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PRINCIPLES OF

ECONOMICS

Eight Edition

CHAPTER

18

The Markets for the Factors of Production

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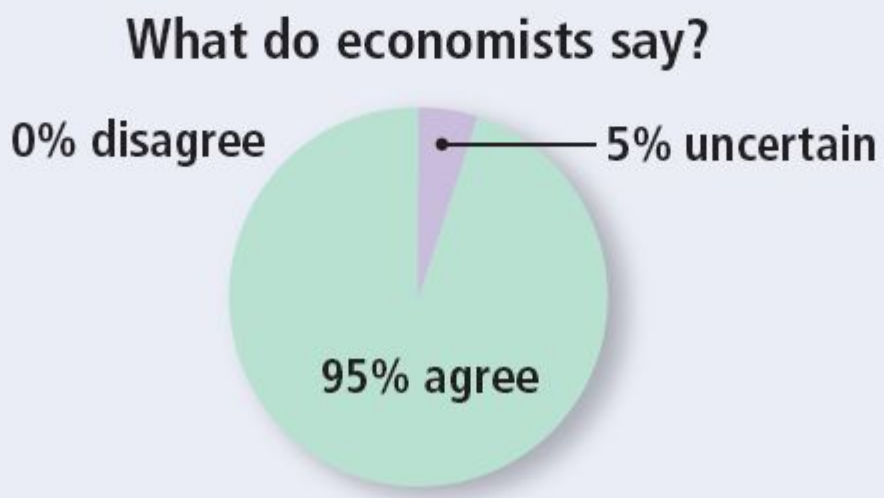
Look for the answers to these questions:

- What determines a competitive firm's demand for labor?
- How does labor supply depend on the wage? What other factors affect labor supply?
- How do various events affect the equilibrium wage and employment of labor?
- How are the equilibrium prices and quantities of other inputs determined?

ASK THE EXPERTS

Immigration

"The average US citizen would be better off if a larger number of highly educated foreign workers were legally allowed to immigrate to the US each year."



Factors of Production and Factor Markets

- Factors of production:
  - Inputs used to produce goods and services
    - Labor
    - Land
    - Capital: the equipment and structures used to produce goods and services
  - Prices and quantities are determined by supply & demand in factor markets.

Derived Demand

- Markets for the factors of production
  - Are like markets for goods & services
  - Except the demand for a factor of production is a derived demand
    - Derived from a firm’s decision to supply a good in another market

Two Assumptions

1. All markets are competitive
   - The typical firm is a price taker
     - In the market for the product it produces
     - In the labor market
2. Firms care only about maximizing profits
   - Each firm’s supply of output and demand for inputs are derived from this goal

Our Example: Farmer Jack

- Farmer Jack sells wheat in a <u>perfectly competitive market</u>.
- He hires workers in a <u>perfectly competitive labor market</u>.

When deciding how many workers to hire, Farmer Jack maximizes profits by thinking at the margin:

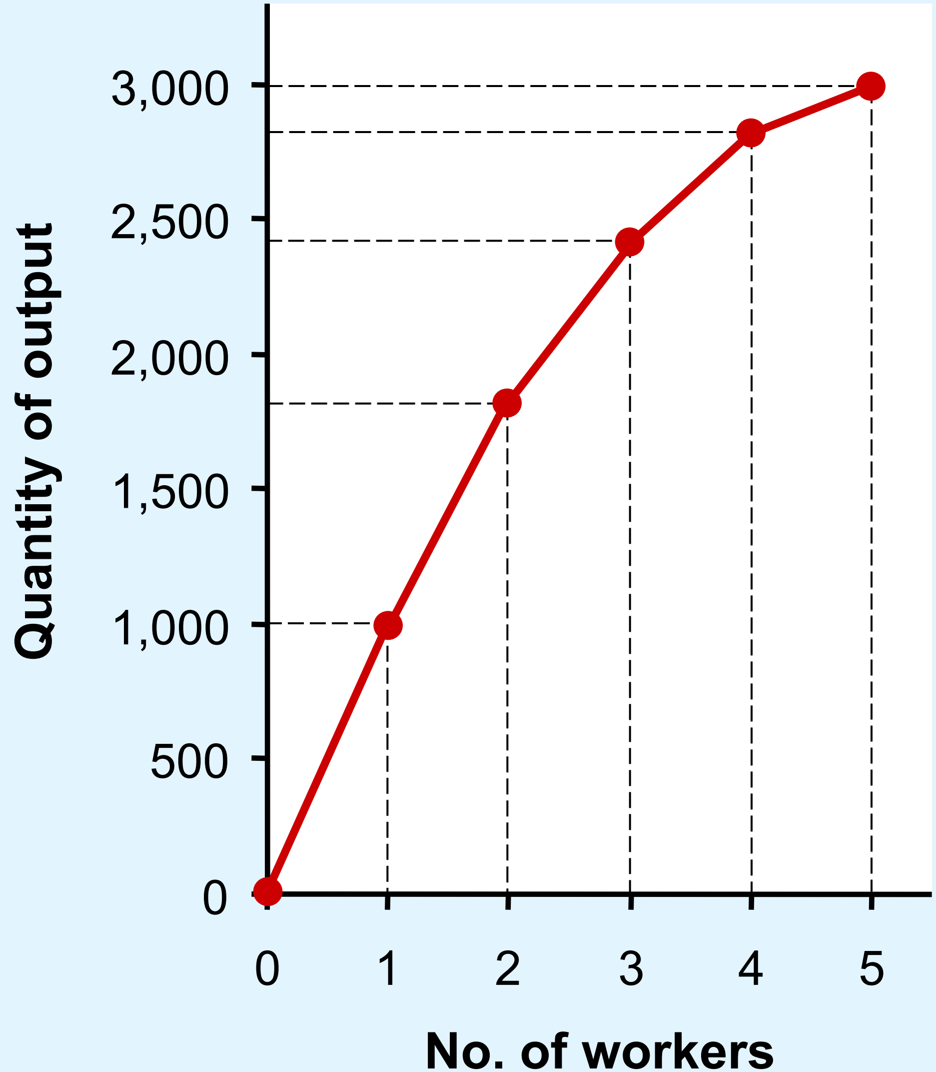
- If the benefit from hiring another worker exceeds the cost, Jack will hire that worker.

Our Example: Farmer Jack

- Cost of hiring another worker:
  - The wage = the price of labor
- Benefit of hiring another worker:
  - Jack can produce and sell more wheat, increasing his revenue.
  - The size of this benefit depends on Jack's **production function**: the relationship between the quantity of inputs used to make a good and the quantity of output of that good

Farmer Jack's Production Function

L (no. of workers)	***Q*** (bushels of wheat per week)
0	0
1	1000
2	1800
3	2400
4	2800
5	3000



Marginal Product of Labor (MPL)

- Marginal product of labor, MPL= ΔQ / ΔL
  - The increase in the amount of output from an additional unit of labor
  - where

    ΔQ = change in output

    ΔL = change in labor

The Value of the Marginal Product

- Problem:
  - Cost of hiring another worker (wage) is measured in dollars
  - Benefit of hiring another worker (MPL) is measured in units of output
  - Solution: convert MPL to dollars
- Value of the marginal product, VMPL=Px MPL
  - The marginal product of an input times the price of the output

Active Learning 1 Computing MPL and VMPL

- P = $5/bushel.
- Find MPL and VMPL, fill them in the blank spaces of the table.
- Then graph a curve with VMPL on the vertical axis, L on horizontal axis.

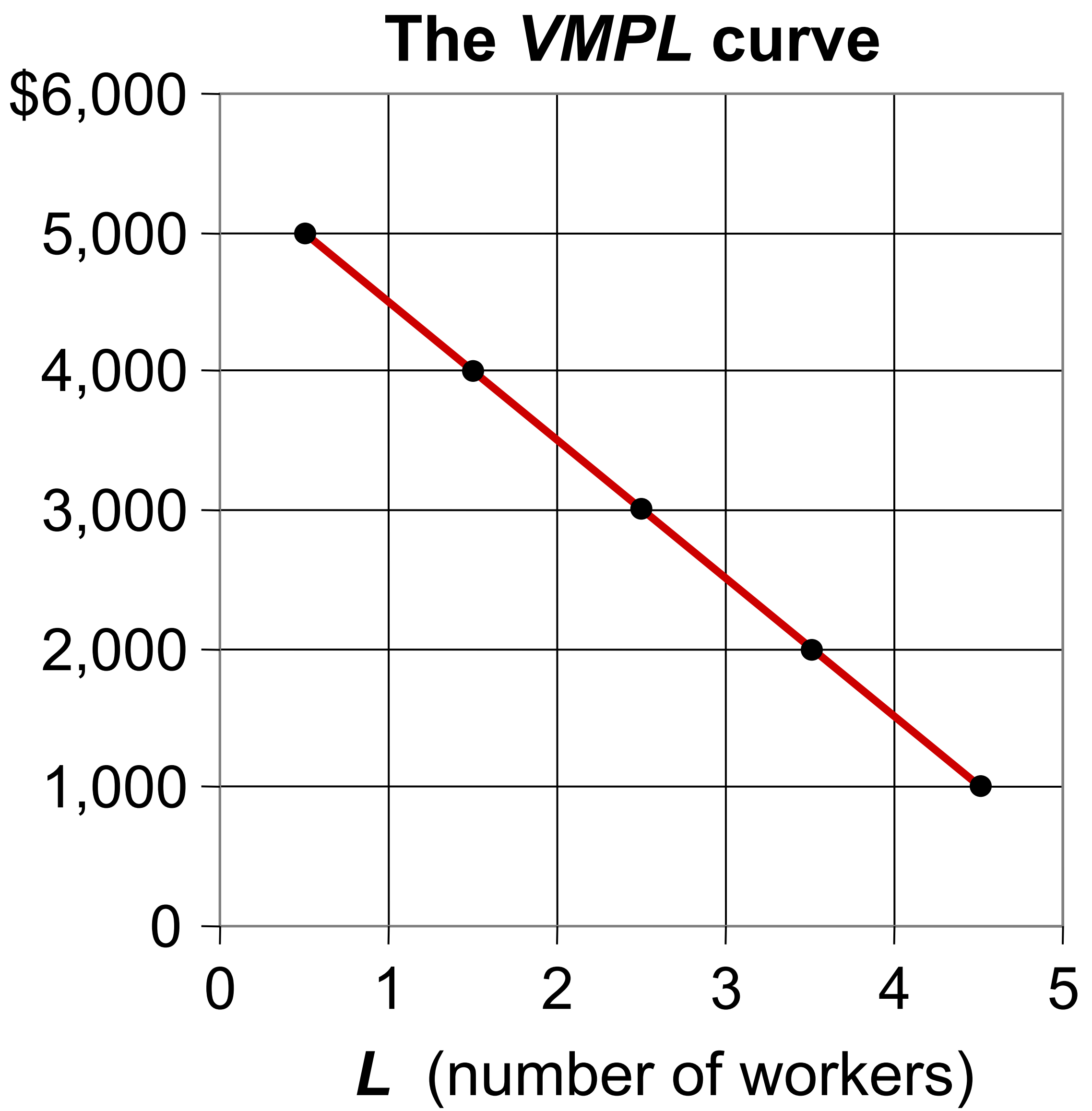
L (no. of workers)	***Q*** (bushels of wheat)	*MPL*	*VMPL*
0	0		
1	1000		
2	1800		
3	2400		
4	2800		
5	3000		

Active Learning 1 Answers

- Farmer Jack's production function exhibits diminishing marginal product:
- MPL falls as L increases.
- This property is very common.

L (no. of workers)	***Q*** (bushels of wheat)	*MPL* = Δ***Q***/Δ***L***	*VMPL* = ***P*** x *MPL*
0	0		
1	1000	1000	$5000
2	1800	800	4000
3	2400	600	3000
4	2800	400	2000
5	3000	200	1000

Active Learning 1 Answers



Farmer Jack's VMPL curve is downward sloping due to diminishing marginal product.

Farmer Jack's Labor Demand

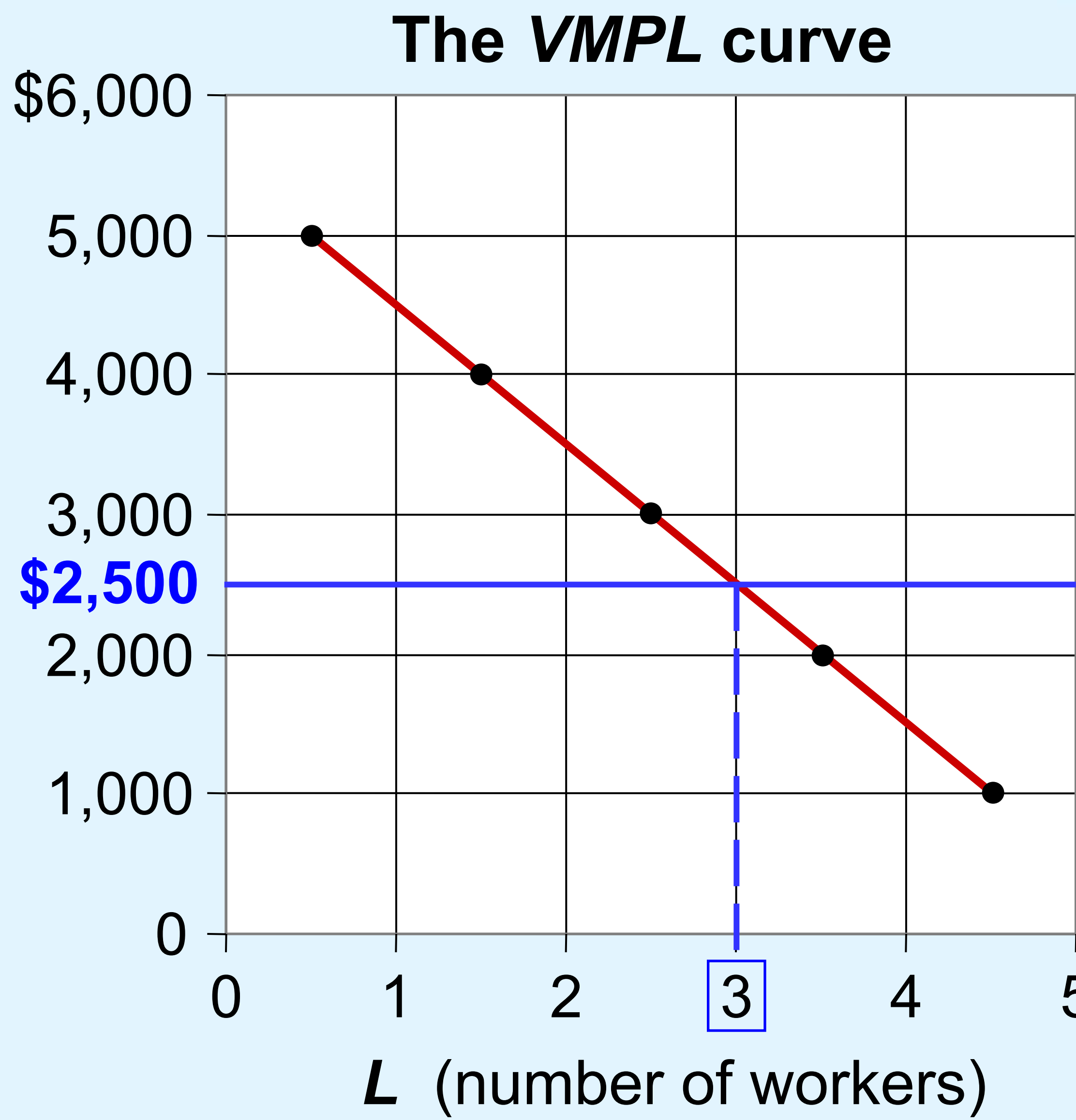
Suppose wage *W* = $2500/week.

How many workers should Jack hire?

Answer: ***L*** = 3

At any smaller ***L:*** increase profit by hiring another worker

At any larger ***L:*** increase profit by hiring one fewer worker.

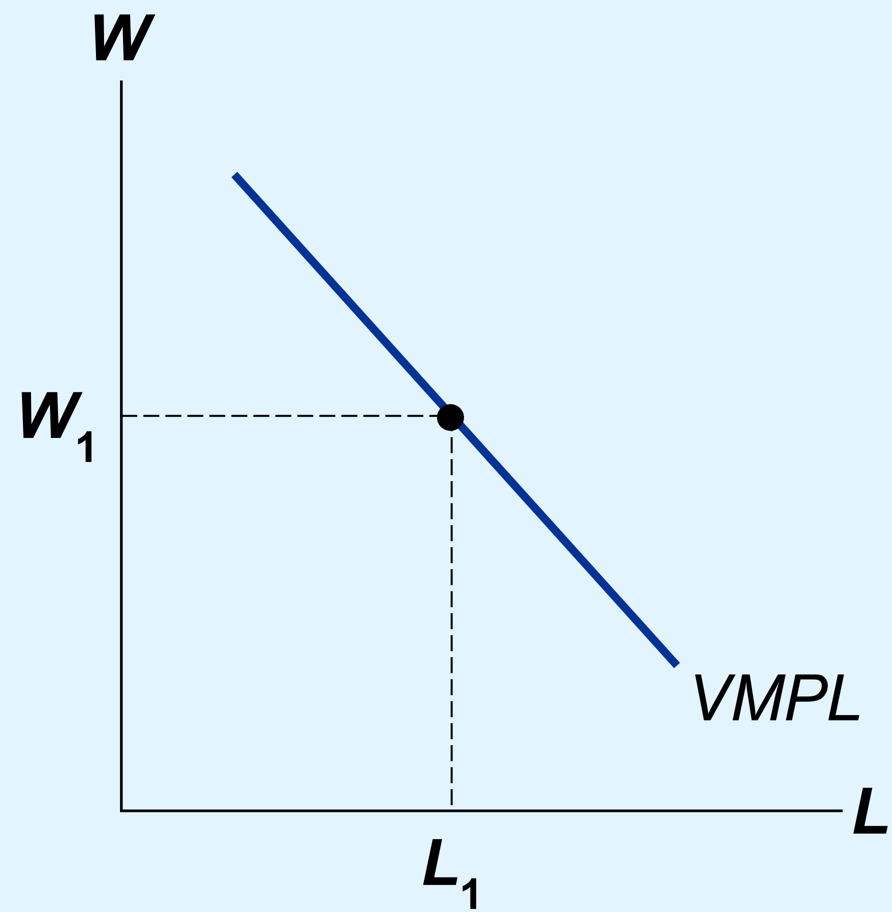


VMPL and Labor Demand

For any competitive, profit-maximizing firm:

To maximize profits, hire workers up to the point where *VMPL* = *W*.

The *VMPL* curve is the labor demand curve.

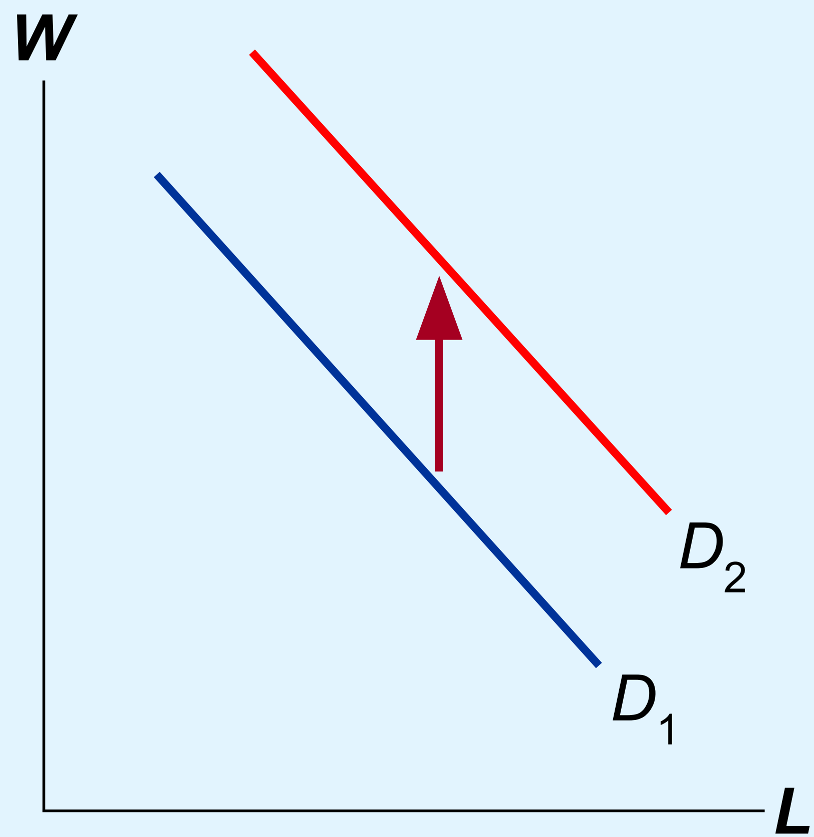


Shifts in Labor Demand

Labor demand curve = *VMPL* curve.

VMPL = *P* x *MPL*

Anything that increases *P* or *MPL* at each *L* will increase *VMPL* and shift the labor demand curve upward.



Things that Shift the Labor Demand Curve

- Changes in the output price, P
- Technological change (affects MPL)
- The supply of other factors (affects MPL)
  - Example:
    If firm gets more equipment (capital), then workers will be more productive; MPL and VMPL rise, labor demand shifts upward.

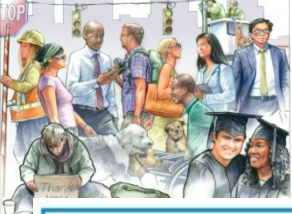
Input Demand & Output Supply

- Marginal Cost (MC)
  - Cost of producing an additional unit of output

  $MC = \Delta TC/\Delta Q$, where TC = total cost
- Suppose W = \$2500, MPL = 500 bushels
  - If Farmer Jack hires another worker:

    $\Delta TC = \$2500$, $\Delta Q = 500$ bushels

    $MC = \$2500/500 = \$5$ per bushel
- In general: MC = W / MPL



Input Demand & Output Supply

$MC = W / MPL$

- To produce additional output
  - Hire more labor.
  - As L rises, MPL falls…
  - causing W/MPL to rise…
  - causing MC to rise.
- Hence:
  - Diminishing marginal product and increasing marginal cost are two sides of the same coin

Input Demand & Output Supply

- The competitive firm's rule for demanding labor: P x MPL = W
  - Divide both sides by MPL: P = W/MPL
  - Substitute MC = W/MPL from previous slide: P = MC
    - This is the competitive firm's rule for supplying output.
- Hence
    - Input demand and output supply are two sides of the same coin.

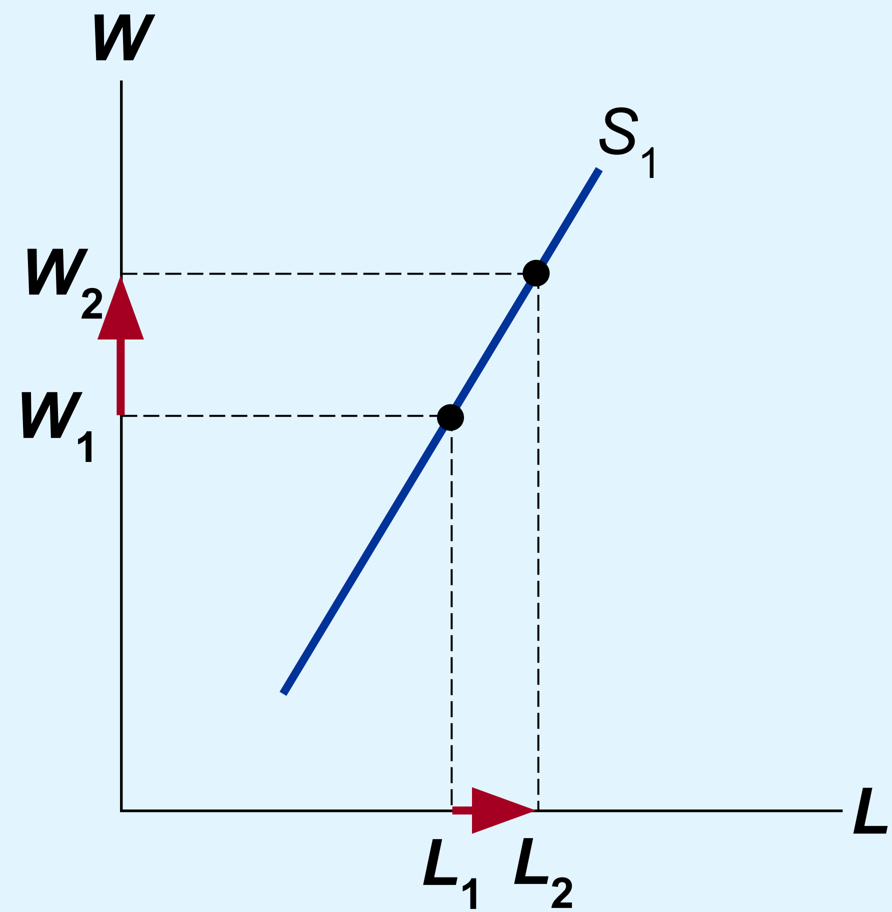
Labor Supply

- Trade-off between work and leisure:
  - The more time you spend working, the less time you have for leisure.
- Wage
  - Is the opportunity cost of leisure

The Labor Supply Curve

An increase in *W* is an increase in the opp. cost of leisure.

People respond by taking less leisure and by working more.



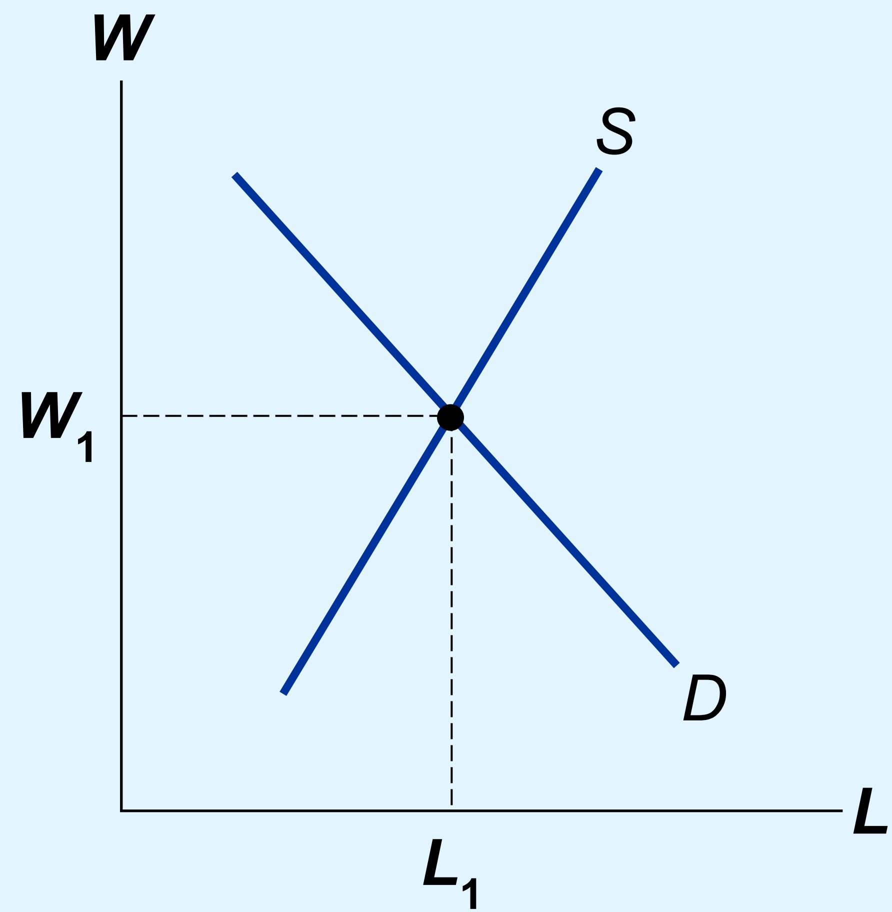
Things that Shift the Labor Supply Curve

- Changes in tastes or attitudes regarding the labor–leisure trade-off
- Changes in alternative opportunities
- Immigration
  - Movement of workers from region to region, or country to country

Equilibrium in the Labor Market

The wage adjusts to balance supply and demand for labor.

The wage always equals *VMPL*.



ASK THE EXPERTS

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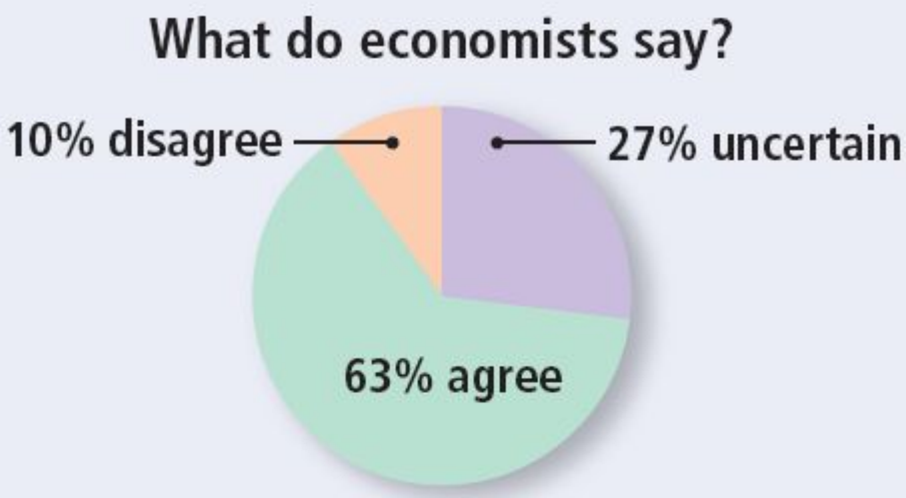
"The average US citizen would be better off if a larger number of low-skilled foreign workers were legally allowed to enter the US each year."



Active Learning 2 Changes in labor-market equilibrium

In each of the following scenarios, use a diagram of the market for (domestic) auto workers to find the effects on their wage and employment.

A. Baby boomers who worked in the auto industry retire.

B. Car buyers' preferences shift toward imported autos.

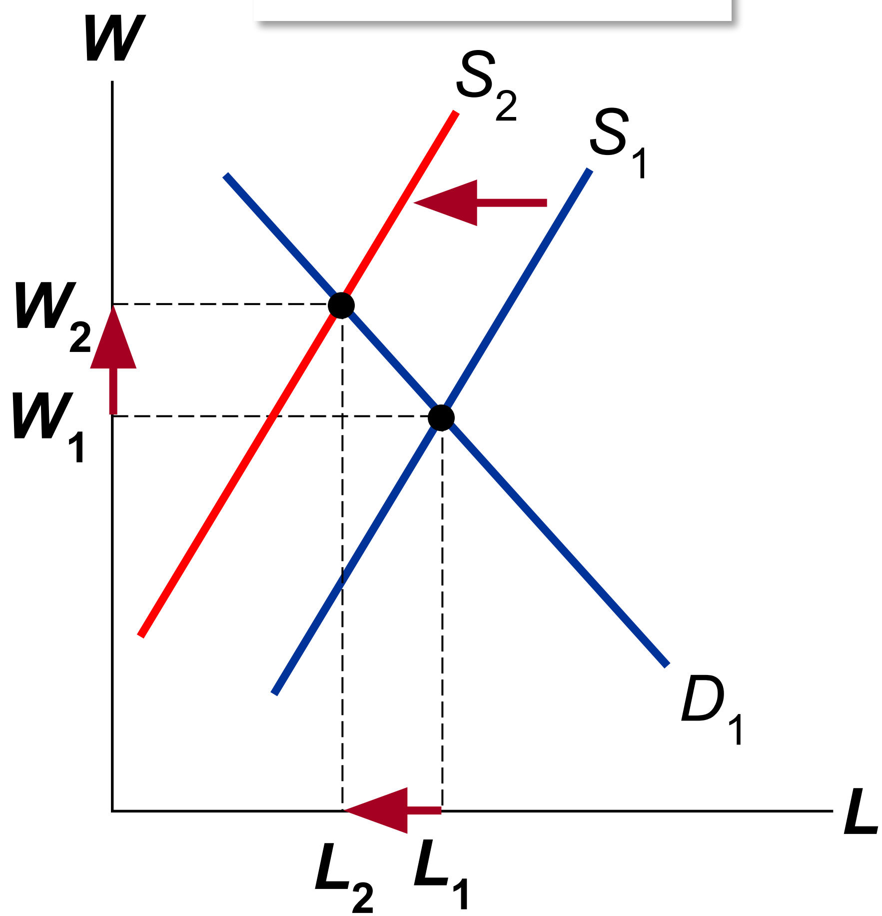
C. Technological progress boosts productivity in the auto manufacturing industry.

Active Learning 2 Answers to A

The retirement of baby boomer auto workers shifts supply leftward.

- W rises, L falls.

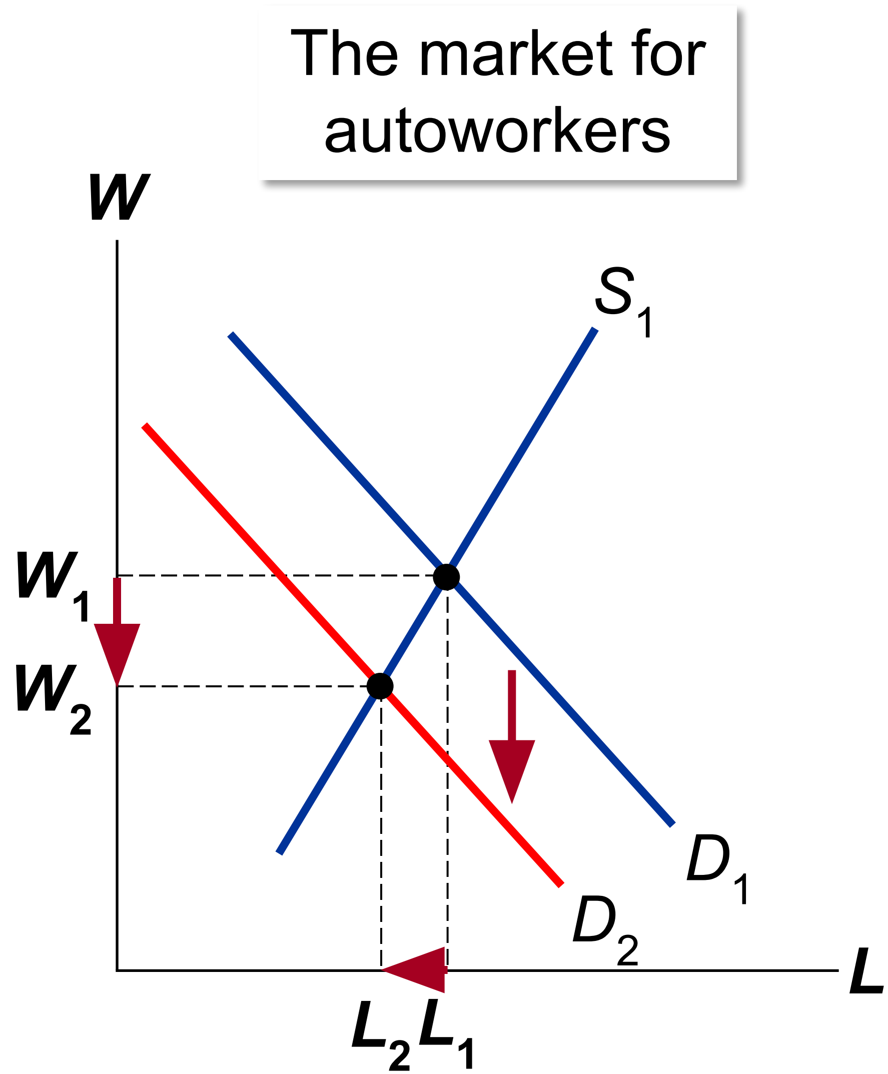
The market for autoworkers



Active Learning 2 Answers to B

A fall in the demand for U.S. autos reduces P.

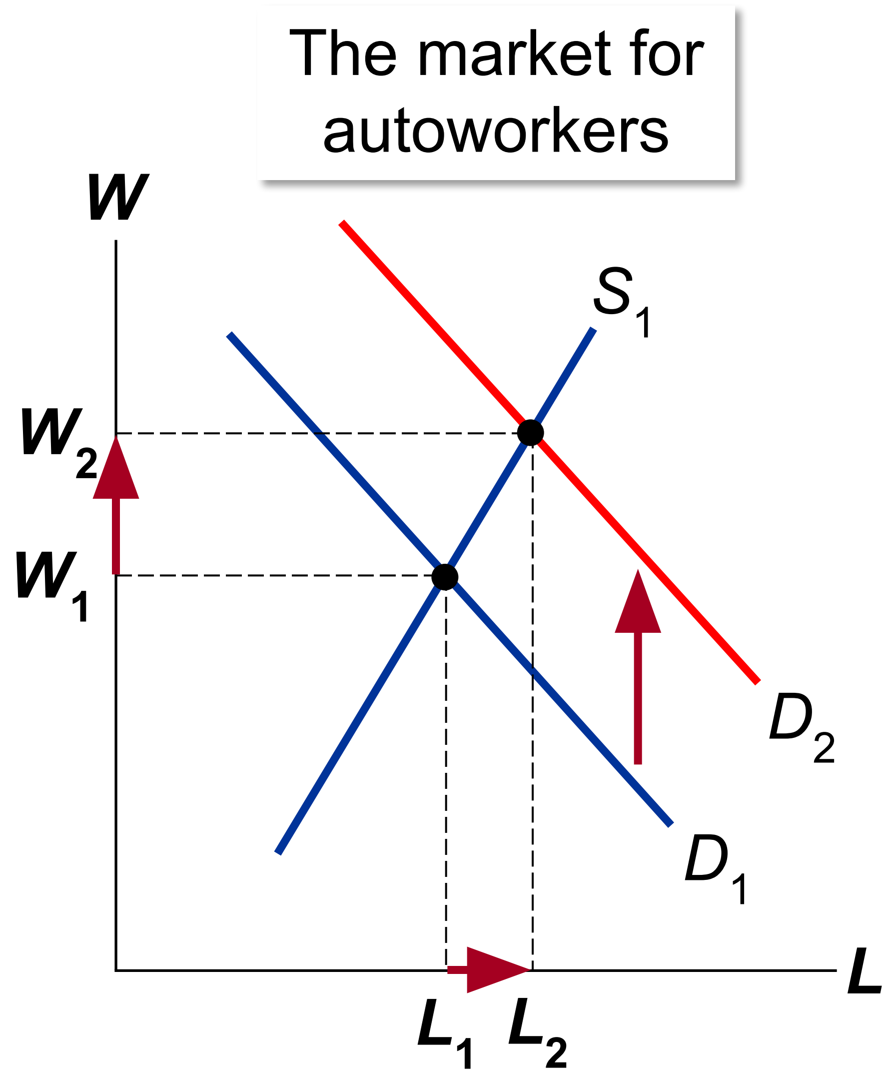
- At each L, VMPL falls.
- Labor demand curve shifts down.
- W and L both fall.



Active Learning 2 Answers to C

At each L,
MPL rises due to tech. progress.

- VMPL rises and labor demand curve shifts upward.
- W and L increase.



Productivity and Wage Growth in the U.S.

time period	growth rate of produc-tivity	growth rate of real wages
1960–2015	2.0%	1.8%
1960–1973	2.7	2.7
1973–1995	1.4	1.2
1995–2015	2.1	1.8

Recall one of the Ten Principles:

A country's standard of living depends on its ability to produce goods and services.

Our theory implies wages tied to labor productivity ($W = VMPL$).
We see this in the data.

Monopsony

- Monopsony:
  - A market with one buyer
  - A monopsony employer can use its market power to increase its profits by paying lower wages
  - As with monopoly, economic activity under monopsony is below the socially optimal level, causing a deadweight loss
- Monopsonies are rare in the real world

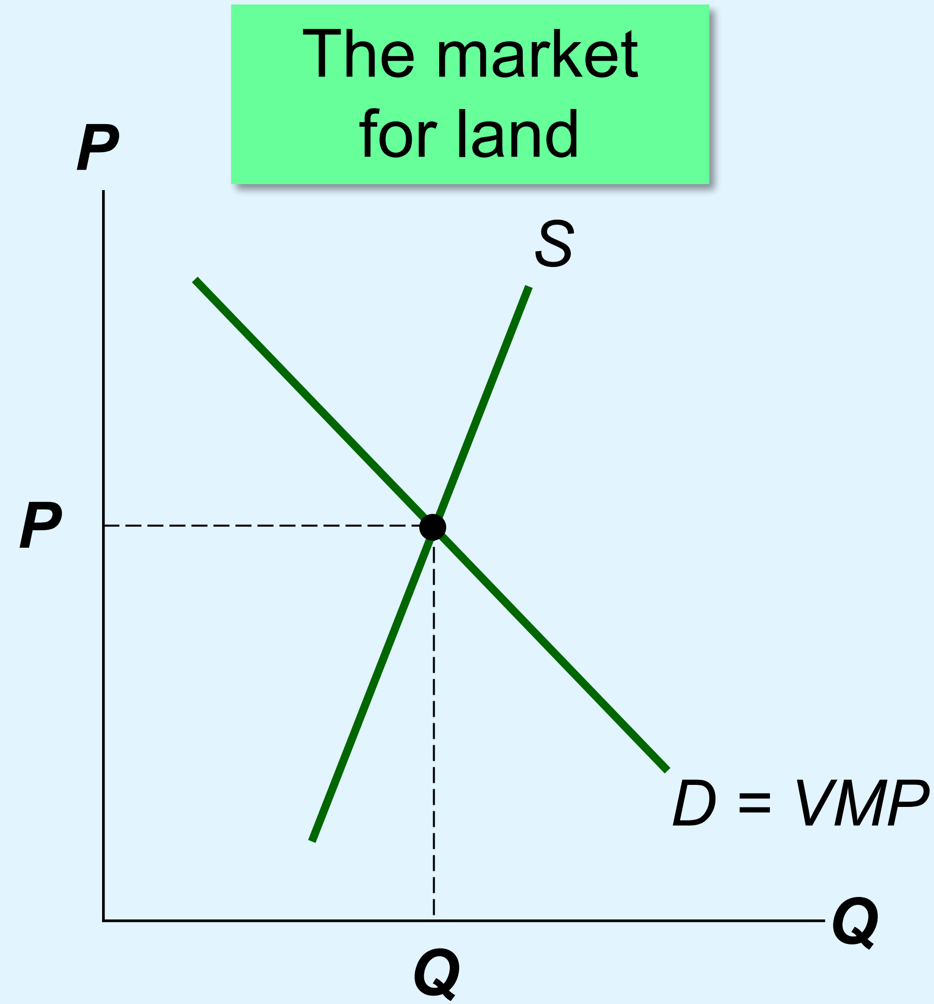
Land and Capital

- With land and capital, must distinguish between:
  - Purchase price: the price a person pays to own that factor indefinitely
  - Rental price: the price a person pays to use that factor for a limited period of time
    - The wage is the rental price of labor
- The determination of the rental prices
  - Analogous to the determination of wages

How the Rental Price of Land Is Determined

Firms increase the quantity of land to rent until the value of the marginal product (*VMP*) of land equals the land's rental price.

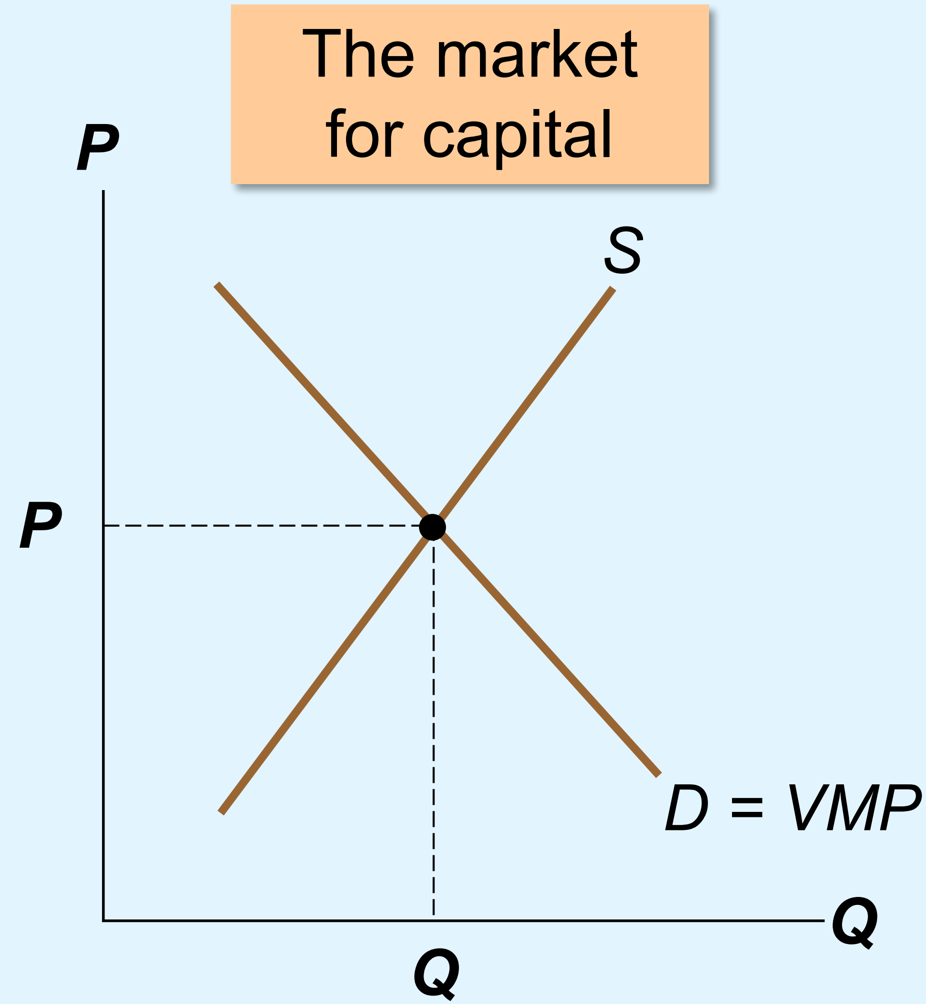
The rental price of land adjusts to balance supply and demand for land.



How the Rental Price of Capital Is Determined

Firms increase the quantity of capital to rent until the value of the marginal product (*VMP*) of capital equals the capital's rental price.

The rental price of capital adjusts to balance supply and demand for capital.



Rental and Purchase Prices

- Buying a unit of capital or land
  - Yields a stream of rental income.
- The rental income in any period
  - Equals the value of the marginal product (VMP)
- Hence, the equilibrium purchase price of a factor
  - Depends on both the current VMP and the VMP expected to prevail in future periods.

Linkages Among the Factors of Production

- Factors of production are used together
  - In a way that makes each factor’s productivity dependent on the quantities of the other factors
  - Example: an increase in the quantity of capital
    - The marginal product and rental price of capital fall
    - Having more capital makes workers more productive, MPL and W rise

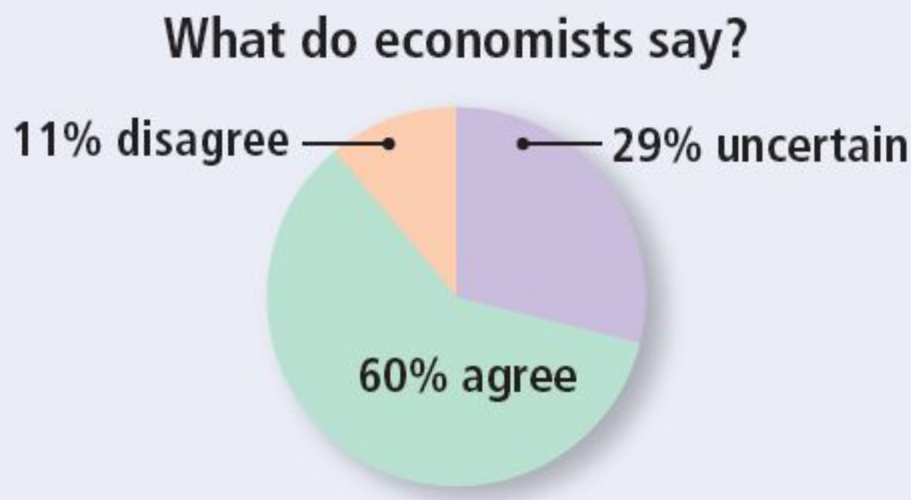
Conclusion

- Neoclassical theory of income distribution
  - Theory developed in this chapter
  - Factor prices are determined by supply and demand
  - Each factor is paid the value of its marginal product
  - Used by most economists as a starting point for understanding the distribution of income

ASK THE EXPERTS

Immigration

"Unless they were compensated by others, many low-skilled American workers would be substantially worse off if a larger number of low-skilled foreign workers were legally allowed to enter the US each year."



Summary

- The economy's income distribution is determined in the markets for the factors of production. The three most important factors of production are labor, land, and capital.
- A firm's demand for a factor is derived from its supply of output.
- Competitive firms maximize profit by hiring each factor up to the point where the value of its marginal product equals its rental price.

Summary

- The supply of labor arises from the trade-off between work and leisure; yields an upward-sloping labor supply curve.
- The price paid to each factor adjusts to balance supply and demand for that factor. In equilibrium, each factor is compensated according to its marginal contribution to production.
- Factors of production are used together. A change in the quantity of one factor affects the marginal products and equilibrium earnings of all factors.