Chapter 1
Monetary Policy

1. The Model

An increase in money supply lowers unemployment. On the other hand, it raises inflation. In the numerical example, a unit increase in money supply lowers the rate of unemployment by 1 percentage point. On the other hand, it raises the rate of inflation by 1 percentage point. For instance, let initial unemployment be 2 percent, and let initial inflation be 2 percent as well. Now consider a unit increase in money supply. Then unemployment goes from 2 to 1 percent. On the other hand, inflation goes from 2 to 3 percent.

The model of unemployment and inflation can be represented by a system of two equations:

\[ u = A - \alpha M \]  
\[ \pi = B + \alpha \varepsilon M \]  

Of course this is a reduced form. Here \( u \) denotes the rate of unemployment, \( \pi \) is the rate of inflation, \( M \) is money supply, \( \alpha \) is the monetary policy multiplier with respect to unemployment, \( \alpha \varepsilon \) is the monetary policy multiplier with respect to inflation, \( A \) is some other factors bearing on the rate of unemployment, and \( B \) is some other factors bearing on the rate of inflation. The endogenous variables are the rate of unemployment and the rate of inflation.

According to equation (1), the rate of unemployment is a positive function of \( A \) and a negative function of money supply. According to equation (2), the rate of inflation is a positive function of \( B \) and a positive function of money supply. A unit increase in \( A \) raises the rate of unemployment by 1 percentage point. A unit increase in \( B \) raises the rate of inflation by 1 percentage point. A unit increase in money supply lowers the rate of unemployment by \( \alpha \) percentage points. On the other hand, it raises the rate of inflation by \( \alpha \varepsilon \) percentage points.
The target of the central bank is zero inflation. The instrument of the central bank is money supply. By equation (2), the optimum level of money supply is:

$$M = -\frac{B}{\alpha \varepsilon}$$

(3)

That is, an increase in A requires no change in money supply. And an increase in B requires a cut in money supply. From equations (1) and (3) follows the optimum rate of unemployment:

$$u = \frac{\varepsilon A + B}{\varepsilon}$$

(4)

And from equations (2) and (3) follows the optimum rate of inflation:

$$\pi = 0$$

(5)

Inflation is zero. By contrast, unemployment is not zero.
2. Some Numerical Examples

For ease of exposition we assume that monetary policy multipliers are unity $\alpha = \varepsilon = 1$. On this assumption, the model of unemployment and inflation can be written as follows:

$$u = A - M$$  \hspace{1cm} (1)

$$\pi = B + M$$  \hspace{1cm} (2)

A unit increase in $A$ raises the rate of unemployment by 1 percentage point. A unit increase in $B$ raises the rate of inflation by 1 percentage point. A unit increase in money supply lowers the rate of unemployment by 1 percentage point. On the other hand, it raises the rate of inflation by 1 percentage point. The model can be solved this way:

$$M = -B$$  \hspace{1cm} (3)

$$u = A + B$$  \hspace{1cm} (4)

$$\pi = 0$$  \hspace{1cm} (5)

Equation (3) shows the optimum level of money supply, equation (4) shows the optimum rate of unemployment, and equation (5) shows the optimum rate of inflation.

It proves useful to study two distinct cases:

- a demand shock
- a supply shock.

1) A demand shock. Let initial unemployment be zero, and let initial inflation be zero as well. Step one refers to a decline in aggregate demand. In terms of the model there is an increase in $A$ of 2 units and a decline in $B$ of equally 2 units. Step two refers to the outside lag. Unemployment goes from zero to 2 percent. And inflation goes from zero to – 2 percent. Step three refers to the policy response. What is needed, according to the model, is an increase in money supply
of 2 units. Step four refers to the outside lag. Inflation goes from – 2 to zero percent. And unemployment goes from 2 to zero percent. Table 1.1 presents a synopsis.

As a result, given a demand shock, monetary policy achieves zero inflation and zero unemployment. The loss function of the central bank is:

\[ L_1 = \pi^2 \] (6)

The initial loss is zero. The demand shock causes a loss of 4 units. Then monetary policy brings the loss down to zero again.

2) A supply shock. Let initial unemployment and inflation be zero each. Step one refers to the supply shock. In terms of the model there is an increase in B of 2 units and an increase in A of equally 2 units. Step two refers to the outside lag. Inflation goes from zero to 2 percent. And unemployment goes from zero to 2 percent as well. Step three refers to the policy response. What is needed, according to the model, is a reduction in money supply of 2 units. Step four refers to the outside lag. Inflation goes from 2 to zero percent. And unemployment goes from 2 to 4 percent. Table 1.2 gives an overview.

As a result, given a supply shock, monetary policy achieves zero inflation. However, as a side effect, it raises unemployment. The initial loss is zero. The supply shock causes a loss of 4 units. Then monetary policy brings the loss down to zero again.

3) Summary. Given a demand shock, monetary policy achieves zero inflation and zero unemployment. Given a supply shock, monetary policy achieves zero inflation. However, as a side effect, it raises unemployment.
Table 1.1  
**Monetary Policy**  
A Demand Shock

<table>
<thead>
<tr>
<th>Unemployment</th>
<th>0</th>
<th>Inflation</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock in A</td>
<td>2</td>
<td>Shock in B</td>
<td>−2</td>
</tr>
<tr>
<td>Unemployment</td>
<td>2</td>
<td>Inflation</td>
<td>−2</td>
</tr>
<tr>
<td>Change in Money Supply</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment</td>
<td>0</td>
<td>Inflation</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1.2  
**Monetary Policy**  
A Supply Shock

<table>
<thead>
<tr>
<th>Unemployment</th>
<th>0</th>
<th>Inflation</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock in A</td>
<td>2</td>
<td>Shock in B</td>
<td>2</td>
</tr>
<tr>
<td>Unemployment</td>
<td>2</td>
<td>Inflation</td>
<td>2</td>
</tr>
<tr>
<td>Change in Money Supply</td>
<td>−2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment</td>
<td>4</td>
<td>Inflation</td>
<td>0</td>
</tr>
</tbody>
</table>
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