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THE PROSPECT OF A DEPRECIATING DOLLAR AND POSSIBLE TENSION INSIDE THE EMS

by

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ABSTRACT

This paper analyses the possibility of increased tensions in the European Monetary System (EMS) as a result of the recent dollar depreciation. The analysis employs a static, fairly stylised macroeconomic model in which the EMS is characterized as a means of achieving a cooperative outcome even though policymakers in member countries weigh output-inflation tradeoffs differently. Compared with the Nash (noncooperative) equilibrium, such cooperation is shown to have been welfare-improving for member countries before the depreciation of the dollar began. However, the inflationary consequences of the dollar depreciation in Europe give rise to the possibility that even if there is an optimal realignment afterwards, the members will not be able to achieve a better output-inflation tradeoff within the EMS than outside of it.

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We have now entered a period of dollar depreciation after four to five years of dollar appreciation. This paper makes an attempt to show that this change in policy environment could lead to tensions within the European Monetary System (EMS). What I have done is to construct a special theoretical example where, depending upon the extent of dollar depreciation, either Germany or France achieves "bliss" by leaving the EMS. In either of these two cases, the best the EMS can do is to duplicate the non-cooperative solution. But even if the EMS does so, the system has no particular advantage, and this is true for either country, the one which is not so blessed as well as the other. Hence, if there are any political rigidities in the system or other costs of upholding it, the EMS would not survive. There are two ways of reading this example. It can be viewed as a prediction about the future, as I have suggested above. Regarded in this way, the example spells trouble for the EMS. The second way, which is perhaps less obvious but equally important, is as policy advice. Read in this other way, the argument tells both countries that national interests may call for moving out of the EMS.

The example has two critical features. The first is a difference in the policy preferences of Germany and France. The Germans are supposed to have a lower tolerance for inflation than the French. The second is a supposed inability of either country to neutralise the impact of the dollar depreciation without altering the franc-mark exchange rate. This inability to adjust in other ways can be interpreted as a reflection of a combination of inertia and problems of forecasting. In other words, the difficulty may be seen as being that other means of adjustment are too slow to take effect while the shock of the dollar appreciation is impossible to foresee sufficiently far ahead of time.

The paper will be divided into five sections. The first will present the basic model. The next will derive and compare the non-cooperative and the EMS solutions. The third will analyse the impact of a dollar depreciation, and the fourth will provide a graphical interpretation of the analysis. This last interpretation will add to the argument. The last section is a conclusion.

I

I will begin with a modified version of a model that I have used before in order to explain the EMS [MELITZ (1985)]. In the simplest form of this model, there are only two countries, France and Germany, both of which produce a good that differs from the other's and which both of them consume. The respective prices of the two goods, q and q^*, are p and p^*, where the starred notation applies to Germany. The interest rates in the two countries are i and i^*, their money stocks are m and m^*, the exchange rate or the number of francs per mark is e, and the two countries' respective utility losses resulting from deviations from desired values are L and L^*. All variables are logarithms except the two interest rates (i and i^*) and the inflation rates (p_o, I, p_o^*, and I^*). The superscript a designates anticipated values. In the present illustration, there is one extra complication : namely, the two countries also consume a third good coming from the United States, whose price is p^{**}. The price of dollars in marks is e^*. The equations are as follows :

$$1.\quad q = a_1(p^* + e - p) + a_2\,(p^{**} + e^* + e - p) - a_3\,(i - p^{e}_{+1} + p) + a_4 q^*$$

$$2.\quad q^* = -a_1\,(p^* + e - p) + a_2\,(p^{**} + e^* - p) - a_3\,(i^* - p^{*e}_{+1} + p^*) + a_4\,q$$

$$3.\quad m - p = \mu q \qquad\qquad 4.\quad m^* - p^* = \mu q^*$$

$$5.\quad p = p_0 + p_{-1} \qquad\qquad 6.\quad p^* = p^*_0 + p^*_{-1}$$

$$p_0 > 0 \qquad\qquad p^*_0 > 0$$

$$7.\quad e^{e}_{+1} - e = i - i^* \qquad\qquad 8.\quad p^{e}_{+1} - p = p - p_{-1}$$

$$9.\quad p^{*e}_{+1} - p^* = p^* - p^*_{-1} \qquad\qquad 10.\quad e^{e}_{+1} + p^{*e}_{+1} - p^{e}_{+1} = e_{-1} + p^*_{-1} - p_{-1}$$

$$11.\quad I = \Psi(p - p_{-1}) + \Phi\,(p^{**} - p^{**}_{-1} + e^* - e^*_{-1} + e - e_{-1})$$
$$+ (1 - \Psi - \Phi)(p^* - p^*_{-1} + e - e_{-1})$$

$$12.\quad I^* = \Psi(p^* - p^*_{-1}) + \Phi\,(p^{**} - p^{**}_{-1} + e^* - e^*_{-1})$$
$$+ (1 - \Psi - \Phi)(p - p_{-1} - e + e_{-1})$$

$$0.5 < \Psi < 1 \qquad\qquad \Psi + \Phi < 1$$

$$13.\quad L = \frac{1}{2}\,[q^2 + \varepsilon\,(I - p_0)^2] \qquad\qquad 14.\quad L^* = \frac{1}{2}\,[(q^*)^2 + \varepsilon^*(I^*)^2]$$

There are various simplifications here. In the first two equations, I ignore U.S. output as an influence on the aggregate demand in both countries. This simply does away with a constant term in these two equations. In the next two equations, (3) and (4), I suppose no interest-rate-elasticity of demand for money.

This has a major advantage, as Matthew CANZONERI and Dale HENDERSON (1985) and Gilles OUDIZ (1985) have shown, since it makes it possible to view q as the policy instrument in France, q^* as the one in Germany. p and p^* in eqs. (3) and (4) are respectively given by core inflation in France and Germany (p_0 and p_0^*), based on eqs. (5) and (6). Hence, the two demand for money equations imply that by controlling money, the French and German authorities also directly control home output. The demands for goods equations, (1) and (2), in this view, essentially determine the two national interest rates, i and i^*. Eq. (7), stating the interest rate parity condition, next determines the exchange rate e. This supposes perfect capital mobility. Eqs. (8), (9), (10), in turn, describe anticipations. They suppose that price anticipations are backward-looking and exchange rate anticipations are forward-looking. People expect p and p^* to go up as much next period as they did the last one, while they expect the terms of trade next period to return where they were the last one. Eqs. (11) and (12) are the inflation rates that enter the utility functions of the authorities. The welfare functions (13) and (14) are fundamental. They introduce the basic asymmetry that I referred to previously : the French would like to limit inflation to core inflation while the Germans would like to get rid of it altogether. For the moment, both of them not only experience core inflation, but import inflation through the appreciation of the home-currency price of the U.S. good.

The system, as thus stated, would require treating e^* as exogenous. This is troublesome in a way since it introduces an asymmetry between Germany and France that has no particular foundation. The exogeneity of e^*, if maintained, would mean that the price of the U.S. good, if given to both countries in dollars, would also be given to both of them in marks. But why not in francs ? Why should the Europeans be able to do nothing about the price of the U.S. good in marks while they can do something about it francs ? The asymmetry that would result from retaining this feature would run right through the rest of the analysis. But the problem can be avoided by resorting to the notion of an evenly weighted average exchange rate of francs and marks. This average -- some hypothetical écu -- can then be treated as exogenous instead of e^*. Let the hypothetical écu/dollar, S, be defined as follows :

$$S = \left(\frac{FF}{DM} \quad \frac{DM}{\$} \right)^{0.5} \left(\frac{DM}{\$} \right)^{0.5}$$

Then in logarithms, it becomes

$$15.\ s = 0.5e+e^*$$

where s is the log of S and e and e^* have the preceding significations. Wherever e^* occurs, s minus 0.5e may be substituted. This will alter the two a_2 terms of the demands for goods [in eqs. (1) and (2)] and the two ϕ terms of the inflation rates [in eqs. (11) and (12)]. Letting

$$16.\ p^{us} = p^{**}+s,$$

these four terms become respectively

$a_2\ (p^{us}+0.5e-p)$ [eq. (1)]

$a_2\ (p^{us}-0.5e-p^*)$ [eq. (2)]

$$\Phi \quad (p^{us}-p^{us}_{-1}+0.5e-0.5e_{-1}) \qquad [eq.(11)]$$

and

$$\Phi \quad (p^{us}-p^{us}_{-1}-0.5e+0.5e_{-1}) \qquad [eq.(12)]$$

No asymmetry between Germany and France now results from treating the price of the U.S. good in écus, p^{us}, as exogenous.

The exogeneity of s is itself a simplification, which depends on the idea that the factors affecting s in the relevand period come from the outside world. But the assumption is quite innocuous for two reasons. First, France and Germany can be supposed to have little effect on U.S. policy behavior. Second, most of the news regarding s in the period of the EMS (since 1979) can be considered as stemming from the U.S. We could endogeneise s, of course, by modelling the U.S. explicitly, but all of the essential results would stay the same.

To proceed, we need to solve for the reduced forms of the I and I* terms in the two loss functions. As a preliminary, we must then solve for e. Let us begin with the simplifying assumption :

$$p_{-1} = p^{*}_{-1} = p^{us}_{-1} = e_{-1} = 0.$$

Next if the subtract eq. (2) from eq. (1), and use eqs. (5) through (10) in order to eliminate various terms, we find [(1)] :

$$17.\ q-q^{*} = \frac{2a_1+a_2+a_3}{1+a_4}\ \bar{e} = \theta\bar{e}$$

where

$$\bar{e} = e+p_o^{*} - p_o$$

Next the definitions of inflation can be written in the form :

$$18.\ I = p_o+\Phi\ (p^{us}-0.5p_o-0.5\ p_o^{*}) + (1-\Psi-0.5\Phi)\ \bar{e}$$

and

$$19.\ I^{*} = p_o^{*}+\Phi\ (p^{us}-0.5p_o-0.5p_o^{*}) - (1-\Psi-0.5\Phi)\ \bar{e}$$

The two can then be conveniently restated as :

$$20.\ I = p_o+I_o+\alpha\ (q-q^{*})$$

and

$$21.\ I^{*} = p_o^{*}+I_o-\alpha\ (q-q^{*})$$

where

$$I_o = \Phi\ (p^{us}-0.5\ (p_o+p_o^{*}))$$

and

$$\alpha = (1-\Psi-0.5\Phi)/\theta$$ [see eq. (17)]

We shall assume that I_0 is positive because of dollar appreciation : that is, the inflation of the price of the U.S. good in écus, p^{us}, will be supposed to exceed core inflation in Europe in écus, $0.5\,(p_0-p_0^*)$. Later on, in section III, we will switch to the assumption of dollar depreciation and consider I_0 negative. But as the situation stands now, both Germany and France undergo inflation as a result of the rising écu price of the U.S. good as well as through core inflation [see eqs. (21) and (22)]. The only other factor affecting their inflation rates is the movement in their bilateral terms of trade. This last is the only factor that they can affect.

The policy problem can be seen at a glance. Since France wants $I-p_0 = 0$, it would like e to be such that $\bar{\alpha}\theta e = -I_0$ in eq. (21). But Germany wants $I^* = 0$, therefore it wants $\alpha\theta\bar{e} = I_0+p_0^*$ in eq. (22). Evidently e cannot satisfy both of these values at once. Further, while both countries want an appreciation of their currency relative to the other, Germany wants a larger appreciation than France.

For the rest of the analysis, we will focus on eqs. (13) and (14), the two utility-loss functions, and (17), (20), and (21), the reduced forms for $\bar{e}$, I, and I^*.

II

Consider first the non-cooperative or Cournot-Nash solution to the system. This means solving the following problem :

$$\min_{q} \frac{1}{2} [q^2+\varepsilon(I-p_o)^2]$$

$$I-p_o = I_o+\alpha(q-q^*)$$

and q^* fixed

and

$$\min_{q^*} \frac{1}{2} [(q^*)^2+\varepsilon^*(I^*)^2]$$

$$I^* = I_o+p_o^*-\alpha(q-q^*)$$

and q fixed

The result is a French reaction function for q as a function of q^* and a German reaction function for q^* as a function of q. The two equations are :

$$22. \quad q^N = \frac{\varepsilon\alpha^2}{1+\varepsilon\alpha^2} q^{*N} - \frac{\varepsilon\alpha}{1+\varepsilon\alpha^2} I_o$$

and

$$23. \quad q^{*N} = \frac{\varepsilon^*\alpha^2}{1+\varepsilon^*\alpha^2} q^N - \frac{\varepsilon^*\alpha}{1+\varepsilon^*\alpha^2} I_o^*$$

where $I_o^* = I_o+p_o^*$

The two have the following solutions :

$$24. \quad q^N = \frac{-\varepsilon\alpha[\varepsilon^*\alpha^2 I_o^* + (1+\varepsilon^*\alpha^2) I_o]}{1 + (\varepsilon+\varepsilon^*)\alpha^2}$$

and

$$25.\quad q^{*N} = \frac{-\varepsilon^{*}\alpha[\varepsilon\alpha^2 I_o + (1+\varepsilon\alpha^2)I_o^{*}]}{1 + (\varepsilon+\varepsilon^{*})\alpha^2}$$

It follows that

$$26.\quad q^{N}-q^{*N} = \frac{\alpha(\varepsilon^{*}I_o^{*}-\varepsilon I_o)}{1+(\varepsilon+\varepsilon^{*})\alpha^2}$$

and

$$27.\quad \bar{e}^{N} = \frac{\alpha}{\theta}\,\frac{(\varepsilon^{*}I_o^{*}-\varepsilon I_o)}{1+(\varepsilon+\varepsilon^{*})\alpha^2}$$

Further

$$28.\quad I^{N}-p_o = I_o + \alpha\,(q^{N}-q^{*N}) = \frac{(1+\varepsilon^{*}\alpha^2)\,I_o + \varepsilon^{*}\,\alpha^2\,I_o^{*}}{1 + (\varepsilon+\varepsilon^{*})\,\alpha^2}$$

$$29.\quad I^{*N} = I_o^{*} - \alpha\,(q^{N}-q^{*N}) = \frac{(1+\alpha^2)\,I_o^{*} + \varepsilon\,\alpha^2\,I_o^{*}}{1 + (\varepsilon+\varepsilon^{*})\,\alpha^2}$$

From a comparison of (28) and (29) with (24) and (25), we discover :

$$30.\quad q^{N} = -\varepsilon\alpha\,(I^{N}-p_o)$$

$$31.\quad q^{*N} = -\varepsilon^{*}\alpha I^{*N}$$

If we analyse this solution, we find that the sign of $\bar{e}^{N}$ depends on

$$\varepsilon^{*} I_{0}^{*} \gtrless \varepsilon I_{0}, \text{ that is, } \varepsilon^{*} (I_{0}+p_{0}^{*}) \gtrless \varepsilon I_{0}$$

Thus, if only the Germans are at least as much concerned with inflation as the French in relation to output, or $\varepsilon^{*} \geq \varepsilon$, $\bar{e}^{N}$ is necessarily positive. We can also see, quite independently, that both inflation rates must be positive. But if so, from eqs. (30) and (31), both outputs are necessarily negative. This last result simply reflects the counterproductive effort of both countries to neutralise the inflationary forces coming from the movement of the dollar by appreciating their own currency relative to the other. Germany wins this battle in a sense, because it wants to do so more badly, but it does so at the cost of a greater loss of output than France. As we shall see immediately, the EMS solution is more sensible.

In order to find this next solution, a bit of preliminary material is necessary. Let us suppose momentarily that each country's instrument is domestic credit not money, or d not m, where m-d depends on an intervention rule. This intervention rule basically represents the way the EMS proposes to reconcile $d-d^{*}$ with the required value of $m-m^{*}$ in order to achieve the agreed exchange rate.(2) Corresponding to the identity

$$m = d + (m-d)$$

we can also write

$$q = q^d + (q-q^d)$$

Subsequently, we can express the intervention rule in terms of $q-q^d$. Doing so, we have :

$$32.\ q-q^d = -\gamma\,(q^d-q^{*d}-\theta\bar{e}^{EMS})$$

and

$$33.\ q^*-q^{*d} = (1-\gamma)\,(q^d-q^{*d}-\theta\bar{e}^{EMS})$$

where $0 \leqslant \gamma \leqslant 1$ and $\bar{e}^{EMS}$ is obviously the value of $e+p^*_o-p_o$ deriving from the agreed value of e in the EMS. It can be checked out that (32) and (33) will yield

$$q-q^* = \theta\,\bar{e}^{EMS}$$

as they must. The coefficient γ therefore simply reflects the agreement between Germany and France about the distribution of the burden of intervention.

As I have shown elsewhere, this system will work as long as both countries do not engage in any sterilization.(3) This means not only that they must treat q^d not q (q^{*d} not q^*) as their basic instrument, but that they must disregard $q-q^d$ in setting q^d.

Quite exactly, the problem they must solve is the following :

$$\underset{q^d}{\text{Min}} \ \frac{1}{2} \left[(q^d)^2 + \varepsilon (I-p_o)^2 \right]$$

$$I - p_o = I_o + \alpha\theta\bar{e}^{EMS}$$

and

$$\underset{q^{*d}}{\text{Min}} \ \frac{1}{2} \left[(q^{*d})^2 + \varepsilon^* (I^*)^2 \right]$$

$$I^* = I_o^* - \alpha\theta\bar{e}^{EMS}$$

If they do so, the solution will be $q^d = q^{*d} = 0$. Consequently, based on (32) and (33), the EMS will yield :

$$34. \ q^{EMS} = \gamma \ \theta \ \bar{e}^{EMS}$$

and

$$35. \ q^{*EMS} = -(1-\gamma) \ \theta\bar{e}^{EMS}$$

This solution remains incomplete as long as we do not know γ and $\bar{e}^{EMS}$.

These two values were necessarily set by a joint agreement at the time of the last realignment. At this time France and Germany supposedly reached their agreement by minimising some joint loss function consisting of a combination of L and L*. Let us consider this joint loss function to be

36. $\underline{L} = (1-\lambda)\ L + \lambda L^*$

where λ is the weight of German welfare in the aggregate. The minimisation of (36), of course, must lead the two countries to a point on their contract curve.

The problem is then :

$$\min_{\bar{e},\gamma} \frac{(1-\lambda)}{2} [q^2 + \varepsilon\ (I-p_o)^2] + \frac{\lambda}{2}\ [(q^*)^2 + \varepsilon^*\ (I^*)^2]$$

$$\begin{aligned} q &= \gamma\ \theta\ \bar{e} \\ q^* &= (\gamma - 1)\ \theta\ \bar{e} \\ I - p_o &= I_o + \alpha\ \theta\ \bar{e} \\ I^* &= I_o^* - \alpha\ \theta\ \bar{e} \end{aligned}$$

The solution to this problem with $\bar{e}$ and γ both as a function of the other is :

37. $$\bar{e}^{EMS} = \frac{\alpha}{\theta} \left(\frac{\lambda\ \varepsilon^*\ I_o^* - (1-\lambda)\ \varepsilon I_o}{\gamma^2 - 2\ \gamma\ \lambda + \lambda + [(1-\lambda)\ \varepsilon + \lambda\ \varepsilon^*]\ \alpha^2} \right)$$

and

38. $\gamma = \lambda$

However, γ cannot rest on some arbitrarily given λ in eq. (38) or else the EMS solution would not necessarily be as good or better than the Cournot-Nash one. Suppose, for example, that the Cournot-Nash solution is perfect or nearly so for Germany but not France (as in one of our later examples). Then any arbitrarily chosen λ far below one will necessarily be inferior to Cournot-Nash as far as Germany is concerned. The right way to obtain the EMS solution therefore is to set $\gamma = \lambda$ from the start. That is, we must begin with the hypothesis

$$39.\quad \underline{L} = (1-\gamma)\, L + \gamma\, L^*$$

and thereby equate the French burden of intervention between realignments with the weight of German welfare on the occasion of any realignment right at once.(4) Then if we solve for $\bar{e}^{EMS}$ and γ, we get :

$$40.\quad \bar{e}^{EMS} = \frac{\alpha}{\theta}\left(\frac{\gamma\, \varepsilon^*\, I_o^* - (1-\gamma)\, \varepsilon I_o}{\gamma\,(1-\gamma) + [(1-\lambda)\, \varepsilon + \lambda\, \varepsilon^*]\, \alpha^2}\right)$$

and

$$41.\quad \gamma = \frac{1}{2} + \frac{\varepsilon^*\,(I_o^* - \alpha\,\theta\,\bar{e}^{EMS})^2 - \varepsilon\,(I_o + \alpha\,\theta\,\bar{e}^{EMS})^2}{2\,(\theta\,\bar{e}^{EMS})^2}$$

The full solution for $\bar{e}$ and γ based on these two interdependent equations is a pair of very complicated expressions, which we will avoid using. Based on (40) and (41), we have :

$$42.\quad q^{EMS} - q^{*EMS} = \theta\,\bar{e}^{EMS} = \alpha\left(\frac{\gamma\, \varepsilon^*\, I_o^* - (1-\gamma)\, \varepsilon\, I_o}{\gamma(1-\gamma) + [(1-\gamma)\, \varepsilon + \gamma\, \varepsilon^*]\, \alpha^2}\right)$$

$$43.\ I^{EMS} - p_0 = \frac{\gamma\ (1-\gamma + \varepsilon^* \alpha^2)\ I_0 + \gamma\ \varepsilon\ \alpha^2\ I_0^*}{\gamma\ (1-\gamma) + [(1-\gamma)\ \varepsilon + \gamma\ \varepsilon^*]\ \alpha^2}$$

and

$$44.\ I^{*EMS} = \frac{(1-\gamma)\ (\gamma + \varepsilon\ \alpha^2)\ I_0^* + (1-\gamma)\ \varepsilon\ \alpha^2\ I_0}{\gamma\ (1-\gamma) + [(1-\gamma)\ \varepsilon + \gamma\ \varepsilon^*]\ \alpha^2}$$

If we compare this EMS solution with the non-cooperative one, we can see little difference in regard to inflation, which is still positive in both countries. But otherwise the situation is quite different. French and German output necessarily have opposite signs [see eqs. (34) and (35)]. With $\bar{e}$ positive, French output is positive and German output negative ; with $\bar{e}$ negative, the opposite is true. In any case, both countries cannot have negative output, as happens under Cournot-Nash. This is understandable, since there is no longer any attempt at a competitive appreciation on either side. Hence, if either country departs from the common zero-output objective on the low end, the other will do so on the high one. In the case of γ equal 0.50 (which is not necessarily optimal based on (41)), q^{EMS} will be positive, q^{*EMS} will be negative, and the mean value of the two will be exactly zero.

Figure 1 depicts the situation. RR, which corresponds to eq. (22), is the Nash reaction function for France. R*R* is the similar German one and corresponds to eq. (23). F is the French bliss point, G

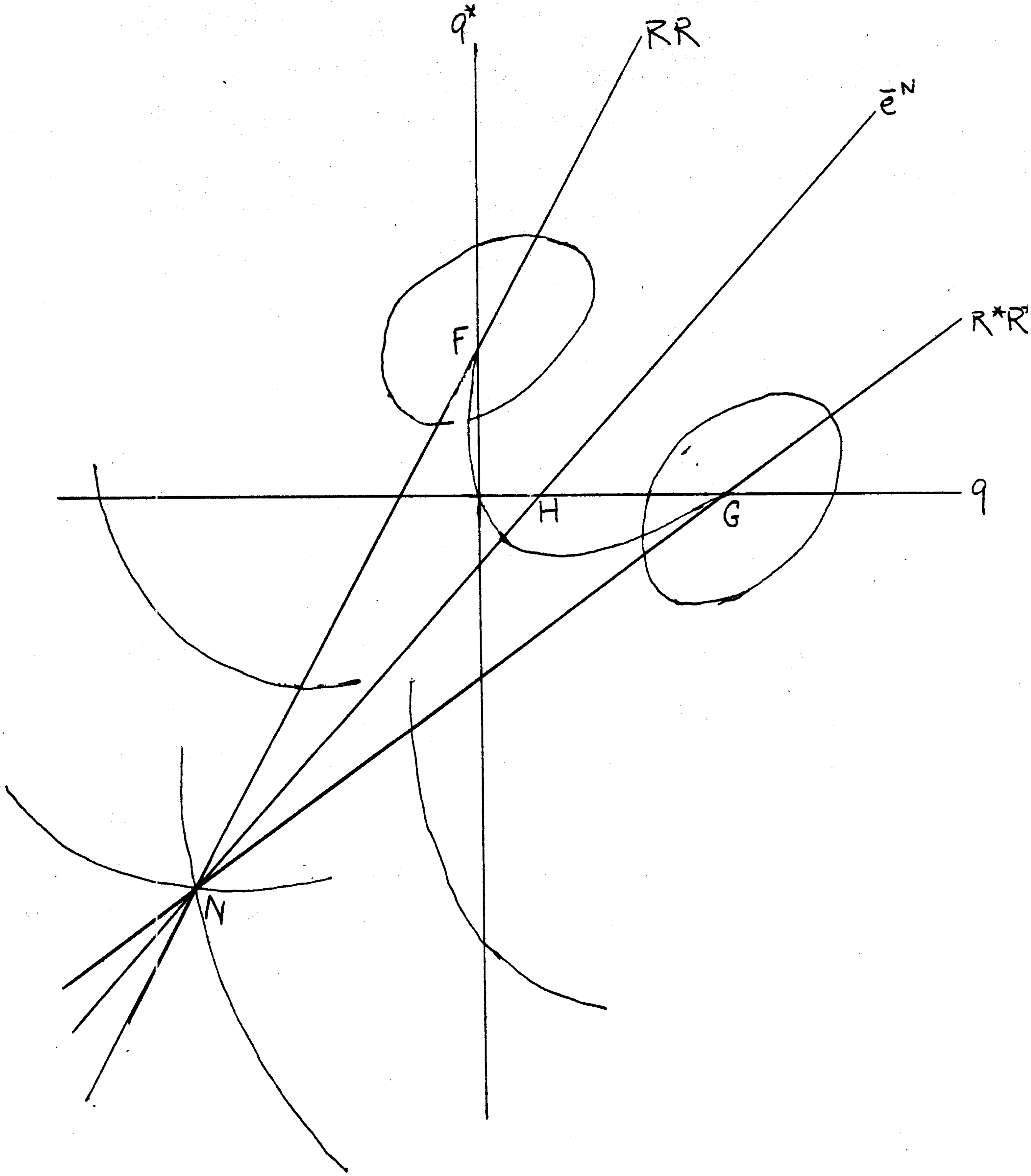


FIGURE 1

the German one. These two points, of course, reflect the fact that both countries would like zero output for themselves but positive output for the other one in order to benefit from the exchange rate appreciation and the consequent deflationary pressure this would bring them. The positive value of q at point G exceeds the positive value of q^* at point F because the Germans desire more deflationary pressure than the French. N is the Nash solution and thus corresponds to the values of q and q^* implicit in eqs. (24) and (25). The 45-degree e^N line traces all of the combinations of q and q^* that are compatible with $\bar{q}^N - \bar{q}^{*N}$ (or e $\bar{e}^N$), based on eq. (26).

The EMS solution, on the other hand, places the two countries, not at N, but somewhere on their contract curve going from F to G. In accordance with eqs. (34) and (35), all points on this curve necessarily yield opposite signs of q^* and q. I do not indicate the exact EMS solution in the figure, but this point must be wherever the correct 45-degree $\bar{e}^{EMS}$ line intersects the contract curve. Hence it is to the left or the right of point H, depending on whether $\bar{e}^{EMS}$ is greater or less than $\bar{e}^N$. As it stands, however, the illustration clearly shows the essential superiority of the EMS solution. The general superiority of this solution rests on the reasoning in footnote 4.

III

I will next introduce a basic simplification in the analysis, which is to suppose $\varepsilon = \varepsilon^*$. In this case, from (26) and (27), we have

$$45.\quad q^{N} - q^{*N} = \frac{\varepsilon\ \alpha}{1 + 2\ \varepsilon\ \alpha^{2}}\ p_{0}^{*}$$

and

$$46.\quad \bar{e}^{N} = \frac{\varepsilon\ \alpha}{\theta\ [1 + 2\ \varepsilon\ \alpha^{2}]}\ p_{0}^{*}$$

and from (42),

$$47.\quad q^{EMS} - q^{*EMS} = \frac{\varepsilon\ \alpha\ [(2\ \gamma - 1)\ I_{0} + \gamma\ p_{0}^{*}]}{\gamma\ (1 - \gamma\ ) + \varepsilon\ \alpha^{2}}$$

$$48.\quad \bar{e}^{EMS} = \frac{\varepsilon\ \alpha\ [(2\ \gamma - 1)\ I_{0} + \gamma \cdot p_{0}^{*}]}{\theta\ [\gamma\ (1 - \gamma\ ) + \varepsilon\ \alpha^{2}]}$$

Thus $\bar{e}^{N}$ is strictly independent of I_0 whereas $\bar{e}^{EMS}$ is not. It is this independence of $\bar{e}^{N}$ from I_0 that makes the analysis much simpler. The result is that a change in I_0 will not affect the exchange rate that would exist in the absence of the EMS.

We must also observe that with $\varepsilon = \varepsilon^{*}$, as long as I_0 is positive, γ must be somewhat above 0.5, and therefore $\bar{e}^{EMS}$ must be higher than $\bar{e}^{N}$. The proof of these two propositions follows by footnote below.(5) Since the slopes of RR and R^*R^* are symmetrical in figure 1, they imply $\varepsilon=\varepsilon^*$, and it follows that the EMS solution in the figure is to the right of H.

We are now prepared to introduce dollar depreciation and a consequent move of I_0 into the negative range. The equations for $I^N - p_0$ and I^{*N} [(28) and (29)] show us that there exists some negative value of I_0 for which $I^N - p_0$ will be zero, and some other, larger negative value for which I^{*N} will be zero and $I^N - p_0$ negative. In the former case, q^N would also be zero and France would find bliss. In the latter, q^{*N} would be zero and Germany would find bliss. The required level of I_0 for the first event to happen is :

49. $$I_0 = -\frac{\varepsilon\alpha^2}{1+2\varepsilon\alpha^2}\, p_0^*$$

For the latter event to happen, it is :

50. $$I_0 = -\frac{1+\varepsilon\alpha^2}{1+2\varepsilon\alpha^2}\, p_0^*$$

The problem that a depreciation of the dollar can then pose for the EMS is quite obvious. In either of our last examples, the survival of the system would depend on a realignment bringing $\bar{e}^{EMS}$ down to $\bar{e}^N$ and leaving the otherwise perfectly happy nation without any responsibility for intervention whatever. But in this circumstance, the other nation would also derive no benefit from the system, as we shall see.

Let us begin by verifying that the EMS could and would indeed produce the required values in order to match the Cournot-Nash solutions in our two previous examples. If we plug $\gamma = 0$ into eq. (48), we get

$$51. \quad \bar{e}^{EMS} = -\frac{I_o}{\theta\alpha}$$

If next we also substitute eq. (49) for I_o, we have

$$52. \quad \bar{e}^{EMS} = \frac{\varepsilon\alpha}{\theta[1+2\varepsilon\alpha^2]} p_o^* = \bar{e}^N .$$

In addition, $\gamma = 0$ implies $q^{EMS} = 0$. Thus, in case of eq. (49) and $\gamma = 0$, we obtain $L = 0$, and therefore

$$\underline{L} = \gamma L^* + (1-\gamma)L = 0$$

It follows that the minimisation of $\underline{L}$ with respect to $\bar{e}$ and γ must yield $\bar{e}^{EMS} = \bar{e}^N$ and $\gamma = 0$ if eq. (49) holds.(6) Furthermore, $\bar{e}^{EMS}=\bar{e}^N$ means the same inflation rate for Germany in or out of the EMS because $I^* = I_o^*-\alpha\theta\bar{e}$ is then independent of this presence in the EMS. Based on $\gamma = 0$, $q^{*EMS} = (\gamma-1)\theta\bar{e}^{EMS}$ also yields

$$53. \quad q^{*EMS} = -\frac{\varepsilon\alpha}{1+2\varepsilon\alpha^2} p_o^*$$

which is exactly the value we get for q^{*N} after setting $\varepsilon = \varepsilon^*$ and substituting (49) for I_o [see eq. (25)]. Hence Germany will also be no better off in or out of the EMS.

Similarly, if we set $\gamma = 1$, we get

$$54. \quad \bar{e}^{EMS} = \frac{I_o^*}{\theta\alpha} = \frac{I_o+p_o^*}{\theta\alpha}$$

Then if we substitute eq. (50) [rather than (49)] for I_o, we get $\bar{e}^{EMS}=\bar{e}^{N}$ once more. Everything else follows : from the conclusion $L^* = 0$, we obtain $\underline{L} = 0$ with $\gamma = 1$, and the French will be no better off in or out of the EMS.

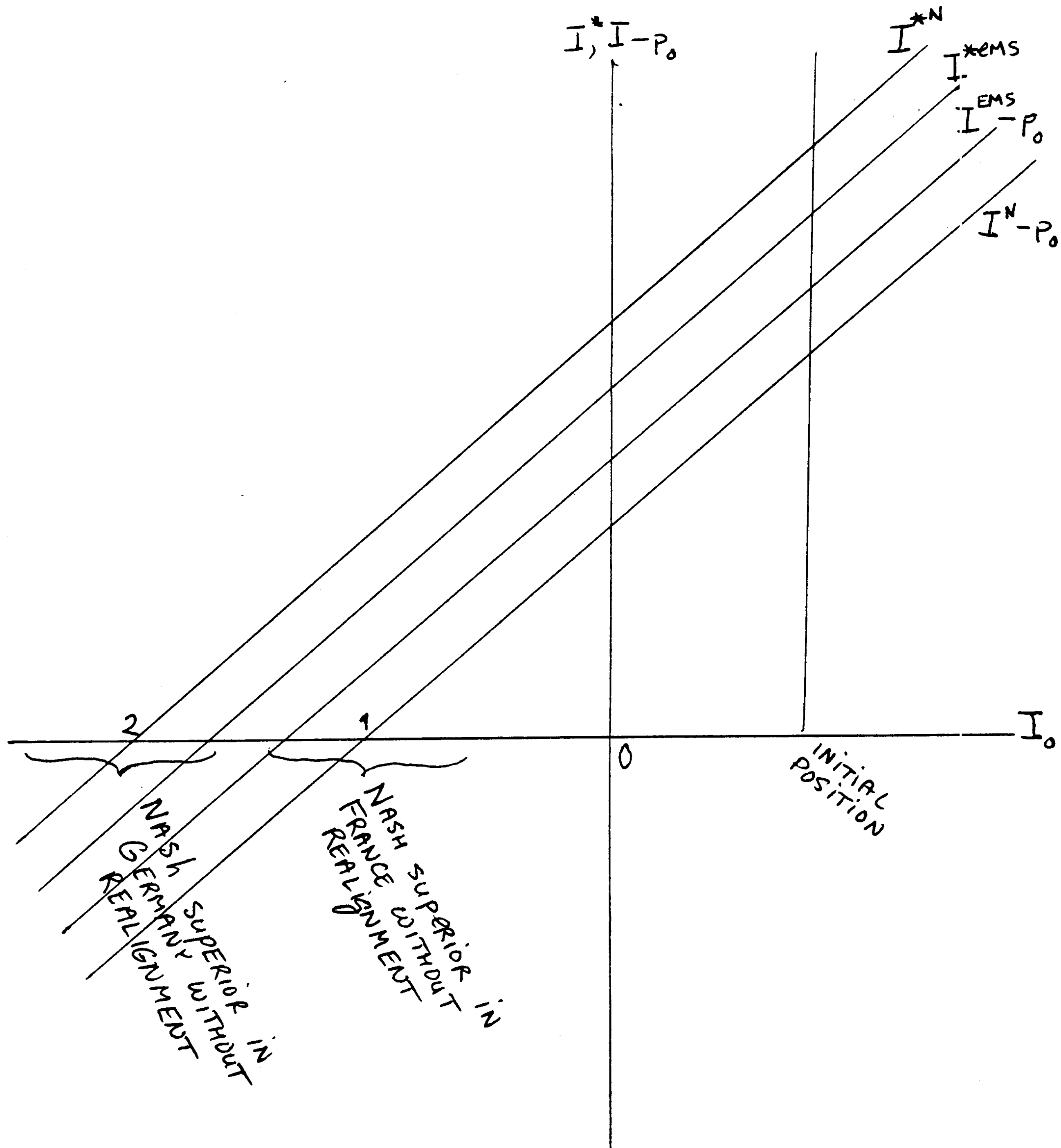
Thus the EMS could survive in either one of our difficult set of circumstances. But would it do so ? The fact remains that the system would then cease to yield any advantages. There are a least two reasons why it might therefore crack. The first has to do with the fact that the survival of the system would require a return to the conditions of the European "snake", thus placing one country in a position of dominance. In the case of eq. (49), this country would be France. In the case of eq. (50). It would be -- more familiarly so -- Germany. Politically speaking, however, it is not clear that either solution is feasible. In the light of the evolution of the EMS since the Bremen agreement in the last seven years, neither France nor Germany may be in a position to accept a realignment entirely on the other's terms with complete endorsement on its part of its own exclusive responsibility for defending the parity. In other words, γ values in the vicinity of zero or one may not be politically feasible. Second, there are economic costs of maintaining the EMS, of which capital controls are the foremost example. I have assumed in this discussion that the EMS is dynamically stable even though the French and German rates of inflation differ. But it is not clear that this stability is possible without capital controls, and efforts to deal with the question have generally come to the opposite conclusion.(7)

A graphical illustration of the argument will make a number of things clearer. It will also permit bringing into view some important, additional aspects of the EMS.

IV

Figure 2 traces the excess over desired inflation in France and Germany as a function of I_0 both in and out of the EMS. More exactly, the figure traces these excess values as a function of p^{US}. That is, only the changes in I_0 resulting from movements in p^{US} and not p_0 or p_0^* are in question.(8) The $I^N - p_0$ and I^N lines concern the situation under Cournot-Nash or outside the EMS. They thus show simple one-for-one reductions in inflation with reductions in I_0 (as they must, of course, since I_0 has no effect on $\bar{e}^N$, based on the simplifying assumption $\varepsilon = \varepsilon^*$). At point 0, where I_0 equals zero, p^{US} is equal to $0.5\ (p_0 + p_0^*)$; at point 1, I_0 has the negative value of eq. (49) ; at point 2, it has the larger negative value of eq. (50). There is therefore French bliss at point 1, German bliss at point 2.

The lines I^{*EMS} and $I^{EMS} - p_0$ have a somewhat different interpretation, and it is one that brings us in touch with something that has escaped us thus far. These lines relate to what happens in the EMS in the absence of realignment. Our previous formulas for the EMS assume optimal values of $\bar{e}^{EMS}$ and γ. Thus they assume continuous realignment as the parameters of the situation change. But the rules of the EMS do not allow such continuous adaptation. On the contrary, these rules require keeping at least $\bar{e}^{EMS}$, if not γ,



$$I^N - P_0 = I_0 + \alpha\theta\bar{e}^N$$

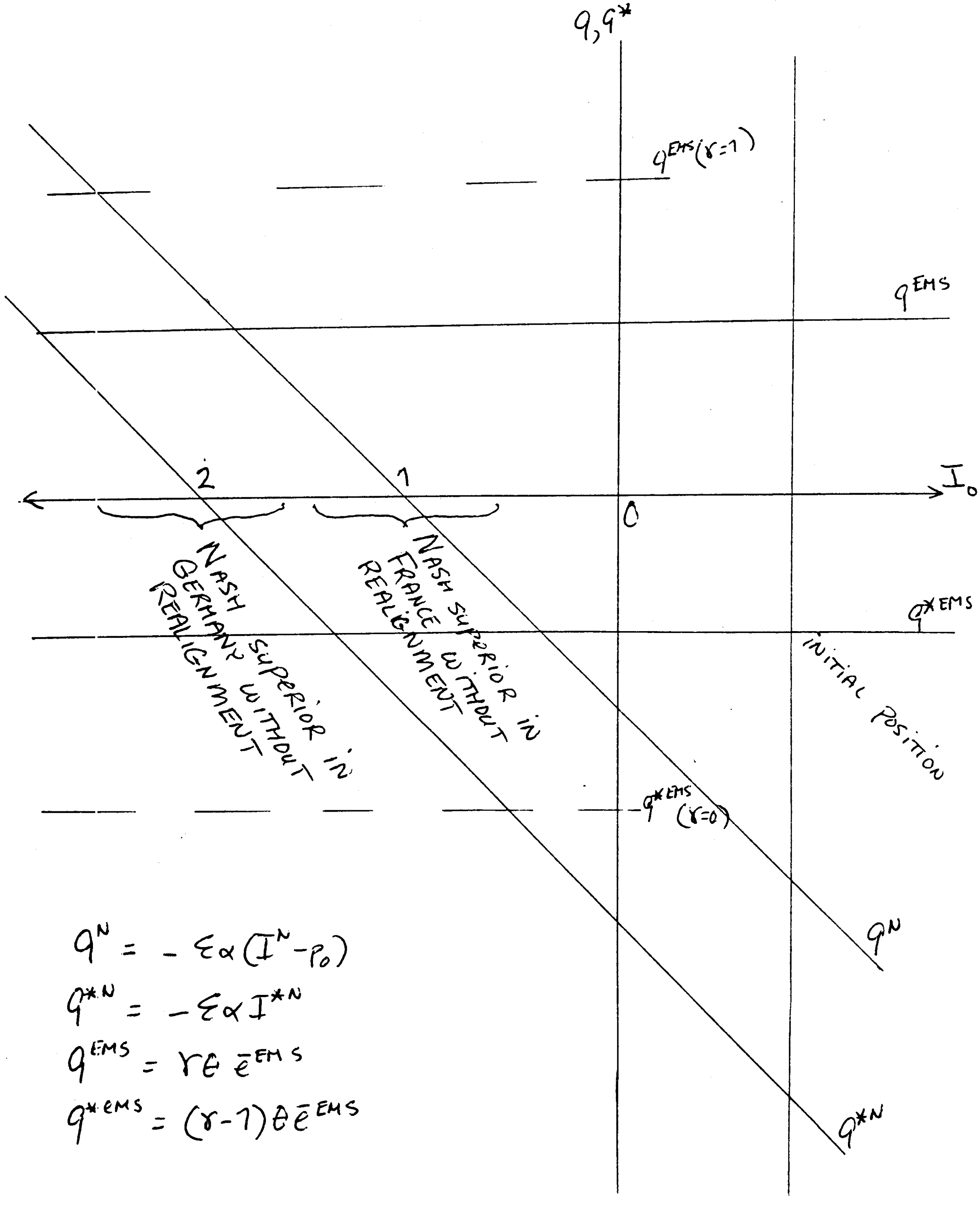
$$I^{*N} = I_0 + P_0^* - \alpha\theta\bar{e}^N$$

$$I^{EMS} - P_0 = I_0 + \alpha\theta\bar{e}^{EMS}$$

$$I^{*EMS} = I_0 + P_0^* - \alpha\theta\bar{e}^{EMS}$$

$$\bar{e}^{EMS} > \bar{e}^N$$

FIGURE 2



q, q^*
$q^{EMS}(\gamma=1)$
q^{EMS}
I_0
2
1
0
NASH SUPERIOR IN GERMANY WITHOUT REALIGNMENT
NASH SUPERIOR IN FRANCE WITHOUT REALIGNMENT
q^{*EMS}
INITIAL POSITION
$q^{*EMS}(\gamma=0)$
q^N
q^{*N}
$q^N = -\varepsilon\alpha(I^N - p_0)$
$q^{*N} = -\varepsilon\alpha I^{*N}$
$q^{EMS} = \gamma\theta\bar{e}^{EMS}$
$q^{*EMS} = (\gamma-1)\theta\bar{e}^{EMS}$

FIGURE 3

constant until the next realignment. Accordingly, the I^{*EMS} and $I^{EMS} - p_0$ lines in the figure, resting on $\bar{e}^{EMS}$ at the initial position, are depicted as parallel to the previous price lines. The $I^{EMS} - p_0$ line exceeds the $I^{M} - p_0$ one because the initial $\bar{e}^{EMS}$ exceeds $\bar{e}^{M}$, and by the same token, the I^{*EMS} line is always below the I^{*M} one (by an exactly equal amount).

It is impossible to infer from the figure where a realignment must happen following a fall in p^{us} or as I_0 moves down. But since 1 and 2 bliss points, this is necessarily somewhere at a distance from either of these two points. Let us assume that either France or Germany will call for a realignment as soon as it finds itself in a position which is inferior to Cournot-Nash. It immediately follows that France will call for a realignment in the vicinity of point 1, and Germany will do so in the vicinity of point 2. This explains the hypothetical intervals in the diagram where a realignment must happen.

Figure 3 adds to our understanding. It shows French and German output as a function of I_0. In the case of Cournot-Nash, undesired inflation leads to a contraction in output ; less than desired inflation leads to an expansion of output. The negative slopes of q^{*N} and q^{**} follow. These two curves are also parallel lines, of slope $- \varepsilon\, \alpha$, as indicated by the relevant equations (which are repeated for convenience at the bottom of the figure), and the two necessarily run respectively through points 1 and 2. At the initial position they are necessarily in negative space. (In fact, their values must correspond to those at point N in figure 1).

q^{EMS} and q^{*EMS}, on the other hand, are independent of I_0 and they are spaced on either side of the horizontal axis. The vertical distance between q^{EMS} and q^{*EMS} is greater than the one between the q^N and q^{*N} because $\bar{e}^{EMS}$ exceeds $\bar{e}^N$. q^{EMS} is somewhat higher above the origin than q^{*N} is below it because γ is greater than 0.5.

It is important to see that nothing but a realignment can affect the positions of the $I^{EMS} - p_0$ and I^{*EMS} lines in figure 2, whereas the positions of q^{EMS} and q^{*EMS} in figure 3 depend on the intervention coefficient γ as well. A realignment alters the distance between these two quantity lines, while a change in γ situates them differently at a given distance apart. This brings us to an interesting point.

As I_0 approaches point 1, we might imagine, for example, that France would tend to pull back from its agreement about γ, while Germany might allow France to do so because an immediate realignment would only lead to a devaluation of the mark at a time when Germany still views its inflation rate as too high. But around point 2, the shoe is on the opposite foot. Germany might be unhappy about $1 - \gamma$ while France might be willing to make concessions in order to avoid the realignment that would otherwise force an immediate appreciation of the franc at a time when France considers its price level as already too low. On these grounds, some adjustment of q^{EMS} and q^{*EMS} could take place without any realignment. But this sort of adjustment will not take the EMS very far. Even in the extreme case where γ drops to zero in the vicinity of point 1 and the q^{EMS} line therefore converges with the horizontal axis (while the q^{*EMS} line drops down to the position of the dashed q^{*EMS} line in the figure), France would remain dissatisfied : q^{EMS} would then be zero, but $I^{EMS} - p_0$ would still be positive, while France could have the zero value of $I - p_0$ it wants outside of the EMS. Symmetrical reasoning applies at point 2. Even if γ rose to one, and q^{*EMS} therefore converged with the horizontal axis (while the q^{EMS} line rose to the level of the dashed q^{EMS} line), the Germans would not be pleased. Although q^{*EMS} would then be zero I^{*EMS} would be negative, while the Germans could obtain the zero value of I^* they want outside of the EMS. Perfect flexibility of γ, therefore, may narrow the interval where a realignment is essential, but cannot obviate the necessity for a realignment.(9) Nothing can save the EMS around points 1 and 2, in the terms of our problem.

V

The one feature of the example that might arouse discomfort is the required appreciation of the franc in the danger zone. This feature necessarily follows in the example from the fact that the EMS sets the franc lower than it would otherwise be. Since the exchange rate that would exist independently of the EMS does not change, the forces that would require the EMS to adapt itself to the non-cooperative solution necessarily require an appreciation of the franc. It would be possible to modify this feature of the example only by complicating it. The essential point is independent : as long as there are divergent tendencies in the EMS, the depreciation of the dollar can be an element of stress. Indeed, under the conditions that I have designed, a dollar depreciation might cause the system to fall apart.

Finally, as indicated at the start, the message should not be interpreted strictly as a prediction of possible trouble, but can also be read in a normative way. Thus seen, it tells both countries to keep in mind the possibility of moving out of the system. Admittedly, one could always argue in favor of preserving the EMS by insisting on the possibility of a change in the future causing the system to become beneficial once more. Indeed, I think this argument has a lot of merit since a choice of regimes is fundamentally involved, and such choices should rest on long-run possible changes, not only the current situation. Still, the weight of the argument depends on its recognition on both sides. If either country becomes complacent whenever current circumstances happen to favor it, the ground for a mutually satisfactory intertemporal compromise will be undercut. Thus, it remains sound advice to both countries never to close off the possibility of moving out of the system.

FOOTNOTES

1. The only basic step in this derivation is :

$$a_3\ (i - i^* + p - p^{\bullet}_{+1} + p^{*\bullet}_{+1} - p^*) = a_3\ (p_0 - p^*_0 - e) = -\ a_3\ \bar{e}$$

2. See MELITZ (1985).

3. MELITZ (1985). Any sterilization is a problem since we assume perfect capital mobility.

4. This equation of λ and γ, which means letting the weights of L and L^* in eq. (39) be endogenous, is much more plausible than it might seem. For any case, the equation should be interpreted as a linear approximation to the Nash bargaining solution $\underline{L} = LL^*$, in which no terms like λ and $1-\lambda$ of eq. (36) ever appear. It was the minimisation of LL^* -- no other loss function -- that was shown by John Nash in 1950 to lead to a result that is necessarily as good or superior to the non-cooperative one. If we were actually to approximate LL^* linearly, the intervention coefficient γ would indeed appear as a critical term in the relative weights of French and

German welfare (along with ε and ε^*). Hence eq. (39) is not surprising. I avoid LL*, since its use, as such, would be mathematically unwieldy, as it would involve a polynomial of the fourth order.

5. With $\varepsilon = \varepsilon^*$, eq. (41) becomes

$$(41a) \quad \gamma = \frac{1}{2} + \frac{\varepsilon(I_o^* + I_o)(I_o^* - I_o - 2\,\alpha\,\theta\,\bar{e}^{EMS})}{2(\theta\,\bar{e}^{EMS})^2}$$

This equation says that as long as the sum $I_o^* + I_o$ is positive, γ will necessarily exceed 0.5 if only

$$I_o^* - I_o = p_o^* \text{ exceeds } 2\,\alpha\,\theta\,\bar{e}^{EMS}.$$

But $\bar{e}^{EMS}$ is positively related to γ and even for γ as low as 0.5,

$$2\,\alpha\,\theta\,\bar{e}^{EMS} = \frac{4\,\varepsilon\,\alpha^2}{1 + 4\,\varepsilon\,\alpha^2}\,p_o^*$$

which is less than p_o^*. Therefore γ is necessarily greater than 0.5. Further, for γ as low as 0.5, eq. (48) says :

$$\bar{e}^{EMS} = \frac{2\,\varepsilon\,\alpha}{\theta\,[1 + 4\,\varepsilon\,\alpha^2]}\,p_o^*$$

which is greater than

$$\bar{e}^{M} = \frac{2\,\varepsilon\,\alpha}{\theta\,[2 + 4\,\varepsilon\,\alpha^2]}\,p_o^*$$

6. I resort to this indirect form of argument in order to avoid the overly complex, fully reduced forms of eqs. (40) and (41) [or eqs. (48), and (41a) of the previous footnote, in case $\varepsilon = \varepsilon^*$], as indicated before.

7. See MELITZ and Philippe MICHEL (1985) and GIAVAZZI and Alberto GIOVANNINI (1986). GIAVAZZI and Marco PAGANO (1985) seem to come to the opposite conclusion that capital controls can be avoided, but they do so only by implicitly assuming official indifference to the effect of the interest rate on output.

8. Remember that $I_0 = \Phi\,[p^{us} - 0.5\,(p_0 + p_0^*)]$

9. Besides explaining some possible retardation of the realignment, the hypothesis of some flexibility of γ at times of stress may be useful in explaining why the pressure for realignment may come from the country in the weaker position. Thus, if Germany fails to intervene around point 2, France may be the one to press for a realignment near this point. The discussion in this section may be profitably compared with OUDIZ (1985).

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