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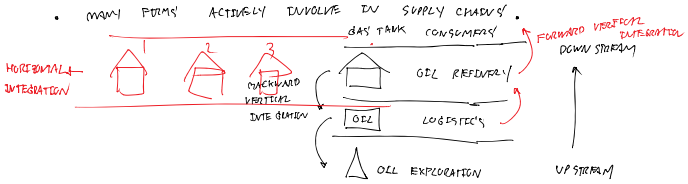
CHAPTER 12 VERTICAL INTEGRATION & VERTICAL RESTRICTIONS

- SO FAR, WE CONSIDER ONLY FIRM WHO PRODUCES AS WELL AS SELLS FINAL PRODUCT.
- MANY FIRMS ACTIVELY INVOLVE IN SUPPLY CHAINS.



- VERTICAL INTEGRATION : FIRMS AT DIFFERENT LEVELS OF THE SUPPLY CHAIN "MERGE".
  - EX: OIL REFINERY BUYS A LOGESTIC FIRM → BACKWARD VI
  - OIL REFINERY TAKES OVER GAS STATIONS → FORWARD VI
- VERTICAL RESTRICTION : A FIRM RESTRICT BEHAVIORS OF OTHER FIRMS THAT ARE AT A DIFFERENT LEVEL OF SUPPLY CHAIN.
  - EX: CHINESE TRADERS DO CONTRACT W/ GARDENERS IN CHANTABURI PROVINCE. (NON-PRICE CONTRACT)
- CONGLOMERATE : A FIRM TAKES OVER A COMPLETELY DIFFERENT BUSINESS-TYPE FIRM. → TO REDUCE OR DIVERSIFY RISKS.

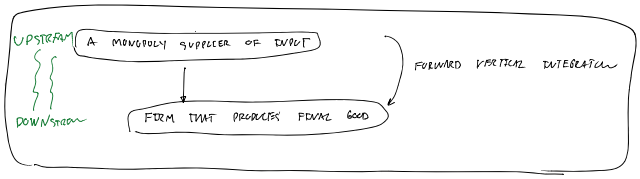
GAINS FROM VERTICAL INTEGRATION

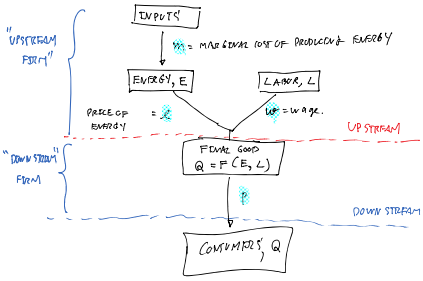
1. LOWER TRANSACTION COSTS
2. ASSURE THE SUPPLY OF IMPORTANT INPUTS (= BACKWARD VI)
3. ELIMINATE NEGATIVE EXTERNALITIES
   - Ex: MCDONALD, BURGER KING OWNS UPSTREAM FIRMS → DOWNSTREAM FIRMS TO ENSURE THAT ITS REPUTATION WILL NOT BE AFFECTED BY ANY MISTAKES THAT MIGHT OCCUR IN THE SUPPLY CHAIN IF IT IS NOT VERTICALLY INTEGRATED.
4. AVOID GOVERNMENT RULES / REGULATION
   - Ex: PRICE CONTROLS
   - IF YOU WANT TO BUY STEEL TO PRODUCE CARS AND GOVT SETS A CONTROLLED PRICE (MINIMUM PRICE THAT SELLERS MUST GET WHEN THEY SELL), YOU CAN AVOID THIS REGULATION BY TAKING OVER THE STEEL FIRM! (SELLING STEEL TO YOURSELF)
5. INCREASE MONOPOLY PROFITS FOR A VERTICALLY INTEGRATED FIRM.
6. REDUCE OR ELIMINATE MARKET POWER. (= REDUCE BIG FIRMS' POWER)

COSTS OF VERTICAL INTEGRATION ?

- LEGAL COSTS OF MERGING MAY BE HIGH
- LARGE FIRMS ARE HARDER TO MANAGE
- COSTS MAY BE HIGHER THAN THE CASE YOU JUST BUY INPUT FROM COMPETITIVE SUPPLIERS.

VERTICAL INTEGRATION TO MONOPOLIZE ANOTHER INDUSTRY



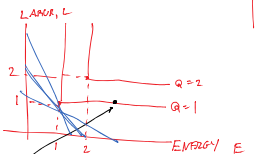


Assumptions

1. CONSTANT RETURN TO SCALE
2. CONSTANT MARGINAL COST OF INPUTS $\bar{m}$, $\bar{w}$
3. UPSTREAM FIRM ⇒ MONOPOLY
   DOWNSTREAM FIRM ⇒ COMPETITIVE FIRM (WE RELAX THIS ASSUMPTION LATER)
4. VERTICAL INTEGRATION IS

DOWNSTREAM FIRM ⇒ COMPETITIVE (WE RELAX THIS ASSUMPTION LATER)

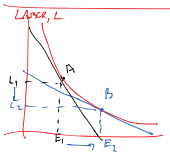
④ VERTICAL INTEGRATION IS COSTLY.



FIXED-PROPORTION PRODUCTION

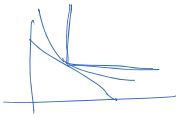
- TWO INPUTS MUST BE USED IN THE FIXED PROPORTION, i.e.

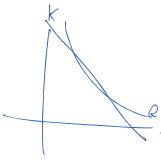
1L + 1E ⟶ 1Q
2L + 2E ⟶ 2Q
1L + 2E ⟶ 1Q

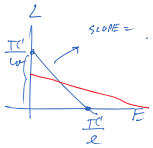


VARIABLE-PROPORTION PRODUCTION

- TWO INPUTS CAN BE SUBSTITUTED TO VARIOUS DEGREE.





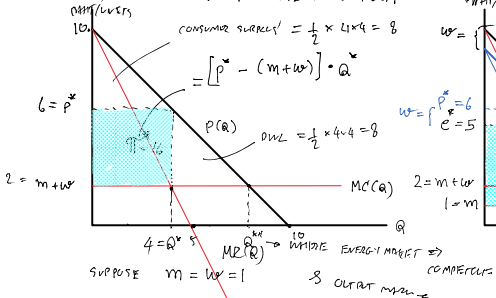


$Q_E \cdot P_E + Q_L \cdot P_L = \pi'$

$\text{SLOPE} = -\frac{\frac{\pi'}{w}}{\frac{\pi'}{r}} = -\frac{r}{w}$

CASE 1 FIXED-PROPORTIONS PRODUCTION FUNCTION

(a) PROFIT OF AN INTEGRATED FIRM



SUPPOSE $m = w = 1$ & OUTPUT MARKET IS COMPETITIVE

$Q = F(E, L)$

MINIMUM COST = $m \cdot E + w \cdot L$
$= 1 \cdot 1 + 1 \cdot 1$
$= 2$

SINCE $1E + 1L \rightarrow 1Q$

EX: $P = 10 - Q \equiv P = a - bQ$

$TR = P \times Q = (10 - Q)Q = 10Q - Q^2$

$MR = \frac{dTR}{dQ} = 10 - 2Q \equiv a - 2bQ$

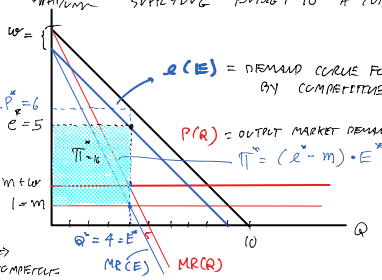
Q^* ⇒ $MR = MC$ ⇒ $10 - 1Q = 2$

SO $Q^* = 4$

$P^* = 6$

$\pi^* = (P^* - AC) \cdot Q^* = (6 - 2) \cdot 4 = 16$

(b) PROFITS OF MONOPOLY SUPPLYING ENERGY TO A COMPETITIVE FIRM



TO PRODUCE A UNIT OF GOOD, A COMPETITIVE DOWNSTREAM FIRM MUST SPEND w BAHT + e BAHT. THE GOOD CAN BE SOLD AT PRICE = P.

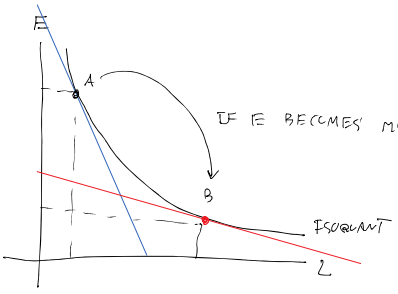
SO, $e = P - w$ IS THE HIGHEST PRICE OF E HE IS WILLING TO PAY!

OBSERVE THAT, HERE, ENERGY MONOPOLY FULLY TAKES CONTROL OVER THE MARKET PRICE OF OUTPUT, i.e.,

IF e RISES BY 1 BAHT, THEN PRICE OF FINAL GOOD WILL ALSO RISE BY 1 BAHT

CASE 2 VARIABLE-PROPORTIONS PRODUCTION FUNCTION

NOW, DOWNSTREAM FIRM CAN SUBSTITUTE AWAY FROM USING A RELATIVELY EXPENSIVE INPUT TO A RELATIVELY CHEAPER INPUT.



IF E BECOMES MORE EXPENSIVE RELATIVE TO L

- IN THIS CASE, ENERGY MONOPOLY CANNOT TAKE CONTROL OF DOWNSTREAM FIRM FOR THE CHOICE OF USING INPUT MIX.
- ENERGY MONOPOLY MAY WANT TO DO FORWARD INTEGRATION TO HAVE ABILITY TO CONTROL THE MIX OF INPUTS BY DOWNSTREAM FIRM

COST FUNCTION FOR DOWNSTREAM FIRM : $C(e, w, Q) = \min_{L,E} e \cdot E + w \cdot L$

PRODUCTION FUNCTION : $Q = E^{\frac{1}{2}} \cdot L^{\frac{1}{2}}$ [COB-DOUGHLAS PRODUCTION FUNCTION]

$C(e, w, Q) = \min_{L,E} e \cdot E + w \cdot L$

$= \min e \cdot E + w Q^2 / E$ [USING $Q = E^{\frac{1}{2}} \cdot L^{\frac{1}{2}}$]

SOLVING THE F.O.C TO OBTAIN DEMAND FUNCTION FOR E CONDITIONAL ON FACTOR COSTS AND OUTPUT

$L^{\frac{1}{2}} = \frac{Q}{E^{\frac{1}{2}}}$ OR $= \frac{Q}{\sqrt{E}}$

$\sqrt{L} = \frac{Q}{\sqrt{E}}$

SO $L = \frac{Q^2}{E}$

$E(e, w, Q) = Q \left(\frac{w}{e}\right)^{\frac{1}{2}}$

$L(w, e, Q) = Q \left(\frac{e}{w}\right)^{\frac{1}{2}}$ → DEMAND FOR L

SO, TOTAL COST $C(e, w, Q) = e \cdot E(e, w, Q) + w \cdot L(w, e, Q)$

OR $C(e, w, Q) = 2Q(w \cdot e)^{\frac{1}{2}}$

* IF VERTICALLY INTEGRATED :

THE DOWNSTREAM FIRM MAXIMIZES Π BY SETTING $MR = MC$:

$MR = MC$

$p - 2bQ = 2w^{\frac{1}{2}} \cdot m^{\frac{1}{2}}$ (NOTE $e = m$) (RECALL THAT $p = a - bQ$ AS DEMAND FUNCTION)

AS WE INTEGRATE !

$Q = \frac{(a - 2w^{\frac{1}{2}} m^{\frac{1}{2}})}{2b}$

"THE OUTPUT OF THE INTEGRATED FIRM"

USING THE SAME PARAMETERS' ($a = 10$, $w = m = 1$, $b = 1$), WE WILL GET

$Q^* = 4$ UNITS' **** !

NOTE THAT THE INTEGRATED FIRM W/ VARIABLE PROPORTION PRODUCTION FUNCTION PRODUCES THE SAME AMOUNT OF OUTPUT AS WE FOUND IN THE CASE OF FIXED PROPORTION PRODUCTION FUNCTION.

* IF NO VERTICAL INTEGRETION

THE DEMAND FOR E FACING THE UPSTREAM ELECTRECITY MONOPOLY CAN BE DERIVED BY SETTING $p = MC$:

$P = 2w^{\frac{1}{2}} e^{\frac{1}{2}}$ AND THEN SOLVING FOR E :

$$E = \frac{a\left(\frac{w}{e}\right)^{\frac{1}{2}} - 2w}{b}$$

UPSTREAM MONOPOLY MAXIMIZES ITS PROFIT : $(e - m)E$.

BY DOING F.O.C, WE GET :

$$a w^{\frac{1}{2}} - 2 w \cdot e^{\frac{1}{2}} - \frac{1}{2}(e-m)\, a \left(\frac{w^{\frac{1}{2}}}{e}\right) = 0$$

USING THE SAME PARAMETERS, $e = 7.9265$.

THE MARGINAL COST $= 2 w^{\frac{1}{2}} \cdot e^{\frac{1}{2}} = 2 e^{\frac{1}{2}} = 5.6308 = P$.

$Q = 10 - 5.6308 = 4.3692 \Rightarrow$ OUTPUT THAT DOWNSTREAM FIRM PRODUCES.

OBSERVE THAT $Q_{\text{NO INTEGRATION, W/ VARIABLE PROPORTION}} > Q = 4$ IN ALL CASES.

OBSERVATIONS

① W/ INTEGRATION, $e = m = 1 \Rightarrow E^* = L^* = Q^* = 4$

$(Q = E^{\frac{1}{2}} \cdot L^{\frac{1}{2}})$

W/O INTEGRATION, IF $e \uparrow$, DOWNSTREAM WILL DO SUBSTITUTION BY USING MORE L AND LESS E. WHEN HE DOES SO, MC OF OUTPUT WILL NOT RISE AS MUCH AS e does!!! (WHY?)

EX: $MC = 2(w \cdot e)^{\frac{1}{2}} = 2e^{\frac{1}{2}}$ (NOTE $w = 1$)

e	$2e^{\frac{1}{2}}$	
1	2	→
2	2.82	→
4	4.00	→
8	5.64	→

MC RISES BY ONLY 41% IN RESPONSE TO 100% INCREASE IN e.

NOTICE THAT E AND L ARE NO LONGER USED IN EQUAL PROPORTIONS!

② PRICE OF FINAL GOOD $= 5.63$ WHICH IS CHEAPER THAN WHEN 2 FIRMS MERGE. $(P = 6)$

$CS_{\text{NO VI}} (= 9.55) > CS_{VI} (= 8)$

CS IS HIGHER BY 19.375%

③ INEFFICIENT PRODUCTION OCCURS WHEN NO INTEGRATION, HOWEVER... (WHY?)

ACTUALLY, THE LEAST EXPENSIVE WAY TO PRODUCE THE QUANTITY WE FOUND $(Q = 4.37)$ IS TO USE $E = 4.37$ + $L = 4.37$

$Q = E^{\frac{1}{2}} L^{\frac{1}{2}}$

WHICH COSTS 8.74

BUT, LOOK..., NOW, W/O VI, $E = 1.55$ + $L = 12.30$

WHICH COSTS 13.85

SO, SOCIAL LOSS FROM INEFFICIENT PRODUCTION =

$13.85 - 8.74 = 5.11$

④ SOCIETY'S WELARE IS LOWER W/O INTEGRATION THAN WITH IT!

	W/O INTEGRATION		W// INTEGRATION	
CS	9.55	+	8	+
π	10.75		16	
	20.3	<	24	

$\Delta SW = 20.3 - 24 = (3.7)$ — REFLECTS LOSS FROM INEFFICIENT PRODUCTION OF 5.11 THAT "OUTWEIGHS"

THE REDUCTION IN DWL DUE TO MONOPOLY PRICING OF 1.44 (= 8 − 6.59)