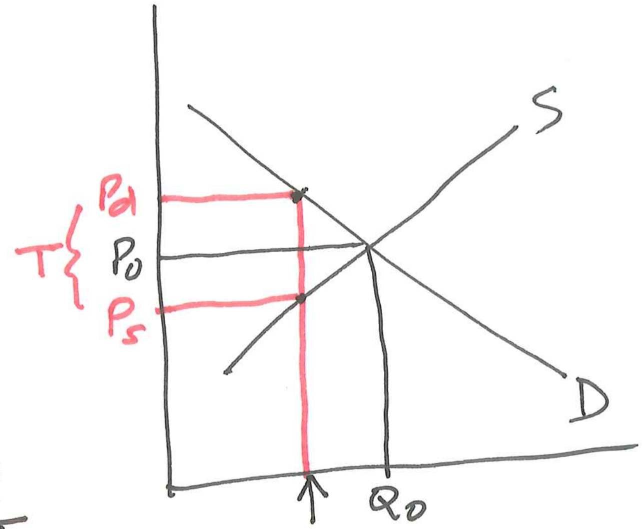
Calculating the effect of a specific tax.



$$P_d = P_s + T$$

$$Q_d(P_d) = Q_s(P_s)$$

$$Q_d(P_s + T) = Q_s(P_s)$$

$$\frac{dQ_d}{dP_d} \cdot \left[\frac{dP_s}{dT} + 1\right] = \frac{dQ_s}{dP_s} \cdot \frac{dP_s}{dT}$$

$$\left[\frac{dQ_s}{dP_s} \cdot \frac{P_0}{Q_0} - \frac{dQ_d}{dP_d} \cdot \frac{P_0}{Q_0}\right] \cdot \frac{dP_s}{dT} = \frac{dQ_d}{dP_d} \cdot \frac{P_0}{Q_0}$$

$$\left[\varepsilon_s - \varepsilon_d\right] \cdot \frac{dP_s}{dT} = \varepsilon_d$$

$$\frac{dP_s}{dT} = \frac{\varepsilon_d}{\varepsilon_s - \varepsilon_d} < 0$$

$$\Delta P_s \approx \frac{\varepsilon_d}{\varepsilon_s - \varepsilon_d} \cdot \Delta T$$

$$\frac{dP_d}{dT} = \frac{dP_s}{dT} + 1 = \frac{\varepsilon_d}{\varepsilon_s - \varepsilon_d} + 1 = \frac{\varepsilon_s}{\varepsilon_s - \varepsilon_d}$$

$$\Delta P_d \approx \frac{\varepsilon_s}{\varepsilon_s - \varepsilon_d} \cdot \Delta T$$

$P_0 = \$10, \quad Q_0 = 1{,}000. \quad \varepsilon_d = -0.5, \ \varepsilon_s = 2, \ T = \$1$

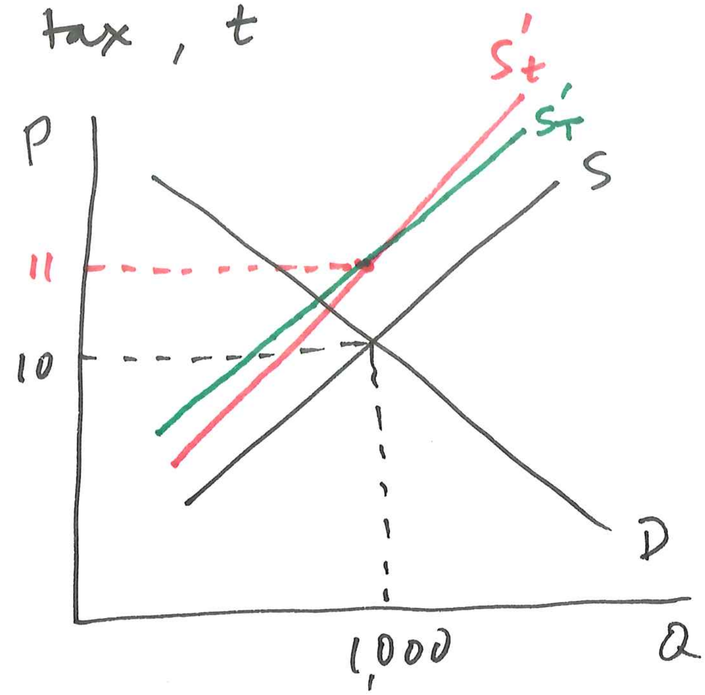
$$\Delta P_s \approx \frac{-0.5}{2.5} \cdot 1 = -0.2$$

$$P_s = 10 - 0.2 = \$9.80$$

$$\Delta P_d = \frac{2}{2.5} \cdot 1 = 0.8$$

$$P_d = \$10.80$$

Effect of a Percentage tax, t



Let's assume demand + supply have constant elasticities.

$$Q_d = a P_d^{\varepsilon_d}, \quad Q_s = c P_s^{\varepsilon_s}$$

$$a P_0^{\varepsilon_d} = c P_0^{\varepsilon_s}$$

$$P_0^{\varepsilon_s - \varepsilon_d} = \frac{a}{c}$$

$$P_0 = \left(\frac{a}{c}\right)^{\frac{1}{\varepsilon_s - \varepsilon_d}}$$

Final Eq$^{\underline{m}}$: $P_d = P_s(1+t)$

$$a\left[P_s(1+t)\right]^{\varepsilon_d} = c\,P_s^{\varepsilon_s}$$

$$a\,P_s^{\varepsilon_d}(1+t)^{\varepsilon_d} = c\,P_s^{\varepsilon_s}$$

$$P_s^{\varepsilon_s-\varepsilon_d} = \frac{a}{c}(1+t)^{\varepsilon_d}$$

$$P_s = \left(\frac{a}{c}\right)^{\frac{1}{\varepsilon_s-\varepsilon_d}}(1+t)^{\frac{\varepsilon_d}{\varepsilon_s-\varepsilon_d}}$$

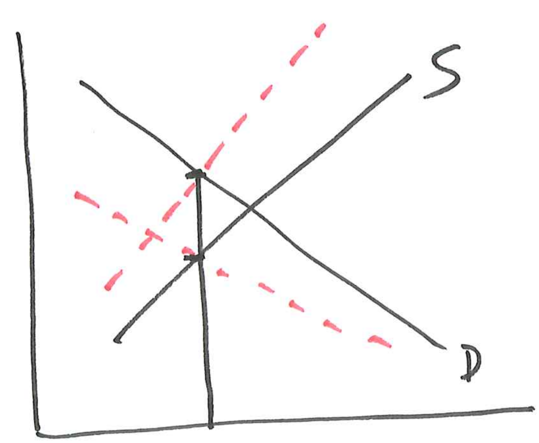
$$= P_0(1+t)^{\frac{\varepsilon_d}{\varepsilon_s-\varepsilon_d}}$$

$$P_d = P_s(1+t)$$

$$= P_0(1+t)^{\frac{\varepsilon_s}{\varepsilon_s-\varepsilon_d}}$$

In example: $P_d = 10(1.1)^{0.8} = 10.79$

$P_s = 9.81$



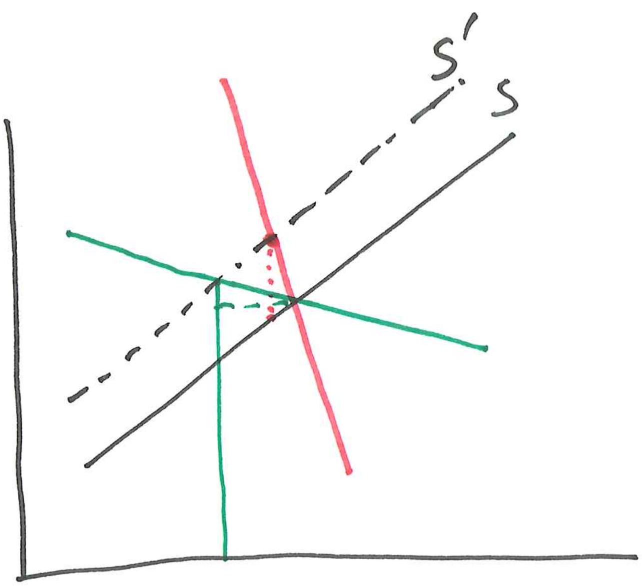
Three tax "theorems".

1. Effect of sales tax + excise tax are identical.

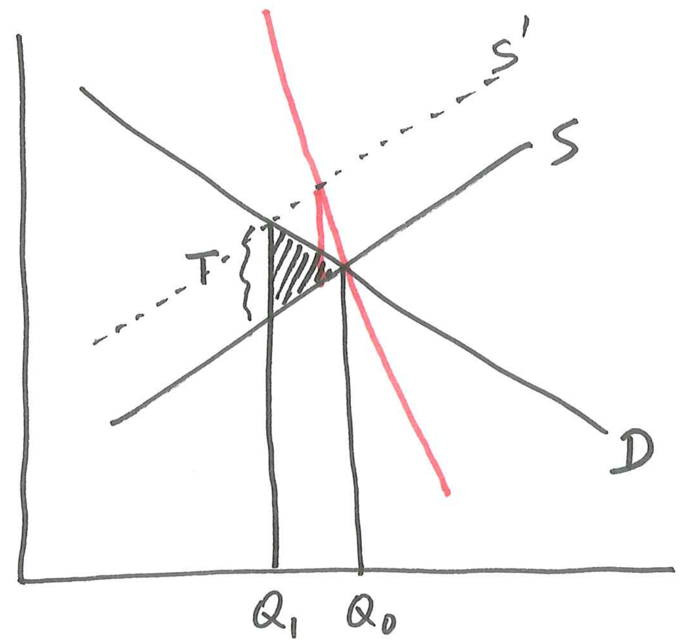
                                         sellers
2. Burden of tax on buyers is bigger:

             more
   (i) the less elastic the demand

             less
   (ii) " more " " supply

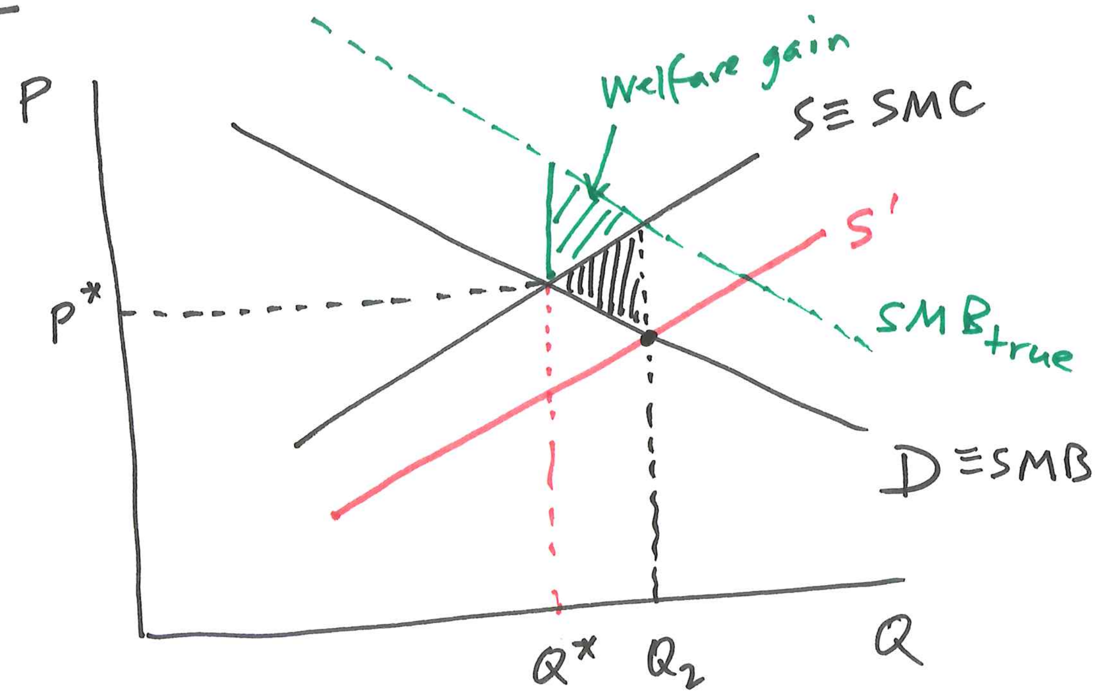


3. Excess burden (or deadweight loss) of tax is higher the more elastic the demand + supply



$$EB \approx \frac{1}{2} * T * \Delta Q$$

Subsidies



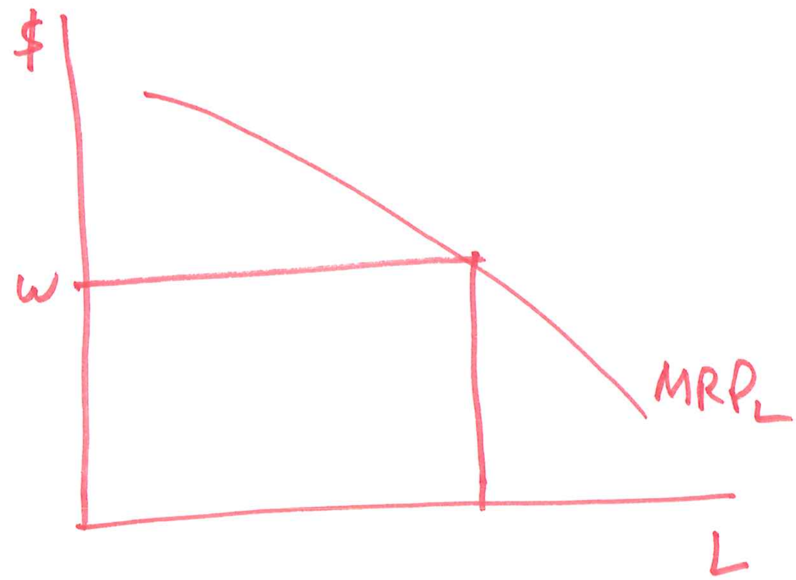
Labor Market

$$\pi = p \cdot q(L) - wL - rK$$

$$\underbrace{\frac{\partial \pi}{\partial L} = p \cdot \underbrace{\frac{\partial q}{\partial L}}_{MP_L}}_{\text{Marginal Revenue Product of Labor}} - w = 0$$

$$\pi = R(L) - wL - rK$$

$$\frac{\partial \pi}{\partial L} = \underbrace{\frac{\partial R}{\partial L}}_{MRP_L} - w = 0 \rightarrow MRP_L = w$$



Capital Market.

$$PV = \frac{R_t}{(1+r)^t} \quad \text{or} \quad R_t e^{-rt}$$

$$e = \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$$

$$= 2.7183$$

1	2	3	4
R	R	R	R

$$PV = \frac{R}{1+r} + \cancel{\frac{R}{(1+r)^2}} + \cancel{\frac{R}{(1+r)^3}} + \cdots +$$

$$\frac{PV}{1+r} = \cancel{\frac{R}{(1+r)^2}} + \cancel{\frac{R}{(1+r)^3}} + \cdots +$$

$$PV\left(1 - \frac{1}{1+r}\right) = \frac{R}{1+r}$$

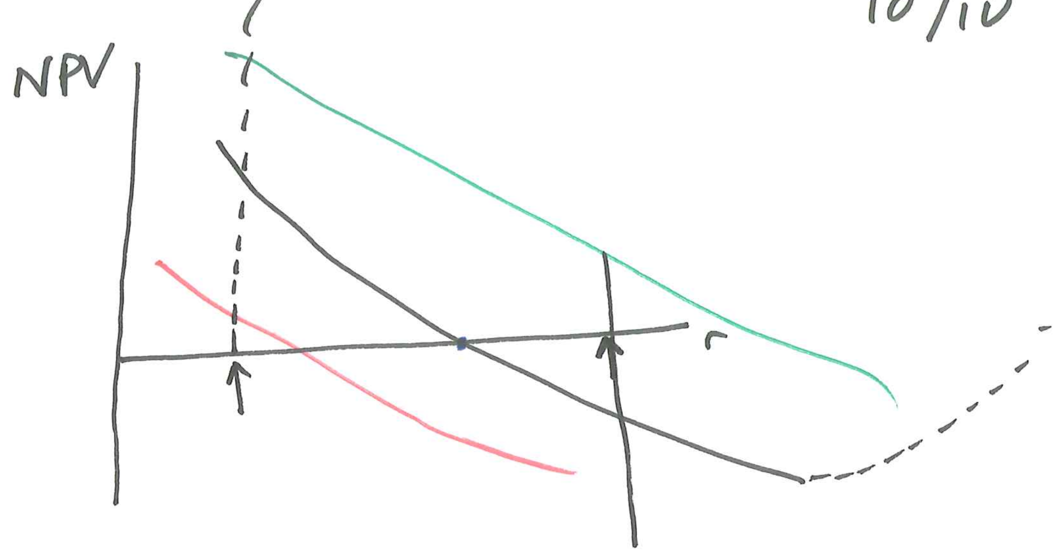
$$PV\left(\frac{\cancel{1}+r-\cancel{1}}{1+r}\right) = \frac{R}{1+r}$$

$$PV = \frac{R}{r}$$

$$PV = \int_0^\infty R e^{-rt}\,dt$$

$$= -\frac{R}{r} e^{-rt} \Big|_0^\infty$$

$$= \frac{R}{r}$$



$$NPV_{project} = -I_0 + \frac{R_1}{1+r} + \frac{R_2}{(1+r)^2} + \cdots$$

$$K_d = f(r)$$

$$\frac{dK_d}{dr} < 0$$