The Labor Market

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Issues

- We move from the short run to the medium run
- Short run:
  - supply is elastic; we don't have to worry about it
  - only demand matters
- Medium run: supply depends on prices
  - price setting mechanisms push output towards trend
  - demand and supply matter
- Long run: output is on its trend growth path
  - only supply matters
  - capital stock is endogenous

Objectives

In this section you will learn:

1. How do labor supply and labor demand "work".
2. How is employment determined when **wages are flexible**.
   Why aggregate demand is irrelevant in that case.

Next, we make **wages sticky**.

- Then aggregate demand affects employment.
- The model becomes useful for analyzing business cycles.

2. Labor Demand

2.1 Firm's Hiring Decision

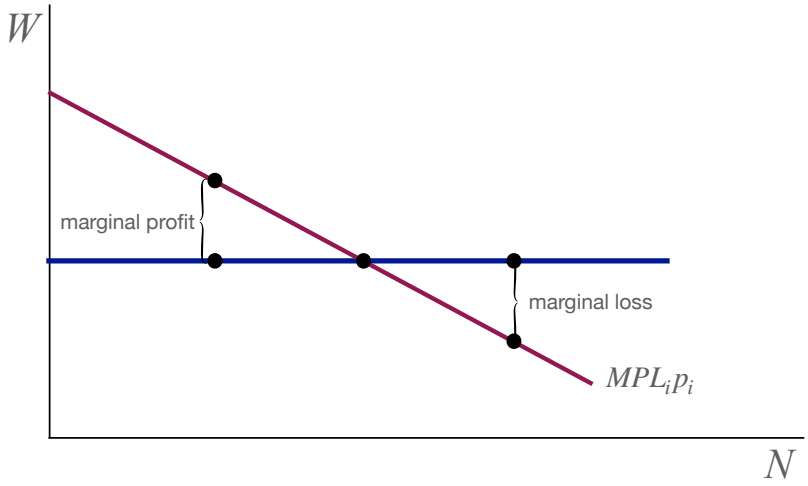
Basic idea:

- Firms hire labor until real wage equals marginal product of labor.
- The last worker just pays for themselves.

The labor demand curve is the MPL curve.

- Labor demand is determined by technology.

Firm's Hiring Decision



Marginal profit from hiring one more worker: $MPL_i \times p_i - W$

Example: Cobb-Douglas

Cobb-Douglas production function:

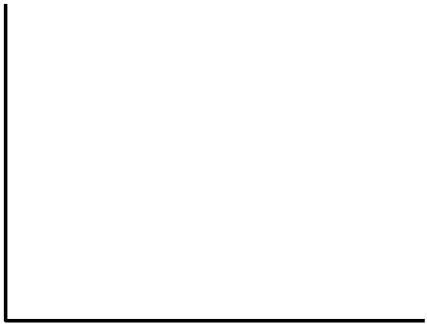
$$Y = \bar{A} K^{\alpha} L^{1-\alpha} \tag{1}$$

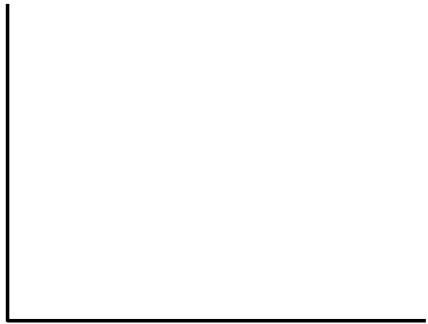
Parameters:

- productivity $\bar{A}$
- "capital share" $\alpha \in (0, 1)$

Example: Cobb-Douglas

Holding K fixed, graph $Y(L)$ and MPL ...





Example: Cobb-Douglas

The firm hires labor until $W = MPL \times p$ or real wage

$$w = W/p = MPL \tag{2}$$

The MPL is given by

$$MPL = (1-\alpha)\bar{A}K^{\alpha}L^{-\alpha} \tag{3}$$

Everything else equal, the wage is downward sloping in L.

Labor demand shifters are technology parameters ($\bar{A}$ and α) and K.

Deriving MPL

$$Y = \bar{A}K^{\alpha}L^{1-\alpha} \tag{4}$$

Then

$$MPL = dY/dL = \bar{A}K^{\alpha} \times \frac{dL^{1-\alpha}}{dL} \tag{5}$$

Recall:

$$d\left(L^{1-\alpha}\right)/dL = (1-\alpha)L^{-\alpha} \tag{6}$$

Therefore:

$$MPL = (1-\alpha)\bar{A}K^{\alpha}L^{-\alpha} \tag{7}$$

Constant Labor Share

In the Cobb Douglas case:

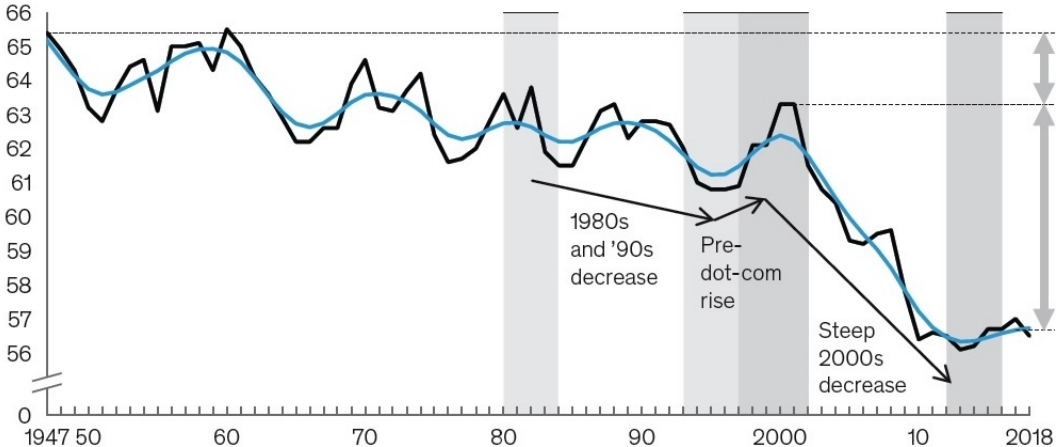
$$w = (1-\alpha)\bar{A}K^{\alpha}L^{-\alpha} \tag{8}$$

Labor income

$$wL = (1-\alpha)\bar{A}K^{\alpha}L^{-\alpha}L = (1-\alpha)Y \tag{9}$$

The labor share wL/Y is constant at $1-\alpha$

Constant Labor Share



Until recently, the labor income share has been constant.

2.2 Labor Demand

Labor demand is determined entirely by technology.

- So are wages!

Note what does **not** matter:

- Wages in other countries.
  - **Our wages are not set in China**
  - We study later why not...
- **Aggregate demand**

Shouldn't the **demand for goods** shift the demand for labor?

- Firms hire less labor in a recession than in a boom...

Why doesn't AD affect labor demand?

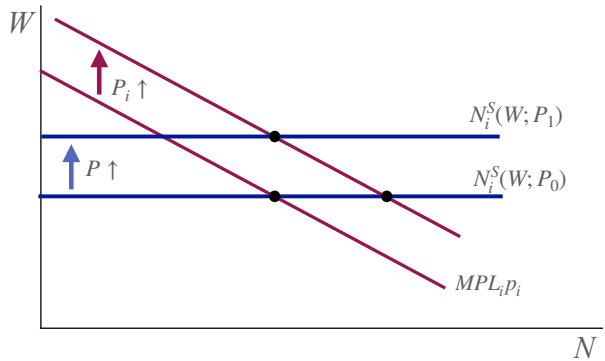
For a single firm i:

- $w/p_i = MPL_i$ where p_i is the firm's own price
- higher demand for its good $\Longrightarrow$

For the economy as a whole:

- higher demand for all goods $\Longrightarrow$

Labor Demand



Firm i's demand rises: $P_i \uparrow \Longrightarrow N_i^D \uparrow$

All firms' demand rises: $P \uparrow \Longrightarrow N_i^S \uparrow$

Key: labor demand and supply shift by the same factor (the rise in P).

Summary

Labor demand is simply the **marginal product of labor**.

Completely determined by **technology**.

- and institutions that affect productivity (regulation, ...)

But wait ...

Labor demand falls in recessions because there isn't enough demand for goods!

The AS/AD model clarifies what's really going on there.

- sticky prices play a key role

3. Labor Supply

Labor Supply and Real Wage

How does labor supply change with real wages?

Simple intuition: get paid more $\Longrightarrow$ work more.

- substitution effect

But would you really work a lot of hours if you were paid \$100,000 per hour?

- income effect

3.1 A Simple Model of Labor Supply

Households choose labor supply just like consumption

- recall the discussion of the MPC

Household maximizes lifetime utility

$$\sum_{t=1}^{T} [u(c_t) - v(l_t)] \tag{10}$$

Lifetime budget constraint

$$\underbrace{\sum_{t=1}^{T} c_t}_{\text{p.v. of consumption}} = \underbrace{\sum_{t=1}^{T} (w_t/p_t)\, l_t + b\,(1-l_t)}_{\text{p.v. of income}} \tag{11}$$

Notes:

- $v(l)$ is the disutility from working l hours
- b is pay when not working (welfare, UI)
- the budget constraint assumes no discounting (zero real interest rate)

Digression

Why not

$$\underbrace{\sum_{t=1}^{T} p_t c_t}_{\text{p.v. of consumption}} = \underbrace{\sum_{t=1}^{T} w_t l_t}_{\text{p.v. of income}} \tag{12}$$

This assumes a zero **nominal** interest rate.

With a zero **real** interest rate, we get (11) on the previous slide.

Labor Supply Model

Lagrangian

$$\mathscr{L} = \underbrace{\sum_{t=1}^{T} \left[u(c_t) - v(l_t) \right]}_{\text{objective}} + \lambda \underbrace{\left[\sum_t \left(c_t - \frac{w_t}{p_t} l_t - b(1 - l_t) \right) \right]}_{\text{constraint}} \tag{13}$$

Households choose

- consumption c_t for all t
- hours worked l_t for all t

3.2 Consumption Choice

$$\mathscr{L} = \underbrace{\sum_{t=1}^{T} [u(c_t) - v(l_t)]}_{\text{objective}} + \underbrace{\lambda \left[\sum_t \left(c_t - \frac{w_t}{p_t} l_t - b(1 - l_t) \right) \right]}_{\text{constraint}} \tag{14}$$

First order condition for consumption:

$$\frac{\partial \mathscr{L}}{\partial c_t} = 0 \implies u'(c_t) = \lambda \tag{15}$$

Consumption Choice

$$u'(c_t) = \lambda \tag{16}$$

Interpretation ...

- Careful about what λ is ...

Consumption smoothing

- with zero real interest rate, the household wants constant consumption
- rich household $\Longrightarrow$ high c_t for all t $\Longrightarrow$ low λ
- regardless of real wage profile

3.3 Labor Supply Choice

First order condition for labor supply:

$$\frac{\partial \mathscr{L}}{\partial l_t} = 0 \implies v'(l_t) = \lambda \left(\frac{w_t}{p_t} - b \right) \tag{17}$$

where $\lambda = u'(c_t)$.

Interpretation:

- An additional hour of working costs marginal utility $v'(l)$
- It earns $w/p - b$ units of income, each worth λ

Hours smoothing

- If real wages are constant, households want constant hours worked.
- Rich household $\implies$ high c $\implies$ low λ $\implies$ low hours.
- Leisure is a normal good.

Transitory wage increase

$$v'(l_t) = \lambda \left(\frac{w_t}{p_t} - b \right) \tag{18}$$

Transitory rise in w/p leaves lifetime income roughly unchanged.

Consumption rises just a little in each period.

λ **approximately unchanged**

Labor supply in this period rises unambiguously

- **substitution effect**

Refresher: income and substitution effects

Permanent wage increase

$$v'(l_t) = \underbrace{\lambda}_{\downarrow} \underbrace{\left(\frac{w_t}{p_t} - b\right)}_{\uparrow} \tag{19}$$

Lifetime income rises $\Longrightarrow \lambda$ falls

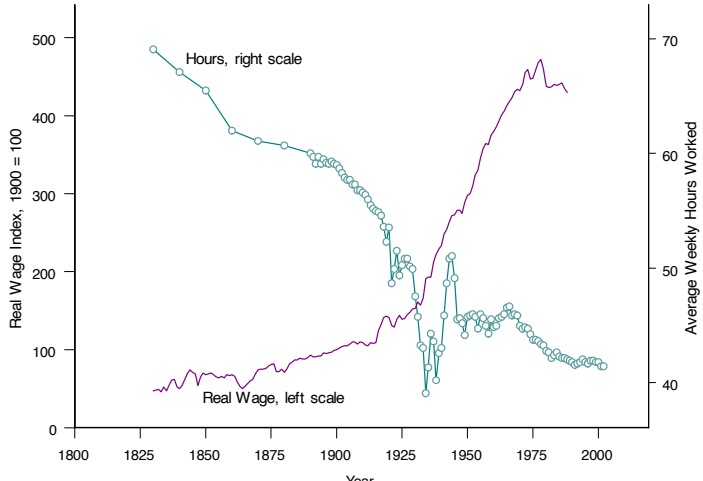
- c_t rises a lot in all periods

Income effect

- smaller increase in labor supply compared with transitory shock

Labor supply could even fall when wages rise permanently.

Labor Supply: Long-run Trends



Source: Greenwood & Vandenbroucke (2005)

For long-run trend wage growth, income effects win.

3.4 Labor Supply Curve

Key takeaways:

- wage increases have two opposing effects on labor supply
- substitution effect: $N^S \uparrow$
- income effect: $N^S \downarrow$
- the longer the shock lasts, the more important income effects become

For our model, we assume:

- labor supply is upward sloping in the wage
- because we focus on transitory wage changes
- but keep in mind that wages may not affect employment in medium run

Labor Supply Curve

What shifts labor supply?

Think

$$v'(l_t) = \lambda \left(\frac{w_t}{p_t} - b \right) \tag{20}$$

where $\lambda = u'(c_t)$.

Not visible here (because we assumed zero real interest rate):

- Higher interest rates cause households to postpone leisure (and consumption)
- Hours rise.

Implications

$$v'(l_t) = \lambda \left(\frac{w_t}{p_t} - b \right) \tag{21}$$

How does labor supply vary over the business cycle?

How does the answer depend on the persistence of business cycle shocks?

Summary: Labor Supply

Labor supply is mainly determined by **preferences**

- but also by transfer payments (income when not working)

Short-run labor supply is increasing in wages

- substitution effects

Long-run labor supply is roughly independent of wages

- big income effects

Recap Questions

1. Do transitory wage shocks affect labor supply more or less than persistent shocks?
2. Should high earners supply more or less labor than low earners?
3. Do labor income taxes reduce labor supply?

4. Labor Market Equilibrium

Labor Market Equilibrium

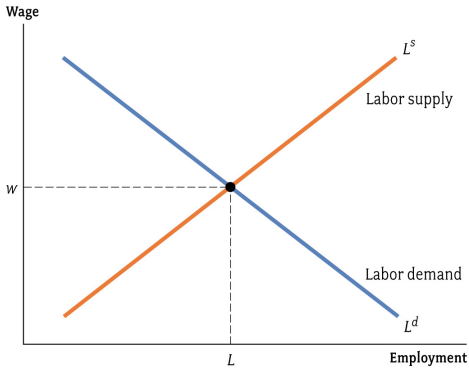


FIGURE 7.3 **The Labor Market**

Labor demand is just technology (MPL)

Labor supply is just preferences

Change in labor demand

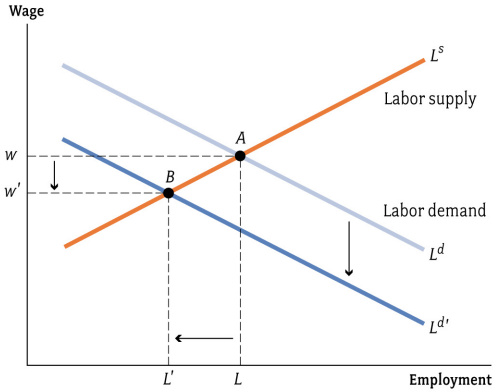


FIGURE 7.5 A Reduction in Labor Demand

Key assumption: wages are flexible.

What are we missing?

Aggregate demand for goods does not affect employment

There is no "real" unemployment

- everyone who wants to work at going wages has a job

The solution: sticky wages

- AS/AD model...

Reading

Blanchard, Macroeconomics

- 7th + 8th ed, ch. 7 "The Labor Market"

Further Reading:

- Jones, *Macroeconomics*, ch. 7.