Announcements

- Midterm 2 one week from today
- Materials for review posted on website tomorrow
  - Lecture guide
  - Practice Midterm
- Class on Tuesday: Review for Midterm
The Phillips Curve

- Until now, our treatment of unemployment has been loose; want to formalize this

- **Phillips curve**: shows the short-run trade-off between inflation and unemployment

- 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.”
Deriving the Phillips Curve

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 *Phillips Curve* appeared to offer policymakers a menu of choices:
  - low unemployment with high inflation
  - low inflation with high unemployment
  - anything in between

- 1960s: U.S. data supported the Phillips curve. Many believed the *Phillips Curve* 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.
1968: Milton Friedman and Edmund Phelps argued that the tradeoff was temporary.

**Natural-rate hypothesis**: the claim that unemployment eventually returns to its normal or “natural” rate, regardless of the inflation rate.

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.

- **LRAS**: Long-Run Aggregate Supply
- **AD**: Aggregate Demand
- **P**: Price Level
- **Y**: Output Level
- **u-rate**: Unemployment Rate

**Natural rate of output**

**Natural rate of unemployment**

**LRPC**: Long-Run Phillips Curve

- **P_2**: Higher Price Level
- **P_1**: Lower Price Level

High inflation

Low inflation
Reconciling Theory and Evidence

- Evidence (from ’60s): *Phillips Curve* slopes downward.

- Theory (Friedman and Phelps): *Phillips Curve* is vertical in the long run.

- To bridge the gap between theory and evidence, Friedman and Phelps introduced a new variable: *expected inflation* – a measure of how much people expect the price level to change.
The Phillips Curve Equation

\[
\text{Unemp. rate} = \text{Natural rate of unemp.} - a \left( \text{Actual inflation} - \text{Expected inflation} \right)
\]

**Short run**
Fed can reduce u-rate below the natural u-rate by making inflation greater than expected.

**Long run**
Expectations catch up to reality, u-rate goes back to natural u-rate whether inflation is high or low.
Historical Example: 1970s Oil Shock

- Fluctuations in oil prices in the 1970s had a huge effect on the economy

- Many economists believed that the Phillips Curve offered a clear way out of the recession:
  - Use monetary policy to increase aggregate demand
  - Reducing unemployment more important than increased inflation

- Provides an important lesson about the role of the Phillips Curve in policymaking
Oil Shock

- What happens to the economy if there is an increase in the price of oil?
- What happens to the Phillips Curve?
- What happens if the Fed responds with an increase in the money supply?
The 1970s Oil Price Shocks

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

Result:
Higher expected inflation, which further shifted $PC$.

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

<table>
<thead>
<tr>
<th>Oil price per barrel</th>
<th></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 Breakdown of the Phillips Curve

Inflation rate (% per year)

Early 1970s: unemployment increased, despite higher inflation.

Unemployment rate (%)
The 1970s Oil Price Shocks

Supply shocks & rising expected inflation worsened the PC tradeoff.
The Cost of Reducing Inflation

- **Disinflation**: a reduction in the inflation rate

- To reduce inflation, Fed must slow the rate of money growth, which reduces agg demand.

- Short run: Output falls and unemployment rises.

- Long run: Output & unemployment return to their natural rates.
Disinflationary Monetary Policy

Contractionary monetary policy moves economy from A to B.

Over time, expected inflation falls, $PC$ shifts downward.

In the long run, point C: the natural rate of unemployment, lower inflation.
The Cost of Reducing Inflation

- Disinflation requires enduring a period of high unemployment and low output.

- **Sacrifice ratio**: percentage points of annual output lost per 1 percentage point reduction in inflation

- Typical estimate of the sacrifice ratio: 5
  - To reduce inflation rate 1%, must sacrifice 5% of a year’s output.

- Can spread cost over time, e.g.
  - To reduce inflation by 6%, can either
    - sacrifice 30% of GDP for one year
    - sacrifice 10% of GDP for three years
The value of the sacrifice ratio is related to the slope of the SRAS curve.

If the SRAS curve is steep, then there can be a large reduction in prices for a small loss in output.
But, if the SRAS curve is flat you need a large loss in output to get a small drop in prices.
Sargent’s Paper: Four Big Inflations

- Looked at Hungary, Germany, Austria and Poland who had hyperinflations in the 1920s
- E.g., German mark went from 800 marks/dollar in Dec. 1922...
- .... to 4,210,500,000,000 in Nov. 1923
- If the sacrifice ratio is a constant, it would have been completely impossible to reduce inflation
- In fact, inflation stopped quickly and with little economic cost
Rational Expectations, Costless Disinflation?

- **Rational expectations**: a theory according to which people optimally use all the information they have, including info about government policies, when forecasting the future.

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

- Implied that disinflation could be much less costly...
Rational Expectations, Costless Disinflation?

- Suppose the Fed convinces everyone it is committed to reducing inflation.
- Then, expected inflation falls, the short-run $PC$ shifts downward.
- Result: Disinflations can cause less unemployment than the traditional sacrifice ratio predicts.
- Important point: People don’t have to observe lower inflation in order to change their beliefs.
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 tight to reduce inflation.
- Success: Inflation fell from 10% to 4%, but at the cost of high unemployment...
The Volcker Disinflation

Disinflation turned out not to be too costly

Inflation rate
(% per year)

0 2 4 6 8 10

Unemployment rate (%)

1979 80 81 82 83

1982-83

u-rate near 10% in 1982-83
Percentage Change in Real GDP

Real Gross Domestic Product, 1 Decimal (GDPC1)
Source: U.S. Department of Commerce: Bureau of Economic Analysis

Shaded areas indicate US recessions.
2012 research.stlouisfed.org
Real GDP

Real Gross Domestic Product, 1 Decimal (GDPC1)
Source: U.S. Department of Commerce: Bureau of Economic Analysis

Shaded areas indicate US recessions.
2012 research.stlouisfed.org
Implied Sacrifice Ratio

- GDP losses were about 3% for a 6% drop in inflation
- Implies a sacrifice ratio of about 0.5
  - Much lower than previously estimated
- This is led to the widespread acceptance of the rational expectations view
Conclusion

- The disinflation caused a recession
  - However, it was not nearly as bad as predicted
- Led to further acceptance of the rational expectations viewpoint by economists
- In 2013, Thomas Sargent (one of the developers of rational expectations) won the Nobel Prize