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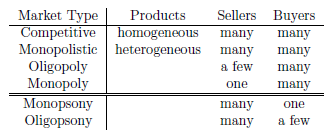
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# Chapter 1 Overview

1. Types of markets



1. CPI = total spending on a market basket of goods
2. Inflation rate = CPI(current year) / CPI(base year)
3. Real price = Nominal price(current year)/inflation rate(base year to current year)
4. Positive analysis: the relationship of cause and effect (explanation, prediction).

Normative analysis: analysis on what ought to be (value judgements)

# Chapter 2 Supply and Demand

1. Demand and supply curves: usually price on y-axis, quantity on x-axis.
2. Change in price causes movement along the supply/demand curve; change in something other than price (e.g., production cost, income) causes shift of supply/demand curve.
3. Substitutes: increase in price of A leads to increase in demand of B. (chicken and pork)

Complements: increase in price of A leads to decrease in demand of B. (pasta and pasta sauce)

1. Surplus and shortage.

# Chapter 3 Elasticities of Demand

1. Price elasticity of demand:
2. Properties of price elasticity of demand
   1. Usually negative: when price increase, demand decreases
   2. When , the good is price elastic; when , the good is price inelastic.
   3. When , the total consumer expenditure= is maximized.
3. Income elasticity of demand

It is usually positive.

1. Cross price elasticity: measures the %change in quantity demand of resulting from %change in price of
   1. If y is a substitute of x, the cross price elasticity is positive
   2. If y is a complement of x, the cross price elasticity is negative
2. Elasticity over short run versus long run
   1. Consumption goods: in the short run, people have to buy them for daily life; but in the long run, people may change habits in face of high price. Therefore, consumption goods are more elastic in the long run.
   2. Durable goods: consider cars. In the short run, if price of cars increases, people might use current car longer; but in the long run, people have to replace their cars. So durable cars are more elastic in the short run.

# Lecture 4 Price Elasticity of Supply; Consumer Preferences

1. Price elasticity of supply:

Supply is more elastic in the long run, because when price increases, firms have to hire workers and buy machines, and cannot start increase production immediately.

1. Assumption for preferences:
   1. Completeness: can always rank any basket of goods
   2. Transitivity: and implies
   3. Non-satiation: more is better
   4. Convexity: given two different points A, B (), we have .
2. Properties of indifference curves:
   1. Download sloping: from the non-satiation assumption
   2. Two indifference curves cannot cross: from non-satiation and transitivity
   3. Shape: convex
3. Marginal rate of substitution (MRS): how many units of one is willing to give up to get one more unit of .
4. Perfect substitution: MRS is constant. One unit of X always substitutes constant units of Y.

Perfect complements: Indifference curves are shaped as right angles (e.g., left and right shoes).

# Lecture 5-6 Utility, MRS, Optimization with Budget Constraint

1. Examples of utility function:
   1. Perfect substitutes:
   2. Perfect complements:
   3. Cobb-Douglas function:
2. Derivation of MRS from utility function:

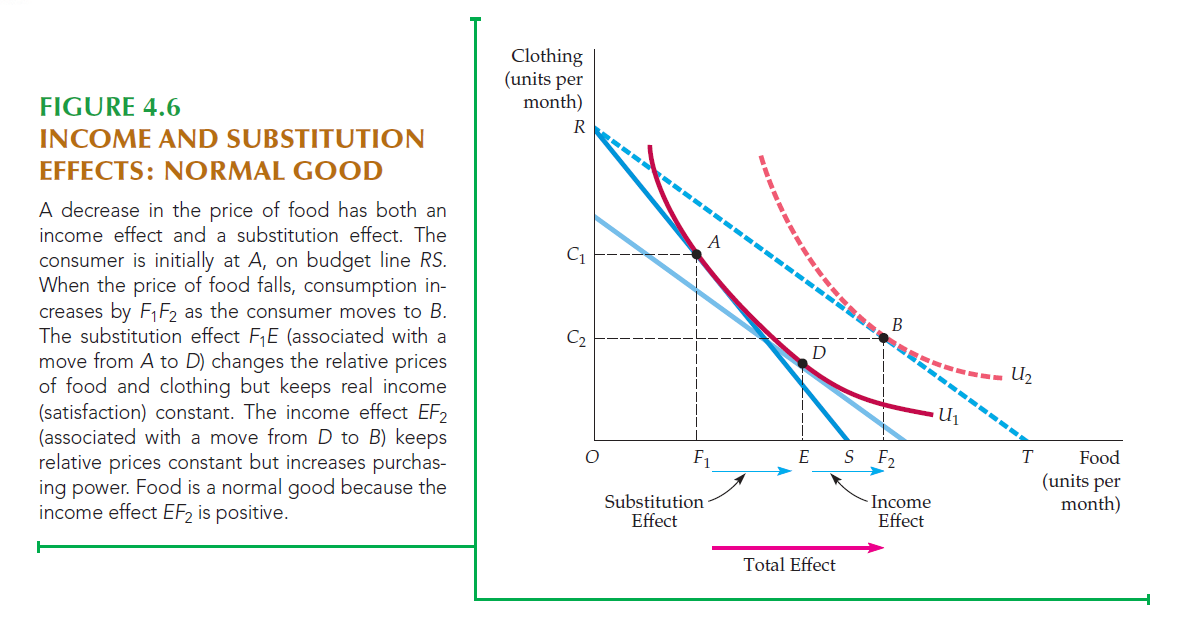
Thus

1. Optimize utility subject to budget constraint
   1. Interior solution (): Lagrange multiplier. must have a solution for .
   2. Corner solution (or : has no solution for . If , then we do not want to consume y, and the solution is at ; If , then we do not want to consume x, and the solution is at .
2. Normal good: quantity demanded increases with income.

Inferior good: quantity demanded decrease with income.

# Lecture 7 Substitution and Income Effect, Market Demand, Consumer Surplus

1. Substitution effect and income effect: when the price of a good changes, the change in quantity demanded can be divided into two parts:
   1. Substitution effect: As the relative price changes, people will increase the demand for the good that becomes relatively cheaper (vice versa), while keep the utility level constant.
   2. Income effect: As the price changes, the purchasing power changes, people will be able to consume a different amount of goods, while keep the relative price constant.



1. Direction of substitution effect and income effect:
   1. Under the convex indifference curve assumption, substitution effect will always lead to an increase in the quantity demanded with a decline in price.
   2. The direction of income effect can be in either way.
2. When price decreases:
   1. Normal good: both substitution effect and income effect increase its quantity
   2. Inferior good: substitution effect increases quantity, but income effect decreases quantity
   3. Giffen good: a special case of inferior good. The magnitude of income effect is larger than substitution effect, and thus it has an upward demand curve.
3. Market demand = sum of demand for all individuals
4. Consumer surplus = total willingness to pay – total expenditure

# Lecture 9 Risk Preference, Risk Premium

1. Risk averse: given the same expected payoff, prefer the less risky one. Diminishing marginal utility of income. , e.g., .

Risk neutral: given the same expected payoff, indifferent about risk. Linear marginal utility of income. , e.g., .

Risk seeking: given the same expected payoff, prefer the riskier one. Increasing marginal utility of income. , e.g., .

1. For a risk-averse person, the maximum amount of (expected value of) money he would pay to avoid taking a risk is called risk premium.

# Lecture 10 Insurance, Production Function

1. Insurance premium: if the insurance premium is equal to the expected loss, then a risk-averse person will buy the insurance, since the insurance can make the risk smaller. Therefore, insurance company can charge an insurance premium that is higher than the expected loss.

On the other hand, the insurance company can diversify the risk when the number of insurance buyers is large.

1. Production function: , where is output, is capital, is labor.
2. It’s easier to change labor level but not to change capital in a short time.

# Lecture 11 Production Functions

1. In the short run, is constant, so is function of only.
   1. Average product of labor:
   2. Marginal product of labor:
   3. When , is maximized.
   4. When , is maximized.
2. In the long run, both and are variables.
   1. Isoquants: curves showing all possible combinations of and that yield the same .
   2. Marginal rate of technical substitutions:

# Lecture 12 Production Functions and Cost of Production

1. Increasing return to scale: . One big firm is more efficient than many small firms.

Constant return to scale: . One big firm is as efficient as many small firms.

Decreasing return to scale: . One big firm is as efficient as many small firms.

1. Cobb-Douglas:
   1. If , increasing return to scale
   2. If , constant return to scale
   3. If , decreasing return to scale
2. Accounting cost: actual expenses + depreciation

Economic cost: opportunity cost, the most valuable forgone alternative

# Lecture 13 Cost Functions

1. Production cost can be decomposed in two ways:
   1. Labor and capital:
   2. Fixed and variable cost:
2. Short run cost function: in the short run, capital is constant.
   1. Average total cost
   2. Average variable cost
   3. Marginal cost
   4. When , is minimized.

When , is minimized.

It means intersects with at their minimum level.

1. Long run cost function: in the long run, both and are variable. To find the optimal allocation of K and L given a fixed cost, we need to find the tangent point of cost equation and production function:

Cost: , slope is

Production: slope is

So solves the optimal allocation of and .

1. As cost changes, the optimal and also change, and the relationship of optimal and is called “expansion path”.

# Lecture 14 Cost of Production and Profit Maximization

1. Long run cost short run cost, because short run is a “constrained” optimization version of long run.
2. Economies of scope: if the firm produces two types of products that are closely linked, the cost is lower than if producing separately.

If , it’s economies of scope; if , it’s diseconomies of scope.

# Lecture 15 Short Run and Long Run Supply

1. In a perfect competition market, profit , where is price, and is cost. Profit maximization leads to .
2. is the condition that maximizes profit. However, the maximized profit may still be lower than 0, or even lower than shut down.

If the firm decides to produce, it will produce at ; otherwise it will shut down.

* 1. When , the firm makes profit; when , the firm has loss.
  2. When , the firm still produces; when , the firm shuts down.

Note: when , the firm produces but has loss.

1. Producer Surplus = Revenue – Total Variable Cost

# Lecture 16 Long Run Supply and Analysis of Competitive Markets

1. Long run competitive equilibrium: In the short run, when market price P is high, the firms will produce until , and , where is short run marginal cost, is short run average total cost. The existing firms are making profits, so old firms expand and new firms enter, which lead to price decreasing. The price will decrease until , so that firms have no economic profit.
2. In a constant-cost Industry, the prices of some or all inputs to production does not change as the industry expands and the demand for the inputs grows.

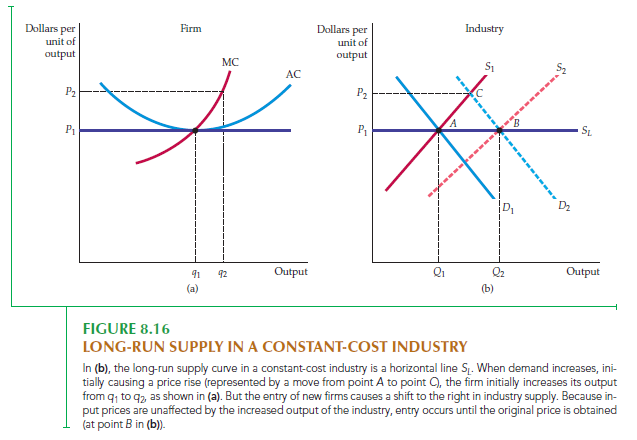
In an increasing-cost industry, the prices of some or all inputs to production increase as the industry expands and the demand for the inputs grows.

In a decreasing-cost industry, the prices of some or all inputs to production increase as the industry expands and the demand for the inputs grows.

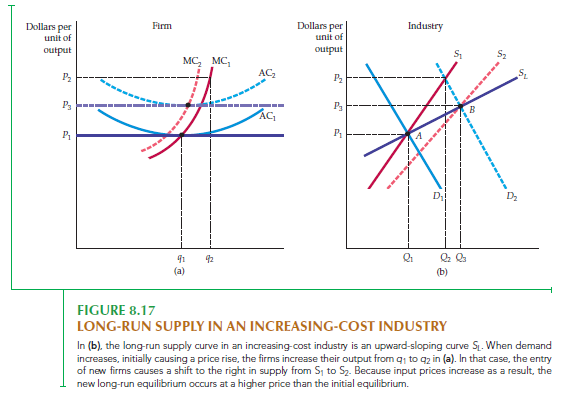
1. The primary reason for the constant cost is that industry demand for the accompanying raw materials is much lower than the overall demand for these raw materials.

The fundamental reason for the increased cost in increasing cost industry is that industry demand for raw materials accounts for a substantial portion of overall raw materials demand.

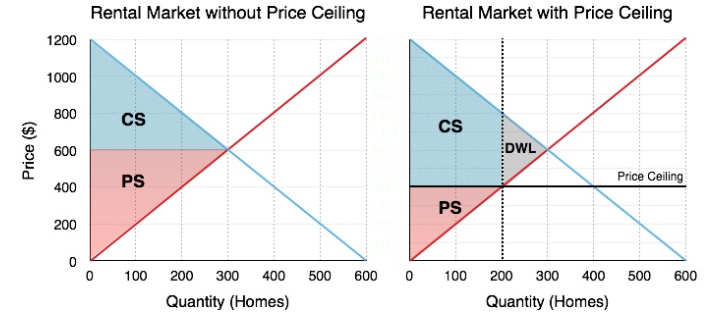
1. Long run market supply with constant cost: if price is higher than the minimum , then existing firms are earning positive economic profit, and new firms will keep entering. Thus supply will increase and thus it drives the price down, until price is back to the minimum again. Therefore, long run supply is a horizontal line at the price of minimum LAC.

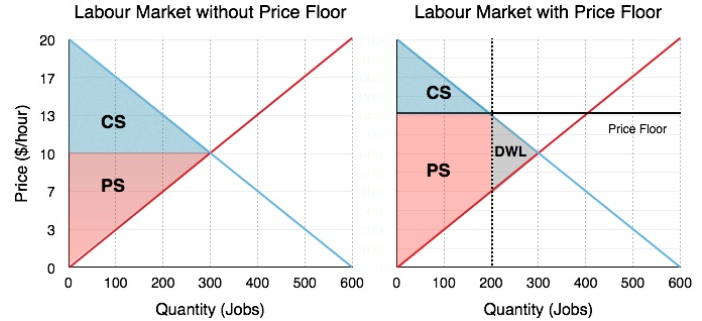


1. Long run market supply with increasing cost: if price is higher than the minimum , then existing firms are earning positive economic profit, and new firms will keep entering. Then and will increase, and the minimum will be higher. The supply will increase, and market price will move to the new minimum LAC. Therefore, the new equilibrium will have a higher price and higher quantity. So the supply curve is upward sloping.

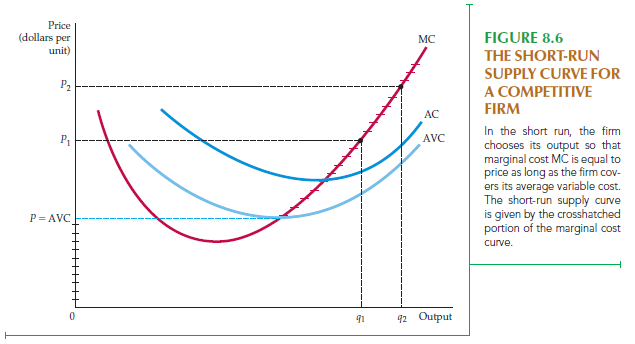


1. Long run market supply with decreasing cost: similarly, the supply curve is downward sloping.
2. Consumer/Producer surplus impacted by price ceiling/floor

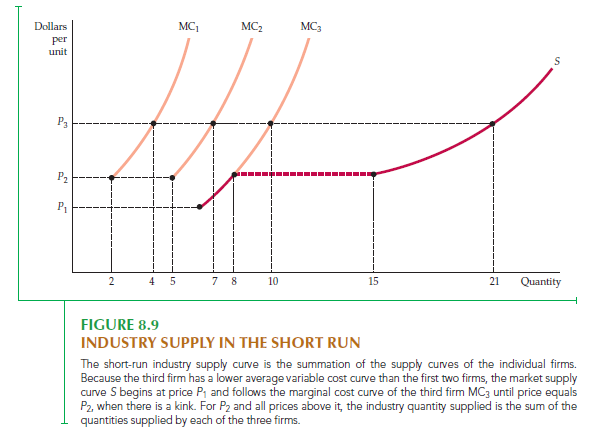




1. Deadweight loss
2. Summary on supply curves in competitive market
   1. Short run supply curve on firm level: the firm will produce to the point where price equals marginal cost, but will shut down if price is below average variable cost. Therefore, the firm’s supply curve is the portion of marginal cost curve where



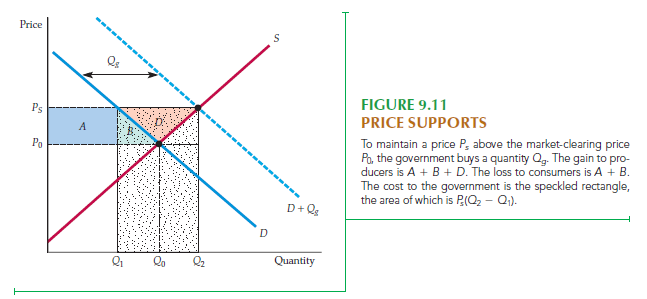
* 1. Short run supply curve on market level: the market supply curve can be obtained by adding the supply curve of individual firms.



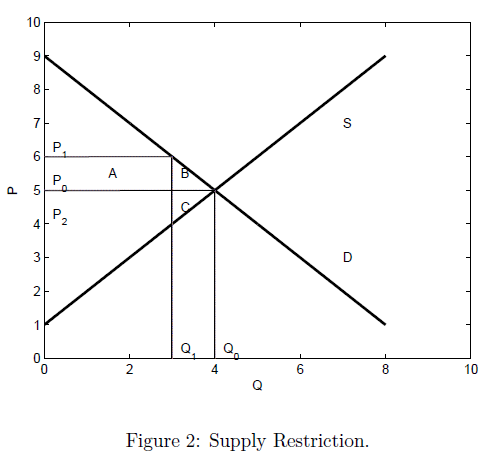
* 1. Long run supply curve on firm level: the firm will produce at where price equals long term marginal cost; price will move to lowest ATC, and each firm produce at long term marginal cost = price = lowest ATC
  2. Long run supply curve on market level: constant/increasing/decreasing cost industry

# Lecture 17 Supply Restrictions, Tax, and Subsidy

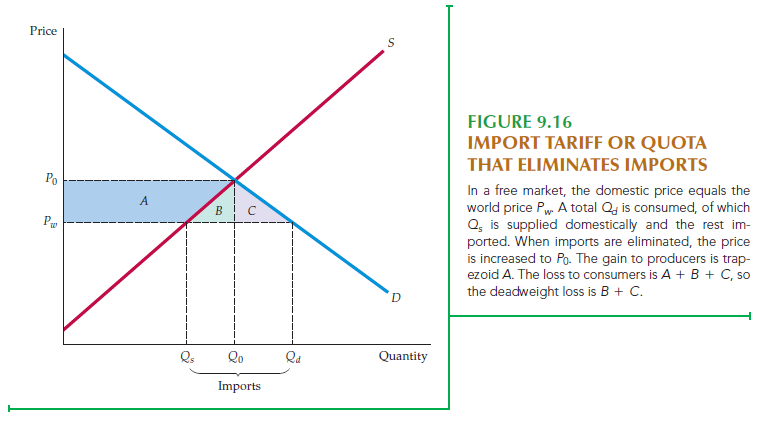
1. (Agriculture) price support: the government sets a price higher than the market equilibrium price, and buys excess supply. Consumers loss, producers gain, and government pays a cost. The total change in welfare is



1. Supply restriction: if the government restricts the quantity supplied to be , then

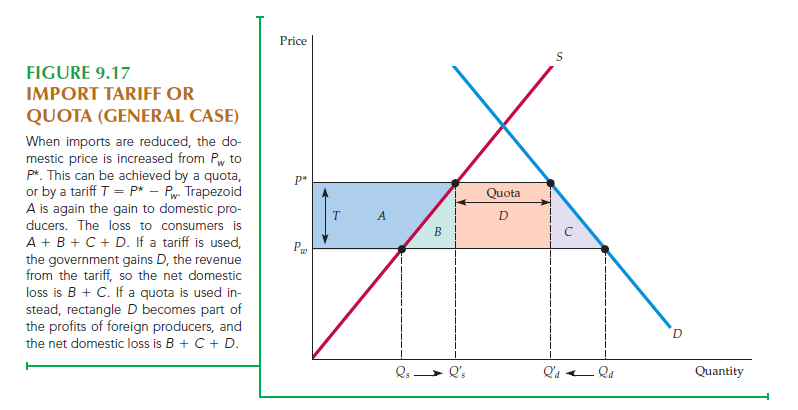


1. Zero quota (on import): world price is lower than the domestic price . In a free market, the price is , and total quantity consumed is , of which is supplied domestically and rest imported. If no import is allowed, the price is and quantity is . The impact of import restriction (compared to free market) is:



1. Non-zero quota (on import): if the government sets a non-zero quota , then the domestic price is where the difference between domestic demand and domestic supply equals . Then:

The foreign producer surplus increases by

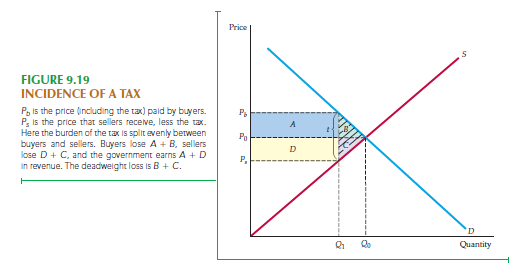


1. Import tariff: similar to non-zero quota, but the restriction is not set by quota, but charging a tariff of .

The government has profit of (where in non-zero quota, this is the surplus of foreign producers.)

# Lecture 18 Tax, Subsidy and General Equilibrium

1. The quantity after tax is where the price paid by consumers and received by producers differ by the tax amount.



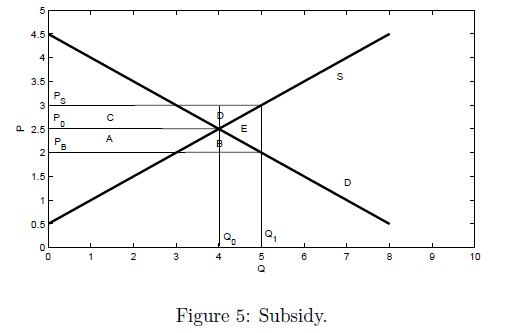
1. Whether the tax is imposed on consumer or producer does not make a difference in the final price paid by consumers/received by producers.

The relative amount borne by consumers and producers depends on relative elasticities of demand and supply, not on whom the government imposes tax.

The party with inelastic quantity bears more relative amount of tax.

1. Subsidy is the “opposite” of tax, sellers receive more than buyers pay.

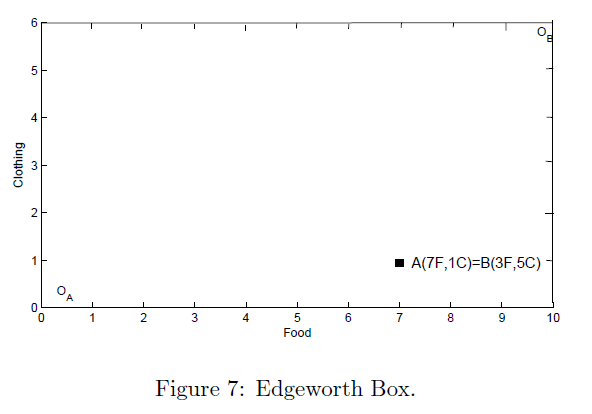
The benefit of subsidy goes more to the more inelastic party.



1. So far, our analysis is mainly partial equilibrium, i.e., ignore effect from other markets like substitutions and complements.

In contrast, general equilibrium considers feedback effect of other markets, i.e., the price/quantity adjustment caused by other related markets.

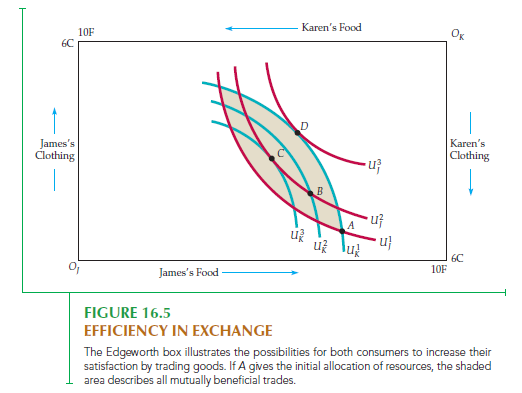
1. Edgeworth box. Interpretation: A has 7 foods and 1 cloth (read from in lower left corner); B has 3 foods and 5 clothes (read from from upper right corner).



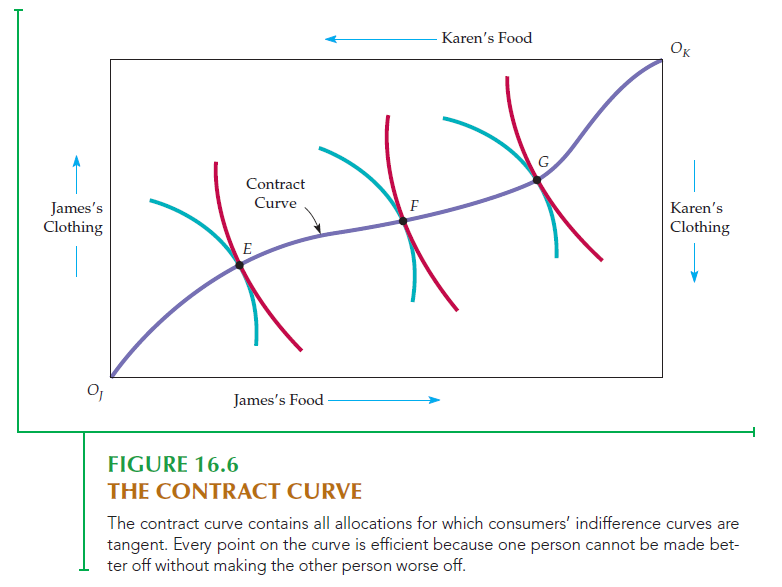
# Lecture 19 Efficiency in Exchange, Equity and Efficiency, and Efficiency in Production

1. Suppose the initial state is A, where the indifference curve of and intersects. Then all points in the shaded area between and will make both persons better off.

At points and , the MRS of both people are identical (since the indifference curves are tangent). Both and are an efficient allocation.



1. Contract curve: all possible efficient allocations of food and clothing, i.e., all points of tangency between James’s and Karen’s indifference curves.



1. General equilibrium in a competitive market: suppose there are 2 consumers A and B, and 2 goods X and Y in the market. Each consumer has an initial amount of X and Y respectively, and each consumer has a utility function. Assume the total amount of X and Y in the market equals the sum of initial amount held by A and B.

The equilibrium state has 5 unknowns: , with 6 equations (here is the relatively price of Y when we assume price of X is 1):

* Utility maximization for A and B: ,
* Total amount of goods: ,
* Budget: ,

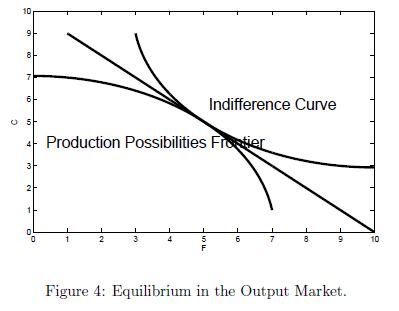
Here one of the equations is redundant, and thus we can solve the general equilibrium.

1. Utility possibilities frontier: the utility levels when two individuals have reached the contract curve.
2. Production in Edgeworth box: the x and y axis are labor and capital, and indifference curve is the output.

# Lecture 20 Production Possibility Frontier and Output Market Efficiency

1. Marginal rate of transformation (MRT) of food for clothing: how much clothing must be given up to produce one more unit of food.
2. , where is the marginal cost of producing food, and is the marginal cost of producing clothing.
3. The production possibilities frontier shows the various combinations of food and clothing that can be produced with fixed inputs of labor and capital, holding technology constant.
4. Output market efficiency: a Pareto efficient result occurs when production possibilities frontier is tangent to indifference curve, i.e.,

The reason is: (1)(2) by profit maximization, ; (3) consumers maximize utility:

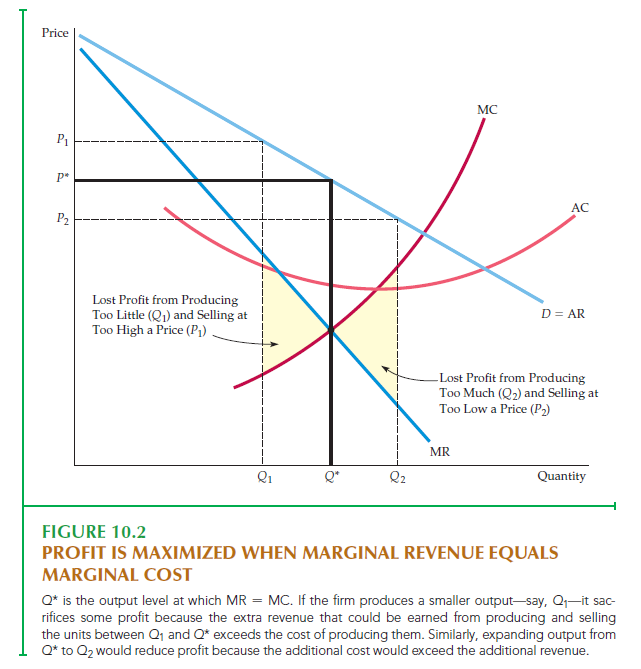


# Lecture 21 Why Markets Fail

1. Market power: e.g., monopoly power
2. Incomplete information
3. Externalities: Consumption or production has indirect effect on other consumption or production, which is not reflected in market prices. E.g., pollution.
4. Public goods: e.g., no patent protection.

# Lecture 22 Monopoly

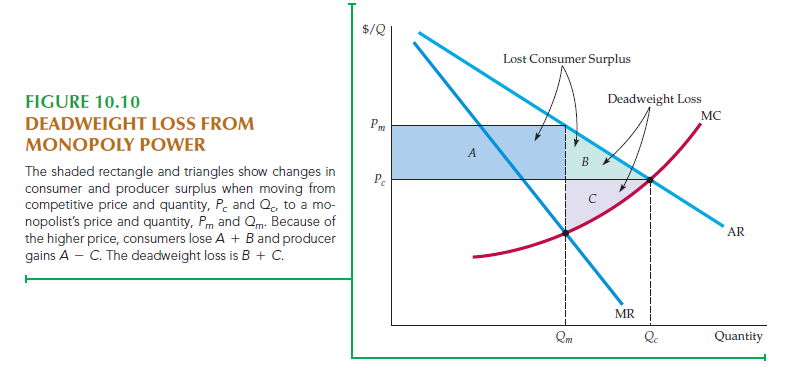
1. In perfect competition, long run market price is the lowest average total cost, and firms are price takers.
2. In contrast, monopolist only takes market demand curve, but its supply can affect the market price.
3. Profit maximization in monopoly: still applies. The difference between competitive market and monopoly is: (1) in competitive market, gives not only the quantity produced, but also the firm have to take price (2) in monopoly, only gives the quantity produced. The price is determined by the market demand curve, and



1. In monopoly, average revenue (AR) is the same as the market demand curve.
2. Lerner’s index: measures the monopoly power of a firm.
   1. In a competitive market, Lerner’s index = 0
   2. In a monopolistic market, Lerner’s index > 0
   3. . Lerner’s index is the inverse of the demand elasticity. Proof: so
   4. The larger the demand elasticity, the smaller Lerner’s index is, and thus the monopolist is less profitable.
3. A monopolistic market has no supply curve. The reason is, when demand shifts, we do not know how marginal revenue shifts (is it the correct explnation?). When demands shifts, it may be the case that only price changes, only quantity changes, or both change. So there is no one-to-one relationship between price and quantity produced.
4. Effect of tax: in competitive markets, the tax is shared by producers and consumers; but in monopolistic markets, the price may raise more than tax.

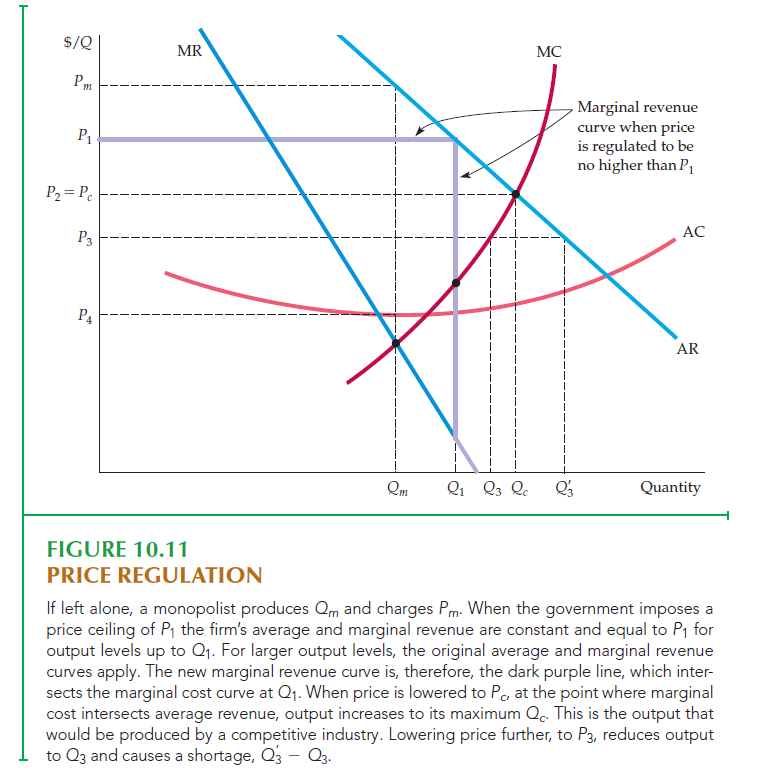
# Lecture 23 Monopoly and Monopsony

1. Multi­-plant firm: it will produce at
2. Social cost of monopoly power:



Compared to competitive market, the monopoly market has

1. Rent seeking: Spending money in socially unproductive efforts to acquire, maintain, or exercise monopoly.
2. Price regulation in monopoly market:



In the chart, the price and production quantity is for competitive market, and in monopoly market.

When the government has price regulation, i.e., has a price ceiling, the AR curve will be capped at the ceiling, i.e., . And the MR curve is derived from , which is the purple line in the chart. The price and production quantity will still be the intersection of . Following this logic, we can analyze the effect of price regulation in monopoly market.

* 1. If the regulation price is , then price = , quantity = . Compared to monopoly without regulation, quantity increases and deadweight loss decreases.
  2. If the regulation price is , then price = , quantity = . Compared to monopoly without regulation, quantity increases and deadweight loss is eliminated. It reaches the same state as competitive market.
  3. If regulation price where is the lowest AC, then the effect is the same as imposing a ceiling in a competitive market.
  4. If regulation price, then the firm will quit the market.

1. In a competitive market, price regulation always results in a deadweight loss; however, in a monopoly market, price regulation may eliminate the deadweight loss resulting from monopoly power.

# Lecture 24 Monopoly and Monopsony

1. Monopsony: there is a single buyer. Resulting in lower quantity and lower price.
2. Factors affecting monopoly power:
   1. Elasticity of market demand: the less elastic its demand curve, the more monopoly power a firm has.
   2. Number of firms in market: with more firms, the monopoly power is less
   3. Interaction among firms: if firms collude, they will have more market power.
3. Price discrimination
   1. First degree: charges a separate price to each customer. It is used when knowing each consumer’s identity and willingness to pay.
   2. Second degree: charges a different price for different quantity purchased. It applies to the situation when consumers are heterogeneous and the seller cannot tell their identity, and consumers have multiple unit demand.
   3. Third degree: dividing consumers into two or more groups with separate demand curves and charging different prices to each group.

# Lecture 25-26 Pricing with Market Power; Monopolistic Competition

1. Peak-load pricing: charge higher prices during peak hours.
2. Two-part tariff: charge both an entry(T) and usage(P) fee.
3. Bundling: packaging two or more products.
4. Monopolistic competition:
   1. there are many firms;
   2. there is free entry and exit;
   3. products are differentiated but close substitutes.
5. In monopolistic competition:
   1. each firm faces a distinct demand, which is download sloping
   2. there is no profit in long run.
   3. price is higher than marginal cost because firms have some monopoly power, and thus there is some deadweight loss.

# Lecture 27-28 Game Theory and Oligopoly

1. Dominant strategy is the optimal strategy no matter what the opponent does.
2. When all players play dominant strategies, we call it equilibrium in dominant strategy.
3. Nash equilibrium is a set of strategies such that each player is doing the best given the actions of its opponents. There could be multiple Nash equilibriums in a game.
4. Oligopoly: Small number of firms, and production differentiation may exist.
5. Different oligopoly models:
   1. Cournot model: firms produce the same good, and choose the production quantity simultaneously.
   2. Stackelberg model: firms produce the same good, and choose the production quantity sequentially.
   3. Bertrand model: firms produce the same good, and hey choose the price.
6. Cournot model

Market demand , two firms . Each firm wants to maximize its revenue. , so gives . Similarly, Therefore, at equilibrium.

1. Stackelberg model

Using the same example above, but firm 1 chooses first, and then firm 2 chooses . We solve the sequential decision using backward induction. The optimal quantity for firm 2 is . Then . So , and the optimal solution for firm 1 is . The optimal

Firm 1 has the advantage to go first.

1. Bertrand model

If the goods are homogeneous, it will be like competitive market. Price = MC. Otherwise, the firm with lower cost will get the whole demand.

If the goods are heterogeneous but substitutes, suppose the demands are:

Then the reaction functions are:

At equilibrium,

If the firms choose price sequentially, then firm 2 will set price . Substitute into firm 1’s revenue function gives Then at equilibrium, In this case, firm 1 has disadvantage for moving first.

1. Prisoners’ Dilemma: without collusion, both prisoners betray.

# Lecture 29 Strategic Games

1. Prisoners’ Dilemma tells us collusion could make both better off. We apply it to the cases of Cournot and Bertrand models.
2. Cournot model with collusion: demand is Without collusion, the equilibrium will be . With collusion, they should first choose a total quantity which maximizes total revenue . Then if they share profit equally, .

Both firms will get better off in the collusion case. However, given the opponent produces 7.5, each of them could increase its own profit by producing more, but it will break the collusion.

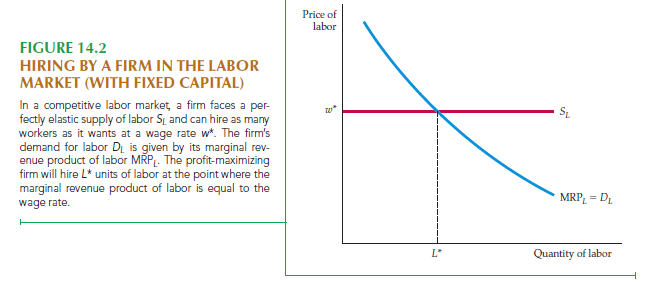
Bertrand model with collusion: demand is . Without collusion, equilibrium is With collusion, they can first choose and to maximize total revenue, and

Again, each of the firms could increase its own profit by lowering price, but it will break the collusion.

1. Repeated games: the collusion will succeed only if they will be cooperative forever and patient.
2. Maximin strategy: renders the highest minimum payoff.

# Lecture 30 Dominant Firm Model and Factor Market

1. Dominant firm model: one large firm has a major share, and it has the power to set the price; a group of smaller firms take the price set by the dominant firm.
2. Factor market: individuals are producers, firms are buyers. Firms need labor and capital to produce.
3. Short run versus long run demand of labor: in the short run, only labor is variable and other factors are fixed; in the long run, labor and other factors are variable.
4. Conditional versus unconditional demand of labor: conditional means conditional on output price fixed; unconditional means output price varies.
5. Short run conditional demand of labor: define marginal revenue product of labor , where is revenue, is output quantity, is labor. Then . Notice here is the “marginal revenue” of labor, so the short run demand curve is , where is the price of .



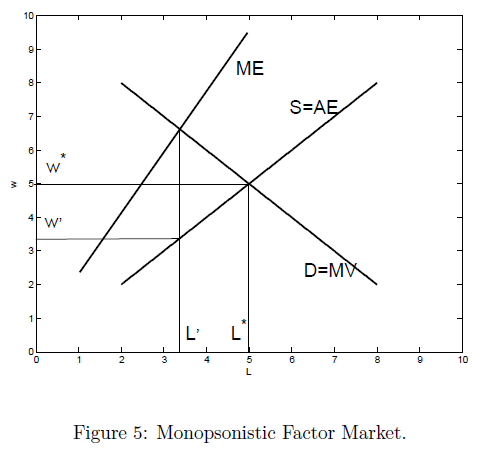
1. Long run conditional demand of labor: in the long run, both and are variable. If the price of labor decreases, then decreases, thus increases, and the firm will buy more machine increases. Then increases further, and the firm will hire more. Therefore, the demand of labor is more elastic in the long run than short run.
2. Unconditional demand of labor: when the output price is variable, if the price of labor decreases, then increases and increases, then will decreases. If decreases, decreases and will decrease. Therefore, the demand is less elastic than when output price is fixed.

# Lecture 31 Factor Market.

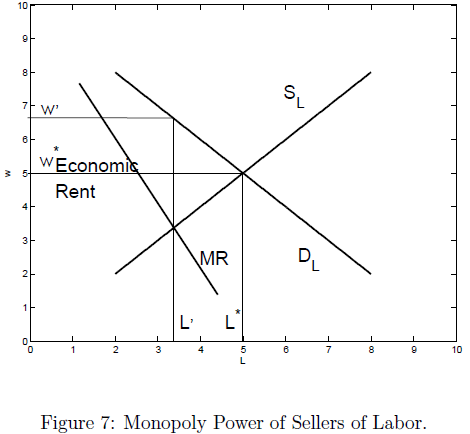
1. Supply of labor: using a utility maximization problem , where is utility, is leisure time, and is income. When wage increases, there are two effects:
   1. Substitution effect: work for more hours while keeping the utility constant
   2. Income effect: increasing wage will make utility higher, allowing them to work for less hours.

It depends on which effect is larger.

1. Competitive factor market: most efficient
2. Monopsony factor market: equilibrium is determined by , where , is the demand curve. It will result in lower wage and lower labor quantity. An example is government hiring soldiers.



1. Monopoly factor market: an example is labor unions. It depends on whether the union wants to maximize the number of workers hired or maximize economic rent. If the union tries to maximize the number of workers hired, it should set the wage and labor employed w∗ and L∗; if the union tries to maximize economic rent, it should set the wage and labor employed w1 and L1.



# Lecture 32 Investment, Savings, Time and Capital Markets

1. Present value
2. Effective yield

# Lecture 33 Asymmetric Information

1. Adverse selection: only worst cars stay in the market, because it is cheaper than good ones, but buyers do not know which cars are good or bad
2. Moral hazard: buying an insurance will make you less likely to lock the door or install a security system.

# Lecture 34 Externalities, Market Failure and Government

1. Efficient wage theory
2. Externalities: effects of production and consumption activities not directly reflected in the market.
   1. Negative: e.g., pollution.
   2. Positive: e.g., your neighbor has a beautiful garden, you are happier but do not need to pay.
3. Solution: Tax each unit produced by MEC (marginal external cost).

# Lecture 35 Public Goods

1. Characteristic of public goods:
   1. Non-rival: For any given level of production, the marginal cost of providing it to an additional consumer is zero. i.e., consumption of one consumer does not prevent consumption of others.
   2. Non-exclusive: cannot exclude someone from consuming the good, i.e., cannot be limited to paying customers only.
2. Free rider problem: no one is willing to pay for public goods.