Econ 301: Microeconomic Analysis

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Equilibrium

Market Supply

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  - Guiding principle: equilibrium

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  - Guiding principle: equilibrium
- For now, assume that $S(p)$ measures how much producers are willing to supply in aggregate at price p
  - Assume $S(p)$ is upward sloping

Setting up Equilibrium

- ▶ What do we mean when we say equilibrium?
  - ▶ An agent (consumer or producer) is *best-responding* if they are choosing their best possible action given what everyone else is choosing
  - ▶ We are in an *equilibrium* if all agents are best-responding

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  - ► An agent (consumer or producer) is *best-responding* if they are choosing their best possible action given what everyone else is choosing
  - ► We are in an *equilibrium* if all agents are best-responding
- ► We also assume that agents are *price-takers*
  - ► Small agents have negligible market power
  - ► We also call this a *competitive equilibrium*
  - ► Contrast with monopoly, oligopoly

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- ▶ Consider price $p = p^*$
  - ▶ No suppliers want to raise or lower their prices
  - ▶ No consumers want to enter/leave market

Equilibrium with Inverse Supply and Demand

- ► Recall we could invert demand so that we talked about price as a function of quantity
  - ► Call inverse demand $P_D(q)$
- ► We can do the same with supply
  - ► Call inverse demand $P_S(q)$
- ► Equilibrium condition then becomes $P_S(q^*) = P_D(q^*) = p^*$

Example: Linear Supply and Demand

- Let demand and supply be given by

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\begin{aligned}
D(p) &= a - bp \\
S(p) &= c + dp
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- Plug in to find q^*:

$$q^* = a - b\frac{a-c}{b+d}$$
$$= \frac{ad+bc}{b+d}$$

Equivalence of Inverse Supply and Demand

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▶ Plug in to find price:

$$p^* = \frac{a - \frac{ad+bc}{b+d}}{b} = \frac{ab + ad - ad - bc}{b(b+d)} = \frac{a-c}{b+d}$$

Example: Horizontal and Vertical Supply

- Vertical (fixed) supply
  - Producers willing to supply the same amount $\hat{q}$ at any price
  - Supply curve is vertical at $\hat{q}$
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  - In equilibrium, price is fixed by supply side ($p^* = \hat{p}$) but quantity determined by demand
- In general, p^* and q^* determined jointly by supply and demand
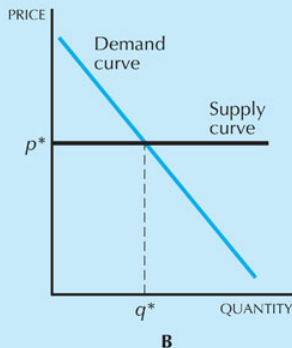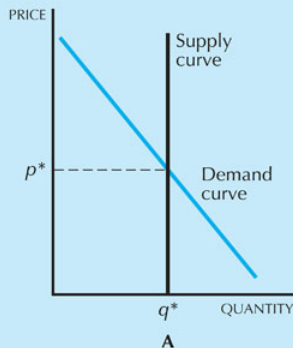
Vertical and Horizontal Supply Graphically

Figure 16.1

Taxes and Deadweight Loss

Taxes

- A tax on an item means that consumers pay a different price than produces receive for the good
    - We say taxes introduce a *wedge* between prices
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- ▶ However, shape of supply and demand curves will affect who is made worse-off by taxes

Equilibrium Effect of a Quantity Tax

- ▶ Under a quantity tax, we have different prices (p_D^* and p_S^*) but same quantity bought and sold
- ▶ Therefore, equilibrium now has two conditions:
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- ► We can combine this to one equation:

$$D(p_S^* + t) = S(p_S^*)$$

- ► Alternatively, we can work with inverse demand and supply, in which case equilibrium condition is

$$P_D(q^*) = P_S(q^*) + t$$

- ► Graphically, we search for the quantity where demander's price and supplier's price are separated by an amount equal to the tax
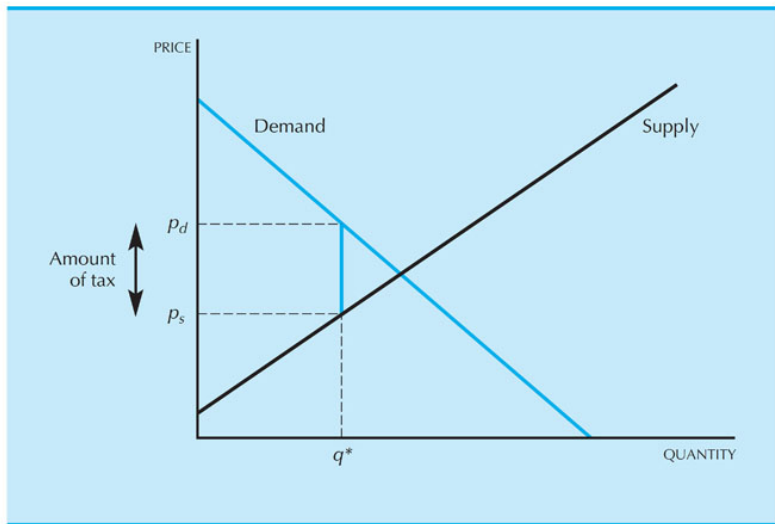
Effect of a Tax Graphically

Figure 16.4

Example: Taxation with Linear Supply

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$$q^* = \frac{ad+bc-bdt}{b+d} < \frac{ad+bc}{b+d}$$

Elasticity of Supply and Producer's Surplus

- ▶ For what follows, we need to introduce supply-side analogues of two big ideas from consumer theory
- ▶ Supply elasticity
  - ▶ Just as with demand, we want to know how much supply changes with price
  - ▶ Define *elasticity of supply* as $\eta = \frac{p_s}{q_s} \frac{dq_s}{dp_s} \approx \frac{p_s}{q_s} \frac{\Delta q_s}{\Delta p_s}$

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- Producer surplus
  - Recall consumer surplus (CS) is area between demand curve and market price
  - Producer surplus (PS) is defined as area between supply curve and market price
  - Concerned mostly with changes in surplus: ΔPS

Deadweight Loss

- The *total surplus* is the sum of consumer surplus and producer surplus

$$TS = PS + CS$$

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- The *tax revenue* given by

$$TR = tq^* = q^*(p_D^* - p_S^*)$$

- The *deadweight loss* of the tax is the sum of change in surplus, minus the tax revenue

$$DWL = |\Delta TS| - TR$$
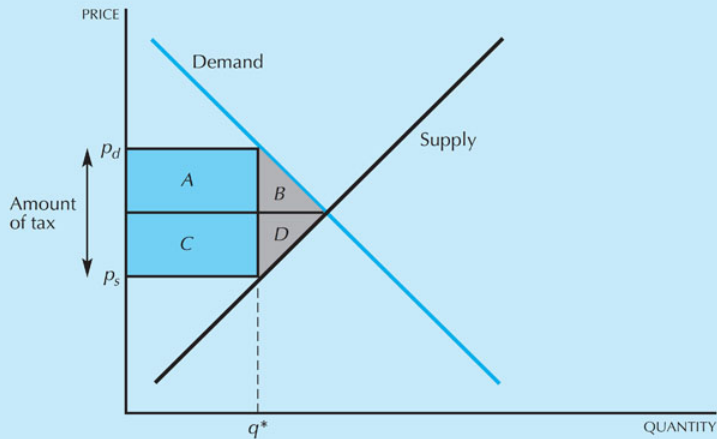
Tax Revenue and Deadweight Loss

Figure 16.7

Passing Along A Tax: Motivating Examples

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  - ▶ We say *tax burden* borne entirely by consumers
  - ▶ Note that supply is perfectly elastic in this case
- ▶ What is the effect of a quantity tax when we have vertical supply?
  - ▶ Must have demand unchanged
  - ▶ Therefore producer price must drop by *t*
  - ▶ Consumer price unaffected
  - ▶ So tax burden borne entirely by producers
  - ▶ Note that supply is perfectly inelastic in this case

Effect of a Tax On Horizontal and Vertical Supply
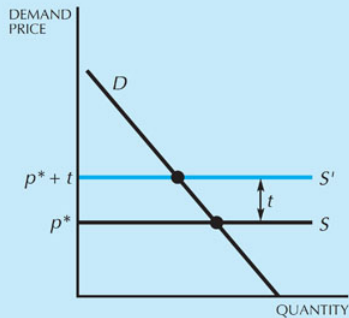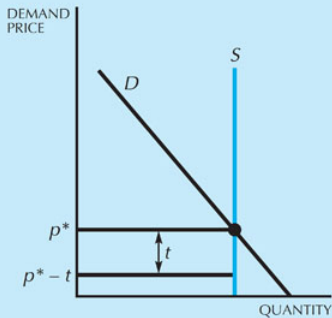
Figure 16.5

Tax Burden in General

▶ We need a way to compare change in consumer price and change in producer price before and after tax

▶ From our definitions of elasticity:

$$\frac{\Delta q_S}{q_S} = \eta \frac{\Delta p_S}{p_S}$$
$$\frac{\Delta q_D}{q_D} = \epsilon \frac{\Delta p_D}{p_D}$$

▶ Note that
  ▶ Quantities are the same for consumers and producers in both pre- and post-tax equilibria, so $\frac{\Delta q_S}{q_S} = \frac{\Delta q_D}{q_D}$
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- ▶ Thus we can rearrange to find that

$$\frac{\Delta p_D}{\Delta p_S} = \frac{\eta}{\epsilon}$$

Relative Tax Burden

▶ Can also be shown that

$$\frac{dp_D}{dt} = \frac{\eta}{\eta - \epsilon}$$

$$\frac{dp_S}{dt} = \frac{\epsilon}{\eta - \epsilon}$$

▶ Thus the party with the larger elasticity (in magnitude) will bear less of the tax burden

▶ Eg When supply is perfectly elastic, tax burden entirely on consumers