Exercice: Exclusive dealing to deter entry

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 $[0, 1]$.

- In $t = 0$, A and M sign a contract or not;
- In $t = 1$, E observes the contract, learns its unit cost c_E and chooses to enter or not.
- In $t = 2$, firms set their prices.
- In $t = 3$, A decides where to buy.

1. Without contract, the competition is a la Bertrand.
   a. Determine the equilibrium and the probability ϕ of entry.
   b. What are the expected profits?
2. M offers a take-it-or-leave-it contract (P, P_0) where P is the price that A must pay if he chooses to buy the good from M and P_0 is the penalty A must pay to M if he buys from E.
   a. Given (P, P_0), under which conditions does E enter?
   b. What is the profit of A if he accepts a contract (P, P_0) ?
   c. Determine the optimal contract $(P, P0)$ for M.
   d. What are the expected profits under this contract? Comment!

Solution

1. Without contract, competition is a la Bertrand.
   a. Bertrand $\Rightarrow p^* = max\{c_E, c_M\}$. E enters only if $c_E < c_M$, The probability of entry is $\phi = c_M = \frac{1}{2}$. The situation is efficient, the firm who produces is the firm with the lowest unit cost.
   b. The expected profits are:

$$\Pi_M = \phi 0 + (1-\phi)(1-c_M) = \frac{(1-c_M)^2}{4},$$

$$\Pi_E = \int_0^{c_M} (c_M - c)dc + 0 = \frac{c_M^2}{2} = \frac{1}{8},$$

$$\Pi_A = \phi(1-cM) + (1-\phi)0 = c_M(1-c_M) = \frac{1}{4}.$$

2. M offers a tiolit contract (P, P_0)

   a. Given (P, P_0) and P_E the price offered by E $\Pi_A = 1 - P_0 - P_E$ if he buys from E $\Pi_A = 1 - P$ if he buys from M. Therefore A buys from E if $c_E \leq P_E \leq P - P_0$ i.e. $P - P_0 \geq c_E$ (in that case $P_E = P - P_0$)

   b. $\Pi_A = \frac{1}{4}$ without contract, M makes a tiolit offer and its profit remains $\frac{1}{4}$. In accepting the contract, its profit is $1 - P$ (as $P_E = P - P_0$), this implies that $P \leq \frac{3}{4}$.

   c. M maximizes

$$\max_{P \leq \frac{3}{4}, P_0} \Pi(P, P_0) = \underbrace{(P - P_0)}_{probaentry} P_0 + \underbrace{(1 - (P - P_0))}_{probanoentry} (P - C_M)$$

c.
$$\frac{\partial \Pi(P, P_0)}{\partial P_0} = -P_0 + P - P_0 + P - \frac{1}{2} = 0 \Rightarrow P_0 = P - \frac{1}{4}.$$

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

d. Expected profits are:

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

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

$$\Pi_A = (1 - \frac{1}{4})(1 - \frac{3}{4}) + \frac{1}{4}(1 - \frac{3}{4}) = \frac{1}{4}.$$

The welfare decreases because efficient entries are blockaded.