Firms' Strategies and Markets
Entry

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October 06, 2021

Introduction

- Entrant's strategy: "Judo economics"
  - A case study
  - Exercice

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  - A case study
  - Exercice
- Incumbent's strategies vis-à-vis entry
  - Entry deterred
  - Entry Accomodated

Entrant's strategy: Judo Economics

In the art of "judo", a combatant uses the weight and strenght of his opponent to his own advantage.

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- Case study: Four short stories about small firms challenging large incumbent firms!

  1. Softsoap on the liquid soap market
  2. Red Bull on the energy drinks market
  3. UK supermarket chains on the gazoline retail
  4. Freeserve against AOL.

Judo Economics: Exercice

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A monopolist I sets a price p_{max} and its profit is $p_{max}D$.

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The firm can also sell at p_E and obtain $p_E D$. I chooses the price that maximizes its profit i.e.: p_{max} if $p_E \leq \frac{p_{max}(D-K_E)}{D}$ and p_E otherwise.

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- If $c_E = 0$, i.e; the entrant is as efficient as the incumbent, $K_E^* = \frac{D}{2}$, the two firms share the market and the price is $\frac{p_{max}}{2}$.

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A less efficient entrant can enter the market and realize a positive profit when facing an incumbent more efficient and with more capacity. The entrant chooses a relatively low size to make it very costly for the incumbent to go into a price war.

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With personnalized prices, I would sell at $p_E - \epsilon$ at population K_E but at P_{max} to other consumers and entry would be always deterred.

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- Two strategies: Entry deterrence and Accomodation.

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  - If $\frac{d\pi_2}{dK_1} < 0$, investment makes the incumbent tough: "top dog"; If $\frac{d\pi_2}{dK_1} > 0$, investment makes the incumbent soft: "lean and hungry look".

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  - The strategic effect:

$$Sign(\frac{\partial \pi_1}{\partial \sigma_2}\frac{\partial \sigma_2^*(K_1)}{\partial K_1}) = Sign(\frac{\partial \pi_2}{\partial \sigma_1}\frac{\partial \sigma_1^*(K_1)}{\partial K_1}) x Sign(\frac{d\sigma_2^*}{d\sigma_1})$$

Table: TAXONOMY

Strategic substitutes	(D) Top Dog	(D) Lean & Hungry
$\frac{d\sigma_2^*}{d\sigma_1} < 0$	(A) Top Dog	(A) Lean & Hungry
Strategic complements	(D) Top Dog	(D) Lean & Hungry
$\frac{d\sigma_2^*}{d\sigma_1} > 0$	(A) Puppy Dog	(A) Fat Cat

- Top Dog: Overinvestment;
- Lean & Hungry: Underinvestment;
- Puppy Dog: Overinvestment for (D) and Underinvestment for (A);
- Fat Cat: Underinvestment for (D) and Overinvestment for (A).

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- k is the marginal cost of capacity.

A top dog example: Investment in capacity

- In stage 1, an incumbent firm 1 sets its capacity $\bar{q}_1$.
- In stage 2, the entrant 2 decides to enter or not. In case of entry the two firms set additional capacity $\Delta\bar{q}_1$ and $\Delta\bar{q}_2$ respectively and produce at most $\bar{q}_1 + \Delta\bar{q}_1$ for the incumbent and $\Delta\bar{q}_2$ for the entrant.
- Products are homogeneous and the inverse demand function is $P = 1 - q_1 - q_2$.
- Entry cost : e
- k is the marginal cost of capacity.
- c the marginal cost of production.

Assume that 2 has entered. The incumbent's profit is:

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$$q_1(q_2) = \begin{cases} \frac{1}{2}(1 - q_2 - c - k) & \text{for } q_1 > \bar{q_1}, \\ \frac{1}{2}(1 - q_2 - c) & \text{for } q_1 \leq \bar{q_1} \end{cases}$$

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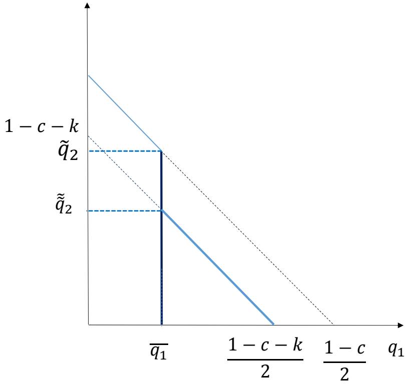

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$$q_2(q_1) = \begin{cases} \frac{1}{2}(1 - q_1 - c - k) & \text{for } q_1 < \tilde{q}_1, \\ 0 & \text{for } q_1 \geq \tilde{q}_1 \end{cases}$$

$$\tilde{q}_1 = 1 - c - k - 2\sqrt{e} \Leftrightarrow \pi_2(q_2(q_1), q_1) = \frac{1}{4}(1 - q_1 - c - k)^2 - e = 0$$

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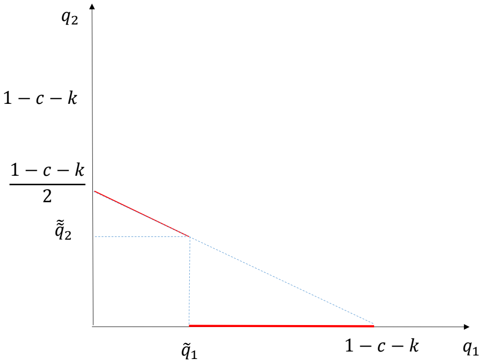
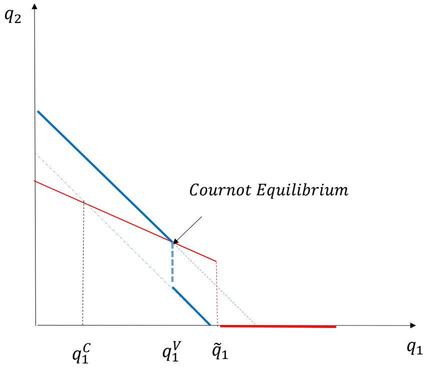


4 cases to consider

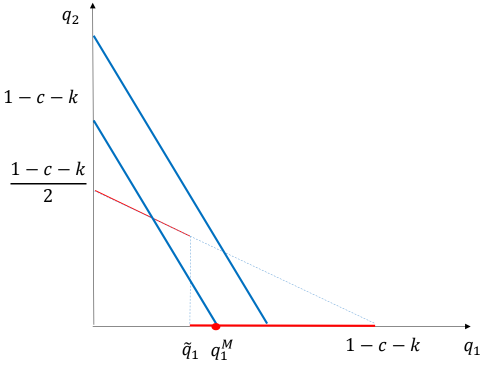
1. Inevitable entry: $\tilde{q}_1 > q_1^V \Rightarrow e < e^- = \frac{1}{9}(1-c-2k)^2$. q_1^V corresponds to a Nash equilibrium between the entrant 2 and an unconstrained firm 1.

- if $\bar{q}_1 = q_1^V \Rightarrow \pi_1 = \frac{1}{9}(1-c+k)(1-c-2k)$
- if $\bar{q}_1 = q_1^C \Rightarrow \pi_1^C = \frac{1}{9}(1-c-k)^2$.



4 cases to consider

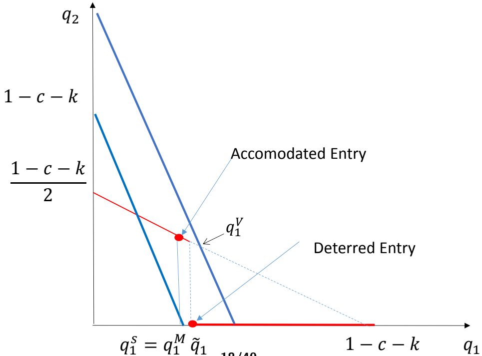
2. Blockaded entry
   $q_1^M = \frac{1}{2}(1-c-k)$ and $q_1^M > \tilde{q}_1 \Rightarrow e > e^+ = \frac{1}{16}(1-c-k)^2$
   - Then $\bar{q}_1 = q_1^M \Rightarrow \pi_1^M = \frac{1}{4}(1-c-k)^2$



4 cases to consider

If $q_1^M < \tilde{q}_1 < q_1^V \Leftrightarrow e^- < e < e^+$

3. Deterred entry $\bar{q}_1 = \tilde{q}_1$ — Commitment from 1 to be on its highest reaction function $\Rightarrow$ credible that $q_1 = \tilde{q}_1$ and no entry.
4. Accomodated entry
   - $\bar{q}_1 = q_1^S = \frac{1}{2}(1-c-k) = q_1^M < \tilde{q}_1$. In the competition stage, 1 is on the high reaction function only if $q_1 < q_1^M < q_1^V$.



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- To deter entry, the incumbent must install a larger capacity $\tilde{q}_1$ and its profit is:

$$\pi_1^D = (1 - c - k - \tilde{q}_1)\tilde{q}_1 = 2\sqrt{e}(1 - c - k - 2\sqrt{e})$$

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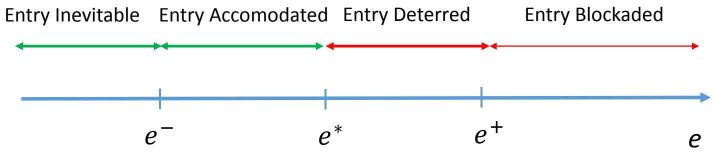
It is possible to show that $\pi_1^D > \pi_1^A$ if $e > e^* = \frac{(2-\sqrt{2})^2(1-c-k)^2}{64}$.



Remember

This investment capacity model illustrates the TOP DOG strategy for Deterrence:

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- Deterrence $\rightarrow q_1 = \tilde{q}_1$ which corresponds to a capacity expansion above the monopoly level.
- Accomodation $\rightarrow q_1^S = q_1^M$ which corresponds to a capacity expansion above the competition level $(q_1^C = \frac{1-c-k}{3})$.

Lean and Hungry look: An innovation model

Assumptions

- **Period 1**: Firm 1 can make an investment K_1 to reduce its marginal cost $c(K_1)$ and obtain the corresponding gross profit $\pi^M(c(K_1))$ which strictly increases in K_1 in period 1.

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Table: Gains in period2

Innovation probabilities	ρ_2	$(1-\rho_2)$
ρ_1	$(0,0)$	$(\pi^M(c),0)$
$(1-\rho_1)$	$(0,\pi^M(c))$	$(\pi^M(c(K_1)),0)$

Period 2: Firms 1 and 2 choose their $R\&D$ levels ρ_1 and ρ_2 to maximize their expected profit:

$$\begin{aligned}\pi_1 &= \rho_1(1-\rho_2)\pi^M(c) + (1-\rho_1)(1-\rho_2)\pi^M(c(K_1)) - \rho_1^2/2, \\ \pi_2 &= \rho_2(1-\rho_1)\pi^M(c) - \rho_2^2/2\end{aligned}$$

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FOCS are:

$$\begin{cases}(1-\rho_2^*)(\pi^M(c) - \pi^M(c(K_1)) = \rho_1^*,\\ (1-\rho_1^*)\pi^M(c) = \rho_2^*\end{cases}$$

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The equilibrium investments ρ_1^* and ρ_2^* that solve the above system are such that $\frac{\partial \rho_1^*}{\partial K_1} < 0$ and $\frac{\partial \rho_2^*}{\partial K_1} > 0$. FOC

Deterrence

$$\frac{d\pi_2(K_1, \rho_1^*, \rho_2^*)}{dK_1} = -\rho_2^*\pi^M(c)\frac{\partial \rho_1^*}{\partial K_1} > 0$$

The deterrence strategy consists in reducing K_1.

Accomodation

$$\begin{aligned}\frac{d\pi_1(K_1,\rho_1^*,\rho_2^*)}{dK_1} &= \frac{\pi_1(K_1,\rho_1^*,\rho_2^*)}{\partial K_1} - (\rho_1^*\pi^M(c) + (1-\rho_1^*)\pi^M(c(K_1))\frac{\partial \rho_2^*}{\partial K_1} \\ &< \frac{\pi_1(K_1,\rho_1^*,\rho_2^*)}{\partial K_1}\end{aligned}$$

where $\frac{\pi_1(K_1,\rho_1^*,\rho_2^*)}{\partial K_1} = (1-\rho_1^*)(1-\rho_2^*)\frac{\partial \pi^M(c(K_1))}{\partial K_1}$

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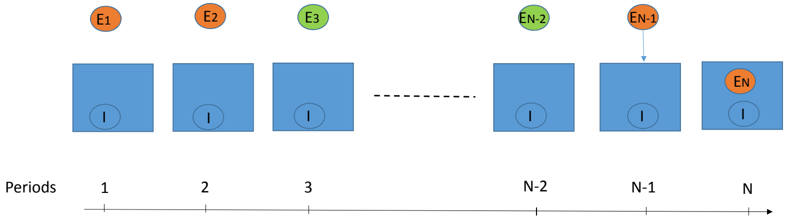
Why? $R\&D$ investments are strategic substitutes and the larger K_1 the higher $\pi^M(c(K_1))$ and therefore the lower the incumbent's incentive to invest in period 2 (Arrow replacement effect).

The chain store paradox (Selten, 1978)



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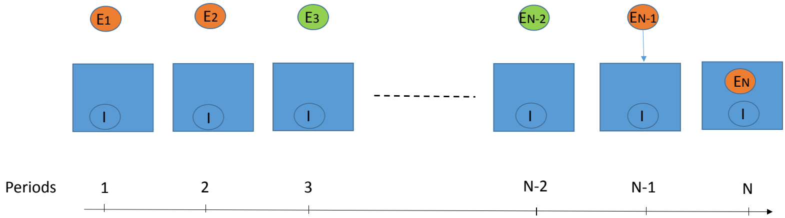

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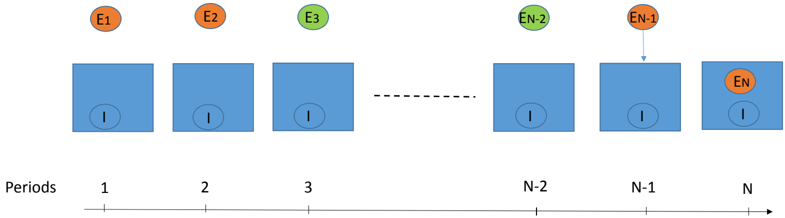

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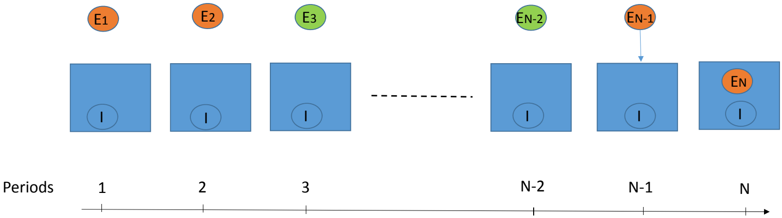

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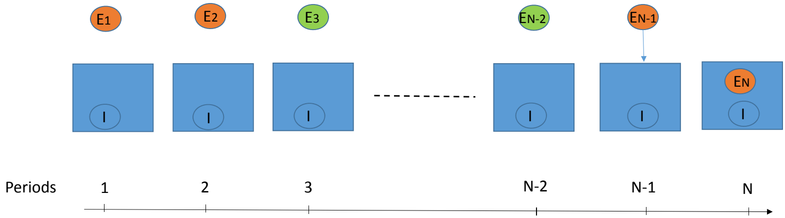

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  3. ...
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- Selten Paradox (1978): Incomplete information framework, i.e. I can be of type tough or weak with a probability => a reputation issue!!

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- If $p < \underline{p} = \frac{b}{b+1}$, a weak I gains 0. If $p \geq \underline{p} = \frac{b}{b+1}$, I gains a.

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If $-1 + \delta(1 - q)a < 0$, there is **No reputation strategy** for a weak I.

In $t = 1$, a weak E_1 enters if $p < \underline{p} = \frac{b}{b+1}$ and stays out otherwise.

- If I is weak, he accomodates in $t = 1$, a weak or tough E_2 enters.
- If I is tough, he fights in $t = 1$, a weak E_2 stays out.

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  - Because fighting in $t=1$ always deters entry in $t=2$, a weak I always fights ($\beta=1$) in $t=1$ and earns the expected profit : $-1+\delta(1-q)a>0$

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  - A weak E_1 prefers to stay out if $-p\frac{(1+b)}{b} + (1-p\frac{(1+b)}{b})b < 0$, i.e. if $p > (\frac{b}{1+b})^2$ and I gains a. Otherwise if $p < (\frac{b}{1+b})^2$, a weak E_1 enters and I thus gains $\beta^*(-1+\delta(1-q)a) > 0$.
    A lower β would reduce I's gains and a higher β cannot block entry of E_2.

Conclusion

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The generalization to any N is possible

- Assuming that $N = 3$, we now find that E_1 enters if and only if $p < (\frac{b}{1+b})^3$ and so on for $N = T$ for $p < (\frac{b}{1+b})^T$.

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  - The European Court of Justice confirms the EC's prohibition of free freezers in 2003.

Exercice 2: Aghion and Bolton (1987)

M sells a good to A who is willing to pay at most $p = 1$ for one unit. The unit cost of M is $c_M = \frac{1}{2}$. An entrant, E can produce the same good at an unknown unit cost c_E uniformly distributed over $[0, 1]$.

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$\Pi_A = \frac{1}{4}$ without contract.

With the contract,
$\Pi_A(P, P_0) = (P - P_0)(1 - P_E - P_0) + (1 - P + P_0)(1 - P) = 1 - P$ (as $P_E = P - P_0$).

A accepts the contract only if $1 - P \geq \frac{1}{4} \Rightarrow P \leq \frac{3}{4}$.

Solution

c. Determine the optimal contract (P, P_0) for M.

$$\Pi_M(P, P_0) = (P - P_0)P_0 + (1 - P + P_0)(P - C_M)$$

$$\frac{\partial \Pi(P, P_0)}{\partial P_0} = -2P_0 + P + P - c_M = 0$$

Replacing $c_M = \frac{1}{2}$, we obtain:

$$\Rightarrow P_0 = P - \frac{1}{4}.$$

For $P_0 = P - \frac{1}{4}$, the profit of M is $\frac{1}{4}(P - \frac{1}{4}) + \frac{3}{4}(P - \frac{1}{2}) = P - \frac{7}{16}$.

However we know that $P \geq \frac{3}{4}$ to be accepted by A.

The optimal contract is thus $P = \frac{3}{4}$, $P_0 = \frac{1}{2}$.

With the exclusive dealing contract, the probability of entry is reduced to $\frac{1}{4}$.

Solution

d. What are the expected profits under this contract? Comment!
Expected profits are:

$$\Pi_M = (1-\frac{1}{4})(\frac{3}{4}-c_M)+\frac{1}{4}\frac{1}{2} = \frac{5}{16} > \frac{1}{4},$$

$$\Pi_E = (1-\frac{1}{4})0+\int_0^{\frac{1}{4}}(\frac{1}{4}-c)dc = \frac{1}{32} < \frac{1}{8},$$

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The welfare decreases because efficient entries are blockaded.

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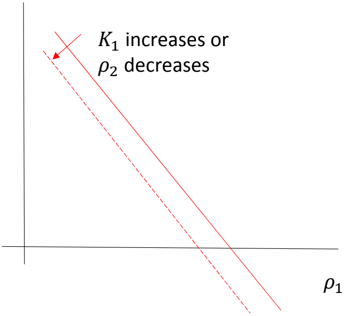
FOC $f(\rho_1, \rho_2, K_1) = 0$
$f_{\rho_1} < 0$



FOC $g(\rho_1, \rho_2, K_1) = 0$
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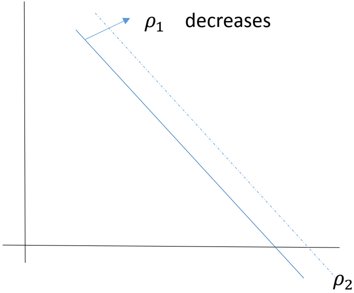

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Two events A and B respectively occur with probability $p(A)$ and $p(B)$. Bayes's rule is as follows:

$$p(A/B) = \frac{p(B/A)P(A)}{p(B)}$$

where conditional probabilities:

- $p(A/B)$ is the likelihood of event A occurring given that B is true;
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