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CREDIBILITY OF POLICIES VERSUS CREDIBILITY OF POLICYMAKERS

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ABSTRACT

Standard models of policy credibility, defined as the expectation that an announced policy will be carried out, emphasize the preferences of the policymaker (his "type") and the role of policies in signalling type. Whether a policy is carried out, however, should also reflect the state of the economy, so that even a "tough" policymaker may renege on an announced policy in adverse circumstances. We investigate this alternative notion of credibility, using an "escape-clause" model of devaluation, in which a policymaker maintains a fixed parity in good times, but devalues if the unemployment rate gets too high. Our main conclusion is that if there is persistence in the process driving unemployment, following a tough policy in a given period may lower rather than raise the credibility of a no-devaluation pledge in subsequent periods, in contrast to the results in the earlier literature. We test this implication on EMS interest rates and find support for our hypothesis.

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I. INTRODUCTION

There is now an extensive literature on policy credibility, credibility being defined as the expectation that an announced policy will be carried out. Much of this literature has emphasized the role of a government's "type" (for example, the relative weights it puts on the losses from inflation versus unemployment) in determining the credibility of a policy. In this approach, introduced into the macroeconomics literature by Backus and Driffill (1985a,1985b), following the work of Kreps and Wilson (1982), a policymaker who assigns a relatively low cost to inflation may find it optimal to mimic the actions of a more inflation-averse policymaker. Observed monetary policy choices are thus taken to provide information about the government's (unobserved) inflation preferences and hence affect expectations about future policy. More specifically, when a policymaker delivers on an announced commitment to low inflation, this strengthens the belief that he really is inflation averse. Hence, a government that follows tough policies will see the credibility of its commitment to anti-inflationary policies increase over time. 1/

Whether or not an announced policy is carried out, however, often reflects more than the policymaker's intentions. The situation in which he

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1/ The basic approach of Backus and Driffill has been extended in several directions. Whereas they considered the case where the "tough" policymaker cares only about inflation, Vickers (1986) showed that if both tough and "weak" types care about unemployment, tough governments tend to be even more restrictive. Persson (1988) and Rogoff (1987,1989) provide excellent surveys of models of credibility and reputation. An alternative approach is to define strength in terms of ability to precommit to a particular policy, as in Cukierman and Liviatan (1991).

finds himself can be as important: even a "tough" policymaker may renege on a commitment in sufficiently adverse circumstances. Hence, credibility should reflect not simply the desire to carry out a policy, but also the ability to deliver on a promise in unfavorable circumstances. 1/

The purpose of this paper is to investigate this alternative notion of credibility. Our main point is that when credibility reflects the circumstances in which a policymaker finds himself (the "external circumstances" model of credibility), there may be significantly different implications than the now-standard model of "types" predicts. If tough policies constrain the room for manoeuver in the future, then following a tough policy may not increase credibility: it may actually harm it.

Our alternative view of credibility also makes clear that toughness of a policy and credibility of a policymaker are not identical. Whether a policymaker is credible in announcing a given policy will depend on the nature of the policy itself in a stochastic world. In fact, it may be more accurate to think of a tradeoff between the toughness of an announced policy and its credibility: an easy target will be credible when the economy is subject to random shocks, but will not enhance a policymaker's reputation for being "tough."

We apply this alternative notion to the credibility of a commitment to keep a fixed parity in a pegged exchange rate system, such as the European Monetary System. 2/ There is a well-known argument (see, for example,

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1/ A related point, made by Flood (1983) and Blanchard (1985), among others, is that if policies are too tough then current policymakers may be removed from power, leading to an easing of policies.

2/ Other illustrations could be drawn from stabilizations in Latin America or market reform in Eastern Europe. For instance, the ability to deliver on promised reforms would temper the attractiveness of a "big bang" approach; this would provide a counterargument to the strong case against gradualism made, for example, by van Wijnbergen (1990).

Giavazzi and Pagano [1988]) that membership in the EMS has enabled countries to improve their macroeconomic performance by "tying their hands", so that the credibility of the EMS would lend credibility to their inflation stabilization efforts. Our interest is in effects in the other direction, namely how the credibility of the EMS is *affected by* stabilization policy. Though the credibility of the EMS had been reinforced in its early years by the willingness of governments to accept unemployment costs in order to avoid (or limit the extent of) realignments, and in the period in January 1987-August 1992 by the absence of realignments, this was not sufficient to establish credibility definitively. 1/ In times of weak activity, pressures to restore high employment and growth will be strong, and this will affect the perceived probability of a realignment. Even a tough government cannot ignore output losses or unemployment: there may be a social consensus that too great (or prolonged) a downturn cannot be tolerated--even if offsetting it requires somewhat higher inflation and an abandonment of the exchange rate commitment. Thus, even if a government has been successful in convincing investors that it is "tough" rather than "weak", it will not maintain its EMS parity at all costs. 2/

Under the "external circumstances" view of credibility, tough policies may make future devaluation more, rather than less, likely, if such policies have persistent effects on output and employment. That is, a tough anti-

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1/ The paper was initially drafted in mid-1992. Events of September 1992 provide strong support for our contention that credibility is never definitively established because in some circumstances governments will choose to devalue.

2/ Froot and Rogoff (1991) suggest a number of reasons why the credibility of the EMS may not be increasing monotonically over time.

inflation policy may raise unemployment well into the future; a prolonged period of stagnation will increase the pressure on subsequent governments to devalue. Therefore, credibility need not monotonically increase with the length of time there has been no devaluation;1/ for a given distribution of shocks, the probability of devaluation may rise over time because previous policies have already lowered economic activity, and a future negative shock (such as high interest rates in neighboring Germany) is more likely to take unemployment beyond the range where it is tolerable. Interest differentials (taken as measure of the credibility of the fixed rate policy) should therefore be interpreted as reflecting not only signalling, but also the shared perception that in certain circumstances, devaluation is desirable.

Another linkage by which tough past policies could lead to an increased likelihood of devaluation currently is the accumulation of debt. In the face of an adverse revenue shock, maintaining a fixed exchange rate and forgoing monetary expansion may induce increased issuance of debt. Because of the higher debt service this implies, future governments would have higher financing needs and a lower threshold level at which a further adverse fiscal shock triggers a devaluation. In this paper, we do not treat debt accumulation.

In the next sections we consider the issue of signalling when employment effects of policy are persistent. We show formally how

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1/ Klein and Marion (1992) use duration analysis to study the credibility of a fixed exchange rate as a function of the length of time since the last devaluation. They do not consider a persistence effect, however, and their model has the credibility of the no-devaluation policy rising over time the longer there has been no devaluation.

persistent effects on employment of a tough policy, for example, maintaining a fixed parity, may lower rather than raise the credibility of a pledge of no devaluations in subsequent periods. In the final section we apply the theory to France. Regression results suggest that while the signalling model may apply in a period in the mid-1980s in which the stated priorities of the authorities changed, the alternative notion of credibility set out in the paper may help explain devaluation expectations and interest differentials in the remainder of the EMS period.

II. A BASIC SINGLE-PERIOD MODEL

We begin by illustrating the type of model we will use in a single period framework. The model developed here is based on Obstfeld's (1991) model of escape clauses, a model also used by Flood and Isard (1989). The escape-clause model is a variation of the Barro-Gordon (1983) time consistency model, here applied to exchange rates: surprise devaluations increase output, but an expected devaluation has no effect on employment. In the basic Barro-Gordon model the optimal policy would be a commitment to maintain the exchange rate at an announced parity; however, the private sector knows that the government has incentives to renege, and forms its expectations accordingly.

The escape-clause model adds a stochastic element to the Barro-Gordon framework, so that the devaluation decision will depend on both the relative weight the government puts on inflation and on the realization of stochastic shocks. The government therefore chooses between following the no-devaluation rule and following a discretionary policy: in the latter case it optimally chooses the magnitude of devaluation as a function of the realized state of the world, where optimality is defined as maximization of social welfare. The basic escape clause approach views the policymaker as choosing between a rule and discretion on the basis of the realized state of the world, rather than as using a two-part rule, in order to capture the notion that all states of the world cannot be foreseen ex-ante. Hence, a fully state-contingent rule cannot be specified. (To avoid problems of time-consistency, it is assumed that the policymaker must pay a private fixed cost when choosing discretion; otherwise a benevolent policymaker would always choose discretion ex post.) The credibility of the rule hence refers to the expectation that the policymaker will follow it rather than reverting to discretion. In such a stochastic framework, even a government which is tough on inflation will devalue for a sufficiently adverse realization of exogenous shocks. The model thus will capture the point stressed above about the importance of external circumstances in determining credibility.

We will depart from the basic escape-clause model by assuming that the choice is between the rule of a fixed parity, and the alternative of a devaluation of a fixed size (rather than discretion, where the policymaker chooses the size of devaluation with no constraint). Formally, this is a state-contingent, two-part rule, so that devaluation at the pre-announced trigger could be characterized as carrying out the "announced," or at least implicit, policy. In our opinion, this view is semantically correct, but misses the whole point -- that even a tough policymaker who plans ex ante to keep the fixed parity (and makes public statements to that effect) will devalue in adverse circumstances. We therefore take devaluation to represent departing from the announced (no-devaluation) policy.

For EMS countries it is probably reasonable to consider a devaluation of an exogenously fixed size as representing the alternative to no realignment, since the EMS puts constraints on the realignments that are possible. The problem of discretion always dominating does not arise here, as long as there is no linkage between periods and no ability to precommit to a policy. Even looking at just a single-period optimization, in some circumstances maintaining the existing parity is best, depending on the size of the shocks. Moreover, limiting ourselves to two options does not change the qualitative nature of the results: allowing other size realignments will leave our basic point intact.

The single-period problem will first be examined, before a two-period problem is considered, where what the government does in the first period helps to signal its type, and hence affects its policy choice (through credibility effects) in the second period. However, since the government's first-period policy choice has persistent effects on its targets, it also limits its room for manoeuver in the second period--in a way that may detract from the government's credibility.

Assume, as in Obstfeld (1991), that the exchange rate e is the policy instrument; that exchange rate surprises affect employment n (which in equilibrium is suboptimal due to distortions captured by κ); and that the government's objective function is quadratic both in the deviation of employment from the natural rate level n^* and in the exchange rate change (proxying inflation):

$$n = n^* + \sqrt{a}[(e - Ee) - u - \kappa] \tag{1}$$

$$L = (n - n^*)^2 + \theta(\Delta e)^2 \tag{2}$$

It is assumed that wages are set before the shock u is observed; Ee is conditioned on information available at the end of the previous period. However, the central bank, after observing u, chooses the exchange rate, and this value affects employment.

Let us write L^F the value of L when the exchange rate remains fixed (conditional on a particular value for u), and L^D its value when the central bank devalues by a fixed amount, d. Then in forming its expectations of e, investors calculate the probability that $L^D < L^F$, because this is probability that the central bank will choose to realign. Call this ρ. Substituting into (2), it can easily be shown that

$$\rho = prob(u > \frac{(a + \theta)d}{2a} - \kappa + e_{-1} - Ee) \tag{3}$$

However, the right hand side of (3) also depends on ρ, since Ee does. If we make the assumption that u is drawn from a uniform distribution symmetric about zero, then we can derive a closed-form expression of ρ. Let

$$prob(u > u^*) = \frac{(v - u^*)}{2v} \tag{4}$$

where u ranges between -v to +v. Let

$$u^* = \frac{(a + \theta)d}{2a} - \kappa + e_{-1} - Ee.$$

Then it can be shown, since $Ee - e_{-1} = \rho d$, that

$$\rho = [v - (a + \theta)d/2a + \kappa + \rho d] \; / \; 2v \quad \text{if} \quad -v \leq u^* \leq v \tag{5a}$$

$$= 1 \quad \text{if } u^* < -v \tag{5b}$$

$$= 0 \quad \text{if } u^* > v \tag{5c}$$

In the case of an interior solution, from (5a), the value of ρ is given by

$$\rho = \frac{[v - \frac{(a + \theta)d}{2a} + \kappa]}{2v - d} \tag{6}$$

Since the purpose of the devaluation is to offset adverse employment shocks, it is reasonable to assume that the size of a devaluation is smaller than the largest possible shock, that is, $d < 2v$. Thus the denominator of (6) is positive. It can be seen from (5) and the definition of u^* that if the distortion κ in the labor market is very large, then investors will always (correctly) expect that the central bank will want to devalue, so $\rho=1$. Even if κ is zero, however, it will not necessarily be the case that $\rho=0$; though if θ, the welfare cost of inflation, is large, then this must be true. Note that in this simple framework, credibility, i.e., ρ, is constant over time, since it just depends on parameters in the objective function of the authorities and the structure of the labor market. However, this feature would not hold in more general models, such as the two-period model presented in the next section.

III. A TWO-PERIOD MODEL WITH SIGNALLING IN THE FIRST PERIOD

A. Set-up

We now assume instead that there can be different types of governments, implying possible uncertainty about the government's objective function. 1/ For simplicity, we will suppose that the tough government (with superscript T) cares about inflation, with the weight θ^T, while the weak government (superscript W) gives a lower weight θ^W to inflation in its objective function. The objective function depends on output and inflation in both periods. In the first period, the type of government is unknown, so that the government's choice of policy may influence the expectation of a devaluation in the second period.

The i-type government's objective function conditioned on information available at t-1, including u_1 but not u_2, will be assumed to be

$$\begin{aligned}\Lambda^i &= L_1^i + \beta E L_2^i \\ &= (n_1 - n^*)^2 + \theta^i(e_1 - e_0)^2 + \beta E[(n_2 - n^*)^2 + \theta^i(e_2 - e_1)^2]\end{aligned} \quad (7)$$

In addition, the previous model is modified by allowing for persistence in the effects of shocks and of the exchange rate on employment:

$$n_t = n^* + \sqrt{a}\ [(e_t - Ee_t) - u_t - \kappa + \delta(n_{t-1} - n^*)] \quad (1')$$

1/ An alternative approach is to use a trigger-strategy model of expectations with uncertainty, along the lines of Canzoneri (1985). Though this allows the government to depart from tough monetary policy in response to observable adverse shocks without losing credibility and may be simpler than the Kreps-Wilson framework for some purposes, it does not allow a simple comparison with the role of the signalling of type motive for tough policy, which we feel is important in understanding devaluation policy.

where $\delta \geq 0$ is a measure of persistence in employment fluctuations (in the initial period, t=1, the inherited employment gap $n_0 - n^*$ is assumed to be zero, so that persistence only affects employment in the second period).

Now the values of the objective function in (7) will depend on both the government's ability to offset shocks in periods 1 and 2 and also the signalling of its type through its actions in the first period, since the value for employment in the second period will depend on exchange rate expectations. The public is assumed to know the values θ^T and θ^W. We will consider both the case where the shock u_1 is observed before forming expectations Ee_2 and the case where it is not. The expected depreciation will be $\mu_2 d$, where μ_2 is the probability of a devaluation in period 2. It can be written

$$\mu_2(j,u_1) = \pi_2(j,u_1)\ \rho_2^w(j,u_1) + (1 - \pi_2(j,u_1))\ \rho_2^T(j,u_1),$$

where π_2 = probability the government is of type w,

ρ_2^w = probability a government of type w will devalue (given the distribution of u_2),

ρ_2^T = probability a government of type T will devalue.

The first argument (j = D or F) indicates whether the government devalued (D) or kept the exchange rate fixed (F) in period 1; the second what the shock was (for the case where it is observed or where it can be inferred from other variables. The calculation of the probability that the government is of a given type will depend on the information structure.

B. Period two decision problem

In order to solve the government's optimization problem, and impose consistency between the government's actions and the public's expectations, we start by solving the government's second period problem, for given expectations of a devaluation μ_2. We will solve for μ_2 when we solve the first period problem.

The government will devalue in period 2 if

$$L_2^{i,D}(j,u_1) - L_2^{i,F}(j,u_1) < 0 .$$

Using (1'), this implies there is a devaluation if

$$a[d - \mu_2(j,u_1)d - u_2 - \kappa + \delta(n_1(j,u_1) - n^*)]^2 + \theta^i d^2 - a[-\mu_2(j,u_1)d - u_2 - \kappa + \delta(n_1(j,u_1) - n^*)]^2 < 0, \tag{8}$$

where, once again, dependence on period 1 actions is indicated by the (j,u_1) arguments. (From here on we will suppress these arguments in cases where no confusion should occur.) Equation (8) can be used to calculate the probability of a devaluation in period 2 conditional on the government being of type i and having played policy j in period 1:

$$\rho_2^i(j,u_1) = \text{prob}\ [u_2 > -\mu_2(j,u_1)d - \kappa + \delta(n_1(j,u_1) - n^*) + \frac{(a + \theta^i)d}{2a}] = \text{prob}\ (u_2 > U_2^i(j)) \tag{9}$$

Once again, we will assume a uniform distribution for u (and, moreover, assume that it is symmetric around zero), so

$$\rho_2^i = \begin{cases} [v - U_2^i(j,u_1)]/2v & \text{if } -v \le U_2^i(j,u_1) \le v & (10a) \\ 0 & \text{if } U_2^i(j,u_1) < -v & (10b) \\ 1 & \text{if } U_2^i(j,u_1) > v & (10c) \end{cases}$$

C. Period one decision problem

Turning to the government's policy choice in period 1, a government of type i will use (10) to calculate its expected policy in period 2, and hence the expected value of its objective function EL_2^i. For values of u_2 less than $U_2^i(j)$ it will keep the exchange rate fixed, while for larger values it will devalue. Using the density function for u_2 and integrating:

$$EL_2^i(j,u_1) = \frac{1}{2v} \int_{-v}^{U_2^i(\ )} a[-\mu_2(j)d - u_2 \ - \kappa + \delta(n_1(j) - n^*)]^2 du_2 \qquad (11)$$

$$+ \frac{1}{2v} \int_{U_2^i(\ )}^{v} \{a[d - \mu_2(j)d - u_2 - \kappa + \delta(n_1(j) - n^*)]^2 + \theta^i d^2\} du_2$$

where we have suppressed the argument u_1 in the functions μ_2 and n_1 on the right-hand side.

Substitution of (11) into (7) allows consideration of the government's first period choice between j=D or j=F: it will devalue if $\Lambda^i(D,u_1) <$ $\Lambda^i(F,u_1)$, that is, if

$$a(d - \mu_1 d - u_1 - \kappa)^2 + \theta^i d^2 - a(-\mu_1 d - u_1 - \kappa)^2 + \beta[EL_2^i(D,u_1) - EL_2^i(F,u_1)] < 0, \qquad (12)$$

where μ_1 is the ex-ante probability of a devaluation in the first period. From (11), the term between brackets [] in (12) reduces to (see the Appendix):

$$EL_2^i(D,u_1) - EL_2^i(F,u_1) = a[\mu_2(D)d - \delta n_1(D) - \mu_2(F)d + \delta n_1(F)] \{[\mu_2(D)d - \delta(n_1(D) - n^*) + \mu_2(F)d - \delta(n_1(F) - n^*)][1 - d/2v] + (1 - d/2v)(2\kappa - d) - \theta^i d^2/2av\} \qquad (13)$$

Equations (12) and (13) characterize the type-i government's policy choice conditional on the realization of the first period shock u_1 and on the public's perception of the probability of a devaluation in the second period. The latter reflects whether the public knows the actual government's type, that is whether the equilibrium is pooling or separating, an issue to which we now turn.

D. Expectations of period two devaluation

To model formation of expectations of devaluation for period 2, we assume that the public uses a Bayesian approach to assess the type of government, starting from uniform priors over the two types. As indicated above, we assume that expectations are conditioned on whether the government devalued or not in period 1, as well as possibly the value of u_1.

Consider first the case where the public does not observe the shock u_1. In this case, we begin with the probability that a government of a given type would follow one policy or the other. In particular, we write

$$\rho_1^i = \text{prob } (\Lambda^i(D) - \Lambda^i(F) < 0). \qquad (14)$$

If the government devalues in period 1, the probability that it is weak is

$$\pi_2(D) = \frac{\rho_1^W}{\rho_1^W + \rho_1^T} \quad , \qquad (15)$$

when we start with uniform priors. Similarly, if the government holds the exchange rate fixed in period 1, the probability that it is weak is

$$\pi_2(F) = \frac{1 - \rho_1^W}{2 - \rho_1^W - \rho_1^T} \qquad (16)$$

In the case where the shock u_1 is observed, we need to distinguish between pooling or separating equilibria. Consider the period-one decision of a tough (type T) government. There exists a critical value of u_1 (call it U_1^T) above which the tough government will devalue, below which it will not. Since a weak government will always devalue in the neighborhood of U_1^T, there will be a pooling equilibrium for $u_1 > U_1^T$ (that is, both types devalue). $\pi_2(D,u_1)$ therefore equals the prior, namely 1/2. For $u_1 < U_1^T$ the equilibrium will be separating, with $\pi_2(D,u_1) = 1$. For the two cases the value of $\mu_2(j,u_1)$ will be derived accordingly. U_1^T would then be defined as the value of u_1 such that $\Lambda^i(D,u_1) = \Lambda^i(F,u_1)$, that is, where the LHS of (12) equals 0 with $\mu_2(D)$ and $\mu_2(F)$ derived as indicated.

Similarly, for a weak government there exists a value U_1^W of u_1 (which will be less than U_1^T) above which the government will devalue and below which it will not. Since a tough government would maintain a fixed parity in the neighborhood of U_1^W, there will be pooling for $u_1 < U_1^W$ (with both types playing F), and $\pi_2(D,u_1) = 1/2$, separation for values of u_1 between U_1^W and U_1^T, and pooling (with both types playing D) for $u_1 > U_1^T$.

IV. WILL TOUGH POLICY NECESSARILY RAISE CREDIBILITY?

We can now derive the key equation relating credibility of the no-devaluation commitment in the second period to the policy action observed in the first period. This will allow us to demonstrate that no devaluation in the first period may raise rather than lower the public's expectation of a devaluation in the second period. Specifically, we must derive the difference in the probability of a devaluation in period 2 as a function of the policy action in the first period. One minus this probability is a measure of the credibility of the commitment to a fixed exchange rate.

Consider first the case where only the government's actions in the first period are observed. Since

$$\mu_2(j) = \pi_2(j)\ \rho_2^W(j) + (1 - \pi_2(j))\ \rho_2^T(j),$$

we have

$$\mu_2(D) - \mu_2(F) = \pi_2(D)[\rho_2^W(D) - \rho_2^T(D)] + \rho_2^T(D) - \pi_2(F)\ [\rho_2^W(F) - \rho_2^T(F)] - \rho_2^T(F) \qquad (17)$$

From (9), we have

$$\rho_2^W(j) - \rho_2^T(j) = (\theta^T - \theta^W)d/4av$$

$$\rho_2^T(D) - \rho_2^T(F) = [(\mu_2(D) - \mu_2(F))d - \delta(n_1(D) - n_1(F))]/2v \tag{18}$$

Using (15) and (16) to define $\pi_2(D)$ and $\pi_2(F)$ and (1') to yield $n_1(D) - n_1(F) = \sqrt{ad}$, we have

$$\mu_2(D) - \mu_2(F) = \frac{1}{1-d/2v} \left\{ - \frac{\sqrt{a}\delta d}{2v} + \frac{(\rho_1^W - \rho_1^T)(\theta^T - \theta^W)d/4av}{(\rho_1^W + \rho_1^T)(2-\rho_1^W-\rho_1^T)} \right\} \tag{19}$$

It can further be shown that

$$\rho_1^W - \rho_1^T = \frac{(\theta^T - \theta^W)d}{4av} > 0,$$

That is, a weak government is always more prone to devalue than a tough one (as one would expect). However, from (19) it is not necessarily the case that $\mu_2(D) > \mu_2(F)$. Consider the term in curly brackets. Although the second term (reflecting the signalling role of not devaluing in period one) is positive, the first (reflecting the effect of employment persistence) is negative, unless δ=0. (Note that 1-d/2v > 0, for otherwise the devaluation size would exceed twice the maximum size of the shock it was aimed to offset). Shocks that are not offset through a devaluation in period 1 have further unfavorable effects in period 2, increasing the probability that a government of either type will devalue. If these persistence effects are sufficiently strong (for example from large δ), not devaluing in the first period will raise the probability of a devaluation in the second. Thus, credibility will not necessarily be enhanced by "playing tough" in period 1.

In the case where the shock u_1 is observed, it makes sense to ask how the probability of a devaluation in period 2 will be affected by whether or not a devaluation was observed in period 1 only in the case where either action could be observed in the first period. That is, the question makes sense only for values of u_1 such that there is a separating equilibrium, in which case that $\pi_2(D) = 1$ and $\pi_2(F) = 0$. This simplifies the calculation considerably. One obtains

$$\mu_2(D) - \mu_2(F) = \rho_2^W(D) - \rho_2^T(F)$$

$$= \frac{1}{1-d/2v}\left[- \frac{\sqrt{a}\delta d}{2v} + \frac{(\theta^T - \theta^W)d}{4av}\right] > 0. \tag{20}$$

Hence, we see the same possible offset: if persistence effects are strong enough, playing tough in the first period will lower the credibility of the no devaluation policy in the second.

V. EMPIRICAL EVIDENCE

We now turn to how one can distinguish empirically between the two notions of credibility, one reflecting the signalling of types, the other the external circumstances in which a government finds itself. The model we have developed above implies that the correlation between changes in employment (or, given the labor force, in unemployment rates) and the expectation of a devaluation will be quite different depending on whether the signalling factor or the "external circumstances" factor in policymaking dominates. If there is great uncertainty about the government's type, then high unemployment may convincingly signal that the government is tough and determined to carry through on its policy commitment; therefore, policy credibility should improve. However, if the government's type is either subject to little uncertainty, or the difference in types is small, then increased unemployment may be seen as reducing credibility, since it makes it more likely that either type of government will not deliver on its policy commitments--in particular, on a commitment not to devalue, since a devaluation would (at least in the short run) mitigate the unemployment costs.

The EMS provides a good application of such a model, and interest rate differentials relative to Germany, the anchor for EMS monetary policy, provide a good proxy for expected devaluation, and hence for the lack of credibility of fixed parities. Recent empirical analyses of EMS credibility include Bartolini and Bodnar (1992), Koen (1991), and Weber (1991, 1992).1/ Moreover, received wisdom suggests that the EMS has gone from an initial stage of low credibility, lack of policy convergence, and relatively frequent realignments, to a later stage in which there is considerable policy convergence and realignments have been infrequent or have not occurred at all. Giavazzi and Spaventa (1990), for instance, refer to the latter period as the "New EMS." If there is a change in behavior along those lines, our model suggests that the partial effect of unemployment on the interest rate differential should be quite different: significantly negative in the first period, and less negative or positive in the second.

France may be an especially good case for examining alternative models of credibility. Between the formation of the EMS in March 1979 and the present, France has had six realignments relative to the deutsche mark

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1/ Koen calculates credibility bands around interest differentials which take into account the freedom for exchange rates to change without realignments being necessary; for long-term interest rates, which we use in our empirical work, the bands are quite narrow, however.

(September 24, 1979; October 5, 1981; June 14, 1982; March 21, 1983; April 7, 1986; and January 12, 1987). While in the early part of the period the long-term interest differential between the Franc and DM rose, since the end of 1982, the interest differential has been falling steadily and, at the end of 1991, stood at less than half of a percentage point (Chart 1).1/

In the early part of the EMS period, the socialist government which came to power in May 1981 followed strongly expansionary policies, making it clear that it had little commitment to fixed exchange rates. Higher unemployment would signal the need to stimulate aggregate demand, and hence make a realignment more likely; it should therefore have been associated with higher long-term interest rate differentials vis-à-vis Germany. However, there was an important change in behavior in June 1992, reinforced in March 1983, when France shifted to far tighter fiscal and monetary policies, the politique de rigueur. We would argue that the shift in policy in 1983 was not immediately perceived as a long-term shift, that is, that it took time for policymakers to convince investors; they did so by showing that they accepted the unemployment costs without devaluing, and there were in fact no realignments for a three-year period, despite high unemployment, which rose above 10 percent (Chart 2). The commitment to a strong franc made by the socialist government was reaffirmed by the conservatives, who were in power between 1986 and 1988. After returning to power in May 1988, socialist finance minister Bérégovoy further asserted that the franc would not be realigned against the deutsche mark in the future. The consistency

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1/ It has since widened, in large part because of the considerations discussed in this paper.

Chart 1. Long-Term Interest Differentials Against Germany

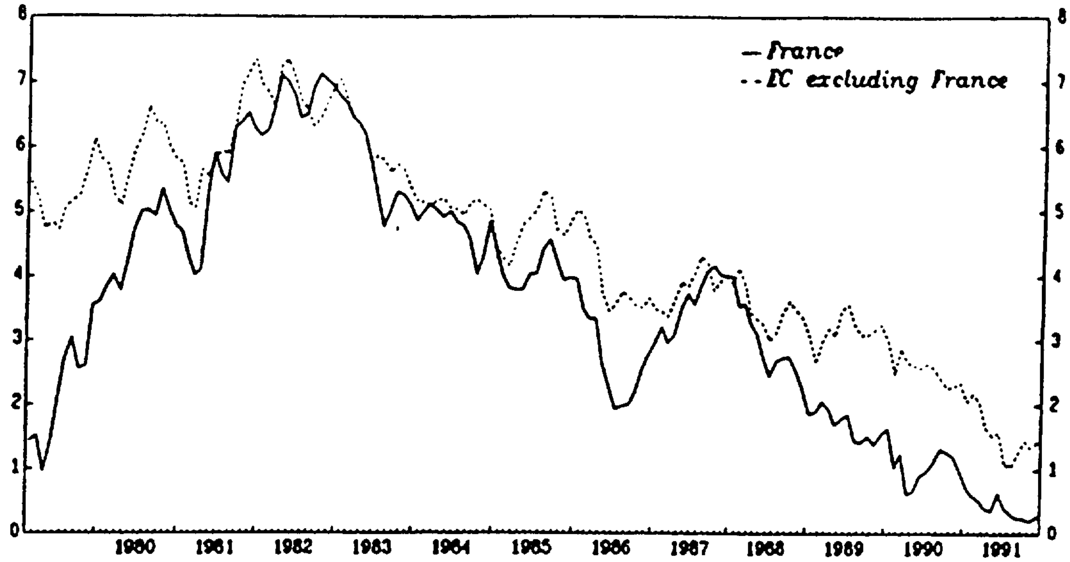
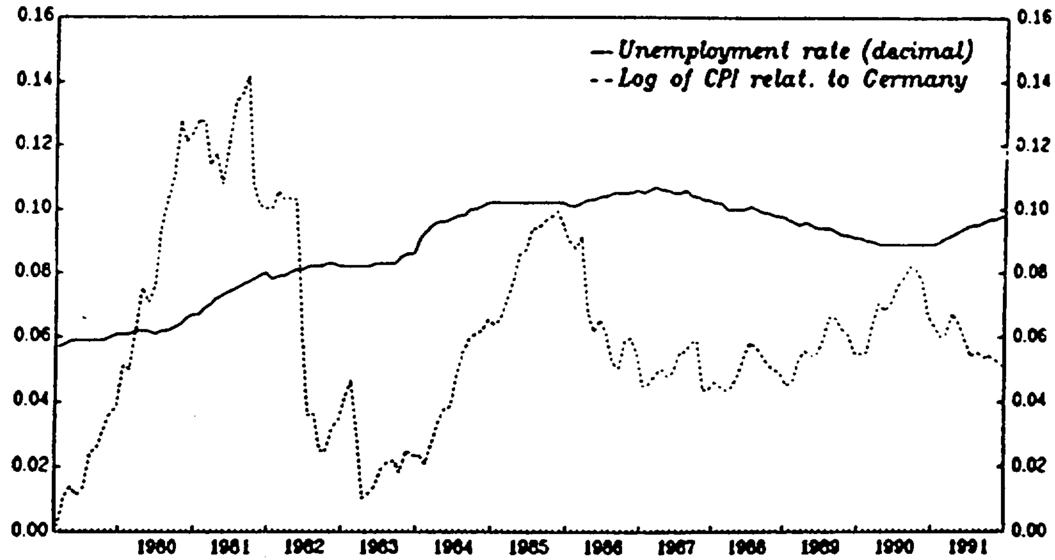


Chart 2. France: Unemployment and Relative Prices



in French policy no doubt helped to establish a reputation for toughness. However, unemployment remained a problem; after declining to about 9 percent, it rose once again to 10 percent as the economy slowed in 1990-91. Though the reputation for toughness was established, there may have been legitimate concerns that restrictive policies could not be maintained. In these circumstances, higher unemployment should once again tend to raise interest differentials, since even a tough government might devalue if the unemployment costs became too high.

Our theory therefore implies that the relationship between unemployment and long-term interest differentials should change over time, perhaps going through three phases. In the initial period following the election of François Mitterand as President and the formation of a socialist government, the authorities were perceived as not being tough with respect to inflation nor committed to resisting realignments. They were willing to devalue, and the higher was the unemployment rate, the more likely was a realignment. After the 1983 switch to a politique de rigueur, however, the absence of devaluations in spite of high unemployment helped signal to the public the change in the type of government, so that higher unemployment should have raised credibility and hence led to declining interest differentials relative to Germany. Once a reputation for toughness was established, devaluation in the face of an adverse shock or accumulated loss of competitiveness (as occurred in January 1987) should not have significantly damaged the credibility of the strong franc policy. However, despite this favorable effect on credibility, continued high unemployment would be associated with fears of an eventual devaluation and hence would lead to higher interest differentials than would otherwise have prevailed.

This characterization of the difference in the relation between unemployment and interest differentials depending on which credibility factor dominates suggests the following sort of test: one can regress the long-term interest differential with Germany on variables which measure the policy stance to see how the relation changed over time. One can then ask whether such changes reflect political changes taking place in France which would operate in the direction predicted above.

Long-term interest differentials between France and Germany were regressed on some plausible measures of expected devaluation, including the unemployment rate. These indicators are: a measure of competitiveness (the ratio of the French CPI relative to Germany); the EC wide interest differential (excluding France) with respect to Germany, which is intended to capture the overall credibility of the EMS commitment to fixed parities; and the lagged dependent variable, which can be expected to enter because the accumulation (or loss) of credibility can be expected to occur gradually. (More general lag structures were tried, but in general other lagged dependent or independent variables were not significant.)

Changes in the relationship between the unemployment rate and interest differentials were examined in two ways. First, natural breaks in the series that correspond to the dating discussed above were imposed in estimation, using appropriately specified dummy variables. The discussion suggests an initial period ending in late 1982 or early 1983, a middle period extending to the most recent devaluation, in January 1987, and a final period since then. Second, tests of structural stability were performed, splitting the whole sample into two subperiods by successively trying different break points; if breaks are significant at several dates, the one that gives the maximum value of the likelihood ratio is chosen. Then, each of the two subsamples is further tested for break points in the same fashion. In doing these tests, the coefficients of both the unemployment rate and the constant term were allowed to vary, but the remaining coefficients were assumed constant over the whole sample.1/

Using the first approach, the unemployment rate and the constant are entered with separate coefficients for the three subperiods discussed above (1979:05-1982:12, 1983:01-1986:12, and 1987:01-1991:12). The likelihood ratio test indicates that there is a significant difference in the regression coefficients on the unemployment rate and the constant across the three subperiods.2/ In the first and third subperiods, higher unemployment is associated with higher interest differentials, reflecting increasing concern with the possibility of realignment. The constant term is considerably more negative in the third subperiod, suggesting that the threshold for a realignment in terms of the unemployment rate was higher. That is, grouping the terms multiplied by each of the dummy variables as a_4DUM1 (UR + a_5/a_4), etc., then $-a_5/a_4$ is the level of the unemployment rate in the first subperiod at which there is a positive effect on the interest differential, and similarly for the other subperiods. These values for the

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1/ Tests that allowed all of the coefficients to vary gave similar break points and test statistics.

2/ On the assumption that the break points are known--see discussion below, however.

Table 1. Regressions for the French Long-Term Interest Differential Against Germany (ID), May 1979-December 1991
(Standard error in parentheses)

$$ID = a_1 LRP + a_2 IDEC + a_3 ID_{-1} + DUM1(a_4 UR + a_5) + DUM2(a_6 UR + a_7) + DUM3(a_8 UR + a_9)$$

Independent Variables 1/									Statistics 2/					
LRP	IDEC	ID_{-1}	DUM1	DUM1.UR	DUM2	DUM2.UR	DUM3	DUM3.UR	R^2	SER	ARCH	LM(1,8)	Q(1,20)	LR(4)
Whole Sample														
0.492 (0.789)	0.265* (0.050)	0.801* (0.037)	-0.892* (0.311)	0.043 (0.024)	--	--	--	--	0.979	0.279	0.83	12.20	26.3	--
Subperiods: May 1979-Dec. 1982, Jan. 1983-Dec. 1986, Jan 1987-Dec. 1991														
0.985 (0.956)	0.316* (0.059)	0.703* (0.047)	-2.125* (0.522)	0.242* (0.072)	0.309 (0.778)	-0.074 (0.070)	-3.269* (0.804)	0.294* (0.084)	0.981	0.267	1.18	8.21	25.7	17.9*
Subperiods: May 1979-Sept. 1981, Oct. 1981-Oct. 1986, Nov. 1986-Dec. 1991														
-0.670 (1.044)	0.359* (0.060)	0.717* (0.043)	-3.449* (0.828)	0.425* (0.120)	-0.333 (0.694)	-0.026 (0.057)	-2.486* (0.707)	0.207* (0.075)	0.982	0.262	0.96	9.40	29.3	23.5*

1/ Variables names: LRP - log of French CPI relative to Germany's; IDEC - EC interest differential with Germany (excluding France); ID_{-1} - lagged dependent variable; DUM1, DUM2, DUM3 - dummy variables, equal to unity within the relevant subperiods, zero otherwise; UR - French unemployment rate.

2/ Statistics: R^2 - explained sum of squares as a ratio to total sum of squares; SER - standard error of regression; ARCH - autoregressive conditional heteroscedasticity test, distributed as F(1,150); LM(1,8) - Lagrange multiplier test for serial correlation, lags 1 to 8, distributed as $\chi^2(8)$; Q(1,20) - Ljung-Box test for serial correlation, lags 1 to 20, distributed $\chi^2(20)$; LR(4) - likelihood ratio test of structural break, distributed $\chi^2(4)$, assuming that breakpoints are known.

* Significant at 5 percent level.

transformed constant term are, respectively, 8.78 and 11.12 for the first and third subperiods. In the second subperiod, when the authorities were attempting to signal a change in the priorities of the government and gaining credibility for a "hard currency" policy, higher unemployment rate is associated with lower interest differentials, as the discussion above suggested that it should. However, the coefficient is not strongly significant.

The second approach identified the break points on the basis of the values of the likelihood ratio at the different dates (allowing for different coefficients on the unemployment rate and the constant before and after that date). The critical values of hte likelihood ratio when the break point is not knwon have recently been tabluated by Andrews (1990). For two degrees of freedom, they are 11.7 at the 5 percent level and 10.1 at the 10 percent level. Starting with the whole sample, the maximum likelihood ratio statistic (a value of 11.0) occurred when the sample was broken at 1986:9, and this is signifciant at the 10 percent level. If we then treat the first subperiod as a separate sample, the maximum likelihood ratio statistic (a value of 13.5) occurs when a further break is made at 1981:9. Using the second subperiod as a separate sample, the likelihood ratio has a maximum value of 8.1, well below the 10 percent critical value, suggesting no breakpoint in this period. Therefore, the coefficients on unemployment and the constant were estimated over three subperiods: 1979:5-1981:9, 1981:10-1986:9, and 1986:10-1991:12. Interestingly, the second break point is very close to that suggested by our historical discussion.

Again the unemployment coefficients evolve over time as our model would suggest. Unemployment has a strongly significant, positive coefficient in the early and late periods. In contrast, in the middle period, when unemployment was rising strongly and the government was trying to establish credibility for greater exchange-rate stability and for limiting inflation, the coefficient is negative, though insignificant.

VI. CONCLUSIONS

The initial work on modelling credibility stressed a policymaker's intentions as summarized by his "type". It enabled macroeconomists to understand better how a "tough" policy could yield benefits well into the future via enhanced reputation. We were always uneasy, as were others, with the picture of a tough policymaker who would adhere to his anti-inflation policy no matter what was happening to the economy.

A more realistic picture is that of a policymaker who will renege on his commitment if circumstances are bad enough. Credibility, namely the expectation that an announced policy will be carried out, then reflects not only the policymaker's intentions, but also the state of the economy, where stochastic shocks will be important. The purpose of this paper was to show that this view of policymaking and credibility implies that tough policies may have adverse effects on credibility in the future if they severely constrain the choices of future policymakers. Policies that raise unemployment into the future, for example, will lower the "threshold" level of the random shock at which a future policymaker will find it optimal to devalue.

Using interest differentials relative to Germany as a measure of the perceived credibility of a country's pledge to maintain a fixed parity in the EMS, we found support for this alternative view in the effect of unemployment on credibility in France. In fact, though there was some weak evidence of the signalling role of unemployment in a period in the mid-1980s in which the priorities of the authorities had changed, in the earlier and later subperiods there seems to be clear evidence of a negative association between credibility and the unemployment rate. This suggests that both policy makers' reputation for pursuing a hard-currency peg and durably lower unemployment are necessary to eliminate the interest differential with Germany to zero. The results are far from conclusive. But they indicate that modelling credibility solely in terms of a policymaker's preferences or intentions is seriously incomplete.

1. Derivation of equation (13) in the text

Let $m(j) = \mu_2(j)d - \delta(n_1(j) - n*)$. Note that $U_2^i(j) = -m(j) - \kappa + (a + \theta^i)d/2a$. Then $EL_2^i(j)$ would be equal to

$$\frac{1}{2v}\int_{-v}^{v} a[m(j) + u_2 + \kappa]^2 du_2 + \frac{1}{2v}\int_{U_2^i(j)} \{-2ad[m(j) + u_2 + \kappa] + (a + \theta^i)d^2\} du_2$$

$$= a[m(j) + \kappa]^2 + a\, v^2/3 - \frac{ad}{v}[m(j) + \kappa - (a + \theta^i)d/2a][v - U_2^i(j)] - ad[v^2 - U_2^i(j)^2]/2v$$

$$= a[m(j)]^2 + 2a\kappa\, m(j) + a\kappa^2 + av^2/3 + \frac{ad}{2v}U_2^i(j)[v - U_2^i(j)] - \frac{ad}{2}[v - U_2^i(j)]$$

Now $U_2^i(D) - U_2^i(F) = -[m(D) - m(F)]$, and

$U_2^i(D) + U_2^i(F) = -[m(D) + m(F) + 2\kappa - (a + \theta^i)\, d/a]$

so $EL_2^i(D) - EL_2^i(F) = a[m(D)^2 - m(F)^2] + 2a\kappa[m(D) - m(F)]$

$$- ad[m(D) - m(F)] - \frac{ad}{2v}\{[m(D) - m(F)][m(D) + m(F) + 2\kappa - (a + \theta^i)d/a]\}$$

$$= a[m(D) - m(F)][(1 - d/2v)(m(D) + m(F) + 2\kappa - d) - \theta^i d^2/2av]$$

$$= a[\mu_2(D)d - \delta n_1(D) - \mu_2(F)d + \delta n_1(F)]\{[\mu_2(D)d - \delta(n_1(D) - n*) + \mu_2(F)d - \delta(n_1(F) - n*) + 2\kappa - d][1 - d/2av] - \theta^i d^2/2av\}$$

2. Derivation of equation (17) in the text

From the definition $\mu_2(j) = \pi_2(j)\,\rho_2^W(j) + (1 - \pi_2(j))\,\rho_2^I(j)$, we have

$$\mu_2(D) - \mu_2(F) = \pi_2(D)[\rho_2^W(D) - \rho_2^I(D)] + \rho_2^I(D) - \pi_2(F)[\rho_2^W(F) - \rho_2^I(F)] - \rho_2^I(F)$$

Now, from (9) in the text, provided $-v \le U_2^i(D),\ U_2^i(F) \le v$,

$$\rho_2^w(j) - \rho_2^T(j) = (\theta^T - \theta^w)d/4av$$

and $\rho_2^T(D) - \rho_2^T(F) = [(\mu_2(D) - \mu_2(F))d - \delta(n_1(D) - n_1(F))]/2v$

So, from the equations above

$$\mu_2(D) - \mu_2(F) = [\pi_2(D) - \pi_2(F)]\ (b^T - b^w)d/4av$$

$$+\ [\mu_2(D) - \mu_2(F)]\ d/2v - [n_1(D) - n_1(F)]\ \delta/2v$$

Since from (1') $n_1(D) - n_1(F) = \sqrt{a}d$, we may derive

$$[\mu_2(D) - \mu_2(F)]\ [1 - d/2v] =$$

$$-\sqrt{a}\delta d/2v \quad + \left[\frac{\rho_1^w}{\rho_1^w + \rho_1^T} - \frac{1 - \rho_1^w}{2 - \rho_1^w - \rho_1^T} \right]$$

References

Andrews, Donald W.K. (1990), "Tests for Parameter Instability and Structural Change with Unknown Change Point," Cowles Foundation Discussion Paper No. 943 (New Haven: Yale University).

Backus, David, and E. John Driffill (1985a), "Inflation and Reputation," American Economic Reviews, vol. 75 (June), pp. 530-538.

______ (1985b), "Rational Expectations and Policy Credibility Following a Change in Regime," Review of Economic Studies, vol. 52 (April), pp. 211-221.

Barro, Robert J., and David B. Gordon (1983a), "Rules, Discretion, and Reputation in a Model of Monetary Policy," Journal of Monetary Economics, vol. 12, pp. 101-121.

_____ (1983b) "A Positive Theory of Monetary Policy in a Natural Rate Model," Journal of Political Economy, vol. 91 (August), pp. 589-610.

Bartolini, Leonardo, and Gordon Bodnar (1992), "Target Zones and Forward Rates in a Model With Repeated Realignments," IMF Working Paper WP/92/22 (March).

Blanchard, Olivier J. (1985), "Credibility, Disinflation, and Gradualism," Economics Letters, vol. 17, pp. 211-17.

Canzoneri, Matthew (1985), "Monetary Policy Games and the Role of Private Information," American Economic Review, vol. 75 (December), pp. 1056-70.

Cukierman, Alex, and Nissan Liviatan (1991), "Optimal Accommodation by Strong Policymakers Under Incomplete Information," Journal of Monetary Economics, vol. 27 (February), pp. 99-127.

Flood, Robert P. (1983), "Comment on Buiter and Miller," in Jacob A. Frenkel, ed., Exchange Rates and International Macroeconomics (Chicago: University of Chicago Press), pp. 359-365.

______, and Peter Isard (1989), "Monetary Policy Strategies," IMF Staff Papers, vol. 36 (September), pp. 612-632.

Froot, Kenneth. A., and Kenneth Rogoff (1991), "The EMS, the EMU, and the Transition to a Common Currency, Olivier J. Blanchard and Stanley Fischer, eds., NBER Macroeconomics Annual 1991, (Cambridge MA: MIT Press). pp. 269-317.

Giavazzi, Franceso, and Marco Pagano (1988), "The Advantage of Tying One's Hands: EMS Discipline and Central Bank Credibility," European Economic Review, vol. 32 (June), pp. 1055-75.

______, and Luigi Spaventa (1990), "The New EMS," CEPR Discussion Paper No. 369 (January).

Klein, Michael, and Nancy Marion (1992), "The Duration of Fixed Exchange Rate Regimes," working paper (November).

Koen, Vincent R. (1991), "Testing the Credibility of the Belgian Hard Currency Policy," IMF Working Paper WP/91/79 (August).

Kreps, David and Robert Wilson (1982), "Reputation and Imperfect Information," Journal of Economic Theory, vol. 27, pp. 253-79.

Obstfeld, Maurice (1991), "Destabilizing Effects of Exchange Rate Escape Clauses," NBER Working Paper No. 3603 (January).

Persson, Torsten (1988), "Credibility of Macroeconomic Policy: An Introduction and Broad Survey," European Economic Review, vol. 32, pp. 519-32.

Rogoff, Kenneth (1987), "Reputational Constraints on Monetary Policy," in K. Brunner and A. Meltzer, eds. Carnegie-Rochester Series on Public Policy 26, Amsterdam: North-Holland, pp. 141-82.

______ (1989), "Reputation, Coordination, and Monetary Policy," in R. Barro, ed., Modern Business Cycle Theory, Cambridge, MA: Harvard, pp. 236-64.

van Wijnbergen, Sweder (1990), "Intertemporal Speculation, Shortages and the Political Economy of Price Reform: A Case Against Gradualism," mimeo, World Bank (December).

Vickers, John (1986), "Signalling in a Model of Monetary Policy with Incomplete Information," Oxford Economic Papers, vol. 38, pp. 443-55.

Weber, Axel (1991), "Reputation and Credibility in the European Monetary System," European Policy, No. 12 (April), pp. 57-102.

02.__ (1992), "The Role of Policymakers' Reputation in the EMS Disinflations: An Empirical Evaluation," European Economic Review, vol. 36, pp. 1473-92.