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Evaluating Policy Rules under Imperfect Credibility *

Prepared by Paul R. Masson and
Steven A. Symansky

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Abstract

Evaluation of policy rules using empirical macroeconomic models is usually done on the assumption that the rules are perfectly credible. However, there are usually circumstances that cause the authorities to abandon any given rule. The public's expectations reflect this possibility. In the paper, credibility is assumed to depend on the probability that the authorities will abandon a rule because the resulting utility exceeds that from maintaining the rule. Simulations of a disinflation policy leading to price stability are presented. Its credibility varies over time, depending on the paths for output and inflation.

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Summary

The numerical evaluation of policy rules usually assumes that they are credible; hence there is no question that the policies will be followed, and the private sector forms its expectations accordingly. In practice, however, changes in regime, or more basically, changes in operating rules can be readily observed. In the light of the nonzero probability that rules may be abandoned, it seems to be stacking the deck in their favor to assume that expectations are formed on the basis of complete credibility. In general, lack of credibility will make policy less effective in attaining policy goals.

This paper attempts to implement, in a medium-size nonlinear model, an index of credibility reflecting the probability that the rule will be abandoned in favor of a simple alternative rule. The probability assessment is based on assumed knowledge of the authorities' objective function, of the parameters of the model, and of the distribution of shocks hitting the economy.

The rule considered is an exogenous deceleration of the money supply, leading eventually (at the end of four years) to stable prices. The paper presents numerical simulations of such a path for money with an assumed function for the authorities' objectives, such that in some circumstances they would find it desirable to abandon the announced monetary deceleration and instead continue a positive money growth rate forever. The simulations give examples of lack of credibility, which is shown to affect the success of the policy.

I. Introduction

The numerical evaluation of policy rules usually assumes that they are credible; hence there is no question that the policies will be followed, and the private sector's expectations are formed accordingly. However, in practice we observe changes in regime, or more basically, changes in operating rules. These may occur because there are changes in the objectives of the authorities, resulting from political changes, or there are shifts in perceptions of what is important. They may also occur because changed circumstances make an announced path for a policy instrument, or a rule for that policy instrument, no longer optimal. Indeed, there is a large literature, beginning with Kydland and Prescott (1977) and extended by Barro and Gordon (1983) and many other authors, that considers the "time inconsistency" of optimal policy, which occurs because the passage of time--even in the absence of shocks--changes the incentives to stick to the chosen policy. More recent authors have explained that in a multi-period context with stochastic shocks, concern for reputation on the part of the authorities might remove the temptation for reneging on announced policy. 1/ However, uncertainty about the future is likely to mean that no policy is perfectly credible: even for a policy that is "time consistent" in the absence of shocks, the subsequent occurrence of random shocks will change the attractiveness of that policy relative to alternative policies (Canzoneri and Henderson (1988)).

In the light of the nonzero probability that rules may be abandoned, it seems to be stacking the deck in their favor to assume that expectations are formed on the basis of complete credibility. In general, lack of credibility will tend to make policy less effective in attaining policy goals. For instance, monetary deceleration may well lead to a slower decline in inflation if wage and price behavior is not modified to reflect lower expected inflation. Similarly, a policy of fixed exchange rates may not be tenable--or involve prohibitively high interest rates--if expectations of a depreciation persist. Therefore, it would seem to be important to evaluate policies on the basis of an estimate of their credibility, if that credibility can be modeled. 2/ Taking account of the private sector's assessment of the credibility of policy rules helps to meet the criticism made by Lucas (1976) concerning the use of models in this context.

1/ See Backus and Driffill (1986) and Currie and Levine (1987).

2/ Of course, if the ranking of rules is not affected by the introduction of less-than-perfect credibility, then the insights from the standard comparisons of outcomes may still be useful. It is not obvious that this would be the case, however. For instance, the success of some rules may be more dependent on credibility than that of others; and rules may also differ in their degree of credibility, for a given distribution of shocks affecting the economy.

This paper is intended to be exploratory, rather than a definitive analysis of how credibility affects different policy rules. It is an attempt to implement, in a medium size nonlinear model, an index of credibility that reflects the probability that the rule will be abandoned in favor of a simple alternative rule. The probability assessment is based on assumed knowledge of the authorities' objective function, of the parameters of the model, and of the distribution of shocks hitting the economy. Expectations are assumed to be formed on the basis of a linear combination of solutions of the model in future periods under the announced rule and under a single alternative rule, the weights applied to each being the assessment of the probability of the two policies being followed. One or the other policy is assumed to be chosen on the basis of whether the authorities' objective function turns out to yield a larger value if they stick to the rule or if they abandon it.

In our framework, there is no question of trying to discover the "type" of government, i.e., its objective function: it is assumed to be known by the private sector. Rather, given a particular objective function, for some shocks the announced path for policy will not be optimal, and both the government and the private sector realize this ex ante and can evaluate the probability of this occurring. As Canzoneri and Henderson (1988) show in the context of international cooperation, if shocks are unbounded, then the efficient point cannot be supported for all realizations.

There are a number of aspects of credibility that are not taken into account by our analysis. 1/ In particular, as discussed above we do not consider the possibility that the private sector would not know the true preferences of the authorities, who might therefore have an incentive to signal or hide their characteristics and to invest in building "reputation." 2/ Those preferences are assumed to be constant over time. 3/ Likewise, we do not take into account the possibility of "private information." 4/ Instead, here the authorities' preferences are assumed to be known, and it is assumed that the authorities and the private sector have the same information about current shocks. There is no distortion in the economy for which the authorities attempt to compensate by aiming at an overly expansionary target, as in Barro and Gordon (1983). We do not examine strategic behavior on the part of the private sector, 5/ but instead assume that it is made up of atomistic private agents; the only issue is how they form their expectations.

1/ See Blackburn and Christensen (1989) for a survey of issues related to monetary policy credibility.

2/ Rogoff (1987) surveys some of the literature on reputation as it relates to monetary policy, and emphasizes how sensitive the results are to differences in information structure.

3/ Cukierman and Meltzer (1986) assume that preferences shift stochastically over time.

4/ Canzoneri (1985).

5/ As, for instance, in Horn and Persson (1988).

Two strands of the literature that are closely related to ours concern the evaluation of simple policy rules in the face of stochastic shocks and the formulation of policy rules, which, though simple, allow for the possibility of abandoning a rule if shocks make it optimal to do so. Related to the first strand, Levine, Currie and Gaines (1988) have examined the sustainability of simple policy rules in a stochastic context, showing that the degree of discounting and the nature of the shocks are important determinants. Shocks are shown generally to support the sustainability of those policies, though the authors point out (p. 20) that for some combination of shocks, temptation to renege on the rule exceeds the reputational benefits from sticking to it. However, they assume that this probability is negligible and that expectations are formed on the basis of perfect policy credibility. Here, we explore the probability of going off the rule, and endogenize expectations accordingly.

Turning to the second strand, Flood and Isard (1989) consider simple policy rules with "escape clauses," that is, rules that take into account the fact that particular drawings for shocks may make the incentives to abandon the rule too great, at which point the authorities revert to discretion, i.e., reoptimization. The private sector is assumed to form its expectations in a way that reflects this possibility. The model they consider is quite simple, and the distribution of shocks is assumed to be uniform, giving a bound on shocks and making an analytical solution possible. Moreover, their interest is in designing policy rules with escape options, rather than modeling credibility. We extend the analysis to the question of imperfect credibility of a simple policy rule in the face of unbounded shocks drawn from a normal distribution, and apply it to an empirical macromodel.

The size of our model, MULTIMOD, and its nonlinearity, preclude calculating fully optimal feedback rules, which in any case would be too complex to be realistic policy alternatives. 1/ Moreover, our interest here is in modelling expectations formation, rather than a game between the private sector and the authorities (or between various national governments). We restrict ourselves to a simple rule, namely to an exogenous path for money growth. We do allow for a feedback of expectations formation onto the authorities' optimal policy, however, since the comparison of utility from sticking to the rule takes into account the negative effects of loss of credibility that would result from going off the rule. In this respect, then, our setup corresponds to a trigger strategy equilibrium in the game literature, with an infinite punishment period. 2/

1/ See Masson, Symansky, and Meredith (1990) for a description of the latest version of the model.
2/ See Canzoneri and Henderson (1990).

II. A Simple Theoretical Example

It is convenient to illustrate the issue, and to give a flavor for the numerical simulations reported below, by setting out a model that is similar in some, but not all, respects to that in Barro and Gordon (1983). We will work with a two-period model, in order to avoid the complications of solving a multiperiod rational expectations model (for instance, using the techniques of Blanchard and Kahn (1980)). In the first period, the authorities announce a policy of lowering the growth rate of money by x in the second period. In the second period, the authorities either lower money growth as announced or renege, keeping it unchanged. How credible is the commitment to lower the rate of growth of money by x?

The authorities decide between the two policies in period 2 on the basis of a simple objective function V that depends only on the discounted present value of inflation, π. In our analysis, only the objective function in period 2 plays a role; it is assumed that in period 1 the announced policy yielded a lower expected disutility than the alternative. In period 1 the private sector forms expectations of inflation for the next period on the basis of the probability of the two policies being carried out in period 2: sticking to the rule, with probability ρ, and keeping money growth unchanged, with probability $1-\rho$.

The model of inflation is simple, but unlike the model in Barro and Gordon (1983) it contains the key feature that inflation in period 2 depends on inflation in period 1, as well as on the policy choice in period 2. 1/ Inflation in period 1 is a weighted average of inflation in the previous period ($\pi_0 > 0$) and expected inflation in period 2, $E(\pi_2)$; such a model would result from staggered wage contracts, for instance (see Taylor (1979), Calvo (1983)). Inflation in period 2 is equal to the change in money growth, μ, plus inflation in period 1; 2/ μ takes on the value -x or 0. So we can write the model as follows:

(1) $$V_1 = \pi_1^2 + E(V_2)$$

(2) $$V_2 = \pi_2^2$$

(3) $$\pi_1 = (\pi_0 + E(\pi_2))/2 + u_1$$

1/ In this section we also ignore the output target, and the possibility that the authorities aim for a value that would yield unemployment below the natural rate. However, in the next section we relax the assumption that only the discounted present value of inflation enters the objective function and include deviations from full capacity output.

2/ Such an equation could also be the result of a multiperiod model in which no further money growth changes were expected to occur, and hence inflation was expected to continue at its period-2 rate in subsequent periods.

(4) $$\pi_2 = \pi_1 + \mu + u_2$$

(5) $$E_1(\pi_2) = \rho\pi_2(r) + (1-\rho)\pi_2(n)$$

where $\pi_2(r)$ and $\pi_2(n)$ are the expected inflation outcomes, given information available in period 1, if the authorities stick to the rule, or not, respectively. It is clear that these outcomes depend on the value of ρ itself, since inflation in period 2 depends on inflation in period 1. It is also clear that the objective probability ρ depends on the distribution of the shocks, since the particular drawing for u_2 will cause $V_2(r)$ to be either greater or less than $V_2(n)$, and hence lead the authorities to choose a value of μ equal to 0 or -x, respectively.

As a result of this interrelationship, the effects of the announced policy therefore depend on the credibility of that policy. To see how <u>actual</u> inflation in periods 1 and 2 depends on this credibility, for a given policy μ, we can substitute equation (5) into (3) and (4). Expected inflation for period 2 can be written

(6) $$E_1(\pi_2) = \pi_1 - \rho x$$

and hence inflation in period 1 is given by

(7) $$\pi_1 = \pi_0 - \rho x + 2u_1$$

and actual inflation in period 2 will be equal to

(8) $$\pi_2 = \pi_0 - \rho x + 2u_1 + \mu + u_2$$

The lower credibility is, the higher will inflation be in periods 1 and 2, whatever the policy actually chosen in period 2, i.e., whatever the value of μ.

The incentives to stick to the rule also depend on credibility, in the following way. We assume in period 2 that the authorities chose to follow the rule (i.e., carry out a deceleration of money growth by x) provided the disutility from doing so, $V_2(r)$, is less than the disutility of reverting to constant money growth, $V_2(n)$. The value of the objective function facing the authorities when choosing a value of μ in period 2 can be expressed as

(9) $$V_2 = [\pi_0 - \rho x + 2u_1 + \mu + u_2]^2$$

Therefore, the values of V_2 should the authorities stick to the rule (μ = -x) or keep money growth constant (μ = 0) will be respectively

(10) $$V_2(r) = [\pi_0 - \rho x + 2u_1 - x + u_2]^2$$

and

(11) $$V_2(n) = [\pi_0 - \rho x + 2u_1 + u_2]^2$$

We will call the difference in disutilities $R(\rho)$, where we make explicit the dependence on ρ:

(12) $$R(\rho) = V_2(r) - V_2(n) = (1+2\rho)x^2 - 2\pi_0 x - 2xu_2 - 4xu_1$$

If $R > 0$ the authorities choose to abandon the rule. Thus a higher ρ increases the value of R, making it more likely that that the rule will abandoned. The reason for this is that by lowering inflation in period 1, a higher value of ρ makes it less attractive to carry out the monetary disinflation when period 2 arrives, since the inflation gains have already been achieved--the standard example of time inconsistency. For some realizations of u_2 therefore, the authorities will choose to leave money growth unchanged.

Credibility ρ should depend on a rational assessment of the likelihood that R is greater or less than zero, and hence depends on the variance of the shocks in period 2. We can find a fixed point for ρ as follows; we assume for simplicity that $u_1 = 0$. The expected value of R is given by

(13) $$E_1(R(\rho)) = (1+2\rho)x^2 - 2\pi_0 x$$

and its variance by

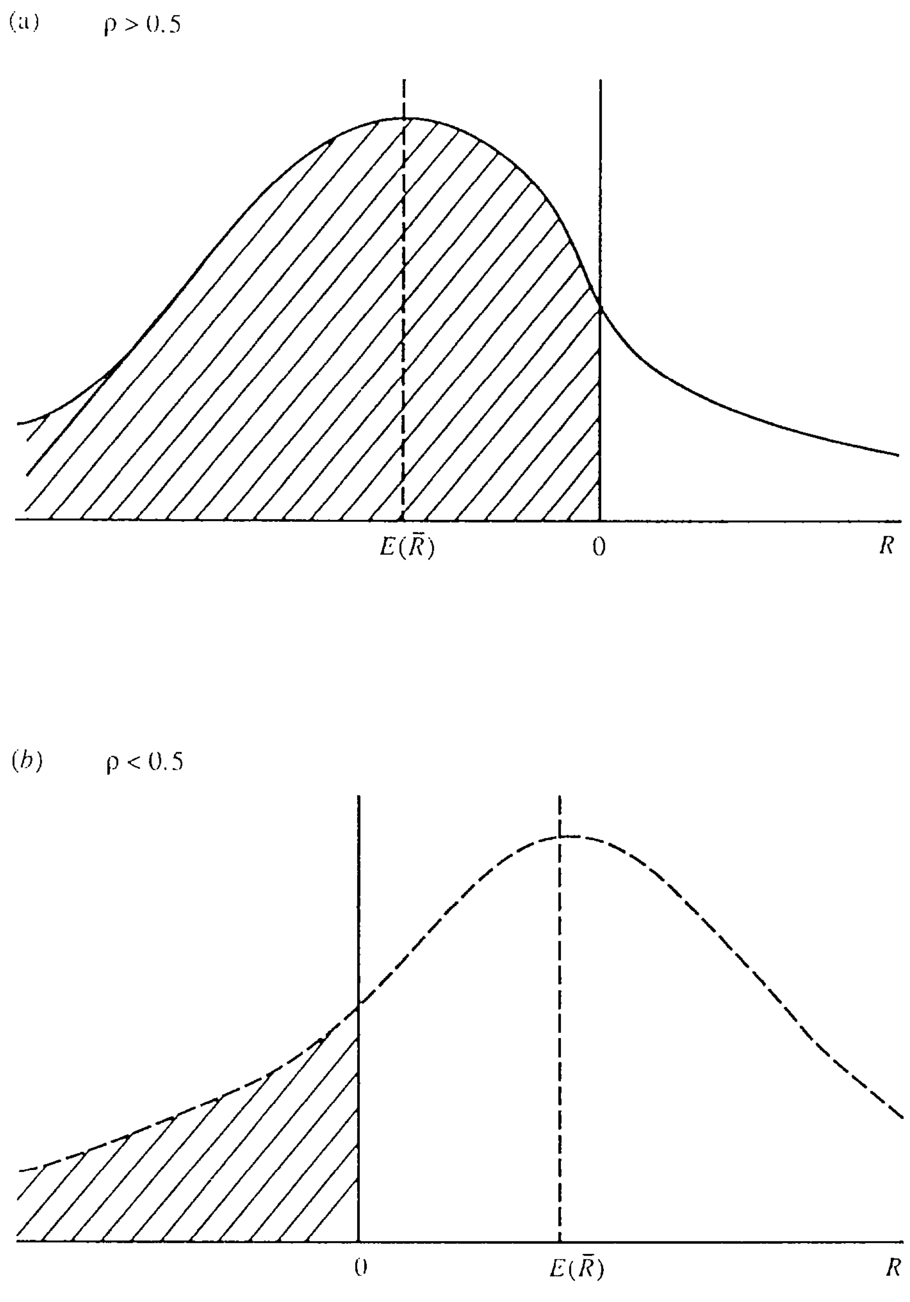
(14) $$\text{var}(R(\rho)) = 4x^2\ \text{var}(u_2)$$

We can therefore evaluate credibility on the basis of the distribution of outcomes for $R(\rho)$. Figure 1 illustrates two possibilities: in panel (a), the expected value for R is negative, so that for the distribution shown, sticking to the rule is more probable than abandoning it. The shaded area is the estimate of credibility: it is the proportion of the outcomes where $R < 0$ so that the authorities stick to the rule. In panel (b), the expected value for R is positive, giving a value for credibility that is less than 0.5.

From the fact that the mean of the distribution depends positively on ρ from (12), and that the area to the left of the vertical axis depends negatively on the mean of the distribution, it follows that a fixed point for ρ exists. In the simulation examples reported below, we assume that shocks are normally distributed (as is done for the standard stochastic simulations performed for the conference); we therefore integrate under the normal distribution to calculate estimates of ρ. Starting from an initial value ρ_0, we calculate the expected value of R, and therefore the likelihood of $R < 0$, yielding ρ_1. Iteration on this difference equation

(15) $$\rho_i = A(\rho_{i-1})$$

Figure 1. Calculation of Credibility Parameter ρ



continues until values of ρ from one iteration to the next are arbitrarily close. It should be noted here that the values of R are not bounded--since a normal distribution is assumed--and credibility is neither complete nor zero. Instead, $\rho \in (0,1)$. Thus, imperfect credibility prevails and this has an effect on expectations and on the effectiveness of policy rules. 1/

III. Simulation Examples

In what follows, we make joint estimates of credibility and of the effects of policy rules using the methodology described above, applied to a medium-sized multi-region model, MULTIMOD. As in the discussion above, our illustration concerns a policy of disinflation that involves an announced path for deceleration of money growth, applied to the U.S. economy. The initial position in our baseline involves 4 percent inflation and full utilization of capacity, as is roughly the case for the United States today. The announced policy is for a deceleration of money growth of 1 percent per year, so that after 4 years money would be growing at a rate that would be consistent with price stability, after lags in the economy had worked themselves out.

In our first example, the alternative policy that we assume is relevant for expectations formation is for the authorities to allow money to grow at its most recent rate, rather than pursuing the announced deceleration. Thus, even if money growth has already declined, there is still doubt as to whether the other staged reductions will take place. After four years of money growth rate declines, however, the two policies converge.

To illustrate the importance of credibility, we begin by simulating the outcomes of the policy of monetary deceleration under alternative assumptions of credibility, with credibility exogenous. They are summarized in Table 1. The first-year (1990) effects of the policy change differ widely, with declines in inflation ranging from 0.7 percent (the baseline contains a steady 4 percent inflation) to 1.6 percent. It is clear from Table 1 that the more credible is the policy, the quicker is the deceleration of inflation, though under all three assumptions about credibility, price stability is achieved by 1993. However, output losses may be higher in the first few years if the announced policy is credible, because forward-looking exchange rates and bond prices respond more in this

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1/ Currie and Levine (1987) show that for bounded shocks, there is a discount rate sufficiently low that there is no incentive with an infinite horizon to switch from the optimal policy. With unbounded shocks, the probability of a switch is nonzero, but can be made arbitrarily low by choosing the discount rate low enough. In Levine, Currie and Gaines (1988), it is assumed that the effect on expectations is negligible, that is, that credibility is close to complete. This is not the case in our simulations discussed below, however.

Table 1. Effects of Monetary Deceleration 1/ with Different Assumptions for Credibility, 1989-93

	1989	1990	1991	1992	1993
Inflation			(Percent per annum)		
ρ = 0	4.0	3.3	2.6	1.5	0.2
ρ = 0.5	3.5	2.9	2.0	1.0	-0.1
ρ = 1.0	2.9	2.4	1.4	0.4	-0.4
Deviation from full capacity utilization			(In percent)		
ρ = 0	--	-1.1	-2.5	-3.8	-4.8
ρ = 0.5	-0.7	-1.7	-2.7	-3.4	-3.9
ρ = 1.0	-1.5	-2.4	-2.9	-3.1	-2.9

1/ The path for money growth rate is lowered relative to baseline by 1 percent in 1990, 2 percent in 1991, 3 percent in 1992, and 4 percent from 1993 onwards. The policy is announced in 1989.

case, leading to short-run declines in aggregate demand. This possibility results from the nature of the inflation model in MULTIMOD, for which the degree of inertia depends on average contract length. The parameter which captures contract length is assumed to be fixed; if contract length were to be endogenous (permitting recontracting when the disinflation policy is announced), output losses would be smaller, or even zero. Cumulative deviations from full capacity utilization over the period 1989-93 are in any case lower in the perfect credibility case (-9.8 percent) than in the zero credibility case (-12.2 percent).

The net effect on authorities' objective function depends on how inflation and capacity utilization are weighted. Generalizing the welfare function posited above in the theoretical section, we assume that the authorities attempt to minimize the following function:

$$(16) \qquad V = E \sum_{i=0}^{\infty} [\pi_i{}^2 + \alpha(CU_i -1)^2]/(1.05)^i,$$

where π is the rate of change of absorption prices (as a decimal fraction), CU is capacity utilization (a value of unity indicates full utilization), and a discount rate of 5 percent is assumed. A parameter that greatly affects credibility is the weight on output losses, α. In our first set of experiments, we assume that $\alpha = 2$.

Using this objective function, which is assumed known by the private sector, we then proceed to endogenize credibility, ρ. The first step is to calculate an estimate of the variance of the difference R in objective function values under the two policies in response to random shocks. Using the same set of shocks as were generated for the stochastic simulations discussed elsewhere at the conference, we calculated the variances of R, which were used to generate values for credibility corresponding to particular expected values for R.

Table 2 shows how the credibility of the policy and outcomes for inflation and capacity utilization evolve over time in this case. It should be stressed here that though we performed stochastic simulations to calculate the variance of R, we ran deterministic simulations of the model *when calculating the effects of policy, presented here.* Moreover, the announced policy was in fact always carried out. This rather stylized example allows the effects of credibility to be more clearly explained. However, a realistic comparison of alternative policies would include random shocks and allow for the possibility of regime switches.

Since random shocks are absent, the difference between what was expected and what actually occurred solely reflects lack of credibility of policy. In the example we give, credibility starts at a high level, with $\rho = 0.97$ when the policy of monetary deceleration starting in 1990 is announced in 1989. This degree of credibility reflects an assessment of the

Table 2. Effects of Monetary Deceleration 1/
with Endogenous Credibility, 1989-93

	1989	1990	1991	1992	1993
Inflation (percent per annum)	3.0	2.7	1.9	0.9	-0.1
Deviation from full capacity utilization (in percent)	-1.4	-1.9	-2.1	-2.7	-3.4
Expected welfare loss from following the rule	6.1	6.1	5.8	5.1	4.5
Expected welfare loss from abandoning the rule 2/	11.5	7.4	4.5	3.4	4.5
Credibility of the rule 2/	0.97	0.68	0.33	0.28	0.50

1/ The path for money growth rate is lowered relative to baseline by 1 percent in 1990, 2 percent in 1991, 3 percent in 1992, 4 percent from 1993 onwards. The policy is announced in 1989.

2/ In favor of a policy of no further deceleration of money growth (i.e., projected continuation of current growth).

probability that authorities would find it to their advantage to stay with the rule in 1990 instead of leaving money growth unchanged. For instance, negative output shocks would tend to make the further output losses implied by a tightened monetary policy too costly. In 1990, the authorities lower money growth by 1 percent. The credibility of their commitment to the announced rule evolves over time: it in fact has decreased, because the policy has already brought down inflation, and, given the momentum built into the economy, inflation would continue to decline even if money growth were not cut further. Since inflation is closer to zero the quadratic objective function attributes a smaller gain from further declines in inflation; conversely, since capacity utilization is farther away from unity the disutility of further output losses has increased.

As time progresses, therefore, the credibility of the policy declines in this example, even though the policy is actually carried out. In our simple example, the policy "rule" and the alternative policy when the authorities abandon it converge to the same money growth in 1993, so the "credibility" of the rule becomes indeterminate. We nevertheless calculate in Table 2 the values implied for the objective function, which are of course equal in this case, so we indicate $\rho = 0.5$.

The sensitivity of credibility to the objective function postulated for the authorities is illustrated in Table 3, where the weight α on output losses is varied. It should be emphasized that the policy actually carried out by the authorities is the same as in Table 2--a deceleration of money growth by 1 percentage point in each of the years 1990-93. The alternative fall-back policy is also the same, namely that the authorities would keep money growth constant at its most recent value, rather than continuing the deceleration to a money growth rate consistent with zero inflation (achieved in 1993).

Putting a higher weight on output ($\alpha = 4$) than in Table 2 reduces credibility considerably; indeed, from 1990-92, the probability that the authorities would find it in their interest to continue their policies is virtually zero in this case. Interestingly, though the low credibility retards achievement of the deceleration of inflation, it also produces somewhat lower output losses through 1991, as the initial long-term real interest rate increase and real exchange rate appreciation are somewhat smaller. Conversely, much lower values of α improve credibility, which speeds disinflation, but initial output losses increase.

The importance of the alternative fall-back policy is illustrated in Table 4, which also considers a range of α values. Here, the authorities choose between the same announced monetary deceleration path as above, and a policy of expanding the money supply at its initial (1989) rate, consistent with 4 percent inflation. In this case, the policies never converge; on the contrary there is a widening difference between them, as reversion to the initial policy in the later years would involve a large monetary acceleration, and inflation gains would be lost. As a result, credibility

Table 3. Effects of Monetary Deceleration: 1/ Outcomes for Various Objective Function Weights, 1989-93

	1989	1990	1991	1992	1993
			(α = 4)		
Inflation	3.6	3.3	2.4	1.3	0.1
Deviation from full capacity utilization	-0.5	-1.0	-2.2	-3.4	-4.4
Credibility of the rule 2/	0.39	0.02	0.01	0.03	0.50
			(α = 1)		
Inflation	3.0	2.4	1.6	0.8	-0.3
Deviation from full capacity utilization	-1.5	-2.2	-2.4	-2.6	-3.1
Credibility of the rule 2/	1.00	0.89	0.60	0.43	0.50
			(α = 0.33)		
Inflation	2.9	2.4	1.5	0.7	-0.3
Deviation from full capacity utilization	-1.5	-2.3	-2.6	-2.7	-3.0
Credibility of the rule 2/	1.00	0.95	0.73	0.52	0.50

1/ The path for money growth rate is lowered relative to baseline by 1 percent in 1990, 2 percent in 1991, 3 percent in 1992, 4 percent from 1993 onwards. The policy is announced in 1989.

2/ In favor of a policy of no further deceleration of money growth (i.e., projected continuation of the current growth rate).

Table 4. Effects of Monetary Deceleration 1/ with a Different Alternative Monetary Policy: 2/ Outcomes for Various Objective Function Weights, 1989-93

	1989	1990	1991	1992	1993
			(α = 3.5)		
Inflation	3.3	2.9	1.8	0.7	-0.1
Deviation from full capacity utilization	-1.0	-1.6	-2.7	-3.6	-3.7
Credibility of the rule 2/	0.68	0.64	0.83	1.00	1.00
			(α = 3)		
Inflation	3.1	2.4	1.4	0.5	-0.3
Deviation from full capacity utilization	-1.2	-2.2	-3.0	-3.2	-3.1
Credibility of the rule 2/	0.84	0.92	0.99	1.00	1.00
			(α = 2)		
Inflation	3.0	2.3	1.3	0.5	-0.4
Deviation from full capacity utilization	-1.4	-2.4	-2.9	-3.1	-2.9
Credibility of the rule 2/	0.97	0.99	1.00	1.00	1.00

1/ The path for money growth rate is lowered relative to baseline by 1 percent in 1990, 2 percent in 1991, 3 percent in 1992, 4 percent from 1993 onwards. The policy is announced in 1989.

2/ The alternative policy is money growth equal to that in the baseline (i.e., consistent with 4 percent inflation in steady-state).

increases over time, and converges to 1.0 in all simulations. 1/ Not surprisingly, the weight on output losses influences the path, with somewhat lower credibility initially when α is large. Even larger values for α, which might cause the authorities to engineer a large monetary expansion in the later years of the simulation, caused the model not to converge.

IV. Concluding Remarks and Suggested Extensions

Our paper is just a preliminary attempt to allow for imperfect credibility in evaluating policy rules. The rules we have considered relate to an exogenous path for money growth, and we have simplified the problem by considering a simple alternative fall-back rule. In Flood and Isard (1989) and in game-theoretic discussions of policy, abandoning the rule involves re-optimizing. We have not attempted to calculate optimal policies in MULTIMOD because of the computational difficulty and also because fully optimal policies are too complex to be reasonable alternatives. However, the question of what a reasonable benchmark regime for comparing simple rules might be is an important one. If one is considering disinflation policies, unchanged monetary growth seems like a plausible alternative. If one is considering the credibility of an exchange rate peg, reversion to floating exchange rates with a money supply target would also be the most natural alternative. Our framework is clearly less plausible when considering other situations.

What our simple examples show is that given the assumption that the distribution of shocks is the same as in some historical period, and assuming a plausible objective function for the authorities, credibility can be far short of complete, and as a result, expectations can differ significantly from those in the full credibility case. The implied performance of the monetary targeting policy is thereby significantly affected. An interesting question which we hope to explore is whether the ranking of rules--for instance, money versus nominal income or exchange rate targeting--is modified by making the degree of credibility endogenous. It is also of interest to examine how other policies can affect the credibility of monetary policy; for instance, bond-financed fiscal expansion may destroy the credibility of an anti-inflationary monetary policy. 2/ This could in principle be captured by our objective function, which takes into account expected future outcomes.

1/ This is not to deny that for very large shocks, the authorities might choose to return to their initial expansionary policies, just that such shocks are very unlikely.

2/ An overlapping-generations model in which the probability of inflating away outstanding debt in made a function of the debt stock is presented in Masson (1985).

It could also be that some rules, because they give tolerable results in all circumstances, are more credible than others. It should be the case that loss of credibility from deviation from a policy rule also depends on how the rule is framed, i.e., how absolute are the targets, and how well the target variable is measured. These questions however take us well beyond the subject of our paper.

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