The Theory of Monopoly

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First Guest Lecture
Price Theory
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Introduction

Much of course will focus on price-taking

- Keep in mind what happens when not from start
- Models with market power useful for three reasons
  1. More detailed understanding of pricing behavior
  2. Allows study of policies (antitrust, regulation, IP)
  3. Government impacts prices: tool in optimal policy
- Foundational model focuses on one firm ("monopoly")
  1. Quantity reduction incentive
  2. Lerner's elasticity pricing rule
  3. Deadweight loss and measurement
  4. Pass-through rate and comparative statics
  5. Connections of pass-through to other concepts
     - Division of surplus, strategic effects
  6. Evidence on pass-through

Quantity reduction and marginal revenue

Basic idea: monopolies reduce quantity to raise price

- To sell more, price must fall on all *infra-marginal* units

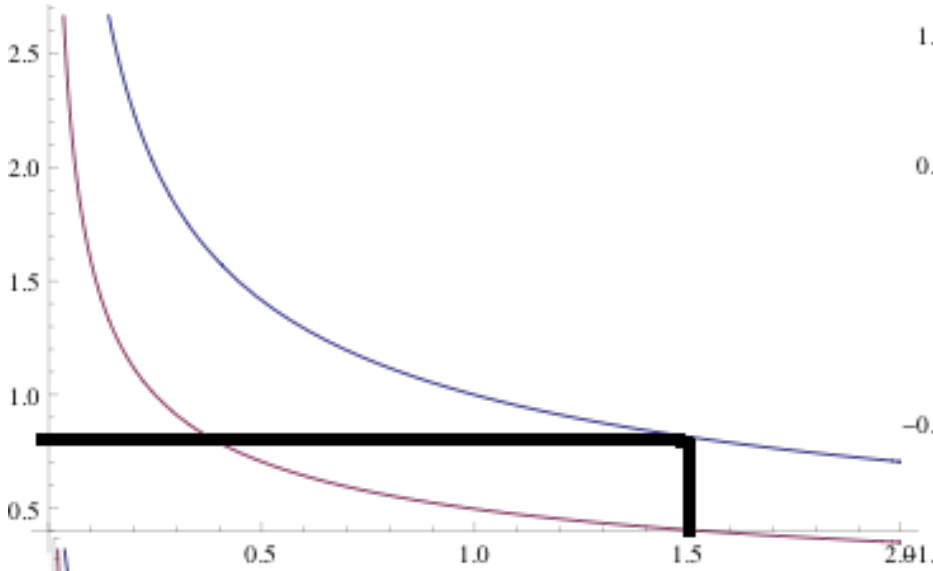
$\Longrightarrow$ Trade-off between selling more and higher price

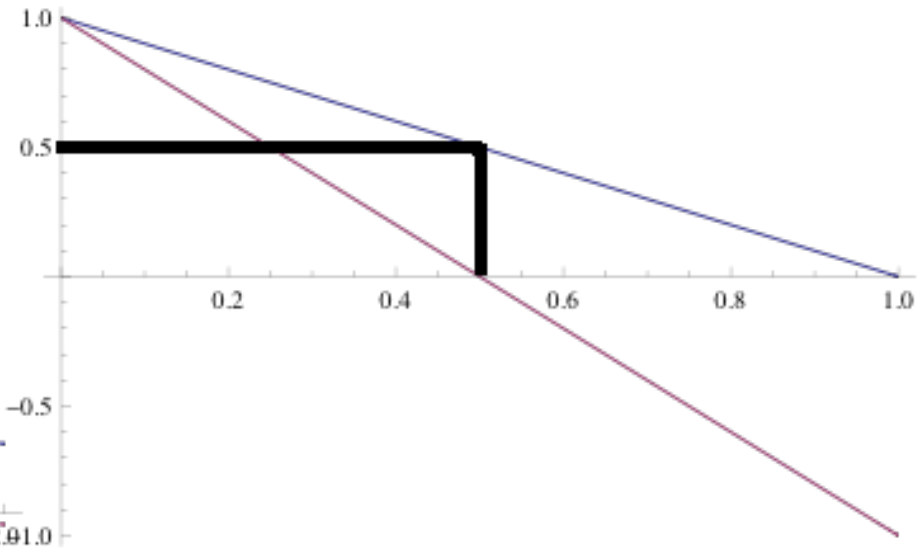
- Maximize $\pi(q) = P(q)q - C(q)$; but don't set $P = MC$
- Instead set $MR = MC$: MR formula?

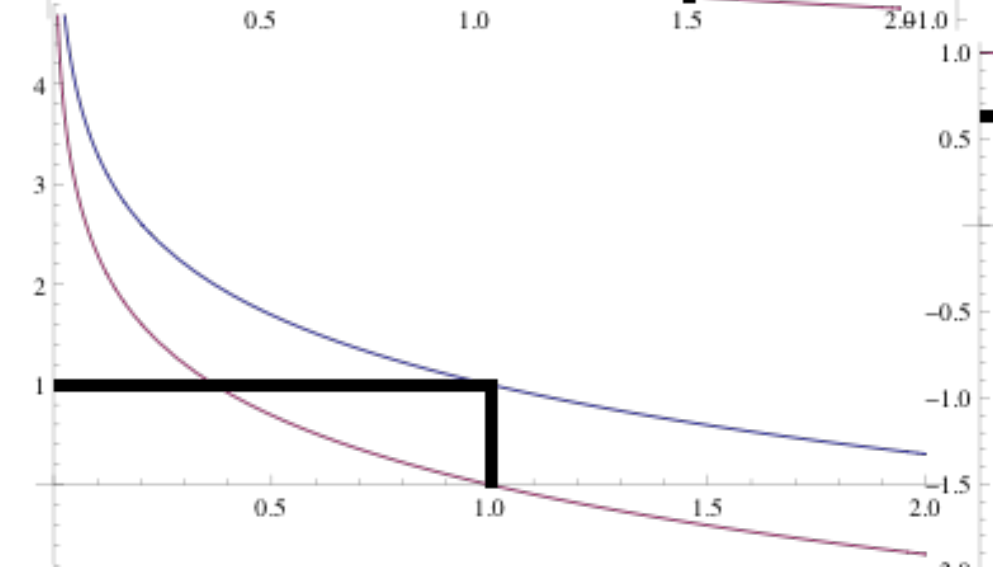
$$MR(q) = \underbrace{P(q)}_{\text{good, competitive}} + \underbrace{P'(q)q}_{\text{market power/Cournot distortion}}$$

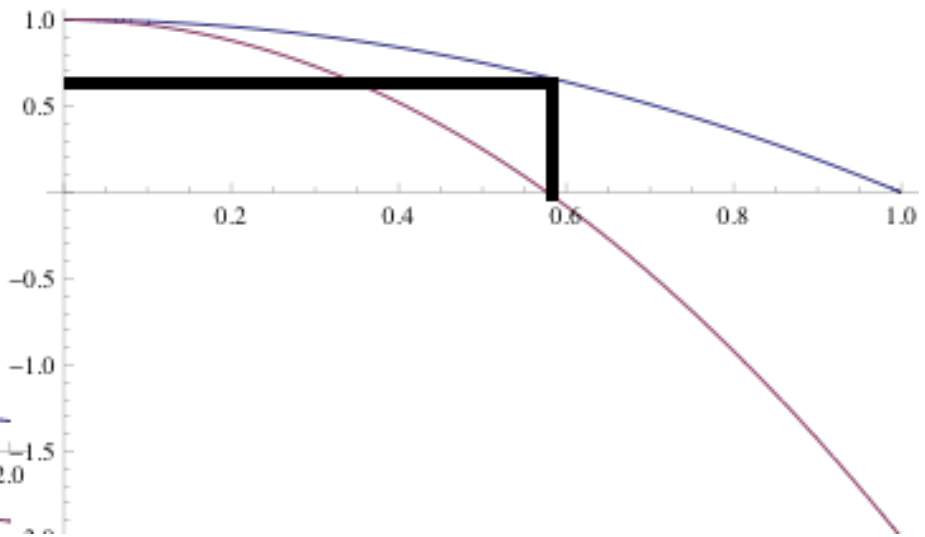
- Distortion is proportional to:
  1. The number of units you sell
     - If you are small part of industry, small impact
  2. The amount you move the price
     - If industry impact on price is small, distortion small
- Distortion proportional to "bigness", elasticity (soon)

Graphical examples of marginal revenue









Lerner's mark-up pricing rule

Another way to write MR is $P(q)\left(1-\frac{1}{\epsilon(q)}\right)$; why?

- $\epsilon = -\frac{dQ}{dp}\frac{p}{q}$ so $-\frac{1}{\epsilon} = \frac{dP}{dq}\frac{q}{p}$
- So $-\frac{P}{\epsilon} = P'q = MR - P$

$\Longrightarrow$ Marginal revenue is negative if $\epsilon < 1$

$\Longrightarrow$ Elasticity of demand determines level of prices

- Summarizes "bigness" in market, substitution to other goods

- Rearranging yields canonical formula:

Lerner's elasticity pricing rule

$$\frac{p-MC}{p} = \frac{1}{\epsilon}$$

- Can be problematic measure when price negative
  - Credit cards have market power, but negative cost

$\Longrightarrow$ Subsidies consumers to profit from merchants

- Better to use absolute mark-up $P'q$ in this case

The monopoly wedge

Monopoly raises prices above costs; two effects:

1. *Transfers* wealth from consumer to monopoly
   - Distributive problems, but no net social loss
2. *Reduces quantity* of goods consumed
   - Some generate net surplus, but don't because of price

   $\Longrightarrow$ *Deadweight loss from monopoly*
   - Monopolist raises prices on all to charge *infra-marginal*
     - If could tell who is who, price discriminate, no distortion

     $\Longrightarrow$ Monopolist doesn't like, tries to avoid with discrimination

   $\Longrightarrow$ Consumer purchases create externality, firm profits
     - Could internalize in Pigouvian manner
     - Could also mandate higher quantity, lower price
   - These solutions rarely used...why not?
     - Information problems are a major issue
     - Incentives for best products to be created

Deadweight loss from monopoly

Like any externality/tax, value of production $Mdq \equiv (p - MC)dq$

$\Longrightarrow$ Measure with standard *deadweight loss* "triangle"

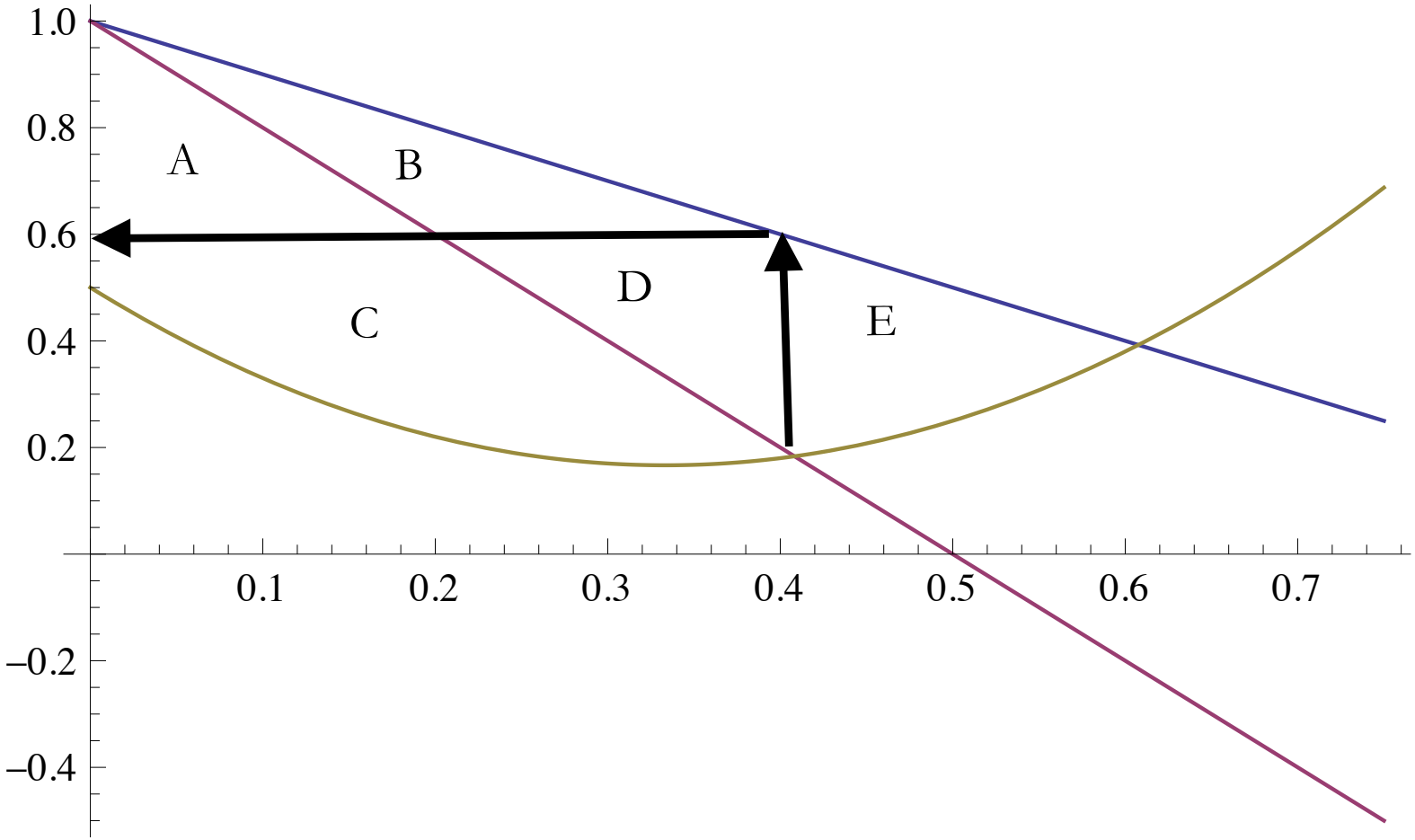
- Only difference is size determined by monopoly's optimum

$\Longrightarrow$ Particular size, relationship to monopoly profits

- We'll explore this in a bit

- Note: assumes 0 mark-up on all substitutes
  - Real formula $\left(M - \overline{M}\right) dq$, $\overline{M}$ avg mark-up switched into
  - Thus it is not really market power, but *heterogeneity* thereof
  - One firm competitive and others monopolies bad
- Sticking with standard version, measure graphically
- DWL: triangle between supply, demand, eq. quantity
- Profits: between demand or *MR* and *MC*
- *CS*: between demand and price or *MR*
- Gain from monopoly: profit square -firm half of DWL

Graphical examples of deadweight loss triangle



When does monopoly apply?

Monopoly sounds like "this is the only company"

- But basic mechanism applies to *any non-price-taker*
- More or less severe depending on size of distortion
- So when do we use monopoly v. oligopoly?
  1. Monopoly focuses on *direct effects of interventions*
     - Effects through changes in other eq. behavior ignored
     - Monopoly takes these as fixed, changes small
  2. Monopoly ignores welfare effects on other firms
     - Cannot be used to think about cross-firm externalities
     - Ignores other firms mark-ups: often overstates DWL
  3. Monopoly model cannot study changes in structure
     - Useless for topics like merger analysis, effect of competition
  4. Even with problems, many intuitions from monopoly
     - Teaches focus on elasticity: substitutes can *raise* production

$\Longrightarrow$ Focus on incentives of one firm, input to other analysis

Pass-through under monopoly v. competition

Prominent example is tax incidence, classic comparative static

- Competition: $P = MC$ so $\rho_C \equiv \frac{dp}{dt} = \frac{P'}{P' - MC'}$ or $\frac{dp}{dt} = \frac{1}{1 + \frac{\epsilon_D}{\epsilon_S}}$
- Classical incidence formula
- Under monopoly $MR = MC$ so $\rho \equiv \frac{dp}{dt} = \frac{P'}{MR' - MC'}$ or

$$\rho = \frac{1}{1 + \frac{\epsilon_D}{\epsilon_S} + \frac{\bar{\epsilon}_D}{\epsilon_D} - \frac{1}{\epsilon_S} - \frac{1}{\epsilon_D}}$$

- Always positive (bottom is second-order condition)
- $\bar{\epsilon}_D \equiv \frac{d\epsilon_D}{dp} \frac{p}{\epsilon_D}$ is *super-elasticity*: what intuitive property?
  - Curvature of demand function; new element from monopoly
  - When demand v. elastic (almost competitive) doesn't matter
  - Large the more concave demand is; negative if very convex

  $\Longrightarrow$ More convex demand has higher pass-through
    - If MR slopes up, may be infinite
    - We'll see real-world example below; meantime made-up

Pass-through and consumer surplus

Raising taxes enough eliminates market

- Thus use pass-through to trace out surplus of market
- How much does raising taxes reduce profits?
  - Envelope theorem on price, just current quantity: $\frac{d\pi}{dt} = -q$
- How much does it reduce *CS*?
  - Consumer surplus formula: $\frac{dCS}{dt} = -q\frac{dp}{dt} = -q\rho$

$\Longrightarrow$ $\frac{CS}{\pi}$ = average pass-through rate

$$\frac{CS}{\pi} = \overline{\rho} \equiv \frac{\int_{t=0}^{\bar{t}} \rho q dt}{\int_{t=0}^{\bar{t}} q dt}$$

- Similar argument under competition
- Profits fall by $1 - \rho$, so $\frac{CS}{\pi} = \frac{\overline{\rho}}{1-\overline{\rho}}$
- More general ($\lambda = 1$ competition, 0 monopoly): $\frac{CS}{\pi} = \frac{\overline{\rho}}{1-\lambda\overline{\rho}}$

Pass-through and price strategic effects

Pass-through also determines response to demand; why?

- Subsidy s to consumers: *demand pass-through* $\rho_d \equiv \frac{dP}{ds}$
- Consumer subsidy and producer tax of \$1 has no effect
  - If firm raises price \$1, everything exactly the same
  - Fundamental result on neutrality of physical incidence

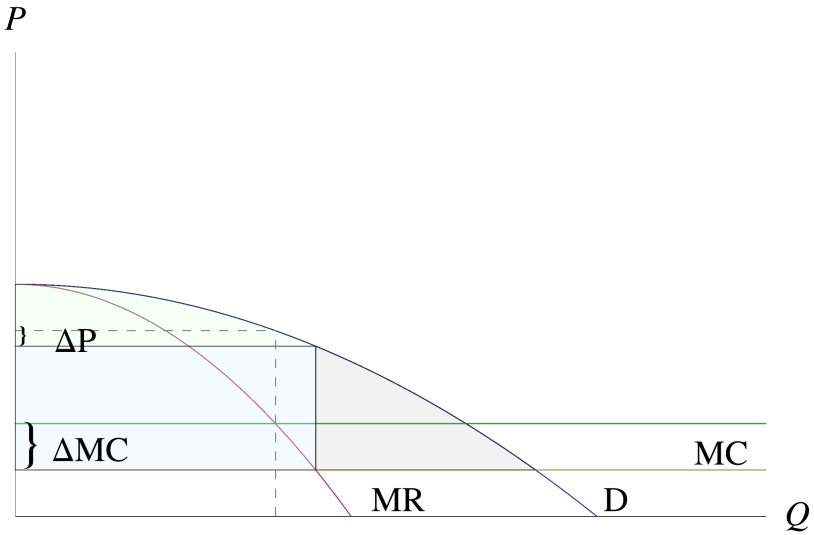
$\Longrightarrow$ Quantity does not change, price rises by \$1

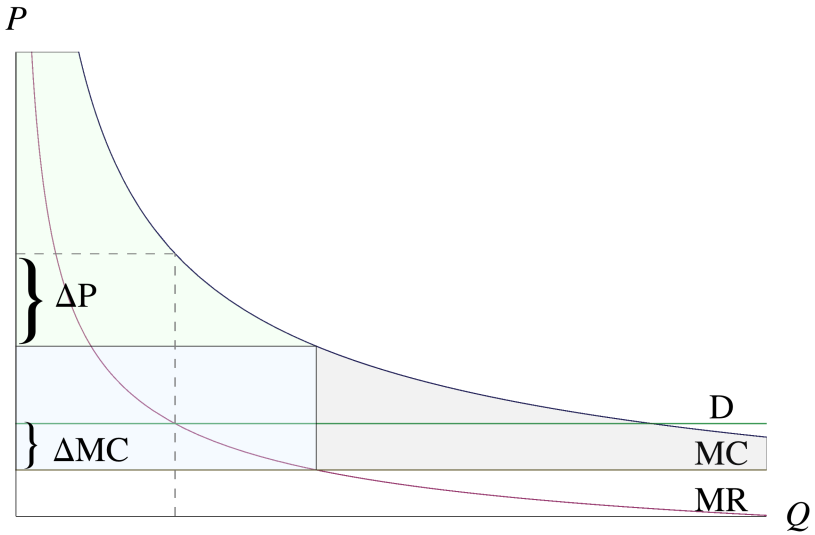
Theorem

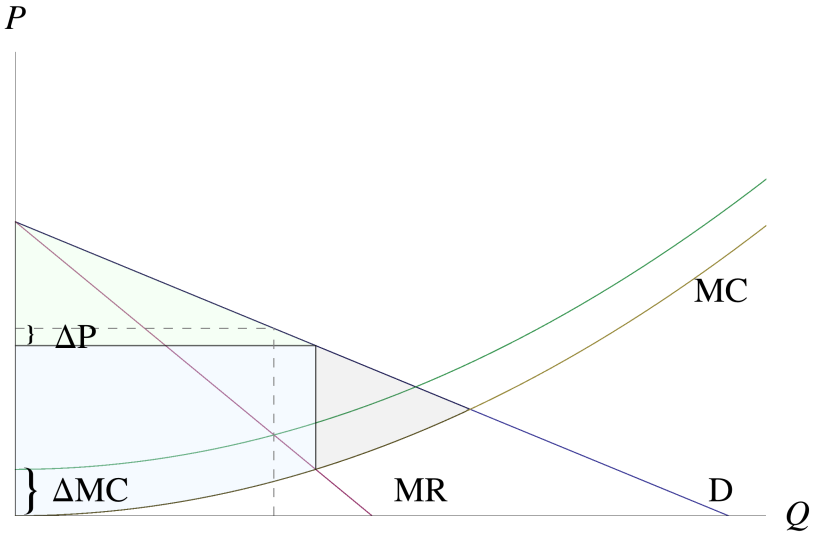
$$\rho + \rho_d = 1$$

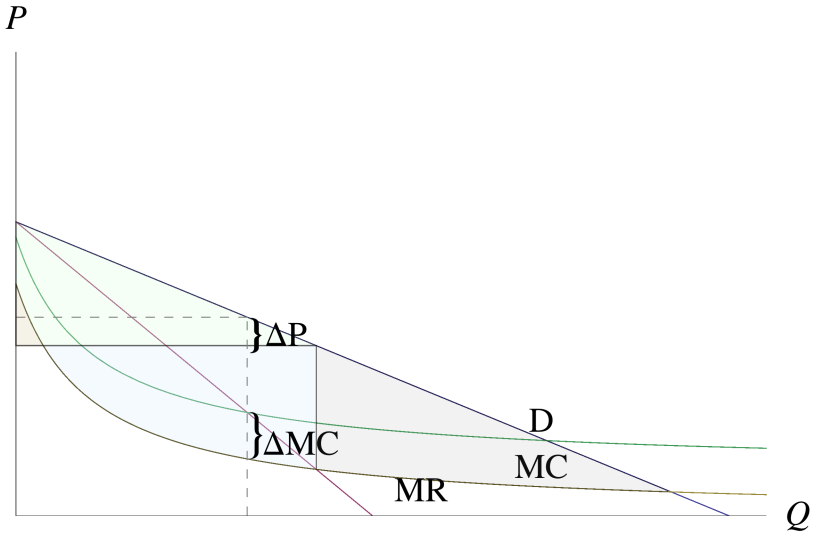
- $\rho > 0$, but may be > 1 so ρ_d may be negative
  - May seem counter-intuitive, but monopolist follows demand
- Tight link to strategic complements v. substitutes in prices
  - Others changing prices shifts willingness to pay
  - Direct with perfect complements

Graphical representation of pass-through results









Einav et al. (2011) analysis of seller experiments

Easy to measure demand curves on internet

- Einav et al. collect data from seller experiments on EBay
  - Many seller try identical items at different prices
  - Trying to figure out what price to charge, terms to use
  - Just like they should do to learn
- Use to construct "demand curve" in auctions?
  - Higher reserve price set $\Longrightarrow$ higher price if sale
    - If higher than bid of second highest, raises price
  - Also reduces probability of sale
    - If no one bids above, no sale occurs

  $\Longrightarrow$ Just like a demand curve
    - Draw out average price, probability of sale relationship
    - Marginal cost always constant (probability of sale)
  - Basic shape very similar across products
    - Interestingly, has non-montone MR, requires ironing

Einav et al. data