Chapter 4 Externalities

(*) Second welfare theorem

Redistribution implies no social cost

(lump-sum personalized taxes T_i)

→ consumption taxes

——————— a social cost

(*) interaction goes through prices

I Global warming

$I = 2$, $i = 1, 2$

$u(x) + m - \theta_i E$

$E = x_1 + x_2$ ↑

parameter $\theta_i > 0$

suffering due to E

$C(y) = cy$ $c > 0$ marginal cost (independent of y)

$C'(y) = c$

$\pi(y) = py - cy = \overbrace{(p-c)y}$

if $p > c \Rightarrow y(p) = +\infty$

$p < c \Rightarrow y(p) = 0$

$p = c \Rightarrow y(p) \in [0, +\infty[$ ←

$\boxed{p^* = c}$ $\quad u(x) + (\cancel{px} - px) - \cancel{\theta E}$ ↑ E

$\rightarrow u'(x(p)) = p \quad (\Rightarrow \quad u'(x^*) = p^* = c$

$X^* = Y^* = x^* + x^* = 2x^*$

social optimum?

Marshallian definition:

$$\begin{cases} \max\limits_{(x_1, x_2, E)} \; [u(x_1) - \theta_1 E] + [u(x_2) - \theta_2 E] - \overbrace{C(x_1 + x_2)} \\ \text{s.t.} \quad \boxed{E = x_1 + x_2} \end{cases}$$

$\Rightarrow \max \quad u(x_1) + u(x_2) - C(x_1 + x_2) - (\theta_1 + \theta_2)(x_1 + x_2)$

(x_1, x_2)

$$\Leftrightarrow \max_{(x_1,x_2)} \; u(x_1) + u(x_2) - \underbrace{(c+\theta_1+\theta_2)}_{\text{marginal social cost}}(x_1+x_2)$$

$$u'(x_1^{opt}) = c + \theta_1 + \theta_2$$

$$u'(x_2^{opt}) = c + \theta_1 + \theta_2$$

1) $u'(x_1^{opt}) = u'(x_2^{opt}) \Leftrightarrow x_1^{opt} = x_2^{opt} \equiv x^{opt}$

2) $\boxed{u'(x^{opt}) = c + \theta_1 + \theta_2}$

x^{opt} does not depend on the suffering of consumers, but on how much damage they cause to the society.

3) $u'(x^{opt}) = c + \theta_1 + \theta_2 > c = u'(x^*)$

$$\Leftrightarrow \boxed{x^{opt} < x^*}$$

Remark. "Activist"

$$\max \; u(x_1) + (\bar{m} - p x_1) - \theta_1 (x_1 + x_2)$$

(x_1) X ↳ $p^* = c$

$u'(x_1) = c + \theta_1 > c = u'(x^*) \Rightarrow x_1 < x^*$

$< c + \theta_1 + \theta_2 = u'(x^{opt})$

$\Rightarrow x_1 > x^{opt}$

$x^{opt} < x_1 < x^*$

II Policy tools for restoring optimality

ti on consumption

↳ tax collected $\Rightarrow T_i$ transfer (income)

$$\max_{(x_i, m)} \; u(x_i) + m_i - \theta_i E - t_i x_i + T_i$$

m_i = $\bar{m} - px_i$ = $\bar{m} - cx_i$

$t_i x_i$: paid through taxes; T_i: transfer

$$\max_{(x_i)} \; u(x_i) + \bar{m} - cx_i - \theta_i E - t_i x_i + T_i$$

$u'(x_i) - c - t_i = 0$

$$u'(x_i) = c + t_i$$

$t_i \,/\, x_i = x^{opt}$?

$$u'(x^{opt}) = c + \theta_1 + \theta_2$$

$$x_i = x^{opt} \Leftrightarrow u'(x_i) = u'(x^{opt})$$

$$\Leftrightarrow c + t_i = c + \theta_1 + \theta_2$$

$$\Leftrightarrow \boxed{t_i = \theta_1 + \theta_2} = t \quad \forall i = 1,2$$

internalizes the externality