How Will Transatlantic Policy Interactions Change with the Advent of EMU?*

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Abstract

This paper analyzes US-European policy interactions under different assumptions about the policy-making regime and the nature of the fiscal environment, contrasting the standard Keynesian case with an anti-Keynesian case in which government spending cuts are expansionary. When fiscal policy is anti-Keynesian, EMU may enhance monetary and fiscal discipline in Europe and stabilize employment in the face of supply shocks, in striking contrast to popular fears. The European Central Bank (ECB) and central banks outside Europe will have little incentive to coordinate their responses to such shocks. Governments (the fiscal authorities) will wish central banks to coordinate, but the latter will not share their interest. We show that fiscal coordination can be counterproductive in this setting. Governments and central banks on both sides of the Atlantic are worse off when European governments cooperate. The results for the Keynesian case are different: EMU may reduce monetary discipline, the ECB and central banks outside Europe will wish to coordinate their responses to supply shocks, and the ECB will want European governments to coordinate their policies.

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I. Introduction

European monetary unification will alter interactions not just between members of the monetary union but between those countries and the rest of the world. In the language of the literature on policy coordination, the monetary policy game involving Europe's national central banks and the Federal Reserve Board will become a two-player game between the European Central Bank and the Fed.[1] It may be obvious that creating a European Central Bank that internalizes monetary-policy externalities within Europe will have implications for strategic interactions between monetary authorities in Europe and the rest of the world, but it is not clear in which direction those changes will run. The implications become even less clear when one observes that changes in the responsiveness of Europe's monetary policy may affect the behavior not just of monetary authorities elsewhere in the world but also of fiscal authorities both inside and outside Europe.

In this paper we make a start at analyzing these questions. We specify a simple model -- the closest thing to a consensus model in the policy coordination literature -- and analyze strategic interactions before and after EMU. Following Canzoneri and Henderson (1991) we use a three-country Mundell-Fleming model in which policymakers minimize quadratic loss functions. But we extend their framework by modeling fiscal as well as monetary policies.[2]

Adding fiscal policy raises issues that are particularly contentious in the current European setting. In standard textbook models, fiscal retrenchment reduces output and employment. In the current European context, however, the possibility has been raised that fiscal contractions can be expansionary.[3] Fiscal contraction may increase aggregate supply by reducing distortionary taxes; it may stimulate demand (consumption in particular) by

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[1] In this paper we follow the literature on strategic aspects of monetary policy in Europe which focuses on interactions between the Bundesbank and other European central banks. In our model, the Bank of France should be thought of as representing these other central banks. European central banks will become operating arms of the ECB with the advent of Stage III. We abstract from interactions between the EMU insiders and outsiders (a topic which is the subject of Ghironi and Giavazzi 1997*b*). Similarly, the Federal Reserve should be thought of as representative of non-EU central banks generally.

[2] Jensen (1991) presents a two-country model of monetary and fiscal policy interactions. We, in contrast, consider three countries. In addition, our model differs in other respects described below.

[3] See for example Giavazzi and Pagano (1990), Bertola and Drazen (1991) and IMF (1995).

reducing expectations of distortionary future taxes.[4] This uncertainty about the own-country impact of fiscal initiatives renders the cross-border effects, and the nature of strategic interactions, even less clear.

In this paper we analyze policymakers' response to aggregate supply disturbances in both the Keynesian and anti-Keynesian cases.[5] For the anti-Keynesian case we obtain three surprising results.

@ ***EMU may enhance monetary and fiscal discipline in Europe and stabilize employment in the face of supply shocks.*** The change in the responses of monetary and fiscal authorities that comes with the advent of Stage III may stabilize European output and employment. EMU may stabilize European fiscal policies. Our results contrast with popular fears that EMU encourage governments to pursue unstable fiscal policies. Also, the ECB's monetary policy turns out to be more rigorous than the Bundesbank's under the EMS, and European inflation under EMU is lower than German inflation under the EMS, contrary to current German fears. Nonetheless, inflation rises elsewhere in Europe and the average European inflation rate is higher than under the EMS (if for reasons different from those usually invoked to argue that the ECB will be subject to inflationary pressure).

@ ***The ECB and central banks outside Europe will have little incentive to coordinate their response to supply shocks.***[6] Governments (the fiscal authorities) will wish central banks to coordinate, but the latter will not share their interest. This points to conflicts in a situation where ministers are entitled to provide "general orientations" for exchange rate policy (under the provisions of the Maastricht Treaty) but the ECB is not obliged to accept them.

@ ***Fiscal coordination can be counterproductive under EMU.*** Governments and central banks on both sides of the Atlantic are worse off when the French and German governments cooperate. This is because there remain other externalities in the model: the transatlantic fiscal externality arising from the failure of the U.S. and European governments to coordinate their tax and spending policies, the transatlantic monetary externality arising from the failure of the Fed and the ECB to coordinate, and externalities resulting from the failure of fiscal *and* monetary policymakers to cooperate. Absent fiscal

[4] An effect that is not formally captured in our model.

[5] Respectively, contractionary and expansionary fiscal contractions.

[6] In this paper, policy coordination and cooperation both mean joint minimization of the players' loss functions.

coordination, governments cut spending and taxes too aggressively in an effort to export unemployment; cooperation between France and Germany reduces this bias in Europe but reinforces it in the United States (the U.S. has an incentive to cut taxes even more aggressively).[7] When there is no fiscal coordination in Europe, the expansionary bias of European fiscal policies reduces inflation; fiscal cooperation is thus harmful for inflation stabilization, and central banks react by contracting more, raising unemployment. Fed-ECB cooperation causes the central banks to resist exporting inflation and encourages them to use monetary policy more cautiously. This stabilizes employment but aggravates inflation. It is widely presumed that EMU requires intra-EU fiscal coordination; we find that there are cases where this is undesirable. Moreover, global fiscal cooperation would not be beneficial because the externalities that monetary and fiscal policymakers impose on one another inside each country play an important role.[8]

The results for the Keynesian case are different.

@ ***EMU may reduce monetary discipline in Europe.*** In a Keynesian world, the ECB's policy is less rigorous than that of the Bundesbank under the EMS. Our findings for the Keynesian case are thus consistent with the presumption that EMU weakens monetary discipline. But the reason is not lack of fiscal discipline - in fact, the transition to EMU continues to stabilize fiscal policy relative to the EMS (both French and German fiscal policies are less expansionary than under the EMS). As before, EMU removes the intra-European monetary externality; this reduces unemployment in both France and Germany and enhances welfare for both the French and German governments. As before, European inflation is higher than under the EMS, and the ECB is worse off than the Bank of France, but better off than the Bundesbank. Both German authorities prefer EMU to the EMS because of the effects of increased fiscal discipline. Both the Fed and the U.S. government are better off under EMU; this is in contrast to the anti-Keynesian case, where EMU leaves them worse off.

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[7] Under the assumption that fiscal policy has anti-Keynesian effects, cutting taxes and public spending is expansionary and stabilizes prices, for reasons we elaborate below.

[8] To capture the notion of central bank independence, we assume that each country's central bank and fiscal authority play Nash against one another. Obviously, there is no cooperation between the central bank in one country and any fiscal authority in others.

@ ***The ECB and central banks outside Europe will wish to coordinate their response to supply shocks.*** Inflation is higher when monetary policies are coordinated, but the employment gains more than offset the inflation loss for central banks. The conflict of interest between central banks and governments in the anti-Keynesian case evaporates here.

@ ***The ECB will want European governments to coordinate their policies.*** In the anti-Keynesian case, European and U.S. governments wanted their central banks to cooperate but the central banks did not. Now the reverse is true in Europe: in the Keynesian case, the ECB wants European governments to cooperate but the latter do not. This accords with the policy debate in which European central banks are insisting on mutual surveillance of fiscal policies but national governments are resisting.

These results are derived from a specific model.[9] In the Barro-Gordon (1981) tradition, wages are set at the start of each period, a convenience which allows nominal variables to have real effects. But in contrast to most previous treatments (e.g. Canzoneri and Henderson 1991), interest rates help determine money-market equilibrium.[10] Due to this and due to the introduction of fiscal policy, the reduced forms of the model are complicated functions of the structural parameters. We therefore assign numerical values to the structural parameters and simulate the stabilization game.

II. The Anti-Keynesian Case

We start by describing the structure of the model before considering alternative policymaking regimes.

1. The Model

The world is divided into three countries: France, Germany and the United States. Their three outputs are imperfect substitutes in consumption. To focus on international interactions, we assume no time inconsistency problem and that all disturbances are unexpected. All variables denote

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[9] Because of this we do not claim too much for their generality. But we would argue that this model is a natural point of departure for thinking about these issues.

[10] This allows a global aggregate-supply disturbance to affect not just inflation but also output and employment. In addition, the dependence of money-market equilibrium on the interest rate means that stabilizing nominal exchange rates does not automatically stabilize real exchange rates (in contrast to Canzoneri and Henderson). While in their model, employment depends only on own-country money supply, adding interest-rate linkages allows foreign money supplies to affect domestic employment as well.

deviations from zero-disturbance values and are expressed in logarithms.[11]

Output in each country (y^{US}, y^G, y^F) is an increasing function of employment (n^{US}, n^G, n^F) and a decreasing function of a world productivity disturbance (x):

(1) $$y^j = (1-\alpha)n^j - x, \qquad j = US,\ G,\ F,$$

where $(1 - \alpha)$, with $0 < \alpha < 1$, the elasticity of output with respect to employment, is the same in all countries. The productivity disturbance is identically and independently distributed with zero mean.

Labor demand is derived from the profit maximization condition for firms, where τ indicates the rate of taxation of revenues:[12]

(2) $$w^j - p^j = -\alpha n^j - \tau^j - x, \qquad j = US,\ G,\ F.$$

The anti-Keynesian effects of fiscal policy in our model come through this equation. For plausible parameter values, the supply-side distortion associated with (non-lump-sum) taxes dominates the effect on aggregate demand of the associated increase in public spending.[13]

Consumer price indices (q^{US}, q^G, q^F) are weighted averages of the prices of U.S., German and French goods. American consumers allocate a fraction β of their spending to European goods (half to each) so the U.S. CPI is:

(3) $$q^{US} = (1-\beta)p^{US} + \frac{1}{2}\beta\left(p^G + e^G\right) + \frac{1}{2}\beta\left(p^F + e^F\right).$$

Exchange rates e^G and e^F are the dollar prices of the deutschmark (DM) and the French franc (FF). Equation (3) can be rewritten as:

(4) $$q^{US} = p^{US} + \frac{1}{2}\beta\left(z^G + z^F\right);$$

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[11] Except in the case of interest rates, public expenditures and taxes. Time subscripts are dropped where possible.

[12] Using upper-case letters to denote anti-logs, firms maximize $Profit = (1-\tau)PY - WN$, subject to $Y = N^{1-\alpha}/X$. Each firm is a price taker in the output and in the labor market and is taxed on its total revenues. The first order condition for maximization with respect to N is $(1-\tau)P(1-\alpha)N^{-\alpha}/X = W$. Taking logs, approximating $ln(1 - \tau)$ with $-\tau$, and omitting unimportant constants, we obtain equation (2).

[13] We are implicitly assuming that fiscal policies are budget balancing. In the Keynesian case of Section III, we eliminate the tax term from this equation, assuming instead that all taxes are lump sum. In addition, public expenditure is in logs under the assumptions of that case.

where z^G and z^F are the relative prices of the two European goods in terms of the U.S. good:

$$(5)\qquad \begin{aligned} z^G &= e^G + p^G - p^{US}, \\ z^F &= e^F + p^F - p^{US}. \end{aligned}$$

z^G is the dollar-DM real exchange rate, z^F the dollar-FF real exchange rate. If the dollar depreciates in real terms against one of the other currencies, the dollar real exchange rate rises.

European consumers allocate a fraction β of their spending to the U.S. good and divide the rest equally between the two European goods. The European CPIs are:

$$(6)\qquad \begin{aligned} q^G &= \frac{1}{2}(1-\beta)p^G + \frac{1}{2}(1-\beta)\left(p^F + e^F - e^G\right) + \beta\left(p^{US} - e^G\right), \\ q^F &= \frac{1}{2}(1-\beta)p^F + \frac{1}{2}(1-\beta)\left(p^G + e^G - e^F\right) + \beta\left(p^{US} - e^F\right), \end{aligned}$$

or:

$$(7)\qquad \begin{aligned} q^G &= p^G - \beta z^G - \frac{1}{2}(1-\beta)\left(z^G - z^F\right), \\ q^F &= p^F - \beta z^F - \frac{1}{2}(1-\beta)\left(z^F - z^G\right). \end{aligned}$$

The relative price of German goods in terms of French goods (the FF-DM real exchange rate) is (z^G - z^F).

Demands for all goods increase with output. Residents of all countries increase their spending by the same fraction ($0 < \varepsilon < 1$) of increases in output. The marginal propensity to spend is equal to the average propensity to spend for all goods for residents of all countries. The German propensity to import from France is one-half of one minus the German propensity to import from the United States. Thus, if the German propensity to import from the U.S. is one-third, the German propensity to import from France is one-third, and the total German propensity to import is two-thirds.

Demands for all goods fall with ex ante real interest rates (r^{US}, r^G, r^F). Residents of each country decrease spending by the same amount ($0 < \nu < 1$) for each percentage point increase in the ex ante real interest rate facing them.

Denoting government spending as g, we have equilibrium conditions for the three goods.

$$
\begin{aligned}
2y^{US} &= \delta z^{G} + \delta z^{F} + 2(1-\beta)\varepsilon y^{US} + \beta\varepsilon\left(y^{G}+y^{F}\right) - 2(1-\beta)\nu r^{US} + \\
&-\beta\nu\left(r^{G}+r^{F}\right) + 2\eta g^{US} + (1-\eta)\left(g^{G}+g^{F}\right) + 2u, \\
y^{G} &= -\delta z^{G} - \frac{1}{2}\delta\left(z^{G}-z^{F}\right) + \beta\varepsilon y^{US} + \frac{1}{2}(1-\beta)\varepsilon\left(y^{G}+y^{F}\right) - \beta\nu r^{US} + \\
&-\frac{1}{2}(1-\beta)\nu\left(r^{G}+r^{F}\right) + (1-\eta)g^{US} + \frac{1}{2}\eta\left(g^{G}+g^{F}\right) - u, \\
y^{F} &= -\delta z^{F} + \frac{1}{2}\delta\left(z^{G}-z^{F}\right) + \beta\varepsilon y^{US} + \frac{1}{2}(1-\beta)\varepsilon\left(y^{G}+y^{F}\right) - \beta\nu r^{US} + \\
&-\frac{1}{2}(1-\beta)\nu\left(r^{G}+r^{F}\right) + (1-\eta)g^{US} + \frac{1}{2}\eta\left(g^{G}+g^{F}\right) - u.
\end{aligned} \tag{8}
$$

Ex ante real interest rates are:

$$r^{j} = i^{j} - E\left(q^{j}_{+1}\right) + q^{j}, \qquad j = US,\ G,\ F, \tag{9}$$

where i^{US}, i^{G}, and i^{F} are nominal interest rates on bonds denominated in dollars, DM's, and FF's, respectively, and $E(\bullet_{+1})$ indicates the expected value of a variable tomorrow on the basis of information available today. Depreciation of a currency shifts world demand toward that country's good.[14] [15]

The government budget constraints are:

$$g^{j} = \tau^{j}, \qquad j = US,\ G,\ F. \tag{10}$$

Government spending falls entirely on goods (transfers are considered negative taxes and are included in τ); g^j defines the ratio $G^j/(P^j Y^j)$ and government j's budget constraint is: $G^j=\tau^j P^j Y^j$, $j = US, G, F$.[16]

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[14] The increase in demand due to a real depreciation depends on two factors: the common elasticity parameter δ and the size of the country with respect to whose currency the domestic currency is depreciating. Thus, for example, if the deutschmark depreciates against the dollar, the increase in demand for German goods is twice as much as it would be were the deutschmark depreciating against the franc, reflecting the fact that the U.S. economy is twice the French one in our model and that, under perfect mobility of goods, "depreciation against a larger market is more profitable." Alternatively, one could think of demand for European goods being more sensitive to changes in the transatlantic real exchange rates than in the intra-European ones because of the characteristics of the goods that are traded and of the presence of impediments to perfect mobility of goods across the Atlantic.

[15] The random disturbance u is identically and independently distributed with zero mean and can shift the world demand from European to U.S. goods.

[16] We assume $\eta > 1/2$ to capture the fact that each government is likely to devote a greater fraction of its expenditure to goods produced in its own

Each country issues domestic-currency-denominated bonds. Investors regard bonds denominated in different currencies as perfect substitutes and hold positive amounts of all three bonds only when their expected returns measured in a common currency are equal:

$$(11) \qquad \begin{aligned} i^{US} &= i^G + E\left(e^G_{+1}\right) - e^G, \\ i^{US} &= i^F + E\left(e^F_{+1}\right) - e^F. \end{aligned}$$

Each country's currency is held only by its residents. Demands for real money balances are:

$$(12) \qquad m^j - p^j = y^j - \lambda i^j, \qquad j = US,\ G,\ F.$$

Firms' labor demands can be rewritten as:

$$(13) \qquad p^j = w^j + \alpha n^j + \tau^j + x, \qquad j = US,\ G,\ F.$$

Substituting (1) and (13) into the demands for real money balances and solving for employment, we obtain:

$$(14) \qquad n^j = m^j - w^j - \tau^j + \lambda i^j, \qquad j = US,\ G,\ F.$$

At the beginning of each period, competitive unions and firms sign contracts specifying nominal wages. Unions choose wages to minimize a linear convex combination of expected deviations of employment and the real wage from equilibrium values. They minimize:

$$(15) \qquad L^{u^j} = \frac{1}{2}\left\{\omega E_{-1}\left[\left(n^j\right)^2\right] + (1-\omega)E_{-1}\left[\left(w^j - q^j\right)^2\right]\right\}, \qquad 0 < \omega < 1, \qquad j = US,\ G,\ F.$$

Unions take into account the constraints given by the labor demands of firms. They solve:

$$\min_{w^j} \frac{1}{2}\left\{\omega E_{-1}\left[\left(m^j - w^j - \tau^j + \lambda i^j\right)^2\right] + (1-\omega)E_{-1}\left[\left(w^j - q^j\right)^2\right]\right\}, \qquad j = US,\ G,\ F.$$

The first order condition leads to the wage setting rule:

$$(16) \qquad w^j = \omega E_{-1}\left(m^j + \lambda i^j - \tau^j\right) + (1-\omega)E_{-1}\left(q^j\right), \qquad j = US,\ G,\ F.$$

Nominal wages are a weighted average of expected total labor costs of firms because $m^j + \lambda\, i^j - \tau^j = w^j + n^j$, and of the expected CPI.[17]

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region. Note that the French and German governments are assumed to have identical spending propensities. This assumption may be justified by noting that the Maastricht Treaty prohibits discrimination in public procurement.

[17] If any of these components increases, the nominal wage increases as well, lowering employment. If expected taxation increases, the required nominal wage declines since taxation hits the firms' revenues and does not affect labor

To focus on international interactions, we assume that all disturbances are random and unexpected and that there are no time inconsistency problems. The endogenous variables are shown in the appendix to be linear functions of the policy instruments and the shocks. Expected values of the instruments and the endogenous variables at the beginning of the period therefore coincide with their no-disturbance equilibrium values, *i.e.* zero.[18] The wage setting rule simplifies to:

(17) $$w^j = 0, \qquad j = US,\ G,\ F.$$

Plugging these results into the expressions for employment and prices, we obtain:

(18) $$n^j = m^j - \tau^j + \lambda i^j,$$

(19) $$p^j = \alpha n^j + \tau^j + x, \qquad j = US,\ G,\ F.$$ [19]

Under flexible exchange rates, each central bank chooses its money supply to minimize:

(20) $$L^{cb^j} = \frac{1}{2}\left[a\left(q^j\right)^2 + (1-a)\left(n^j\right)^2\right], \qquad 0 < a < 1, \qquad j = US,\ G,\ F.$$

where a measures the weight central bankers attach to inflation relative to employment.

The government chooses taxes to minimize a quadratic loss function which depends on deviations of inflation, employment, and taxation from their equilibrium values. We assume that the volatility of taxation is a cost for fiscal authorities (to capture the idea that fiscal policy is difficult to fine

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income. Higher taxation reduces labor demand by firms; the higher is the weight ω of employment in the unions' loss functions, the greater will be the reduction in the nominal wages in response to the decreased labor demand.

[18] Zero values for the authorities' instruments are optimal in the absence of disturbances. In Rogoff's (1985) terminology, static expectations are rational.

[19] Equation (19) can be rewritten as: $p^j = \alpha m^j + (1-\alpha)\tau^j + \alpha\lambda i^j + x$. From this expression, we see that, leaving aside indirect effects through changes in the nominal interest rate, if $\alpha < 1/2$, fiscal policy has a larger direct impact on the producer price level than monetary policy. Equation (18) shows that both monetary and fiscal policy have a direct one-to-one impact on employment. As we shall see below, the size of the impact of monetary policy on employment and of fiscal policy on prices is important to our results. In the Keynesian world, the τ-terms disappear from these equations, so that fiscal policy affects employment and producer prices only through changes in the nominal interest rate.

tune relative to monetary policy and the fact that governments may care about the distortions they impose to the economy when actively using their instruments). Thus, country j's government minimizes:

(21) $$L^{fa^j} = \frac{1}{2}\left\{b_1\left[b_2\left(q^j\right)^2 + \left(1-b_2\right)\left(n^j\right)^2\right] + \left(1-b_1\right)\left(\tau^j\right)^2\right\}, \qquad 0 < b_1,\ b_2 < 1,\quad j = US,\ G,\ F.$$

b_1 measures the degree of fiscal activism in the management of fiscal policies. b_2 measures the relative weight attached to inflation and employment by the fiscal authorities. The higher b_1, the higher the degree of fiscal activism.

Endogenous variables in the U.S. depend on the stance of U.S. monetary and fiscal policies, on the aggregate stance of European policies, and on the productivity and demand shocks. Since there are no intra-U.S. policy spillovers, except for the externalities that the Fed and the American fiscal authority impose on each other, only the relative position of U.S. versus aggregate European policies matters. U.S. inflation and employment are:

(22) $$q^{US} = \mathrm{A}m^{US} - \mathrm{B}\left(\frac{m^G + m^F}{2}\right) + \mathrm{E}\tau^{US} + \Gamma\left(\frac{\tau^G + \tau^F}{2}\right) + \mathrm{K}u + \mathrm{H}x;$$

(23) $$n^{US} = \left(1-\lambda\Lambda\right)m^{US} + \lambda\Theta\left(\frac{m^G + m^F}{2}\right) - \left(1-\lambda\Omega\right)\tau^{US} + \lambda\Psi\left(\frac{\tau^G + \tau^F}{2}\right) + \Phi u - \Sigma x.$$

The German CPI and employment depend on the German money supply and taxation, on how policy affects the position of Europe relative to the U.S., and on how they affect the position of Germany relative to France. German and French inflation and employment are given by:

(24) $$q^G = \alpha m^G + \left(\mathrm{A}-\alpha\right)\left(\frac{m^G + m^F}{2}\right) - \mathrm{B}m^{US} + \left(1-\alpha\right)\tau^G + \left[\mathrm{E} - \left(1-\alpha\right)\right]\left(\frac{\tau^G + \tau^F}{2}\right) + \\ + \Gamma\tau^{US} + \mathrm{M}\left(m^F - m^G\right) - \mathrm{N}\left(\tau^F - \tau^G\right) - \mathrm{K}u + \mathrm{H}x;$$

(25) $$q^F = \alpha m^F + \left(\mathrm{A}-\alpha\right)\left(\frac{m^G + m^F}{2}\right) - \mathrm{B}m^{US} + \left(1-\alpha\right)\tau^F + \left[\mathrm{E} - \left(1-\alpha\right)\right]\left(\frac{\tau^G + \tau^F}{2}\right) + \\ + \Gamma\tau^{US} - \mathrm{M}\left(m^F - m^G\right) + \mathrm{N}\left(\tau^F - \tau^G\right) - \mathrm{K}u + \mathrm{H}x;$$

(26) $$n^G = m^G - \lambda\Lambda\left(\frac{m^G + m^F}{2}\right) + \lambda\Theta m^{US} - \tau^G + \lambda\Omega\left(\frac{\tau^G + \tau^F}{2}\right) + \lambda\Psi\tau^{US} + \\ + \lambda\mathrm{O}\left(m^F - m^G\right) - \lambda\mathrm{Z}\left(\tau^F - \tau^G\right) - \Phi u - \Sigma x;$$

$$n^F = m^F - \lambda\Lambda\left(\frac{m^G + m^F}{2}\right) + \lambda\Theta m^{US} - \tau^F + \lambda\Omega\left(\frac{\tau^G + \tau^F}{2}\right) + \lambda\Psi\tau^{US} + \tag{27}$$
$$-\lambda \mathrm{O}\left(m^F - m^G\right) + \lambda Z\left(\tau^F - \tau^G\right) - \Phi u - \Sigma x.$$

When simulating the interactions among policymakers, we impose "consensus" values for the structural parameters and the weights in the loss functions. The parameters we use are shown in Table 1.[20]

The reduced forms above are derived assuming that exchange rates are freely flexible. Ghironi and Giavazzi (1997*a*) obtain a set of general results about how the tradeoffs faced by policymakers change under different assumptions about the prevailing exchange-rate regime. Following their approach, we define the employment-inflation tradeoffs of the authorities as follows. Central banks face tradeoffs given by $\left(\partial q^j/\partial n^j\right)^{CB^j} = \left(\partial q^j/\partial m^j\right)/\left(\partial n^j/\partial m^j\right)$, j = *US*, *G*, *F*. These tradeoffs are positively sloped (see Figure 1), a steeper tradeoff being more favorable for inflation-averse central bankers (it allows the central bank to achieve a larger reduction in inflation at the cost of a smaller employment loss.)[21] The results obtained by Ghironi and Giavazzi (1997*a*) allow us to argue that the German and the French central banks face more favorable tradeoffs than the U.S. monetary authority.[22] Numerical values of the tradeoffs are summarized

[20] The values that we assign to the structural parameters are arbitrary but consistent with intuition and observation. ε can be interpreted as the consumers' marginal propensity to consume out of current income, and a value of .8 for this parameter does not seem too far from reality. a = .9 signals that central banks care much more about inflation than about unemployment in their loss functions, while b_1 = .2 and b_2 = .1 signal that governments care more about employment than about inflation but the degree of activism in managing fiscal policy is limited. This last assumption is consistent with the relative rigidity of fiscal policymaking. Ghironi and Giavazzi (1997*b*) consider also cases in which fiscal activism for stabilization purposes is removed, arguing that this may be consistent with the presence of a strict "fiscal stability pact" in Europe.

[21] In figures 1 and 2, the tradeoffs are centered in the disequilibrium point to which the economies are shifted by a negative productivity shock which causes inflation and unemployment.

[22] The tradeoff faced by a central bank under flexible exchange rates becomes steeper as the size of the economy for which the central bank sets its instrument declines. Germany and France being identical and half the size of the U.S. economy, the Bundesbank and the Bank of France face identical tradeoffs which are more favorable than the Fed's.

in Table 2.

Governments face tradeoffs given by $\left(\partial q^j/\partial n^j\right)^{Gov^j} = \left(\partial q^j/\partial \tau^j\right)/\left(\partial n^j/\partial \tau^j\right)$, j = *US*, *G*, *F*. These are negatively sloped in the anti-Keynesian case we consider first.[23] For unemployment-averse governments, a flatter tradeoff will be more favorable, as the economy will move closer to the situation of zero unemployment for any given decrease in CPI inflation. Consistent with Ghironi and Giavazzi (1997*b*), the German and the French governments face more favorable tradeoffs than the U.S. government under flexible rates (see Figure 2.)

2. Employment-Inflation Tradeoffs under Alternative Exchange-Rate Regimes

A. The EMS

We characterize the EMS, following Giavazzi and Giovannini (1989), as a regime in which the Bundesbank sets its money supply and the Bank of France sets the DM/franc rate.[24] Since it effectively sets the money supply for all of Europe (and since the U.S. and Europe are symmetric), the Bundesbank faces the same employment-inflation tradeoff as the Fed. (The tradeoff facing the German fiscal authority differs from that of the American government, for reasons explained below.)

The reduced form for the DM/franc exchange rate is shown in the appendix to be:

(28) $$e^G - e^F \doteq \phi\left(m^F - m^G\right) - \xi\left(\tau^F - \tau^G\right).$$

Solving for m^F produces the constraint on the French money supply:

(29) $$m^F = m^G + \frac{1}{\phi}\left(e^G - e^F\right) + \frac{\xi}{\phi}\left(\tau^F - \tau^G\right).$$

Reduced forms for employment and the CPI are obtained by plugging this equation into the previously-obtained reduced forms. For the U.S.:

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[23] Recall that a decrease in τ is expansionary, raising employment and stabilizing the CPI. As a consequence, the tradeoffs faced by the fiscal policymakers are negatively sloped. Starting from the combination of inflation and unemployment induced by a negative supply shock, fiscal policy actually moves both variables in the desired direction.

[24] What we have in mind is the choice of the central parity between the two European currencies rather than of the daily exchange rate. In this sense, assuming that realignments are noncooperative -- as we are going to do -- may be too strong, as realignments are a matter of common discussion under the EMS. However, we believe that the way cooperation is modeled in this paper also goes beyond what was observed.

(30) $$q^{US} = \mathrm{A}m^{US} - \mathrm{B}m^{G} - \frac{\mathrm{B}}{2\phi}\left(e^{G} - e^{F}\right) - \frac{\mathrm{B}\xi}{2\phi}\left(\tau^{F} - \tau^{G}\right) + \mathrm{E}\tau^{US} + \Gamma\frac{\tau^{G} + \tau^{F}}{2} + \mathrm{K}u + \mathrm{H}x;$$

(31) $$\begin{aligned} n^{US} &= (1 - \lambda\Lambda)m^{US} + \lambda\Theta m^{G} + \frac{\lambda\Theta}{2\phi}\left(e^{G} - e^{F}\right) + \frac{\lambda\Theta\xi}{2\phi}\left(\tau^{F} - \tau^{G}\right) - (1 - \lambda\Omega)\tau^{US} + \\ &+ \lambda\Psi\frac{\tau^{G} + \tau^{F}}{2} + \Phi u - \Sigma x. \end{aligned}$$

The asymmetry between the instruments controlled by the two European central banks makes U.S. prices and employment sensitive to movements of the French franc against the deutschmark and to differences between French and German fiscal policies.

Making use of definitions in the appendix, German and French CPIs and employment become:

(32) $$\begin{aligned} q^{G} &= \mathrm{A}m^{G} - \mathrm{B}m^{US} + (1-\alpha)\tau^{G} + [\mathrm{E} - (1-\alpha)]\frac{\tau^{G} + \tau^{F}}{2} + \Gamma\tau^{US} + \\ &+ \left(\frac{\mathrm{A} - \alpha}{2\phi} + \frac{\mathrm{M}}{\phi}\right)\left(e^{G} - e^{F}\right) + \left[\frac{\xi(\mathrm{A} - \alpha)}{2\phi} + \frac{\mathrm{M}\xi}{\phi} - \mathrm{N}\right]\left(\tau^{F} - \tau^{G}\right) - \mathrm{K}u + \mathrm{H}x; \\ q^{F} &= \mathrm{A}m^{G} - \mathrm{B}m^{US} + (1-\alpha)\tau^{F} + [\mathrm{E} - (1-\alpha)]\frac{\tau^{G} + \tau^{F}}{2} + \Gamma\tau^{US} + \\ &+ \left(\frac{\mathrm{A} + \alpha}{2\phi} - \frac{\mathrm{M}}{\phi}\right)\left(e^{G} - e^{F}\right) + \left[\frac{\xi(\mathrm{A} + \alpha)}{2\phi} - \frac{\mathrm{M}\xi}{\phi} + \mathrm{N}\right]\left(\tau^{F} - \tau^{G}\right) - \mathrm{K}u + \mathrm{H}x; \end{aligned}$$

(33) $$\begin{aligned} n^{G} &= (1 - \lambda\Lambda)m^{G} + \lambda\Theta m^{US} - \tau^{G} + \lambda\Omega\frac{\tau^{G} + \tau^{F}}{2} + \lambda\Psi\tau^{US} + \\ &+ \frac{\lambda}{2}\left(1 - \frac{\Lambda}{\phi}\right)\left(e^{G} - e^{F}\right) - \frac{\lambda\Lambda\xi}{2\phi}\left(\tau^{F} - \tau^{G}\right) - \Phi u - \Sigma x; \\ n^{F} &= (1 - \lambda\Lambda)m^{G} + \lambda\Theta m^{US} - \tau^{F} + \lambda\Omega\frac{\tau^{G} + \tau^{F}}{2} + \lambda\Psi\tau^{US} + \\ &+ \left[\frac{1}{\phi} - \frac{\lambda}{2}\left(1 + \frac{\Lambda}{\phi}\right)\right]\left(e^{G} - e^{F}\right) + \frac{\xi}{\phi}\left(1 - \frac{\lambda\Lambda}{2}\right)\left(\tau^{F} - \tau^{G}\right) - \Phi u - \Sigma x. \end{aligned}$$

Under the EMS, the employment-inflation tradeoff faced by the Bank of France is $\left(\partial q^{F}/\partial n^{F}\right)^{BoF} = \left[\partial q^{F}/\partial\left(e^{G} - e^{F}\right)\right]/\left[\partial n^{F}/\partial\left(e^{G} - e^{F}\right)\right]$. The tradeoffs facing the Fed and the U.S. government do not depend on the European exchange-rate regime.[25] The tradeoff facing the Bundesbank worsens (relative to the flexible-rate case) and equals that of the Fed, while the tradeoff facing the Bank of France remains unchanged.[26] The German and French governments face more favorable tradeoffs than before, but the French government's gain is larger.[27]

B. EMU

Under EMU, the DM/franc nominal exchange rate is locked. France and Germany's monetary policies are managed subject to this constraint by a European Central Bank with preferences defined over aggregate European variables. The ECB chooses m^{Eu}, the European money supply, to minimize:

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25 The reduced-form parameters determining the U.S. authorities' tradeoffs are independent of the relative size of the two European countries (Ghironi and Giavazzi 1997*b*). If Europe consisted of one large country symmetric to the United States and a small open economy with no impact abroad, intra-European exchange-rate arrangements would have no implications for the U.S. By implication, since changes in the relative size of European countries do not affect the relevant parameters, the nature of the intra-EU regime must have no impact on U.S. tradeoffs also when European countries are identical.

26 The tradeoffs are constraints subject to which policymakers optimize their objective functions. The Bank of France's tradeoff does not change across regimes because, even if the instrument controlled by the French central bank changes, there is no change in the structural characteristics which determine the tradeoff facing the central bank. In particular there is no change in the size of the economy for which the French authority sets its instrument. This is different from the situation facing the Bundesbank, which now sets the money supply for all of Europe.

27 Under both floating and the EMS, the German and the French governments set taxes only for the domestic economy. But as we move from one intra-European exchange rate arrangement to another, the structural features of the economies which determine the governments' tradeoffs *are* affected. Under flexible rates, the FF-DM exchange rate is endogenous and taxes affect the endogenous variables through their direct supply- and demand-side impacts. But changes in the exchange rate also feed back through prices and employment, providing an *indirect* channel for fiscal impulses. With the transition from floating to the EMS, the French money supply becomes endogenous with respect to not just the German money supply but also both European governments' policies. Instead of having an *indirect* effect on prices and employment via the exchange rate, another *direct* channel for fiscal impulses is added through what was the direct impact of m^F on the economies. Since the French money supply has a larger impact on the French economy under flexible rates, this new channel of direct transmission of fiscal policies is more effective for the French economy, which explains why the French government's tradeoff improves more with the transition from flexible rates to the EMS.

(34) $$L^{ECB}=\frac{1}{2}\left[.9\left(q^{Eu}\right)^2+.1\left(n^{Eu}\right)^2\right].$$

With some algebra:

(35) $$q^{Eu}=\frac{q^G+q^F}{2}=\mathrm{A}m^{Eu}-\mathrm{B}m^{US}+\mathrm{E}\frac{\tau^G+\tau^F}{2}+\Gamma\tau^{US}+\mathrm{K}u+\mathrm{H}x;$$
$$n^{Eu}=\frac{n^G+n^F}{2}=(1-\lambda\Lambda)m^{Eu}+\lambda\Theta m^{US}-(1-\lambda\Omega)\frac{\tau^G+\tau^F}{2}+\lambda\Psi\tau^{US}-\Phi u-\Sigma x.$$

The reduced form equations for U.S. variables can be rewritten as:

(36) $$q^{US}=\mathrm{A}m^{US}-\mathrm{B}m^{Eu}+\mathrm{E}\tau^{US}+\Gamma\left(\frac{\tau^G+\tau^F}{2}\right)+\mathrm{K}u+\mathrm{H}x;$$
$$n^{US}=(1-\lambda\Lambda)m^{US}+\lambda\Theta m^{Eu}-(1-\lambda\Omega)\tau^{US}+\lambda\Psi\left(\frac{\tau^G+\tau^F}{2}\right)+\Phi u-\Sigma x.$$

Since the Maastricht Treaty does not require European governments to cooperate in the sense of jointly minimizing their loss functions, the French and German governments can still play Nash and have preferences defined over national variables. Therefore:

$$q^G=p^G-\beta z^G-\frac{1}{2}(1-\beta)\left(z^G-z^F\right);$$

and:

$$q^F=p^F-\beta z^F-\frac{1}{2}(1-\beta)\left(z^F-z^G\right)=p^F-\beta z^F+\frac{1}{2}(1-\beta)\left(z^G-z^F\right).$$

Subtracting q^G from q^F:

(37) $$q^F-q^G=p^F-p^G+z^G-z^F.$$

The definitions of the real exchange rates imply:

(38) $$z^G-z^F=e^G-e^F+p^G-p^F.$$

Because the DM-FF nominal exchange rate is fixed (e^G - e^F = 0):

(39) $$z^G-z^F=p^G-p^F.$$

Plugging (39) into (37), we have that $q^G = q^F = q^{Eu}$. Locking the nominal exchange rate between European currencies thus implies that French and German inflation rates are equalized ex ante. Differences in fiscal policies across European countries only affect employment. This can be shown by deriving the reduced forms for n^G and n^F. Recalling the reduced form for the nominal exchange rate between the French franc and the deutschmark, we see that e^G - e^F = 0 implies:

(40) $$m^F - m^G = \frac{\xi}{\phi}\left(\tau^F - \tau^G\right).$$

Another consequence of e^G - e^F = 0 is i^F - i^G = 0. (18) therefore becomes:

(41) $$n^F - n^G = m^F - m^G - \left(\tau^F - \tau^G\right) = -\left(1 - \frac{\xi}{\phi}\right)\left(\tau^F - \tau^G\right).$$

From(41), differences between τ^G and τ^F imply differences in employment. Solving for n^F and plugging the result into $n^G = 2n^{Eu} - n^F$ yields:

(42) $$n^G = n^{Eu} - \frac{1}{2}\left(1 - \frac{\xi}{\phi}\right)\left(\tau^G - \tau^F\right).$$

Finally, plugging the reduced form equation for n^{Eu} into this equation, we obtain reduced forms for employment:

(43) $$\begin{aligned} n^G &= (1 - \lambda\Lambda)m^{Eu} + \lambda\Theta m^{US} - \frac{1}{2}\left(2 - \lambda\Omega - \frac{\xi}{\phi}\right)\tau^G + \\ &-\frac{1}{2}\left(\frac{\xi}{\phi} - \lambda\Omega\right)\tau^F + \lambda\Psi\tau^{US} - \Phi u - \Sigma x. \end{aligned}$$

(44) $$\begin{aligned} n^F &= (1 - \lambda\Lambda)m^{Eu} + \lambda\Theta m^{US} - \frac{1}{2}\left(2 - \lambda\Omega - \frac{\xi}{\phi}\right)\tau^F + \\ &-\frac{1}{2}\left(\frac{\xi}{\phi} - \lambda\Omega\right)\tau^G + \lambda\Psi\tau^{US} - \Phi u - \Sigma x. \end{aligned}$$

The Fed's employment-inflation tradeoff under EMU is the same as under the EMS (because it is independent of the DM/franc exchange-rate regime). The ECB now faces the same tradeoff as the Bundesbank previously.[28]

The German government's tradeoff improves with the shift from EMS to EMU, while the French government's tradeoff worsens. Say that the French fiscal authorities want to stimulate employment under the EMS; they cut government spending. But the cut in French government spending must be coupled with an increase in the French money supply for any exchange rate chosen by the Bank of France, reinforcing the expansionary employment effect and improving the French government's tradeoff.[29]

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[28] Since both set monetary policy for the whole of Europe. The ECB's tradeoff is therefore the same as that facing the Fed.

[29] This can be seen from equation (29). Under our assumptions, it is $\phi > 0$ and $\xi < 0$. Recall also footnote 27.

With the transition to EMU, a cut in French spending now provokes both an increase in the French money supply and a reduction in the German money supply (leaving the Europe-wide money supply unchanged). Because the induced change in the French money supply is smaller than under the EMS, the tradeoff faced by the French government is worse (a given change in taxes and spending produces smaller employment gains). The same logic runs in reverse for the German fiscal authority: the tradeoff between its policy objectives improves following the transition to EMU.[30] [31]

The behavior of the tradeoffs under different regimes provides insight into the strategic interaction of policymakers, as we now show.

3. The Stabilization Game in an Anti-Keynesian World

We analyze the response of policymakers to a positive realization of x (a symmetric negative global productivity shock) in the absence of demand disturbances.

A. The Flexible Exchange Rate Solution

Here, all policymakers play noncooperatively and take other players' actions as given.

Reduced forms for the U.S. and Germany are shown in Table 3.[32] Solving the central banks' minimization problem yields the first order conditions:

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[30] European governments' tradeoffs follow from the symmetry of the EMU regime. Consider the change from flexible exchange rates to symmetrically fixed rates under EMU. The endogeneity constraint on monetary policy with respect to taxation is a constraint on the difference of m^G and m^F rather than m^F alone. As a consequence, the improvement in government tradeoffs is split evenly between France and Germany: the French government's tradeoff does not improve as much as when going from flexible rates to the EMS and the German government's tradeoff is better than in that case.

[31] Because nominal exchange rate stability does not imply real exchange rate stability, in the absence of fiscal cooperation European governments still have an incentive to export unemployment to the U.S. (via nominal and real movements of the European currencies with respect to the dollar) and to one another (via real FF-DM exchange rate movements). The U.S. has a similar incentive to export unemployment.

[32] Reduced forms for the French CPI and employment can be obtained by relabelling the corresponding German equations. We report approximate values of the reduced form parameters -- here as in the Keynesian case examined later. Details on the restrictions that hold across parameters are available upon request.

$$(45) \qquad .9q^j \frac{\partial q^j}{\partial m^j} + .1n^j \frac{\partial n^j}{\partial m^j} = 0, \qquad j = US, G, F.$$

Solving the fiscal authorities' minimization problems yields their reaction functions:

$$(46) \qquad .2\left(.1q^j \frac{\partial q^j}{\partial \tau^j} + .9n^j \frac{\partial n^j}{\partial \tau^j} \right) + .8\tau^j = 0, \qquad j = US, G, F.$$

These six conditions comprise a system of six linear equations in six unknowns. Symmetry between France and Germany implies equal settings for the French and German instruments, reducing the system to four equations in four unknowns.

Central banks, concerned mainly with inflation, respond to the supply shock with a monetary contraction (Table 4). Fiscal authorities, concerned mainly with employment, adopt expansionary policies (in the present context, by cutting public spending). European monetary policies are more contractionary than American monetary policy, while European fiscal policies are more expansionary. The asymmetry reflects the different tradeoffs facing policymakers on the two sides of the Atlantic.[33] Each European central bank contracts more because the two European economies are smaller and more open. The exchange rate appreciation induced by domestic monetary contraction, ceteris paribus, does more to damp down inflation in more open economies. Compared to the United States, the monetary contraction reduces inflation more, at lower cost in employment, encouraging the more active use of the instrument. Tax and spending cuts raise employment and further damp down inflation; because governments care mainly about employment, the more active use of monetary policy by their national central banks encourages them to use fiscal policy more actively.[34]

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[33] The absence of intra-European cooperation is necessary for the asymmetry. If the Bundesbank and the Bank of France cooperated with one another and the same was true of the two European governments, they would act as a single monetary authority and a single government setting instruments for the whole European economy, and different national tradeoffs would not induce an asymmetry across the Atlantic.

[34] As a result of the policy mix chosen by central banks and governments, European inflation is lower than U.S. inflation, European unemployment higher (the fiscal response only partly offsetting the impact of the monetary contraction on employment because the fiscal authorities pay a cost when changing taxes). The European central banks are better off than the Fed, while both European governments are worse off than the U.S. government. Note that

B. <u>The EMS Solution</u>

Reduced forms for the EMS scenario are shown in Table 3. The Bank of France now minimizes its loss function with respect to e^G-e^F, yielding:

$$(47)\quad .9q^F\frac{\partial q^F}{\partial\left(e^G-e^F\right)}+.1n^F\frac{\partial n^F}{\partial\left(e^G-e^F\right)}=0.$$

U.S. policies differ little from the case of flexible exchange rates.[35] But French and German policies are significantly different. Under flexible rates the Bank of France could not successfully export inflation by appreciating the franc against the DM (since France and Germany were symmetric). Now the Bank of France can push up the franc relative to the deutschmark, exporting inflation.[36] The French central bank still faces the same tradeoff as under flexible rates, but the Bundesbank faces a less favorable tradeoff (the same as the Fed). The German inflation rate is now higher than under flexible rates. The Bundesbank's optimal policy is less contractionary than before: the fact that it faces the same employment-inflation tradeoff as the Fed damps its incentive to appreciate its currency relative to the dollar.

Both European governments face better tradeoffs than the U.S. government's, and this gives them a chance to export unemployment to the other side of the Atlantic. This time, European governments are successful at achieving a better stabilization of employment than their U.S. counterpart,

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both European currencies depreciate in real terms against the dollar ($\left(z^G+z^F\right)/2=-.0268x$). In the appendix we show that fiscal policies have a larger impact than monetary policies on the U.S.-Europe real exchange rate. Fiscal authorities aim at exporting unemployment via real depreciation, and the impact on the exchange rate of European fiscal expansions dominates that of monetary contractions. But that depreciation is damped by the European central banks' incentive to move along their more favorable tradeoffs and to react to its inflationary consequences. Monetary contraction in Europe results in larger employment losses for the two European economies, while the fiscal expansion stabilizes inflation relative to the United States.

[35] While the Federal Reserve's optimal reaction to the negative supply shock is less contractionary, the U.S. government's fiscal policy is less expansionary.

[36] It is $z^G-z^F=-.0236x$. Note that it is $m^F=-1.6262x$. Although the Bank of France manages to appreciate the franc against the deutschmark, the fact that the Bundesbank contracts by less causes the French money supply to decrease by less than under flexible rates. There is an analogous result in the Keynesian case.

being helped by the reduced degree of monetary contraction in Europe.[37] The French government faces a more favorable tradeoff than the German. French fiscal policy is more expansionary than German fiscal policy because of this and to counteract the contractionary consequences of the appreciation of the franc. Nonetheless, unemployment is higher in France than in Germany. Thus, while the Bank of France is better off than the Bundesbank, the French government is worse off than the German. Even if the latter faces a more favorable tradeoff under the EMS regime than under the symmetric regime, German fiscal policy is less aggressive when the intra-European regime is asymmetric. This is a consequence of the reduced monetary contraction by the Bundesbank, which lowers the need for fiscal expansion to sustain employment.

C. The EMU Solution

Under EMU the first-order condition for the ECB is:

$$.9q^{Eu}\frac{\partial q^{Eu}}{\partial m^{Eu}}+.1n^{Eu}\frac{\partial n^{Eu}}{\partial m^{Eu}}=0. \tag{48}$$

The system of reaction functions can be simplified by observing that there are no asymmetries between the European countries.[38]

In contrast to the fears of inflation expressed by EMU critics in Germany, the ECB's policy is more contractionary than the Bundesbank's under the EMS.[39] The Bank of France adopted an aggressive anti-inflationary policy under the EMS because it faced a more favorable tradeoff than the Bundesbank; this allowed the French authority to export inflation to Germany via exchange rate appreciation. The Bundesbank was less aggressive because it controlled the money supply for all of Europe and thus faced an unfavorable employment-inflation tradeoff. Since the ECB now makes monetary policy for all of Europe, like the Bundesbank under the EMS, it faces the Bundesbank's tradeoff. But it selects a more contractionary point on that tradeoff. Because there

[37] In fact, the real depreciation of the European currencies against the dollar is now given by: $\left(z^G+z^F\right)/2=-.0468x$.

[38] First order conditions for the Fed and all three governments remain unchanged. The results for EMU are different from those in Ghironi and Giavazzi (1997*b*), which distinguishes EMU insiders and outsiders. Moreover, we allow for the absence of fiscal cooperation in the monetary union, a case not considered by these authors.

[39] But it is less contractionary than those of the French and German central banks under flexible exchange rates for reasons that should be clear.

is no Bank-of-France-like monetary contraction under EMU and the relevant tradeoff is worse, the French government's employment-friendly tax cut is smaller. That smaller tax cut does less to damp down inflation in both European countries, so the ECB adopts a more contractionary monetary policy than the Bundesbank previously. Effectively, the ECB's response lies between those of the two European central banks under the EMS. German fiscal policy is little changed, even if the tradeoff facing the German government is now better: on the one hand, a more contractionary monetary policy prompts a bigger tax cut to stimulate employment; on the other hand, France's diminished tendency to export unemployment moderates the size of the German tax cut.[40]

Because EMU removes the intra-European monetary externality, unemployment is lower in both European countries. This leaves both European governments, which care mainly about unemployment, better off with the transition from the EMS to EMU. European inflation is lower under EMU than German inflation under EMS. Intuitively, since the ECB's response lies between those of the two European central banks under the EMS, Europe-wide (and German) inflation lies between the French and German rates under the EMS. Thus, the Bundesbank's successors are left better off by the transition to EMU. Only the Bank of France's successors are left worse off (because Europe-wide inflation is higher than French inflation under the EMS).

This is our first important result. The change in the responses of monetary and fiscal authorities with the advent of Stage III may stabilize European output and employment. EMU may stabilize European fiscal policies. And the ECB's monetary policy may be even more rigorous than the Bundesbank's. Thus, results obtained using an approach that focuses on strategic interactions contrast with popular fears that EMU will encourage governments to pursue unstable fiscal policies and destabilize employment. They also contrast with German fears about the inflationary consequences of EMU for the German economy. Eliminating the contractionary bias of monetary policies under the EMS actually benefits Germany. At the same time, inflation rises elsewhere in Europe, driving the average European inflation rate above its level under the EMS.[41] [42]

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[40] It turns out that also the German government is less active than in the EMS regime. Recall also that, in the EMU scenario, the German and French governments face identical tradeoffs. This makes it impossible for them to successfully export unemployment to one another.

[41] If for reasons different from those usually invoked to argue that the ECB will be subject to inflationary pressure. Because the ECB faces the same tradeoff as the Bundesbank under the EMS, it selects a point on that tradeoff

Although there are no asymmetries between the two European countries, the fact that intra-European fiscal externalities are not internalized makes the U.S.-Europe equilibrium asymmetric. Both European governments still enjoy better tradeoffs than the U.S. government. Hence, fiscal policies in Europe are more active than U.S. fiscal policy and European governments successfully export some unemployment to the United States. Inflation is higher in the U.S. than in Europe (bigger European tax and spending cuts do more to damp down inflation).[43]

4. EMU and Policy Coordination in the Anti-Keynesian World

We consider a number of possible scenarios in the post-EMU era.

A. Cooperation Between Central Banks

In previous cases, European central banks were able to take advantage of the asymmetry between the U.S. and Europe to achieve lower levels of inflation than in the United States.[44] This may be interpreted to provide an argument for Transatlantic cooperation. Under this scenario, the dollar/Euro exchange rate is free to float, and fiscal authorities play Nash. But now the Fed and the ECB jointly minimize a weighted average of their loss functions. Symmetry

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closer to the point selected by the Bundesbank under the EMS than to the outcome the Bank of France could achieve.

[42] In Eichengreen and Ghironi (1996) we analyzed political-economy explanations for why Germany might support EMU. The results here provide an *economic* explanation of why the Bundesbank might prefer EMU. As argued by Giavazzi and Giovannini (1989) (and further explored by Ghironi and Giavazzi (1997*a*)), a managed exchange rate regime in which peripheral countries are able to export inflation to a core country can survive only so long as the latter is relatively large. In the absence of significant differences in country size and preferences, the core country will prefer a symmetric regime. This would appear to be the increasingly relevant case for Europe. Our results suggest that the political-economy case for EMU may be as important for other countries as for Germany, since the former will no longer enjoy the inflation benefits of an asymmetric regime.

[43] The Fed is more contractionary under EMU than under the EMS, since less active European fiscal policies do less to stabilize U.S. inflation. At the same time, Fed policy is more aggressive than that of the ECB (although this is insufficient to drive U.S. inflation below European levels).

[44] Indeed, in all cases, the dollar appreciates in real terms against the European currencies (under EMU, it is: $\left(z^G + z^F\right)/2 = -.0251x$) due to the interplay of monetary and fiscal policies, but still U.S. inflation is always higher than in Europe.

motivates setting the weights to one half.[45] Central banks solve:

$$\min_{m^{US},\, m^{Eu}} \frac{1}{2} L^{Fed} + \frac{1}{2} L^{ECB}. \tag{49}$$

The first order conditions are:

$$.9q^{US} \frac{\partial q^{US}}{\partial m^{US}} + 0.1 n^{US} \frac{\partial n^{US}}{\partial m^{US}} + .9q^{Eu} \frac{\partial q^{Eu}}{\partial m^{US}} + .1 n^{Eu} \frac{\partial n^{Eu}}{\partial m^{US}} = 0; \tag{50}$$

$$.9q^{US} \frac{\partial q^{US}}{\partial m^{Eu}} + 0.1 n^{US} \frac{\partial n^{US}}{\partial m^{Eu}} + .9q^{Eu} \frac{\partial q^{Eu}}{\partial m^{Eu}} + .1 n^{Eu} \frac{\partial n^{Eu}}{\partial m^{Eu}} = 0. \tag{51}$$

Monetary policies become less contractionary since central banks no longer have an incentive to manipulate the exchange rate to export inflation across the Atlantic.[46] In turn, this induces all three fiscal authorities to respond more moderately in all three countries. The equilibrium is still asymmetric because of the existence of intra-European fiscal externalities. France and Germany continue to cut taxes and spending more aggressively than the U.S. (in the effort to export unemployment to one another and to the U.S. by depreciating the Euro relative to the dollar). Because tax cuts damp down European inflation relative to U.S. inflation, the ECB is still less contractionary than the Fed.

Transatlantic monetary cooperation is undesirable from the standpoint of central banks because less contractionary monetary policies coupled with smaller reductions in taxation cause both U.S. and European inflation to rise. It is desirable from the standpoint of governments, however, because preventing central banks from manipulating exchange rates raises equilibrium output and employment. This is our second important result. Though the fiscal authorities will wish central banks to cooperate, the Fed and the ECB will not.

One can imagine how this could give rise to conflicts. Article 109 of the Maastricht Treaty empowers the Council of Ministers, acting by qualified majority, to adopt "general orientations" for exchange rate policy vis-a'-vis non-EU currencies. A purpose of this provision is presumably to facilitate

[45] An alternative, which we do not pursue here, is that the ECB and the Fed bargain over the weights attached to their loss functions.

[46] The equilibrium of the monetary-policy game is no longer a Nash equilibrium. This raises the usual implementability problems, which we assume away in what follows. For a survey of the standard reputation arguments on this issue, see Canzoneri and Henderson (1991). The mechanism design approach was first introduced in Persson and Tabellini (1995) and further explored in Morales and Padilla (1996).

the negotiation of Louvre-like intervention agreements. Article 109 states that such orientations must not jeopardize the pursuit of price stability, although it does not indicate who will determine whether this is the case. Nor does it provide a mechanism that would make the Council's general orientations binding on the ECB.[47]

That monetary cooperation can be counterproductive is not a new result. Canzoneri and Henderson (1991) show that cooperation limited to a subset of central banks can be counterproductive. Rogoff (1985) shows that cooperation can be counterproductive when it aggravates time inconsistency. Ghironi and Giavazzi (1997*b*) show that cooperation can be counterproductive when it prevents a central banker from optimally exploiting a favorable tradeoff. Here the result derives from the fact that cooperation encompasses central banks but not governments (that fiscal authorities cooperate with neither one another nor with their central banks).

B. Cooperation Between European Governments

We now assume that the French and German governments cooperate but the ECB and Fed do not. The two European governments minimize the average of their respective loss functions, solving:

$$\min_{\tau^G,\,\tau^F} \frac{1}{2} L^{fa^G} + \frac{1}{2} L^{fa^F}. \tag{52}$$

The first order conditions are:

$$.2\left(.1q^{Eu}\frac{\partial q^{Eu}}{\partial \tau^G} + .9n^G\frac{\partial n^G}{\partial \tau^G}\right) + .8\tau^G + .2\left(.1q^{Eu}\frac{\partial q^{Eu}}{\partial \tau^G} + .9n^F\frac{\partial n^F}{\partial \tau^G}\right) = 0; \tag{53}$$

$$.2\left(.1q^{Eu}\frac{\partial q^{Eu}}{\partial \tau^F} + .9n^F\frac{\partial n^F}{\partial \tau^F}\right) + .8\tau^F + .2\left(.1q^{Eu}\frac{\partial q^{Eu}}{\partial \tau^F} + .9n^G\frac{\partial n^G}{\partial \tau^F}\right) = 0; \tag{54}$$

The system can be further simplified by noting that intra-European fiscal cooperation under EMU renders European policymakers' incentives identical to those of American policymakers.[48]

Again, policy coordination is counterproductive. This is our third important result. Both central banks and all three governments are worse off

[47] A decision to establish a system of pegged exchange rates for the industrial countries or a global system of target zones would rest with the Council of Ministers. The Council must act unanimously after consulting with the ECB and attempting to reach a consensus on the compatibility of its decision with price stability. In this case the Council's decision will bind the ECB.

[48] We thus have two equations in two unknowns.

than when neither central banks nor governments cooperate. Neither France nor Germany cuts taxes as aggressively (since they refrain from trying to export unemployment to the other). This induces the ECB to contract more aggressively. Because policy instruments are set identically in the U.S. and Europe, European governments no longer manage to depreciate the Euro against the dollar. In the absence of the favorable effect of the appreciation of the dollar on U.S. prices, the Fed contracts more aggressively to damp down inflation, inducing the U.S. government to respond more actively. This notwithstanding, both U.S. inflation and unemployment rise, leaving the U.S. government and the Fed worse off. Inflation and unemployment also rise in Europe, rendering all three European policy authorities worse off too.[49]

Thus, intra-EU fiscal policy coordination is counterproductive under EMU when the policy has anti-Keynesian effects. Governments and central banks on both sides of the Atlantic are worse off when the French and German governments cooperate.[50] This is because there remain other externalities in the model: the transatlantic fiscal externality arising from the failure of the U.S. and European governments to coordinate their tax and spending policies, the transatlantic monetary externality arising from the failure of the Fed and the ECB to coordinate, and the externalities associated with the failure of central banks *and* governments to coordinate. Absent fiscal cooperation, all three governments cut taxes too aggressively to export unemployment; cooperation between France and Germany reduces this bias in Europe but reinforces it in the United States (the U.S. has an incentive to cut taxes even more aggressively). The two central banks react by contracting more. Inflation nevertheless remains high, and unemployment worsens.

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[49] Alternatively, consider the comparison with the case where central banks cooperate but fiscal authorities do not. Monetary policy is more contractionary when European fiscal authorities cooperate but central banks do not (for the reasons described above). Fiscal policies converge to a point between those pursued by the U.S. and Europe when governments do not cooperate. Neither France nor Germany now cuts taxes as aggressively in an effort to export unemployment to its European neighbor. The U.S. cuts taxes more aggressively to stimulate employment because monetary policy is more contractionary. Strikingly, all three governments and both central banks are worse off than when central banks cooperate but European governments do not. The Fed is worse off because U.S. inflation declines only marginally but unemployment rises significantly. This same rise in American unemployment renders the U.S. government worse off. The European authorities are left worse off because European inflation and unemployment both rise.

[50] Regardless of whether or not the Fed and the ECB cooperate.

The presumption in Europe is that EMU requires intra-EU fiscal coordination. The Maastricht Treaty provides a Mutual Surveillance Procedure (Article 103) which instructs the Council to develop guidelines for the economic policies of member states, to monitor their economic policies, and to issue recommendations should policies be inconsistent with its guidelines. The rationale for this procedure is to encourage fiscal policy coordination. Our analysis suggests that there are cases where this is undesirable.

C. Cooperation Between Central Banks and Cooperation Between European Governments

If the French and German governments cooperate and the Fed and the ECB cooperate as well, only policy externalities associated with the absence of transatlantic fiscal cooperation and with cooperation *between* monetary and fiscal authorities remain. Relative to where the two European governments cooperate but the Fed and the ECB do not, all three governments are better off, but both central banks are worse off. Governments will want their central banks to cooperate, but their central banks will resist. This is the same result we obtained in the absence of intra-EU fiscal coordination.

D. Cooperation Between Central Banks plus Global Fiscal Cooperation

When all three fiscal policymakers cooperate, they jointly minimize a weighted sum, with weights equal to 1/2, of the U.S. government's loss function and of an average of the German and French governments' losses. The problem is:

(55) $$\min_{\tau^{US},\,\tau^{G},\,\tau^{F}} \frac{1}{2} L^{fa^{US}} + \frac{1}{2}\left(\frac{L^{fa^{G}} + L^{fa^{F}}}{2} \right).$$

The first order conditions are:

(56) $$\begin{aligned} &.2\left(.1q^{US} \frac{\partial q^{US}}{\partial \tau^{US}} + .9n^{US} \frac{\partial n^{US}}{\partial \tau^{US}} \right) + .8\tau^{US} + \\ &+.5\left[.2\left(.1q^{Eu} \frac{\partial q^{Eu}}{\partial \tau^{US}} + .9n^{G} \frac{\partial n^{G}}{\partial \tau^{US}} \right) + .2\left(.1q^{Eu} \frac{\partial q^{Eu}}{\partial \tau^{US}} + .9n^{F} \frac{\partial n^{F}}{\partial \tau^{US}} \right) \right] = 0; \end{aligned}$$

(57) $$\begin{aligned} &.2\left(.1q^{US} \frac{\partial q^{US}}{\partial \tau^{G}} + .9n^{US} \frac{\partial n^{US}}{\partial \tau^{G}} \right) + \\ &+.5\left[.2\left(.1q^{Eu} \frac{\partial q^{Eu}}{\partial \tau^{G}} + .9n^{G} \frac{\partial n^{G}}{\partial \tau^{G}} \right) + .8\tau^{G} + .2\left(.1q^{Eu} \frac{\partial q^{Eu}}{\partial \tau^{G}} + .9n^{F} \frac{\partial n^{F}}{\partial \tau^{G}} \right) \right] = 0; \end{aligned}$$

$$(58)\quad \begin{aligned} &.2\left(.1q^{US}\frac{\partial q^{US}}{\partial\tau^{F}}+.9n^{US}\frac{\partial n^{US}}{\partial\tau^{F}}\right)+ \\ &+.5\left[.2\left(.1q^{Eu}\frac{\partial q^{Eu}}{\partial\tau^{F}}+.9n^{G}\frac{\partial n^{G}}{\partial\tau^{F}}\right)+.2\left(.1q^{Eu}\frac{\partial q^{Eu}}{\partial\tau^{F}}+.9n^{F}\frac{\partial n^{F}}{\partial\tau^{F}}\right)+.8\tau^{F}\right]=0. \end{aligned}$$

These can be combined with (50) and (51) to obtain values for the policy instruments.

When governments no longer attempt to export unemployment, fiscal policies become dramatically less expansionary. This fuels inflation and central banks respond with sharp monetary contraction (even though the Fed and the ECB, now playing cooperatively, no longer seek to export inflation to one another). The employment loss is larger than before. Smaller tax cuts end up destabilizing inflation. Consequently, central banks as well as governments suffer larger losses.[51]

Global fiscal cooperation together with global monetary cooperation leads to the worst possible outcome due to the absence of cooperation *between* monetary and fiscal authorities. The main impact of monetary policy is on the variable that is most important for fiscal policymakers -- employment -- while the main impact of fiscal policy is on the variable that is most important for central banks -- inflation. Our result is consistent with the familiar finding that, when multiple externalities tend to offset each other, internalizing only some of them can be counterproductive.

IV. The Keynesian Case

In the Keynesian case we eliminate the distortionary tax in equation (2), assuming instead that taxes are lump sum. Two features of the specification are important for the results. Because European governments are assumed to divide their spending evenly between French and German goods, (paralleling the behavior of French and German households), European fiscal policies do not affect the intra-European exchange rate once we remove the distortionary tax.[52] And international cooperation will not generally be

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[51] The only authorities that are worse off in an alternative scenario are the European governments in the pre-EMS era: although the outcome in terms of inflation and unemployment in that scenario was more favorable, that outcome was achieved at the cost of more volatile taxation, which kept the European governments' losses above those obtained in the present scenario.

[52] In the anti-Keynesian case European fiscal policies affected the intra-European exchange rate because in addition to changing the demand for European goods, as here, they also affected the supply (through distortionary taxes).

superior to other regimes because of the existence of other distortions (associated with the lack of cooperation between monetary and fiscal authorities within countries). As in the anti-Keynesian case, global cooperation between monetary or fiscal authorities will not be optimal.

Reduced forms for the Keynesian case are in the appendix. Numerical values of the reduced forms are displayed in Table 7.

1. The Stabilization Game

Now that government spending has Keynesian effects (operating through the balanced-budget multiplier), governments concerned mainly to offset the rise in unemployment respond by raising spending (though that increase will be damped because the sign of their tradeoff has changed, additional government spending increasing inflation).[53]

A. The Flexible Exchange Rate Solution

Under flexible rates, central banks concerned mainly with inflation cut back the money supply, while governments concerned more with unemployment increase spending (Table 8). As was the case before, European central banks continue to tighten more than the Fed because the two European economies are more open than the United States and face more favorable tradeoffs. The French and German governments, in contrast, increase spending less than the U.S. because they fail to internalize the employment-creating effects of their spending on the other European country. (This contrasts with the anti-Keynesian case, where European governments adjusted their spending more radically than the U.S. because they faced more favorable tradeoffs and intra-European fiscal spillovers were negative.)[54]

Now that the asymmetric supply-side effect has been removed, only the symmetric demand-side effect remains. Note however that European fiscal policies continue to affect the U.S. real exchange rate because of the asymmetries between the United States and the individual European countries.

[53] This change in the nature of fiscal policies does not affect the tradeoffs facing the central banks. Because fiscal policies do not affect the intra-European exchange rate, changes in the monetary arrangement between European countries no longer affect the tradeoff facing governments. All governments' tradeoff remains $(\partial q/\partial g)/(\partial n/\partial g) = .0276$. It is positively sloped, fiscal policy having the standard Keynesian effects.

[54] In the anti-Keynesian case, a cut in German spending reduced French employment by increasing the supply of German goods, driving down their price, and driving up (appreciating) France's real exchange rate. Now an increase in German spending affects French output mainly by increasing the (German) demand for French goods.

B. The EMS

Just as in the anti-Keynesian case, the Bundesbank contracts less dramatically with the shift from floating to the EMS; as before, it sees itself as possessing less opportunity to export inflation because it sets monetary policy for all of Europe. And as before, the Bank of France manages to export inflation to Germany by appreciating the exchange rate. German monetary policy being less contractionary, German fiscal policy can be less expansionary (limiting the cost to the government from changing spending). The French government now expands less than under flexible exchange rates. Even if the Bank of France manages to appreciate the franc, French money supply still decreases by less than under flexible rates.[55] This reduces the need for expansion to stabilize employment. However, since French monetary policy is more contractionary than German monetary policy, the French government expands more than the German. As in the anti-Keynesian case, the French government and central bank are better off now that they have the exchange rate to manipulate. While the Bundesbank is worse off, the German government is better off due to the smaller fall in German employment and the need to alter the level of public spending by less.

Thus, while the signs of the fiscal responses differ from the anti-Keynesian case, the consequences for welfare are little affected.

C. EMU

In the anti-Keynesian case, the ECB was more restrictive than the Bundesbank under the EMS but less restrictive than the two European central banks under floating. Now the ECB is less restrictive than the Bundesbank under the EMS.[56] Since there is no radical monetary contraction by the Bank of France, the French government increases spending by less. Because that smaller spending increase contributes less to inflation, the ECB contracts the money supply by less.[57]

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55 It is $m^F = -2.4196x$.

56 Even if it remains less contractionary than the two European central banks under floating, consistent with the changes in incentives due to the different tradeoffs facing the monetary authorities.

57 As we show in the appendix, German and French employment is equalized *ex ante* under EMU (different from the anti-Keynesian case). This is because fiscal policies no longer affect the intra-European exchange rate, removing a distortion in non-cooperative fiscal policymaking. Intra-European fiscal externalities still exist due to the impact of European fiscal policies on the U.S./Europe exchange rate, and it is precisely the failure to internalize these employment-creating externalities that causes European fiscal policies

Thus, the results in the Keynesian case are consistent with the popular presumption that EMU weakens monetary discipline. The reason is not lack of fiscal discipline -- to the contrary, the transition to EMU continues to stabilize fiscal policy relative to the EMS (both French and German fiscal policies are less expansionary than under the EMS). As before, EMU removes the intra-European monetary externality and the incentive for the Bank of France to tighten excessively; this produces less unemployment in both France and Germany and an improvement in welfare for both the French and German governments. As before, average European inflation is higher than under the EMS, and the ECB is worse off than the Bank of France but better off than the Bundesbank under that regime. The transition continues to benefit the German authorities because of the increase in fiscal discipline.

Both the Fed and the U.S. fiscal authority are better off due to EMU. That there is no Bank-of-France-like contraction driving up U.S. import prices means that a less radical monetary contraction is required of the Fed, and a less pronounced (and costly) increase in public spending is required of the U.S. government. This is in contrast to the anti-Keynesian case, in which both the Fed and the U.S. government were left worse off by EMU. Then the move from EMS to EMU induced the Fed to adopt a more contractionary policy and the U.S. government to cut taxes by more. The more aggressive monetary policy had a destabilizing impact on employment, which the further fiscal expansion was insufficient to offset. In contrast, the impact on inflation of more active monetary and fiscal policies was more than offset by the more rigorous stance adopted by the ECB together with the inflationary impact in the U.S. of smaller tax cuts in Europe.

2. EMU and Policy Coordination in the Keynesian World

We focus on the same four scenarios as before.

A. Cooperation Between Central Banks

As before, monetary policy becomes less contractionary now that central banks resist the incentive to export inflation. As before, this allows governments to respond more moderately (now this means that they *increase* spending by less). While unemployment is lower and inflation is higher, now central banks as well as governments are better off. The conflict over cooperation that arose in the anti-Keynesian case (where governments wanted central banks to cooperate but central banks did not) evaporates here. Even

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to remain less expansionary than the U.S. fiscal policy when there is no fiscal cooperation in Europe.

if inflation is higher, the employment gains associated with the removal of the contractionary bias of non-coordinated monetary policies offset the inflation loss and induce the central banks to cooperate.

B. Cooperation Between European Governments

In the anti-Keynesian case, European and U.S. governments wanted central banks to cooperate but central banks did not. Now the ECB wants European governments to cooperate but governments do not. This seems to accord with the policy debate in which European central banks are insisting on mutual surveillance of fiscal policies but national governments are resisting. When European governments cooperate, they increase their spending much more dramatically (internalizing the stimulus to employment in the rest of Europe). Central banks respond by contracting more. Both inflation and unemployment are lower in Europe, although the French and German governments are left worse off because they pay an additional cost from changing their policy instruments.[58]

C. Cooperation Between Central Banks and Cooperation Between European Governments

When fiscal cooperation in Europe is coupled with transatlantic monetary cooperation, monetary policies become less contractionary. Governments adopt less expansionary fiscal policies to stimulate employment. Inflation rises in both Europe and the U.S., unemployment falls. Now there is no conflict over the desirability of monetary cooperation. Though inflation rises, the employment gain suffices to induce central banks to cooperate.

D. Cooperation Between Central Banks and Global Fiscal Cooperation

As in the anti-Keynesian case, cooperation among central banks together with cooperation among governments is counterproductive. When the transatlantic employment-creating effect of fiscal policies is internalized, fiscal expansions increase sharply (in contrast to the anti-Keynesian case, where internalization of fiscal externalities reduced the degree of fiscal activism). This fuels inflation and induces central banks to react with more contractionary policies (as in the anti-Keynesian world). Although the effects on endogenous variables are negligible (inflation and unemployment remain basically unchanged with respect to the previous policy regime),

[58] The Fed does not share the ECB's desire for European fiscal cooperation. Even if it adopts a more contractionary policy, it cannot fully counteract the inflationary consequences of increased government spending and of the more restrictive policy of the ECB, and its own restrictive policy further aggravates U.S. unemployment.

governments are significantly worse off because of the more active use they make of their instrument.

V. Conclusion

We have addressed the question of how EMU will affect U.S.-Europe policy interactions and the prospects for transatlantic cooperation, focusing on optimal reactions to a common supply disturbance in both Keynesian and anti-Keynesian settings. The anti-Keynesian case could prevail in the early years of Stage III, when European countries are still seeking to move away from unsustainable fiscal trajectories. The Keynesian case may be a more accurate depiction of subsequent years.

In the anti-Keynesian scenario, EMU may enhance monetary and fiscal discipline and stabilize employment in Europe. This contrasts with fears that EMU will encourage governments to pursue unstable fiscal policies and with current German fears about EMU. But the ECB and central banks outside Europe will have little incentive to coordinate their response to supply shocks. Governments may wish central banks to coordinate, but the latter will not share their interest. And fiscal coordination can be counterproductive under EMU because there remain other externalities in the model even when intra-European fiscal externalities are internalized. It is widely presumed that EMU requires intra-EU fiscal coordination; we find that there are cases where this is undesirable.

Things change when fiscal policy has Keynesian effects. In this case, EMU may reduce monetary discipline, the ECB's policy being less restrictive that the Bundesbank's under the EMS. But the reason is not lack of fiscal discipline -- to the contrary, the transition to EMU continues to stabilize fiscal policy relative to the EMS. Along with the German authorities, the Fed and the U.S. government are made better off by EMU. This is in contrast to the anti-Keynesian case, where both the Fed and the U.S. government are left worse off. Finally, when fiscal policy has standard textbook effects, the ECB and central banks outside Europe will wish to coordinate their response to supply shocks. The conflict between central banks and governments in the anti-Keynesian setting evaporates, but a new conflict arises. The ECB will want European governments to coordinate their policies, but governments will not. This result seems consistent with the current policy debate, in which European central banks are insisting on mutual surveillance of fiscal policies but national governments are resisting.

Our conclusions do not encourage hopes for transatlantic monetary cooperation in the early years of Stage III when anti-Keynesian conditions may prevail. This confirms Kenen's (1995) skepticism about the prospects for monetary cooperation and reinforces cautions expressed in Eichengreen and Ghironi (1996*a*). At the same time, the arrangements central banks prefer may not be optimal either. Governments in both Europe and the U.S. would prefer the ECB and Fed to cooperate. But this is not sufficient to argue in favor of monetary cooperation if we regard central bank independence as a "good" to be preserved. There is a need for another solution to the problem of choosing the optimal post-EMU policymaking regime.

Suppose no cooperation exists among monetary *and* fiscal authorities, so that central bank independence (in the sense we have defined it) is preserved. Suppose also that citizens in each country care about both the central bank and government's loss functions and value monetary regimes according to an arithmetic average of the losses after optimal policies are implemented. Table 11 suggests that residents of all countries prefer EMU coupled with ECB-Fed cooperation. However, while the choice criterion summarized in Table 11 does not require the central banks to cooperate with governments, the scenario that is preferred by citizens in all countries is not what central banks prefer.[59] We are left with the problem of how to implement the optimal arrangement without violating the independence of central banks. This points to the importance of the institutional design as a means for dealing with conflicts that might arise among policymakers.[60]

There are several other lines along which our research could be extended and improved. An interesting one has to do with the interactions *between* monetary and fiscal policy and with the potential presence of asymmetries across countries in the way fiscal policy affects the economy. Empirical observation seems to suggest that a model in which cross-country asymmetries in the impact of fiscal policy are allowed could be a better depiction of reality in the short as well as in the long run. For example, it may be argued that the U.S. economy and the core European economies are indeed more likely

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[59] Table 12 summarizes the results for the Keynesian case. As expected, EMU coupled with monetary cooperation is first best. In both tables, citizens in Europe and the U.S. have different views of the second best outcome, Europeans preferring the EMU-no cooperation scenario and Americans favouring EMU coupled with monetary cooperation and intra-European fiscal cooperation. Monetary cooperation with global fiscal cooperation is the worst of all worlds.

[60] We make a start at analyzing institutional issues in Eichengreen and Ghironi (1996*b*).

to be in a Keynesian environment also in the short run, while the anti-Keynesian case would better apply to peripheral European economies. Other sources of cross-country asymmetry that are not explored in the paper may be relevant.[61] Exploring the consequences of alternative Euro-dollar exchange-rate regimes could also be interesting. The abundance of potentially interesting extensions of our analysis makes it even more apparent that our results have been obtained within the framework of a model which, as all models, is an extremely simplified picture of reality. Therefore we do not claim too much for their generality.[62] However, the results we have obtained for a sensible parameterization of the model seem to point to interesting phenomena, which do deserve further exploration. Finally, on the sensitivity of the findings to our assumptions about parameter values, although some sensitivity analysis would be appropriate, we believe that the consistency of the numerical results with theoretical results presented in the paper lends some robustness to the conclusions of our exercise.

[61] Artis and Gazioglu (1987) analyze the consequences of asymmetries in the wage-setting procedure in a two-country model. Reactions to asymmetric disturbances may be considered, as well as the impact of cross-country differences in the weights attached by policymakers to the targets in their loss functions. We did not consider such asymmetries in order to focus on the sheer impact of strategic interactions in the simplest possible framework.

[62] The time-frame is another limit of our analysis: monetary and fiscal policy are characterized by different internal and external lags, which we cannot consider in our model. Also, a static framework does not allow to analyze the impact of deficit spending and incomplete pass-through from exchange rates to prices -- a commonly observed phenomenon.

Appendix

A. Solution of the Model under Flexible Exchange Rates

This Appendix presents the solution of the model under flexible exchange rates for the case of anti-Keynesian fiscal policies.

We use the following simplified notation. For any variable f, we define: $\bar{f} = \frac{f^G + f^F}{2}$; $\tilde{f} = f^{US} - \frac{f^G + f^F}{2}$; $\hat{f} = f^G - f^F$.

With these definitions in mind, subtracting the sum of equations (8*G*) and (8*F*) from equation (8*US*), rearranging, and dividing by two yields: (A.1) $-\left[1-(1-2\beta)\varepsilon\right]\tilde{y}-(1-2\beta)v\tilde{r}-(1-2\eta)\tilde{g}+2\delta\tilde{z}+2u=0$; where we assume that β and ε are such that $1 - (1 - 2\beta)\varepsilon > 0$.

Subtracting (8*F*) from (8*G*) and rearranging gives: (A.2) $-\hat{y}-2\delta\hat{z}=0$.

Subtracting $(r^G + r^F)/2$ from r^{US}, multiplying by two, eliminating $(i^{US} - i^G)$ and $(i^{US} - i^F)$ using the uncovered interest parity conditions, and using the definitions of CPIs and real exchange rates allows us to write: (A.3) $\tilde{r}=\frac{1}{2}(1-2\beta)\left\{\left[E\left(z^G_{+1}\right)-z^G\right]+\left[E\left(z^F_{+1}\right)-z^F\right]\right\}$. To simplify this expression, recall that static expectations are rational in our model. Expected values of all disturbances for tomorrow and beyond based on today's information are zero, and expected real exchange rates for tomorrow and beyond based on today's information are independent of expected future money supplies because expected nominal wages and output prices are flexible. We can therefore impose a no-speculative-bubble condition such that: $E(z^g_{+1})=E(z^f_{+1})=0$.

Equation (A.3) can now be rewritten as: (A.4) $\tilde{r}=-(1-2\beta)\bar{z}$.

Equations (1*US, G, F*) , together with equations (18*US, G, F*), allow us to write: (A.5) $\tilde{y}=(1-\alpha)\left\{\tilde{m}-\tilde{\tau}+\lambda\tilde{i}\right\}$.

Imposing the no-speculative-bubbles condition on the nominal exchange rate and summing the uncovered interest parity conditions, we obtain: (A.6) $\tilde{i}=-\bar{e}$. Solving the equations defining the dollar-DM and dollar-FF real exchange rates for the nominal exchange rates and plugging the results into the previous equation, we have:

(A.7) $\tilde{i}=-\bar{z}-\tilde{p}$.

Equations (19*US, G, F*) allow us to write:

(A.8) $\tilde{p}=\alpha\tilde{m}+\alpha\lambda\tilde{i}+(1-\alpha)\tilde{\tau}$.

Substituting this result into (A.7) and rearranging:

(A.9) $$\tilde{i} = -\frac{1}{1+\alpha\lambda}\left\{\bar{z} + \alpha\tilde{m} + (1-\alpha)\tilde{\tau}\right\}.$$

Plugging (A.9) into (A.5), we obtain:

(A.10) $$\tilde{y} = \frac{1-\alpha}{1+\alpha\lambda}\left\{\tilde{m} - (1+\lambda)\tilde{\tau} - \lambda\bar{z}\right\}.$$

We can now derive a reduced form for $\bar{z} = (z^G + z^F)/2$. Substituting (A.4) and (A.10) into (A.1), taking the governments' budget constraints into account and rearranging, we have: (A.11) $\bar{z} = \frac{\rho}{\gamma}\tilde{m} - \frac{\mu}{\gamma}\tilde{\tau} - \frac{2}{\gamma}u;$

where the parameters are:

$$\gamma = \frac{\lambda(1-\alpha)\left[1-(1-2\beta)\varepsilon\right]}{1+\alpha\lambda} + (1-2\beta)^2 v + 2\delta;\ \rho = \frac{(1-\alpha)\left[1-(1-2\beta)\varepsilon\right]}{1+\alpha\lambda};$$

$$\mu = \frac{(1-\alpha)(1+\lambda)\left[1-(1-2\beta)\varepsilon\right]}{1+\alpha\lambda} - (1-2\eta);$$

which are all positive given our assumptions.

In the case of monetary union in Europe, the previous equation defines the reduced form for the real exchange rate between the dollar and the Euro. [63] Since public expenditures coincide with tax revenues, an increase in taxes is also an increase in expenditure and induces a real appreciation.[64]

Using (18*G*) and (18*F*) together with (1*G*) and (1*F*) yields:

(A.12) $$\hat{y} = (1-\alpha)\left[\hat{m} - \hat{\tau} + \lambda\hat{i}\right].$$

From the uncovered interest parity conditions: (A.13) $\hat{i} = \hat{e}.$

However, it is also true that: (A.14) $\hat{z} = \hat{e} + \hat{p}.$

Making use of (18*G, F*) and (19*G, F*), we get:

(A.15) $$\hat{e} = \hat{z} - \alpha\hat{m} - (1-\alpha)\hat{\tau} - \alpha\lambda\hat{i}.$$

Since equation (A.13) holds: (A.16) $\hat{i} = \frac{1}{1+\alpha\lambda}\left[\hat{z} - \alpha\hat{m} - (1-\alpha)\hat{\tau}\right].$

Plugging (A.16) into (A.12) and substituting into (A.2), we obtain: (A.17) $-(1-\alpha)\left\{\hat{m} - \hat{\tau} + \lambda\left[\frac{1}{1+\alpha\lambda}\left[\hat{z} - \alpha\hat{m} - (1-\alpha)\hat{\tau}\right]\right]\right\} - 2\delta\hat{z} = 0.$

[63] Summing German and French variables and dividing by two is equivalent to defining "European" variables.

[64] Since $\mu > \rho$, fiscal policy always has a greater effect than monetary policy on the U.S.-Europe real exchange rate.

The world demand disturbance does not appear in expressions for differences between German and French variables since it affects both countries in the same way.

(A.11) and (A.17) can be solved for z^G and z^F to obtain:

(A.18G) $$z^G = \frac{\rho}{\gamma}\widetilde{m} - \frac{\mu}{\gamma}\widetilde{\tau} - \frac{2}{\gamma}u - \frac{1-\alpha}{2\left[\lambda(1-\alpha)+2\delta(1+\alpha\lambda)\right]}\left[\hat{m}-(1+\lambda)\hat{\tau}\right];$$

(A.18F) $$z^F = \frac{\rho}{\gamma}\widetilde{m} - \frac{\mu}{\gamma}\widetilde{\tau} - \frac{2}{\gamma}u + \frac{1-\alpha}{2\left[\lambda(1-\alpha)+2\delta(1+\alpha\lambda)\right]}\left[\hat{m}-(1+\lambda)\hat{\tau}\right].$$

Subtracting (A.18F) from (A.18G) gives the reduced form for the FF-DM real exchange rate: (A.19) $\hat{z} = -\frac{1-\alpha}{\lambda(1-\alpha)+2\delta(1+\alpha\lambda)}\left[\hat{m}-(1+\lambda)\hat{\tau}\right].$

If m^G increases, the FF tends to appreciate with respect to the DM, further weakening the DM relative to the dollar. Thus, the model captures the so-called dollar-DM polarization, with European currencies other than the DM strengthening with respect to the German currency when the latter weakens against the dollar.[65]

Plugging (A.11) into (A.9) gives the reduced form for the U.S.-Europe nominal interest differential: (A.20) $\widetilde{i} = -\varphi\widetilde{m} + \upsilon\widetilde{\tau} + 2\kappa u;$ where:

$$\varphi = \frac{\rho+\alpha\gamma}{\gamma(1+\alpha\lambda)} > 0;\ \upsilon = \frac{\mu-\gamma(1-\alpha)}{\gamma(1+\alpha\lambda)} > 0 \Leftrightarrow \mu > \gamma(1-\alpha);\ \kappa = \frac{1}{\gamma(1+\alpha\lambda)} > 0.$$

Together with the uncovered interest parity conditions, (A.20) implies the reduced form for the nominal exchange rate between the dollar and the European currency: (A.21) $\bar{e} = \varphi\widetilde{m} - \upsilon\widetilde{\tau} - 2\kappa u.$ A monetary expansion in the U.S. causes the dollar to depreciate against the European currency.

Plugging the reduced form for the FF-DM real exchange rate into (A.16), we obtain the reduced form for the FF-DM nominal rate:

(A.22) $\hat{e} = -\phi\hat{m} + \xi\hat{\tau};$ where:

[65] Since Germany and France are assumed to be symmetric, U.S. monetary and fiscal policies have no effects on the position of their currencies against each other. Thus, the model captures the dollar-DM polarization only when this is caused by German or French economic policies.

$$\phi = \frac{1-\alpha}{1+\alpha\lambda}\frac{1}{\lambda(1-\alpha)+2\delta(1+\alpha\lambda)} + \frac{\alpha}{1+\alpha\lambda};$$

$$\xi = \frac{(1+\lambda)(1-\alpha)}{1+\alpha\lambda}\frac{1}{\lambda(1-\alpha)+2\delta(1+\alpha\lambda)} - \frac{1-\alpha}{1+\alpha\lambda}.$$

Holding the German money supply and taxation constant, a higher money supply in France depreciates the FF against the DM. The same effect is produced by an increased taxation in France if $\xi < 0$.

To find reduced form equations for interest rates, it is useful to use Aoki's (1981) technique of reasoning in terms of averages and differences. Define the world nominal and real interest rates as averages of the U.S. and (aggregate) European values:

(A.23) $i^W = \frac{1}{2}\left(i^{US} + \bar{i}\right);$ (A.24) $r^W = \frac{1}{2}\left(r^{US} + \bar{r}\right).$

We know that: $\tilde{r} = -(1-2\beta)\bar{z}$. Also: $\bar{i} = 2i^W - i^{US}$. Plugging this into $\tilde{i} = -\bar{e}$ and rearranging, we have: (A.25) $i^{US} = i^W - \frac{1}{2}\bar{e}$. Using (A.23), we find: (A.26) $\bar{i} = i^W + \frac{1}{2}\bar{e}$.

Substituting $\bar{r} = 2r^W - r^{US}$ into $\tilde{r} = -(1-2\beta)\bar{z}$ and rearranging:

(A.27) $r^{US} = r^W - \frac{1}{2}(1-2\beta)\bar{z}$. Given (A.24), we have: (A.28) $\bar{r} = r^W + \frac{1}{2}(1-2\beta)\bar{z}$.

Imposing the no-speculative-bubble condition on the world consumer price index: (A.29) $r^W = i^W + q^W$.

Since real exchange rate movements cancel on a world scale, the world CPI coincides with the world PPI:

(A.30)
$$q^W = \frac{1}{2}\left[p^{US} + \beta\bar{z} + \frac{1}{2}p^G - \frac{1}{2}\beta z^G - \frac{1}{4}(1-\beta)\hat{z} + \frac{1}{2}p^F - \frac{1}{2}\beta z^F + \frac{1}{4}(1-\beta)\hat{z}\right] = $$
$$= \frac{1}{2}\left(p^{US} + \bar{p}\right) = p^W.$$

Thus, (19*US, G, F*) yield:

(A.31) $q^W = p^W = \frac{1}{2}\left[\alpha m^{US} + (1-\alpha)\tau^{US} + \alpha\lambda i^{US} + \alpha\bar{m} + (1-\alpha)\bar{\tau} + \alpha\lambda\bar{i} + 2x\right].$

Or: (A.32) $q^W = p^W = \alpha m^W + (1-\alpha)\tau^W + \alpha\lambda i^W + x.$

Plugging this result into (A.29):

(A.33) $r^W = (1+\alpha\lambda)i^W + \alpha m^W + (1-\alpha)\tau^W + x.$

World interest rates are obtained by summing (8*US, G, F*) and dividing by two: (A.34) $y^{US}+\bar{y}=\varepsilon y^{US}+\varepsilon\bar{y}-\nu\left(r^{US}+\bar{r}\right)+g^{US}+\bar{g}$.

This can be rewritten as: (A.35) $(1-\varepsilon)y^{W}=-\nu r^{W}+g^{W}$;

and solved for the world real interest rate: (A.36) $r^{W}=\frac{1}{\nu}g^{W}-\frac{1-\varepsilon}{\nu}y^{W}$.

Observing that: $y^{W}=(1-\alpha)n^{W}-x;\ n^{W}=m^{W}-\tau^{W}+\lambda i^{W};\ g^{W}=\tau^{W};$

(A.36) can be rewritten as:

(A.37) $r^{W}=\frac{1}{\nu}\tau^{W}-\frac{1-\varepsilon}{\nu}(1-\alpha)\left(m^{W}-\tau^{W}+\lambda i^{W}\right)+\frac{1-\varepsilon}{\nu}x.$

Finally, equating the right hand sides of (A.33) and (A.37) and solving for i^{W}, we have: (A.38) $i^{W}=-\frac{\chi}{\vartheta}m^{W}+\frac{\sigma}{\vartheta}\tau^{W}-\frac{\varsigma}{\vartheta}x;$ where:

$$\chi=\alpha+\frac{(1-\alpha)(1-\varepsilon)}{\nu}>0;\ \sigma=\frac{1}{\nu}-1+\alpha+\frac{(1-\alpha)(1-\varepsilon)}{\nu}>0;$$

$$\varsigma=1-\frac{1-\varepsilon}{\nu}>0\Leftrightarrow\varepsilon+\nu>1;\ \vartheta=1+\alpha\lambda+\frac{\lambda(1-\alpha)(1-\varepsilon)}{\nu}>0.$$

Since $\chi>0$, an increase in the world money supply leads to a lower world nominal interest rate. An increase in world public expenditure induces a higher world nominal interest rate.

Substituting (A.38) and (A.21) into (A.25) and (A.26), we have the reduced forms for the U.S. and the "European" nominal interest rates:[66]

(A.39) $i^{US}=-\frac{\chi+\varphi\vartheta}{2\vartheta}m^{US}+\frac{\varphi\vartheta-\chi}{2\vartheta}\bar{m}+\frac{\sigma+\upsilon\vartheta}{2\vartheta}\tau^{US}+\frac{\sigma-\upsilon\vartheta}{2\vartheta}\bar{\tau}+\kappa u-\frac{\varsigma}{\vartheta}x;$

(A.40) $\bar{i}=-\frac{\chi+\varphi\vartheta}{2\vartheta}\bar{m}+\frac{\varphi\vartheta-\chi}{2\vartheta}m^{US}+\frac{\sigma+\upsilon\vartheta}{2\vartheta}\bar{\tau}+\frac{\sigma-\upsilon\vartheta}{2\vartheta}\tau^{US}-\kappa u-\frac{\varsigma}{\vartheta}x;$

where: $\frac{\chi+\varphi\vartheta}{2\vartheta}>0;\ \frac{\varphi\vartheta-\chi}{2\vartheta}>0\Leftrightarrow\chi<\varphi\vartheta;\ \frac{\sigma+\upsilon\vartheta}{2\vartheta}>0;\ \frac{\sigma-\upsilon\vartheta}{2\vartheta}>0\Leftrightarrow\sigma>\upsilon\vartheta.$

In order to find reduced forms for the German and French nominal interest rates, observe that the uncovered interest parity conditions and

[66] Plugging(A.38) into (A.32) gives a reduced form for q^{W}. The reduced form for the world real interest rate can be found by plugging (A.38) into (A.33). Finally, substituting the reduced form for r^{W} and (A.17) into (A.27) and (A.28), we obtain reduced-form equations for the U.S. and the "European" real interest rates.

(A.22) imply: (A.41) $\hat{i} = \hat{e} = -\phi\hat{m} + \xi\hat{\tau}$. (A.41) provides the reduced form for the FF-DM nominal exchange rate.[67]

(A.40) and (A.41) allow us to obtain reduced forms for German and French nominal interest rates:

(A.42) $$i^G = -\frac{\chi+\varphi\vartheta}{2\vartheta}\overline{m} + \frac{\varphi\vartheta-\chi}{2\vartheta}m^{US} + \frac{\sigma+\upsilon\vartheta}{2\vartheta}\overline{\tau} + \frac{\sigma-\upsilon\vartheta}{2\vartheta}\tau^{US} - \frac{\phi}{2}\hat{m} + \frac{\xi}{2}\hat{\tau} - \kappa u - \frac{\varsigma}{\vartheta}x;$$

(A.43) $$i^F = -\frac{\chi+\varphi\vartheta}{2\vartheta}\overline{m} + \frac{\varphi\vartheta-\chi}{2\vartheta}m^{US} + \frac{\sigma+\upsilon\vartheta}{2\vartheta}\overline{\tau} + \frac{\sigma-\upsilon\vartheta}{2\vartheta}\tau^{US} + \frac{\phi}{2}\hat{m} - \frac{\xi}{2}\hat{\tau} - \kappa u - \frac{\varsigma}{\vartheta}x.$$

With these reduced forms for nominal interest rates, we can derive reduced forms for employment and CPI in the U.S., Germany, and France. Using (18*US, G, F*) and (19*US, G, F*), and the reduced forms for the real exchange rates, some algebra allows us to obtain:

(A.44) $$\begin{aligned} q^{US} &= \left[\alpha + \frac{\beta\rho}{\gamma} - \frac{\alpha\lambda(\chi+\varphi\vartheta)}{2\vartheta}\right]m^{US} - \left[\frac{\beta\rho}{\gamma} - \frac{\alpha\lambda(\varphi\vartheta-\chi)}{2\vartheta}\right]\overline{m} + \\ &+ \left[1-\alpha-\frac{\beta\mu}{\gamma} + \frac{\alpha\lambda(\sigma+\upsilon\vartheta)}{2\vartheta}\right]\tau^{US} + \left[\frac{\beta\mu}{\gamma} + \frac{\alpha\lambda(\sigma-\upsilon\vartheta)}{2\vartheta}\right]\overline{\tau} + \\ &+ \left(\alpha\lambda\kappa - \frac{2\beta}{\gamma}\right)u + \left(1 - \frac{\alpha\lambda\varsigma}{\vartheta}\right)x = \\ &= \mathrm{A}m^{US} - \mathrm{B}\frac{m^G+m^F}{2} + \mathrm{E}\tau^{US} + \Gamma\frac{\tau^G+\tau^F}{2} + \mathrm{K}u + \mathrm{H}x; \end{aligned}$$

(A.45) $$\begin{aligned} n^{US} &= \left[1 - \frac{\lambda(\chi+\varphi\vartheta)}{2\vartheta}\right]m^{US} + \frac{\lambda(\varphi\vartheta-\chi)}{2\vartheta}\overline{m} - \left[1 - \frac{\lambda(\sigma+\upsilon\vartheta)}{2\vartheta}\right]\tau^{US} + \\ &+ \frac{\lambda(\sigma-\upsilon\vartheta)}{2\vartheta}\overline{\tau} + \lambda\kappa u - \frac{\lambda\varsigma}{\vartheta}x = \\ &= (1-\lambda\Lambda)m^{US} + \lambda\Theta\frac{m^G+m^F}{2} - (1-\lambda\Omega)\tau^{US} + \lambda\Psi\frac{\tau^G+\tau^F}{2} + \Phi u - \Sigma x; \end{aligned}$$

(A.46) $$\begin{aligned} q^G &= \alpha m^G + (\mathrm{A}-\alpha)\frac{m^G+m^F}{2} - \mathrm{B}m^{US} + (1-\alpha)\tau^G + [\mathrm{E}-(1-\alpha)]\frac{\tau^G+\tau^F}{2} + \\ &+ \Gamma\tau^{US} + \mathrm{M}(m^F-m^G) - \mathrm{N}(\tau^F-\tau^G) - \mathrm{K}u + \mathrm{H}x; \end{aligned}$$

[67] If combined with (A.21) and solved for the dollar-DM and dollar-FF nominal exchange rates, it allows us to argue in favour of the presence of a dollar-DM polarization also in nominal terms.

(A.47) $$n^G = m^G - \lambda\Lambda\frac{m^G + m^F}{2} + \lambda\Theta m^{US} - \tau^G + \lambda\Omega\frac{\tau^G + \tau^F}{2} + \\ + \lambda\Psi\tau^{US} + \lambda\mathrm{O}\left(m^F - m^G\right) - \lambda\mathrm{Z}\left(\tau^F - \tau^G\right) - \Phi u - \Sigma x;$$

(A.48) $$q^F = \alpha m^F + (\mathrm{A} - \alpha)\frac{m^G + m^F}{2} - \mathrm{B}m^{US} + (1-\alpha)\tau^F + \left[\mathrm{E} - (1-\alpha)\right]\frac{\tau^G + \tau^F}{2} + \\ + \Gamma\tau^{US} - \mathrm{M}\left(m^F - m^G\right) + \mathrm{N}\left(\tau^F - \tau^G\right) - \mathrm{K}u + \mathrm{H}x;$$

(A.49) $$n^F = m^F - \lambda\Lambda\frac{m^G + m^F}{2} + \lambda\Theta m^{US} - \tau^F + \lambda\Omega\frac{\tau^G + \tau^F}{2} + \\ + \lambda\Psi\tau^{US} - \lambda\mathrm{O}\left(m^F - m^G\right) + \lambda\mathrm{Z}\left(\tau^F - \tau^G\right) - \Phi u - \Sigma x;$$

where M, N, O, and Z are defined by:

$$\mathrm{M} = \frac{\alpha\lambda\phi}{2} - \frac{1-\alpha}{2\left[\lambda(1-\alpha) + 2\delta(1+\alpha\lambda)\right]};\ \mathrm{N} = \frac{\alpha\lambda\xi}{2} - \frac{(1+\lambda)(1-\alpha)}{2\left[\lambda(1-\alpha) + 2\delta(1+\alpha\lambda)\right]};\ \mathrm{O} = \frac{\phi}{2};\ \mathrm{Z} = \frac{\xi}{2}.$$

Summing the reduced-form equations for German and French variables and dividing by two, we obtain the reduced form for European variables (which are symmetric to the reduced form equation for the U.S. variables). When we sum these reduced form equations, the intra-European cross-country externalities cancel.

B. The Keynesian World

In the Keynesian-case, government spending g is financed with lump-sum taxes, so that the τ-term in equation (2) cancels. The solution procedure of the model under flexible exchange rates is exactly as in Appendix A. Here we highlights some of the consequences of having non-distortionary taxation and present the main reduced forms for the cases of flexible exchange rates, EMS, and EMU.

Equations (18) and (19) in the text become:

(B.1) $n^j = m^j + \lambda i^j,$

(B.2) $p^j = \alpha n^j + x;$ $\qquad\qquad j = US, G, F.$

The reduced form for $\bar{z} = (z^G + z^F)/2$ is now:

(B.3) $$\bar{z} = \frac{\rho}{\gamma}\tilde{m} - \frac{2\eta - 1}{\gamma}\tilde{g} - \frac{2}{\gamma}u;$$

where γ and ρ are as above and $\eta > 1/2$ by assumption.

z^G and z^F become:

(B.4G) $z^G = \frac{\rho}{\gamma}\tilde{m} - \frac{2\eta - 1}{\gamma}\tilde{g} - \frac{2}{\gamma}u - \frac{1-\alpha}{2[\lambda(1-\alpha)+2\delta(1+\alpha\lambda)]}\hat{m};$

(B.4F) $z^F = \frac{\rho}{\gamma}\tilde{m} - \frac{2\eta - 1}{\gamma}\tilde{g} - \frac{2}{\gamma}u + \frac{1-\alpha}{2[\lambda(1-\alpha)+2\delta(1+\alpha\lambda)]}\hat{m}.$

So that the reduced form for the FF-DM real exchange rate is:

(B.5) $\hat{z} = -\frac{1-\alpha}{\lambda(1-\alpha)+2\delta(1+\alpha\lambda)}\hat{m}.$

Having removed the distortionary effect of taxes on domestic PPIs implies that fiscal policies do not affect the intra-European exchange rate. This is because the pattern of government spending is identical across European countries. Instead, asymmetry in the pattern of government spending across the Atlantic ensures that fiscal policies do affect the transatlantic exchange rates.

The U.S.-Europe nominal interest differential becomes:

(B.6) $\tilde{i} = -\varphi\tilde{m} + \upsilon'\tilde{g} + 2\kappa u;$ where φ and κ are defined above and:

$$\upsilon' = \frac{2\eta - 1}{\gamma(1+\alpha\lambda)} > 0.$$

Hence: (B.7) $\bar{e} = \varphi\tilde{m} - \upsilon'\tilde{g} - 2\kappa u.$ The FF-DM nominal rate does not depend on fiscal policies:

(B.8) $\hat{e} = -\phi\hat{m};$ where ϕ is unchanged.

Going through the same steps as before, we obtain the following reduced form for the world nominal interest rate:

(B.9) $i^W = -\frac{\chi}{\vartheta}m^W + \frac{1}{\vartheta\nu}g^W - \frac{\varsigma}{\vartheta}x;$

where the new parameters are as in Appendix A.

Hence, the reduced forms for the U.S., German, and French nominal interest rates are:

(B.10) $i^{US} = -\frac{\chi+\varphi\vartheta}{2\vartheta}m^{US} + \frac{\varphi\vartheta-\chi}{2\vartheta}\overline{m} + \frac{1-\upsilon'\vartheta\nu}{2\vartheta\nu}g^{US} + \frac{1+\upsilon'\vartheta\nu}{2\vartheta\nu}\overline{g} + \kappa u - \frac{\varsigma}{\vartheta}x;$

(B.11) $i^G = -\frac{\chi+\varphi\vartheta}{2\vartheta}\overline{m} + \frac{\varphi\vartheta-\chi}{2\vartheta}m^{US} + \frac{1-\upsilon'\vartheta\nu}{2\vartheta\nu}\overline{g} + \frac{1+\upsilon'\vartheta\nu}{2\vartheta\nu}g^{US} - \frac{\phi}{2}\hat{m} - \kappa u - \frac{\varsigma}{\vartheta}x;$

(B.12) $i^F = -\frac{\chi+\varphi\vartheta}{2\vartheta}\overline{m} + \frac{\varphi\vartheta-\chi}{2\vartheta}m^{US} + \frac{1-\upsilon'\vartheta\nu}{2\vartheta\nu}\overline{g} + \frac{1+\upsilon'\vartheta\nu}{2\vartheta\nu}g^{US} + \frac{\phi}{2}\hat{m} - \kappa u - \frac{\varsigma}{\vartheta}x.$

Fiscal policies do not affect the intra-European exchange rate. As a consequence, differences in European fiscal policies no longer affect European interest rates.

With these reduced forms for nominal interest rates, we can derive reduced forms for employment and CPI in the U.S., Germany, and France. Using (B.1*US, G, F*) and (B.2*US, G, F*), and the reduced forms for the real exchange rates, some algebra allows us to obtain:

$$\text{(B.13)}\quad \begin{aligned} q^{US} &= \left[\alpha + \frac{\beta\rho}{\gamma} - \frac{\alpha\lambda(\chi+\varphi\vartheta)}{2\vartheta}\right]m^{US} - \left[\frac{\beta\rho}{\gamma} - \frac{\alpha\lambda(\varphi\vartheta-\chi)}{2\vartheta}\right]\overline{m} + \\ &+\left[\frac{\alpha\lambda(1-\upsilon'\vartheta\nu)}{2\vartheta\nu} - \frac{\beta(2\eta-1)}{\gamma}\right]g^{US} + \left[\frac{\alpha\lambda(1+\upsilon'\vartheta\nu)}{2\vartheta\nu} + \frac{\beta(2\eta-1)}{\gamma}\right]\overline{g} + \\ &+\left(\alpha\lambda\kappa - \frac{2\beta}{\gamma}\right)u + \left(1-\frac{\alpha\lambda\varsigma}{\vartheta}\right)x = \\ &= \mathrm{A}m^{US} - \mathrm{B}\frac{m^G+m^F}{2} + \mathrm{E}'g^{US} + \Gamma'\frac{g^G+g^F}{2} + \mathrm{K}u + \mathrm{H}x; \end{aligned}$$

$$\text{(B.14)}\quad \begin{aligned} n^{US} &= \left[1 - \frac{\lambda(\chi+\varphi\vartheta)}{2\vartheta}\right]m^{US} + \frac{\lambda(\varphi\vartheta-\chi)}{2\vartheta}\overline{m} + \frac{\lambda(1-\upsilon'\vartheta\nu)}{2\vartheta\nu}g^{US} + \\ &+\frac{\lambda(1+\upsilon'\vartheta\nu)}{2\vartheta\nu}\overline{g} + \lambda\kappa u - \frac{\lambda\varsigma}{\vartheta}x = \\ &= (1-\lambda\Lambda)m^{US} + \lambda\Theta\frac{m^G+m^F}{2} + \lambda\Omega' g^{US} + \lambda\Psi'\frac{g^G+g^F}{2} + \Phi u - \Sigma x; \end{aligned}$$

$$\text{(B.15)}\quad \begin{aligned} q^G &= \alpha m^G + (\mathrm{A}-\alpha)\frac{m^G+m^F}{2} - \mathrm{B}m^{US} + \mathrm{E}'\frac{g^G+g^F}{2} + \\ &+\Gamma' g^{US} + \mathrm{M}\left(m^F - m^G\right) - \mathrm{K}u + \mathrm{H}x; \end{aligned}$$

$$\text{(B.16)}\quad \begin{aligned} n^G &= m^G - \lambda\Lambda\frac{m^G+m^F}{2} + \lambda\Theta m^{US} + \lambda\Omega'\frac{g^G+g^F}{2} + \\ &+\lambda\Psi' g^{US} + \lambda\mathrm{O}\left(m^F - m^G\right) - \Phi u - \Sigma x; \end{aligned}$$

$$\text{(B.17)}\quad \begin{aligned} q^F &= \alpha m^F + (\mathrm{A}-\alpha)\frac{m^G+m^F}{2} - \mathrm{B}m^{US} + \mathrm{E}'\frac{g^G+g^F}{2} + \\ &+\Gamma' g^{US} - \mathrm{M}\left(m^F - m^G\right) - \mathrm{K}u + \mathrm{H}x; \end{aligned}$$

$$\text{(B.18)}\quad \begin{aligned} n^F &= m^F - \lambda\Lambda\frac{m^G+m^F}{2} + \lambda\Theta m^{US} + \lambda\Omega'\frac{g^G+g^F}{2} + \\ &+\lambda\Psi' g^{US} - \lambda\mathrm{O}\left(m^F - m^G\right) - \Phi u - \Sigma x. \end{aligned}$$

The parameters defining the impact of monetary policies on endogenous variables are unchanged relative to the case of anti-Keynesian fiscal policies. Instead, having removed the distortionary effect of taxation affects the parameters defining the impact of fiscal policies and cancels the impact of differences in European fiscal policies on German and French variables.

Solution of the model under the EMS regime follows the same steps as in the text. The EMS-constraint now implies:

(B.19) $$m^F = m^G + \frac{1}{\phi}\left(e^G - e^F\right).$$

Plugging this equation into the previous reduced forms gives:

(B.20) $$q^{US} = \mathrm{A}m^{US} - \mathrm{B}m^G - \frac{\mathrm{B}}{2\phi}\left(e^G - e^F\right) + \mathrm{E}'g^{US} + \Gamma'\frac{g^G + g^F}{2} + \mathrm{K}u + \mathrm{H}x;$$

(B.21) $$n^{US} = \left(1 - \lambda\Lambda\right)m^{US} + \lambda\Theta m^G + \frac{\lambda\Theta}{2\phi}\left(e^G - e^F\right) + \lambda\Omega' g^{US} + \lambda\Psi'\frac{g^G + g^F}{2} + \Phi u - \Sigma x;$$

(B.22) $$q^G = \mathrm{A}m^G - \mathrm{B}m^{US} + \left(\frac{\mathrm{A} - \alpha}{2\phi} + \frac{\mathrm{M}}{\phi}\right)\left(e^G - e^F\right) + \mathrm{E}'\frac{g^G + g^F}{2} + \Gamma' g^{US} - \mathrm{K}u + \mathrm{H}x;$$

(B.23) $$n^G = \left(1 - \lambda\Lambda\right)m^G + \lambda\Theta m^{US} + \frac{\lambda}{2}\left(1 - \frac{\Lambda}{\phi}\right)\left(e^G - e^F\right) + \lambda\Omega'\frac{g^G + g^F}{2} + \lambda\Psi' g^{US} + \\ -\Phi u - \Sigma x;$$

(B.24) $$q^F = \mathrm{A}m^G - \mathrm{B}m^{US} + \left(\frac{\mathrm{A} + \alpha}{2\phi} - \frac{\mathrm{M}}{\phi}\right)\left(e^G - e^F\right) + \mathrm{E}'\frac{g^G + g^F}{2} + \Gamma' g^{US} - \mathrm{K}u + \mathrm{H}x;$$

(B.25) $$n^F = \left(1 - \lambda\Lambda\right)m^G + \lambda\Theta m^{US} + \left[\frac{1}{\phi} - \frac{\lambda}{2}\left(1 + \frac{\Lambda}{\phi}\right)\right]\left(e^G - e^F\right) + \lambda\Omega'\frac{g^G + g^F}{2} + \\ +\lambda\Psi' g^{US} - \Phi u - \Sigma x.$$

The solution under EMU is extremely simple in the Keynesian world. $(e^G - e^F)=0$ implies the constraint $m^G = m^F$. Once this is taken into account, we have that not only q^G and q^F are equalized *ex ante* under EMU, but it is also $n^G = n^F = n^{Eu}$. Reduced forms for U.S. variables become:

(B.26) $$q^{US} = \mathrm{A}m^{US} - \mathrm{B}m^{Eu} + \mathrm{E}'g^{US} + \Gamma'\frac{g^G + g^F}{2} + \mathrm{K}u + \mathrm{H}x;$$

(B.27) $$n^{US} = \left(1 - \lambda\Lambda\right)m^{US} + \lambda\Theta m^{Eu} + \lambda\Omega' g^{US} + \lambda\Psi'\frac{g^G + g^F}{2} + \Phi u - \Sigma x.$$

Reduced forms for q^{Eu} and n^{Eu} can be easily recovered by symmetry between the U.S. and Europe. Note that $n^G = n^F = n^{Eu}$ *ex ante* does not imply the absence of intra-European fiscal externalities. These come indirectly through the impact of European fiscal policies on transatlantic exchange rates.

Table 1. Structural parameters and target weights

α = .34	β = .2	δ = .8	ε = .8	ν = .4
η = .9	λ = .6	a = .9	b_1 = .2	b_2 = .1

Table 2. The players' tradeoffs in an anti-Keynesian world

	Federal Reserve	Bundesbank	Bank of France	ECB
Flexible rates	.3534	.5449	.5449	
EMS	.3534	.3534	.5449	
EMU	.3534			.3534

	U.S. government	German government	French government
Flexible rates	-1.3393	-.5542	-.5542
EMS	-1.3393	-.5122	-.3084
EMU	-1.3393	-.4872	-.4872

Table 3. Reduced form equations in an anti-Keynesian world

(*a*) Flexible exchange rates

$$q^{US} = .26m^{US} - .02\frac{m^G + m^F}{2} + .75\tau^{US} + .22\frac{\tau^G + \tau^F}{2} + .93x;$$

$$n^{US} = .75m^{US} - .03\frac{m^G + m^F}{2} - .56\tau^{US} + .49\frac{\tau^G + \tau^F}{2} - .21x;$$

$$q^G = .39m^G - .13m^F - .02m^{US} + .46\tau^G + .29\tau^F + .22\tau^{US} + .93x;$$

$$n^G = .72m^G + .03m^F - .03m^{US} - .83\tau^G + .27\tau^F + .49\tau^{US} - .21x.$$

(*b*) EMS

$$q^{US} = .26m^{US} - .02m^G - .02\left(e^G - e^F\right) + .75\tau^{US} + .11\tau^G + .11\tau^F + .93x;$$

$$n^{US} = .75m^{US} - .03m^G - .03\left(e^G - e^F\right) - .56\tau^{US} + .24\tau^G + .25\tau^F - .21x.$$

$$q^G = .26m^G - .02m^{US} + .42\tau^G + .33\tau^F + .22\tau^{US} - .24\left(e^G - e^F\right) + .93x;$$

$$q^F = .26m^G - .02m^{US} + .42\tau^G + .33\tau^F + .22\tau^{US} + .75\left(e^G - e^F\right) + .93x;$$

$$n^G = .75m^G - .03m^{US} - .82\tau^G + .26\tau^F + .49\tau^{US} + .06\left(e^G - e^F\right) - .21x;$$

$$n^F = .75m^G - .03m^{US} + .51\tau^G - 1.07\tau^F + .49\tau^{US} + 1.38\left(e^G - e^F\right) - .21x.$$

(*c*) EMU

$$q^{US} = .26m^{US} - .02m^{Eu} + .75\tau^{US} + .22\frac{\tau^G + \tau^F}{2} + .93x;$$

$$n^{US} = .75m^{US} - .03m^{Eu} - .56\tau^{US} + .49\frac{\tau^G + \tau^F}{2} - .21x;$$

$$q^{Eu} = .26m^{Eu} - .02m^{US} + .75\frac{\tau^G + \tau^F}{2} + .22\tau^{US} + .93x;$$

$$n^{Eu} = .75m^{Eu} - .03m^{US} - .56\frac{\tau^G + \tau^F}{2} + .49\tau^{US} - .21x;$$

$$n^G = .75m^{Eu} - .03m^{US} - .78\tau^G + .22\tau^F + .49\tau^{US} - .21x;$$

$$n^F = .75m^{Eu} - .03m^{US} + .22\tau^G - .78\tau^F + .49\tau^{US} - .21x.$$

Table 4. Optimal values of the policy instruments in an anti-Keynesian world

	Flexible rates	EMS	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
m^{US}	-1.4443x	-1.4280x	-1.4614x	-1.4351x	-1.5000x	-1.4717x	-1.7329x
m^{G}	-1.6941x	-1.4174x					
m^{F}	-1.6941x						
m^{Eu}			-1.4433x	-1.4161x	-1.5000x	-1.4717x	-1.7329x
τ^{US}	-.1671x	-.1668x	-.1671x	-.1649x	-.1676x	-.1652x	-.0348x
τ^{G}	-.2588x	-.2269x	-.2148x	-.2116x	-.1676x	-.1652x	-.0348x
τ^{F}	-.2588x	-.3055x	-.2148x	-.2116x	-.1676x	-.1652x	-.0348x
$e^{G} - e^{F}$		-.1217x					

Table 5. Endogenous variables in an anti-Keynesian world

	Flexible rates	EMS	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
q^{US}	.3988x	.3891x	.3988x	.4075x	.3999x	.4091x	.4730x
q^{G}	.2789x	.3793x					
q^{F}	.2789x	.2577x					
q^{Eu}			.3786x	.3881x	.3999x	.4091x	.4730x
n^{US}	-1.2685x	-1.2660x	-1.2683x	-1.2493x	-1.2719x	-1.2519x	-1.4475x
n^{G}	-1.3675x	-1.2065x					
n^{F}	-1.3675x	-1.2637x					
n^{Eu}			-1.2042x	-1.1855x	-1.2719x	-1.2519x	-1.4475x

Table 6. Values of the loss functions in an anti-Keynesian world

	Flexible rates	EMS	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
L^{Fed}	$.1520x^2$	$.1514x^2$	$.1520x^2$	$.1528x^2$	$.1529x^2$	$.1537x^2$	$.2055x^2$
L^{Buba}	$.1285x^2$	$.1375x^2$					
L^{BoF}	$.1285x^2$	$.1097x^2$					
L^{ECB}			$.1370x^2$	$.1381x^2$	$.1529x^2$	$.1537x^2$	$.2055x^2$
$L^{US\ govt.}$	$.1576x^2$	$.1569x^2$	$.1575x^2$	$.1530x^2$	$.1584x^2$	$.1536x^2$	$.1913x^2$
$L^{G\ govt.}$	$.1959x^2$	$.1530x^2$	$.1504x^2$	$.1459x^2$	$.1584x^2$	$.1536x^2$	$.1913x^2$
$L^{F\ govt.}$	$.1959x^2$	$.1817x^2$	$.1504x^2$	$.1459x^2$	$.1584x^2$	$.1536x^2$	$.1913x^2$

Table 7. Reduced form equations in a Keynesian world

(*a*) Flexible exchange rates

$$q^{US} = .26m^{US} - .02\frac{m^G + m^F}{2} + .18g^{US} + .19\frac{g^G + g^F}{2} + .93x;$$
$$n^{US} = .75m^{US} - .03\frac{m^G + m^F}{2} + .64g^{US} + .43\frac{g^G + g^F}{2} - .21x;$$
$$q^G = .39m^G - .13m^F - .02m^{US} + .09g^G + .09g^F + .19\tau^{US} + .93x;$$
$$n^G = .72m^G + .03m^F - .03m^{US} + .32g^G + .32g^F + .43g^{US} - .21x.$$

(*b*) EMS

$$q^{US} = .26m^{US} - .02m^G - .02\left(e^G - e^F\right) + .18g^{US} + .19\frac{g^G + g^F}{2} + .93x;$$
$$n^{US} = .75m^{US} - .03m^G - .03\left(e^G - e^F\right) + .64g^{US} + .43\frac{g^G + g^F}{2} - .21x.$$
$$q^G = .26m^G - .02m^{US} + .09g^G + .09g^F + .19g^{US} - .24\left(e^G - e^F\right) + .93x;$$
$$q^F = .26m^G - .02m^{US} + .09g^G + .09g^F + .19g^{US} + .75\left(e^G - e^F\right) + .93x;$$
$$n^G = .75m^G - .03m^{US} + .32g^G + .32g^F + .43g^{US} + .06\left(e^G - e^F\right) - .21x;$$
$$n^F = .75m^G - .03m^{US} + .32\tau^G + .32g^F + .43g^{US} + 1.38\left(e^G - e^F\right) - .21x.$$

(*c*) EMU

Reduced forms for q^{US} and n^{US} are as in (*a*), with m^{Eu} replacing $(m^G + m^F)/2$. Reduced forms for q^{Eu} and n^{Eu} can be recovered by symmetry.

Table 8. Optimal values of economic policy instruments in a Keynesian world

	Flexible rates	EMS	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
m^{US}	-2.1332x	-2.1112x	-2.0907x	-2.0461x	-2.1671x	-2.1212x	-2.3374x
m^{G}	-2.5075x	-2.1531x					
m^{F}	-2.5075x						
m^{Eu}			-2.0804x	-2.0363x	-2.1671x	-2.1212x	-2.3374x
g^{US}	.2166x	.2160x	.2156x	.2115x	.2165x	.2124x	.3566x
g^{G}	.1307x	.1126x	.1087x	.1067x	.2165x	.2124x	.3566x
g^{F}	.1307x	.1260x	.1087x	.1067x	.2165x	.2124x	.3566x
$e^{G} - e^{F}$		-.1382x					

Table 9. Endogenous variables in a Keynesian world

	Flexible rates	EMS	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
q^{US}	.4806x	.4794x	.4783x	.4880x	.4804x	.4901x	.4901x
q^{G}	.3748x	.4997x					
q^{F}	.3748x	.3615x					
q^{Eu}			.4826x	.4921x	.4804x	.4901x	.4901x
n^{US}	-1.5284x	-1.5247x	-1.5213x	-1.4930x	-1.5281x	-1.4997x	-1.4997x
n^{G}	-1.8380x	-1.5892x					
n^{F}	-1.8380x	-1.7729x					
n^{Eu}			-1.5348x	-1.5064x	-1.5281x	-1.4997x	-1.4997x

Table 10. Values of the loss functions in Keynesian world

	Flexible rates	EMS	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
L^{Fed}	$.2207x^2$	$.2196x^2$	$.2187x^2$	$.2186x^2$	$.2206x^2$	$.2205x^2$	$.2205x^2$
L^{Buba}	$.2321x^2$	$.2386x^2$					
L^{BoF}	$.2321x^2$	$.2160x^2$					
L^{ECB}			$.2226x^2$	$.2225x^2$	$.2206x^2$	$.2205x^2$	$.2205x^2$
$L^{US\ govt.}$	$.2313x^2$	$.2302x^2$	$.2292x^2$	$.2209x^2$	$.2312x^2$	$.2229x^2$	$.2557x^2$
$L^{G\ govt.}$	$.3123x^2$	$.2349x^2$	$.2191x^2$	$.2112x^2$	$.2312x^2$	$.2229x^2$	$.2557x^2$
$L^{F\ govt.}$	$.3123x^2$	$.2905x^2$	$.2191x^2$	$.2112x^2$	$.2312x^2$	$.2229x^2$	$.2557x^2$

Table 11. Average losses in an anti-Keynesian world

	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
U.S.	$.15475x^2$	$.1529x^2$	$.15565x^2$	$.15365x^2$	$.1984x^2$
Germany	$.1437x^2$	$.142x^2$	$.15565x^2$	$.15365x^2$	$.1984x^2$
France	$.1437x^2$	$.142x^2$	$.15565x^2$	$.15365x^2$	$.1984x^2$

Table 12. Average losses in a Keynesian world

	EMU	Post-EMU (A)	Post-EMU (B)	Post-EMU (C)	Post-EMU (D)
U.S.	$.22395x^2$	$.21975x^2$	$.2259x^2$	$.2217x^2$	$.2381x^2$
Germany	$.22085x^2$	$.21685x^2$	$.2259x^2$	$.2217x^2$	$.2381x^2$
France	$.22085x^2$	$.21685x^2$	$.2259x^2$	$.2217x^2$	$.2381x^2$

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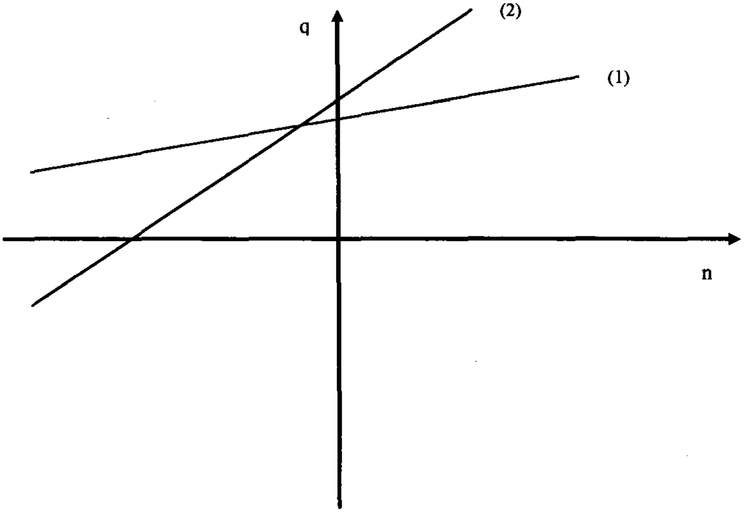

Figure 1. Central banks' tradeoffs

(1) Faced by:
- Fed, irrespective of exchange-rate regime in Europe;
- Bundesbank under EMS;
- ECB.

(2) Faced by:
- Bundesbank under flexible exchange rates in Europe;
- Bank of France under flexible exchange rates in Europe and under EMS.

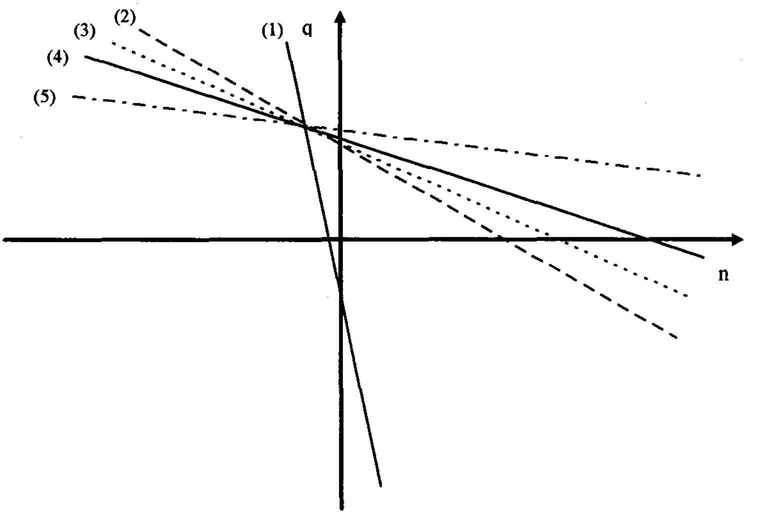

Figure 2. Governments' tradeoffs

(1) Faced by U.S. government, irrespective of exchange-rate regime in Europe.
(2) Faced by both German and French governments under flexible exchange rates in Europe.
(3) Faced by German government under EMS.
(4) Faced by both German and French governments under EMU.
(5) Faced by French government under EMS.