Chapter 14
8th and 9th edition
Aggregate Supply and the Short-run Tradeoff Between Inflation and Unemployment

We cover...

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

More realistic SRAS

- LRAS: All wages and prices flexible
- SRAS: Some wages and prices flexible
- VSRAS: Some wages and prices fixed

In between the two extreme assumptions we considered before.
Three models of aggregate supply - 2 models presented in the book
1. The sticky-price model
2. The imperfect-information model
3. The sticky-wage model (not in the book)

All three models imply:

\[
Y = \bar{Y} + \alpha (P - P^e)
\]

How the equation works

\(\bar{Y}\) is full employment output from chapter 3 assuming perfect competition and flexible wages and prices.

The sticky-wage model (not in the book) but conveys a lesson.

- Assumes that firms and workers negotiate contracts and fix the nominal wage before they know what the price level will turn out to be.
- The nominal wage, \(W\), they set is based on a target real wage and the expected price level:

\[
W = \frac{\bar{W}}{P^e}
\]
The sticky-wage model

If it turns out that

\[ P = P^e \]

then

- Unemployment and output are at their natural rates.
- Actual real wage is less than the target, firms hire more workers and output rises above its natural rate.
- Actual real wage exceeds its target, so firms hire fewer workers and output falls below its natural rate.

The sticky-wage model

- Implies that the real wage should be *counter-cyclical*, should move in the opposite direction as output during business cycles:
  - In booms, when \( P \) typically rises, real wage should fall.
  - In recessions, when \( P \) typically falls, real wage should rise.
- This prediction does not come true in the real world – which is why Mankiw dropped the theory from the book.

The cyclical behavior of the real wage.

The real wage is *pro-cyclical*
The imperfect-information model

Assumptions:

- All wages and prices are perfectly flexible, all markets are clear. (drops the assumption of imperfect competition)
- Each supplier produces one good and consumes a lot of others.
- Each supplier knows the nominal price of her own good, but not all of the other goods - 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 doesn’t know price level at the time she makes her production decision, so uses the expected price level, $P^e$.

Suppose $P$ rises but $P^e$ does not. Then supplier thinks her relative price has risen, so she produces more. With many producers thinking this way, $Y$ will rise whenever $P$ rises above $P^e$.

The imperfect-information model, also called the Misperceptions Theory

Q: What is the best time for an individual producer to increase production?

A: When there has been an increase in demand for her specific product

In that case, price of the good she produces rises relative to the goods that she consumes

Producer will want to “make hay while the sun shines” and take advantage of relative increase in demand

Q: What will be the effect of an increase in aggregate demand (say, from higher $M$)?

A: All prices will rise

But individual producers will not be able to distinguish this increase from a shift in specific demand

So individual producers will increase production somewhat, at least temporarily
The sticky-price model:

- Reasons for sticky prices and wages:
  - Not all wages and prices are flexible
  - Long-term contracts between firms and customers
  - Menu costs
  - Firms not wishing to annoy customers with frequent price changes

Summary and implications

\[ Y = \bar{Y} + \alpha(P - P^*) \]
\[ Y - \bar{Y} = \alpha(P - P^*) \]

\( \bar{Y} \) is full employment output from chapter 3 assuming perfect competition and flexible wages and prices.

What shifts the curves?

- Change in \( P^* \)
- \( P^* = P \Rightarrow Y = \bar{Y} \)
- \( P^* > P \Rightarrow Y < \bar{Y} \)
  - This increase in \( P^* \) shifts the SRAS curve upward to the left
- \( P^* < P \Rightarrow Y > \bar{Y} \)
  - This decrease in \( P^* \) shifts the SRAS curve downward to the right
Increase in potential GDP $\bar{Y}$

- The LRAS curve shifts rightward and the SRAS curve shifts along with the LAS curve.
- Suppose $\bar{Y} = $16 trillion and increases to $17$ trillion.

Summary & implications

Suppose a positive AD shock moves output above its natural rate (to $Y_2$) and $P$ rises to $P_2$, above the level people had expected.

As the price level rises, over time $P_e$ rises.

The SRAS shifts up, and output returns to its natural rate.

Imperfect Information - Misperceptions Theory and the Non-neutrality of Money

- Monetary policy and the misperceptions theory
  - Because of misperceptions, unanticipated monetary policy has real effects; but anticipated monetary policy has no real effects because there are no misperceptions
  - The previous slide showed the effect of an unanticipated demand shock. For example, and unanticipated change in the money supply.
The Misperceptions Theory and the Nonneutrality of Money

- Anticipated changes in the money supply
  - If people anticipate the change in the money supply and thus in the price level, they aren't fooled, there are no misperception, and the SRAS curve shifts immediately to its higher level
  - So anticipated monetary is neutral in both the short run and the long run

An anticipated increase in the money supply – go directly from P1 to P3 - directly from point E to H.

Inflation, Unemployment, and the Phillips Curve
Unemployment and Inflation: Is There a Trade-off?

- Some economists think there is a trade-off between inflation and unemployment.
- In the 1960s such a trade-off existed. This suggested that policymakers could choose the combination of unemployment and inflation they most desired.
- But the relationship fell apart in the following three decades.
- The 1970s were a particularly bad period, with both high inflation and high unemployment, inconsistent with the Phillips curve.
Supply-Side Inflation

- Inflation 1970 – 1983
  - Adverse supply shocks
    - Crop failures 1972-1973
  - Costs increase, prices rise, output falls, unemployment increases

Supply-side Inflation

- 1996-1998, favorable supply shocks
  - Lower oil prices, advances in technology
  - Both aggregate demand and supply increase
  - But aggregate supply shifted more
  - Rapid growth, lower unemployment, and lower inflation

Favorable Supply Shock

Inflation and unemployment in the United States, 1970-2005
What the Phillips Curve Is and Is Not

- Is a statistical relationship between inflation and unemployment
- Holds if business cycle fluctuations arise mainly from demand with AS stable
- If AS shifts, the Phillips curve shifts
- During 1970s, 1980s, AS was not stable.

The Phillips Curve is Not Stable

- Self-correcting mechanism shifts the AS curve
- Refers to the way money wages respond to recessionary or expansionary gaps
- Wage changes shift the aggregate supply curve
- Effecting equilibrium real GDP and the price level
- The Phillips curve shifts

The Elimination of a Recessionary Gap: As the AS curve shifts down the Phillips curve shifts down
The Vertical Long-Run Phillips Curve

Augmented Phillips Curve Theory

States that $\pi$ depends on:
- expected inflation, $\pi^e$
- cyclical unemployment: the deviation of the actual rate of unemployment from the natural rate
- supply shocks, $\nu$ (Greek letter “nu”).

$$\pi = \pi^e - \beta(u - u^*) + \nu$$

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

The Phillips Curve formula is derived from the SRAS

1. $Y = \bar{Y} + \alpha(P - P^e)$
2. $P = P^e + (1/\alpha)(Y - \bar{Y})$
3. $P = P^e + (1/\alpha)(Y - \bar{Y}) + \nu$
4. $(P - P_1) = (P^e - P_1) + (1/\alpha)(Y - \bar{Y}) + \nu$
5. $\pi = \pi^e + (1/\alpha)(Y - \bar{Y}) + \nu$
6. $(1/\alpha)(Y - \bar{Y}) = -\beta(u - u^*)$ From Okun’s Law
7. $\pi = \pi^e - \beta(u - u^*) + \nu$
The Phillips Curve and SRAS

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

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

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

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

How are expectations about inflation formed? Adaptive expectations

- **Adaptive expectations:** an approach that assumes people form their expectations of future inflation based on recently observed inflation.

- **A simple example:**
  Expected inflation = last year’s actual inflation
  \( \pi^e = \pi_{-1} \)

- Then, the Phillips Curve 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: \( \pi = \pi_{-1} \)

- Past inflation influences expectations of current inflation, which in turn influences the wages & prices that people set.
Two causes of rising & falling inflation

\[ \pi = \pi_e - \beta(u - u^e) + \nu \]

- **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.

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Graphing the Phillips curve

In the short run, policymakers face a tradeoff between \( \pi \) and \( u \).

Here, the “short run” is the period until people adjust their expectations of inflation.

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Shifting the Phillips curve

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

E.g., an increase in \( \pi_e \) shifts the short-run Phillips Curve upward.
THE COST OF REDUCING INFLATION

• To reduce inflation, policy makers can contract aggregate demand, causing unemployment to rise above the natural level.
• The economy must endure a period of high unemployment and low output.
• When the Fed combats inflation, the economy moves down the short-run Phillips curve.
• The economy experiences lower inflation but at the cost of higher unemployment.

Example:
• Consider an economy in which inflation has been steady at 13 percent per year for several years.
• Assume firms and households form their expectations on the basis of past experience (adaptive or backward-looking expectations)
  • everyone will expect inflation for the coming year to be 13 percent.
    \[ u = u^*, \nu = 0; \Rightarrow \pi = \pi_{-1} = .13 \]
• Thus, labor negotiations will ensure a 13 percent rise in wages. Firms expect their input costs to rise by 13 percent so they will raise their prices by 13 percent as well.
• The Fed must be increasing the money supply 13 percent per year as well.

Example
• In this scenario, at full employment with 13% inflation.
• Now, suppose the Fed wishes to break this cost-price spiral and bring down the rate of inflation.
• The only way to induce firms to raise prices by less than 13 percent is to create a situation where they are unable to sell their output at currently planned prices.
Example:

- Similarly, the only way to induce workers to accept less than a 13 percent rise in their wages is to create excess supply in the labor market, so that competition for scarce jobs will lead to a slower rate of wage growth.

- **Create a recession!!!**

  - To create the recession, the Fed simply needs to cut the growth rate of the money supply below __ percent. Initially, with prices still rising at 13 percent, the demand for money will be rising faster than the supply of money causing the interest rate to rise and investment to fall.

  - The result is a decline in aggregate expenditure and a decline in output, together with a slowing down of wage and price increases.

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**The Volcker Disinflation**

- When Paul Volcker became Fed chairman in 1979, inflation was widely viewed as one of the nation’s foremost problems.

- Volcker succeeded in reducing inflation (from 10 percent to 4 percent), but at the cost of high employment (about 10 percent in 1983).
The Volcker Disinflation: 1979 - 1987

Unemployment Rate (percent)

Inflation Rate (percent per year)


The Greenspan Era


- In 1986, OPEC members abandoned their agreement to restrict supply.

- This led to falling inflation and falling 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. Expectations adjust quickly.
  - The trade-off between inflation and unemployment disappears quickly.

Painless disinflation?

- Proponents of rational expectations believe that the cost of reducing inflation may be very small:

- Suppose $u = u^f$ and $\pi = \pi^e = 6\%$, 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 $\pi^e$ will fall, perhaps by the full 4 points.

- Then, $\pi$ can fall without an increase in $u$. 
The natural rate hypothesis

The analysis of the costs of disinflation, and of economic fluctuations in the preceding chapters, is based on the **natural rate hypothesis**:

- Changes in aggregate demand affect output and employment only in the short run.
- In the long run, the economy returns to the levels of output, employment, and unemployment described by the classical model (Chap. 3).
- Allows economist to study SR and LR separately.

An alternative hypothesis: Hysteresis

Read the first or 5 pages of the Yellen Presentation

- **Hysteresis**: the long-lasting influence of history on variables such as the natural rate of unemployment.
- A recession (negative demand shock) may increase $u^*$, so economy may not fully recover.

Hysteresis: Why negative shocks may increase the natural rate

- The skills of cyclically unemployed workers may deteriorate while unemployed, and they may not find a job when the recession ends.
- Cyclically unemployed workers may lose their influence on wage-setting; then, insiders (employed workers) may bargain for higher wages for themselves.
  Result: The cyclically unemployed “outsiders” may become structurally unemployed when the recession ends.
Mankiw NYT Article 11/23/13

- "The most arresting piece of economic data is in the number of weeks the average unemployed person has been looking for work — statistics that have been compiled since 1948.

- Until recently, the largest such figure was 22 weeks, in the aftermath of the deep recession of 1981-82.

- In the most recent recession, however, the average reached about 41 weeks, and it still stands at more than 36 weeks (Oct 2014 at 32.7; Oct 2015 at 28.9). In other words, after more than four years of recovery, the economy still has an unprecedented number of long-term unemployed.

Mankiw NYT Article 11/23/13

- Some economists believe that long-term unemployment leaves permanent scars on the economy — a theory called hysteresis.

- One possible reason for hysteresis is that the long-term unemployed lose valuable job skills and, over time, become less committed to the labor market. In some ways, perhaps, they should be thought of as effectively out of the labor force.

- If this theory is right, the labor market today may have less slack than the unemployment rate and the employment-to-population ratio suggest. Policy makers at the Fed may have to accept that lower employment is the new normal. Higher unemployment is the new normal.
Chapter Summary

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

   All three 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
Chapter Summary

4. The natural rate hypothesis and hysteresis
   - the natural rate hypotheses
     - states that changes in aggregate demand can only affect output and employment in the short run
   - hysteresis
     - states that aggregate demand can have permanent effects on output and employment