個 體 經 濟 學 二

Microeconomics (II)

Ch10. Price taking firm

＊ Price taking firm:

$$\text{revenue} = P(x) \cdot x = P \cdot x$$

$$\text{profit} = \text{total revenur} - \text{total cost}$$

$$\text{Short Run Decision:SR profit} = TR(x) - SRTC(x)$$

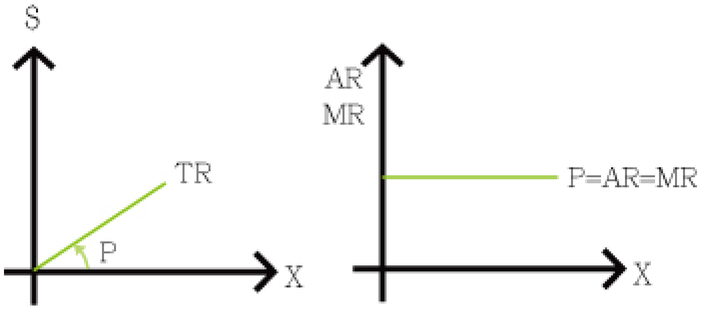

Figure 82:

$$AR = \frac{TR}{x} = \frac{P \cdot x}{x} = P$$

$$MR = \frac{\Delta TR}{\Delta x} = \frac{\Delta Px}{\Delta x} = P\frac{\Delta x}{\Delta x} = P$$

$$SR\ \pi(x) = P \cdot x - SRTC(x)$$

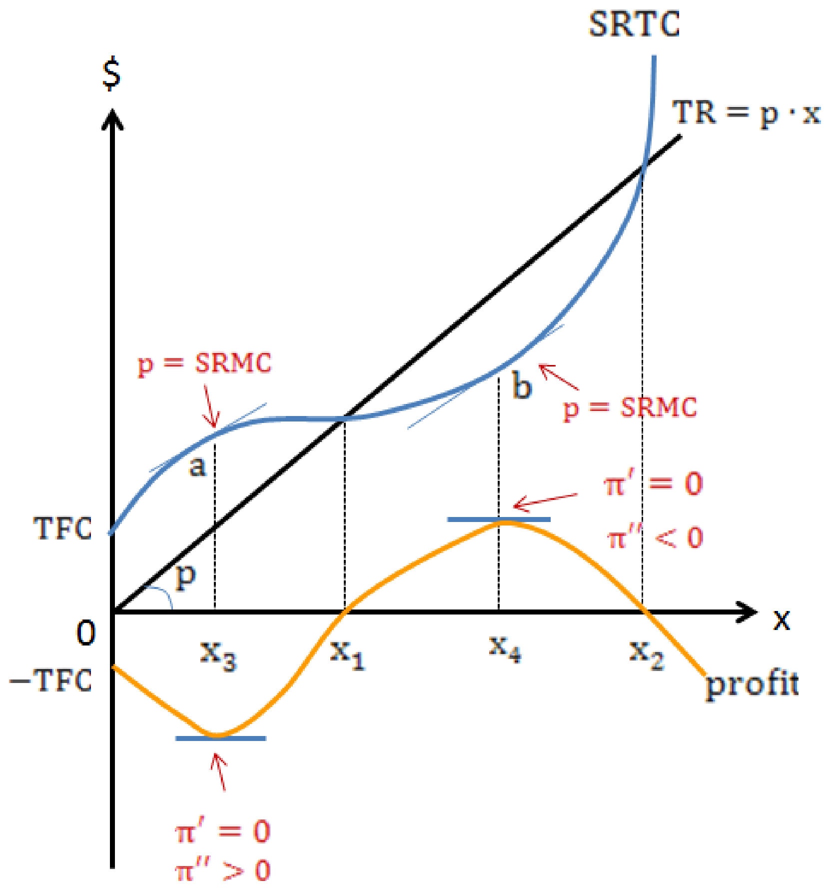

Figure 83:

∗ at X_3 and X_4,

slope of TR = slope of SRTC

MR=P= SRMC

X_3 profit is minimized

X_4 profit is maximized(SR equilibrium of a price taking firm)

at a, SRMC'(x) < 0

at b, SRMC'(x) > 0 ⇒ increasing SRMC ⇒ diminish marginal return

$\max\ \pi\,(x) = TR(x) - SRTC(x) = P \cdot x - SRTC(x)$

F.O.C. $\pi'(x) = 0$

$\pi'(x) = MR(x) - SRTC'(x)$

$= P - SRMC(x) = 0 \;\Rightarrow\; P = SRMC(x)$

S.OC. $\pi''(x) < 0$

$$\pi''(x) = \frac{d\pi'(x)}{dx} = \frac{d\big(P - SRMC(x)\big)}{dx} = \frac{-dSRMC(x)}{dx} = -SRMC'(x) < 0$$

$\Rightarrow SRMC'(x) > 0$

increasing SRMC(x) or diminishing marginal returns

∗shut down decision:

x=0, $\pi(0) = TR(0) - TFC = -TFC$

compare $\pi(x*)$ with $\pi(0) = -TFC$, if $\pi(x*) < 0$

~

x*, s.t, FOC, SOC

$\pi(x*) < \pi(0) \Leftrightarrow$ shut down

$\pi(x*) \geq \pi(0) \Leftrightarrow$ not shut down

∗ **x* is the equilibrium:**

$\pi(x*) = Px* - SRTC(x*) \geq -TFC$

$\Rightarrow Px* - (TFC + TVC(x*)) \geq -TFC$

$Px* - TVC(x*) \geq 0$ revenue enough to cover TVC

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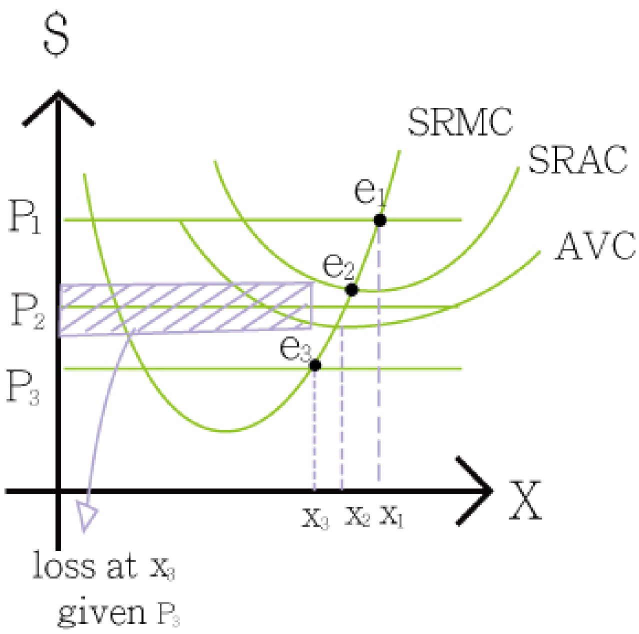
TR

$(P - AVC(x*))x* \geq 0 \quad \Rightarrow P \geq AVC(x*)\ (P < AVC(x*)\ \text{shut down})$



F igure 84:

SR supply curve = SRMC above AVC + shut downward

x=0 when P < min AVC

∗ Price taking firm

Inputs demander → firm → Final goods and services supplier

∗ SR equilibrium

P = SRMC≥ AVC

SR supply curve = SRMC above AVC

if P < min AVC ⇒ shut down. x*=0

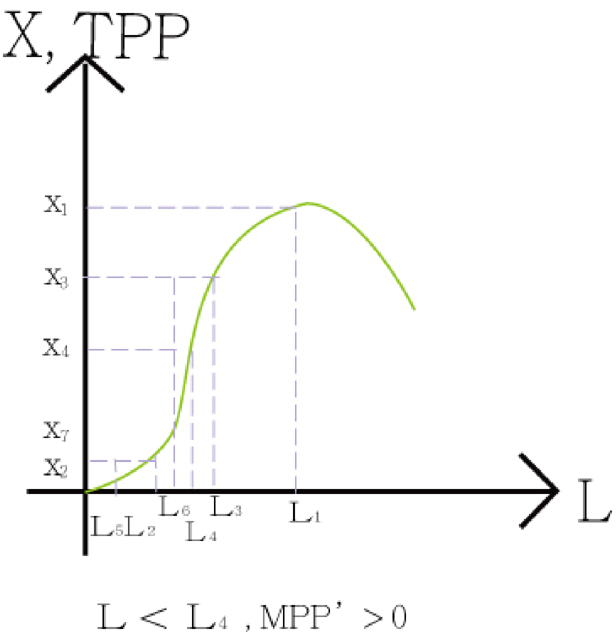


Figure 85:

* LR equilibrium (P is fixed [given])

LR cost function

LR profits = PX -LRTC(x)

LRTC(x) is the envelope of the SRTC(x)

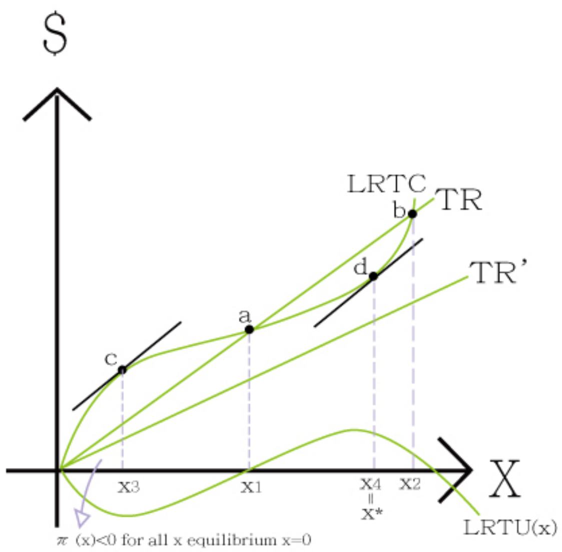


Figure 86:

* LR $\pi(x) \geq 0$

Firm's problem:

Max LR profits $\pi(x) = Px - LRTC(x)$

F.O.C. $\pi'(x) = 0$

$\pi'(x) = P - LRTC'(x) = P - LRMC(x) = 0 \Rightarrow P = LRMC(x)$

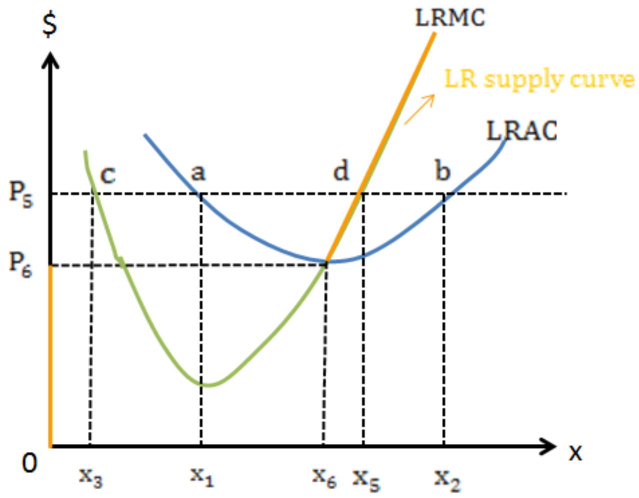
S.O.C. $\pi''(x) < 0$

$\pi''(x) = 0 - LRMC'(x) = -LRMC'(x) < 0 \Rightarrow LRMC'(x) > 0$

No TFC in the LR.

In the LR, $P \geq LRAC(\text{or } \pi(x) \geq 0)$, the firm survives.

The firm exits when $P < LRAC \Rightarrow x = 0$



F igure 87:

∗ SR vs. LR supply curve

slope of LRS < slope of SRS

(= LRMC)平　　(= SRMC)陡

price elasticity of LRS < price elasticity of SRS

$$\varepsilon^S = \frac{\frac{\Delta x^S}{x^S}}{\frac{\Delta p}{p}}$$

SR , LR output supply — $\text{Max } \pi(x) = P_x - C_{(x)}$

P = MC　　P ≥ AVC (SR)

MC'(x) > 0　　P ≥ LRAC (LR)

＊ **SR, LR input demand. not conditional input demand**

SR, L variable , K fixed

$\min_{L,K} wL + rK$, s.t $f(L, K) = x$ → conditional on: $L^{\circ} = L(w, r, x)$, $K^{\circ} = K(w, r, x)$

前面談的是 SR optimal output

現在要談 SR optimal input(以前是找最適產量極大化利潤，但這裡是直接從 input 來看)

The firm’s problem:

$$\max_{L} \pi(L) = P\, f(L) - (rK_0 + wL)$$

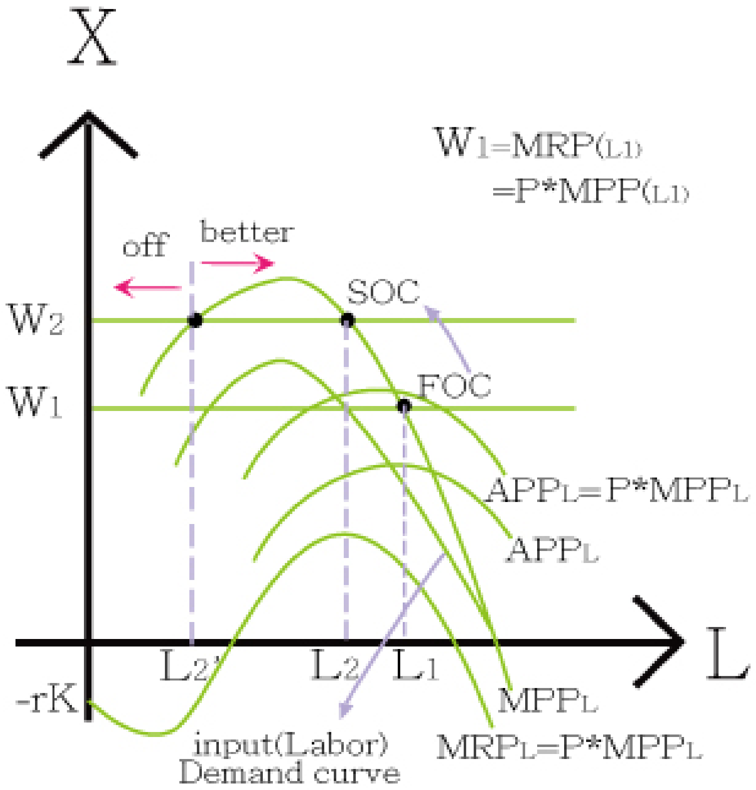
$$= TRP(L) - TFC(L)$$

total revenue product(總生產收益量)　　total factor cost(總要素成本)

$$F.O.C.\quad \pi'(L) = TRP'(L) - TFC'(L)$$

$$TRP'(L) = \frac{dTRP(L)}{dL} = MRP_L(\text{邊際生產收益量}) = \frac{dPf(L)}{dL} = P \cdot f'(L) = P \cdot MPP_L$$

$$TFC'(L) = \frac{dTFC(L)}{dL} = \frac{d(wL + rK_0)}{dL} = w$$



F igure 88:

$\pi(L) = TRP(L) - TFC(L)$

F.O.C . $\pi'(L) = 0$

$$\pi'(L) = MRP_L - w$$
$$= P \cdot MPP_L - w = 0$$

$\Rightarrow MRP_L = w$

S.O.C. $\pi''(L) < 0$

$$\pi''(L) = TRP''(L) - TFC''(L) = MRP'(L) - \frac{dw}{dL} = P \cdot MPP'_L - 0 < 0$$

$\Rightarrow MPP'_L < 0$ *diminishing marginal returns*

**compare with $SRMC' > 0$

$$SRMC = \frac{\Delta(wL + rK_0)}{\Delta x} = \frac{\Delta wL}{\Delta x} = \frac{w}{MPP_L}$$

$\therefore$ diminishing $MPP_L \Leftrightarrow$ increasing SRMC

both S. O. C. are consistent to each other

Also, from F.O.C.

$$P = \frac{w}{MPP_L} = SRMC$$

$\therefore$ 從**output**和**input**方面來看, 求解的**F. O. C.** 及**S. O. C.** 都相同, 符合成本極小化的決策

也會符合利潤極大化的決策, 廠商面對的是同一個決策

<u>shut down decision (input decision)</u>

$\pi(L), L^*$ satisfies F. O. C. +S. O. C.

$\pi(L^*) < \pi(L=0) = -rK_0$ $\rightarrow$ shut down

$\pi(L^*) \geq \pi(L=0)$ $\rightarrow$ not shut down, L^* is the equilibrium

$\Leftrightarrow P \cdot f(L^*) - (rK_0 + wL^*) < \pi(L = 0)$

$\Leftrightarrow P \cdot f(L^*) - rK_0 - wL^* < -rK_0$

$\Leftrightarrow P \cdot f(L^*) - wL^* < 0$

$\Leftrightarrow P \cdot f(L^*) < wL^*$

$\Leftrightarrow P \cdot \frac{f(L^*)}{L^*} < w$ 收益能否 cover 工資

$\Leftrightarrow P \cdot APP(L^*) < w$

$\Rightarrow ARP_L(L^*) < w$ shut down

$\underbrace{MRP\ (= w)}_{\text{profit max}} \underbrace{\le ARP}_{\text{shut down decidion}}$

profit max shut down decidion

SR, L demand curve

$= MRP_L$ below ARP_L

↓

downward sloping ← diminishing Marginal Return

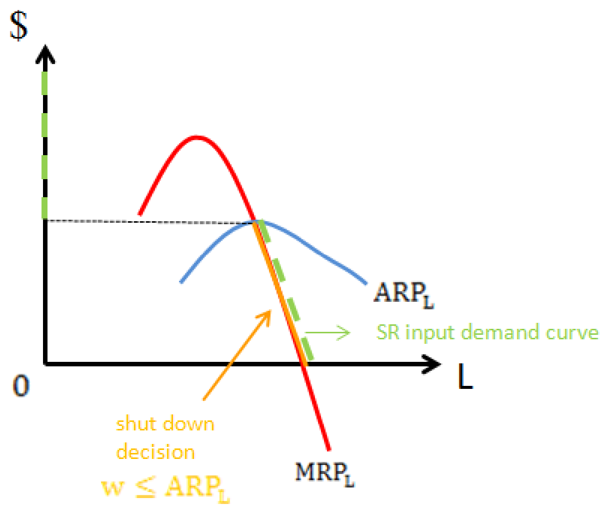
price taking firm ⟶ w, r, p given

$\max_L SR\ \pi(L) = \overline{P} \cdot f(L) - (\overline{r}K + \overline{w}L)$

FOC. $MRP_L = w$ (no r)

$\Rightarrow P \cdot MPP_L(L) = w \Rightarrow L^* = L(w, r, P, ; K)$

In the SR, SRTC = TFC + TVC



$= \underline{rK} + w\underline{L(x)}$

↓ given ↓ input requirment

L(x) x= f(L) when x is produced ⟶ L(x) can be calculated

TVC= wL(x)

$SRMC = \frac{W}{MPP_L}$

||

$\frac{\Delta TVC}{\Delta x} = \frac{\Delta wL(x)}{\Delta x} = w \cdot \frac{1}{\frac{\Delta x}{\Delta L}}$

$AVC = \frac{w}{APP_L}$

||

$\frac{TVC}{x} = \frac{wL}{x} = \frac{w}{\frac{x}{l}} = \frac{w}{APP_L}$

suppose w↑

given each x, SRMC ↑, AVC ↑ both shift upward

SRMC1 ⟶ SRMC2

AVC1 $\rightarrow$ AVC2

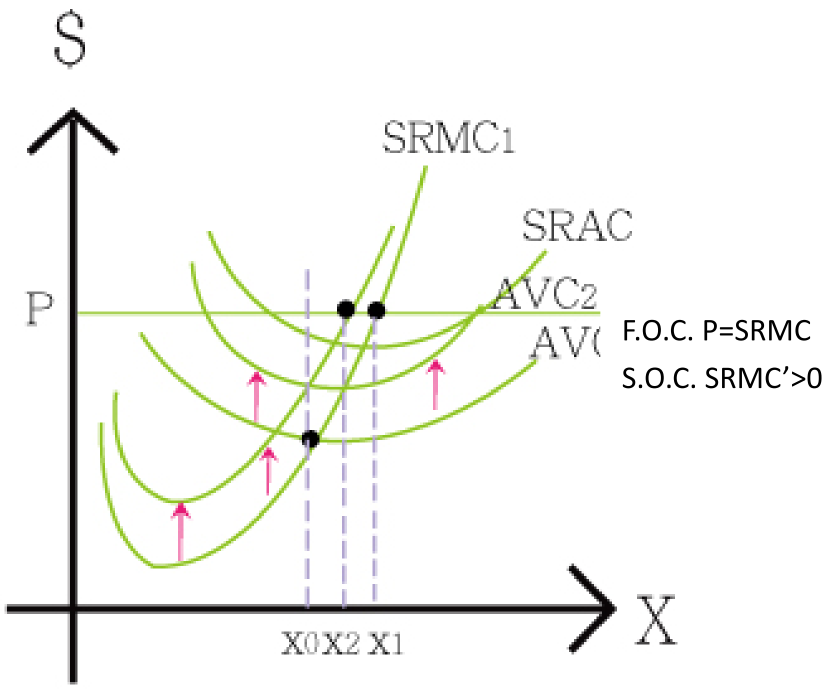


Figure 89:

From FOC. $\rightarrow x^*,\ x_1 \rightarrow x_2,\ x_2 < x_1,\ x\downarrow$

$L(x_2) < L(x_1)$(induced demand) 引申需求

LR input demand

The firm's problem: $\max \pi(L,K) = \underbrace{P\cdot f(L,K)}_{\text{TRP(L, K)}} - \underbrace{(rK+wL)}_{\text{TFC}}$

FOC. $\frac{\partial\pi(L,K)}{\partial L} = 0$ and $\frac{\partial\pi(L,K)}{\partial K} = 0$

$\frac{\partial\pi(L,K)}{\partial L} = MRP_L(L,K) - \underbrace{w}_{MFC_L(L,K)} = 0$ ①

$\frac{\partial\pi(L,K)}{\partial K} = MRP_K(L,K) - r = 0$ ②

① $\Rightarrow$ $P \cdot MPP_L(L,K) = w$ ①'

② $\Rightarrow$ $P \cdot MPP_K(L,K) = r$ ②'

①', ②' $\Rightarrow$ $L^* = L(w, r, p)$

$K^* = K(w, r, p)$

LR input demand Curve

like to know if $w\uparrow, L^*\downarrow$

$r\uparrow, K^*\downarrow$

(downward sloping input demand curve)

$\frac{①'}{②'} \Rightarrow \frac{P \cdot MPP_L(L, K)}{P \cdot MPP_K(L,K)} = \frac{w}{r}$

$$\frac{MPP_L}{MPP_K} = \frac{w}{r}$$

$MRTS_{L,K} = \frac{w}{r}$ ③

note: ③ is the FOC. for cost min

$\min_{L,K} wL + rK$
s.t. $f(L, K) = x$ $\Longrightarrow$ $L^\circ = L(w,r,x)$, $K^\circ = K(w,r,x)$

追求利潤最大，成本一定最低

$\pi(x) = TR - TC$

$\max_{L,K} \pi(L,K) \Rightarrow \min_{L,K} wL + rK$

L^*, K^* s.t. $f(L,K) = x$ L°, K°

$\pi(L^*, K^*)$ $TC(x)$

$x^* = f(L^*, K^*)$ $x^* \to TC(x^*)$

$TC(x^*) = wL^* + rK^*$

相等

w,r change ⇒ Total cost change

$\min_{L,K} wL + rK$ ← $L° = L(w, r, x)$
s.t. $f(L, K) = x$ ← $K° = K(w, r, x)$

$w(\text{or } r) \uparrow \Rightarrow LRTC \uparrow \qquad LRAC = \dfrac{LRTC}{x} \uparrow$

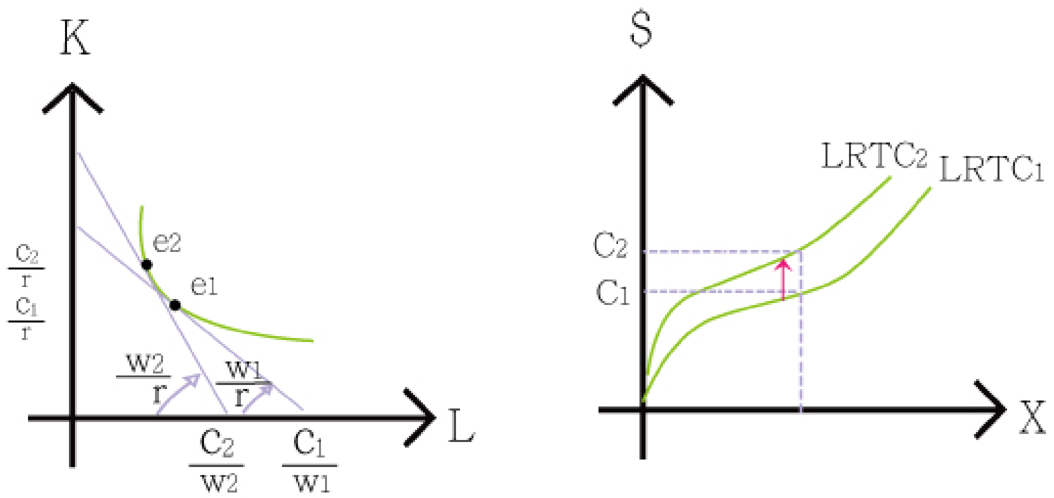


Figure 90:

$$\text{LRAC} = \frac{\text{LRTC}}{x}\uparrow$$

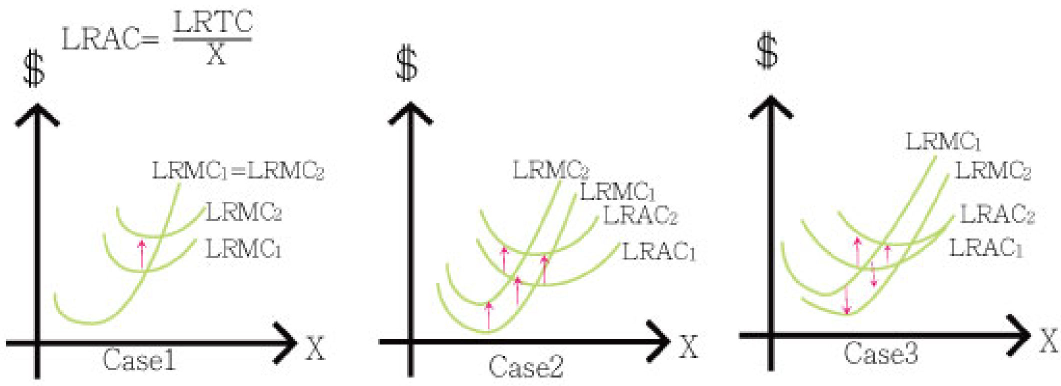


Figure 91:

∗ w↑ ⇒ LRAC↑ (shift) LRMC shift ↑↓? or not shift ?

output effect ?

even we know X* ↑↓⇒ we still don't know L* ↑↓?

Suppose at w_1, X_1, L_1, K_1 are equilibrium (and r, p)

output and input quantities

w↑, $w_1 \rightarrow w_2$, $w_2 > w_1$

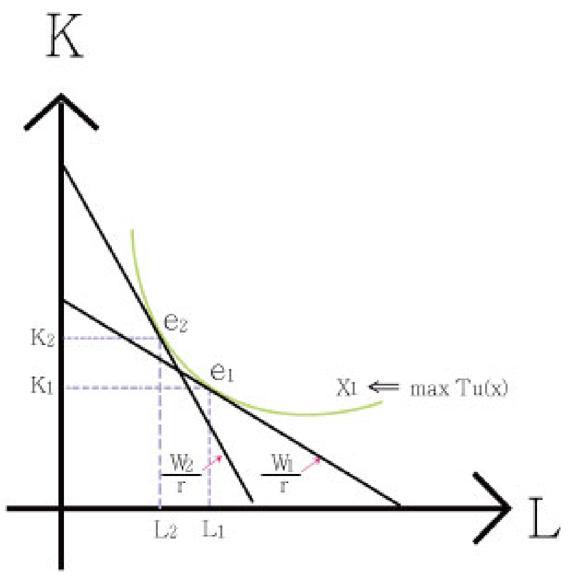
and suppose LRMC is not affected (case 1)

(LRTC and LRAC shift↑)

⇒ $e_1 \rightarrow e_2$

$L_1 \rightarrow L_2$ L↓ } input substitution effect

$K_1 \rightarrow K_2$ K↑



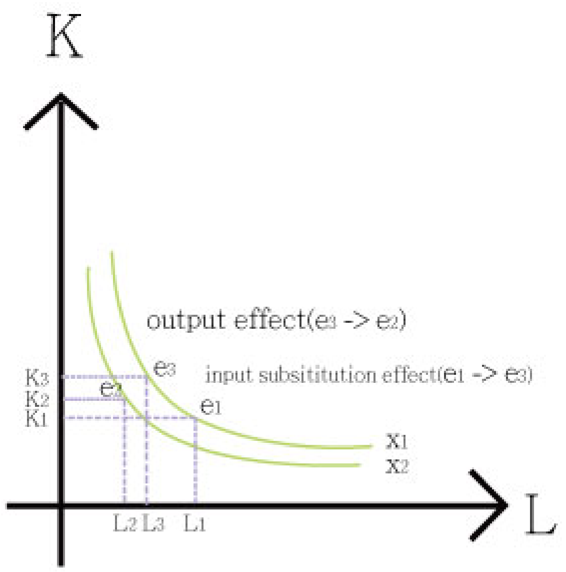
F igure 92:

∗ case 2

w↑, $w_1 \rightarrow w_2$, $w_2 > w_1$ and LRMC shifts↑ (LRTC and LRAC shift ↑)

From FOC. P= LRMC ⇒ x*(max π(x)) ↓

x1 → x2 , x2 < x1 ⇒ L ∗, K ∗ change output effect



F igure 93:

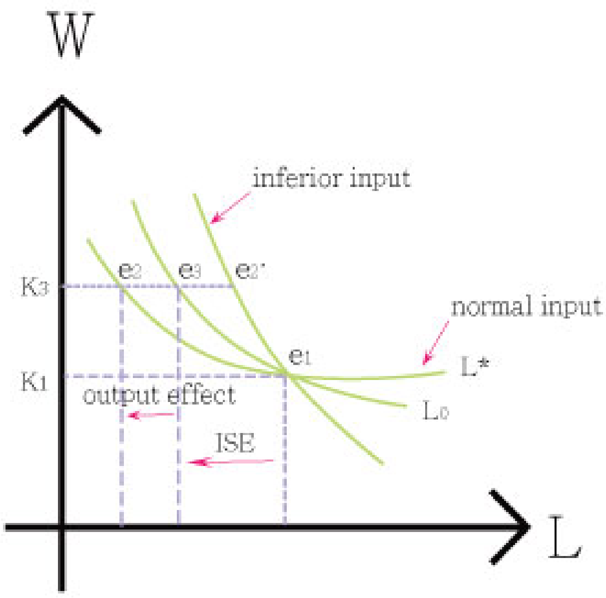
x↓ , L↑↓?　inferior input?(x↓ ⇒ L↑?)

In <u>normal input</u> case, X↓, L↓

output effect(L ↓) ＋ input substitution effect(L ↓) ⇒ L ↓

In <u>interior input</u> case, X↓, L↑

output effect(L ↑) + input substitution effect(L ↓) ⇒ L $\overset{\uparrow}{\underset{-}{\downarrow}}$(視何者效果大決定)



F igure 94:

∗ case 3

LRTC, LRAC↑, LRMC↓

p= SRMC　⇒ x* ↑, $x_2 > x_1$

normal input case: output effect(L ↑) ＋ ISE(L ↓) ⇒ L ↑↓?

Suppose (x_1, L_1, K_1) is the equilibrium at (p, w_1, r)

　　　　(x_2, L_2, K_2)　　　　　　　(p, w_2, r)

$(w_2 > w_1 \Rightarrow L_1 < L_2?)$

$Px_1 - w_1L_1 - rK_1$ ① $\geq Px_2 - w_1L_2 - rK_2$ ②

$Px_2 - w_2L_2 - rK_2$ ③ $\geq Px_1 - w_2L_1 - rK_1$ ④

① - ④ $\geq$ ② - ③

$(P-P)\,x_1 - (w_1 - w_2)\,L_1 - (r-r)\,K_1 \geq (P-P)\,x_2 - (w_1 - w_2)\,L_2 - (r-r)\,K_2$

$(w_2 - w_1)\,L_1 \geq (w_2 - w_1)\,L_2$

$(w_2 - w_1)(L_2 - L_1) \leq 0$

Given $w_2 > w_1$ $(w\uparrow) \Rightarrow L_2 - L_1 \leq 0$

$\therefore w\uparrow \Rightarrow L^* \downarrow$ LR input demand curve is downward sloping