Unit 5: The Resource Market

(aka: The Factor Market or Input Market)

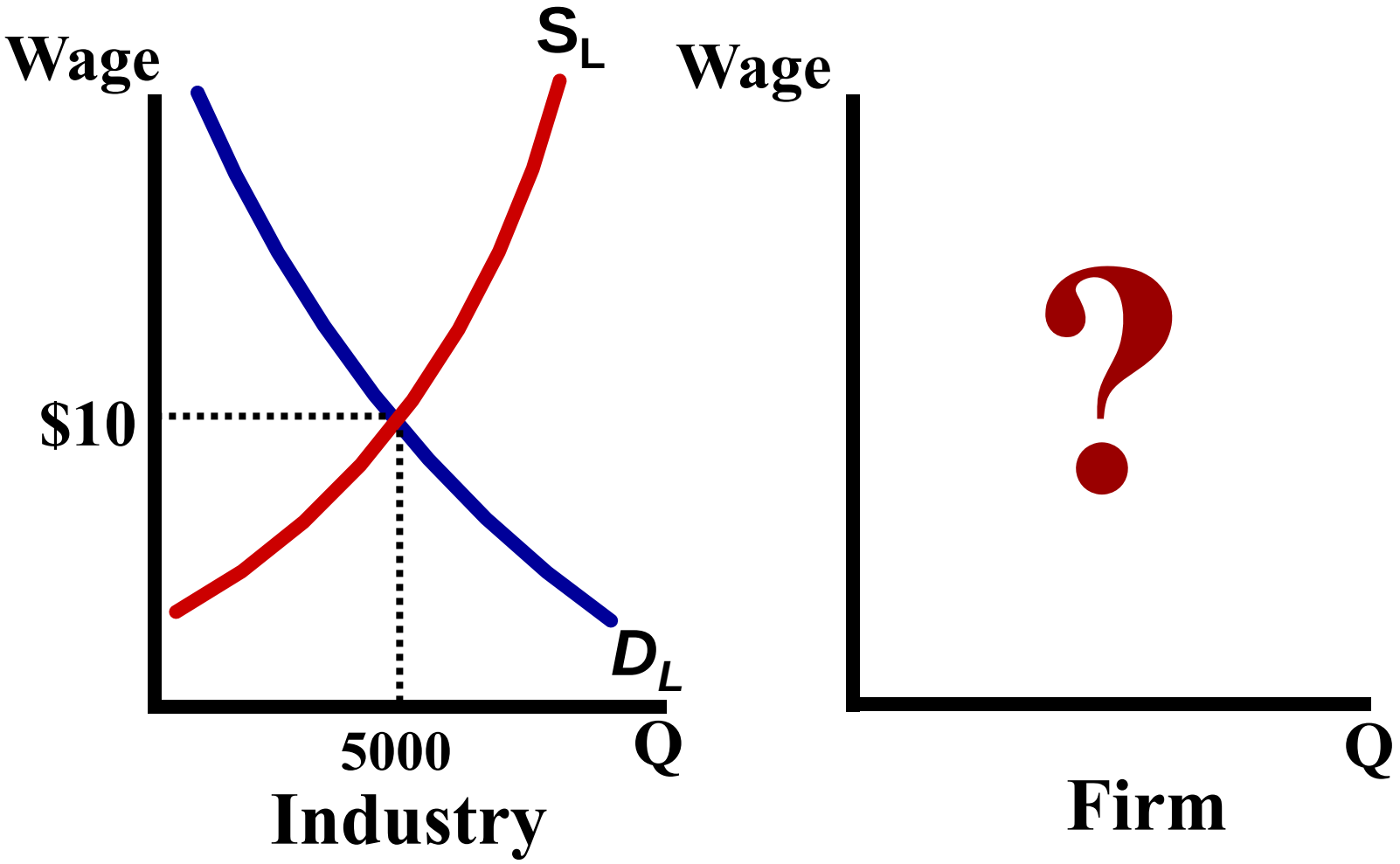
Resource Markets

Perfectly Competitive Labor Market

Characteristics:

- Many small firms are hiring workers
  - No one firm is large enough to manipulate the market.
- Many workers with identical skills
- Wage is constant
- Workers are wage takers
  - Firms can hire as many workers as they want at a wage set by the industry

Perfectly Competitive Labor Market and Firm



Resource Demand

Example 1:

If there was a significant increase in the demand for pizza, how would this affect the demand for cheese?

Cows? Milking Machines? Veterinarians? Vet Schools? Etc.

Example 2:

An increase in the demand for cars increases the demand for…

<u>Derived Demand</u>-

The demand for resources is determined (derived) by the products they help produce.

Marginal Resource Cost (MRC)

The additional cost of an additional resource (worker).

In perfectly competitive labor markets the MRC equals the wage set by the market and is constant.

Ex: The MRC of an unskilled worker is $8.75.

Another way to calculate MRC is:

$$\text{Marginal Resource Cost} = \frac{\text{Change in Total Cost}}{\text{Change in Inputs}}$$

Marginal Revenue Product

The additional revenue generated by an additional worker (resource).

In perfectly competitive product markets the MRP equals the marginal product of the resource times the price of the product.

Ex: If the Marginal Product of the 3rd worker is 5 and the price of the good is constant at $20 the MRP is…….

$100

Another way to calculate MRP is:

$$\text{Marginal Revenue Product} = \frac{\text{Change in Total Revenue}}{\text{Change in Inputs}}$$

The Push-Up Machine

Supply

- **Supply and demand in the INDUSTRY GRAPH has resulted in a equilibrium wage of $10.**
- **How much MUST each worker work for?**
- **Why not ask for more? Why not less?**

Demand

- **If each push up generates $1 worth of energy what is the MRP for each worker?**
- **How much is each worker worth to the firm?**

The Push-Up Machine

Why does the MRP eventually fall?

- **Diminishing Marginal Returns.**
- **Fixed resources means each worker will eventually add less than the previous workers.**

The MRP determines the demand for labor

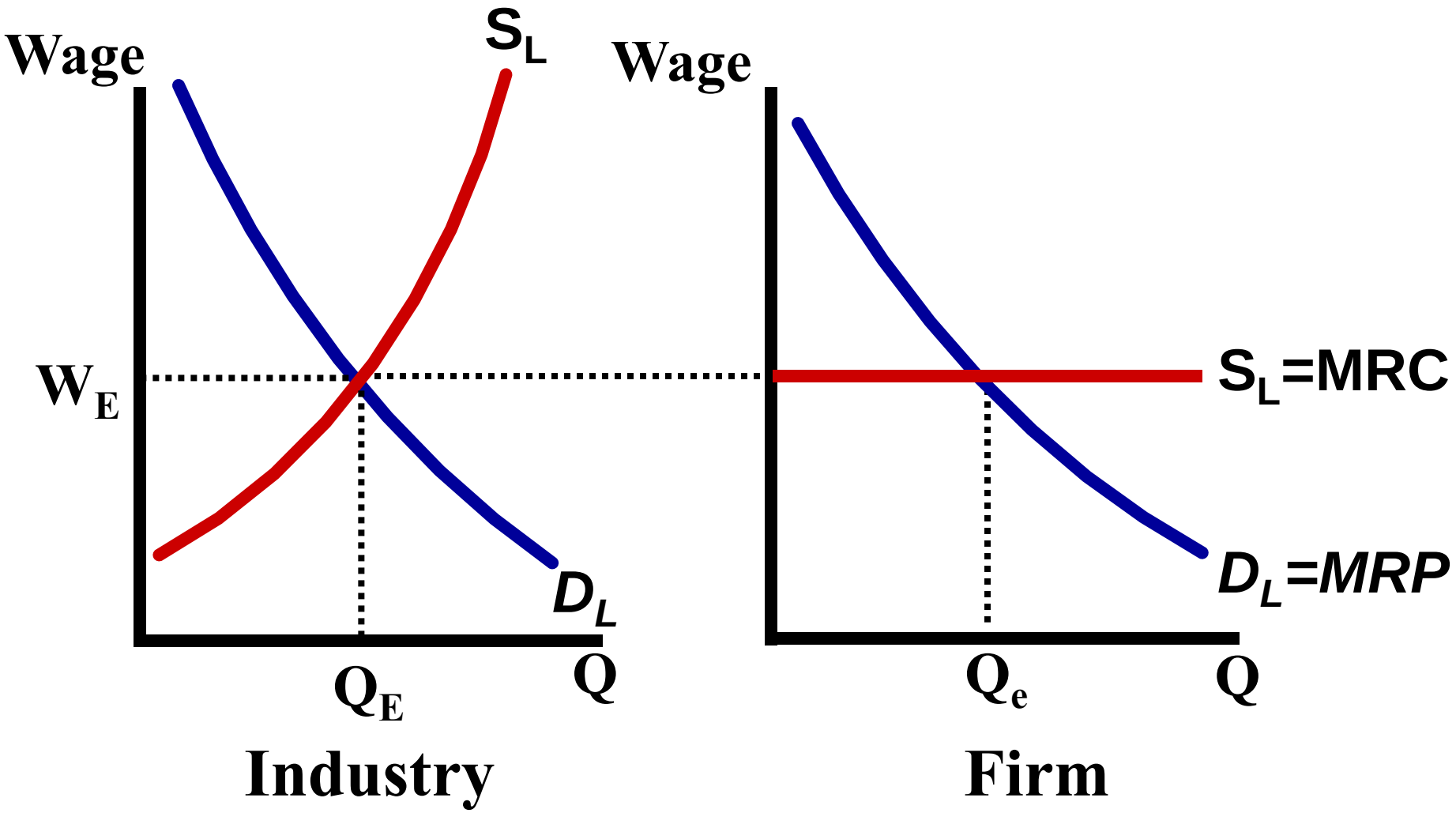
- **The firm is willing and able to pay each worker up to the amount they generate.**
- **Each worker is worth the amount of money they generate for the firm.**

How do you know how many resources (workers) to employ?

Continue to hire until…

MRP = MRC

Side-by-side graph showing Market and Firm



Industry Graph

DEMAND RE-DEFINED

What is Demand for Labor?

Demand is the different quantities of workers that businesses are willing and able to hire at different wages.

What is the Law of Demand for Labor?

There is an INVERSE relationship between wage and quantity of labor demanded.

What is Supply for Labor?

Supply is the different quantities of individuals that are willing and able to sell their labor at different wages.

What is the Law of Supply for Labor?

There is a DIRECT (or positive) relationship between wage and quantity of labor supplied.

Workers have trade-off between work and leisure

Where do you get the Market Demand?

McDonalds

Wage	Q_LDem
$12	1
$10	2
$8	3
$6	5
$4	7

+

Burger King

Wage	Q_LDem
$12	0
$10	1
$8	2
$6	3
$4	5

+

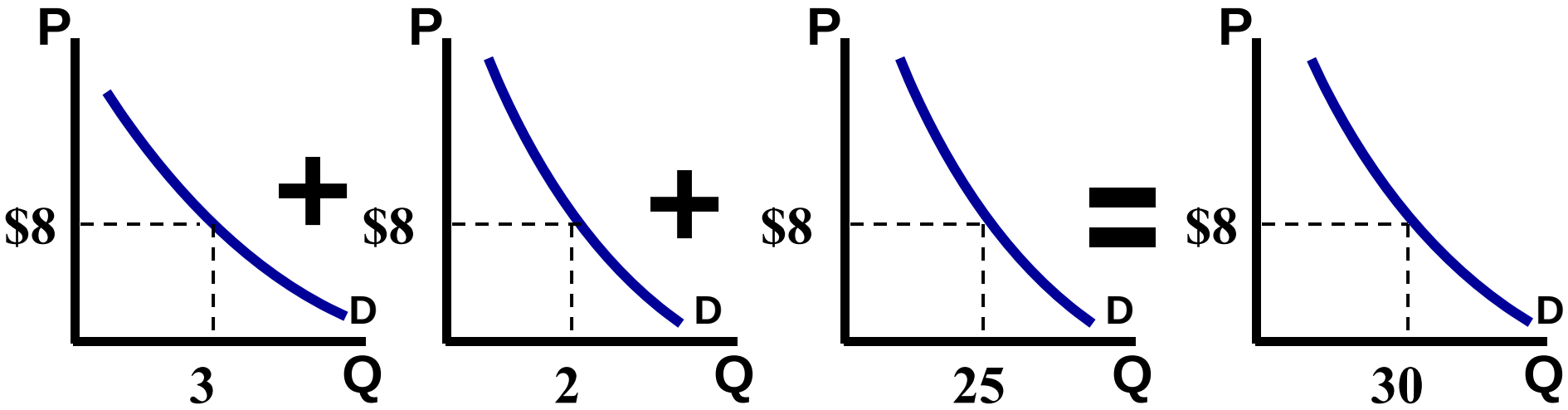
Other Firms

Wage	Q_LDem
$12	9
$10	17
$8	25
$6	42
$4	68

=

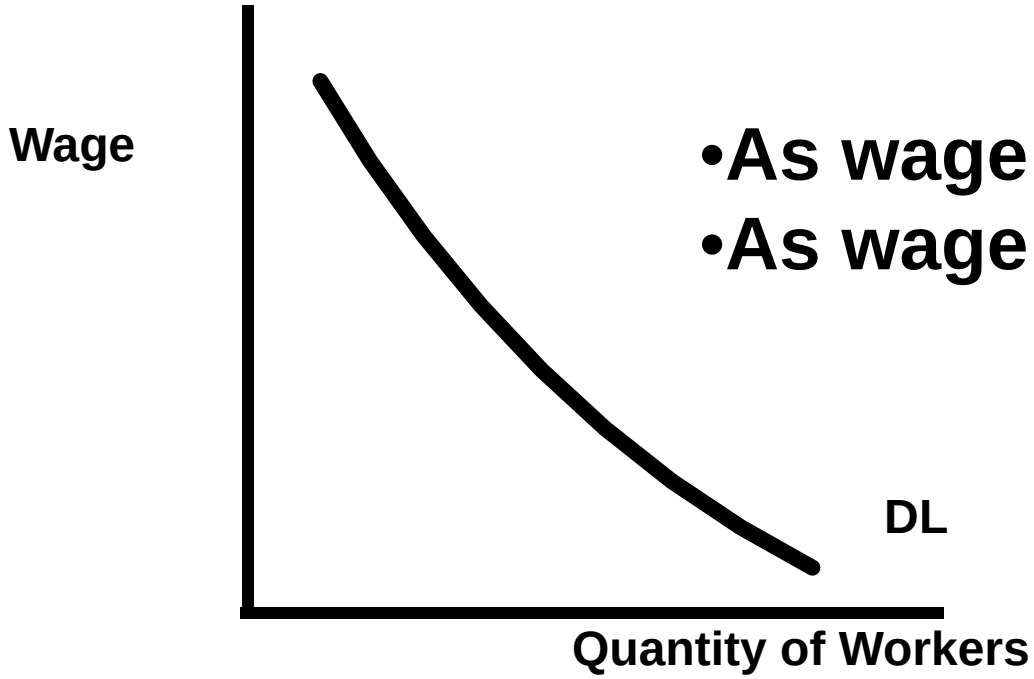
Market

Wage	Q_LDem
$12	10
$10	20
$8	30
$6	50
$4	80



Who demands labor?

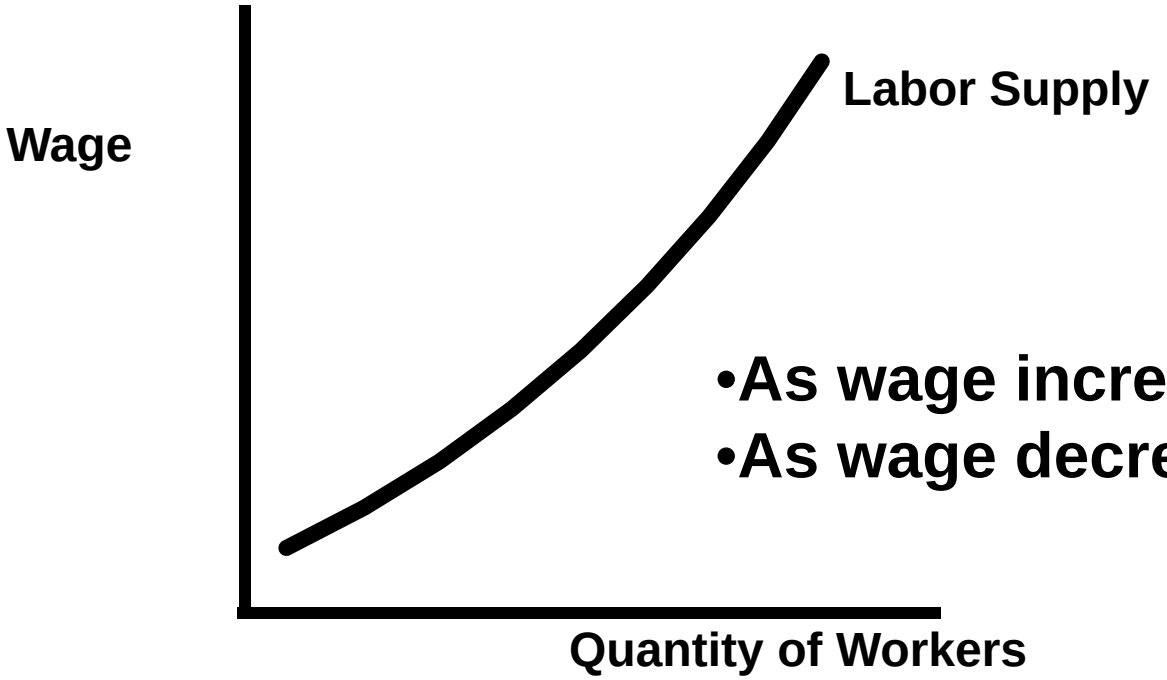
- **FIRMS demand labor.**
- **Demand for labor shows the quantities of workers that firms will hire at different wage rates.**
- **Market Demand for Labor is the sum of each firm's MRP.**



- **As wage falls, Qd increases.**
- **As wage increases, Qd falls.**

Who supplies labor?

- **Individuals supply labor.**
- **Supply of labor is the number of workers that are willing to work at different wage rates.**
- **Higher wages give workers incentives to leave other industries or give up leisure activities.**

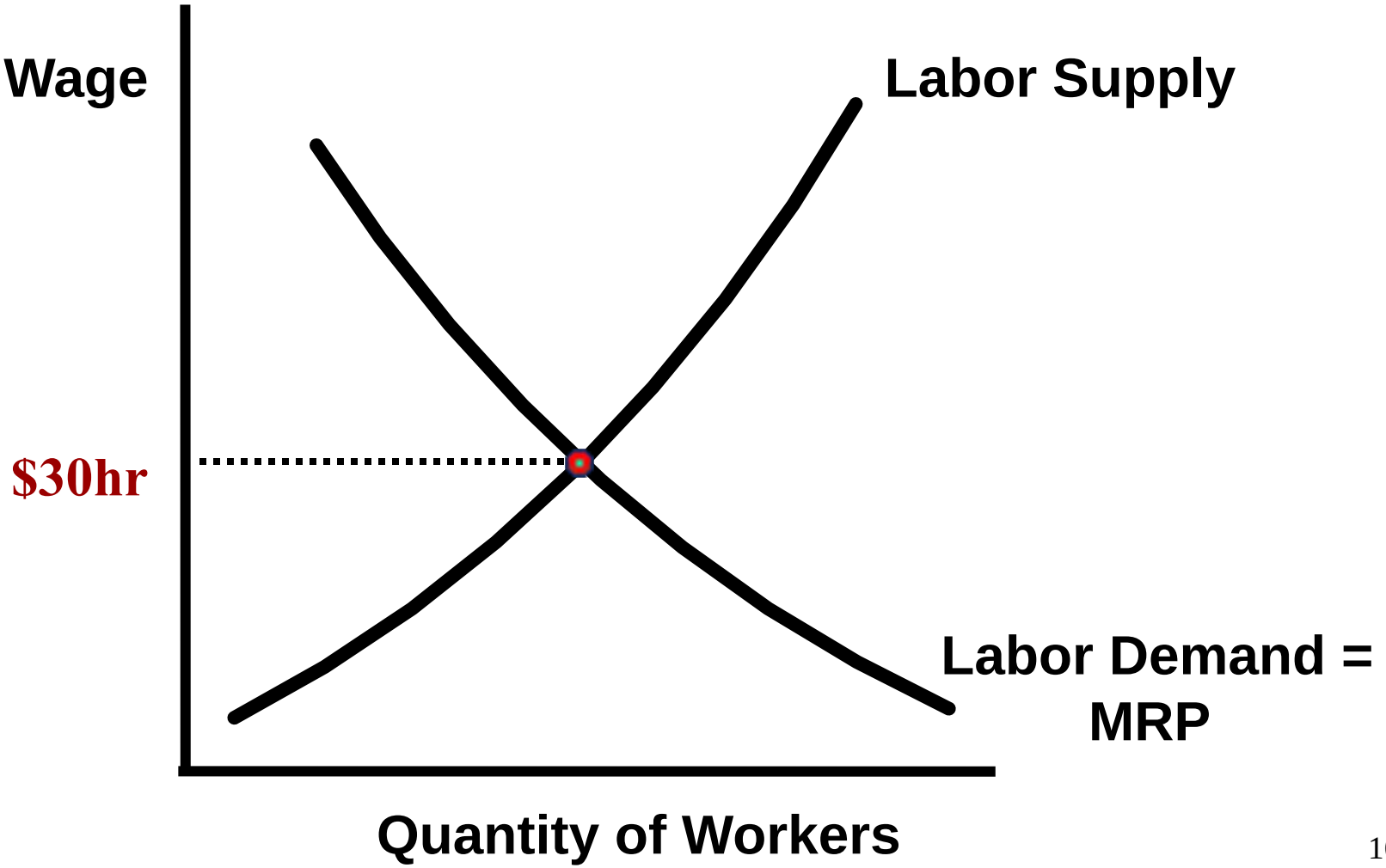


- **As wage increases, Qs increases.**
- **As wage decreases, Qs decreases.**

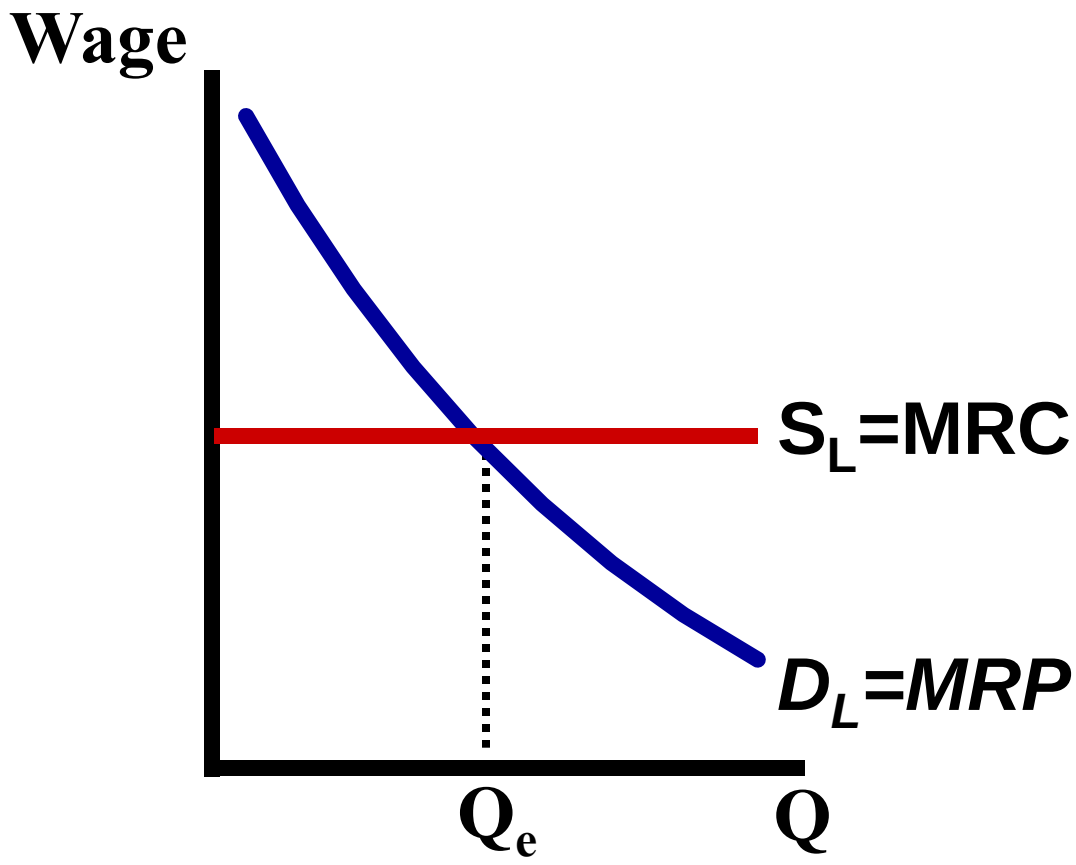
Equilibrium

Wage (the price of labor) is set by the market.

EX: Supply and Demand for Carpenters



Individual Firms



Example:

- You hire workers to mow lawns. The wage for each worker is set at $100 a day.
- Each lawn mowed earns your firm $50.
- If you hire one work, he can mow 4 laws per day.
- If you hire two workers, they can mow 5 lawns per day together.

1. What is the MRC for each worker?
2. What is the first worker's MRP?
3. What is the second worker's MRP?
4. How many workers will you hire?
5. How much are you willing to pay the first worker?
6. How much will you actually pay the first worker?
7. What must happen to the wage in the market for you to hire the second worker?

You're the Boss

- **You and your partner own a business.**
- **Assume the you are selling the goods in a perfectly competitive PRODUCT market so the price is constant at $10.**
- **Assume that you are hiring workers in a perfectly competitive RESOURCE market so the wage is constant at $20.**
- **Also assume the wage is the ONLY cost.**

To maximize profit how many workers should you hire?

Use the following data:

Price = $10 Wage = $20

Workers	Total Product (Output)
0	0
1	7
2	17
3	24
4	27
5	29
6	30
7	27

Hint

How much is each worker worth?

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)
0	0
1	7
2	17
3	24
4	27
5	29
6	30
7	27

1. What is happening to Total Product?
2. Why does this occur?
3. Where are the three stages?

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)
0	0	-
1	7	7
2	17	10
3	24	7
4	27	3
5	29	2
6	30	1
7	27	-3

This shows the PRODUCTIVITY of each worker.

Why does productivity decrease?

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price
0	0	-	0
1	7	7	10
2	17	10	10
3	24	7	10
4	27	3	10
5	29	2	10
6	30	1	10
7	27	-3	10

Price constant because we are in a perfectly competitive market.

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	Marginal Revenue Product
0	0	-	0	0
1	7	7	10	70
2	17	10	10	100
3	24	7	10	70
4	27	3	10	30
5	29	2	10	20
6	30	1	10	10
7	27	-3	10	-30

This shows how much each worker is worth

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	Marginal Revenue Product	Marginal Resource Cost
0	0	-	0	0	0
1	7	7	10	70	20
2	17	10	10	100	20
3	24	7	10	70	20
4	27	3	10	30	20
5	29	2	10	20	20
6	30	1	10	10	20
7	27	-3	10	-30	20

How many workers should you hire?

Drawing the Demand Curve for Resources

Yesterday's Activity

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	MRP
0	0	-	0	0
1	7	7	10	70
2	17	10	10	100
3	24	7	10	70
4	27	3	10	30
5	29	2	10	20
6	30	1	10	10
7	27	-3	10	-30

Shows how many workers a firm is willing and able to hire at different wages.

Use the following data:

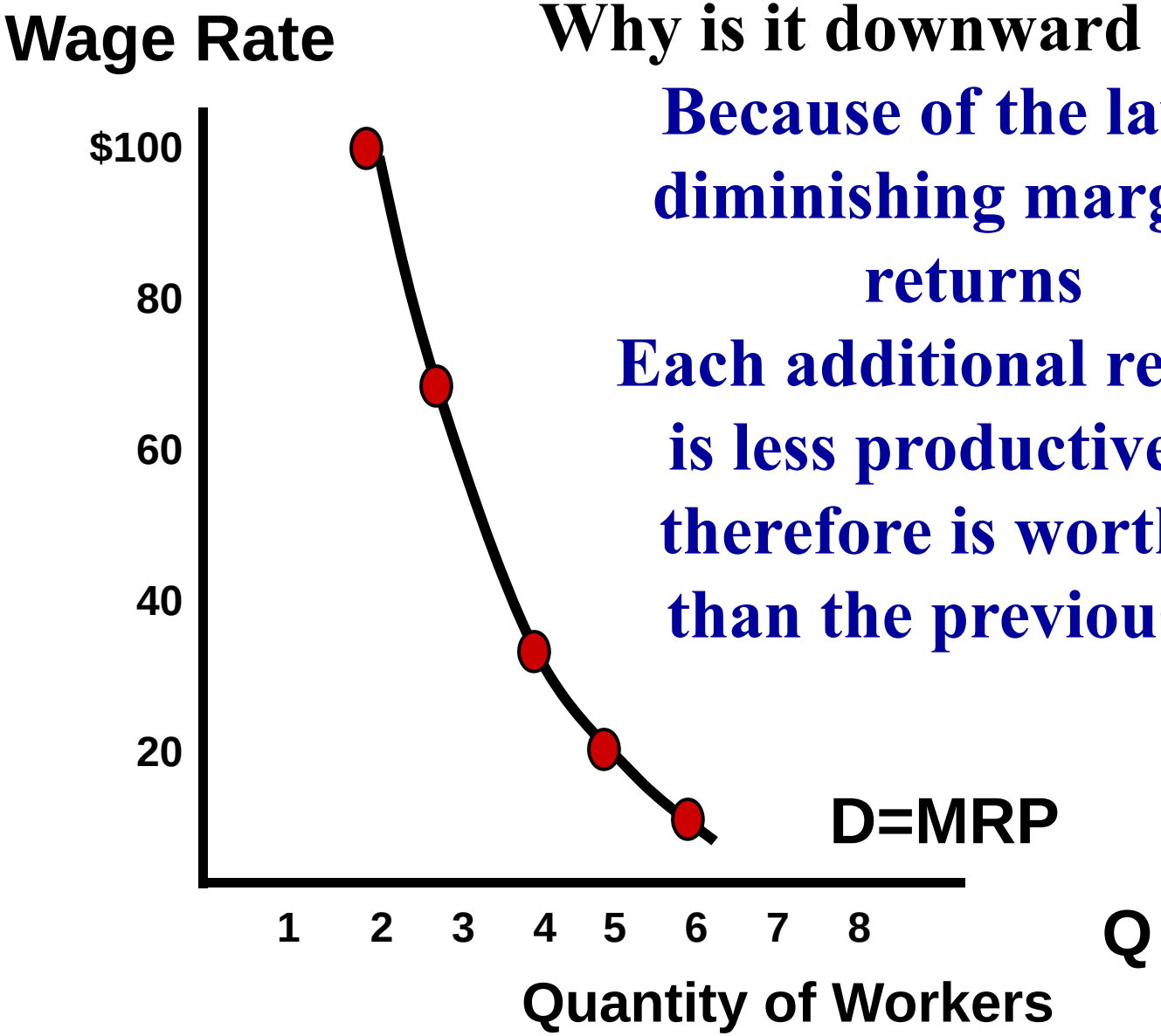
Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	MRP
0	0	-	0	0
1	7	7	10	70
2	17	10	10	100
3	24	7	10	70
4	27	3	10	30
5	29	2	10	20
6	30	1	10	10
7	27	-3	10	-30

Demand for this resource

Plotting the MRP/Demand curve

Demand=MRP

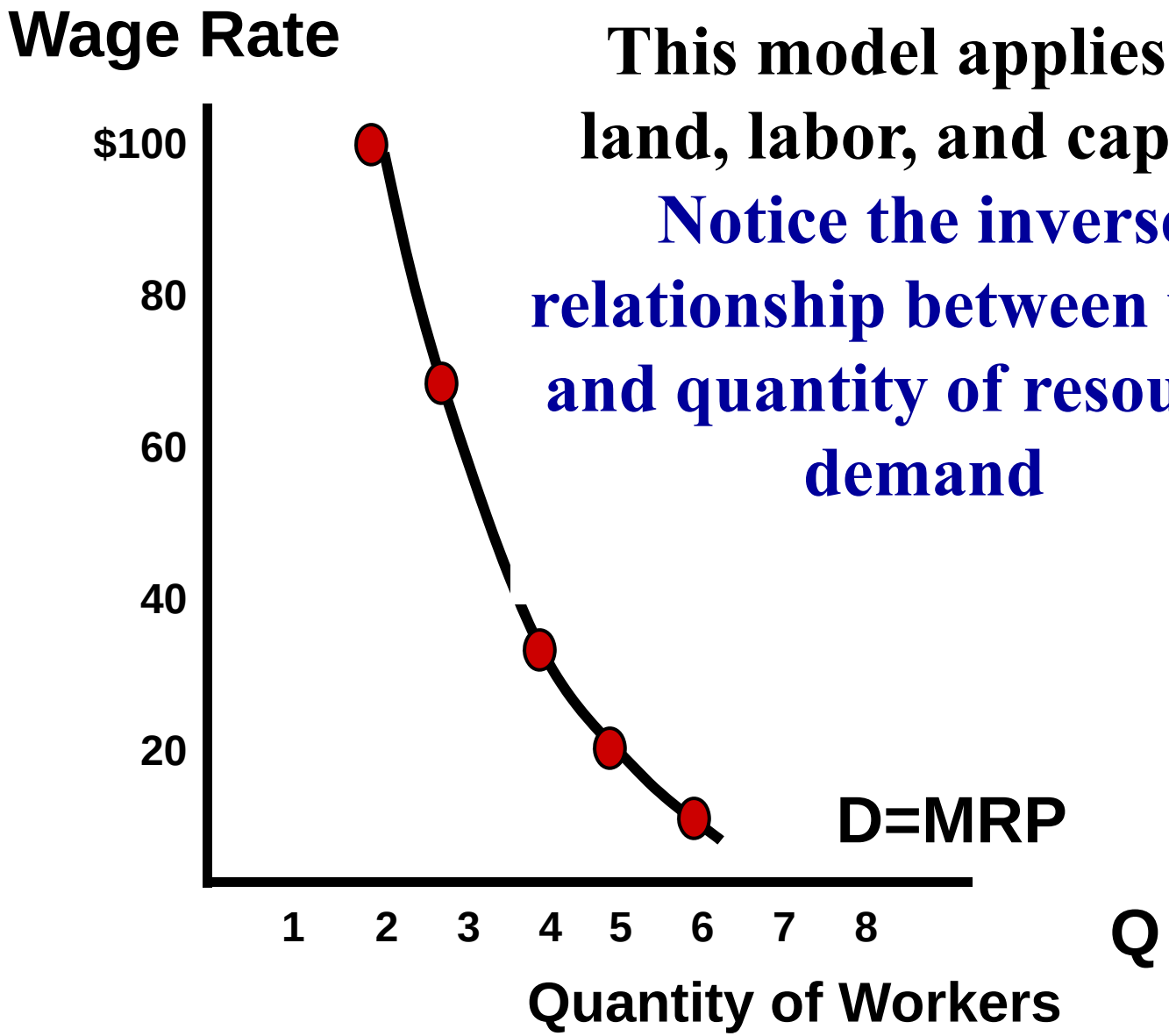


Why is it downward sloping?

Because of the law of diminishing marginal returns

Each additional resource is less productive and therefore is worth less than the previous one

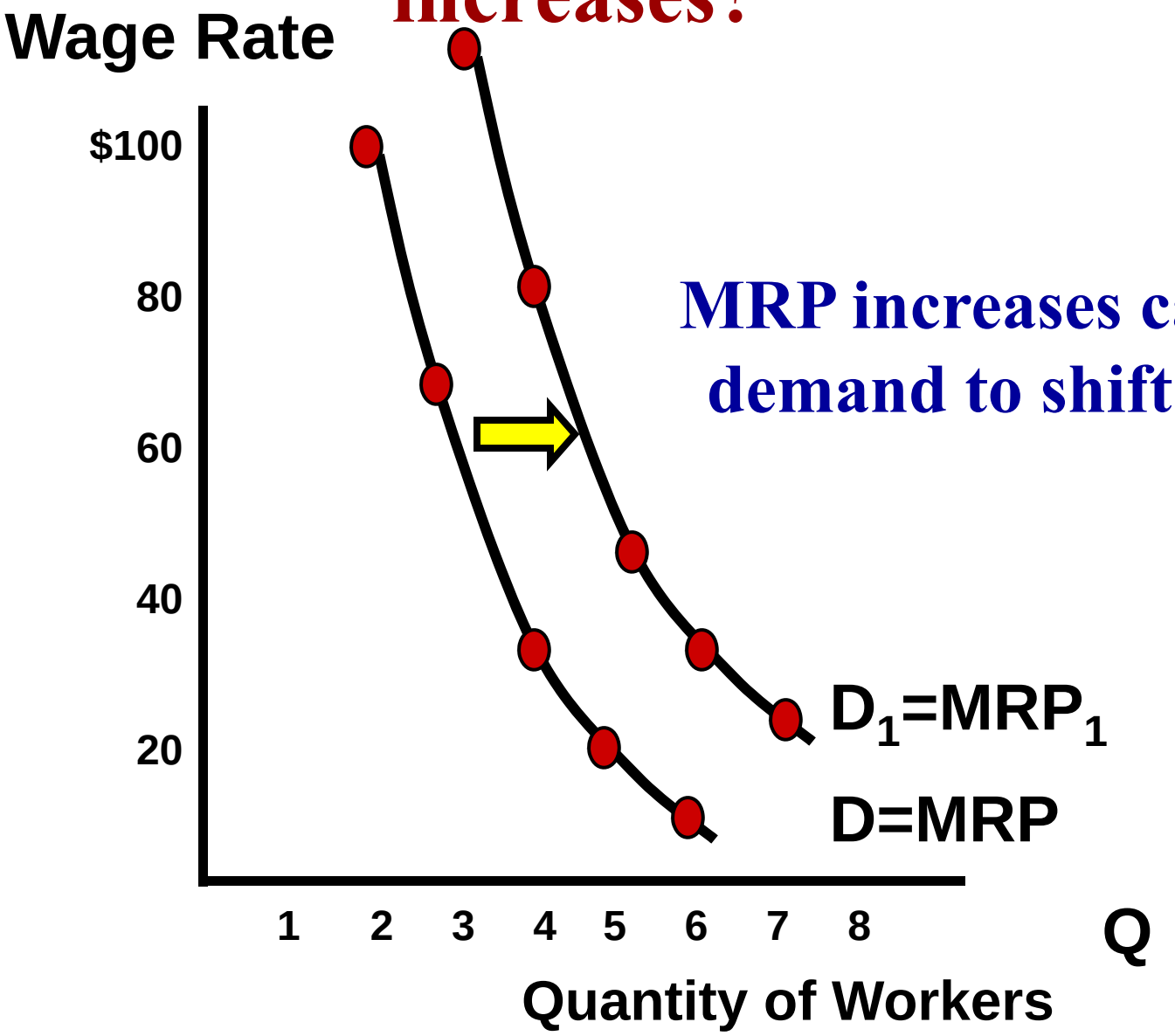
Demand=MRP



This model applies to land, labor, and capital

Notice the inverse relationship between wage and quantity of resources demand

What happens if demand for the product increases?



MRP increases causing demand to shift right

3 Shifters of Resource Demand

1.) Changes in the Demand for the Product

- **Price increase of the product increases MRP and demand for the resource.**

2.) Changes in Productivity

- **Technological Advances increase Marginal Product and therefore MRP/Demand.**

3.) Changes in Price of Other Resources

- **Substitute Resources**
- **Ex: What happens to the demand for assembly line workers if price of robots falls?**
- **Complementary Resources**
- **Ex: What happens to the demand nails if the price of lumber increases significantly?**

Drawing the Demand Curve for Resources

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	Additional Revenue per worker	Additional Cost per worker
0	0	-	0	0	0
1	7	7	10	70	20
2	17	10	10	100	20
3	24	7	10	70	20
4	27	3	10	30	20

How would this change if the demand for the good increased significantly?

1. Price of the good would increase.
2. Value of each worker would increase.

Use the following data:

Price = $100 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	Additional Revenue per worker
0	0	-	0	
1	7	7	100	
2	17	10	100	
3	24	7	100	
4	27	3	100	
5	29	2	100	
6	30	1	100	
7	27	-3	100	

Use the following data:

Price = $100 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	Additional Revenue per worker
0	0	-	0	0
1	7	7	100	700
2	17	10	100	1000
3	24	7	100	700
4	27	3	100	300
5	29	2	100	200
6	30	1	100	100
7	27	-3	100	-300

Each worker is worth more!!

THIS IS DERIVED DEMAND.

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	Additional Revenue per worker	Additional Cost per worker
0	0	-	0	0	0
1	7	7	10	70	20
2	17	10	10	100	20
3	24	7	10	70	20
4	27	3	10	30	20

How would this change if the productivity of each worker increased?

1. Marginal Product would increase.
2. Value of each worker would increase.

Use the following data:

Price = $10 Wage = $20

Units of Labor	Total Product (Output)	Marginal Product (MP)	Product Price	Additional Revenue per worker
0	0	-	0	0
1	70	70	10	700
2	170	100	10	1000
3	240	70	10	700
4	270	30	10	300
5	290	20	10	200
6	300	10	10	100
7	270	-30	10	-300

Each worker is worth more!

More demand for the resource.

3 Shifters of Resource Demand

Identify the Resource and Shifter (*ceteris paribus*):

1. Increase in demand for microprocessors leads to a(n) _____ in the demand for processor assemblers.
2. Increase in the price for plastic piping causes the demand for copper piping to _____.
3. Increase in demand for small homes (compared to big homes) leads to a(n) _____ the demand for lumber.
4. For shipping companies, _____ in price of trains leads to decrease in demand for trucks.
5. Decrease in price of sugar leads to a(n) _____ in the demand for aluminum for soda producers.
6. Substantial increase in education and training leads to an _____ in demand for skilled labor.

3 Shifters of Resource Demand

Identify the Resource and Shifter (*ceteris paribus*):

1. Increase in demand for microprocessors leads to a(n) _increase_ in the demand for processor assemblers.
2. Increase in the price for plastic piping causes the demand for copper piping to _increase_.
3. Increase in demand for small homes (compared to big homes) leads to a(n) _decrease_ the demand for lumber.
4. For shipping companies, _decrease_ in price of trains leads to decrease in demand for trucks.
5. Decrease in price of sugar leads to a(n) _increase_ in the demand for aluminum for soda producers.
6. Substantial increase in education and training leads to an _increase_ in demand for skilled labor.

Resource Supply Shifters

Supply Shifters for Labor

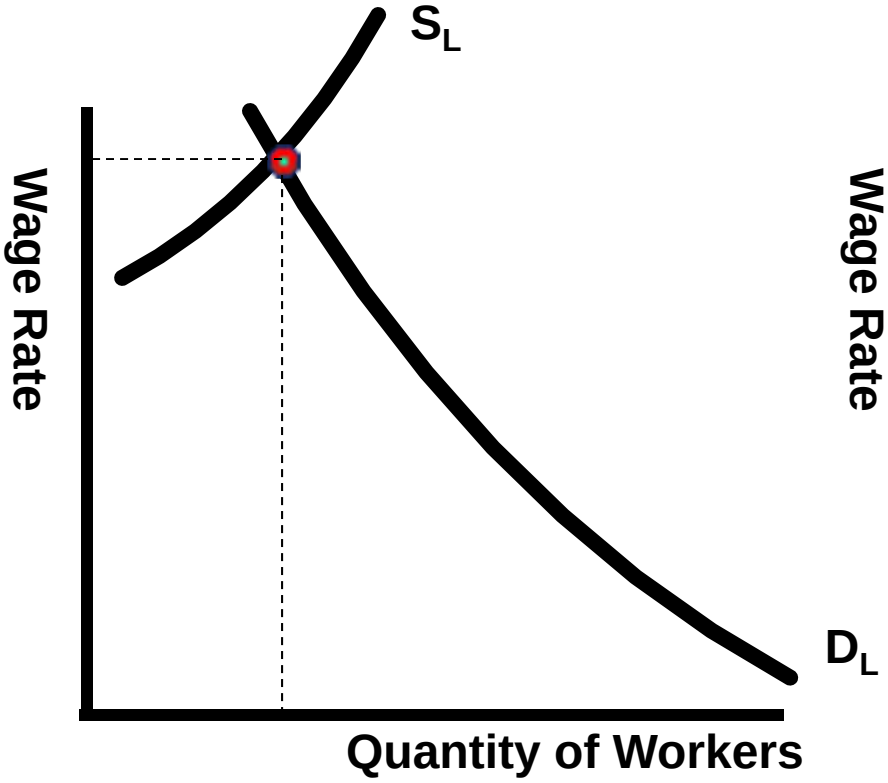
1. **Number of qualified workers**
   - **Education, training, & abilities required**
2. **Government regulation/licensing**
   Ex: What if waiters had to obtain a license to serve food?
3. **Personal values regarding leisure time and societal roles.**
   Ex: Why did the US Labor supply increase during WWII?

Why do some occupations get paid more than others?

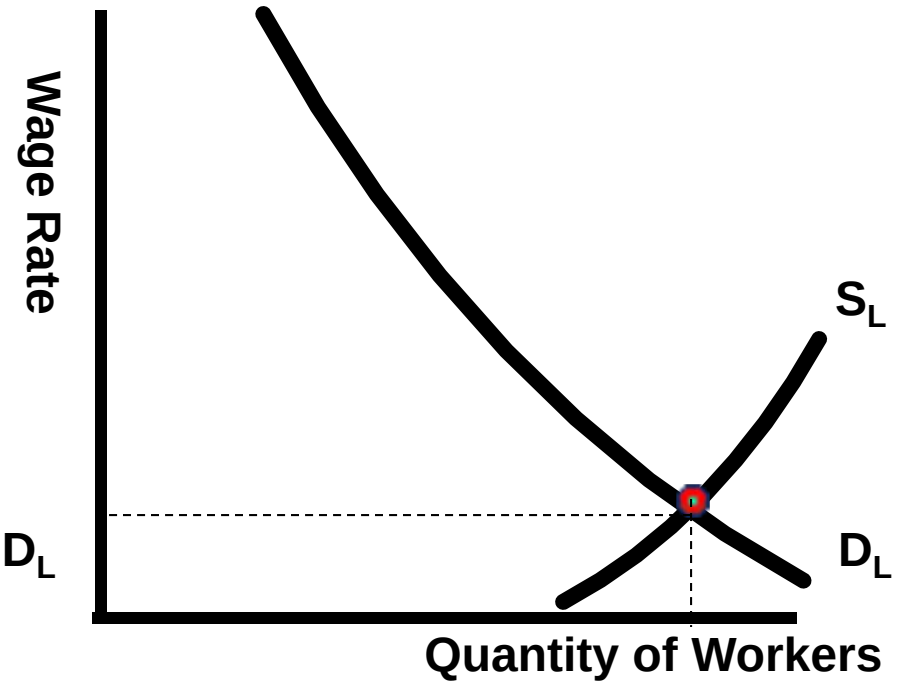
With your partner...

Use supply and demand analysis to explain why surgeons earn an average salary of $137,050 and gardeners earn $13,560.

Supply and Demand For Surgeons



Supply and Demand For Gardeners



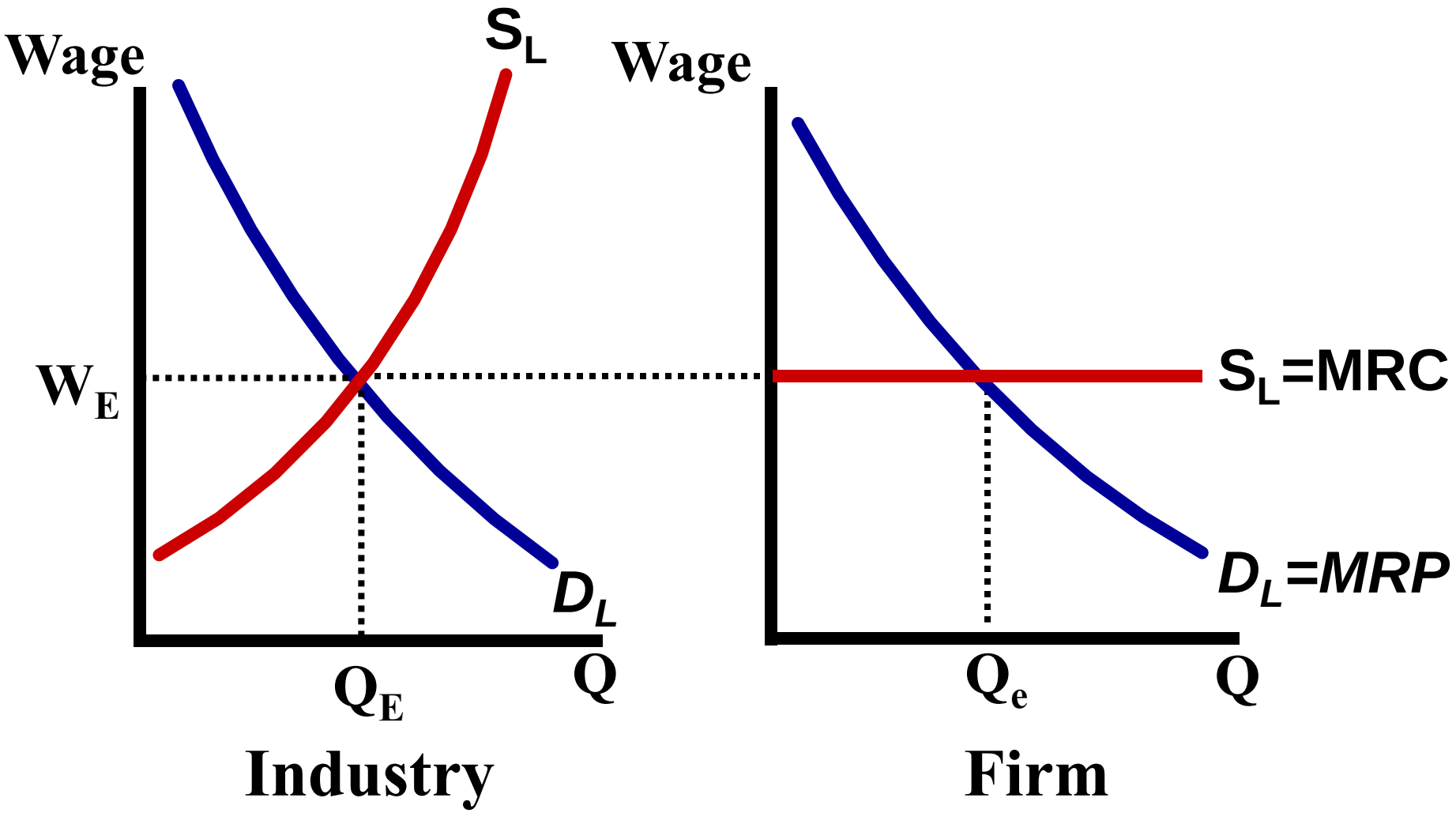
What are other reasons for differences in wage?

Labor Market Imperfections-

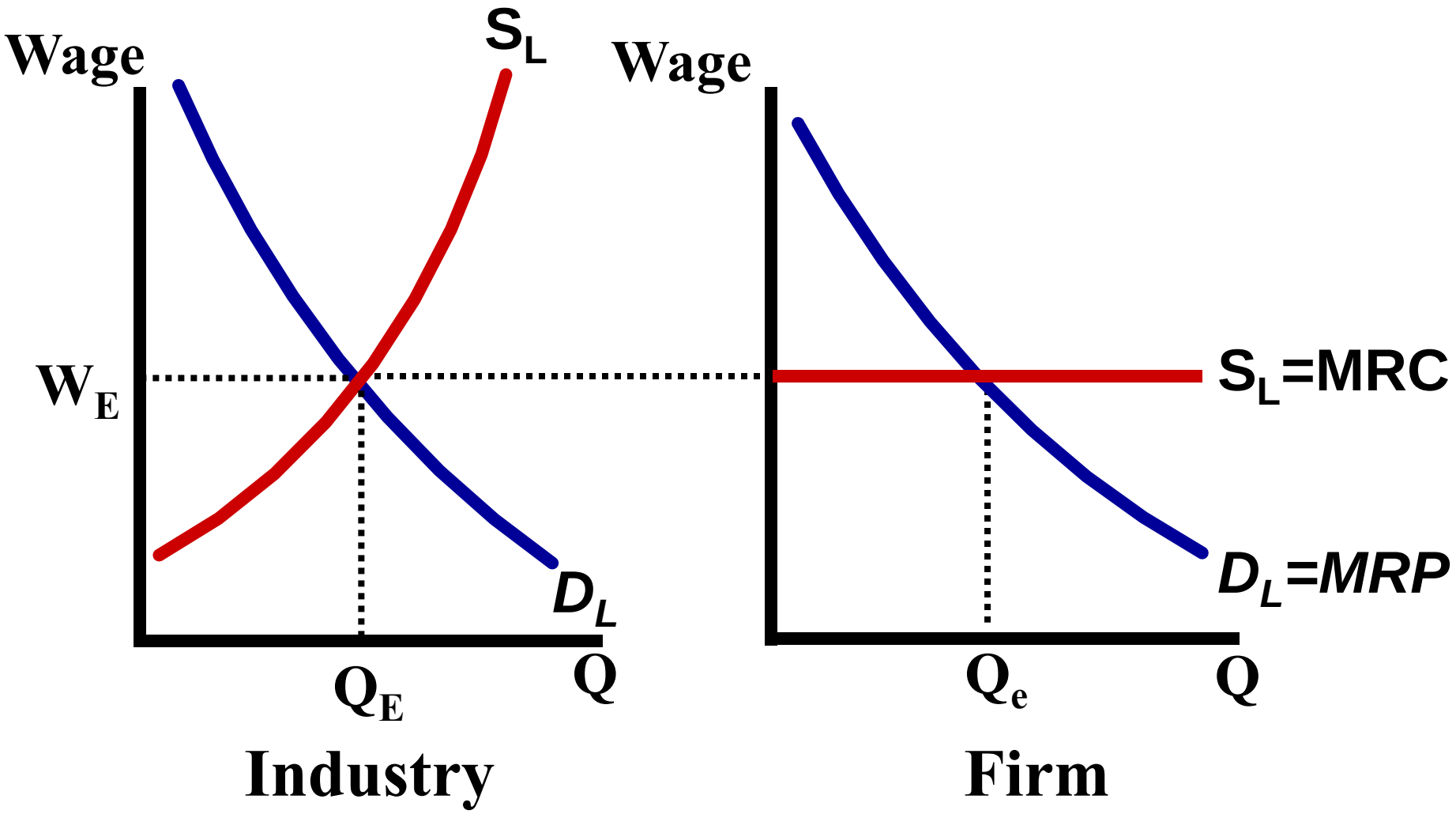
- **Insufficient/misleading job information-**
  - **This prevents workers from seeking better employment.**
- **Geographical Immobility-**
  - **Many people are reluctant or too poor to move so they accept a lower wage**
- **Unions**
  - **Collective bargaining and threats to strike often lead to higher that equilibrium wages**
- **Wage Discrimination-**
  - **Some people get paid differently for doing the same job based on race or gender (Very illegal!).**

Use side-by-side graphs to draw a perfectly competitive labor market and firm hiring workers

Wage is set by the market
Demand/MRP falls



What happens to the wage and quantity in the market and firm if new workers enter the industry?



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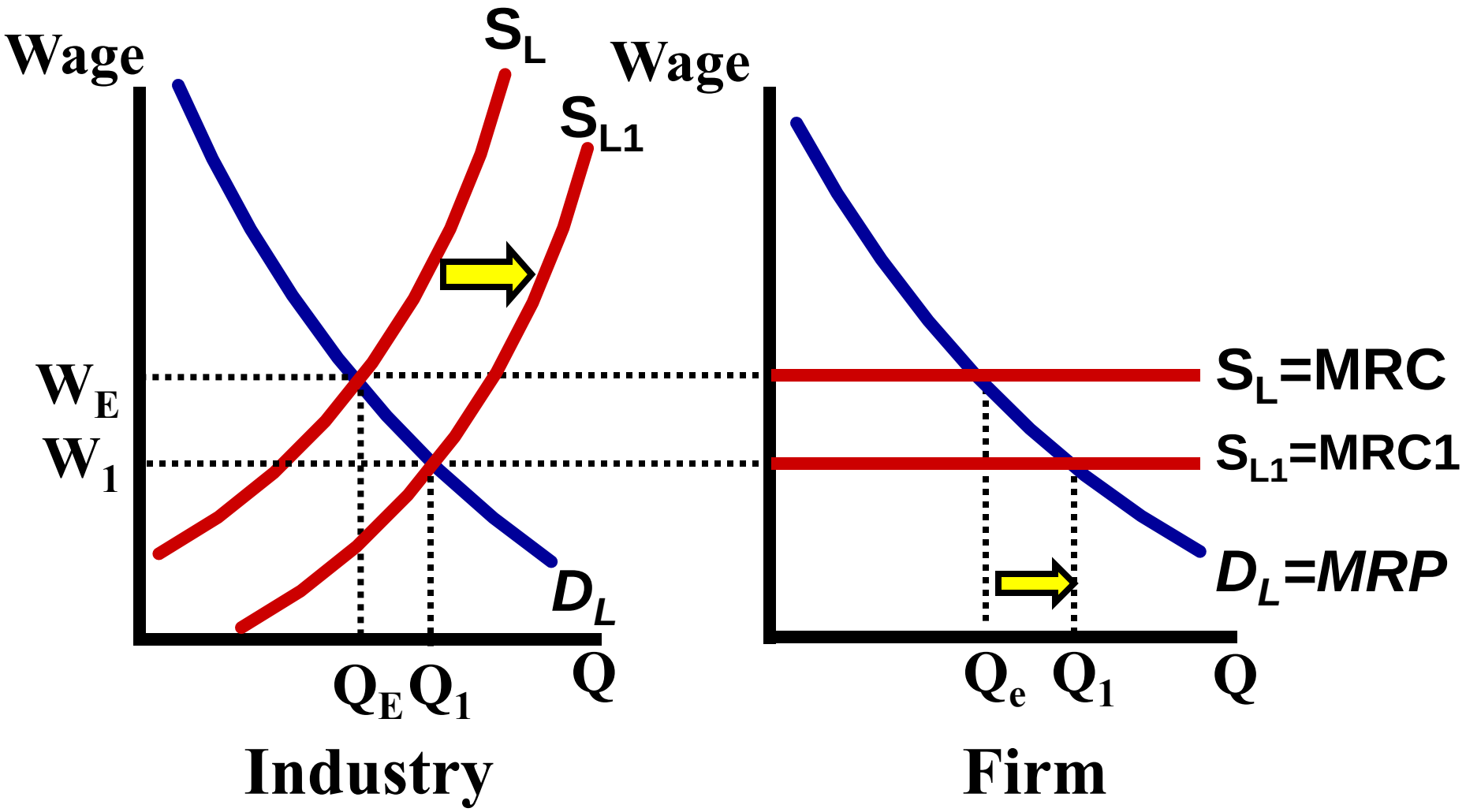


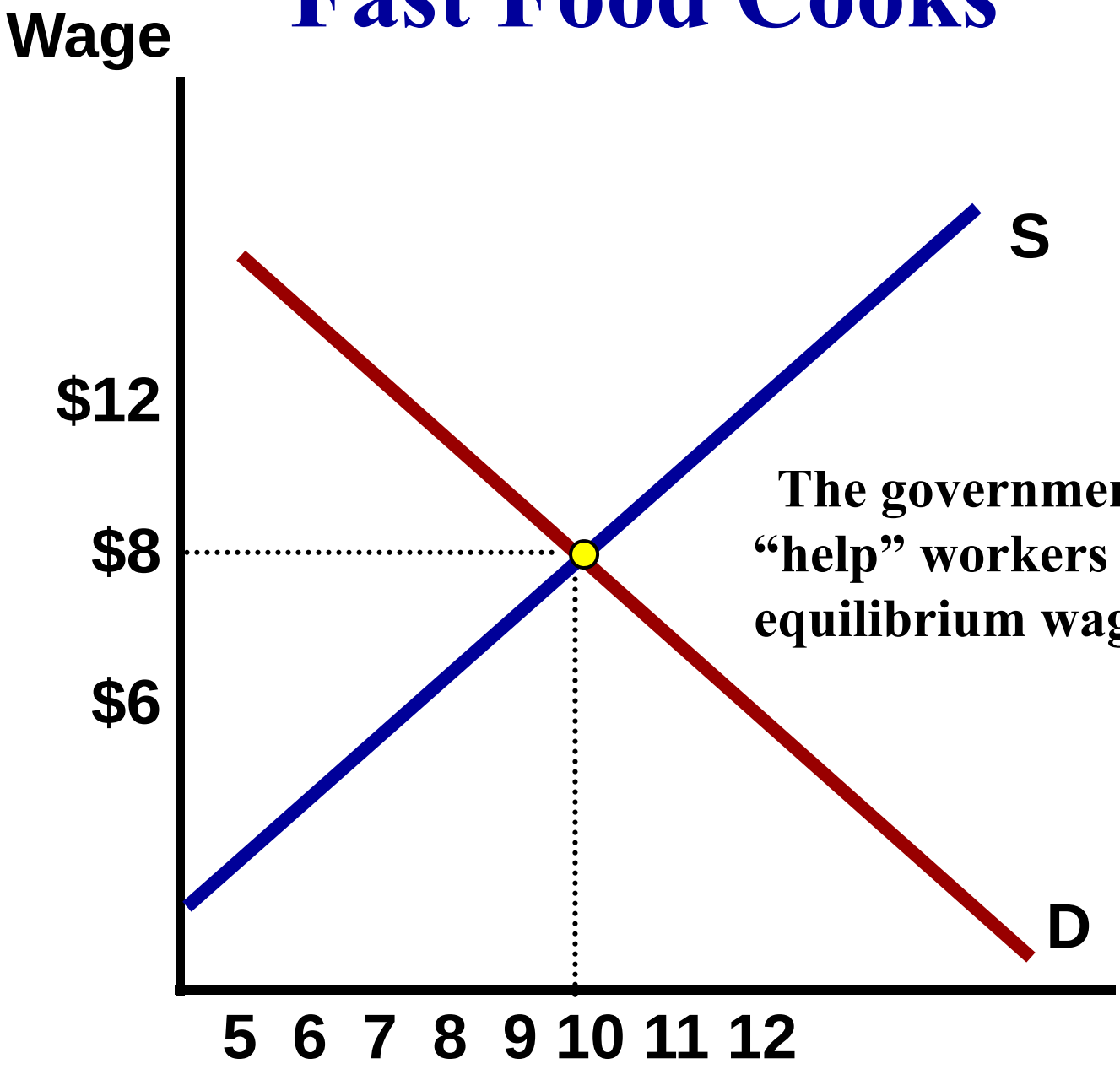
Minimum Wage

Assume the government was interest in increasing the federal minimum wage to $12 an hour

Do you support this new law?

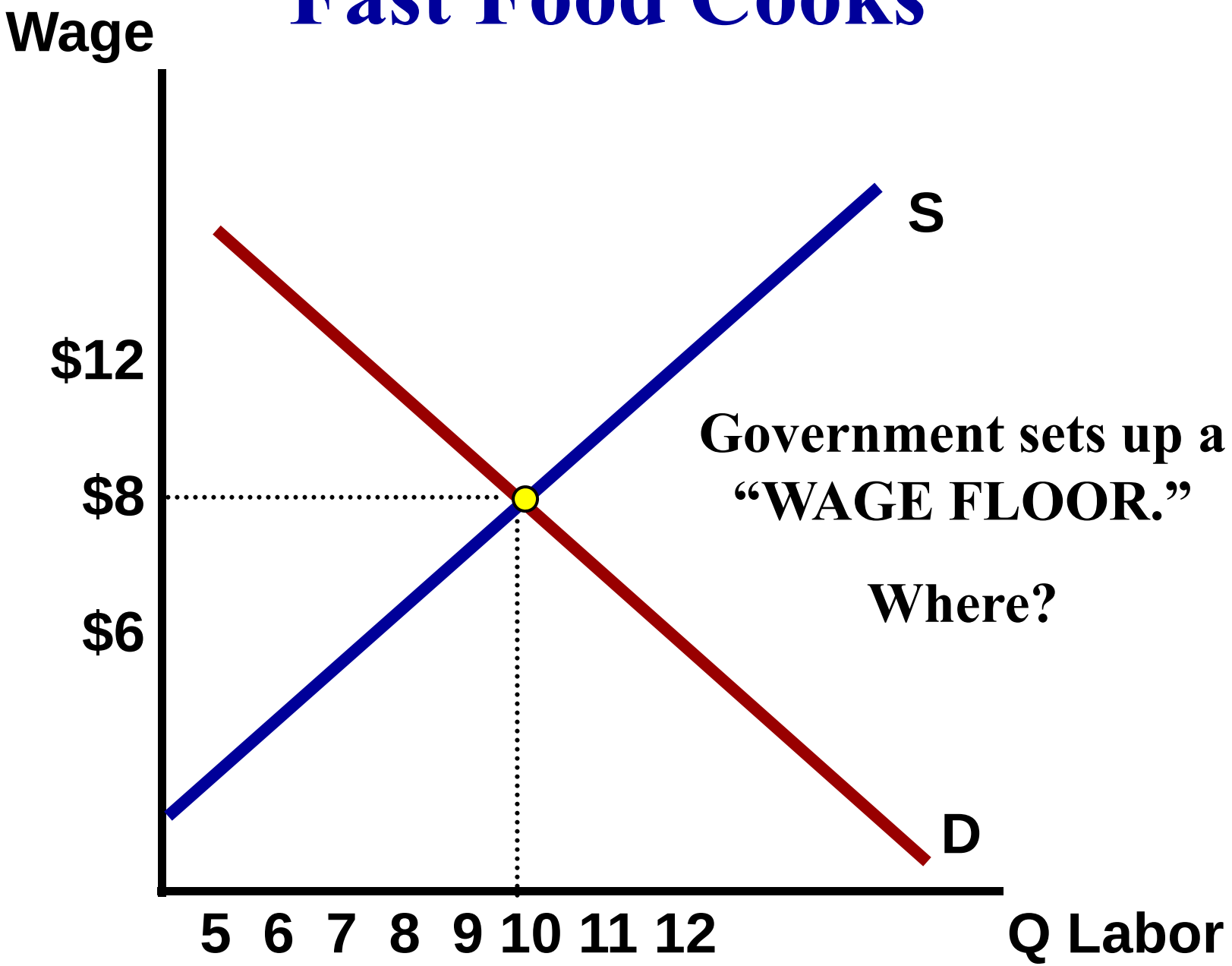
Why or why not

Fast Food Cooks

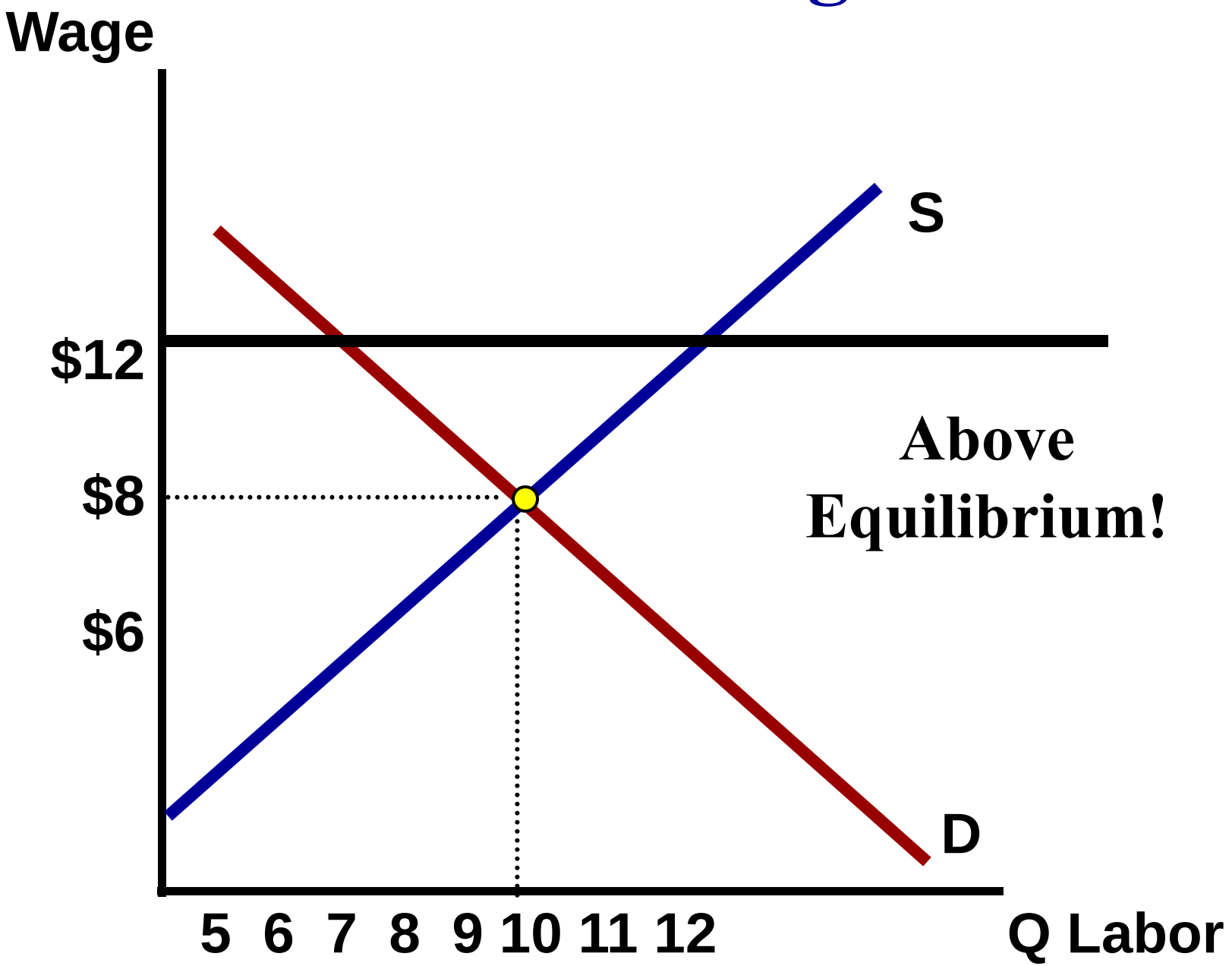


The government wants to "help" workers because the equilibrium wage is too low

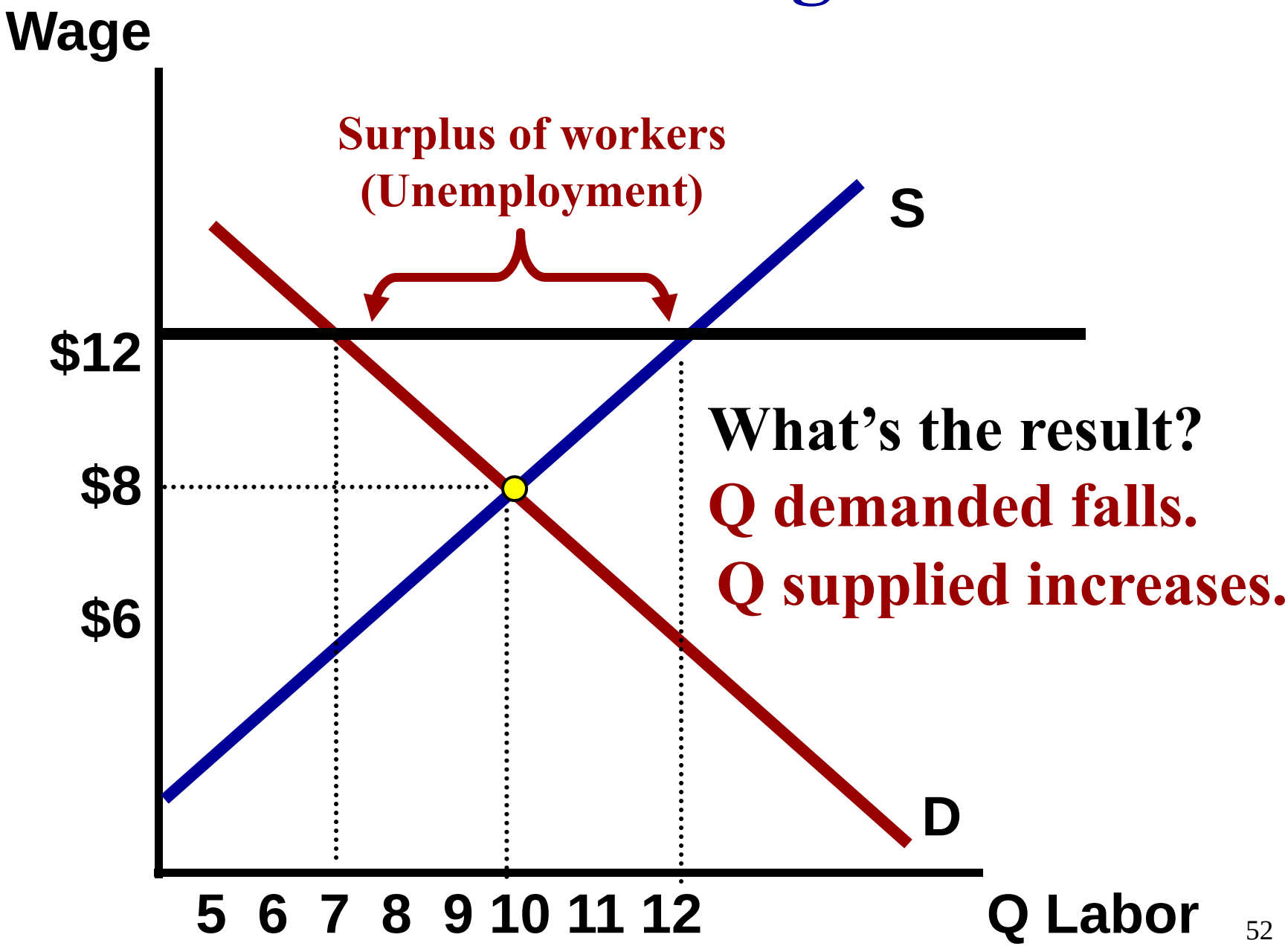
Fast Food Cooks



Minimum Wage



Minimum Wage



Is increasing minimum wage good or bad?

GOOD IDEA-

We don't want poor people living in the street, so we should make sure they have enough to live on.

BAD IDEA-

Increasing minimum wage too much leads to more unemployment and higher prices.

Producing 50 units at Least Cost

Equate the ratios of Marginal Product to Price for both labor and capital in order to compare the two, then simply go down the list choosing the larger ratio until you've satisfied the production condition.

$$\frac{MP_L}{P_L} = \frac{MP_C}{P_C}$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12		$24		1	13	13		$26	
2	22	10		$44		2	22	9		$44	
3	28	6		$56		3	28	6		$56	
4	33	5		$66		4	32	4		$64	
5	37	4		$74		5	35	3		$70	
6	40	3		$80		6	37	2		$74	
7	42	2		$84		7	38	1		$76	

Producing 50 units at Least Cost

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Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24		1	13	13		$26	
2	22	10	5/4	$44		2	22	9		$44	
3	28	6	3/4	$56		3	28	6		$56	
4	33	5	5/8	$66		4	32	4		$64	
5	37	4	1/2	$74		5	35	3		$70	
6	40	3	3/8	$80		6	37	2		$74	
7	42	2	1/4	$84		7	38	1		$76	

Producing 50 units at Least Cost

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Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13		$26	
2	22	10	5/4	$44	$20	2	22	9		$44	
3	28	6	3/4	$56	$12	3	28	6		$56	
4	33	5	5/8	$66	$10	4	32	4		$64	
5	37	4	1/2	$74	$8	5	35	3		$70	
6	40	3	3/8	$80	$6	6	37	2		$74	
7	42	2	1/4	$84	$4	7	38	1		$76	

Producing 50 units at Least Cost

Equate the ratios of Marginal Product to Price for both labor and capital in order to compare the two, then simply go down the list choosing the larger ratio until you've satisfied the production condition.

$$\frac{MP_L}{P_L} = \frac{MP_C}{P_C}$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	

Producing 50 units at Least Cost

Equate the ratios of Marginal Product to Price for both labor and capital in order to compare the two, then simply go down the list choosing the larger ratio until you've satisfied the production condition.

$$\frac{MP_L}{P_L} = \frac{MP_C}{P_C}$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Producing the Profit-Maximizing Quantity

Equate the ratios of MRP to Price to each other, then set them equal to 1.

$$\frac{MRP_L}{P_L} = \frac{MRP_C}{P_C} = 1$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Producing the Profit-Maximizing Quantity

Note that this is the same MR=MC rule that we have been using all semester. In this unit we have called it MRP = MRC.

$$\frac{MRP_L}{P_L} = \frac{MRP_C}{P_C} = 1$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Producing the Profit-Maximizing Quantity

For Labor, MRP = MRC at the 5th worker. For capital, it happens at the 3rd.

$$\frac{MRP_L}{P_L} = \frac{MRP_C}{P_C} = 1$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Producing the Profit-Maximizing Quantity

Prove that this is indeed the profit-maximizing combination by comparing TR and TC.

$$\frac{MRP_L}{P_L} = \frac{MRP_C}{P_C} = 1$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Producing the Profit-Maximizing Quantity

$74 + $56 = $130 (TR)
$40 + $36 = $76 (TC)
$54 economic profit

$$\frac{MRP_L}{P_L} = \frac{MRP_C}{P_C} = 1$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Producing the Profit-Maximizing Quantity

No other combination will yield greater than $54 economic profit (this chart is on page 544 if you would like to experiment)

$$\frac{MRP_L}{P_L} = \frac{MRP_C}{P_C} = 1$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Least Cost Rule

$10

$$\frac{MPx}{P_x} = \frac{MPy}{P_y}$$

$5

# Times Going	MP_R (Robots)	MP/P_R ($Price_R$ =$10)	MP_W (Workers)	MP/P_W ($Price_W$ =$5)
1st	30		20	
2nd	20		15	
3rd	10		10	
4th	5		5	

If you only have $35, what combination of robots and workers will maximize output?

Least Cost Rule

$$\frac{MPx}{P_x} = \frac{MPy}{P_y}$$

$10

$5

# Times Going	MP_R (Robots)	MP/P_R ($Price_R$ =$10)	MP_W (Workers)	MP/P_W ($Price_W$ =$5)
1st	30	3	20	4
2nd	20	2	15	3
3rd	10	1	10	2
4th	5	.50	5	1

If you only have $35, the best combination is 2 robots and 3 workers (similar to key question 4a)

Producing 65 units at Least Cost

You are the manager of this factory and have been tasked with producing 65 units at a cost of no more than $76 (assuming only labor and rent on capital as costs). What is the most efficient way to do it? Explain.

$$\frac{MP_L}{P_L} = \frac{MP_C}{P_C}$$

Labor (Price = $8)						Capital (Price = $12)					
Q	TP	MP	MP/P	TR	MRP	Q	TP	MP	MP/P	TR	MRP
0	0	---	---	$0	---	0	0	---	---	$0	---
1	12	12	3/2	$24	$24	1	13	13	13/12	$26	$26
2	22	10	5/4	$44	$20	2	22	9	3/4	$44	$18
3	28	6	3/4	$56	$12	3	28	6	1/2	$56	$12
4	33	5	5/8	$66	$10	4	32	4	1/3	$64	$8
5	37	4	1/2	$74	$8	5	35	3	1/4	$70	$6
6	40	3	3/8	$80	$6	6	37	2	1/6	$74	$4
7	42	2	1/4	$84	$4	7	38	1	1/12	$76	$2

Profit Maximizing Rule

$$\frac{MRPx}{P_x} = \frac{MRPy}{P_y} = 1$$

$10 $5

# Times Going	MP_R (Robots)	MP/P_R ($Price_R$ =$10)	MP_W (Workers)	MP/P_W ($Price_W$ =$5)
1st	30	3	20	4
2nd	20	2	15	3
3rd	10	1	10	2
4th	5	.50	5	1

Assume the firm sells its product in a perfectly competitive market at a price of $1 per unit (makes MRP the same as MP).

Profit Maximizing Rule

$$\frac{MRPx}{P_x} = \frac{MRPy}{P_y} = 1$$

$10 $5

# Times Going	MP_R (Robots)	MP/P_R ($Price_R$ =$10)	MP_W (Workers)	MP/P_W ($Price_W$ =$5)
1st	30	3	20	4
2nd	20	2	15	3
3rd	10	1	10	2
4th	5	.50	5	1

To maximize profit, set the least cost equation equal to 1 (where MRP=MRC) (similar to key question 4b)

Profit-Maximization re-visited

- To maximize profit, each factor (input) should be employed until its price equals its marginal revenue product (MRC=MRP).
- In the preceding example, the MRP of the first worker was $20 and her price was $5. What should the firm do?
- Hire more! And keep hiring (going down the MRP curve) until MRP = MRC.

Practice: What should the firm do – hire more, less, or stay put?

1. $MRP_L = \$10$; $P_L = \$8$; $MRP_C = \$20$; $P_C = \$20$
   MORE **STAY PUT**
2. $MRP_L = \$8$; $P_L = \$10$; $MRP_C = \$10$; $P_C = \$20$
   LESS **LESS**
3. $MRP_L = \$30$; $P_L = \$20$; $MRP_C = \$10$; $P_C = \$10$
   MORE **STAY PUT**
4. $MRP_L = \$10$; $P_L = \$10$; $MRP_C = \$45$; $P_C = \$40$
   STAY PUT **MORE**
5. $MRP_L = \$25$; $P_L = \$15$; $MRP_C = \$100$; $P_C = \$50$
   MORE **MORE**

- (similar to Key Question 5)

The Connection Between Input Demand & Output Supply

- Recall: **marginal cost (*MC*)**

  = cost of producing an additional unit of output

  = $\Delta \boldsymbol{TC}/\Delta \boldsymbol{Q}$, where TC = total cost

- Suppose W = \$2500, MPL = 500 bushels of corn
- If Farmer Jack hires another worker,

  $\Delta \boldsymbol{TC}$ = \$2500, $\Delta \boldsymbol{Q}$ = 500 bushels

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

The **Connection** Between Input Demand & Output Supply

- In general: $MC = W/MPL$
- Notice:
  - 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.***

2010 Practice FRQ

2. The John Lamb Company, a profit-maximizing firm producing widgets, is in a perfectly competitive widget market. Assume John Lamb employs a fixed number of employees and rents a machine for a variable number of hours from a perfectly competitive market.

   (a) Using correctly labeled side-by-side graphs of the factor market for machines and the John Lamb Company, show each of the following.

      (i) The equilibrium rental price of machines in the factor market, labeled as P_R

      (ii) John Lamb's equilibrium rental quantity of machines, labeled as Q_L

   (b) Assume that the popularity of widgets declines, decreasing the demand for widgets. What will happen to each of the following?

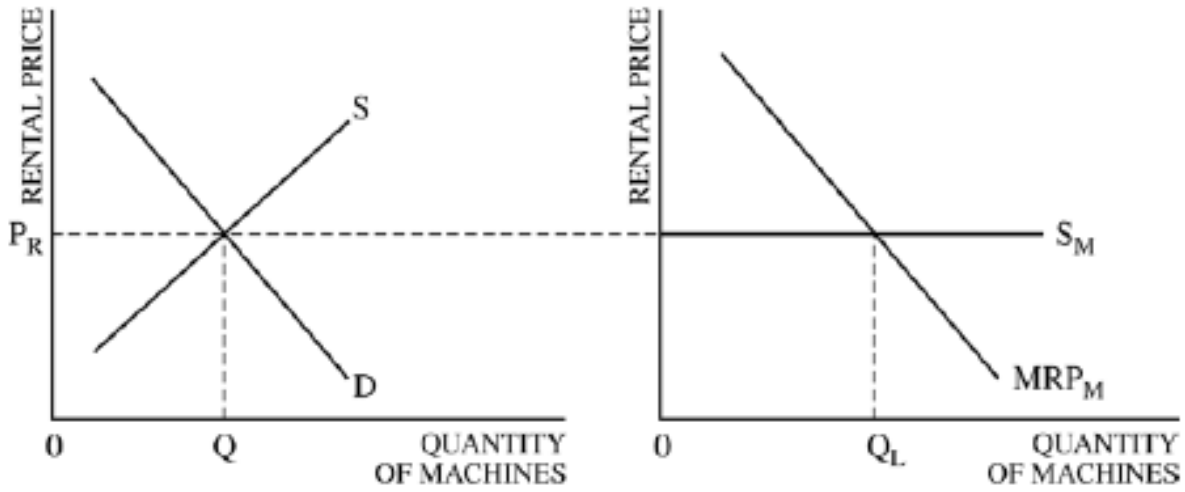
      (i) Marginal product curve for machine-hours

      (ii) Marginal revenue product curve for machine-hours. Explain.

   (c) John Lamb is employing the cost-minimizing combination of inputs. The marginal product of labor is 28 widgets per worker hour and the wage rate is $14 per hour. The marginal product of the machine is 60 widgets per machine-hour. What is the hourly rental price of a machine?

Question 2

5 points (2+2+1)



(a) 2 points:

- One point is earned for the correct side-by-side graphs with a horizontal machine supply curve for John Lamb (S, D, P_R, S_M).
- One point is earned for showing the equilibrium rental quantity of machines, Q_L, at the intersection of MRP and the horizontal supply curve.

(b) 2 points:

- One point is earned for stating that there will be no change to the marginal product curve for machine-hours.
- One point is earned for explaining that the MRP curve for machine-hours will decrease (shift to the left) because the decrease in demand decreases the price of widgets.

(c) 1 point:

- One point is earned for correctly calculating the rental price of a machine: $MP_L/w = MP_K/r = 28/14 = 60/r$. Therefore, $r = \$30$.

Resource Markets

Imperfect Competition: Monopsony

Characteristics:

- **One firms hiring workers**
  - **The firm is large enough to manipulate the market**
- **Workers are relatively immobile**
- **To hire add**
- **Firm is wage maker**
  - **To hire additional workers the firm must increase**

Examples:

Central American Sweat Shops

Midwest small town with a large Car Plant

NCAA

Assume that this firm CAN'T wage discriminate and must pay each worker the same wage.

Acme Coal Mining Co.		
Wage rate (per hour)	**Number of Workers**	**Marginal Resource Cost**
$4.00	**0**	
4.50	**1**	
5.00	**2**	
5.50	**3**	
6.00	**4**	
7.00	**5**	
8.00	**6**	
9.00	**7**	
10.00	**8**	

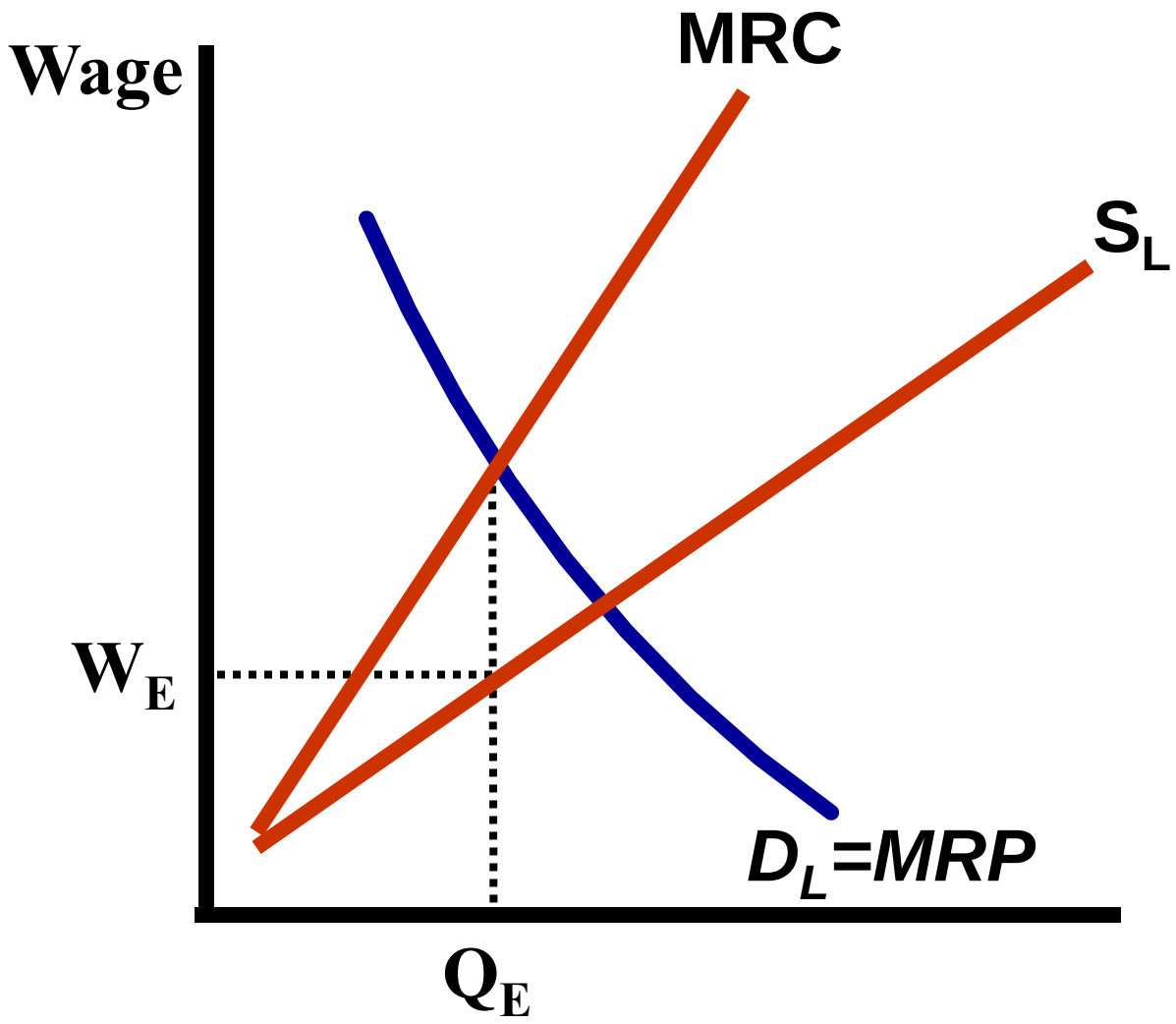
Assume that this firm CAN'T wage discriminate and must pay each worker the same wage.

7.0		11
8.00		13
9.00	7	15
10.00	8	17

MRC doesn't equal wage

Monopsony

If the firm can't wage discriminate, where is MRC?



Labor Unions

Goal is to increasing wages and benefits

How do Unions Increase Wages?

1. **Convince Consumers to buy only Union Products**
   Ex: Advertising the quality of union/domestic products
2. **Lobbying government officials to increase demand**
   Ex: Teacher's Union petitions governor to increase spending.
3. **Increase the price of substitute resources**
   Ex: Unions support increases in minimum wage so employers are less likely to seek non-union workers

Labor Markets and Globalization

Why is Globalization Happening?

- **Globalization is the result of firms seeking lowest costs. Firms are seeking greater profits.**
- **Parts are made in China because labor in significantly cheaper.**

What is Outsourcing?

- **Outsourcing is when firms send jobs overseas.**

What types of jobs are outsourced?

- **For many years it was only unskilled jobs, but now other skilled jobs are sent overseas.**

Advantages and Disadvantages

Disadvantages

- Increases U.S. unemployment
- Less US tax revenue generated from workers and corporations means less public benefits
- Foreign workers don't receive same protections as US workers

Advantages

- Lowers prices for nearly all goods and services
- Decreases world unemployment
- Improves quality of life and decreases poverty in less developed countries