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 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

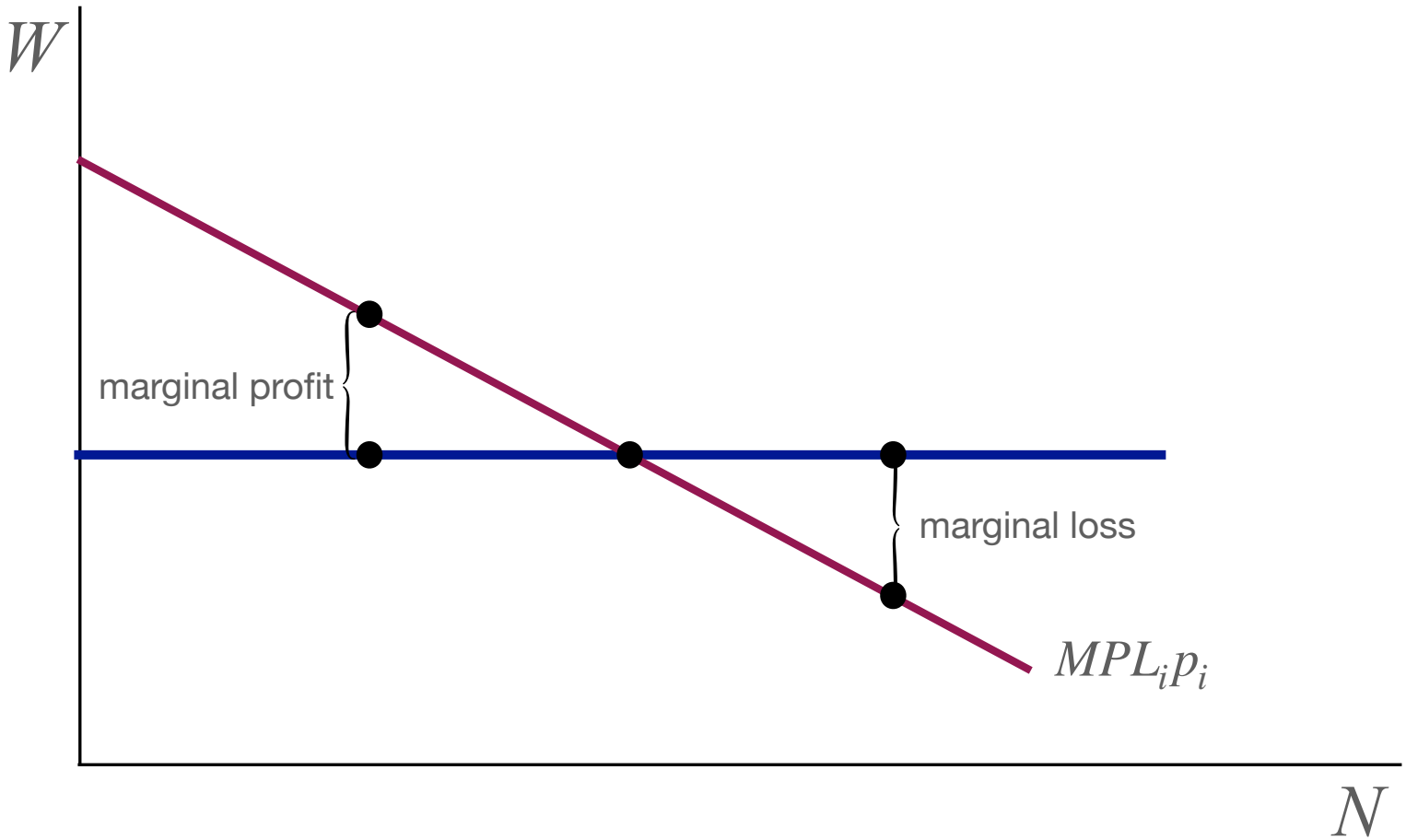
Basic idea:

- 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).

Labor Demand



Example

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

The firm hires labor until $w = MPL$.

Recall:

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

Therefore:

$$w = dY/dL = \bar{A}K^{\alpha}\frac{dL^{1-\alpha}}{dL} \tag{3}$$

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

or

$$wL = (1-\alpha)Y \tag{5}$$

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

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

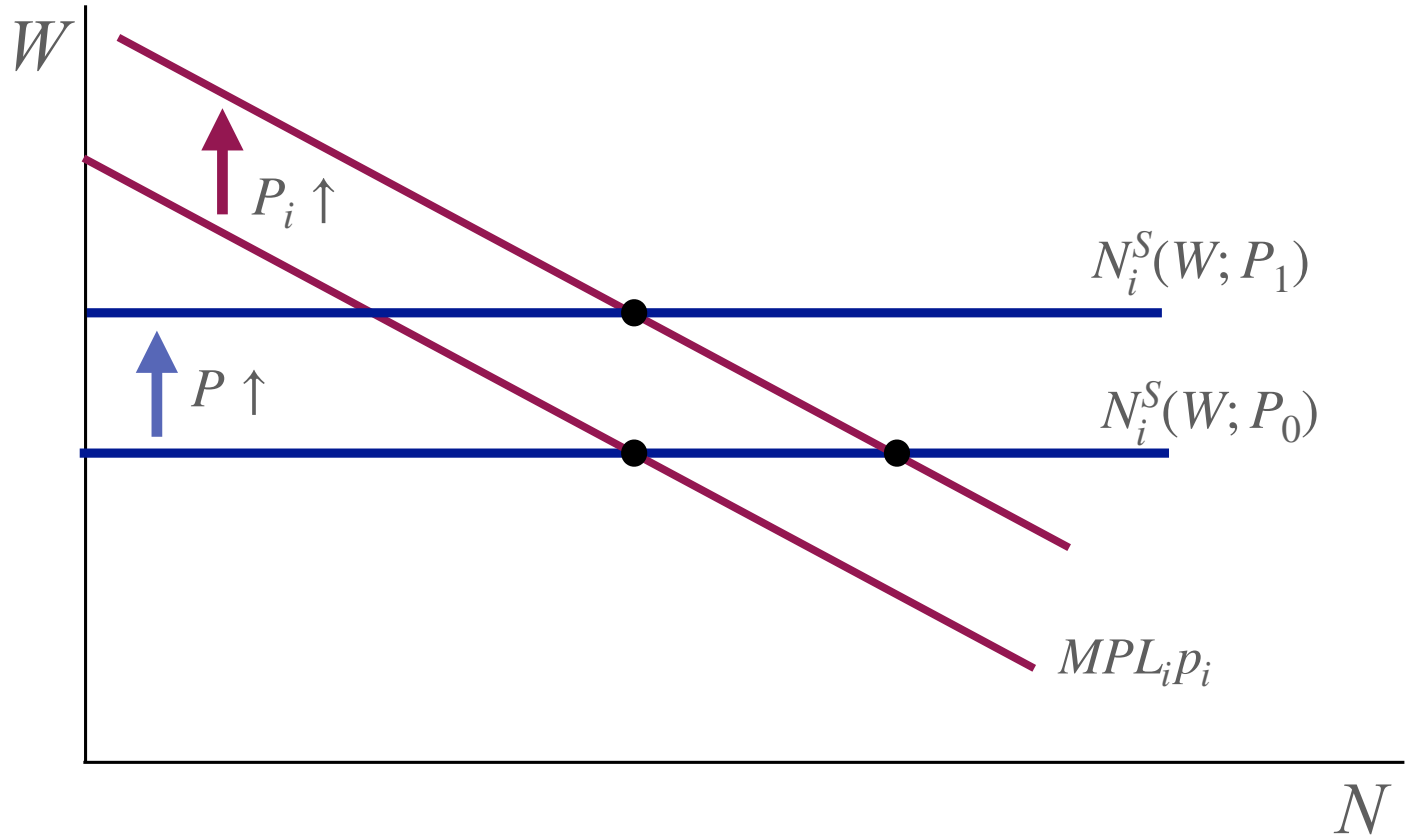
For a single firm i:

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

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.

But wait ... doesn't labor demand fall 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

Labor Supply

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

$$\sum_{t=1}^{T} [u(c_t) - v(l_t)] \tag{6}$$

subject to the lifetime budget constraint

$$\underbrace{\sum_{t} c_t}_{\text{p.v. of consumption}} = \underbrace{\sum_{t} (w_t/p_t)\, l_t}_{\text{p.v. of income}} \tag{7}$$

assuming no discounting (zero real interest rate)

Labor Supply Model

Lagrangian

$$\mathscr{L} = \sum_{t=1}^{T} [u(c_t) - v(l_t)] + \lambda \left[\sum_t \left(c_t - \frac{w_t}{p_t} l_t \right) \right] \tag{8}$$

First order condition for consumption:

$$u'(c_t) = \lambda \tag{9}$$

Consumption smoothing

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

Labor Supply Model

First order condition for labor supply:

$$v'(l_t) = \lambda \frac{w_t}{p_t} \tag{10}$$

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

Rich household $\implies$ high c $\implies$ low λ.

Transitory wage increase:

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

Refresher: income and substitution effects

Labor Supply Model

Permanent wage increase:

$$v'(l_t) = \underbrace{\lambda}_{\downarrow} \underbrace{\frac{w_t}{p_t}}_{\uparrow} \tag{11}$$

- λ 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

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
- not long-run wage growth

Labor Supply Curve

What shifts labor supply?

Think

$$v'(l_t) = \lambda \frac{w_t}{p_t} \tag{12}$$

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

Implications

$$v'(l_t) = \lambda \frac{w_t}{p_t} \tag{13}$$

How does labor supply vary over the business cycle?

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

Labor Market Equilibrium

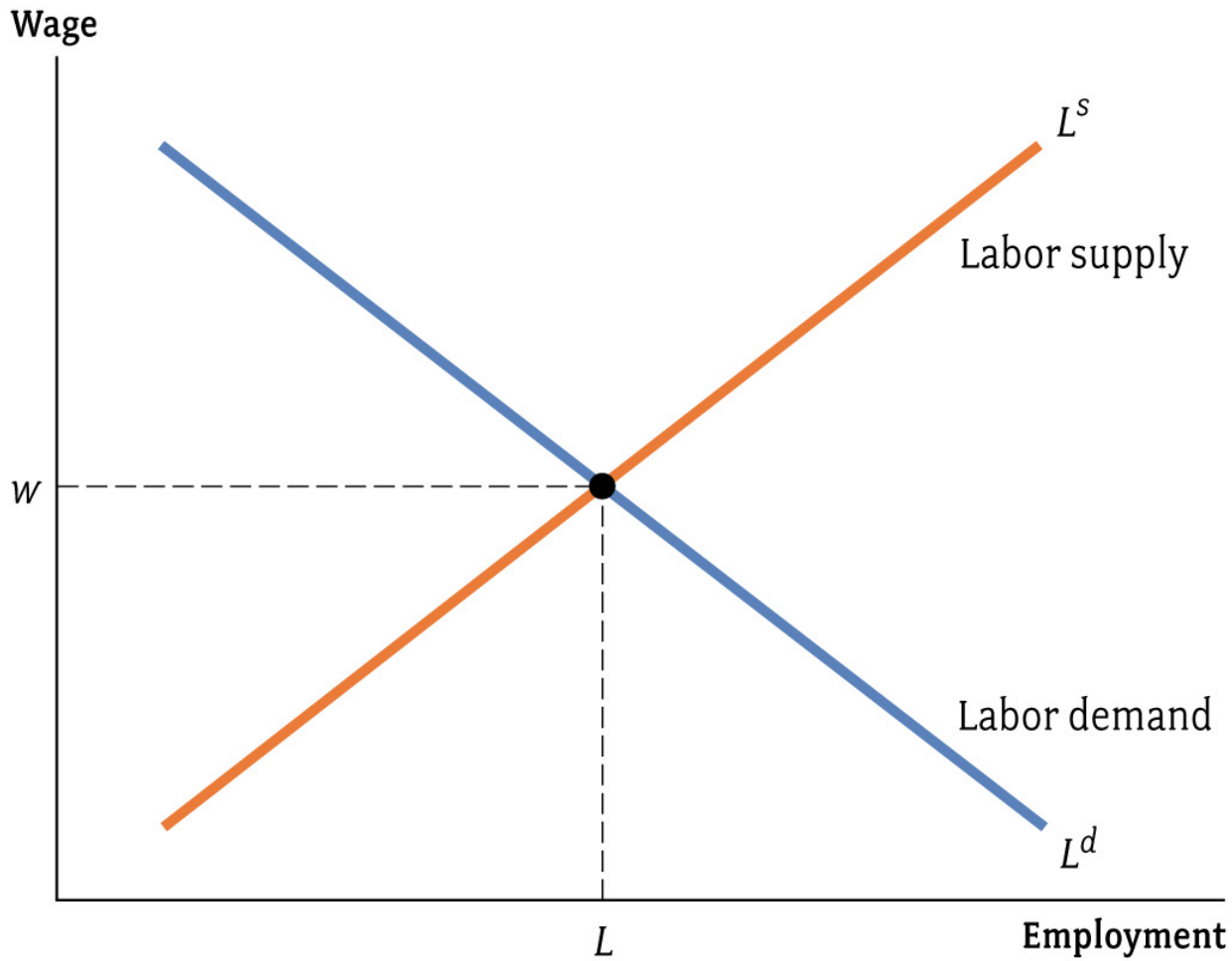


FIGURE 7.3 The Labor Market

Macroeconomics, Charles I. Jones

Change in labor demand

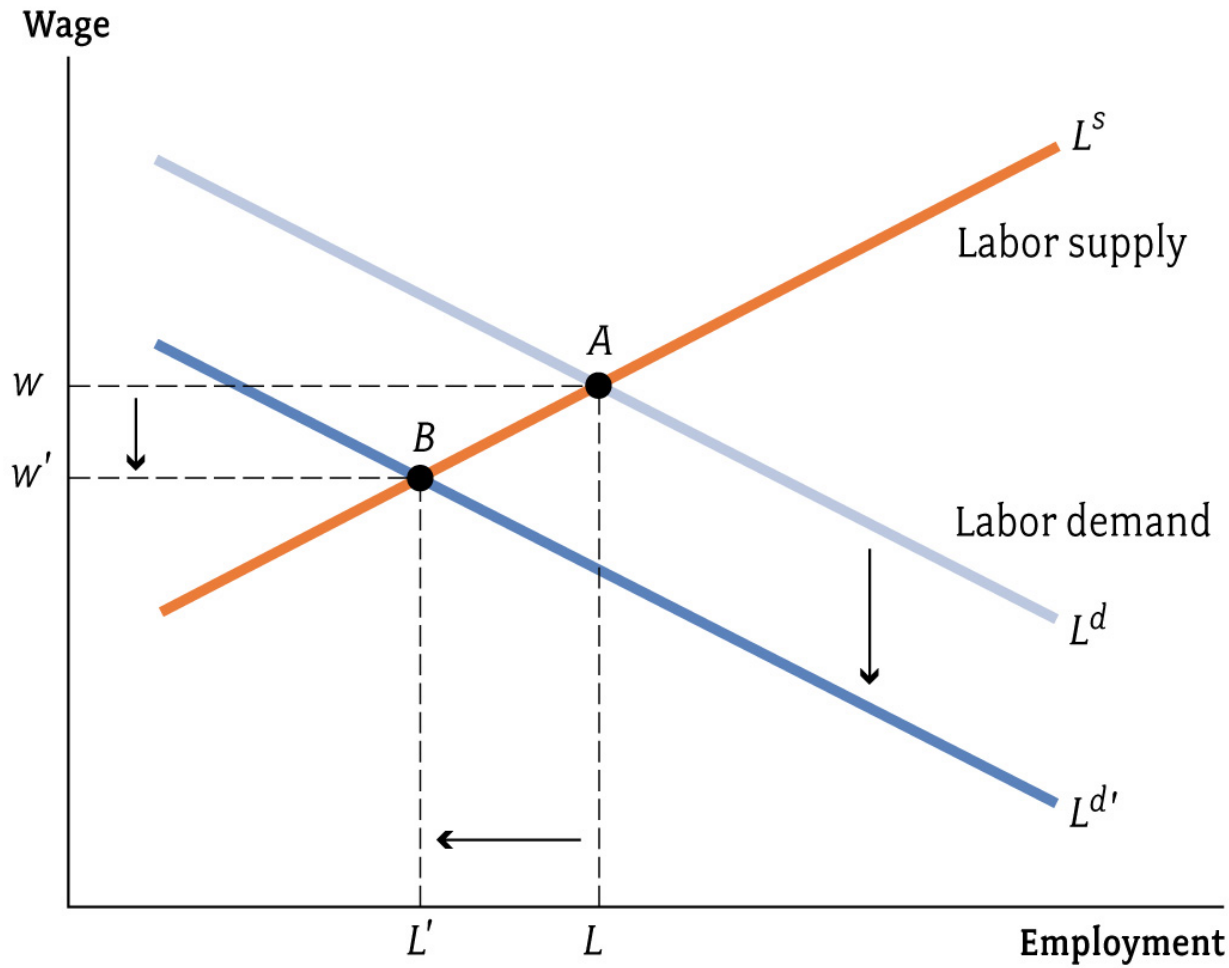


FIGURE 7.5 A Reduction in Labor Demand

Macroeconomics, Charles I. Jones

Points to note

Labor demand is just technology (MPL)

Labor supply is just preferences

Aggregate demand for goods does not affect employment

- unless wages (or prices) are sticky
- AS/AD model...

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

We can tell that story in various ways

- sticky wages $\rightarrow$ labor demand story
- sticky price expectations $\rightarrow$ labor supply story
- sticky prices ...

The Labor Demand Story

The story in a nutshell

1. Wages are sticky (require time to adjust to shocks)
2. Inflation erodes the real wage.
3. At lower real wages, firms hire more labor.
4. Hence, employment is higher when inflation is higher

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.
- w could be the outcome of wage bargaining.

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

Firms set employment based on the true W/P.

- labor demand $= MPL$

After W is fixed, shocks are realized

- including government policy surprises

The Labor Demand Story

Labor market outcomes depend on whether price expectations are too high or too low.

If price expectations are correct:

- $P^e = P \implies W/P = w$
- workers get the target real wage
- we call that outcome "full employment"
  even though not everyone will work
  full employment = work hours are what workers want this period
- that's the Walrasian outcome

The Labor Demand Story

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

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

- but anticipated inflation doesn't matter

The real wage is eroded

$$W/P = (W/P^e)(P^e/P) \tag{14}$$
$$= w(P^e/P) \tag{15}$$
$$< w \tag{16}$$

That induces firms to hire more (cheap) workers.

Result: Unexpected inflation stimulates the economy.

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

The Labor Supply Story

We model a simpler version of the story (with similar outcomes).

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

Labor supply:

- Workers see W and think the real wage is W/P^e
- How much they want to work is given by $N^s(W/P)$.
- How much they actually work is $N^s(W/P^e)$.

The Labor Supply Story

Labor demand:

Firms set prices as a constant markup m over wages

$P = (1+m)\,W$ or

$$W = P/(1+m) \tag{17}$$

The real wage is always

$$W/P = 1/(1+m) \tag{18}$$

Details below ...

The Labor Supply Story

If inflation expectations are **correct**:

- workers work as much as they want at the market clearing real wage
- full employment

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

- Workers think the real wage is high
  - even though it's always $1/(1+m)$.
- They supply more labor and employment rises.

Unexpected inflation stimulates the economy

- by tricking workers into working too much

Labor Supply

Labor supply:

$$N^s = \hat{F}\left(W/P^e, z\right) \tag{19}$$

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: $Y = N$
- $MPL = dY/dN = 1$
- Marginal cost $MC = W$

Firms charge a markup m over marginal cost

$$P = (1+m)W \tag{20}$$

Labor demand is perfectly elastic at **fixed real wage**

$$W/P = \frac{1}{1+m} \tag{21}$$

Labor Market Clearing

In general we would set $N^S(W/P) = N^D(W/P)$.

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.

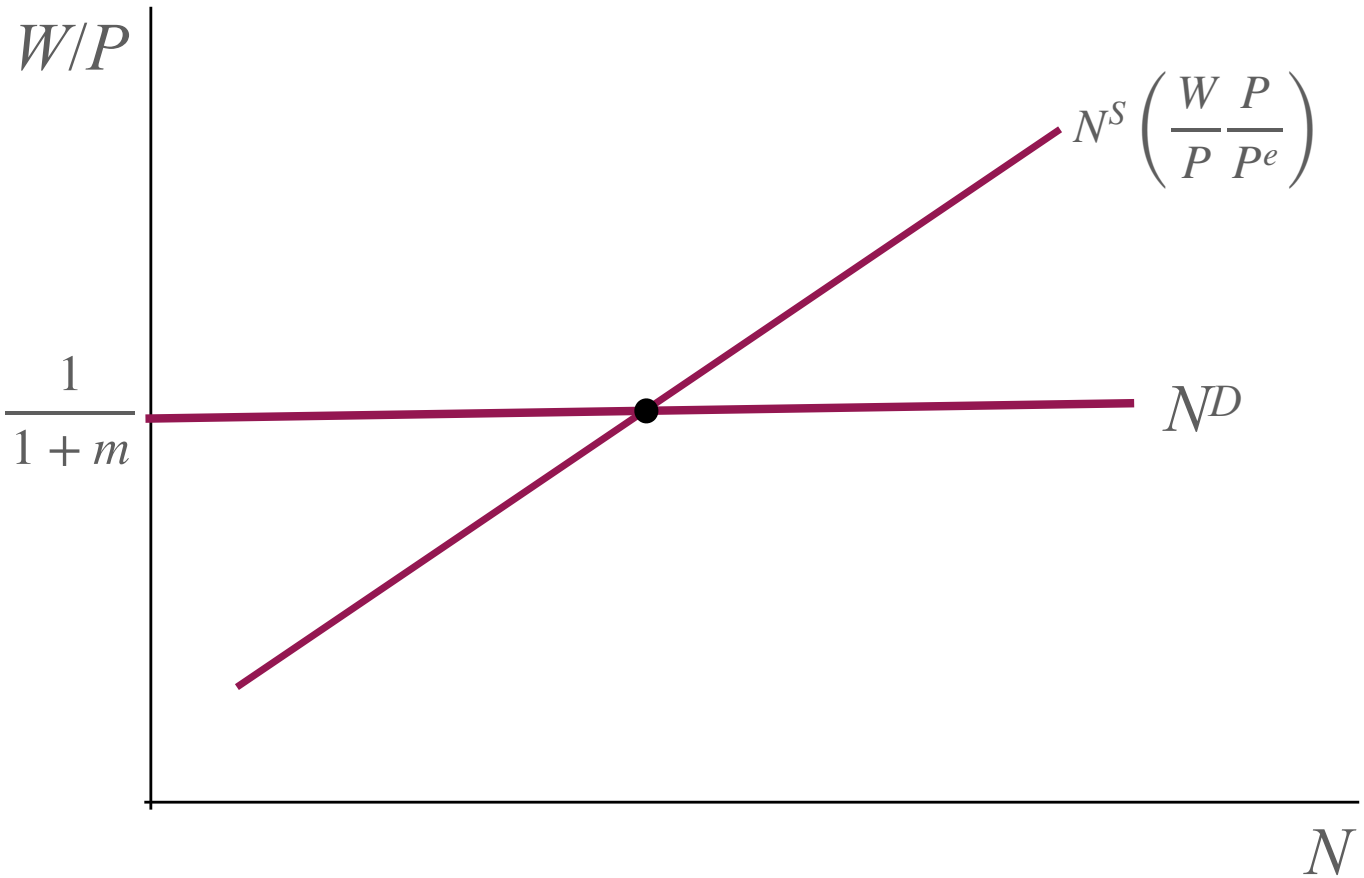
$$N = \hat{F}(W/P^e, z) \tag{22}$$

$$= \hat{F}\left(\frac{P}{P^e}\frac{W}{P}, z\right) \tag{23}$$

$$= \hat{F}(\underbrace{\frac{P}{P^e}}_{\text{mistake}}, \underbrace{\frac{1}{1+m}}_{\text{real wage}}, z) \tag{24}$$

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

Labor Market Clearing



Model Summary

Production function

$$Y = N \tag{25}$$

Labor demand:

$$W/P = 1/(1+m) \tag{26}$$

Labor supply:

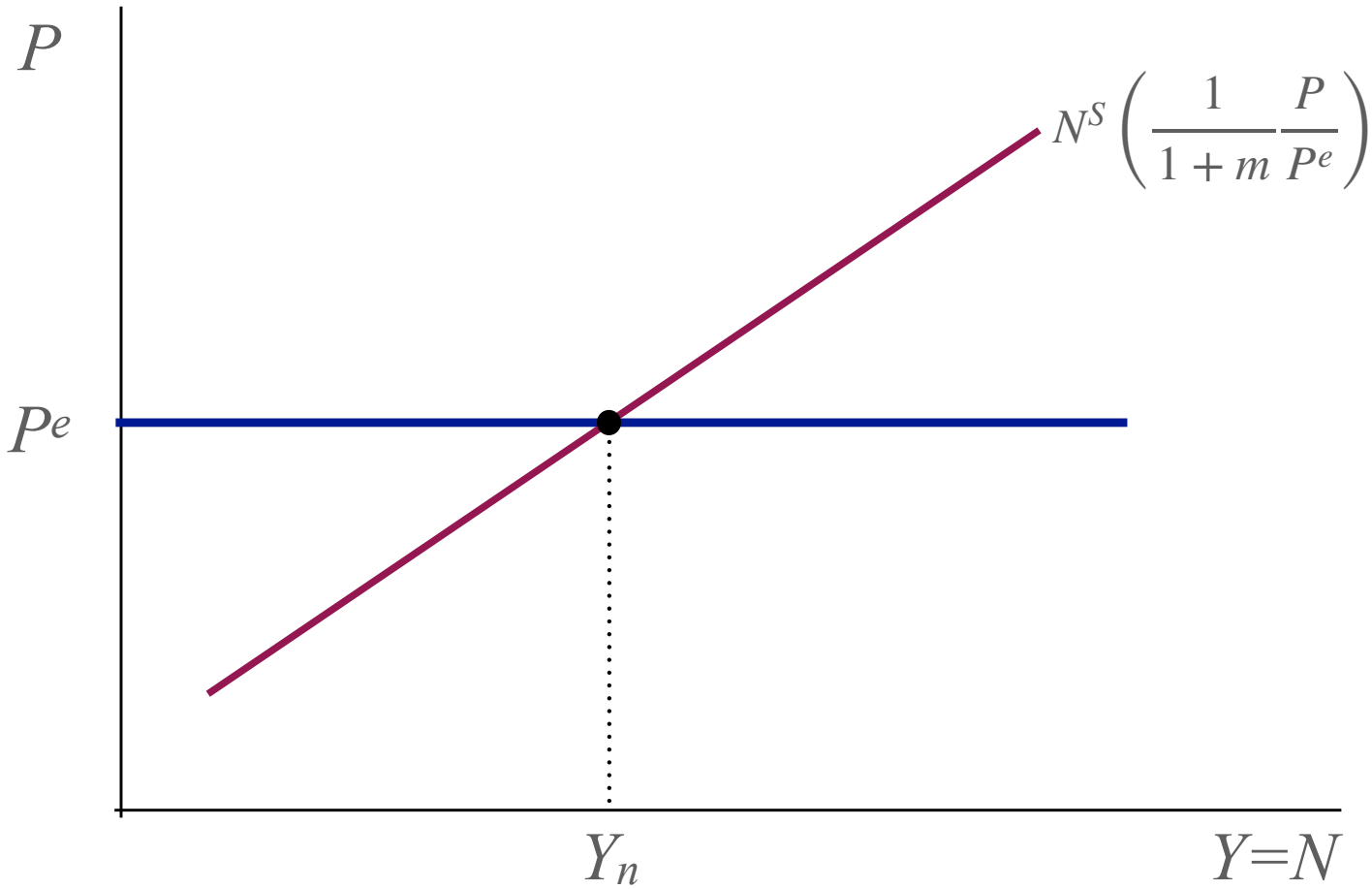
$$N^S = \hat{F}(W/P^e, z) \tag{27}$$

Labor market clearing:

$$Y = N = \hat{F}(W/P^e, z) \tag{28}$$

$$= \hat{F}\left(\frac{P}{P^e}\frac{1}{1+m}, z\right) \tag{29}$$

Summary



Higher (unexpected) prices $\Longrightarrow$ 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:

$$Y_n = N_n = F(\underbrace{\frac{P}{P^e}}_{=1} \frac{1}{1+m}, z) \tag{30}$$

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.

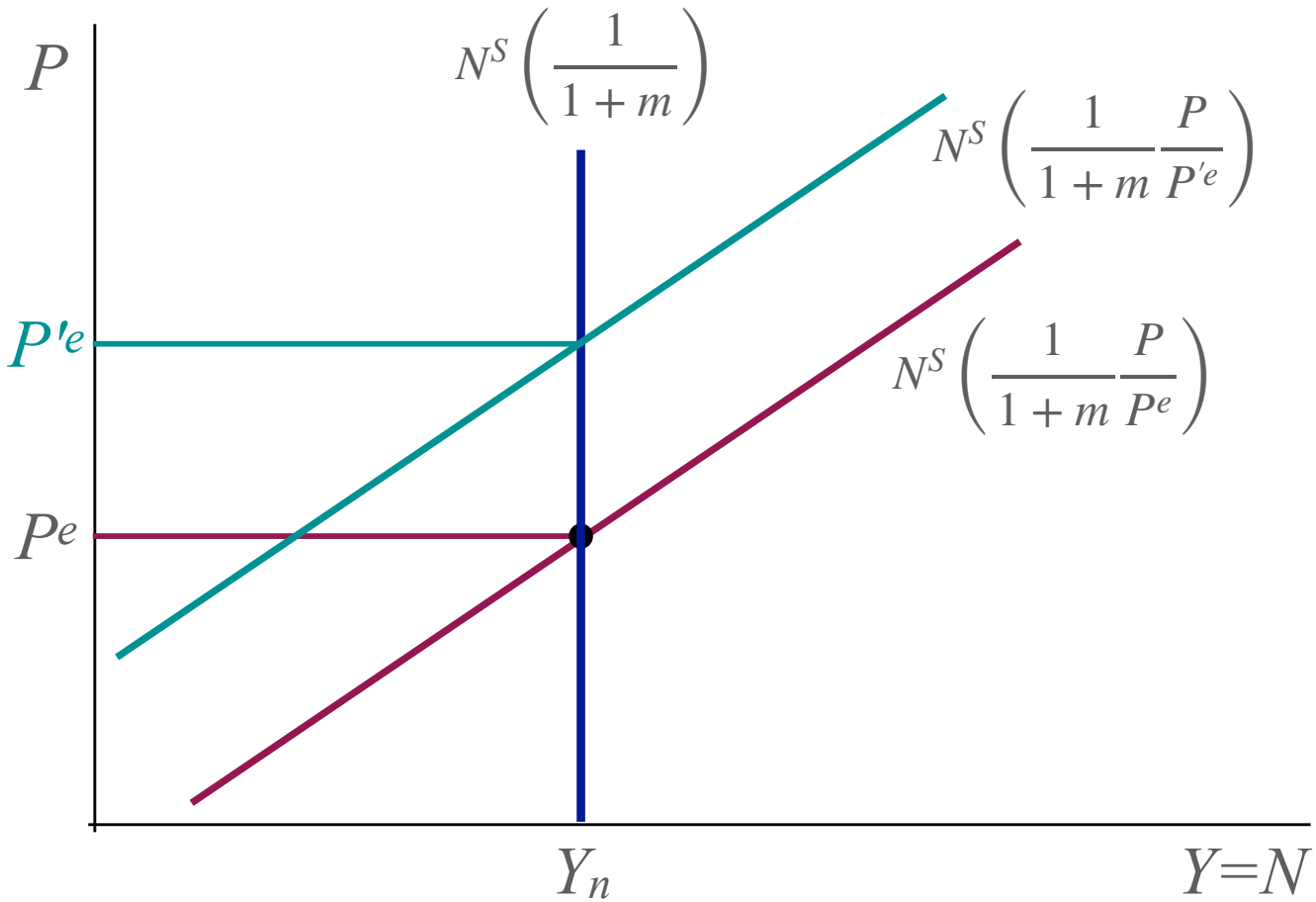
What affects "full employment?"

$$Y_n = N_n = F(\underbrace{\frac{P}{P^e}}_{=1} \frac{1}{1+m}, z) \tag{31}$$

From the equation:

- F
- m
- z

Long-run Supply Curve



If price expectations eventually catch up with prices $(P^e = P)$, we get $Y_n = F\left(\frac{1}{1+m}, z\right)$.

The price level does not matter for employment / output.

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.