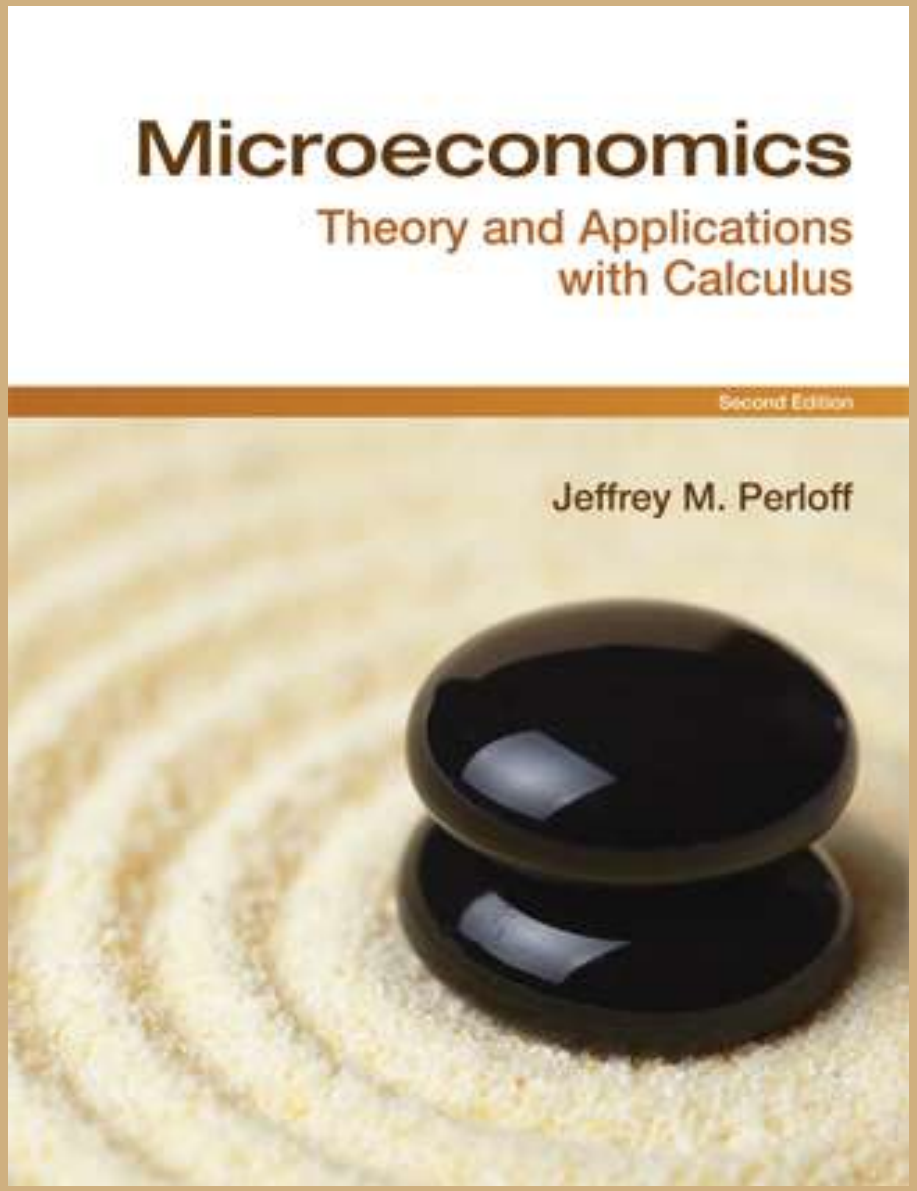
Chapter 10

General Equilibrium and Economic Welfare

Capitalism is the astounding belief that the most wickedest of men will do the most wickedest of things for the greatest good of everyone.

John Maynard Keynes



Addison-Wesley is an imprint of PEARSON

Chapter 10 Outline

Chapter 10 Introduction

- For a market equilibrium to be **efficient**, two conditions must be met:
  1. consumption must be efficient
     - Happens if goods cannot be reallocated among people so that at least someone is better off and no one is worse off
  2. production must be efficient
     - Happens if it is impossible to produce more output at current cost given current knowledge
  - An allocation is ***Pareto efficient*** if any possible reallocation would harm at least one person.
- For a market equilibrium to be **equitable**, we need to be willing to make a value judgment about whether everyone has their fair share

10.1 General Equilibrium

- ***Partial-equilibrium analysis*** is an examination of equilibrium and changes in equilibrium in one market in isolation.
- By contrast, ***general-equilibrium analysis*** addresses how equilibrium is determined in all markets simultaneously.
  - This is especially important for markets that are closely related
  - Example:
    - discovery of oil deposit in a small country
    - citizens' income is raised
    - increased income affects all markets in that country simultaneously (*spillover effects*)

10.1 Competitive Equilibrium in Two Interrelated Markets

- Consider linear demand functions for two goods, Q_1 and Q_2, as functions of their prices, p_1 and p_2:

$$Q_1 = a_1 - b_1 p_1 + c_1 p_2 \qquad Q_2 = a_2 - b_2 p_2 + c_2 p_1$$

- The supply functions (with positive coefficients) are:

$$Q_1 = d_1 + e_1 p_1 \qquad Q_2 = d_2 + e_2 p_2$$

- What do we do with these equations?
  - Equate Q_d and Q_s in each market

10.1 Competitive Equilibrium in Two Interrelated Markets

- After equating Q_d and Q_s, two equations and two unknowns can be solved for the prices of both goods:

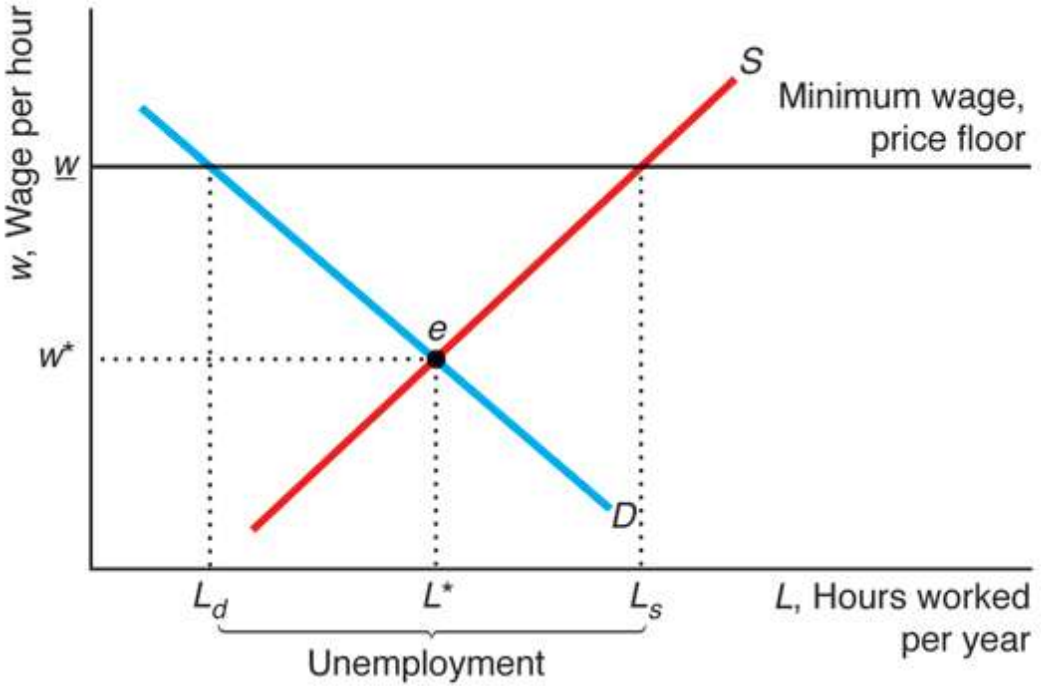
$$p_1 = \frac{(b_2 + e_2)(a_1 - d_1) + c_1(a_2 - d_2)}{(b_1 + e_1)(b_2 + e_2) - c_1 c_2}$$

$$p_2 = \frac{(b_1 + e_1)(a_2 - d_2) + c_2(a_1 - d_1)}{(b_1 + e_1)(b_2 + e_2) - c_1 c_2}$$

- These expressions for p_1 and p_2 can be substituted back into either demand or supply equations to yield a solution for Q_1 and Q_2.
- Note that both prices and quantities are functions of ***all*** of the demand and supply coefficients.

10.1 Minimum Wages with Incomplete Coverage

- Partial-equilibrium analysis of minimum wage laws from Chapter 2 predicted unemployment:

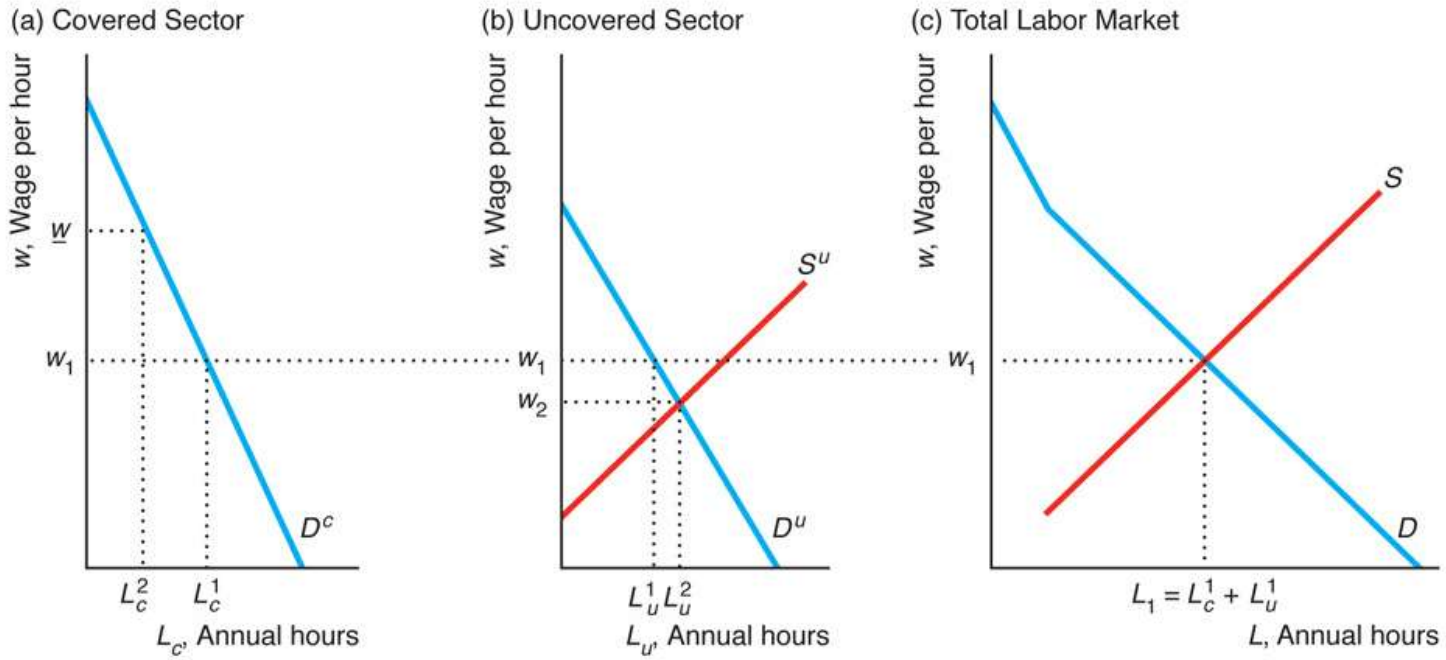


10.1 Minimum Wages with Incomplete Coverage

- General-equilibrium analysis of minimum wage laws that only cover workers in some sectors tells a different story.
- The increase in the wage in the covered sector causes a decrease in quantity demanded of labor in that sector.
- Displaced workers move from the covered to the uncovered sector, which drives down wages in the uncovered sector.
- Decreases in covered sector employment are (partially) offset by increases in uncovered sector employment.

10.1 Minimum Wages with Incomplete Coverage

- General-equilibrium analysis of minimum wage laws indicates that unemployment need not be created:

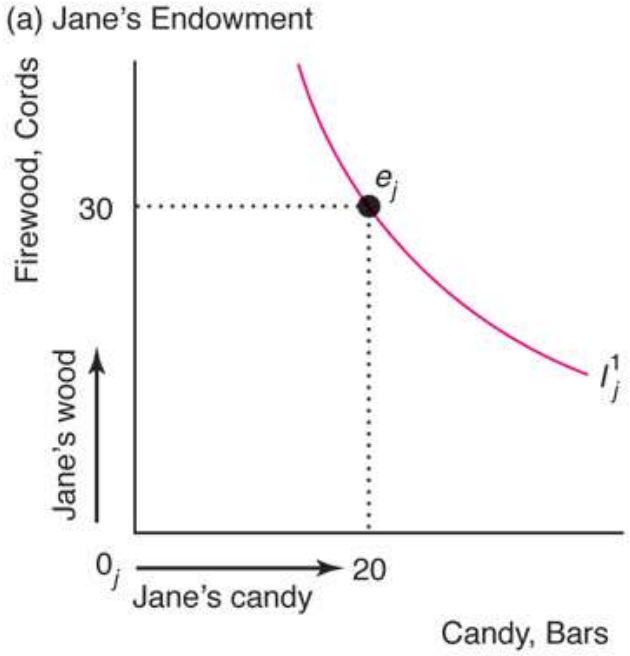


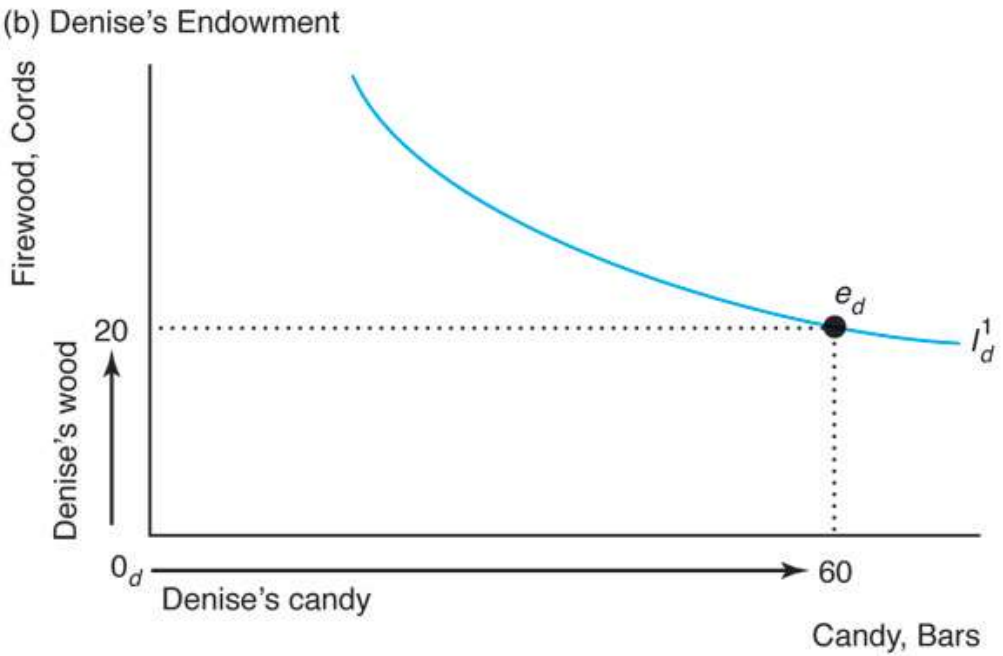
10.2 General-Equilibrium Exchange Economy: Trading Between Two People

- General-equilibrium model can be used to show that free trade is ***Pareto efficient***.
  - After all voluntary trades have occurred, we cannot reallocate goods so as to make one person better off without harming another.
- Consider example of neighbors, Jane and Denise, who each have an initial endowment of firewood and candy
  - Jane: 30 cords of firewood and 20 candy bars
  - Denise: 20 cords of firewood and 60 candy bars
- These endowments can be shown graphically using indifference curves.

10.2 Trading Between Two People

- Jane and Denise before they engage in trade



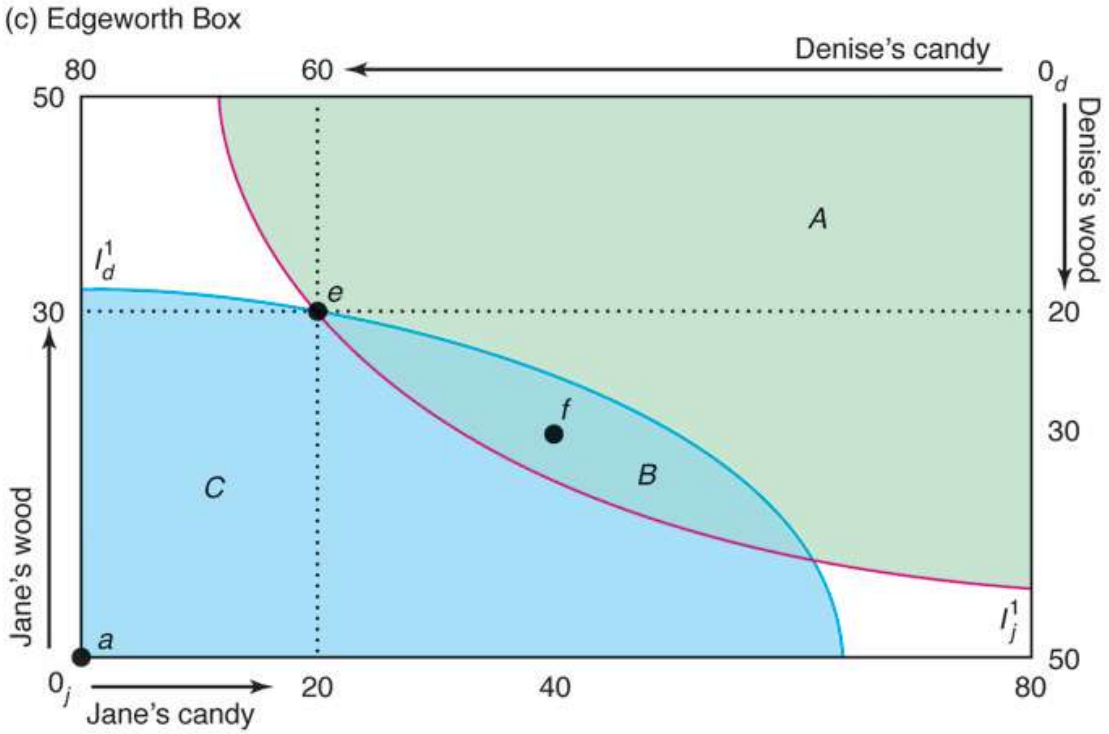


10.2 Trading Between Two People

- If Jane and Denise do not trade, they can each only consume their initial endowments.
- In order to see whether Jane and Denise would benefit from trading firewood and candy bars, we use an Edgeworth box.
  - An ***Edgeworth box*** illustrates trade between two people with fixed endowments of two goods.
  - An Edgeworth box is useful in general equilibrium models because both the firewood and candy bar markets are being affected simultaneously.

10.2 Trading Between Two People

- Initial endowments place Jane and Denise at point *e*, but area *B* holds more preferred bundles for both.

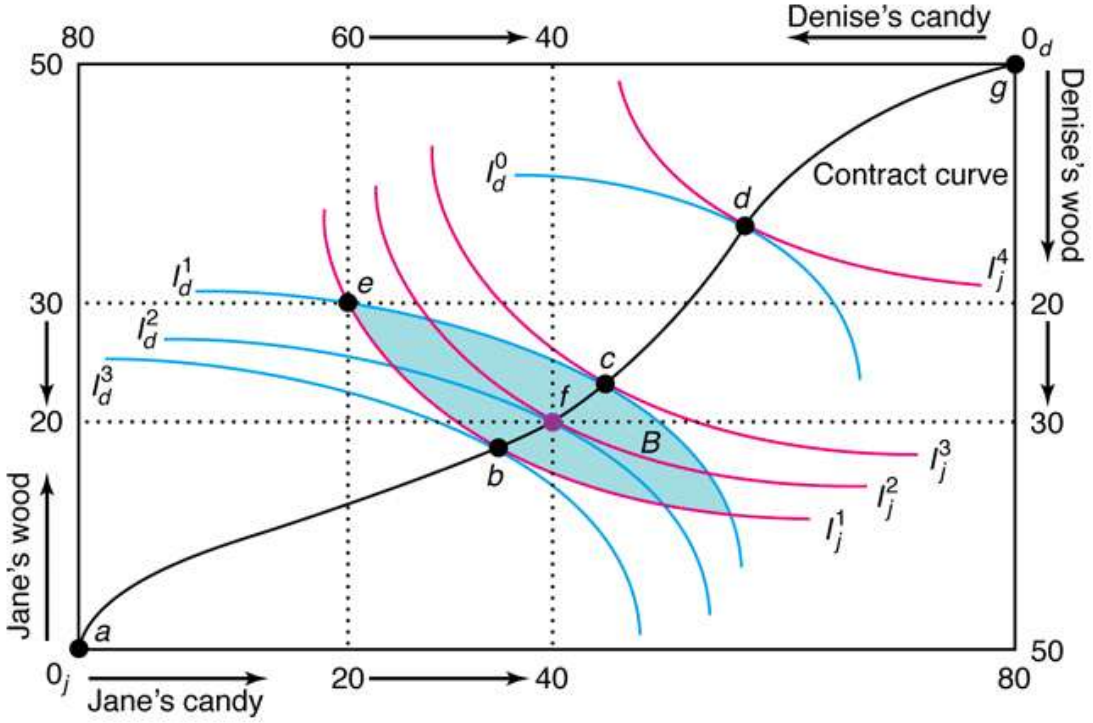


10.2 Trading Between Two People

- Should Jane and Denise trade? Yes.
- We make four assumptions about their tastes and behavior in order to answer this question:
  1. **Utility maximization**: Each person maximizes her utility.
  2. **Usual-shaped indifference curves**: Each person's indifference curves have the usual convex shape.
  3. **Nonsatiation**: Each person has strictly positive marginal utility for each good (e.g. each wants as much of each good as possible).
  4. **No interdependence**: Neither person's utility depends on the other's consumption and neither person's consumption harms the other person

10.2 Trading Between Two People

- No further trade is possible at a bundle like *f* because Jane's MRS is equal to Denise's MRS at point *f*.



10.2 Trading Between Two People

- The ***contract curve*** is the set of all Pareto-efficient bundles.
  - Name refers to the fact that Jane and Denise are unwilling to engage in further trades, or contracts, only at points along the contract curve.
  - These allocations are the final contracts.
- The contract curve is derived by maximizing Jane's utility subject to leaving Denise's utility unchanged (or vice versa).
  - Calculus can be used to show that this maximization problem boils down to points where their indifference curves have the same slopes: $MRS_j = MRS_d$.

10.3 Competitive Exchange

- Without knowledge of the trading process, we only know that Jane and Denise trade to some allocation on the contract curve.
- With knowledge of the exact trading process, we can determine their final allocation.
- General-equilibrium models can show that a competitive market has two desirable properties:
  1. Competitive equilibrium is efficient
     - *First Theorem of Welfare Economics*
  2. Any efficient allocations can be achieved by competition
     - *Second Theorem of Welfare Economics*

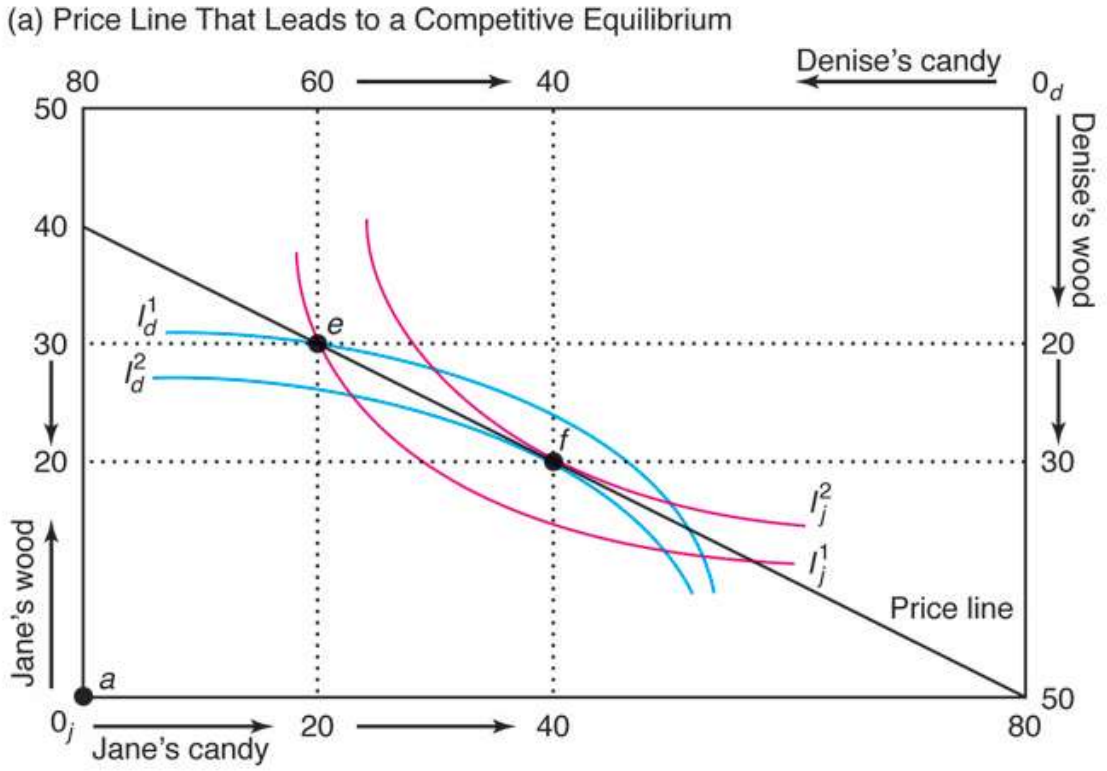
10.3 Competitive Exchange

- Given prices of the two goods, a price line can be added to the Edgeworth box.
  - The price line is all the combinations of goods that Jane could get by trading, given her endowment.

- If the price of firewood is $2 and the price of a candy bar is $1, then the price line indicates that Jane would choose to trade wood for candy and move from point *e* to *f*.
- Similarly, given those prices, Denise would prefer to trade candy for wood and move from point *e* to *f*.

10.3 Competitive Exchange

- Both Jane and Denise enjoy higher utility when they and can afford to move to point *f*.



10.3 The Efficiency of Competition

- In a competitive equilibrium, the indifference curves of both types of consumers are tangent at the same bundle on the price line, thus:

$$MRS_j = -\frac{p_c}{p_w} = MRS_d$$

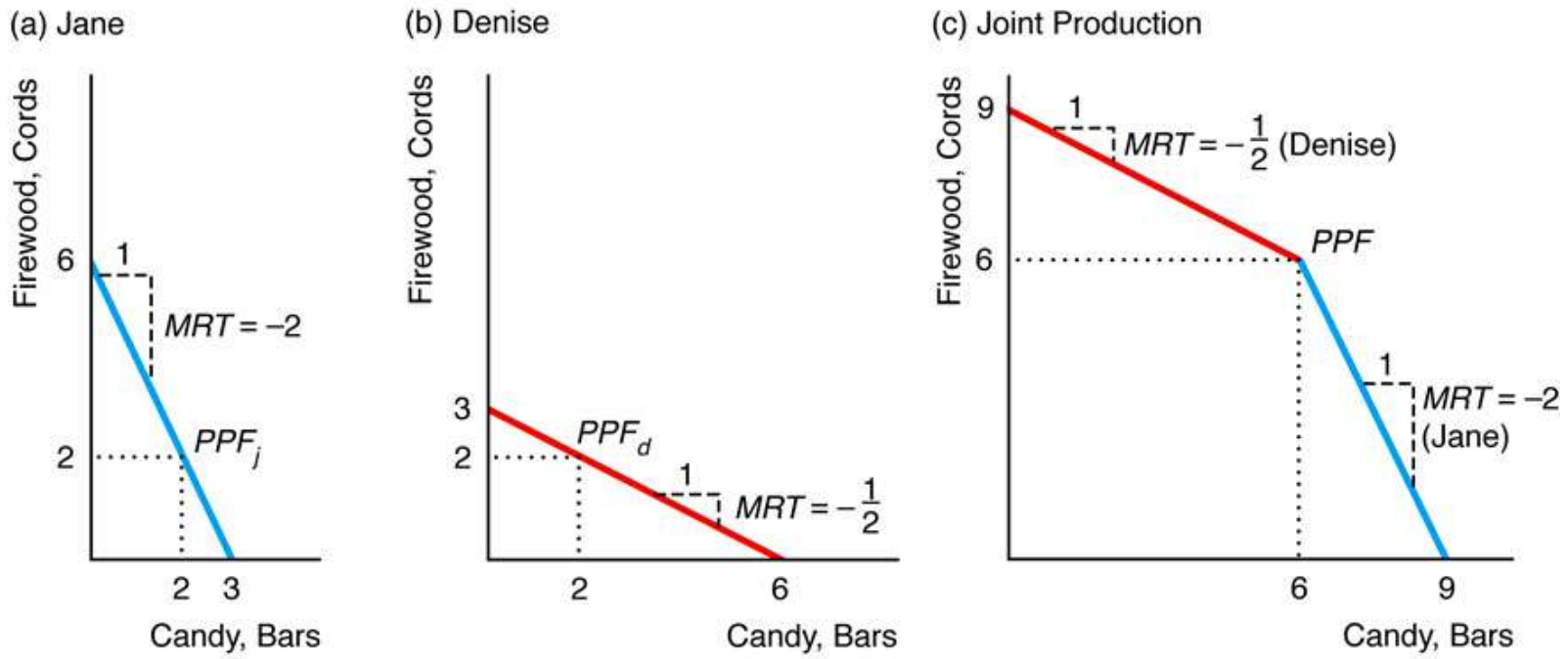
- If the competitive equilibrium must lie on the contract curve, we have demonstrated the *First Theorem of Welfare Economics*
  - Any competitive equilibrium is Pareto efficient
- By adjusting initial endowments so they lie along the price line, we demonstrate the *Second Theorem of Welfare Economics*
  - Any Pareto-efficient equilibrium can be obtained by competition given an appropriate endowment

10.4 Production and Trading

- So far our discussion of trade has been entirely about consumption, but what about production?
- Production capabilities can be summarized with a ***production possibility frontier*** (PPF).
  - PPF shows the maximum combination of two outputs that can be produced from a given amount of input.
- In our example, assume:
  - Jane can use her labor to produce up to 3 candy bars or 6 cords of firewood in a day
  - Denise can use her labor to produce up to 6 candy bars or 3 cords of firewood in a day

10.4 Production and Trading

- PPF curves can be combined to show joint productive capacity.



10.4 Production and Trading

- The slope of the production possibility frontier is the ***marginal rate of transformation*** (MRT).
  - MRT tells us how much more wood can be produced if the production of candy is reduced by one bar.
  - More generally, MRT shows how much it costs to produce one good in terms of the forgone production of the other good.

- The ***comparative advantage*** in producing a good goes to the person who can produce the good at a lower opportunity cost.
  - Jane has comparative advantage in producing wood
  - Denise has comparative advantage in produce candy

10.4 Benefits of Trade

- Differences in MRTs imply that Jane and Denise can benefit from trade.
- Assume both like to consume wood and candy in equal proportions.
  - Without trade, each produces 2 candy bars and 2 cords of wood each day
  - With trade:
    - Denise specializes in candy production and makes 6 candy bars
    - Jane specializes in firewood production and makes 6 cords of wood
    - If production is split equally, each gets 3 candy bars and 3 cords of wood each day!
- Trade works when comparative advantage is followed.

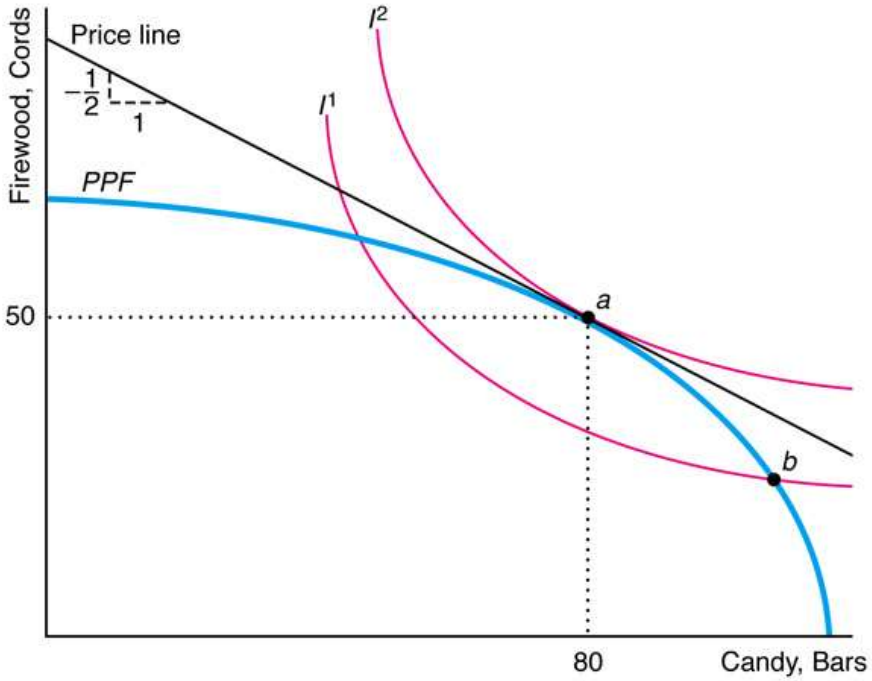
10.4 The Number of Producers

- With just two producers – Jane and Denise – the PPF has one kink.
- As other methods of production with different MRTs are added, the PPF gets more kinks.
- As the number of different producers gets very large, the PPF becomes a smooth curve that is concave to the origin.
- The MRT along this smooth PPF tells us about the marginal cost of producing one good relative to the other.

$$MRS_j = -\frac{p_c}{p_w} = MRS_d$$

10.4 Optimal Product Mix

- Individual's utility is maximized at point *a*, the point where the PPF touches the indifference curve (MRS = MRT).



10.4 Competition

- Each price-taking consumer picks a bundle of goods such that:

$$MRS = -\frac{p_c}{p_w}$$

- If all relative prices are the same for all individuals in competitive equilibrium, all will have equal MRSs and no further trades can occur.
- The competitive equilibrium achieves ***consumption efficiency***
  - Impossible to redistribute goods to make one person better off without making someone worse off.

10.4 Competition

- Each competitive firm sells a quantity of candy (c) and wood (w) such that price equals marginal cost:

$$p_c = MC_c \qquad p_w = MC_w$$

- Taking the ratio of these and combining with the fact that MRT is the ratio of marginal costs yields:

$$MRT = -\frac{p_c}{p_w}$$

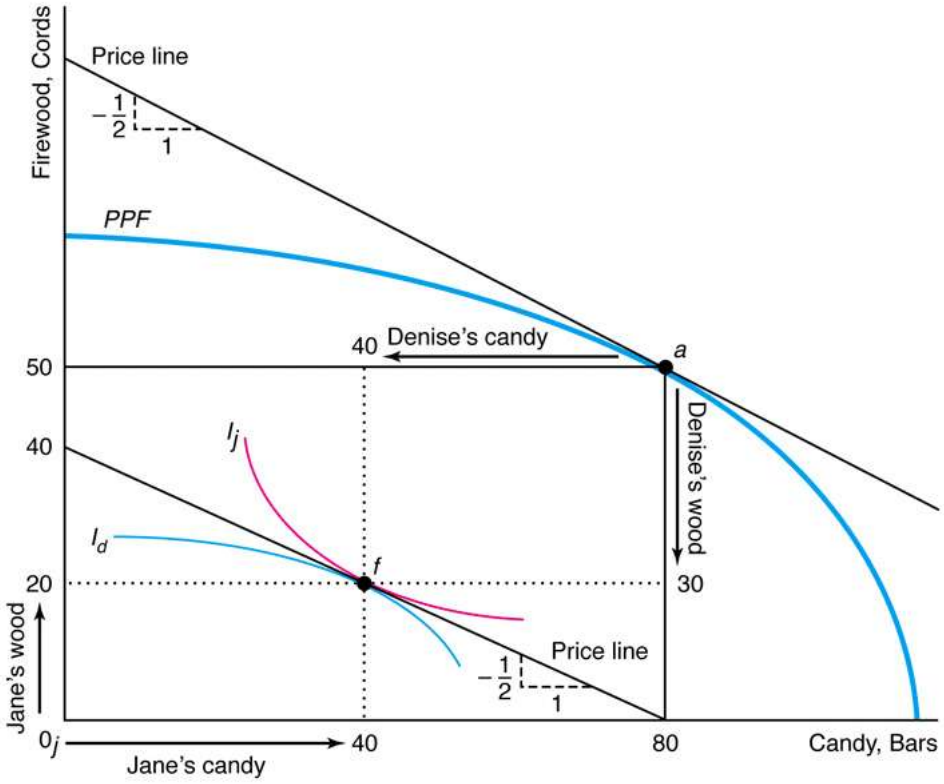
- Thus, competition insures an efficient product mix:

$$MRS = -\frac{p_c}{p_w} = MRT$$

  - The rate at which firms can transform one good into another equals the rate at which consumers are willing to substitute between goods.

10.4 Competitive Equilibrium

- At the competitive equilibrium, the relative prices that firms and consumers face are the same.



10.5 Efficiency and Equity

- How well various people in a society live depends on:
  - Efficiency (size of the pie)
  - Equity (how the pie is divided)

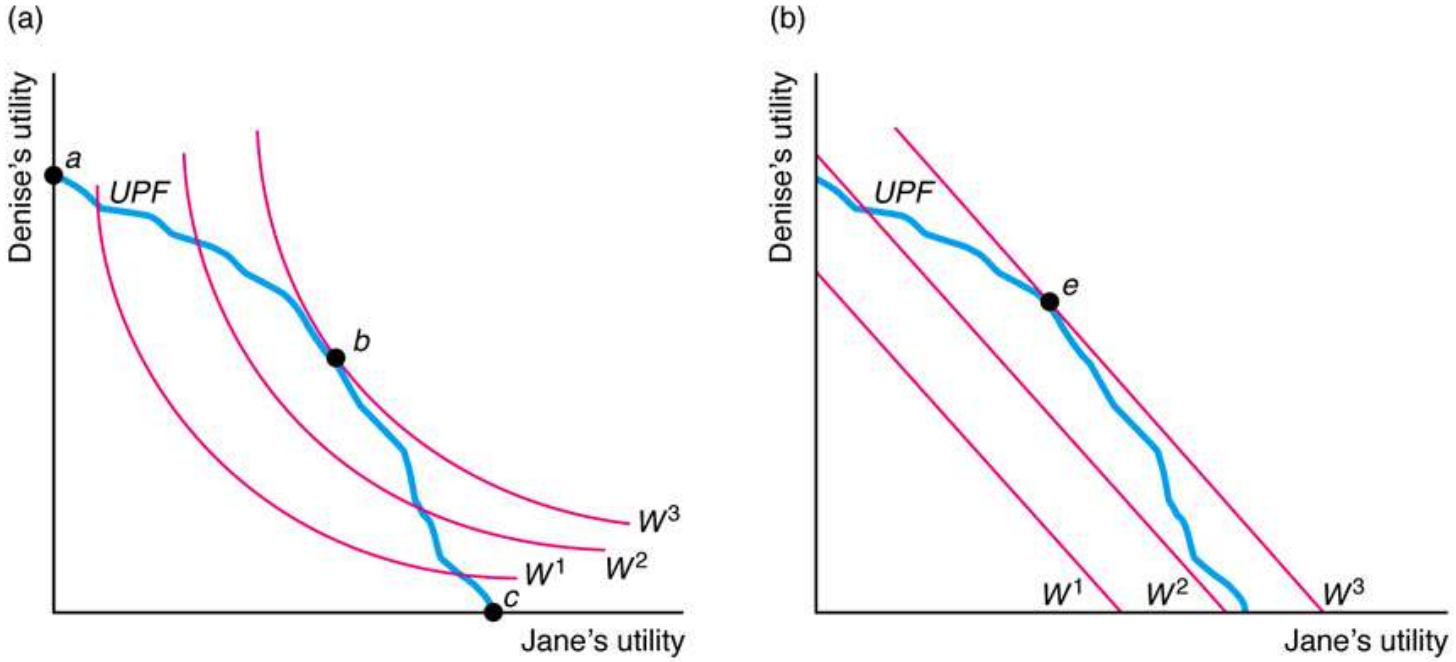
- Role of the government
  - Wealth is redistributed with every government action
  - Agricultural price support programs transfer wealth to farmers
  - Income taxes transfer income from better-off to poor
  - Proceeds from the lottery (played by mostly lower-income people) funds merit-based college scholarships in many states

10.5 Efficiency and Equity

- A ***social welfare function*** combines various consumers' utilities to provide a collective ranking for allocations.
  - Graphically summarized by a ***isowelfare curve***, along which social welfare is constant.
- A ***utility possibility frontier*** (UPF) is the set of utility levels corresponding to Pareto-efficient allocations along the contract curve.
- Society maximizes welfare by choosing the allocation for which the highest possible isowelfare curve touches the UPF.

10.5 Efficiency and Equity

- Society maximizes welfare by choosing the allocation for which the highest possible isowelfare curve touches the UPF.



10.5 Efficiency and Equity

- Many rules by which society might decide among various allocations have been suggested.
- These different social welfare functions yield different distributions of goods:

1. **Utilitarian**: equal weight to all people in society ($W = U_1 + U_2 + \cdots + U_n$)

2. **Generalized utilitarian**: different weights assigned, perhaps to adults, hard workers, etc. ($W = \alpha_1 U_1 + \alpha_2 U_2 + \cdots + \alpha_n U_n$)

3. **Rawlsian**: maximizes well-being of worst off individual ($W = \min (U_1, U_2, \ldots, U_n)$)

10.5 Efficiency versus Equity

- Given a particular welfare function, society might prefer an inefficient allocation to an efficient one.
  - Example: one person has everything, which means any reallocation would make that one person worse off, but would likely be preferred by everyone else.

- Sometimes, in an attempt to achieve greater equity, efficiency is reduced.
  - Example: advocates for the poor prefer providing them with public housing (equity), but this is inefficient because the poor would be better off with a cash transfer of equal value.

10.5 Efficiency versus Equity

- If competition maximizes efficiency and our usual welfare measure, shouldn't we strive to eliminate any distortion (tariff, quota, tax, etc.)?
- An economy with no distortions is a ***first-best equilibrium***
  - Any distortion will reduce efficiency
- Eliminating *some* distortions does not guarantee the same outcome as eliminating *all* of them.
- The ***Theory of the Second Best*** says that if an economy has at least two market distortions, eliminating just one may either increase or decrease welfare!

10.5 Efficiency and Equity

- Permitting trade may raise welfare (as in panel (a)) or may lower it (as in panel (b)) depending on existing distortions.

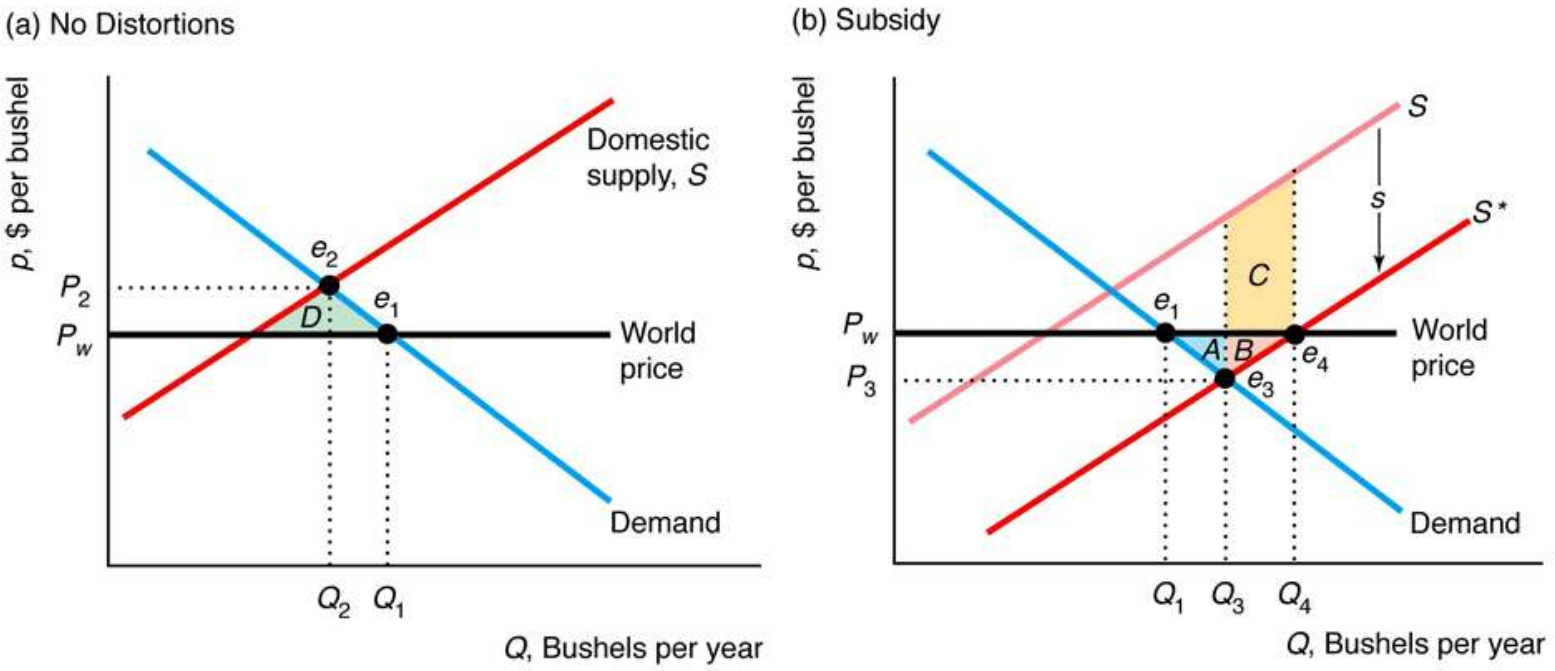


Figure 10.4 Competitive Equilibrium