Example 3.1 Suppose that demand/supply equation can be given by

$$P^d = 80 - 3Q^d \rightarrow \text{steeper}$$

$$P^s = 10 + 2Q^s \rightarrow \text{flatter}$$

- Find the market equilibrium.

$P^d = P^s \Rightarrow 80 - 3Q = 10 + 2Q$

$70 = 5Q$

$Q^* = 14$ units

$P^* = 10 + 2(14) = 10 + 28 = 38$ $

- Suppose that government imposes tax on producer equal to \$5 per unit, determine market equilibrium under taxation.

→ "P" ⇒ clear the market: $Q^d = Q^s$

$P^s = P^d - 5$

3 consumer

2 producers

$P^d = 80 - 3Q^d$

$P^s = P^d - 5 = 10 + 2Q^s$

$P^d = 15 + 2Q^s$

$80 - 3Q = 15 + 2Q$

$65 = 5Q$

$Q^* = 13$ units

$P^{d*} = 41$ $

$P^{s*} = 41 - 5$

Before $P^d = 10 \Rightarrow$ good ; $P^d < 10 \rightarrow$ out = 36

P^d, P^s

$P^s = 5$; need at least \$5 for

TR = 13 × 5 = 65 $

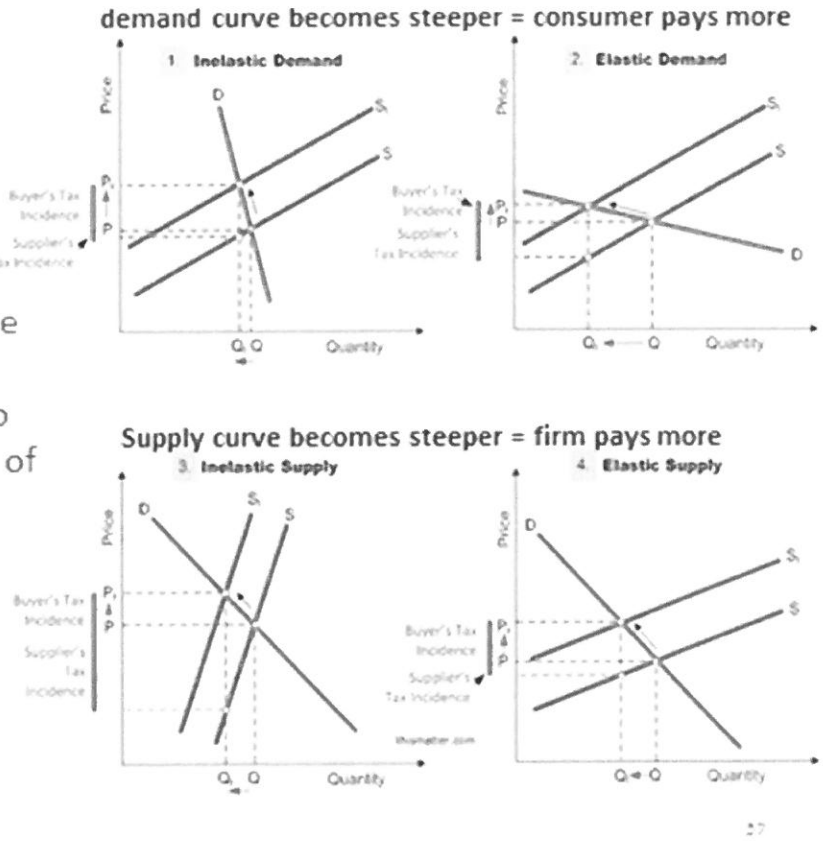
Consumer price =

- How much is the tax revenue that the government can collect in the equilibrium?

- Calculate the tax burden.

Excess burden/Tax incidence:

Main Idea: Whoever cannot adjust themselves instantaneously to the new situation would unfortunately have to bear a larger portion of the tax burden.



Example 3.J: Excess burden *formula under linear model*

Demand: $p^d = a - bQ^d \quad ; \ a \geq 0, \ b \leq 0.$ ①

Supply : $p^s = c + dQ^s \quad ; \ d \geq 0.$ ②

- Solve for quantity and prices equilibrium when the unit tax is imposed. Analyze the result

Impose tax on consumer:

$$p^d = p^s + t$$

$$\rightarrow \quad p^s + t = a - bQ^d$$

$$p^s = a - t - b \cdot Q^d \quad (3) \rightarrow \text{expressed in terms of producer's price}$$

(2) I=(3) $\quad Q^d = Q^s = Q^*$

$$a - t - bQ^* = c + d \cdot Q^*$$

$$Q^* = \frac{a - t - c}{b + d}$$

Baseline $t = 0$, $a > c$

$$Q^*(t) - Q^*(t=0) = \frac{a-c}{b+d} - \frac{t}{b+d}$$

$$= -\frac{t}{b+d}$$

→ taxation reduces the market size.

- Derive the excess burden formula for buyers and sellers

$$Q^*(t) = Q^*(t=0) - \frac{t}{b+d} = \frac{a-c}{b+d} - \frac{t}{b+d}$$

because

$\therefore t \uparrow \rightarrow$ ~~b/c~~ ; $-\frac{1}{b+d} < 0$

$\therefore t \uparrow \rightarrow$ market shrinks "Eqm Q"

$$P^S = c + dQ$$

$$= c + d\left(\frac{a-c}{b+d} - \frac{t}{b+d}\right)$$

$$= c + \frac{d(a-c)}{b+d} - \frac{d}{b+d} \cdot t$$

$$= \frac{bc + \cancel{dc} + da - \cancel{dc}}{b+d} - \frac{d}{b+d} \cdot t$$

$$P^{S*}(t) = \frac{bc+da}{b+d} - \frac{d}{b+d} \cdot t \quad (+t)$$

$$\Downarrow$$

$$P^{S*}(t=0) - \frac{d}{b+d} \cdot t$$

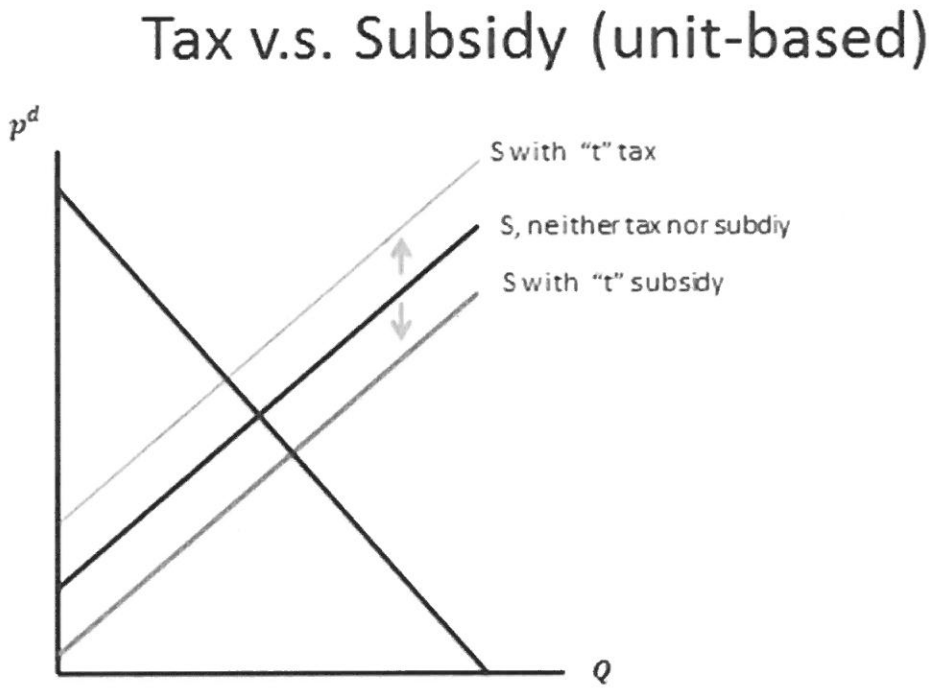
$$P^{D*} = P^{S*} + t = \frac{bc+da}{b+d} + \frac{b}{b+d} \cdot t$$

Unit-subsidy?

- Do we have to start everything from the beginning to derive the implications of subsidy program for market equilibrium?

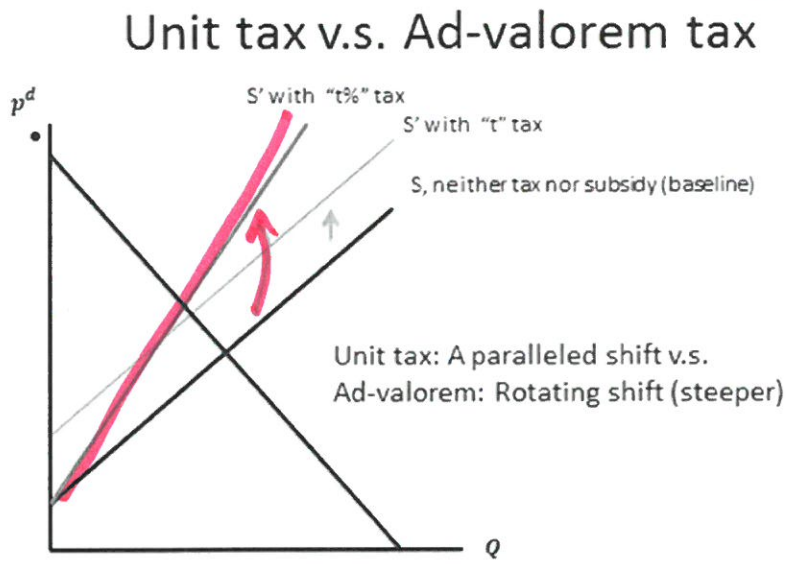
  - No, the analytical result for the impact of subsidy would have been the same, because we can treat subsidy as a negative tax. "t" is negative number!

  - The burden concept would be changed into the benefit received, i.e. who's getting more benefit.



Ad-valorem tax

- Tax by t% of price!. An example is the value-added tax.
- *Most* Ad-valorem taxes are imposed at the point of purchase, i.e. imposing on consumers
- If the tax is imposed on consumer, it would be that: $p^d = p^s\left(1 + \frac{t}{100}\right)$.



$$Q^*(t) = \frac{a-c}{b+d} - \frac{t}{b+d}$$

Burden Producer (BP)

$$\Rightarrow \frac{d \cdot t}{b+d}$$

$$P^{S*} = \frac{bc+da}{b+d} - \frac{dt}{b+d}$$

$$P^{d*} = \frac{bc+da}{b+d} + \frac{b}{b+d} \cdot t$$

$\frac{dQ^*}{dP}$

Burdent Consumer (BC)

$$\Rightarrow \frac{b}{d+b} \cdot t$$

$\frac{dQ^*}{dP}$

$$\Rightarrow \frac{BP}{BC} = \frac{d}{b} \cdot \frac{P^*/Q^*}{P^*/Q^*}$$

slope supply

slope of demand Curv.

$$\left| \frac{b}{b+d} \cdot t \right| + \left| \frac{-dt}{b+d} \right| = "t"$$

$$\frac{BP}{BC} = \frac{|\varepsilon^d|}{|\varepsilon^s|}$$

$$\varepsilon^s = \frac{dQ}{dP} \cdot \frac{P}{Q} = \frac{1}{d} \cdot \frac{P}{Q} \; ; \; \varepsilon^d = \frac{dQ}{dP} \cdot \frac{P}{Q} = \frac{1}{b} \cdot \frac{P}{Q}$$