Monetary Discipline, Germany, and the European Monetary System*

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I. Modelling the European Monetary System

There have been a number of efforts to model the European Monetary System (EMS). The first notable ones, by *Marston* (1980, 1982), treated the system as aiming at optimal stabilization in a stochastic environment.[1] This raises issues of "fine tuning" that do not seem to do fully justice to the macroeconomic problems that the system was intended to treat. To many observers, the EMS had wider ambitions than handling issues of undesired noise in the turbulent environment of the late 1970s where it got started.

More recently, the strategic approach to the EMS has gained ground. According to this alternative interpretation, the system permits member countries to deal better with the management of the return to equilibrium following some big economic shocks. By agreeing upon an exchange rate, the members can avoid inefficiencies arising from common efforts to depreciate or appreciate, and thereby get closer to cooperative outcomes.[2] Some of the interest of this view still goes unappreciated. For example, critics often focus on the persistence of differences in inflation rates among the members of the EMS and the recurrence of realignments.[3] But the cooperative gains of the EMS do not depend on any change in exchange rates inside and outside the system from one realignment to the next. Even if countries continue to

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[1] See also the more recent work by *Richard Marston* (1985), (1986).

[2] For direct applications to the EMS, see *Melitz* (1985), (1988), and *Gilles Oudiz* (1985a), (1985b). The basic early work, following seminal papers by *Jurg Niehans* (1968) and *Koichi Hamada* (1974), (1976), (1979), is *Matthew Canzoneri* and *Joanna Gray* (1983). See also *Richard Cooper* (1985), *Jeffrey Sachs* (1983), *Oudiz* and *Sachs* (1984), and *Charles Bean* (1985). For a critical view, see *Roland Vaubel* (1985a).

[3] See, for example, *Paul de Grauwe* (1985) and *Samuel Brittain,* Financial Times, March 24, 1983.

get the same inflation rates in the system, using occasional realignments to adjust to differentials in their inflation rates, they will do so at a lower cost in terms in output, according to the argument. The realignments are simply to be interpreted as the mechanism assuring that whenever a situation arises where a member country would otherwise cease to benefit from the system, an adjustment will take place.[4]

Nonetheless, the cooperative view of the EMS faces two major empirical obstacles. The first is the difficulty of explaining the dominant position of Germany. This country is not exceptionally large relative to the next biggest in the EMS, and it is not easy to explain its position on the basis of any particular structural characteristics, at least in the context of game-theoretical analysis.[5] The tendency has been to skip over this problem, treat the EMS as a two-country game with identical members, and leave it understood, if not explicit, that the country with the monetary instrument can be regarded as Germany, thereby at least recognizing the special reserve-currency status of the country.[6] But this can lead to paradoxical results. For example, as soon as a shock affecting both players in the game enters, the allocation of the instruments between them can make a difference. But if the two are really identical, the difference is difficult to comprehend. The problem comes out clearly in *Giavazzi* and *Giovannini* (1984), who show, with particular reference to the EMS, that in the case of an oil shock affecting the two identical players identically, the one with control over the exchange rate can take advantage of its twin who controls the stock of money. But rather than conclude that the latter would never go along with the arrangement, they conclude that the EMS is indeed a disadvantage to Germany.[7]

If the reserve-currency role of Germany demands care in presentation, a *Stackelberg*-leadership interpretation of the German situation would require even more preparation. As a Stackelberg leader with reserve-cur-

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[4] There is also evidence that the EMS has served to reduce the variability of nominal exchange rates. See the European Commission (1982), *Horst Ungerer, O. Evans,* and *P. Nyberg* (1983), *Tommaso Padoa-Schioppa* (1984), *Kenneth Rogoff* (1985c), *Francesco Giavazzi* and *Alberto Giovannini* (1986a), and *Ungerer, Evans, T. Mayer,* and *P. Young* (1986). *Daniel Laskar* (1986) has developed an argument for cooperative gains of the EMS depending entirely on this reduction in the variability of exchange rates.

[5] See, however, *Barry Eichengreen* (1986), to which we will return in note 8.

[6] See, for example, *Marston* (1980), (1982), and *Giavazzi* and *Giovannini* (1984) and compare *Canzoneri* and *Dale Henderson* (1985). Of course, the sharing of monetary control by the two countries raises special issues. These have been treated in *Melitz* (1985), (1988).

[7] This is clearest in *Giavazzi* and *Giovannini* (1986a), pages 472 - 74. See also Giavazzi and Giovannini (1986b).

rency status, Germany moves first, and does so in anticipation of the responses of the other member(s). This interpretation is therefore inconsistent with the view that Germany behaves independently of the others (a form of benign neglect). More significantly, and also contrary to the preceding view of *Giavazzi* and *Giovannini,* this interpretation puts the non-German members at a grave disadvantage, since in practice they do not even retain control over their exchange rate.[8] Germany is very much a party to the exchange rate agreements at the time of realignments. Why are the others so weak, and what advantage do they get from the system notwithstanding?

In addition to the difficulty of explaining the prominent status of Germany, the other basic problem with the cooperative view of the EMS relates to the anti-inflationary tendency of the system in the 1980's. An anti-inflationary stance prevailed throughout most of the Western world during the period. This might suggest that the members would have disinflated as much had they been outside the system. But the evidence goes the other way. Since 1972, the pressure in the fixed-rate arrangements that have existed in continental Europe has always been on the weak-currency countries to adjust. Under the earlier "snake", members in difficulty often moved out of the system, and any disinflationary effect therefore can be easily discounted, if not dismissed. But there have been no similar exits from the EMS, and realignments have provided the countries with the weaker currencies incomplete relief, as the adjustments in exchange rates have failed to offset the excess in their inflation rates.[9] Hence the pressure on the weaker currencies has been felt. More specific evidence is available too. The French decision to stay in the EMS in the summer of 1981 was instrumental in the reversal of the expansionary fiscal policy of the Socialist government of *Mitterrand.* Italian membership in the EMS has strengthened the Bank of Italy's hand in dealing with political pressures to inflate at home. In the British

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[8] In a closely related study dealing with the leadership position of England in setting short-term interest rates in the pre-World War I period, *Eichengreen* (1986) shows that this special English position can be explained, despite the fact that the country was not particularly larger than several others. The explanation lies in certain elasticity conditions. The fundamental condition is a less elastic demand for English money, exclusive of demand by foreign central banks, than the comparable demand for the other countries' monies. In any similar approach to the EMS, a basic difference, however, would be that the non-German members do not retain complete control over the exchange rate, whereas in the pre-World War I period, the other major countries, outside of England, did retain complete control over the analogous instrument at the time, namely, these countries' central bank lending rate.

[9] This is mostly so for the Italians and the Irish, but to some degree since 1983, also for the French. See *Ungerer* et al. (1986), tables 11 and 13.

parliamentary debates about entry into the EMS since 1983, the view that entry would hook the country to tighter monetary policy has been a steady feature.[10] Hence the indications of the disinflationary tendency of the system are impressive.

Unfortunately, the strategic interpretation of the EMS has a great deal of difficulty in coming to terms with this tendency. If we assume that Italy and France followed an anti-inflationary course by choice in recent years, the game-theoretical interpretation would say that had the two been outside the system, they would have gone further in this direction, since they would then have been prodded by the resistance of the others to their effort to appreciate their currency. On this view, therefore, the EMS calmed the French and Italian proclivity to disinflate. In other words, if either France or Italy had moved out of the system, the result would have been more disinflation by this country. But it looks very much the opposite as if such an exit by either one would have been associated with easier monetary policy.[11]

There is indeed a way, however, of making sense of German leadership in the EMS that would explain the disinflationary influence of the system. This is the hypothesis that the other countries really want the restrictive German monetary policy for themselves, but have no better way to get it. Recent advances in macroeconomic analysis, largely forged by *Barro* and *Gordon* (1983a, 1983b), following seminal work by *Kydland* and *Prescott* (1977), now render this hypothesis fully tractable. In this paper, I would like to explore this hypothesis. The conclusion will be that it is only partial, like the rest, and in addition, not altogether reliable. It is partial because the hypothesis fails to explain the advantage of the EMS for the Germans. It is not altogether reliable because the monetary discipline only follows under stringent conditions that limit the benefits. For the argument to make sense, new political costs of exceeding the German inflation rate must occur inside the system. Such costs can be easily admitted. But some of the them, in fact, really make matters worse, and there are basic economic considerations

[10] See the House of Lords Select Committee (1983); and the House of Commons Treasury and Civil Service Committee (1985).

[11] There is a way of avoiding this conclusion in our discussion, but it does not fit. This would be to suppose a positive supply shock in Europe that raised output above target levels during the period. In this case, France and Italy would have wished to contract in order to limit output, and would have regarded the disinflationary consequences of this action as unfortunate repercussions. Therefore, the EMS would have allowed both countries to go further in a contractionary direction by eliminating their fear of currency appreciation. An exit from the system by either one in these circumstances would indeed have been associated with expansionary monetary policy. I need hardly insist on the inapplicability of this example.

working the opposite way. Consequently, even if the required conditions are met, the long run advantage of the EMS to the non-German members based on this sort of argument can be questioned. In any event, the inflation-prone members would be well-advised to find cheaper, more reliable means of getting responsible monetary policy. Some aspect of international cooperation therefore may still be necessary in order to provide a permanent basis for the EMS.

Section two will introduce the basic framework for analyzing the monetary discipline of the Germans and the lack of it of the others. Section three will then develop the conditions for the EMS to yield benefits outside of Germany based on German monetary behavior. The policy analysis will proceed in terms of discrete time, and it will turn out to be important whether realignments take place every period or less often. Less frequent realignments hamper monetary discipline. By enabling a country to inflate without bearing any depreciation of the currency, even temporarily, the realignments only aggravate such inflationary tendencies as may exist. We will conclude, in Section four, with a general assessment of the "monetary discipline" hypothesis.

II. Monetary Discipline Outside the EMS

Monetary discipline will be taken to concern the ability to resist the temptation to inflate in order to raise output. Surprise inflation will raise output if nominal wages are fixed over a contract period. In addition, normal output may be below optimum because of market imperfections, like governmental interferences with laying off or firing labor or payroll taxes. Thus, a well-meaning government may be tempted to inflate by suprise. Still, to resist the temptation is better, and therefore a matter of discipline, because the private sector will adjust its expectations to any such temptation as may exist, and the result will thus be positive inflation without any corresponding benefit.

To apply these ideas to the EMS means putting the problem in an international setting. Let there be two countries producing a separate good, consuming both of them, but each with a preference for its own good in consumption. We shall use asterisks to denote the foreign country, "Germany," and regard the home one as "France." The equations are:

2.1 $$\begin{cases} y = c\,(p - p_e) + \bar{y} \\ y^* = c\,(p^* - p_e{}^*) + \bar{y}^* \end{cases}$$

2.2
$$\begin{cases} i = \psi p + (1-\psi)(p^* + e) = p + (1-\psi)\, q \\ i^* = \psi p^* + (1-\psi)(p - e) = p^* - (1-\psi)\, q \end{cases} \qquad 0.5 < \psi < 1$$

2.3
$$q = p^* + e - p = 0$$

2.4
$$L = \sum_{j=0}^{\alpha} \left(\frac{1}{1+\delta}\right)^j \{(y - k\bar{y})^2 + ai^2\}$$

$$L^* = \sum_{j=0}^{\alpha} \left(\frac{1}{1+\delta^*}\right)^j \{(y^* - k\bar{y}^*)^2 + ai^{*2}\}$$

$$0 < \delta^* \ll \delta \qquad k > 1$$

Equation (2.1) is the ordinary *Phillips* curve in "news" form. p is the growth rate of the price of the home-produced good and P_e its expected value. Surprise inflation thus raises output, presumably because of rigidity in nominal wages. $\bar{y}$ is the logarithm of normal output. Equation (2.2) defines the inflation rate, or the growth rate of the cost-of-living index. q is the rate of change of the commodity terms of trade. Hence e is the rate of appreciation of the mark relative to the franc. Equation (2.3) expresses purchasing power parity. From (2.3) and (2.2) combined, we infer:

2.5
$$\begin{cases} i = p \\ i^* = p^* \end{cases}$$

Equation (2.4), which defines the utility losses resulting from deviations from optimal levels, is critical. $k\bar{y}$ is the optimal output, where k therefore is greater than one. Any inflation or deflation reduces welfare. The target values $k\bar{y}$ and $i = 0$, and the weight attached to inflation, a, reflect the preferences of everybody, government and private individuals alike. There is only one difference between France and Germany. It relates to the rate of discount of the (infinite) future. δ^* is the private rate of discount of the future in both countries, which is also the socially optimal discount rate. But whereas the German monetary authorities actually use this rate in setting their monetary instrument, the French authorities do not, but use instead the much higher rate δ. This essential difference in the two countries may be motivated by assuming total monetary independence in Germany but not in France. We shall assume that in France the money stock is in the hands of elected officials with short terms of office. As a result, the authorities discount the future very heavily. Influence over p results from monetary control, but we shall also simplify by supposing that both countries control p directly.

Based on the previous reasoning, the optimal setting of p will correspond exactly to private preferences in Germany, but not in France. Later in this section we will introduce the right parametric restrictions so that the German solution is the best possible one under any conceivable social arrangement short of removing the market distortions underlying equation (2.1), whereas the French solution corresponds to short-run optimization. This will make the difference as clear as it can be: Germany will have all the monetary discipline either country could wish while France will have essentially none of it.

1. *The Rudimentary Results*

It is useful to begin by considering the best constitutional rule either country would introduce if it wanted to tie the hands of its monetary authorities. This rule obtains by minimizing L with respect to p under the restriction $p = p_e$. It thus yields $p = 0$, and $i = 0$ as well. As long as the authorities exercise discretion, however, they will minimize L with respect to p *given* p_e. This will yield the different result:

2.6
$$p_d = \frac{c\,[(k-1)\,\bar{y} + cp_e]}{a + c^2} = i_d$$

where the subscript d stands for "discretionary." Based on equation (2.6), p_d is positive even for p_e equal zero and grows with p_e. In case p_e is zero, the equation reduces to

2.7
$$p_d\,(p_e = 0) = \frac{c\,(k-1)\,\bar{y}}{a + c^2} = i_d\,(i_e = 0)\,.$$

Since equation (2.6) governs discretionary behavior, the private sector might very well set p_e accordingly. In this case we get

2.8
$$p_d\,(p_e = p_d) = \frac{c\,(k-1)\,\bar{y}}{a} = i_d\,(i_e = i_d)\,.$$

The welfare consequences of these various price assumptions are brought together in Table 1, where we ignore the obvious extension to the future and treat L only in the present.

Table 1

2. 9	$p = p_r$	$L_r = (k-1)^2\ \bar{y}^2 + ap_r^2$
2.10	$p = p_r\ (p_r = 0)$	$L_{ro} = (k-1)^2\ \bar{y}^2$
2.11	$p = p_d$	$L_d = \dfrac{a\,[(k-1)\,\bar{y} + cp_e]^2}{a + c^2}$
2.12	$p = p_d\ (p_e = 0)$	$L_{do} = \dfrac{a\,(k-1)^2\,\bar{y}^2}{a + c^2}$
2.13	$p = p_d\ (p_e = p_d)$	$L_{dd} = \dfrac{a + c^2}{a}\ (k-1)^2\,\bar{y}^2$

The first equation in the table, (2.9), shows the utility-loss L issuing from a constitutional price rule, p_r, where p_r can be zero, positive or negative. Equation (2.10) gives this loss for $p_r = 0$, the best constitutional rule. Correspondingly, equation (2.11) shows the utility-loss under discretion for any expected value of p, while equations (2.12) and (2.13) give p_d for two specific values of p_e, zero and p_d, respectively.[12] Results now familiar to readers of *Barro* and *Gordon* (1983b) (and neatly summarized in *Fischer* (1986)) follow. If people expect zero inflation, the discretionary rate of inflation yields bet-

[12] The steps in solving for equation (2.11), which is more difficult to calculate than the others in Table 1, are as follows. We wish to find

$$L_d = (y - k\bar{y})^2 + ai^2 = \left\{c\,(p - p_e) + (1-k)\,\bar{y}\right\}^2 + ap^2$$

given

$$p = \frac{c\,(p - p_e) + (1-k)\,\bar{y}}{a + c^2}$$

The first-order condition, $\partial L_d / \partial p = 0$, yields

$$2c\left\{c\,(p - p_e) + (1-k)\,\bar{y}\right\} + 2ap = 0$$

or equivalently (from (2.1))

$$2c\,(y - k\bar{y}) + 2ap = 0$$

and therefore

$$y - k\bar{y} = -\frac{a}{c}\,p$$

Substituting $-(a/c)\,p$ for $y - k\bar{y}$ in the previous expression for L_d, $(y - k\bar{y})^2 + ai^2$, we get

$$L_d = \left(\frac{a^2}{c^2} + a\right)p^2 = a\left(\frac{a + c^2}{c^2}\right)p^2$$

Further substituting equation (2.6) for p in this expression, we immediately obtain equation (2.11).

ter results than the best constitutional rule ($L_{do} < L_{ro}$). But if they expect the rate of inflation consistent with optimizing discretionary behavior, the outcome will be inferior to the best constitutional rule ($L_{dd} > L_{ro}$). It is easy to understand these conclusions since in the absence of any surprises, the best value of p is zero, while for any $p_e < p_d$, some surprise inflation is necessarily advantageous, most so (over the range $p_e \geqslant 0$) when $p_e = 0$. I will use the term inflation to cover both p and i in this discussion even though we are in an open economy, as would not be possible if p did not equal i, that is, without purchasing power parity.

2. *Further Results*

So far there is no basis for any result under discretion except $p = p_{dd}$ and $L = L_{dd}$ – the discretionary outcome given $p_e = p_d$ – either in France or Germany. This can only change if we allow the authorities to affect popular expectations through promises. Then there arises a whole new set of issues of adherence or nonadherence to promises, involving honesty, deceit, credibility, and reputation. Correspondingly a whole new set of equilibria crops up.

In order to proceed with possible promises, as reasonable, and yet keep things as simple as we can, we shall repeat the same rudimentary assumptions that *Barro* and *Gordon* (1983b) borrow from *James Friedman* (1971). If the authorities promise a price rule, p_r, the private sector will be supposed to respond as follows. Should the authorities have behaved as expected in the preceding period, and should they be promising enforceable actions (to be explained), people will believe them. Thus $p_e = p_r$. Otherwise, people will take no notice of what the authorities say, but simply expect the short-run discretionary outcome, and $p_e = p_d$. This means that only enforceable promises are ever believed. These are promises implying a present value of future losses from cheating (because of the rise in p_e to p_d resulting from cheating) that are equal or greater than the current gains from cheating. The only meaning of a "precommitment" under discretion in this context, it should be noted, is an "enforceable promise" or a "credible promise," which are better terms.

The assumptions have two nice consequences. First, they enable us to analyse the indefinite future by viewing the situation only for the next two periods, including the present, since conditions will forever repeat themselves thereafter. This situation stems from the accelerated operation of a Hindu law of karma: every false action carries its own punishment but also its own pardon the second period afterwards. Evidently, the total loss of credibility coming from a lie biases the results in favor of veracity. But the automatic restoration of it one period later has the opposite bias in favor of mendacity. The net bias of the assumptions one way or the other is an open issue.[13]

The second desirable consequence of these assumptions is that they necessarily yield some enforceable price rule below p_{dd} (or the value of p_d for $p_e = p_d$), which must be preferable to p_{dd} since it will deliver the same output at a lower rate of inflation. As a result, the assumptions are bound to yield a "reputational" equilibrium. This will be at the point of the lowest non-negative enforceable price rule.

To find the equilibrium and thereby prove the assertion, we must first define the gain from cheating – or the temptation to cheat – for any particular promise, p_r. This gain will be the difference between the loss if the authorities keep their word, L_r, and the loss if they break it, $L_d\,(p_e = p_r)$:

2.14 $$L_r - L_d\,(p_e = p_r) = (k-1)^2\bar{y}^2 + ap_r^2 - \frac{a\,[(k-1)\,\bar{y} + cp_e]^2}{a + c^2} = \frac{[c\,(k-1)\,\bar{y} - ap_r]^2}{a + c^2}$$

We must also define the future loss from cheating coming from the shift of p_e from p_r to p_d, which will be:

2.15 $$L_{dd} - L_r = \frac{a + c^2}{a}\,(k-1)^2\,\bar{y}^2 - (k-1)^2\,\bar{y}^2 - ap_r^2$$

of which the present value (after collecting the $\bar{y}$ terms) will be

2.16 $$\frac{1}{1+\delta}\,(L_{dd} - L_r) = \frac{1}{1+\delta}\left[\frac{c^2\,(k-1)^2\,\bar{y}^2 - a^2p_r^2}{a}\right]$$

Any p_r yielding (2.16) > (2.14) is enforceable (by definition). The lowest (non-negative) enforceable p_r is the best one. To find the best one, equate (2.16) and (2.14) and solve for p_r. Equating the two yields:

2.17 $$(a\delta - c^2)c^2(1-k)^2\bar{y}^2 + [a(2+\delta) + c^2]a^2\,p_r^2 - 2(1+\delta)ca^2(k-1)\bar{y}p_r = 0\,.$$

The application of the quadratic formula provides both solutions for p_r to this second-order equation:

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13 Compare *Rogoff* (1987).

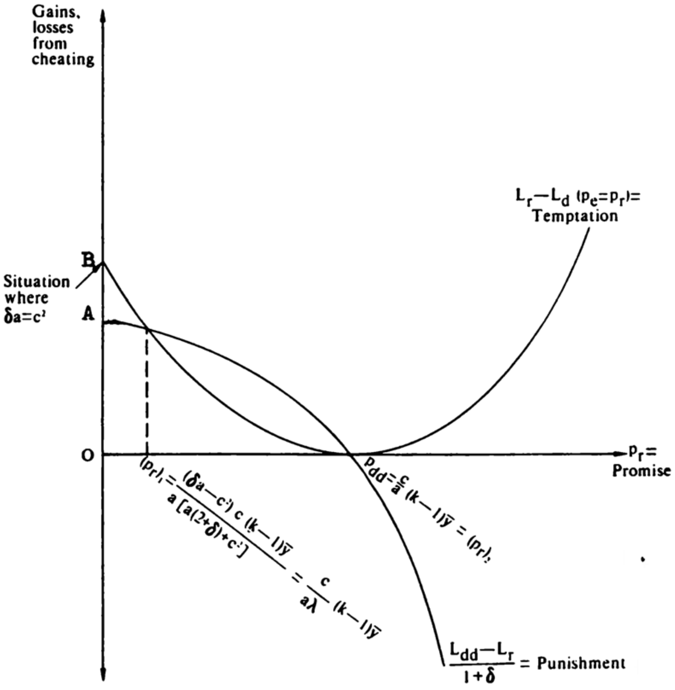
2.18 $$(p_r)_1 = \frac{(\delta a - c^2)\, c\,(k-1)\,\bar{y}}{a\,[a\,(2+\delta) + c^2]} = \frac{c\,(k-1)\,\bar{y}}{a\lambda}$$

$$\frac{1}{\lambda} = \frac{\delta a - c^2}{\delta a + 2a + c^2} < 1$$

and

2.19 $$(p_r)_2 = \frac{c}{a}\,(k-1)\,\bar{y} = p_{dd}$$

FIGURE I



$(p_r)_1$ to $(p_r)_2$: the range of enforceable promises.

Fig. 1, which is familiar to readers of *Barro-Gordon,* graphs the basic results. The temptation and the cost of cheating are obviously the same at $p_r = p_{dd}$ since there can be no temptation to cheat and no cost of cheating at this point regardless of the discount rate δ. At lower p_r values, there is necessarily a temptation to cheat and also a cost of cheating, whereas for higher p_r values, the promises of p_r are non-enforceable since they must yield a temptation to cheat through surprise deflation, while this temptation will only be reinforced in the future through the return of p_e to p_d. Both the U-shape of the temptation to cheat and the opposite curvature of the cost of cheating follow (it can be verified that the second derivative of (2.16) with respect to p_r is negative). Therefore either the two curves meet at some non-negative p_r below $[p_r]_2$, as in the illustration (involving an arbitrary δ) or the punishment curve stays above the temptation curve throughout the relevant range of non-negative p_r values. From the mathematics (see equation (2.18)), this depends on $c^2 > a\,\delta$ or $c^2 < a\,\delta$. In case $c^2 > a\,\delta$ and the curves do not meet, the lowest enforceable price rule is $p_r = 0$. This is then the reputational equilibrium.

The possibility of a reputational equilibrium at a zero rate of inflation may surprise readers of *Barro-Gordon,* since the latter obtain a reputational equilibrium at zero inflation only for $\delta = 0$, or when there is no discount of the future at all. But this result of theirs hinges entirely on their use of the utility function

$$L = k\bar{y} - y + ai^2$$

implying increasing penalisation of marginal deviations from the inflation target but not the output one, rather than the more symmetric form

$$(y - k\bar{y})^2 + ai^2$$

3. *Conclusion*

We can now easily make sense of the difference between France and Germany. Let us assume $\delta^* a \leqslant c^2$. Consequently, the rule $p^* = i^* = 0$ is perfectly enforceable if it is announced by the German Bundesbank. Hence it is a reputational equilibrium for Germany. In France, however, where $\delta \gg \delta^*$, the matter is different. Still, even for France, unless δ is quite high, the reputational equilibrium may be close to zero inflation, and in this case, any benefit of the EMS through lower inflation will be correspondingly small. Thus, in order to provide for a firm French advantage of monetary discipline in the EMS, we will assume δ sufficiently high to bring $(p_r)_1$ close to $(p_r)_2$ – so close that, for all practical purposes, France is stuck to the short-run discretionary solution, p_{dd}. This simplifying assumption will affect the quantitative but not the qualitative results. The French reputational solution at $(p_r)_1$ implies:

$$L = \frac{a\lambda^2 + c^2}{a\lambda^2} (k - 1)^2 \bar{y}^2$$

rather than

$$L_{dd} = \frac{a + c^2}{a} (k - 1)^2 \bar{y}^2$$

Consequently, if only we substitute $a\lambda$ for a in our various expressions for p (see and compare equations (2.18) and (2.19)) in the rest of the discussion (thereby referring to $[p_r]_1$ instead of p_{dd} outside the EMS), everything else will follow. I am assuming λ very close to one, but any French reputational solution with p positive would do as well.

III. Monetary Discipline Inside the EMS

In the case of the EMS, the exchange rate behaves differently. It stays constant until a realignment and then jumps. Each realignment, we will suppose, brings back the terms of trade to the same initial position. If so, then if realignments take place every period, and if the authorities consider every period as lasting from one realignment until the moment after the next one, nothing really changes in the analysis. That is, nothing changes unless we provide for it; but we will. If realignments take place less frequently, then something does change independently, since the equality of p and i will be upset. We will proceed by dealing first with the case of a realignment every period and next that of a less frequent realignment. In the latter case, we will assume a realignment every other period.

1. Realignments Every Period

There is a lot of reason to think that even if realignments take place every period, things will differ inside the EMS. Basically, the system gives rise to special costs of doing more inflation than one's neighbors. One source of these costs is the burden of keeping the exchange rate fixed despite the induced capital outflows. These costs may take the form of capital controls, official reserve losses, or the compromise of another policy instrument besides p, like fiscal policy, in order to keep a higher interest rate. The simplest factor to admit would be capital controls. A second source of the costs is the political unpopularity of devaluations. Voters tend to regard devaluations as a failure on the part of their political leaders. Devaluations cost votes.

Suppose we model these costs as follows:

3.1
$$C_1 = \alpha_o + \alpha_1 \, (i - i^*)$$
$$\alpha_o, \ \alpha_1 \ \begin{cases} = 0 \text{ if } i \leqslant i^* \\ > 0 \text{ if } i > i^* \end{cases}$$

This formulation says the costs of the EMS are borne entirely by the high-inflation country. The hypothesis also posits some fixed costs and some variable ones. The distinction between the two types of costs is vital, since the solution will differ depending upon the magnitude of the fixed costs. If they are high enough, the EMS will enjoy complete success. The system will spur the same rate of inflation in France as in Germany at no extra cost. If the fixed costs are not high enough, the success of the EMS will be partial. Inflation will go down – to an extent depending on the variable costs – and there will be a price to pay. The experience of the EMS, of course, would argue in favor of the latter solution. Inflation differentials have narrowed without disappearing. Regular realignments have become a part of the system. Nevertheless both possibilities are important from an analytical point of view. Even though the high-fixed-cost one seems inoperative, this one may best reflect the hopes of the system.

The reason for the no-inflation solution if the fixed costs are high enough lies in a certain discontinuity in the cost function C_1, which says that if inflation goes down all the way to the German level, there are no political costs of membership in the EMS at all – not even any fixed ones. Examples of fixed costs would be the installation and/or maintenance of capital controls, and the lost votes resulting from any devaluation, no matter how small.

Let us start the analysis with the positive solution for p_{ems}, or the one where the fixed costs are too small to lead to zero inflation. In this case, the loss function says:

3.2
$$L = \sum_{j=0}^{a} \left(\frac{1}{1 + \delta} \right)^j \{ (y - k\bar{y})^2 + ai^2 + C_1 \}$$

Since realignments are supposed to take place every period, p and i are identical, and except for C_1 everything else is the same. After substituting equation (3.1) for C_1 in (3.2), the solution for p is:

3.3
$$p_{\text{ems}} \, (= i_{\text{ems}}) = \frac{2c\,(k-1)\,\bar{y} - \alpha_1}{2a} = p_{dd} - \frac{\alpha_1}{2a}$$

In order to bring out the fact that this equation holds only for positive p_{ems} values (since for $p_{ems} \leqslant 0$, $\alpha_1 = 0$ and the formula is wrong), let us redefine α_1 as:

3.4 $$\alpha_1 = 2\eta c (k-1) \bar{y} \qquad 0 < \eta < 1$$

and then write

3.5 $$p_{ems} (= i_{ems}) = \frac{(1-\eta) c (k-1) \bar{y}}{a} \qquad 0 < \eta < 1$$

It emerges immediately from equation (3.5), not only that p_{ems} is positive, but also that any extra monetary discipline must stem from η, or the variable-cost coefficient α_1. The fixed-cost coefficient α_o does not even come in.

If this p_{ems} solution is to be acceptable, however, it must also be true that $L_{ems} < L_{dd}$. To check for this condition, we must solve for L_{ems} (using 3.2) based on (3.5). Ignoring the obvious extension into the future (and using 2.1, 2.2, and 2.3 as before), we get:

3.6 $$L_{ems} = \frac{a + c^2 (1-\eta^2)}{a} (k-1)^2 \bar{y}^2 + \alpha_o$$

$$= L_{dd} - \frac{\eta^2 c^2}{a} (k-1)^2 \bar{y}^2 + \alpha_o$$

Thus, it follows that this EMS solution will only yield a utility advantage if

3.7 $$\frac{\eta^2 c^2}{a} (k-1)^2 \bar{y}^2 > \alpha_o \ .$$

Evidently the fixed costs, α_o, not only fail to contribute anything to monetary discipline, but even prove to be a hurdle for the EMS to overcome if the system is to stand and the disciplinary effect therefore is to result.

If people expected the previous p_{ems} solution, however, would the French authorities have the right incentives to deliver it, when by setting $p_{ems} = 0$, they would eliminate C_1 entirely, though admittedly thereby also hurting output through surprise deflation? To answer this question, we must consider the welfare level the authorities would attain by setting $p_{ems} = 0$ when the expected p_{ems} was given by equation (3.5). This welfare level is:

3.8 $$L = \{-cp_e + (1-k)\bar{y}\}^2$$

where the negative cp_e term signifies the output loss from the lower-than-expected level of inflation. After substituting (3.5) for p_e in this equation and analysing the expression, we find

$$3.9 \qquad L_{ems} = (k-1)^2 \bar{y}^2 + \{c^2 (1-\eta) + 2a\} \frac{(1-\eta)\, c^2 (k-1)^2 \bar{y}^2}{a^2}$$

The value of L in (3.9) must then be below the L_{ems} of equation (3.6) for there to be a temptation to set inflation at zero. In other words, we must have, as the calculation shows:

$$3.10 \qquad \alpha_o > \frac{a + c^2}{a^2} (1-\eta)^2 c^2 (k-1)^2 \bar{y}^2$$

If this next condition fails, while condition (3.7) holds, the previous p_{ems} solution holds. Once again, fixed costs, α_o, must be low enough.

To complete the analysis, we would also need to consider the possibility of the $p_{ems} = 0$ solution based on high enough fixed costs. It turns out that the absence of an incentive to inflate if people expect $p_{ems} = 0$ depends not on condition (3.10), but:[14]

$$3.11 \qquad \alpha_o > \frac{c^2 (1-\eta)^2}{a + c^2} (k-1)^2 \bar{y}^2$$

If condition (3.11) is rejected, so must condition (3.10) be, or otherwise we would have

$$3.12 \qquad \frac{c^2}{a + c^2} (1-\eta)^2 (k-1)^2 \bar{y}^2 > \frac{a + c^2}{a^2} (1-\eta)^2 c^2 (k-1)^2 \bar{y}^2$$

$$\text{or} \quad a^2 > (a + c^2)^2$$

[14] If people expect $p_{ems} = 0$, then the temptation to cheat obtains by calculating the maximum attainable welfare by minimising L_{ems} with respect to p when

$$(3.11\,a) \qquad L_{ems} = \{cp + (1-k)\,\bar{y}\}^2 + ap^2 + \alpha_o + \alpha_1 p$$

The solution value for p is:

$$(3.11\,b) \qquad p_{ems} = \frac{(1-\eta)\, c\, (k-1)\, \bar{y}}{a + c^2}$$

After substituting this value for p in (3.11 a), using (3.4) to eliminate α_1, and a tedious collection of terms, we obtain:

$$(3.11\,c) \qquad L_{ems} = \frac{a + (2-\eta)\, \eta c^2}{a + c^2} (k-1)^2 \bar{y}^2 + \alpha_o$$

Once we substract (3.11 c) from $L_{ems} = (k-1)^2 \bar{y}^2$, or the level of L_{ems} with $p_{ems} = p_e = 0$, we obtain the temptation to cheat, which is then positive when (3.11) in the text holds.

which cannot be. Hence, in case (3.11) is rejected, the positive p_{ems} solution holds. On the other hand, if condition (3.11) is accepted, condition (3.10) may still be rejected. The acceptance of (3.11) would mean that if people expected $p_{\text{ems}} = 0$, their expectations would be confirmed, while the rejection of (3.10) would mean that if they expected the positive p_{ems} solution, their expectations would again be confirmed. In a situation of this sort, the authorities would have every incentive to promise the better alternative, $p_{\text{ems}} = 0$, and the private sector would have every reason to believe the official promise. Hence, there is no genuine problem. It does follow, nonetheless, that condition (3.11) dominates condition (3.10). Thus, the combined rejection of (3.11) and acceptance of (3.7) is what we need for the positive p_{ems} solution to hold.

There is still, however, the issue of a possible incentive to make a surprise exit from the EMS. For any p below p_{dd}, we know that outside the system there would be an incentive to cheat. But this automatically means that in case of either of the previous p_{ems} solutions there must be an incentive to move out unless there are special costs of doing so. Such costs, C_2, make sense, since any surprise move out of the system would be highly conspicuous, and the voters would presumably interpret it as breaking an international engagement. But the costs C_2 must also be high enough.

To analyse the minimal size of C_2 in the case of $p_{\text{ems}} = 0$, it is obvious that these costs must be higher than the difference between L_{ro} in equation (2.10) and L_{do} in equation (2.12) of Table 1. Thus we have, as an extra condition for $p_{\text{ems}} = 0$, besides the satisfaction of (3.11):

3.13 $$C_2 > \frac{c^2}{a + c^2} (k - 1)^2 \bar{y}^2$$

In terms of Figure 1, this means that C_2 must be greater than the distance AB. In the case of the other p_{ems} solution, which interests us principally, the minimal size of C_2 obtains by calculating the difference between the welfare losses inside the EMS, or given L_{ems} of equation (3.6), with the minimised level of L outside the EMS on a current basis in case people expect the p of equation (3.5) (depending on equation (2.11)). Accordingly, we must find

$$C_2 > L_{\text{ems}} - L_d (p_e = p_{\text{ems}})$$

In this case, ultimately we obtain:[15]

(3.14) $$C_2 > f(\eta) + \alpha_o$$

where $f(\eta)$ is always positive. Significantly thus, both η and α_o raise the required value of C_2. But η does not do so monotonically since the first derivative of $f(\eta)$ turns negative as p approaches zero, as shown in the preceding footnote.

In conclusion, for the $p_{ems} > 0$ solution to hold, we need the acceptance of (3.7), the rejection of (3.11) (regarding C_1), plus the satisfaction of (3.14) (regarding C_2).

Fig. 2 illustrates the basic solution. There we reproduce the L_r - L_d schedule from Figure 1. The $(L_r)_{ems}$ - $(L_d)_{ems}$ curve is exactly the corresponding schedule within the EMS. That is, it shows the temptation to cheat through a surprise inflation inside the EMS for alternative price rules (or alternative p promises) on the hypothesis of popular expectations always according with the rules. The punishment schedule is not shown. But as the reputational solution is supposed to be so close to the p_{dd} one as almost to merge with it, this next curve can be identified with the horizontal axis. p_{ems} is below p_{dd}, and therefore the $(L_r)_{ems}$ - $(L_d)_{ems}$ schedule necessarily hits zero below the point where the L_r - L_d curve does so. At this point or that of tangency with the horizontal axis, we show in the figure

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[15] We have, as a condition, C_2 greater than L_{ems} in equation (3.6) minus the L in equation (2.11) (after the substitution of (3.5) for p_e), or

$$3.14\text{a} \qquad C_2 > \frac{a + c^2(1-\eta^2)}{a}(k-1)^2\bar{y}^2 + \alpha_o - \frac{a\{(k-1)\bar{y} + cp_{ems}\}^2}{a+c^2}$$

Squaring $(k-1)\bar{y} + cp_{ems}$ and multiplying by $a/(a+c^2)$ yields

$$\frac{\{a + (1-\eta)c^2\}^2(k-1)^2\bar{y}^2}{a(a+c^2)}$$

Therefore the righthandside of inequality (3.14 a) reduces to

$$3.14\text{b} \qquad L_{ems} - L_d(p_e = p_{ems}) = \alpha_o + \frac{2(a+c^2) - \eta(a+2c^2)}{a(a+c^2)}\eta c^2(k-1)^2\bar{y}^2$$

Since $0 < \eta < 1$, the numerator of the η term is necessarily positive. Thus $f(\eta) > 0$.

The first derivative of equation (3.14 b) with respect to η, however, will turn negative when p_{ems} approaches zero. This first derivative is

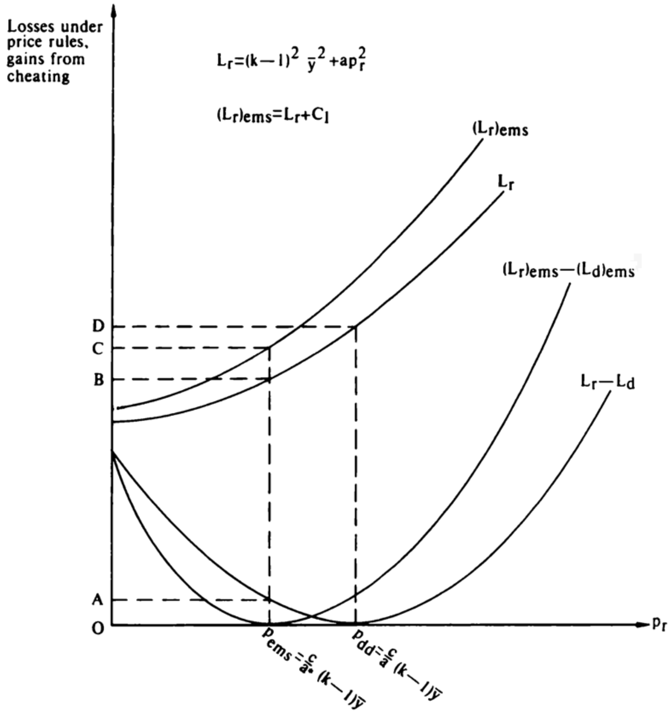
$$\{(a+c^2) - \eta(a+2c^2)\}\frac{2c^2(k-1)^2\bar{y}^2}{a(a+c^2)}$$

and though this value is always positive for $0 < \eta < 0.5$, it becomes negative when η attains a value exceeding

$$\frac{a+c^2}{a+2c^2}$$

Of course, as η approaches one, condition (3.11) will be satisfied at some point since $\alpha_o > 0$, and the relevant p_{ems} solution will then become zero. For this reason, $f'(\eta)$ could remain positive over the entire relevant range of η values.

FIGURE 2



3.15 $$p_r = p_{\text{ems}} = \frac{c}{a^*}\,(k-1)\,\bar{y}$$

This simply introduces a new hypothetical weight on the inflation objective, a^*, such that equations (3.15) and (3.5) are equivalent, implying

3.16 $$a^* = \frac{a}{1-\eta}$$

where a^* is necessarily greater than a.

The required condition for the p_{ems} solution to hold can now be easily seen. The temptation to move out of the EMS is the distance OA. Hence the required condition regarding C_2, inequality (3.14), says $C_2 > \text{OA}$. Condition (3.7), regarding η, derives by comparing the welfare losses from adhering to a given price rule, p_r, both inside and outside the EMS. Outside the system these losses are shown by the schedule L_r. The corresponding loss schedule

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inside the EMS, $(L_r)_{ems}$, is L_r plus C_1, or it is so everywhere except at $p_r = 0$ where C_1 is nil and L_r and $(L_r)_{ems}$ therefore coincide. Outside the EMS, accordingly, welfare losses would be OD, whereas inside of it, they are only OC. The required condition $L_{ems} < L_d$ is thus met. But as can be seen from the figure, it need not have been, and would not have if α_o, affecting the vertical distance between $(L_r)_{ems}$ and L_r without touching p_{ems}, had been sufficiently high. Condition (3.11), implying that $(c/a^*)(k-1)\bar{y}$ is the right solution for p_{ems} rather than zero, has been left in the background. But the satisfaction of this condition is consistent with the implicit orders of magnitude in the illustration (since α_o is sufficiently modest relative to the distance between p_{ems} and p_{dd}).

In a related work dealing with the problem of excessive inflation in a closed economy, *Rogoff* (1985 a) proposes the introduction of a "conservative" central banker. It is interesting to consider Rogoff's suggestion at present. Suppose that, acting on Rogoff's counsel, France were to look for a conservative central banker. If it found one who attaches the weigh a^* to the inflation objective, this person would deliver the same rate of inflation to the country as the EMS. Yet the result would be higher welfare, since the associated utility losses would be OB, while inside the EMS this loss is OC. Hence Rogoff's proposal looks good at first sight. It suggests that all of the costs C_1 of the EMS can be avoided (even under the implicit conditions of the argument where $p_{ems} = 0$ is impossible). On the other hand, in case of a conservative central banker, there would still be a political incentive to switch back to one whose views are more in line with community preferences, and this problem may be more serious than that of a surprise exit from the system. In other words, the political costs of removing the conservative central banker from office could be lower than OA, whereas inside the EMS C_2 may be well above OA. Therefore the EMS may be a sounder alternative after all. We shall come back to this issue in the final section.

2. *Realignments Every Other Period*

It makes no difference if realignments take place only every other period if the solution $p_{ems} = 0$ is the right one. But in case of the other solution, there is a fundamental difference, since every period following a realignment, thus every other period, the relation between p and i is upset. A percentage-point increase in the price of the home-produced good (p) has a distributed-lag effect on the growth of the cost-of-living index (i). Part of the effect comes in the current period, but part takes place only in the next one when the devaluation finally raises the purchase price of the imported good. Since the next-period effect is discounted by the authorities, the sum-effect on i is less than one for one. Surprise inflation (meaning surprise p) thus is less costly (in utility terms), and the result is pro-inflationary. In other words, the longer interval between realignments reduces monetary discipline. The point is essentially the same as *Rogoff's* in an earlier paper arguing that an exchange rate agreement can be counter-productive (1985 b). Hence, for the EMS to work as a disciplinary device, the political costs of realignments in the preceding subsection that pull in the right direction must be all the greater.

Let us examine the matter closely. In the period immediately following a realignment, e equals zero, therefore

3.17 $$q = p^* - p$$

In the next period, since the terms of trade are restored,

3.18 $$q_{+1} = -q$$

and

3.19 $$e_{+1} = p_{+1} - p_{+1}^* + p - p^*$$

The Germans, quite impervious to all this, set $i^* = 0$ in every period. But to do so now requires some manipulation of p^*. In the first period, when $e = 0$, $i^* = 0$ says

3.20 $$i^* = \psi p^* + (1 - \psi)\, p = 0$$

and thus requires

3.21 $$p^* = -\frac{1-\psi}{\psi}\, p$$

In the second period, the condition $i_{+1}^* = 0$ says

3.22 $$i_{+1}^* = \psi p_{+1}^* + (1 - \psi)\,(p_{+1} - e_{+1}) = 0$$

and requires

3.23 $$p_{+1}^* = \frac{1-\psi}{\psi}\, p$$

On the French side, we find, after substituting for p^*, that

3.24 $$i = \psi p + (1 - \psi) p^*$$

in the first period implies

3.25 $$i = \frac{2\psi - 1}{\psi} p$$

and

3.26 $$i_{+1} = \psi p_{+1} + (1 - \psi)(p_{+1} + e_{+1})$$

in the second period implies

3.27 $$i_{+1} = p_{+1} + \frac{1 - \psi}{\psi} p$$

Attention centers on (3.25) and (3.27) relating i and i_{+1} to p. Adding the two together, we get

3.28 $$i + i_{+1} = p + p_{+1}$$

Thus, a rise in p still raises inflation as much. But part of the inflationary effect comes in the future and will be discounted. In effect, even though the coefficient of influence of p on $i + i_{+1}$ is still one, it is as if it was only

$$\frac{2\psi - 1}{\psi} + \frac{1}{1 + \delta} \frac{(1 - \psi)}{\psi}$$

and thus (because of the factor δ) less than one. This is why, following every realignment, France considers a surprise rise in p more beneficial than earlier, and why the new equilibrium rate of inflation, accordingly, is higher. As we show in the appendix, this rate is now

3.29 $$i = \frac{(\theta - \eta)\, c\, (k - 1)\, \bar{y}}{a} \qquad \theta > 1$$

where the crucial coefficient θ is higher for higher values of δ, or for heavier discounting of the future. Since $\theta > 1$, $\theta - \eta$ will be greater than one for low enough values of η. Thus η must now be sufficiently high to drive down inflation at all in the first period.

It should be added that in every second period following a realignment or every period preceding a new realignment, the previous equation for i, (3.5), holds exactly. There is a difference regarding p in this next period, or p_{+1}, for it is now below i_{+1}, and is so to the right extent to keep i_{+1} the same as previously (in equation (3.5)) despite the adjustment of the exchange rate at the end of this period (+1) to the excess of p over p^* in the previous period as well the current one. More specifically, as we show again in the appendix, we have

3.30 $$p_{+1} = \frac{(1-\eta)\, c\, (k-1)\, \bar{y}}{a} - \frac{1-\psi}{\psi}\, p$$

leading exactly (from equation (3.27)) to

3.31 $$i_{+1} = \frac{(1-\eta)\, c\, (k-1)\, \bar{y}}{a}$$

thus precisely to equation (3.5). In other words, the previous result holds for every period preceding a realignment, and the difference comes every period after a realignment.

Returning to the period immediately following a realignment, when the basic difference takes place, we find solving for (3.2) (based on (3.29)):

3.32 $$L_{\text{ems}} = \frac{a + (\theta^2 - \eta^2)\, c^2}{a}\, (k-1)^2\, \bar{y}^2 + \alpha_o$$

For any improvement in the EMS to follow, or $L_{dd} > L_{\text{ems}}$, therefore, we now require

3.33 $$\frac{a + c^2}{a}\, (k-1)^2\, \bar{y}^2 > \frac{a + (\theta^2 - \eta^2)\, c^2}{a}\, (k-1)^2\, \bar{y}^2 + \alpha_o$$

or

3.34 $$\frac{\eta^2\, c^2}{a}\, (k-1)^2\, \bar{y}^2 > \alpha_o + \frac{\theta^2 - 1}{a}\, c^2\, (k-1)^2\, \bar{y}^2 \qquad (\theta > 1)$$

The new $\theta^2 - 1$ term on the right (in comparison with the earlier condition (3.7)) reflects the worsening of the situation. For the EMS to be beneficial as a disciplining device, the critical η coefficient now has more work to do. Not only must it be high enough to get inflation down at all, which was not even an issue before, but relatedly, it must also be higher in order to get inflation down sufficiently to reap a net advantage. Correspondingly, the required level of C_2, or for lack of an incentive to make a surprise move out of the system, is lower.

The aforementioned relationship to *Rogoff's* argument (1985b) should be underlined. In Rogoff's schema, exchange rate cooperation meant a movement from exchange rate overshooting to purchasing power parity. This lowered monetary discipline under cooperation. There is never any overshooting in our case, but the basic situation is the same, since entry into the EMS also tends to make any monetary policy action less inflationary during periods in which realignments are not immediate (even though they may be and are very much in sight). An added impulse to create surprise inflation follows in both cases.[16]

IV. A Concluding Assessment

As we argued at the beginning, the "monetary discipline" hypothesis helps a lot in understanding the behaviour of the EMS in the 1980's. We have seen two sets of conditions that could explain this result. One of them would imply much more monetary discipline than the other, and more than any we have ever witnessed. This gives rise to a certain presumption in favor of the other set of conditions. In addition, the satisfaction of this other set looks plausible enough. The political costs of membership that are required – those that grow with inflation relative to Germany – certainly echo a reality. Every devaluation of the franc and the lira in the system since 1979 was a political embarrassment. The occasional incident of a tightening of capital controls in France and Italy has been unpopular, and the relaxation of the controls a political advantage. The fixed costs of membership, on the other hand, may be smaller than they seem. The political alternative to the EMS is not necessarily complete freedom of capital markets, in which case moving out of the system would not mean a total removal of capital controls.[17] Further, the fixed costs of realignments can be exaggerated since they should be interpreted on the basis of the maximum duration between realignments.[18] But though the required conditions for the "monetary discipline" hypothesis to work are quite reasonable, nonetheless I will argue that we cannot pin the benefits of the EMS entirely on monetary discipline.

[16] The same logic explains why *John Taylor's* (1985) simulations of the seven summit countries show that exchange rate cooperation leads to more accomodation of inflation. Compare *Marcus Miller* and *Mark Salmon* (1986).

[17] On the other hand, the British are rightly worried that moving in may require reintroducing capital controls. Compare *Michael Artis* (1986).

[18] The maximum duration is the longest one consistent with avoiding a speculative crisis. Efforts to cope with this issue may be found in *Charles Wyplosz* (1986), *Melitz* and *Philippe Michel* (1988), and *Giavazzi* and *Marco Pagano* (1985). By supposing that realignments occur at set dates, we have obviously abstracted from the entire matter.

There is, in the first place, the ineluctable problem of explaining the German motivation. Admittedly, the Germans suffer no damage from the EMS in our framework, but they get nothing out of it either. Hence, they should have no reason to object if other countries tie their currency to theirs like the Austrians do. But why should they offer anything in exchange? Yet they do offer something to the others in the EMS. According to the rules of the system, the Germans must automatically lend support to any member whose currency hits the lower boundary. This automatic support may make the Germans readier to accept realignments when the boundaries are reached, and for this reason may be less important than it seems. But even so, this does not answer the question why the Germans should ever have agreed to such a commitment in the first place. Quite significantly too, the Bundesbank occasionally affirms the influence of the EMS on its conduct of monetary policy.[19] Observers sometimes cite the absence of German intervention within the agreed band as telling evidence of the small effect of the EMS on the Germans.[20] But, in the end, which central bank does the intervention is inessential. What really counts is whether the Lombard rate and the stock of German money – that is, the instruments of German monetary policy – are affected by the German presence in the EMS. It is difficult to consider them so little affected as to think that the Germans are in the same position relative to France, Belgium, Denmark, and Italy, as everybody else.

As for the other members – those who benefit from the German monetary discipline – the fact remains that they would do well to turn to cheaper means of getting the same results. Based on our discussion, such means are apparent. The basic problem these countries face is an inadequate appreciation of the future in policy-making, stemming from a lack of central bank independence. The obvious remedy is to provide the central bank independence. *Rogoff's* proposal of placing a conservative central banker at the helm has a certain appeal. But as we indicated, the proposal does not avoid the issue of central bank independence since it leaves open the question of the ease of removing the conservative head from office. Over and above, the pro-

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[19] See the annual report of the Deutsche Bundesbank of 1983, pp. 36 - 40. Consider also the conclusion of the section of the 1984 report dealing with the EMS: "Moreover, the close cooperation among the central banks of Europe in the field of monetary policy – which cooperation is increasingly characterized by mutual understanding for the interests of the other partners and by willingness to show consideration for them – has also contributed to the smooth functioning of the system" (p. 67). Compare *Niels Thygesen* (1984) and Vaubel (1985 b).

[20] See *Giavazzi* and *Giovannini* (1986 a), (1986 b) and their references. But compare the annual reports of the Bundesbank, 1983, p. 36, and 1984, pp. 33 - 34. The Bundesbank reports of recent years repeatedly refer to the provisions for automatic support of other currencies and their effects.

posal of central bank independence must dominate Rogoff's reform in any model, like ours, where a reputational equilibrium is attainable at zero inflation, since in this type of model, any central banker with preferences that do not reflect the views of the community would introduce unnecessary distortions as soon as we admit possible shocks requiring some inflation for optimal policy during a transition. This last argument applies as well to the idea of raising the fixed political costs of doing more inflation than the Germans enough to attain the zero-inflation EMS solution. Even if this plan were feasible, the objection would be that, once adopted, the enacting country would be strapped if new circumstances made a little inflation desirable (since the costs of moving out would need to be raised as well, or else the reform could do nothing but harm).

But if central bank independence therefore is the answer, maybe it will come. What future therefore lies ahead for the EMS? There is already a movement afoot in France toward greater independence of the Bank of France. Does this spell the coming end of French interest in the EMS?

The conclusion to which I am coming is that the cooperative gains of exchange rate agreements that were raised at the beginning of the discussion must be kept in sight. In particular, the cooperative gains of the EMS in avoiding fighting over the exchange rate must not be forgotten. The issue of "monetary discipline" abstracts completely from the strategic aspect, at least on an international plane. The gains of the EMS then appear to regard exclusively the relations between a government and its own people. The international element comes in as a way of getting credibility in the pursuit of better policies. But not everyone can benefit from the EMS on such grounds since the benefit to anyone depends entirely on differences between his credibility in such pursuit and others'.[21] Yet the superiority of cooperative to noncooperative solutions in the game-theoretical context is just the same if all the government players are equally good representatives of true national preferences.

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[21] The second part of the statement follows, though, only because we have abstracted from any positive desired rate of inflation, and in particular, the possibility of an optimal inflation tax (see *Edmund Phelps* (1967)). (The latter is probably relevant in the case of Italy where there is a large national debt; compare *Barro* and *Gordon* (1983 a.) A country desiring a positive inflation rate may get some monetary discipline from the system even though his partner(s) lacks such discipline as much as he does because some differential inflation will exist independently, and he will bear the costs of it (C_1) if inside the system. On the other hand, the welfare advantage of monetary discipline for such a country will depend on even stiffer conditions than ours. See, inter alia, *Giavazzi* and *Pagano* (1986).

When German interest in forming the EMS arose in 1977 - 78, it was under the impact of current account deficits combined with an appreciating mark. Presumably the Germans were not thinking of aiding neighbors to get more monetary discipline at the time. Rather their concerns resemble those involved in the issues of gains of exchange rate cooperation in the preceding paragraph.[22] Should the others ever come to rely more on themselves, and less on the Germans, for monetary discipline, the issues of exchange rate cooperation could become the only basis for the EMS for everyone.

Appendix

The EMS Solution with Realignments Every Other Period

Given equations (3.17) to (3.27), we wish to prove (3.29) and (3.30). From

A.1 $$L = (y - k\bar{y})^2 + ai^2 + C_1 + \frac{1}{1+\delta}\left[(y_{+1} - k\bar{y})^2 + ai^2_{+1} + C_1\right]$$

we get

A.2 $$\frac{\partial L}{\partial p} = 2c\left[c(p - p_e) + (1-k)\bar{y}\right] + 2a\Omega^2 p + \alpha_1\Omega + 2\varrho a(1-\Omega)^2 p + 2\varrho a(1-\Omega)p_{+1} + \varrho\alpha_1(1-\Omega)$$

$$\Omega = \frac{2\Psi - 1}{\Psi} \qquad \frac{1-\psi}{\psi} = 1 - \Omega \qquad \varrho = \frac{1}{1+\delta}$$

For $\partial L/\partial p = 0$ and $p = p_e$, this resolves to

A.3 $$p = \frac{2c(k-1)\bar{y} - [\Omega + \varrho(1-\Omega)]\alpha_1 - 2\varrho a(1-\Omega)p_{+1}}{2a[\Omega^2 + \varrho(1-\Omega)^2]}$$

From

A.4 $$L_{+1} = (y_{+1} - k\bar{y})^2 + ai_{+1} + C_1 + \frac{1}{1+\delta}\left[(y - k\bar{y})^2 + ai^2 + C_1\right]$$

we get

A.5 $$\frac{\partial L_{+1}}{\partial p_{+1}} = 2c\left[(p_{+1} - p_{+1,e}) + (1-k)\bar{y}\right] + 2a\left[p_{+1} + (1-\Omega)p\right] + \alpha_1$$

[22] It is interesting to refer to *Herbert Giersch's* reasons (1979) for anticipating that "a disguised form of support for real growth in West Germany may arise from the European Monetary System" (p. 649).

and therefore, for $p_{+1} = p_{+1,e}$

A.6 $$p_{+1} = \frac{2c(k-1)\bar{y} - 2a(1-\Omega)p - \alpha_1}{2a}$$

or (3.30) in the text (after substituting $(1-\psi)/\psi$ for $1-\Omega$ and eliminating α_1).

Substituting for p_{+1} in (A.3), we then find

A.7 $$p = \frac{2c(k-1)\bar{y} - [\Omega + \varrho(1-\Omega)]\alpha_1}{2a[\Omega^2 + \varrho(1-\Omega)^2]} - \frac{\varrho(1-\Omega)[2c(k-1)\bar{y} - 2a(1-\Omega)p - \alpha_1]}{2a[\Omega^2 + \varrho(1-\Omega)^2]}$$

Collecting terms, this gives

A.8 $$p = \frac{[1-\varrho(1-\Omega)]\,2c(k-1)\bar{y} - \Omega\alpha_1}{2a\Omega^2}$$

and therefore

A.9 $$i = \Omega p = \frac{1-\varrho(1-\Omega)}{\Omega}\;\frac{c(k-1)\bar{y}}{a} - \frac{\alpha_1}{2a}$$

(A.9) is equivalent to (3.29) for

A.10 $$\theta = \frac{1-\varrho(1-\Omega)}{\Omega}$$

and defines θ accordingly. The condition for $\theta > 1$ is then

A.11 $$\frac{1-\varrho(1-\Omega)}{\Omega} > 1$$

or

A.12 $$1-\Omega > \varrho(1-\Omega)$$

which is met (since $\Omega > 0$) if only $\varrho < 1$.

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Zusammenfassung

Monetäre Disziplin – Deutschland und das Europäische Währungssystem

Dieser Aufsatz untersucht die Hypothese, daß alle Mitgliedsländer des Europäischen Währungssystems (EWS) außer Deutschland Nutzen aus diesem System ziehen, weil es ihnen monetäre Disziplin auferlegt. Die Hypothese erklärt die führende Rolle Deutschlands im EWS und läßt sich mit der Erfahrung vereinbaren, daß die Zugehörigkeit zum EWS mehrere Länder veranlaßt hat, ihre Inflation stärker zu bekämpfen, als sie es andernfalls getan hätten. Allerdings zeigt die Analyse, daß die notwendigen Bedingungen für die Gültigkeit der Hypothese sehr streng sind. Selbst wenn diese Bedingungen erfüllt sind, könnten die übrigen Mitgliedsländer die Vorteile monetärer Disziplin auch auf andere Weise erlangen.

Summary

Monetary Discipline, Germany, and the European Monetary System

This paper explores the hypothesis that the non-German members of the European Monetary System (EMS) draw benefits from the system because of the monetary discipline that it imposes upon them. The hypothesis explains the dominant position of Germany in the EMS and is consistent with the evidence that membership has induced several countries to disinflate more than they would have done otherwise. Analysis shows, however, that the required conditions for the hypothesis to work are very stringent. Even if the conditions are met, the non-German members could obtain the advantages of monetary discipline in other ways.

Résumé

Discipline monétaire, l'Allemagne et le système monétaire européen

Cet article examine l'hypothèse affirmant que les membres non-allemands du système monétaire européen tirent profit du système à cause de la discipline monétaire qui leur est imposée. L'hypothèse explique la position dominante de l'Allemagne dans le système monétaire européen et est conforme à la preuve que l'adhésion a conduit plusieurs pays à désinflationner plus qu'elles ne l'auraient sinon fait. L'analyse montre toutefois que les conditions requises pour que l'hypothèse fonctionne sont très strictes. Même si les conditions sont remplies, les membres non-allemands pourraient obtenir les avantages d'une discipline monétaire par d'autres voies.