Economics of Industrial Organization

Lecture 11: Limit Pricing, Entry Deterrence and Predatory Pricing

Limiting Entry

- In markets where firms receive positive profits, we would expect that over time new firms would attempt to enter the industry in order to capture some of these profits.
- As we have seen in many previous models, in general the more firms are in a given industry, the lower are profits for industry members. New entrants reduce the market power of incumbents and reduce the ability of incumbents to maintain collusion.
- Now we consider what kinds of actions a firm might take in order to try to deter or prevent entry, either through pricing or through other strategic activities.
- Such actions are also generally illegal, as they breach the Sherman act makes it illegal to "monopolize or attempt to monopolize… any part of the trade or commerce."

Stylized Facts of Firm Dynamics

- Entry is common. Dunne, Roberts, Samuelson (1988, 89) find annual entry rates ~8-10% for 2-digit SIC codes over 1963-82.
  Gerowski (1995) finds 2.5-14.5% annual entry rates for 1974-79 for 3-digit manufacturing industries in the UK.
  Jarmin et al (2004) show entry rates in the retail sector of over 60% (especially during economic prosperity).
- Most entry is by small-scale firms. DRS: entrant market share 13.9-18.8% (over 5 years). Gerowksi market share 1.34-6.35%. Cable and Scwalbach (1991): in the US, entrants constitute 7.7% of firms but only 3.2% of output.

- Survival rates are low. DRS find 61.5% of entrants exit within 5 years, 79.6% within 10 years. Jarmin et al 59-82% exit rates. Birch (1987) US data, 50% of entrants fail within 5 years.
- Exit and entry rates vary across industries, but industries with high entry rates also have high exit rates. Very highly correlated. This is in contrast to a view where industries with entry are those that are highly profitable and those with exits are suffering losses. Maybe due to variation in entry costs across industries?

- So, when thinking about industries, these are not fixed equilibria that remain stable over time; the business environment is very dynamic. Industries can have a "revolving door" of small, new entrants, most of whom fail.

Predatory Conduct

- Strategies that are designed to deter rivals from competing in a market are called "*predatory conduct*". A firm engaging in such conduct wants to influence the behavior of rivals, either those currently in the market or those thinking of entering it.
- Predatory conduct must be credible to be effective.
- For example, let us return to our simple game of entry that we considered in Lecture 9. (Challenger enters or stays out, incumbent fights or accommodates, payoffs are 1,2 from staying out, 0,0 from fighting entry, 2,1 from accommodating entry). Here, a threat to fight entry is non-credible.
- What if the game is repeated a (finite) number of times? Can we use a tough reputation effect to deter entry?

The Chain Store Paradox

- Suppose that the simple entry game is repeated N times, in N separate markets. The incumbent is the same in every market (it is a chain store) while each entrant is a separate firm. So the incumbent cares about the sum of its payoffs across all N markets, while each entrant cares only about their payoff in that market.
- We might think that we can create a “tough-guy” reputation by fighting early entrants in order to deter entry in later markets.
- But this strategy unravels. Consider the Nth market. The only rational strategy in that market is to accommodate, because there are no future entrants to deter. Knowing this, the entrant in the Nth market will enter. So, there is no point in fighting in the N-1 th market, because we know that the N-market entrant will enter anyway. So the N-1 entrant will enter.
- We can use this logic recursively all the way back to the initial market. The unique subgame perfect Nash equilibrium is for all entrants to enter and to be accommodated.
- In some sense this is a weakness of subgame perfect Nash equilibrium, and in some sense this is a weakness of the model; we need to consider other entry models in order to effectively describe (credible) entry deterrence strategies.

Predatory and Limit pricing

- **Predatory pricing** is a form of predatory conduct used to try to force current firms to exit. By “irrationally” lowering their prices in the short-term (to a level below long-run average costs, and possibly even below short-run marginal cost) firms seek to force their rivals to receive negative profits, and to exit the industry.
- This is only rational if the firm can recoup its short term losses later by exploiting its market power. This requires that there are entry costs or entry barriers, otherwise the rival could simply re-enter the market in the future.
- A similar strategy can be used to deter entry. Keeping prices lower than they would otherwise be could deter entrants from entering the market – this is known as **limit pricing.**
- Courts and policy-makers have traditionally been much more concerned with predatory pricing than limit pricing, partly because there is a clear victim in predatory pricing, whereas it is harder to prove a victim in limit pricing.
- These strategies typically require; it might be possible for a large firm to muscle out a small rival in this way, but it is much more likely to be optimal to accommodate an equally sized rival.

Informal Model of Entry Deterrence

- Consider a simple variant to the Stackelburg Cournot model. So this is more properly a "limit quantity" model rather than a limit pricing quantity.
- The incument is the Stackelburg leader. The entrant makes the assumption that whatever its quantity choice is, it will not alter the leader's choice of output; the leader only gets to choose its quantity once, and it must be able to credibly commit to this level.
- We must also assume that the entrant's average cost declines over at least the initial range of low levels of production.
- When both these assumptions hold, then the incumbent can manipulate the entrant's profit calculation and discourage entry.

Capacity expansion as entry-deterring commitment (Dixit 1980)

- Consider a dynamic, 2-stage game of capacity expansion. In the first stage, the incumbent moves first and chooses a capacity level $\overline{K}_1$ at a cost of $r\overline{K}_1$. This capacity is measured in terms of output, and the cost r is the constant cost of 1 unit of capacity.
- By investing in capacity $\overline{K}_1$, the incumbent firm has the capability of producing any output less than or equal to $\overline{K}_1$ in the second stage of the game; the incumbent's capacity can be further increased in the second stage, but it cannot be reduced. (Imagine that capacity expansion costs are sunk.)
- The entrant observes the incumbent's choice of capacity in stage one, then in stage 2 makes its entry decision. If entry occurs, the two firms choose capacity levels K_1 and K_2, and then play a simultaneous Cournot game in output. The incumbent cannot choose $K_1 < \overline{K}_1$, and then firms cannot choose quantities $q_1 > K_1$ or $q_2 > K_2$.

- Market demand is $P = A – B(q_1 + q_2)$.
- Denote any sunk costs incurred by the incumbent (other than those associated with capacity choice as F_1.
- Each unit of output has a constant marginal cost w. Each unit of capacity costs r per unit. (So in the second round the incumbent pays $r(K_1 - \bar{K}_1)$ for capacity.
- So, in round 2, the incumbent faces:
  $C_1(q_1,q_2; \bar{K}_1)$ $= F_1 + wq_1 + r\bar{K}_1$ for $q_1 \leq \bar{K}_1$
  $= F_1 + (w + r)q_1$ for $q_1 > \bar{K}_1$
- The only difference between the incumbent and the entrant is that the entrant cannot invest in capacity in stage 1. The entrant faces:
  $C_2(q_2; \bar{K}_1)$ $= F_2 + (w + r)q_2$
- Note that the firms face different marginal costs in stage 2 of the game, and so they face different marginal incentives. As long as it is below capacity, the incumbent firm faces a lower marginal cost and so is more willing to increase its output.
- Thus, investing in capacity can serve as a credible device for the incumbent to commit to producing a higher output level.

- We solve this dynamic game by working out what happens in the last stage of the game, in order to then work out the incumbent's optimal move in the first stage.
- In stage 2, the firms are playing a Cournot game in quantities.
- Incumbent firm profits will be:
  $\pi_1(q_1, q_{2;}\ \bar{K}_1) = [A - B(q_1 + q_2)]q_1 - [wq_1 - F_1]$ for $q_1 \leq \bar{K}_1$
  $\pi_1(q_1, q_{2;}\ \bar{K}_1) = [A - B(q_1 + q_2)]q_1 - [(w+r)q_1 - F_1]$ for $q_1 > \bar{K}_1$
- We can see that marginal revenue for the incumbent from increasing q_1 is always $MR_1 = A - 2Bq_1 - Bq_2$. Marginal cost will change depending on whether or not the firm decides to add capacity: it is either w or r depending on whether or not it adds capacity. Accordingly, we get two separate results from setting MR = MC, and so two separate best response functions:
  $q_1^* = (A - w)/2B - q_2/2$ when $q_1^* \leq \bar{K}_1$
  $q_1^* = (A - w - r)/2B - q_2/2$ when $q_1^* > \bar{K}_1$

- This means that the incumbent firm's best response function jumps at the output level $q_1^* = \overline{K}_1$, whereas the entrant firm's does not.
- The entrant firm profits will be:
  $\pi_2(q_1, q_{2;}\ \overline{K}_1) = [A - B(q_1 + q_2)]q_2 - [(w+r)q_2 - F_2]$
- This gives a best response function:
  $q_2^* = (A - w - r)/2B - q_1/2$
  Note that this is the entrant's best response **given** that it chooses to produce a positive level of output. This does not take into account the sunk costs F_2 that the potential entrant incurs should it actually decide to enter.
- Note that $(A - w - r)/2B$ is the quantity that the entrant would produce if the incumbent chose $q_1 = 0$. At this quantity, the entrant will make a positive profit. As q_1 increases, the optimal q_2 will decline, and the entrant's profits will decline, eventually to the point where profits are exactly zero, and then go negative.
- At this point, the best response function jumps, and the entrant should stay out of the market entirely and get profits of zero.

- Understanding how this works, the incumbent in the first round knows that they can use $\overline{K}_1$ to manipulate this. The incumbent will choose $\overline{K}_1$ to give itself the maximum profit possible in stage 2, which might be to commit to a large enough quantity so that the entrant will stay out.

- What the solution shows is that (depending on the particular parameters) entry may well not occur, either because
a) the entrant's costs are so high that it cannot profitably enter even if the incumbent acts nonstrategically as a monopolist or
b) entry might otherwise be profitable except that the incumbent acts strategically and deters entry by investing in enough capacity to produce beyond the output of a pure monopoly.

- If entry cannot be deterred, the incumbent can still act as a Stackelburg leader. If entry can be deterred, the incumbent can do even better.
- The incumbent's advantage comes from its ability to commit credibly to a particular output level in stage 2 by means of its choice of capacity in stage 1.
- Effectively, the incumbent commits to producing at least as much as the initial capacity it installs, because to produce any less amounts to throwing away some of that investment, which is costly.
- The incumbent can sometimes deter entry by deliberately over-investing in capacity – i.e. investing in capacity that would not be profitable were it not for the fact that doing so eliminates the competition. So such capacity expansion is predatory.
- Note also that the capacity expansion is credible as a deterrent strategy only to the extent that the capacity, one in place, is a sunk cost. If capacity was not sunk, then over-investment would not be credible, since it could be undone, and the game would revert to Cournot.
- The incumbent is gaining strategic advantage by deliberately tying their hands and modifying their stage 2 incentives.