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Lecture 12

Strategic entry deterrence

Industrial Economics

Dynamic competition model

- Two firms (L and F) produce a ***homogeneous*** good
- Production ***costs*** are zero and total ***demand*** is

$$p = 1 - q$$

- Timeline with ***3 stages***:
  - **Stage 1:** firm L chooses irrevocably a level of capacity K_L
  - **Stage 2:** firm F observes K_L and chooses K_F
  - **Stage 3:** L and F compete by simultaneously setting prices
- At stage 3 we will consider that both firms will ***sell to capacities***

  then, we will ***focus*** on the sequential choice of capacities

Strategic choice of K

- F's profit is $\Pi_F = K_F(1 - K_L - K_F)$
- Maxing Π_F: $\frac{\partial \Pi_F}{\partial K_F} = 1 - K_L - 2K_F = 0 \Rightarrow K_F = \frac{1-K_L}{2} \quad (R_F)$
- L's profit is $\Pi_L = K_L(1 - K_L - K_F)$
- Given (R_F): $\Pi_L = K_L - K_L^2 - \frac{K_L - K_L^2}{2} = \frac{1}{2}K_L - \frac{1}{2}K_L^2$
- Maxing Π_L: $\frac{\partial \Pi_L}{\partial K_L} = \frac{1}{2} - K_L = 0 \Rightarrow K_L = \frac{1}{2}$
- Then from (R_F): $K_F = \frac{1}{4}$, $\Pi_L = \frac{1}{8}$, $\Pi_F = \frac{1}{16}$

If firms set K simultaneously

- ***Symmetrical*** reaction functions

$$K_L = \frac{1-K_F}{2} \ (R_L) \quad \text{and} \quad K_F = \frac{1-K_L}{2} \ (R_F)$$

- The linear system yields: $K_L = K_F = \frac{1}{3}$, $\Pi_L = \Pi_F = \frac{1}{9}$
- In the sequential model the leader makes more profit because ***commits in investing*** $K_L = 1/2$

  this ***influences*** the choice of the follower
- If investment in capacities was ***not sunk*** then:
  1. The leader would choose capacity 1/2
  2. But the follower would also choose capacity 1/3
  3. The leader would have to ***reconsider*** capacity to 1/3, too

Entry consideration

- Now, assume that L is the ***incumbent*** and F is a potential ***entrant***
- ***Cost of entry*** (evaluated per period) is f
- F will ***enter*** iff: $\Pi_F > f \Rightarrow K_F(1 - K_L - K_F) > f$
- L wants to ***deter entrance*** and ***knows*** $K_F = {}^{1-K_L}/_{2} \quad (R_F)$
- L will ***set*** $K_L = K^*$ such that: $K_F(1 - K^* - K_F) = f \quad (1)$
- ***Substituting*** $K_L = K^*$ into (R_F) and then ***plugging*** in (1):

$$\left(\frac{1-K^*}{2}\right)^2 = f \Rightarrow K^* = 1 - 2\sqrt{f}$$

Profitability of deterrence

- After successful deterrence

$$\Pi_L = K^*(1 - K^* - 0) = (1 - 2\sqrt{f}) \cdot 2\sqrt{f}$$

- This is ***IC*** for L iff: $(1 - 2\sqrt{f}) \cdot 2\sqrt{f} > \frac{1}{8} \Rightarrow f > \frac{1}{189}$

  that is, "deterrence profit" > "accommodation profit"
- The incumbent's choice for deterrence ***depends on f***

  if f is high, deterrence is ***cheap enough*** and L will go for it

Cost of deterrence

- Deterrence ***does not come free*** for L
- Under threat of entrance, L ***cannot*** charge more than

$$p_L = 1 - K^* = 2\sqrt{f}$$

- If monopoly ***was secured*** by exogenous barriers

$$\Pi_L = K_L(1 - K_L) \quad = K_L - K_L^2$$

- Maximizing profit

$$\frac{\partial \Pi_L}{\partial K_L} = 1 - 2K_L = 0 \Rightarrow K_L = \frac{1}{2} \Rightarrow p_L^M = \frac{1}{2}$$

- For f such that deterrence is ***feasible*** and ***profitable***

$$p_L < p_L^M$$

Conflict

- Deterrence is a strategic problem first analyzed by ***Thomas Schelling*** in his path-breaking book ***The Strategy of Conflict*** **(1960)**
  - ***Threats*** denote a penalty to be imposed on a rival if they take some action (prevention)
  - ***Promises*** involve a reward to be conferred on a rival if they take some action (encouragement)
  - ***Credibility*** refers on whether threats or promises are IC
- Often threats involve "***dynamic inconsistency***"
- The role of a ***strategic move*** is to convert a threat or promise into a ***commitment***

Strategic moves

Four elements are required for an action to be ***strategic***:

1. Existence of a leader
   someone must be able to ***move before*** others
2. Perfect information
   followers must be able to ***observe*** the action of the leader
3. Incentive compatibility
   the leader selects the strategy that will affect ***most favorably*** its final payoff
4. Rational expectations
   the leader's action must affect the behavior of followers in a manner ***beneficial*** to the leader

Deterrence with excess capacity

		Entrant (E)	
		Enter	Pass
Inc. (I)	Accommodate	100, 20	200, 0
	Fight	70, -10	130, 0

- ***Entrant*** can either *enter* or *pass* (not enter)
- ***Incumbent*** can either *accommodate* the entrant by maintaining a high price or *fight* him by lowering the price
- ***Entrant*** moves ***first***

Threat

		Entrant (E)	
		Enter	Pass
Inc. (I)	Accommodate	100, 20	200, 0
	Fight	70, -10	130, 0

- The incumbent could ***threaten*** the entrant with war if enters the market
- ***Not credible!***
  once the entrant ***has entered***, it is in incumbent's ***best interest*** to ***accommodate*** and maintain high price

Excess capacity

		Entrant (E)	
		Enter	Pass
Inc. (I)	Accommodate	50, 20	150, 0
	Fight	75, -10	135, 0

- Incumbent wants to ***preempt*** entry
- Invests ***50 million*** in excess capacity
  - This allows her to produce (a bit) ***cheaper*** in case of fight
  - ***BUT decreases*** her net profit by 50 in case of accommodation
- The threat is now completely ***credible***
  it is ***rational*** for entrant to ***stay out*** of market

Excess capacity

Rent seeking

- The monopolist ***didn't really*** invest in capacity to just earn 5 additional units of profit in case of fight
- She just ***"burned"*** the 50 million to ***bar the entrance***
  - Now the entrant will *pass* and profit will be 150
  - If the monopolist didn't spend the 50, entry would occur and her profit would fall to 100
- Fight ***was never meant*** to occur – the excess capacity will ***never be used*** in production – it is pure ***rent seeking***

Reputation

- Deterrence is a ***strategic*** action and requires a ***leader***
  the leader brings the ***dynamic component*** to the game
- Sequential setting demands ***irrevocable moves***
  - If moves can be taken back, commitment ***cannot stand***
  - Second-mover will ***force*** the first-mover to treat them as ***equal***
- You have to ***convince*** your rivals you "mean business"
  impossible to bar the entry without ***credible threat***
- Credibility can be achieved via ***reputation***
  the incumbent is ***not rational***, values ***dominant position*** more than S-R profit, ***never accommodates*** but fights at ***any cost***

Reputation

The chain store game

- The following game demonstrates the ***process*** through which ***reputations*** are built
- A chain store is a ***monopolist*** in N locations
- Faces N different ***potential entrants***
  one in every location
- The game is played in N ***sequential rounds***
- This is a classic Entry / Pass – Fight / Accommodate game with ***non-credible threat***

Reputation

SPNE

- In the last round the monopolist will want to *Accommodate*
  because *fight* is a dominated strategy (both lose)
- Same in the second-to-last round
- Same in every round
  the chain store ***cannot protect*** its turf
- From a game theoretical perspective, ***nothing is strange*** in this solution – ***SPNE*** is perfectly ***legitimate***
- From an economic perspective, this is a ***paradox***
  the ***dynamic component*** of the game offers the opportunity for ***improvement***

Reputation

Reputation consideration

- Assume now that the incumbent looks backward but reasons forward
  - In round 1: the incumbent ***fights*** – both lose in location 1
  - In round 2: the entrant ***starts accounting*** for the probability that the incumbent is irrational (concerning decision within the round) – incumbent ***fights*** again
  - In round 3: the entrant has to ***update the probability*** of dealing with an ***statically irrational*** incumbent – incumbent ***fights*** again
  - Within $K < N$ rounds the incumbent has built a reputation of static irrationality – entrants in later rounds ***pass***

Does reputation pay off?

- ***If*** the incumbent tries to build a reputation
  - ***loses*** rounds 1 to K
  - ***wins*** rounds $K+1$ to N
- The incumbent ***will want*** to build such reputation iff

$$\sum_{i=1}^{K} \Pi_i^F + \sum_{i=K+1}^{N} \Pi_i^M > \sum_{i=1}^{N} \Pi_i^A$$

Perfect information

- In initial rounds incumbent fights to ***protect later markets***
- Knowing this, potential entrants may want to ***start entering again*** towards the last rounds
  - they understand that the incumbent does not have ***that many*** remaining markets to fight for
- If $L \in [K, N]$ is the round where entrants ***start entering again***, decision rule becomes

$$\sum_{i=1}^{K} \Pi_i^F + \sum_{i=K+1}^{L} \Pi_i^M + \sum_{i=L+1}^{N} \Pi_i^A > \sum_{i=1}^{N} \Pi_i^A \Rightarrow$$

$$\sum_{i=1}^{K} \Pi_i^F + \sum_{i=K+1}^{L} \Pi_i^M > \sum_{i=1}^{L} \Pi_i^A$$

Thank you!

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