Lecture 12
The Phillips Curve

Principles of Macroeconomics
KOF, ETH Zurich, Prof. Dr. Jan-Egbert Sturm
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## General Information

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Q&A Session next week (december 16)

• Please send your questions to
  • moser@kof.ethz.ch

• Questions received before
  **Friday, december 12, 23:59**
  will be discussed during the Q&A session
Remember: Natural Rate of Unemployment

- The *natural rate of unemployment* is unemployment that does not go away on its own even in the long run.

- There are two reasons why there is a positive natural rate of unemployment:
  1. job search (frictional unemployment)
  2. wage rigidity (structural unemployment)
     - Minimum-wage laws
     - Unions
     - Efficiency wages
Remember: The Classical Dichotomy

• **The quantity equation:**
  \[ M \times V = P \times Y \]
  - relates the quantity of money \((M)\) to the nominal value of output \((P\times Y)\)

• The **quantity equation** shows that an increase in money must be reflected in one of three other variables:
  - The price level must rise,
  - the quantity of output must rise, or
  - the velocity of money must fall

• The velocity of money is considered to be (relatively) fixed

• The **classical dichotomy**
  - Real economic variables do not change with changes in the money
  - Hence, changes in the money supply only affect the price level
Remember: A Contraction in Aggregate Demand

1. A decrease in aggregate demand...

2. ... causes output to fall in the short run
Short-Run Trade-Off between Inflation and Unemployment

- Unemployment and Inflation

  - Society faces a short-run tradeoff between unemployment and inflation.
  - If policymakers expand aggregate demand, they can lower unemployment, but only at the cost of higher inflation.
  - If they contract aggregate demand, they can lower inflation, but at the cost of temporarily higher unemployment.
THE PHILLIPS CURVE

The *Phillips curve* shows the short-run trade-off between inflation and unemployment.
Aggregate Demand, Aggregate Supply, and the Phillips Curve

- The Phillips curve shows the short-run combinations of unemployment and inflation that arise as shifts in the aggregate demand curve move the economy along the short-run aggregate supply curve.
- The greater the aggregate demand for goods and services, the greater is the economy’s output, and the higher is the overall price level.
- A higher level of output results in a lower level of unemployment.
How the Phillips Curve is Related to Aggregate Demand and Aggregate Supply

(a) The Model of Aggregate Demand and Aggregate Supply

- Short-run aggregate supply
- High aggregate demand
- Low aggregate demand

(b) The Phillips Curve

- Phillips curve
- Low aggregate demand (output is 8,000, unemployment is 4%)
- High aggregate demand (output is 7,500, unemployment is 7%)
Okun’s Law states that a one-percent decrease in unemployment is associated with two percentage points of additional growth in real GDP.
Full-time equivalent employment vs. GDP

Source: BFS and KOF
SHIFTS IN THE PHILLIPS CURVE:

- The Phillips curve seems to offer policymakers a menu of possible inflation and unemployment outcomes.
The Long-Run Phillips Curve

• In the 1960s, Friedman and Phelps concluded that inflation and unemployment are unrelated in the long run.
  • As a result, the long-run Phillips curve is vertical at the natural rate of unemployment.
  • Monetary policy could be effective in the short run but not in the long run.
The Long-Run Phillips Curve

1. When the CB increases the growth rate of the money supply, the rate of inflation increases . . .

2. . . . but unemployment remains at its natural rate in the long run.
The Meaning of “Natural”

• The “natural” rate of unemployment is the rate to which the economy gravitates in the long run.
• The natural rate is not necessarily desirable, nor is it constant over time.
• Monetary policy cannot change the natural rate, but other government policies that strengthen labor markets can.
How the Phillips Curve is Related to Aggregate Demand and Aggregate Supply

(a) The Model of Aggregate Demand and Aggregate Supply

1. An increase in the money supply increases aggregate demand...
2. ...raises the price level...
3. ...and increases the inflation rate...
4. ...but leaves output and unemployment at their natural rates.

(b) The Phillips Curve

- Long-run aggregate supply
- Aggregate demand, AD
- Long-run Phillips curve

Price Level: $P_1$, $P_2$

Unemployment Rate

Inflation Rate: $P_1$, $P_2$
Question: How can classical macroeconomic theories predicting a vertical long run Phillips curve be reconciled with the evidence that, in the short run, there is a tradeoff between unemployment and inflation?
The Short-Run Phillips Curve

• Expected inflation measures how much people expect the overall price level to change.
• In the long run, expected inflation adjusts to changes in actual inflation.
• The CB’s ability to create unexpected inflation exists only in the short run.
  • Once people anticipate inflation, the only way to get unemployment below the natural rate is for actual inflation to be above the anticipated rate.
The Short-Run Phillips Curve

• This equation relates the unemployment rate to the natural rate of unemployment, actual inflation, and expected inflation.

The Unemployment Rate = 

Natural rate of unemployment - $\alpha(\text{Actual inflation} - \text{Expected inflation})$

SRAS: $Y = \bar{Y} + \alpha(P - P^e)$
The Phillips Curve in the 1960s (USA)
The Natural Experiment for the Natural-Rate Hypothesis

• The view that unemployment eventually returns to its natural rate, regardless of the rate of inflation, is called the *natural-rate hypothesis*.

• Historical observations support the natural-rate hypothesis.

• The concept of a stable Phillips curve broke down in the early ’70s.

• During the ’70s and ’80s, the economy experienced high inflation and high unemployment simultaneously. WHY??
The Breakdown of the Phillips Curve (USA)

Inflation Rate
(percentage per year)

Unemployment Rate (percentage)


0 1 2 3 4 5 6 7 8 9 10
How Expected Inflation Shifts the Short-Run Phillips Curve

1. Expansionary policy moves the economy up along the short-run Phillips curve . . .

2. . . . but in the long run, expected inflation rises, and the short-run Phillips curve shifts to the right.
SHIFTS IN THE PHILLIPS CURVE: THE ROLE OF SUPPLY SHOCKS

- Historical events have shown that the short-run Phillips curve can shift due to changes in expectations.

- The short-run Phillips curve also shifts because of shocks to aggregate supply.
  - Adverse changes in aggregate supply can worsen the short-run trade-off between unemployment and inflation.
  - An adverse supply shock gives policymakers a less favorable trade-off between inflation and unemployment.
SHIFTS IN THE PHILLIPS CURVE: THE ROLE OF SUPPLY SHOCKS

• A *supply shock* is an event that directly alters the firms’ costs, and, as a result, the prices they charge.

• This shifts the economy’s aggregate supply curve...

• . . . and as a result, the Phillips curve.
An Adverse Shock to Aggregate Supply

(a) The Model of Aggregate Demand and Aggregate Supply

1. An adverse shift in aggregate supply...

2. ...lowers output...

3. ...and raises the price level...

Aggregate supply, AS_1

Price Level

Inflation Rate

Quantity of Output

Unemployment Rate

(b) The Phillips Curve

4. ...giving policymakers a less favorable tradeoff between unemployment and inflation.

Phillips curve, PC_1
Two causes of rising & falling inflation

- **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.

- **cost-push inflation**: inflation resulting from supply shocks. Adverse supply shocks typically raise production costs and induce firms to raise prices, “pushing” inflation up.
World economic growth and oil

Quellen: IMF, BFS
Shifts in the Phillips Curve: The role of supply shocks

• In the 1970s, policymakers faced two choices when OPEC cut output and raised worldwide prices of petroleum.
  • Fight the unemployment battle by expanding aggregate demand and accelerate inflation.
  • Fight inflation by contracting aggregate demand and endure even higher unemployment.
The Supply Shocks of the 1970s
United States

Unemployment vs. Inflation

Year:
- 1973
- 1974
- 1979
- 1980
- 1984
- 1992
- 1999

Data Source:
ETH (Swiss Federal Institute of Technology Zurich)
The Cost of Reducing Inflation

• To reduce inflation, the CB has to pursue contractionary monetary policy.
• When the CB slows the rate of money growth, it contracts aggregate demand.
• This reduces the quantity of goods and services that firms produce.
• This leads to a rise in unemployment.
Disinflationary Monetary Policy in the Short Run and the Long Run

1. Contractionary policy moves the economy down along the short-run Phillips curve...

2. ...but in the long run, expected inflation falls, and the short-run Phillips curve shifts to the left.
The Sacrifice Ratio

• To reduce inflation, an economy must endure a period of high unemployment and low output.

• When the CB combats inflation, the economy moves down the short-run Phillips curve.

• The economy experiences lower inflation but at the cost of higher unemployment.
The Sacrifice Ratio

- The *sacrifice ratio* is the number of percentage points of annual output that is lost in the process of reducing inflation by one percentage point.
- An estimate of the sacrifice ratio is five.
- To reduce inflation from about 10% to 4% in 1979 would have required an estimated sacrifice of 30% of annual output!
Rational Expectations and the Possibility of Costless Disinflation

- The theory of rational expectations suggests that people optimally use all the information they have, including information about government policies, when forecasting the future.
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.
Rational Expectations and the Possibility of Costless Disinflation

- Expected inflation explains why there is a trade-off between inflation and unemployment in the short run but not in the long run.
- How quickly the short-run trade-off disappears depends on how quickly expectations adjust.
- The theory of rational expectations suggests that the sacrifice-ratio could be much smaller than estimated.
The Volcker Disinflation

• When Paul Volcker was Fed chairman in the 1970s, inflation was widely viewed as one of the United States’ foremost problems.
• Volcker succeeded in reducing inflation (from 10 percent to 4 percent), but at the cost of high unemployment (about 10 percent in 1983).
Figure 11 The Volcker Disinflation

Inflation Rate (percent per year)

Unemployment Rate (percent)

The Greenspan Era

- Alan Greenspan’s term as Fed chairman began with a favorable supply shock.
  - In 1986, OPEC members abandoned their agreement to restrict supply.
  - This led to falling inflation and falling unemployment.
The Greenspan Era

- Fluctuations in inflation and unemployment in recent years have been relatively small due to the Fed’s actions.
Figure 12 The Greenspan Era

Inflation Rate (percent per year) vs. Unemployment Rate (percent)
The Phillips curve describes a negative relationship between inflation and unemployment. By expanding aggregate demand, policymakers can choose a point on the Phillips curve with higher inflation and lower unemployment.
• By contracting aggregate demand, policymakers can choose a point on the Phillips curve with lower inflation and higher unemployment.
The trade-off between inflation and unemployment described by the Phillips curve holds only in the short run.

The long-run Phillips curve is vertical at the natural rate of unemployment.
Summary

- The short-run Phillips curve also shifts because of shocks to aggregate supply.
- An adverse supply shock gives policymakers a less favorable trade-off between inflation and unemployment.
Summary

• When the CB contracts growth in the money supply to reduce inflation, it moves the economy along the short-run Phillips curve.

• This results in temporarily high unemployment.

• The cost of disinflation depends on how quickly expectations of inflation fall.