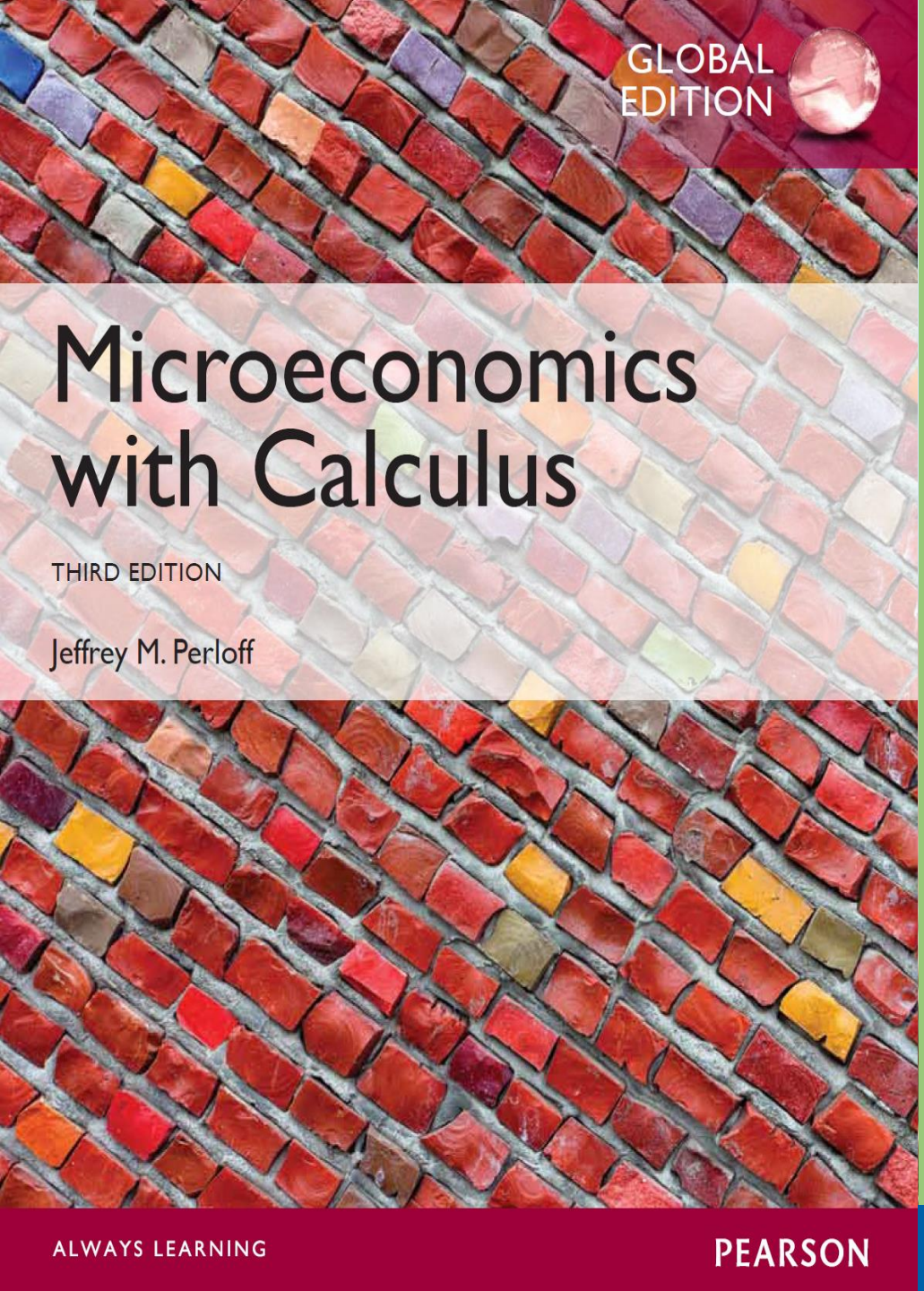


Lecture 2:

General Equilibrium and Economic Welfare

PEARSON

Outline

Question: Is a market economy with competition efficient?

1 Pareto Efficiency and General Equilibrium
2 Trading Between Two People
3 Competitive Exchange
4 Social Welfare

Readings: Perloff 10.1-10.3, 10.5

1 Pareto Efficiency

- A ***Pareto improvement*** is a change, such as a reallocation of goods between people, that helps at least one person without harming anyone else.
- An allocation is ***Pareto efficient*** (a. k. a. Pareto optimal) if no Pareto improvement is possible.

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 economy
    - citizens' income is raised
    - increased income affects all markets in that economy simultaneously (*spillover effects*)

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 demand and supply for each market
  - This will give us two equations with two unknown variables (p_1, p_2)

1 Competitive Equilibrium in Two Interrelated Markets

- Solving the equations gives:

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

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

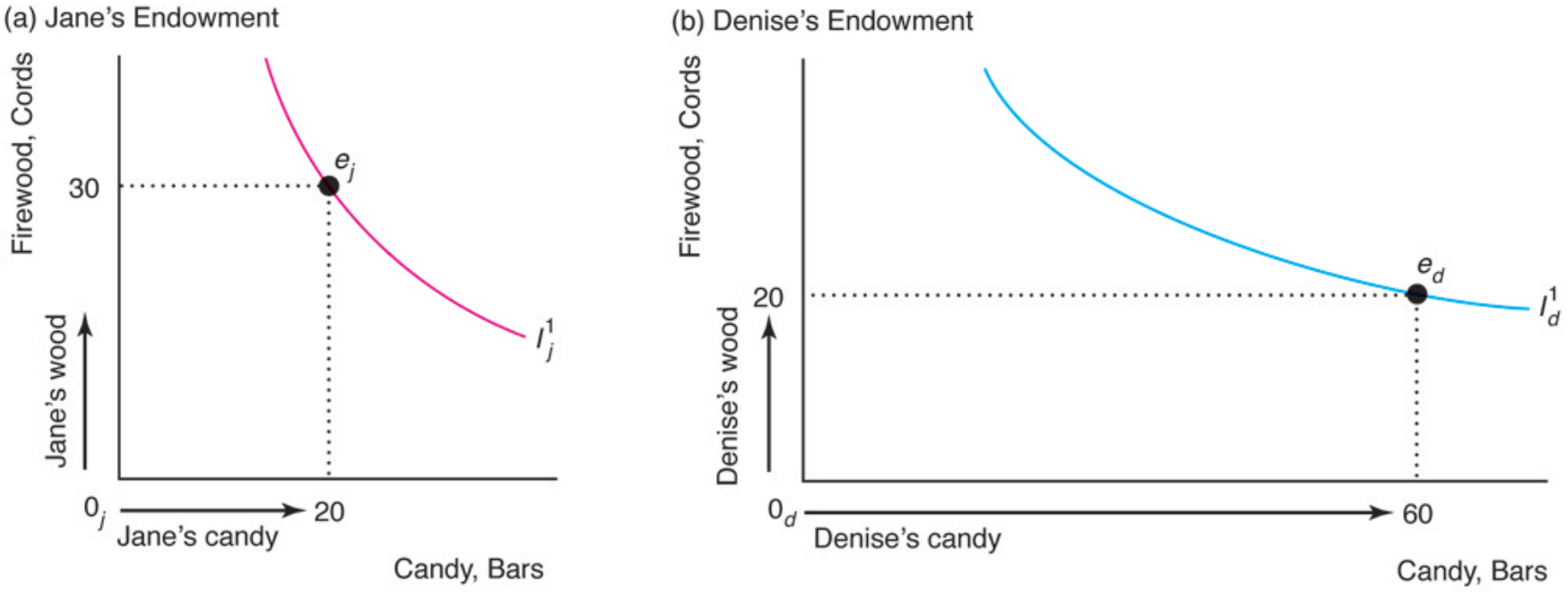
- These expressions for p_1 and p_2 can be substituted back into either demand or supply equations to yield a solution for Q_1 and Q_2.
- Prices and quantities are functions of ***all*** of the demand and supply coefficients.

2 Trading Between Two People

- General-equilibrium model can be used to show that the competitive equilibrium of a market economy is ***Pareto efficient***.
- We first show that free trade between two people 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 an 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

2 Trading Between Two People

- Jane and Denise before they engage in trade



2 Trading Between Two People

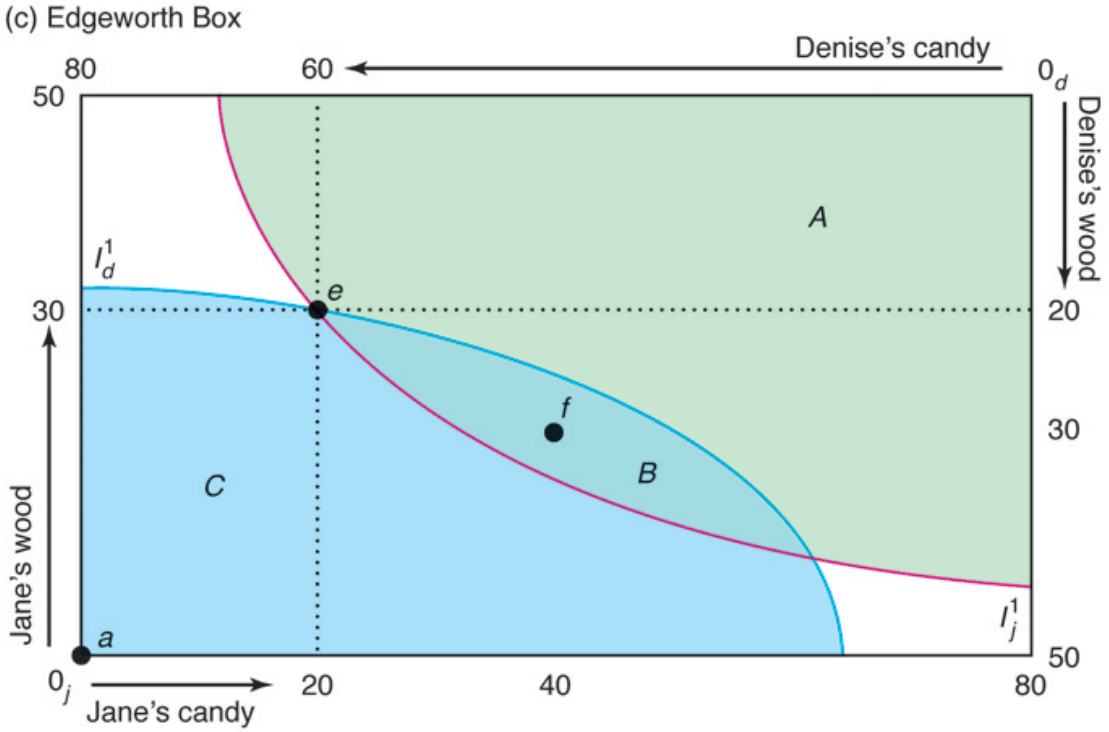
- We make four assumptions about their preferences.
  1. **Utility maximization**: Each person maximizes her utility.
  2. **Usual-shaped indifference curves**: Each person's indifference curves have the usual convex shape (convex to the origin).
  3. **"More is better" (Non-satiation)**: Each person 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.

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.

2 Trading Between Two People

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

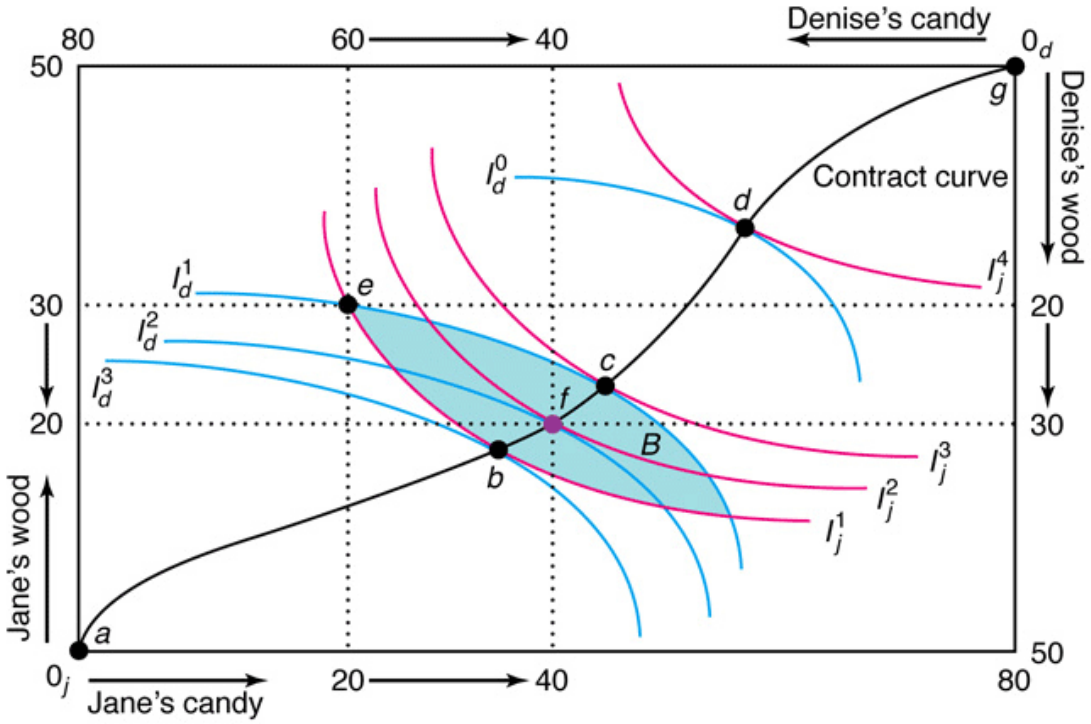


2 Trading Between Two People

- The ***contract curve*** is the set of all Pareto-efficient bundles in the Edgeworth box.
  - Jane and Denise are unwilling to engage in further trades, or contracts, only at points along the contract curve.
- The contract curve is derived by maximizing Jane's utility subject to leaving Denise's utility unchanged (or vice versa).
  - This maximization problem boils down to points where their indifference curves have the same slopes: $MRS_j = MRS_d$.

2 Trading Between Two People

- After trade, they will end up at a point between b and c on the contract curve, such as *f*.
- No further trade is possible at a bundle like *f,* which is:
  - A mutually beneficial trade, compared to *e*, since *f* is in area B
  - On the contract curve, and therefore Pareto optimal. Note that Jane's MRS is equal to Denise's MRS at point *f*.



3 Competitive Exchange

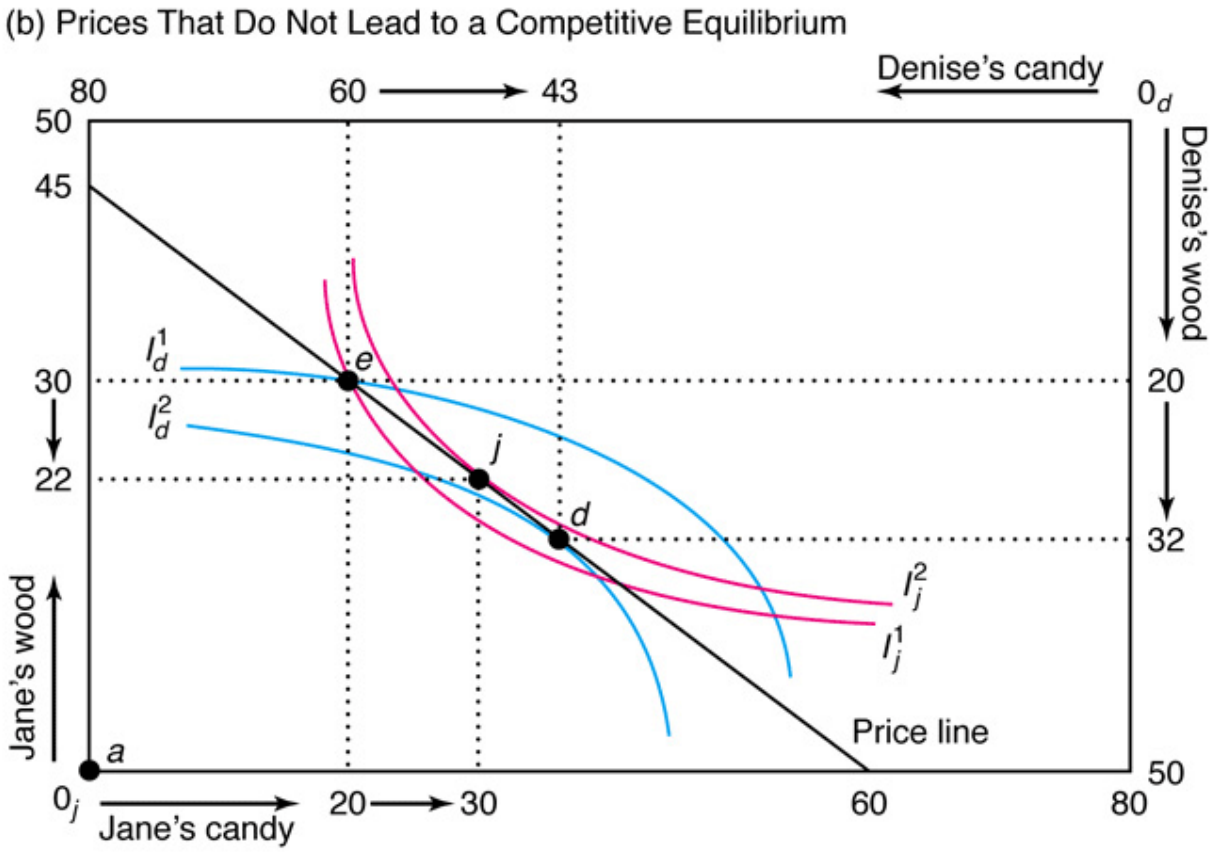
- Without knowledge of the trading process, we only know that Jane and Denise trade to some allocation on the contract curve and in Area B.
- Now consider an economy with many people with preferences and endowments like Jane's and many people with preferences and endowments like Denise's.
- Two markets: Firewood and candy -- General equilibrium analysis
- Everyone is a price-taker. In such a market where all buyers and sellers are price-takers, when quantity demanded equals quantity supplied, we have a competitive equilibrium.
- The competitive equilibria in the two markets give us the general equilibrium.

3 Competitive Exchange

- Given prices of the goods, a price line can be added to Edgeworth box, passing through the endowment point.
  - The price line is all the combinations of goods that one could get by trading, given her endowment.
- How to determine equilibrium price line?
- Given the price line, each chooses a consumption bundle to maximize utility.
- In the following case, the markets are not in equilibrium because quantity demand is not equal to quantity supplied.
- Prices will be adjusted until quantity demanded equals quantity supplied.
- When quantity demanded equals quantity supplied, we have a competitive equilibrium.

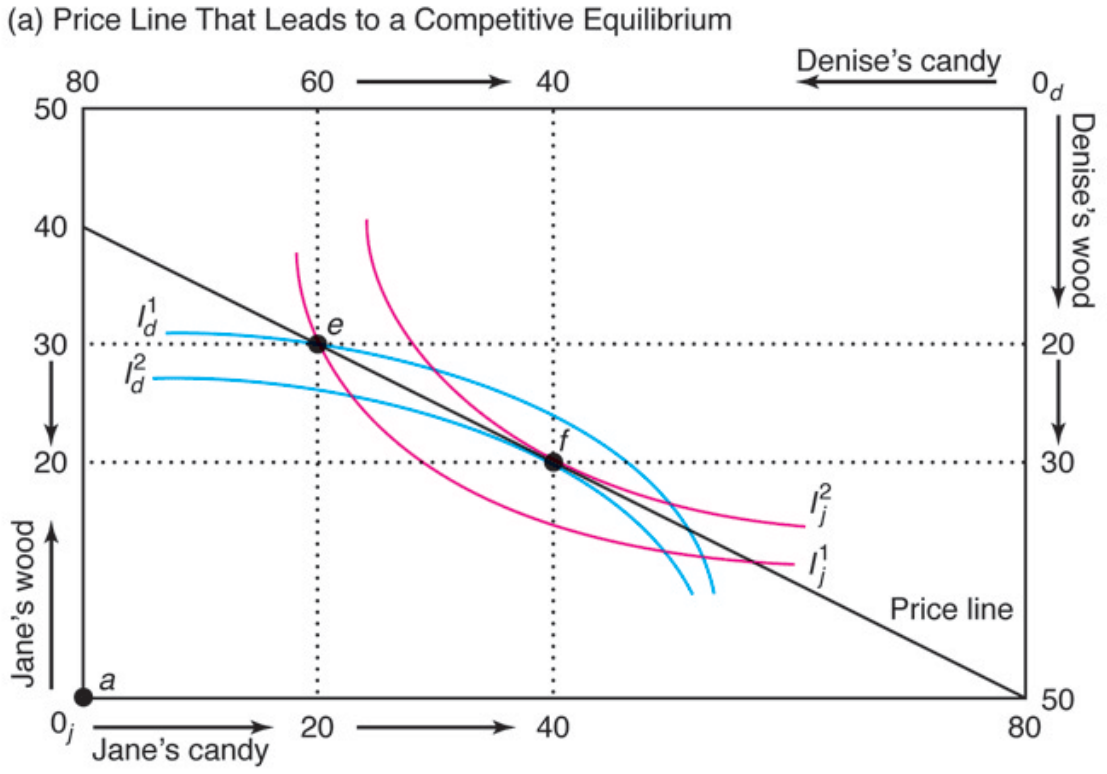
3 Competitive Equilibrium

- Example: The prices that set this price line are not consistent with a competitive equilibrium.



3 Competitive Exchange

- Under the following price line, a competitive equilibrium is achieved.
- At these prices, Jane sells wood to Denise, and Denise sells candy to Jane. They trade to the allocation, *f.*



3 The Efficiency of Competition

- In a competitive equilibrium, the indifference curves of both types of consumers and the price line, are tangent at the same bundle on the price line; thus it is Pareto efficient, and on the contract curve.

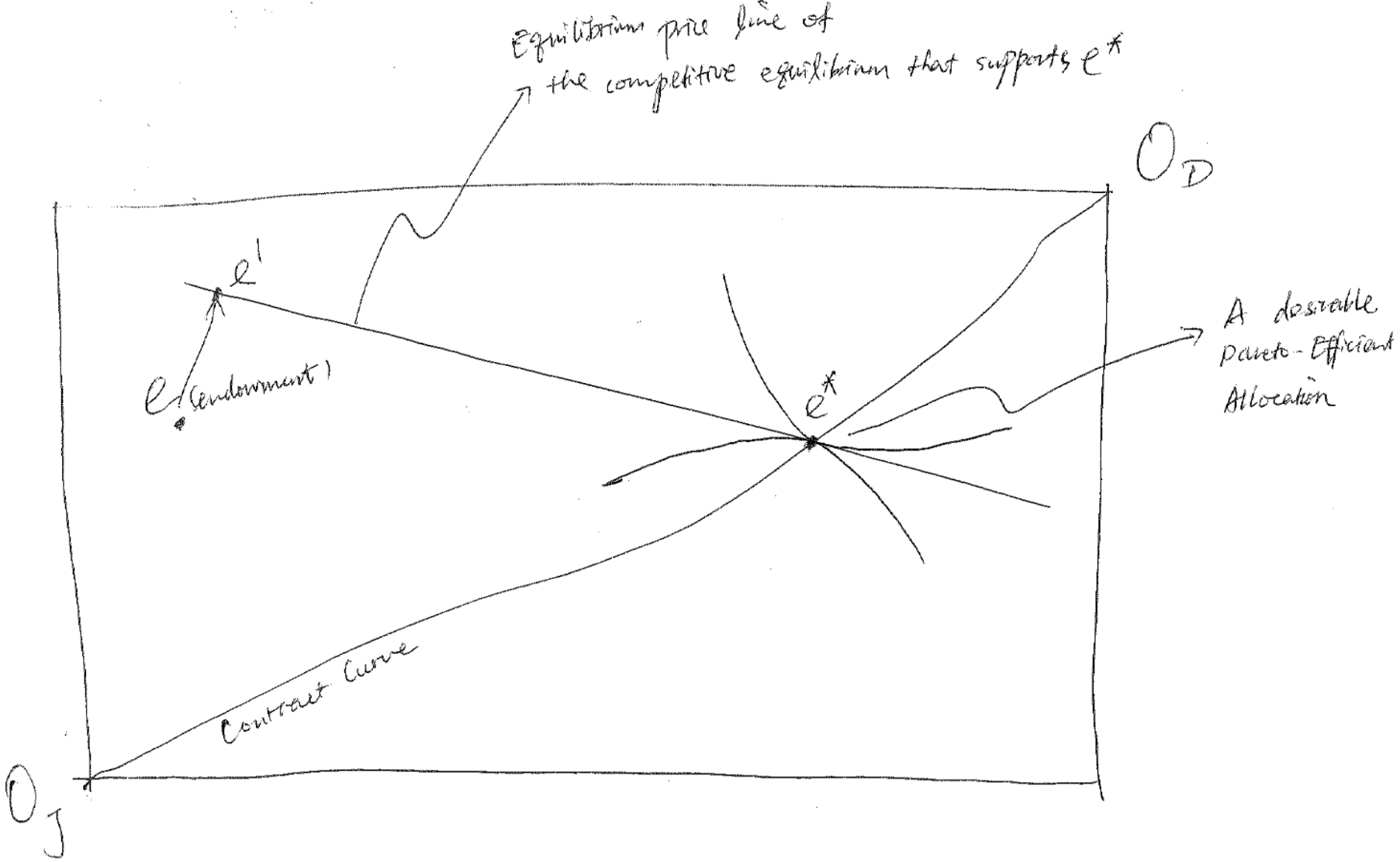
$$MRS_j = -\frac{p_c}{p_w} = MRS_d$$

- We have thus demonstrated the *First Theorem of Welfare Economics:*

  Any competitive equilibrium is Pareto efficient.

3 The Efficiency of Competition

- Another question: Starting with an initial endowment point, can we achieve a certain Pareto-efficient allocation via competitive equilibrium?
- Yes, if transfers are allowed.
- We can find the equilibrium price line for the Pareto-efficient allocation, and adjust the initial endowment point so it lies along the price line (by making transfers between the two types of people). Then the competitive equilibrium will lead to this Pareto-efficient allocation.
- This is the *Second Theorem of Welfare Economics:*
  - Any Pareto-efficient allocation can be obtained by a competitive equilibrium given an appropriate endowment.



Second Theorem of Welfare Economics

To achieve e^*, the govt can adjust endowment from e to e'. The competitive equilibrium will then lead to e^*.

4 Social Welfare

- A ***utility possibility frontier*** (UPF) is the set of utility levels corresponding to Pareto-efficient allocations along the contract curve.
- 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, if there are only two consumers.

4 Social Welfare

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

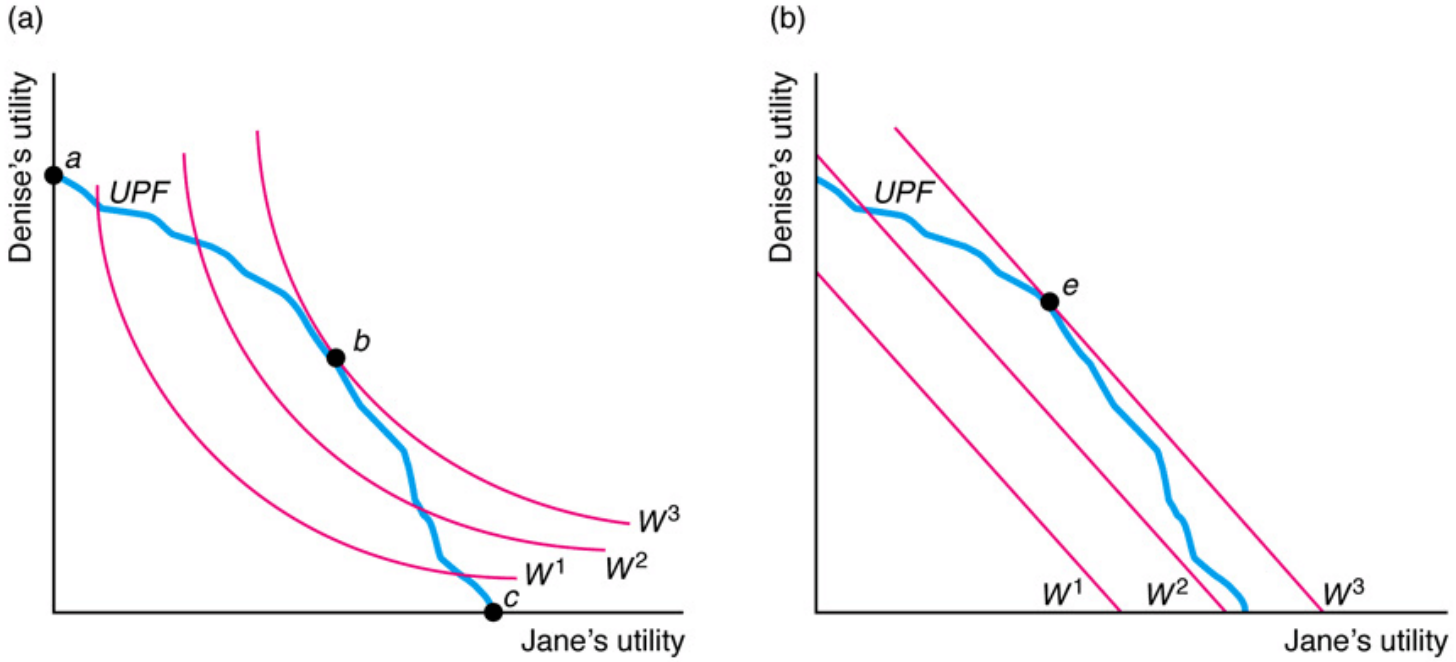
1. **Utilitarian**: equal weight to all people in society ($W = U_1 + U_2 + \cdots + U_n$)

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 ($W = \min(U_1, U_2, \ldots, U_n)$)

4 Social Welfare

- Given a particular welfare function, society might prefer a Pareto-inefficient allocation to an efficient one.
- Society maximizes welfare by choosing the allocation for which the highest possible isowelfare curve touches the UPF.



Reference:

- Chapter 10:
- Microeconomics: Theory and Applications with Calculus, 3rd Edition. By Jeffrey M. Perloff. 2014 Pearson Education.