In this chapter, look for the answers to these questions:

- How are inflation and unemployment related in the short run? In the long run?
- What factors alter this relationship?
- What is the short-run cost of reducing inflation?
- Why were U.S. inflation and unemployment both so low in the 1990s?

**Introduction**

- In the long run, inflation & unemployment are unrelated:
  - The inflation rate depends mainly on
  - Unemployment (the “natural rate”) depends on

- One of the Ten Principles:  
  *In the short run, society faces a trade-off between inflation and unemployment.*
The Phillips Curve

- **Phillips curve:**

1958: A.W. Phillips showed that nominal wage growth was negatively correlated with unemployment in the U.K.

1960: Paul Samuelson & Robert Solow found a negative correlation between U.S. inflation & unemployment, named it “the Phillips Curve.”

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Deriving the Phillips Curve

- Suppose $P = 100$ this year.
- The following graphs show two possible outcomes for next year:
  - A. Agg demand low, small increase in $P$ (i.e., low inflation), low output, high unemployment.
  - B. Agg demand high, big increase in $P$ (i.e., high inflation), high output, low unemployment.

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![Graphs showing the Phillips Curve](image)

A. Low agg demand, low inflation, high u-rate

B. High agg demand, high inflation, low u-rate
The Phillips Curve: A Policy Menu?

- Since fiscal and monetary policy affect aggregate demand, the PC appeared to offer policymakers a menu of choices:
  - Γ
  - Γ
  - anything in between
- 1960s: U.S. data supported the Phillips curve. Many believed the PC was stable and reliable.

Evidence for the Phillips Curve?

During the 1960s, U.S. policymakers opted for reducing unemployment at the expense of higher inflation.

The Vertical Long-Run Phillips Curve

- 1968: Milton Friedman and Edmund Phelps argued that
  - Natural-rate hypothesis: the claim that
  - Based on the classical dichotomy and the vertical LRAS curve
The Vertical Long-Run Phillips Curve

- In the long run, faster money growth only causes faster inflation.

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Reconciling Theory and Evidence

- **Evidence (from '60s):**
  - The Phillips Curve (PC) slopes downward.
- **Theory (Friedman and Phelps):**
  - In the long run, the Phillips Curve (PC) is vertical.
- **To bridge the gap between theory and evidence,**
  - Friedman and Phelps introduced the concept of **expected inflation** —

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The Phillips Curve Equation

- **Unemp. rate**
  - **Short run**
    - Fed can reduce the unemployment rate below the natural rate by...
  - **Long run**
    - Expectations catch up to reality.
How Expected Inflation Shifts the PC

Initially, expected & actual inflation = 3%, unemployment = natural rate (6%).

A numerical example

Natural rate of unemployment = 5%
Expected inflation = 2%
In PC equation, \( a = 0.5 \)

A. Plot the long-run Phillips curve.
B. Find the u-rate for each of these values of actual inflation: 0%, 6%. Sketch the short-run PC.
C. Suppose expected inflation rises to 4%. Repeat part B.
D. Instead, suppose the natural rate falls to 4%. Draw the new long-run Phillips curve, then repeat part B.

Answers
The Breakdown of the Phillips Curve

Inflation rate (% per year) vs. Unemployment rate (%)

Early 1970s: unemployment increased, despite higher inflation.

Friedman & Phelps’ explanation: expectations were catching up with reality.

Another PC Shifter: Supply Shocks

Supply shock:

Example: large increase in oil prices

How an Adverse Supply Shock Shifts the PC
The 1970s Oil Price Shocks

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil Price per Barrel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1973</td>
<td>$3.56</td>
</tr>
<tr>
<td>1/1974</td>
<td>10.11</td>
</tr>
<tr>
<td>1/1979</td>
<td>14.85</td>
</tr>
<tr>
<td>1/1980</td>
<td>32.50</td>
</tr>
<tr>
<td>1/1981</td>
<td>38.00</td>
</tr>
</tbody>
</table>

The Fed chose to accommodate the first shock in 1973 with faster money growth.

Result:

1979:
Oil prices surged again, worsening the Fed’s tradeoff.

The Cost of Reducing Inflation

**Disinflation:**

To reduce inflation,

**Short run:**

**Long run:**
The Short-Run Trade-Off

Disinflationary Monetary Policy

Contractionary monetary policy moves economy from A to B. Over time,

The Cost of Reducing Inflation

Disinflation requires enduring a period of

Sacrifice ratio:

Typical estimate of the sacrifice ratio: 5
- To reduce inflation rate 1%, must sacrifice
- Can spread cost over time, e.g.
  - To reduce inflation by 6%, can either
    - sacrifice
    - sacrifice

Rational Expectations, Costless Disinflation?

Rational expectations: a theory according to which

Early proponents:
- Robert Lucas, Thomas Sargent, Robert Barro

Implied that disinflation could be
Rational Expectations, Costless Disinflation?

Suppose the Fed convinces everyone it is committed to reducing inflation.

Then,

Result:

The Volcker Disinflation

Fed Chairman Paul Volcker

- Appointed in late 1979 under high inflation & unemployment
- Changed Fed policy to disinflation

1981-1984:

- Fiscal policy was expansionary, so Fed policy had to be very contractionary to reduce inflation.
- Success:

Disinflation turned out to be very costly

u-rate near 10% in 1982-83
The Greenspan Era

1986: Oil prices fell 50%.

1989-90:
Unemployment fell, inflation rose. Fed raised interest rates, caused a mild recession.

1990s:
Unemployment and inflation fell.

2001: Negative demand shocks created the first recession in a decade. Policymakers responded with expansionary monetary and fiscal policy.

Ben Bernanke’s challenges

Aggregate demand shocks:

Aggregate supply shocks:

Corn per bushel: $2.10 in 2005-06, $5.76 in 5/2008

Oil per barrel: $35 in 2/2004, $134 in 6/2008

From 6/2007 to 6/2008,

unemployment rose from 4.6% to 5.5%

CPI inflation rose from 2.6% to 4.9%
CONCLUSION

The theories in this chapter come from some of the greatest economists of the 20th century. They teach us that inflation and unemployment are affected by expectations, which play an important role in