MACROECONOMICS

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PowerPoint® Slides by Ron Cronovich

SEVENTH EDITION

CHAPTER 13

Aggregate Supply and the Short-run Tradeoff Between Inflation and Unemployment

In this chapter, you will learn:

- two models of aggregate supply in which output depends positively on the price level in the short run
- about the short-run tradeoff between inflation and unemployment known as the Phillips curve

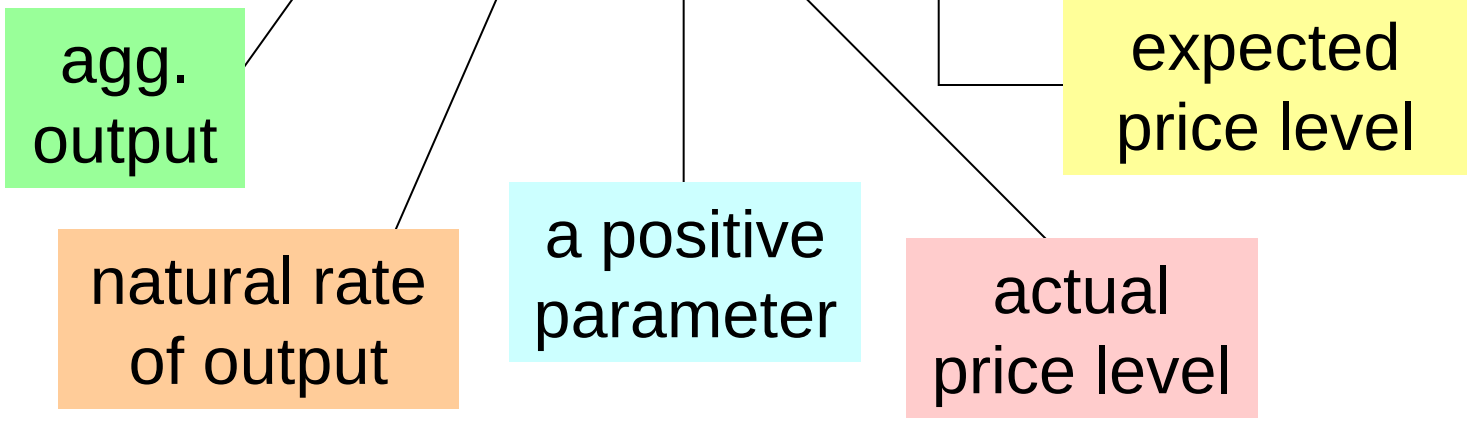
Introduction

- In previous chapters, we assumed the price level ***P*** was "stuck" in the short run.
  - This implies a horizontal SRAS curve.
- Now, we consider two prominent models of aggregate supply in the short run:
  - Sticky-price model
  - Imperfect-information model

Introduction

- Both models imply:

$$Y = \bar{Y} + \alpha(P - EP)$$



- Other things equal, ***Y*** and ***P*** are positively related, so the SRAS curve is upward-sloping.

The sticky-price model

- Reasons for sticky prices:
  - long-term contracts between firms and customers
  - menu costs
  - firms not wishing to annoy customers with frequent price changes
- Assumption:
  - Firms set their own prices (*e.g.*, as in monopolistic competition).

The sticky-price model

- An individual firm's desired price is:

$$p = P + a(Y - \bar{Y})$$

where $a > 0$.

Suppose two types of firms:

- firms with flexible prices, set prices as above
- firms with sticky prices, must set their price before they know how P and Y will turn out:

$$p = EP + a(EY - E\bar{Y})$$

The sticky-price model

$$p = EP + a(EY - E\bar{Y})$$

- Assume sticky price firms expect that output will equal its natural rate. Then,

$$p = EP$$

- To derive the aggregate supply curve, first find an expression for the overall price level.
- s = fraction of firms with sticky prices. Then, we can write the overall price level as…

The sticky-price model

$$P = s[EP] + (1-s)[P + a(Y - \bar{Y})]$$

price set by sticky price firms

price set by flexible price firms

- Subtract $(1-s)P$ from both sides:

$$sP = s[EP] + (1-s)[a(Y - \bar{Y})]$$

- Divide both sides by s:

$$P = EP + \frac{(1-s)a}{s}(Y - \bar{Y})$$

The sticky-price model

$$P = EP + \frac{(1-s)a}{s}(Y - \bar{Y})$$

- High $EP \Rightarrow$ High P
  If firms expect high prices, then firms that must set prices in advance will set them high.
  Other firms respond by setting high prices.
- High $Y \Rightarrow$ High P
  When income is high, the demand for goods is high.
  Firms with flexible prices set high prices.
  The greater the fraction of flexible price firms, the smaller is s and the bigger is the effect of ΔY on P.

The sticky-price model

$$P = EP + \frac{(1-s)a}{s}(Y - \bar{Y})$$

- Finally, derive *AS* equation by solving for Y:

$$Y = \bar{Y} + \alpha(P - EP),$$

where $\alpha = \frac{s}{(1-s)a} > 0$

The imperfect-information model

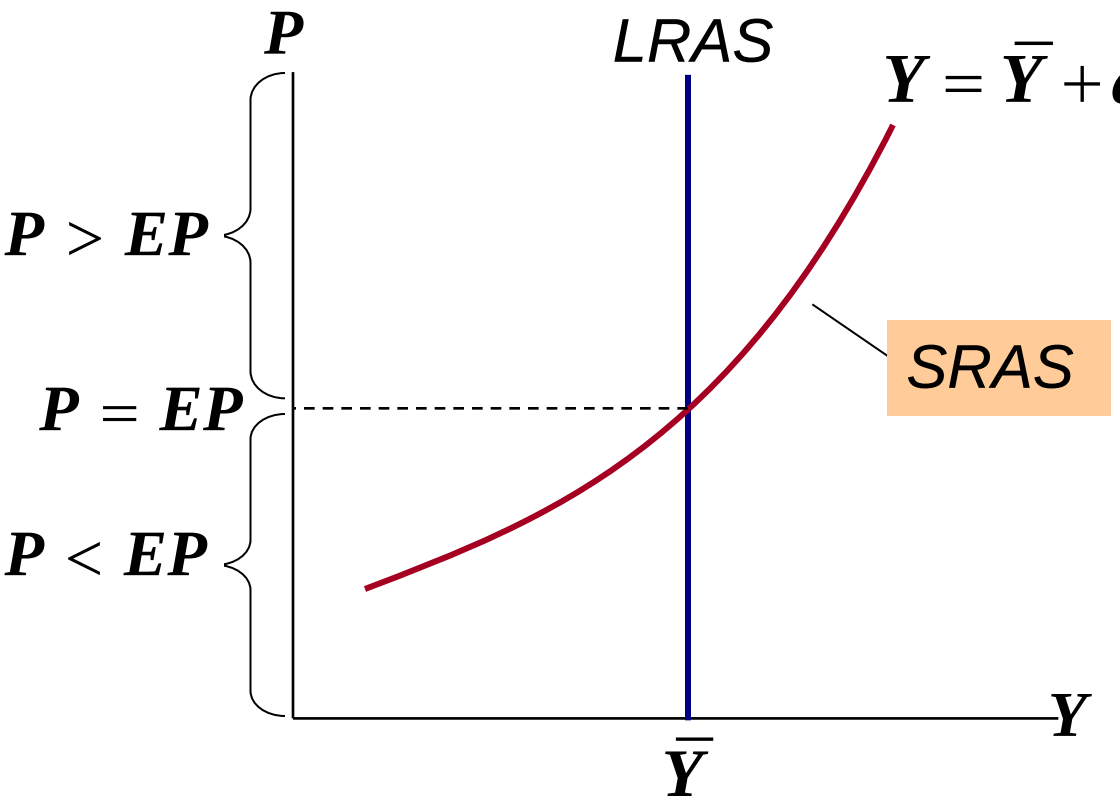
Assumptions:

- All wages and prices are perfectly flexible, all markets are clear.
- Each supplier produces one good, consumes many goods.
- Each supplier knows the nominal price of the good she produces, but does not know the overall price level.

The imperfect-information model

- Supply of each good depends on its relative price: the nominal price of the good divided by the overall price level.
- Supplier does not know price level at the time she makes her production decision, so uses $\boldsymbol{EP}$.
- Suppose $\boldsymbol{P}$ rises but $\boldsymbol{EP}$ does not.
  - Supplier thinks her relative price has risen, so she produces more.
  - With many producers thinking this way, $\boldsymbol{Y}$ will rise whenever $\boldsymbol{P}$ rises above $\boldsymbol{EP}$.

Summary & implications



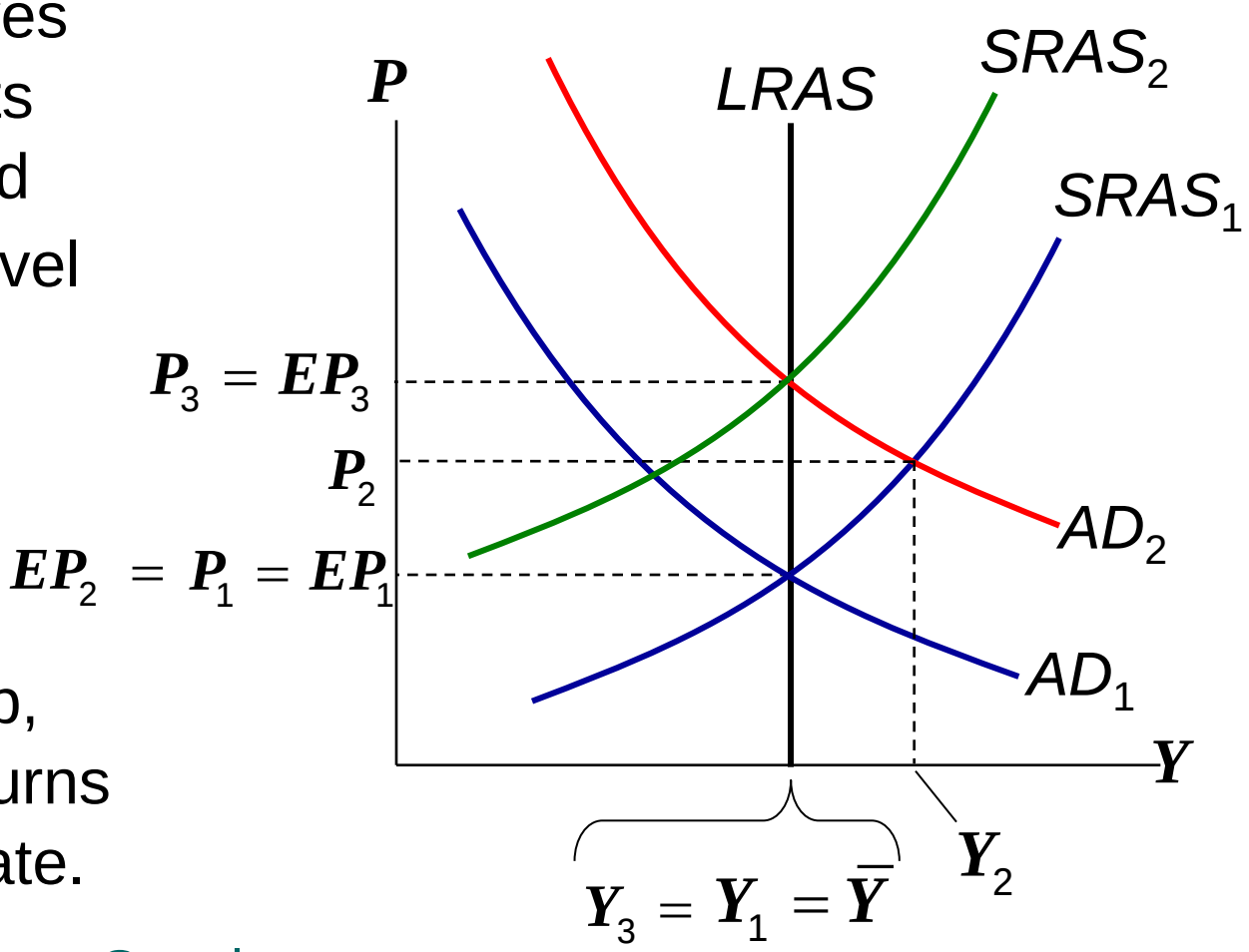
Both models of agg. supply imply the relationship summarized by the *SRAS* curve & equation.

Summary & implications

Suppose a positive *AD* shock moves output above its natural rate and P above the level people had expected.

Over time, EP rises, *SRAS* shifts up, and output returns to its natural rate.

SRAS equation: $Y = \bar{Y} + \alpha(P - EP)$



Inflation, Unemployment, and the Phillips Curve

The **Phillips curve** states that π depends on

- expected inflation, $E\pi$
- **cyclical unemployment**: the deviation of the actual rate of unemployment from the natural rate
- supply shocks, ν (Greek letter "nu").

$$\pi = E\pi - \beta(u - u^n) + \nu$$

where $\beta > 0$ is an exogenous constant.

Deriving the Phillips Curve from SRAS

(1) $Y = \bar{Y} + \alpha(P - EP)$

(2) $P = EP + (1/\alpha)(Y - \bar{Y})$

(3) $P = EP + (1/\alpha)(Y - \bar{Y}) + v$

(4) $(P - P_{-1}) = (EP - P_{-1}) + (1/\alpha)(Y - \bar{Y}) + v$

(5) $\pi = E\pi + (1/\alpha)(Y - \bar{Y}) + v$

(6) $(1/\alpha)(Y - \bar{Y}) = -\beta(u - u^n)$

(7) $\pi = E\pi - \beta(u - u^n) + v$

Comparing *SRAS* and the Phillips Curve

SRAS: $Y = \bar{Y} + \alpha(P - EP)$

Phillips curve: $\pi = E\pi - \beta(u - u^n) + \nu$

- *SRAS* curve:
  Output is related to
  unexpected movements in the price level.
- Phillips curve:
  Unemployment is related to
  unexpected movements in the inflation rate.

Adaptive expectations

- **Adaptive expectations**: an approach that assumes people form their expectations of future inflation based on recently observed inflation.
- A simple version:
  Expected inflation = last year's actual inflation

$$E\pi = \pi_{-1}$$

- Then, P.C. becomes

$$\pi = \pi_{-1} - \beta(u - u^n) + \nu$$

Inflation inertia

$$\pi = \pi_{-1} - \beta(u - u^n) + \nu$$

In this form, the Phillips curve implies that inflation has inertia:

- In the absence of supply shocks or cyclical unemployment, inflation will continue indefinitely at its current rate.
- Past inflation influences expectations of current inflation, which in turn influences the wages & prices that people set.

Two causes of rising & falling inflation

$$\pi = \pi_{-1} - \beta(u - u^n) + \nu$$

- **cost-push inflation**:
  inflation resulting from supply shocks

  Adverse supply shocks typically raise production costs and induce firms to raise prices, "pushing" inflation up.

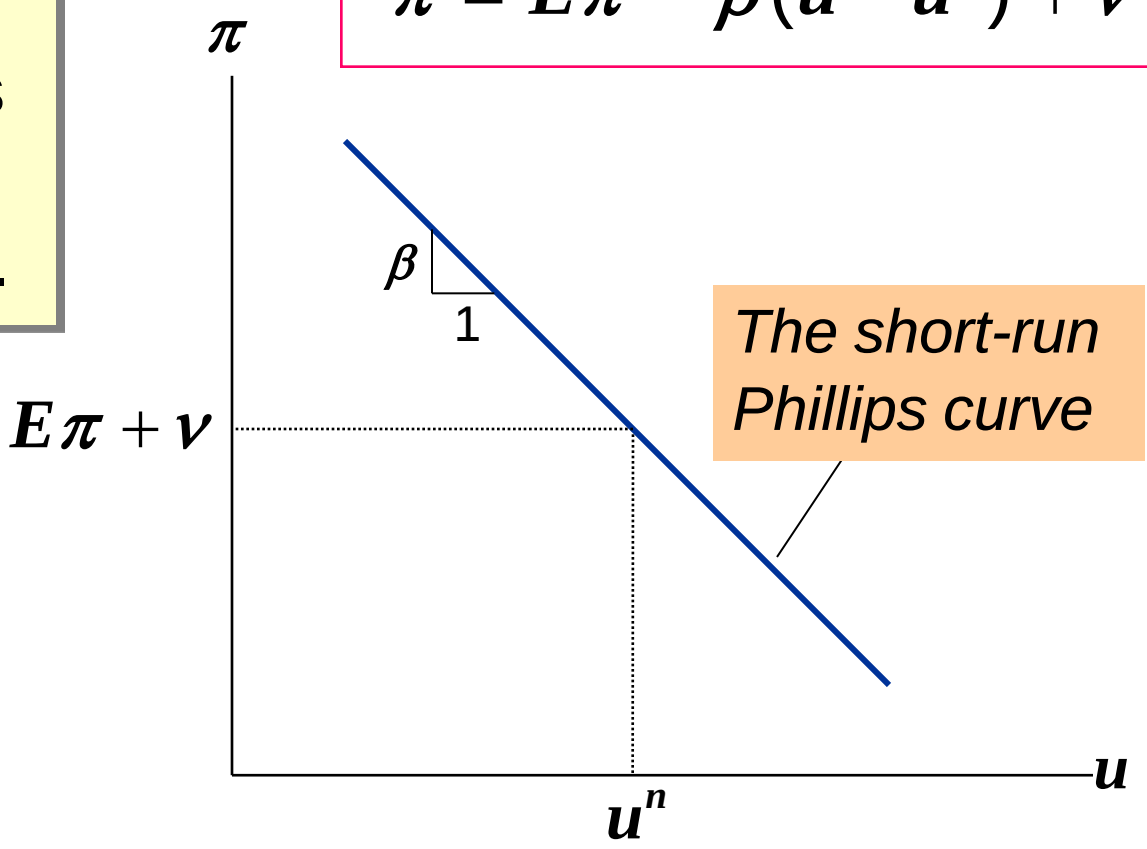
- **demand-pull inflation**:
  inflation resulting from demand shocks

  Positive shocks to aggregate demand cause unemployment to fall below its natural rate, which "pulls" the inflation rate up.

Graphing the Phillips curve

In the short run, policymakers face a tradeoff between π and u.

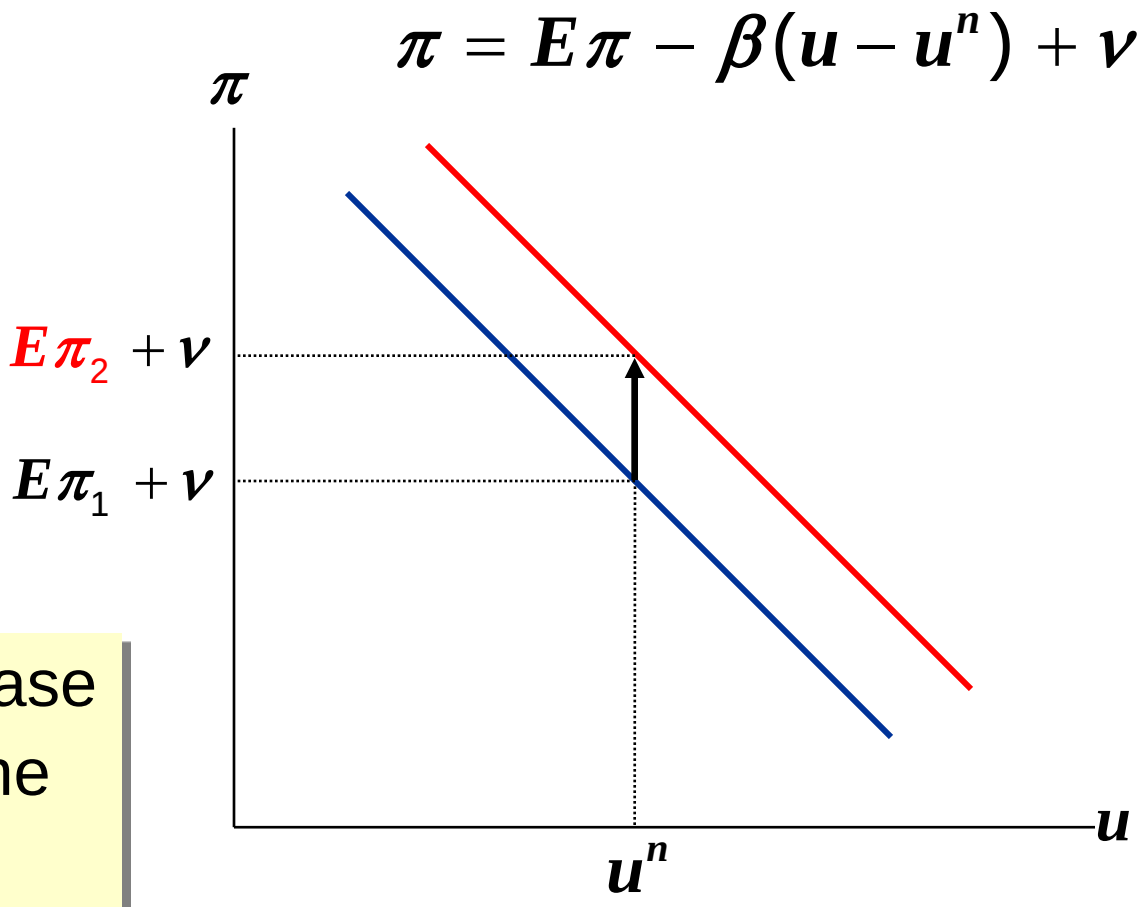
$$\pi = E\pi - \beta(u - u^n) + \nu$$



Shifting the Phillips curve

People adjust their expectations over time, so the tradeoff only holds in the short run.

E.g., an increase in $E\pi$ shifts the short-run P.C. upward.



The sacrifice ratio

- To reduce inflation, policymakers can contract agg. demand, causing unemployment to rise above the natural rate.
- The **sacrifice ratio** measures the percentage of a year's real GDP that must be foregone to reduce inflation by 1 percentage point.
- A typical estimate of the ratio is 5.

The sacrifice ratio

- Example: To reduce inflation from 6 to 2 percent, must sacrifice 20 percent of one year's GDP:

  GDP loss = (inflation reduction) x (sacrifice ratio)
  = 4 x 5

- This loss could be incurred in one year or spread over several, *e.g.*, 5% loss for each of four years.

- The cost of disinflation is lost GDP.
  One could use Okun's law to translate this cost into unemployment.

Rational expectations

Ways of modeling the formation of expectations:

- **adaptive expectations**:
  People base their expectations of future inflation on recently observed inflation.
- **rational expectations**:
  People base their expectations on all available information, including information about current and prospective future policies.

Painless disinflation?

- Proponents of rational expectations believe that the sacrifice ratio may be very small:
- Suppose $u = u^n$ and $\pi = E\pi = 6\%$,

  and suppose the Fed announces that it will do whatever is necessary to reduce inflation from 6 to 2 percent as soon as possible.
- If the announcement is credible, then $E\pi$ will fall, perhaps by the full 4 points.
- Then, π can fall without an increase in u.

Calculating the sacrifice ratio for the Volcker disinflation

- 1981: $\pi = 9.7\%$
  1985: $\pi = 3.0\%$

  } Total disinflation = 6.7%

year	u	u^n	$u - u^n$
1982	9.5%	6.0%	3.5%
1983	9.5	6.0	3.5
1984	7.4	6.0	1.4
1985	7.1	6.0	1.1
		Total	9.5%

Calculating the sacrifice ratio for the Volcker disinflation

- From previous slide: Inflation fell by 6.7%, total cyclical unemployment was 9.5%.
- Okun's law:
  1% of unemployment = 2% of lost output.
- So, 9.5% cyclical unemployment
  = 19.0% of a year's real GDP.
- **Sacrifice ratio** = (lost GDP)/(total disinflation)
  = 19/6.7 = 2.8 percentage points of GDP were lost for each 1 percentage point reduction in inflation.

Chapter Summary

1. Two models of aggregate supply in the short run:
   - sticky-price model
   - imperfect-information model

   Both models imply that output rises above its natural rate when the price level rises above the expected price level.

Chapter Summary

2. Phillips curve
   - derived from the SRAS curve
   - states that inflation depends on
     - expected inflation
     - cyclical unemployment
     - supply shocks
   - presents policymakers with a short-run tradeoff between inflation and unemployment

Chapter Summary

3. How people form expectations of inflation
   - adaptive expectations
     - based on recently observed inflation
     - implies “inertia”
   - rational expectations
     - based on all available information
     - implies that disinflation may be painless