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).

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:

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

or

$$wL = (1-\alpha)Y \tag{4}$$

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...

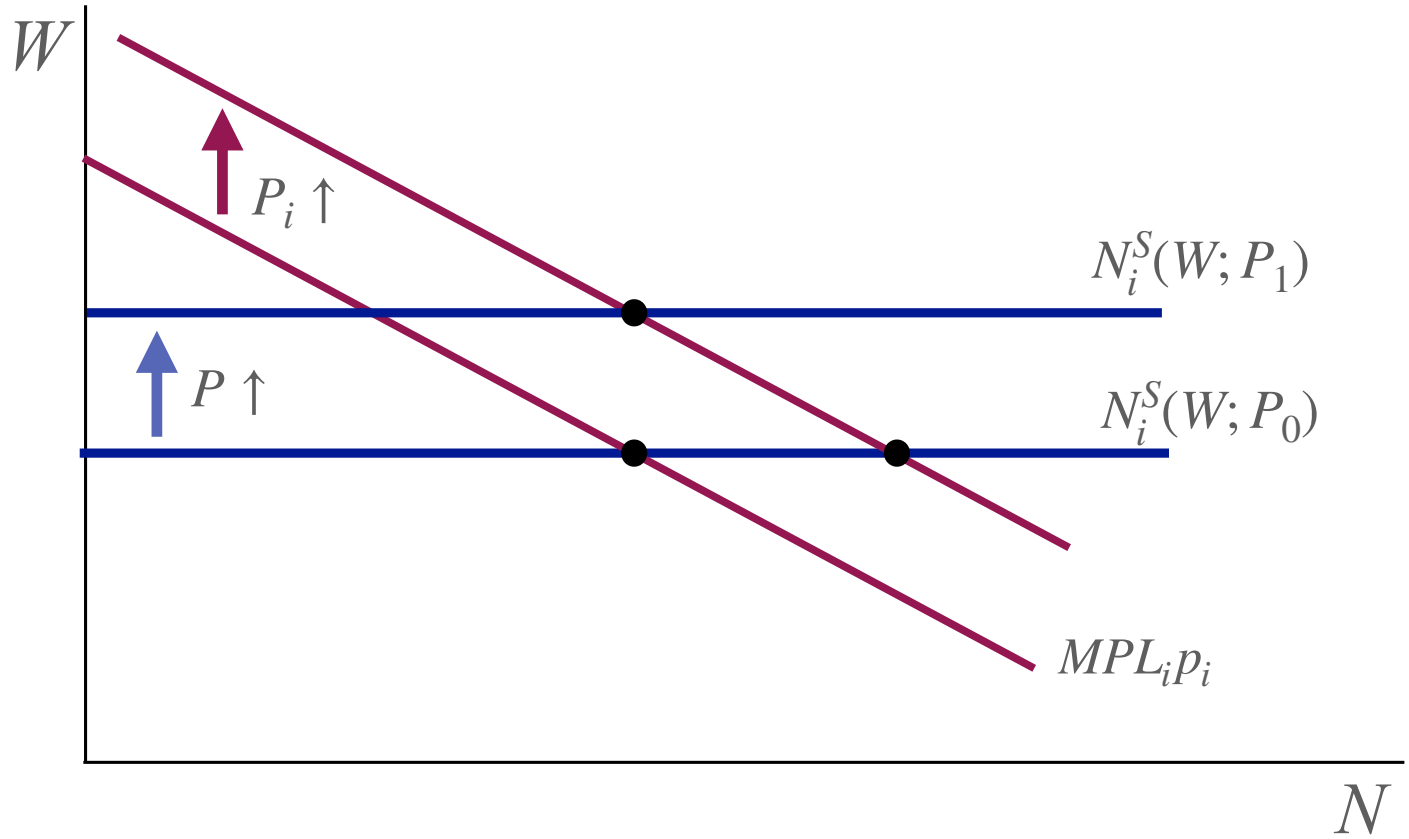
For a single firm i:

- $w/p_i = MPL_i$ 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).

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

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

subject to the lifetime budget constraint

$$\underbrace{\sum_{t} c_t}_{\text{p.v. of consumption}} = \underbrace{\sum_{t} (w_t/p_t)\, l_t}_{\text{p.v. of income}} \tag{6}$$

assuming no discounting (zero real interest rate)

Labor Supply Model

Lagrangian

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

First order condition for consumption:

$$u'(c_t) = \lambda \tag{8}$$

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:

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

Transitory wage increase:

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

Labor Supply Model

Permanent wage increase:

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

- 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

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

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

Labor Market Equilibrium

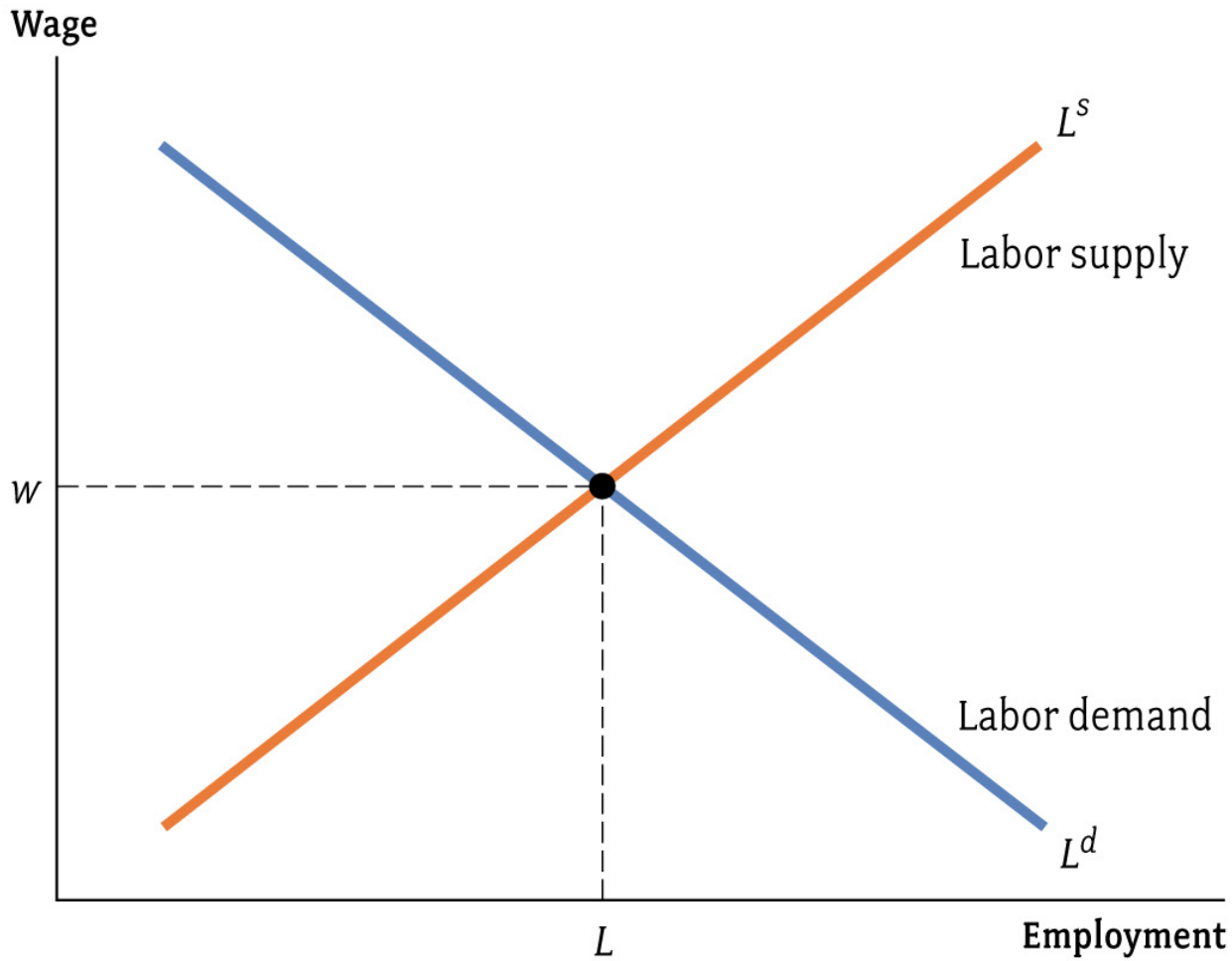


FIGURE 7.3 The Labor Market

Macroeconomics, Charles I. Jones
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Change in labor demand

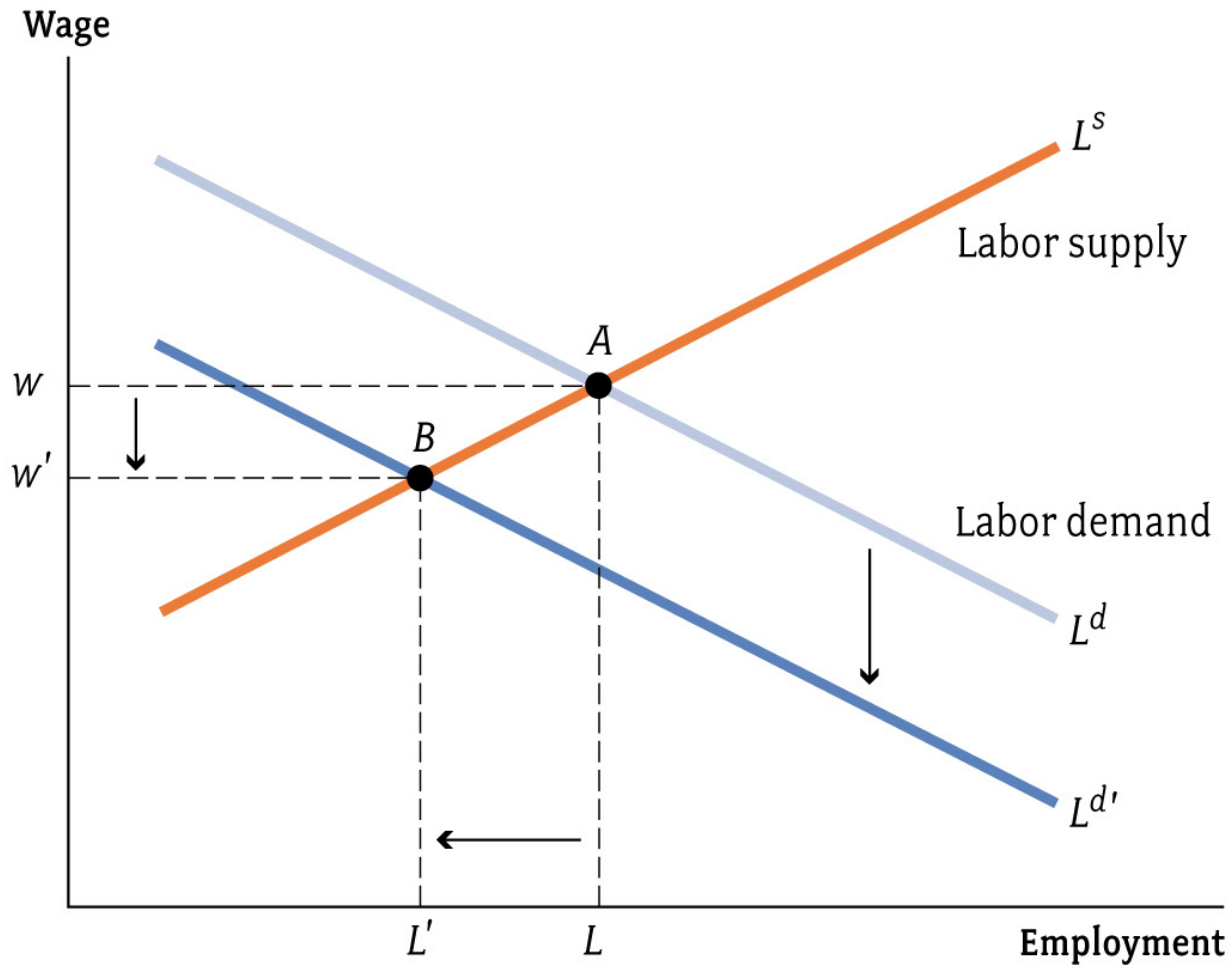


FIGURE 7.5 A Reduction in Labor Demand

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

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

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

$$W/P = (W/P^e)(P^e/P) \tag{12}$$
$$= w(P^e/P) \tag{13}$$
$$< w \tag{14}$$

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:

$$N^s = \hat{F}\left(W/P^e, z\right) \tag{15}$$

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

$$P = (1+m)W \tag{16}$$

Labor demand is perfectly elastic at real wage

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

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.

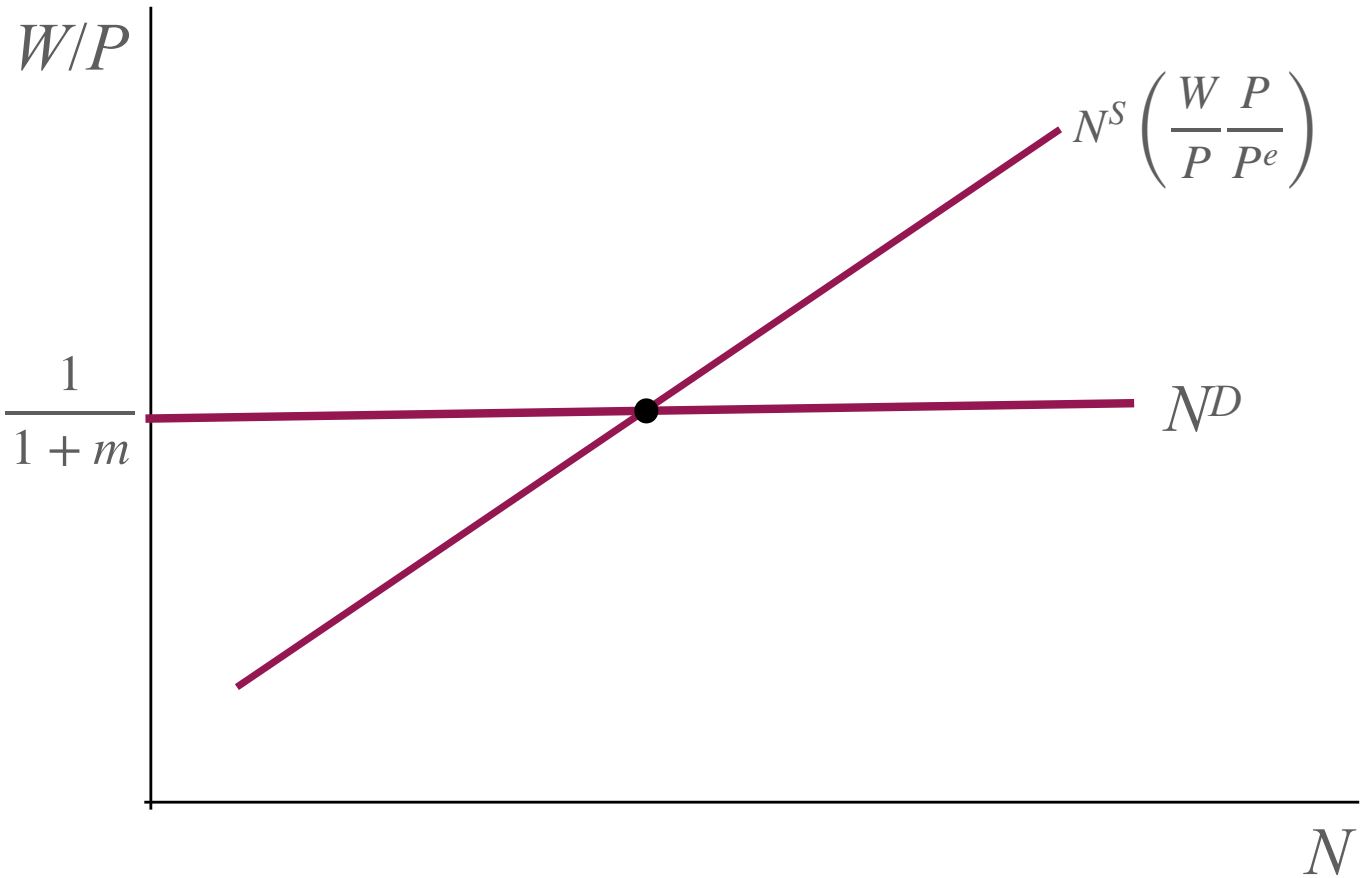
$$N = \hat{F}(W/P^e, z) \tag{18}$$

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

$$= \hat{F}(\underbrace{\frac{P}{P^e}}_{\text{mistake}}, \underbrace{\frac{1}{1+m}}_{\text{real wage}}, z) \tag{20}$$

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

Labor Market Clearing



Model Summary

Production function

$$Y = N \tag{21}$$

Labor demand:

$$W/P = 1/(1+m) \tag{22}$$

Labor supply:

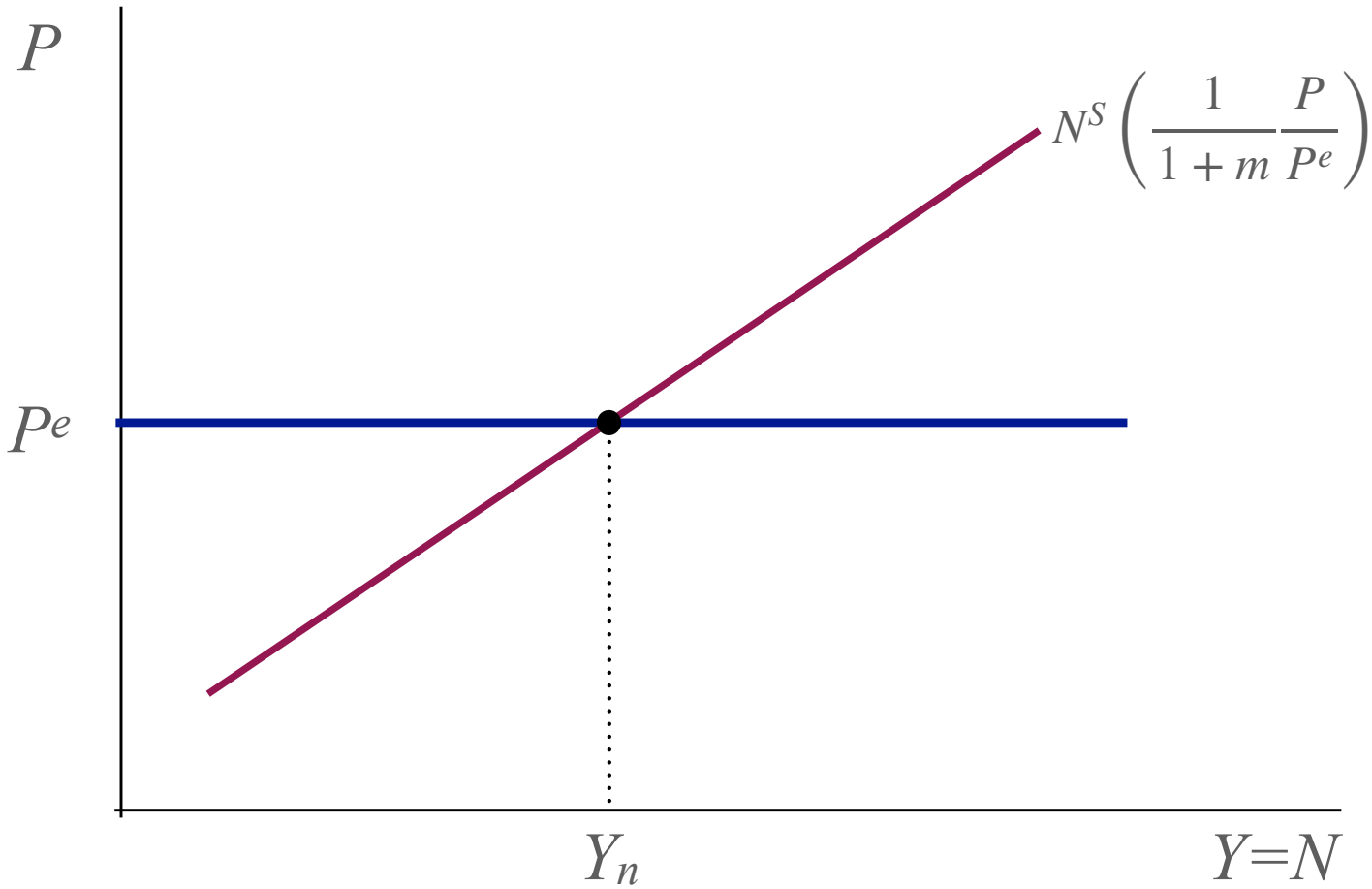
$$N^S = \hat{F}(W/P^e, z) \tag{23}$$

Labor market clearing:

$$Y = N = \hat{F}(W/P^e, z) \tag{24}$$

$$= \hat{F}\left(\frac{P}{P^e}\frac{1}{1+m}, z\right) \tag{25}$$

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:

$$Y_n = N_n = F\left(1/\left(1+m\right), z\right) \tag{26}$$

This is the medium-run outcome.

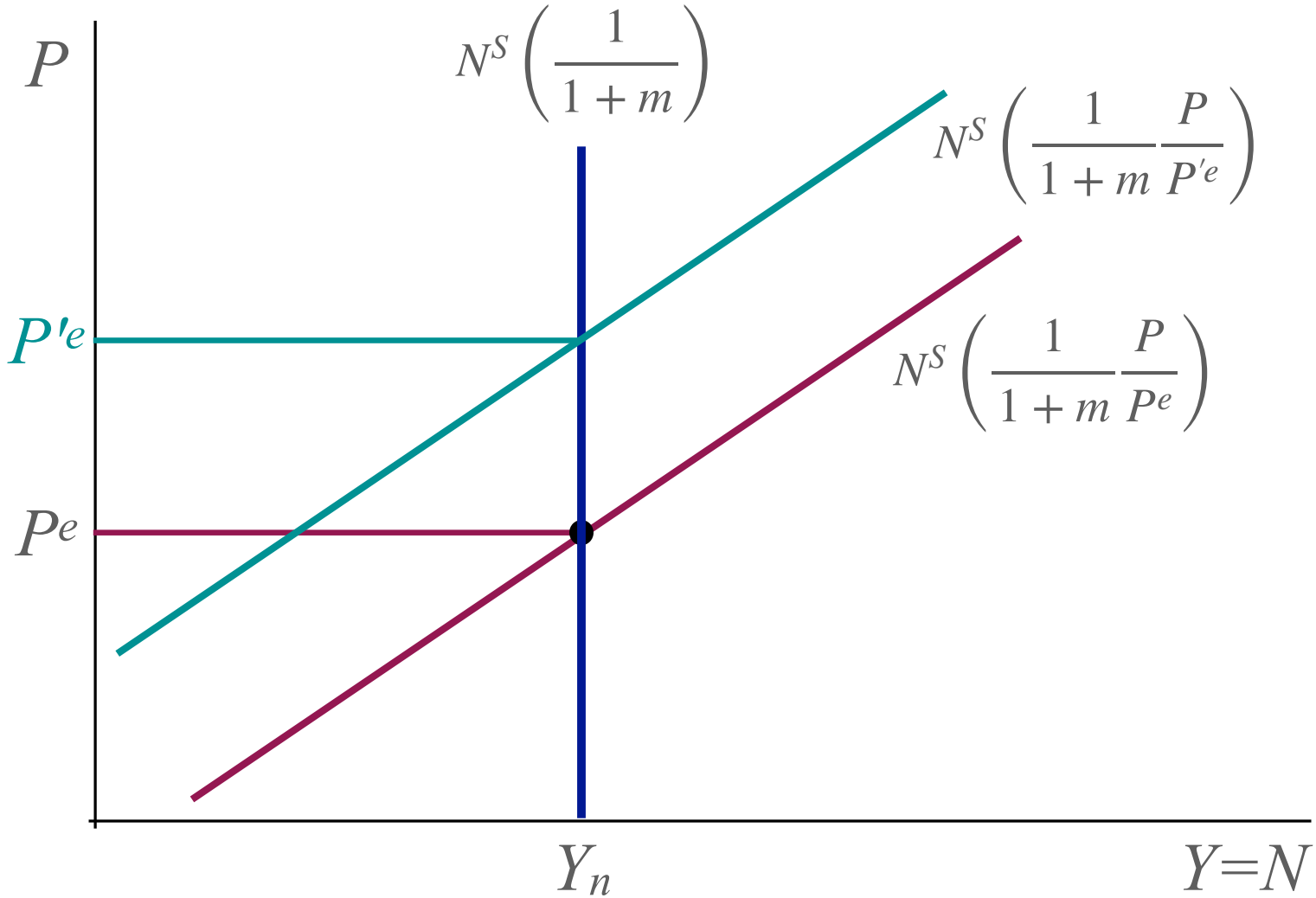
- The medium-run supply curve is **vertical.**
- The price level does not matter.

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.