Elements of Microeconomics Lecture 6

Elasticity, Taxation, and Welfare

Qingyang Han



Roadmap

- Elasticity
- Taxation
 - Unit tax
 - Ad valorem tax
 - Lump sum tax
- Tax incidence
- Tax rate and tax revenue (Laffer curve)
- Welfare analysis of taxation



- It measures the responsiveness of quantity demanded to a change in price
 - If Johns Hopkins increases its undergraduate tuition by 10%, what will be the percentage change of its enrollment?
 - Will Johns Hopkins earn higher or lower total revenue after the price change?

• The demand curve faced by Johns Hopkins



- The demand curve faced by Johns Hopkins
- Total revenue = $P \times Q$



- The demand curve faced by Johns Hopkins
- Total revenue = $P \times Q$
- \bullet Now, price increases by $\Delta P,$ and as a result, quantity demanded decreases by ΔQ
- New revenue = $(P + \Delta P)(Q \Delta Q)$



- A little bit math
- New revenue



• If $\frac{\Delta P}{P}$ and $\frac{\Delta Q}{Q}$ are very small, we could ignore the last term



• New revenue
$$= PQ(1 + \frac{\Delta P}{P} - \frac{\Delta P}{P})$$

- of price is larger, or the percentage change of quantity demanded is larger
- The price elasticity of demand

$$E_D = \left| \frac{\Delta Q/Q}{\Delta P/P} \right| = \frac{\text{The percent}}{\text{The percent}}$$

Whether the new revenue becomes lower or higher depends on whether the percentage change

ntage change of quantity demanded

e percentage change of price

• The price elasticity of demand

$$E_D = \left| \frac{\Delta Q/Q}{\Delta P/P} \right| = \frac{\text{The pe}}{\Delta P/P}$$

- If $E_D > 1$, demand is elastic, revenue will decrease when price increases
- If $E_D < 1$, demand is inelastic, revenue will increase when price increases
- If $E_D = 1$, demand is of unit elasticity, revenue will not change when price increases

ercentage change of quantity demanded

The percentage change of price

• The price elasticity of demand

$$E_D = \left| \frac{\Delta Q/Q}{\Delta P/P} \right| = \frac{\text{The pe}}{\Delta P/P}$$

Consumers are very sensitive to price change • If $E_D > 1$, demand is elastic revenue will decrease when price increases

- If $E_D < 1$, demand is inelastic, revenue will increase when price increases
- If $E_D = 1$, demand is of unit elasticity, revenue will not change when price increases

ercentage change of quantity demanded

The percentage change of price

The price elasticity of demand

$$E_D = \left| \frac{\Delta Q/Q}{\Delta P/P} \right| = \frac{\text{The period}}{\Delta P/P}$$

• If $E_D > 1$, demand is elastic, revenue will decrease when price increases

- If $E_D < 1$, demand is inelastic, revenue will increase when price increases
- If $E_D = 1$, demand is of unit elasticity, revenue will not change when price increases

ercentage change of quantity demanded

The percentage change of price

















Elasticity vs. Slope



Elasticity vs. Slope



• Elasticity \neq slope

Every point on the demand curve has the same slope

• Elasticity is point-specific

• For the same point on the demand curve, if the slope at that point becomes steeper, then the elasticity at that point decreases

Special Case: Perfectly Inelastic Demand



• Consumers do not respond to price change

Special Case: Perfectly Elastic Demand



• Consumers respond to price change infinitely

- At any price above P^* , quantity demanded is 0
- At price P^* , consumers will buy any quantity
- ullet At any price below P^* , quantity demanded is infinity
- Example: a very small shop selling a homogeneous good

Special Case: Unit Elasticity



 \bullet Total revenue PQ is always a constant

What factors affect the price elasticity of demand?

- Availability of close substitutes
 - iPhone vs. Android phones
- Necessities or luxuries?

...

• When price of staple food increases, you still have to buy it



Other elasticities

• Income elasticity

$$E_I = \frac{\Delta Q/Q}{\Delta I/I} = \frac{\text{The pe}}{\Delta I/I}$$

- $E_I < 0$: inferior good
- $E_I > 0$: normal good
 - $E_I < 1$: necessity good
 - $E_I > 1$: luxury good

ercentage change of quantity demanded

The percentage change of income

Other elasticities

• Price elasticity of supply

$$E_S = \frac{\Delta Q^S / Q^S}{\Delta P / P} = ---$$

- Short term: inelastic
 - It is difficult for a firm to expand its capital and labor in a short time period
- Long term: elastic

percentage change of quantity supplied

The percentage change of income

Other elasticities

• Cross-price elasticity of demand

$$E_{ab} = \frac{\Delta Q_b / Q_b}{\Delta P_a / P_a} = \frac{The \ perturbative}{\Delta P_a / P_a}$$



ercentage change of quantity demanded of Good b

The percentage change of price of Good a

Taxation

- How does taxation affect market outcomes?
- Tax the consumers or tax the producers?
- What kind of tax?
 - Unit tax
 - Ad valorem tax
 - Lump sum tax
- How much tax to collect?

Taxing the Consumers; Unit Tax

- The government taxes the consumers *t* dollars per unit
- At each given quantity, the consumers' willingness-to-pay decreases by *t*
- The demand curve moves downward by t





Taxing the Consumers; Unit Tax

- The government taxes the consumers *t* dollars per unit
- At each given quantity, the consumers' willingness-to-pay decreases by *t*
- The demand curve moves downward by t
- $\bullet \ P_d$: the actual price paid by the consumer
- P_s : the actual price charged by the producer



Taxing the Consumers; Unit Tax

- Unit tax inserted a "wedge" between the supply curve and the demand curve
- Consumers now pays a higher price
- Producers now charges a lower price
- The price gap = t
- Equilibrium quantity decreased



Taxing the Producers vs. Taxing the consumers







Taxing the Producers vs. Taxing the consumers





Taxing the Producers; Ad valorem Tax

- Tax amount based on the value of transaction
- \bullet Tax rate is τ
- \bullet Producers' marginal cost increased by τ
- Supply curve rotates upward
- Same effect as the unit tax



Welfare Analysis

- Without tax
 - Consume surplus
 - Producer surplus



Welfare Analysis

- With unit tax charging consumers
 - Consumer surplus decreases
 - Producer surplus decreases
 - Government gained tax revenue
 - Deadweight loss
- Total welfare decreases because the market failed to reach the optimal quantity



- Tax incidence: the division of the tax burden between buyers and sellers
- Consumers burden $(P_d P_1)Q_2$
- Producers burden $(P_1 P_s)Q_2$



- What happens if the demand becomes more inelastic?
- Consumers burden $(P_d P_1)Q_2$
- Producers burden $(P_1 P_s)Q_2$



- What happens if the demand becomes more inelastic?
- Consumers burden $(P_d P_1)Q_2$
- Producers burden $(P_1 P_s)Q_2$
- Two findings:
 - Consumers now burden a larger share of tax
 - Equilibrium quantity increases, and therefore deadweight loss decreases



- What happens if the demand becomes perfectly inelastic?
- Consumers burden $(P_d P_1)Q_2$
- Findings:
 - Consumers now takes up all the tax burden
 - Equilibrium quantity remains the same as without tax
 - No deadweight loss!





Tax Incidence: Remarks

thus reducing the equilibrium quantity

Either the supply or the demand side becomes more inelastic

- welfare loss
- Which side takes up a larger tax burden? The more inelastic side. The more need to burden more.

• Why tax results in welfare loss? It either lowers the WTP or increases the MC,

 Quantity reduction
caused by tax
becomes smaller -> Less welfare loss

• If the demand curve is perfectly inelastic, consumers do not respond to price change (tax) at all, so the equilibrium quantity does not change and there is no

inelastic side is less willing to cut their quantity by a lot, and as a result they

Lump sum tax

- Lump sum tax is a head tax
- Does not depend on the volume of transaction
- It does not change WTP or the MC
- It does not change the market outcomes
- It does not result in welfare loss
- But why lump sum tax is rarely used?

Tax Rate and Tax Revenue

• When tax rate *t* increases, will the government collect more tax?



Tax Rate and Tax Revenue

• When tax rate *t* increases, will the government collect more tax?



Tax Rate and Tax Revenue

• When tax rate *t* increases, will the government collect more tax?



The Laffer Curve





The Laffer Curve





Roadmap

• Elasticity \bigstar

- Taxation
 - Unit tax ★
 - Ad valorem tax
 - Lump sum tax
- Tax incidence ★
- Tax rate and tax revenue (Laffer curve)
- Welfare analysis of taxation \star



Subsidy: similar analysis

