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WHETHER TO JOIN EMS OR NOT: SIGNALLING AND THE MEMBERSHIP*

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ABSTRACT

It is argued that if in a dynamic context a central bank wants to signal its commitment to non-inflationary policies an EMS membership makes its task easier by requiring less restrictive policies than if it stays out. Despite this depending on the initial beliefs of the public the central bank may not like to be an EMS member. It is also shown that the EMS membership has partial signalling value in that the public thinks that a central bank choosing EMS is non-inflationary with a higher probability than a bank staying outside.

TIIVISTELMÄ

Selvityksessä tarkastellaan, auttaako EMS jäsenyys lisäämään inflaation vastaisen rahapolitiikan uskottavuutta. Osoittautuu, että EMS:n jäsenmaan rahapolitiikan ei tarvitse olla yhtä tiukkaa kuin ei-jäsenen, jotta politiikka olisi uskottavaa. Tästä huolimatta EMS jäsenyys ei välttämättä ole paras ratkaisu, jos pankilla on hyvä maine ilman jäsenyyttäkin. Toisaalta EMS jäsenyys sinällään voi osittain signalloida, että keskuspankki haluaa harjoittaa inflaation vastaista politiikkaa.

CONTENTS

1. INTRODUCTION

One of the major issues relating to the benefits of joining the EMS has been the question of policy credibility: Does the membership in the EMS increase the credibility of the authorities in fighting inflation?[1] In this paper this question is studied using the standard policy credibility models for a small open economy which can direct its exchange rate policies by choosing its exchange rate index properly. A weight of unity for Germany is seen to imply a membership in EMS. We are particularly concerned whether the membership decision has any signalling role for the public's expectation formation and whether the EMS membership has any implications if the central bank uses monetary policy also to signal its commitment to non-inflationary policies.

In the literature the question of the credibility of the anti-inflationary monetary policy is mostly analyzed by contrasting the fixed and flexible exchange rate regimes. Thus, e.g. Giavazzi and Pagano (1988) analyze the benefits of an EMS-membership against the possibility that a country adopts for pure floating exchange rates. This question gained importance after Rogoff (1985) argued that in the flexible exchange rate regime the prospect of changes in the real exchange rates caused by changes in money supply are a more effective way to control monetary policies than co-ordination of monetary policies (which fixed exchange rate regime necessarily implies) could be. Here I contrast two fixed exchange rate systems, one in which the currency is pegged to a basket of consisting of several currencies, and one in which the peg is to one currency only, the DM. It can be argued that this framework allows a better consideration of the policy choices for most small European countries (Austria and the Nordic countries) than the alternative.

The analysis of (monetary) policy credibility has been analyzed in at least three different contexts. First e.g. Horn and Persson (1988)

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[1]The collection of essays in Giavazzi, Mocossi and Miller (1988) gives a review of both the theoretical and empirical arguments.

have considered the credibility in a repeated game framework. It reproduces the standard result that with sufficiently low discount rates the optimal (low inflation) solution can be supported as a subgame perfect solution.

Secondly, the reputation building has been analyzed by e.g. Barro and Gordon (1985) and Backus and Driffill (1985). In these models the "high inflation" policy makers can initially imitate the behaviour of the "tough" central banks in order to gain later substantially by a large "surprise" inflation.

The third approach uses the reputation framework but assumes that the tough policy maker can behave strategically, i.e. it can signal its type through initially tough policies. This approach was initially applied by Vickers (1986) (see also Persson and van Wijnbergen (1989) for an application to wage and price controls). In this paper we follow the approach used by Vickers. It turns out that this switch in the mode of analysis gives some surprising results compared to the earlier literature.

2. THE MODEL

Consider a world consisting of two large economies, Germany and USA, and one small economy, Finland. Let p_1 = German inflation, p_2 = US inflation, e = rate of depreciation of the Dollar vis a vis the DM, e_1 = rate of depreciation of the FIM vis a vis the DM, e_2 = rate of depreciation of the FIM vis a vis the Dollar, and r = rate of depreciation in the Finnish currency index. By definition

$$(1) \qquad r = \Phi e_1 + (1-\Phi)e_2.$$

By triangular arbitrage in the foreign exchange market

$$(2) \qquad e = e_1 - e_2.$$

These equations can be solved for e1 and e_2:

$$(3) \qquad e_1 = r + (1-\Phi)e, \quad e_2 = r - \Phi e.$$

Assume next that the small economy is completely open so that domestic inflation is determined by foreign inflation and exchange rate policy. If the share of German goods in the relevant[2] price index is Θ domestic inflation is

$$(4) \qquad p = \Theta(p_1+e_1) + (1-\Theta)(p_2+e_2).$$

Assume next that on average the PPP holds between Germany and USA. Then $e = p_2 - p_1$ which together with (3) and (4) gives

$$(5) \qquad p = r + \Phi p_1 + (1-\Phi)p_2 \equiv r + g(\Phi).$$

Here $g(\Phi) = \Phi p1 + (1-\Phi)p2$ gives the foreign component of domestic inflation. This component can be changed by changing the weights in the currency index. We take it for granted that German inflation is below the US inflation, $p_1 < p_2$. This implies that $g' < 0$, i.e. that

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[2]The relevant index here is the GDP deflator.

an increase of the weight of the DM in the domestic currency index reduces the foreign inflation component in the domestic inflation. In the present framework it is natural to interpret that joining the EMS means that Φ is increased to 1 from whatever level it is currently. Here we allow for the possibility that exchange rate realignments are possible within the EMS (as it has been in the past).

Time is divided in two periods, the present and the future. The period t cost function of the policy maker is of the standard form used in the literature:

$$u_t = (p_t)^2/2 + c_j(Ep_t - p_t), \quad t = 1,2. \tag{6}$$

The policy makers do not like inflation but they would like to keep the level of economic activity above the natural level by surprise inflation. Had we assumed that real exchange rates are variable we could have added a term indicating that the policy makers do not like real exchange rate variability as in Giavazzi and Pagano (1988).

We assume that the discount rate is 0 which makes the intertemporal costs equal to $Z = u_1 + u_2$. The policy makers aim at minimizing Z. The policy maker can be either non-inflationary, c_n, or inflationary, c_i, with $c_n < c_i$. The game between the public and the policy makers proceeds as follows: In each period the public moves first by fixing its expectation of the period's inflation, Ep_t, and the central bank moves after that by setting the inflation for the period. Initially the public has the belief that the central bank is non-inflationary with the probability Π and inflationary with the probability $1-\Pi$. Finally we assume that the foreign inflation rates are non-stochastic and constant. This gives the period t utility function as

$$u_t = [r_t + g(\Phi)]^2/2 + c_j(Er_t - r_t). \tag{7}$$

3. EXCHANGE RATE POLICY AND THE EMS MEMBERSHIP AND SIGNALLING WITH MONETARY POLICY ONLY

It is clear that in period 2 the policy makers will not behave strategically since the expectations are then fixed and there are no future actions by the public. This gives the period 2 optimal exchange rate policy as

$$(8) \qquad r_{2j} = c_j - g(\Phi),\ j = n,i.$$

It could be assumed that $c_n = g(1) \equiv p_1$, i.e. that for the tough central bank joining EMS is consistent with a fixed exchange rate.

Next we proceed exactly along the lines of Vickers (1986). Let K_j be the lowest level r_1 such that the policy maker of type j is indifferent between i) choosing $r_1 = K_j$ and being believed to be non-inflationary and ii) choosing $r_1 = c_j - g(\Phi)$ and being believed to be inflationary. These are given by

$$(9) \qquad K_n(\Phi) = c_n - g(\Phi) - \left[2c_n^2(m-1)+g(\Phi)^2\right]^{1/2}$$

$$(10) \qquad K_i(\Phi) = c_i - g(\Phi) - \left\{2c_i^2\left[(m-1)/m\right]+g(\Phi)^2\right\}^{1/2}.$$

where $m \equiv c_i/c_n$.

Vickers shows that all the separating equilibria (i.e. equilibria at which the policy makers' characters are revealed in period 1) have the following properties:

a) The tough central bank follows the policy $r_{1n} \in [K_n, K_i]$, $r_{2n} = c_n - g(\Phi)$.

b) The loose central bank follows the policies $r_{ti} = c_i - g(\Phi)$.

Vickers further argues that among the separating equilibria only the equilibrium at which $r_{1n} = K_i$ is plausible eliminating all the dominated strategies. Most likely all the pooling equilibria (at which the loose central bank imitates the tough in period 1) are non-plausible using

the selection criteria proposed by Cho and Kreps (1987). In what follows we look only at the unique plausible separating equilibrium with $r_{1n} = K_i$, $r_{1i} = c_i - g(\Phi)$.

Consider now how these policies are affected by the EMS membership.

First, from (10) it is clear that upon entering EMS the policies of both of the central banks become more "devaluation prone", i.e. r increases for both types of the central banks. In this sense the EMS membership increases the credibility of the non-inflationary central bank: its policy does not have to be so restrictive as the policy outside EMS to signal its commitment to anti-inflationary policies. This is made clearer by the second characteristic of policy equilibrium:

Secondly, in EMS the policies of both of the central banks are closer to each other in period 1:

$$\delta K_i/\delta\Phi = -g'[1 + g(\Phi)/2A] > -g', \quad \delta r_i/\delta\Phi = -g'.$$

where A = the square root term in (10).

This result is in strong contrast to Giavazzi and Pagano (1988) who argue that EMS brings about credible more restrictive policies. Here just the opposite happens. The difference can be explained by noting that in Giavazzi and Pagano there is no signalling role for the monetary policy. The intuition for the difference is the following: Since the foreign component of domestic inflation would be in EMS lower than outside the tough central bank does not have to use so tough policies as outside to make its intentions clear.

Finally, one can make some remarks on the choice of the optimal peg within this framework. Consider how the intertemporal disutilities of the central banks are affected when Φ increases (i.e. a move towards the EMS is made), when the central bank cannot (and does not think) that it can affect Π:

$$\delta Z_n/\delta\Phi = -[g'g/2A]\{(K_i+g(\Phi) - (1-\Pi)\}.$$

This is negative (i.e. the change increases utility) only if $(1-\Pi) > K_i(\Phi)+g(\Phi)$, i.e. only if the public initially beliefs that the likelihood of the central bank being loose is larger than the period 1 inflation rate the tough central bank would want to have in period 1. Thus not even a tough central bank would always like to join the EMS. It would benefit only if the public initially has strong doubts about its toughness. If initially $(1-\Pi) < K_i(\Phi)+g(\Phi)$ then the tough central bank would prefer to stay out. The intuition is clear: credibility is only a means to achieve the policy targets. Credibility can be reached by policies which are tougher than the strong central bank desires in the long run. But if the public already has strong beliefs that the central bank is strong then the EMS membership does not help to reduce the toughness of the policies very much. EMS is the most preferable alternative only if $(1-\Pi) > K_i(1)+g(1)$. The optimal currency basket is given by Φ^* which solves the equation

$$K_i(\Phi^*)+g(\Phi^*) = 1-\Pi. \tag{11}$$

The impact of an increase in Φ on the utility of the inflation prone central bank is

$$\delta Z_i/\delta\Phi = -\Pi g'g/2A$$

which is clearly positive. Thus, the inflationary central bank would always have a higher utility outside EMS.

4. THE POSSIBLE SIGNALLING ROLE OF AN EMS MEMBERSHIP

The preceding analysis raises the question whether the central banks could use the membership in EMS as a signalling device. This issue can be considered in the following three-stage game: In period 0 the central bank decides whether to join EMS (i.e. whether to set $\Phi = 1$) or remain in status quo ($\Phi < 1$). In periods 1 and 2 the game is as described above. We take it for granted that the equilibrium in the game of periods 1 and 2 is the signalling equilibrium described in the previous section except when the membership choice is fully revealing.

It is straightfoward to see that no pure strategy separating (fully revealing) equilibria exist. Consider the following candidate for an equilibrium: The n policy maker joins EMS with certainty and the i policy maker remains in status quo with certainty. In this case the public would know at the beginning of period 1 the identity of the central banker. Thus the payoff of the n authority would be c_n^2 and for the i authority c_i^2. The n authority would not have any incentives (given reasonable out of equilibrium beliefs) to deviate from the equilibrium. The i authority, on the other hand, would clearly benefit by imitating the tough authority in period 0 and producing surprise inflation in either period 1 or 2. This is analogous to the Barro-Gordon -problem. Similarly, the other possible fully revealing choice of the currency index (n choosing the status quo and i choosing EMS) cannot be an equilibrium.

The only possible pure strategy equilibria are thus perfectly pooled equilibria in which the choice of Φ is completely non-informative (both choose either $\Phi = 1$ or the status quo). It looks as if the most reasonable uninformative equilibrium is the one where the tough authority chooses its preferred regime and the inflationary authority imitates that choice.

The remaining question is whether there exist any semi-separating (partly revealing) equilibria. They can arise only if the policy makers use mixed strategies. To study this, let P denote the a priori probability that the authority is tough and $\Pi(s)$ the corresponding after stage 1 posterior probability, if the choice s has been

observed. Let Q be the probability that n chooses EMS and v the probability that i chooses EMS. Then obviously

$$(12) \qquad \Pi(1) = PQ/[PQ+(1-P)V], \ \Pi(\Phi) = P(1-Q)/[P(1-Q)+(1-P)(1-V)].$$

The expected payoffs of the policy authorities are then

$$(13) \qquad EZ_n = Q\{(1/2)[K_i(1)+g(1)]^2 + c_n[\Pi(1)K_i(1) + (1-\Pi(1))r_i - K_i(1)] + (1/2)c_n^2\} + (1-Q)\{(1/2)[K_i(\Phi)+g(\Phi)]^2 - c_n[\Pi(\Phi)K_i(\Phi) + (1-\Pi(\Phi))r_i - K_i(\Phi)] + (1/2)c_n^2\},$$

$$EZ_i = V\{(1/2)c_i^2 + c_i[\Pi(1)K_i(1) + (1-\Pi(1))r_i - r_i] + (1/2)c_i^2\} + (1-V)\{(1/2)c_i^2 + c_i[\Pi(\Phi)K_i(\Phi) + (1-\Pi(\Phi))r_i - r_i] + (1/2)c_i^2\}.$$

These are to be minimized with respect to Q (EZ_n) and V (EZ_i) (taking into account (12) (which means that the authorities recognize their power to affect the expectation formation). It is cumbersome (and quite uninformative) to try to provide a full solution to the problem posed. Instead we are able to characterize the most important property of the mixed strategy equilibria for the purposes of this paper. Consider minimizing EZ_i. The first order condition can be written as

$$-c_i\Pi(1)^2[r_i-K_i(1)] + c_i\Pi(\Phi)^2[r_i-K_i(\Phi)] = 0$$

which gives

$$(14) \qquad \Pi(1)^2/\Pi(\Phi)^2 = [r_i-K_i(\Phi)]/[r_i-K_i(1)].$$

Since $[r_i-K_i(\Phi)] > [r_i-K_i(1)]$, it is clear that $\Pi(1) > \Pi(\Phi)$. This means that the membership choice has some signalling value: The decision to join EMS leads the public to expect with a higher probability that the policy-maker is non-inflationary. The intuition is that with the EMS

the gains from the surprise inflation are smaller. Thus by joining EMS the authorities can show that they put smaller weight to the gains from inflationary policies.

Finally, we could allow the authorities to choose Φ freely (so that they are not constrained to choose only either 1 or the status quo). It seems that the only reasonable equilibrium in this case is the pure strategy equilibrium where the tough policy maker chooses her preferred regime and the inflationary policy maker imitates and so the choice of the currency index does not have any signalling function. Also, in general, the EMS membership would not be a solution to the game.

5. CONCLUDING REMARKS

It has been argued that for a non-inflationary central bank in a fixed exchange rate regime, an EMS membership could increase the policy credibility

a) in the sense that it does not have to signal its type with so restrictive a policy as it would have to outside EMS

b) it can partly signal its type by deciding to join the EMS.

It was, however, shown that the EMS membership cannot completely convince the public that the central bank is committed to non-inflationary policies. Furthermore, relating to signalling with restrictive policies, the non-inflationary central bank may not find it optimal to join the EMS. The inflationary central bank would always prefer to stay outside EMS.

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