Inflation and money growth

Output, Unemployment, and Inflation

This chapter characterizes the economy by three relations:

- Okun's Law, which relates the change in unemployment to *output growth*.
- The Phillips curve, which relates the changes in *inflation* to *unemployment*.
- The aggregate demand relation, which relates *output growth* to both nominal *money growth* and *inflation*.

Output, Unemployment, and Inflation

Okun's Law

$$u_t - u_{t-1} = -g_{yt}$$

According to the equation above, the change in the unemployment rate should be equal to the negative of the growth rate of output.

For example, if output growth is 4%, then the unemployment rate should decline by 4%.

Output, Unemployment, and Inflation

Okun's Law

The actual relation between output growth and the change in the unemployment rate is known as Okun's law.

Using thirty years of data, the line that best fits the data is given by:

$$u_t - u_{t-1} = -0.4(g_{yt} - 3\%)$$

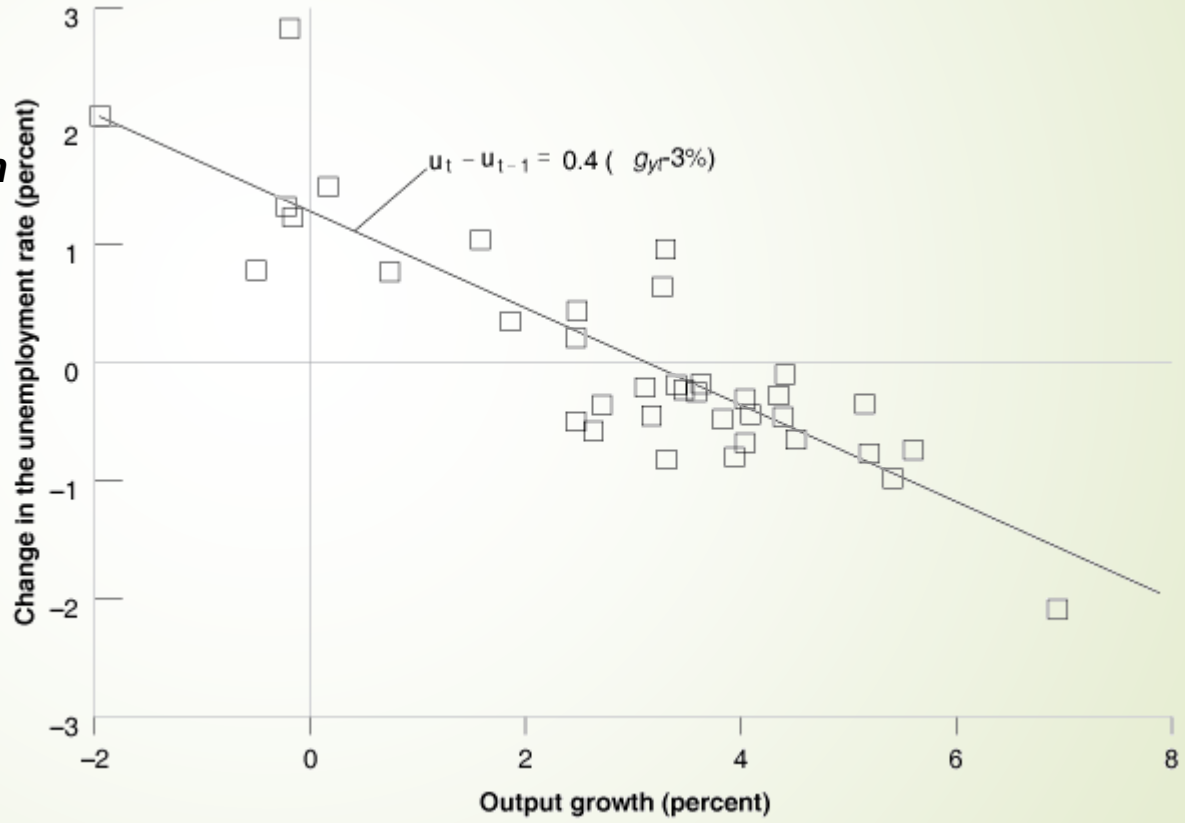
Output, Unemployment, and Inflation

Okun's Law

Figure 1

Changes in the Unemployment Rate Versus Output Growth in the United States since 1970

High output growth is associated with a reduction in the unemployment rate; low output growth is associated with an increase in the unemployment rate.



Output, Unemployment, and Inflation

Okun's Law

$$u_t - u_{t-1} = -0.4(g_{yt} - 3\%)$$

According to the equation above,

$$If\ g_{yt} > 3\%,\ then\ u_t - u_{t-1} = -0.4(+) < 0$$

$$If\ g_{yt} < 3\%,\ then\ u_t - u_{t-1} = -0.4(-) > 0$$

$$If\ g_{yt} = 3\%,\ then\ u_t - u_{t-1} = -0.4(0) = 0$$

To maintain the unemployment rate constant, output growth must be 3% per year. This growth rate of output is called the **normal growth rate.**

Output, Unemployment, and Inflation

Okun's Law

$$u_t - u_{t-1} = -0.4(g_{yt} - 3\%)$$

According to the equation above, output growth 1% above normal leads only to a 0.4% reduction in unemployment, for two reasons:

1. **Labor hoarding**: firms prefer to keep workers rather than lay them off when output decreases.

2. When employment increases, not all new jobs are filled by the unemployed. A 0.6% increase in the employment rate leads to only a 0.4% decrease in the unemployment rate.

Output, Unemployment, and Inflation

Okun's Law

$$u_t - u_{t-1} = -0.4(g_{yt} - 3\%)$$

Using letters rather than numbers:

$$u_t - u_{t-1} = -\beta(g_{yt} - \bar{g}_y)$$

Output growth above (below) normal leads to a decrease (increase) in the unemployment rate. This is Okun's law:

$$g_{yt} > \bar{g}_y \Rightarrow u_t < u_{t-1}$$

$$g_{yt} < \bar{g}_y \Rightarrow u_t > u_{t-1}$$

Output, Unemployment, and Inflation

The Phillips Curve

$$\pi_t = \pi^e{}_t - \alpha(u_t - u_n)$$

Inflation depends on expected inflation and on the deviation of unemployment from the natural rate of unemployment. When $\pi^e{}_t$ is well approximated by π_{t-1}, then:

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$$

According to the Phillips curve,

$$u_t \leq u_n \Rightarrow \pi_t > \pi_{t-1}$$

$$u_t > u_n \Rightarrow \pi_t < \pi_{t-1}$$

Output, Unemployment, and Inflation

The Aggregate Demand Relation

The aggregate demand relation, as stated in Chapter 7, adding the time indices:

$$AD\ Relation\quad Y_t = Y\left(\frac{M_t}{P_t}, G_t, T_t\right)$$

Ignoring changes in output caused by other than changes in the real money stock, then:

$$Y_t = Y\left(\frac{M_t}{P_t}\right)$$

Okun's Law across Countries

The coefficient β in Okun's law gives the effect on the unemployment rate of deviations of output growth from normal. A value of β of 0.4 tells us that output growth 1% above the normal growth rate for 1 year decreases the unemployment rate by 0.4%.

Table 1 Okun's Law Coefficients Across Countries and Time

Country	1960-1980	1981-2006
United States	0.39	0.42
Germany	0.20	0.29
United Kingdom	0.15	0.51
Japan	0.02	0.11

Output, Unemployment, and Inflation

The Aggregate Demand Relation

$$Y_t = \gamma \frac{M_t}{P_t}$$

Keep in mind this simple relation hides the mechanism you saw in the *IS-LM* model:

- An increase in the real money stock leads to a decrease in the interest rate.
- The decrease in the interest rate leads to an increase in the demand for goods and therefore, to an increase in output.

The Effects of Money Growth

- Okun's law relates the change in the unemployment rate to the deviation of output growth from normal:

$$u_t - u_{t-1} = \beta\left(g_{gt} - \overline{g_y}\right)$$

- The Phillips curve relates the change in inflation to the deviation of the unemployment rate from the natural rate:

$$\pi_t - \pi_{t-1} = -a\left(u_t - u_n\right)$$

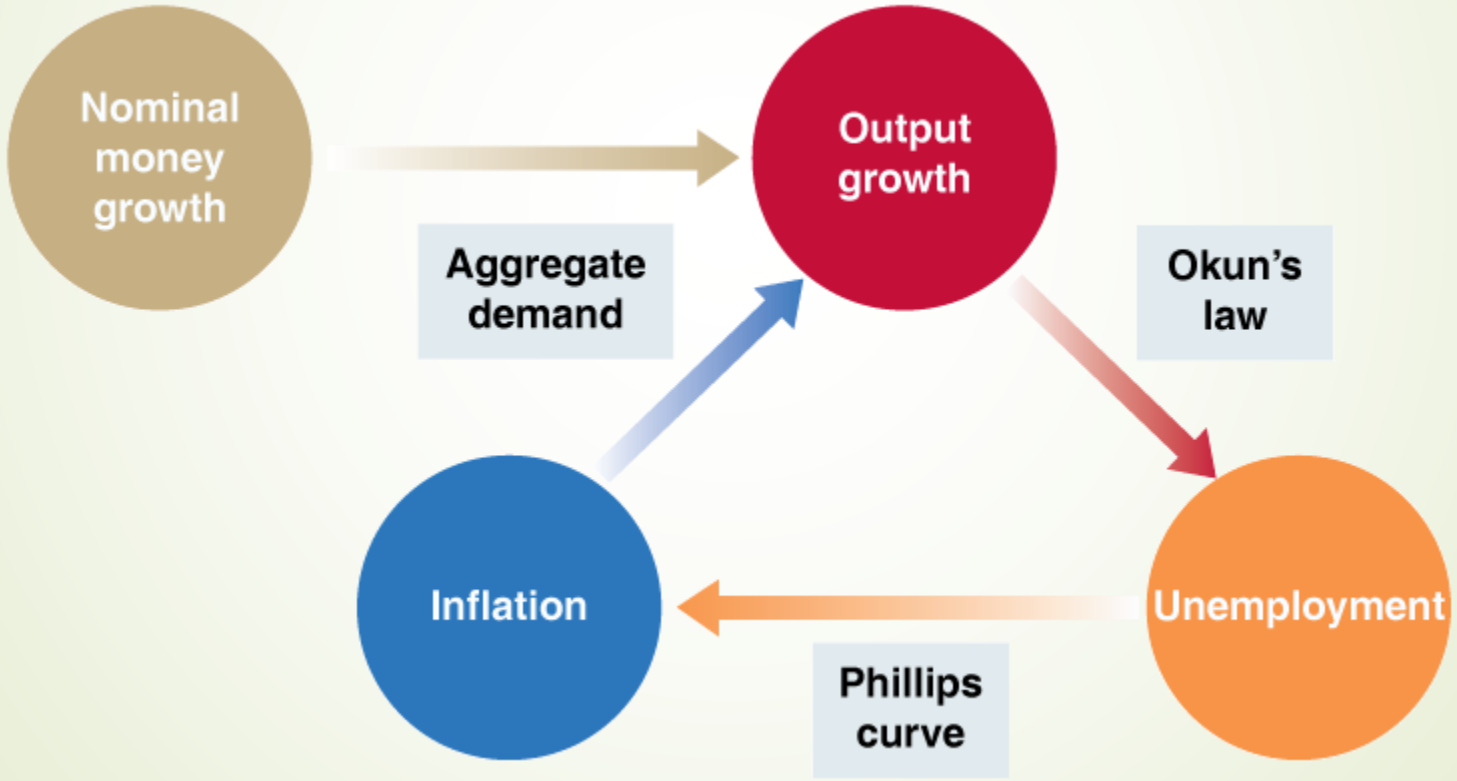
- The aggregate demand relation relates output growth to the difference between nominal money growth and inflation.

$$g_{yt} = g_{mt} - \pi t$$

The Effects of Money Growth

Figure 2

Output Growth, Unemployment, Inflation, and Nominal Money Growth



The Effects of Money Growth

The Medium Run

Assume that the central bank maintains a constant growth rate of nominal money, call it $\bar{g}_m$. In this case, the values of output growth, unemployment, and inflation in the *medium run*:

- Output must grow at its normal rate of growth, $\bar{g}_y$.
- If we define **adjusted nominal money growth** as equal to nominal money growth minus normal output growth, then *inflation equals adjusted nominal money growth.*
- *The unemployment rate must be equal to the natural rate of unemployment.*

The Effects of Money Growth

The Short Run

Now suppose that the central bank decides to decrease nominal money growth. What will happen in the short run?

- Given the initial rate of inflation, lower nominal money growth leads to lower real nominal money growth , and thus to a decrease in output growth.
- Now, look at Okun's law, output growth below normal leads to an increase in unemployment.
- Now, look at the Phillips curve relation. Unemployment above the natural rate leads to a decrease in inflation.

The Effects of Money Growth

The Short Run

In words: In the short run, monetary tightening leads to a slowdown in growth and a temporary increase in unemployment. In the medium run, output growth returns to normal, and the unemployment rate returns to the natural rate.

Table 2 The Effects of Monetary Tightening

			Year 0	Year 1	Year 2	Year 3
1	Real money growth %	$(g_m-\pi)$	3.0	0.5	5.5	3.0
2	Output growth %	(g_y)	3.0	0.5	5.5	3.0
3	Unemployment rate %	(u)	6.0	7.0	6.0	6.0
4	Inflation gate %	(π)	5.0	4.0	4.0	4.0
5	(Nominal money growth) %	(g_m)	8.0	4.5	9.5	7.0

Disinflation

A First Pass

We know from the previous section that lower inflation requires lower money growth. We also know that lower money growth implies an increase in unemployment for some time. Now we discuss at what pace the central bank should proceed.

Disinflation

A First Pass

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$$

In the Phillips curve relation above, disinflation—a decrease in inflation—can be obtained only at the cost of higher unemployment.

$$(\pi_t - \pi_{t-1}) < 0 \Rightarrow (u_t - u_n) > 0 \Rightarrow u_t > u_n$$

A **point-year of excess unemployment** is a difference between the actual and the natural unemployment rate of one percentage point for one year.

Disinflation

A First Pass

For example, let's assume that $\alpha = 1$

- Suppose the central bank wants to achieve the reduction in inflation in 1 year, then 1 year of unemployment at 10% above the natural rate is required.
- Suppose the central bank wants to achieve the reduction in inflation over 2 years, then 2 years of unemployment at 5% above the natural rate is required.
- By the same reasoning, reducing inflation over 5 years requires 5 years of unemployment at 2% above the natural rate (five times 2% = 10%); reducing inflation over 10 years requires 10 year of unemployment at 1% above the natural rate.

Disinflation

A First Pass

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$$

The sacrifice ratio is the number of point-years of excess unemployment needed to achieve a decrease in inflation of 1%.

For example, if α is roughly equal to one, as the estimated Phillips curve suggests, then the sacrifice ratio is roughly equal to one.

Disinflation

Expectations and Credibility: The Lucas Critique

The **Lucas critique** states that it is unrealistic to assume that wage setters would not consider changes in policy when forming their expectation.

If wage setters could be convinced that inflation was indeed going to be lower than in the past, they would decrease their expectations of inflation, which would in turn reduce actual inflation, without the need for a change in the unemployment rate.

Disinflation

Expectations and Credibility: The Lucas Critique

Thomas Sargent, who worked with Robert Lucas, argued that in order to achieve disinflation, any increase in unemployment would have to be only small.

The essential ingredient of successful disinflation, he argued, was credibility of monetary policy—the belief by wage setters that the central bank was truly committed to reducing inflation. The central bank should aim for fast disinflation.

Disinflation

Nominal Rigidities and Contracts

A contrary view was taken by Stanley Fischer and John Taylor. They emphasized the presence of nominal rigidities, or the fact that many wages and prices are not readjusted when there is a change in policy.

If wages are set before the change in policy, inflation would already be built into existing wage agreements.

Disinflation

Nominal Rigidities and Contracts

While Fischer argued that even with credibility, too rapid a decrease in nominal money growth would lead to higher unemployment, Taylor's argument went one step further.

He argued that wage contracts are not all signed at the same time, but that they are staggered over time.

He showed that this staggering of wage decisions imposed strong limits on how fast disinflation could proceed without triggering higher unemployment.

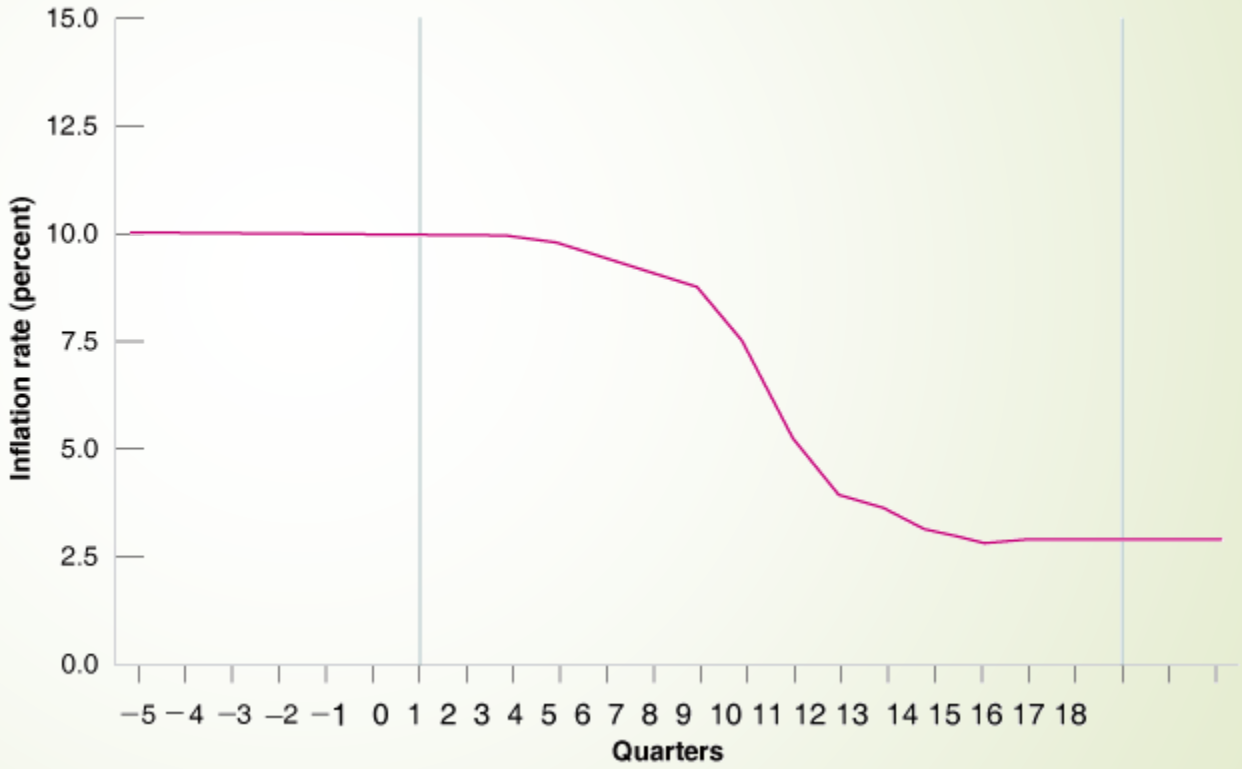
Disinflation

Nominal Rigidities and Contracts

Figure 3

Disinflation Without Unemployment in the Taylor Model

If wage decisions are staggered, disinflation must be phased in slowly to avoid an increase in unemployment.

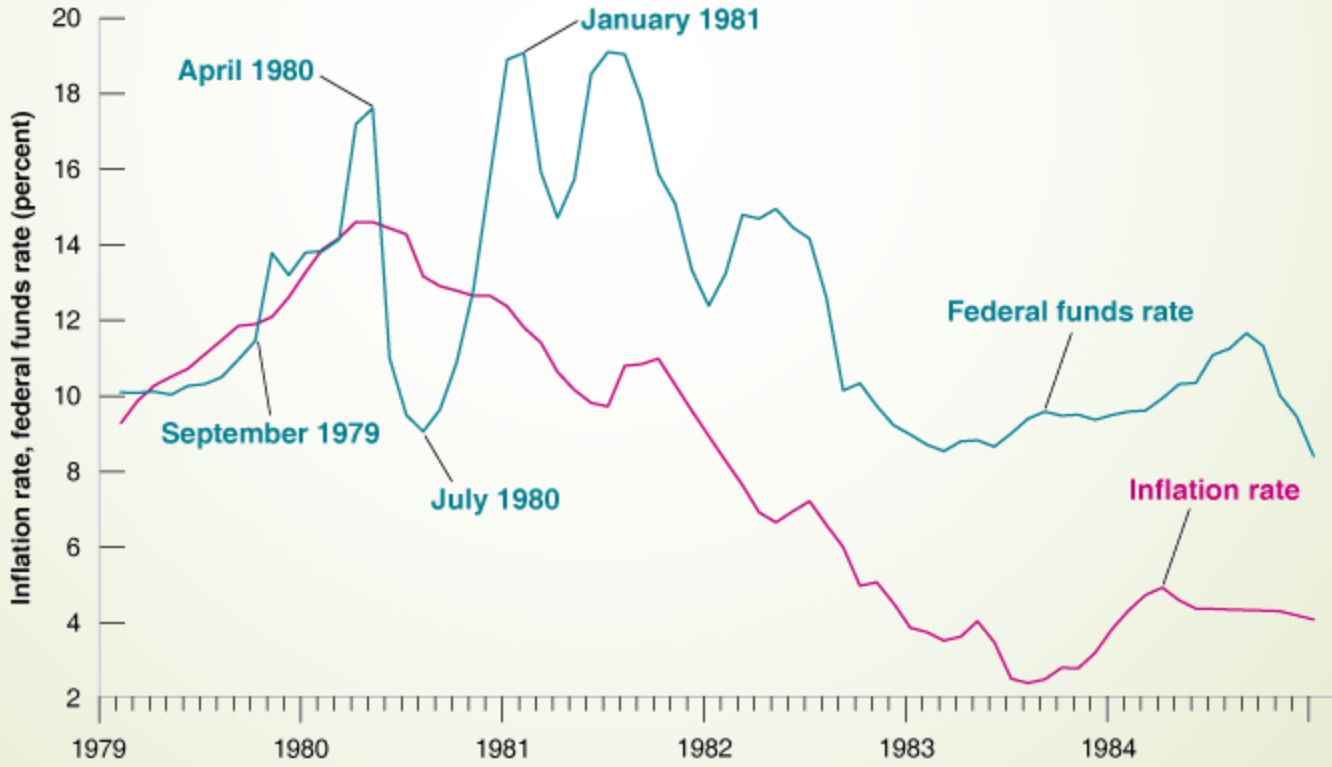


U.S. Disinflation, 1979–1985

Figure 1

The Federal Funds Rate and Inflation, 1979-1984

A sharp increase in the federal funds rate from September 1979 to April 1980 was followed by a sharp decline in mid-1980, and then a second and sustained increase from January 1981 on, lasting for most of 1981 and 1982.



U.S. Disinflation, 1979–1985

Table 1 Inflation and Unemployment, 1979-1985

	1979	1980	1981	1982	1983	1984	1985
GDP growth (%)	2.5	–0.5	1.8	–2.2	3.9	6.2	3.2
Unemployment rate (%)	5.8	7.1	7.6	9.7	9.6	7.5	7.2
CPI inflation (%)	13.3	12.5	8.9	3.8	3.8	3.9	3.8
Cumulative unemployment		1.0	2.6	6.3	9.9	11.4	12.6
Cumulative disinflation		0.8	4.4	9.5	9.5	9.4	9.5
Sacrifice ratio		1.25	0.59	0.66	1.04	1.21	1.32

Cumulative unemployment is the sum of point-years of excess unemployment from 1980 on, assuming a natural rate of unemployment of 6%. Cumulative disinflation is the difference between inflation in a given year and inflation in 1979. The sacrifice ratio is the ratio of cumulative unemployment to cumulative disinflation.

Disinflation

Nominal Rigidities and Contracts

In 1993, Laurence Ball, from Johns Hopkins University estimated sacrifice ratios for 65 disinflation episodes in 19 OECD countries over the last 30 years. He reached three main conclusions:

- Disinflations typically lead to a period of higher unemployment.
- Faster disinflations are associated with smaller sacrifice ratios.
- Sacrifice ratios are smaller in countries that have shorter wage contracts.

Thank YOU for attention

End