

# The Labor Market

Prof. Lutz Hendricks

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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 wage setting determines unemployment
2. how to set up the AS-AD model
3. how price adjustment pushes the economy towards the long-run trend growth path
4. how to analyze policies and shocks

# Wage Determination: Walrasian Model

# Wage Determination

- ▶ How wages are set determines
  - ▶ the level of unemployment
  - ▶ the adjustment path towards full employment
- ▶ We start with a textbook / frictionless Walrasian view
  - ▶ labor markets always clear
  - ▶ there is no unemployment
  - ▶ this approach is useful for long run analysis
- ▶ We then introduce the key labor market friction that generates unemployment

# Labor Demand

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.
- ▶ Wages are marginal products (not set in China).

## Example

Cobb-Douglas production function:

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

Parameters:

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

## Example

The firm hires labor until  $w = MPL$ .

Recall:

$$d(L^{1-\alpha})/dL = (1-\alpha)L^{-\alpha} \quad (2)$$

Therefore:

$$w = MPL = dY/dL = (1-\alpha)\bar{A}K^{\alpha}L^{-\alpha} \quad (3)$$

or

$$wL = (1-\alpha)Y \quad (4)$$

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

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



# Labor Demand

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

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

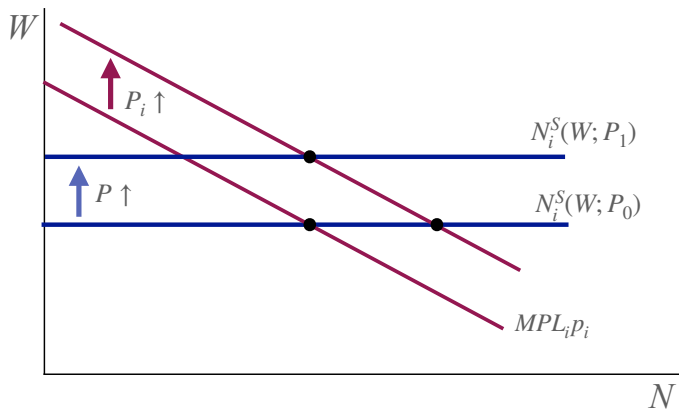
For a single firm  $i$ :

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

For the economy as a whole:

- ▶ higher demand for all goods  $\implies$

# Labor Demand



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

All firm's demand rises:  $P \uparrow \Rightarrow N_i^S \uparrow$

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

# Labor Supply

How does labor supply change with real wages?

## A simple model

Households choose labor supply just like consumption (discussed earlier).

Household maximizes lifetime utility

$$\sum_{t=1}^T [u(c_t) - v(l_t)] \quad (5)$$

subject to the lifetime budget constraint

$$\underbrace{\sum_t p_t c_t}_{\text{p.v. of consumption}} = \underbrace{\sum_t w_t l_t}_{\text{p.v. of income}} \quad (6)$$

assuming no discounting (zero interest rate)

# Labor Supply Model

## Lagrangian

$$\mathcal{L} = \sum_{t=1}^T [u(c_t) - v(l_t)] + \lambda \left[ \sum_t \left( c_t - \frac{w_t}{p_t} l_t \right) \right] \quad (7)$$

First order condition for consumption:

$$u'(c_t) = \lambda \quad (8)$$

## Consumption smoothing

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

# Labor Supply Model

First order condition for labor supply:

$$v'(l_t) = \lambda \frac{w_t}{p_t} \quad (9)$$

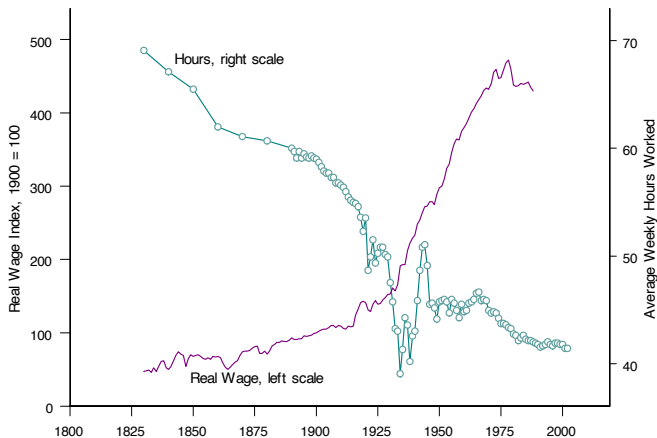
**Transitory** wage increase:

- ▶  $\lambda$  approximately unchanged ( $c_t$  rises just a little for all  $t$ )
- ▶ labor supply rises this period
- ▶ **substitution effect**

**Permanent** wage increase:

- ▶  $\lambda$  falls ( $c_t$  rises a lot in all periods)
- ▶ **income effect**
- ▶ smaller increase in labor supply
- ▶ with more general preferences  $u(c_t, l_t)$  labor supply could even fall

# Labor Supply: Long-run Trends



Source: Greenwood & Vandenbroucke (2005)

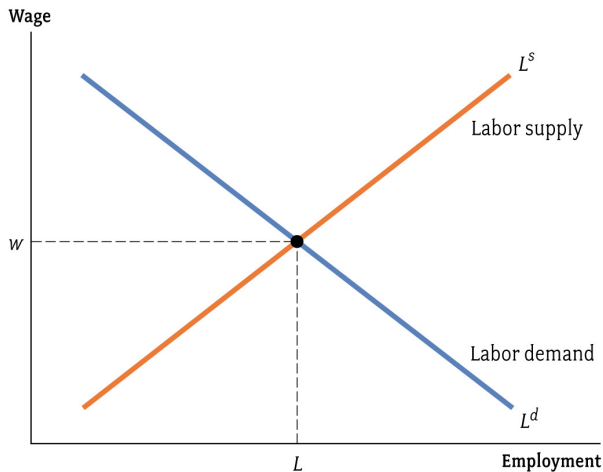
For long-run trend wage growth, income effects win.

# Labor Supply Curve

For our model, we assume:

- ▶ labor supply is upward sloping in the wage
- ▶ because we focus on transitory wage changes
- ▶ not long-run wage growth

# Labor Market Equilibrium

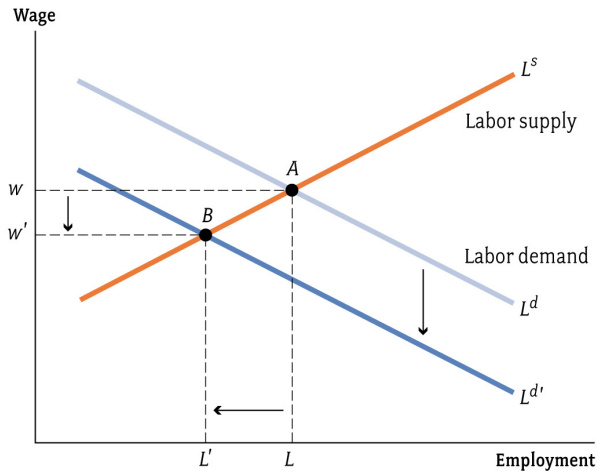


**FIGURE 7.3** The Labor Market

*Macroeconomics*, Charles I. Jones  
Copyright © 2008 W. W. Norton & Company



# Change in labor demand



**FIGURE 7.5 A Reduction in Labor Demand**

Macroeconomics, Charles I. Jones  
Copyright © 2008 W. W. Norton & Company

# Where is unemployment?

Which workers are unemployed?

In what sense?

# Where is unemployment?

## Insight:

We are missing a friction that prevents workers from finding jobs.

Would measured unemployment be zero?

# Where is unemployment?

## Insight

Unemployment is an arbitrary concept.

Caution when interpreting unemployment rates.

# A Model With Frictions

# The Idea

The basic idea we want to capture:

**Unexpected** inflation increases output

- ▶ either by increasing labor supply or labor demand
- ▶ monetary policy has real effects in the short run
- ▶ but they wear off as expectations adjust

**Anticipated** inflation just increases prices.

- ▶ this is why money is neutral in the long run

# The Labor Demand Story

The story in a nutshell

1. Inflation erodes the real wage.
2. At lower real wages, firms hire more labor.
3. Hence, employment is higher when inflation is higher

This requires **sticky wages**.

- ▶ Sticky prices would work as well (a different channel).

# The Labor Demand Story

Wage bargaining sets **nominal wages**  $W$  for a period of time.

Workers aim for a certain **real wage**  $W/P = w$ .

- ▶ If “economic conditions” are good, the target  $W/P$  is high.

They have price expectation  $P^e$  and set  $W = wP^e$ .

Firms set employment based on the true  $W/P$ .

If price expectations are correct:  $P^e = P \implies W/P = w$

- ▶ we get “full employment” (workers work as much as they want)
- ▶ that's the Walrasian outcomes



# The Labor Demand Story

If workers get  $P^e$  wrong, the real wage deviates from  $w$ .

Notably: unexpected inflation implies  $P > P^e$

The real wage is eroded

$$W/P = (W/P^e)(P^e/P) \quad (10)$$

$$= w(P^e/P) \quad (11)$$

$$< w \quad (12)$$

That induces firms to hire more (cheap) workers.

Unexpected inflation can stimulate the economy.

This is a good story – but not the one we are modeling.

# The Labor Supply Story

The model (adapted from the text) contains a different version of the story (for simplicity).

At the start of the period, workers form price expectations  $P^e$ .

Say the equilibrium price is  $P$ .

Firms set prices as a constant markup over wages

- ▶  $P = (1 + m)W$  or  $W = P / (1 + m)$

- ▶ details below

Labor supply:

- ▶ Workers see  $W$  and think the real wage is  $W/P^e$

- ▶  $N^s(W/P^e)$  is increasing in the perceived real wage.

Unexpected inflation ( $P > P^e$ ) implies high  $W/P^e$ .

- ▶ Workers think the real wage is high.

- ▶ They supply more labor and employment rises.

# Labor Supply

Labor supply:

$$N^s = \hat{F}(W/P^e, z) \quad (13)$$

$z$ : labor market conditions

- unemployment benefits, taxes, etc

Key:  $N^s$  depends on the real wage evaluated at  $P^e$  (not  $P$ ).

We assume that  $N^s$  is increasing in  $W/P^e$ .

# Labor Demand

In general:  $MPL$  is decreasing in  $N$

- ▶ Firms hire labor up to the point where  $MPL = W/P$

We simplify and assume:

- ▶ Output is produced from labor only:  $Y = N$
- ▶  $MPL = 1$  or marginal cost  $MC = W$

But firms have market power and set price as a markup over marginal cost

$$P = (1 + m)W \quad (14)$$

Labor demand is perfectly elastic at real wage

$$W/P = \frac{1}{1 + m} \quad (15)$$

# Labor Market Clearing

In general we would set  $N^S = N^D$ .

But here  $N^S$  is horizontal at the fixed real wage  $1/(1+m)$ .

So we sub that real wage into labor supply to get market clearing.

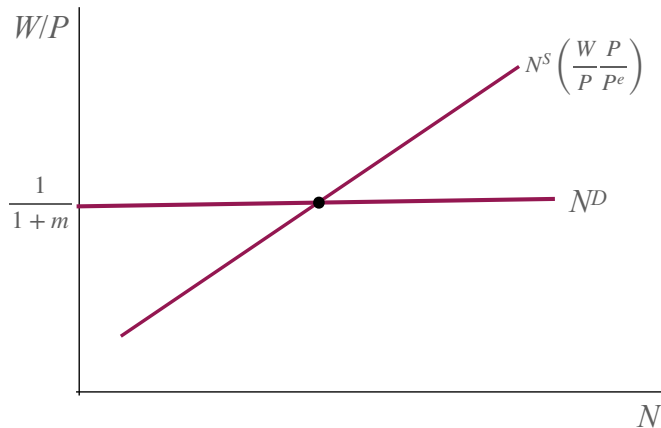
$$N = \hat{F}(W/P^e, z) \quad (16)$$

$$= \hat{F}\left(\frac{P}{P^e} \frac{W}{P}, z\right) \quad (17)$$

$$= \hat{F}\left(\underbrace{\frac{P}{P^e}}_{\text{mistake}}, \underbrace{\frac{1}{1+m}}_{\text{real wage}}, z\right) \quad (18)$$

Employment is increasing in  $P/P^e$  and  $z$ .

# Labor Market Clearing



## Model Summary

Production function

$$Y = N \quad (19)$$

Labor demand:

$$W/P = 1/(1+m) \quad (20)$$

Labor supply:

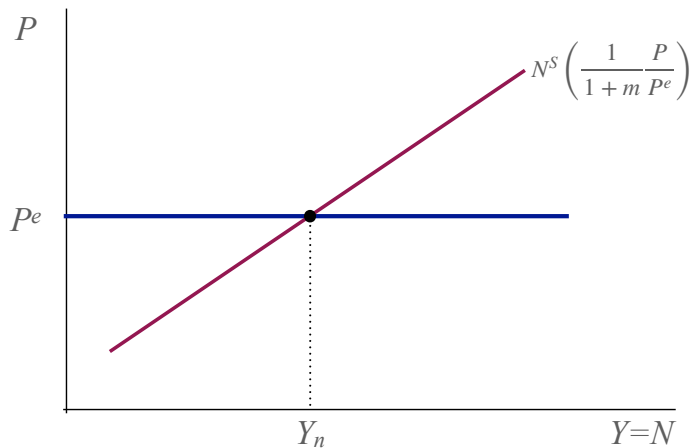
$$N^S = \hat{F}(W/P^e, z) \quad (21)$$

Labor market clearing:

$$Y = N = \hat{F}(W/P^e, z) \quad (22)$$

$$= \hat{F}\left(\frac{P}{P^e} \frac{1}{1+m}, z\right) \quad (23)$$

# Summary



Higher (unexpected) prices  $\Rightarrow$  higher employment.



# Intuition

Workers see a high nominal wage and think they see a high real wage.

So they supply more labor.

In reality, price setting by firms fixes the real wage

- ▶ Workers are wrong every time.

Until worker's price expectations adjust ( $P^e \rightarrow P$ ), inflation affects employment.

# Exercises

What happens to  $Y = N$  when (holding  $P$  fixed)

1. price expectations are higher?
2. markups rise?
3. unemployment benefits improve?

# Natural Rate of Unemployment

When price expectations are correct:

$$Y_n = N_n = F(1/(1+m), z) \quad (24)$$

This is the medium-run outcome.

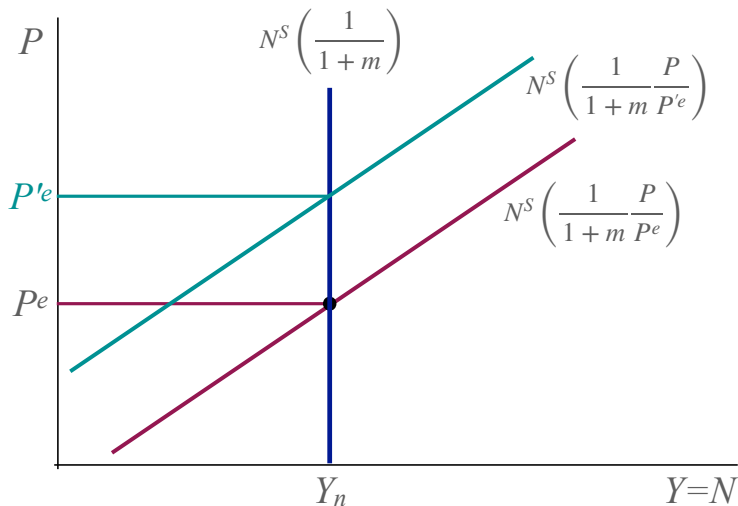
- ▶ The medium-run supply curve is **vertical**.
- ▶ The price level does not matter.

Full employment should really be called “normal employment” or “trend employment.”

- ▶ Not everyone works.
- ▶ But those who want to work do.

What affects full employment?

## Long-run Supply Curve



# What's Next?

- ▶ If price expectations were always correct, we would be done:
  - ▶ markups and labor productivity determine the real wage
  - ▶ the real wage determines (un)employment
  - ▶ employment determines output
- ▶ This is what happens in the long run
  - ▶ only the supply side matters
- ▶ But what happens when  $P^e \neq P$ ?
  - ▶ the AS/AD model answers that question

## Does Gov't Spending Create Jobs?

*A bipartisan infrastructure deal ... could create roughly half a million new manufacturing jobs by 2024 ... an analysis conducted on behalf of the trade group Association of Equipment Manufacturers found. ...*

*[T]he manufacturing jobs would come from \$1.1 trillion spent over eight years ...*

*CBS New, July 27, 2021*

## Destroying Jobs

The same logic applies to measures that raise the cost of doing business:

*Michele Bachmann, the congresswoman from Minnesota, in 2011 said she wanted to rename the Environmental Protection Agency “the job-killing organization of America” and Mitt Romney lamented that “Day by day, job-killing regulation by job-killing regulation, bureaucrat by bureaucrat, this president is crushing the dream.”*

*The Atlantic, Jan 19, 2017*

What is the link between regulation and long-run employment?

# Reading

- ▶ Blanchard / Johnson, *Macroeconomics*, 6th ed, ch. 6

Further Reading:

- ▶ Jones, *Macroeconomics*, ch. 7.