Predation and Financial Constraints

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- A type of competitive threat that has attracted the attention of economists, policymakers and legal scholars for a long time is known as "predatory pricing."
- Predatory pricing involves a firm setting prices at a level that implies sacrifice of current profits with the intention of driving out a rival firms(firms) and reaping higer profits in the future.
- Predatory pricing is hard to detect in practice, although court cases are not uncommon.
- One form it takes is known as "dumping" whereby governments might subsidize their firms so that they can enter other markets.
- However, without government intervention, it has been hard to pin down why predation occurs.

- The main explanation of predation was probably that a large firm with "deep pockets", but charging below-cost prices, might drive out a small firm with "shallow pocket" that would be unable to survive losses for a long time.
- In an influential article, McGee (1958) questioned the argument on the following grounds.
  1. Larger firms have to incur higher overall losses for the same per-unit loss (because they produce more)
  2. The assets and plants of the small firm may not disappear – to keep the small firm out, prices may have to be kept permanently low.
  3. Why cannot the small firm go to a bank for financing, and make the case that if the bank made a commitment to "bankroll" it and cover the losses of a price-war, the predator would be discouraged and predation will never occur?
  4. Why doesn't the large firm buy out the small firm rather than sustain profits to drive it out?

- Counterarguments
  1. Large firm may operate in many markets and only needs to lower price in the market in which the small firm operates [See below an alternative explanation].
  2. There are sunk costs of entry and exit. Moreover, running out a rival from the market might deter new entry if the large firm develops a reputation for being aggressive.
  3. Financial constraints may change the story – we build on this below.
  4. Some mergers may not be allowed if they lead to more market concentration. Moreover, a merger may encourage new entry (perhaps in anticipation of a merger).
- Financial constraints offer the most convincing arguments for predation.
- We develop a framework below.

- A version of the one-period model of Holmstrom and Tirole (1998).
- There are two firms.
- The strong firm (S) is financially unconstrained in the sense that it has sufficient liquid reserves to take all investment projects.
- The weak firm has limited cash holding (internal funds), denoted by $c_0 < 1$.
- Both firms can invest \$1 either productively or unproductively. It will be clear that it is never in the interest of firm S to invest unproductively.
- An unproductive investment also requires an investment of \$1 and leads to no cash flows but a private non-cash benefit of $B < 1$ to the entrepreneur.

- If both firms invest \$1 productively, firm S's cash flow is θa_s with probability p and 0 with probability $1 - p$.
- That for firm W is $(1 - \theta)a_w$ with probability p and 0 with probability $1 - p$.
- Here, θ and $1 - \theta$ denote, respectively, the fraction of customers (market shares) of the two firms.
- If only one firm invests, it gets all the customers and the market share is \$1.
- a_s and a_w are assumed uncorrelated.
- One way to think about this is that the profits of the firms are subject to idiosyncratic shocks such as cost shocks or the success of their products.
- p can be regarded as a "state of the economy" parameter, and will be high (low) in boom (bust) periods.

- The timing is as follows:
- At time t=0, the firms randomly draw the respective a_i from some distribution $F(a_i)$.
- The value of a_i becomes common knowledge.
- We assume that the support of $F(\cdot)$ is $[0, b]$ WLOG.
- The firms then decide whether to invest productively or unproductively, or not invest at all.
- For firm S, investing unproductively is never optimal as it spends \$1 but gets $B < 1$.

- For firm W, investing requires borrowing $1 - c$ (where we allow c to be less than c_0 for reasons explained below).
- Let d denote the repayment obligation. Then the fair pricing of debt requires

$$pd = 1 - c. \tag{1}$$

- However, the firm could borrow the money and invest unproductively if it is incentive compatible to do so.
- So, for lenders to be willing to lend, the following Incentive Compatibility condition must be satisfied

$$p((1-\theta)a_w - d) \geq B. \tag{2}$$

- Substituting from the FP condition, for the firm W to invest,

  a_w must be at least

$$a_w \geq \frac{B + 1 - c}{(1-\theta)p}$$

- Notice also that the firm must be better off saving c than investing.
- Substituting for d in the IC condition, the firm's payoff from investing is clearly $p(1-\theta)a_w - 1 + c$.
- For this to exceed c, we must have $p(1-\theta)a_w > 1$ or $a_w > \frac{1}{p(1-\theta)}$.
- Thus, the firm W invests productively iff

$$a_w \geq \text{Max}\left(\frac{1}{(1-\theta)p}, \frac{B+1-c}{(1-\theta)p}\right) = A_c$$

Predation:

- Predation involves the strong firm spending x to lower firm W's cash flows (which can be though of as accumulated past profits).
- Predation occurs at time t=-1, before a is revealed.
- As a result of predation, firm W's cash flow at t=0 is $c = c_0 - \alpha x^{1/2}$.
- Thus, there is decreasing returns to predation – the more firm S spends on predation, the less the marginal decrease in firm W's cash holding.

Case of $B > c$

- For $B > c$, the W firm is financially constrained in the sense that it cannot invest in all positive NPV projects ($a_w > 1/(1-\theta)p$).

$$A_c = \frac{B + 1 - c}{(1-\theta)p}. \tag{3}$$

- In what follows, initially, we focus on this case.
- To ensure $c < B$, we assume $c_0 < B$ for now.

Firm S's payoff from predation:

$$\Pi_S = ((1 - F(A_c)) \int_{\frac{1}{p\theta}}^{b} (p\theta a_s - 1) dF + F(A_c) \int_{\frac{1}{p}}^{b} (pa_s - 1) dF - x$$

Here, we have used the observation that the S firm invests when firm W also invests iff $p\theta a > 1$, and it invests when firm W does not invest iff $pa > 1$.

Differentiating the above expression w.r.t. x, we get the following first-order condition:

$$f(A_c) \frac{\alpha}{2(1-\theta)p} \left(\int_{\frac{1}{p}}^{b} (pa_s - 1) dF - \int_{\frac{1}{p\theta}}^{b} (p\theta a_s - 1) dF \right) = x^{\frac{1}{2}}$$

Switching to the case where $F(\cdot)$ is uniform, we get:

$$x^{1/2} = \frac{\alpha}{2p(1-\theta)b}\left(\int_{\frac{1}{p}}^{b}(pa-1)da - \int_{\frac{1}{p\theta}}^{b}(p\theta a-1)da\right)$$

$$\Rightarrow x = \alpha^2\left(\frac{b}{4} - \frac{1}{4bp^2\theta}\right)^2$$

Note: $x = 0$ if $\frac{b}{4} - \frac{1}{4bp^2\theta} < 0 \rightarrow b^2p^2\theta < 1$

Assume:

$b^2p^2\theta > 1$ which must be true if $bp\theta > 1$, and the second integral above is positive.

If $bp\theta < 1$, the strong firm never invests in the absence of predation. So we rule this case out.

Comparative Statics:

(i) $\frac{d\left(\frac{b}{4}-\frac{1}{4bp^2\theta}\right)}{d\theta} = \frac{1}{4bp^2\theta^2} > 0 \Rightarrow \frac{dx}{d\theta} > 0.$

(ii) $\frac{d\left(\frac{b}{4}-\frac{1}{4bp^2\theta}\right)}{dp} = \frac{1}{2bp^3\theta} > 0 \Rightarrow \frac{dx}{dp} > 0.$

(iii) $\frac{d\left(\frac{b}{4}-\frac{1}{4bp^2\theta}\right)}{db} = \frac{1}{4b^2p^2\theta}\left(\theta b^2 p^2 + 1\right) > 0 \Rightarrow \frac{dx}{db} > 0.$

Discussion

- Why does the firm with already high market share (θ) predate more? – Because the return from predation is higher: each dollar spent has a larger effect on the weak firm when it's market share is lower
- If the economy is in a boom period (higher p), return from predation is higher – Consistent with counter-cyclical markups
- If projects are more profitable (higher b means higher NPV) predation increases.

Firm S's payoff from predation [drop the subscript from a]

$$\Pi_S = \left((1 - \frac{\frac{B+1-c_0+\alpha x^{1/2}}{(1-\theta)p}}{b} \right) \int_{\frac{1}{p\theta}}^{b} (p\theta a - 1) da$$
$$+ \frac{\frac{B+1-c_0+\alpha x^{1/2}}{(1-\theta)p}}{b} \int_{\frac{1}{p}}^{b} (pa - 1) da - x$$

where $x = \alpha^2 \left(\frac{b}{4} - \frac{1}{4bp^2\theta} \right)^2$.

Case of $B < c$.

If $B < c$, firm W is no longer financially constrained. There is no benefit to predation unless predation pushes c to B and lower.

Firm S has two choices: (i) to not spend any money on predation, (ii) to spend $(1/\alpha^2)(c_0 - B)^2$ which lowers c_0 to B, and then spend an additional $x = \alpha^2 \left(\frac{b}{4} - \frac{1}{4bp^2\theta} \right)^2$. It's payoff in the former case is

$$\Pi_S^1 = \left((1 - \frac{\frac{1}{(1-\theta)p}}{b} \right) \int_{\frac{1}{p\theta}}^{b} (p\theta a - 1) da + \frac{\frac{1}{(1-\theta)p}}{b} \int_{\frac{1}{p}}^{b} (pa - 1) da$$

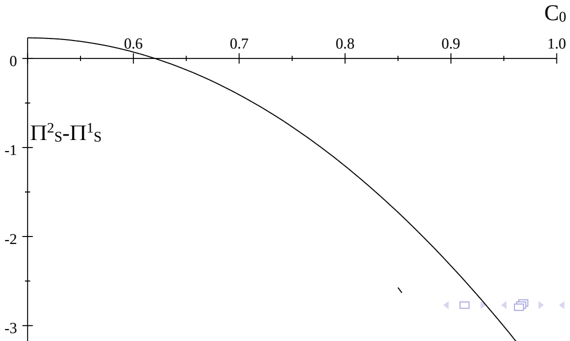
while in the latter case, it is

$$\Pi_S^2 = \left((1 - \frac{\frac{1+\alpha x^{1/2}}{(1-\theta)p}}{b} \right) \int_{\frac{1}{p\theta}}^{b} (p\theta a - 1) da$$
$$+ \frac{\frac{1+\alpha x^{1/2}}{(1-\theta)p}}{b} \int_{\frac{1}{p}}^{b} (pa - 1) da - x - \frac{1}{\alpha^2}(c_0 - B)^2$$

We show some numerical comparisons.

Parameters:

$\alpha = 0.25$; $b = 8$; $p = 0.75$; $\theta = 0.75$; $B = 0.5$;



- Predation is profitable until c_0 crosses 0.62037.
- Firms with c_0 in the range $[B, 0.62037]$ cannot avoid predation, but they can save money by paying out any cash in excess of B as a dividend.
- The threat of predation an induce financially constrained firms to pay out some cash as dividends!
- This calls into question one way empirical researchers sometimes classify firms as financially constrained.
- However, in a multi-period setting, firms with cash is excess of B may want to save the cash for the future.
- How can they do so?
- One way is to make predation more costly for the S firm.

Governance/Bank Monitoring

- Assume that by paying K out of current cash holdings, B can be lowered by δ, where $\delta - K > 0$.
- For example, the entrepreneur could hire reputable auditors and set up a board with reputable independent directors who will expend effort to limit the possible range of unproductive investment, which lowers B.
- Alternatively, K could represent the cost of borrowing from a large bank (as opposed to a small bank or from the public (i.e. *public debt*) that has a culture and resources to monitor borrowers.

The net gain is (assuming uniform distribution):

$$
\begin{aligned}
& \frac{1}{b}\left(\int_{\frac{B+1-c-\delta+K}{(1-\theta)p}}^{b}(pa-1)da-\int_{\frac{B+1-c}{(1-\theta)p}}^{b}(pa-1)da\right)-K(4) \\
= \quad & \frac{1}{2bp}\frac{\delta-K}{(\theta-1)^2}\left(2B-2c+2\theta-(\delta-K)\right)-K
\end{aligned}
$$

Thus, not surprisingly, δ has to be larger than K for monitoring to be worthwhile for firm S.

Observations:

Gain from monitoring is higher if

1. p is lower
2. $B-c$ is higher (i.e., the firm is more financially constrained)
3. θ is higher (smaller market share for firm W)

Predation and Monitoring

For $c_0 < B$, it is clear from (4) that as predation lowers c below c_0, the firm's incentive to incur monitoring cost increases.

Interestingly, if predation leads to bank monitoring here, the firm could become more likely to invest.

This is not better for the entrepreneur of firm W than if predation did not exist; however, more investment may have social benefit that is not captured by the entrepreneur.

Consider c_0 such that

(i) Equation (4) is negative for $c = c_0$ (i.e., when there is no predation), but

(ii) positive for $c = c_0 - \alpha x^{1/2}$ (such a c_0 clearly exists for a non-empty set of parameter values).

Thus, when there is no predation, there is no monitoring, and the marginal state in which investment occurs is $A_c = \frac{1+B-c_0}{(1-\theta)p}$.

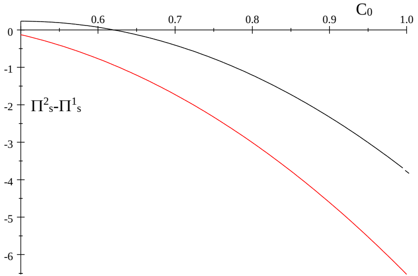
On the other hand, when there is predation, the firm goes for monitoring, and the marginal state is $A_c^{'} = \frac{1+B+\alpha x^{1/2}-(\delta-K)-c_0}{(1-\theta)p}$.

Assume $\delta = 0.15$.

for $K < \delta - \alpha x^{1/2} = 0.02\,963$, $A_c^{'} < A_c$.

- Next, consider $c_0 > B$.
- From previous analysis, we know that there exists some level of $c_0 > B$, say c_1, such that predation does not occur for any higher c_0 .
- So for $c_0 > c_1$ clearly predation has no effect on monitoring.
- However, for $c \in (B, c_1)$, predation does occur.
- We show numerically that if the firm W with c_0 in this range invests in bank monitoring, then it can escape predation.

Parameters: $\alpha = 0.25$; $b = 8$; $p = 0.75$; $\theta = 0.75$; $B = 0.5$; $\delta = 0.15$



- It can be shown that for some parameter values, firms with $c_0 \in (B, c_1)$ will invest in monitoring.
- Finally, here also, the threat of predation leads to monitoring/governance improvements.
- But it is possible to extend the model so show that predation can also destroy the incentive to invest in monitoring.

- Suppose the entrepreneur can invest effort, at cost $r\mu$, $r < 1$, to get a productivity gain μ which is realized only if he invests.
- In this situation, it can be shown that for some parameter values,the entrepreneur invests in productive effort and monitoring in the absence of predation, but in neither when predation occurs.
- The intuition is that (a) predation reduces the likelihood of investment (even with monitoring) and thus the return from productive effort.
- The lowering of productive effort in turn reduces the incentive to improve monitoring (as the return from investment is lower).

Empirical Evidence

- Although there is plenty of anecdotal evidence, and several court cases, direct large scale empirical evidence of predation is hard to come by.
- Chevalier's (1995) seminal study of LBOs in the supermarket industry finds that when a rival firm in a local market had low leverage, prices dropped after a firm underwent LBO.
- Examples of other studies that indirectly find support for predation:
  1. Kini, Shenoy and Subramaniam (2017): firms that recall products have more adverse stock price reactions around announcement when they are more levered and operate in more concentrated markets (suggesting that competitors prey on financially weak rivals).
  2. Haushalter, Klasa and Maxwell (2007): firms hold more cash and hedge more when they are subject to more "predation risk."

- In Baneree, Dasgupta, Shi and Yan (2019), we examine a setting in which an industry leader is suddenly impaired and becomes vulnerable to predation.
- In particular, we examine how competitors react when the industry leader's financial misconduct becomes public information.
- We find that when financial misconduct becomes public, the stock price of the "fraud firm" drops about 20% and there is a steep increase in market leverage.
- The firm becomes *financially constrained* and most likely is unable to match predatory strategies of rivals.
- We examine how rival firms change their advertisement spending (on which we have data for publicly traded US firms) and also their price-cost margins (proxied by profit margin).

- Our empirical methodology is a stacked difference-in-difference approach for multiple events (Gormley and Matsa (2011)).
- We follow Hoberg and Phillip's (20190, 2016) text-based industry network classification to define treated and control firms.
- The industry classifications are constructed based on product descriptions in firms 10K filings.
- The TNIC industry classifications list a distinct set of competitors for each firm that they all produce similar products and services.
- TNIC3 classification is as coarse as three-digit SIC codes.
- TNIC2 classification is as coarse as two-digit SIC codes. TNIC3 is a subset of TNIC2.

- "Treated firms" are all firms in the same TNIC3 group as a fraud firm.
- Control firms are matched firms in the same TNIC2 group as the fraud firm (excluding those in the same TNIC3 group).
- Independent variables of interest are (i) advertising spending $log(1 + advertising)$, advertising intensity (advertising divided by sales) and scaled advertising (advertising divided by assets) and adjusted profit margin (earnings before interest and advertising spending scaled by sales).

- The estimation methodology is

$$Y_i = \beta Peer_{ic} * Post_{ict} + \gamma_{ic} + \omega_{ct} + \varepsilon_{ict}$$

where

- c indexes cohort (each fraud event defines a cohort comprising of treat peer firms and marche control firms)
- i indexes firm and t indexes time
- $Peer_{ic}$ equals 1 if firm i belongs to cohort c (0 otherwise).
- $Post_{ict}$ equals 1 for firm i if year t is one of the 3 years after the fraud event for cohort c (0 otherwise).
- γ_{ic} equals 1 for firm i in cohort c (0 otherwise).
- ωct equals 1 for cohort c and year t (0 otherwise).

Findings

1. treated firms gain market share, increase advertisement and lower prices (as proxies by profit margins).
2. Advertisement spending increases more in concentrated industries, and when the fraud firm has more debt prior to fraud revelation, and when industry has lower leverage.
3. profit margin drops more when industry is more concentrated, but less when fraud firm leverage and industry leverage is higher.
4. Advertisement increases only in industries in which consumers have high switching costs, and especially when fraud firm debt is high.
5. In high switching cost industries, advertisement increases when past sales growth is high (many new customers), but profit margins drop when past sales growth is low (old customers)