Factor Markets
EE311

Topics to be Discussed

- Competitive Factor Markets
- Equilibrium in a Competitive Factor Market
- Factor Markets with Monopoly Power
- Factor Markets with Monopsony Power
- Bilateral Monopoly

Summary

Factor Seller Market	Factor Buyer Market	Final Good Market	
		Competitive	Monopoly
Competitive	Competitive	1	2
	Monopoly	3	---
Monopoly	Competitive	4	---
	Monopoly	5	

Competitive Factor Markets

- Characteristics
  1. Large number of sellers of the factor of production
  2. Large number of buyers of the factor of production
  3. The buyers and sellers of the factor of production are price takers
  4. Examples: construction worker market (In 2006, there were about 89,000 construction firms)

Factor Input Demand – One Variable Input (L), short run

- Demand for a Factor Input when only one input is variable (L), assuming K fixed
  - Factor demands are derived demand
    - Demand for an input that depends on, and is derived from, both the firm's level of output and the cost of inputs.
    - Demand for carpenters derived from how much furniture the firm expects to sell

Factor Input Demand – One Variable Input

- How does a firm decide if its profitable to hire another worker?
  - If the additional revenue from the output of hiring another worker is greater than its additional cost
- The incremental cost of a unit of labor is the wage rate, *w*

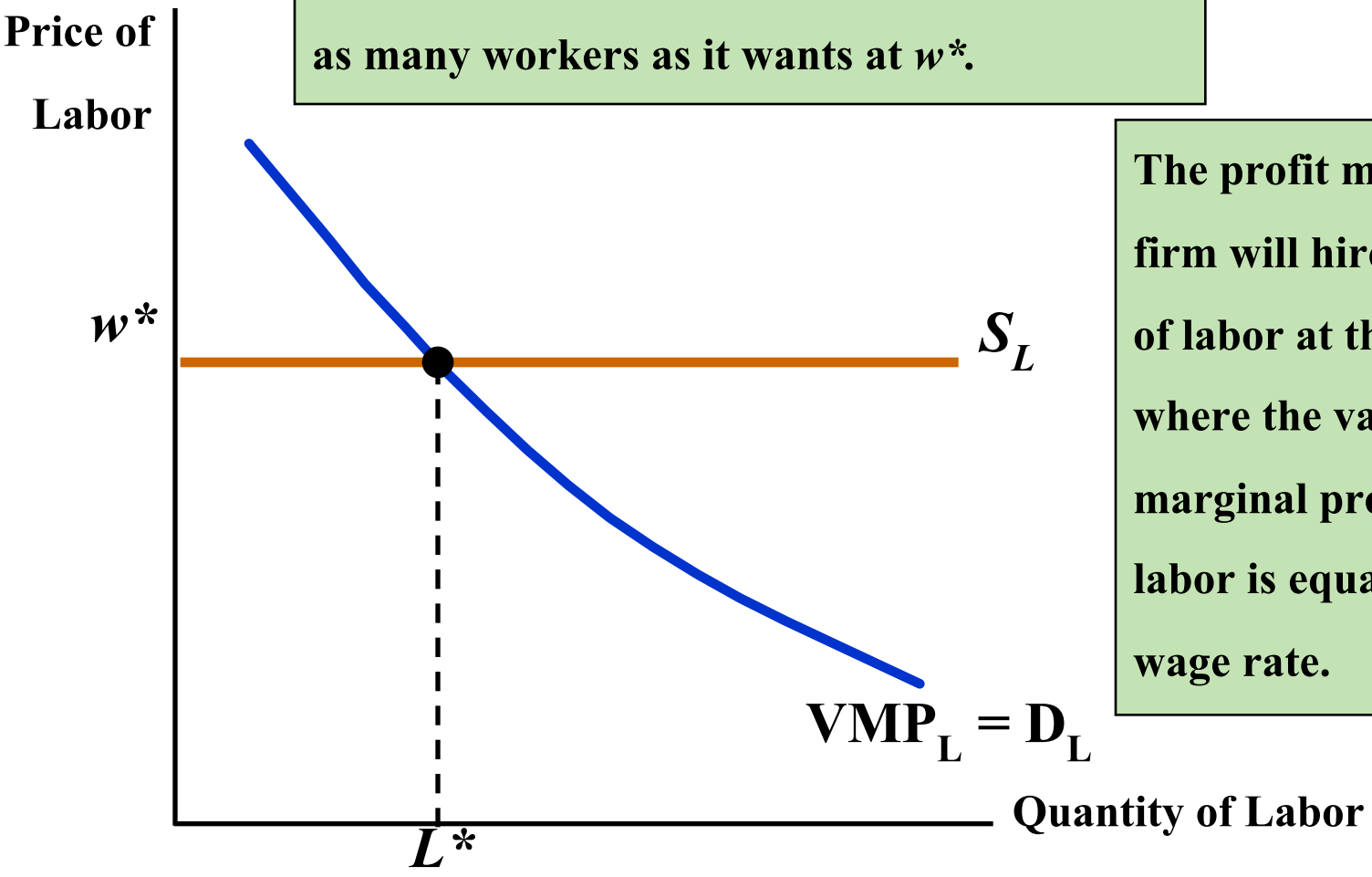
Factor Input Demand – One Variable Input

- Value of Marginal Product of Labor $VMP_L = P \times MP_L$
  - Additional revenue resulting from the sale of output created by the use of one additional unit of an input
- Profitable to hire more labor if the VMP_L is at least as large as the wage rate, *w*

$$VMP_L \geq W$$

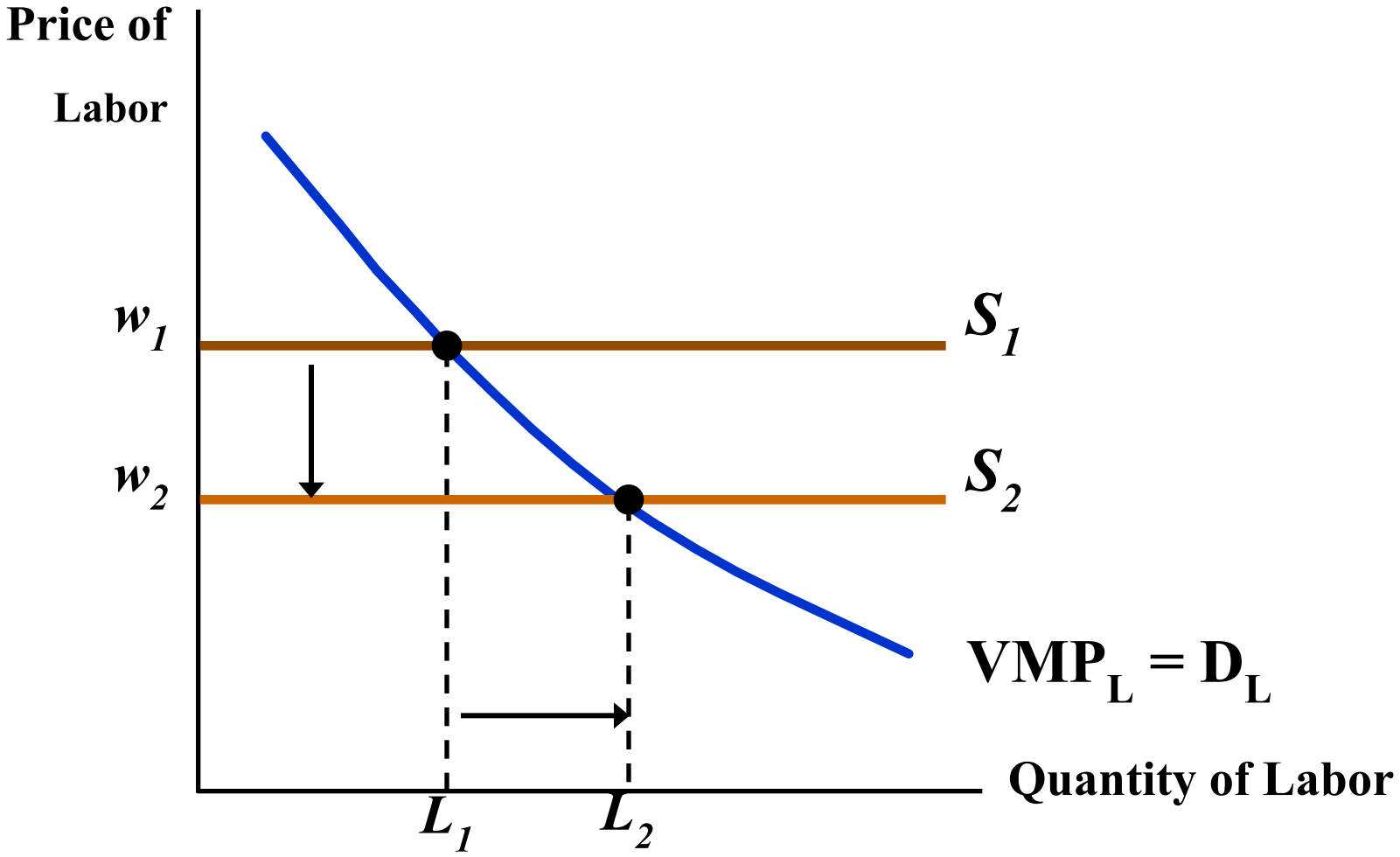
Hiring by a Firm in the Labor Market

In a competitive labor market, a firm faces a perfectly elastic supply of labor and can as many workers as it wants at w^*.



The profit maximizing firm will hire L^* units of labor at the point where the value of marginal product of labor is equal to the wage rate.

A Shift in the Supply of Labor



Comparing Input and Output Markets

$$\text{Max } \pi = TR - TC = PQ(L) - wL$$

$$\frac{d\pi}{dL} = P(MP_L) - w = 0$$

Example: $Q(L) = (L)^{0.5}$, $MP_L = 0.5(L)^{-0.5}$,

$$P(0.5(L)^{-0.5}) = w$$

$L = (P/2w)^2$ is the derived demand

Comparing Input and Output Markets

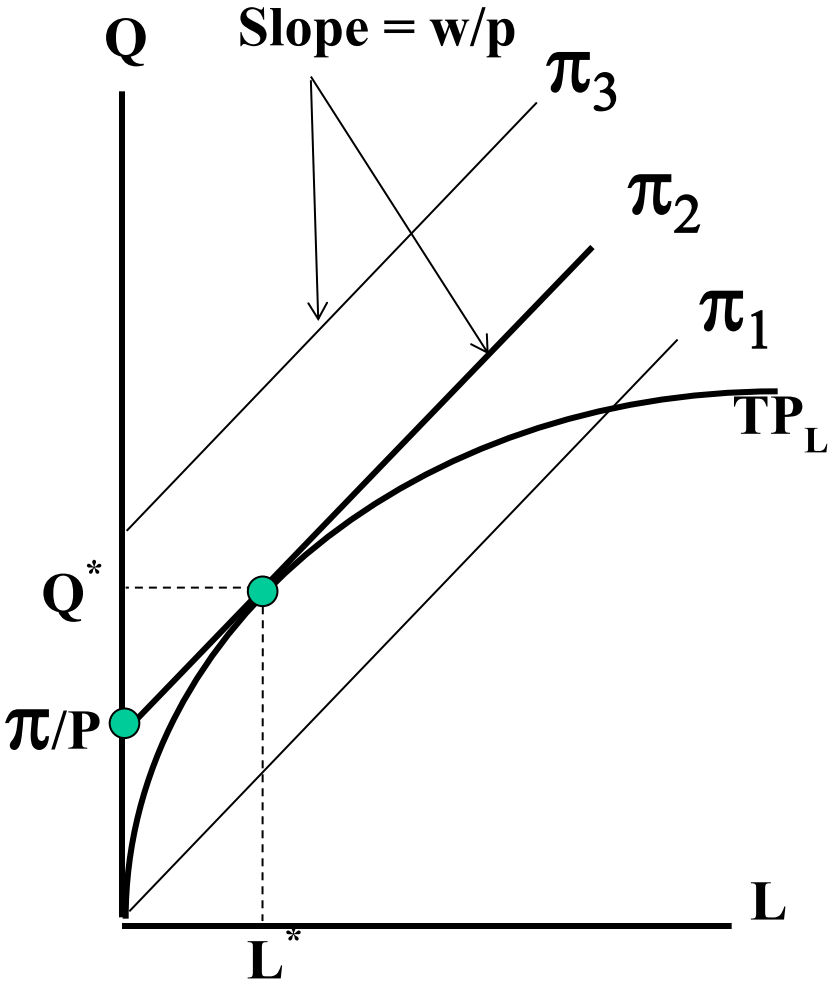
- From $VMP_L = P \times MP_L = w$

$$P = \frac{w}{MP_L} = \frac{w}{\Delta Q / \Delta L} = \frac{w\Delta L}{\Delta Q}$$

$$= \frac{\Delta wL}{\Delta Q} = \frac{\Delta TVC}{\Delta Q} = MC$$

- If $VMP_L = w$, then $P = MC$.

Comparing Input and Output Markets



- The profit function

$\pi = PQ - wL$, can be rewritten as

$Q = \pi/P + wL/P$

- This is called Iso-profit function that gives all combinations of L and Q that keep profits at π
- The slope of this function is w/p; while the slope of Q is MP_L

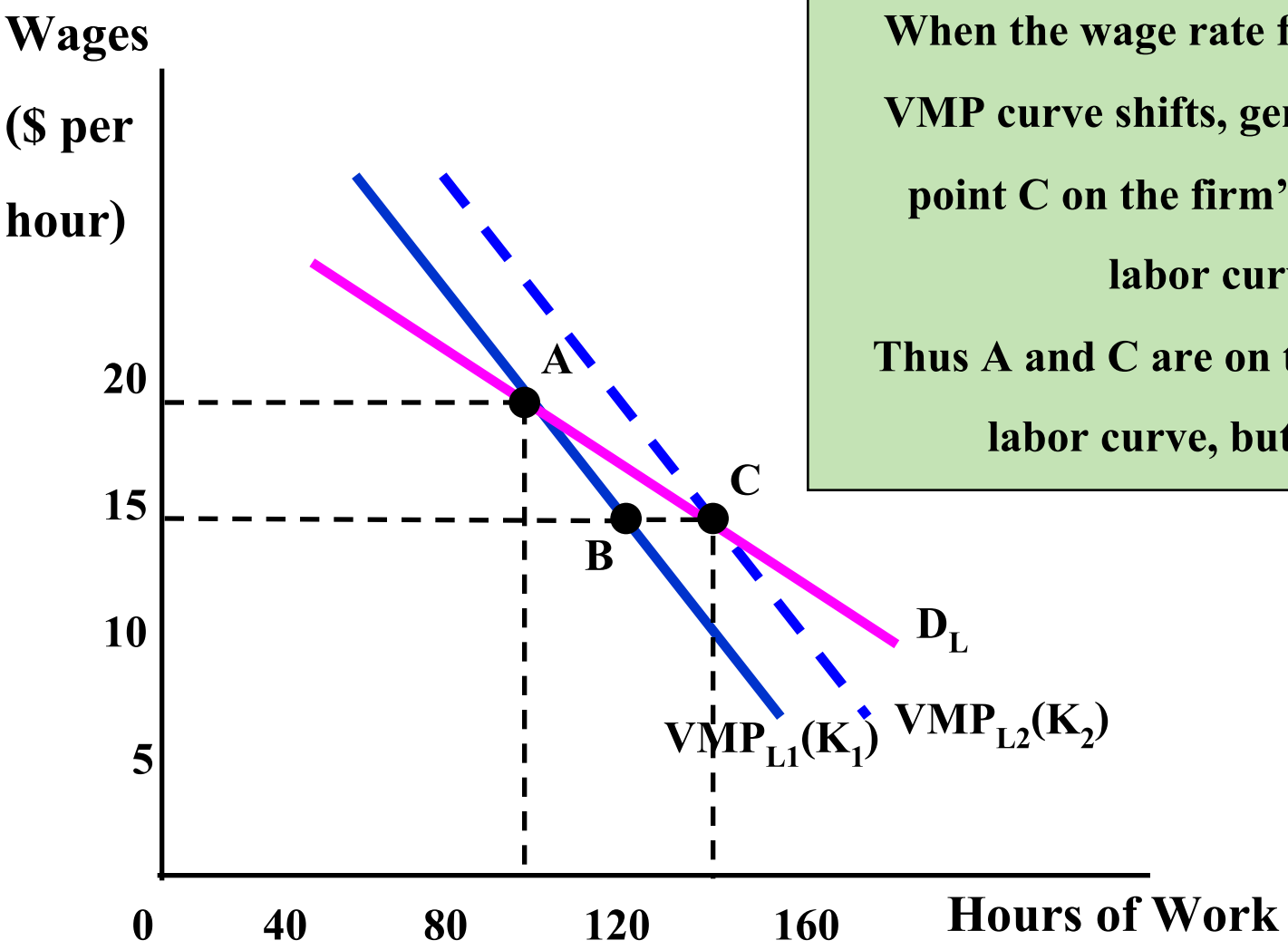
Comparing Input and Output Markets

- At point B in Panel I, the iso-profit line tangents TP_L , $w/P = MP_L$ or $P \times MP_L = w$ or max π at L^*
- In panel II, L^* causes $VMP_L = w$ or $D_L = S_L$
- In Panel I, L^* generates output Q^*
- Using the 45^O degree line in Panel III, we can flip the output Q^* to the horizontal axis in Panel IV
- This output Q^* must corresponds to the output that causes MR = MC in Panel IV

Factor Input Demand – Many Inputs, long run

- If the wage rate falls
  - MC of production falls
  - Profitable for firm to increase output
  - Will invest in additional machinery to expand production causing MP_L to increase
  - VMP_L will shift right, quantity of labor demanded increases

Factor Input Demand – Many Inputs, long run



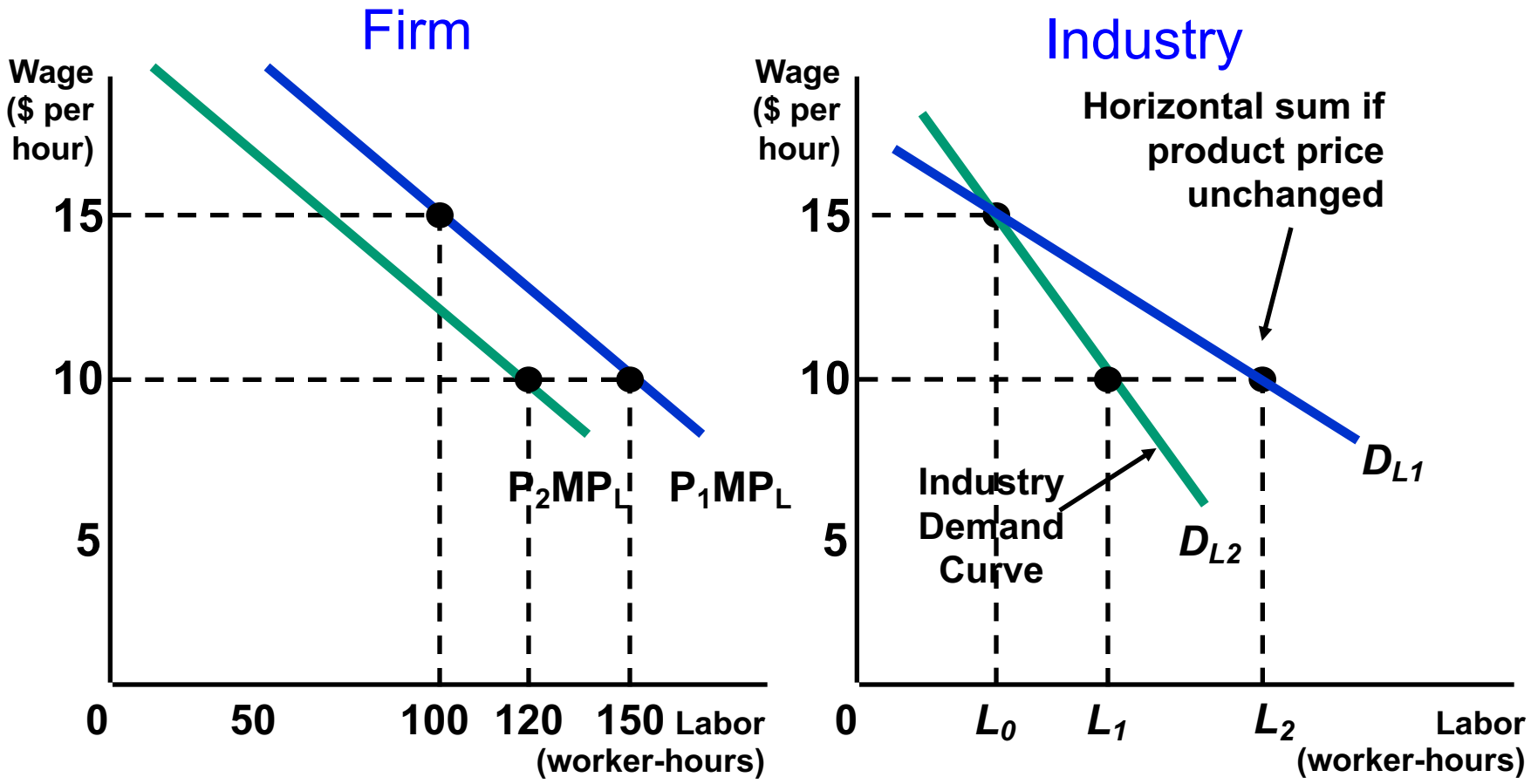
When the wage rate falls to $15, the VMP curve shifts, generating a new point C on the firm's demand for labor curve.

Thus A and C are on the demand for labor curve, but B is not.

Market or Industry Demand Curve

- Because all firms increase demand for labor as the wage is lowered
  - All firms would hire more workers
  - Market supply of that good would increase
  - The market price will fall
  - The quantity demanded for labor by each firm will be lower, as compared to the case where price is constant --> Market demand is less elastic

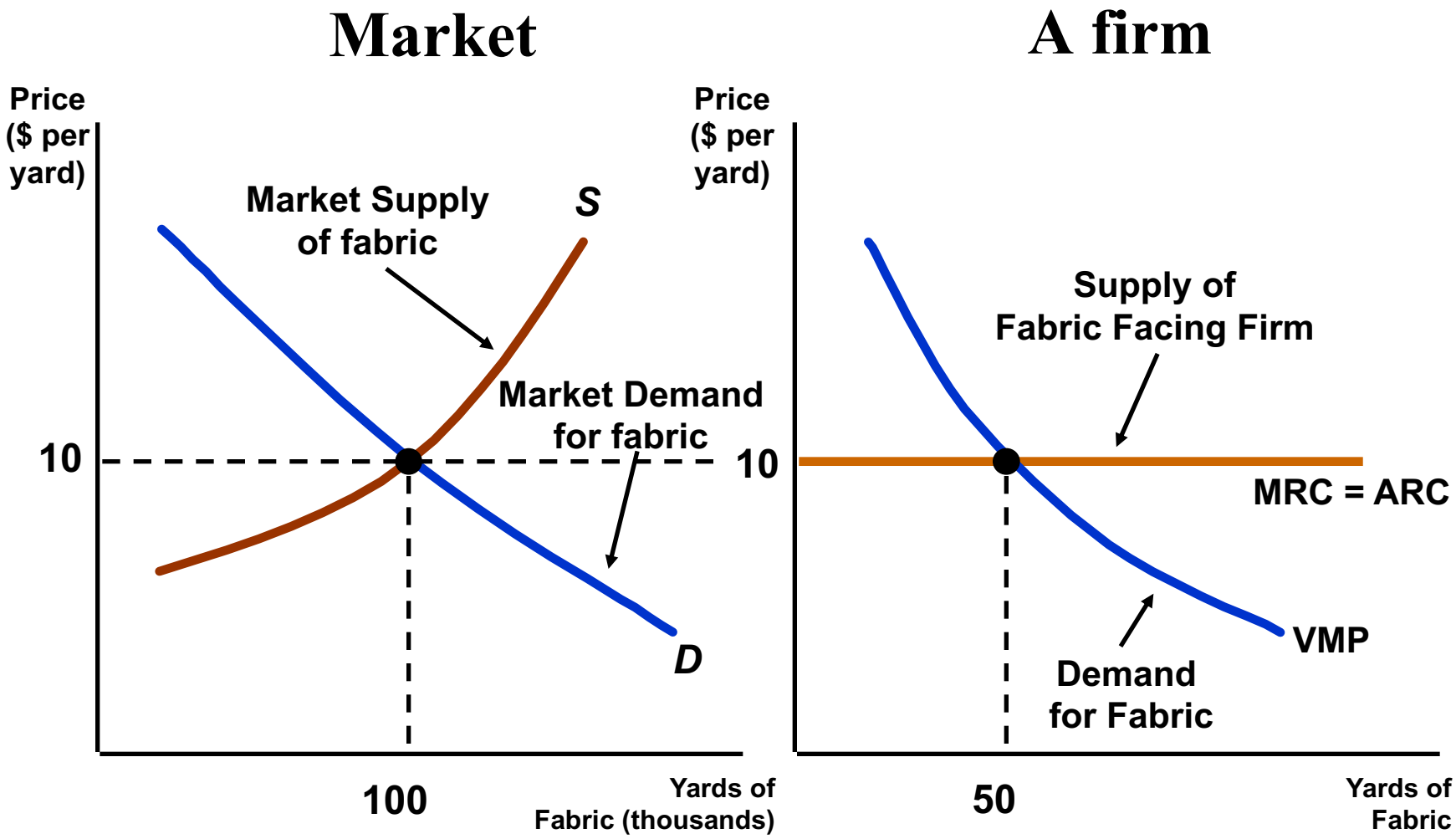
Industry Demand for Labor



The Supply of Inputs to a Firm

- In competitive market, firm can purchase as much of an input it wants at the market price
  - Determined by supply/demand of input market
- Input supply to a firm is perfectly elastic
- It is a small part of market so does not affect market price

A Firm's Input Supply in a Competitive Factor Market



The Supply of Inputs to a Firm

- The firm supply curve is also the average resource cost (ARC) curve to the firm
  - Supply curve representing the price per unit that the firm pays for an input
- Also, marginal resource cost (MRC) curve represents the firm's expenditures on an additional unit of input that it buys
  - Analogous to MC curve in output market

The Supply of Inputs to a Firm

- When factor market is competitive, ARC and MRC are identical horizontal lines
- How much of the input should the firm purchase?
  - As long as VMP > MRC, profit can be increased by buying more input
  - When VMP < MRC, benefits lower than costs
  - Maximize profit when VMP = MRC

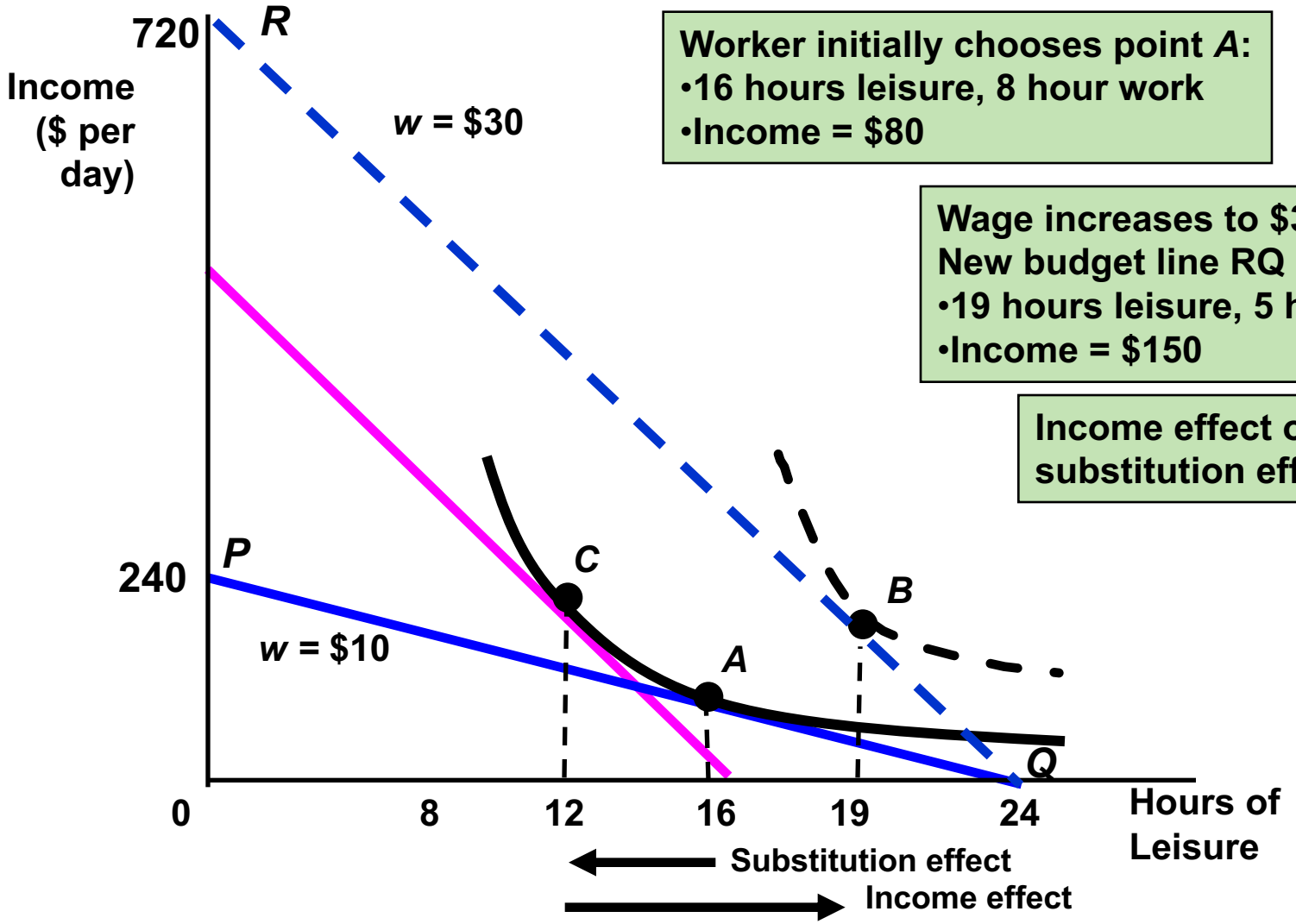
The Market Supply of Inputs

- The market supply for factor inputs is upward sloping
  - Examples: jet fuel, fabric, steel
- The market supply for labor may be upward sloping and backward bending

The Supply of Inputs to a Firm

- The Supply of Labor
  - The choice to supply labor is based on utility maximization
  - Leisure competes with labor for utility
  - Wage rate measures the price of leisure
  - Higher wage rate causes the price of leisure to increase

Substitution and Income Effects of Wage Increase



Worker initially chooses point *A*:
- 16 hours leisure, 8 hour work
- Income = $80

Wage increases to $30.
New budget line RQ
- 19 hours leisure, 5 hours work
- Income = $150

Income effect overrides substitution effect

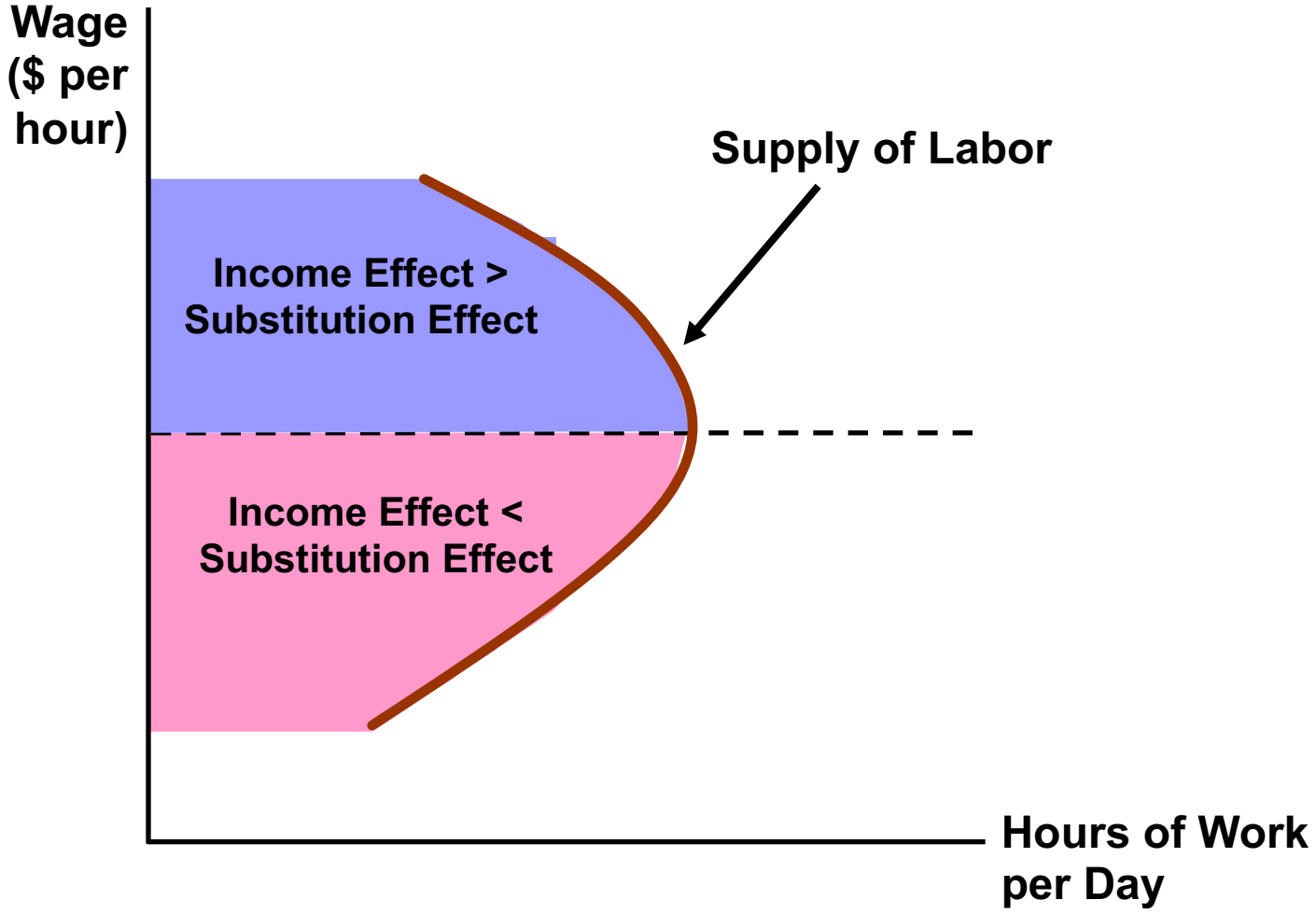
The Market Supply of Inputs

- The Supply of Labor
  - Higher wages encourage workers to substitute work for leisure
    - The substitution effect
  - Higher wages allow the worker to purchase more goods, including leisure which reduces work hours
    - The income effect

Competitive Factor Markets

- The Supply of Labor
  - If the income effect exceeds the substitution effect the supply curve is backward bending
  - By using utility and budget line graph, we can show how the supply curve can be backward bending
    - Can show how the income effect can exceed the substitution effect

Backward-Bending Supply of Labor



Equilibrium in a Competitive Factor Market

- Competitive factor market is in equilibrium when the prevailing price equate quantity supplied and quantity demanded
- Since workers are well informed, all received the same wage and generate identical VMP_L when employed

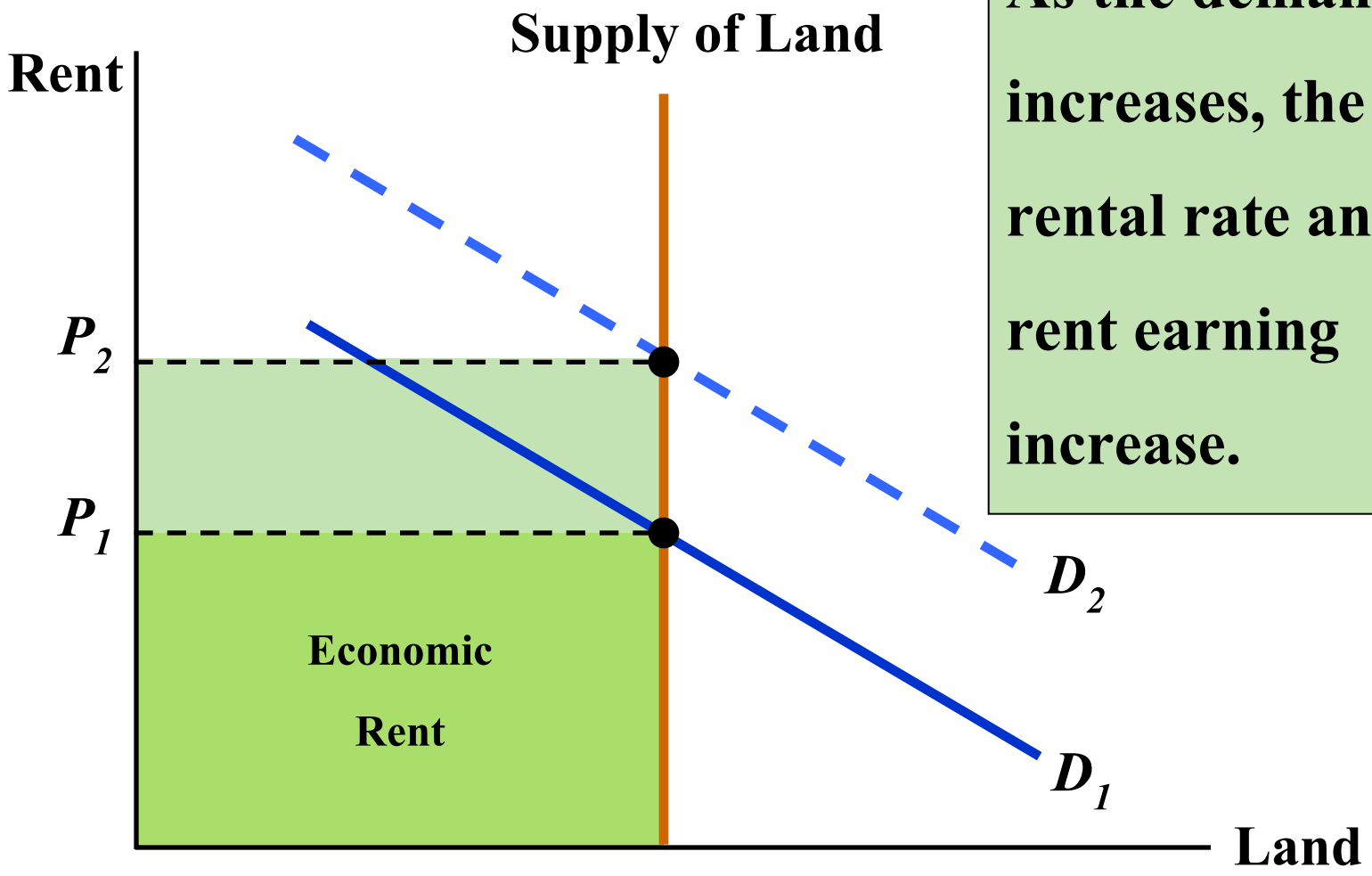
Equilibrium in a Competitive Factor Market

- Economic Rent
  - For a factor market, economic rent is the difference between the payments made to a factor of production and the minimum amount that must be spent to obtain the use of that factor.
  - The economic rent associated with the employment of labor is the excess of wages paid above the minimum amount needed to hire workers
  - The concept is similar to the producer surplus.

Ricardian rents: Land

- Land: Perfectly Inelastic Supply
  - The supply of land for housing or agriculture is fixed at least in the short run
  - The land rental rate is therefore determined by the market demand
  - If the demand is higher, the rental rate and the total value of economic rents are higher

Ricardian rents: Land

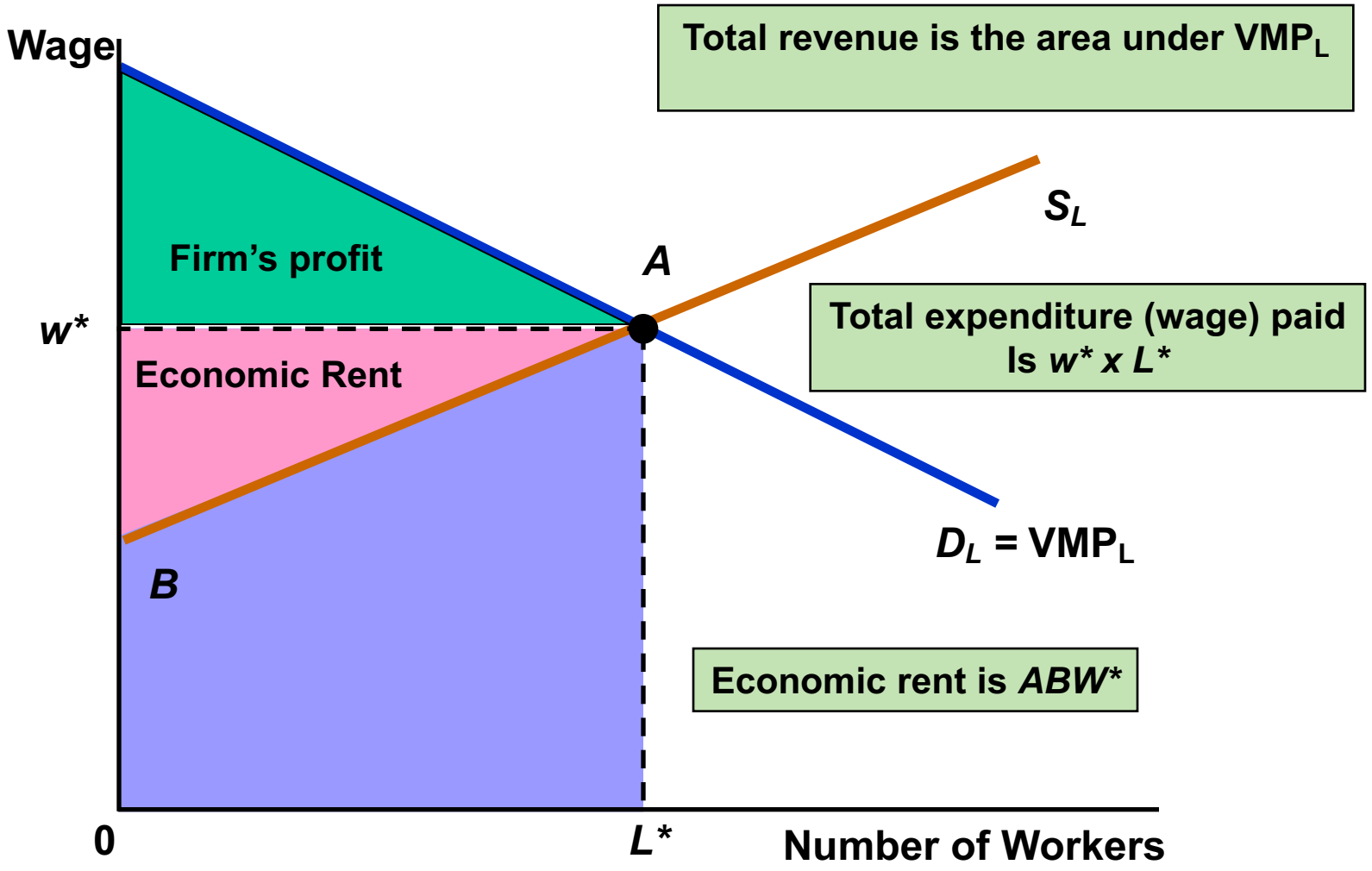


As the demand increases, the rental rate and rent earning increase.

Economic rents: Labor

- The lowest wage rate that necessary to motivate a worker to work is called the reservation wage. It is measured by the higth of the S_L curve
- The economic rent for labor is the summation of all wage payments that are higher than the reservation wage
- or the area between the wage rate and the S_L curve

Economic Rent



Labor Market Equilibrium in a Monopolistic Output Market

- Example: Disney company hiring people to act as Mickey Mouse
- If output market is not competitive
  - P > MR = MC
  - VMP_L no longer measures additional revenue from hiring L
- Marginal Revenue product: $MRP_L = MR \times MP_L$ is now the additional revenue to the firm when it hires more labor.

$$\text{Max } \pi = \text{TR} - \text{TC} = P(Q(L))Q(L) - wL$$

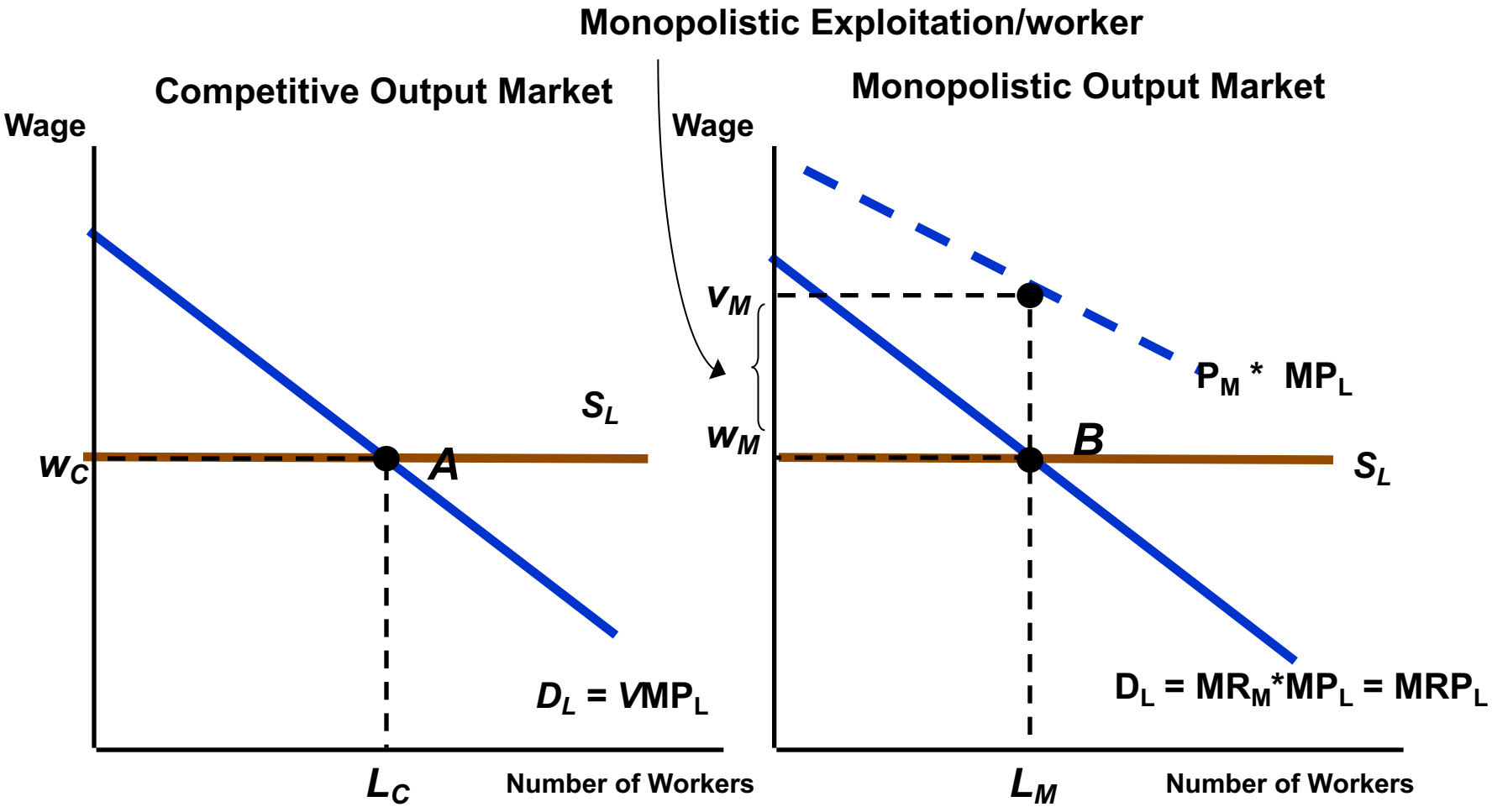
$$\frac{\Delta\pi}{\Delta L} = P\frac{\Delta Q(L)}{\Delta L} + Q\frac{\Delta P}{\Delta Q}\frac{\Delta Q(L)}{\Delta L} - w = 0$$

$$\left[P + Q\frac{\Delta P}{\Delta Q}\right]\frac{\Delta Q(L)}{\Delta L} = w$$

$$(MR)(MP_L) = w \quad \text{or} \quad MRP_L = w$$

This implies that $$MR = \frac{w}{MP_L} = \frac{w}{\Delta Q/\Delta L} = \frac{w\Delta L}{\Delta Q}$$

$$= \frac{\Delta wL}{\Delta Q} = \frac{\Delta TVC}{\Delta Q} = MC$$


Monopolistic Exploitation/worker
Competitive Output Market
Monopolistic Output Market
Wage
Wage
S_L
w_C
A
$D_L = VMP_L$
L_C
Number of Workers
v_M
w_M
$P_M * MP_L$
B
S_L
$D_L = MR_M*MP_L = MRP_L$
L_M
Number of Workers

- If output market is not competitive
  - Although firm maximises profits, output is below efficient level and uses less than efficient level of output
  - Economic efficiency would be increased if more laborers were hired and more output produced
    - At equilibrium number of workers, marginal cost to firm, w_M, is less than marginal benefit to consumers v_M.
    - Gains to consumers would outweigh firm's lost profit

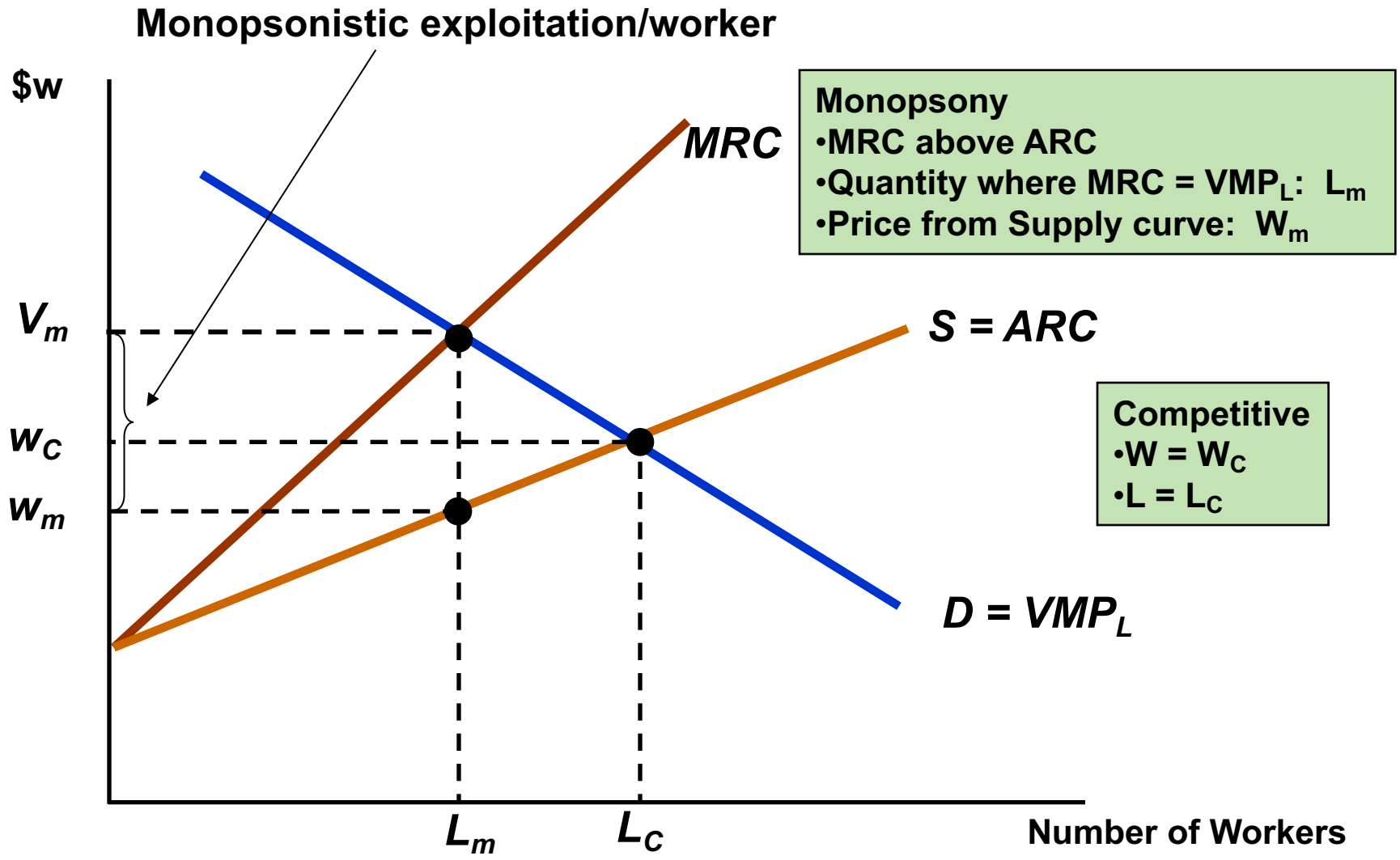
Monopsony

- Single factor buyer
- In reality, there may be a few factor buyers or Oligopsony
- Example:
  - Army is the single employer for soldiers
  - Ministry of Education is the single employer for teachers
  - Large discounted stores

Monopsony

- Buyer will buy until value from last unit (VMP) equals expenditure on that unit (MRC).
- Market supply show how much must pay per unit as a function of total units purchased
- Supply curve is ***average resource cost*** (ARC) curve
- The market supply curve is not the marginal expenditure (MRC) curve
  - Upward sloping supply implies the marginal resource cost curve must lie above ARC
  - Decision to buy extra unit raises price paid for *all* units
- Example: at w_1=10, L_1 =2, at w_2 = 12, L_2 = 3

Monopsony


Monopsonistic exploitation/worker
$w
MRC
Monopsony
•MRC above ARC
•Quantity where MRC = VMP$_L$: L_m
•Price from Supply curve: W_m
V_m
S = ARC
w_C
w_m
Competitive
•W = W_C
•L = L_C
D = VMP_L
L_m
L_C
Number of Workers

Monopsony

$$\text{Max } \pi = TR - TC = PQ(L) - TRC(L)$$

$$\frac{d\pi}{dL} = PMP_L - \frac{dTRC}{dL} = 0$$

$$VMP_L = MRC_L$$

$$\text{where } \frac{dTRC}{dL} = \frac{dARC \cdot L}{dL} \quad \text{or}$$

$$MRC_L = ARC + L\frac{dARC}{dL}$$

Example

- VMP_L: $L_D = 600 - 20W$ --> $W(L_D) = 30 - L_D/20$
- $L_S = 20W$ --> $W(L_S) = L_S/20$
- $TRC = W(L)L = L^2/20$, $ARC = L/20$,

  $MRC = dTRC/dL = 2L/20 = L/10$
- Maximize profits require $VMP_L = MRC$:

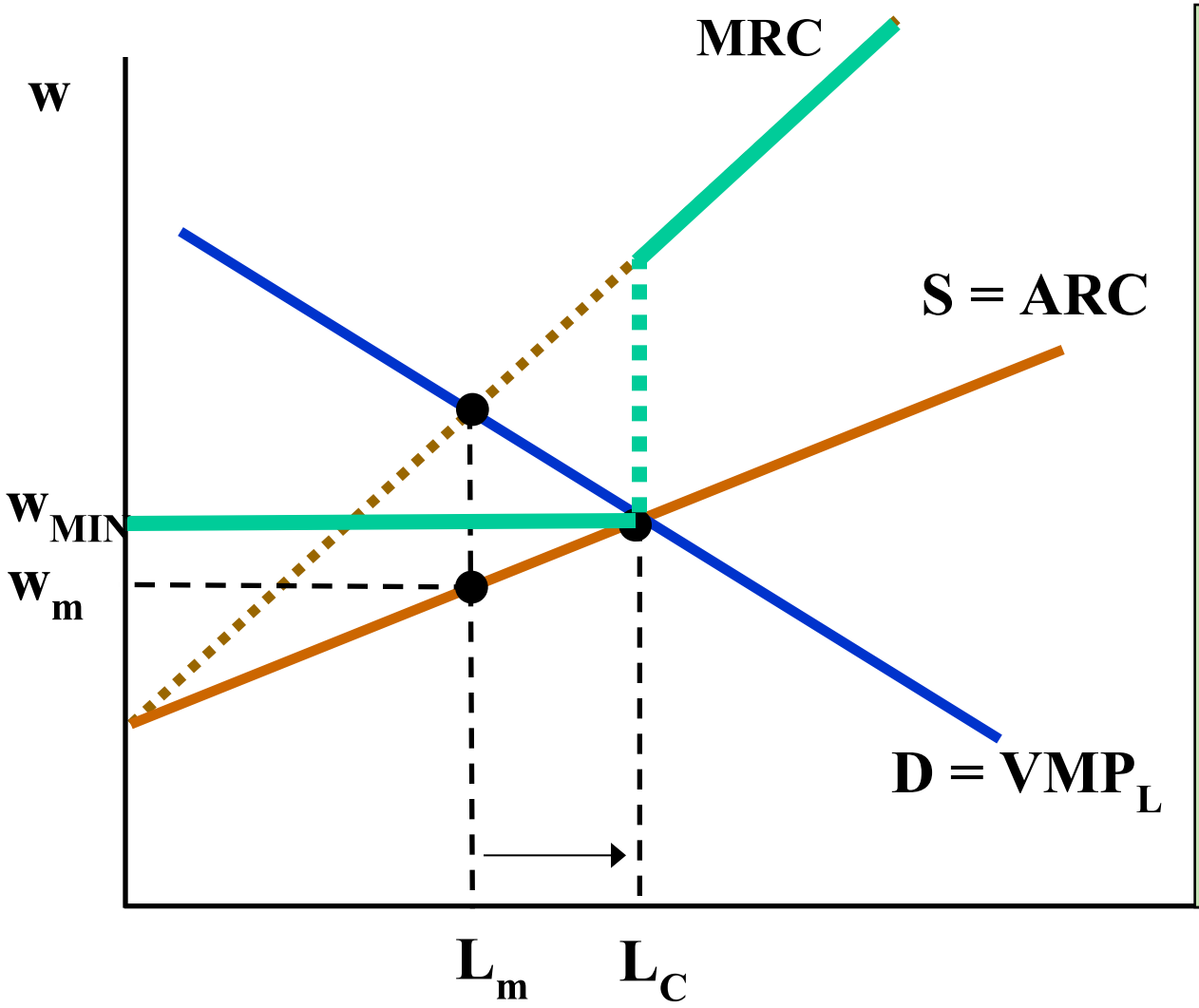
  $30 - L/20 = L/10$

  $600 - L = 2L$

  $L = 200$, $W(L_S) = 200/20 = 10$

  $W(L_D) = 30 - 200/20 = 20$, exploitation = 2000

Minimum wage and Monopsony

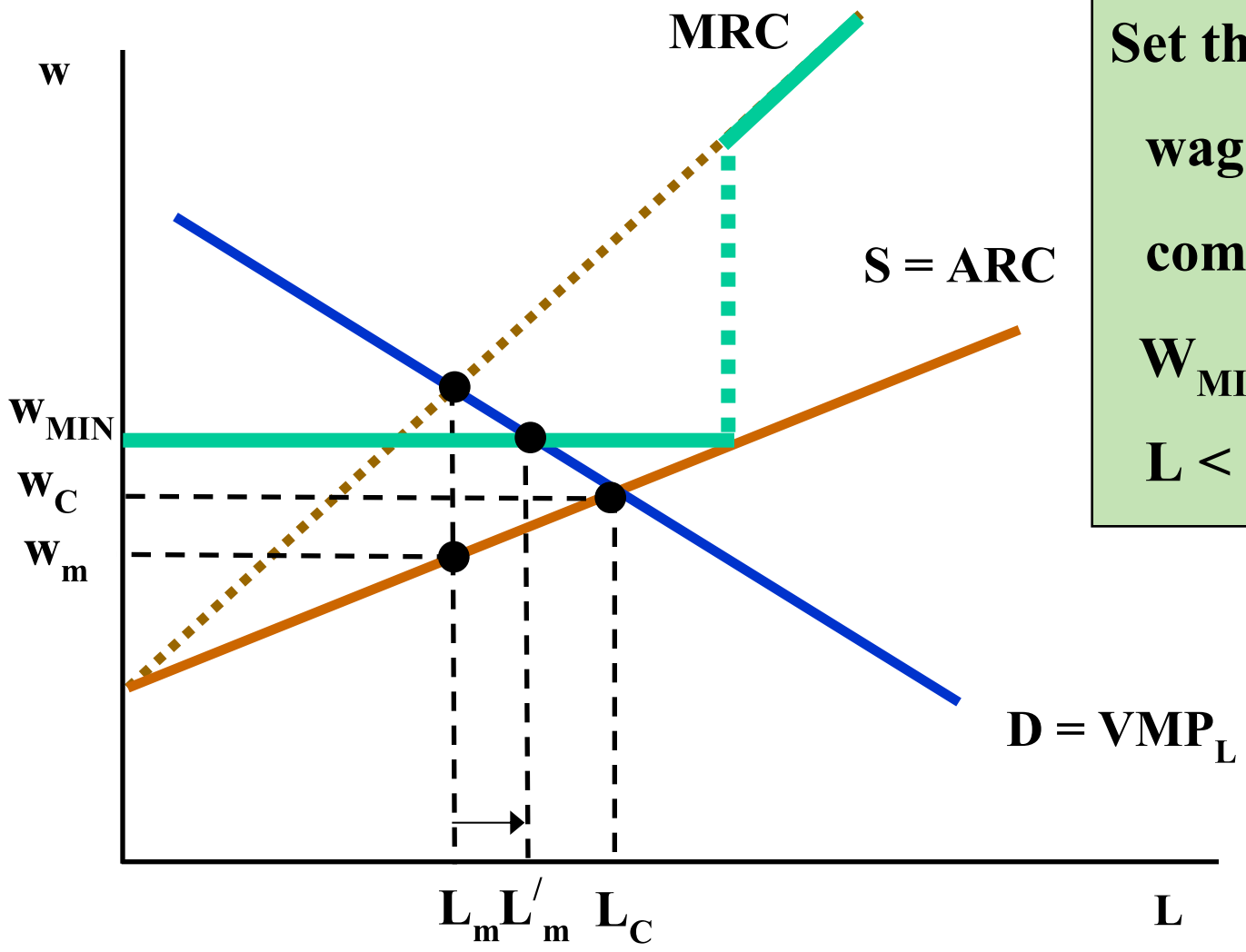


Set the minimum wage at competitive wage rate

$W_{MIN} = W_C$, $L = L_C$

- **Improve efficiency**

Minimum wage and Monopsony



Set the minimum wage above the competitive level

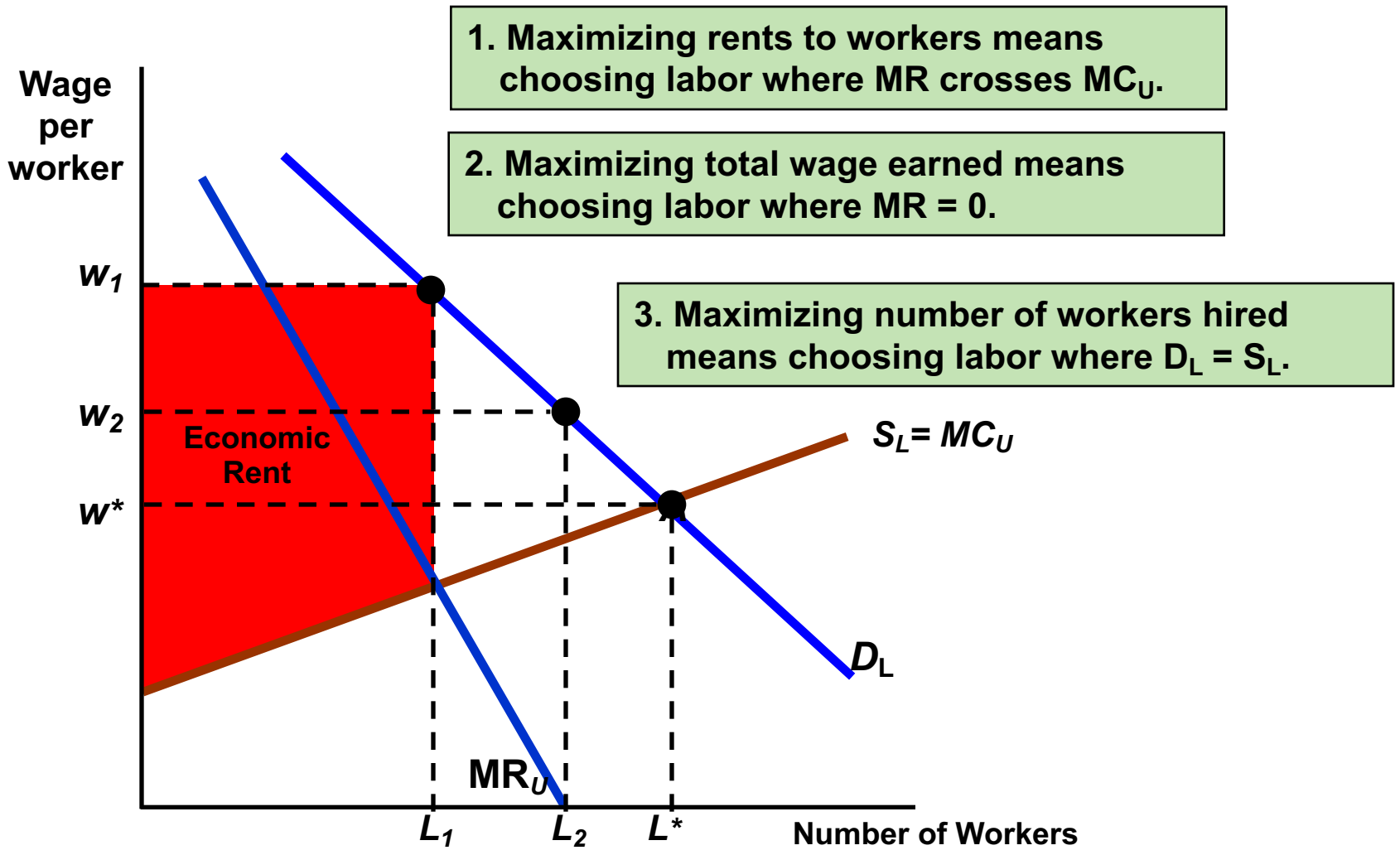
$W_{MIN} > W_C$,

$L < L_C$

Factor Markets with Monopoly Power

- Sellers of inputs have monopoly power
- Example: Labour unions
- The monopoly power of the labor union allow it to be price maker

Monopoly Power of Sellers of Labor



Monopoly Power of Sellers of Labor

- The union's monopoly power allows it to choose any wage rate and quantity supplied
  - If wanted to obtain higher wages, would restrict membership to L_1 workers to get hirer wage w_1
  - Those who find jobs are better off. Those without jobs are worse off.

Monopoly Power of Sellers of Labor

- Rent maximization: combination of wage rate and number of workers is where MR crosses MC_U = supply.
- Price comes from the demand curve
- This gives a combination of L_1 and w_1
- Shaded area below the demand curve and above the supply curve to the left of L_1 is the economic rent that all workers receive

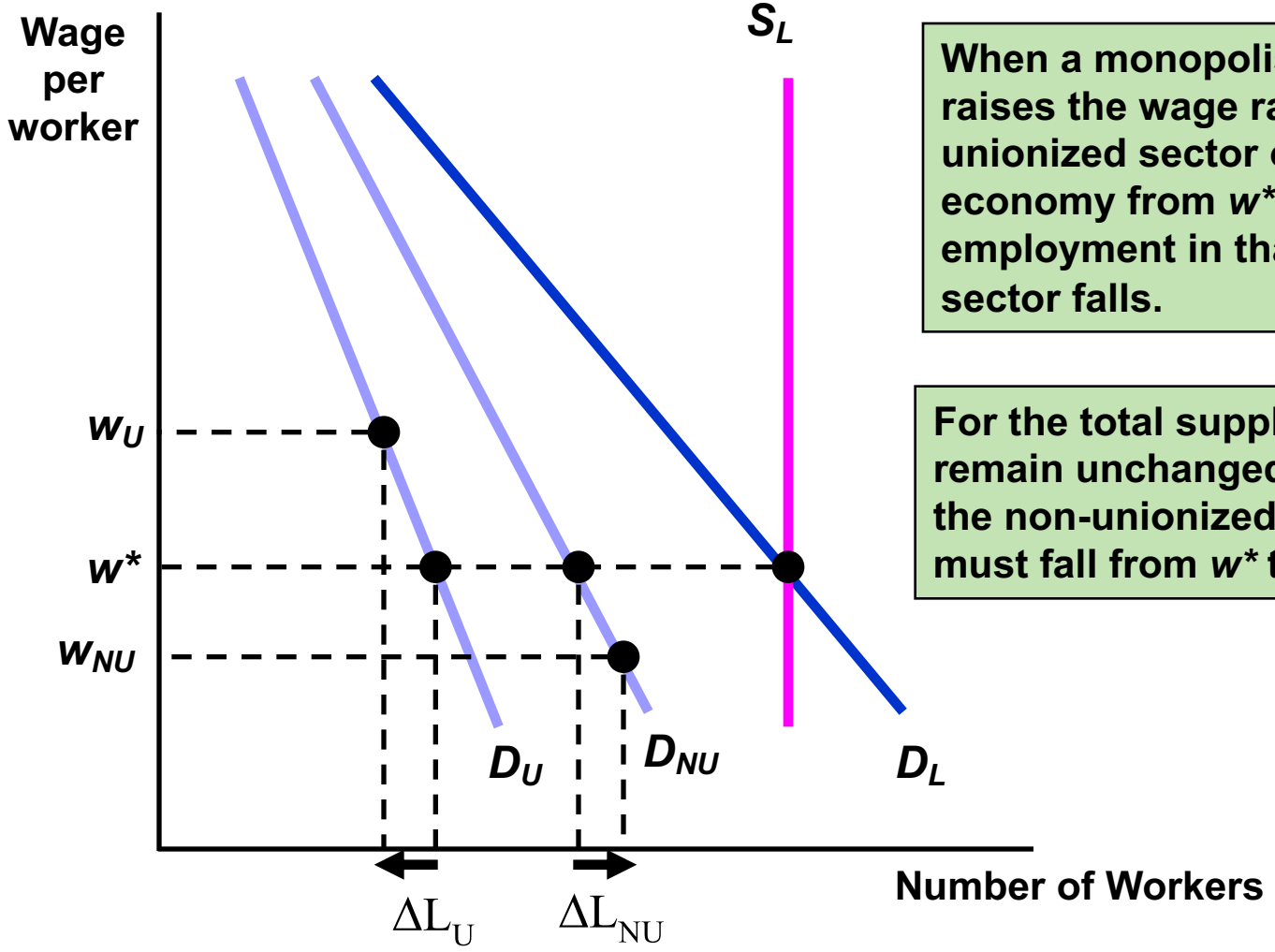
Factor Markets with Monopoly Power

- An alternative objective is to maximize aggregate wages that all union members receive
  - This gives L_2 and w_2 where $MR_U = 0$
- The last alternative is to maximize the number of workers hired
  - This gives L^* and w^* where $D_L = S_L$ or competitive outcome

Unionized and Non-unionized Workers

- Assume the total supply of workers is fixed – supply is S_L
- Demand for unionized labor is D_U and demand for non-unionized labor is D_{NU}
- Total market demand is $D_U + D_{NU} = D_L$

Wage Discrimination in Labour Market



When a monopolistic union raises the wage rate in the unionized sector of the economy from w^* to w_U, employment in that sector falls.

For the total supply of labor to remain unchanged, the wage in the non-unionized sector must fall from w^* to w_{NU}

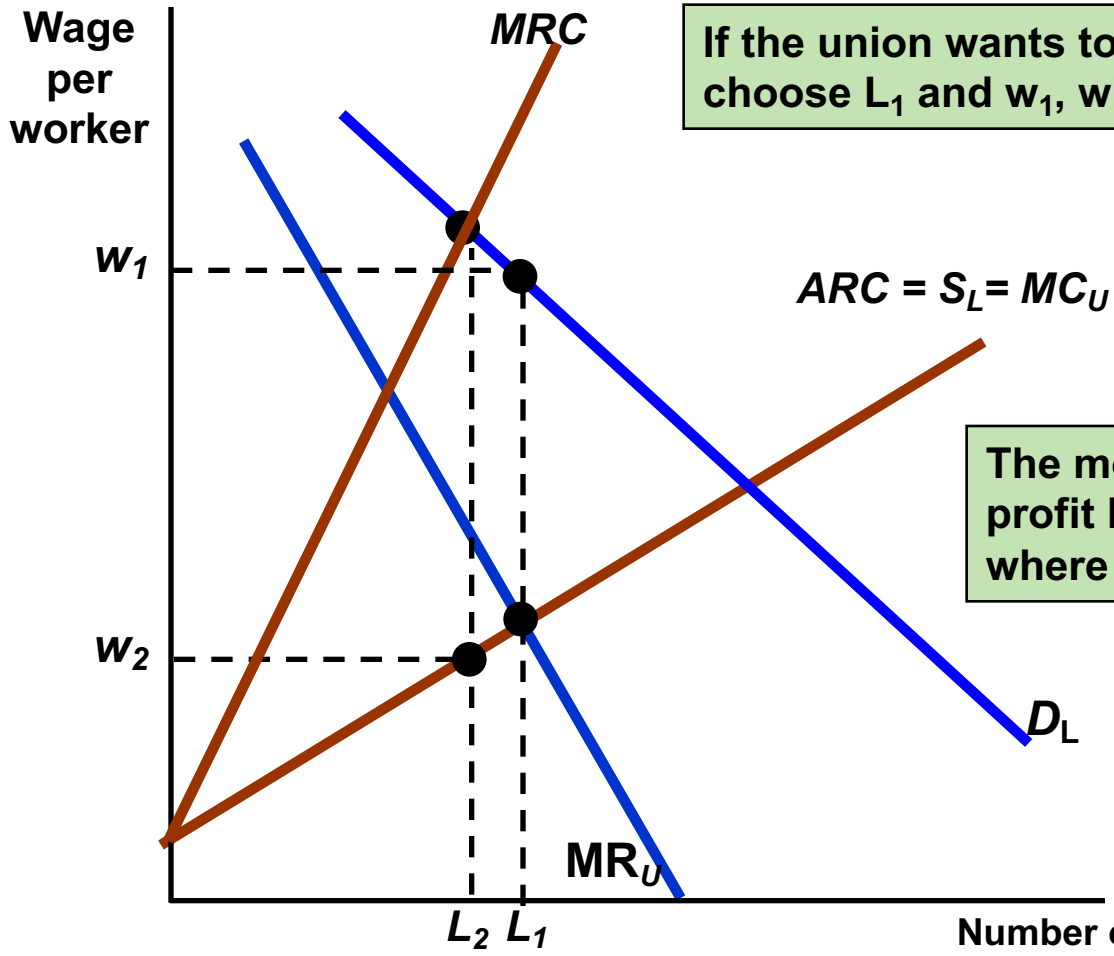
Unionised and Non-unionised Workers

- What if union chooses to raise wage above competitive wage w*, to w_U
- Number of workers hired by the union falls by amount ΔL_U
- As these workers find employment in nonunion sector, wage rate in that sector adjusts until labor market is in equilibrium
- At new wage rate, w_{NU}, additional numbers hired in sector is ΔL_{NU}
  - Equals number of workers who left unionized sector

Bilateral Monopoly

- Bilateral Monopoly
  - Market where there is only one buyer and one seller
  - Bilateral monopoly is rare, however, markets with a small number of sellers with monopoly power selling to a market with few buyers with monopsony power is more common.
- Example: Association of sugar producers vs. Sugarcane grower union

Bilateral Monopoly



If the union wants to maximize rent, it should choose L_1 and w_1, where $MR_U = MC_U$.

The monopsony maximizes profit by choosing L_2 and w_2, where MRC = D_L .

The end result depends on the negotiation power of each side.

Summary

Factor Seller Market	Factor Buyer Market	Final Good Market	
		Competitive	Monopoly
Competitive	Competitive	$VMP_L = w = MRC$	$VMP_L > MRP_L = w = MRC$
	Monopoly	$VMP_L = MRC > w$	$VMP_L > MRP_L = MRC > w$
Monopoly	Competitive	$VMP_L > MR_U = MC_U$	$MRP_L > MR_U = MC_U$
	Monopoly	Depends on each side's bargaining power	