Dominant Firms, Barriers to Entry Capital and Antitrust Policy

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Dominant Firm vs. Fringe Firms

- Threat of entry limits the price setting power of the dominant firm and stimulates it to undertake innovations.

- Dominant firm attempts to restrict or inhibit competition through “competition-restricting investments”
  - e.g. advertisement, political lobbying, pressuring for anti-competitive regulatory measures, protection of innovations through patents, creating excess capacity, investment in coalition formation, etc.

- Accumulation of “entry-deterring capital” to secure and increase its market share.
A dominant firm (or a dominant group) and fringe firms compete for a market demand. The industry faces a downward-sloping market demand. The market price is largely controlled by the dominant firm. The market share of the dominant firm is explained by the entry-deterring capital.
Model

- Dominant firm’s problem

\[
\max_x \int_0^\infty e^{-rt} [pq - C'(q) - x - \varphi(x)] \, dt
\]

\[q = s(E)d(p)\]

- **\(p\):** mkt price
- **\(q\):** output
- **\(C\):** production cost
- **\(x\):** competition-restricting investments
- **\(\varphi\):** adjustment costs
- **\(s\):** mkt share by \(D\)
- **\(E\):** entry-deterring cap
- **\(d\):** mkt demand
- **\(\delta_E\):** obsolescence rate of \(E\)
- **\(r\):** discount rate
$s(E)$ – Market Share by the $D$ firm
Model

- Dominant firm’s problem

\[ \max_x \int_0^\infty e^{-rt} \left[ pq - C'(q) - x - \varphi(x) \right] dt \]

\[ q = s(E) d(p) \]

\[ p(s) > 0 \text{ for } 0 \leq s \leq 1 \]

with \( p(0) = p_c, p(1) = p_m \)

\( p \): mkt price
\( q \): output
\( C \): production cost
\( x \): competition-restricting investments
\( \varphi \): adjustment costs
\( s \): mkt share by \( D \)
\( E \): entry-deterring cap
\( d \): mkt demand
\( \delta_E \): obsolescence rate of \( E \)
\( r \): discount rate
\( p(s) \) – Market Share and Price
Model

- Dominant firm’s problem

\[
\max_x \int_0^\infty e^{-rt} [pq - C'(q) - x - \varphi(x)] \, dt
\]

\[
q = s(E)d(p)
\]

\[
p(s) > 0 \text{ for } 0 \leq s \leq 1
\]

with \( p(0) = p^c, p(1) = p^m \)

\[
\dot{E} = x - \delta_E E
\]

- Model parameters:
  - \( p \): mkt price
  - \( q \): output
  - \( C \): production cost
  - \( x \): competition-restricting investments
  - \( \varphi \): adjustment costs
  - \( s \): mkt share by \( D \)
  - \( E \): entry-deterring cap
  - \( d \): mkt demand
  - \( \delta_E \): obsolescence rate of \( E \)
  - \( r \): discount rate
Non-negativity condition

\[ h = -E \leq 0 \Rightarrow \dot{h} = -\dot{E} = -(x - \delta_{E}E) \leq 0 \text{ whenever } h = 0 \]

Lagrangian

\[ \mathcal{L} = p(s)s(E)d(p) - C(q) - x - \varphi(x) + \lambda(x - \delta_{E}E) - \theta \dot{h} \]
FOCs

$$\mathcal{L}_x = -1 - \varphi'(x) + \lambda + \theta = 0$$

$$\mathcal{L}_\theta = -\dot{\theta} = x - \delta_E E \geq 0 \quad \theta \geq 0 \quad \theta \mathcal{L}_\theta = 0$$

$$-E \leq 0 \quad \theta E = 0 \quad \dot{\theta} \leq 0 \quad (= 0 \text{ when } -E < 0)$$

$$\dot{E} = x - \delta_E E$$

$$\dot{\lambda} = (r + \delta_E)\lambda - p'(s)s'(E)s(E)d(p)$$

$$- (p(s) - c)\{s'(E)d(p) + s(E)d'(p)p'(s)s'(E)\} + \theta \delta_E$$

and transversality conditions
Entry-deterring rules

- When $E > 0$, non-negativity constraint drops ($\theta = \dot{\theta} = 0$).

\[
\begin{cases}
  x > 0 & \lambda > 1 \\
  x = 0 & \text{for } \lambda = 1 \\
  x < 0 & \lambda < 1
\end{cases}
\]

$\lambda = \text{discounted value of marginal future net cash flows}$

by increasing a unit of entry-deterring capital

$1 = \text{price of a unit of competition-restricting investment good}$

- When $E = 0$, non-negativity constraint is binding.

\[
x = 0 \quad E = \dot{E} = 0
\]
Industry Dynamics

- 2D dynamics in $x$ and $E$

\[
\dot{x} = \frac{1}{\varphi''(x)} [(r + \delta_E)(1 + \varphi'(x)) - p'(s)s'(E)s(E)d(p) \\
- (p(s) - c)\{s'(E)d(p) + s(E)d'(p)p'(s)s'(E)\} - \theta r + \dot{\theta}]
\]

\[
\dot{E} = x - \delta_E E
\]
Dynamics of $x$ and $E$
Scenario 1: Dominance of high market share

- For any $E > 0$, high concentration is reached in the long run.
Scenario 2: Threshold dynamics

- For $E >$ threshold, high concentration is realized in the long run.
- For $E <$ threshold, competitive state is restored.
Scenario 3: Restoration of competitive market

- For any $E > 0$, competitive state is restored in the long run.
Scenario 4: Competitive region as sole attractor

- For any $E > 0$, competitive state is restored in the long run.
Solution Method

- Local analysis
  - Steady states
  - Local stability

- Global analysis
  - Local value functions associated with each path
  - Global value function – Max \{Local value functions\}
  - Dominant steady state
  - Threshold (when Scenario 2 arises)
  - Policy function
Numerical Exercises

- Linear production cost
  \[ C'(q) = cq \]

- Convex adj costs of competition-restricting investment
  \[ \varphi(x) = \alpha x^2 \]

- S-shaped market share of entry-deterring cap
  \[ s(E) = \frac{E^\rho}{\chi^\rho + E^\rho} < 1 \]

- Linear mkt price
  \[ p(s) = p^c + (p^m - p^c)s \quad \text{for } 0 \leq s \leq 1 \]

- Downward-sloping mkt demand
  \[ d = b - ap \]
Key Parameters

- $\chi$: Deterrence efficiency of the dominant firm
  \[ s(E) = \frac{E^\rho}{\chi^\rho + E^\rho} < 1 \]
  - Small $\chi \rightarrow$ high efficiency

- $\delta_E$: Obsolescence rate of entry-deterring cap
  \[ \dot{E} = x - \delta_E E \]
  - Obsolescence of patent value, past advertisement, past lobbying

- $r$: Discount rate
Default example

\[ r = .02, \; \delta_E = .15, \; \rho = 5, \; \chi = 30, \; c = .001, \; \alpha = .5, \; p^m = 8 \]

\[ \rho^c = 2, \; b = 10, \; a = .5 \]

<table>
<thead>
<tr>
<th></th>
<th>( E_1^* )</th>
<th>( E_2^* )</th>
<th>( E_3^* )</th>
</tr>
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<tbody>
<tr>
<td>Entry-deterring capital ( E )</td>
<td>0.00</td>
<td>19.6056</td>
<td>39.8492</td>
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<tr>
<td>Investment level ( x )</td>
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<tr>
<td>Market share ( s )</td>
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<td>0.1065</td>
<td>0.8053</td>
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<tr>
<td>Price Level ( p )</td>
<td>2.00</td>
<td>2.6391</td>
<td>6.8316</td>
</tr>
<tr>
<td>Market Demand ( d )</td>
<td>9.00</td>
<td>8.6805</td>
<td>6.5842</td>
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</table>
- Global value function, policy function
Global dynamics

- Scenario 1: Dominance of high market share

<table>
<thead>
<tr>
<th>$E_3^*$</th>
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<tbody>
<tr>
<td>$E$</td>
</tr>
<tr>
<td>$x$</td>
</tr>
<tr>
<td>$s$</td>
</tr>
<tr>
<td>$p$</td>
</tr>
<tr>
<td>$d$</td>
</tr>
</tbody>
</table>
Welfare Loss

\[ l \equiv E S^c - E S^* \]

\[ = \int_{c}^{p(s^*)} d(p)dp - (p(s^*) - c)d(p(s^*)) \]

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<th>( E_3^* )</th>
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</thead>
<tbody>
<tr>
<td>Welfare Loss ( l )</td>
<td>0.00</td>
<td>1.74</td>
<td>11.664</td>
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Regulatory Policy

- $\delta_E$: Obsolescence rate of entry-deterring cap as a policy parameter

- Regulatory agency can counteract the dominant firm’s entry-deterring efforts such that it accelerates the obsolescence of entry-deterring capital
  - Apply a shorter life time of patent,
  - Increase patent renewal fees,
  - Lower the legal limit of political donations,
  - Impose more severe restriction on political lobbying,
  - Set a stricter law enforcement to antitrust activities etc.

- Is it possible to alter the scenario to the preferable scenario, Scenario 3 or 4 with $\delta_E$?
Example 1: Tighter regulation

- $\delta_E = .15$ (Default B) $\Rightarrow$ $\delta_E = .24$

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</thead>
<tbody>
<tr>
<td>$E$</td>
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<td>30.7209</td>
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<tr>
<td>$x$</td>
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<td>$s$</td>
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<td>$p$</td>
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<td>$l$</td>
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- Scenario 1, 2 or 3
Global value function, policy function
Global dynamics

- Scenario 3: Restoration of competitive market

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<td>2.00</td>
<td>9.00</td>
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Example 2: Tighter regulation

- $\delta_E = .15$ (Default B) $\rightarrow$ $\delta_E = .26$

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<td>9.00</td>
<td>0.00</td>
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- Scenario 4
Global value function, policy function
Global dynamics

- Scenario 4: Competitive region as sole attractor

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<td>0.00</td>
<td>0.00</td>
<td>2.00</td>
<td>9.00</td>
<td>0.00</td>
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Conclusions 1

- “Safety zone” by the US Dept of Justice & the FTC
  - 30%
- Safety zone = domain of the competitive attractor

- Obsolescence rate of entry-deterring cap, deterrence efficiency are critical to determine the long-run scenario.
  - Higher obsolescence rate of entry-deterring cap
    Lower deterrence efficiency $\rightarrow$ a wider safety zone,
  - Current high market share of the dominant firm doesn’t necessarily leads to high concentration in the long run.

- Market-specific safety zone
- Type of entry-deterring capital matters
Conclusions 2

- We studied a type of regulatory policy that accelerates the obsolescence of entry-deterring capital.

- When there are desirable (competition) and undesirable (high concentration) attractors, regulatory agency can enlarge the domain of the desirable attractor by raising $\delta_E$.

- It can even make the desirable attractor a sole attractor.

- Once the regulatory agency is successful to alter the scenario, it doesn’t have to intervene persistently.
  - Policy needs to concern the domain of desirable attractor (e.g., safety zone) but not the level of steady state.