Chapter 2
First the Government Decides, then the Central Bank Decides

1. Target System A

1.1. The Model

1) The static model. The target of the central bank is zero inflation. By contrast, the target of the government is zero unemployment. The model of unemployment and inflation can be represented by a system of two equations:

$$u = A - M - G \tag{1}$$

$$\pi = B + M + G \tag{2}$$

An increase in money supply lowers unemployment. On the other hand, it raises inflation. Correspondingly, an increase in government purchases lowers unemployment. On the other hand, it raises inflation.

The target of the central bank is zero inflation. The instrument of the central bank is money supply. By equation (2), the reaction function of the central bank is:

$$M = -B - G \tag{3}$$

An increase in B requires a cut in money supply. And an increase in government purchases requires a cut in money supply too.

The target of the government is zero unemployment. The instrument of the government is its purchases. By equation (1), the reaction function of the government is:

$$G = A - M \tag{4}$$

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An increase in A requires an increase in government purchases. And a cut in money supply requires an increase in government purchases as well.

The Nash equilibrium is determined by the reaction functions of the central bank and the government. From the reaction function of the central bank follows:

$$\frac{dM}{dG} = -1 \tag{5}$$

And from the reaction function of the government follows:

$$\frac{dG}{dM} = -1 \tag{6}$$

That is to say, the reaction curves do not intersect. As a result there is no Nash equilibrium.

2) The dynamic model. We assume that the government and the central bank decide sequentially. First the government decides, then the central bank decides. Step 1 refers to a specific shock. Step 2 refers to the time lag. Step 3 refers to fiscal policy. Step 4 refers to the time lag. Step 5 refers to monetary policy. Step 6 refers to the time lag. Step 7 refers to fiscal policy. Step 8 refers to the time lag. Step 9 refers to monetary policy. Step 10 refers to the time lag. And so on.

Now have a closer look at the dynamic model. Step 1 refers to a specific shock. This could be a demand shock, a supply shock or a mixed shock. Step 2 refers to the time lag. This includes both the inside lag and the outside lag. Step 3 refers to fiscal policy. The government sets its purchases so as to achieve zero unemployment. The reaction function of the government is:

$$G = A - M \tag{7}$$

Step 4 refers to the time lag. Step 5 refers to monetary policy. The central bank sets its money supply so as to achieve zero inflation. The reaction function of the central bank is:

$$M = -B - G \tag{8}$$

Step 6 refers to the time lag. Step 7 refers to fiscal policy. The government sets its purchases so as to achieve zero unemployment. The reaction function of the government is:

$$G = A - M \tag{9}$$

Step 8 refers to the time lag. Step 9 refers to monetary policy. The central bank sets its money supply so as to achieve zero inflation. The reaction function of the central bank is:

$$M = -B - G \tag{10}$$

Step 10 refers to the time lag. And so on. Then what are the dynamic characteristics of this process?

1.2. Some Numerical Examples

It proves useful to study four distinct cases:

- a demand shock
- a supply shock
- a mixed shock
- another mixed shock.

The target of the government is zero unemployment. By contrast, the target of the central bank is zero inflation.

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 time lag. Unemployment goes from zero to 2 percent. And inflation goes from zero to – 2 percent.

Step three refers to fiscal policy. Current unemployment is two percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 2 units. Step four refers to the time lag. Unemployment goes from 2 to zero percent. And inflation goes from – 2 to zero percent. Step five refers to monetary policy. Current inflation and target inflation are zero percent each. So what is needed is no change in money supply. Step six refers to the time lag. Unemployment stays at zero percent, as does inflation. Table 1.13 presents a synopsis.

Table 1.13
Sequential Policy Decisions
A Demand Shock

Unemployment	2	Inflation	– 2
Change in Govt Purchases	2		
Unemployment	0	Inflation	0
Change in Money Supply	0		
Unemployment	0	Inflation	0

As a result, given a demand shock, sequential policy decisions produce zero unemployment and zero inflation. There is an increase in government purchases but no change in money supply. The loss functions of the central bank and the government are respectively:

$$L_1 = \pi^2 \quad (1)$$

$$L_2 = u^2 \quad (2)$$

The initial loss of the central bank is zero, as is the initial loss of the government. The demand shock causes a loss to the central bank of 4 units and a loss to the

government of equally 4 units. Then sequential policy decisions bring the loss of the central bank and the government down to zero each.

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 time lag. Inflation goes from zero to 2 percent. And unemployment goes from zero to 2 percent as well.

Step three refers to fiscal policy. Current unemployment is 2 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 2 units. Step four refers to the time lag. Unemployment goes from 2 to zero percent. And inflation goes from 2 to 4 percent. Step five refers to monetary policy. Current inflation is 4 percent, and target inflation is zero percent. So what is needed is a reduction in money supply of 4 units. Step six refers to the time lag. Unemployment goes from zero to 4 percent. And inflation goes from 4 to zero percent.

Step seven refers to fiscal policy. Current unemployment is 4 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 4 units. Step eight refers to the time lag. Unemployment goes from 4 to zero percent. And inflation goes from zero to 4 percent. Step nine refers to monetary policy. Current inflation is 4 percent, and target inflation is zero percent. So what is needed is a reduction in money supply of 4 units. Step ten refers to the time lag. Unemployment goes from zero to 4 percent. And inflation goes from 4 to zero percent. And so on. Table 1.14 gives an overview.

As a result, given a supply shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. The economy oscillates between unemployment and full employment. Correspondingly, the economy oscillates between price stability and inflation. And what is more, there is an explosion of government purchases and an implosion of money supply.

Table 1.14
Sequential Policy Decisions
A Supply Shock

Unemployment	2	Inflation	2
Change in Govt Purchases	2		
Unemployment	0	Inflation	4
Change in Money Supply	– 4		
Unemployment	4	Inflation	0
Change in Govt Purchases	4		
Unemployment	0	Inflation	4
Change in Money Supply	– 4		
Unemployment	4	Inflation	0
and so on			

3) A mixed shock. Let initial unemployment and inflation be zero each. Step one refers to the mixed shock. In terms of the model there is an increase in B of 4 units. Step two refers to the time lag. Inflation goes from zero to 4 percent. And unemployment stays at zero percent.

Step three refers to fiscal policy. Current unemployment is zero percent, and target unemployment is the same. So what is needed is no change in government purchases. Step four refers to the time lag. Unemployment stays at zero percent, and inflation stays at 4 percent. Step five refers to monetary policy. Current inflation is 4 percent, and target inflation is zero percent. So what is needed is a reduction in money supply of 4 units. Step six refers to the time lag. Unemployment goes from zero to 4 percent. And inflation goes from 4 to zero percent.

Step seven refers to fiscal policy. Current unemployment is 4 percent, and target unemployment is zero percent. So what is needed is an increase in

government purchases of 4 units. Step eight refers to the time lag. Unemployment goes from 4 to zero percent. And inflation goes from zero to 4 percent. Step nine refers to monetary policy. Current inflation is 4 percent, and target inflation is zero percent. So what is needed is a reduction in money supply of 4 units. Step ten refers to the time lag. Unemployment goes from zero to 4 percent. And inflation goes from 4 to zero percent. And so on. For a synopsis see Table 1.15.

Table 1.15
Sequential Policy Decisions
A Mixed Shock

Unemployment	0	Inflation	4
Change in Govt Purchases	0		
Unemployment	0	Inflation	4
Change in Money Supply	– 4		
Unemployment	4	Inflation	0
Change in Govt Purchases	4		
Unemployment	0	Inflation	4
Change in Money Supply	– 4		
Unemployment	4	Inflation	0
and so on			

As a result, given a mixed shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. The economy oscillates between unemployment and full employment. Correspondingly, the economy oscillates between price stability and inflation. And what is more, there is an explosion of government purchases and an implosion of money supply.

4) Another type of a mixed shock. Let initial unemployment and inflation be zero each. Step one refers to the mixed shock. In terms of the model there is an increase in A of 4 units. Step two refers to the time lag. Unemployment goes from zero to 4 percent. And inflation stays at zero percent.

Step three refers to fiscal policy. Current unemployment is 4 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 4 units. Step four refers to the time lag. Unemployment goes from 4 to zero percent. And inflation goes from zero to 4 percent. Step five refers to monetary policy. Current inflation is 4 percent, and target inflation is zero percent. So what is needed is a reduction in money supply of 4 units. Step six refers to the time lag. Unemployment goes from zero to 4 percent. And inflation goes from 4 to zero percent. And so on. For an overview see table 1.16.

Table 1.16
Sequential Policy Decisions
Another Mixed Shock

Unemployment	4	Inflation	0
Change in Govt Purchases	4		
Unemployment	0	Inflation	4
Change in Money Supply	– 4		
Unemployment	4	Inflation	0
and so on			

As a result, given another type of a mixed shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. The economy oscillates between unemployment and full employment. Correspondingly, the economy oscillates between price stability and inflation. And what is more, there is an explosion of government purchases and an implosion of money supply.

5) Summary. Given a demand shock, sequential policy decisions produce zero unemployment and zero inflation. There is an increase in government purchases but no change in money supply. Given a supply shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. And what is more, there is an explosion of government purchases and an implosion of money supply. And much the same applies to mixed shocks.

2. Target System B

2.1. The Model

1) The static model. The central bank has two targets, that is zero inflation and zero unemployment. By contrast, the government has a single target, that is zero unemployment. The model of unemployment and inflation can be characterized by a system of two equations:

$$u = A - M - G \tag{1}$$

$$\pi = B + M + G \tag{2}$$

An increase in money supply lowers unemployment. On the other hand, it raises inflation. Correspondingly, an increase in government purchases lowers unemployment. On the other hand, it raises inflation.

The targets of the central bank are zero inflation and zero unemployment. The instrument of the central bank is money supply. There are two targets but only one instrument, so what is needed is a loss function. We assume that the central bank has a quadratic loss function:

$$L_1 = \pi^2 + u^2 \tag{3}$$

L_1 is the loss to the central bank caused by inflation and unemployment. For ease of exposition we assume equal weights in the loss function. The specific target of the central bank is to minimize the loss, given the inflation function and the unemployment function. Taking account of equations (1) and (2), the loss function of the central bank can be written as follows:

$$L_1 = (B + M + G)^2 + (A - M - G)^2 \tag{4}$$

Then the first-order condition for a minimum loss gives the reaction function of the central bank:

$$2M = A - B - 2G \tag{5}$$

An increase in A requires an increase in money supply. An increase in B requires a cut in money supply. And an increase in government purchases requires a cut in money supply too.

The target of the government is zero unemployment. The instrument of the government is its purchases. By equation (1), the reaction function of the government is:

$$G = A - M \tag{6}$$

An increase in A requires an increase in government purchases. An increase in B requires no change in government purchases. And a cut in money supply requires an increase in government purchases.

The Nash equilibrium is determined by the reaction functions of the central bank and the government. From the reaction function of the central bank follows:

$$\frac{dM}{dG} = -1 \tag{7}$$

And from the reaction function of the government follows:

$$\frac{dG}{dM} = -1 \tag{8}$$

That is to say, the reaction curves do not intersect. As a result there is no Nash equilibrium.

2) The dynamic model. We assume that the government and the central bank decide sequentially. First the government decides, then the central bank decides. Step 1 refers to a specific shock. Step 2 refers to the time lag. Step 3 refers to fiscal policy. Step 4 refers to the time lag. Step 5 refers to monetary policy. Step 6 refers to the time lag. Step 7 refers to fiscal policy. Step 8 refers to the time lag. Step 9 refers to monetary policy. Step 10 refers to the time lag. And so on.

Now take a closer look at the dynamic model. Step 1 refers to a specific shock. Step 2 refers to the time lag. Step 3 refers to fiscal policy. The government sets its purchases so as to achieve zero unemployment. The reaction function of the government is:

$$G = A - M \tag{9}$$

Step 4 refers to the time lag. Step 5 refers to monetary policy. The central bank sets its money supply so as to reduce its loss. The reaction function of the central bank is:

$$2M = A - B - 2G \tag{10}$$

Step 6 refers to the time lag. Step 7 refers to fiscal policy. The government sets its purchases so as to achieve zero unemployment. The reaction function of the government is:

$$G = A - M \tag{11}$$

Step 8 refers to the time lag. Step 9 refers to monetary policy. The central bank sets its money supply so as to reduce its loss. The reaction function of the central bank is:

$$2M = A - B - 2G \tag{12}$$

Step 10 refers to the time lag. And so on. Then what are the dynamic characteristics of this process?

2.2. Some Numerical Examples

Here are four distinct cases:

- a demand shock
- a supply shock
- a mixed shock
- another mixed shock.

The government has a single target, that is zero unemployment. By contrast, the central bank has two targets, that is zero inflation and zero unemployment.

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 time lag. Unemployment goes from zero to 2 percent. And inflation goes from zero to – 2 percent.

Step three refers to fiscal policy. Current unemployment is 2 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 2 units. Step four refers to the time lag. Unemployment goes from 2 to zero percent. And inflation goes from – 2 to zero percent. Step five refers to monetary policy. Current unemployment and current inflation are zero percent each. Accordingly, target unemployment and target inflation are zero percent each. So what is needed is no change in money supply. Step six refers to the time lag. Unemployment stays at zero percent, as does inflation. Table 1.17 presents a synopsis.

As a result, given a demand shock, sequential policy decisions produce zero unemployment and zero inflation. There is an increase in government purchases but no change in money supply. The loss functions of the central bank and the government are respectively:

$$L_1 = \pi^2 + u^2 \quad (1)$$

$$L_2 = u^2 \quad (2)$$

The initial loss of the central bank is zero, as is the initial loss of the government. The demand shock causes a loss to the central bank of 8 units and a loss to the government of 4 units. Then sequential policy decisions bring the loss of the central bank and the government down to zero each.

Table 1.17
Sequential Policy Decisions
A Demand Shock

Unemployment	2	Inflation	– 2
Change in Govt Purchases	2		
Unemployment	0	Inflation	0
Change in Money Supply	0		
Unemployment	0	Inflation	0

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 time lag. Inflation goes from zero to 2 percent. And unemployment goes from zero to 2 percent as well.

Step three refers to fiscal policy. Current unemployment is 2 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 2 units. Step four refers to the time lag. Unemployment goes from 2 to zero percent. And inflation goes from 2 to 4 percent. Step five refers to monetary policy. Current unemployment is zero percent, and current inflation is 4 percent. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is a reduction in money supply of 2 units. Step six refers to the time lag. Unemployment goes from zero to 2 percent. And inflation goes from 4 to 2 percent. And so on. Table 1.18 gives an overview.

As a result, given a supply shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. The economy oscillates between unemployment and full employment. Correspondingly, the economy oscillates between low and high inflation. And what is more, there is an explosion of government purchases and an implosion of money supply.

Table 1.18
Sequential Policy Decisions
A Supply Shock

Unemployment	2	Inflation	2
Change in Govt Purchases	2		
Unemployment	0	Inflation	4
Change in Money Supply	– 2		
Unemployment	2	Inflation	2
and so on			

3) A mixed shock. Let initial unemployment and inflation be zero each. Step one refers to the mixed shock. In terms of the model there is an increase in B of 4 units. Step two refers to the time lag. Inflation goes from zero to 4 percent. And unemployment stays at zero percent.

Step three refers to fiscal policy. Current unemployment is zero percent, and target unemployment is the same. So what is needed is no change in government purchases. Step four refers to the time lag. Unemployment stays at zero percent, and inflation stays at 4 percent. Step five refers to monetary policy. Current unemployment is zero percent, and current inflation is 4 percent. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is a reduction in money supply of 2 units. Step six refers to the time lag. Unemployment goes from zero to 2 percent. And inflation goes from 4 to 2 percent.

Step seven refers to fiscal policy. Current unemployment is 2 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 2 units. Step eight refers to the time lag. Unemployment goes from 2 to zero percent. And inflation goes from 2 to 4 percent. Step nine refers to monetary policy. Current unemployment is zero percent, and current inflation is 4 percent. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is a reduction in money supply of 2 units. Step ten refers to the time lag. Unemployment goes from zero to 2 percent. And inflation goes from 4 to 2 percent. And so on. For a synopsis see Table 1.19.

Table 1.19
Sequential Policy Decisions
A Mixed Shock

Unemployment	0	Inflation	4
Change in Govt Purchases	0		
Unemployment	0	Inflation	4
Change in Money Supply	– 2		
Unemployment	2	Inflation	2
Change in Govt Purchases	2		
Unemployment	0	Inflation	4
Change in Money Supply	– 2		
Unemployment	2	Inflation	2
and so on			

As a result, given a mixed shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. The economy oscillates between unemployment and full employment. Correspondingly, the economy oscillates

between low and high inflation. And what is more, there is an explosion of government purchases and an implosion of money supply.

4) Another type of a mixed shock. Let initial unemployment and inflation be zero each. Step one refers to the mixed shock. In terms of the model there is an increase in A of 4 units. Step two refers to the time lag. Unemployment goes from zero to 4 percent. And inflation stays at zero percent.

Step three refers to fiscal policy. Current unemployment is 4 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 4 units. Step four refers to the time lag. Unemployment goes from 4 to zero percent. And inflation goes from zero to 4 percent. Step five refers to monetary policy. Current unemployment is zero percent, and current inflation is 4 percent. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is a reduction in money supply of 2 units. Step six refers to the time lag. Unemployment goes from zero to 2 percent. And inflation goes from 4 to 2 percent.

Step seven refers to fiscal policy. Current unemployment is 2 percent, and target unemployment is zero percent. So what is needed is an increase in government purchases of 2 units. Step eight refers to the time lag. Unemployment goes from 2 to zero percent. And inflation goes from 2 to 4 percent. Step nine refers to monetary policy. Current unemployment is zero percent, and current inflation is 4 percent. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is a reduction in money supply of 2 units. Step ten refers to the time lag. Unemployment goes from zero to 2 percent. And inflation goes from 4 to 2 percent. And so on. For an overview see Table 1.20.

As a result, given another type of a mixed shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. The economy oscillates between unemployment and full employment. Correspondingly, the economy oscillates between low and high inflation. And what is more, there is an explosion of government purchases and an implosion of money supply.

5) Summary. Given a demand shock, sequential policy decisions produce zero unemployment and zero inflation. There is an increase in government

purchases and no change in money supply. Given a supply shock, sequential policy decisions cause uniform oscillations in unemployment and inflation. And what is more, there is an explosion of government purchases and an implosion of money supply. And much the same applies to mixed shocks.

Table 1.20
Sequential Policy Decisions
Another Mixed Shock

Unemployment	4	Inflation	0
Change in Govt Purchases	4		
Unemployment	0	Inflation	4
Change in Money Supply	– 2		
Unemployment	2	Inflation	2
Change in Govt Purchases	2		
Unemployment	0	Inflation	4
Change in Money Supply	– 2		
Unemployment	2	Inflation	2
and so on			

3. Target System C

3.1. The Model

1) The static model. The targets of the central bank are zero inflation and zero unemployment. And the targets of the government are the same. The model of unemployment and inflation can be represented by a system of two equations:

$$u = A - M - G \tag{1}$$

$$\pi = B + M + G \tag{2}$$

An increase in money supply lowers unemployment. On the other hand, it raises inflation. Correspondingly, an increase in government purchases lowers unemployment. On the other hand, it raises inflation.

The targets of the central bank are zero inflation and zero unemployment. The instrument of the central bank is money supply. There are two targets but only one instrument, so what is needed is a loss function. We assume that the central bank has a quadratic loss function:

$$L_1 = \pi^2 + u^2 \tag{3}$$

L_1 is the loss to the central bank caused by inflation and unemployment. We assume equal weights in the loss function. The specific target of the central bank is to minimize the loss, given the inflation function and the unemployment function. Taking account of equations (1) and (2), the loss function of the central bank can be written as follows:

$$L_1 = (B + M + G)^2 + (A - M - G)^2 \tag{4}$$

Then the first-order condition for a minimum loss gives the reaction function of the central bank:

$$2M = A - B - 2G \tag{5}$$

An increase in A requires an increase in money supply. An increase in B requires a cut in money supply. And an increase in government purchases requires a cut in money supply too.

The targets of the government are zero unemployment and zero inflation. The instrument of the government is its purchases. There are two targets but only one instrument, so what is needed is a loss function. We assume that the government has a quadratic loss function:

$$L_2 = u^2 + \pi^2 \tag{6}$$

L_2 is the loss to the government caused by unemployment and inflation. We assume equal weights in the loss function. The specific target of the government is to minimize the loss, given the unemployment function and the inflation function. Taking account of equations (1) and (2), the loss function of the government can be written as follows:

$$L_2 = (A - M - G)^2 + (B + M + G)^2 \tag{7}$$

Then the first-order condition for a minimum loss gives the reaction function of the government:

$$2G = A - B - 2M \tag{8}$$

An increase in A requires an increase in government purchases. An increase in B requires a cut in government purchases. And a cut in money supply requires an increase in government purchases.

The Nash equilibrium is determined by the reaction functions of the central bank and the government. Obviously, equations (5) and (8) are identical. There are two endogenous variables, money supply and government purchases. On the other hand, there is only one independent equation. As a result there are multiple Nash equilibria.

2) The dynamic model. We assume that the government and the central bank decide sequentially. First the government decides, then the central bank decides.

Step 1 refers to a specific shock. Step 2 refers to the time lag. Step 3 refers to fiscal policy. Step 4 refers to the time lag. Step 5 refers to monetary policy. Step 6 refers to the time lag. Step 7 refers to fiscal policy. Step 8 refers to the time lag. Step 9 refers to monetary policy. Step 10 refers to the time lag. And so on.

Now have a closer look at the dynamic model. Step 1 refers to a specific shock. Step 2 refers to the time lag. Step 3 refers to fiscal policy. The government sets its purchases so as to reduce its loss. The reaction function of the government is:

$$2G = A - B - 2M \tag{9}$$

Step 4 refers to the time lag. Step 5 refers to monetary policy. The central bank sets its money supply so as to reduce its loss. The reaction function of the central bank is:

$$2M = A - B - 2G \tag{10}$$

Step 6 refers to the time lag. Step 7 refers to fiscal policy. The government sets its purchases so as to reduce its loss. The reaction function of the government is:

$$2G = A - B - 2M \tag{11}$$

Step 8 refers to the time lag. Step 9 refers to monetary policy. The central bank sets its money supply so as to reduce its loss. The reaction function of the central bank is:

$$2M = A - B - 2G \tag{12}$$

Step 10 refers to the time lag. And so on. Then what are the dynamic characteristics of this process?

3.2. Some Numerical Examples

Here are four distinct cases:

- a demand shock
- a supply shock
- a mixed shock
- another mixed shock.

The targets of the government are zero unemployment and zero inflation. And the targets of the central bank are the same.

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 time lag. Unemployment goes from zero to 2 percent. And inflation goes from zero to – 2 percent.

Step three refers to fiscal policy. Current unemployment is 2 percent, and current inflation is – 2 percent. Accordingly, target unemployment and target inflation are zero percent each. So what is needed is an increase in government purchases of 2 units. Step four refers to the time lag. Unemployment goes from 2 to zero percent. And inflation goes from – 2 to zero percent. Step five refers to monetary policy. Current unemployment and current inflation are zero percent each. Accordingly, target unemployment and target inflation are zero percent each. So what is needed is no change in money supply. Step six refers to the time lag. Unemployment stays at zero percent, as does inflation. Table 1.21 presents a synopsis.

As a result, given a demand shock, sequential policy decisions produce zero unemployment and zero inflation. There is an increase in government purchases but no change in money supply. The loss functions of the central bank and the government are respectively:

$$L_1 = \pi^2 + u^2 \quad (1)$$

$$L_2 = \pi^2 + u^2 \quad (2)$$

The initial loss of the central bank is zero, as is the initial loss of the government. The demand shock causes a loss to the central bank of 8 units and a loss to the government of equally 8 units. Then sequential policy decisions bring the loss of the central bank and the government down to zero each.

Table 1.21
Sequential Policy Decisions
A Demand Shock

Unemployment	2	Inflation	– 2
Change in Govt Purchases	2		
Unemployment	0	Inflation	0
Change in Money Supply	0		
Unemployment	0	Inflation	0

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 time lag. Inflation goes from zero to 2 percent. And unemployment goes from zero to 2 percent as well.

Step three refers to fiscal policy. Current unemployment and current inflation are 2 percent each. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is no change in government purchases. Step four refers to the time lag. Unemployment stays at 2 percent, as does inflation. Step five refers to monetary policy. Current unemployment and current inflation are 2 percent each. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is no change in money supply. Step six refers to the time lag. Unemployment stays at 2 percent, as does inflation. Table 1.22 gives an overview.

As a result, given a supply shock, sequential policy decisions are ineffective. There is no change in government purchases and money supply. Correspondingly, there is no change in unemployment and inflation. The initial loss of the central bank is zero, as is the initial loss of the government. The supply shock causes a loss to the central bank of 8 units and a loss to the government of equally 8 units. Then sequential policy decisions keep the loss of the central bank and the government at 8 units each.

Table 1.22
Sequential Policy Decisions
A Supply Shock

Unemployment	2	Inflation	2
Change in Govt Purchases	0		
Unemployment	2	Inflation	2
Change in Money Supply	0		
Unemployment	2	Inflation	2

3) A mixed shock. Let initial unemployment and inflation be zero each. Step one refers to the mixed shock. In terms of the model there is an increase in B of 4 units. Step two refers to the time lag. Inflation goes from zero to 4 percent. And unemployment stays at zero percent.

Step three refers to fiscal policy. Current unemployment is zero percent, and current inflation is 4 percent. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is a reduction in government purchases of 2 units. Step four refers to the time lag. Unemployment goes from zero to 2 percent. And inflation goes from 4 to 2 percent. Step five refers to monetary policy. Current unemployment and current inflation are 2 percent each. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is no change in money supply. Step six refers to the time lag.

Unemployment stays at 2 percent, as does inflation. For a synopsis see Table 1.23.

As a result, given a mixed shock, sequential policy decisions lower inflation. On the other hand, they raise unemployment. There is a reduction in government purchases but no change in money supply. The initial loss of the central bank is zero, as is the initial loss of the government. The mixed shock causes a loss to the central bank of 16 units and a loss to the government of equally 16 units. Then sequential policy decisions bring the loss of the central bank and the government down to 8 units each.

Table 1.23
Sequential Policy Decisions
A Mixed Shock

Unemployment	0	Inflation	4
Change in Govt Purchases	– 2		
Unemployment	2	Inflation	2
Change in Money Supply	0		
Unemployment	2	Inflation	2

4) Another type of a mixed shock. Let initial unemployment and inflation be zero each. Step one refers to the mixed shock. In terms of the model there is an increase in A of 4 units. Step two refers to the time lag. Unemployment goes from zero to 4 percent. And inflation stays at zero percent.

Step three refers to fiscal policy. Current unemployment is 4 percent, and current inflation is zero percent. Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is an increase in government purchases of 2 units. Step four refers to the time lag. Unemployment goes from 4 to 2 percent. And inflation goes from zero to 2 percent. Step five refers to monetary policy. Current unemployment and current inflation are 2 percent each.

Accordingly, target unemployment and target inflation are 2 percent each. So what is needed is no change in money supply. Step six refers to the time lag. Unemployment stays at 2 percent, as does inflation. For an overview see Table 1.24.

As a result, given another type of a mixed shock, sequential policy decisions lower unemployment. On the other hand, they raise inflation. There is an increase in government purchases but no change in money supply. The initial loss of the central bank is zero, as is the initial loss of the government. The mixed shock causes a loss to the central bank of 16 units and a loss to the government of equally 16 units. Then sequential policy decisions bring the loss of the central bank and the government down to 8 units each.

Table 1.24
Sequential Policy Decisions
Another Mixed Shock

Unemployment	4	Inflation	0
Change in Govt Purchases	2		
Unemployment	2	Inflation	2
Change in Money Supply	0		
Unemployment	2	Inflation	2

5) Summary. Given a demand shock, sequential policy decisions produce zero unemployment and zero inflation. There is an increase in government purchases but no change in money supply. Given a supply shock, sequential policy decisions are ineffective. There is no change in government purchases or money supply. Correspondingly, there is no change in unemployment or inflation. Given a mixed shock, sequential policy decisions lower inflation. On the other hand, they raise unemployment. There is a reduction in government purchases but no change in money supply. Given another type of a mixed shock, sequential policy decisions lower unemployment. On the other hand, they raise

inflation. There is an increase in government purchases but no change in money supply.

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Carlberg, M.

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