

General Equilibrium

Partial Eqbm and General Eqbm

Definition: **Partial Equilibrium analysis** is the study of how equilibrium is determined in only a single market (e.g. a single product market).

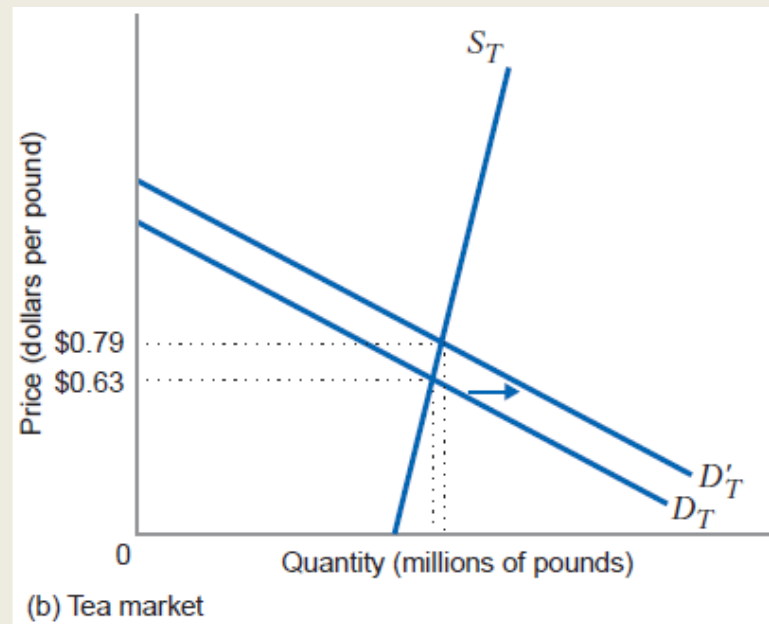
In such analysis, we focus on the equilibrium price one good, taking as given the prices of all other goods.

Definition: **General Equilibrium analysis** is the study of how equilibrium is determined in all markets simultaneously (e.g. product markets and labor markets).

Note that these markets must be related somehow.

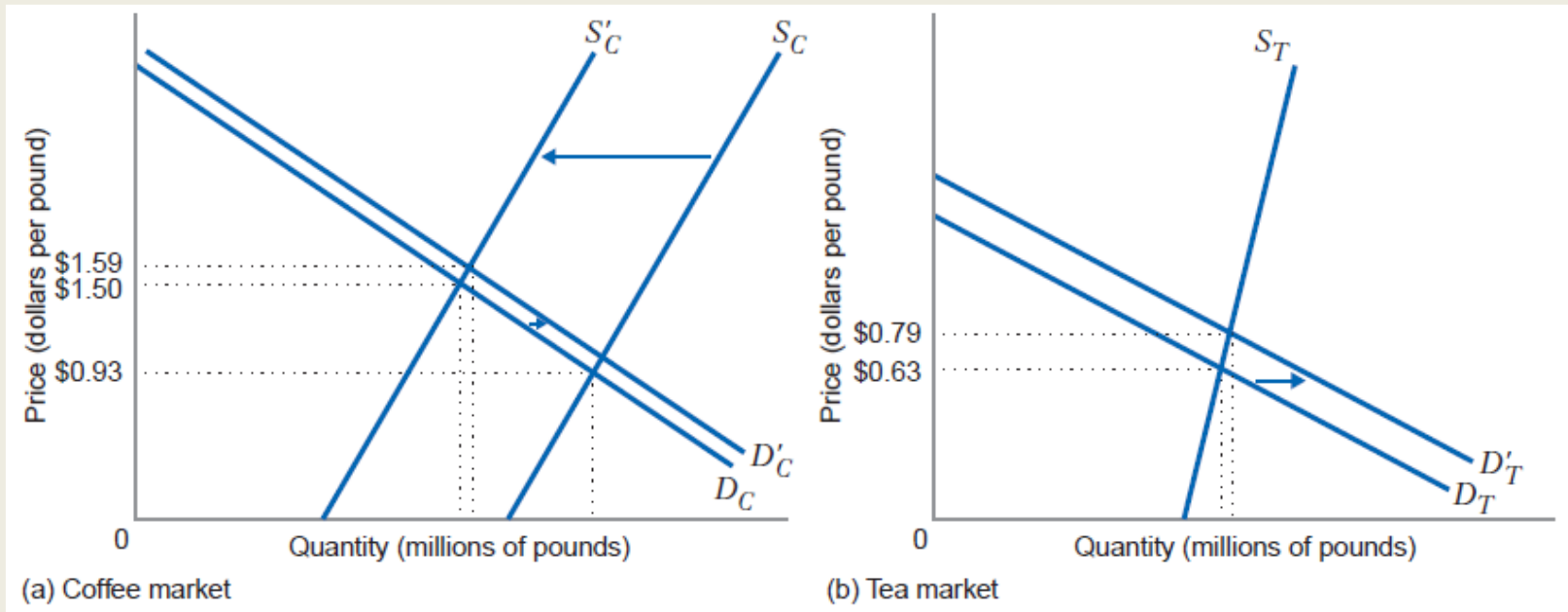
Partial Equilibrium – Example

Suppose there is a report saying that drinking tea is good. As a result, the demand of tea rises. In the tea market, the equilibrium price and quantity of tea is now higher.



General Equilibrium – Example

Suppose bad weather affects coffee crops. The supply of coffee falls, raising its equilibrium price. **Because tea and coffee are substitutes**, this raises the demand for tea and its price. Finally, the higher price of tea raises the demand for coffee a little.



General Equilibrium – Many Markets

Consider an economy with two types of consumers and goods.

Consumers: Blue-Collar and White-Collar

Goods: Food and Energy

FoP: Labor and Capital.

Hence, there are 4 markets in total:

Markets for Food, Energy, Labor, and Capital.

We will now examine Supply and Demand in each market.

General Equilibrium – Many Markets

In the following analysis, we will assume that all markets in consideration are **perfectly competitive**.

This is when the markets have

- Many Buyers and Sellers who are all Price-Takers
- Identical Products
- No Barriers to Entry and Exit
- Perfect Information / Perfect Knowledge

General Equilibrium – Many Markets

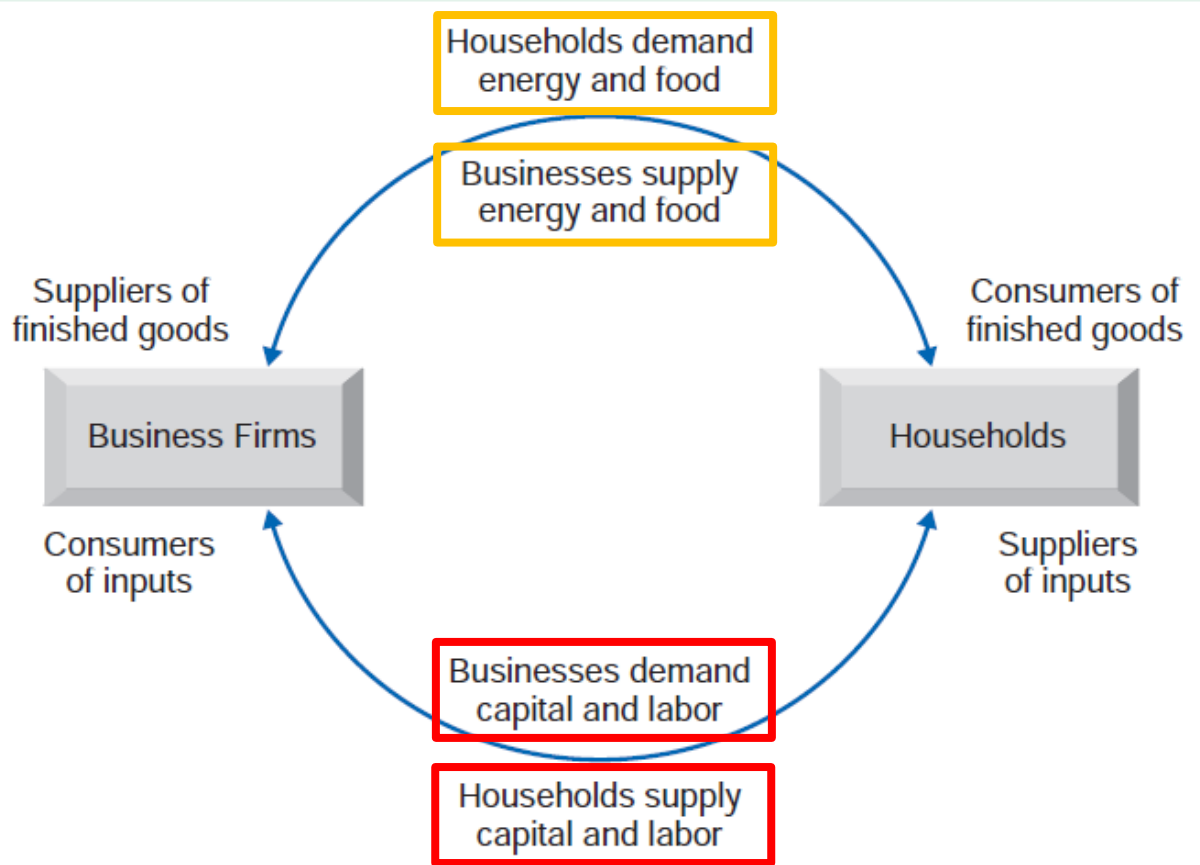


FIGURE 16.4 Interactions between Firms and Households in a General Equilibrium

Households, in their role as consumers of finished goods, purchase the energy and food that are supplied by business firms. Firms, in their role as consumers of inputs, purchase the services of labor and capital that are supplied by households.

**4 Boxes represents the 4 components of this economy.
We will now analyze each of these 4 components**

General Equilibrium – Many Markets

The First Component: Demand Curves for Food and Energy

The demands for both food and energy come from the households: white-collar and blue-collar.

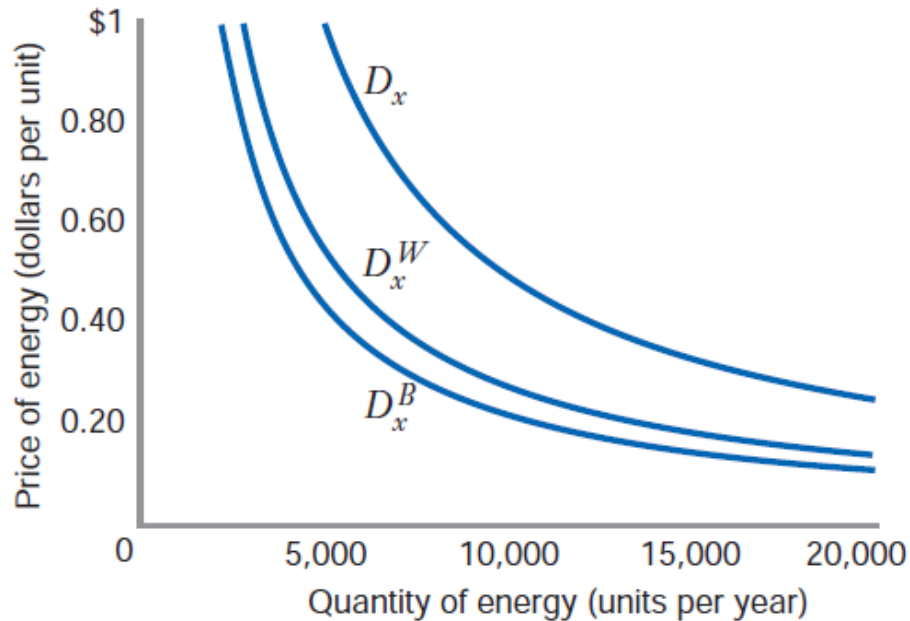
The demand curves are derived from the optimality conditions:

$$MRS_{x,y}^W = \frac{P_x}{P_y} \quad \text{and} \quad MRS_{x,y}^B = \frac{P_x}{P_y}$$

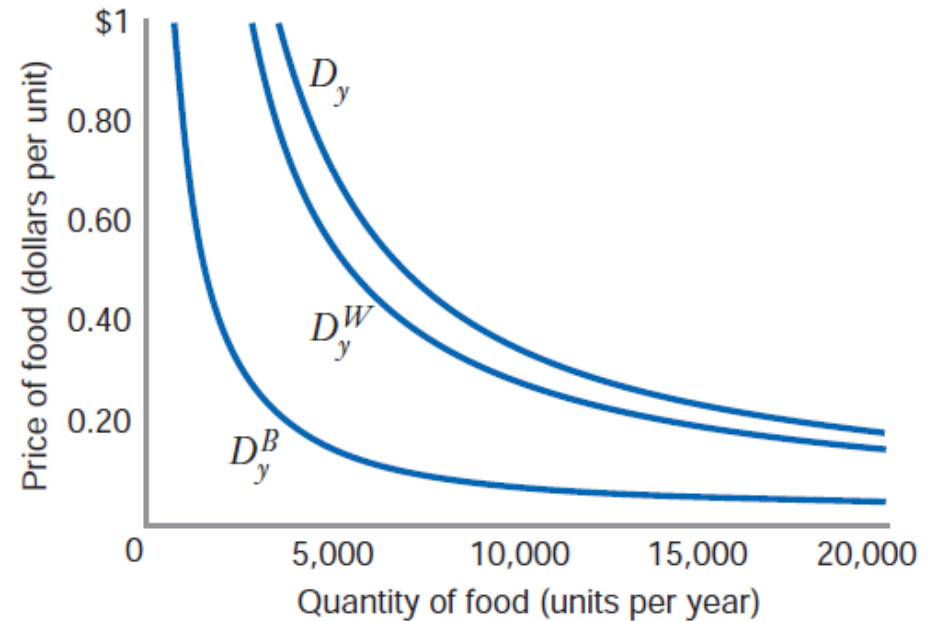
Thus, the demand curves for food and energy come from utility maximization of households.

General Equilibrium – Many Markets

The First Component: Demand Curves for Food and Energy



(a) Energy market



(b) Food market

General Equilibrium – Many Markets

The Second Component: Demand Curves for Labor and Capital

The demands for both labor and capital come from the firms.

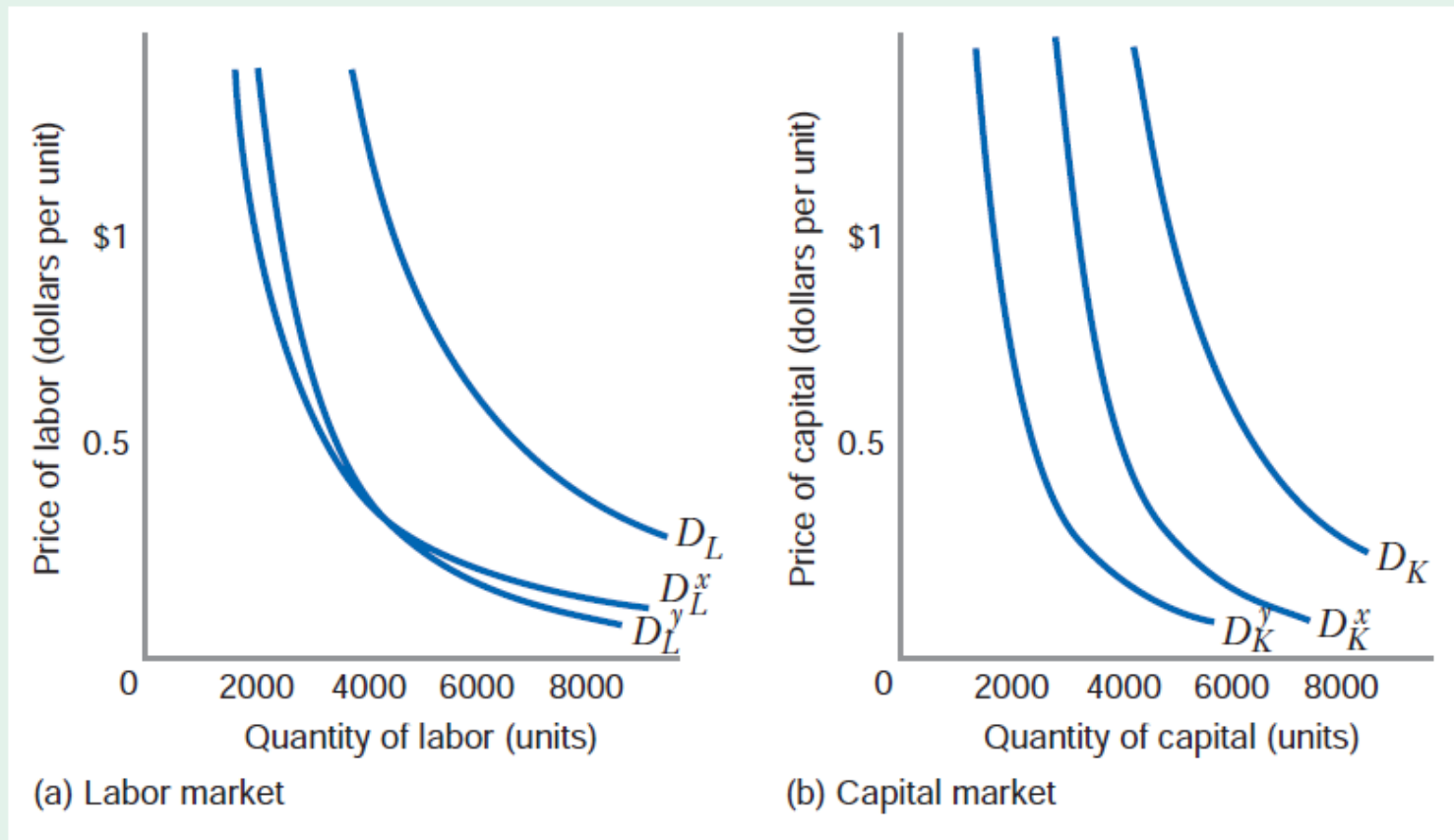
The demand curves are derived from the optimality conditions:

$$MRTS_{l,k}^x = \frac{w}{r} \quad \text{and} \quad MRTS_{l,k}^y = \frac{w}{r}$$

Thus, the demand curves for labor and capital come from cost minimization of firms.

General Equilibrium – Many Markets

The Second Component: Demand Curves for Labor and Capital



General Equilibrium – Many Markets

The Third Component: Supply Curves for Food and Energy

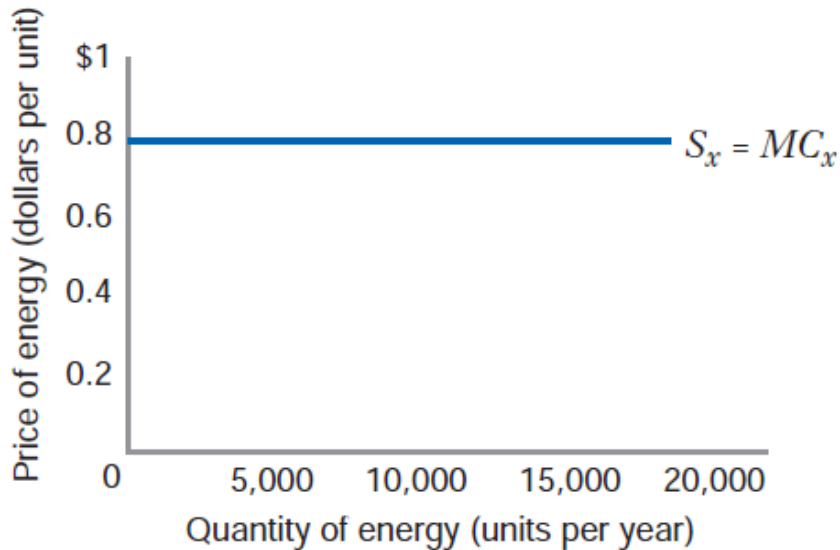
We assume here that the markets for food and energy are **perfectly competitive**. Hence, the supply curves for both goods are perfectly elastic. Firms can supply as much as they want at the market prices, which equal the marginal costs. **Note that the equilibrium prices must also equal the MCs.**

$$P_x = MC_x \quad \text{and} \quad P_y = MC_y$$

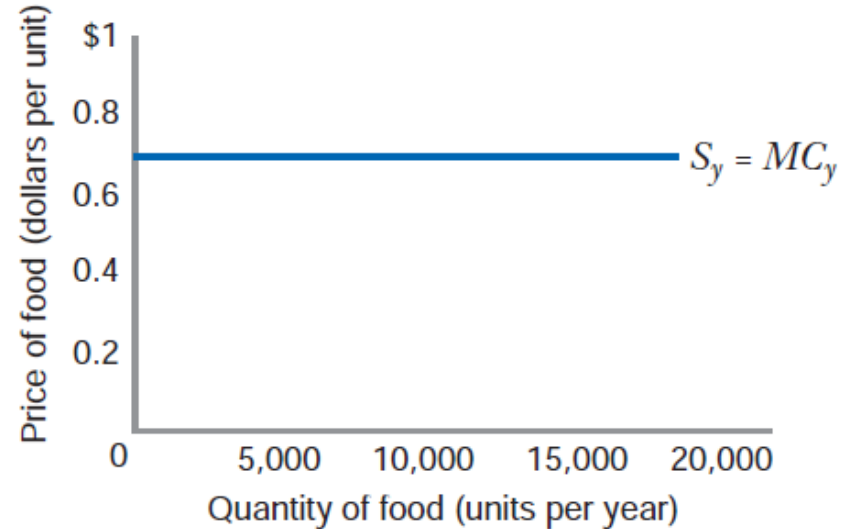
Thus, the supply curves for food and energy come from profit maximization of firms.

General Equilibrium – Many Markets

The Third Component: Supply Curves for Food and Energy



(a) Energy market



(b) Food market

General Equilibrium – Many Markets

The Fourth Component: Supply Curves for Labor and Capital

The two factors of production are provided by households.

Each household can offer a fixed supply of labor and capital.

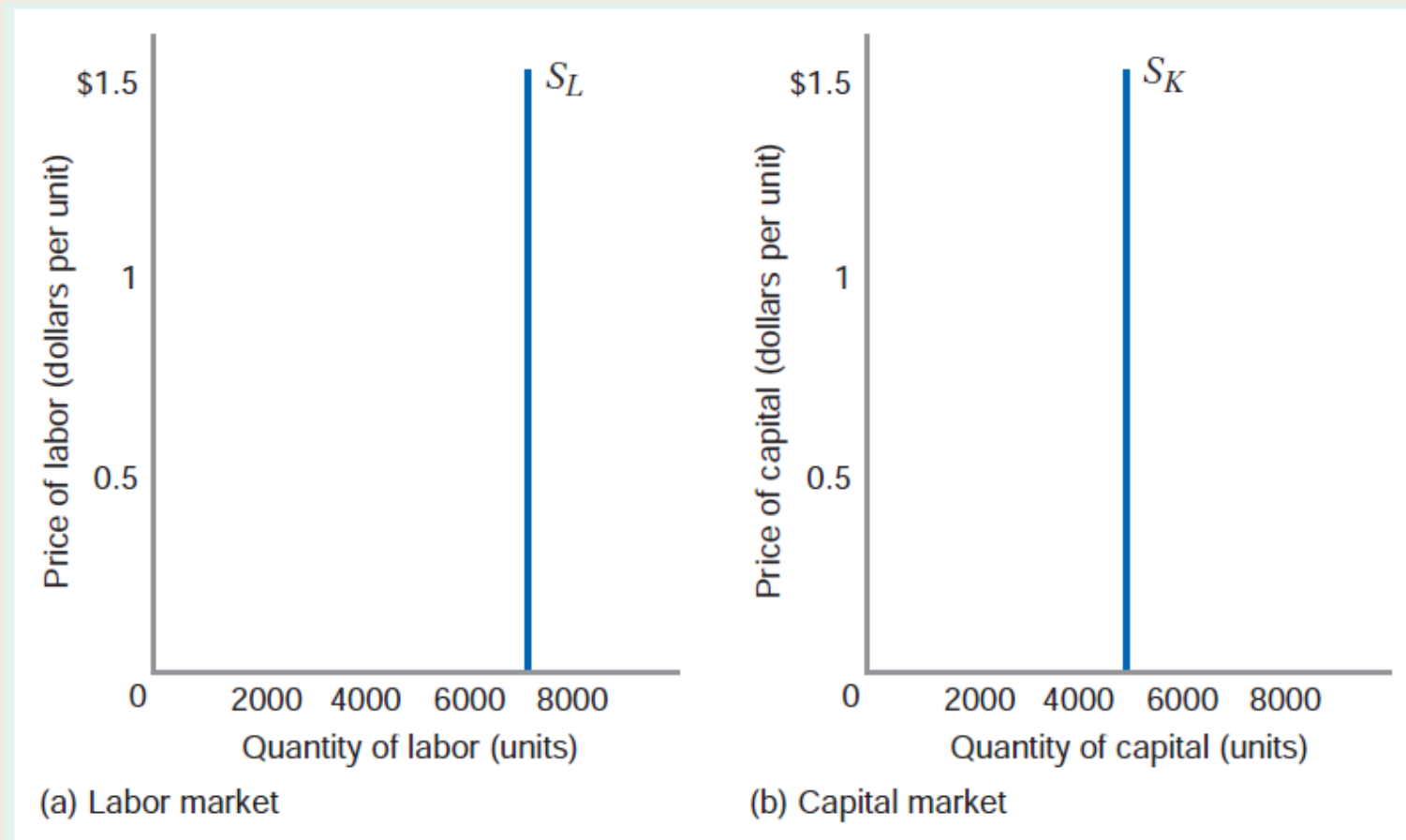
The households will supply positive amounts of inputs as long as their prices are positive. They will supply inputs in either industries as long as their prices are the same in each industry.

This implies that the supply curves are vertical.

Thus, the supply curves for labor and capital come from profit maximization of households.

General Equilibrium – Many Markets

The Fourth Component: Supply Curves for Labor and Capital



General Equilibrium – Many Markets

The General Equilibrium occurs when all markets are in equilibrium. This implies that

In the two goods markets,

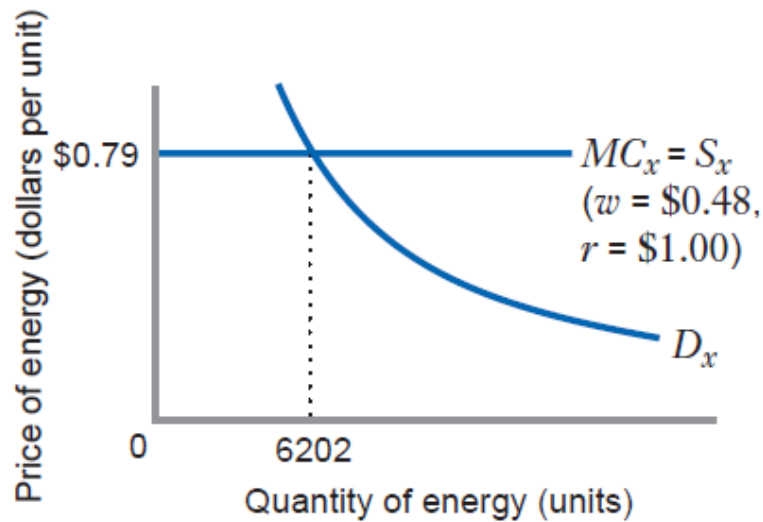
Household Demand for Energy = Firm Supply of Energy

Household Demand for Food = Firm Supply of Food

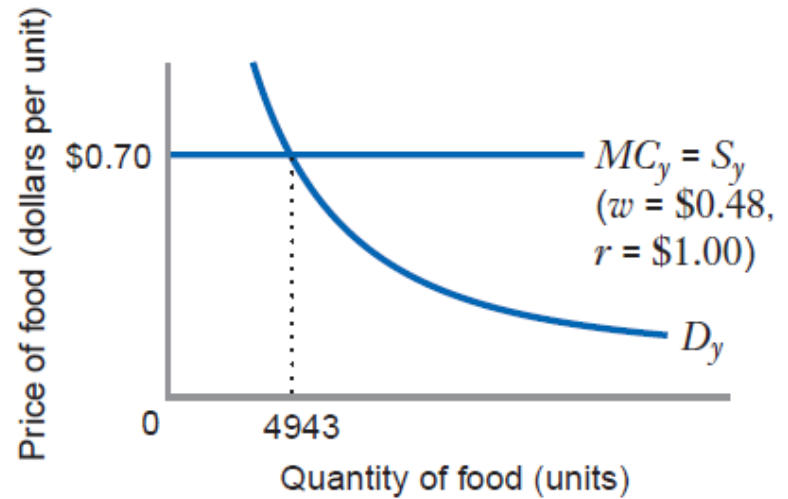
In the two factor markets,

Firm Demand for Labor = Household Supply of Labor

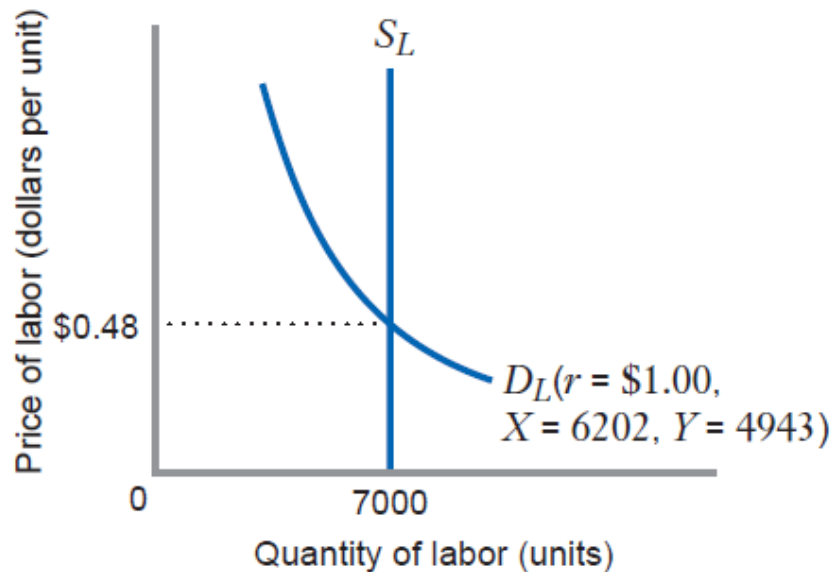
Firm Demand for Capital = Household Supply of Capital



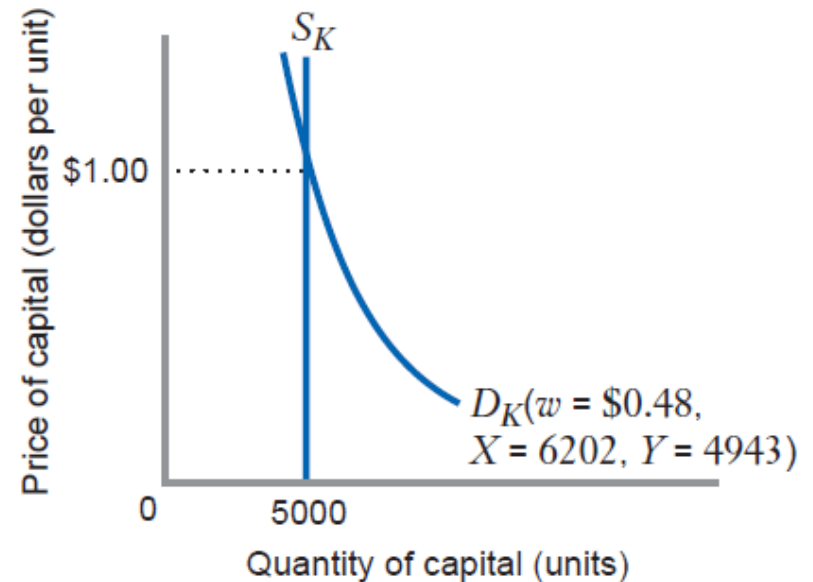
(a) Energy market



(b) Food market



(c) Labor market



(d) Capital market

Economic Efficiency

Our goal is to determine whether allocation of resources in a general equilibrium is efficient or not.

In a partial equilibrium, we see that competition in the market can lead to efficient allocation of resources.

In this lecture, we want to prove the same idea.

We will show that...

Economic Efficiency

General equilibrium implies that markets determine allocation of **goods and inputs**.

We say that such allocation is **Economically Efficient** (or **Pareto Efficient**) **IF there is no feasible allocation of goods and inputs that can make someone better off without making someone else worse off.**

Note that Efficiency and Equity are not the same.

An efficient allocation may NOT be FAIR.

Economic Efficiency

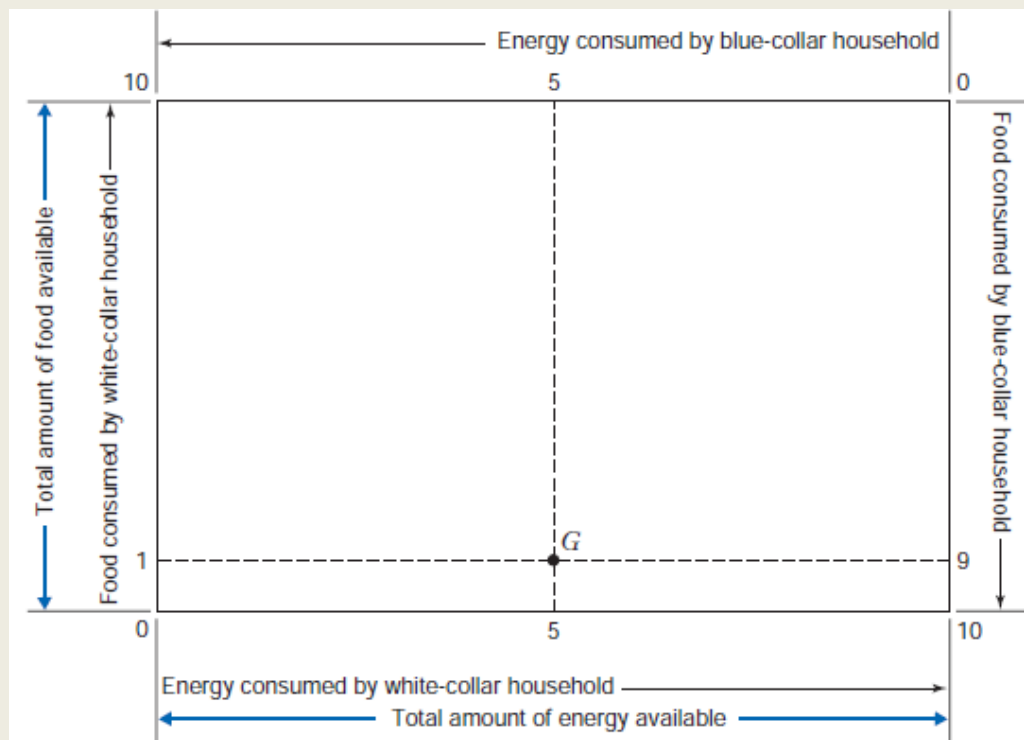
Economic Efficiency requires 3 conditions:

- 1) **Exchange Efficiency** – when a fixed amount of goods cannot be reallocated among consumers to make someone better off without making someone else worse off.
- 2) **Input Efficiency** – when a fixed amount of inputs cannot be reallocated among firms to increase production of one good without reducing production of another good.
- 3) **Substitution Efficiency** – when the total available inputs cannot be reallocated to make everyone better off by producing more of one good and less of another.

Economic Efficiency – Edgeworth Box

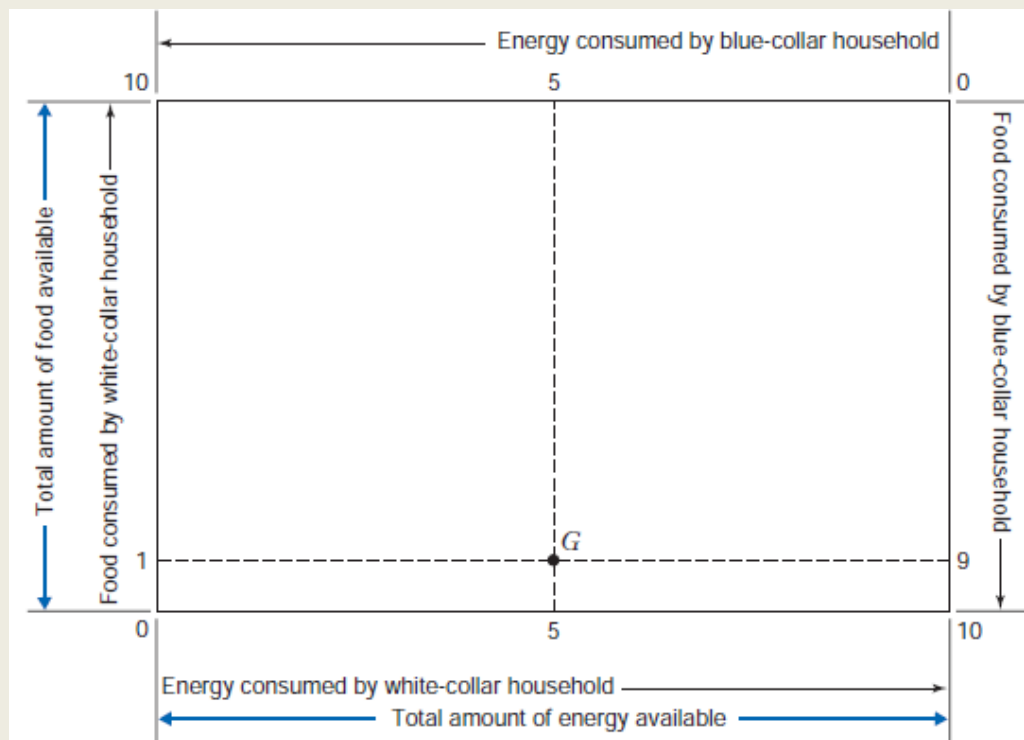
We use Edgeworth Box to analyze Economic Efficiency.

Edgeworth Box shows all the possible allocation of two goods in the economy, given the total available supply of each good.

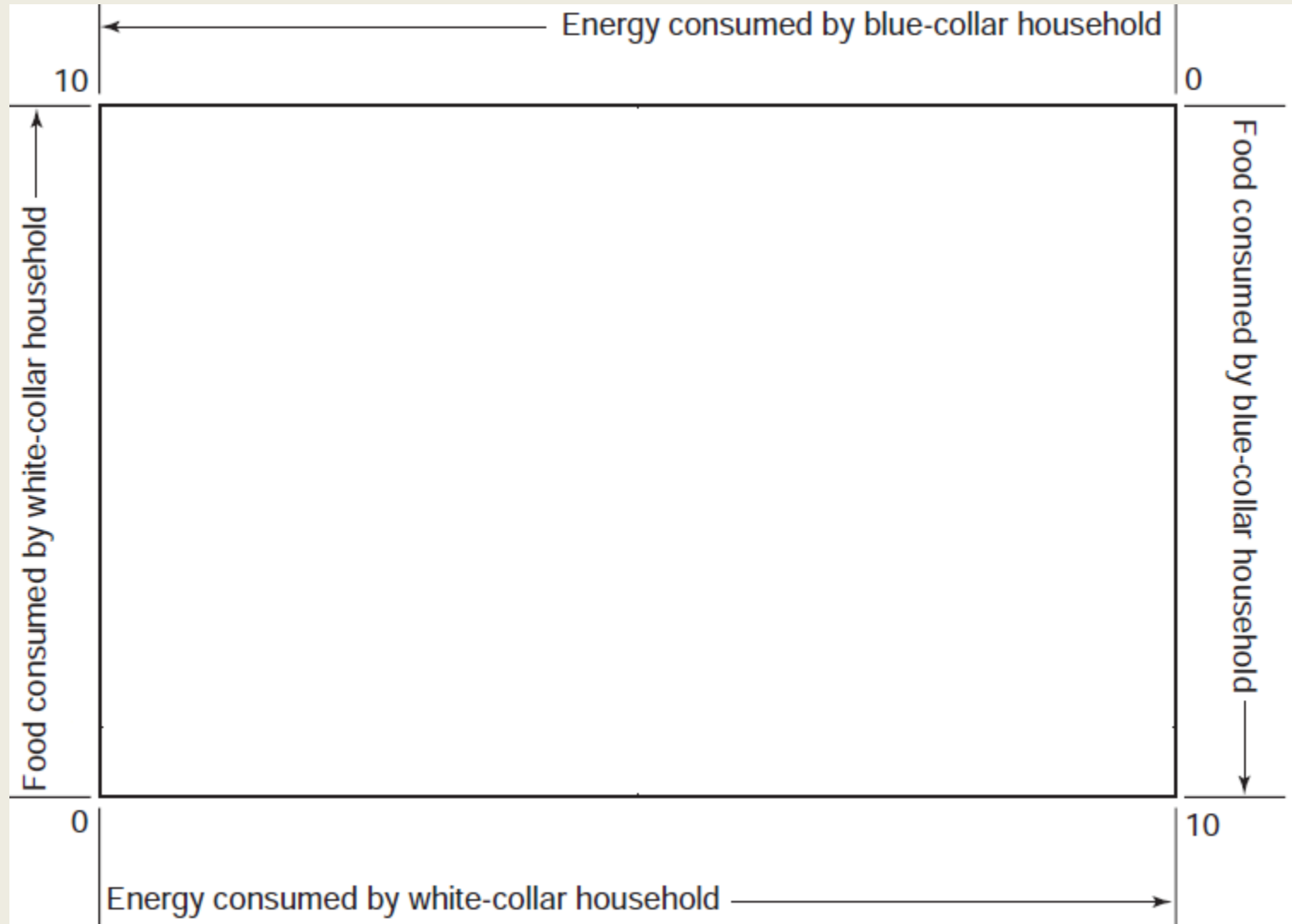


Economic Efficiency – Edgeworth Box

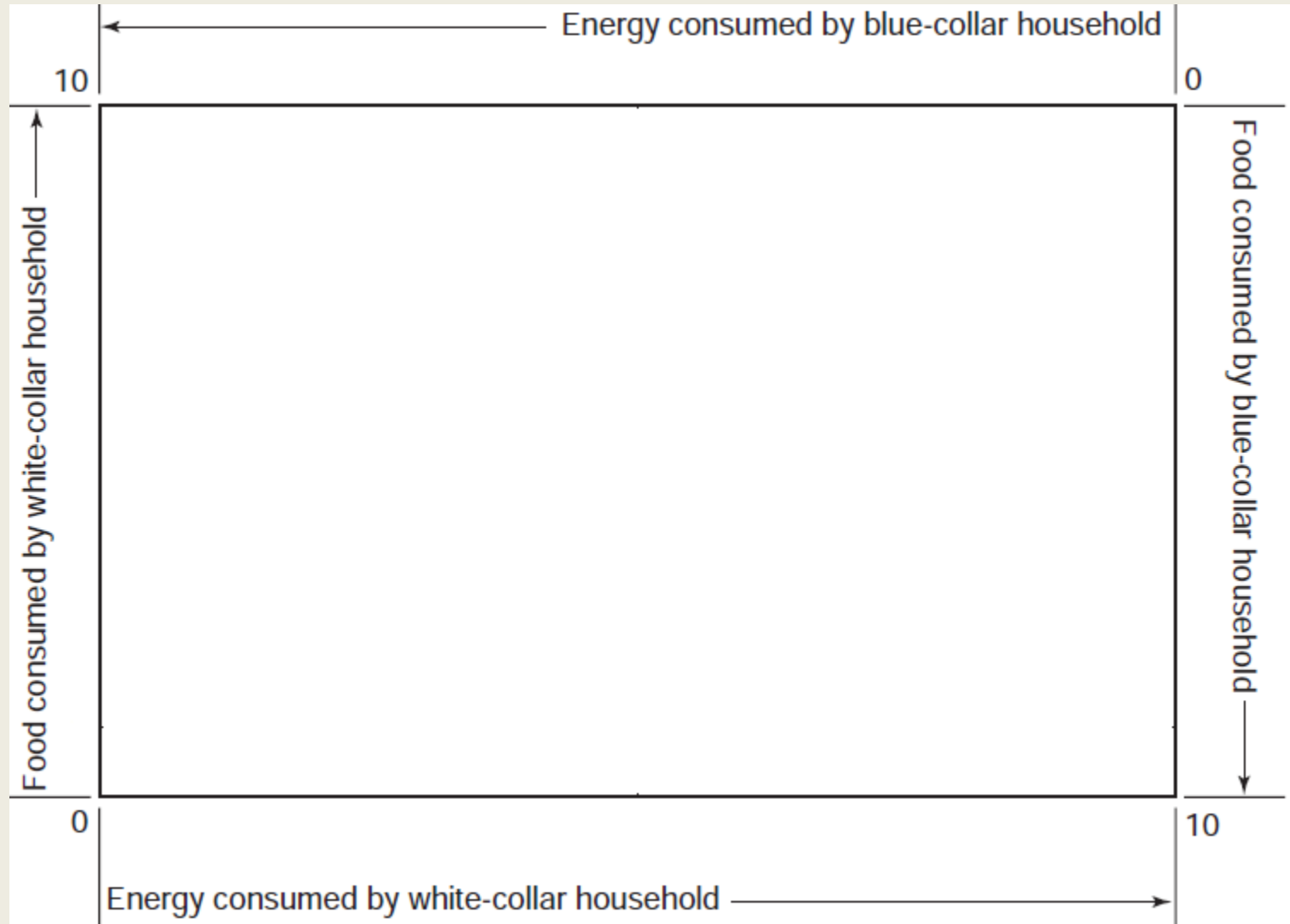
In this economy, 10 food and 10 energy are available.
At Point G, Blue-collar consume 5 energy and 9 food
White-collar consume 5 energy and 1 food.



Indifference Curves



Exchange Inefficient Allocation (point Y)



Exchange Efficient Allocation (point X)



Exchange Efficiency

Point Y is not an exchange-efficient allocation.

At Y, there are potential trades/exchanges among consumers that make at least one consumer better off without making the other consumer worse off.

Point X is an exchange-efficient allocation.

At X, there are **NO** potential trades/exchanges among consumers that make at least one consumer better off without making the other consumer worse off.

Exchange Efficiency

Condition for Exchange Efficiency (Efficiency in Consumption)

$$MRS_{X,Y}^{White} = MRS_{X,Y}^{Blue} = \frac{P_X}{P_Y}$$

Note: X denotes Energy and Y denotes Food.

1. $MRS_{X,Y} = P_X/P_Y$ implies that both consumers are maximizing their utility.
2. $MRS^{White} = MRS^{Blue}$ implies exchange efficiency, i.e. there are no unexploited gains from trade between households.

Exchange Efficiency

$MRS^{\text{white}} = MRS^{\text{blue}}$ implies exchange efficiency. WHY?

For example, **at Point Y**, suppose $MRS^{\text{white}} = 1$ and $MRS^{\text{blue}} = 2$.

Note $MRS_{x,y} = |dy/dx| = |\text{Slope of Indifference Curve}|$

$MRS^{\text{white}} = 1$ means that white-collar is willing to sacrifice 1 unit of Y for 1 unit of X.

$MRS^{\text{blue}} = 2$ means that blue-collar is willing to sacrifice 2 units of Y for 1 unit of X.

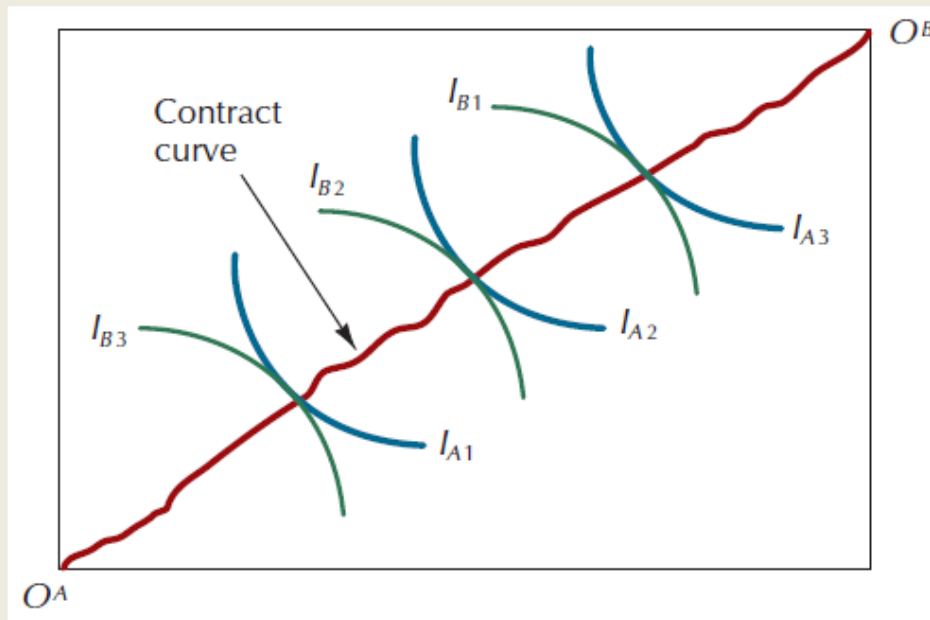
Clearly, blue-collar values X more than white-collar.

At Point X, blue-collar has given some Y to white-collar, while white-collar has given some X to blue-collar. Both are better off.

Contract Curve

A **Contract Curve** shows all the allocations of goods in an Edgeworth Box that are exchange efficient.

If the two households were free to bargain and trade, and if all their trades were mutually beneficial, they would bargain their way to an allocation that was on the contract curve.



Input Efficiency

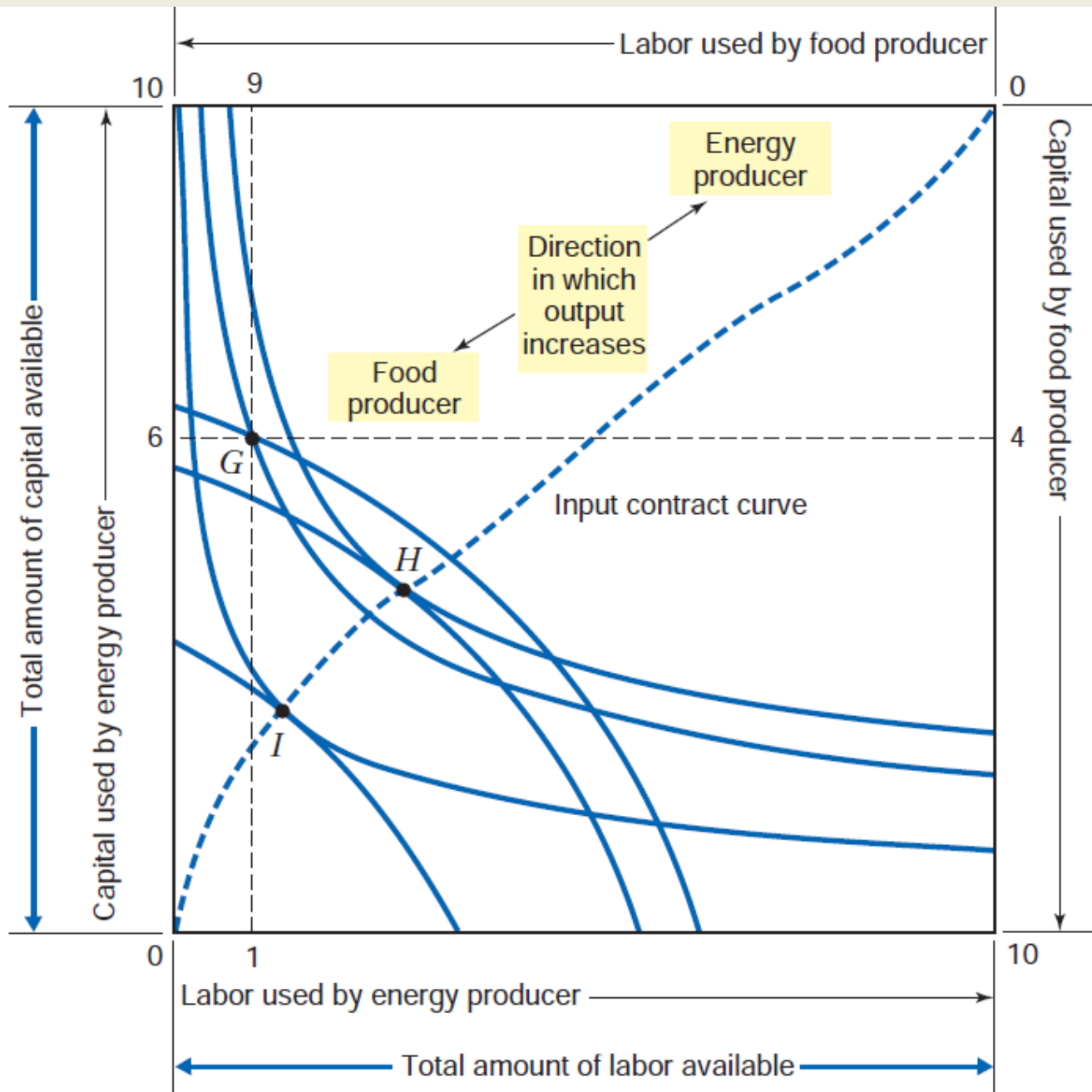
Exchange Efficiency concerns consumption.

Input Efficiency concerns production.

Instead of having two consumers, **we have two producers: energy producer and food producer.**

Instead of indifference curves, **we now have isoquant curves,** with labor and capital as factors of production.

An **Input Contract Curve** then shows all the allocations of inputs in an Input Edgeworth Box that are input efficient.



Input Efficiency

Condition for Input Efficiency (Efficiency in Production)

$$MRTS_{L,K}^{Energy} = MRTS_{L,K}^{Food} = \frac{w}{r}$$

1. $MRTS_{L,K} = w/r$ implies that both producers are minimizing their cost.
2. $MRTS^{Energy} = MRTS^{Blue}$ implies input efficiency, i.e. there are no unexploited gains from reallocation of inputs between producers.

Input Efficiency implies that the production is ON the PPF.

Input Efficiency

$MRTS^{\text{Energy}} = MRTS^{\text{Food}}$ implies input efficiency. WHY?
For example, **at Point G**, let $MRTS^{\text{Energy}} = 2$ and $MRTS^{\text{Food}} = 1$.

Note $MRTS_{L,K} = |dK/dL| = |\text{Slope of Isoquant}|$

$MRTS^{\text{Energy}} = 2$ means that Energy Producer is willing to replace 2 units of K with 1 unit of L.

$MRTS^{\text{Food}} = 1$ means that Food Producer is willing to replace 1 unit of K for 1 unit of L.

Energy Producer needs more L than Food Producer does.

At Point H, Energy Producer has given some K to and receive some L from Food Producer. More outputs are now produced.

Substitution Efficiency

Exchange Efficiency concerns consumption.

Input Efficiency concerns production.

Substitution Efficiency combines the two conditions above.

This is because **we may have both exchange efficiency and input efficiency, but the goods produced may not reflect the consumers' needs.**

For example, the economy now spends all resources of energy. It is clear that all people will be better off if more food is made.

To illustrate this concept, we use the PPF.

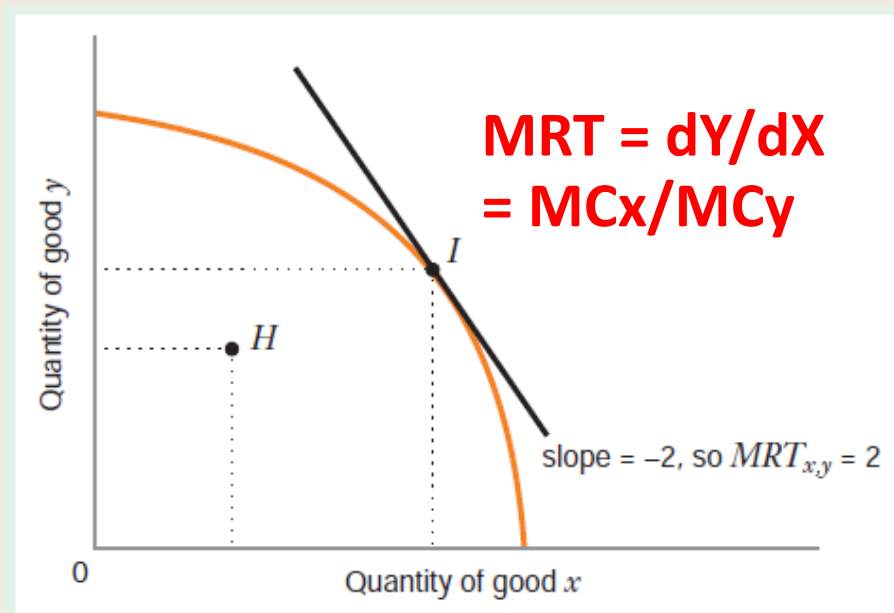
Substitution Efficiency

Input Efficiency requires **production on the PPF**.

Substitution Efficiency requires

$$\text{MRT or Slope of PPF} = \text{MRS or Slope of IC}$$

MRT or **Marginal Rate of Transformation** is the slope of PPF.



Substitution Efficiency

Condition for Substitution Efficiency (Efficiency in Allocation)

$$MRT_{X,Y} = MRS_{X,Y}^{White} = MRS_{X,Y}^{Blue}$$

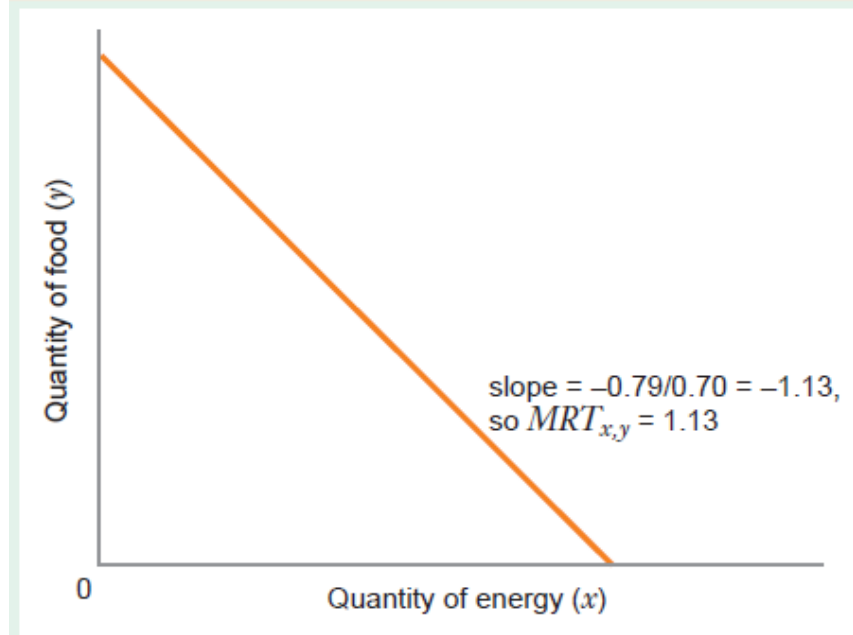
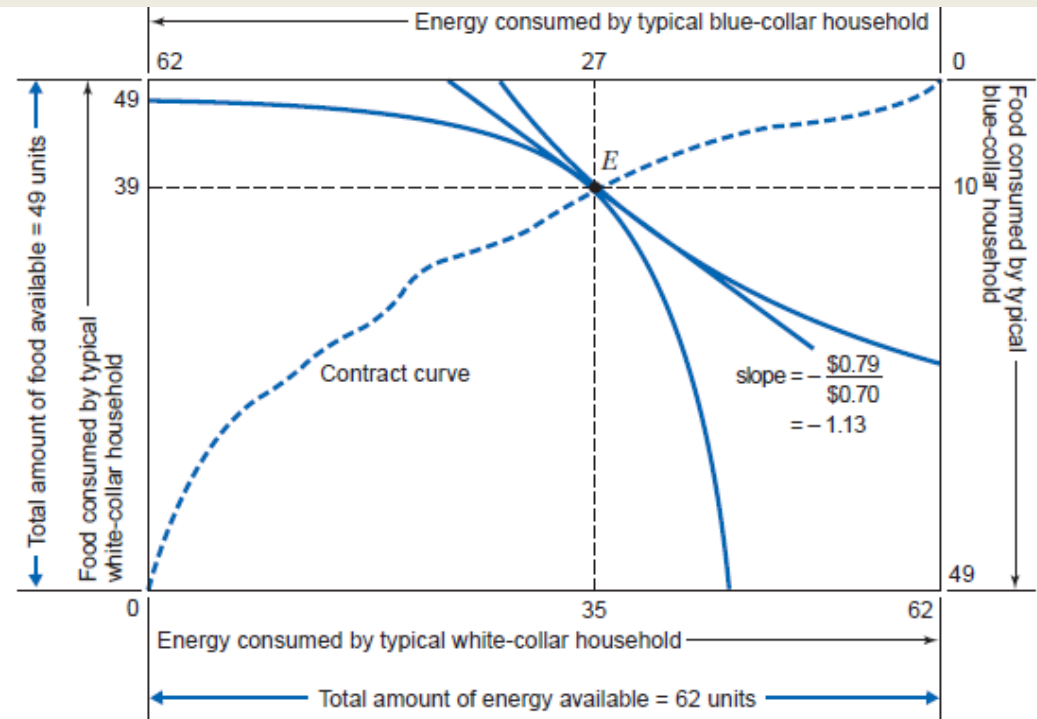
MRT = MRS implies $MC_x/MC_y = MU_x/MU_y$

Rearranging, we have $\frac{MU_x}{MC_x} = \frac{MU_y}{MC_y}$.

That is, the substitution efficiency is such that **1\$ spent to produce X gives the same MU as 1\$ spent to produce Y.**

If $MRS_{X,Y} > MRT_{X,Y}$, the economy should produce more X and less Y, and household utility would go up.

Substitution Efficiency



Competitive General Equilibrium

In the partial equilibrium with one market, a competition in that market ensures efficient allocation of resources.

This is the same as in the general equilibrium case.

When **ALL markets are competitive**, then $P = MC$.

$$MRS_{X,Y}^{White} = MRS_{X,Y}^{Blue} = \frac{P_X}{P_Y} = \frac{MC_X}{MC_Y} = MRT_{X,Y}$$

As a result, Exchange Efficiency, Input Efficiency, and Substitution Efficiency are all satisfied.

We can then conclude that we have “Economic Efficiency” in a “Competitive General Equilibrium”.

Fundamental Theorems of Welfare

Fundamental Theorems of Welfare concerns **Efficiency and Equity** in the allocation of resources.

First Fundamental Theorem of Welfare (EFFICIENCY)

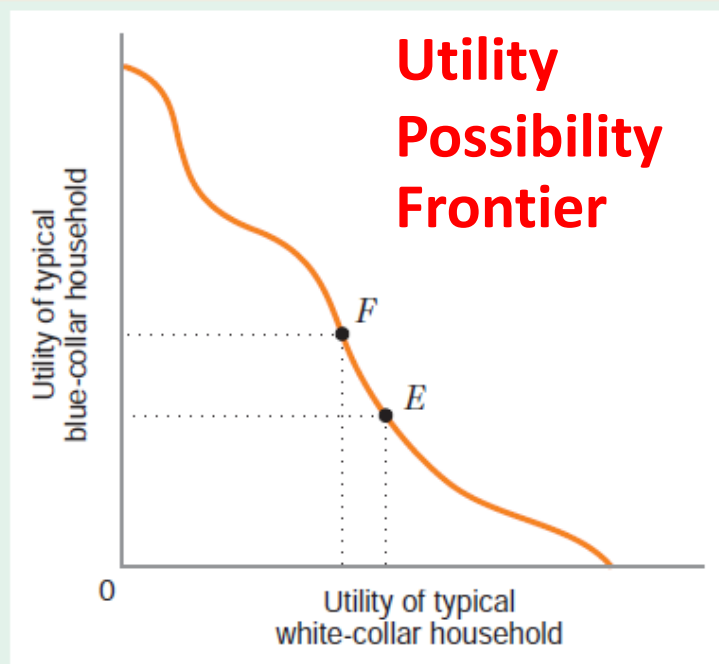
The allocation of goods and inputs in a competitive GE is economically efficient (Pareto efficient).

In other words, given the resources available, there is no other feasible allocation of goods and inputs that could simultaneously make all consumers better off.

Fundamental Theorems of Welfare

Second Fundamental Theorem of Welfare (EQUITY)

Any economically efficient allocation of goods and inputs can be attained as a competitive GE through a **judicious** allocation of the economy's scarce supplies of resources.



Implication

A “Social Planner” may allocate resource such that both blue-collar and white-collar are **EQUALLY** happy, i.e. from E to F.