Volume Title: NBER Macroeconomics Annual 1991, Volume 6

Volume Author/Editor: Olivier Jean Blanchard and Stanley Fischer, editors

Volume Publisher: MIT Press

Volume ISBN: 0-262-02335-0

Volume URL: http://www.nber.org/books/blan91-1

Conference Date: March 8-9, 1991

Publication Date: January 1991

Chapter Title: The EMS, the EMU, and the Transition to a Common Currency

Chapter Author: Kenneth A. Froot, Kenneth Rogoff

Chapter URL: http://www.nber.org/chapters/c10985

Chapter pages in book: (p. 269 - 328)

Kenneth A. Froot and Kenneth Rogoff
HARVARD BUSINESS SCHOOL AND NBER/UNIVERSITY OF CALIFORNIA AT BERKELEY, AND NBER

*The EMS, the EMU, and the Transition to a Common Currency**

1. *Introduction*

Over the past decade, the European Monetary System (EMS) has surprised most observers. It has gone from a loose confederation of countries trying, by sometimes almost desperate means, to coordinate exchange rates (and little else), to a powerful institution built on increasingly credible, and apparently fixed parities. Its progress has created a momentum of its own, as planning for the ambitious next step—the creation of a monetary union and common currency—is now well underway. The rush toward monetary union in Europe today is shared by both businesspeople and politicians. (Although economists remain skeptical, surveys repeatedly show that the popularity of the European 1992 program is dramatically strengthened when EMU is included.[1])

This enthusiasm has made the question of the day how—not whether—to accomplish monetary union. One widely acknowledged concern is that the EMS may be extremely vulnerable to speculative attacks during the transition process, which is presently envisioned to require several years. As a way of avoiding such potential turmoil, a number of authors have suggested an acceleration of the timetable for union.[2]

In this paper, we argue that speeding up the process will not by itself

*This paper was prepared for NBER's *Macroeconomics Annual 1991*. We thank Lorenso Bini Smaghi, Alberto Giovannini, Maurice Obstfeld, Torsten Persson, and Julio Rotemberg for helpful discussions, Rudi Dornbusch and Nobuhiro Kiyotaki for comments, Yacine Ait-Sahalia for excellent research assistance, and the MIT International Financial Services Research Center for generous research support.

1. See Commission of the European Communities (1990).
2. See, for example, Commission of the European Communities (1990) and Giovannini (1990).

make the transition stable. One problem is that once the date of currency union is fixed, national central banks will face a known, finite horizon after which they must relinquish the possibility of an independent exchange-rate policy. Consequently, there is a danger that their interest in maintaining a long-term antiinflationary reputation may wane as monetary union approaches. A related problem is that their ability to improve competitiveness and to devalue away the government's debt becomes especially high as currency union approaches. As long as currency unification is perceived to be far away, neither of these problems arises, and the system can remain quite stable. But this stability will not necessarily translate into an easier transition. Our analysis suggests that intra-EMS interest-rate differentials might begin rising sharply as union draws closer.

This theoretical possibility might not generate much concern if it were not for mounting evidence of strains within the convergence process. One of the most puzzling features of the EMS performance to date is that member countries have seemingly pursued very different inflation rate policies while allowing for only relatively small adjustments in their exchange rates. The Italian lira, for example, has appreciated in real terms by almost 40% against the Deutsche mark over the EMS period. Yet despite substantial current account deficits and a spiraling debt/GNP ratio, the Italian government has not been forced to devalue the lira against the DM since January 1987. At one time, it seemed that Italian capital controls might explain this phenomenon but these controls have now been dramatically reduced.

Clearly, explaining the behavior of real exchange rates in the EMS is an important step toward understanding the dangers that lie ahead for the transition. Unfortunately, as many studies in recent years have shown, developing an empirical model of real exchange rates is extremely difficult.[3] Virtually all recent studies, however, concentrate on floating exchange rates, and the EMS experience is more akin to a crawling peg. Here we study intra-EMS real exchange rates using a simple intertemporal maximizing model of the exchange rates and current accounts, in which prices are fully flexible. Government spending affects the real exchange rate because it falls more heavily on nontraded goods than does private spending. We use the model to show that divergent government spending trajectories provide a surprisingly plausible explanation of the apparent divergence of EC real exchange rates. The results for the Bretton Woods period are similarly striking.

We also explore alternative explanations for the real exchange rate

3. See for example, Meese and Rogoff (1988). See also Marston (1987) and Hsieh (1982).

anomaly, including productivity disturbances and improving credibility of monetary policy. Whereas the evidence supports the hypothesis that high productivity growth in the traded-goods sector can provide part of the explanation, we argue that productivity shocks alone cannot account for the large real exchange rate gaps. Furthermore, we argue that explanations based on improving monetary credibility are at odds with ever-increasing real wage gaps.

Our overall assessment of the situation is that the degree of monetary-policy convergence is generally overstated, and that sharply varying debt/GNP ratios and real exchange rates provide a very strong temptation for realignments along the path to currency union. Indeed, we argue that the temptation is likely to be especially strong near the time of union.

The rest of the paper is structured as follows. Section 2 explores various indicators of convergence, including measures of real exchange rates and real wages. Section 3 contains the main results on government spending and real exchange rates discussed above. Section 4 presents a model that illustrates some of the reputational issues that arise during the transition to monetary union. Section 5 concludes. In Appendix 1 we present a description of the EMS and a brief assessment of the arguments for currency union. (Readers less familiar with the EMS may want to read Appendix 1 before proceeding to the main text.)

2. *Convergence within the EMS*

The official 1989 Delors report advocates the creation of a monetary union only after monetary convergence among EMS countries has been achieved. During "stage II" (which is expected to begin in 1992) member countries are to achieve further convergence of monetary policies, maintain exchange rates within even narrower bands, and develop the institutional framework for a European Central Bank. More controversially, the EC is to develop mechanisms for achieving greater coordination of fiscal policy. Stage II is expected to require 4 or 5 years to complete. The hope of the Delors report is that this steady process of convergence will culminate in a seamless transition to a common currency.

2.1 CONVERGENCE IN INFLATION

The result of arguments for a gradual move to a common currency has been a heightened concern with the convergence process. The degree to which convergence has already been achieved is most often summarized by the shrinking of inflation differentials. At first glance, the progress has been impressive. The top panel of Table 1 reports average annual rates of

CPI inflation for several individual countries (Germany, France, Italy, and the United States), the average across original members of the EMS (Germany, France, Italy, Denmark, the Netherlands, Belgium, Luxembourg, and Ireland), and the average for non-EMS European countries (Norway, Sweden, Switzerland, Portugal, Greece, plus recent entrants into the exchange-rate mechanism—Spain and the United Kingdom).

Table 1 INFLATION RATES IN THE EMS

	Germany	*France*	*Italy*	*U.S.*	*EMS8*[a]	*Non-EMS Eur*[b]
1979	4.1	10.7	14.7	11.2	8.7	12.3
1980	5.4	13.3	21.3	13.6	12.0	14.7
1981	6.3	13.3	19.5	10.4	12.2	14.2
1982	5.3	12.0	16.5	6.2	10.8	12.3
1983	3.3	9.5	14.7	3.2	7.9	10.7
1984	2.4	7.7	10.8	4.3	6.5	10.7
1985	2.2	5.9	9.2	3.6	4.9	9.3
1986	−0.1	2.5	5.9	1.9	2.5	7.7
1987	0.2	3.3	4.7	3.7	2.3	6.7
1988	1.3	2.7	5.1	4.1	2.5	6.4
1989	2.8	3.5	6.3	4.8	3.7	7.5
1990	2.7	3.4	6.6	5.2	3.7	8.2

AVERAGE ABSOLUTE ANNUAL INFLATION DIFFERENTIALS

	EMS8[a]	*Non-EMS Eur*[b]	*Non-EMS*[c]	*EMS/ Non-EMS*	*EMS/U.S.*
1979	5.3	9.3	8.5	3.6	2.5
1980	7.4	7.6	6.9	2.7	1.6
1981	7.0	6.9	6.6	2.0	1.9
1982	5.7	7.8	7.7	1.5	4.6
1983	5.0	9.6	9.4	2.8	4.7
1984	3.5	10.5	9.8	4.2	2.2
1985	2.8	7.5	7.3	4.3	1.3
1986	2.6	8.4	8.1	5.2	0.6
1987	2.5	5.7	5.3	4.4	1.4
1988	2.0	4.4	4.1	3.8	1.5
1989	2.0	4.7	4.4	3.8	1.2
1990	1.6	4.9	4.6	4.5	1.5

[a]EMS8 is comprised of Belgium, Denmark, France, Germany, Italy, the Netherlands, Ireland, and Luxembourg.
[b] Non-EMSEur is comprised of Greece, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom.
[c] Non-EMS is comprised of Greece, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.
Source: IMF.

The table helps clarify two points. First, the disinflation experienced by the EMS was shared by most countries, regardless of their presence in the exchange-rate mechanism.[4] Nevertheless, the EMS disinflation is the most dramatic. Second, there are still lingering differences in inflation rates across EMS nations. The French–German differential has fallen to an almost inconsequential level—about 0.7%—whereas the Italian–German differential remains at almost 4%.

The bottom panel of Table 1 attempts to measure inflation convergence across the EMS more systematically, by computing average mean absolute inflation differentials across groups of countries.[5] By this measure, there has been an impressive degree of convergence within the original EMS8; the average absolute inflation differential now stands at about 1.6%, down from 5.3% in 1979 and 7.4% in 1980. Notice that while there has also been convergence among non-EMS countries in Europe (which are denoted as "non-EMSEur" in Table 1 and which have witnessed a fall in the mean absolute inflation differential over the same period from 9.3 to 4.9%), the inflation differential between the average EMS country and average non-EMS country has not shrunk. This is because high-inflation countries such as Spain, Portugal, Greece, and the United Kingdom have experienced no more disinflation on average than have the original Exchange-Rate-Mechanism (ERM) countries. It is hard to know whether this pattern will persist with the recent entry of relatively high-inflation countries (Spain and the United Kingdom) into the exchange-rate mechanism. Nevertheless, the convergence among EMS countries over the last decade has been uniquely dramatic.

2.2 REDUCTIONS IN CAPITAL CONTROLS

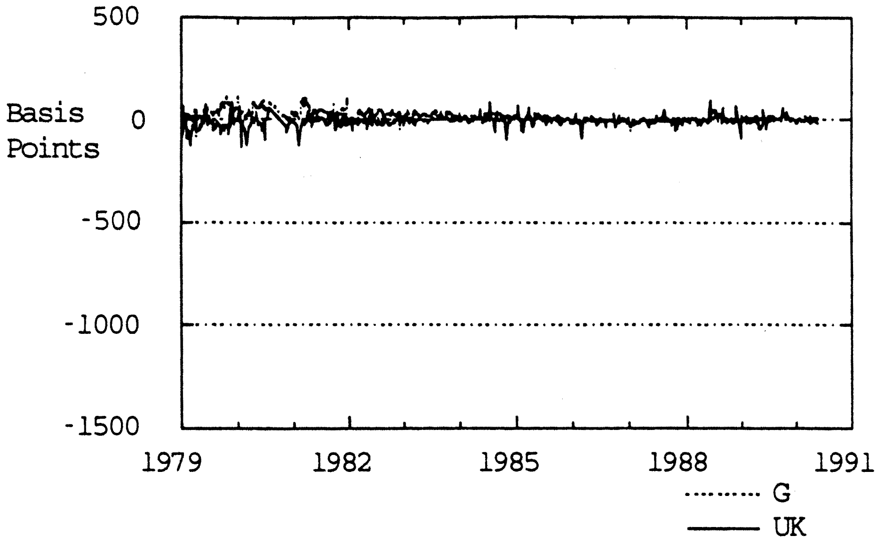
Figure 1 uses the differential between on-shore and euromarket 3-month deposit rates to illustrate the extent of deregulation of international capital flows. With unrestricted capital flows the rates should be approximately equalized; binding controls on capital inflows (outflows) lead to a positive (negative) differential. The top graph shows that those countries with relatively unrestricted capital transactions—the United Kingdom and Germany—exhibit differentials that are small in size, and that were only slightly larger at the inception of the EMS. For those countries with controls in place for much of the period—France and Italy—there

4. A number of authors have pursued this point in greater detail. See for example Rogoff (1985), Giavazzi and Giovannini (1989), Collins (1988), and Dornbusch (1990).

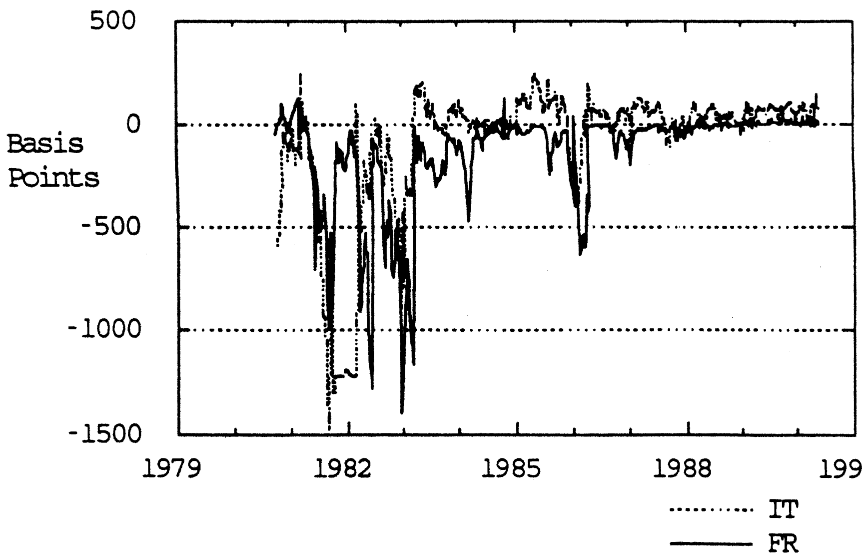
5. This column is computed by taking a simple average of the absolute value of all pairwise inflation differentials in each period.

Figure 1 ONSHORE/OFFSHORE DEPOSIT RATE DIFFERENTIAL FOR THE UNITED KINGDOM AND GERMANY (a) AND FOR FRANCE AND ITALY (b)

(a)



(b)



has been a dramatic reduction in deviations from onshore–offshore parity, as those controls were lifted.[6]

2.3 CONVERGENCE IN BUDGET DEFICITS

Efforts toward convergence have not been limited to monetary policy coordination. The fiscal authorities in EMS countries with budgetary problems have also been under pressure to align their deficits. Table 2 shows levels of surpluses and primary surpluses as percentages of country GNP.[7] Although many countries ran primary deficits throughout the 1980s, currently all countries, except Greece and the Netherlands, enjoy primary surpluses (bottom panel, Table 2). This effort is particularly noteworthy for countries with historically high inflation—France, Spain, Italy, Portugal, Ireland, and the United Kingdom—for whom the cutting of primary deficits represents an adjustment to the loss of seigniorage revenues.

These improvements are much less obvious in the top panel of Table 2, which shows straight measures of budget surpluses as percentages of GNP. Moreover, as Dornbusch (1990) notes, once the surpluses in Table 2 are cyclically adjusted, any move toward convergence becomes even less evident. Italy, for example, has witnessed very positive growth performance in the last several years, indicating that its cyclically adjusted deficit has worsened over time.

2.4 CONVERGENCE IN PRICE AND DEBT LEVELS

The evidence on price and debt *levels* is far less suggestive of successful convergence than is the experience with inflation and financial market deregulation. Table 3 shows cumulated inflation (measured by CPIs) in several EMS countries relative to Germany, and compares it with each

6. See Giavazzi and Giovannini (1986). To many observers, the successful removal of capital controls is a clear manifestation of the improved stability of the EMS. It is evident from Figure 1 that throughout the early 1980s, capital controls permitted the French and Italian governments to finance their debts at substantially lower rates than an open international capital market would have demanded. Perhaps at that time, the system could not have survived without these controls: if the French and Italian governments were forced to pay the higher off-shore rates, they might have found it too costly *not* to devalue. Presumably, the market would have known this, and would have charged *even higher* interest rates than those actually observed in the off-shore market. In other words, with such low levels of credibility, there simply may not have been an equilibrium intermediate between a pure float (or crawling peg) and irrevocably fixed parities. In this sense, capital controls may have been a critical ingredient in the evolution of the EMS, seeing it through its early, unpredictable adolescence.
7. Primary surpluses are computed by subtracting an estimate of interest payments (the short-term interest rate times the stock of outstanding government debt) to receipts less expenditures. This estimate is likely to be too high, primarily because gross government debt is often less than net debt.

Table 2 BUDGET SURPLUSES IN THE EMS AS A PERCENT OF GNP

	Belgium	*Denmark*	*Germany*	*Greece*	*Spain*	*France*	*Ireland*	*Italy*	*Luxbg*	*Nthlds*	*Prtgl*	*U.K.*
Av. 79–82	−10.1	−5.3	−3.1	−9.4	−3.4	−1.4	−12.8	−9.9	−0.9	−5.1	−9.9	−3.0
Av. 83–86	−9.5	−2.5	−1.7	−11.2	−5.9	−2.9	−11.0	−11.6	3.5	−5.9	−9.6	−3.1
Av. 87–90	−6.5	0.2	−1.8	−16.2.	−3.1	−1.6	−5.3	−10.6	2.5	−5.6	−5.5	0.1

PRIMARY BUDGET SURPLUSES AS A PERCENT OF GNP

	Belgium	*Denmark*	*Germany*	*Greece*	*Spain*	*France*	*Ireland*	*Italy*	*Luxbg*	*Nthlds*	*Prtgl*	*U.K.*
Av. 79–82	1.2	1.0	−0.0	−2.9	0.2	1.9	0.4	1.0	0.4	−0.1	1.8	5.4
Av. 83–86	1.6	5.3	0.6	−1.9	0.1	0.3	2.1	0.6	4.9	−2.0	2.6	3.3
Av. 87–90	3.9	6.3	0.8	−2.9	3.6	1.6	5.8	0.8	3.3	−0.6	3.9	5.8

Notes: Budget surpluses are from the Commission of the European Communities (1990). Primary surpluses are computed from simple surpluses by adding interest payments on outstanding debt to the surpluses. Interest payments are computed by multiplying short-term interest rates times the government-debt/GNP ratio (these data also from the Commission of the European Communities).

Table 3 CUMULATED CHANGES IN CPIs AND NOMINAL EXCHANGE RATES AGAINST THE DM

	Logarithmic percent changes in			
	CPI 1979–1986	*Exchange rate 1979–1986*	*CPI 1987–1990*	*Exchange rate 1987–1990*
Netherlands	2	4	−3	0
Belgium	18	22	2	0
Luxembourg	16	22	1	0
Denmark	34	23	8	0
France	41	27	4	0
Italy	74	31	15	0
Ireland	55	25	6	0

Sources: Commission of the European Communities (1990) and IMF.

currency's nominal exchange rate change against the DM.[8] Denmark, France, and (especially) Italy and Ireland have experienced large real appreciations, whereas the Netherlands, Belgium, and Luxembourg have recently more or less anchored their price levels to that of Germany. The table also shows that since the last realignment against the DM of January 1987, Italy has experienced a substantial real appreciation of about 16%.

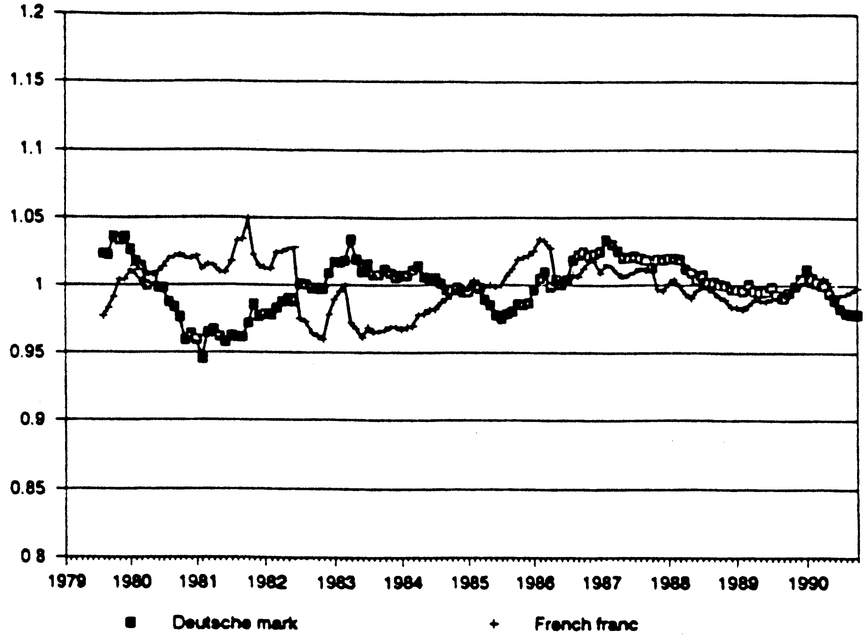
A more comprehensive picture of relative price movements can be gained from Figures 2a–d, which show real exchange rate movements of EMS currencies against an ECU-weighted basket of consumer prices. The graphs reveal three general types of country experience: Belgium, the Netherlands, Denmark, and France have all succeeded in stabilizing their real ECU exchange rates in parallel with that of Germany; Ireland has cut its inflation rate to the point where it has achieved a real *depreciation* of the pound against the ECU countries; and Italy, Spain, and the United Kingdom have appreciated substantially in real terms. While Spain and the United Kingdom have only recently joined the ERM (Spain in June 1989, and the United Kingdom in October 1990), their real exchange rates along with Italy's currently appear both appreciated and appreciating. Indeed, during its brief participation in the ERM, the Spanish peseta has already appreciated over 10% in real terms (using CPIs).

However, although inflation *rates* are converging, divergences in consumer price *levels* are continuing to grow. Even though countries such as Italy, Spain, and the United Kingdom have attenuated their inflation differentials with Germany, all three differentials remain positive at about 3.5, 2.5, and 3% per annum, respectively. In fact, as can be seen

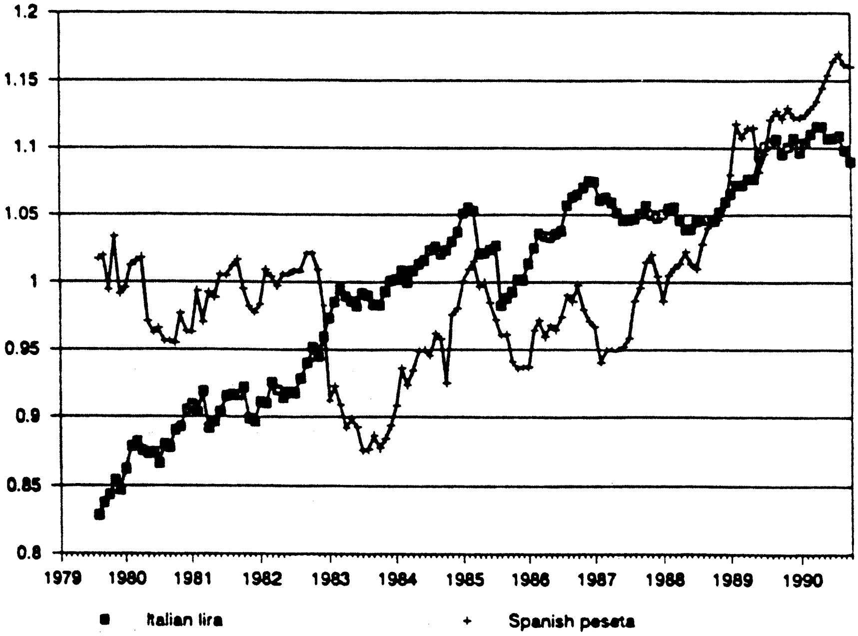
8. The exchange rate and CPI data are through January 1991.

Figure 2a–d INTRA-EMS REAL EXCHANGE RATE INDEXES (ECU-BASED WEIGHTS)

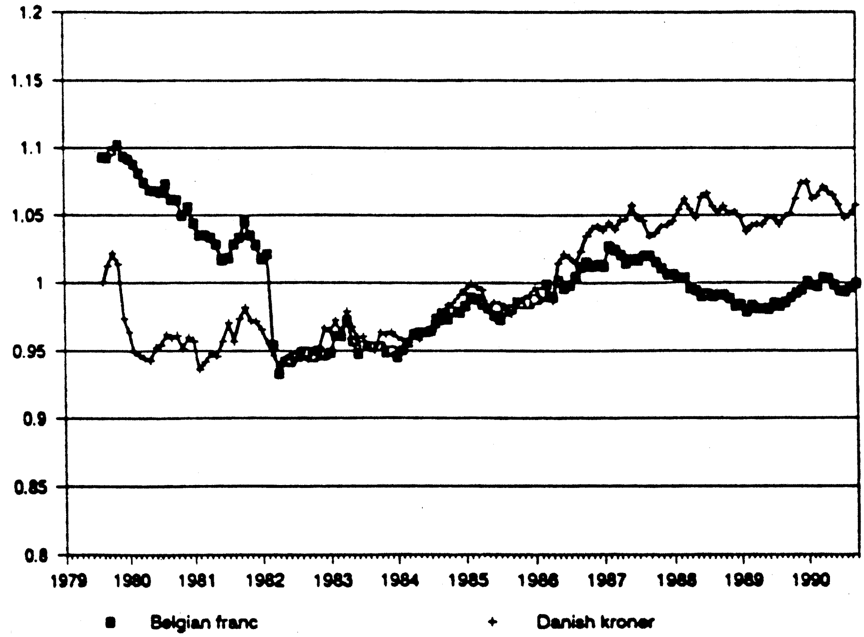
(a)



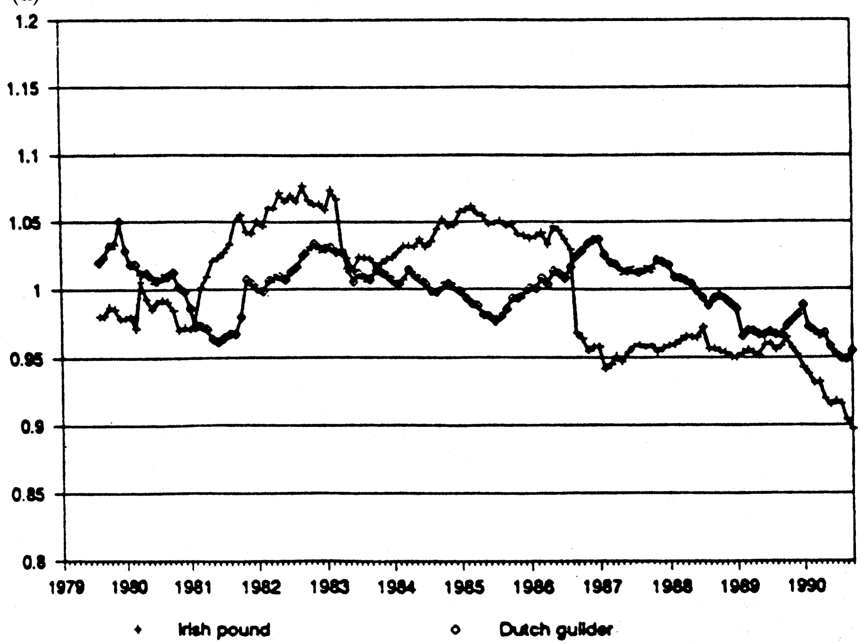
(b)



(c)


1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Belgian franc
Danish kroner

(d)


1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Irish pound
Dutch guilder

from Table 1, the Italian–German inflation differential has not fallen over the last 3 years. If these cumulated price differentials are to be erased before monetary union without further realignments, Italy will have to run a substantially *lower* rate of inflation than Germany for a sustained period.

Current account deficits are another measure that might reveal evidence of important recent divergences. Table 4 shows deficits as percentages of GNP. Those countries with growing price-level gaps are also experiencing deteriorating current accounts. Spain and Italy have seen their current accounts fall by 5.5 and 1.8% of their respective GNPs between 1986 and 1990. Portugal, the United Kingdom, and Germany have also had their current surpluses shrink (the latter apparently associated with German unification, since the deterioration begins suddenly in the second quarter of 1990).

3. *Explaining the Real Exchange Rate Puzzle*

As is well known, the growing divergences in price levels and current accounts could be due to several factors, not all of which require an ultimate downward readjustment in the level of the real exchange rate. In what follows we consider three likely kinds of sources that could account, at least in principle, for intra-EMS real exchange rate movements: shocks to government spending or deficits, shocks to productivity, and imperfectly credible aggregate demand policy.

3.1 SHOCKS TO GOVERNMENT SPENDING

To understand the intra- and intertemporal effects of government spending on real exchange rates and current accounts, it is useful to think of a simple Ricardian neoclassical model of a small country that produces two goods in fixed supply.[9] (For a technical discussion, see Appendix 2.) One

9. In thinking about how fiscal policies affect the exchange rate and current account, it might seem most natural to begin with the classic Mundell–Fleming model. Under floating exchange rates, and with a high degree of capital mobility, that model predicts that increases in government spending or decreases in taxes lead to a real exchange rate appreciation and a current account deficit.

For our present purposes, however, the logic behind this result is unsatisfactory for two reasons. First, in that model nominal goods prices are fixed, so an increase in the price of domestic goods relative to the domestic price of foreign goods can be achieved only through an appreciation of the nominal exchange rate. The sticky-price assumption may not be very realistic here, since in practice any sluggishness in the response of prices is likely to be matched (at the very least) by sluggishness in the state of fiscal policy. Moreover, within the EMS it is clear that exchange rates do not float; as Table 3 suggests, nominal prices across EMS countries seem more flexible over time than do the associated exchange rates. A second problem with this Mundell–Fleming model is that it ignores the intertemporal dimension of current account and government budget imbalances.

Table 4 CURRENT ACCOUNT SURPLUSES IN THE EMS AS A PERCENT OF GNP

	Belgium	*Denmark*	*Germany*	*Greece*	*Spain*	*France*	*Ireland*	*Italy*	*Nthlds*	*Prtgl*	*U.K.*
1979	−2.9	−4.7	−0.8	−1.9	0.5	0.9	−13.4	1.6	−1.2	−1.7	−0.1
1980	−4.3	−3.7	−1.7	0.5	−2.5	−0.6	−11.8	−2.2	−1.5	−5.9	1.5
1981	−3.8	−3.0	−0.7	−0.7	−2.7	−0.8	−14.7	−2.2	2.2	−12.2	2.4
1982	−3.7	−4.2	0.5	−4.4	−2.5	−2.1	−10.6	−1.6	3.2	−13.5	1.4
1983	−0.8	−2.6	0.7	−5.0	−1.5	−0.8	−6.9	0.3	3.1	−8.3	0.9
1984	−0.6	−3.3	1.3	−4.0	1.5	0.0	−5.8	−0.6	4.2	−3.4	−0.2
1985	0.3	−4.6	2.6	−8.2	1.6	0.1	−4.0	−0.9	4.1	0.4	0.6
1986	2.0	−5.5	4.4	−5.3	1.7	0.5	−2.9	0.5	2.7	2.4	−0.8
1987	1.2	−3.0	4.1	−3.1	0.1	−0.3	1.3	−0.2	1.4	−0.4	−1.9
1988	1.0	−1.8	4.1	−1.7	−1.1	−0.4	1.8	−0.6	2.4	−4.4	−4.1
1989	1.0	−1.3	4.7	−4.8	−2.9	−0.2	1.6	−1.3	3.6	−1.2	−3.7
1990	0.3	0.0	2.6	−5.1	−3.8	−0.3	1.2	−1.3	3.3	−1.2	−2.8

Source: Commission of the European Communities (1990).

is a traded international good, the demand for which is perfectly elastic, so its price can be taken as given. The other is a domestic good (which may or may not be traded), the demand for which is inelastic. The price of the domestic good is fully flexible and determined by market clearing.

Consider first the simplest case—an unanticipated, permanent increase in government consumption expenditure that falls relatively more on domestic goods than does private expenditure. This permanently reduces the supply of domestic goods available to the foreign and domestic private sectors.[10] (If there is perfect factor mobility, then there is no effect on the real exchange rate; if there is slow intersectoral factor adjustment, then there is no *long-run* effect on the real exchange rate, see Froot and Rogoff, 1991.) Thus the real exchange rate—the price of domestic relative to international goods—appreciates permanently. There is no effect on the current account.[11]

For temporary changes in government consumption, real exchange rate and current account behavior are somewhat more complex. Here it suffices to note that an unanticipated but *temporary* increase in government consumption unambiguously appreciates the real exchange rate for the same reasons as discussed above. However, the impact effect on the current account is ambiguous, as the change in domestic consumption depends on the elasticities of both intra- and intertemporal substitution. And since the direction of change in the current account determines the change in the country's long-run indebtedness, temporary changes in government spending also must have an ambiguous effect on the long-run trade balance and real exchange rate.

3.1.1 Evidence on the Real-Exchange-Rate/Fiscal-Policy Relation As is often the case when it comes to the real exchange rate, we are enriched by the apparent insights from these models, but impoverished by their lack of empirical confirmation. There is very little empirical evidence that *any* known fundamentals—let alone government consumption in particular—have reliable effects on the real exchange rate. Much of the existing empirical work, however, has centered on the major floating exchange rates.[12] Perhaps the much lower volatility of intra-EMS real

10. We are implicitly assuming that both goods are normal.

11. The real-exchange-rate result is likely to be quite robust. In some instances, government consumption can be thought of as absorbing some of the available supply of certain goods. In other cases, government consumption draws factors away from their alternative uses in production. Since government consumption is labor intensive (paying bureaucrats, educators, medical practitioners, and military personnel) the reduction in private labor supply can be expected to have a disproportionately large negative effect on the production of domestic goods, which are typically more labor intensive than international goods.

12. See Meese and Rogoff (1983).

exchange rates can help reveal an empirical relationship between government consumption and the real exchange rate that cannot be identified when nominal exchange rates float.

Table 5 shows the results of regressions of the real exchange rate on the current levels of both domestic and foreign government spending as a fraction of GNP:

$$r_t = \alpha + \beta_1 g_t + \beta_2 g_t^* + \epsilon_t, \tag{1}$$

where r_t is the time-t real exchange rate measured using the CPIs for the EMS8 and using GNP weights, g_t is domestic government consumption expenditures divided by domestic GNP, and g_t^* is a GNP-weighted average of foreign (other-EMS) government consumption expenditure divided by foreign GNP. In Appendix 2, we show that the specification in (1) comes directly out of a simple neoclassical model, with Cobb–Douglas intratemporal preferences and an intertemporal elasticity of substitution of one.[13] To attribute the coefficients β_1 and β_2 in the regression model (1) directly to the effects of fiscal policy, it is necessary to assume that the shares of government spending are exogenous, and that they are uncorrelated with other exogenous determinants of the real exchange rate, such as monetary policy on productivity.

Table 5 presents three groups of OLS estimates: in the top panel are estimates from the cross section, time-series panel of 11 years and 8 countries; in the middle panel are cross-sectional estimates, one for each of the 11 years in the sample; and in the bottom panel are time-series estimates for the 8 individual countries. The residuals in the regressions with time-series components are highly serially correlated (note the Durbin–Watson statistics).[14] As a result, we have allowed for arbitrary serial correlation using the Newey and West (1987) covariance-matrix estimator.[15] Nevertheless, with so few time-series observations, one should be careful when drawing inferences from any single time-series coefficient.

With these caveats in mind, note that the estimates of β_1 in Table 5 are consistently positive, and those for β_2 are consistently negative. Indeed, in the top panel of the table (which pools the time series and cross section), the estimates of β_1 and β_2 are of almost equal magnitude; they

13. Table 5 uses annual data from 1979 to 1989. In some of the estimates, we constrain $\beta_1 = -\beta_2$ in order to conserve on degrees of freedom and to limit multicollinearity.
14. The reported Durbin–Watson statistics are cross-sectional averages of the country time-series Durbin–Watson statistics.
15. In all of the regressions that follow, we tried this covariance matrix estimator and its heteroscedasticity-adjusted counterpart in addition to the standard OLS covariance matrix. In all cases we have taken the most conservative approach by selecting the largest of standard errors estimated across these various techniques.

Table 5 REGRESSIONS OF REAL EXCHANGE RATES ON GOVERNMENT CONSUMPTION/GNP AND BUDGET SURPLUSES/GNP, FOR EMS COUNTRIES, 1979–1989

	$r_t = \alpha + \beta_1 g_t + \beta_2 g_t^* + \gamma_1 s_t + \gamma_2 s_t^* + \epsilon_t$										
	β_1	*SE*	β_2	*SE*	γ_1	*SE*	γ_2	*SE*	R^2	*DW*	*DF*
1. In levels	2.103†	0.735	−3.618†	1.959					0.14	0.81	82
2. In levels	2.109†	0.791	−2.109†	0.791					0.13	0.79	83
3. In levels	3.481†	0.860	−3.090	3.595	0.786†	0.333	−0.250	1.393	0.21	0.88	80
4. In levels	3.496†	0.850	−3.496†	0.850	0.777†	0.330	−0.777†	0.330	0.21	0.88	82
5. In changes	0.361	0.626	−0.108	1.248					0.01	1.59	74
6. In changes	0.375	0.622	−0.375	0.622					0.01	1.60	75
7. In changes	0.471	0.774	−0.289	1.929	0.037	0.209	−0.187	0.664	0.01	1.58	72
8. In changes	0.455	0.762	−0.455	0.762	0.037	0.204	−0.037	0.204	0.01	1.60	74
	Cross-sectional regression with annual dummies, $\beta_1 = -\beta_2$										
1979, in levels	6.176†	1.854							0.23		63
1980	1.389	1.888									
1981	1.148	2.427									
1982	0.728	2.694									
1983	−1.568	4.432									
1984	0.823	4.329									

1985	3.063	3.430	−3.063	3.430			
1986	1.151	2.286	−1.151	2.286			
1987	2.468	3.817	−2.468	3.817			
1988	2.353	2.074	−2.353	2.074			
1989	2.834†	1.562	−2.834†	1.562			
	Time series regressions by country, $\beta_1 = -\beta_2$						
Belgium, in levels	4.117†	1.373	−4.117†	1.373	0.50	0.47	9
Denmark	0.967	0.781	−0.967	0.781	0.14	0.73	9
France	−3.993†	1.819	3.993†	1.819	0.63	1.01	9
Germany	3.218	2.209	−3.218	2.209	0.19	1.36	9
Ireland	−1.058	2.100	1.058	2.100	0.03	0.42	9
Italy	7.111†	1.137	−7.111†	1.137	0.81	0.95	9
Luxembourg	7.137†	2.036	−7.137†	2.036	0.67	1.45	7
Netherlands	2.278†	0.526	−2.278†	0.526	0.76	1.46	9

Notes: †Statistical significance at the 10% level. r_t is an index of the intra-EMS real exchange rate (expressed as the price of a domestic CPI basket relative to the price of a GNP-weighted basket of other EMS countries' CPI). g_t is the ratio of government consumption to GNP; g_t^* is the GNP-weighted average of other EMS countries' g_ts. s_t and s_t^* are comparable ratios of government budget surpluses to GNP. All variables have country-specific means removed. The cross-sectional regression is run using dummy intercept and slope-interaction terms for individual years.

Sources: IMF and European Commission.

say that an increase (decrease) in domestic (foreign) government consumption of 1% of domestic (foreign) GNP yields a real appreciation of about 2%. The adjusted standard errors suggest that these estimates are reliably positive.[16]

In the third and fourth lines of the top panel, we add domestic and foreign government budget surpluses (from Table 2 above) as percentages of GNP to regression (1):

$$r_t = \alpha + \beta_1 g_t + \beta_2 g_t^* + \gamma_1 s_t + \gamma_2 s_t^* + \epsilon_t. \tag{2}$$

This regression is more difficult to interpret than is (1) as s_t and s_t^* are much less likely to be exogenous. Nevertheless, if Ricardian equivalence fails, we might expect that an increase in the surplus (holding constant government spending) leads to an decrease in total expenditure. With a fixed supply of domestic goods, the real exchange rate must depreciate. In other words, we might expect $\gamma_1 < 0$ and $\gamma_2 > 0$.

The data show no evidence of this effect, however. The coefficients on the surplus measures are not statistically different from zero, and are even of the wrong signs. The coefficients on foreign and domestic government consumption become larger and even more statistically significant when surpluses are included. But the serial correlation in the residuals remains quite severe.

One way of mitigating the serial correlation problem in these regressions is to run them in changes rather than in levels. A potential objection to such a regression is its low power: If there is independent measurement error in the regressors, it may become accentuated when the regression is run in changes.[17] In this case we would expect the coefficients to be smaller when estimated in changes rather than in levels. In lines 5 through 8 of the top panel of Table 5, we run Equations (1) and (2) in changes. The coefficients are indeed much smaller and lose their statistical significance, but nevertheless retain their expected signs;

16. We tried several other versions of these regressions, not reported here to save space. A time trend was included on the right-hand side of (1), but was found to be statistically insignificant. We also tried reversing that regression, by running government spending on the real exchange rate and a time trend, but again found the time trend to be insignificant and the positive covariance between the real exchange rate and government spending to be statistically significant.

17. Suppose that measured government consumption is the sum of true consumption, $g'_t = g_t = g'_t + \epsilon_t$. Suppose also that g'_t + follows an AR (1) process: $g'_t = \delta g'_{t-1} + u_t$, where $0 < \delta < 1$ and u_t is iid. Under these assumptions it is easy to show that the downward bias in β_1 is greater for the regression in changes than for the regression in levels.

the Durbin–Watson tests show very little remaining serial correlation in the residuals.

In the middle panel of the table we use cross-sectional regressions as a second means of alleviating the serial correlation problem.[18] Like the regressions in changes above, this method suffers from low power. However, it gives us another check on the correct magnitude of the coefficients, since the expected decline in power comes from increased standard errors and not decreased coefficient estimates. Of the 11 estimates of β from this method, only two are statistically different from zero, but both are positive. Moreover, 10 of the 11 estimates are greater than zero, with an average estimate of 2.2—very close to that for the data set as a whole.

Finally, in the bottom panel we present the estimates from the individual country time-series regressions. Of these, 7 of 8 coefficient estimates are positive. Of the 4 that are statistically different from zero, all are positive as well. Interestingly, the Italian real exchange rate appears among the most sensitive to changes in relative government expenditure.[19]

The evidence in Table 5 is admittedly sketchy—the EMS experience involves a limited number of countries over a limited period of time. However, as we show in Froot and Rogoff (1991), a strikingly similar relationship between the real exchange rate and government spending occurs during the Bretton Woods period (1950–1973) for a broader group of 17 countries. The coefficients on government spending (which for the combined cross section time-series regressions are roughly the same order of magnitude as the EMS period estimates) are even more statistically significant in this larger data set. Moreover, they remain significant in the first-difference regressions. Interestingly, however, this relationship appears to weaken during floating-rate periods (1973–1989 for non-EMS countries, and 1973–1979 for the broader group of countries). Taken together, these results suggest a fairly reliable relation between government spending and the real exchange rate (see Froot and Rogoff, 1991, for more detail). At the same time, they provide no positive evi-

18. In these regressions, both the regressors and regressands are demeaned by *country*. This allows for country-specific fixed effects. To save space and to conserve on degrees of freedom, we report only estimates from (1), under the constraint that $\beta_1 = -\beta_2$. The omitted estimates of (1) and (2) are not qualitatively different from the other results reported in Table 5.

19. We also estimated (1) and (2) using total government expenditure, which includes government investment and transfer payments, in addition to consumption expenditure. If transfer payments divert labor resources away from production, they will drive up the price of domestic goods provided that the production of those goods is relatively labor intensive. The estimates from these regressions, not reported here, are very similar to those in Table 5.

dence that deficits or taxes themselves have important effects on real exchange rates.

3.1.2 Implied Impact of Government Spending on Real Exchange Rates What do our estimates suggest about the magnitude of real exchange rate changes within the EMS induced by government expenditure? Table 6 shows in the first column the change in $g_t - g_t^*$ from 1979 to 1989 as a percent of GNP. Within the EMS8, Italy has had the largest growth in its relative fiscal position, which has increased by 2.9%. At the other extreme, Belgium, Ireland, and the Netherlands have succeeded in cutting substantially their relative shares of government spending.

The second column of Table 6 reports the estimated real exchange rate appreciation caused by the divergences in government consumption, using a coefficient from (1) of $\beta_1 = -\beta_2 = 2.1$. Italy has the largest implied appreciation within the EMS8 of almost 9%. This measure is probably conservative; if we were to use Italy's individual coefficient from the bottom panel of Table 5 of 7.1, the implied appreciation would instead be 29.1%.

If government spending patterns can indeed help explain real exchange rates within the EMS, the question becomes whether there is any reason to believe that recent budgetary trends will have to be reversed. It is clear from our model above that as long as the two intertemporal budget constraints—those for the fiscal authority and the country as a whole—are satisfied, any increase in government consumption expenditure, and the associated change in the real exchange rate, can be sustained. The next three columns of Table 6 help shed light on the potential

Table 6 CHANGES IN RELATIVE POSITION OF GOVERNMENT CONSUMPTION AND CURRENT ACCOUNTS 1979–1989, PERCENT OF GNP

	Change in government consumption	*Implied % change in real exchange rate (relative to DM)*	*Change in debt*	*Change in current account*	*Change in intra-EEC trade balance*
Belgium	−2.9	−3.7	57.5	3.2	0.1
Denmark	0.5	3.5	35.2	4.7	4.1
France	1.2	5.0	12.2	−1.2	−1.3
Germany	−1.2	0.0	13.8	3.4	1.8
Ireland	−2.5	−2.8	28.7	14.6	19.9
Italy	2.9	8.6	40.2	−2.9	−1.4
Netherlands	−2.8	−3.4	33.6	4.5	3.5

Sources: Commission of the European Communities (1990), IMF, and authors' calculations.

permanence of changes in government consumption by examining the behavior of government and external debt relative to GNP.

The third column of Table 6 shows changes in government debt/GNP ratios; columns four and five try to assess the external constraint by looking at changes in the current account and intra-EEC trade balance.[20] It is clear from these measures that Italy (which has the largest implied exchange rate appreciation within the EMS8) also has had a large increase in its government debt ratio and a substantial deterioration of its external accounts.[21] Of course, an increase in Italian taxes could correct the explosive trend in the domestic debt burden. But if the added taxes are distortionary, and the government attempts to smooth across distortions, any fiscal adjustment program is likely to combine decreases in government expenditure with increases in taxes.

The evidence on the current accounts also provides support for the notion that the changes in government spending are likely to be temporary. Recall from our model above that permanent changes in government consumption have little effect on the current account, whereas temporary increases in spending generally lead to current account deficits. It is true that in the non-Ricardian-equivalence version of the model, an increase in taxes (without any change in government consumption) can reduce current private expenditure on domestic goods, thereby permitting an improvement in the current account and a depreciation in the real exchange rate. However, this mechanism appears empirically unimportant: the regression results above show no evidence of an effect of deficits (controlling for government expenditure) on the price of domestic goods. This reasoning therefore suggests both that the real appreciation in column two of Table 6 is temporary, and that adjustment will require cuts in government consumption.[22]

3.2 SHOCKS TO PRODUCTIVITY

A second, complementary explanation of the divergences in real exchange rates within the EMS is that of productivity shocks.

The usual story linking productivity shocks with the real exchange

20. Whereas the current account is the correct gauge of debt accumulation, our emphasis is on alignment *within* the EMS. For this reason, the intra-EEC trade balance is also reported.
21. Only Belgium had a larger increase in its government debt ratio during this period. But over the last 4 years, Belgium has been working down its debt, whereas Italy's ratio continues to grow. See also Table 11.
22. The EEC-1992 program is itself likely to force down the price of Italian domestic goods (and factors) through increased economic integration and factor mobility, even if government spending differentials are sustained.

rate, which is due to Balassa (1964) and Samuelson (1964), can again be illustrated within the basic model of Appendix 2. Each country produces two goods, international and domestic, with labor mobile between sectors (capital is assumed to be a fixed factor) but with total labor in fixed supply. International goods are traded, and compete directly with goods from other countries. They also have more rapid productivity growth than do domestic goods. Under these assumptions if productivity growth in the international-goods sector exceeds that of the domestic-goods sector, the price of domestic goods rises relative to the price of international goods.[23]

The prima facie case for the Balassa–Samuelson explanation seems reasonable enough. Table 7 compares the 1979–1989 real exchange rate appreciation within the EMS8 against average annual real growth rates. Those countries which experienced the largest real appreciations against the DM (Ireland and Italy) have indeed enjoyed relatively more rapid real growth.[24] A devotee of this view might even interpret the regression results in the previous subsection as confirmatory evidence, arguing that changes in the ratio of government consumption to GNP are highly positively correlated with productivity shocks.[25]

We explored this possibility further in two ways. First, we ran a set of regressions comparable to those presented in Table 5, but including time trends as additional regressors in an effort to pick up country-specific differences in rates of productivity growth. The reported coefficients were qualitatively unaffected by the added time trends. In addition, almost all of the coefficients on the trend term were insignificant.

Second, since productivity growth differences during our sample may not be well approximated by constants (which is what is captured in the time-trend terms mentioned above), we obtained direct estimates of productivity for use as additional regressors alongside of government spending. Conceptually, the model calls for measures of total factor productivity in all countries for both the domestic and international sectors. We show in Appendix 2 that in the presence of permanent and unantici-

23. See Appendix 2 for a formal derivation.
24. In the third column of Table 7, we report real appreciation using nominal unit labor costs rather than consumer prices (which are used in the first column). The fastest growing countries—Ireland and Italy—have experienced large real appreciations as measured by unit labor costs as well. It is interesting to note, however, that since the last realignment in January 1987, Ireland has grown almost 2% per year more rapidly than has Italy, yet Italian unit labor costs have risen much more rapidly. (See the last column of Table 7.)
25. Note that the regressions in Table 5 are based on the ratio of nominal government spending to nominal GNP. In the model of Appendix 2, an unanticipated permanent traded-goods productivity shock has no effect on this ratio; an anticipated (or partly temporary) shock lowers it.

Table 7 LOGARITHMIC PERCENT CHANGES IN RELATIVE PRICES AND ECONOMIC GROWTH

	Change in CPI real exchange rate (relative to DM) (1979–1989)	*Change in real GNP (relative to Germany) (1979–1989)*	*Change in NUL adjusted for exchange-rate realignments (relative to DM) (1979–1989)*	*Change in NUL since last exchange rate realignment (relative to DM) (1987–1990)*
Belgium	−5.7	−1.1	−5.1	2.2
Denmark	10.9	−6.0	10.6	4.5
France	6.1	−0.9	6.0	4.0
Ireland	24.2	9.7	20.4	−4.1
Italy	31.9	6.0	34.5	15.4
Netherlands	−0.4	−4.9	−0.3	−3.0

Note: NUL, nominal unit labor costs.
Sources: Commission of the European Communities (1990), IMF, and authors' calculations.

pated productivity shocks in these sectors (holding government spending constant), the percentage change in the domestic CPI is given by

$$dp_{\mathrm{CPI},t} = da_{Tt} - dy_t, \tag{3}$$

where $dp_{\mathrm{CPI},t}$ is the percentage change in the CPI, da_{Tt} is the percentage change in relative (domestic less foreign) total factor productivity in the international-goods sector, and dy_t is the percentage change in total output (i.e., a share-weighted average of output growth in the international and domestic sectors).

To measure these productivity changes we employ data on labor productivity for both the manufacturing sector and the entire economy. (Note that with Hicks-neutral growth, labor and total-factor productivity growth rates are equal in any given sector.) In using these measures, we are therefore implicitly assuming that output from the manufacturing sector is traded, and (therefore) that its price is determined internationally.[26] The series for labor productivity in manufacturing output are computed by taking the ratio of an index of manufacturing output to manufacturing employment (both from OECD Main Economic Indicators); to measure economywide labor productivity we used the ratio of real GNP (from the IMF) to civilian employment (from OECD Main Economic Indicators).

Table 8 presents the results of the regression:

$$r_t = \alpha + \beta(g_t - g_t^*) + \delta_1(z_t - z_t^*) + \delta_2(Z_t - Z_t^*) + \epsilon_t, \tag{4}$$

26. To the extent that some manufacturing output falls into the class of domestic goods (i.e., if its price is at least partially determined by domestic supply and demand), our measure of $da_{Tt} - dy$ will be biased toward zero.

Table 8 REGRESSIONS OF REAL EXCHANGE RATES ON GOVERNMENT CONSUMPTION/GNP AND PRODUCTIVITY DIFFERENTIALS, FOR EMS COUNTRIES, 1979–1989

	$r_t = \alpha + \beta(g_t - g_t^*) + \delta_1(z_t - z_t^*) + \delta_2(Z_t - Z_t^*) + \epsilon_t$								
	β	SE	δ_1	SE	δ_2	SE	R^2	DW	DF
1. In levels	2.357†	0.631					0.18	0.65	83
2. In levels	1.677†	0.758	−0.053	0.044			0.14	0.69	77
3. In levels	1.694†	0.754	−0.091	0.049	0.077†	0.038	0.19	0.65	73
	Cross-sectional regression with annual dummies, $\delta_1 = -\delta_2$								
1979, in levels	4.471	4.006	−0.072	0.179			0.31	1.85	54
1980	2.400	2.798	−0.080	0.134					
1981	2.363	2.572	−0.028	0.103					
1982	1.393	2.809	−0.055	0.119					
1983	0.337	3.932	−0.049	0.118					
1984	2.672	3.546	−0.052	0.112					
1985	2.191	1.922	0.012	0.092					
1986	0.264	0.991	0.028	0.071					
1987	1.512	2.716	−0.189	0.165					
1988	4.150†	0.681	−0.150†	0.055					

Time series regressions by country, $\delta_1 = -\delta_2$

Belgium, in levels	6.509†	2.753	−0.762†	0.372	0.38	1.34	7
Denmark	−2.176†	0.586	−0.234†	0.467	0.78	1.45	8
France	−5.678†	1.966	−0.424†	0.166	0.52	1.69	6
Germany	−2.531	5.813	−0.082	0.201	0.00	1.38	6
Ireland	2.097†	1.057	−0.354	0.246	0.38	1.25	8
Italy	2.357	4.039	−0.763†	0.249	0.96	3.04	7
Luxembourg	6.350†	1.677	0.675	0.382	0.73	1.52	5
Netherlands	2.124†	1.779	0.106	0.132	0.00	1.78	7

Notes: †Statistical significance at the 10% level. r_t is an index of the intra-EMS real exchange rate (expressed as the price of a domestic CPI basket relative to the price of a GNP-weighted basket of other EMS countries' CPI). g_t is the ratio of government consumption to GNP; g_t^* is the GNP-weighted average of other EMS countries' g_ts. z_t and z_t^* are indexes of labor productivity (domestic and GNP-weighted foreign, respectively) in the manufacturing sector. Z_t and Z_t^* are comparable indexes of labor productivity for the entire economy. All variables have country-specific means removed. The cross-sectional regression is run using dummy intercept and slope-interaction terms for individual years.

Sources: IMF, Commission of the European Communities (1990), and OECD Main Economic Indicators.

where z_t and Z_t are indexes of productivity in the manufacturing sector and entire economy, respectively. Table 8 is laid out in a manner similar to that of Table 5. However, the sample period and selection of countries are somewhat different, owing to the more restrictive availability of productivity data.[27] Clearly, if differences in relative productivity growth explain the simple correlation between the real exchange rate and government spending, we would expect $\beta = 0$, $\delta_1 > 0$, and $\delta_2 < 0$ in Equation (4).

Table 8 makes several points clear. First, neither relative productivity growth in manufacturing nor differences between manufacturing and economywide productivity seem to have the right effect on the real exchange rate; if anything, relatively faster productivity growth in the domestic manufacturing sector appears to be associated with a *depreciation* of the real exchange rate. Second, the inclusion of the relative productivity regressors in (4) has little effect on estimates of β. These remain as statistically significant as before, with point estimates essentially unchanged. Thus, accounting for relative productivity growth differentials does not seem to overturn our result that government spending affects the real exchange rate.

As we have focused on Italy throughout the discussion, it is useful to look more directly at the Italian experience to see how plausible a productivity–growth explanation is. Here, a simple back-of-the-envelope calculation suggested by our model reveals that only a small fraction of Italy's real appreciation (since the last realignment of January 1987) is likely to be due to rapid productivity growth. Between the end of 1986 and the end of 1990, productivity in the manufacturing sector grew about 17%, and economywide productivity increased by about 11%.[28] Using Equation (3), this implies that the predicted change in Italian prices is about 6%, which is a little more than a third of the increase of 17% in the Italian CPI (relative to Germany). It seems a much higher productivity growth rate in manufacturing would be needed to justify such a large increase in domestic prices.[29]

27. We ran comparable regressions to those in Table 5 for the more restrictive sample used for Table 8; there was no substantive change in the coefficients.

28. See DeNardis and Micossi (1991).

29. One might hypothesize that some sector within manufacturing should be thought of as the international sector, and that this sector grew rapidly indeed. However, this does not help productivity shocks explain Italy's real appreciation in terms of both prices and wages. To see this, suppose we pick productivity growth in international goods to be just the right size to explain the increase in Italian prices, i.e., $da_1 = dp + dy = 17 + 11 = 28\%$. Under the assumption above, it is easy to show that productivity growth in international goods is entirely responsible for wage increases (in terms of international goods), $dw = da_1$. (See Appendix 2.) From this equality it follows that, with such large productivity growth in international goods, Italian wages should have risen by 28%.

Evidence on Italian wages similarly suggests that productivity growth cannot be the dominant source of Italy's real appreciation. First (as noted in footnote 29), real wage growth has been relatively slight. Second, a number of other factors seem to be driving *nominal* wage increases. For example, DeNardis and Micossi (1991) show that the ratio of public to private wages has grown by 14% since 1980 in Italy, while it has fallen by a comparable amount in France and the United Kingdom. Few would argue that Italian productivity shocks have been concentrated in the public sector. In addition, progressive increases in employer social security contributions have added about 7% to total labor compensation costs since 1981 and about 3% since 1986.

3.3 IMPERFECTLY CREDIBLE AGGREGATE DEMAND POLICY

Another popular explanation of intra-EMS real-exchange-rate divergences is that credibility of commitment to established parities has improved only slowly. The usual argument is that forward-looking Italian wage setters and lira debt holders used to believe that Italy was, and would remain, a high-inflation country. But the increasingly aggressive commitment of the authorities to a fixed DM parity continually surprised the private sector, which only gradually changed its beliefs. As a result, the story goes, expected inflation and nominal lira interest rates have been high—but falling—as the central bank has demonstrated its resolve not to devalue the exchange rate.[30]

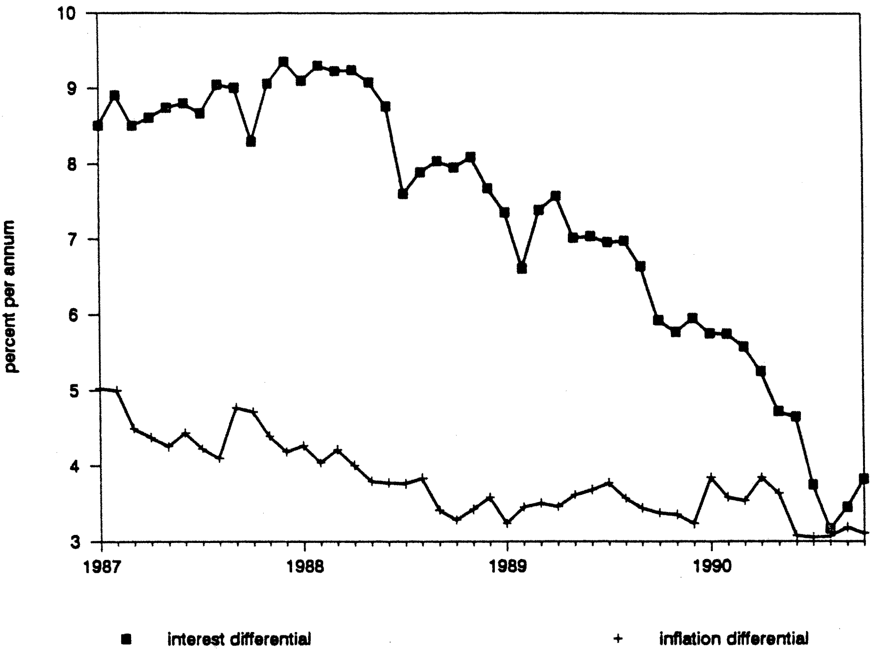
The evidence supporting this view seems secure enough. Figure 3 shows lira inflation- and interest-rate differentials against the DM. The interest rates are 3-month government borrowing rates in Italy and Germany. Although the inflation differential ceased improving in 1987, the interest differential (which was considerably larger at that time) has since continued its steady fall to its current level of about 3 percentage points.

3.3.1 Interpreting Evidence on Interest Differentials To be clear about what interest differentials have to say about credibility requires some explanation. As is well known, the nominal one-period interest differential between, say, Italy and Germany, $i_t^I - i_t^G$, can be decomposed into three

However, wages over this period have increased by only 18%. In other words, if a large productivity shock was behind the increase in Italian prices, Italian real wages should have increased by 11%, much more than the actual increase of about 1%. Our calculations must be qualified to the extent that they are based on the assumptions that the productivity shocks are both permanent and unanticipated, and that the production function is Cobb–Douglas.

30. See Giovannini (1990) and Dornbusch (1990).

Figure 3 ITALIAN–GERMAN SHORT-TERM INTEREST AND INFLATION DIFFERENTIALS



parts: a country premium, cp_t; a Lira–DM exchange risk premium, rp_t; and expected depreciation of the lira against the DM, Δs^e_{t+1}.[31]

The first of these three components, cp_t, is a premium required by investors as compensation for possible default or inconvertibility that might result from capital or exchange controls, taxes, or outright default. Variation in this premia across EC countries appears quite small. We have already seen in Figure 1 that the on-shore location of these instruments has little impact on their pricing. Second, many European countries borrow in dollars and ECU in addition to borrowing in their own currencies. These latter differentials can be used to form direct measures of country premia, and are indeed very small. Table 9 shows Eurodollar

31. This decomposition is only approximate; it leaves out potential interaction among premia, and excludes terms associated with Jensen's inequality. Often the inflation differential is subtracted from the nominal interest differential, and the resulting real interest differential is used to analyze credibility. (Clearly, the real differential is comprised of the same country- and exchange-risk premia, in addition to expected *real* depreciation.) However, any given speculator will use the nominal—not the real—interest differential to evaluate alternative investments, so the nominal differential is more appropriate for our purposes.

Table 9 EURODOLLAR FLOATING-RATE-NOTE BORROWING RATES FOR DIFFERENT EEC GOVERNMENTS[a]

U.K.	−33.0
Italy	−33.0
France	−20.0
Belgium	−19.0
Denmark	−18.0
Spain	−16.0
Ireland	−2.5
Portugal	+5.5

[a]Expressed in basis points as deviations from the 6-month LIBOR rate, 11/1989.
Source: Salomon Brothers.

floating rate note borrowing rates against the 6-month London Interbank Offer Rate (LIBOR). The largest possible pairwise differential is between the United Kingdom (or Italy) and Portugal, at less than 40 basis points. Most are quite a bit smaller.

The next two components are the exchange risk premium, rp_t, and expected currency depreciation, Δs^e_{t+1}. Several authors have attempted to separate the two by estimating models of the risk premium and attributing what is left over from the interest differential to expected depreciation. Giovannini (1990), for example, finds that the risk premium can explain little, if any, of the differential.[32] However, for the purposes of measuring credibility, it is not really necessary to identify these components individually. If credibility is high, so that the exchange rate is expected to remain within the existing band, *both* components will be small. To the extent that the sum of the exchange-risk premium and expected depreciation is significantly positive, the peg cannot be fully credible.

Of course, the DM/lira rate can fluctuate within a band of $\pm 2.25\%$, or $\pm 1.0225^4 - 1 = 9.3\%$ on an annualized basis. As a result, some authors have pointed out that—strictly speaking—one can conclude little about the credibility of the bands from short-term differentials.[33]

32. Equilibrium models of foreign exchange risk have notoriously poor reputations for explaining interest differentials and predictable components of excess returns on foreign exchange (see Froot, 1990).
33. See, for example, Svensson (1990). While the above point is formally correct, it should not be pushed too hard. If interest differentials represent expected exchange-rate movements within the band, then we would expect there to be a sharp narrowing in interest differentials at longer maturities. However, there is little apparent narrowing in the longer-term differentials reported below.

3.3.2 Interpreting Evidence on Inflation Differentials There is a sense, however, in which the improved-credibility story has been accepted too readily, especially as an explanation of the inflation, wage-growth, and real-exchange-rate data. To see this clearly, let us first take a hypothetical example: that of wage-setting behavior in the presence of positive shocks to credibility.

Suppose that nominal wages must be negotiated one period in advance. Suppose for convenience that initial Italian productivity-adjusted wages are equal to those in Germany, but that Italian wage earners expect inflation. Specifically, let us assume that Italian wage earners assign a 50% probability to a 20% devaluation of the lira against the DM, and the remaining 50% probability to the existing parity remaining in place. Expected depreciation is then 10%, so wage earners set next-period wages 10% higher than those of Germany.

What happens when the next period arrives and the authorities have not devalued? We obviously want to assume that credibility improves, so let the probability wage earners assign to (the same size) devaluation fall to 25%. Do wages rise now at only a 5% rate, reaching 115% of German wages in the upcoming period? The answer is clearly no. Italy's wages in that period should be 105% of Germany's. In other words, *when credibility improves, the sign of the wage-growth differential must be reversed, so as to diminish the gap between wage levels.*[34]

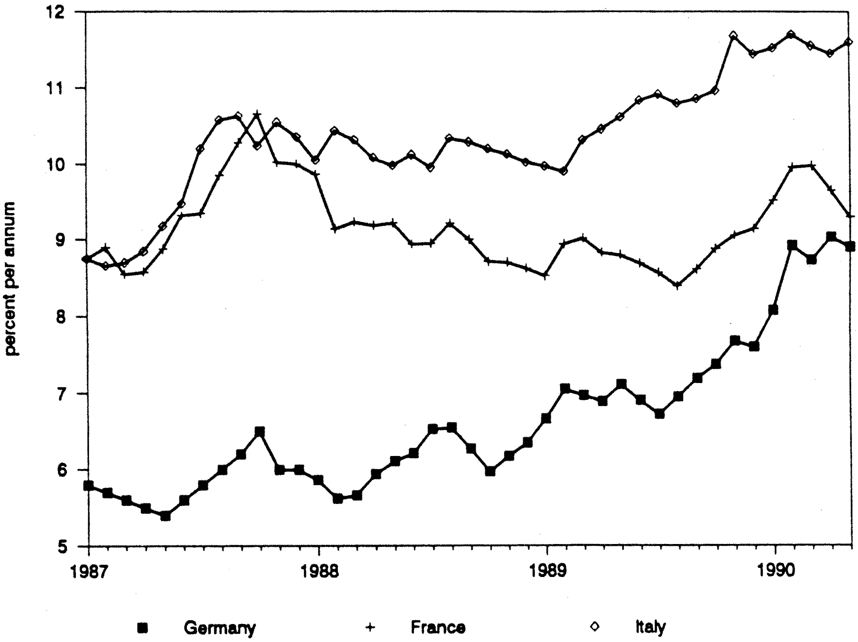
But this has not been the case for Italian wages and prices. (Relative nominal wage movements have been very similar to those of the CPI[35].) To salvage the credibility explanation of the real exchange rate, one would have to argue that Italy has substituted more-accommodative-than-expected fiscal policy for less-accommodative-than-expected monetary policy. But in such a case it is more accurate to say that government spending—not improving credibility, per se—lies behind movements in the real exchange rate.

Notwithstanding the behavior of prices and wages, the narrowing of 3-month interest differentials would seem to suggest that at very short horizons, Italian credibility is indeed improving. This leads us to look at the behavior of longer-term interest differentials—where forecast hori-

34. This argument applies to both prices and wages as long as they are not instantaneously responsive to monetary policy (in which case money is neutral anyway). For a standard model of monetary authorities' reputation with the private sector see Barro and Gordon (1983a,b). For applications to the EMS, see Giovannini (1990) and Dornbusch (1990).

35. To salvage a Barro and Gordon (1983) explanation, one would have to assume that prices and wages are set by very long-term contracts with nominal escalator clauses. That is, the level of prices in 1990 would need to be at least partly determined by the contracts set in 1986 and 1987.

Figure 4 LONG-TERM INTEREST RATES



zons are more similar to those relevant for wage and price setting. Figure 4 shows rates on 10-year government bonds for Italy, France, and Germany. Notice that in the early 1980s, the Italian and French long rates were similar, both considerably above the German long rate. But by the end of the 1980s, France's rates had been converged to Germany's while Italy's remain high. This suggests that Italy has been slower than has France (whose wage/price gap with Germany has not grown nearly as much in recent years, see Table 3) in obtaining credibility with long-term debt markets.[36]

36. There is a large literature on whether the EMS has generated a credibility dividend. Giavazzi and Giovannini (1989) present evidence that, all else equal, actual inflation during the 1980s is lower (albeit with borderline statistical significance) than would have been predicted on the basis of the earlier data alone. The evidence that a similar break occurs in real variables such as output or unemployment is, however, much weaker. Giavazzi and Giovannini (1989) and DeNardis and Micossi (1991), among others, find no evidence of an improved output-inflation trade-off, which should follow from a credibility enhancement. Similarly, Dornbusch (1990) argues that unemployment rates rose most in those countries that experienced the greatest disinflations, again providing no evidence that the EMS made the disinflations of high-inflation countries unusually cheap. Weber (1990) attempts to estimate a formal model of credibility directly.

3.4 DEBT GAPS AND CREDIBILITY

In addition to the competitiveness gap we have identified, differing debt-GNP ratios also present a problem. The authorities might find it optimal to default on government debt through devaluation if debt repayment involves distortionary taxation. Indeed, much has been made of differing relative debt burdens. Table 10 shows the levels of government debt as a percent of GNP. Among those countries with debt burdens in the problematic range, three broad groups can again be discerned on the basis of recent performance: Ireland has made significant steps toward reducing its debt levels; Belgium, the Netherlands, Portugal, and Spain have stabilized their debt ratios, which were growing rapidly in the early part of the 1980s; and Italy and Greece have debt levels that are still rising consistently. Italy and Belgium also have unusually high debt levels.

As currency union becomes more likely the debt gap may pose greater problems for credibility. Monetary union provides the government with a uniquely potent way of reducing the real value of government debt. Because all lira-denominated contracts must be redenominated into new ECU, a 20% devaluation translates immediately into a 20% reduction in the real value of all (nominal) government debt.[37] Ordinarily a devaluation is not nearly this effective, because prices adjust slowly and the government has to pay an interest premium on any expected inflation during the adjustment period.[38] As illustrated by our reputation model below, investors will recognize the temptations offered by currency reform, and they will charge an ever-rising premium on non-indexed debt as the date of union approaches.

A country does face one significant drawback to devaluing at or near the time of currency union, though it would not appear to be large enough empirically to outweigh the temptation. Other things equal, the Italian government would like its citizens to receive as many new ECU as possible for their lira; this implies bringing in the lira at a high rate, not a low one. As Table 11 shows, Italy's current monetary base is 14.6% of

37. Indeed, due to tax regulations and accounting frictions, the government may well be able to convert different types of contracts at different rates. Differential indexation during a currency reform is certainly not without precedent.

38. Consider the following simple example: Suppose that all of a country's debt were in the form of 1-year zero-coupon bonds, and that a constant fraction of the debt matures each week. If prices were perfectly flexible, then of course an unanticipated 20% devaluation would translate into a 20% reduction in real debt, regardless of maturity. Suppose instead, however, that the economy is governed by overlapping 1-year nominal contracts, and (for simplicity), that prices adjust linearly over the year in response to a devaluation. Then it is easy to see that a 20% devaluation will produce approximately a 10% decrease in the real value of debt.

Table 10 GOVERNMENT DEBT AS A PERCENT OF GNP

	Belgium	*Denmark*	*Germany*	*Greece*	*Spain*	*France*	*Ireland*	*Italy*	*Luxbg*	*Nthlds*	*Prtgl*	*U.K.*
1979	71.9	27.6	29.2	32.0	17.1	23.9	72.7	54.0	15.6	42.0	41.0	58.4
1980	80.7	39.3	32.7	32.2	21.9	25.3	78.9	63.5	15.4	48.7	40.6	58.6
1981	89.5	51.0	35.4	36.2	26.7	26.7	85.1	66.4	15.2	53.1	45.7	58.8
1982	98.2	62.6	38.2	40.3	31.5	28.1	91.2	69.2	15.0	57.6	50.9	58.9
1983	107.0	74.3	40.9	44.3	36.3	29.5	97.4	72.0	14.8	62.0	56.0	59.1
1984	112.3	78.0	41.8	53.2	42.8	31.8	102.4	77.2	15.0	66.1	61.4	60.4
1985	119.5	74.6	42.5	62.5	47.6	33.2	104.7	84.0	14.0	69.7	69.5	59.0
1986	123.7	67.2	42.7	65.3	48.5	34.2	115.7	88.5	13.8	71.7	68.4	58.1
1987	131.3	63.9	43.8	71.5	48.7	34.9	118.5	92.9	12.0	75.3	71.6	56.1
1988	132.2	64.0	44.5	79.7	44.5	35.9	115.4	96.1	10.2	77.4	74.0	51.0
1989	129.9	63.3	43.6	85.1	45.2	36.0	104.7	98.9	8.8	77.6	71.5	45.7
1990	129.4	62.8	43.7	89.5	44.7	36.1	101.4	100.9	7.8	77.8	67.8	43.0

Source: Commission of the European Communities (1990).

Table 11 MONETARY BASE AND GDP IN THE EEC, 1988 (PERCENT)

	Monetary base/GDP	*Share of GDP in EC*	*Share of Monetary base in EC*
Belgium	7.5	3.2	2.6
Denmark	3.7	2.3	0.9
France	5.8	20.0	12.5
Germany	9.9	25.3	26.9
Greece	14.9	1.1	1.8
Ireland	10.1	0.7	0.7
Italy	14.6	17.5	27.4
Netherlands	8.1	4.8	4.2
Portugal	13.5	0.9	1.3
Spain	20.4	7.2	15.7
U.K.	3.3	17.0	6.0
Total	9.3	100.0	100.0

Source: Glick and Hutchinson (1990).

GDP, and indeed accounts for over a quarter of the EC's total monetary base. A 20% devaluation at the time of union would amount to a sacrifice of 3% of GDP.[39] However, this effect is probably overstated because, as we have argued earlier, Italy's monetary base is likely to shrink rapidly after 1992. Unified banking regulations will prevent the government from forcing banks to hold large quantities of required reserves.

4. The Finite Horizon Problem and the Transition to Monetary Union

Given that the EMS appears to be functioning smoothly even after the removal of capital controls, what could be wrong with Delors' plan of seamless gradual transition to monetary union? Surely the credibility of the current exchange rate bands can only increase as Europe's governments take steps to permanently lock themselves into monetary union. Indeed, it is sometimes argued that continual forward momentum is precisely the glue that has held the EMS together thus far. (Making the EMS work has sometimes been compared to riding a bicycle; if you stop pedaling forward, you fall down.)

In the preceding sections we have identified a number of countervailing factors that might tempt some of the EC countries to devalue their exchange rate. Clearly a devaluation will not improve competitiveness in the long run. The long-run real exchange rate will fall only once

39. If the devaluation occurs sufficiently far before union, this cost disappears entirely, since the nominal lira money supply will rise by an amount proportional to the devaluation.

the path of government spending drops or factors shift between the traded and nontraded goods sectors. But a devaluation could make the adjustment to lower government spending easier, temporarily cushioning the effects on employment and output. This, of course, presumes some Keynesian price rigidity. In such a case, there might be a temptation to devalue even with no change in government spending. This temptation may become especially great as currency union approaches. To the extent that devaluations improve the terms of trade, 12-hour devaluations hold out the prospect of a final, unanswerable beggar-thy-neighbor gain: He who devalues last, devalues best.

In the subsection below, we formalize these ideas using a simple off-the-shelf model of monetary policy reputation in which the central bank has a finite horizon. As long as the future date of union is far enough away, the central bank will not break its commitment to maintain the exchange rate. As the date of union approaches, however, the odds of a devaluation increase. If private agents recognize this, they may push up the price of multiperiod nominal contracts (such as wage and debt contracts). These increases make it more likely that at least one more round of exchange rate adjustments will in fact occur.

An important insight from this paradigm is that accelerating the date of monetary union (as many have suggested) will not necessarily temper current interest-rate and inflation differentials. Indeed, it could exacerbate them. One way to avoid this problem is for the high-temptation countries to find ways to signal their commitment, perhaps by indexing domestic debt to ECU or by taking extraordinary steps to commit not to devalue (perhaps by tying exchange rates firmly to other EC agreements).[40]

4.1 A MODEL OF THE TEMPTATION TO DEVALUE WITH IMPENDING MONETARY UNION

The following finite-horizon Barro–Gordon (1983a) type model captures the two striking features of monetary union we have identified: the central bank will give up the ability to change the exchange rate at a known date, and the temptation to devalue will grow as union approaches. (Our key policy conclusions depend more on the first feature than the second[41].) Denote d_t as the actual rate of devaluation at time t,

40. We must note that the model neglects the effects of devaluation on a country's partners. For example, if Italy inflates sharply just prior to monetary union, it may damage the antiinflationary reputation of the postunion Eurobank. But to the extent that inflation relieves the real burden of Italian government debt, it could actually increase the antiinflationary resolve of the Eurobank.

41. The model here is an extension of Rogoff (1989), which builds on the general approach of Milgrom and Roberts (1982). See also Tabellini (1983) and Barro (1986).

and d_t^e as the expected rate of devaluation based on $t - 1$ information. Assume further that the government bears a one-time cost C to reneging on its commitment not to inflate. This cost, which might have to do with the impact of devaluation on other EC agreements, is known by the central bank but not by the public. Assume that the central bank has a loss function given by

$$\sum_{t=0}^{T} \beta^t L_t(d_t, d_t^e, C), \tag{5}$$

$$L_t(d_t, d_t^e, C) \equiv -w_t(d_t - d_t^e) + \tfrac{1}{2}d_t^2 + \tfrac{1}{2}R(C, d_t, d_{t-1}, \ldots),$$

where $1/2 < \beta < 1$ and $R = C$ if $d_t \neq 0$ for all $t > 0$; $R = 0$ otherwise. Each period, the central bank perceives a gain to surprise devaluation (through either the debt or real exchange rate channels we have identified).

The higher w_t, the higher the short-term gain. (It is assumed that $w \in [0,1]$.) To capture the rising gain to debt default and competitive devaluation, we assume that $w_{t+1} \geq w_t$. The d^2 term denotes the costs associated with changing the exchange rate; these (for simplicity) are assumed to be proportional to the square of the size of the devaluation. The reneging cost, C, is uniformly distributed on the interval $[0,\mu]$; the public knows μ but not C. It updates its priors using Bayes' rule.

It is easy to see that once the government has broken its commitment and lost its reputation, it will shift to a crawling peg in which $d_t = w_t$ in all subsequent periods. It is similarly easy to check that the one-time gain from reneging is $w_t^2/2$, so that the government will stick to its commitment even in the last period if $C \geq w_T^2$. Of course, if the public were certain that the government would renege in the final period, then its reputation would unravel in all previous periods as well. In the case of the EMS, it is quite probable that the public is unsure whether the government's commitment is binding or not. For example, it may be difficult for the public to judge the general status of intergovernmental bargaining over economic union issues, and therefore the cost of forcing a devaluation.

The basic nature of a solution to this problem is as follows. If the time to monetary union is sufficiently distant, the government will not renege on its exchange rate commitment even if its fixed cost is zero. The cost in terms of high future expected devaluations outweighs the short-term benefits. However, as the currency merger date approaches, the government will eventually devalue if its cost is below the critical value w^2. It will inflate sooner, the lower its cost.

Denote $\hat{C}_t$ as the highest cost type that first devalues at time t, and σ_t as the probability the public attaches to a devaluation at time t, conditional on not having observed a devaluation in any period $t - 1$ or earlier. Then it is easy to show that in a sequential equilibrium, the public forms inflationary expectations according to Bayes' rule

$$\sigma_t = \frac{\hat{C}_t - \hat{C}_{t-1}}{\mu - \hat{C}_{t-1}} \tag{6}$$

where $\hat{C}_t$ is given by

$$\frac{-w_t^2 + (1 - \beta)\hat{C}_t}{2\beta w_{t+1}} = \sigma_{t+1} - w_{t+1}. \tag{7}$$

Equation (6) simply says that the public's expectations that the government will inflate depend on the range of types who would first inflate in period t normalized by the size of the remaining pool. Equation (7) says that the highest cost type who would first inflate in period t is one who is indifferent between first devaluing in period t and first devaluing in period $t + 1$. One can show that the public's expectations of a devaluation rise as the date of currency union approaches. Note that the system need not collapse under a speculative attack because at no point is a devaluation certain.[42] Rather, the government would be forced to pay a high inflation premium on its debt. The higher the trajectory of w, the more likely that there will ultimately be a devaluation.[43]

A key point from the model is that pushing up the date of monetary union may do nothing to enhance credibility. Rather, pushing up the date would lead to a sharp rise in interest rates. Of course, moving the date all the way up to the present, and then announcing it as a *fait accompli,* would prevent the possibility of realignment. (We are certainly not advocating such a policy, since a devaluation may be desirable.)

4.2 SIGNALING COMMITMENT TO EXCHANGE RATE BANDS

As it stands, the model does not permit signaling. If the government knows it will never devalue (e.g., that the cost C of breaking its commitment is very high), then it should index its debt to ECU (thereby avoid-

42. Obstfeld (1988) explores the implications of speculative attacks in EMS-type currency arrangements.
43. The upward-sloping trajectory of w has an ambiguous effect on the timing of devaluation.

ing the payment of a currency-default premium) or seek to irrevocably fix the exchange rate immediately. Indeed, the public may expect to observe some action of this type if the government is serious about its commitment. If this is the case, then failure to index or to announce a completed union would be seen as a sign of lack of commitment, and the exchange rate might then become very vulnerable to speculation. The government would likely have to pay a high premium on non-indexed debt. As long as the time to union is sufficiently far off, the government might be able to index its debt gradually, reducing its short-term temptation as the future value of reputation falls.

There may be other ways to signal commitment. For example, the Italian central bank has recently been given a greater degree of autonomy. This may be helpful under the current system (via the usual conservative central banker credibility argument), but may not help much in dealing with the credibility programs posed by currency union, which involves sharply curtailing the autonomy of national central banks.

5. *Concluding Remarks*

Though inflation rates in the EMS countries have significantly converged over the past decade, exchange-rate adjusted price levels have sharply diverged and continue to do so, albeit at a decreasing rate. The empirical evidence suggests that high government spending in Italy and other high real exchange rate countries may provide a significant component of the explanation. If these levels of government spending are unsustainable—and evidence on budget deficits and current accounts suggests that they are—then eventually an adjustment will have to take place. The need for this adjustment may provide some countries with a significant temptation to devalue during the transition to monetary union; the problem is only exacerbated by high debt/GNP ratios.

We have also argued that the reputation built by weaker central banks over the past decade will not automatically provide credibility during the transition to a common currency. We present a simple theoretical model that suggests that the probability the public attaches to devaluation may become higher and higher as the known fixed date of monetary union approaches. Indeed, the behavior of prices, wages, and long-term interest rates suggests that this process may already have begun.

If the government does not intend to devalue, then it can signal this by indexing debt. Of course, such signals are costly, because they involve foreclosing a valuable option for defaulting on government debt. Either way, the model strongly suggests that accelerating monetary union is not by itself enough to avoid credibility problems. The gradual progress of the EMS so far does not ensure a seamless transition to a common currency.

It is important to note that we have not provided a comprehensive assessment of the welfare aspects of exchange rate realignments. For stabilization purposes, an early adjustment of parities may indeed be beneficial. Rather, we show that a plan built around a seamless transition without changes in current parities may not be stable.

APPENDIX 1: BACKGROUND: THE SURPRISING MATURATION AND LONGEVITY OF THE EMS

When the European Monetary System first went into effect in March 1979, one would scarcely have believed that within just 10 years there would be serious discussion of a single European currency. True, Eurocrats in Brussels have long dreamed of issuing a EC currency through a European Central Bank. But a decade ago, the European Currency Unit (ECU) seemed to have little more chance of becoming Europe's currency than the SDR (the International Monetary Fund's accounting unit) did of becoming the world's currency. Surely no major European country would be willing to relinquish its sovereign right to the seignorage tax. Besides, some governments such as Italy's were far more dependent on seignorage revenues than others such as Germany's.

For that matter, there was every reason to be skeptical about whether the EMS would succeed even in its more modest goal of stabilizing exchange rates across the founding members (Germany, France, Italy, the Netherlands, Belgium, Denmark, Ireland, and Luxembourg; Spain joined in June 1989, and the United Kingdom in October 1990).[44] After all, a similar attempt in the early 1970s (the "Snake") had been a conspicuous failure.[45] How long would a country such as Italy, with an inflation rate well into double digits, be able to stabilize its exchange rate against low-inflation Germany? The answer, of course, is not forever.

Nevertheless, the EMS survived in its early years because it has enough built-in flexibility to handle persistent divergences in inflation. First, members are not obliged to fix their bilateral rates but only to keep them within a 4.5% band (±2.25% of a "central" rate); indeed Italy was

44. Technically speaking, the United Kingdom was also a member of the EMS from the outset. But until very recently (October 1990), it did not participate in the only significant aspect of the EMS, the exchange rate mechanism (ERM). European Monetary Union is envisioned to ultimately include the other EC members, Greece, and Portugal.
45. The only loyal members of the Snake, which began in April 1972, were Germany, the Netherlands, Belgium, and Luxembourg. France pulled out in February 1973, though it briefly rejoined in 1975. Italy pulled out in January 1974.

originally permitted to use 12% bands.[46] More importantly, the bands can be shifted, albeit only with multilateral agreement. During its first several years, the EMS experienced frequent realignments (Fig. 5). Despite these periodic realignments, the EMS was immediately successful in enhancing exchange rate stability by any measure: nominal, real, trade-weighted, conditional or unconditional variance, or mean absolute changes. However, the early EMS appears to have owed much of its success to the use of capital controls.[47] By the mid 1980s, the consensus belief was that without the capital controls, the EMS would be ripped apart by speculative attacks.

In light of this early consensus, the recent performance of the EMS has been nothing short of remarkable. It has continued to hold up despite the virtual dismantling of capital controls; by mid-1990 the last major capital controls in Italy and France had been removed. In fact, there has not been a realignment in over 4 years now; the last episode was in January 1987.

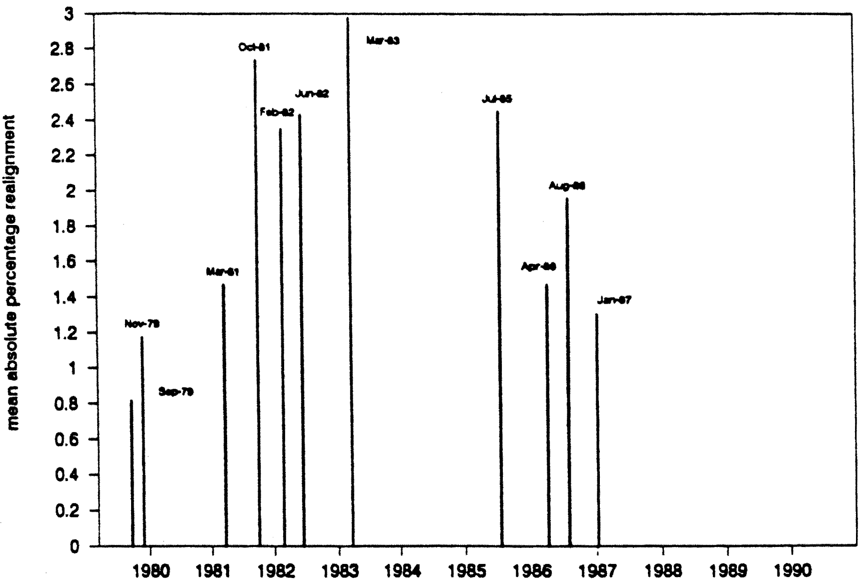
Obviously, with capital controls gone, the continuing survival of the EMS depends critically on significant coordination of monetary policies. Most would agree that the current regime is not symmetric; Germany, with its strong penchant for low inflation, is the leader. Indeed, one can plausibly argue that Italy and France have used the EMS to enhance their own antiinflation credibility. (France's policy of fighting inflation by religiously pegging the DM has sometimes been referred to as its "Franc fort" policy.[48])

1. *Stage III: a single European currency with a Bundesbank-style central bank*

The classic literature on optimum currency areas (Mundell, 1961; McKinnon, 1963) is based on an implicit Keynesian stabilization framework

46. Recently, Italy reduced its margins to 2.25%. The newest active EMS members, Spain and the United Kingdom, still have 6% bands. The bilateral exchange-rate bands are supplemented by an "indicator of divergence," which essentially measures the deviation of a weighted average of a country's EMS-currency exchange rates against a weighted average of its bilateral central rates. When the divergence indicator reaches 75% of its maximum value, a country is (in principle) obligated to undertake corrective changes in fiscal and monetary policy. In practice, a country often hits a bilateral limit before the divergence indicator becomes operative.
47. See Rogoff (1985), Artis and Taylor (1988), Giavazzi and Giovannini (1989).
48. Giavazzi and Pagano (1988) argue that Italy and France used the EMS to achieve antiinflation credibility by letting Germany serve as their "conservative central banker." A cynic might argue that there would have been a revaluation of the DM over the past 2 years were it not for the inflationary impact of German reunification, but this hardly diminishes the system's recent success.

Figure 5 SIZE AND TIMING OF EMS REALIGNMENTS



and emphasizes degree of openness, and capital and labor mobility.[49] Kenen (1969) stresses the importance of industrial diversification within the union. Since the vast majority of EC countries' trade is with other EC members, and since there is nearly perfect capital mobility among the major countries, the EC already meets two of the classic criteria. After 1992, with harmonization of licensing standards, there will also be greater labor mobility.[50] Finally, the EC is highly diversified industrially. Thus, at a glance, the EMS would appear to satisfy the conventional stabilization criteria for currency union.[51]

Aside from stabilization issues, there are also some public finance

49. It is clearly not our purpose here to provide a comprehensive welfare evaluation of the pluses and minuses of stage III of the Delors' plan, that is of ultimate European Monetary Union. Our main points do not particularly depend on the precise final form of the union, so we limit our welfare analysis of stage III to the brief discussion below. The most comprehensive discussion of the welfare effects of EMU is presented in Commission of the European Communities (1990).
50. The early literature's emphasis on labor mobility was based on models in which nominal wages are permanently fixed. Most economists today would probably place far less emphasis on labor mobility since in practice, nominal wages are probably adjusted more quickly than workers can be moved.
51. See Eichengreen (1990) for a more critical assessment of whether the EMS is indeed an optimal currency area.

criteria to consider, though the size of these effects are probably not huge.[52] Some of the EEC countries (such as Greece, and Portugal) raise 2–3% of GNP via seignorage revenues, but most raise less than 1% (see Table 12). Since monetary union is envisioned to produce a very low community inflation rate, the loss in seignorage revenues might be significant for some governments. However, these governments are going to lose most of these revenues after Economic Union in 1992, anyway. Because they will be compelled to open their countries to foreign banking competition and because of new regulation standards, high seignorage countries will no longer be able to force their own banks to hold large quantities of non-interest-bearing reserves. Also, with the proliferation of alternative financial assets, the demand for real balances will drop.[53]

Obviously, the move to one currency will economize on transactions costs involved in changing currencies. These are generally thought to be large only for tourists, but a recent study by the European Commission challenges this view.[54] The study argues that by moving to a common currency, the EC could save on transactions costs of from 0.25 to 0.4% of community GDP per annum. The bulk of these savings (roughly 70%) is composed of exchange margin and commission fees paid to banks. This estimate is obtained using two approaches, one based on banking revenue data, and one based on estimates of firm and household foreign exchange operations and their respective average transactions costs. (The bank revenue data are derived from a comprehensive 1989 BIS survey of major banks and foreign exchange dealers in 20 countries.) The remainder of the savings are to come in the form of in-house accounting savings, and the EC estimates are based in part on an officially commissioned study by a private accounting firm.

It is very likely that the transactions savings would be largest for the

52. See Casella (1989) for further discussion of fiscal aspects of currency unions.

53. It is actually possible that Monetary Union will enable the EC countries to garner some seignorage revenues from abroad, if their new currency partly displaces the dollar in the world underground economy. Estimates of U.S. currency held abroad are speculative, but a figure of half the monetary base, or over $100 billion, is plausible. If the EC is able to capture a market half this large, then EC seignorage revenues could easily amount to 2 or 3 billion dollars per year. The mark is already an international currency, so Germany would be giving up some external revenue. However, the Bundesbank estimates that only 7 to 10 billion (out of total currency holdings of 180 billion) marks are presently held abroad. (We are grateful to the Bundesbank for releasing these data for our study). Of course, if substitution between ECUs and dollars in the underground economy becomes significant, then increased currency substitution could destabilize rates between the dollar and the ECU.

54. See the Commission of the European Communities (1990).

Table 12 SEIGNORAGE IN THE EUROPEAN COMMUNITY AS PERCENT OF GNP

	1982	*1987*
Belgium	0.0	0.2
Denmark	0.1	−1.1
France	1.3	0.3
Germany	0.5	0.8
Greece	3.4	3.0
Ireland	0.2	0.6
Italy	1.5	0.6
Netherlands	0.5	0.7
Portugal	5.9	2.7
Spain	1.9	1.2
U.K.	0.2	0.1

Source: Seignorage is calculated from the change in the supply of currency in circulation plus increases in required reserves less interest paid on total required reserves. See Gros (1989).

smallest members of the EC, since Germany and France are able to conduct many external transactions in their own currency. If the transactions gains are indeed as large as the EC estimates, they could indeed compensate for any loss in seignorage revenues.

Can the transactions costs really be almost half a percent of EC GDP? Part of the need for multinational companies to keep separate books in different currencies comes from the need to satisfy different regulatory and tax requirements. But if this is the case, then the major savings will come not from a move to a single currency but from harmonization of tax regulations across borders. Similarly, regulatory restrictions on banks' ability to issue foreign currency instruments may well account for a significant portion of the bank margin and commission estimates. However, it may be difficult to reap savings in this area without going to a common currency.

It is possible to come up with other arguments for currency union. For example, imaginative economists at the European Commission have managed to obtain much higher estimates of the benefits of currency union by using new growth theory models to argue that the exchange rate risk premium lowers the steady-state growth rate of the economy.[55]

55. Again, see One Market, One Money, op. cit.

APPENDIX 2: FISCAL POLICY, PRODUCTIVITY, AND THE REAL EXCHANGE RATE

In this appendix, we present a standard neoclassical model that can be used to interpret the empirical results presented in the text on fiscal policy, productivity shocks, and the real exchange rate. As we have already noted, a broad range of neoclassical trade models yields the result that an increase in government spending will cause the real exchange rate to appreciate. The key assumption is that a larger fraction of government spending falls on the home good than does private spending. The model presented here emphasizes the distinction between traded and nontraded goods.[56]

Consider a small country that takes the price of tradeables and the world interest rate r (denominated in terms of tradeables) as given. Assume that the representative agent has a utility function given by

$$U = \sum_{t=0}^{\infty} \frac{\beta^t}{1 - \sigma} (C_{Nt}^{\alpha} C_{Tt}^{1-\alpha})^{1-\sigma}, \tag{8}$$

where C_{Nt} denotes consumption of the nontraded good at time t, and C_{Tt} denotes consumption of the traded good. Letting P denote the relative price of nontradeables in terms of tradeables, the budget constraint of the representative agent is given by

$$W_{t+1} = r(W_t + Y_{Tt} + P_t Y_{Nt} - C_{Tt} - P_t C_{Nt} - \tau_t), \tag{9}$$

where W_t denotes wealth entering time t (measured in units of the tradeable good), and Y_{Tt} and Y_{Nt} denote domestic production of the tradeable and the nontradeable good, respectively. For now, we will assume that both types of output are exogenous. τ_t denotes lump-sum taxes.

Since Ricardian equivalence holds here, one can assume without loss of generality that the government runs a balanced budget:

56. The model developed here follows Dornbusch (1983) and Frenkel and Razin (1987). Baxter and Cruccini (1990) and Stockman and Tesar (1990) have used this class of models to explore open-economy real business cycles driven by productivity shocks. Ahmed (1986) explores a model of fiscal policy that distinguishes between exportables and importables, rather than between traded and nontraded goods. This type of model generally yields qualitatively similar results for the effects of permanent fiscal policy changes on the real exchange rate, though the dynamics differ somewhat for the cause of transitory disturbances. Finally, one can also get the result that fiscal policy raises the price of nontraded goods in a model in which government spending is highly service intensive, and where nontraded goods production is more labor-intensive than traded-goods production.

$$\tau_t = P_t G_t. \tag{10}$$

Maximizing (8) with respect (9), imposing the usual non-Ponzi scheme assumption on borrowing, and recognizing that the private sector will internalize the budget constraint (10) yields

$$\frac{C_{Tt+1}}{C_{Tt}} = (r\beta)^{1/(\sigma+\alpha-\alpha\sigma)}\left(\frac{Y_{Nt}-G_t}{Y_{Nt+1}-G_{t+1}}\right)^{(\alpha-\alpha\sigma)/(\sigma+\alpha-\alpha\sigma)} \tag{11}$$

and

$$P_t = \frac{\alpha C_{Tt}}{(1-\alpha)(Y_{Nt}-G_t)}. \tag{12}$$

In both (11) and (12), we have imposed the equilibrium condition that

$$C_{Nt} = Y_{Nt} - G_t, \tag{13}$$

since the country cannot borrow or lend nontraded goods.

1. *Government spending shocks*

By inspection of (11) and (12), it follows immediately that a *permanent* rise in government spending permanently raises the real exchange rate P. If $r\beta = 1$ and nontraded-goods production is constant, there is no impact on the current account.

A temporary (unanticipated) rise in G leads to more complex dynamics. Whereas it is straightforward to show that the impact effect on P is still positive, the impact effect on the current account is ambiguous and depends on whether σ is greater than one. As Dornbusch (1983) has shown, a temporary rise in the current price of nontradeables leads to a rise in the consumption-based real interest rate. Whether current traded-goods consumption rises or falls depends on the size of the income versus substitution effects.

The assumption underlying the regressions reported in the text is that the elasticity of inter-temporal substitution is equal to unity, $\sigma = 1$. In this case, lagged government spending shocks do not affect the real exchange rate, nor do anticipated G shocks.

2. *Productivity shocks*

An unanticipated permanent rise in productivity in the traded goods sector (a rise in Y_t) has similar effects to a permanent increase in government spending on nontradeables. In either case, the relative supply of nontradeables falls and P rises. A perfectly anticipated increase in Y_t has, of course, a much smaller effect on P. Indeed, in the case where output is exogenous, if $r\beta = 1$ and $Y_N - G$ is constant, then an anticipated traded-goods productivity shock has no effect on P. Consumption of traded goods is smoothed perfectly over time as in Hall (1978). Similarly, a temporary shock to Y_t has much less of an impact effect on P than does a permanent shock. However, the impact effect on the current account of a temporary increase in Y is unambiguous; the current account moves into surplus.

3. *Endogenous output*

The above results readily extend to the case where there is a fixed supply of capital in both sectors and where labor is freely mobile between them. Suppose that

$$Y_T = A_{Tt} L_{Tt}^{\theta T} \tag{14}$$

$$Y_N = A_{Nt} L_{Nt}^{\theta N}, \tag{15}$$

where changes in A_{Tt} and A_{Nt} represent productivity shocks to the traded and nontraded goods sectors, and where aggregate labor supply, $\overline{L} = L_T + L_N$ is fixed. In this case, P is given by

$$P_t = \frac{\alpha C_{Tt}}{(1 - \alpha)(Y_{Nt} - G_t)} = \frac{A_{Tt}\theta_T L_{Tt}^{\theta T - 1}}{A_{Nt}\theta_N L_{Nt}^{\theta N - 1}} \tag{16}$$

When output is endogenous, the effect of a permanent government spending shock on P is tempered by a flow of labor into nontraded goods production. It is also straightforward to show that an unanticipated permanent rise in traded goods productivity A_{Tt} leads to a permanent rise in P just large enough to offset any intersectoral movement of labor. (This is assuming that the shock is not diversified away internationally.) When shocks to productivity in both sectors are permanent and unanticipated, then their effect on the relative price of nontraded goods is given by

$$dp_t = da_{Tt} - da_{Nt}, \tag{17}$$

where lower case letters denote changes in logarithms.[57] Letting total output be given by $Y_t = Y_{Tt} + Y_{Nt}$, it is straightforward to show that the rate of change in the domestic CPI is given by

57. Note, however, that a perfectly anticipated increase in A_{Tt} does have an effect on P, since there are labor flows between the sectors.

$$dp_{CPI,t} = (1 - \gamma)dp_t = da_{Tt} - dy_t, \tag{18}$$

where γ is the share of international-goods value-added in GNP.

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Comment

RUDIGER DORNBUSCH
MIT

The Froot–Rogoff paper offers refreshing new directions of research on real exchange rates. At the same time it takes up and reinforces an already existing important literature on the complications posed by potential regime changes. Regime changes pose a potential problem when they actually occur but may not be persistent. They are also a complicating factor when they lie ahead, and economic agents must focus on their implications for asset prices.

In these comments I address three issues: (1) a neglected aspect of currency unification, which is par clearing, (2) the plausibility that government spending is really the chief driving force for real exchange rates, and (3) the issue of transition and what might happen on the eve in the markets of countries with excessive debt or overvalued exchange rates.

1. Par Clearing

The discussion of the benefits of a common money focus conventionally on the savings of transactions costs. This is the approach taken by Froot and Rogoff, and it is also the case in the important research effort reported by the European Commission (1990). But there is an important aspect of transactions costs that is entirely omitted, namely par clearing for checks. The point is simply this: fixed exchange rates do not assure per se clearing of checks at face value, nor does a common currency as is well known from the historical experience of the United States.[1]

In the United States the Federal Reserve act imposed par clearing as a responsibility of member banks. Prior to the foundation of the Federal Reserve exchange, rates between cities in the United States were flexible, a common currency notwithstanding. Par clearing, then, is something

1. See also the discussion in Dornbusch (1990).

that must be introduced to fully facilitate an efficient transactions system. Par clearing will not come spontaneously; in fact commercial banks that presently benefit from a highly ineffective payments system will oppose it.

The European Communities could make headway on this issue even before currency unification actually takes place. Certainly for those countries tempted to suppress exchange margins altogether, a move to par clearing would greatly add to the transactions benefits. In fact, without par clearing most transactions benefits from a fixed rate will not be reaped.

2. *Expectations*

In focusing on the effects of the EMS on exchange rate expectations, Froot and Rogoff rightly note the narrowing of interest differentials between high inflation countries and Germany. They also point to a puzzle of why the term structure of interest differentials is so flat: why does a sustained policy of disinflation not translate into a reduced long-run expectation of inflation differentials and hence of interest differentials?[2]

One possible argument is that in the short run governments are committed to the policy; in the longer run it either succeeds and thus justifies a narrowing of differentials or else it fails and therefore leads to a major attempt to realign exchange rates. In the latter event there would at least be a maxi-devaluation and possibly a return to high inflation and protracted depreciation. In such a setting the long-term interest differential must recognize both possibilities, and hence a relatively flat term structure of differentials merely reflects remaining scepticism about the sustainability and success of policies.

The critical argument here is that sustaining a fixed exchange rate in the face of inflation differentials leaves open how the overvaluation is ultimately undone. It is simply not the case that workers or investors need to assume that just because a policy has been followed in the past, it will be more likely to be followed in the future and that accordingly Bayesian updating is appropriate. To answer what the updating rule should be we also need to make assumptions about what the government is trying to achieve and what tolerance it has to bear the costs of protracted deflation.

Of course, in a game where the only issue is expectations and no actual disinflation costs arise from long-term contracting and the like the credibility problem is not a serious one. In fact, however, disinflation is

2. On the same argument see Dornbusch (1989).

hard and sitting out the process for a decade is not the rule. It was in Ireland, but it is equally clear that Spain may not have the stomach for it, at least not so far.

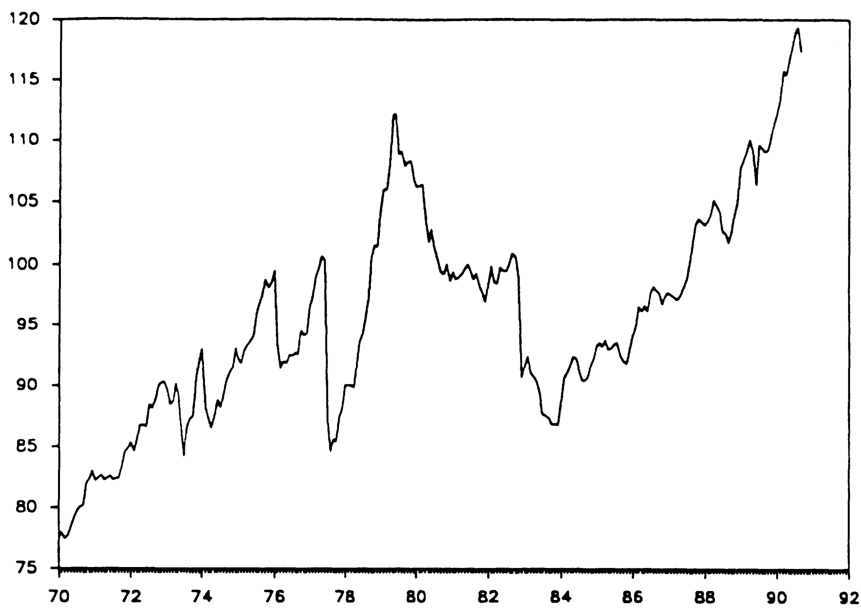
3. *Real Exchange Rates*

The most interesting and controversial part of Froot and Rogoff's paper deals with the hypothesis that divergent trends of government spending drive real exchange rates between countries. The analysis is open to a number of criticisms.

My first point is that if spending shares were the driving force and government spending primarily affected the relative price of nontraded goods in terms of tradeables, we should not expect real exchange rates in manufacturing to show substantial changes. Yet the series constructed by Morgan Guaranty that is built of relative prices in nonfood manufactures *does* show substantial changes over time.

The example of Spain in Figure 1 is a case in point. Is the progressive real appreciation of Spain since 1984 really evidence of a spending boom or rather of an exchange rate policy that has become firmer but has failed to curb inflation with substantial success?

Figure 1 SPAIN; THE REAL EXCHANGE RATE (INDEX 1980–1982 = 100)



The second question concerns the use of the *nominal* spending share in Froot and Rogoff's empirical work. It is well known from the literature on productivity and relative prices that an increase in the productivity of manufacturing will raise the real price of home goods. Is such an effect enough to affect the nominal spending share? And if so, is the spending share effect on real exchange rates simply a disguised avenue by which productivity is the driving force?

Table 1 reports for Germany and Italy regressions that show a significant impact of manufacturing productivity on the *nominal* government spending share. There is in fact a significant impact, and it would therefore be worth asking whether government spending is, in fact, the real driving force. The first step to do so would be to use the *real* spending share in the empirical work.

Figure 2 shows the case of Germany and Italy, focusing on the bilateral relationship. The line G/G^* measures Germany's real government spending share in GDP relative to that of Italy (the ratio is multiplied by 100). The line labeled "Real Ex" measures the relative consumer price levels measured in a common currency. The figure does not lend much support to the Froot–Rogoff hypothesis. It comes as no surprise that a regression of the relative price level on relative real spending shares (not reported here) fails to lend support to the hypothesis of a positive relationship claimed by Froot and Rogoff.

If real government spending is not the single dominant determinant of real exchange rates, what other plausible factors are missing? The Balassa–Samuelson view holds that productivity ought to play a dominant view at least in a trend sense. Hsieh (1982) offers evidence of this effect, and Froot and Rogoff give some weight to this factor. The other important influence is plain-vanilla stickiness. Dornbusch and Fischer (1991) review experiences with disinflation programs. The evidence lends strong support to stickiness of inflation as a key obstacle to disinflation. This fact also explains why overvaluation is an attractive means for initiat-

Table 1 NOMINAL SPENDING SHARES AND PRODUCTIVITY: $\log x = \alpha + \beta \log y$

Country	α	β	ρ	R^2
Italy	2.17	0.13	0.74	0.80
	(11.9)	(3.0)		
Germany	1.49	0.32	0.74	0.94
	(6.2)	(5.7)		

Note: x denotes the share of nominal government spending in GDP and y the level of productivity in manufacturing. The regression was run with annual data for the period 1960–1989. t-statistics are reported in parentheses.

ing disinflation programs. Spain or Italy have done exactly that, using firm exchange rate policies to try and force down inflation.

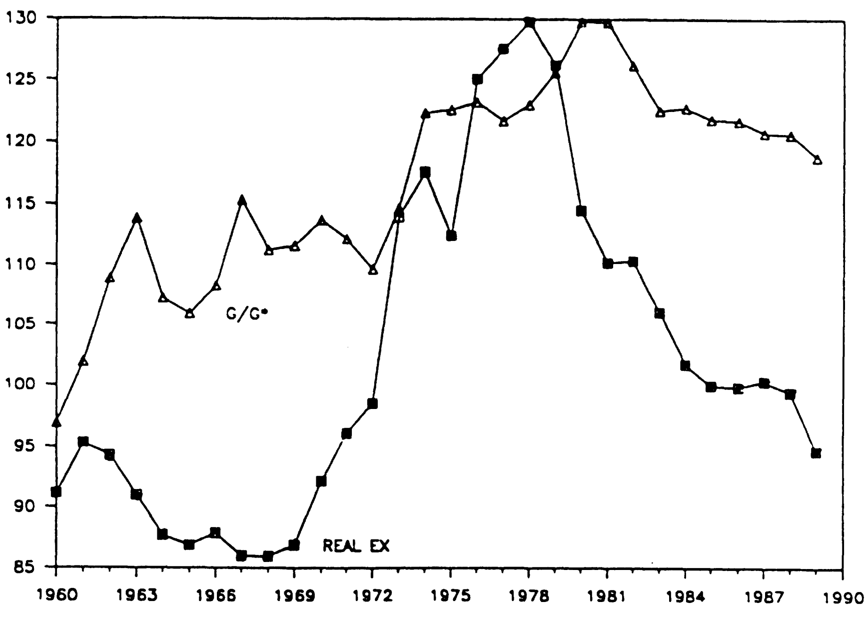
4. End Game

A particularly provocative aspect of the Froot–Rogoff paper deals with the end game aspect of the convergence to a common currency. They argue:

The basic problem is that once the date of a currency union is fixed, national central banks face a known, finite horizon at which they will be legislated out of existence. Consequently, their interest in maintaining a long term antiinflationary reputation may wane as monetary union approaches.

One must doubt the common sense of the theory. Italy's Central Bank is desperately trying to reduce inflation. It is very doubtful that it would be favorably viewed by posterity if it allowed itself a last frivolous fling of inflation. The focus therefore must shift to what might be attained by a terminal devaluation. The authors note specifically that the last days prior to convergence would mark the most likely time for a devaluation to reduce real wages or the real value of the public debt.

Figure 2 SPENDING AND REAL EXCHANGE RATE



The idea of reducing real wages by "one last devaluation" is attractive if overvaluation is the difficulty now. Then entering a firm arrangement with a once-and-for-all depreciation solves the real wage problem just at the time where yet another round is no longer possible so that credibility issues do not lie ahead. Of course, this theory is only plausible only if *nominal* rigidities are the problem. Throughout the paper there is little room for such rigidities and, accordingly, in the perspective of the Froot–Rogoff line of argument, it seems ad hoc to introduce them at this stage.

Also in respect to the real value of public debt there is some question. Monetary union surely does not require convergence of either deficits or debt ratios. The only reason the transition to a monetary union raises special issues is that it creates a "natural" time to effect a levy in one form or another. But, unlike with the real wage problem, there is no reason to wait to the end to accomplish a debt reduction. In principle the government can do so at any time by a write-off or a special tax.

Indeed, devaluation may be a relatively poor or costly way of accomplishing debt reduction, more so the shorter the maturity of the debt and the more it is denominated in foreign currency. Keynes (1923) sorted out the relative merits of devaluation and a levy. His conclusion ran firmly in favor of a levy, which can be tailor-made to suit the political and financial purposes the government has in mind.

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Comment

NOBUHIRO KIYOTAKI
London School of Economics and University of Wisconsin

The paper presented by Froot and Rogoff provides a valuable resource for both international economists and other economists who try to understand the transition of the European Monetary System (EMS) to a single currency of Europe. The paper first examines to what extent macroeconomic variables have been converging and how the real exchange rates have been changing across the EMS member countries since the start of the EMS in 1979. Then Froot and Rogoff evaluate three alternative explanations of the movement of real exchange rates and examine the credibility problem of monetary authorities in the transition to a common European currency. Since the scope of these issues is so large, in the following, I focus on their explanation of real exchange rate movements.

Concerning the real exchange rate, the main observation of Froot and Rogoff is that, although inflation rates of the EMS member countries have been converging in the 1980s, there are still some differences in the inflation rates, and thus the price levels of nontraded goods are diverging across the member countries. Because there has been no realignment of nominal exchange rates since 1987, the differences in inflation rates have accumulated into the divergence of the price levels, leading to considerable movements in real exchange rates. Germany, the Netherlands, Belgium, and Luxembourg have had small movements in real exchange rates since the mid-1980s. France, Denmark, and Ireland have succeeded in pulling down their inflation rates to the level of the German inflation rate, and thus have had only small appreciations of their real exchange rates against Germany in the late 1980s. Italy, the United Kingdom, and Spain have brought their inflation rates down considerably in the 1980s, but they still exceed the German inflation rate by about 3 to 4%. As a result their real exchange rates have appreciated considerably in the late 1980s. Of these three groups, the last group provides the main question of this paper; why have there been such large appreciations of real exchange rates in Italy, the United Kingdom, and Spain, particularly Italy?

To answer this question, Froot and Rogoff examine three alternative explanations of the real exchange rate: differences in government spending, differences in productivity growth, and imperfectly credible demand policy. Of these three explanations, I am going to discuss the first two in the following. The first approach is to explain the real exchange rates by the different patterns of government expenditure across countries, using a competitive real growth model of a small open economy with exogenous output of traded goods and nontraded goods. The key assumption is that government consumption is concentrated in the purchase of the nontraded good. An increase in government consumption increases the relative price of the nontraded good to the traded good. Thus, the real exchange rate appreciates in the country with a high growth rate of government consumption (for example, Italy). Using the log utility function as assumed in the regression, the model in the appendix (8–10) can be simplified as follows: The agent chooses the path of the traded good consumption C_{Tt} and the net foreign asset W_t to maximize the discounted utility:

$$U = \sum_{t=0}^{\infty} \beta^t \left[\alpha \ln(Y_{Nt}-G_t) + (1-\alpha) \ln(C_{Tt})\right] \tag{1}$$

subject to the budget constraint:

$$W_t+_1 = r[W_t + Y_{Tt} - C_{Tt}], \tag{2}$$

taking the path of the output of traded and nontraded goods, Y_{Tt}, Y_{Nt}, government consumption G_t, and the gross real interest rate, r, and the initial asset W_0, as given. The first-order conditions are

$$C_{Tt+1}/C_{Tt} = \beta r \tag{3}$$

$$P_t = \alpha C_{Tt}/[(1-\alpha)(Y_{Nt}-G_t)], \tag{4}$$

where P_t is the relative price of the nontraded good to the traded good. The real exchange rate of the home country R_t is defined as the relative price of the home consumption goods basket to the foreign consumption goods basket: $R_t = (P_t^{\alpha} P_{Tt}^{1-\alpha})/(P_t^{*\alpha} P_{Tt}^{*1-\alpha}) = (P_t/P_t^*)^{\alpha}$, using the normalization $P_{Tt} = P_{Tt}^* = 1$, where the asterisk indicates the foreign value. Thus the log of the real exchange rates r_t (which is different from the real interest rate r) is given as

$$r_t = \text{constant} - \alpha \ln(Y_{Nt}-G_t) + \alpha \ln(Y_{Nt}^*-G_t^*). \tag{5}$$

The main findings of Froot and Rogoff's empirical study of the government model are (1) a 1% increase in the ratio of government consumption to GNP at home increases the real exchange rate by about 2% during the periods under the EMS and the Bretton Woods system; (2) about a quarter of the appreciation of the Italian real exchange rate against the German Mark between 1979 and 1990 can be explained by the relative increase in the consumption of the Italian government; and (3) the government expenditure model does not explain the movement of the real exchange rate during the period of flexible exchange rates from 1973 to 1979. It is notable that the regression results under the EMS and the Bretton Woods system are consistent with the government model. But I am also interested in the residuals of what is explained by their model, particularly in the failure of the model under the flexible exchange rates, because it suggests how the real exchange rate depends on the exchange rate system. I suspect that the poor performance of the model under the flexible exchange rates may be related to a possible failure of the law of one price for traded goods. Thus, it would be interesting to decompose the movement of the real exchange rate into the change in the relative price of nontraded goods to traded goods in each country and the change of the relative price of traded goods between two countries. Then it may become possible to examine how the relative prices of nontraded goods to the traded goods depend on government consumption and to what extent the law of one price does not hold for traded goods.

The second approach to the study of real exchange rates extends the first approach by introducing productivity growth and labor mobility across the traded good and nontraded good sectors. The idea is that, if the growth rate of productivity of the traded good sector is higher than the nontraded good sector in the home country, then the relative price of the nontraded good to the traded good will increase and the real exchange rate of the home country will appreciate. The competitive equilibrium of the small open economy in the model of Froot and Rogoff corresponds to the solution of the following problem. The agent chooses the path of labor and output of traded and nontraded goods $(L_{Tt}, L_{Nt}, Y_{Tt}, Y_{Nt})$, the consumption of traded goods C_{Tt}, and the net foreign asset W_t to maximize the discounted utility in Equation (1); subject to the budget constraint [Equation (2)] the production functions

$$Y_{Tt} = A_{Tt}L_{Tt}^{\theta T},\ Y_{Nt} = A_{Nt}L_{Nt}^{\theta N}, \tag{6}$$

and the labor constraint, $L_{Tt} + L_{Nt} = \overline{L}$, taking total labor $\overline{L}$, the gross interest rate, r, and the initial asset W_0, as given. A_{Tt} and A_{Nt} are the indices of productivity in the traded good and nontraded good sectors. The first order conditions are Equations (3,4) and

$$P_t = \frac{\theta_T A_{Tt} L_{Tt}^{\theta T-1}}{\theta_N A_{Nt} L_{Nt}^{\theta N-1}} = \frac{\theta_T Y_{Tt}/L_{Tt}}{\theta_N Y_{Nt}/L_{Nt}} \tag{7}$$

Froot and Rogoff use these conditions to derive the relationship [Equation (4) in Froot–Rogoff]

$$r_t = \alpha + \beta(g_t - g_t^*) + \delta_1(z_t - z_t^*) + \delta_2(Z_t - Z_t^*) + \epsilon_t \tag{8}$$

where g_t is the ratio of the government consumption to GNP, and z_t and Z_t are the indices of productivity in the traded good sector and the entire economy. Here, however, I have certain difficulties in following their argument. First, they use labor productivity as the index of productivity due to Hicksian neutrality. But the measures of labor productivity are endogenous variables and are not proportional to the productivity indices in the production function (A_{Nt}, A_{Nt}), unless employment is constant. Also, if labor productivity is used in Equation (8), there is no room for government consumption, because the relative price of the nontraded good to the traded good is proportional to the ratio of the labor productivity of the traded good sector to the nontraded good sector by Equation (7). Second, Froot and Rogoff argue that the labor will not move across sectors due to unanticipated permanent productivity shocks in both sectors. But this is true only if the ratio of the government consumption to the output of the nontraded good (G_t/Y_{Nt}) is kept constant, which is difficult to imagine for the case of unanticipated shocks. Also, the model under perfect foresight does not seem to be suitable for analyzing the recurrent productivity shocks. At this point, I do not know how far the results of Froot and Rogoff are affected if a more sophisticated analysis of productivity shocks is made. I think, however, that the model of productivity growth and fluctuations deserves more careful analysis before rejecting it and that it would be desirable to incorporate uncertainty about future productivity and government consumption into the model more explicitly.

One of the reasons why Froot and Rogoff chose to examine the three different models including the real growth model rather than one model is that we have not yet developed a framework of the monetary economy that most macro economists are happy to use for analyzing the exchange rate system and monetary policy. It may be difficult for economists to develop a general framework of the monetary economy, and it might be more difficult for the people to achieve a single currency of Europe. A prominent British economist recently predicted that the single currency of Europe could not be achieved by the year 2000. Europe would be more serious about a single currency only then because the fundamentals will be more favorable in ten years. I hope that we will be able to provide a better theoretical base for studying monetary policy under a common currency by then.

Discussion

Stanley Fischer asked why the reputation of Italy's central bank ceases to be important once a single currency is formed. After all, the Italian government will still want to borrow money. Robert Barro also expressed surprise that the model did not contain some penalty or reward to the individual central bankers conditional on the state in which they deliver their economies on the date of union. Alessandra Casella noted that the Italian Central Bank is concerned with what reputation it will have within the union. Rogoff responded by saying that while these issues do speak to continuity across regimes, there still exists some discontinuities. For instance, at the time of union one can redenominate all contracts in a way that cannot be done at other times.

Rudi Dornbusch asked why a central banker would not just write-off the debt today instead of suffering the large differential due to the anticipation of a write-off on the last day. Rogoff suggested that it is easier to deflate debt through inflation rather than through a write-off. Dornbusch, citing Keynes, stated that a special tax is preferable to inflation; a devaluation causes all sorts of problems for the banking system. Barro countered that there must be some inhibitions to taxing debt, otherwise people would not hold the debt. Dornbusch said that France does tax debt, and that is why they have a premium.

Larry Ball offered that an obvious drawback to monetary union is that different governments give up the ability to independently stabilize their economies given different macro shocks. Rogoff reasoned, however, that many of the important shocks may not be cross-border shocks but shocks that affect different industries similarly across countries.

Alessandra Casella asked whether the process envisioned was an immediate jump to one common currency or whether the process would be smoother. This raises the problem of the perceived substitutability of currencies, and the whole issue becomes more difficult. A hard ECU has been proposed, and she asked what Rogoff thought. He replied that various ideas are proposed continuously, and that is why he and Ken Froot decided not to pursue that issue. He suggested that a hard ECU may mitigate some of the problems that he and Froot suggest are issues.