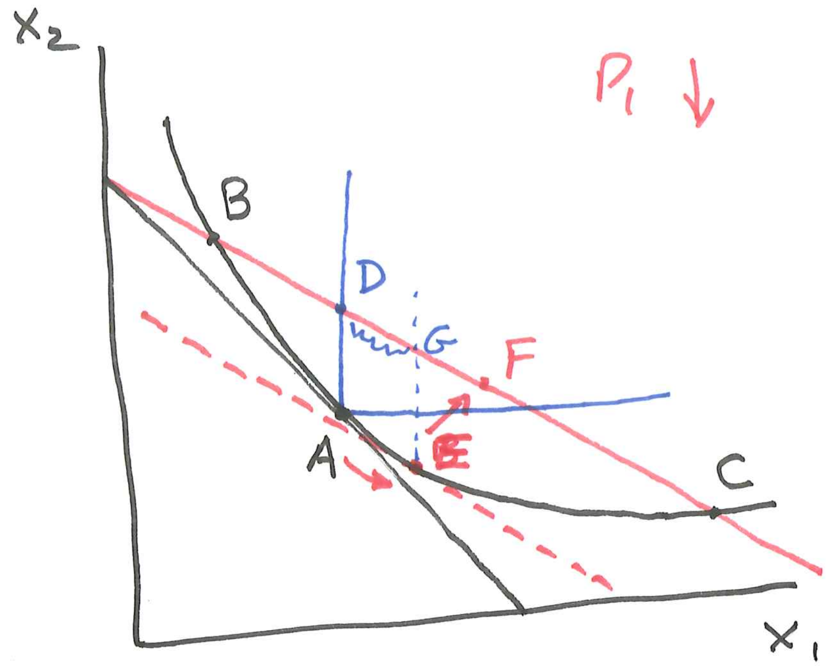
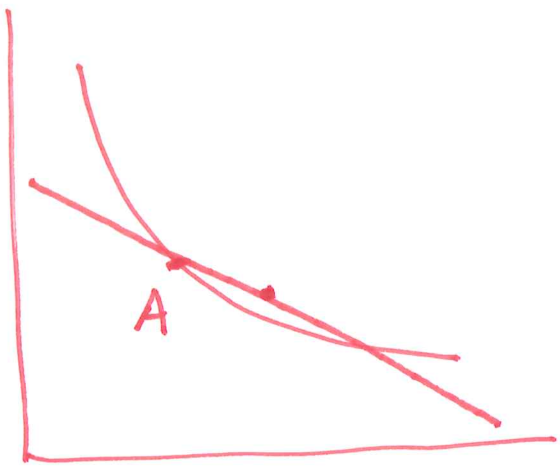
Own-price changes

$$\text{sign}\left(\frac{\partial x_1}{\partial p_1}\right)$$

Law of Demand: $\frac{\partial x_1}{\partial p_1} < 0$

If in BD, law of demand violated





$$\left.\frac{\partial x_1}{\partial p_1}\right|_{\bar{U}} < 0$$

For a normal good $\frac{\partial x_1}{\partial I} > 0$

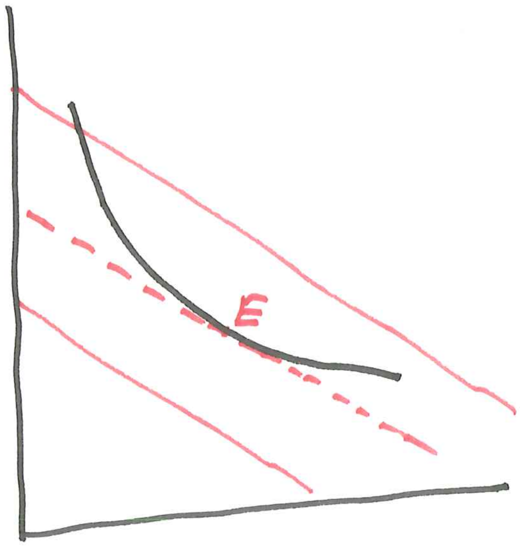
Law of demand holds if good is normal

Left of D: "Giffen" good $\frac{\partial x_1}{\partial p_1} > 0$

Min $E = P_1 x_1 + P_2 x_2$

s.t. $U(x_1, x_2) = U_0$ (1)

$\dfrac{P_1}{P_2} = \dfrac{U_1}{U_2}$ (2)



$x_1^h = x_1^h(P_1, P_2, U)$

$x_2^h = x_2^h(P_1, P_2, U)$

Hicksian or Compensated Demand F$^{\underline{ns}}$.

$E(P_1, P_2, U) \equiv P_1 x_1^h(P_1, P_2, U) + P_2 x_2^h(P_1, P_2, U)$

Expenditure Function

$\dfrac{\partial E}{\partial P_1} = x_1^h \longrightarrow$ <u>Shephard's Lemma</u>

<u>Envelope Theorem.</u>

$y = f(x; \alpha)$

$\underline{f_x = 0} \rightarrow x^* \longrightarrow y^* = f(x^*; \underset{=}{\alpha})$

$\dfrac{dy^*}{d\alpha} = f_\alpha(x^*; \alpha)$

$\dfrac{dy^*}{d\alpha} = f_\alpha + \underbrace{f_x}_{=0} \dfrac{dx^*}{d\alpha} = f_\alpha$

Opt. $y = f(x;\alpha)$ s.t. $g(x;\alpha) = 0$

$$\mathcal{L} = f(x;\alpha) + \lambda\,[g(x;\alpha)]$$

$$\left.\begin{aligned}\frac{\partial \mathcal{L}}{\partial x} &= f_x + \lambda g_x = 0\\ \frac{\partial \mathcal{L}}{\partial \lambda} &= g(x;\alpha) = 0\end{aligned}\right\} \longrightarrow x^*$$

$$y^* = f(x^*;\alpha)$$

$$\frac{dy^*}{d\alpha} = f_\alpha + f_x \frac{dx^*}{d\alpha} \cancel{\neq 0}$$

$$= f_\alpha + (-\lambda g_x)\frac{dx^*}{d\alpha}$$

$$= f_\alpha - \lambda g_x\left(-\frac{g_\alpha}{g_x}\right)$$

$$= f_\alpha + \lambda g_\alpha$$

$$= \mathcal{L}_\alpha$$

$$g(x;\alpha) = 0$$

$$g_x dx + g_\alpha d\alpha = 0$$

$$\frac{dx}{d\alpha} = -\frac{g_\alpha}{g_x}$$

$$\frac{\partial \mathcal{L}}{\partial \alpha} = f_\alpha + \lambda g_\alpha$$

$$x_1^h = x_1^h(P_1, P_2, U) \rightarrow \text{H. dd } f^{\underline{n}}.$$

$$x_1^h = x_1^h(P_1, \overline{P_2}, \overline{U}) \rightarrow \text{H. dd. curve}$$

$$x_1(P_1, P_2, E(P_1, P_2, U)) \equiv x_1^h(P_1, P_2, U)$$

$$\frac{\partial x_1}{\partial P_1} + \frac{\partial x_1}{\partial I} \cdot \frac{\partial E}{\partial P_1} = \frac{\partial x_1^h}{\partial P_1}$$

$$\frac{\partial x_1}{\partial P_1} = \frac{\partial x_1^h}{\partial P_1} - \frac{\partial E}{\partial P_1} \cdot \frac{\partial x_1}{\partial I}$$

$$\frac{\partial x_1}{\partial P_1} = \underbrace{\frac{\partial x_1^h}{\partial P_1}}_{-} - \underbrace{x_1^h}_{+} \cdot \underbrace{\frac{\partial x_1}{\partial I}}_{+}$$

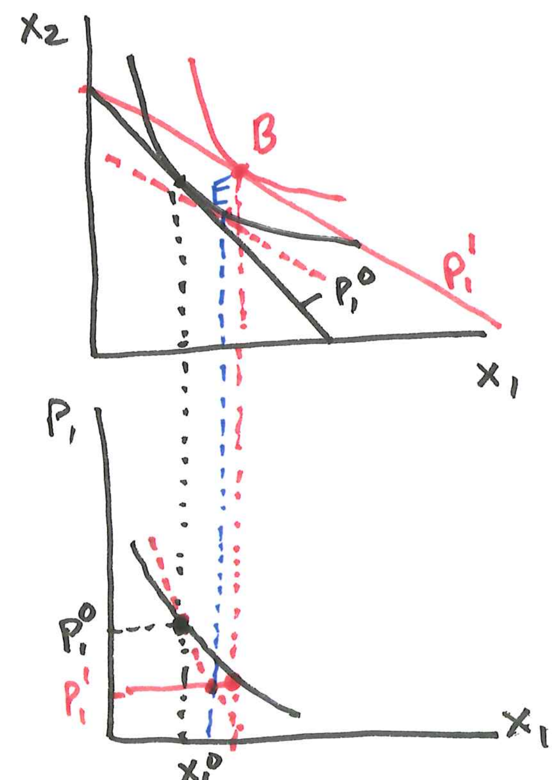
if normal

Suppose ord. dem. $f^{\underline{n}}$ is $x_1 = \dfrac{\alpha_1 I}{(\alpha_1 + \alpha_2) P_1}$

Suppose exp. $f^{\underline{n}}$ is

$$E = P_1 x_1^h + P_2 x_2^h$$

$$x_1 = \frac{\alpha_1 [P_1 x_1^h + P_2 x_2^h]}{(\alpha_1 + \alpha_2) P_1}$$



Ordinary Dem :