4.4 — Factor Markets I: Labor

ECON 306 · Microeconomic Analysis · Fall 2020
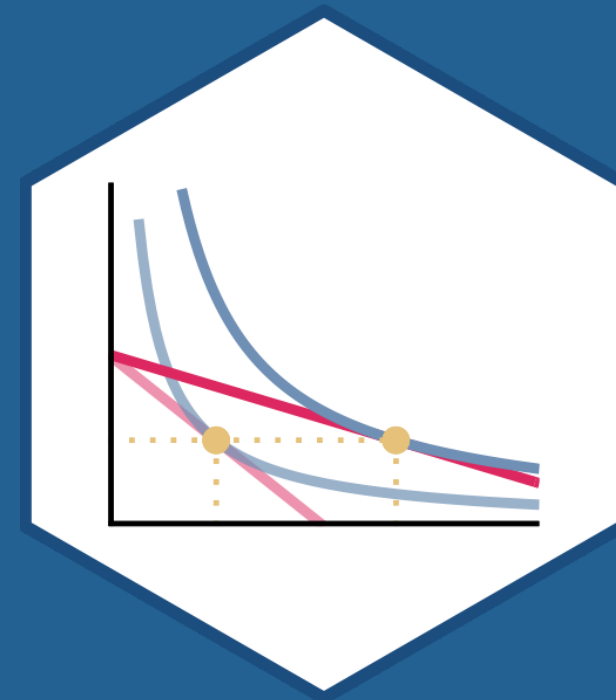
Ryan Safner

Assistant Professor of Economics

✈ safner@hood.edu

⊙ ryansafner/microF20

⊕ microF20.classes.ryansafner.com

Outline

Returning to Firms

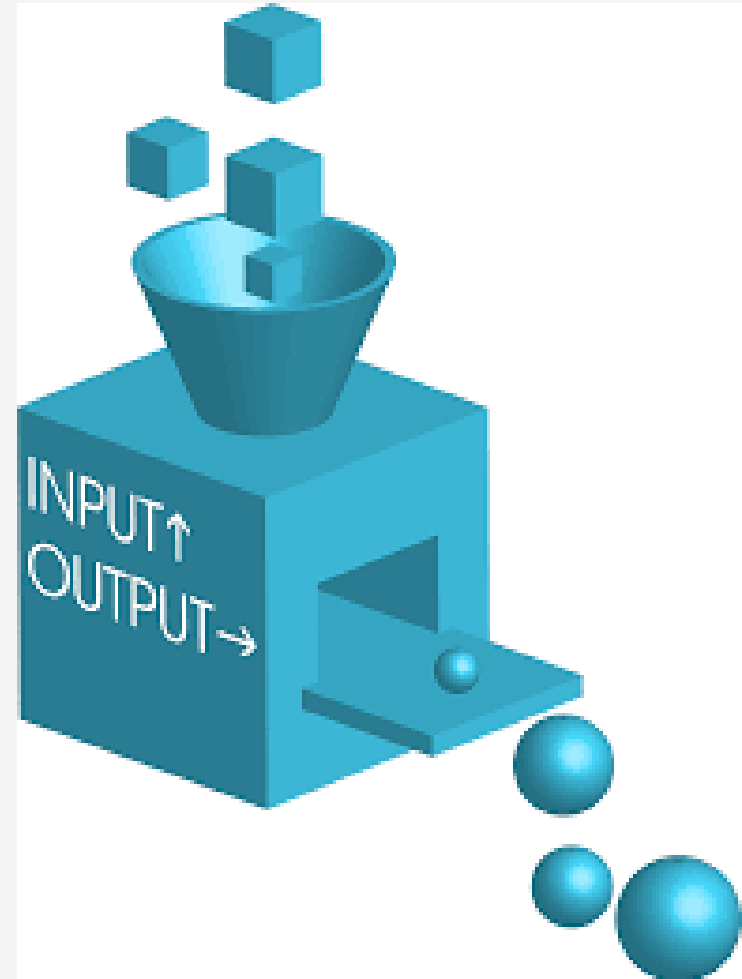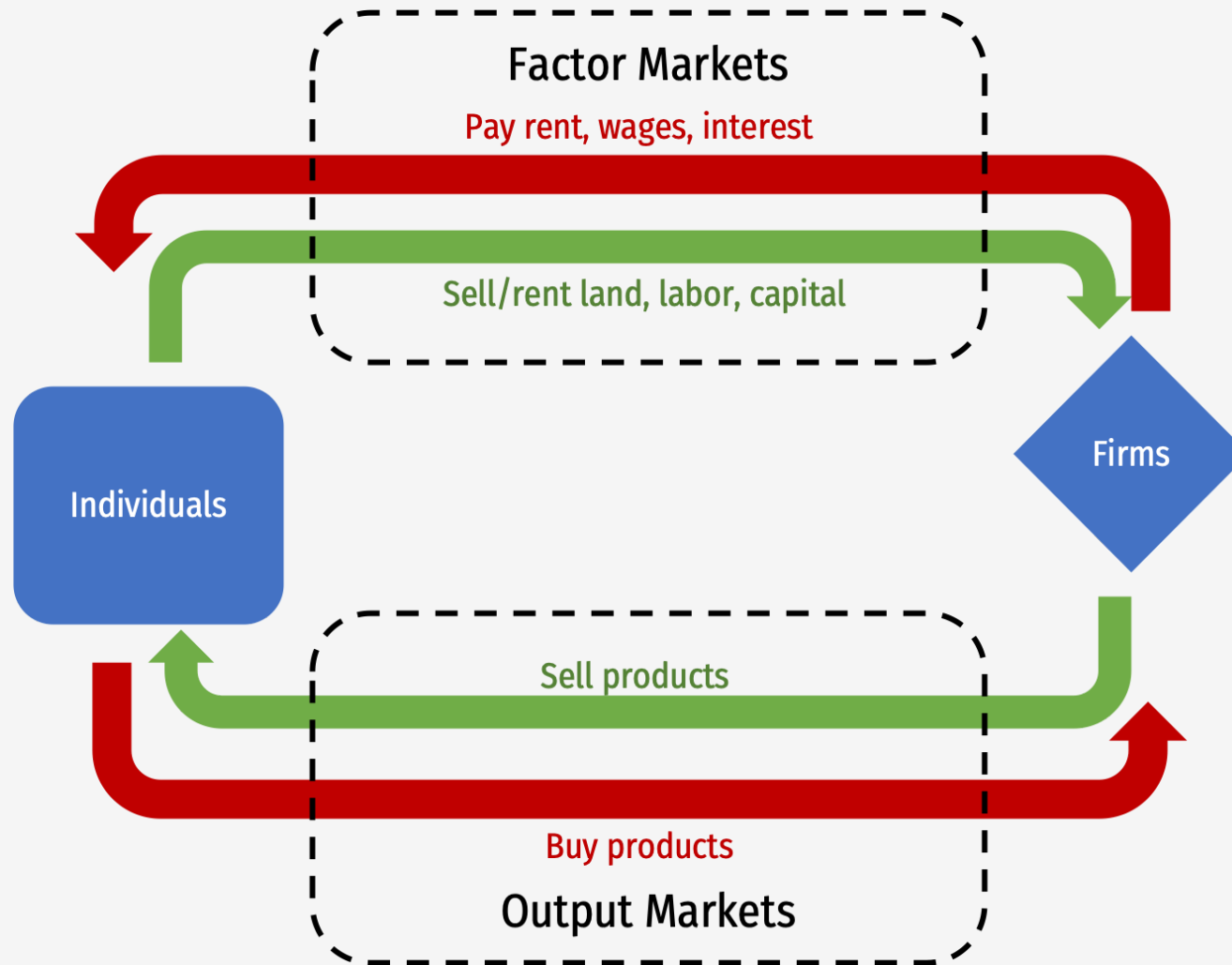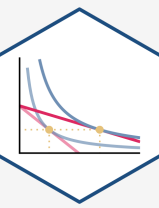- Recall a firm uses technology that buys inputs, transforms them, and sells output
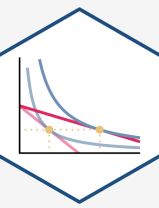
$$q = f(k, l)$$

  - We classified inputs into the **factors of production**: land, labor, capital

- We *assumed* fixed factor prices

  - show up in total cost $= wL + rK$

- Where do they come from? **Factor markets**

Circular Flow

Factor Markets

Pay rent, wages, interest

Sell/rent land, labor, capital

Individuals

Firms

Sell products

Buy products

Output Markets

Firms' Payments to Factors are Income To Households

Income Type	Amount (2016)	Percent
Salaries and wages	$7217 Bn	68.45%
Taxable pensions and annuities	$694 Bn	6.58%
Partnership and S corporation net income	$629 Bn	5.97%
Capital gains less losses	$621 Bn	5.89%
Business net income	$389 Bn	3.69%
Taxable Social Security benefits	$286 Bn	2.71%
Taxable IRA distributions	$258 Bn	2.45%
Ordinary dividends	$254 Bn	2.41%
Total rental and royalty net income	$98 Bn	0.93%
Taxable interest	$97 Bn	0.92%

Firms' Payments to Factors are Income To Households
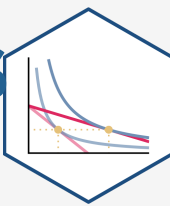
Labor Income Greatly Exceeds Investment Income

Taxable Labor and Investment Income in the United States, 2016 (Billions of Dollars)

Salaries and Wages: $7217
Dividend Income: $254
Capital Gains Income: $875
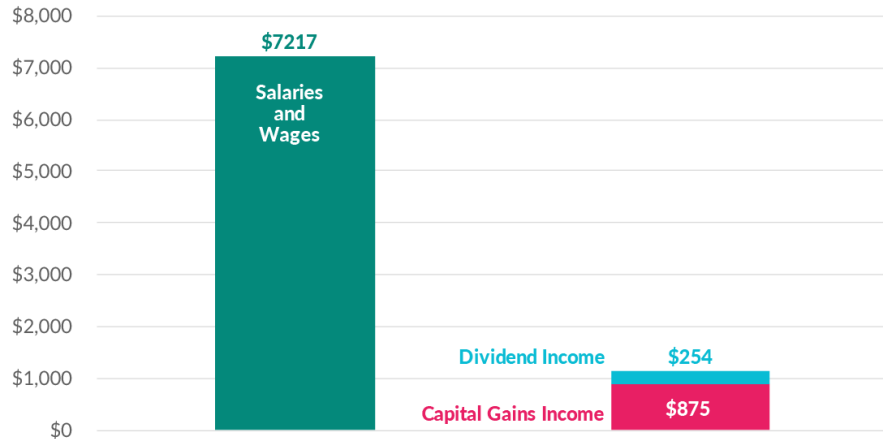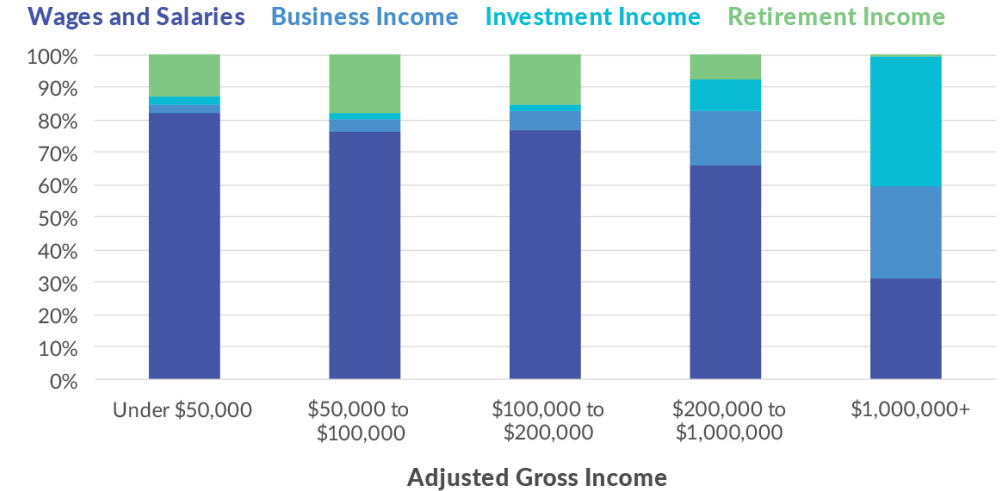
Source: IRS SOI Table 1.3

TAX FOUNDATION   @TaxFoundation

Composition of Income Varies with Income Level

Sources of Personal Income by Income Bracket, 2016

Wages and Salaries   Business Income   Investment Income   Retirement Income

Adjusted Gross Income

Under $50,000 | $50,000 to $100,000 | $100,000 to $200,000 | $200,000 to $1,000,000 | $1,000,000+

Source: IRS SOI Table 1.4

TAX FOUNDATION   @TaxFoundation

Source: Tax Foundation, 2018

Supply and Demand in Factor Markets

- The price of a factor is governed by the same market forces as output:

- **Supply of Factor**: willingness of factor owners to accept and sell/rent their services to firms

  - landowners, workers, capitalists, resource owners, suppliers

- **Demand for Factor**: willingness of firms to pay for/hire factor services

Factor Market

Price of Factor, p_x

p_x

Supply = Min WTA

Demand = Max WTP

0

x

Quantity of Factor (x)
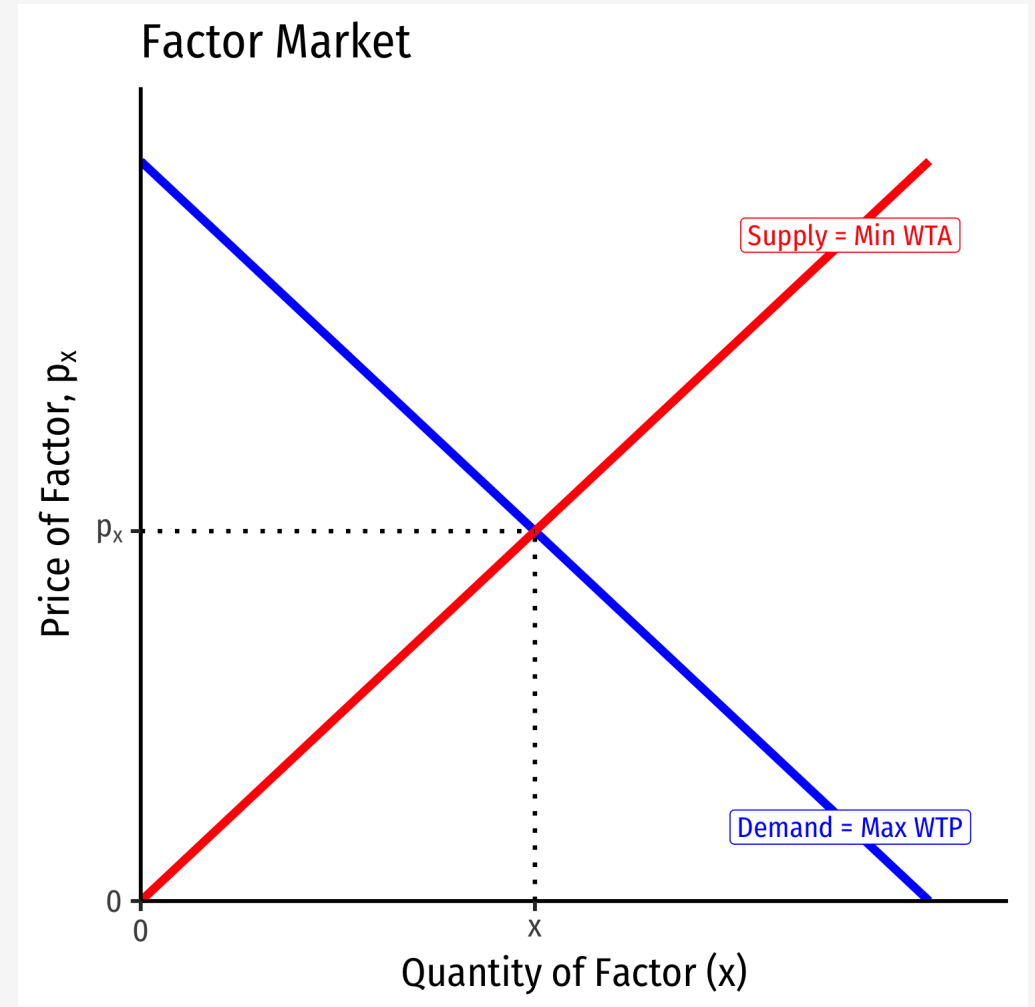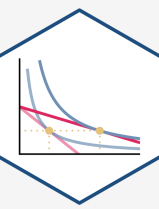
Factor Market Prices and Opportunity Costs
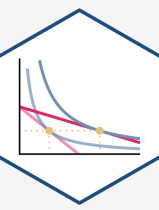
- **Factor price represents opportunity cost of hiring a factor for an alternative use**
  - Firms not only pay for direct use of a factor, but also indirectly for *not using* it in an alternate process!
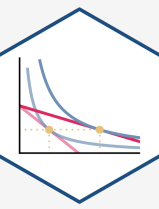
Factor Market Prices and Opportunity Costs

- **Example**: a producer of hammers buys steel, pays (the opportunity cost) for "taking" the steel away from alternative uses
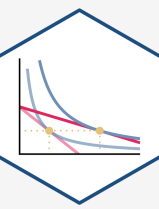
Factor Market Prices and Opportunity Costs

- **Example**: e.g. salary for a skilled worker must be high enough to keep them at their current firm, and not be attracted to other firms/industries
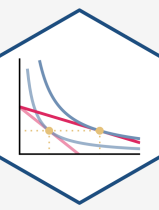
Example Factor Market: Labor Markets

- Empirically, about 70% of total cost of production comes from labor

- We'll focus just on the **market for labor** as an example factor market

- Can do the same for *any* factor market

  ○ (e.g. capital, land, materials, etc.)

- Next class, we'll focus on the particularities of **capital markets**
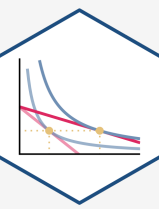
Labor Supply Decisions

Labor Supply Decisions

- The Supply of Labor comes from **individual decisions to work**

- Labor is considered a **disutility** (a **bad**)

  - **Opportunity cost** of labor is **leisure**
  - But, labor generates **income** for **consumption** (a good)

- Tradeoff: if you work more, you get more income, but less leisure
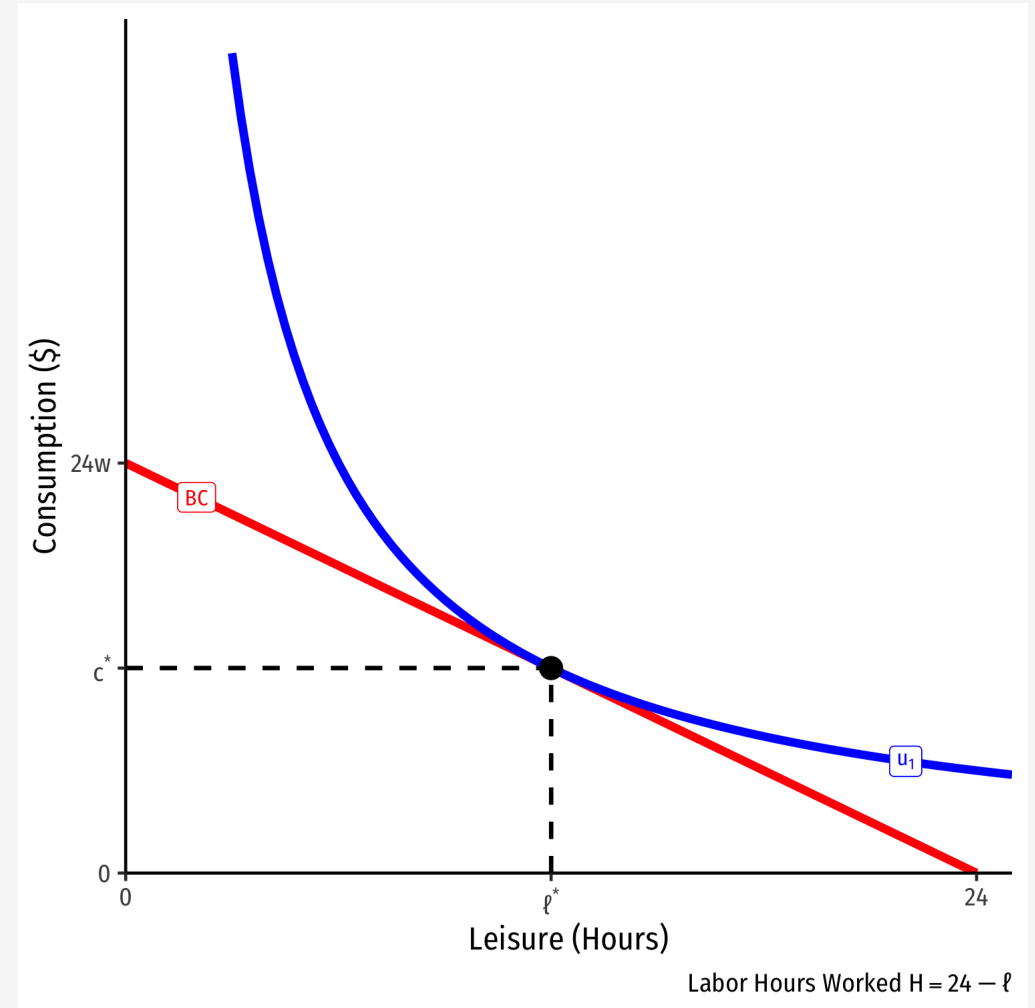
Modeling Labor Supply Decisions

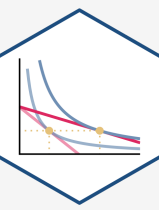- Easiest to apply our consumer choice model between two goods:

$$u(C, \ell)$$

- C: consumption
- ℓ: hours of leisure
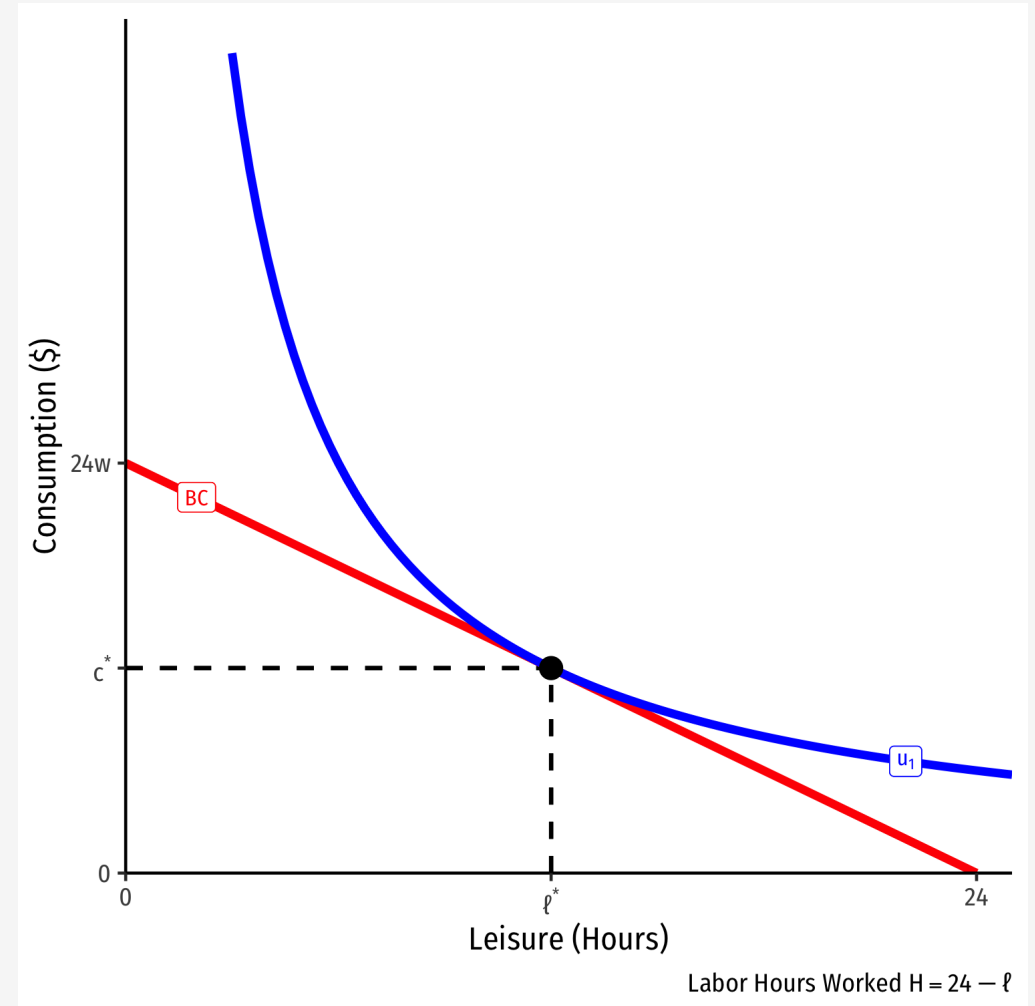
- Define amount of hours worked:

$$H = 24 - \ell$$

- Budget constraint: market price of leisure: $-w$

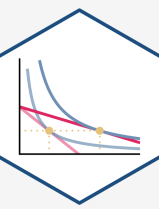- set price of c to $1, a "numeraire" good
- slope = $-\frac{w}{1}$, i.e. $-w$

Modeling Labor Supply Decisions

- Person will **optimally choose** to supply $H^\star = 24 - \ell^\star$ hours

- Enjoy $\ell^\star$ leisure and consume $c^\star$ goods from labor income $wH^\star$

Modeling Labor Supply Decisions: A Change In Wages

- What will happen to the optimal labor supply decision if wage w increases?

- It depends!

- Leisure is a normal good, but this makes labor "inferior"
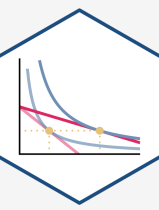
$$H = 24 - \ell$$

  ○ $\uparrow \ell \implies \downarrow H$

- This is why **income and substitution effects** are important! (remember all that stuff? 😰)
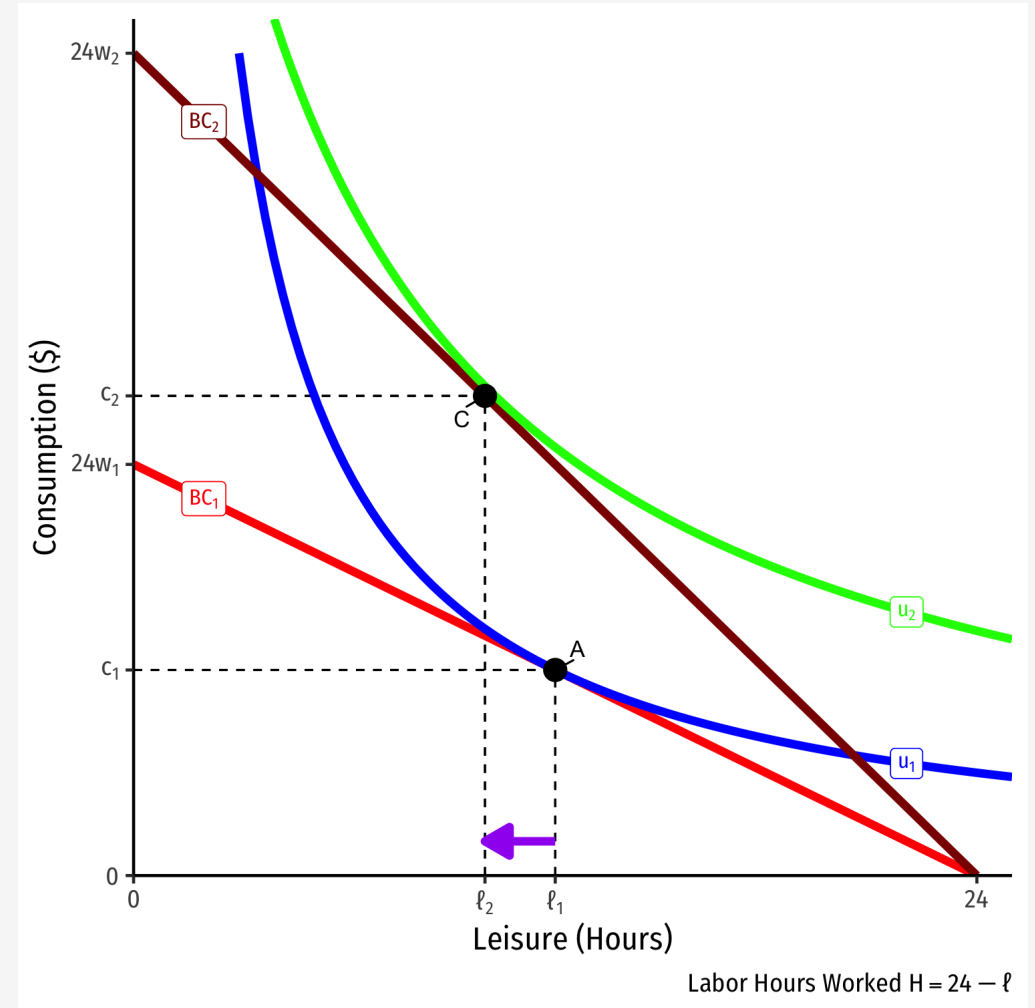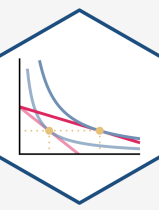
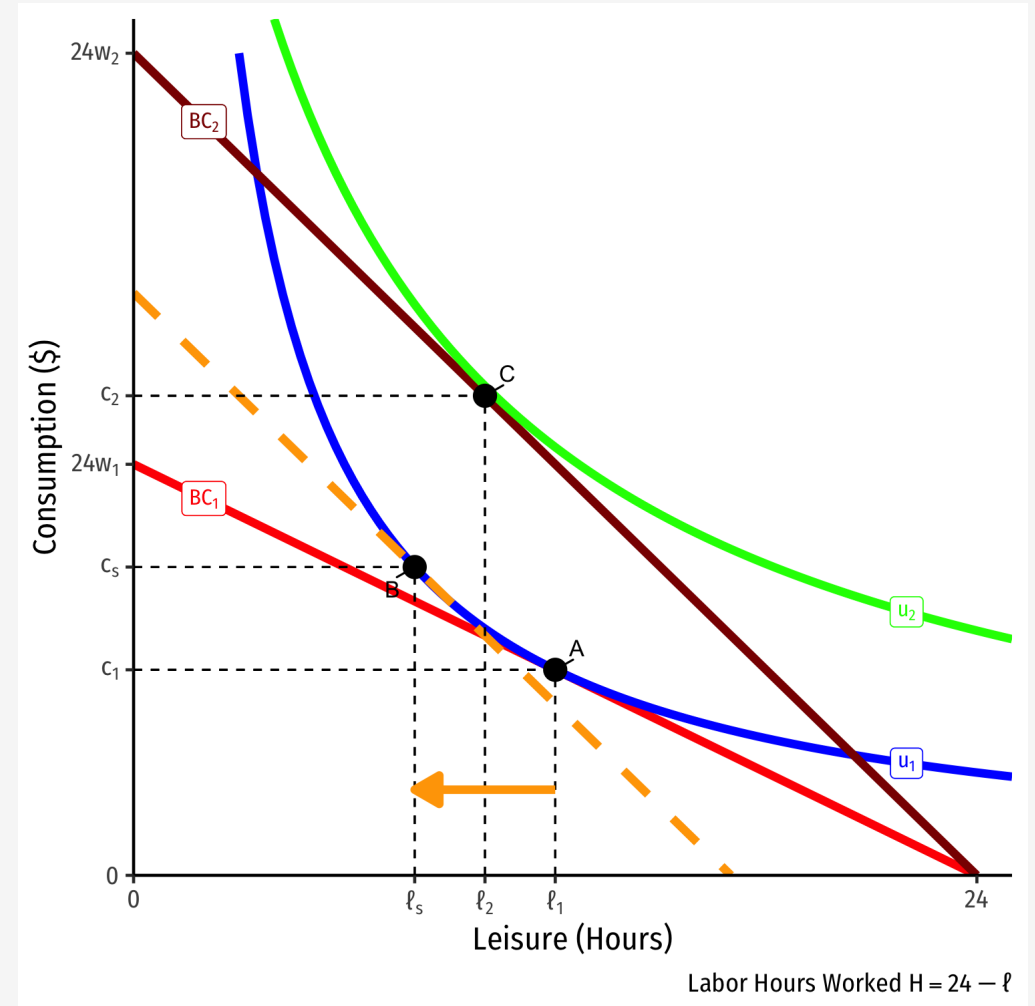# Modeling Labor Supply Decisions: A Change In Wages

- (Overall) Price effect: $A \rightarrow C$

  - Higher wage w leads to less leisure ℓ and therefore, more hours worked H
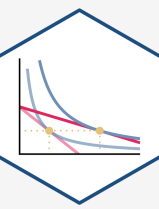
- Upward sloping labor supply curve

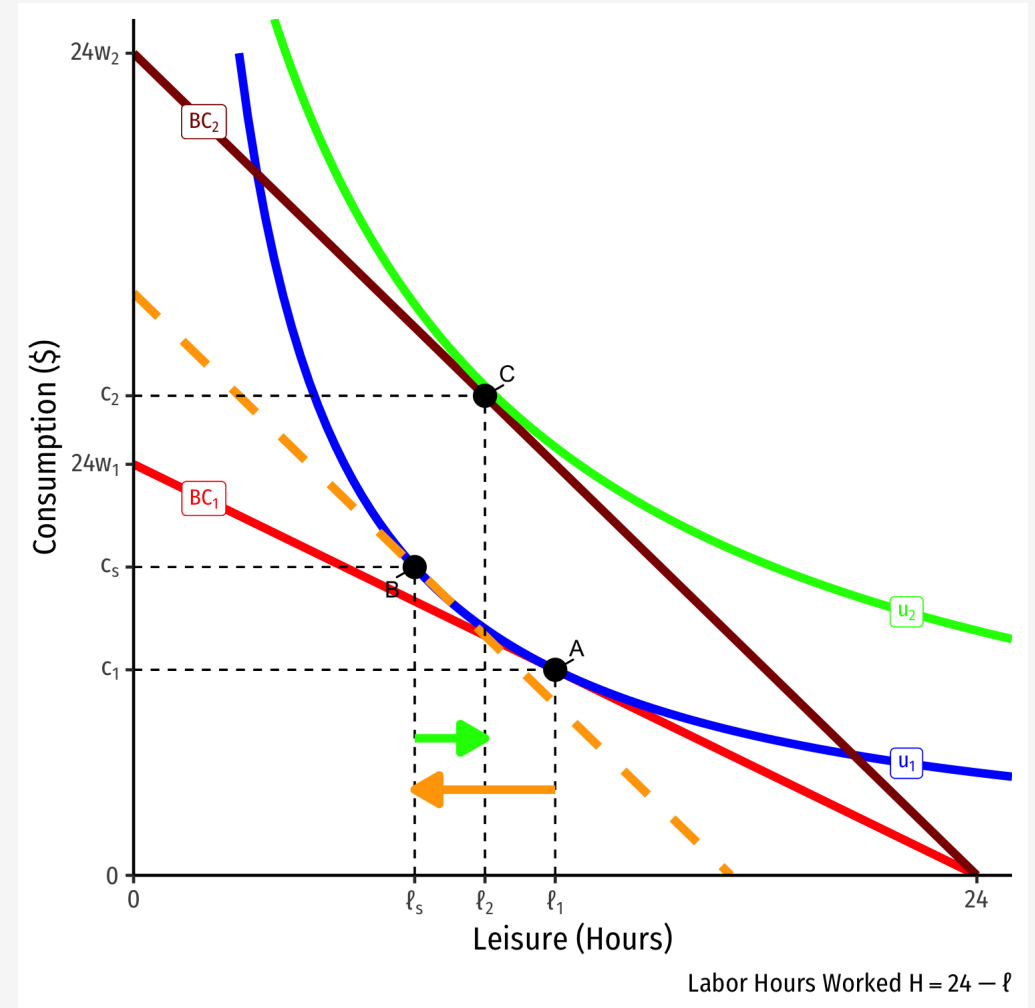# Modeling Labor Supply Decisions: A Change In Wages

- Substitution effect: as wage w increases, the price of leisure ℓ is increasing, so consume less leisure (normal good)

  - Thus, work more hours

- Graphically: under higher wage BC_2, substitute more c for less ℓ (more labor) holding utility constant
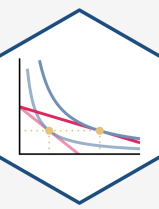
  - $A \to B$: more c, less ℓ (more H)
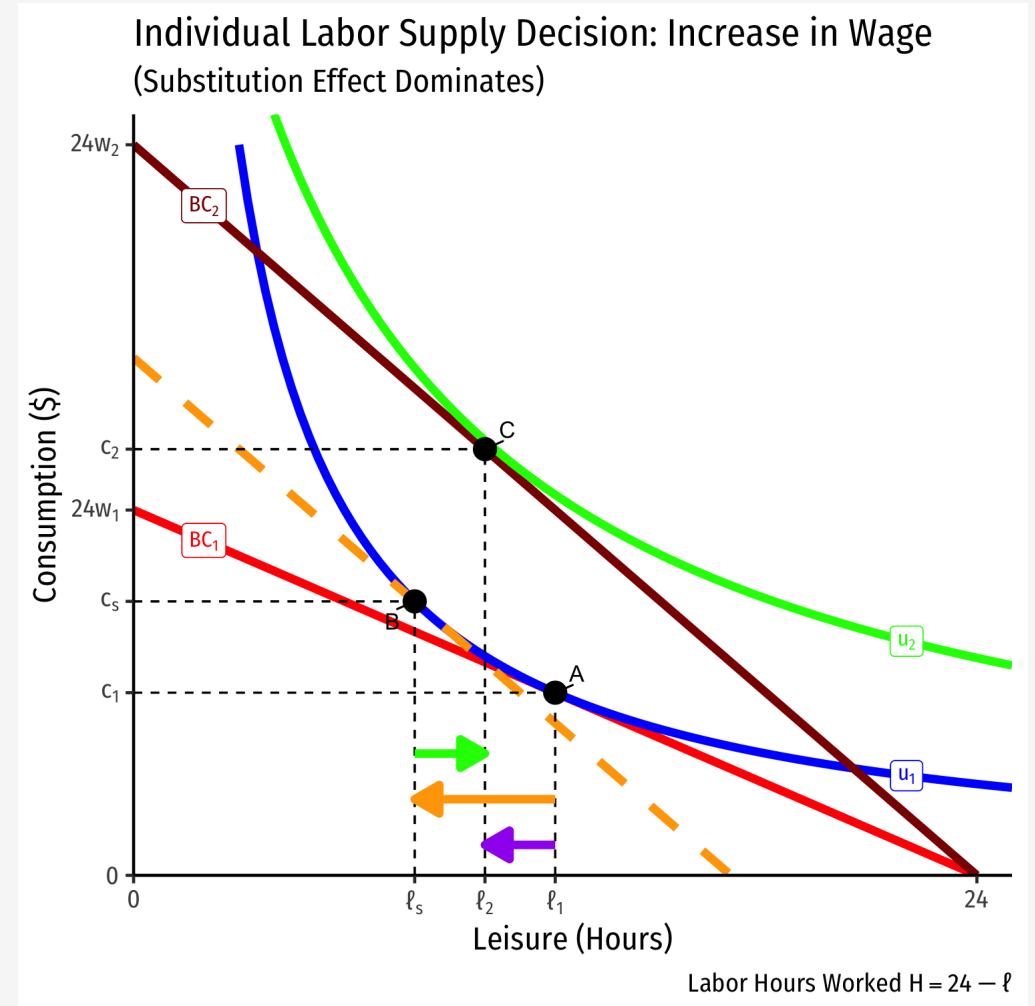
Modeling Labor Supply Decisions: A Change In Wages

- Real income effect: the higher wage makes you wealthier in real terms, so buy more of everything (including ℓ, meaning **work _fewer_ hours!**)
  - $B \to C$: attain higher indifference curve u_2
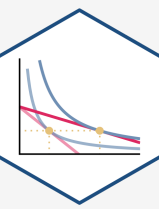 - "Inferior" good: higher wages induce _more_ leisure (and fewer labor hours)

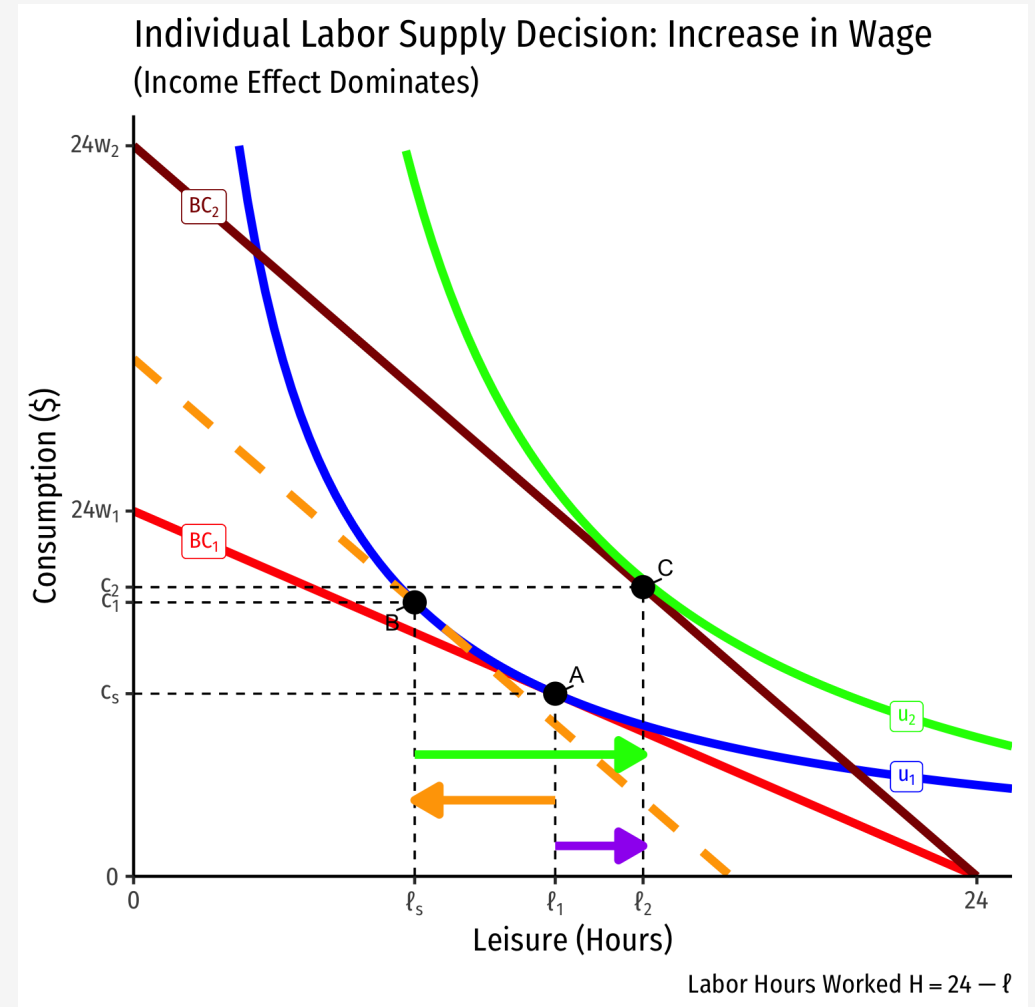# Modeling Labor Supply Decisions: A Change In Wages

- Income & substitution effects cut against each other

- If Substitution effect > Income effect, then we get a positive price effect:

  - **Increase in wages** causes **more work** (less leisure)

- Matches our intuition, upward-sloping labor supply curve

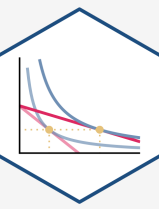Individual Labor Supply Decision: Increase in Wage
(Substitution Effect Dominates)

Consumption ($)

$24w_2$

BC_2

c_2 — C

$24w_1$

BC_1

c_s

B

c_1 — A

u_2

u_1

0

ℓ_s ℓ_2 ℓ_1 24

Leisure (Hours)

Labor Hours Worked $H = 24 - \ell$

Modeling Labor Supply Decisions: A Change In Wages

- If Income effect > Substitution effect, leading to a negative price effect:

  - **Increase in wages** causes **less work** (more leisure)
  - "Giffen-style" scenario, but **very plausible** for labor! (unlike consumer goods)

- Intuition: imagine having an income target for a big purchase, and your salary increases


Individual Labor Supply Decision: Increase in Wage
(Income Effect Dominates)

Labor Hours Worked $H = 24 - \ell$

Modeling Labor Supply Decisions: A Change In Wages

- We often see "backward-bending" labor supply curves

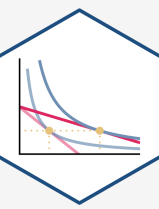- Depends on whether income or substitution effect dominates
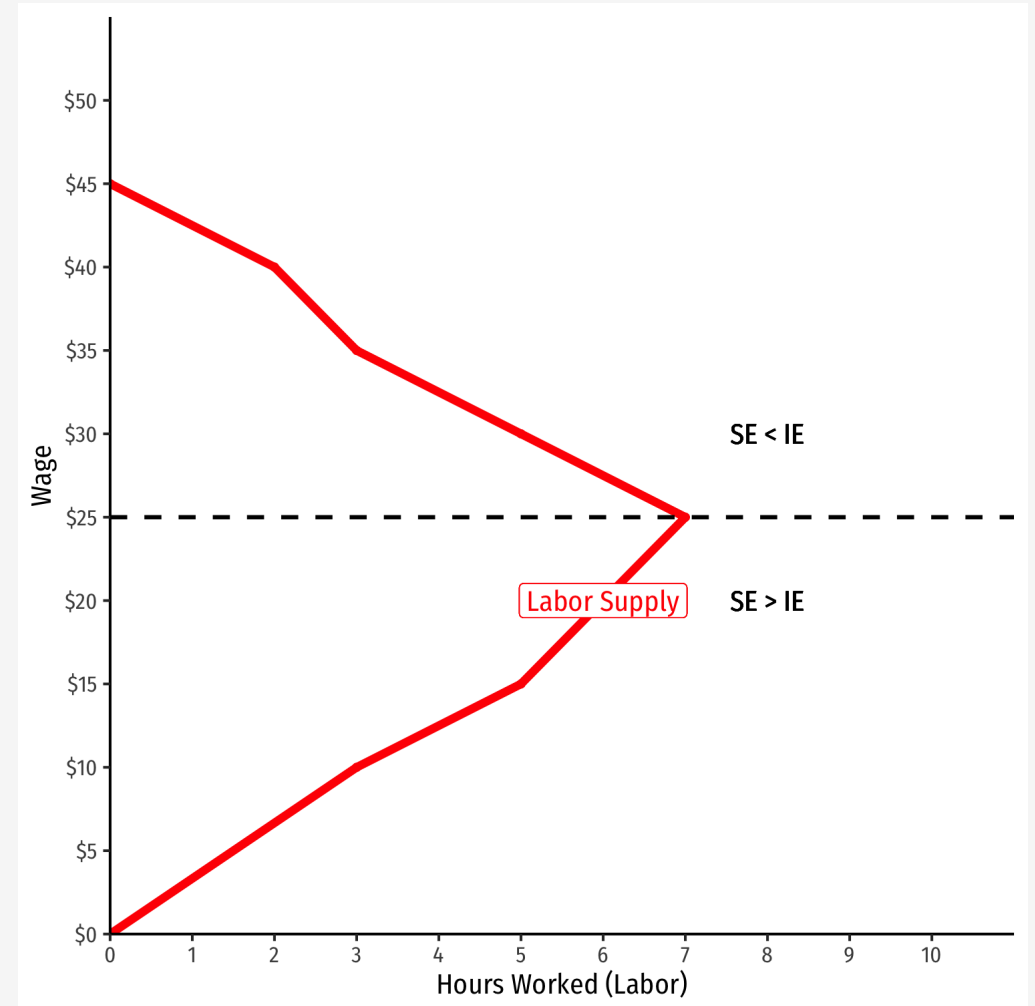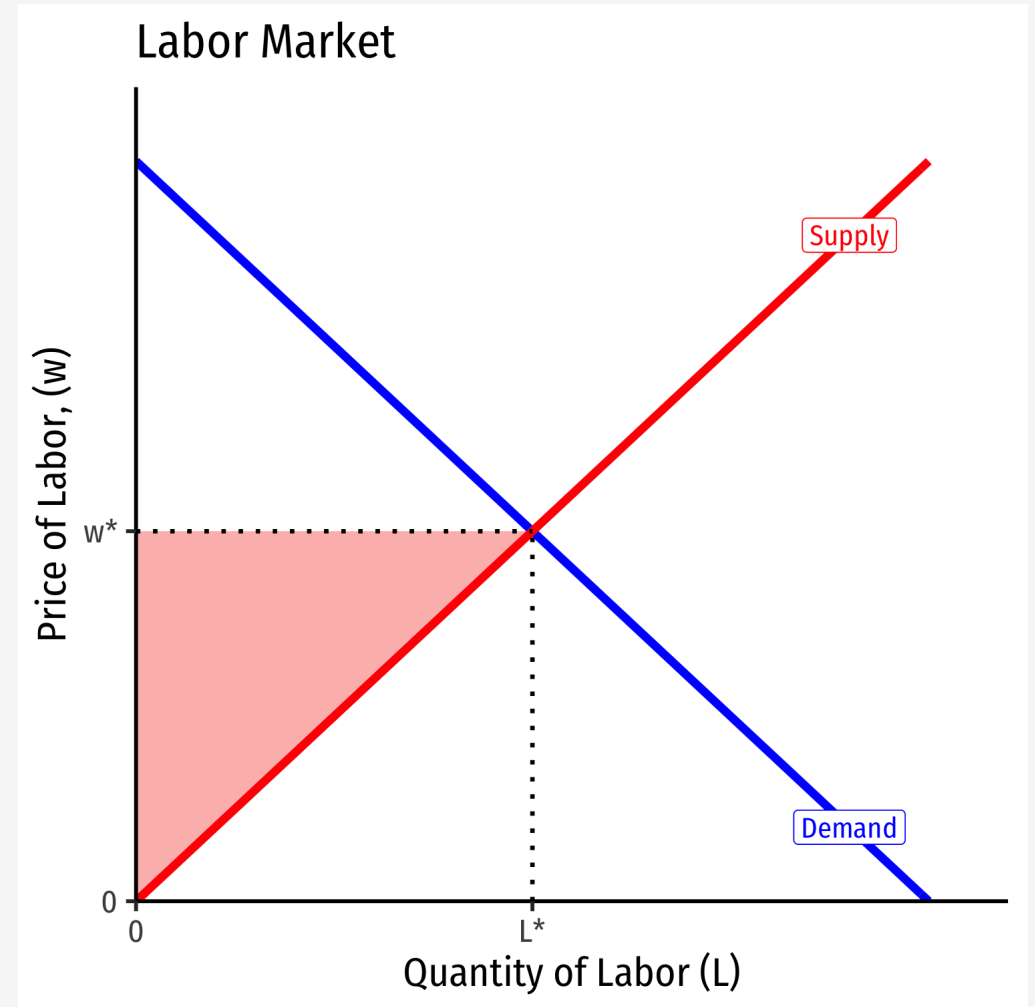
A Brief Digression on Economic Rents I

- Recall **market supply** is the **minimum willingness to accept**, the minimum price necessary to bring a resource to market (its opportunity cost)

- But all (equivalent) labor is paid the *market wage*, w^* determined by market labor supply and labor demand
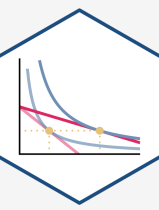
Labor Market
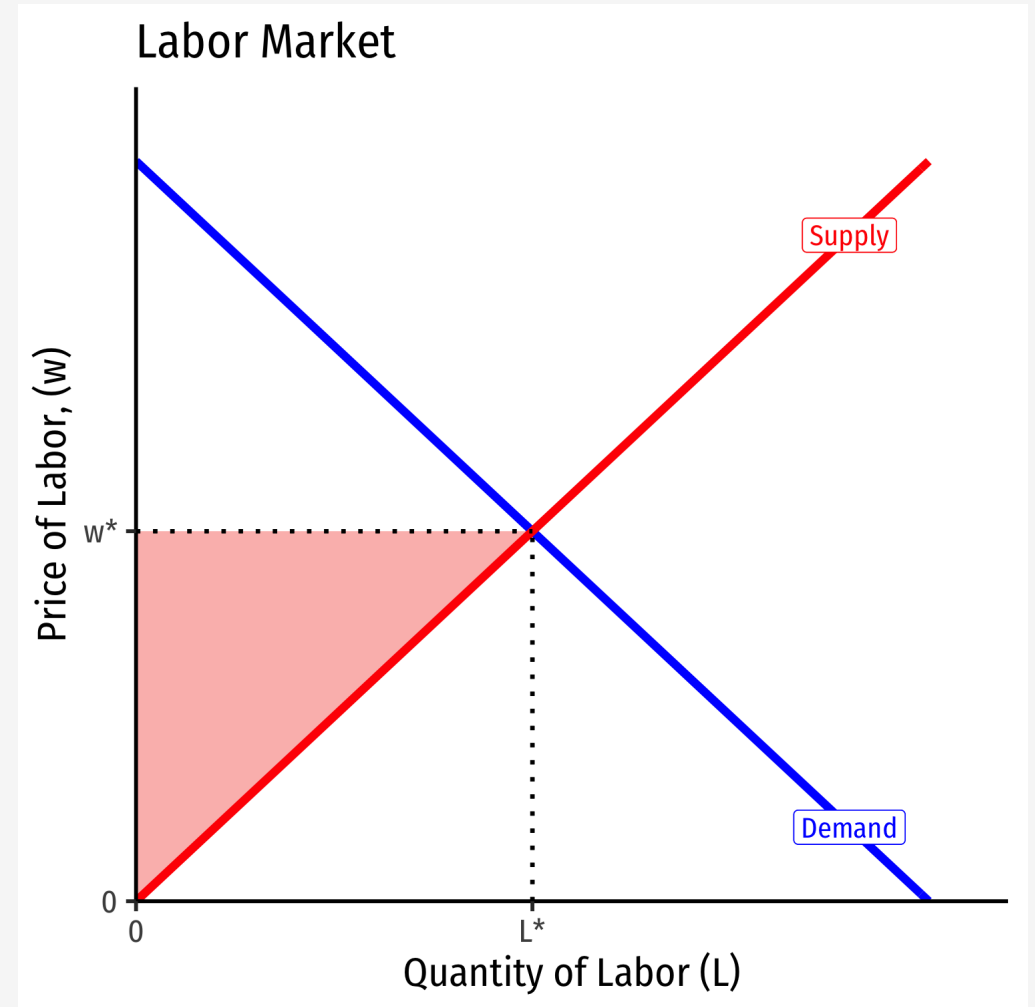
A Brief Digression on Economic Rents II

- Some workers would have accepted a job for less than w^*

- These inframarginal workers earn **economic rent** in excess of what is needed to bring them into the market (their opportunity cost)
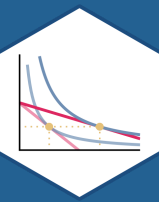
Labor Market

Price of Labor, (w)

Supply

Demand

w^*

0

0

L^*

Quantity of Labor (L)

A Brief Digression on Economic Rents III

- Consider a factor (such as land) for which the supply is perfectly inelastic (e.g. a fixed supply)

- Then the **entire value of the land is economic rent**!

- **The *less* elastic the supply of a factor, the *more* economic rent it generates!**

Land Market
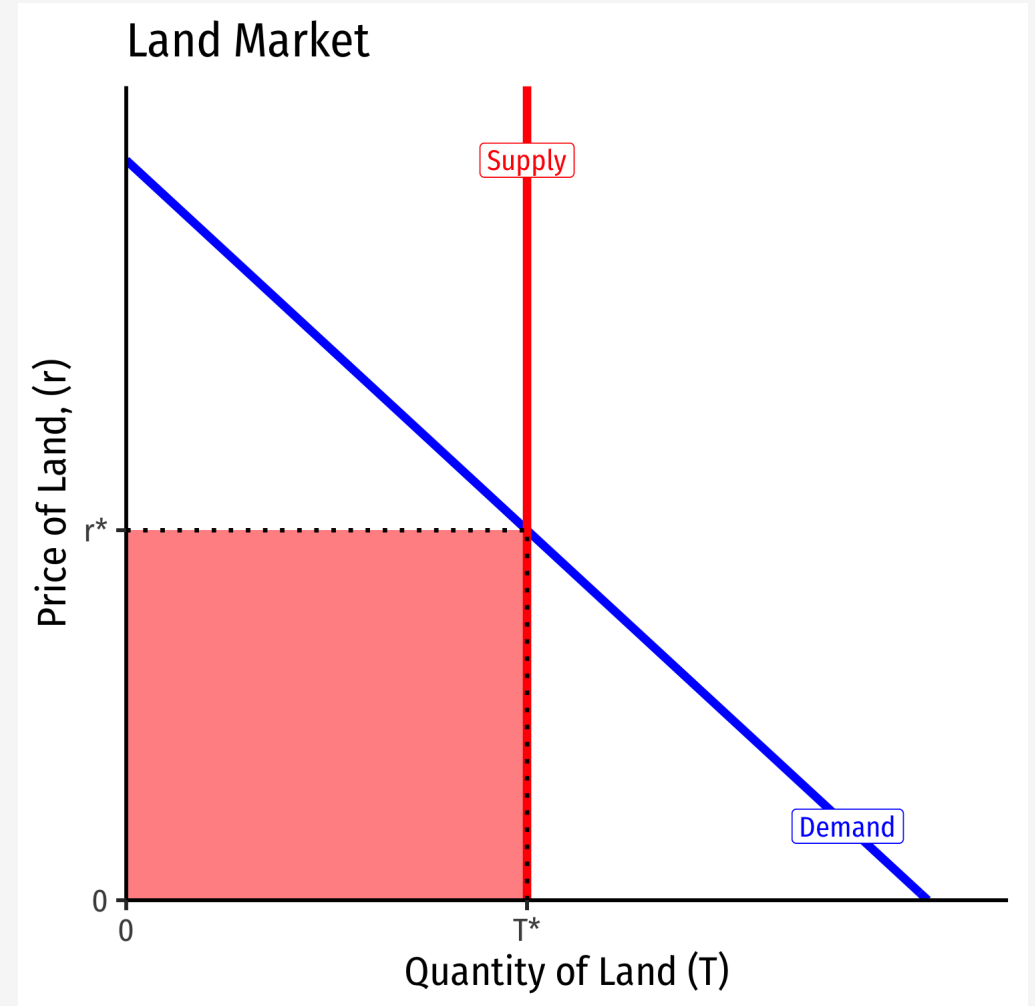
Labor Market for a Competitive Firm

Derived Demand in Factor Markets
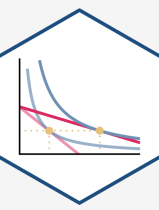
- Demand for factors is a **"derived demand"**:

  - Firm only demands inputs to the extent they **contribute to producing sellable output**

- Firm faces a **tradeoff** when **hiring more labor**, as more labor ΔL creates:

  1. **Marginal Benefit**: Increases output and thus revenue
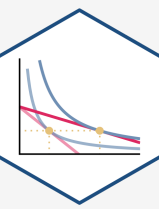 2. **Marginal Cost**: Increases costs

Marginal Revenue Product (of Labor)
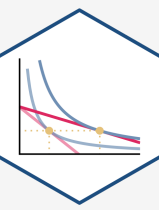
- Hiring more labor increases output (i.e. labor's MP_L)

  - Recall: $MP_L = \frac{\Delta q}{\Delta L}$, where q is units of output

- Additional output generates (i.e. labor's $MR(q)$)

  - Recall: $MR(q) = \frac{\Delta R(q)}{\Delta q}$, where $R(q)$ is total revenue

- Hiring more labor, on the **margin**, generates a **benefit**, called the **marginal revenue product of labor,** MRP_L:

$$MRP_L = MP_L * MR(q)$$

  - i.e. the number of new products a new worker makes times the revenue earned by selling the new products

Marginal Revenue Product for *Competitive* Firms

- This is the **Firm's Demand for Labor**:

$$MRP_L = MP_L * MR(q)$$

- For a firm in a **competitive (output) market**, firm's $MR(q) = p$, hence:

$$MRP_L = MP_L * p$$

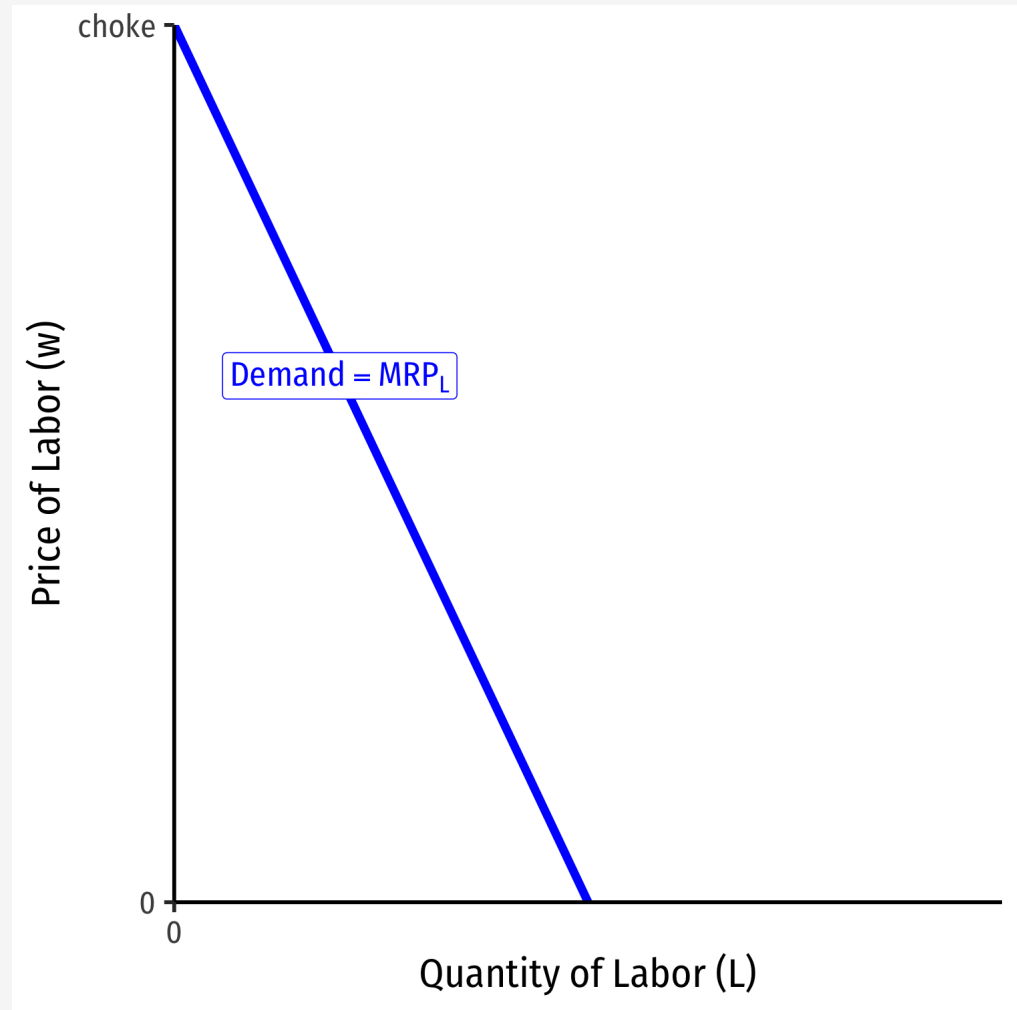where p is the price of the firm's *output*
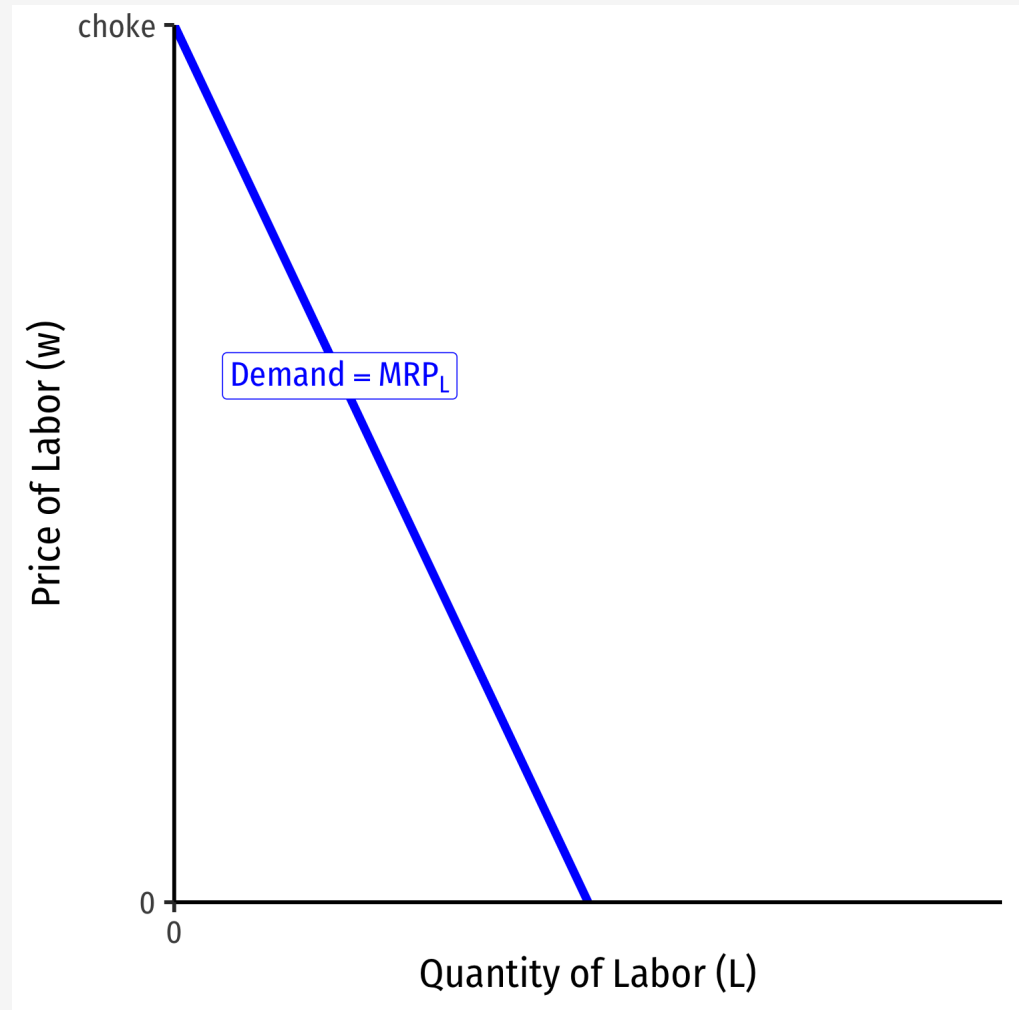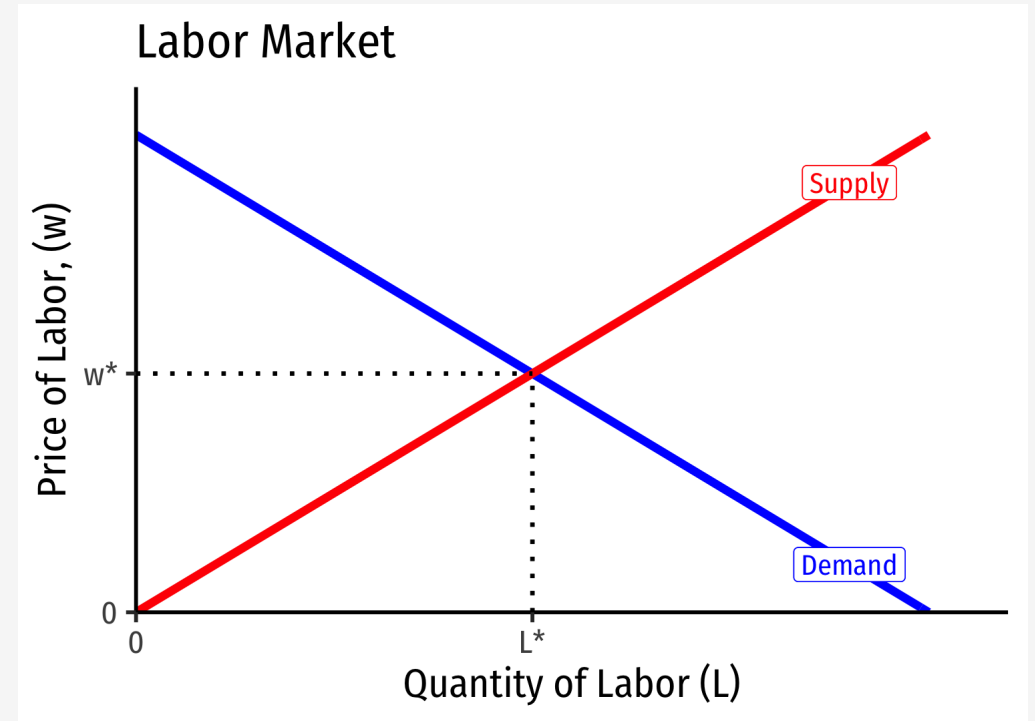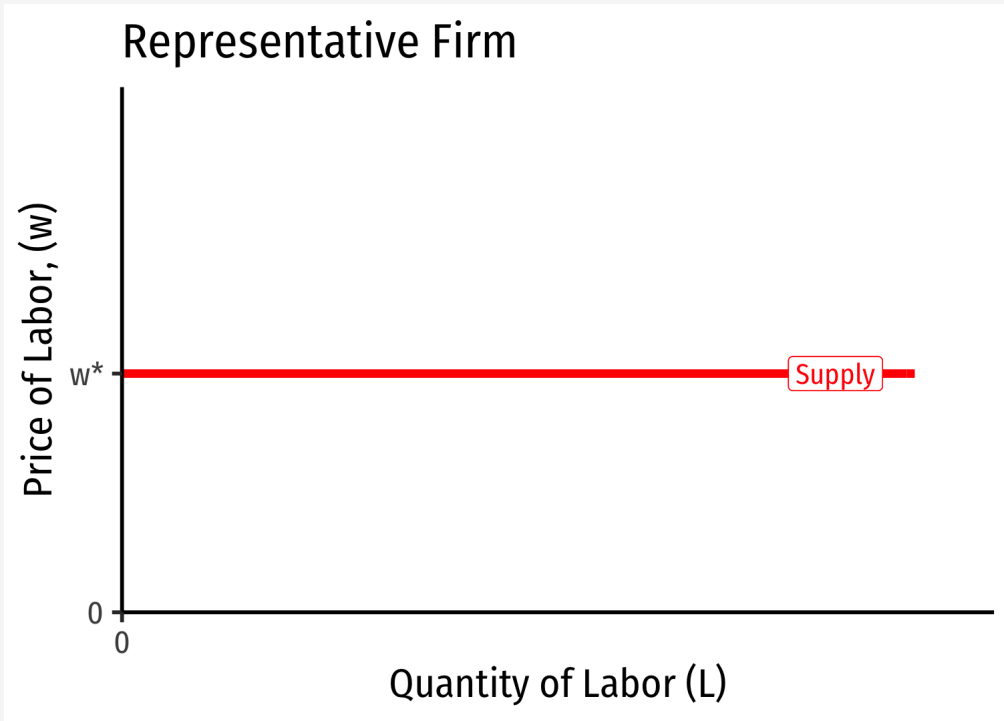
Marginal Revenue Product for *Competitive* Firms

$$MRP_L = MP_L * p$$

- Marginal benefit of hiring labor, MRP_L **falls** with more labor used

  - production exhibits **diminishing marginal returns to labor**!

- **Choke price for labor demand**: price too high for firm to purchase any labor

A Competitive *Factor* Market

- If the *factor* **market is competitive**, labor supply for an individual firm is *perfectly elastic* at the market price of labor (w^*)

Labor Supply and Firm's Demand for Labor

- We've seen a falling MRP_L, the marginal benefit of hiring labor

- **Marginal cost of hiring labor**, w, remains constant

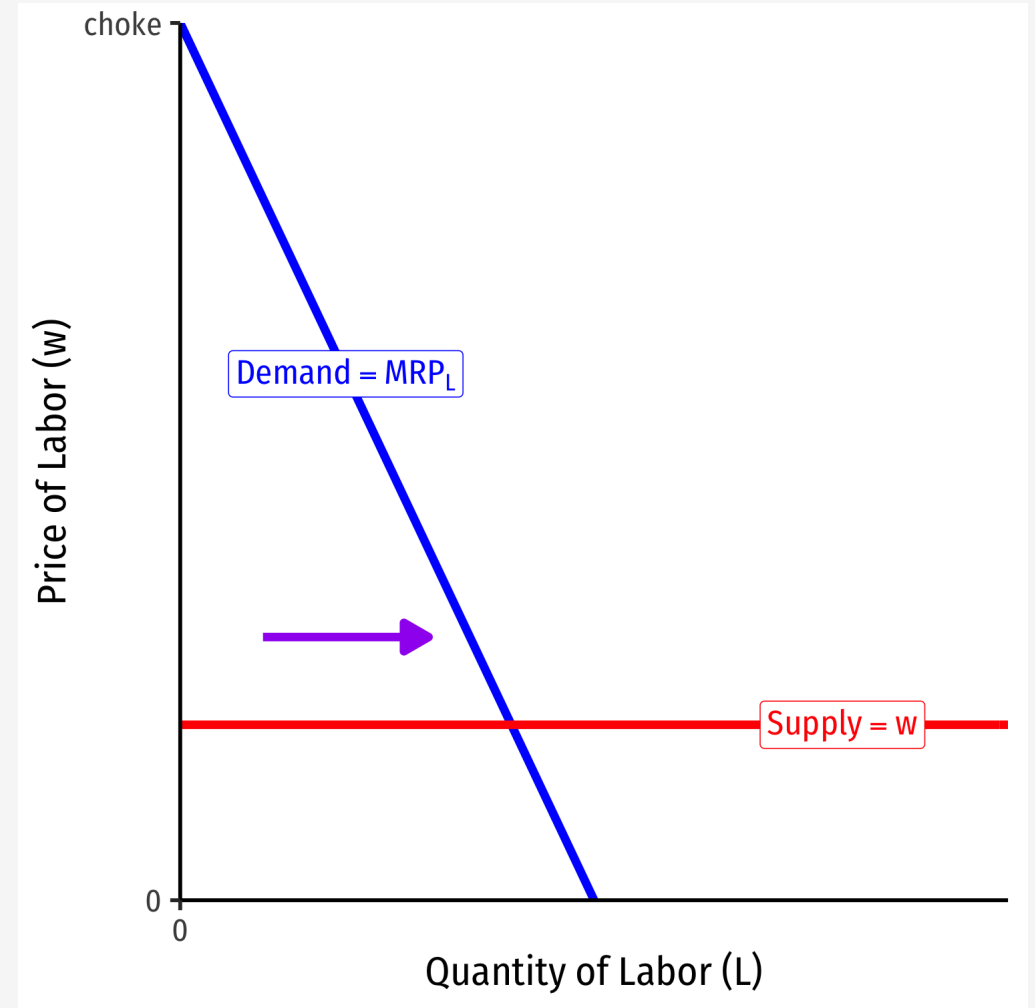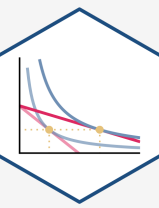 - so long as firm is not a big purchaser (has no market power) in the labor market
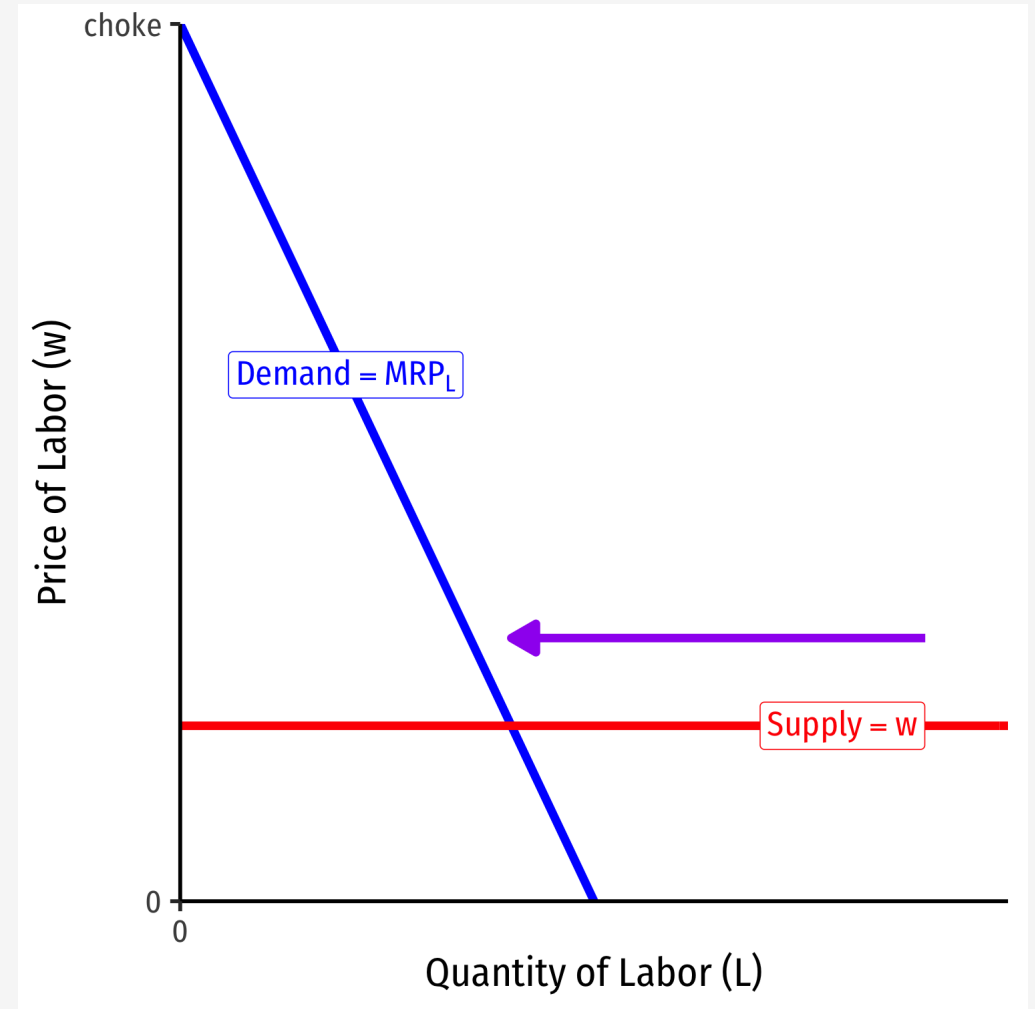
Labor Supply and Firm's Demand for Labor
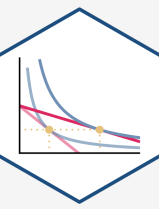
- At low amounts of labor, marginal benefit $MRP_L > w$ marginal cost
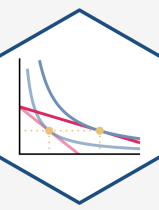
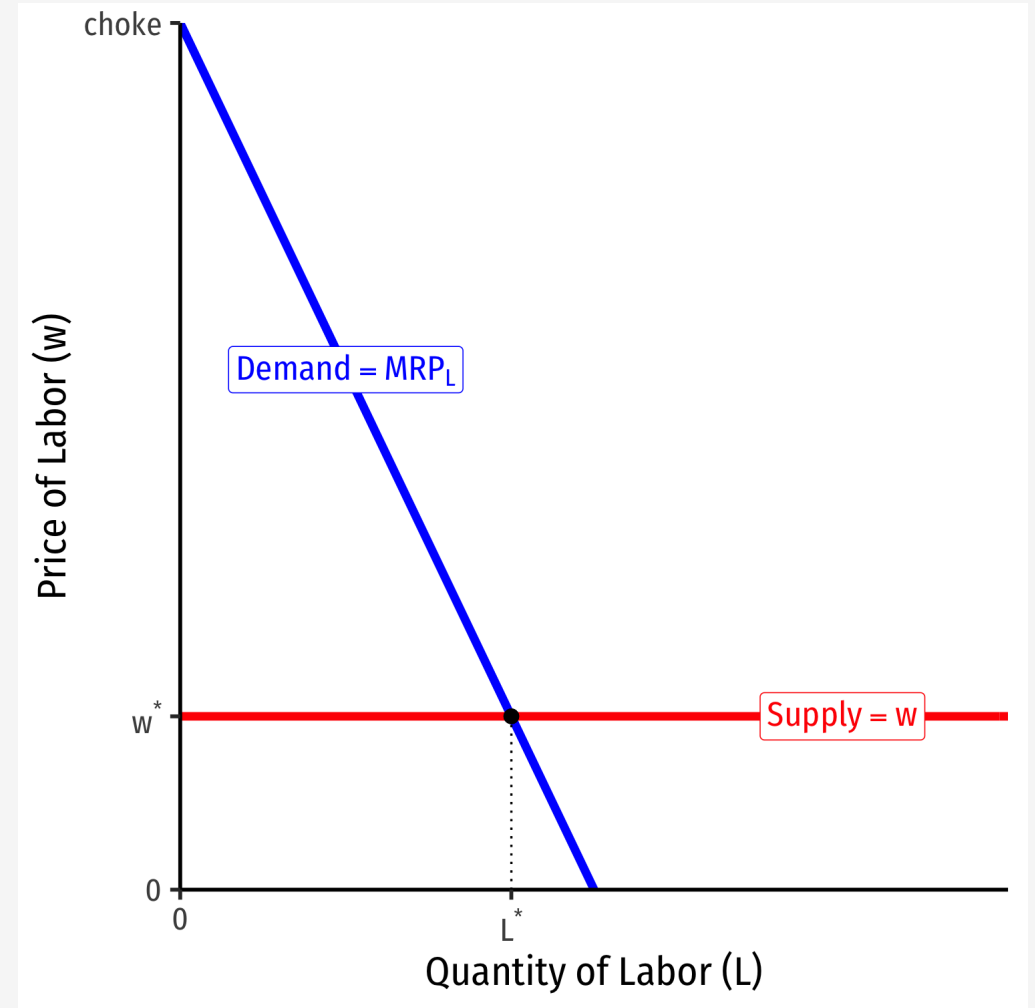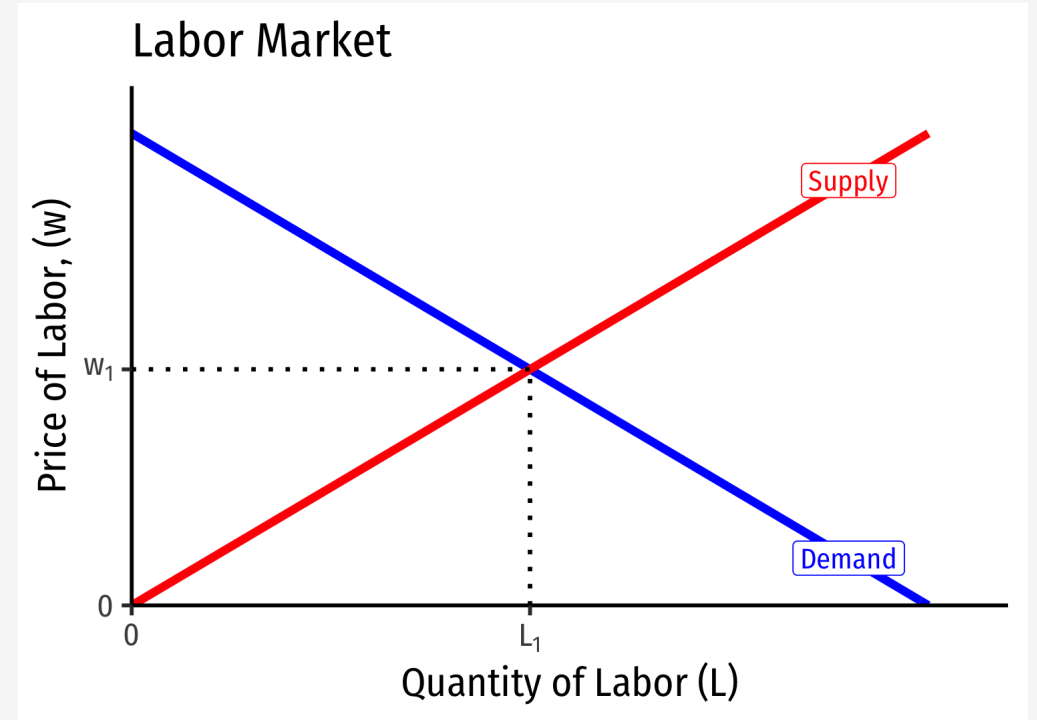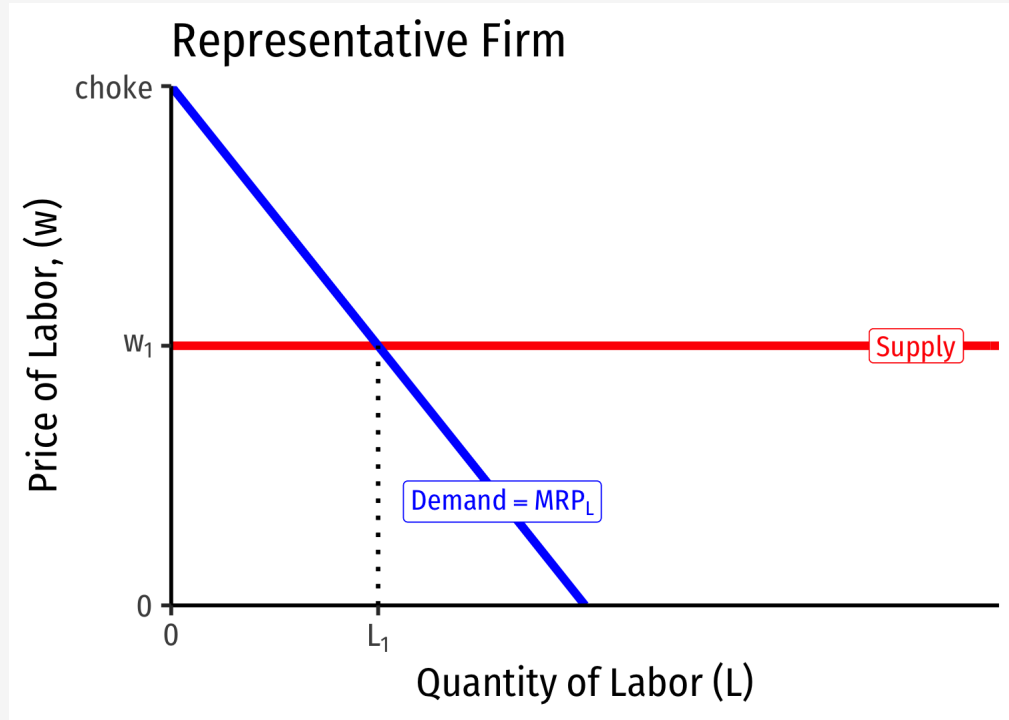- Firm will hire more labor

Labor Supply and Firm's Demand for Labor

- At high amounts of labor, marginal benefit $MRP_L < w$ marginal cost
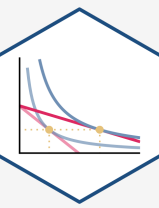
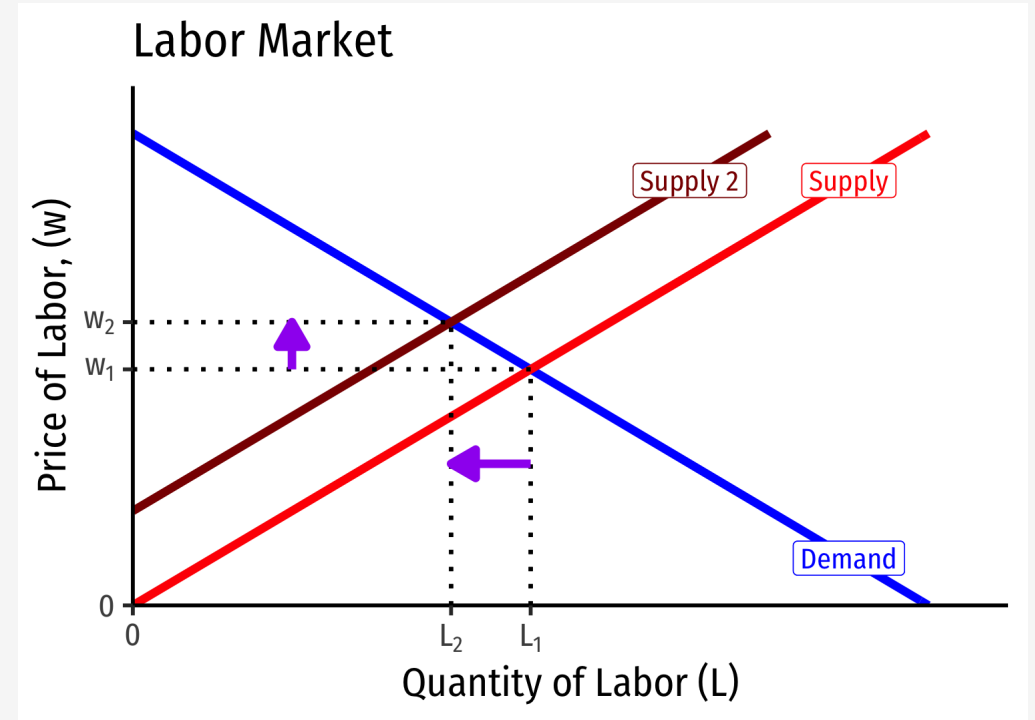- Firm will hire less labor
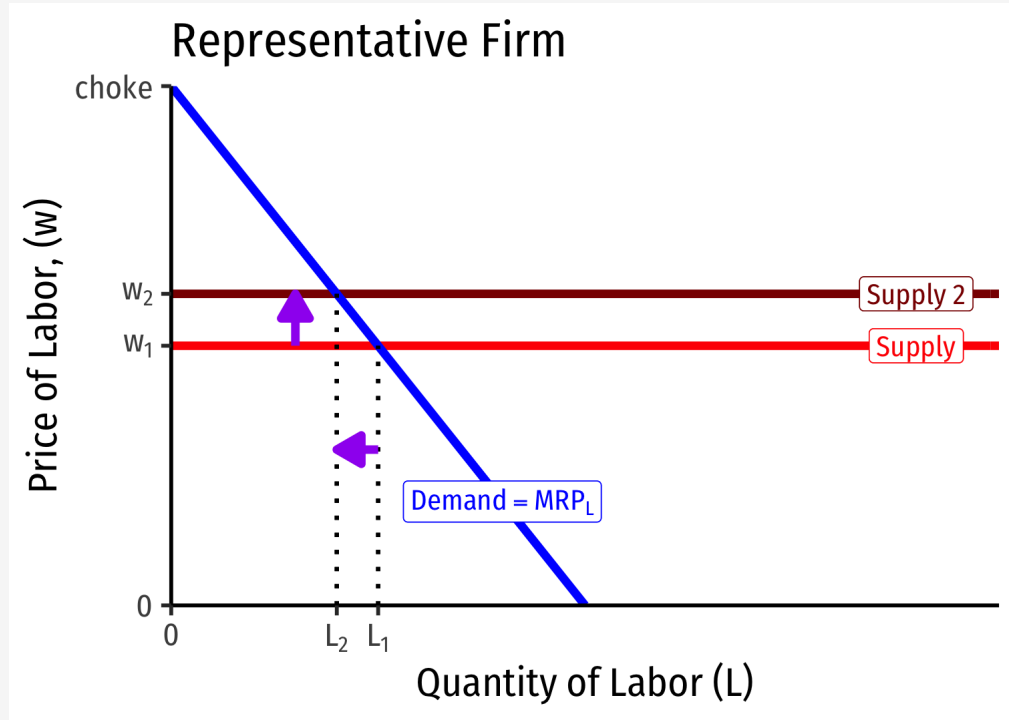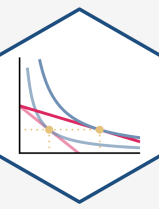
Labor Supply and Firm's Demand for Labor

- Firm hires L^* optimal amount of labor where $w = MRP_L$

- i.e. marginal cost of labor $=$ marginal benefit of labor

Labor Supply and Firm's Demand for Labor

Representative Firm

choke

Price of Labor, (w)

w_1 — Supply

Demand = MRP_L

0

0   L_1

Quantity of Labor (L)

Labor Market

Price of Labor, (w)

Supply

w_1

Demand

0

0   L_1

Quantity of Labor (L)

Labor Supply and Firm's Demand for Labor

Representative Firm


Labor Market

- If market supply of labor decreases, wages increase & firms hire fewer workers (and vice versa)
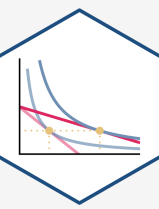
Example
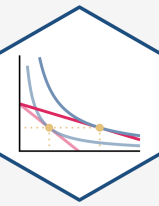
Example: Victoria's Tours is a travel company that offers guided tours of nearby mountain biking trails. Its marginal revenue product of labor is given by $MRP_L = 1,000 - 40l$, where l is the number of tour-guide weeks it hires and MRP_L is measured in dollars per tour-guide week. The going market wage for Victoria's Tours is $600 per tour-guide week.

1. What is the optimal amount of labor for Victoria's Tours to hire?

2. At and above what market wage would Victoria's Tours not want to hire anyone?

3. What is the most labor Victoria's Tours would ever hire, given its marginal revenue product?
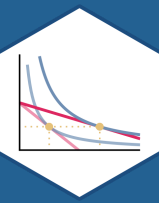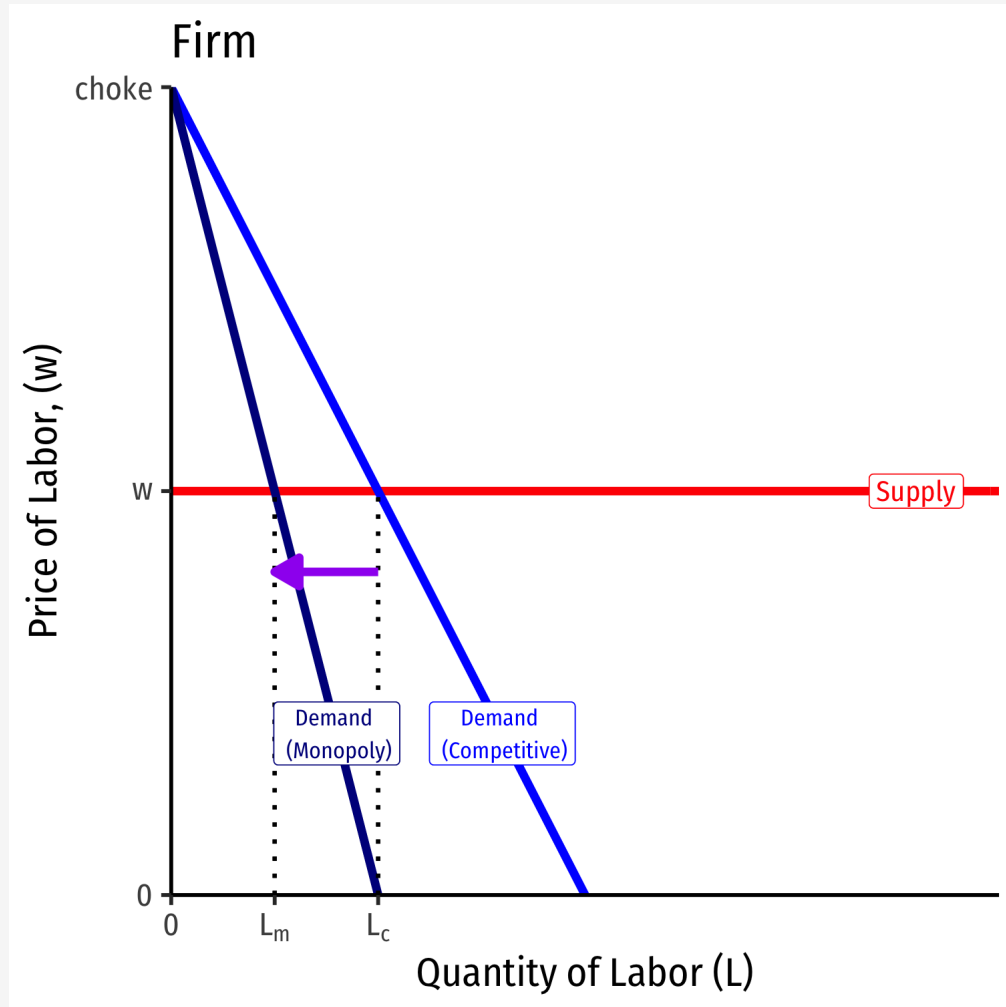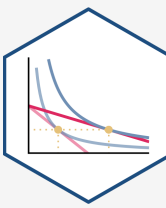
Labor Demand for a Monopoly

Labor Demand for Competitive vs. Monopolist Firm
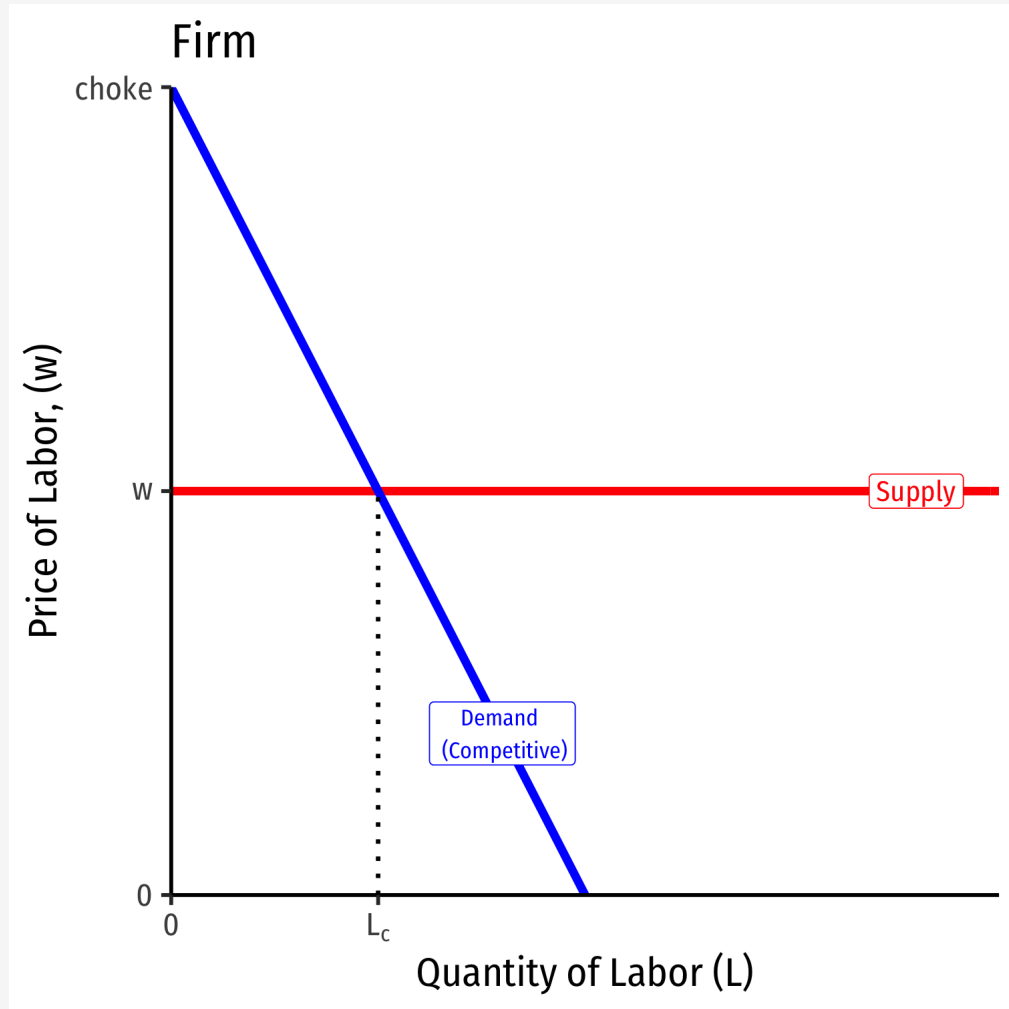
- Recall a firm's demand for labor:
$$MRP_L = MP_L * MR(q)$$

- A firm in a **competitive output industry** has its $MR(q) = p$

 - So we saw its **Labor Demand**, $$MRP_L = MP_L * p$$

# Labor Demand for Competitive vs. Monopolist Firm

- Recall if firm is a **monopolist** in its **output** industry, its $MR(q) < p$

  - So its **Labor Demand**,
    $$MRP_L = MRP_L * MR(q)$$

- Since $MR(q) < p$, **a monopoly in its output industry will always have lower demand for labor**, and thus, **hire less labor than a competitive firm**

  - Monopoly produces less output, so wants fewer inputs!

# Labor Demand for Competitive vs. Monopolist Firm
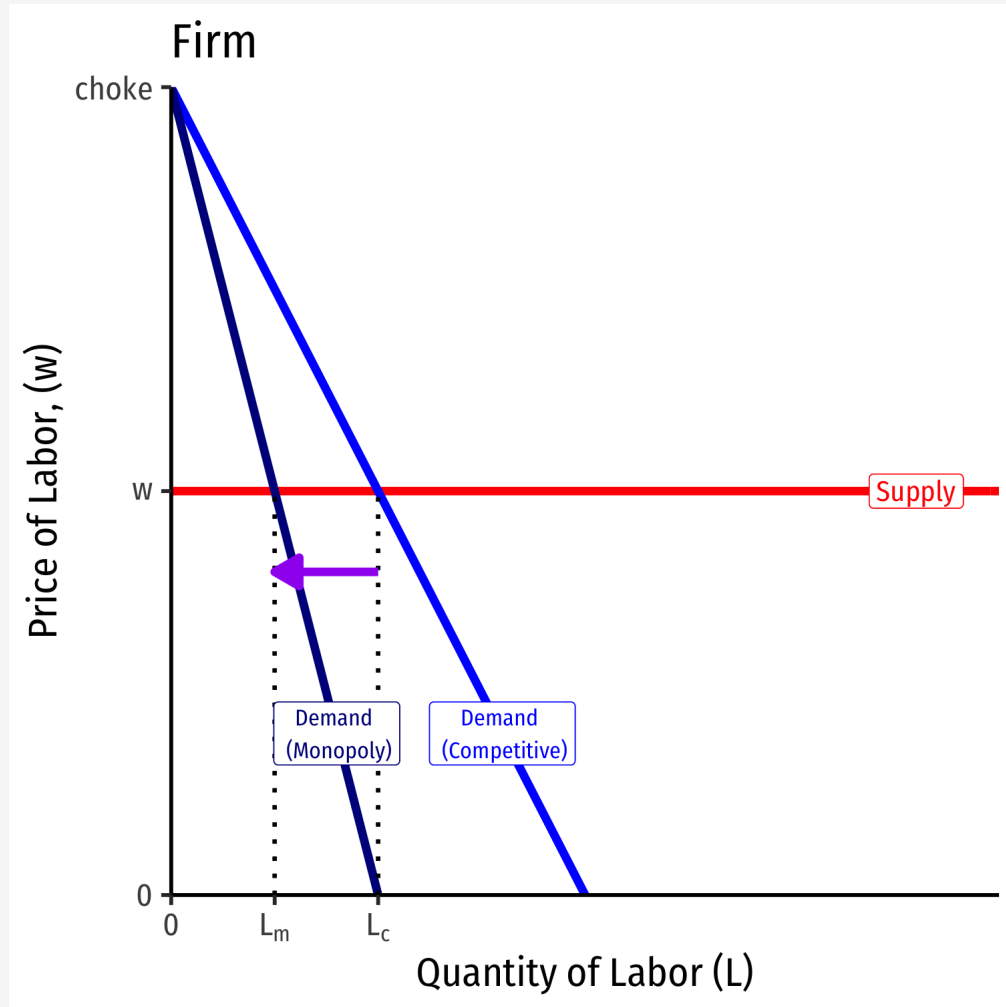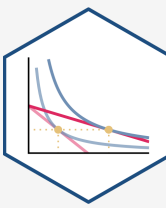
- This is about the competitiveness of the **output** or **"downstream"** market

- Here, both competitive firm and monopolist in downstream markets face the same perfectly elastic **labor supply**

  - We've assumed no market power in the **input** or **"upstream"** market (for labor)

- We next consider market power in the upstream (labor) market...
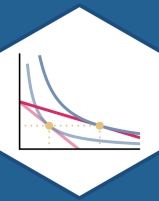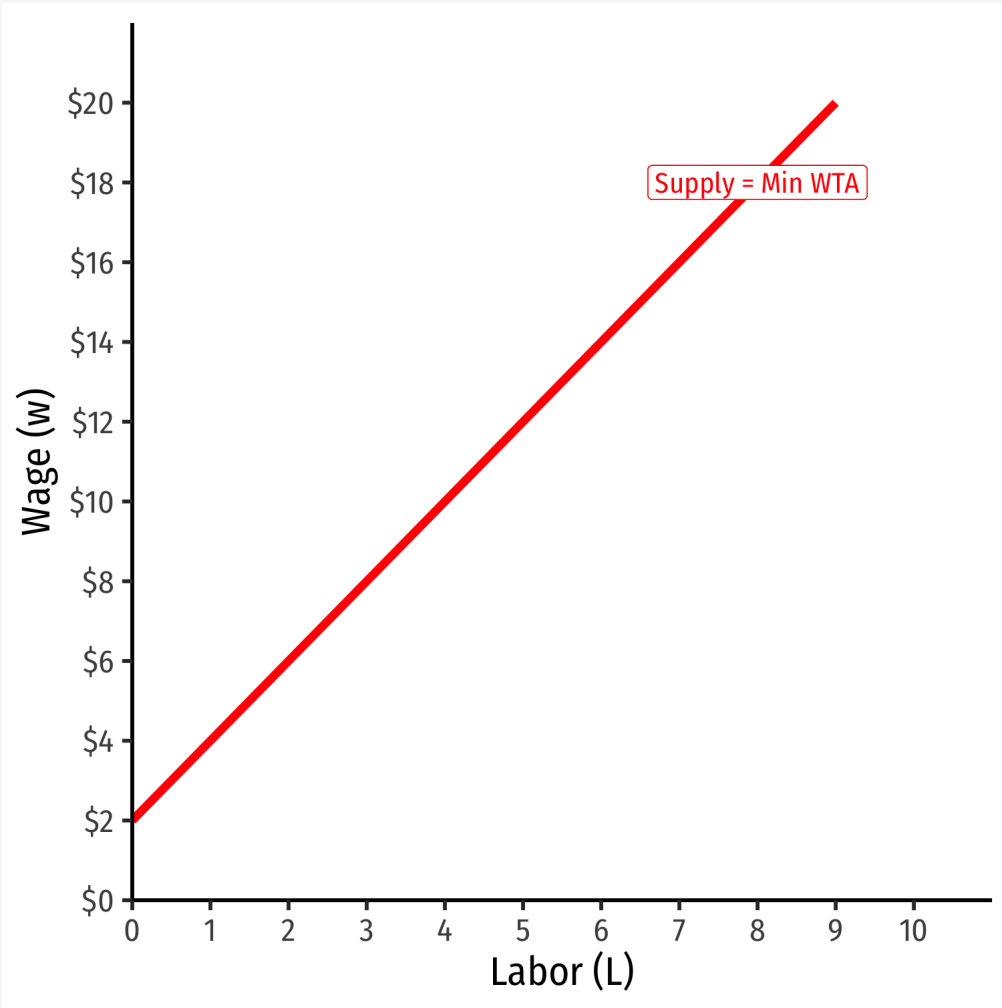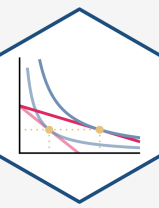
Monopsony Power

Monosony
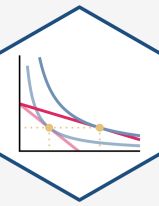
- What if the firm has **market power in a factor market**?

- Consider extreme example: **monopsony**: a factor market with a **single buyer**
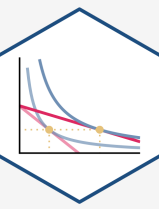
Monosony and Market Supply of Labor


Supply = Min WTA

- Market power in *hiring* labor implies that the firm faces the **whole market factor supply curve** for labor

- Market supply is upward sloping

- **Factor (inverse) supply** describes minimum price workers are willing to accept to work
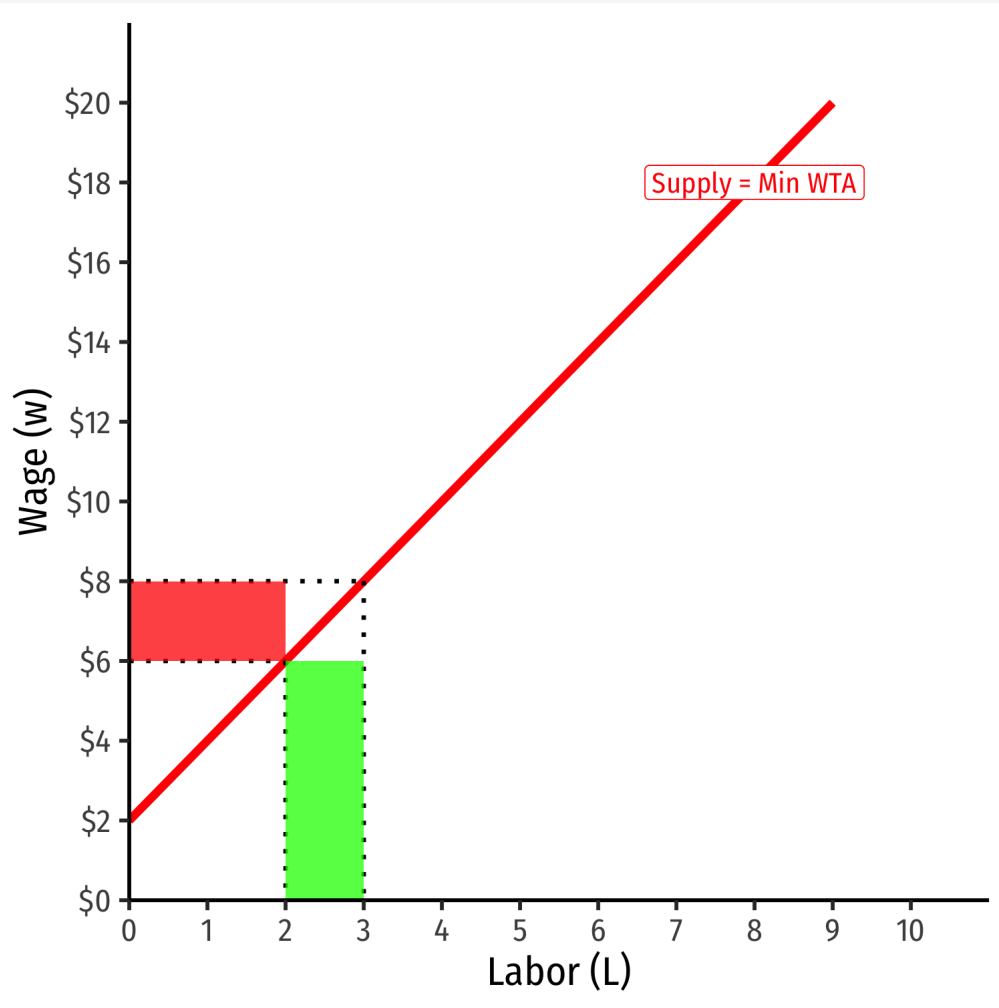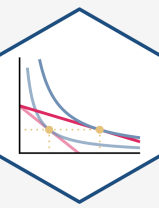
Monosony and Market Supply of Labor

Supply = Min WTA
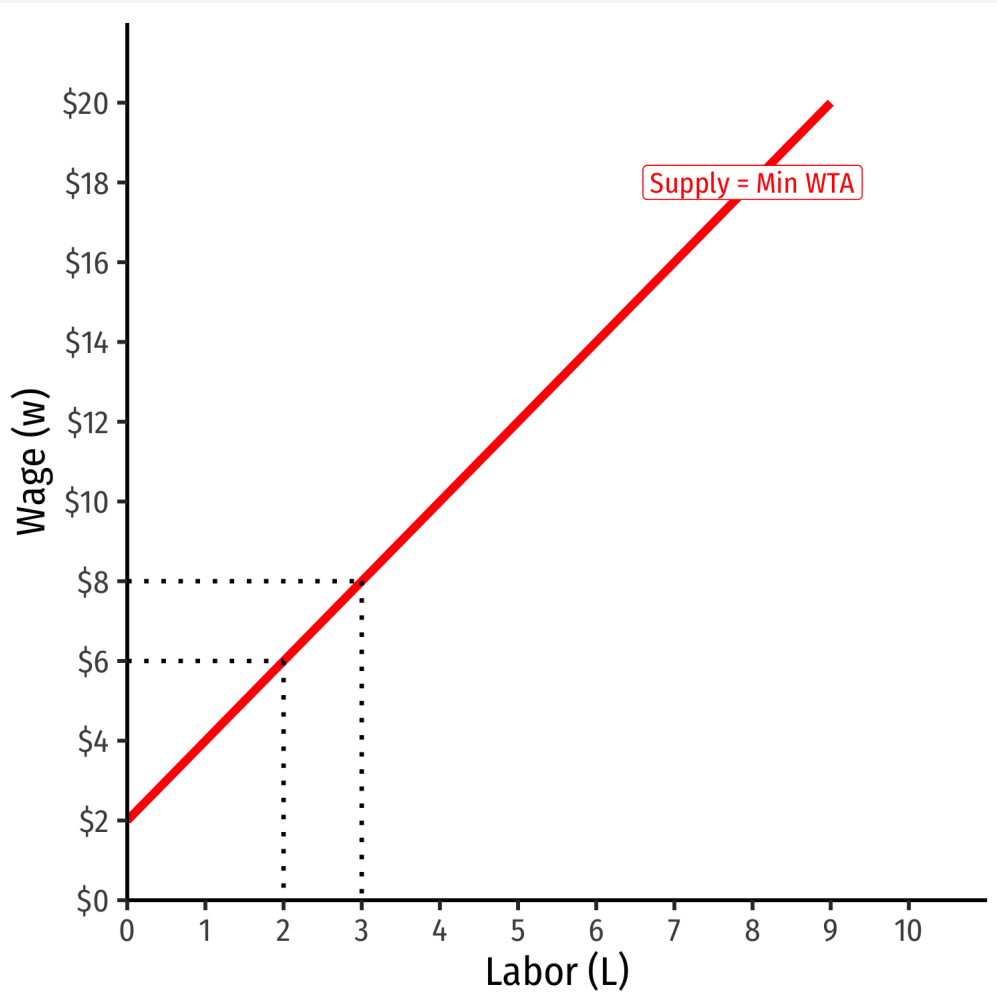
- As firm chooses to hire more L, must raise wages on *all* workers to hire them

Monosony and Market Supply of Labor
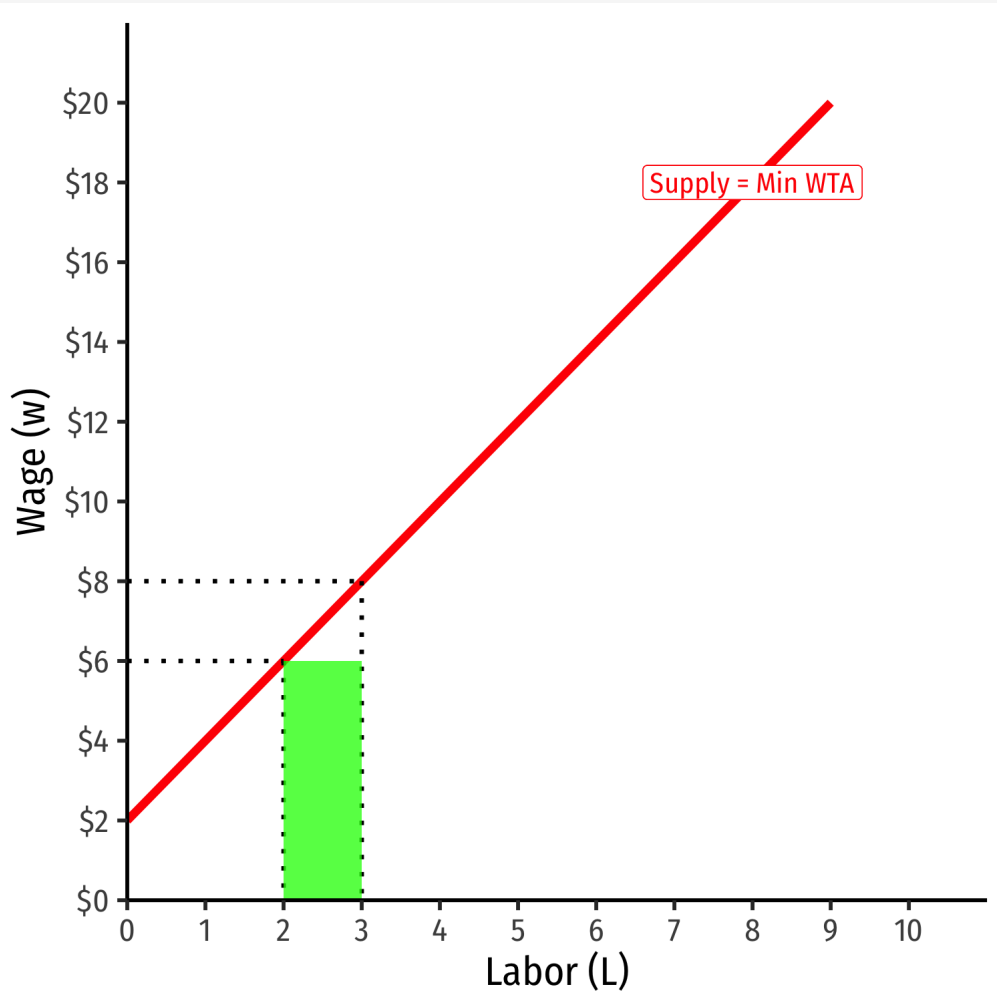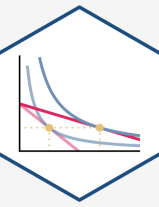
Supply = Min WTA

- As firm chooses to hire more L, must raise wages on *all* workers to hire them

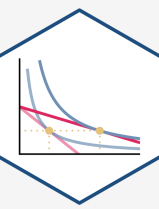- Output effect: increased cost from increased number of workers

Monosony and Market Supply of Labor

- As firm chooses to hire more L, must raise wages on *all* workers to hire them

- Output effect: increased cost from increased number of workers

- Price effect: increased cost from raising wage for all workers

Monopsony and Marginal Cost of Labor I

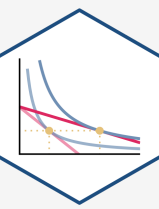- If monopsonist wants to hire more labor, ΔL, its labor cost $C(L)$ would change by:

$$\Delta C(L) = w\Delta L + L\Delta w$$

- Output effect: increases number of labor hired (ΔL) times wage w per worker

- Price effect: raises wage per worker (Δw) on *all* workers hired (L)

- Divide both sides by ΔL to get **Marginal Cost of Labor,** $MC(L)$:

$$\frac{\Delta C(L)}{\Delta L} = MC(L) = w + \frac{\Delta w}{\Delta L}L$$

- Compare: supply for a **price-taking** firm is perfectly elastic: $\frac{\Delta w}{\Delta L} = 0$, so we saw $MC(L) = w$!

Monopsony and Marginal Cost of Labor II

- If we have a linear inverse supply function for labor of the form

$$w = a + bL$$

  - a is the choke price (intercept)
  - b is the slope

- Marginal cost of labor again is defined as:
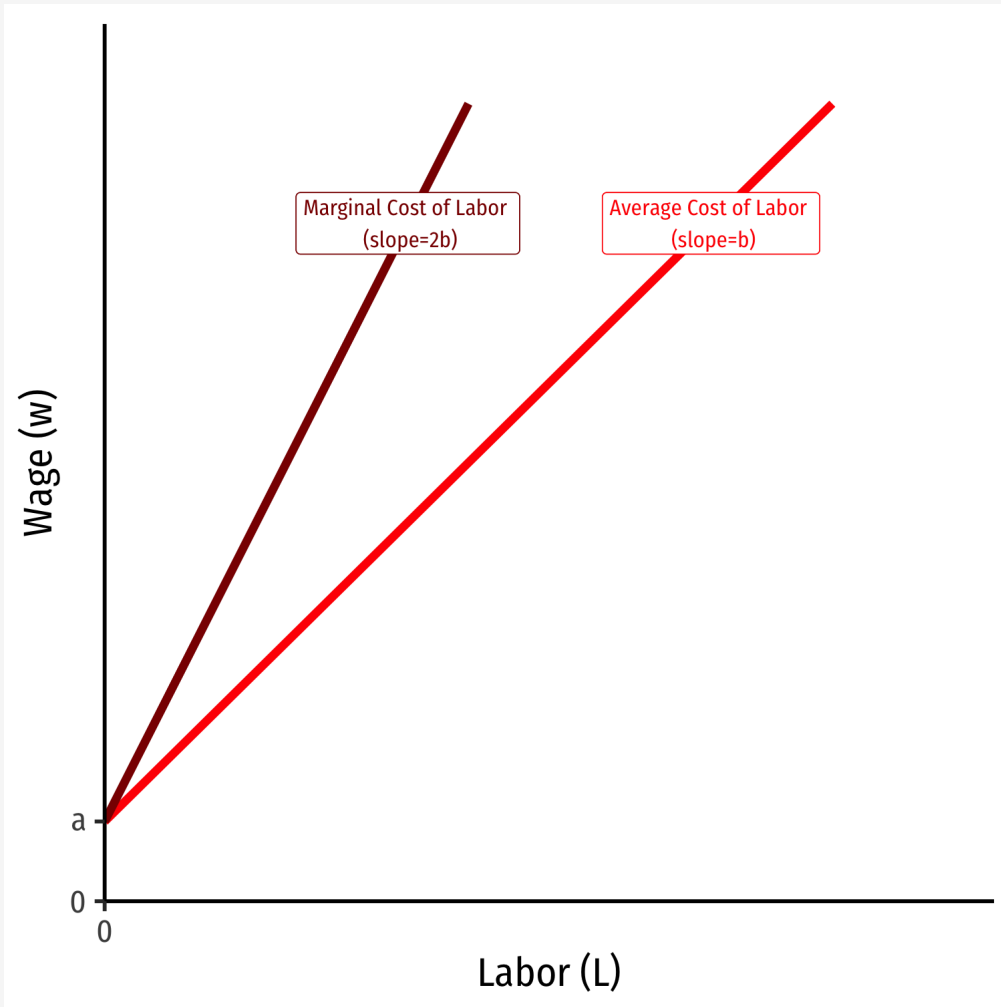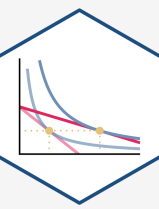
$$MC(L) = w + \frac{\Delta w}{\Delta L}L$$

- Recognize that $\frac{\Delta w}{\Delta L}$ is the slope, b, $\left(\frac{rise}{run}\right)$

$$MC(L) = w + (b)L$$
$$MC(L) = (a + bL) + bL$$
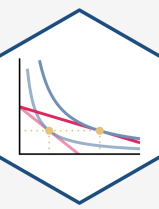$$MC(L) = a + 2bL$$

Monopsony and Marginal Cost of Labor IV

$$w(L) = a + bL$$
$$MC(L) = a + 2bL$$

- Marginal cost of labor starts at same intercept as Supply (average cost of labor) (a) with twice the slope $(2b)$
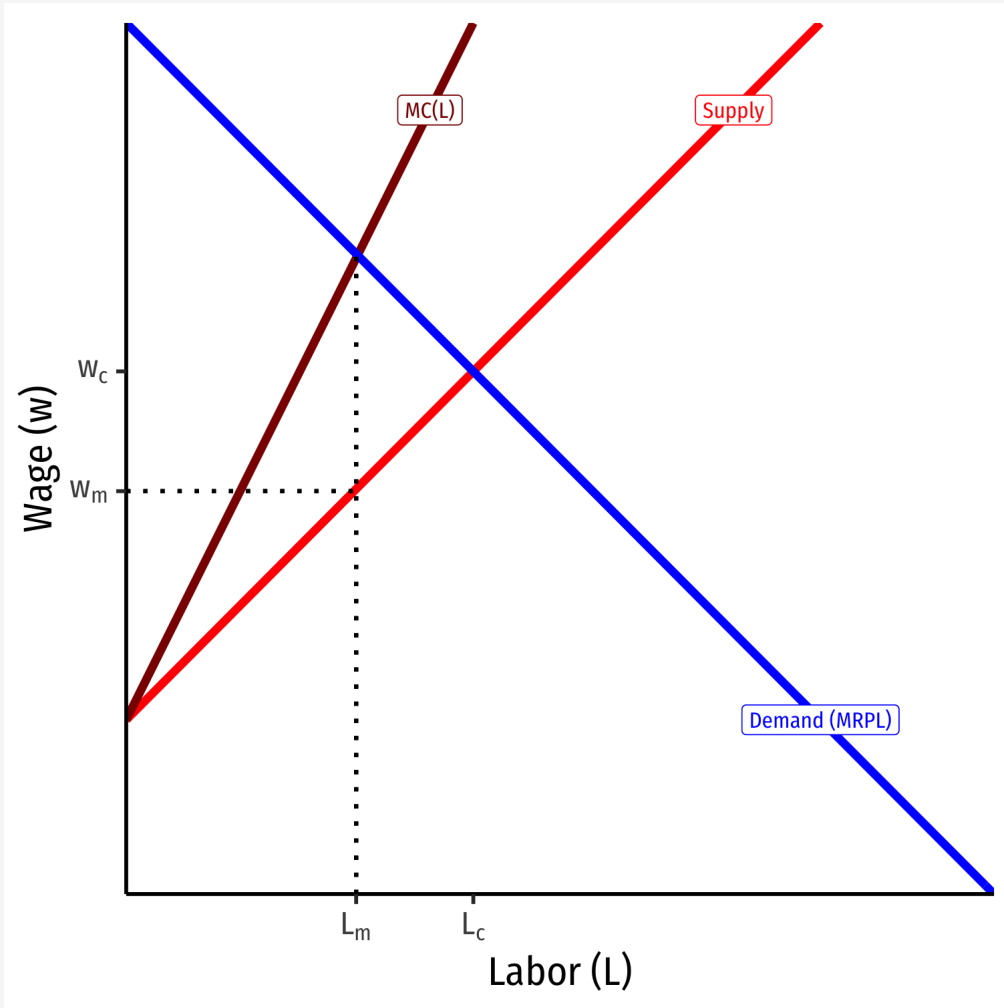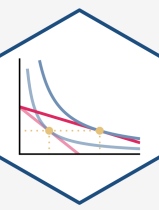
Note: If these past few slides have sounded familiar, this is the exact same process by which we derived a *monopolist*'s marginal *revenue* curve!

Marginal Cost of Labor (slope=2b)

Average Cost of Labor (slope=b)
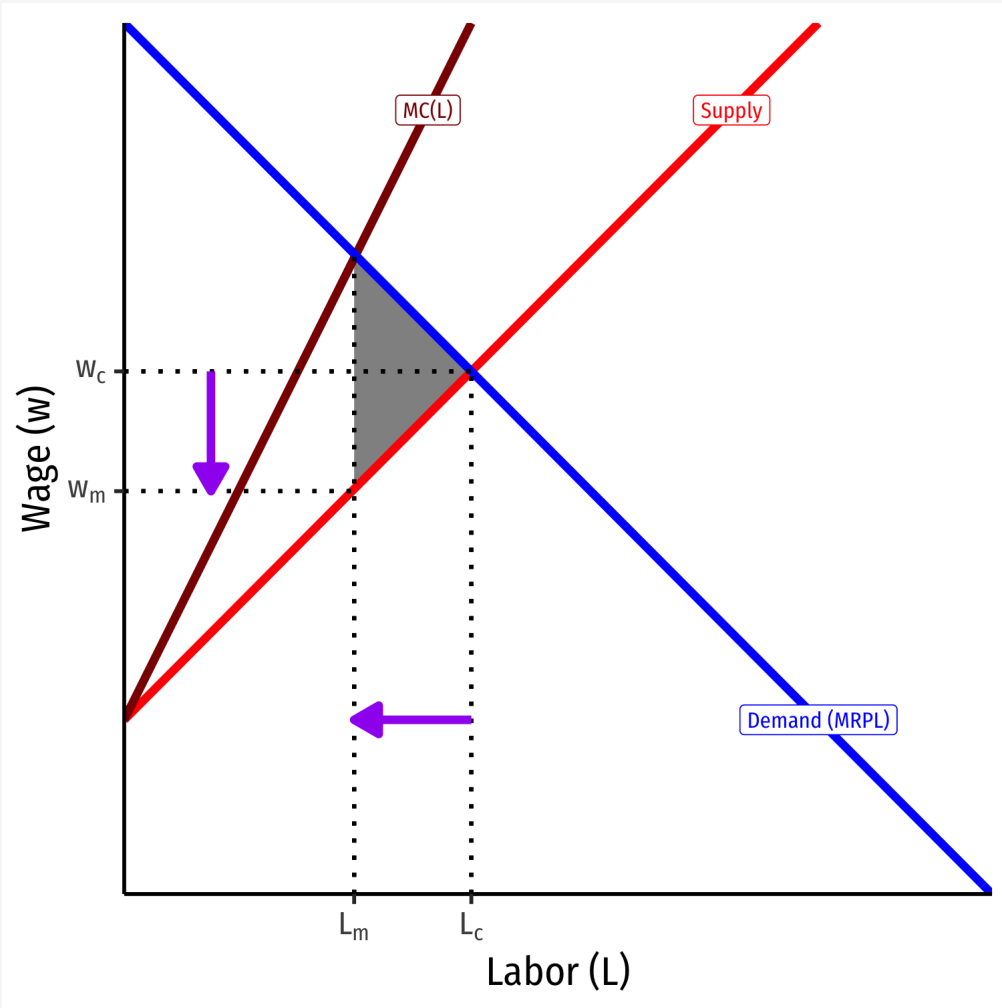
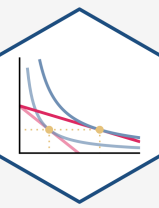# Monopsony's Hiring Decisions
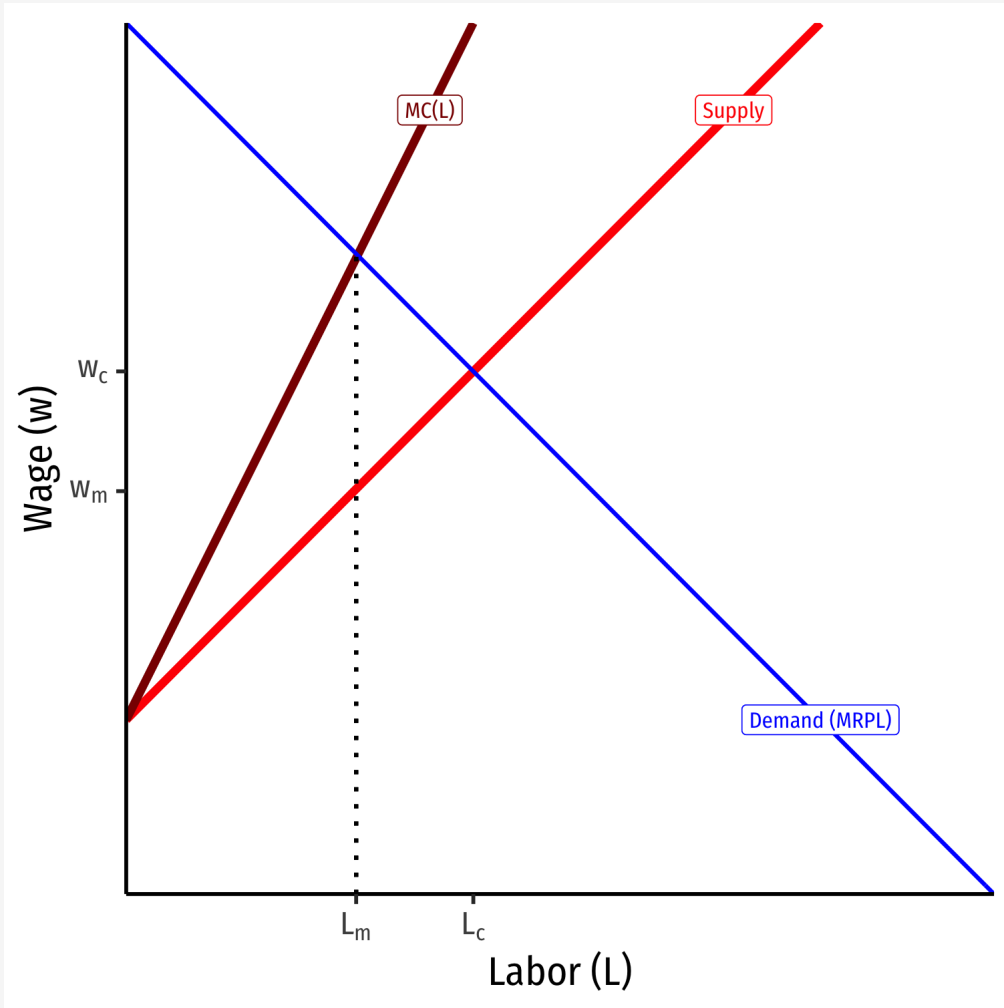
- Optimal quantity is where $MC = MR$
  - Firm's $MC(L) = MRP_L$

Monopsony's Hiring Decisions

- Optimal quantity is where $MC = MR$

  - Firm's $MC(L) = MRP_L$

- Monopsonist faces *entire* **market supply**

  - Can lower wages as low as workers' minimum WTA (Supply)

Monopsonist's Hiring Decisions

- Optimal quantity is where $MC = MR$

  - Firm's $MC(L) = MRP_L$

- Monopsonist faces *entire* **market supply**

  - Can lower wages as low as workers' minimum WTA (Supply)

- Compared to a competitive labor market (L_c, w_c), **monopsonist hires fewer workers and pays them lower wages** (L_m, w_m)
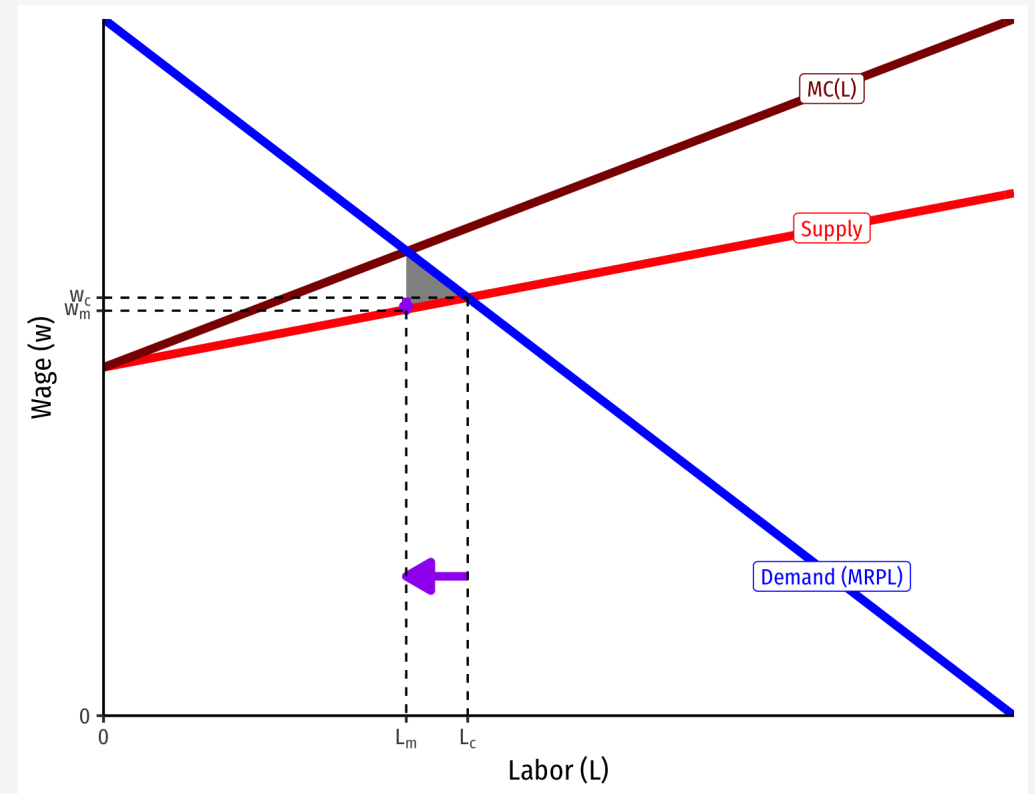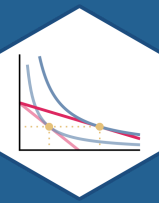
Monopsony Depends on Price Elasticity of Supply

The more (less) elastic labor supply, the less (more) monopsony power

Less Elastic Labor Supply Curve
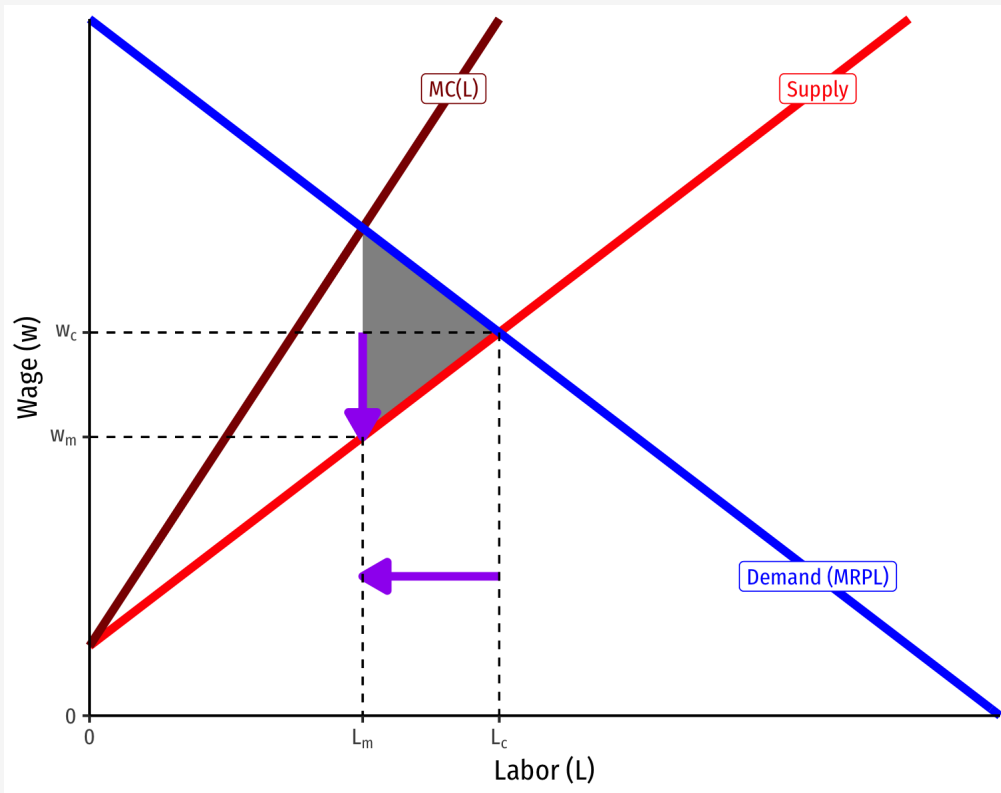
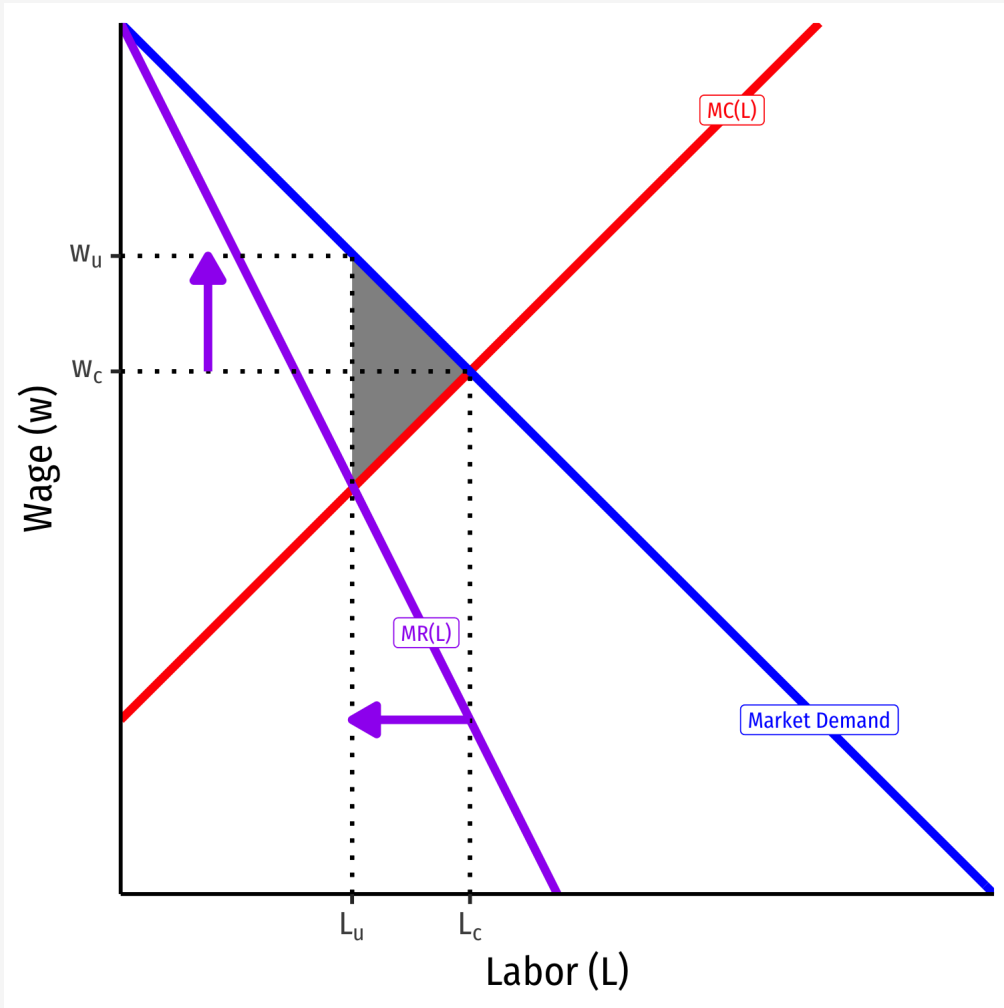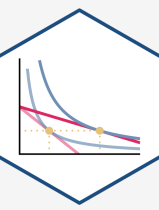### More Elastic Labor Supply Curve

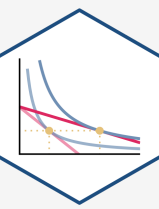# Monopoly Power in Labor Markets: Unions

Monopoly Power in Labor Markets: Unions

- If **seller**/s of labor (workers) has market power, can act like a **monopolist** on the labor market

- **Example**: A labor union

- Faces entire market demand for labor, and thus its marginal revenue curve too

- Acts like a monopolist, restricts $L_u < L_c$ to push up $w_u > w_c$

The Problem of Bilateral Monopoly

- What if **both** sides of the market **have market power**?

  - A downstream **monopsonist buyer** vs. an upstream **monopolist seller**

- This is the problem of **bilateral monopoly**

- Find out more in my industrial organization course

  - One solution is **vertical integration**: merge into a single firm across both markets