Managing Exchange Markets in the EMS with Free Capital

1. Introduction[1]

This paper reviews the functioning of the exchange rate mechanism (ERM) of the EMS in recent years. Its main purpose is to discuss the consequences and implications of increased (full) capital mobility for exchange rate management and monetary policies. In particular, Section 2 examines the evolution of exchange rate management in the short-term and the changing role of interventions, interest rates and official facilities. Section 3 discusses monetary policies within the ERM; after reviewing the debate on the model of monetary coordination that has prevailed in the early years of the EMS, it considers the claim that the degree of symmetry of the system may be increasing, and the possible reasons. Sections 4 and 5 discuss the implications for the ERM of increasing capital mobility, both as regards the long-term viability of the system (Section 4) and the policy requirements in short-term management (Section 5); the issue of the width of the exchange rate band is discussed, in this context. Section 6 summarizes the main conclusions.

2. Recent developments in the EMS

Macroeconomic performance in the ERM area has improved in the second part of the eighties. Growth has picked up, led by

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buoyant investment; average inflation has continued to decline until 1987, and has increased slightly since then; the consolidation of fiscal imbalances has proceeded further. On the external front, the area as a whole has gone to an average surplus in current payments of about 1 per cent of GDP.

Convergence of performances has evolved unevenly. The rise in inflation in 1988-89 has not impeded a further contraction of inflation differentials, and the dispersion of price and unit cost increases is now at the minimum of the decade. The picture is more mixed for macro-policies. Convergence of monetary aggregates growth has improved; on the fiscal side, however, the reduction in the average deficit, in per cent of GDP, has gone along with a persistently high dispersion of performances. The dispersion remains high also for current external payments; bilateral imbalances within the area have widened, with growing deficits in Italy, France and Spain (and the UK) and surpluses in Germany, the Netherlands and Belgium.

As for the international environment — despite the Louvre Accord — during 1986 and most of 1987 the dollar continued to depreciate; in 1987, dollar depreciation was increasingly resisted with official interventions.[2] Subsequently, monetary policy turned restrictive in the US and the dollar started to appreciate,[3] reaching in early June 1989 peaks of 2.05 DM and 151 yen.

The EMS has withstood well the oscillations of the dollar. Central rates between the main ERM currencies, that had been left unchanged since March 1983, were realigned in July 1985 (lira) and April 1986 (French franc). Thereafter turbulence was limited to end 1986-early 1987, when a small realignment of central rates was implemented (on January 12), and to some periods of pronounced dollar decline in 1987. Since January 1987 the currencies of the ERM have rarely touched the band limits (Chart 1). Nominal exchange rates have continued to maintain pressure on relative prices, notably in the case of Italy, Ireland and France. On balance, however, this does not seem to have led to major distortions of competitive positions.[4]

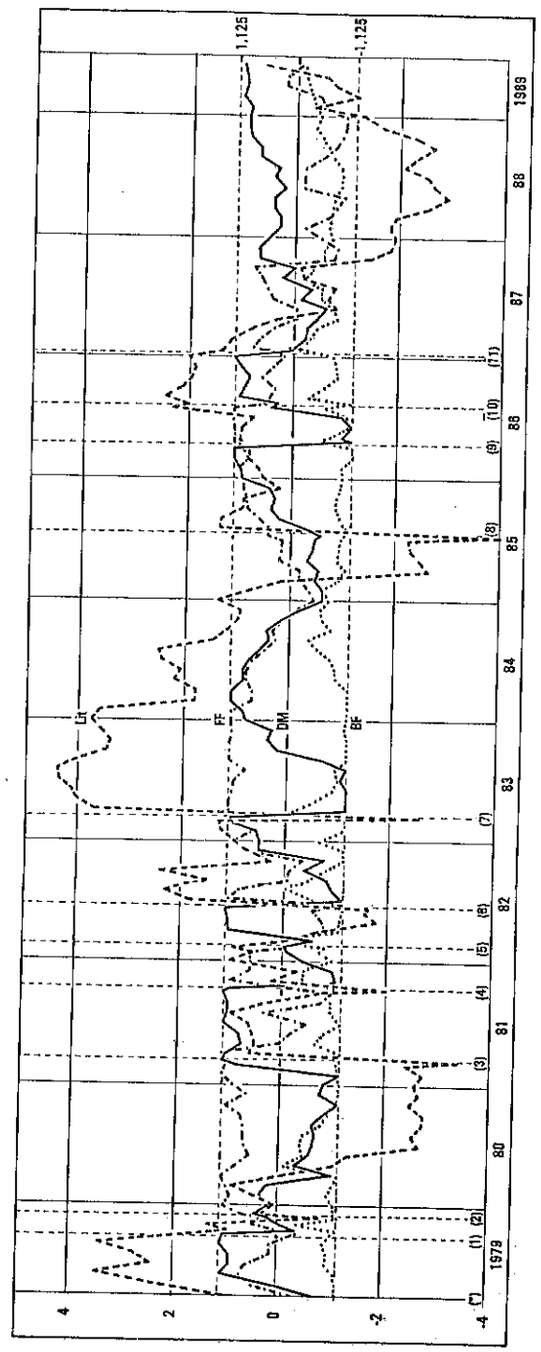
[2] *Cf.* GAIOTTI *et al.* (1989).

[3] The turning point was represented by the "bear squeeze" of early 1988, an episode of concerted intervention in support of the dollar that caught markets by surprise leading to heavy losses on short-positions in dollars. *Cf.* MARRIS (1989).

[4] If international competitiveness is measured in terms of unit labor costs, since the inception of the EMS a systematic depreciation of the DM is only apparent *vis-à-vis* the lira

CHART 1

EXCHANGE RATES IN THE ERM FLUCTUATION BAND+
(percentage values)



Source: Banca d'Italia.
(+) The notes correspond to realignments.
(*) Start of the System.
(1) 24 Sept. 1979; (2) 30 Nov. 1979; (3) 23 Mar. 1981; (4) 5 Oct. 1981; (5) 22 Feb. 1982; (6) 14 Jun. 1982; (7) 22 Mar. 1983; (8) 22 Jul. 1985; (9) 7 Apr. 1986; (10) 4 Aug. 1986; (11) 12 Jan. 1987.

The stability of exchange rates within the ERM has been altogether remarkable, especially if one considers that since 1986 France and Italy have dismantled many of their restrictions on capital transactions; their exchange rates have strengthened as a result. In particular, after the reform of foreign operations legislation entered into effect in October 1988, the lira appreciated markedly, moving back in early 1989 into the narrow fluctuation band (Chart 1). At present, all financial transactions on assets with maturity above eighteen months and most trade-related operations are free.[5] It is therefore interesting to examine in some detail how management techniques have evolved during this period.

It may be recalled, first of all, that in September 1987 the EMS central banks agreed in Bâle to expand considerably the system's financing facilities.[6] However, the important aspect of the agreement was an understanding that participating central banks would be prepared to make fuller use of the fluctuation band and at the same time to adjust interest rates more readily in response to incipient pressures in exchange markets; as a consequence, there was a clear implication that resort to official intervention would be reduced.

Table 1 summarizes foreign exchange interventions of ERM countries. The period 1986-87 stands up as that of heaviest intervention since the EMS was set up; weakness of the dollar is reflected in the large share of dollar purchases (above one fifth of the total). Quite high is also the share of interventions in Community currencies (above 70 per cent, mostly in DM); the prevalence of sales over purchases is a reflection, once again, of the often noted asymmetric effect of the dollar in the ERM currencies, whereby a weak dollar leads in the short run to a stronger DM within the ERM.[7] Chart 2 shows that these sales fell almost entirely on central banks other than

(by some 15 per cent); the DM-rate of the French franc is now close to its 1979 level, and appreciations of the DM are observed *vis-à-vis* all the other ERM currencies, including the Irish pound. Cf. BIS (1989), p. 179.

[5] Limits remain on the possibility of taking short positions and hedging in foreign exchange, and of lending currencies to non-residents.

[6] Access to the very-short-term financing facility (VSTF) was made possible for intramarginal interventions, under certain conditions, and the 50 per cent limit on the obligation to accept ECUs in settlements of debts was *de facto* lifted. *Cf.* Committee of Governors of the EEC (1987) and Dini (1988). The agreement was endorsed shortly afterwards by the ECOFIN Council gathered in Nyborg. For a description of the EMS mechanisms and facilities *cf.* Micossi (1985) and Mastropasqua *et al.* (1988).

[7] *Cf.* Micossi-Padoa Schioppa (1984), Giavazzi-Giovannini (1989).

Table 1

FOREIGN EXCHANGE INTERVENTIONS OF ERM COUNTRIES

		1979-82[1]		1983-85		1986-87		1988-89[2]	
		(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
US dollars	P	31.4	16.5	22.1	15.1	40.4	20.9	5.3	8.1
	S	107.3	56.3	56.3	38.4	13.3	6.9	24.2	37.0
ERM currencies									
— at the margin[3]		20.5	10.7	15.4	10.5	22.3	11.6	0.9	1.4
— intramarginal	P	10.6	5.5	29.0	19.8	42.6	22.1	23.1	35.3
	S	18.6	9.7	19.6	13.4	71.1	36.9	9.3	14.2
Others	P	0.1	0.1	3.2	2.2	1.4	0.7	2.0	3.1
	S	2.2	1.2	0.9	0.6	1.8	0.9	0.6	0.9
Total gross		190.7	100	146.5	100	192.9	100	65.4	100
Total net[4]		–86.0	45.1	–22.5	15.4	–1.8	0.9	–3.7	5.7
Memorandum items:									
— recourse to VSTF[5]		17.1	9.0	15.3	10.4	34.3	17.8	—	—
— ECU spot settlement of intervention		6.4	3.4	1.5	1.0	0.8	0.4	—	—

(a) Flows in billion dollars; (b) percentage of total gross interventions. P = purchases; S = sales. [1] For 1979, March to December. [2] For 1989, January to June. [3] Purchases or sales. [4] (–) Sign denotes net sales. [5] Very short term financing.
Sources: EMCF, BIS.

the Bundesbank. It is also apparent that these central banks took upon themselves a large share of interventions in dollars.[8]

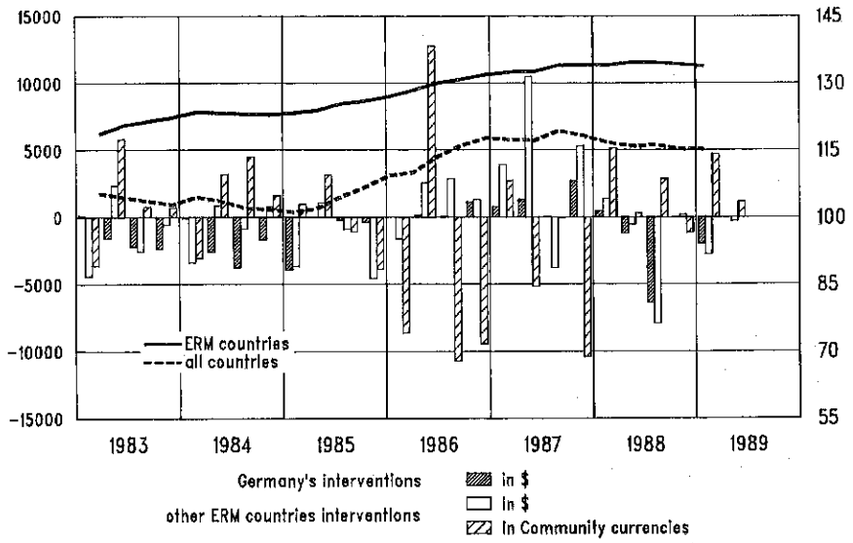
Interventions at the margin were substantial (22 billion dollars or 11 per cent of the total); however, they were mostly undertaken just before the January 1987 realignment. Recourse to the VSTF was also substantial and larger than compulsory interventions, since following the Bâle-Nyborg agreement, the VSTF was used in some occasions to finance intramarginal interventions (notably in the fall of 1987). Large gross interventions corresponded, for the system as a whole, to a small negative net balance (–1.8 billion dollars).

In 1988-89 we see a return to the pattern of interventions typical of periods of dollar strength, with increasing shares of dollar sales and purchases of ERM currencies (DM) in a context of much lower gross interventions. No recourse was made to the system's official

[8] Funabashi (1988) has documented that this was to an extent the result of explicit agreement among ERM central banks, designed to limit the repercussions of dollar interventions stemming from the Louvre Accord on the system's cohesion.

CHART 2

INTERVENTIONS BY ERM COUNTRIES AND EFFECTIVE EXCHANGE RATE OF THE DM[1]



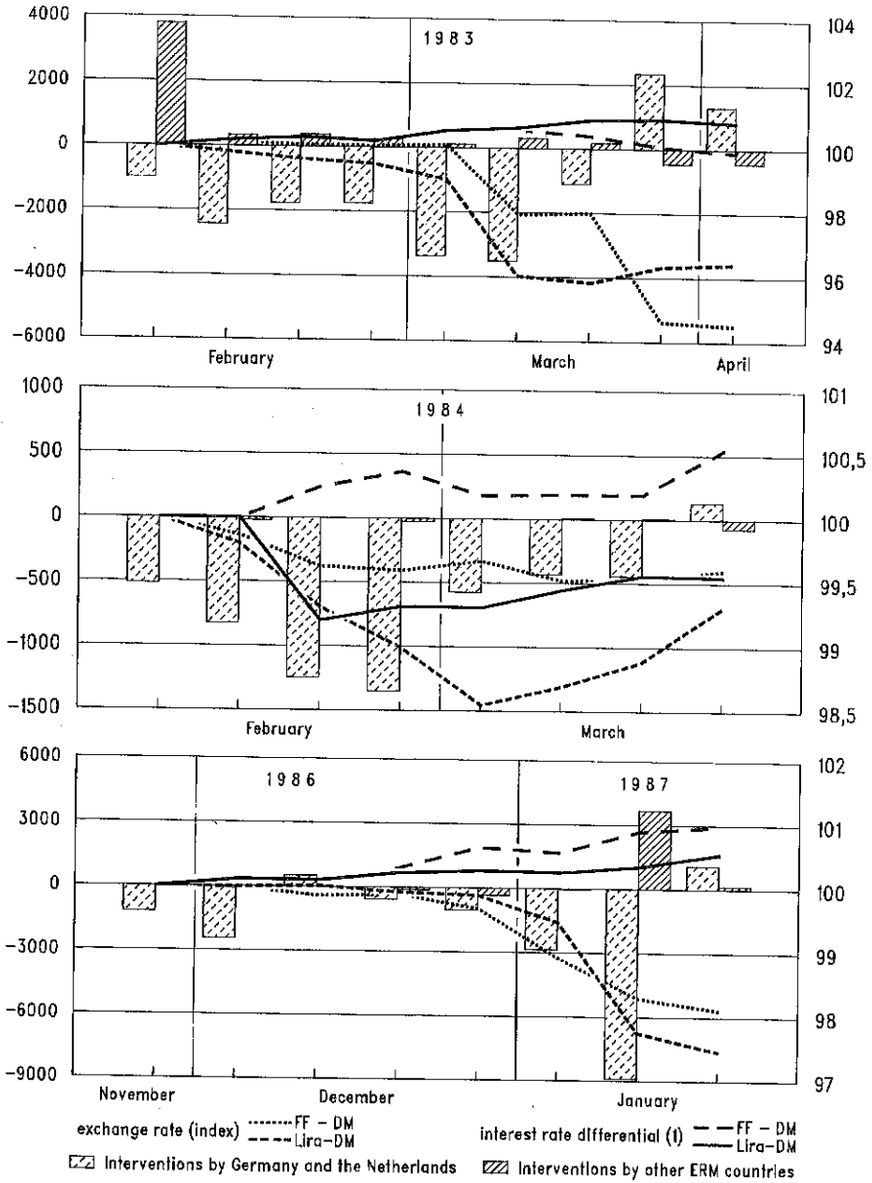
Source: BIS.
[1] The effective exchange rate of the DM is calculated both with respect to all countries and to ERM countries. Increases in the index (1980=100) indicate an appreciation of the exchange rate.

facilities; net interventions were again modest (–3.7 billion dollars) relative to the gross total. At the end of the period the share of dollar holdings in total reserves was about 60 per cent; that of ERM currencies had reached its historical maximum of 28 per cent, a consequence of the DM playing increasingly the reserve-currency role in the system.

Against this background, more detailed information on the evolution of management techniques of the ERM is presented in Tables 2 and 3 and in Charts 3a and 3b. We have adopted here a different period classification, to highlight changes that in fact date back to the January 1987 realignment. Increased cohesion of exchange rates within the band is mirrored in the uniform decline of daily mean (percentage) changes *vis-à-vis* the DM. Moreover, it may be seen that currencies have on average remained closer to their DM central rate than in any previous period since the EMS inception (*cf.* Table 2, the column "position in the ERM band").

CHART 3A

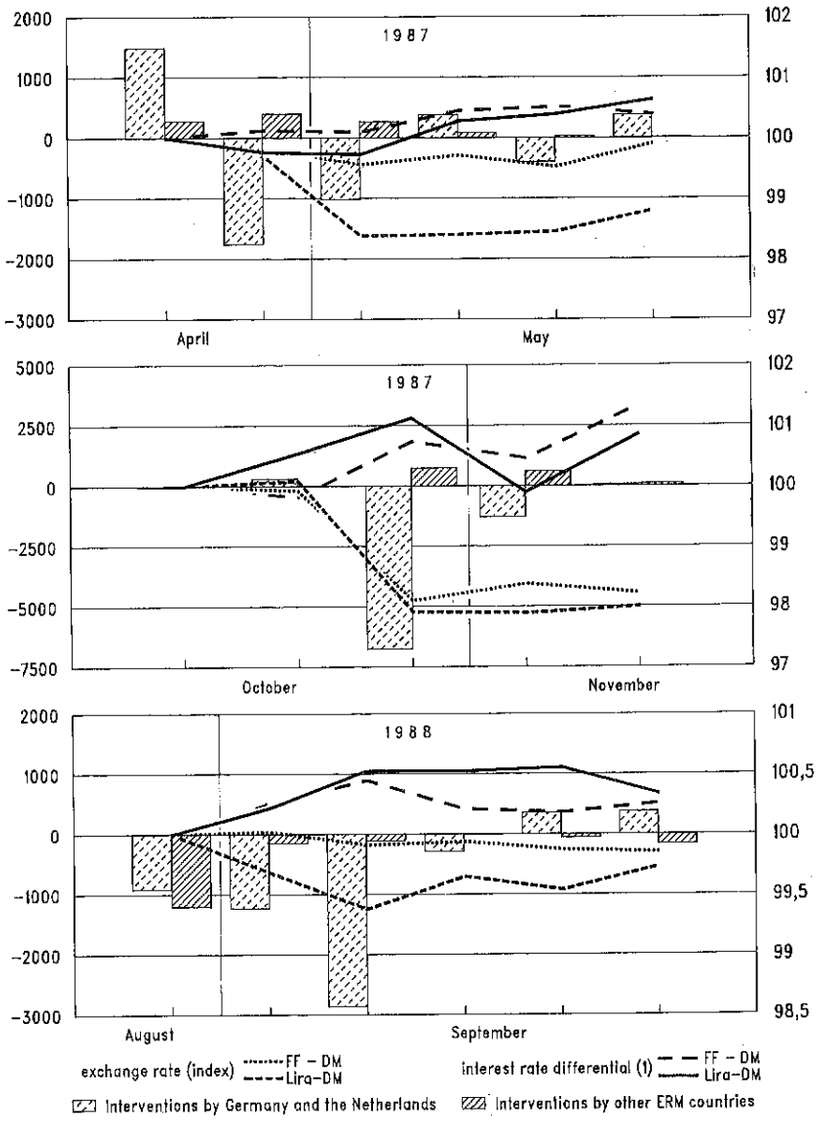
ERM - INTERVENTIONS, EXCHANGE RATE AND INTEREST RATE DIFFERENTIALS IN SELECTED PERIODS



(1) Three-months domestic money market rate, difference in percentage points from beginning of the period (+100).
Source: National bulletins.

CHART 3B

ERM - INTERVENTIONS, EXCHANGE RATE AND INTEREST RATE DIFFERENTIALS IN SELECTED PERIODS



(1) Three-months domestic money market rate, difference in percentage points from beginning of the period (+100).
Source: National bulletins.

TABLE 2

VARIABILITY OF EXCHANGE RATES WITHIN THE ERM[1]

	Percentage changes *vis-à-vis* the DM		Absolute value of percentage changes *vis-à-vis* the DM		Position in the ERM band[2]	
	Mean	Coefficient of variation	Mean	Coefficient of variation	Mean	Standard deviation
Lira						
Mar. 79 - Mar. 83	0.02	16.2	0.12	2.0	0.58	1.82
Apr. 83 - Dec. 86	0.01	9.9	0.08	1.2	1.74	1.72
Jan. 87 - Jun. 89	0.00	38.3	0.09	1.4	–1.19	1.21
French Franc						
Mar. 79 - Mar. 83	0.01	19.8	0.13	1.5	0.67	0.58
Apr. 83 - Dec. 86	0.01	19.7	0.08	1.1	0.66	0.45
Jan. 87 - Jun. 89	0.00	29.8	0.07	1.3	–0.23	0.54
Dutch Guilder						
Mar. 79 - Mar. 83	0.003	52.3	0.09	1.5	0.50	0.61
Apr. 83 - Dec. 86	0.001	207.4	0.07	1.3	0.28	0.73
Jan. 87 - Jun. 89	0.00	—	0.03	1.0	0.65	0.53
Belgian Franc						
Mar. 79 - Mar. 83	0.02	14.9	0.12	1.5	–0.98	0.37
Apr. 83 - Dec. 86	0.004	31.8	0.09	1.3	–0.91	0.22
Jan. 87 - Jun. 89	0.002	40.5	0.04	1.00	–0.55	0.24
Danish Krone						
Mar. 79 - Mar. 83	0.02	18.0	0.16	1.4	0.31	0.65
Apr. 83 - Dec. 86	0.01	16.8	0.10	1.0	0.35	0.71
Jan. 87 - Jun. 89	0.00	30.0	0.09	1.0	–0.13	0.65
Irish Pound						
Mar. 79 - Mar. 83	0.01	24.1	0.16	1.1	–0.12	0.60
Apr. 83 - Dec. 86	0.01	14.3	0.10	1.0	0.49	0.58
Jan. 87 - Jun. 89	0.00	58.0	0.08	1.2	0.18	0.56
Deutsche Mark						
Mar. 79 - Mar. 83					–0.09	–0.12
Apr. 83 - Dec. 86					0.26	0.49
Jan. 87 - Jun. 89					0.42	0.18

[1] Mean and coefficient of variations of the daily percentage rates of change of the bilateral exchange rate *vis-à-vis* the DM. We have excluded the data of the days immediately preceding and following realignments. [2] Calculated from daily maximum spreads from central rates; (–) sign indicates depreciation.
Source: BANCA D'ITALIA, daily data in per cent.

On the other hand, the day-to-day (unconditional) variability of bilateral exchange rates *vis-à-vis* the DM, relative to their mean (measured by the coefficient of variation), shows significant increases in 1987-89 in all cases except for the Dutch guilder, with highest

TABLE 3

INTEREST RATE VARIABILITY

	Domestic market rates[1]		Euro-rates[2]		Differential wih DM		Differential with Euro-DM	
	Mean	Coefficient of variation	Mean	Coefficient of variation	Mean	Coefficient of variation	Mean	Coefficient of variation
Italy								
Mar. 79 - Mar. 83	0.13	7.92	0.11	22.09	8.39	0.31	12.12	0.30
Apr. 83 - Dec. 86	–0.18	– 2.50	–0.12	– 8.08	8.95	0.21	9.38	0.22
Jan. 87 - Jun. 89	0.03	14.33	0.03	21.00	5.58	0.13	6.58	0.14
France								
Mar. 79 - Mar. 83	0.00	0.00	0.26	8.50	4.05	0.50	7.31	0.69
Apr. 83 - Dec. 86	–0.09	– 2.67	–0.10	–11.80	4.87	0.29	6.16	0.35
Jan. 87 - Jun. 89	0.01	32.00	–0.03	–13.00	3.79	0.22	3.94	0.24
Germany								
Mar. 79 - Mar. 83	–0.11	– 6.09	–0.10	– 6.20	—	—	—	—
Apr. 83 - Dec. 86	–0.01	– 19.00	0.00	0.00	—	—	—	—
Jan. 87 - Jun. 89	0.07	5.57	0.07	5.29	—	—	—	—
Denmark								
Mar. 79 - Mar. 83	0.10	34.00	n.a.	n.a.	6.30	0.67	n.a.	n.a.
Apr. 83 - Dec. 86	–0.13	– 14.92	n.a.	n.a.	4.74	0.33	n.a.	n.a.
Jan. 87 - Jun. 89	–0.09	– 3.89	n.a.	n.a.	4.48	0.38	n.a.	n.a.
Ireland								
Mar. 79 - Mar. 83	0.02	45.40	n.a.	n.a.	5.63	0.45	n.a.	n.a.
Apr. 83 - Dec. 86	–0.01	–108.00	n.a.	n.a.	6.94	0.22	n.a.	n.a.
Jan. 87 - Jun. 89	–0.17	– 3.41	n.a.	n.a.	4.69	0.50	n.a.	n.a.
Belgium								
Mar. 79 - Mar. 83	–0.03	– 29.81	–0.02	–53.51	4.57	0.34	4.88	0.32
Apr. 83 - Dec. 86	–0.08	– 5.80	–0.08	– 5.80	4.29	0.24	4.29	0.24
Jan. 87 - Jun. 89	0.02	15.42	0.02	14.08	2.66	0.23	2.63	0.23
Netherlands								
Mar. 79 - Mar. 83	–0.19	– 4.50	–0.17	– 4.90	0.10	15.16	0.37	3.75
Apr. 83 - Dec. 86	0.02	14.29	0.02	14.10	0.60	0.83	0.72	0.61
Jan. 87 - Jun. 89	0.04	8.31	0.04	8.12	0.88	0.55	0.83	0.57

[1] First differences (in levels) of three-month money market rates; monthly averages in percentage points. [2] First differences of three-month Euro deposit rates.

Source: IMF, International Financial Statistics, monthly data.

values for the lira and the Irish pound. Thus, it seems confirmed that countries were defending their currency rates more flexibly in day-to-day operations.

The data on interest rate variability (Table 3) confirm an associate increase in the coefficient of variation of domestic interest rates, notably for France (that displays the highest variability) and Italy.[9] This represents an important break with past practice; in fact, interest rate changes had provided little support in meeting exchange rate tensions in the early years of the EMS,[10] but have become more important as capital restrictions were dismantled.

Charts 3a and 3b offer evidence on the changing roles of interventions and interest rates in meeting exchange market pressures in selected periods. In the first two episodes (February-March 1983 and February-March 1984) we observe interventions in an increasing scale continuing for four-to-five weeks, and interest rate changes coming to help rather late (in 1983) or not at all (1984). In the January 1987 realignment episode interventions were more concentrated, and interest rate differentials tended to adjust earlier to counteract pressures. In the other three episodes (1987 and 1988), in an environment of higher capital mobility, we observe large interventions only initially, while interest rate differentials open up more promptly and exchange rates are allowed to adjust within the fluctuation band. Central banks, in sum, seem to have become aware of the destabilizing effect of large scale interventions and tend to use them with more determination when incipient pressures develop in exchange markets, while partly absorbing them on the exchange rate; interventions, however, subside rather soon and interest rate differentials widen to increase the cost of open positions in foreign exchange.

A final aspect concerns realignments. In this regard, already for some time the experience of the lira showed that tensions can be greatly reduced if market rates are not allowed to change much around realignments. Central rate changes always led to a jump in the franc/DM market rate in the first ten realignments, but not in the case of the lira/DM market rate; in some cases the lira rose in the first

[9] Increased values of the coefficients of variation go hand in hand with a decline in standard deviations.

[10] *Cf.* MASTROPASQUA *et al.* (1988), DE GRAUWE (1989a) and GIAVAZZI-GIOVANNINI (1989).

market-day after the realignment.[11] With the January 1987 realignment, the principle that central rate changes should not exceed the band width or entail jumps in market rates seems to have become a guiding rule of the system.[12] And yet, it was also understood that realignments should be infrequent, with more emphasis on their exceptional nature.

In summary, liberalization of financial flows within the EMS has been accompanied by reduced interventions, increased flexibility in exchange rate management within the fluctuation band, and a strengthened commitment to limit realignments and to bend short-term monetary policy management to the requirements of ERM cohesion.

3. Monetary policies: symmetry and the nominal anchor yet again

For many years it was accepted wisdom that the EMS had worked as an asymmetric system,[13] meaning: (i) that the burden of intervening in foreign exchange markets and moving interest rates to keep exchange rates within agreed margins has been unequally shared among participating central banks; and/or (ii) that the medium-term stance of monetary policy has been set by the Bundesbank, with the other central banks more or less "following" and occasional realignments providing some leeway of monetary independence.

Some empirical evidence supporting the hypothesis of asymmetry is available, albeit not terribly strong; it mainly concerns short-term management. Mastropasqua *et al.* (1988) show that participation by the Bundesbank in ERM-related intervention operations was always minimal, and the data in Section 2 in this paper confirm it for recent years. Their estimates of central bank reaction functions for Germany, France, Italy and Belgium display the expected ordering of sterilization coefficients of the foreign creation of monetary base (with values closer to minus one than to zero for Germany, to zero than to minus one for Belgium, and the other two countries falling in between). This result, however, has been criticised on grounds that there are "optimal" central bank policies that do not entail asymmetric behaviour and that, under a wide range of domestic and foreign disturbances, would nonetheless lead to a pattern of estimated coefficients indicating asymmetry (Roubini 1988b).[14]

The evidence from interest rates behaviour in national markets is mixed. Giavazzi and Giovannini (1989) find that the volatility of unanticipated interest rate movements[15] in domestic markets in Germany is about half that of France, but more or less equal to that of Italy (that maintained through 1985 extensive controls on international capital flows). De Grauwe (1989a), on the other hand, finds that there is no significant difference in interest rate volatility in the three countries. In addition, De Grauwe (1989a) and Fratianni-von Hagen (1989) present evidence respectively that interest rates and monetary base innovations in Germany are affected by innovations in these variables in other ERM countries, which they consider evidence of a symmetric working of the system.[16] In discussing this issue, Thygesen (1988) was careful to point out that asymmetry would in all event be far from complete and that there are instances when the Bundesbank did intervene or change its monetary course in view of exchange rate considerations.[17]

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[11] *Cf.* Bini Smaghi-Masera (1987). The lira devaluation of July 1985 stands out as an exception: as may be recalled, however, in that case the lira was devalued "by surprise" without very heavy market pressures.

[12] And as such is incorporated in the Report of the Governors of the EEC to the ECOFIN Council of September 1987, that is the basis of the Bâle-Nyborg agreements.

[13] *Cf.* Giavazzi-Giovannini (1987). Efforts to model the EMS as a strategic game, such as Giavazzi-Pagano (1988) and Melitz (1988) typically emphasize monetary discipline (that entails asymmetry) in the explanation of the interest of inflation-prone countries in joining the system.

[14] This implies that estimated correlation coefficients cannot by themselves prove (or disprove) the asymmetry hypothesis. They could still be considered an *ex post* measure of sterilization behaviour conditional on the knowledge that the actual policies followed by ERM central banks did imply asymmetry.

[15] Obtained as the residuals from forecasting regressions that include as independent variable a time trend, seasonal dummies and four lags of the dependent variable. *Cf.* Chapter 4, (pp. 73-77).

[16] Similar evidence for money base innovations had already been identified by Bekx-Tullio (1987) and Mastropasqua *et al.* (1988). This last paper, as well as Russo-Tullio (1988), points to the role of the DM as intervention currency in the ERM as an alternative explanation that would make this evidence consistent with asymmetry; and Russo and Tullio were able to conclude, from detailed analysis of the liquidity effects in Germany of DM interventions during the life of the EMS, that these effects were temporary in every year except 1979 and 1981.

[17] An example is that of October 1987 when Germany and France agreed on a coordinated interest rate change of opposite sign. In the same vein, *cf.* also Dudler (1988).

However, until 1985 Germany always met its yearly monetary targets; Italy and France have increasingly constrained their monetary policies to the requirements of stability in nominal exchange rates; Belgium, the Netherlands, Denmark and Ireland have pegged their currencies to the DM rather rigidly since the EMS was set up. Failure to confirm empirically the asymmetric model of coordination, thus, could be seen as casting doubt more on the specification and testing of the hypothesis than on the hypothesis itself. It is important to note that in most cases empirical tests entail the existence of a systematic, more or less automatic response by central banks to monetary and exchange rate disturbances. In practice, however, central banks make little resort to automatic pilots and rather prefer manual sailing; their responses reflect judgement and discretion much more than optimal feed-back rules.[18]

Be that as it may, there seems to be a consensus that in recent years the system has become more symmetric. The data on interest rate variability in Table 3 offer some support to this contention; so does the evidence that the process of convergence may have slowed, if not come to a halt, in the past two-to-three years, and that current account deficits have been "easily financed — rather, overfinanced — by capital flows" (Spaventa 1989). To the extent that, as in Wyplosz (1989), asymmetry was the systemic consequence of a reserve constraint, removal of this constraint may help explain increased symmetry.

Indeed, Germany has not been immune to the general acceleration of inflation since 1987 and does not seem to have placed much restrictive pressure with monetary policy on the rest of the system. Since 1986 monetary targets have been systematically exceeded in Germany, and both in 1986-87 and in 1988-89 the real rate of growth of money (M2) was high by historical standards (Table 4), in 1988-89 higher than either in France or Italy. It is no wonder, therefore, that the system has been perceived as less constraining and that the requests for more symmetry in monetary management have subsided. The performance of the DM in the ERM can also be plausibly related to these developments in relative monetary conditions.

[18] This feature of policy coordination within the ERM has been recognized and explicitly modeled by Begg-Wyplosz (1987): in their model of "bounded rationality", the rules of the system only extend to the choice of a "loose" policy-regime, within which a lot of room remains for the (cooperative or non-cooperative) setting of policy instruments.

Table 4

MONEY, MONETARY BASE AND MONETARY BASE COMPONENTS: REAL RATES OF GROWTH[1]

		1979-82	1983-85	1986-87	1988-89[2]
Germany	M2	0.4	3.0	7.9	4.6
	MB	3.9	2.8	1.9	8.0
	DC	5.9	3.4	–2.9	13.2
	FC	–2.0	–0.7	4.8	–5.1
France	M2	–0.4	1.5	8.2	5.0
	MB	11.3	2.9	–3.1	1.9
	DC	1.6	–0.6	–0.7	6.1
	FC	9.7	3.4	–2.4	–6.5
Italy	M2	–2.4	2.4	4.3	2.7
	MB	3.4	2.6	0.05	2.1
	DC	–0.4	1.4	4.9	–2.3
	FC	3.8	1.2	–4.8	4.0
ERM	M2	–1.5	3.4	8.7	3.1
	MB	3.4	3.0	1.0	2.8
	DC	1.7	0.7	0.4	5.7
	FC	1.7	2.3	0.7	–2.0

MB = Monetary Base; DC = Domestic Component of Monetary Base; FC = Foreign Component of Monetary Base.

[1] The domestic and foreign components are calculated as a contribution to (real) monetary base growth, as follows: $(C_t - C_{t-1})/MB_{t-1}$ where C is the relevant monetary base component.

[2] For 1989, first quarter.

Source: IMF, International Financial Statistics.

Against this background, a fair question to ask is whether the model of monetary coordination of the ERM has continued to perform satisfactorily from the standpoint of providing the system with a stable monetary anchor.

Developments in 1986-87 clearly reflected interventions in the dollar market (Charts 3a and 3b) and loosening monetary conditions by the Bundesbank related to increased resistance to the depreciation of the dollar, in the presence of a large and growing current external surplus.[19] An acceleration of (nominal and real) monetary growth is also observed in both France and Italy (in the former case pushed by the domestic component, in the latter by the foreign component). These developments seem to confirm that when an external (dollar) exchange rate objective is super-imposed on the ERM, notably when the dollar is weak, the system's monetary discipline is loosened.[20]

In 1988-89, however, real monetary growth in Germany has

[19] *Cf.* Gaiotti *et al.* (1989).

[20] *Cf.* Kregel (1989).

remained buoyant and money base has accelerated considerably, despite the dollar appreciation and a sizeable negative contribution to base growth of the foreign component; the real growth rate of the base domestic component has averaged an unprecedented 13.2 per cent.

An explanation in terms of exchange rate or competitiveness objectives is obviously less compelling in this case. The reason, instead, could be found in the consequences of adding capital mobility to the model of monetary coordination that was already there. With high (full) capital mobility, when expectations of exchange rate stability prevail, capital flows increasingly from low to high-yield, high-inflation countries, as the experience of Italy, but also of Spain and in certain periods the UK, clearly shows. As a result, the external component of money base creation is systematically positive in high-inflation countries, reducing the perception of the external constraint on domestic policies; typically, the monetary effects of these inflows are less-than-fully sterilized. At the same time, close-to-full sterilization continues to prevail in the center-country, as confirmed by the strong acceleration of the base domestic component in Germany. As a result, aggregate monetary policy becomes more expansionary.

The above discussion would suggest that, with increasing capital mobility, the existence of inflation differentials within the area and the requirement for higher-inflation countries to maintain more restrictive monetary policies may actually lead the system to converge towards the highest, rather than the lowest, inflation if "collective" monetary management is not modified.[21]

4. Free capital movements and long-term viability of the EMS

At the latest by July 1st, 1990, all remaining restrictions on monetary transactions should be removed in France and Italy,

[21] One possibility that has been suggested would be to set targets for the domestic component of monetary aggregates, along the lines of the earlier literature on monetary policy cooperation under fixed exchange rates. See McKinnon (1977), Caranza, Papadia, Zautzik (1988), Russo-Tullio (1988), Bini Smaghi (1989b). This suggestion is at odd, however, with the general tendency of central banks to move back to interest-rate targeting, owing to the difficulties involved in interpreting and controlling monetary and credit aggregates.

making capital fully free to move around in most of the EMS area.[22] This raises the issue on one hand of the long-term viability of the EMS exchange rate agreement (ERM), on the other of the adequacy of existing rules and arrangements for exchange rate management within the system. We will take up the long-term aspects in this section and discuss the implications for exchange rate management within the ERM in Section 5.

In our view the issue of long-term viability of the EMS with free capital movements has been overemphasized, for a number of reasons. To start with, once we rule out the possibility of an insolvent government, there is little doubt that under any circumstances of practical relevance there will exist appropriate monetary policies that will sustain a system of managed exchange rates;[23] the only question is whether countries will be willing to adopt and maintain such policies. The decision to concur in the liberalization directive already provides an indication of their intention to do so; it may be argued, however, that countries are underestimating the costs implicit in this commitment.

While this may well be so, a convincing case that once inflation rates have been aligned, full liberalization of capital will raise substantially the costs of membership in the ERM, has not been made.

Some authors have argued that with fully free capital it will become more difficult to meet the government solvency constraint, since inflation-prone countries will have to accept a lower-than-optimal rate of inflation from the standpoint of tax policy and reduced revenues from seignorage.[24] This conclusion is far from obvious. First of all, the above models are based on *ad hoc* assumptions on the optimizing behaviour of fiscal authorities, and ignore the possibility that inflation may in fact be the result of the latter's inability to reach a socially desirable optimum because of

[22] Ireland, Spain, Greece and Portugal will still enjoy transitional regimes until 1992-93.

[23] Buiter (1986) has shown that in the absence of a foreign liquidity (reserves) constraint the collapse of a managed exchange rate can only be brought about by expectations of government default. In a more realistic setting where there is a foreign liquidity constraint (reserve cannot be borrowed without limit), then a viable managed exchange rate also requires that the domestic credit component does not grow, along the steady state path, more rapidly than the demand for money. See also Driffill (1988).

[24] *Cf.* Dornbusch (1988), Grilli (1989) and Giavazzi-Giovannini (1989, Chapter 8). Canzoneri and Rogers (1989) argued that the relevance of the optimal taxation arguments increases with the relative share of the "black economy", where the need for cash for transactions is higher.

externalities.[25] In addition, Dornbusch himself recognized, in his comment to Grilli (1989), that equilibrium seignorage rules out inflation as a strategic coordination problem. Even if one was willing to accept that governments indeed try to set inflation optimally, it strains credibility that private agents would not react to the perception of such a policy, with adverse implications for inflation, real interest rates, the tax base and the entire macro-economic picture.

Secondly, the loss of revenues from seignorage would tend to be compensated by a reduction in the (real) cost of government borrowing stemming from enhanced credibility of the government both as a debtor and an inflation-fighter.[26] Enhanced credibility of stability-oriented economic policies would also encourage capital inflows, at least initially, thus facilitating the financing of the public debt and the current external deficit, and reducing their cost. Lower inflation in the context of increased economic integration could entail higher, rather than lower, real growth as a result, among other things, of larger inflows of foreign direct investment, as indeed seems to be confirmed by the experience of the eighties in Europe.

In the long-run a problem of "sustainability" can arise to the extent that overtime foreigners become less willing to accumulate claims on deficit countries. However, economic theory has not provided us with definite answers on this issue. The upper bound on net foreign indebtedness can be very large for a country that maintains "sound" financial policies. At the same time, standard portfolio models[27] do predict that widening real interest rate differentials in favor of deficit countries would be required to offset the resulting changes in net relative supplies of assets denominated in ERM currencies. On the other hand, to the extent that integration of capital markets — in the context of increasingly fixed exchange rates — makes assets denominated in different currencies good (close-to-perfect) substitutes, problems of sovereign risk may loose relevance

[25] This had been argued by AIZENMAN (1989). In this context an exchange rate agreement or monetary unification are a way to remove such externality.

[26] *Cf.* GROS-THYGESEN (1988) and DE GRAUWE (1989b). In the case of Italy, for instance, a 1 per cent reduction in the average cost of government debt, as a result of lower risk premium, would lead to reduced interest payments roughly equivalent to the entire yearly revenues from seignorage (that are at present of the order of 1 per cent of GNP). GROS (1989) also contends that when seignorage is measured in terms of opportunity cost, *i.e.* taking into account the inflation rate expectation imbedded in nominal interest rates, seignorage appears to be rather small in Italy, even smaller than in Germany.

[27] *Cf.* HOOPER-MORTON (1982).

within the area; the creditworthiness of individuals and firms could increasingly become the only criterion relevant in determining the cost of borrowing and risk-premia. A plausible case could thus be made for accelerating, rather than slowing liberalization, in the presence of widening current imbalances, and for tightening up at the same time the exchange rate constraint.

As an empirical matter, nominal interest rate differentials *vis-à-vis* Germany have declined considerably since 1983; real differentials, however, have been higher, on average, in 1986-87 and 1988-89 than they had been at any time since the EMS inception; in France they have gone further up in 1988-89, and they are now higher than in Italy. Since mid-1988, in particular, real interest rates have increased in all three countries, but more in France and Italy than in Germany.[28]

A number of factors may explain these developments;[29] but the turnaround in countries' net foreign positions during the EMS clearly stands out as a potential explanation. Italy and France were in (current account) surplus in 1979 but have now substantial deficits (between 0.5 and 1 per cent of GDP); their net foreign position has worsened in the past 10 years by some 30 billion dollars. The opposite has happened in Germany, that now has large current surpluses and net asset position *vis-à-vis* some ERM countries, and in the other DM-group countries in Northern Europe, Belgium, Denmark and the Netherlands.[30]

If the above argument is considered relevant the only way to reduce real interest differentials — barring a large (once-and-for-all?) realignment that today may not seem feasible — is to tighten the exchange rate constraint so as to reduce differences in risk premia on the various currencies. Financial liberalization would also contribute to ease the external financing constraint.[31]

[28] *Cf.* BINI SMAGHI (1989a).

[29] In 1986-87 the dollar depreciated considerably, placing pressure on "weak" currencies within the EMS (the well-known observed asymmetric response of ERM currencies to the fluctuations in the dollar exchange rate entails rising interest rate differentials *vis-à-vis* the DM when the dollar is falling); domestic demand has tended in general to grow more rapidly in France and Italy. Italy also has larger public sector deficit and debt, and higher cost and price increases; this, however, is no longer true of France, where all these variables are now closely in line with those in Germany (but where perhaps higher real interest rates were precisely the cost to be paid to achieve full convergence of nominal magnitudes). On the other hand, during most of 1987-89 monetary policy has been lax in Germany, with real interest rates going down to the minimum of the decade.

[30] *Cf.* BINI SMAGHI (1989a).

[31] *Cf.* Section 5.

On the other hand, we should keep in mind that the dismantling of restrictions has taken place under considerable market pressure, in the sense that financial innovation was increasingly eroding their effectiveness. Halting or, worse, reversing the liberalization process may prove in practice very difficult and costly now that firms, households and financial intermediaries have learnt to operate in sophisticated open markets. Considerable political costs would also be involved for a country taking such a course that would require resort to a safeguard clause under a Community procedure.

These considerations bring us back, in the end, to the fundamental issue of the role of capital controls in the panoply of instruments available to maintain exchange rate cohesion within the ERM. The experience of the seventies has taught us that controls cannot avoid reserve losses or depreciations if monetary policy accommodates inflation systematically. On the contrary, with monetary policy geared to disinflation, capital controls can reduce the adjustment costs by reducing the volatility of interest and exchange rates.

A simple aggregative model that displays properties consistent with this view is presented in the Appendix. The model is solved to derive the real interest rate and output paths during disinflation under alternative policy regimes of monetary targeting (floating exchange rates) and fixed exchange rates ("the ERM"). It is shown that capital controls can tilt the balance in favor of the ERM regime since they reduce the required increase in interest rates, hence the output loss, along the path of disinflation.

This explanation of the interest of inflation-prone countries in joining the ERM offers an alternative to the "credibility" hypothesis,[32] that has been criticised increasingly as logically unconvincing.[33] It also points to an interpretation of controls on capital transactions within the ERM as a complement to appropriate monetary policies rather than a substitute.[34]

[32] *Cf.* Giavazzi-Pagano (1988), Rogoff (1985).

[33] Begg and Wyplosz (1987) note (i) that the formal setting of the EMS did not specify that one currency would assume a special role (no announcement effect); (ii) that if a country is able to take the decision to join the EMS to disinflate, why then should it not be able to appoint domestically the conservative central banker that is needed for "credibility"?

[34] Micossi and Rossi (1989) present evidence that in Italy the shift to non-accommodative monetary policy after the inception of the EMS gradually eased the pressure on barriers to international capital flows, so that these barriers had on average already ceased to "bite" — in the sense of impeding net outflows that would otherwise take place — when they were removed. This evidence is consistent with the hypothesis that controls were used to ease the transition to lower inflation and reduce its output costs rather than as a device to sustain a systematic divergence in inflation and monetary policy relative to Germany.

Indeed, it is now recognized as a general requirement for monetary policies in the EMS that the medium-term path of nominal variables should not entail devaluations at regular intervals or, stated alternatively, that monetary policies should not accommodate inflation differentials.[35] Realignments, then, could still occur in response to unanticipated real shocks, but they would not be a systematic, hence foreseeable, feature of the system. A system that did not meet this requirement would always be exposed to the risk of collapsing under speculative attacks; the considerations developed above make it clear, however, that this requirement cannot be considered a novel feature of the system, although the leeway for short-run deviations from the prescribed policy course will be reduced with the removal of remaining restrictions.

5. Capital mobility and short-term management of the ERM

It is useful to recall, first of all, that the ERM is an agreement to stabilize within narrow margins nominal exchange rates. Central rate changes were invariably decided under strong market pressure; they were not planned in advance and there is no rule of objective criterion agreed upon to determine when the time is ripe. This strengthens the contention (*cf.* Section 4) that the ERM was not conceived and has not been operated as a crawling peg designed to accommodate systematic divergences in inflation and monetary policies.

In this context, it has been argued above that capital controls may have helped to reduce the output cost of disinflation. In addition controls have performed two other functions. The first one, well recognized in the literature,[36] was that of reducing pressure in

[35] *Cf.* Obstfeld (1988a) and Driffill (1988). Driffill stresses that a monetary policy rule that entailed anticipated discontinuities in asset prices would be inconsistent with conventional assumptions on efficient (and perfectly integrated) capital markets. The only alternative, with "divergent" monetary policies, would really be a system of "soft" bands that would be adjusted automatically whenever a currency hit the edge; such a system would not be qualitatively different from one of floating exchange rates.

[36] *Cf.* Giavazzi-Pagano (1985), De Grauwe (1989b), Micossi-Rossi (1989).

foreign exchange markets, and associated changes in interest rates, when expectations of a realignment developed. The second function was that of facilitating exchange rate management within the band in the time interval between realignments. This is a straightforward implication of asset market theories of exchange rate determination: sterilized interventions tend to be more effective with low capital mobility.[37]

This role of controls was especially relevant for Italy that maintained wide fluctuation margins: in this case capital controls worked to reduce capital inflows[38] when expectations on the lira were stable, thereby avoiding exchange rate changes in a direction opposite to that of "fundamentals". The Bank of Italy then was able to decide when and to what extent arrange an orderly descent of the lira within the band, consistent with its objectives on inflation on one hand, on competitiveness on the other.[39]

Bearing in mind these considerations on the nature of the ERM agreements, we can turn to consider the implications of increasing (full) capital mobility for the short-term management of the system.

A first general requirement for monetary policy — that it should not accommodate inflation differentials — has been noted in Section 4. With full capital mobility, however, sticking to that policy may be tantamount to renouncing to realignments since the conditions of pressure in foreign exchange markets that usually justified changing central rates are not likely to develop.[40] A decision to loosen monetary policy with the explicit objective of provoking a realignment, on the other hand, would entail serious risks of destabilizing foreign exchange markets and setting in motion giant flows of capital. Thus, realignments may have to be decided and implemented not only by surprise, but also to a large extent independently of market developments or the position of currencies in the band. That such a decision would not be likely to happen too often is quite obvious.

[37] For a recent restatement *cf.* OBSTFELD (1988b).

[38] This aspect is recognized by GIAVAZZI (1989) who notes (p. 19) the role of the ceiling on banks' net foreign indebtedness in preventing capital inflows in periods of calm in the system.

[39] There are, we believe, almost no instances of central banks of the ERM actively pushing exchange rates up or down in the band; interventions in foreign exchange markets were typically "leaning into the wind".

[40] *Cf.* SPAVENTA (1989).

Further requirements will have to be met in the management of interest and exchange rates in day-to-day operations, that basically boil down to doing some more of what has already been done following the Bâle-Nyborg agreement of September 1987.[41] Central banks should never provide systematic opportunities for profit to speculators by pegging prices at the same time in the domestic money market and the foreign exchange market: exchange rates should be allowed to oscillate within the band in response to incipient market pressure, the monetary effects of interventions should not be sterilized and interest rates should be allowed to respond even more flexibly to incipient market pressures. Such a policy would not entail systematic deviations of monetary policies from their medium-term course as long as the general requirement of non-accommodation stated above was met.[42] It would also not necessarily entail in practice a large increase in interest rate volatility. For one thing, higher capital mobility would imply stronger stabilizing speculation (higher interest rate elasticity) in response to "virtuous" interest rate changes, once the credibility of the ERM was strengthened by renouncing controls.[43]

Two further issues should be noted. First, full capital mobility may indeed complicate the management of monetary policy to the extent that currency substitution undermines the stability of the demand for monetary base.[44] Attempts to change monetary conditions in one country will more rapidly and extensively spill-over to the others. Given the size of financial intermediation and monetary base in France and Italy, Germany cannot consider itself immune from this implication of free capital. Beyond short-term responses, coordination of monetary target becomes necessary, as argued by Caranza, Papadia and Zautzik (1988).

Second, the issue arises whether official financing facilities of the EMS — notably the VSTF — can still be considered adequate in the new environment. What has been said already provides part of the answer. To the extent that monetary policies adapt more readily to the requirements of exchange rate management within the ERM,

[41] *Cf.* Section 2.

[42] Provided, of course, ERM countries were not intervening collectively to peg their dollar exchange rate. *Cf.* Section 3.

[43] *Cf.* GROS-THYGESEN (1988).

[44] *Cf.* GROS-THYGESEN (1988). The problem of stability of the demand for money base will be aggravated by "structural" shifts in countries where money base is more heavily taxed.

official reserve movements and recourse to the system's financing facilities are likely to be small (and indeed we saw it decreasing over time). If, on the other hand, monetary and intervention policies became mutually inconsistent, then the amount of private capital that could be set in motion would be virtually unlimited and no official facility, however large, would be sufficient to meet it. In a way, therefore, the issue becomes less relevant than it was with capital controls, when some countries on occasion made substantial resort to the system's facilities to resist pressure on their currency.

The last issue that should be addressed is the stringency of the exchange rate constraint, that is the width of the fluctuation band. In Section 4 it was pointed out that a narrow band may entail benefits of a reduction of risk premia on weak currencies because of enhanced credibility of government policies.

However, it is an open question whether from the standpoint of short-term management full capital mobility would require more or less exchange rate flexibility (wider or narrower band). A wider band for all member countries has been advocated[45] on grounds that financial shocks would be more likely and could be more readily absorbed on the exchange rate, thus limiting the need for interest rate changes.

The counter-argument stresses the role of the band width on expectations: a credibly defended smaller band reduces the potential gains from speculation and, therefore, can cut at the root the likelihood of speculative attacks.[46] Marris (1989) also points to the benefit of a narrow band in minimizing the risk of capital flows driving the exchange rate away from fundamentals, and thus becoming a source of real shocks in the system. If narrowing the band reduces the scope for exchange-rate-induced shocks, it can also lessen the need for interest rate changes. To the extent that risk-premia reflect currency instability, a tighter exchange rate constraint would also contribute to reducing them.

The issue, of course, cannot be settled *a priori*: optimal (exchange rate) policies will in general depend on the structure of

[45] *Cf.* Masera (1988) and Kenen (1988).

[46] Krugman (1988) has explicitly modeled, in a seminal paper, the stabilizing role of the band on exchange rate expectations. The literature on "smooth pasting" has rapidly expanded; *cf.* Krugman (1989), Flood and Garber (1989), Froot and Obstfeld (1989). An important factor influencing the credibility of the band is the size of the monetary authorities' foreign exchange reserves.

disturbances that are likely to affect the economy.[47] In the Appendix we show that indeed under certain shocks (real shocks) there can be a trade-off between exchange rate and interest rate variability; on the other hand, the variability is reduced for both variables under pure monetary shocks.

Artis-Taylor (1988) present high-technology empirical evidence of a reduction of variability for both interest rates and exchange rates during the EMS life (see also Chart 4), which would seem to confirm a prevalent stabilizing role of the exchange rate constraint.

In Chart 4 we have plotted the variances of exchange rates and interest rates since mid-1987 for France and Italy; during this period the liberalization of capital has been accelerating in both countries. As can be seen, in the case of France the trend-reduction in the variability of both variables coexists with a distinct tendency for the two to move together (positive covariance). Italy, on the other hand, seems to display recently both a pick-up in the variances and a negative correlation between them, which may indicate that indeed exchange rate flexibility has helped to moderate interest rate variability.

More empirical work is clearly needed on this issue. What can be said, however, is that liberalization does tilt the balance of choice in favor of more exchange rate stability or of a narrowing of the fluctuation band. If, on the other hand, the real sector cannot be made more stable — say, by means of improved fiscal policies — then the choice may be one between two evils: greater exchange rate flexibility may make it easier to absorb shocks stemming from the real sector, but the country will be more exposed to financial shocks both in the foreign exchange and the domestic financial (government debt) market.

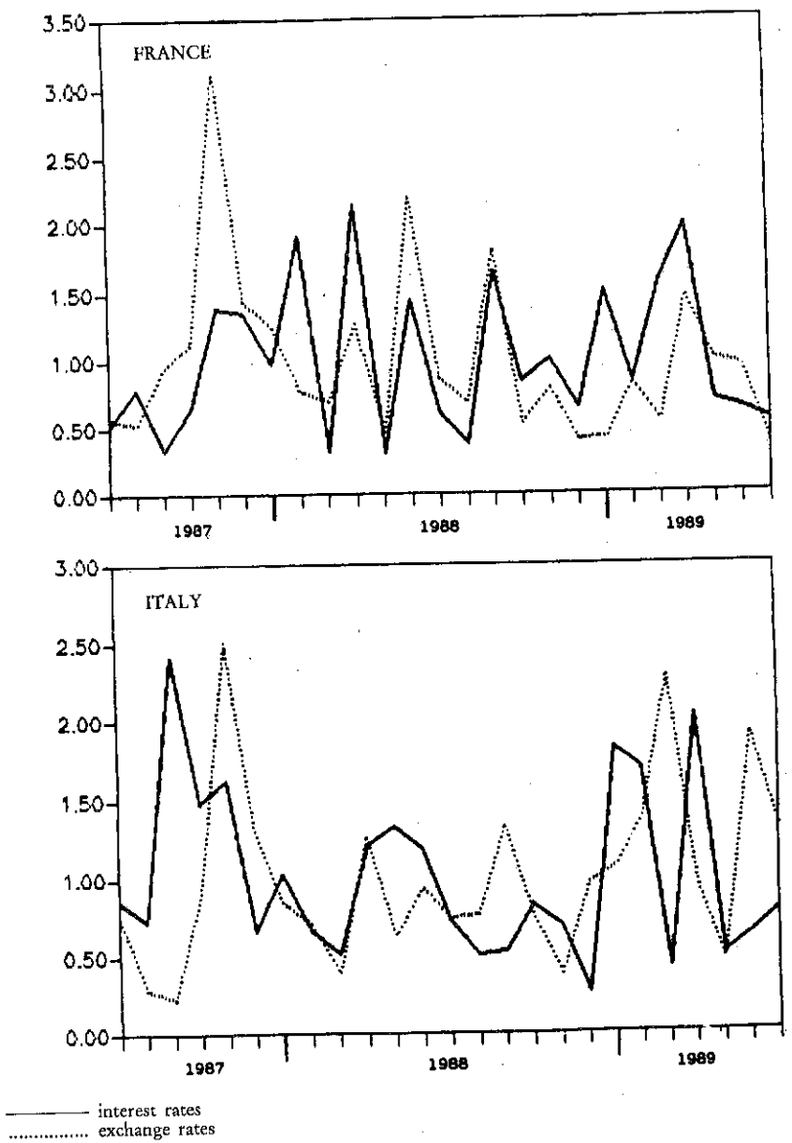
6. Conclusions

In recent years the ERM has functioned remarkably well, both in periods of dollar weakness and dollar strength, not least because of important improvements in management techniques following the Bâle-Nyborg agreement of September 1987. Far from weakening

[47] *Cf.* Henderson (1984).

CHART 4

EXCHANGE RATE AND INTEREST RATE VARIANCES[1]
(daily data)



[1] Variances are normalized with their means.
Source: Bank of Italy.

exchange-rate cohesion within the ERM, increased capital mobility may have helped to strengthen it, especially since inflation differentials have been sharply reduced. Monetary policies have responded more readily to the requirements of exchange rate stability in inflation-prone countries and have been relatively lax in the center-country, thus helping reduce the perception of an asymmetric working of the system. Widening current account imbalances within the EMS have gone along with widening real interest-rate differentials between France and Italy, on one side, and Germany on the other, raising questions as to the real (growth) cost of full economic and monetary integration in Europe.

In this regard, however, there seems to be no convincing argument that full freedom of international capital flows will contribute to raise these costs or threaten per se the long-term viability of the system. On the contrary, improved credibility of stability-oriented policies may help reduce the (real) cost of government borrowing and the external financing constraint, thank to the expanded inflow of foreign capital.

With free capital, the short-term management of the system will require even stricter adhesion to the principles of the Bâle-Nyborg agreement, entailing further losses of monetary autonomy by ERM countries. The full liberalization of monetary transactions will make it more difficult to manage monetary aggregates at national level because of currency substitution. We have also discussed the possibility that monetary discipline in the system may have loosened as a direct consequence of super-imposing free capital on the asymmetric model of coordination that had served the EMS so well during the phase of disinflation. The need for coordination may extend from short-term management to the setting of targets and medium-term objectives.

Free capital would also seem to require that the exchange rate constraint in the ERM be tightened in the sense both of (gradually) renouncing to realignments and of narrowing the fluctuation band, notably for countries that maintain a wide oscillation band: this is basically a consequence of the need to limit, in the new environment, expected changes in exchange rates and, hence, the opportunities for speculative position-taking in the foreign exchange market.

Roma

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APPENDIX

In this appendix we compare, through the use of a simple model *à la* Flood (1981), the adjustment paths for the main macro-economic variables resulting from two disinflation strategies, one based on monetary targeting, the other on an exchange rate objective.

1. The model

Assume a small open economy described by the following equations:

$$m_t^d - p_t = -(1/\lambda)i_t + v_t \tag{1}$$

$$y_t^d = \delta(e_t - p_t) - \sigma[i_t - ({}_tp_{t+1} - p_t)] \tag{2}$$

$$y_t^s = y \tag{3}$$

$${}_{t-1}y_t^d = y_t^s = \bar{y} \tag{4}$$

$$i_t = i_t^* + \beta({}_te_{t+1} - e_t) \qquad 0<\beta<1 \tag{5}$$

$$i_t^* = \bar{i}^* + u_t. \tag{6}$$

All coefficients are positive. The first equation represents the demand for money; v_t is a random money demand disturbance with nil expected value. The second equation defines aggregate demand as a function of the real exchange rate $(e_t - p_t)$ and the real interest rate $[i_t - ({}_tp_{t+1} - p_t)]$, with ${}_tp_{t+1}$ denoting current price expectations for next period. By equation 3 aggregate supply is constant at its steady state. Equation 4 defines the price adjustment process: prices are assumed to be set by agents so as to clear goods markets based on one period ahead expectations, and are therefore (temporarily) "rigid" in response to unexpected shocks.[1] Equation 5 illustrates the interest parity condition, with the coefficient β reflecting the degree of capital mobility (when $\beta=0$, markets are "segmented" by capital controls). The foreign interest rate is defined in equation 6 as the sum of a constant i^* (set for simplicity equal to zero) and a stochastic random term u_t, which represents a real disturbance of zero expected value.

[1] A similar price adjustment mechanism is used by Flood (1981).

2. Disinflation policies

Initially, the economy's nominal variables (*i.e.* money supply, price level and exchange rate) are all assumed to be varying at a constant rate μ. This situation has been prevailing for some time and is expected by market participants to continue $[{}_tp_{t+1} = (1 + \mu)p_t;\ {}_tm_{t+1} = (1 + \mu)m_t]$.

We consider two alternative strategies that the authorities can follow to reduce inflation (to zero). The first one consists in deciding (and announcing) at time t to bring money supply growth down to zero.

$$m_t = m_{t-1}$$

$$m_{t+1} = m_{t-1}\,(1 + \mu) \tag{7}$$

$$m_{t+j} = m_{t+1} \qquad \text{all } j > 1$$

The rate of growth of money supply is brought down to zero at time t and is kept equal to zero afterwards; in period t+1 an additional amount μm is supplied to maintain unchanged the real quantity of money demanded by the market agents and therefore avoid the need for a price level reduction at time t+1.

The second strategy consists in fixing at time t the exchange rate at its t−1 level, and adjusting afterwards, once and for all, for purchasing power parity.

$$e_t = e_{t-1}$$

$$e_{t+1} = e_{t-1}\,(1 + \mu) \tag{8}$$

$$e_{t+j} = e_{t+1} \qquad \text{all } j > 1$$

The exchange rate is adjusted at time t + 1 to eliminate the real appreciation that develops at time t; subsequently it is maintained constant at e_{t+1}.

The two alternative strategies would be announced at time t and are assumed to be credible. We also assume for the time being that there are no other shocks in the economy (v_t, $u_t = 0$). We can solve the model to obtain the adjustment path for the endogenous variables (e, i, y). The first strategy ("monetary targeting") leads to the following exchange and interest rate dynamics:

$$e_t = [1 + \mu - \lambda\mu/\beta]\ e_{t-1}$$

$$e_{t+1} = (1 + \mu)\ e_t \tag{9}$$

$$i_t = \lambda \mu m_{t-1}$$

(10)

$$i_{t+1} = 0$$

Aggregate demand expands as follows:

$$y_t = [\delta\lambda\mu/\beta - \sigma\lambda\mu] m_{t-1}$$

(11)

$$y_{t+1} = \bar{y} = 0$$

In the second strategy ("exchange rate targeting") the exchange rate is an exogenous variable while money supply becomes endogenous. The dynamics of adjustment are as follows:

$$i_t = \beta\mu m_{t-1}$$

(12)

$$i_{t+1} = 0$$

$$m_t = [1 + \mu(1 - \beta)/\lambda] m_{t-1}$$

(13)

$$m_{t+1} = (1 + \mu) m_{t-1}$$

Aggregate demand behaves as follows:

$$y_t = [\delta\mu + \sigma\beta\mu] m_{t-1}$$

(14)

$$y_{t+1} = \bar{y} = 0$$

Comparing the two equilibrium paths (Chart A.1), it can be seen that the steady state (at period t + 1) of all variables is the same in the two cases: this reflects the long-run neutrality property of the model.

During the transition to zero inflation (at time t) the (real and nominal) interest rate response to the two disinflation strategies depends on the size of the β and λ coefficients (*cf.* equations 10 and 12). The coefficient β, which represents the degree of capital mobility, can be reduced by capital controls: with β approaching zero, domestic interest rates only rise very little during the disinflation strategy based on exchange rate targeting; as a consequence, the output cost of disinflation is reduced. On the other hand, with high capital mobility exchange rate targeting becomes very costly in terms of interest rate change and output cost.

This simple model tends thus to suggest that an optimal strategy for disinflation is that of targeting the exchange rate and at the same time limit capital mobility. This intuitive result is in line with the previous literature on this subject, in particular Begg and Wyplosz (1987) and Bini Smaghi (1990).

3. The variability of exchange rates and interest rates with random disturbances

The model above can be used to examine the effects of alternative shocks, under a monetary or an exchange rate target rule, on the variability of the exchange and the interest rate. We assume for simplicity that the disinflation process has already occurred, and therefore $\mu = 0$.

The money supply process can be modeled as follows:

$$m_t = m_{t-1} + \alpha ({}_te_{t+1} - e_t)$$

(15)

where the parameter α represents the degree of flexibility allowed for the exchange rate around its steady state no-shock level. If α is zero the exchange rate is floating and free to move in response to exogenous disturbances; if α is infinite, the exchange rate is fixed (at its steady state level) and the money supply becomes endogenous.

By solving the system of equations 1-6 and 15 with the method of indetermined coefficients we obtain the following:

$$e_t = m_{t-1} + \lambda\pi v_t + \pi u_t$$

(16)

$$i_t = -\pi\beta\lambda v_t + \pi\lambda\alpha u_t$$

where $\pi = 1/(\lambda\alpha + \beta) > 0$.

This result has some interesting implications. For increasing values of α, the exchange rate is decreasingly affected by exogenous shocks (for $\alpha \to \infty, \pi \to 0$). What happens to the domestic interest rate then depends on the nature of the exogenous shocks; for rising values of α the domestic interest rate response to monetary shocks ($v_t > 0$) decreases, while it increases in the presence of real (u_t) shocks.

We can calculate the exchange rate and the interest rate reaction to these shocks:

$$de = \pi^2[\lambda^2(dv)^2 + (du)^2]$$

(17)

$$di = (\pi\lambda)^2 [-\beta^2(dv)^2 + \alpha^2(du)^2]$$

By differentiating (de) and (di) with respect to α, we obtain

$$\partial (de) / \partial \alpha = \pi^3 [-2\lambda(dv)^2 - (du)^2]$$

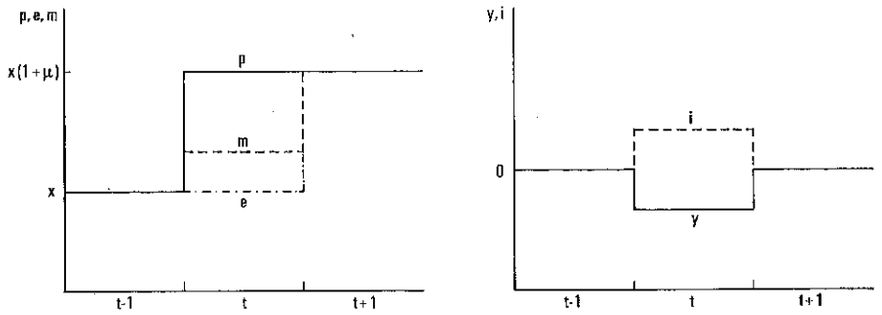
(18)

$$\partial (di) / \partial \alpha = \pi^3 [-\beta^2\lambda^2(dv)^2 + \beta(du)^2]$$

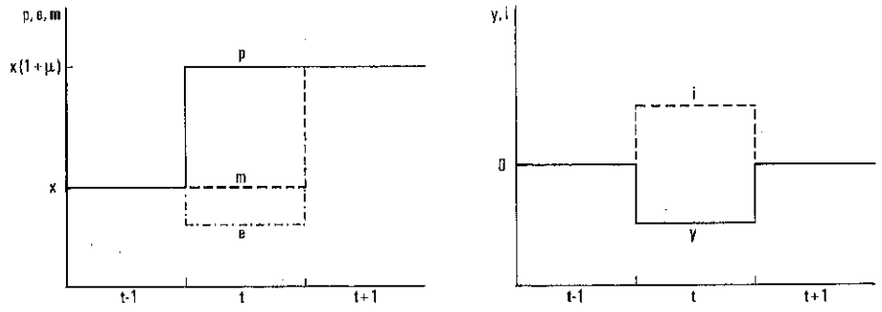
CHART A.1

ADJUSTMENT PATHS UNDER ALTERNATIVE STRATEGIES

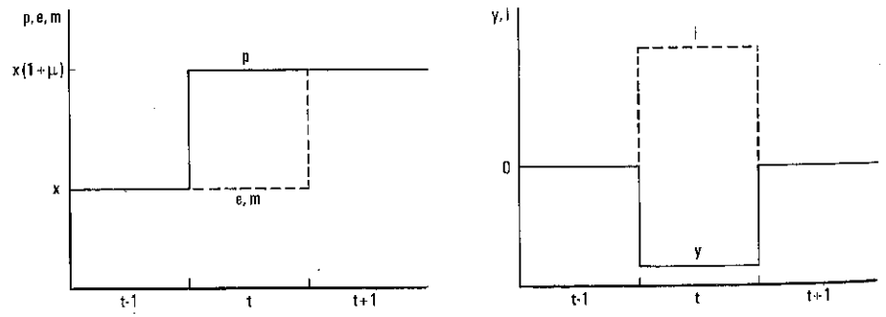
1. Monetary targeting



2. Exchange rate targeting (low capital mobility)



3. Exchange rate targeting (high capital mobility)



It can be seen that as α increases in the presence of monetary shocks we observe a reduction in the variability of both the exchange and the interest rate; in the presence of real shocks, instead, as α rises the decrease in exchange rate variability is associated with an increase in interest rate variability. The obvious implication is that capital controls can be used to limit the "transfer" of shocks from the foreign exchange to the domestic money market when real shocks prevail: from equation 18 it can be seen that as β goes to zero the sensitivity of the exchange rate variability to an increase in α also goes to zero. What is less obvious is that when pure monetary shocks are likely to prevail, increasing "rigidity" in exchange rate pegging will also help reduce the variability of interest rates: in equation 18 the impacts of dv^2 on (de) and (di) have the same sign.

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