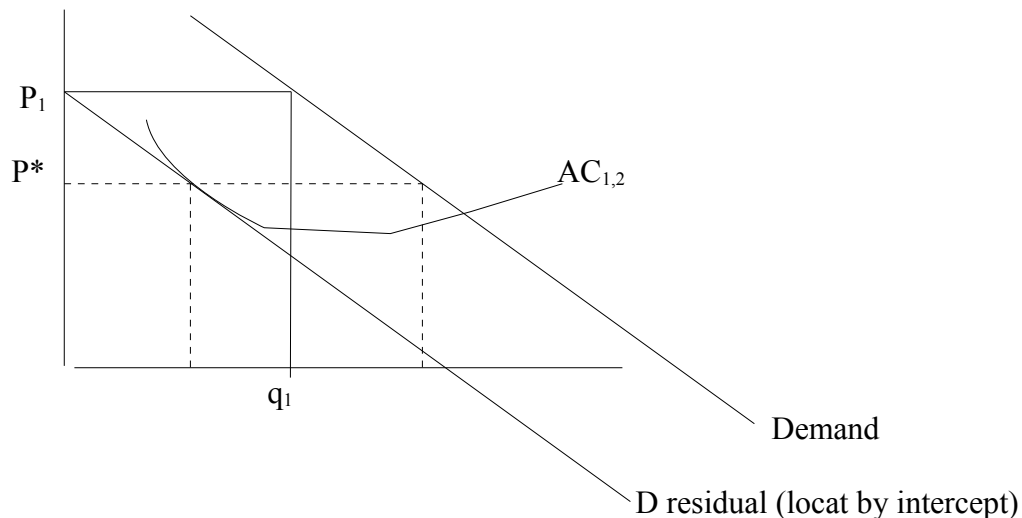
Limit Pricing (preventing entry)

“anybody can take first place, unless there happens to be a second contestant” paraphrase

-George Adfdffd

Limit Pricing: when a firm sets its price and output such that there is not enough market demand left for another firm to enter the market profitably.

- Incumbent firm has an advantage; it gets to choose price and quantity first, exploiting its existing market power
 - (for limit to work) entrant believes that incumbent will not change the price and quantity it has set after attempted entry.
 - Entrant knows that entry will push up supply and drive down price
 - incumbent firm takes these beliefs as given. And chooses its output and price to remove the incentive of a firm to enter,
-
- Identical firms, incumbent has first mover advantage to exploit market power.
 - Firm 1 sets price and quantity. Such that the residual demand curve would be just tangent to AC
 - at this point the entrant would just break even and thus is indifferent between entry and not



Limit Price P^* is that price and quantity that just prevents entry. Incumbent chooses P_1 and q_1 so that the residual demand curve is at AC at P^*

after entry incumbent produces q_1 but charges P^*

Problem: Not a Credible Threat (same as with predatory pricing)

even though P^* is above the AC curve, we have said nothing of Marginal costs (and marginal revenue) and so there is no guarantee that the firm is maximizing profit.

Identical costs necessitate identical strategies for profit maximization.

The entrant may not find limit pricing to be a credible threat, since they have the same costs structure the entrant knows that the incumbent is not maximizing profit at P^* and q_1 .

And the entrant knows (because same costs) that the incumbent could make more profit acting like a duopoly than producing q_1

Further it is plausible that the entrant could threaten the incumbent with producing q_1 so that the incumbent had no profitable demand left.

Or that (as with predatory) the entrant signed fixed long term contracts at some $P < P^*$, a price far above its minimum AC

limit pricing with an advantage:

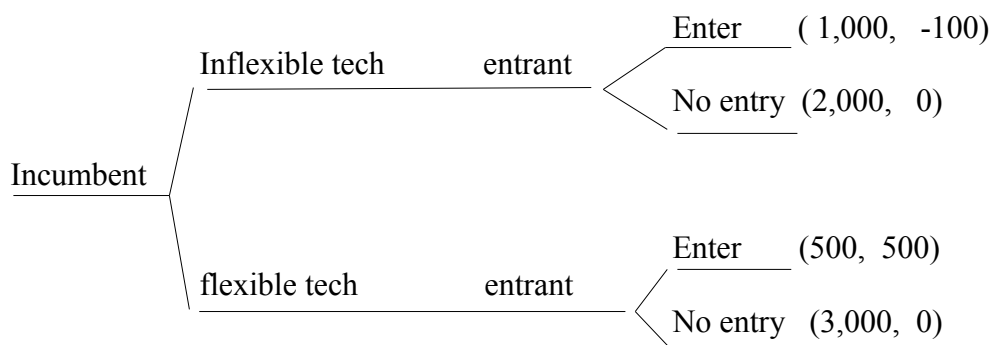
. Thus for limit pricing to be profitable for a firm to continue to produce q_1 even after entry when limit price is P^* .

Thus the incumbent must convince its rival that it is committed to producing q_1 in the event of entry. For the threat to be credible and for limit pricing to work. Thus the firm may make a strategic choice to act against its own immediate interest so as to confine its options. Because this strategy may limit the incumbent's freedom it forces the rival to take the threat as credible.

- Incumbent chooses its investment first.
- Chooses factory space to produce q_1 units. With no flexibility. (choice is removed)
- thus the incumbent has definitively pre-committed.
- (alternatively the incumbent could sign contracts with buyer to produce q_1)

by choosing limiting technology it appears at first glance that the incumbent has shot itself in the foot. But recall this was a strategy to prevent entry and maintain market power. By creating a credible threat.

Extensive form game. Payoffs (incumbent, Entrant)



Work it backwards to find the sub-game equilibrium:

- Entrant will choose No entry with inflexible and Enter with flex.
- Incumbent is thus limited by the choice of making 2,000 with inflex and 500 with flexible.
- Incumbent chooses Inflexible technology

Lesson: the existing and future cost of firms is part of the environment for other firms, and it is this environment that determines the outcome of competition.

(old school you: state of being and environment: actions determined by the choice unit of analysis)

Cost reduction Strategies: Strategic Research and development

Inventive now to invest in low cost latter.

2 firms

2 time periods

period 1: incumbent firm a monopoly

choice to invest in R&D for future cost savings

Period 2: both firms compete via Cournot. (dividing up the market output, competition in quantity)

Demand curve: $Q = 12 - p$

(equivalently $p = 12 - Q$) $Q = q_1$ when monopoly, $Q = (q_1 + q_2)$ when cornout

Firm 1 costs with out R&D:

$F = 1$ $MC = 6$ (constant)

Frim 1 costs after R&D

$F = 1$ $MC = 4$

Cost of Investment = 7.01

The figuring:

Period 1:

monopoly incumbent maximizes profit

$$\pi = (12 - q)q - (1 + 6q)$$

$$q=3$$

$$p=9$$

$$\pi=8$$

Period 2 No entry (same)

Period 2 Entry

firms compete Cournot. To maximize

$$\pi=(12-q-q_e)q-(1+6q)$$

Best response functions: $q=3-\frac{q_e}{2}$ $q=6-2q_e$

$$q=q_e=3$$

$$p=8$$

profit = 3 each

Period 1: profits invested

cost of R&D = 7.01

$$\pi=8-7.01=.99$$

Period 2 (entry and R&D)

firm 1 maximizes $\pi=(12-q-q_e)q-(1+4q)$

Reaction function given

$$q=4-\frac{q_e}{2}$$

firm 2 (e) has the same technology as prior to R&D so their reaction function is the same as is

$$q_e=3-\frac{q}{2} \text{ and can be expressed as } q=6-2q_e$$

Cournot equilibrium:

$$q=7/3 \quad P=7.33 \quad \pi=10.11$$

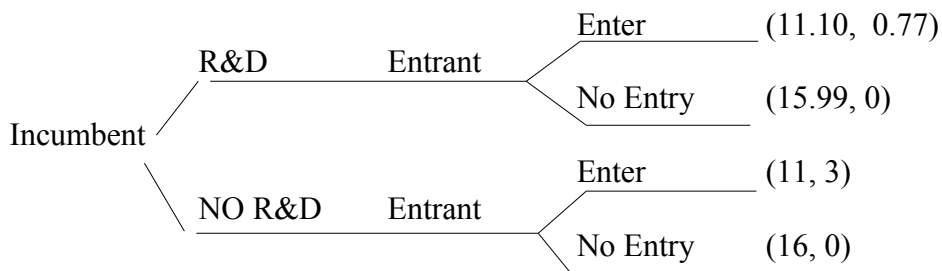
$$q_e=4/3 \quad \pi_e=.77$$

We can add total profits to get payoffs of the overall game:

for instance. If the firm invests in R&D and there is entry the firm 1 earns profit of .99 in period 1 and 10. in period two for a grand total of 11.10

11.

extensive form game view



The incumbent views the entrants payoffs and sees that in either case the entrant will enter. The the Incumbent is left to choose between (R&D, Enter)=11.10 and (No R&D, Enter)=11 The Incumbent invests in R&D.

Thus the incumbent invests in R&D now in order to alter the future environment in its favor. It has the benefit of being able to act before its rival, and establishes credibility by committing to produce large output.

Second Example: the US versus Japan: HD technology:

each country choose between devoting a high or a low amount of resources to the production of HD TV.

US has more resources to start with.

Both sides view the High effort race as the worst scenario because the US (with more resources inherently) is likely to win But this means the US won at a high costs, something not attractive to the US.

Second worst outcome is pursuing low effort while the other uses high effort, since it is spending money with little chance of success.

Japanes want to win the race and minimize the cost to them; they ideally want to use high effort while the US uses low effort.

The US want Low, Low since they win at low costs to themselves.

As single shot game:

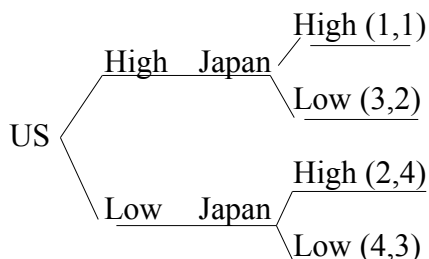
		Japan			
		Low		High	
US	Low	4	3	2	4
	High	3	2	1	1

Dominant strategy for the US is LOW

Japan does not have a dominant strategy, but if the Japanese know that the US does it will

anticipate this and choose High where the payoff is 4.
 the equilibrium is then (Low, High) payoff for US is 2

The US could change this outcome if it were able to make a Unconditional Move. If the US can move first, and announce its Unconditional Effort level It can dictate how the Japanese must respond. WE now have a sequential game.



The US Sees that if it chooses unconditionally that it will pursue High effort then the japanes must pick between payoff of 1 or 2. Japan will have to choose Low. The united states will win the technology race and have a higher payoff than in the one shot game where unconditional moves were not allowed.

Keep in ming that the US could allways wait for Japan to Choose low and then revert to Low. Wining the race at lowest cost. If the japanese suspect this then they will not be duped into choosing Low.

For that reason the US must make its unconditional choice of High, a Credible Threat
 (a alternative if you cannot make a unconditional move, it to anticipate your rivals unconditional move and act first to make a threat or a promist in order to keep them from making an unconditional move)

SEE SHY p 241, boing airbus (also version in Thinking Strategically: role of government in R&D leading to firms world dominance)

Game: How the Presence of Sunk Costs Can help to Deter Entry

Raising a Rivals Costs:

if a firm can costlessly raise its rivals costs relative to its own it can profit at a rivals expense.

- Usually a firm must have market power or political power to raise a rivals costs (tax, tarriff)
- a firm might even benefit from raising its own costs if the same strategy increases the rivals costs by more.

Direct and Indirect Methods

- Direct:

- Interfere with rivals production or selling methods.
(extreme case; outright sabotage, blow up the factory **find historical example; oil, railroads**. Modern examples: hacking and virus')
- compromising security of a firms database may not lead to identity theft but may force the firm to incur additional costs in terms of monitoring and safeguarding, as well as marketing costs to convince customers that their firm is safe.

1993: British airways vs Virgin Atlantic:

BA had to pay 2.5 million\$ to settle a libel suit by the owner of VA.

BA's staff tapped VA computers to obtain names and numbers of passengers; phoned or met them and falsely claimed that their flights were delayed or overbooked. Then offered incentives to fly with BA. Broke into homes and cars of VA staff, hired a consultant to dig up dirt on VA's owner and plant negative new stories and withdrew cooperation in maintenance and training."C&P 371

"competing with BA was like getting into a bleeding competition with a blood bank"

French government hide microphones on Air France flights to funnel information about American business men's technical plans to French firms.

French firms also attempted to infiltrate IBM and Texas Instruments with spies to gain information for French firm (compagnie des machines bull.

Indeed outright theft can lower a firms costs relative to its rivals.

Interference through government regulation

"Grandfather" clauses may be evoked to exempt older entrenched firms from new rules and regulations that affect newer firms. These may make it more onerous for new firms to operate in the market.

Tie-ins of other products

when an incumbent produces two product that *must* be used together.

These produces often compliment each other:

cameras and film, printers and ink, computers and peripheral hardware, operating systems and software.

Product design may further inhibit entry: a special patented plug that connects the printer to the computer.(TAG Heuer watches and Bracelets: the 6000 model; new bands upwards of \$700)

(even if a products design reduces demand, the increased profits that come from hampering a rival may offset the loss)

(see appendix 11.A C&P p 389)

- by tying in products A and B a monopoly can reduce the size of the market available to rival producers of B
- "island; two tennis clubs which serves island locals and guests at some resort hotel. The hotel builds a tennis club and ties in to the hotel (maybe offering free tennis there) this may deprive local tennis clubs enough demand to survive and as a result the Hotel becomes a monopoly on tennis. This result depends critically on the presence of scale effects in the provision of tennis clubs. (which may be the case if the hotel is subsidizing the tennis club with rents earned on the hotel.)

this is the foreclosure of *competition*

- Here by tying A to B the firm which has an existing monopoly on A extends that monopoly to B.
- example computers: one firm only producer of an operating system, a new device, handheld computer, is invented that could use many operating systems, the monopoly has an advantage in selling the operating system for the new device and could thereby become the monopoly supplier of the operating system for the new device.

Areas where tie in matters:

- Product compatibility
- Networks: network industries are those in which activities in one part of the network affect other parts. Example a phone network whose consumer value depends on the number of consumers hooked up to the network. Literature often emphasises the failure of competition to work in network industries. (electricity)
- physical network consist of pathways connecting nodes. Interactions can exist between various parts of the network; example shipping electricity along one path depends on the electricity loads on other paths, traffic on railways, or highways, or information on servers.
- In these situations the use of prices alone doesn't necessarily lead to the optimal use of the network among decentralized firms; thus it may be better if one firm operates the network. Recently consolidation of networks includes: airline, railroad and telecommunication industries.
- Though there may be improved efficiency gains from one firm operating a network these may be offset by monopoly problems.
- (more networks p 392)

Microsoft:

strategic behavior and rapid technological change.

In some markets product design for primary product A and complementary tie in product B can change rapidly. In such markets there is room for strategy in which a firm with market power in A extends this to B.

the government suit against Microsoft was aimed at this.

- Government alleged that Microsoft had market power in operating systems Windows. Government charged that to preserve and enhance its power Microsoft bundled its operating system together with its browser (internet surfing). The consequence of which was that the demand for Netscape's rival Browser declined substantially, Netscape was forced to stop charging for its Browser.
- The court ruled against Microsoft on violation of anti-trust laws.

Raised Switching Costs

- strategy involves making it costly for consumers to switch to rivals products. (cell phone contracts and expensive buyouts or punishments. SIM cards incompatibility between phones so that the cost of switching is lost information)
- this can effectively raise the marketing costs of rivals

raising a rivals wages or cost of other inputs

If firms use different technology, the rivals perhaps more labor intensive. Then an increase in wages will hurt the rival more than the incumbent. (total market profit may go down but individual firm profit can rise)

to do this a firm would need some way of influencing the rivals costs; it might gain this by vertical merger with a key supplier, or negotiation...

Many anti-trust suites allege that incumbent firms buy up industry supplies of scarce resources in an effort to prevent rivals from using them.

Alcoa signed contracts with energy companies to have first dips on all electricity used for making aluminum.

A firm may obtain *sleeping patents*, patents that once obtained are put to sleep and not used. This prevents rival firms from obtaining and using these inventions.

(auto industry and alternative fuel sources/ engines)

Auto unions in the US typically have one union that covers many plants. If an incumbent negotiates higher wages with the union, this negotiation may give the union power to negotiate higher wages from the rival. If the incumbent uses less labor than the rival the rival will be hurt more.

Control of distribution channels would have a similar effect; an incumbent might merge with distribution channels, or flood distribution channels to raise the costs of access to the rival.

Supporting government regulation against pollution could hurt your rival more than you if there is some cost asymmetry; you pollute less than your rival.

Incumbents would be willing to spend monopoly rents (up to the point of duopoly profit) to keep rivals out.

Sometimes the entrant has the advantage

a firm that produces may substitute product view price competition as costly as such competition also affects its revenues from substitutes.

A firm that produces complementary products does not find a price war in one product costly if the lost profits in one product are offset by increased profits in others.

Welfare and courts

- it is difficult to determine whether strategic behavior raises or lowers welfare.
- More difficult is to distinguish competitive from strategic behavior
- some strategic behavior reduces competition and harms consumers: Predatory pricing that leads to market power in the long run.
- Other strategic behavior can produce socially desirable results: even if R&D is a strategic action, consumers may ultimately benefit from lower prices.
- Even if strategic behavior leads to a monopoly consumers may benefit: patents are designed to create monopolies so as to incentivize innovation, and develop new knowledge.
- Governments are in a difficult position when enforcing anti-trust laws:
 - too little enforcement leads to bad behavior and monopoly power
 - too vigorous enforcement may deter firms from pursuing desirable forms of competition for

fear.

- Example: competition through lowering price could be predatory or purely competitive-increased efficiency.
- for these reasons courts must look at the cost of making an error.

Credible commitments, in general:(see chapter 6 of thinking Strategically for examples)

to change the relevant payoffs of the game, to make it in your interest to follow through on your commitment: turn a threat into a warning a promise into an assurance.

1. establish and use a reputation
2. write contracts

to change the game to limit your ability to back out of a commitments

3. cut off communication
4. Burn Bridges Behind you. (cutting off avenue of retreat or the opportunity to back down)
5. Leave the outcome to chance (remove yourself from decision making)

combining these if a large commitment is broken down into smaller ones then the gain from breaking a small commitment is offset by the loss on the remaining contract.

6. Move in small steps.

Use others to help you maintain a commitments

7. Develop credibility through teamwork
8. employ mandated negotiating agents.