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University of the Federal Armed Forces Hamburg

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Department of Economics

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Monetary and Fiscal Policies in the Euro Area

Michael Carlberg

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by Michael Carlberg

Abstract

This paper studies monetary and fiscal policies in the euro area. It discusses the process of policy competition and the structure of policy cooperation. As to policy competition, the focus is on competition between the European central bank, the German government, and the French government. As to policy cooperation, the focus is on the same institutions. These are higher-dimensional issues. The policy targets are price stability and full employment. Special features of this paper are numerical simulations of policy competition and numerical solutions to policy cooperation.

Keywords: European Monetary Union, International Policy Coordination, Monetary Policy, Fiscal Policy

JEL classification: E63, F33, F41, F42

Professor Michael Carlberg
Department of Economics
Helmut Schmidt University
Holstenhofweg 85
D-22043 Hamburg
Germany

Phone +49 40 6541 2775
Fax +49 40 6541 2043
Email carlberg@hsu-hh.de

1. Introduction

This paper studies monetary and fiscal policies in the euro area. It discusses the process of policy competition and the structure of policy cooperation. With respect to policy competition, the focus is on competition between the European central bank, the German government, and the French government. With respect to policy cooperation, the focus is on cooperation between the European central bank, the German government, and the French government.

The targets of the European central bank are price stability and full employment in Europe. The target of the German government is full employment in Germany. And the target of the French government is full employment in France. The key questions are:

- Does the process of policy competition lead to full employment and price stability?
- Can policy cooperation achieve full employment and price stability?
- Is policy cooperation superior to policy competition?

The paper is organized as follows: Monetary policy in Europe – Fiscal policies in Germany and France – Monetary and fiscal competition – Monetary and fiscal cooperation – Summary – References – Tables.

Some recent books and papers on policy interactions in the euro area are R. Beetsma, X. Debrun (2004), M. Buti (2003), M. Buti, D. Franco (2005), X. Debrun (1999), A. Hughes Hallet, P. Mooslechner, M. Schuerz (2001), L. Lambertini, R. Rovelli (2004), L. Onorante (2004), M. Sidiropoulos, E. Spyromitros (2005), H. Uhlig (2003), B. van Aarle, H. Garretsen, F. Huart (2003), and J. von Hagen, S. Mundschenk (2002).

2. Monetary Policy in Europe

1) Introduction. For ease of exposition we make the following assumptions. The monetary union consists of two countries, say Germany and France. The member countries are the same size and have the same behavioural functions. An increase in European money supply raises both German output and French output, to the same extent respectively. In the numerical example, an increase in European money supply of 100 causes an increase in German output of 100 and an increase in French output of equally 100.

The output model can be represented by a system of two equations:

$$Y_1 = A_1 + \alpha M \quad (1)$$

$$Y_2 = A_2 + \alpha M \quad (2)$$

Of course this is a reduced form. Y_1 denotes German output, Y_2 is French output, M is European money supply, α is the monetary policy multiplier, A_1 is some other factors bearing on German output, and A_2 is some other factors bearing on French output. The endogenous variables are German output and French output.

The output model can be compressed to a single equation:

$$Y = A + 2\alpha M \quad (3)$$

Here we have $Y = Y_1 + Y_2$ and $A = A_1 + A_2$. Y denotes European output, M is European money supply, 2α is the monetary policy multiplier in Europe, and A is some other factors bearing on European output. The endogenous variable is European output.

2) The policy model. At the beginning there is unemployment in Germany and France. More precisely, unemployment in Germany is high, and unemployment in France is low. The primary target of the European central bank is price stability in Europe. The secondary target of the European central bank is full employment in Europe. For ease of exposition we assume that unemployment causes deflation whereas overemployment causes inflation. The

specific target of the European central bank is that unemployment in Germany equals overemployment in France. Accordingly, the specific target of the European central bank is that deflation in Germany equals inflation in France. In other words, the specific target of the European central bank is full employment in Europe on average. Accordingly, the specific target of the European central bank is price stability in Europe on average. The instrument of the European central bank is European money supply. The European central bank raises European money supply so as to close the output gap in Europe.

Now have a closer look at the policy model. The specific target of the European central bank is full employment in Europe on average:

$$Y_1 + Y_2 = \bar{Y}_1 + \bar{Y}_2 \quad (4)$$

Here Y_1 denotes target output in Germany, Y_2 is target output in France, \bar{Y}_1 is full-employment output in Germany, and \bar{Y}_2 is full-employment output in France. According to equation (4), target output in Europe should be equal to full-employment output in Europe.

What is the required level of European money supply? To answer this question, eliminate Y_1 and Y_2 in equation (4) by means of equations (1) and (2) and solve for M :

$$M = \frac{\bar{Y}_1 + \bar{Y}_2 - A_1 - A_2}{2\alpha} \quad (5)$$

Obviously, the required level of European money supply depends on full-employment output in Europe, the monetary policy multiplier in Europe, and some other factors bearing on European output. Then substitute equation (5) into equations (1) and (2) and rearrange terms:

$$Y_1 = \frac{\bar{Y}_1 + \bar{Y}_2 + A_1 - A_2}{2} \quad (6)$$

$$Y_2 = \frac{\bar{Y}_1 + \bar{Y}_2 - A_1 + A_2}{2} \quad (7)$$

Equation (6) shows target output in Germany, and equation (7) shows target output in France.

3) Another version of the policy model. As an alternative, the policy model can be stated in terms of the initial output gap and the required increase in money supply. The European central bank raises European money supply so as to close the output gap in Europe:

$$\Delta M = \frac{\Delta Y_1 + \Delta Y_2}{2\alpha} \quad (8)$$

Here ΔM denotes the required increase in European money supply, ΔY_1 is the initial output gap in Germany, ΔY_2 is the initial output gap in France, $\Delta Y_1 + \Delta Y_2$ is the initial output gap in Europe, and 2α is the monetary policy multiplier in Europe.

Here a comment is in place. The output gap is defined as the difference between full-employment output and actual output. For instance, let full-employment output be 1000, and let actual output be 940. Then the output gap is 60. The other way round, the inflationary gap is defined as the difference between actual output and full-employment output. For instance, let actual output be 1030, and let full-employment output be 1000. Then the inflationary gap is 30.

4) A numerical example: the case of unemployment. Full-employment output in Germany is 1000, and full-employment output in France is the same. Let initial output in Germany be 940, and let initial output in France be 970. In each of the countries there is unemployment and hence deflation. Step 1 refers to the policy response. The output gap in Europe is 90. The monetary policy multiplier in Europe is 2. So what is needed in Europe is an increase in European money supply of 45.

Step 2 refers to the output lag. The increase in European money supply of 45 causes an increase in German output of 45 and an increase in French output of

equally 45. As a consequence, German output goes from 940 to 985, and French output goes from 970 to 1015. Table 1 presents a synopsis. In Germany there is still some unemployment and deflation. In France there is now some overemployment and inflation. And in Europe there is now full employment and price stability. Unemployment in Germany equals overemployment in France. And deflation in Germany equals inflation in France.

As a result, monetary policy in Europe can achieve full employment in Europe on average. And what is more, it can achieve price stability in Europe on average. However, monetary policy in Europe cannot achieve full employment in Germany and France. And what is more, it cannot achieve price stability in Germany and France. There is an increase in German output, as there is in French output. There is an increase in German tax revenue, as there is in French tax revenue. And there is a decline in the German budget deficit, as there is in the French budget deficit.

5) A numerical example: the case of inflation. Let initial output in Germany be 1060, and let initial output in France be 1030. In each of the countries there is overemployment and hence inflation. Step 1 refers to the policy response. The inflationary gap in Europe is 90. The monetary policy multiplier in Europe is 2. So what is needed in Europe is a reduction in European money supply of 45.

Step 2 refers to the output lag. The reduction in European money supply of 45 causes a decline in German output of 45 and a decline in French output of equally 45. As a consequence, German output goes from 1060 to 1015, and French output goes from 1030 to 985. Table 2 gives an overview. In Germany there is still some overemployment and inflation. In France there is now some unemployment and deflation. And in Europe there is now full employment and price stability. Overemployment in Germany equals unemployment in France. And inflation in Germany equals deflation in France.

3. Fiscal Policies in Germany and France

1) Introduction. An increase in German government purchases raises German output. Correspondingly, an increase in French government purchases raises French output. For ease of exposition we assume that fiscal policy in one of the countries has no effect on output in the other country. In the numerical example, an increase in German government purchases of 100 causes an increase in German output of 100. Correspondingly, an increase in French government purchases of 100 causes an increase in French output of 100.

The output model can be represented by a system of two equations:

$$Y_1 = A_1 + \beta G_1 \quad (1)$$

$$Y_2 = A_2 + \beta G_2 \quad (2)$$

Of course this is a reduced form. Y_1 denotes German output, Y_2 is French output, G_1 is German government purchases, G_2 is French government purchases, β is the fiscal policy multiplier, A_1 is some other factors bearing on German output, and A_2 is some other factors bearing on French output. The endogenous variables are German output and French output.

2) The policy model. At the start there is unemployment in Germany and France. More precisely, unemployment in Germany is high, and unemployment in France is low. The target of the German government is full employment in Germany. The instrument of the German government is German government purchases. The German government raises German government purchases so as to close the output gap in Germany. The target of the French government is full employment in France. The instrument of the French government is French government purchases. The French government raises French government purchases so as to close the output gap in France.

The policy model can be characterized by a system of two equations:

$$\bar{Y}_1 = A_1 + \beta G_1 \quad (3)$$

$$\bar{Y}_2 = A_2 + \beta G_2 \quad (4)$$

Here \bar{Y}_1 denotes full-employment output in Germany, \bar{Y}_2 is full-employment output in France, G_1 is the required level of German government purchases, and G_2 is the required level of French government purchases. The endogenous variables are German government purchases and French government purchases. The solution to the policy model is:

$$G_1 = \frac{\bar{Y}_1 - A_1}{\beta} \quad (5)$$

$$G_2 = \frac{\bar{Y}_2 - A_2}{\beta} \quad (6)$$

3) Another version of the policy model. As an alternative, the policy model can be stated in terms of the initial output gap and the required increase in government purchases. The German government raises German government purchases so as to close the output gap in Germany:

$$\Delta G_1 = \frac{\Delta Y_1}{\beta} \quad (7)$$

Here ΔG_1 denotes the required increase in German government purchases, ΔY_1 is the initial output gap in Germany, and β is the fiscal policy multiplier in Germany. Similarly, the French government raises French government purchases so as to close the output gap in France:

$$\Delta G_2 = \frac{\Delta Y_2}{\beta} \quad (8)$$

Here ΔG_2 denotes the required increase in French government purchases, ΔY_2 is the initial output gap in France, and β is the fiscal policy multiplier in France.

4) A numerical example. Full-employment output in Germany is 1000, and full-employment output in France is the same. Let initial output in Germany be 940, and let initial output in France be 970. In each of the countries there is

unemployment and hence deflation. Step 1 refers to the policy response. The output gap in Germany is 60. The fiscal policy multiplier in Germany is 1. So what is needed in Germany is an increase in German government purchases of 60. The output gap in France is 30. The fiscal policy multiplier in France is 1. So what is needed in France is an increase in French government purchases of 30.

Step 2 refers to the output lag. The increase in German government purchases of 60 causes an increase in German output of 60. And the increase in French government purchases of 30 causes an increase in French output of 30. As a consequence, German output goes from 940 to 1000, and French output goes from 970 to 1000. In each of the countries there is now full employment and price stability.

As a result, fiscal policies in Germany and France can achieve full employment and price stability in each of the countries. There is an increase in European government purchases, an increase in European output, and an increase in the European budget deficit. There is an increase in the interest rate and a decline in European investment. There is an appreciation of the euro, a decline in European exports, and a decline in the European current account surplus. For a synopsis see Table 3.

5) Comparing fiscal policies with monetary policy. Monetary policy in Europe can achieve full employment and price stability in Europe as a whole. However, monetary policy in Europe cannot achieve full employment and price stability in each of the member countries. By contrast, fiscal policies in Germany and France can indeed achieve full employment and price stability in each of the member countries. However, as a severe side effect, fiscal policies in Germany and France cause an increase in the European budget deficit.

4. Monetary and Fiscal Competition

1) The static model. This section deals with competition between the European central bank, the German government, and the French government. As a point of reference, consider the static model. It can be represented by a system of two equations:

$$Y_1 = A_1 + \alpha M + \beta G_1 \quad (1)$$

$$Y_2 = A_2 + \alpha M + \beta G_2 \quad (2)$$

Of course this is a reduced form. Y_1 denotes German output, Y_2 is French output, M is European money supply, G_1 is German government purchases, G_2 is French government purchases, A_1 is some other factors bearing on German output, A_2 is some other factors bearing on French output, α is the monetary policy multiplier, and β is the fiscal policy multiplier. The endogenous variables are German output and French output.

2) The dynamic model. At the beginning there is unemployment in Germany and France. More precisely, unemployment in Germany is high, and unemployment in France is low. The target of the European central bank is full employment in Europe. The instrument of the European central bank is European money supply. The European central bank raises European money supply so as to close the output gap in Europe. The target of the German government is full employment in Germany. The instrument of the German government is German government purchases. The German government raises German government purchases so as to close the output gap in Germany. The target of the French government is full employment in France. The instrument of the French government is French government purchases. The French government raises French government purchases so as to close the output gap in France.

We assume that the central bank and the governments decide sequentially. First the central bank decides, then the governments decide. Step 1 refers to monetary policy in Europe. Step 2 refers to the output lag. Step 3 refers to fiscal policies in Germany and France. And step 4 refers to the output lag.

Now have a closer look at the dynamic model. Step 1 refers to monetary policy in Europe. The European central bank raises European money supply so as to close the output gap in Europe:

$$\Delta M = \frac{\Delta Y_1 + \Delta Y_2}{2\alpha} \quad (3)$$

Here ΔM denotes the required increase in European money supply, ΔY_1 is the initial output gap in Germany, ΔY_2 is the initial output gap in France, $\Delta Y_1 + \Delta Y_2$ is the initial output gap in Europe, and 2α is the monetary policy multiplier in Europe.

Step 3 refers to fiscal policies in Germany and France. The German government raises German government purchases so as to close the output gap in Germany:

$$\Delta G_1 = \frac{\Delta Y_1}{\beta} \quad (4)$$

Here ΔG_1 denotes the required increase in German government purchases, ΔY_1 is the initial output gap in Germany, and β is the fiscal policy multiplier in Germany. Similarly, the French government raises French government purchases so as to close the output gap in France:

$$\Delta G_2 = \frac{\Delta Y_2}{\beta} \quad (5)$$

Here ΔG_2 denotes the required increase in French government purchases, ΔY_2 is the initial output gap in France, and β is the fiscal policy multiplier in France.

3) A numerical example: the case of unemployment. An increase in European money supply of 100 causes an increase in German output of 100 and an increase in French output of equally 100. An increase in German government purchases of 100 causes an increase in German output of 100. Correspondingly, an increase in French government purchases of 100 causes an increase in French output of 100.

Full-employment output in Germany is 1000, and full-employment output in France is the same.

Let initial output in Germany be 940, and let initial output in France be 970. In each of the countries there is unemployment and deflation. Step 1 refers to monetary policy in Europe. The output gap in Europe is 90. The monetary policy multiplier in Europe is 2. So what is needed in Europe is an increase in European money supply of 45.

Step 2 refers to the output lag. The increase in European money supply of 45 causes an increase in German output of 45 and an increase in French output of equally 45. As a consequence, German output goes from 940 to 985, and French output goes from 970 to 1015. In Germany there is still some unemployment and deflation. In France there is now some overemployment and inflation. And in Europe there is now full employment and price stability.

Step 3 refers to fiscal policies in Germany and France. The output gap in Germany is 15. The fiscal policy multiplier in Germany is 1. So what is needed in Germany is an increase in German government purchases of 15. The inflationary gap in France is 15. The fiscal policy multiplier in France is 1. So what is needed in France is a reduction in French government purchases of 15.

Step 4 refers to the output lag. The increase in German government purchases of 15 causes an increase in German output of 15. And the reduction in French government purchases of 15 causes a decline in French output of 15. As a consequence, German output goes from 985 to 1000, and French output goes from 1015 to 1000. In each of the countries there is now full employment and price stability. For an overview see Table 4.

As a result, the process of monetary and fiscal competition leads to full employment and price stability in each of the countries. There is an increase in European money supply. There is an increase in German government purchases, a reduction in French government purchases, and no change in European government purchases. There is an increase in German output, as there is in French output. In steps 1 and 2 there is some overshooting in French output. There is an increase in European output, an increase in European tax revenue, and a decline in the European budget deficit. There is a decline in the interest rate

and an increase in European investment. There is a depreciation of the euro, an increase in European exports, and an increase in the European current account surplus.

4) Comparing monetary and fiscal competition with pure monetary policy. Pure monetary policy can achieve full employment and price stability in Europe as a whole. However, it cannot achieve full employment and price stability in each of the member countries. By contrast, monetary and fiscal competition can indeed achieve full employment and price stability in each of the member countries. Judging from this point of view, monetary and fiscal competition seems to be superior to pure monetary policy.

5) Comparing monetary and fiscal competition with pure fiscal policies. Pure fiscal policies can achieve full employment and price stability in each of the member countries. And the same holds for monetary and fiscal competition. Pure fiscal policies cause an increase in the European budget deficit. By contrast, monetary and fiscal competition causes a decline in the European budget deficit. Judging from this perspective, monetary and fiscal competition seems to be superior to pure fiscal policies.

6) A numerical example: the case of inflation. Let initial output in Germany be 1060, and let initial output in France be 1030. In each of the countries there is overemployment and inflation. Step 1 refers to monetary policy in Europe. The inflationary gap in Europe is 90. The monetary policy multiplier in Europe is 2. So what is needed in Europe is a reduction in European money supply of 45.

Step 2 refers to the output lag. The reduction in European money supply of 45 causes a decline in German output of 45 and a decline in French output of equally 45. As a consequence, German output goes from 1060 to 1015, and French output goes from 1030 to 985. In Germany there is still some overemployment and inflation. In France there is now some unemployment and deflation. And in Europe there is now full employment and price stability.

Step 3 refers to fiscal policies in Germany and France. The inflationary gap in Germany is 15. The fiscal policy multiplier in Germany is 1. So what is needed in Germany is a reduction in German government purchases of 15. The

output gap in France is 15. The fiscal policy multiplier in France is 1. So what is needed in France is an increase in French government purchases of 15.

Step 4 refers to the output lag. The reduction in German government purchases of 15 causes a decline in German output of 15. And the increase in French government purchases of 15 causes an increase in French output of 15. As a consequence, German output goes from 1015 to 1000, and French output goes from 985 to 1000. In each of the countries there is now full employment and price stability. Table 5 presents a synopsis.

7) First the governments decide, then the central bank decides. So far we have assumed that the central bank decides first. Now we assume that the governments decide first. Let initial output in Germany be 940, and let initial output in France be 970. In each of the countries there is unemployment and deflation.

Step 1 refers to fiscal policies in Germany and France. The output gap in Germany is 60. The fiscal policy multiplier in Germany is 1. So what is needed in Germany is an increase in German government purchases of 60. The output gap in France is 30. The fiscal policy multiplier in France is 1. So what is needed in France is an increase in French government purchases of 30.

Step 2 refers to the output lag. The increase in German government purchases of 60 raises German output by 60. And the increase in French government purchases of 30 raises French output by 30. As a consequence, German output goes from 940 to 1000, and French output goes from 970 to 1000. In each of the countries there is now full employment and price stability.

Step 3 refers to monetary policy in Europe. The output gap in Europe is zero. So there is no reason for changing European money supply. Step 4 refers to the output lag. As a consequence, German output stays at 1000, as does French output. In each of the countries there is still full employment and price stability. As a result, the process of competition between the German government, the French government, and the European central bank leads to full employment and price stability in each of the countries.

8) Comparing

- first the central bank decides, then the governments decide
- first the governments decide, then the central bank decides.

Let initial output in Germany be 940, and let initial output in France be 970.

Case number 1: The central bank decides first. The increase in European money supply is 45, the increase in German government purchases is 15, the reduction in French government purchases is equally 15, and the change in European government purchases is zero.

Case number 2: The governments decide first. The increase in European money supply is zero, the increase in German government purchases is 60, the increase in French government purchases is 30, and the increase in European government purchases is 90.

As a result, if the central bank decides first, there will be a large increase in European money supply and a zero increase in European government purchases. The other way round, if the governments decide first, there will be a zero increase in European money supply and a large increase in European government purchases. Judging from this point of view, it seems that the central bank should decide first.

9) The central bank and the governments decide simultaneously and independently. As a result, the simultaneous process of monetary and fiscal competition does not lead to full employment and price stability in any of the countries. Instead, there are uniform oscillations in money supply, government purchases, and output. The German economy oscillates between unemployment and overemployment, as does the French economy. And what is more, the German economy oscillates between deflation and inflation, as does the French economy.

5. Monetary and Fiscal Cooperation

1) Introduction. This section deals with cooperation between the European central bank, the German government, and the French government. As a starting point, take the output model. It can be represented by a system of two equations:

$$Y_1 = A_1 + \alpha M + \beta G_1 \quad (1)$$

$$Y_2 = A_2 + \alpha M + \beta G_2 \quad (2)$$

Here Y_1 denotes German output, Y_2 is French output, M is European money supply, G_1 is German government purchases, G_2 is French government purchases, α is the monetary policy multiplier, and β is the fiscal policy multiplier. The endogenous variables are German output and French output.

2) The policy model. At the beginning there is unemployment in Germany and France. More precisely, unemployment in Germany is high, and unemployment in France is low. The policy makers are the European central bank, the German government, and the French government. The targets of policy cooperation are full employment in Germany and full employment in France. The instruments of policy cooperation are European money supply, German government purchases, and French government purchases. There are two targets and three instruments, so there is one degree of freedom. As a result, there is an infinite number of solutions. In other words, cooperation between the European central bank, the German government, and the French government can achieve full employment in Germany and France.

Of course there are many more potential targets of policy cooperation:

- balancing the budget in Germany and France
- balancing the current account in Germany and France
- high investment in Germany and France
- preventing foreign exchange bubbles
- preventing stock market bubbles
- and so on.

To sum up, in a sense, policy instruments are abundant. And in another sense, policy instruments are scarce.

Taking differences in equations (1) and (2), the policy model can be written as follows:

$$\Delta Y_1 = \alpha \Delta M + \beta \Delta G_1 \quad (3)$$

$$\Delta Y_2 = \alpha \Delta M + \beta \Delta G_2 \quad (4)$$

Here ΔY_1 denotes the initial output gap in Germany, ΔY_2 is the initial output gap in France, ΔM is the required increase in European money supply, ΔG_1 is the required increase in German government purchases, and ΔG_2 is the required increase in French government purchases. The endogenous variables are ΔM , ΔG_1 and ΔG_2 .

We now introduce a third target. We assume that the increase in German government purchases should be equal in size to the reduction in French government purchases $\Delta G_1 + \Delta G_2 = 0$. Put another way, we assume that the sum total of European government purchases should be constant. Add up equations (3) and (4), taking account of $\Delta G_1 + \Delta G_2 = 0$, to find out:

$$\Delta M = \frac{\Delta Y_1 + \Delta Y_2}{2\alpha} \quad (5)$$

Here $\Delta Y_1 + \Delta Y_2$ is the initial output gap in Europe. Then subtract equation (4) from equation (3), taking account of $\Delta G_1 + \Delta G_2 = 0$, and solve for:

$$\Delta G_1 = \frac{\Delta Y_1 - \Delta Y_2}{2\beta} \quad (6)$$

$$\Delta G_2 = - \frac{\Delta Y_1 - \Delta Y_2}{2\beta} \quad (7)$$

According to equation (5), the required increase in European money supply depends on the initial output gap in Europe and on the monetary policy multiplier in Europe. According to equation (6), the required increase in German government purchases depends on the initial output gap in Germany, the initial output gap in France, and the fiscal policy multiplier. The larger the initial output gap in Germany, the larger is the required increase in German government

purchases. Moreover, the larger the initial output gap in France, the smaller is the required increase in German government purchases. At first glance this comes as a surprise. According to equation (7), the required increase in French government purchases depends on the initial output gap in France, the initial output gap in Germany, and the fiscal policy multiplier.

3) A numerical example: the case of unemployment. Let initial output in Germany be 940, and let initial output in France be 970. In each of the countries there is unemployment and deflation. Step 1 refers to the policy response. The output gap in Germany is 60, the output gap in France is 30, and the output gap in Europe is 90. What is needed, then, is an increase in European money supply of 45, an increase in German government purchases of 15, and a reduction in French government purchases of equally 15.

Step 2 refers to the output lag. The increase in European money supply of 45 causes an increase in German output of 45 and an increase in French output of equally 45. The increase in German government purchases of 15 causes an increase in German output of 15. And the reduction in French government purchases of 15 causes a decline in French output of 15. The net effect is an increase in German output of 60 and an increase in French output of 30. As a consequence, German output goes from 940 to 1000, and French output goes from 970 to 1000. In each of the countries there is now full employment and price stability. Table 6 gives an overview.

As a result, monetary and fiscal cooperation can achieve full employment and price stability in each of the countries. There is an increase in European money supply. There is an increase in German government purchases, a reduction in French government purchases, and no change in European government purchases. There is an increase in German output, as there is in French output. There is an increase in European output, an increase in European tax revenue, and a decline in the European budget deficit. There is a decline in the interest rate and an increase in European investment. There is a depreciation of the euro, an increase in European exports, and an increase in the European current account surplus.

4) Comparing policy cooperation with policy competition. Policy competition can achieve full employment and price stability in each of the countries. And the

same applies to policy cooperation. Under policy competition, the increase in European money supply is 45, the increase in German government purchases is 15, and the reduction in French government purchases is equally 15 (assuming that the central bank decides first). Hence the solution to policy cooperation is identical with the solution to policy competition. Policy competition is a slow process consisting of four steps. By contrast, policy cooperation is a fast process consisting of only two steps. Policy competition causes some overshooting in output. By contrast, policy cooperation does not cause any overshooting in output. Judging from this point of view, policy cooperation seems to be superior to policy competition.

5) A numerical example: the case of inflation. Let initial output in Germany be 1060, and let initial output in France be 1030. In each of the countries there is overemployment and inflation. Step 1 refers to the policy response. The inflationary gap in Germany is 60, the inflationary gap in France is 30, and the inflationary gap in Europe is 90. What is needed, then, is a reduction in European money supply of 45, a reduction in German government purchases of 15, and an increase in French government purchases of equally 15.

Step 2 refers to the output lag. The reduction in European money supply of 45 causes a decline in German output of 45 and a decline in French output of equally 45. The reduction in German government purchases of 15 causes a decline in German output of 15. And the increase in French government purchases of 15 causes an increase in French output of 15. The net effect is a decline in German output of 60 and a decline in French output of 30. As a consequence, German output goes from 1060 to 1000, and French output goes from 1030 to 1000. In each of the countries there is now full employment and price stability. For a synopsis see Table 7.

6) Alternative targets of policy cooperation: no increase in national government purchases. Let initial output in Germany be 940, and let initial output in France be 970. In each of the countries there is unemployment and deflation. Step 1 refers to the policy response. The output gap in Germany is 60, and the output gap in France is 30. What is needed, then, is an increase in European money supply of 60, an increase in German government purchases of zero, and a reduction in French government purchases of 30.

Step 2 refers to the output lag. The increase in European money supply of 60 raises German output and French output by 60 each. And the reduction in French government purchases of 30 lowers French output by 30. The net effect is an increase in German output of 60 and an increase in French output of 30. As a consequence, German output goes from 940 to 1000, and French output goes from 970 to 1000. In each of the countries there is now full employment and price stability.

As a result, monetary and fiscal cooperation can achieve full employment and price stability in each of the countries. There is a large increase in European money supply. There is no change in German government purchases, a reduction in French government purchases, and a reduction in European government purchases.

7) Alternative targets of policy cooperation: no reduction in national government purchases. Let initial output in Germany be 940, and let initial output in France be 970. In each of the countries there is unemployment and deflation. Step 1 refers to the policy response. The output gap in Germany is 60, and the output gap in France is 30. What is needed, then, is an increase in European money supply of 30, an increase in German government purchases of equally 30, and a reduction in French government purchases of zero.

Step 2 refers to the output lag. The increase in European money supply of 30 raises German output and French output by 30 each. And the increase in German government purchases of 30 raises German output by 30. The total effect is an increase in German output of 60 and an increase in French output of 30. As a consequence, German output goes from 940 to 1000, and French output goes from 970 to 1000.

As a result, monetary and fiscal cooperation can achieve full employment and price stability in each of the countries. There is a small increase in European money supply. There is an increase in German government purchases, no change in French government purchases, and an increase in European government purchases.

6. Summary

1) The basic model. For ease of exposition we assume that the monetary union consists of two countries, say Germany and France. For ease of exposition we assume that unemployment causes deflation whereas overemployment causes inflation. At the beginning let there be unemployment and hence deflation.

2) Monetary policy in Europe can achieve full employment in Europe on average. And what is more, it can achieve price stability in Europe on average. However, monetary policy in Europe cannot achieve full employment in Germany and France. And what is more, it cannot achieve price stability in Germany and France.

3) Fiscal policies in Germany and France can achieve full employment and price stability in each of the countries. However, this requires a sharp increase in the European budget deficit.

4) Competition between the European central bank, the German government, and the French government leads to full employment and price stability in each of the countries. And what is more, it causes a decline in the European budget deficit. So monetary and fiscal competition is superior to both pure monetary policy and pure fiscal policy.

5) Cooperation between the European central bank, the German government, and the French government can achieve full employment and price stability in each of the countries. Now compare policy cooperation with policy competition. Policy competition is a slow process consisting of four steps. By contrast, policy cooperation is a fast process consisting of only two steps. Policy competition causes some overshooting in output. By contrast, policy cooperation does not cause any overshooting in output. From this point of view, policy cooperation seems to be superior to policy competition.

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Table 1
Monetary Policy in Europe
 The Case of Unemployment

| | Germany | France |
|------------------------|---------|--------|
| Initial Output | 940 | 970 |
| Change in Money Supply | | 45 |
| Output | 985 | 1015 |

Table 2
Monetary Policy in Europe
 The Case of Inflation

| | Germany | France |
|------------------------|---------|--------|
| Initial Output | 1060 | 1030 |
| Change in Money Supply | | - 45 |
| Output | 1015 | 985 |

Table 3
Fiscal Policies in Germany and France
 The Case of Unemployment

| | Germany | France |
|--------------------------------|---------|--------|
| Initial Output | 940 | 970 |
| Change in Government Purchases | 60 | 30 |
| Output | 1000 | 1000 |

Table 4
Monetary and Fiscal Competition
 The Case of Unemployment

| | Germany | France |
|--------------------------------|---------|--------|
| Initial Output | 940 | 970 |
| Change in Money Supply | | 45 |
| Output | 985 | 1015 |
| Change in Government Purchases | 15 | - 15 |
| Output | 1000 | 1000 |

Table 5
Monetary and Fiscal Competition
 The Case of Inflation

| | Germany | France |
|--------------------------------|---------|--------|
| Initial Output | 1060 | 1030 |
| Change in Money Supply | | - 45 |
| Output | 1015 | 985 |
| Change in Government Purchases | - 15 | 15 |
| Output | 1000 | 1000 |

Table 6
Monetary and Fiscal Cooperation
 The Case of Unemployment

| | Germany | France |
|--------------------------------|---------|--------|
| Initial Output | 940 | 970 |
| Change in Money Supply | | 45 |
| Change in Government Purchases | 15 | - 15 |
| Output | 1000 | 1000 |

Table 7
Monetary and Fiscal Cooperation
 The Case of Inflation

| | Germany | France |
|--------------------------------|---------|--------|
| Initial Output | 1060 | 1030 |
| Change in Money Supply | | - 45 |
| Change in Government Purchases | - 15 | 15 |
| Output | 1000 | 1000 |

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