Central Bank Flexibility and the Drawbacks to Currency Unification

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The European Monetary System proposes both the elimination of all trade barriers and complete monetary integration. The formation of a common European currency controlled by a single European central bank is planned for the mid-1990s. In effect, instituting a single currency permanently fixes the exchange rates between these countries, a system far different from the temporarily fixed exchange rates now in place. A perfect example of a currency union is the United States, where the exchange rate between states is immutably set at one. Discussion of the European currency integration has almost exclusively highlighted its beneficial effects on policy coordination and exchange rate uncertainty. The potential costs of currency unification have been largely ignored. In fact, recent British and West German doubts over the viability of such a union have met with surprise. This article briefly reviews the costs and benefits of monetary integration as articulated in the traditional optimal currency area literature. A full-employment model is then presented that for the first time examines diversity among countries' distaste for unemployment and inflation as a cost to currency unification. Finally, the policy implications for the Federal Reserve System, a central bank within a given currency union, are explored.

Recently, the optimal currency area debate has been subsumed by the optimal exchange rate regime literature. The difference between the two frameworks is a subtle one. The optimal currency area looks for the ideal borders for an area within which the exchange rate should be forever fixed, and outside of which the exchange rate should be flexible. The optimal exchange rate regime literature typically analyzes the preferred foreign exchange system given predetermined borders. For example, studies of the optimal exchange rate regime would examine whether the United States should float or fix the value of the dollar, while the optimal currency area literature might ask whether it is preferable to disaggregate the United States into different regions of flexible regimes. Another important difference between these two liter-

atures is their assumptions concerning unemployment. The more recent exchange rate regime studies usually assume full employment, while the optimal currency area literature typically has not.[1] Yet, both areas of research help to articulate the costs and benefits of monetary integration.

The discussion of the optimal currency area is much broader than an examination of the European Monetary System. It obviously applies to the question of whether the ex-Soviet "republics" should possess independent currencies or whether the East and West German marks should be unified. The optimal currency area analysis also illuminates an important issue in national monetary policy. National boundaries do not necessarily coincide with optimal currency areas; thus, potential regional targets, such as income, often diverge. Yet, interest rates and monetary aggregates are national instruments. As a result, central banks choose monetary policies that are optimal for the currency area as a whole but potentially suboptimal for some, if not all, of the individual regions of the country. How should the Federal Reserve react to a decline in output in the Southwest if helping that region inflates the rest of the country? This paper examines the extent of this problem in Federal Reserve policy formation.

Sections I and II briefly review the major costs and benefits of currency unification as highlighted in the optimal currency area literature.[2] Section III examines the importance of regional taste differences, not modeled in the previous full employment analysis. Section IV discusses how these issues relate to the European Monetary System, the EMS. The implications of the optimal currency area literature for U.S. monetary policy are examined in section V, and part VI presents a conclusion.

I. The Traditional Benefits to Currency Unification

The optimal currency area literature emphasizes the added usefulness of money when currencies are unified. Most importantly, money serves as a medium of exchange and a store of value. Uncertainty about the relative values of currencies, which occurs when exchange rates fluctuate, can impair both of these functions; it makes trade in both goods and capital more expensive and less likely. Although forward exchange contracts do reduce the costs to trade when exchange rates are flexible, the short maturities of these arrangements do not protect long-term trading relationships or long-term capital movements Consider the detrimental effect this uncertainty can have when planning a trip abroad. If the value of the dollar plummets after the commitments have been made, the cost of the trip in dollars soars. It is not surprising that such uncertainty reduces the frequency of inter-currency journeys. The reduction in inter-currency commerce diminishes the benefits to world trade, which is a serious cost of exchange rate uncertainty.

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Another drawback to currency flexibility has recently been articulated by Richard Cooper (1986). Fluctuations in exchange rates affect the trade balance. A dollar appreciation increases the price of our goods abroad and decreases the cost of foreign goods in the United States, thus tending to worsen the trade deficit. Although this may only be a temporary phenomenon, a political reaction to the deficit could result. Use of tariffs or quotas to decrease the imbalance would have lasting costs. Thus, the reduced gains from trade resulting from anything less than permanently fixed exchange rates motivate regions to unify their currencies. In fact, protectionist pressures in the United States have increased as the trade balance has worsened. Yet, serious trade deficits can and do occur under fixed exchange rates, and the immobility of the exchange rate can aggravate these imbalances. Which regime produces the larger temporary deficits depends on the frequency and strength of the forces that produce these trade imbalances in the first place.

A single currency area can also make macro policy more effective. Permanently fixed rates can help to automatically stabilize the economy. All economies are subject to random disturbances. If these shocks are local in origin and nominal in nature, fixing the exchange rate can mitigate their domestic effects by exporting them abroad. For example, a sudden decline in money demand tends to decrease the interest rate and increase output; yet the subsequent decline in the interest rate causes the supply of the domestic currency to fall as funds flee the coun-

try. To support the exchange rate, the central bank would decrease the money supply and increase the interest rate.[3] Along these same lines, fixing the exchange rate may discipline the central bank.[4] Many central banks tend to inflate their economies, and enacting a rule that prevents this undesirable inflation would improve social welfare. Forcing the central bank to maintain a fixed exchange rate is just such a rule. In this case, if domestic prices get out of line with foreign prices, pressure is exerted on the exchange rate. Central bank actions to relieve this strain bring prices back into line. The domestic inflation rate is, therefore, limited by the foreign rate. The gains from trade, automatic stabilization, and monetary discipline are the three most frequently cited policy benefits of a single currency area.

II. The Traditional Costs of Monetary Unification

Relinquishing the use of monetary policy to accommodate region-specific disturbances is the major cost to joining a currency union. If wages are nominally rigid, the price stability mentioned above comes at the expense of quantity adjustments. As an example, consider two regions within the same currency area at the beginning of the 1974 oil shock. As the price of oil increased, the wealth and terms of trade for Texas improved. On the other hand, Michigan, which was a large producer of autos particularly sensitive to the price of gasoline, suffered a decline in income and wealth as well as a deterioration in its terms of trade. Assuming, as the traditional literature does and as appears to be the case, that wages and prices are not immediately flexible, Michigan unemployment should tend to rise and its income fall while Texas unemployment should tend to fall and its income rise. In fact, the annual growth rate in real per capita income from 1973 to 1975 was 1 percent in Texas and −6 percent in Michigan; further, in the ensuing recession of 1974–75 Texas unemployment only increased 1.7 percentage points while Michigan's jumped 6.6 percentage points. Without the possibility of independent monetary policy in each of these two regions, either real wages had to fall rapidly in Michigan or labor had to be mobile between the states. Perfectly flexible wages and prices would avoid unemployment, while labor mobility would mitigate the excess demands and supplies of labor in the different regions.

Thus, the optimal currency area work specifies the diversity of regional responses to external disturbances as the source of the major cost of currency unification. Negative disturbances produce unemployment as wages and prices are assumed to be imperfectly flexible. Since monetary policy can help mitigate the effects of these rigidities by inflating away the nominal wage, decreasing the interest rate, or adjusting net exports through exchange rate movements, refraining from its use produces social losses. The cost of relinquishing control over this policy tool depends on the extent to which wages are rigid and labor is immobile. The slower wages and prices are to adjust, the longer the economy is off its full employment path and the higher is the cost in lost output. The less mobile is labor, the less the excess supply of labor in the depressed region offsets the excess demand elsewhere.[5] The assumption of imperfectly flexible wages and prices within a currency area generates the vital role in the optimal currency area literature for labor mobility in reducing unemployment in the depressed region and alleviating wage inflation in the boom area. Thus, wage rigidity and different stochastic environments do not preclude monetary integration; it is the boundaries of labor mobility that determine optimum currency areas in Mundell (1961).

The traditional literature also distinguishes the loss of sovereignty as a cost to currency unification. The exact nature of this cost is not clearly described, as the phrase really incorporates many ideas. Yet relinquishing authority over monetary policy is, again, the source of this loss. Abdicating control over monetary variables might also reduce the government's influence over long-run features of the country's economy. The optimal currency area literature uses a Phillips curve to analyze this cost. It is assumed that higher rates of inflation are accompanied, in the long run, by lower unemployment. By giving up control over monetary policy, the region forgoes the opportunity to select its preferred point along its Phillips curve. Thus, another drawback to currency

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unification is the loss of a region's ability to attain its preferred mixture of inflation and unemployment.

Other costs, however, fall under the category of loss of sovereignty. Depending on the exact institutional arrangement, by joining a monetary union a country can lose the government revenues produced from money creation; it forgoes its seigniorage. Furthermore, joining a currency area eliminates a region's ability to alter its exchange rate to offset foreign shocks. For example, if wage costs were to accelerate in one part of the currency union, wages and prices would eventually inflate in the remaining section as its current account with the rest of the union would move into surplus. If, however, that region were independent of the union, it could simply appreciate its currency vis-à-vis the high-wage region, leaving its output, wages, and prices unchanged. Its inability to insulate itself from shocks originating in the rest of the currency area increases the costs of monetary integration.

Doubts have been cast on the extent and importance of many of the costs described above. For example, most current theory rejects the idea that the Phillips curve is other than vertical in the long run.[6] Since no long-run trade-off exists between inflation and unemployment, no costs result from losing one's ability to select the optimal inflation-unemployment combination. Furthermore, the relevance of labor mobility has been questioned. Since labor is basically immobile everywhere, between sectors as well as regions, it cannot determine the boundaries of the optimal currency area.

In response, the next section constructs a model in which the long-run Phillips curve is vertical and labor is perfectly mobile between two regions considering a monetary union. Shocks affect each region identically, removing the major drawback to integration in the traditional literature. The only difference between these two areas in this model is their tastes for the trade-off between inflation and unemployment as they move back to full employment after a shock. As in all the optimal currency area literature and most of the optimal exchange rate regime studies, short-run unemployment is possible since wages are assumed to be temporarily rigid.[7] One justification for this assumption is the existence of explicit or implicit contracts. In this model currency unification is never preferred. This conclusion holds even though all of the traditional costs of monetary integration have been removed. The importance of this analysis to recent British and West German objections to European currency integration is, therefore, examined in part IV.

III. A Model of Sovereignty

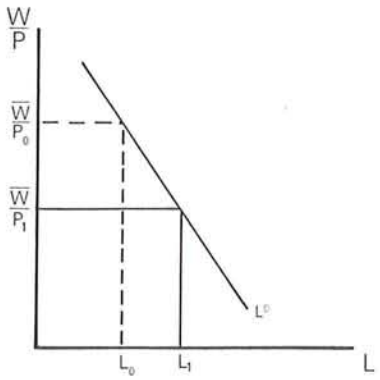
This section analytically examines the costs and benefits of joining a currency area. The model addresses the criticism leveled at the previous work and adds a cost to monetary integration derived from the potential diversity in tastes for unemployment and inflation among regions. It is assumed that there are three areas, two identical regions considering monetary unification, and the rest of the world, the ROW. The two regions considering integration are small in relation to the ROW; thus, they take foreign prices as given. These two areas must choose between two alternatives. Either they unite into a currency union with a common flexible exchange rate relative to the ROW, or they remain separate, floating their exchange rates with each other and with the ROW. It is essential that the currency union have a flexible exchange rate with the ROW, otherwise the entire globe would become a single currency area.[8] The assumption that regions 1 and 2 are identical, with the same reaction to real disturbances, is equivalent to modeling perfect labor mobility; thus the major cost of currency unification in the optimal currency area literature is eliminated. Abstracting from this cost increases the likelihood that monetary integration should be selected and emphasizes the importance of diversity in tastes. Finally, since the two regions are identical, the equations below apply to both together or either separately.

The firm produces output with a fixed quantity of capital and a variable labor input. Output at time t is a function of the real wage and a real productivity shock, μ.

$$Y_t = \overline{Y} + (P_t - {}_{t-1}E\,P_t) + \mu_t \qquad (1)$$
$$E(\mu) = 0 \quad E(\mu^2) = \sigma_\mu^2$$

The $\overline{Y}$ term represents output given the mean real wage, and therefore is referred to as full employment output. The second term in equation (1) depicts unexpected changes in the real wage. The rigid nominal wages, based on expectations of the price level, are set in period $t - 1$, before the realization of the actual prices. If the price level is higher than expected, the real wage falls, employment increases, and output expands. As shown in figure 1, when prices are greater than expected, $P_1 > P_0$, the real wage falls from $\overline{W}/P_0$ to $\overline{W}/P_1$, employment, L, and output rise. If $\mu = 0$ then today's price, P_t, equals last period's expectation of today's price, ${}_{t-1}E\,P_t$, and output hits its mean level. Equation (1) assumes a vertical long-run Phillips curve; regardless of the level

Figure 1



of inflation, with no unexpected price movement, income realizes its full employment level. Modeling a vertical Phillips curve eliminates another cost of currency integration, since the region has no power to select the optimal long-run inflation-unemployment trade-off.

By assumption, the two regions are equally affected by the disturbance to labor productivity. The μ in equation (1) is analogous to an oil price shock. As the price of oil decreases, labor productivity rises and output increases. The traditional literature, however, highlights the costs to currency integration that result from less than perfect correlation between these regional shocks. Different μs in each region would produce different Ys and different preferred monetary reactions. The assumption in this model that μ is perfectly correlated between regions 1 and 2 eliminates this traditional cost to unification and, thus, isolates the costs to lost sovereignty alone. Losses due to less than perfect regional shock correlations, however, can be quite large. Therefore, when discussing the United States and Europe the correlation among the regional μs will also be examined.

Domestic prices are controlled by the central bank in the region or, if the regions unify, the currency area. Competition ensures that the domestic prices of the foreign and home good are always equal so that purchasing power parity, in equation (2), holds. The flexible exchange rate with the ROW guarantees that changes in the world price level have no effect on domestic prices. Conversely, the central bank of the region, or of the combined area, can alter domestic prices and allow fluctuations in the exchange rate to equate the home currency prices of domestic and foreign goods.[9] The central bank uses the money supply to control the domestic price level. All that is needed to determine the domestic price level is a money demand function; the simple one given in equation (3) merely eases the arithmetic.

(2) $P_t = e_t P_t^*$ where * = foreign

$$e = \frac{\text{domestic currency}}{\text{foreign currency}}$$

(3) $$M_t^D = P_t + Y_t$$

(4) $$\underset{P}{\text{MIN}}\ \alpha_i(Y_t - \overline{Y})^2 + \Gamma_i(P_t - P_{t-1})^2 \quad \text{for } i = 1, 2$$

Equation (4) represents society's desire to minimize losses from unemployment and price level changes. The central bank sets P_t according to the μ realization and society's relative distaste for price level movements, Γ, and deviations from full employment, α. The i subscript in equation (4) indicates that these taste parameters can differ between regions. Note that Γ includes the loss in social utility brought about by a decline in the usefulness of money.[10] Although this is a full employment model, non-zero μ realizations motivate price surprises and output movements over the short run.[11] The central bank selects P_t in order to minimize the losses resulting from these shocks by spreading them between employment deviations and inflation.

Minimizing the central bank's loss function with respect to the price level produces the solution for the inflation surprise.

(5) $$(P_t - {}_{t-1}E\ P_t) = -\frac{\mu_t}{1 + \frac{\Gamma_i}{\alpha_i}} \qquad i = 1, 2$$

It is assumed that region 1 has a stronger distaste for employment fluctuations relative to price changes than region 2; thus, α_1 is greater than α_2, and Γ_1 is less than Γ_2. Except for the taste differences, the two regions would agree on the optimal price surprise. Further, it is assumed that if region 1 enters a monetary union with region 2, the central bank in region 2 controls monetary policy for the combined area.[12] In that case, the actual price surprise in equation (5) is a function of α_2 and Γ_2. Whether region 1 should join the union depends on the

expected losses it incurs under each regime. Substituting equation (5), with i = 2, into region 1's loss function, equation (4) with i = 1, and taking expectations, produces the average losses for region 1 if they proceed with currency integration.

$$(6)\quad \text{Region 1's loss (if joins)} = \frac{\alpha_1\left(\frac{\Gamma_2}{\alpha_2}\right)^2\sigma_\mu^2 + \Gamma_1\sigma_\mu^2}{1+\frac{\Gamma_2}{\alpha_2}}$$

Alternatively, region 1 could choose to maintain its own monetary policy. A flexible exchange rate with both ROW and region 2 ensures that region 1's central bank selects its own price surprise. In this case, the taste parameters in equation (5) are those of region 1, not region 2. Substituting the expression for this price surprise into region 1's loss function produces its average losses if it does not join the union.

$$(7)\quad \text{Region 1's loss (if independent)} = \frac{\Gamma_1\sigma_\mu^2}{1+\frac{\Gamma_1}{\alpha_1}}$$

If the losses in (7) are less than the losses in (6), region 1 should not agree to currency integration. This condition reduces to whether (8) holds.

$$(8)\quad \left(\frac{\Gamma_2}{\alpha_2}-\frac{\Gamma_1}{\alpha_1}\right)^2 > 0$$

Equation (8) is always true so, in this model, region 1 should never join the monetary union. It is important to point out that condition (8) is simply a property of maximization. Region 1's reaction to a disturbance will always be preferred to another area's solution. Even with perfect labor mobility between the two regions and no long-run trade-off between unemployment and inflation, region 1 rejects unification. As long as there are disturbances that force the economy away from full employment, taste differentials alone are sufficient to reject monetary integration. The extent of this divergence in taste will be discussed in the next section; however, there are reasons to believe these differences can be quite large.

This model is structured to highlight the importance of diverse tastes. A more complicated version of this paradigm can be found in Tootell (1989). That paper includes a structural bias toward inflation, foreign shocks, and optimal labor contracts. The model with an inflationary bias in both regions is solved in this article's appendix. Given a predilection for inflation, region 1 might join the union since a potential increase in monetary discipline could result in lower inflation. In fact, it has been claimed that France and Italy entered the European Monetary System in an attempt to import the Bundesbank's noninflationary tendencies. In addition, optimal labor contracts complicate both the central bank's power over employment and the determination of the equilibrium inflation rate. Finally, this basic paradigm can incorporate the net losses due to the short-term and long-term effects on trade of a flexible exchange rate rather than a fixed one; simply add another cost expression to the objective function in (3). This term would be subtracted from (8). Joining the currency union is then ambiguous, depending on the magnitude of the trade losses relative to the size of the taste discrepancy. On the other hand, it is assumed above that region 2's central bank when integrated cares equally about both regions' unemployment; if it does not, the union would be less likely to occur. Although these extensions to the paradigm make the decision to join the union ambiguous, the lopsided benefits often portrayed in the popular literature are not present.

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This section provides a rigorous analysis of a new result. Even in a model with full employment, a vertical Phillips curve, and perfect labor mobility, taste differences can create important losses to joining a currency area. The sovereignty issue as represented in this paradigm may be more important than these more frequently cited problems with monetary unification. Even when abstracting from the traditional costs to currency integration, the short-run ability to spread the effects of a real shock over inflation and employment deviations according to the region's own tastes is a sufficient reason for a region to maintain its own monetary policy. This model is quite

adaptable to more sophisticated analysis. The most important of these extensions, highlighted in the traditional literature, would include different μ shocks across the regions considering unification. The next two sections use this basic framework to examine the correlations in these disturbances across countries in Europe and states in the United States, as well as potential differences in their tastes.

IV. European Unification

Analyzing European unification requires incorporating the benefits to monetary integration as well as the costs. The major advantage is increased gains from trade. The lion's share of forthcoming gains for Europe derives from EMS trade unification, not EMS currency integration. Monetary integration affects intra-European trade through the elimination of exchange rate uncertainty. The magnitude of this change is unclear, however. Risk neutrality and the existence of forward exchange contracts can significantly reduce the effects of uncertainty on trade. The relative stability of the European currencies also reduces this loss, as flexible exchange rates do not necessarily entail variable rates. Another benefit to currency integration, as examined in the appendix, is the possible increase in monetary discipline. Yet, the need for discipline and the increased gains from trade make the decision to unify ambiguous, not obvious. Benefits certainly result from currency integration, but it is far from clear they are so large that they offset the potential losses.

To analyze the EMS, the costs to unification must also be examined. Britain, France, and West Germany have diverse mixes of agricultural, primary, durable, and nondurable goods production. Unlike the identical economies modeled in the previous section, these compositional differences ensure that random disturbances have different effects on each of these countries. Thus, the μ in equation (1) affects each country differently, reinforcing the choice for currency independence. The realities of wage rigidity and regional diversity also make the issue of labor mobility vital in any analysis of the costs of European currency unification.[13] The model's assumption of wage rigidity does appear relevant to Europe, as its persistent unemployment throughout the 1980s suggests. Furthermore, labor is far from perfectly mobile within the EMS. Evidence suggests that labor is highly immobile even within a country or between sectors in the same region.[14] Relying on inter-country migration to restore equilibrium is much more tenuous; beyond the usual explanations for geographical immobility such as associations with family and institutions, language and cultural barriers exist. Despite EMS provisions to eliminate all restrictions on intra-European labor migration, the de facto obstacles may prove to be essentially prohibitive to labor mobility. The diverse industry composition among countries and the poor labor mobility only strengthen the conclusion in the previous section of this article, that costs to currency unification are great.

Table 1
Inflation and Unemployment Rates after the 1973 Oil Shock
Percent

	1973	1974	1975	Percentage Point Change 1973–75
United States				
Inflation	6.2	11.0	9.1	2.9
Unemployment	4.9	5.6	8.5	3.6
West Germany				
Inflation	7.0	7.0	6.0	−1.0
Unemployment	.7	1.6	3.4	2.7
France				
Inflation	7.1	13.9	11.7	4.6
Unemployment	2.8	2.9	4.1	1.3
United Kingdom				
Inflation	9.4	15.8	24.5	15.1
Unemployment	3.2	3.1	4.6	1.4
Italy				
Inflation	10.2	19.4	17.1	6.9
Unemployment	3.7	3.1	3.4	−.3

Source: *Economic Report of the President*, February 1990.

The importance of taste differences among the European nations should not, however, be minimized. The inflation and unemployment experiences of the developed economies after the 1973 oil shock are illustrative.[15] Table 1 reveals this divergence in tastes; the United States and West Germany reacted with low inflation and high unemployment rates, while France, Britain, and Italy all experienced high inflation and relatively little change in unemployment. These countries clearly made significantly different choices regarding the division of this shock between unemployment and inflation. A study by Oudiz (1985) reinforces this conclusion in estimates of European taste parameters, reproduced in table 2.

Table 2
European Tastes for Inflation and Unemployment

	Γ	α
West Germany	.91	.05
France	.11	.10
United Kingdom	.07	.07
Italy	.05	.09

Reprinted from Gilles Oudiz, "European Policy Coordination: An Evaluation." *Recherches Economiques de Louvain*, December 1985.

West Germany's distaste for inflation is apparently significantly larger than that of France, the United Kingdom, or Italy. This difference helps to explain why West Germany bore much more unemployment and much less inflation after the 1974 oil shock than her European partners. West Germany's divergence from the rest of Europe is particularly important in light of its disproportionate power over monetary policy in Europe.

The recent debate over who will run the EMS central bank further suggests the importance of the taste differences. Although the United Kingdom has been most noticeably reluctant to integrate, the president of the Bundesbank recently conditioned West German participation in an EMS currency union on the formation of a European central bank independent of political influence and committed to price stability. In fact, Karl Pohl, head of the Bundesbank, expressed fear that European monetary policy will orientate itself "towards averages and compromises, but that is the worst possible compass for monetary policy."[16] Currency integration is being delayed precisely because each country fears which α and Γ will determine European monetary policy; the Bundesbank is attempting to ensure that its tastes are imposed on the European central bank, while Britain is reluctant to subject itself to monetary policy not determined by its own α and Γ. Even France, one of integration's most ardent supporters, has recently proposed an appreciation of the deutsche mark in light of the rise in West German interest rates.[17] As the unification date approaches, it becomes more evident that issues of labor mobility are far less important to the current reluctance to unify than the issues of sovereignty highlighted in section III.

In short, the decision to unify the European currencies is far more ambiguous and complicated than the EMS timetable assumed. The historical literature on the optimal currency area occasionally applied itself to the issue of European unification and generally concluded that Europe is not an optimal currency area.[18] These works examined the issue along the traditional dimensions of structural similarity, labor mobility, and Phillips curve analysis. Section III illustrates that differences in tastes could be affecting the decision. While the benefits that result from unification could outweigh its costs for many countries in Europe, it is not at all clear that this is true for all of Europe. Important and significant costs to monetary integration could easily dominate the gains, particularly for countries like West Germany and Britain.

V. Implications for United States Policy

Applying this framework to U.S. monetary policy casts the optimal currency area literature in another light. Instead of analyzing exactly where the optimal borders for a currency regime should be drawn, one can examine the optimal central bank policy given the pre-existing borders of a currency area. How a unified European central bank would determine policy given the different regions/countries in its currency area is exactly analogous to how the Federal Reserve must make policy within the given borders of the United States. The United States is a vast and diversified economy, roughly equivalent in size to a unified Western Europe. The tool the Federal Reserve employs to affect the economy, bank reserves, is national, as are its potential price level or GNP targets. GNP, however, is merely an aggregation of regional outputs. These regional outputs, like those of the countries in Europe, are affected differently by exogenous shocks. With only a national instrument at its disposal, the Fed can efficiently target only a national variable, regardless of how severely regional variables fluctuate. For example, if the Federal Reserve adjusts its national instrument to aid a depressed region, inflation in the other areas and the country as a whole will increase. If the Federal Reserve does nothing, the price level remains stable, and regional output levels adjust. The Federal Reserve cannot target every individual region's optimal output, as its one instrument would have to be set differently for the different areas. If, on the other hand, it reacted asymmetrically to aid regions distressed by unemployment, it would aggravate the problem of inflation in the remaining areas. It can,

Table 3
Correlations Among Selected States in Annual Deviations from Trend Real Per Capita Gross State Product 1963–86, and Percentage Composition of Real Gross State Product 1986

	CA	NY	IA	LA	AK	MI	TX	MA
California		.247	.694	.185	−.224	.826	.480	.217
New York			−.088	.236	−.587	.508	.014	.853
Iowa				.440	.152	.638	.725	−.256
Louisiana					.293	.309	.852	−.190
Alaska						−.430	.372	−.742
Michigan							.493	.351
Texas								−.398
Agriculture, Forestry, and Fisheries	2.1	.6	11.0	1.2	1.6	1.3	1.9	.7
Mining	1.1	.1	.2	16.8	33.4	.7	10.3	.1
Durable Goods Manufacturing	12.4	9.0	11.9	3.7	.9	24.6	8.0	15.5
Nondurable Goods Manufacturing	5.9	7.5	9.2	9.3	4.0	6.4	8.1	6.3
Transportation, Communications, and Utilities	7.9	9.2	8.1	11.1	7.6	7.4	11.0	7.1
Finance, Insurance, and Real Estate	17.6	22.2	17.9	14.8	9.2	15.8	13.6	17.1
Services	19.4	20.1	13.4	13.1	8.4	15.1	14.2	22.0
Government	11.6	10.7	9.4	10.1	16.5	10.1	10.6	9.2
Other	22.0	20.6	18.9	19.9	18.4	18.6	22.3	22.0

Source: U.S. Bureau of Economic Analysis, Gross State Products computer tape, and author's calculations.

however, be argued that if the variance of regional output is high around the national aggregate mean, the existing borders of the U.S. monetary union severely hinder regional performance.

To assess the extent of the major traditional cost to currency integration in the United States, state and regional reactions to shocks are examined. The more diverse are the reactions to these disturbances, the more variable will be the regional performance for a given national mean. In the context of the optimal currency area literature, the smaller this correlation, the higher the probability that these regions should not unify; from a monetary policy perspective, this correlation measures the difficulties and advantages of charting a national monetary policy. Although one cannot see the μs directly, the correlation of detrended state products is a proxy for the correlation of the μs, as illustrated in part (b) of the appendix. Table 3 gives the correlation coefficients for deviations from trend of real per capita output of selected states from 1962 to 1986.[19] A number of these correlations are actually negative, particularly for Alaska and Massachusetts, and most are very low. The service sector states in the Northeast, the heavy industry states in the Midwest, the agricultural states of the Plains, the mining states of the Southwest, and the diversified states of the Far West react differently to the various μ disturbances. These low correlations reveal significant variance in regional performances within the United States.

One might expect these correlations to be low when small areas are chosen as points of comparison. The states with high correlations are, therefore, aggregated into the different regions depicted in map 1. Although the process was occasionally somewhat arbitrary, aggregation into only a few districts minimizes this problem.[20] The results are provided in table 4. The states are combined into six regions, the Far West, the Southeast, the industrial Midwest, the farm states, the oil and gas producing states of the Southwest, and New England. Higher correlations do result with these more aggregated regions, yet significant differences still remain. The Southwest and New England are poorly correlated with every other district. Even the farm states do not move closely with the other five areas. Although the Midwest, the Far West, and the Southeast are more closely related, they are far from perfectly correlated. In short, even when the United States is disaggregated into regions usually larger than any country in Europe, the variance between the regions' economic performances is quite large.

Table 4
Correlations among "Optimal Currency Regions" in Annual Deviations from Trend, Real Per Capita Gross State Product 1963–86, and Percentage Composition of Real Gross State Product 1986

	New England	Southeast Seaboard	Midwest	Farm Belt	Southwest	Far West
New England		.708	.378	−.251	−.244	.183
Southeast Seaboard			.770	.284	.388	.371
Midwest				.711	.618	.794
Farm Belt					.844	.672
Southwest						.433
Agriculture, Forestry, and Fisheries	.9	1.3	2.3	9.8	2.1	2.3
Mining	.1	.4	1.2	3.5	11.4	1.2
Durable Goods Manufacturing	16.2	8.2	15.4	8.1	7.1	11.8
Nondurable Goods Manufacturing	6.8	9.5	9.5	7.0	7.8	5.4
Transportation, Communications, and Utilities	7.4	9.3	9.6	10.7	10.6	8.5
Finance, Insurance, and Real Estate	18.0	17.9	15.9	16.6	13.8	17.1
Services	19.0	17.9	15.6	13.1	13.8	18.7
Government	9.7	13.3	10.3	11.2	12.0	12.4
Other	21.9	22.2	20.2	20.0	21.4	22.6

Source: U.S. Bureau of Economic Analysis, Gross State Products computer tape, and author's calculations.

The bottom of table 4, listing the percent of regional product by sector, provides the explanation for the regional variability. Agriculture has roughly five times the importance in the "farm" region that it has in any of the others, while mining, including oil and gas, is roughly four times as important in the Southwest as elsewhere. The service sector is biggest in the West and New England, manufacturing in the Midwest. That durables production is much more important in the West than in the Southeast probably explains the lower than expected correlation between these two areas. The reason all these regions behave differently is their divergent sectoral composition; disparate industries react differently to a given set of exogenous shocks. Both the individual states and these fairly aggregated regions have poorly diversified industrial structures, which increases the loss in regional output given the borders of monetary policy in the United States.

Since Federal Reserve decisionmaking incorporates the regional banks, the relationships between the twelve Federal Reserve Districts, represented in map 2, are examined. To keep states intact, these districts are only approximated. As seen in table 5, the correlation coefficients are often quite low. The highly correlated Fed districts tend to be those within the same "optimal currency areas" of table 4. The sectoral breakdown of the districts follows the same basic pattern as the regional differences in table 4. The Federal Reserve Districts are apparently no more diversified than the hypothetical six regions examined in this paper. Regional Reserve Bank presidents vote at Federal Open Market Committee meetings; thus, this diversity may affect monetary policy. Since national tools are inefficient for manipulating regional targets, calls to relieve distressed regions by using the Fed's instruments should not be accommodated within a unified currency area. Instead, regional instruments need to be created, or existing ones used. Breaking the United States into distinct currency areas is merely one possible way to produce a regional instrument to deal with this problem. In this light, the optimal currency framework is simply an interesting way to analyze the problems of national monetary policy in a country with diverse regions.

State, or national, fiscal policy is one possible instrument besides regional money.[21] The importance of fiscal policy and its boundaries relative to those of the currency area are explored in Kenen (1969) and Tower and Willett (1976). The usefulness

Map 1

United States 'Optimal Currency Regions'

of these tools is questionable, however. State fiscal policy is frequently limited by constitutional constraints on budget deficits and nationwide competition to lure investment into each state; beggar-thy-neighbor state tax policy is inefficient and ineffective when state governments compete. For this reason it is argued that the fiscal authority should possess boundaries identical to those of the currency area. With a national authority, as in the United States, or a supranational authority, as in the EMS, income transfers can be made between boom and bust regions. Federal assistance to the unemployed and the poor is one such program. Potentially more useful fiscal actions, however, like locating a super-collider in a depressed region, are slower to mitigate regional losses as the budgetary process takes a great deal of time. Yet, such redistributions seem more likely to occur, or to be sufficient, between different parts of a single country such as the United States than between different countries in Europe. The EMS has yet to institute such a supranational fiscal authority. Fiscal policy spanning the entire currency area can reduce the costs of monetary integration, but its applicability to anything but preexisting currency areas is questionable.

In the light of these considerations, any conclusion that certain regions of the United States should form their own currency area would be dubious. Although the wide variance around the national mean does increase the costs of a unified national

monetary policy, other costs for U.S. currency integration are low. Diverse economic performances do exist in the United States, but labor mobility across regions should be far higher than in Europe. Each state enjoys the same language and roughly the same culture. Labor migration can, therefore, more easily mitigate the effects of the divergent regional economic performances. Furthermore, the analysis of section III is much less appropriate to the United States, as the similar culture and history are more apt to make the α and Γ parameters similar across regions. Interestingly, this dependence of tastes on the borders of the currency area illustrates the potential endogeneity, or path dependence, of the optimal currency area. Being in a currency area probably forces a convergence of cultural values and tastes, as well as a possible convergence of economic structure like a currency-wide fiscal authority, which makes that area more likely to be an optimal currency area in the future. Perhaps for these reasons the West Germans have unhesitatingly embraced currency integration with East Germany, but are dragging their feet over European monetary union.

VI. Conclusion

This article examines the optimal currency area literature and its application to the recent discussion of currency unification in Europe. It shows many reasons why a country may correctly refuse to join such an institution. Beyond the more traditional reasons, such as a lack of labor mobility, different stochastic and structural environments, and the loss of flexibility, is a more general cost to losing sovereignty. An extremely simple model is used to rigorously illustrate the importance of this additional cost. Without the traditional losses ascribed to joining the

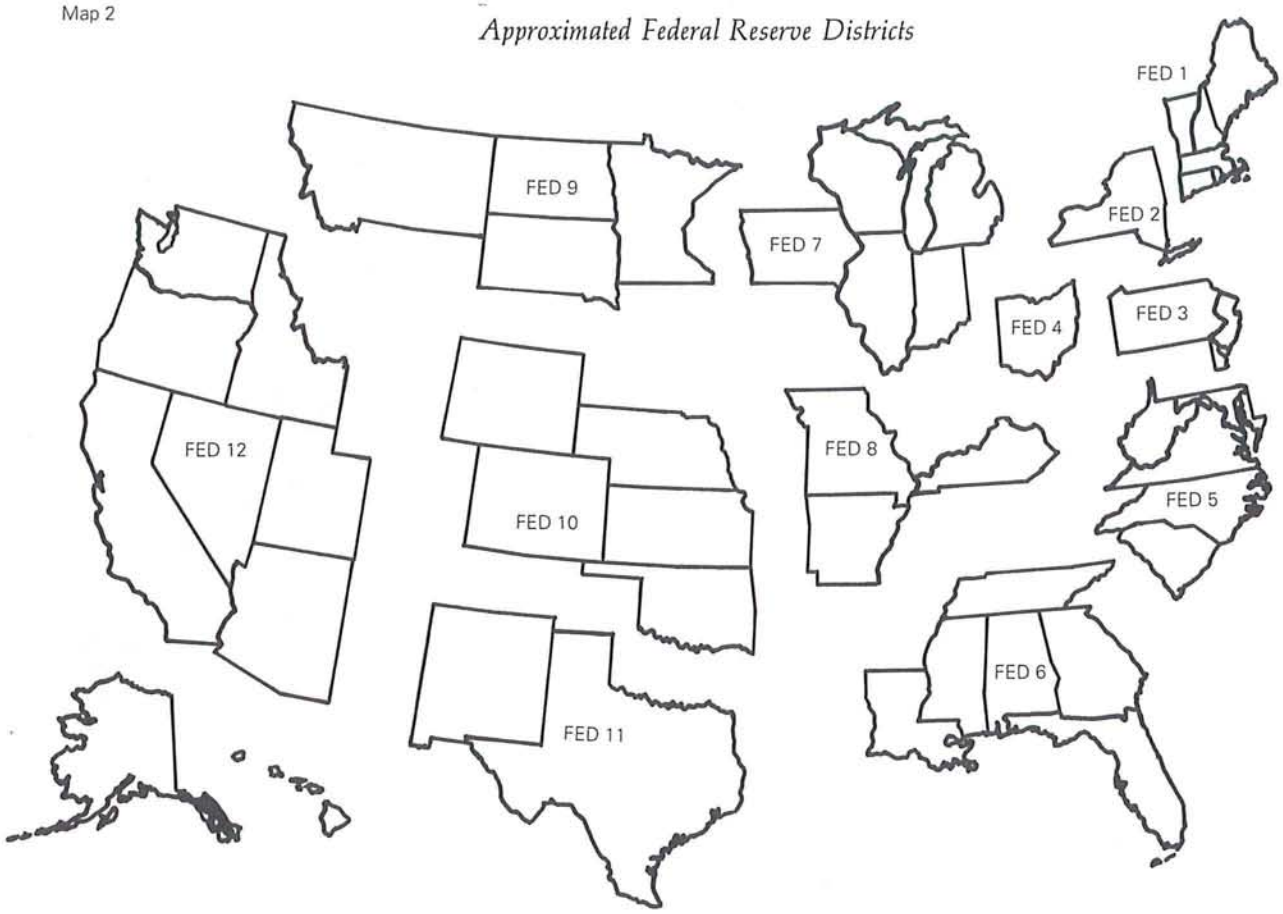
Table 5
Correlations among Federal Reserve Districts[a] in Deviations from Trend Real Per Capita Gross State Product 1963–86, and Percentage Composition of Real Gross State Product 1986

	FED1	FED2	FED3	FED4	FED5	FED6	FED7	FED8	FED9	FED10	FED11	FED12
FED1		.812	.634	.436	.426	.288	.318	.372	.055	−.220	−.312	.133
FED2			.881	.615	.789	.675	.515	.620	.337	.113	.099	.197
FED3				.886	.961	.886	.819	.892	.707	.483	.454	.528
FED4					.873	.797	.975	.960	.851	.633	.607	.821
FED5						.961	.823	.916	.782	.646	.648	.570
FED6							.742	.888	.796	.762	.749	.503
FED7								.945	.850	.622	.629	.847
FED8									.857	.705	.699	.751
FED9										.870	.805	.768
FED10											.937	.640
FED11												.622
Agriculture, Forestry, and Fisheries	.9	.6	1.0	1.3	1.6	2.2	2.9	3.6	7.1	5.2	1.9	2.4
Mining	.1	.1	.6	.8	1.4	3.3	.6	2.3	1.9	5.8	10.5	1.8
Durable Goods Manufacturing	16.2	9.0	10.6	19.1	8.6	8.5	17.0	12.9	9.7	8.1	7.7	11.5
Nondurable Goods Manufacturing	6.8	7.5	10.7	10.1	12.7	9.0	8.6	10.6	7.2	6.0	7.8	5.4
Transportation, Communications, and Utilities	7.4	9.2	10.4	9.3	9.1	9.7	9.1	10.2	9.6	11.3	10.9	8.4
Finance, Insurance and Real Estate	18.0	22.2	17.3	15.4	14.3	15.6	16.6	15.1	17.9	15.4	13.7	16.9
Services	19.0	20.1	18.1	15.2	14.9	15.8	15.4	14.1	14.7	14.2	14.3	18.5
Government	9.7	10.7	10.0	9.4	16.1	12.3	9.7	10.6	10.5	13.1	11.1	12.6
Other	21.9	20.6	21.3	19.4	21.3	23.6	20.1	20.6	21.4	20.9	22.1	22.5

[a] Approximated.
Source: U.S. Bureau of Economic Analysis, Gross State Products computer tape, and author's calculations.

Map 2

Approximated Federal Reserve Districts



union, it is revealed that a divergence in tastes between unemployment and inflation could be sufficient to motivate a refusal to integrate. Thus, the recent reluctance of several members of the European Community to commit to the currency union may be rational and justified. Perhaps Europe is not an optimal currency area, and the EMS unification as now planned is suboptimal.

An application of this analysis to the United States is then undertaken. Several regions within the United States could potentially prefer their own currency. Although our cultural unity may preclude a currency disintegration, the optimal currency area issues highlight an important element of monetary policy in the United States. The Federal Reserve cannot be expected to react to regional disequilibria. Problems in the Southwest, for example, cannot efficiently be solved by using a national policy instrument. Although the variance of regional performance around the national mean is important to social welfare, only more specialized tools can help reduce the costs of this variance. This lesson is not new, but seeing it through the lens of the optimal currency area sheds light on its importance.

Appendix

(a) As in Barro and Gordon (1983), the structural unemployment rate produces an inflationary bias. The central bank now minimizes losses from both unemployment and inflation.

$$(9) \qquad \underset{\Pi}{\text{MIN}}\ \alpha_i(y_t^* - \bar{y})^2 + \Gamma_i(\Pi)^2 \qquad \text{for } i = 1, 2$$

where Π = inflation

$$(10) \qquad y_t = \bar{y} + (\Pi_t - {}_{t-1}E\,\Pi) + \mu_t$$

Note that the central bank's desired level of output, y^*, is greater than the equilibrium employment level, $\bar{y}$. Again assume that $\frac{\Gamma_2}{\alpha_2} > \frac{\Gamma_1}{\alpha_1}$, so that region 1 tends to be more inflationary than region 2. Solving for the losses under each regime, and subtracting the average loss if the region does not join from the average loss if the region does, produces equation (11).

$$(11) \quad \Gamma_1(y^* - \bar{y})^2\left[\left(\frac{1}{1+\frac{\Gamma_2}{\alpha_2}}\right)^2 - \left(\frac{1}{1+\frac{\Gamma_1}{\alpha_1}}\right)^2\right] + \frac{\alpha_1\sigma_\mu^2\left[\frac{\Gamma_1}{\alpha_1} - \frac{\Gamma_2}{\alpha_2}\right]^2}{\left(1+\frac{\Gamma_2}{\alpha_2}\right)^2\left(1+\frac{\Gamma_1}{\alpha_1}\right)^2} \gtrless 0$$

The sign of this expression is ambiguous. The first term is negative, representing the gain to lower-base inflation of fixing the exchange rate, while the second term is positive, revealing the benefits derived from the ability to react to the shocks under the flexible regime. In this case the added discipline of lower inflation at equilibrium, when $\mu = 0$, can offset the benefits of monetary independence when μ is other than zero. This model can be complicated further by allowing the structural unemployment in the two economies to differ, but the results of ambiguity will still be the same.

(b) If output is a random walk, as is fashionable to believe at the moment, equation (12) holds. If it is trend stationary, equation (13) is valid.

$$(12) \qquad y_t = y_{t-1} + \mu_t \ \Rightarrow\ y_t - y_{t-1} = \mu_t$$

$$(13) \quad y_t = \alpha + \beta\ \text{trend} + \mu_t \ \Rightarrow\ y_t - (\alpha + \beta\ \text{trend}) = \mu_t$$

All variables are in logs. Equation (12) reveals that growth in real output is a proxy for μ if output is a unit root. All tables use the procedure in (13). All results were duplicated using the random walk procedure. The results were extremely similar except that New England was incorporated into the Eastern seaboard and Wyoming and Idaho were in the West.

[1] Flood and Marion (1982) and Aizenman (1984) are two examples of studies that assume a long-run vertical Phillips curve. A brief list of models that allow less than full employment is contained in footnote 2.

[2] See Mundell (1961), McKinnon (1963), Kenen (1969), and Tower and Willett (1976), for a complete discussion of these issues.

[3] The exact effect of these shocks depends on the degree of capital mobility and the institutional responsibilities for fixing the exchange rate. For example, under the Bretton Woods system, a decrease in money demand in the United States only raised the money supplies in the other member countries, which were responsible for maintaining the exchange rate. In this sense, the United States exported its inflation.

[4] This point is implicit throughout the literature. Recently, it has been made explicit in Cooper (1985), Giavazzi and Pagano (1988), and Tootell (1989).

[5] I am indebted to Richard Kopcke for pointing out that excessive labor mobility in the face of only temporary shocks could increase the costs of these disturbances. Labor constantly chasing positive disturbances may only waste resources, not save them.

[6] Recent work by Sachs (1986) and Blanchard and Summers (1986) has suggested hysteresis in the unemployment rate. Thus, in their models the long-run Phillips curve is downward-sloping. Yet throughout the 1970s, when most of the criticism of the optimal currency area was leveled, a vertical long-run Phillips curve was widely accepted.

[7] The assumption of rigidity is merely a convenience. As discussed in Clower (1965), all that is necessary is that wages and prices only grope toward their equilibrium values over time.

[8] Shocks from the ROW in this model do not affect the decision to integrate for the two regions. The two regions are assumed to be identical and small in relation to the ROW. Although it will be shown that the flexible regime in this model completely insulates the regions from foreign shocks, in variants of this paradigm where incomplete insulation occurs, the foreign disturbances are exactly the same for each region whether they join or not; thus, they add nothing to the decision. The identical reactions to foreign shocks do not occur if either the small country assumption is dropped, as in Tootell (1989), or some diversity exists between the two regions. If the regions differ, the added diversification gained by joining a currency union could actually mitigate the effects of the foreign shocks. In all of these other models, however, whether to join or not becomes ambiguous, not definitively positive.

[9] It is the policy reactions of the central bank that perfectly insulate the economy from foreign shocks. In a model of differentiated goods, however, this is not the case, as seen in Tootell (1989).

[10] As inflation rises, the usefulness of money declines. Money becomes less functional as inflation rises, which is why flight to other currencies or commodities occurs in inflationary environments.

[11] The optimal, full-employment, y could change with the real shock. The full-employment level will be a function of the real shock's effect on labor demand and the labor supply curve. Only to keep the mathematics simple, a stable and vertical labor supply curve is assumed.

[12] This assumption is merely for ease of exposition. It will become clear that it is only necessary that the tastes of the combined central bank not be identical to region 1's tastes.

[13] Note that Kenen (1969) points out that intersectoral labor mobility is at issue, not interregional. Both regions could be perfectly diversified in the production of different products, and the labor mobility issue would not affect the decision to unify. In fact, regions of this country and countries in Europe are far from perfectly diversified, reemphasizing the need for interregional labor mobility.

[14] Katz and Summers (1989), Kreuger and Summers (1988), and Katz (1986) detail the work done in this area. Traditional attempts to explain inter-industry wage differentials with human capital explanations fail. This finding implies labor immobility even between sectors of the same economy.

[15] Other determinants of this reaction were the rigidity of real wages, as in Sachs (1979), and the dependence of each country's production on oil. But these reactions are extremely diverse in countries that are relatively the same, the developed countries.

[16] This quote appeared in the January 17, 1990 edition of the *Financial Times*. In this same issue, Guido Carli, Italy's Treasury Minister, analyzed in detail the British reaction to the Delors report, articulating U.K. reluctance to join the EMS monetary Union, and the Italian reaction to that reluctance.

[17] "A Shared D-Mark," *Financial Times*, February 8, 1990.

[18] Flemming (1971) and Tower and Willett (1970) both explicitly concluded that Europe is not an optimal currency area. Although they were clear that their conclusions could change, it was their belief that political forces were driving the move toward European currency unification.

[19] Dickey-Fuller tests were run on the real per-capita state products to determine whether they were difference or trend stationary. The lack of many observations would lead one to expect that unit roots would not be rejected. In 13 cases the unit root can be rejected at the 95 percent level. Yet the low power of the test suggests that examining the deviations from trend is superior. The model in section III is trend stationary, also suggesting this approach. As is discussed in part b of the appendix, however, the exact same procedures were performed for the random walk case producing essentially the same results.

[20] These results are too strong to be affected by this complaint. But by having few regions, the effect of including one state in any one region declines. Thus, if a state was misplaced, it would not drastically affect the results. In fact, Arizona belonged with Florida and the Southeast, New Jersey belonged with New England, and Wyoming belonged with the Southwest. They were put in their second best regions to ensure contiguous currency regions.

[21] The use of state fiscal policy to encourage employment growth is surprisingly limited. First, a zero-sum game exists with the other states; each state must compete for capital inflows with its rivals. Furthermore, states are usually constrained to balance their budgets, and expansions in government spending would be needed just as the budget was slipping into deficit.

References

Aizenman, J. 1984. "Optimal Wage Renegotiation in a Closed and Open Economy." *Journal of Monetary Economics*, vol. 13 (2), pp. 251–262.

Barro, Robert J. and David P. Gordon. 1983. "Rules, Discretion, and Reputation in a Model of Monetary Policy." *Journal of Monetary Economics*, vol. 12, no. 1, pp. 101–121.

Blanchard, Olivier J. and Lawrence Summers. 1986. "Hysteresis and the European Unemployment Problem." In *NBER Macroeconomics Annual 1*, Stanley Fischer, ed. Cambridge, MA: MIT Press, September.

Clower, R. W. 1965. "The Keynesian Counter-Revolution: A Theoretical Appraisal." In *The Theory of Interest Rates*, Hahn and Brechling, eds., pp. 108–125. London: Macmillan.

Cooper, Richard N. 1985. "Economic Interdependence and Coordination of Economic Policies." *Handbook of International Economics*, vol. II, pp. 1195–1234.

———. 1986. "Dealing with the Trade Deficit in a Floating Rate System." *Brookings Papers on Economic Activity*: 1, pp. 195–207.

Cordon, W.M. 1972. "Monetary Integration." *Essays in International Finance*, No. 93, Princeton, N.J.: Princeton University Press.

Flemming, J. Marcus. 1971. "On Exchange Rate Unification." *Economic Journal*, vol. 81, pp. 467–488.

Flood, Robert P. and Nancy Peregrim Marion. 1982. "The Transmission of Disturbances under Alternative Exchange Rate Regimes with Optimal Indexation." *Quarterly Journal of Economics*, vol. 97, February, pp. 43–66.

Giavazzi, Francesco and Marco Pagano. 1988. "The Advantage of Tying One's Hands." *European Economics Review*, pp. 1055–1082.

Katz, Lawrence F. 1986. "Efficiency Wage Theories: A Partial Evaluation." *NBER Macroeconomics Annual 1*, pp. 235–276.

Katz, Lawrence F. and Lawrence H. Summers. 1989. "Can Inter-Industry Wage Differentials Justify Strategic Trade Policy?" In *Trade Policies for International Competitiveness*, Robert C. Feenstra, ed., pp. 85–116. Chicago, IL: University of Chicago Press.

Kenen, Peter B. 1969. "The Theory of Optimum Currency Areas: An Eclectic View." In *Monetary Problems of the International Economy*, Mundell and Swoboda, eds., pp. 41–60. Chicago, IL: University of Chicago Press.

Krueger, Alan B. and Lawrence H. Summers. 1988. "Efficiency Wages and the Inter-Industry Wage Structure." *Econometrica*, vol. 56, no. 2, pp. 259–293.

McKinnon, Ronald I. 1963. "Optimum Currency Areas." *The American Economic Review*, September, pp. 717–725.

Mundell, Robert A. 1961. "A Theory of Optimum Currency Areas." *The American Economic Review*, September, pp. 657–665.

Oudiz, Gilles. 1985. "European Policy Coordination: An Evaluation." *Recherches Economiques de Louvain*, vol. 51, December, pp. 301–339.

Renshaw, Vernon, Edward A. Trott, Jr., and Howard J. Friedenberg. 1988. "Gross State Product by Industry, 1963–1986." *Survey of Current Business*, May, pp. 30–46.

Sachs, Jeffrey D. 1979. "Wages, Profits, and Macroeconomic Adjustment: A Comparative Study." *Brookings Papers on Economic Activity*: 2, pp. 269–319.

———. 1986. "High Unemployment in Europe: Diagnosis and Policy Implications." NBER Working Paper no. 1830, February.

Tootell, Geoffrey M.B. 1989. "Optimal Wage Indexation, Optimal Exchange Rate Regimes, and the Enduring European Unemployment Problem." Ph.D Dissertation, Harvard University.

Tower, Edward and Thomas D. Willett. 1970. "The Concept of Optimal Currency Areas and the Choice Between Fixed and Flexible Exchange Rates." In *Approaches to Greater Flexibility of Exchange Rates*, Bergsten, Halm, Machlup, and Roosa eds., pp. 407–415. Princeton, NJ: Princeton University Press.

———. 1976. "The Theory of Optimum Currency Areas and Exchange Rate Flexibility." *Special Papers in International Economics*, Princeton, NJ: Princeton University Press.