RECITATION TEN
- VERTICAL RELATIONS -

- OFTEN, ONE FIRM PRODUCES A GOOD AND SELLS IT TO ANOTHER FIRM. THIS SECOND FIRM USES OR SELLS THE GOOD. THESE ARE VERTICAL RELATIONSHIPS.

BASIC IDEA: HAVING TWO FIRMS CAUSE INEFFICIENCIES IN THE MARKET. IN THIS SECTION, WE MODEL DIFFERENT INEFFICIENCIES AND TALK ABOUT TYPES OF CONTRACTS THAT WOULD FIX THOSE INEFFICIENCIES. (Vertically integrating would also do the trick).

TOPIC ONE: THE HOLD UP PROBLEM

- The inefficiency: Not enough investment by upstream firm because of profit sharing.

ONE GOOD SOLD, INVESTMENT CHANGES COST

stage 1: US firm chooses investment I

stage 2: DS firm's price is predetermined at V.

stage 3: Price US firm sells good to DS firm at results from a bargaining process where the firms split the SHORT RUN PROFIT — THAT IS, NOT INCLUDING FIXED COST OF INVESTMENT.

$$\pi_{US} = p - c(\bar{I}) = V - p = \pi_{DS}$$

Like usual, solve backwards.

Stage 3: $v - p = p - c(I)$

$$\Rightarrow p = \frac{v + c(I)}{2}$$

Stage 2: v is price (DS firm has no choice by assumption)

Stage 1: Knowing $p(I)$ equation, long run profit of US firm is:

$$\max_I \; p(I) - c(I) - I$$

$$\Rightarrow \max_I \; \frac{v - c(I)}{2} - I$$

$$\Rightarrow c'(I) = 2$$

If integrated, $c'(I) = 1$

so investment is lower if not integrated.

How do we fix the 'low investment' issue?

1) Integration

2) Contracting

- Charge DS firm half of I to produce anything (i.e. share fixed costs)

Possible Hold-up Problem Questions 3

1) Type 1: working through the model about with a specified v and $c(I)$ function. This is fairly unlikely, as $c(I)$ would have to be complicated.

2) Type 2: Finite case.

Example:

Boeing is selling a plane to a military procurement firm, who then sells it to the airforce for 140 million $. Boeing must first make an investment decision. If they invest in a new factory, the plane will cost 80 million $ to make. If they do not invest, it will cost 100 million $. The investment cost 15 million $. Boeing and the procurement firm split the short run profit of the sale.

a) Will Boeing make the investment?

Step One: Find Price & US Profit for each I

$$p(I) - c(I) = 140 - p(I)$$

$$\Rightarrow p(I) = \frac{140 + c(I)}{2}$$

$$= \begin{cases} 110 \text{ if } I = 15 \\ 120 \text{ if } I = 0 \end{cases}$$

$$\pi(I) = p(I) - c(I) - I$$

$$= \begin{cases} 110 - 80 - 15 = 15 & \text{if } I = 15 \\ 120 - 100 - 0 = 20 & \text{if } I = 0 \end{cases}$$

So, no, Boeing will NOT invest, even though investment costs only 15 million $ and decreases cost by 20 million $.

b) Why? How could we fix it?

TOPIC TWO: DOUBLE MARINALIZATION

MODEL: $P = a - Q$ $MC_{US} = c$ $MC_{DS} = d$

STAGE ONE: US firm chooses the price $\bar{d}$ to sell the good to DS firm at.

STAGE TWO: DS firm, knowing $\bar{d}$, chooses quantity to sell (i.e. monopoly decision given MC_{DS} of $\bar{d}$).

SOLVE BACKWARDS!

$$\max_Q (a - Q)Q - \bar{d}Q$$

$$\Rightarrow Q(\bar{d}) = \frac{a - \bar{d}}{2}$$

knowing this, US firm:

$$\max_d Q(d)(d - c) \quad \Rightarrow d^* = \frac{a - c}{2}$$

INEFFICIENCY: WE COULD HAVE MADE MORE BY ACTING AS ONE FIRM - TWO markups added.

- How to fix:
  - Integrate
  - Remove the second markup by franchising (set $d=c$ and charge a fixed cost ϕ that recovers profit).

I won't go over an example, but make up your own numbers and try to solve!

TOPIC THREE: Minimum pricing and Downstream Bertrand competition with advertising.

Basic Structure:

STAGE ONE: US firm sets price d to sell to DS firms, and a minimum price p_ϕ.

STAGE TWO: DS firms choose advertising.

STAGE THREE: DS firms compete a la Bertrand.

SOLVING BACKWARDS:

STAGE THREE: Final (DS) price gets pushed to p_ϕ (or d if $p_\phi \leq d$) by Bertrand competition.

STAGE TWO: maximization problem

$\max_{A_i} (p^* - d) Q(p^*, A_1, A_2) - A_i$

Q is a function of prices & advertising levels.

This $A_i = 0$ if $p^* = d$, but can be higher otherwise.
(I.e. inefficiency is $A_i = 0$ if $P_0 \leq d$. Fix is integrating or setting $P_0 > d$.)

EXAMPLE: AGAIN, I WOULD EXPECT A DISCRETE-TYPE QUESTION, OR JUST A GOING OVER THE MODEL FROM LECTURE OR A MODEL EXTREMELY CLOSE

Say Bob's Ice cream selling icecream for 1$ each to 2 Ice cream shops right next to each other who compete in Bertrand. No one notices the Ice Cream shops unless at least one of them puts up a sign that costs 10$ to make. That is, $Q = \begin{cases} 100 - 10P & \text{if } A_1 + A_2 \geq 10 \\ 0 & \text{if } A_1 + A_2 < 10 \end{cases}$

a) What is the NE of this game?

$P_2 = 1$, so $\Pi_2^{PS} = 0$, so advertising is not worthwhile for any firm.

b) Now say the upstream firm sets a minimum price of $P_0 = 2$. What is the NE?

By Bertrand

$P_i = P_j = 2$.

So, now firms have profit

$$\Pi(A_i, A_j) = \begin{cases} \underbrace{\frac{100-10(2)}{2}}_{Q/2} \underbrace{(2-1)}_{P-c} - \underbrace{10}_{A} = 30 & \text{if } A_i = 10 \\ 40 & \text{if } A_i = 0 \text{ but } A_j = 10 \\ 0 & \text{if } A_i = 0 \text{ \& } A_j = 0 \end{cases}$$

So, if opponent puts the sign up, you don't want to put the sign up. If opponent does not put the sign up, you do want to put the sign up.

The NE is one person puts the sign up, & $Q = 80$