

Advanced Microeconomics II

First Tutorial

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Exercise 15.B.1

Consider an Edgeworth Box economy in which two consumers have locally nonsatiated preferences. Let $x_{i\ell}(p)$ be consumer i 's demand for good ℓ at prices $p = (p_1, p_2)$.

(a) Show that $p_1 \left(\sum_i x_{11}(p) - \omega_1 \right) + p_2 \left(\sum_i x_{21}(p) - \omega_2 \right) = 0 \quad \forall p$

The competitive budget set $B_i(p) = \{x \in \mathbb{R}_+^2 \mid p \cdot x \leq p \cdot \omega_i\}$ in vector form for consumers $i = 1, 2$ is given by:

$$\begin{aligned} \begin{pmatrix} p_1 \\ p_2 \end{pmatrix} \cdot (x_{11}, x_{21}) &\leq \begin{pmatrix} p_1 \\ p_2 \end{pmatrix} \cdot (\omega_{11}, \omega_{21}) \\ p_1(x_{11} - \omega_{11}) + p_2(x_{21} - \omega_{21}) &\leq 0 \end{aligned}$$

Recall that the (Walrasian) demand function $x_i(p, p \cdot \omega_i)$ must satisfy Walras's Law. That is,

$$p_1(x_{11} - \omega_{11}) + p_2(x_{21} - \omega_{21}) = 0$$

*Proof*¹: Suppose not, $\exists x_i \in B_i(p) \mid p \cdot x_i < p \cdot \omega_i$ ($\neg B$). Then, by LNS of \succeq $\exists x'_i \in B_i(p)$ with $p \cdot x'_i < p \cdot \omega_i$ such that $x'_i \succ_i x_i$. However, this contradicts the optimality of x_i ($\neg A$). Thus, $x_i(p)$ cannot be the demand at p when $p \cdot x_i < p \cdot \omega_i$. \square

Having established that $p_1(x_{11} - \omega_{11}) + p_2(x_{21} - \omega_{21}) = 0 \quad \forall i$, we now sum over i :

$$\begin{aligned} \sum_i p_1(x_{11} - \omega_{11}) + p_2(x_{21} - \omega_{21}) &= 0 \\ p_1 \left[\left(\sum_i x_{11} \right) - \omega_1 \right] + p_2 \left[\left(\sum_i x_{21} \right) - \omega_2 \right] &= 0 \end{aligned}$$

¹The logical statement, $A \Rightarrow B$ we are proving is Walrasian demand $\Rightarrow p \cdot x_i = p \cdot \omega_i$. This is equivalent to proving that 'not A' implies 'not B' i.e. $\neg B \Rightarrow \neg A$.

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