# Optimal Monetary Policy Design: Rules versus Discretion Again

by A. Steven Englander

Over the last fifteen years, the entire direction of the debate on optimal monetary policy has been reversed. Earlier literature held that an optimal monetary policy could be devised by solving a "dynamic optimization" problem. It assumed that given a set of policy objectives and a model of the economy, the optimal path of inflation and GNP could be obtained [1] The current literature argues that it is precisely the public's recognition that policy makers engage in such optimization that leads the public to expect positive inflation in equilibrium, even when both the public and the government view any inflation as undesirable. According to this argument, the public will perceive that the authorities are willing to exploit a trade-off between inflation and output, and it will adjust its expectations accordingly.

This article reviews and evaluates this newer literature on optimal monetary policy design.[2] It identifies the key arguments of the recent studies and assesses the realism of the author's assumptions. Particular attention is given to the intuitive underpinnings of the models advanced in these studies In addition, the article analyzes the suggested mechanisms for achieving credible policies and considers whether the models' empirical implications are borne out in practice.

The main thrust of the current academic literature is to explain how a positive inflation rate can emerge on average, even when all parties view this as an inferior outcome that produces no extra output. The phenomenon that the authors are trying to explain is readily apparent in the postwar period, inflation has averaged above zero in all countries belonging to the Organization for Economic Cooperation and Development (OECD), but few policy makers or economists believe that these inflation rates have contributed to economic well-being The persistence of inflation at above desired levels in most OECD countries has led analysts to propose economic models yielding inflation as an equilibrium phenomenon explained by optimizing behavior on the part of the public and policy makers rather than happenstance.

[1] For example, J H Kalchbrenner and Peter A Tinsley, "On the Use of Feedback Control in the Design of Aggregate Monetary Policy," *American Economic Review*, May 1976 (Papers and Proceedings of the 88th Annual Meeting of the American Economic Association, December 1975), pp 349-55

[2] Several other reviews of this literature have appeared in recent years Nontechnical discussions can be found in Robert J Barro, "Recent Developments in the Theory of Rules versus Discretion," *The Economic Journal*, vol 95 (1985), Supplement, pp 23-37, Alan S Blinder, "The Rules-versus-Discretion Debate in the Light of Recent Experience," *Welwirtschaftliches Archiv*, Band 123, Heft 3 (1987), pp 399-414, and Stanley Fischer, "Rules Versus Discretion in Monetary Policy," National Bureau of Economic Research, Working Paper no 2518, 1987, forthcoming in Benjamin Friedman and Frank Hahn, eds , *Handbook of Monetary Economics* Somewhat more technical but largely readable are the surveys in Keith Blackburn and Michael Christensen, "Monetary Policy and Policy Credibility Theories and Evidence," *Journal of Economic Literature*, March 1989, pp 1-45, Torsten Persson, "Credibility of

*Footnote 2 continued*
Macroeconomic Policy An Introduction and a Broad Survey," *European Economic Review*, vol 32 (1988), pp 519-32, Bennett T McCallum, "Credibility and Monetary Policy," in *Price Stability and Public Policy*, pp 105-28, Federal Reserve Bank of Kansas City, 1984, and Kenneth Rogoff, "Reputational Constraints on Monetary Policy," in Karl Brunner and Allan Meltzer, eds , *Bubbles and Other Essays*, Carnegie-Rochester Conference Series, no 26, 1987 Of these authors, Barro and McCallum are most sympathetic to the policy thrust of the literature, and Blinder the least

The proposed explanation is that the public views policy making as opportunistic: policy makers are willing to exploit a short-run inflation/output trade-off even if a long run trade-off neither exists nor is thought to exist This explanation also yields a strong policy conclusion. If the public expects positive inflation because it believes that policy makers are trying to exploit this trade-off, the key to lowering actual and expected inflation is to guarantee that no such exploitation will occur. The mechanism by which this can be accomplished is to propose a readily visible rule that eliminates policy makers' discretion to inflate opportunistically. In large part this literature argues that the mere ability of policy makers to use discretion, even if the discretion is not actually exercised, will lead the public to expect positive inflation. Hence, the new monetary policy literature examines the old question of "rules versus discretion" from a new perspective.

The argument that the *structure* of the monetary policy making process (that is, the presence of discretion) rather than the *conduct* of monetary policy is the source of inflationary bias also points, as the authors see it, to the solution Changing the structure of policy making to one guided by formal rules, they contend, might yield lower inflation on average with a relatively small loss of output. Implicit in such a recommendation is the assumption that preventing policy makers from responding to shocks or disturbances will yield only small losses Advocates of such rules generally argue that feedback mechanisms can be incorporated in the rules to offset shocks and that the magnitude of such shocks might be lower if a consistent noninflationary policy rule were installed.[3]

An alternative view attributes the prevalence of inflation in recent decades to a combination of mistaken policies and adverse shocks, subsequently compounded by the unwillingness of policy makers to accept the output costs of disinflation through much of the 1970s. In this view, changing the structure of policy making would not accomplish much if the public and policy makers were unwilling to accept the costs of policies aimed at lowering inflation.

Such considerations have a direct connection with the issues surrounding the use of "intermediate targets" for monetary policy It can be argued that if policy makers do not have a reputation for maintaining low inflation, they may find it necessary to pursue an intermediate target rule that can be monitored easily and on a timely basis by the public This course may involve some loss of output or inflation control if the intermediate target is imperfectly linked to the final objectives. Nevertheless, the visible pursuit of a nominal intermediate target may provide sufficient offsetting benefits in the form of improved credibility and lowered inflation expectations to offset the imperfect linkage In one sense, the rules-versus-discretion question involves comparing the losses from the imperfect linkages of intermediate targets to final objectives under a rules mechanism with the losses due to the inflation bias alleged to arise from discretion.

The focus of this article, however, is the interaction between the policy makers' goals and the public's expectations and behavior in response to these goals Thus, intermediate targets will be discussed again only as a potential means for improving credibility. Much of the discussion below will assume that policy can successfully hit not only intermediate targets but also ultimate goal variables, such as inflation or nominal income growth. More specifically, the discussion will assume that policy makers can achieve their long-run inflation target *and* hit an output target temporarily by exploiting a short-term inflation/output trade-off. Over the long term it is assumed that output growth is at trend and is independent of policy.[4]

Recent literature has also examined the question of optimal monetary policy under conditions of considerable uncertainty about the structure of the economy and the policy makers' ability to hit targets on a period-by-period basis In the face of such uncertainty, some results are weakened because the public, as might be expected, finds it more difficult to distinguish policy moves from random shocks—and to distinguish policy makers who are inflation prone from those who are not Uncertainty about the structure of the economy also generally makes strict adherence to rules undesirable because it is difficult to design rules suitable under a broad range of conditions, in forming inflation expectations during periods of uncertainty, the public will usually place more weight on the policy makers' past inflation record

After examining the policy implications of the recent literature, this article concludes that the policy relevance of this literature has been overstated. The the-

[3]Most of the literature is theoretical and does not make any effort to calculate the benefits or losses of adhering to a rule Bennett T McCallum, however, has written a series of articles proposing a specific feedback rule and attempting to estimate the losses from it See, for example, McCallum, "The Case For Rules in the Conduct of Monetary Policy A Concrete Example," Federal Reserve Bank of Richmond *Economic Review*, September-October 1987, pp 10-17

[4]This assumption can be identified with the Lucas supply curve, which is common in the literature See Robert E Lucas, Jr, "Expectations and the Neutrality of Money," *Journal of Economic Theory*, vol 4, no 2 (April 1972), pp 103-24, and Robert J Barro and David Gordon, "A Positive Theory of Monetary Policy in a Natural Rate Model," *Journal of Political Economy*, vol 91, no 4 (July 1983), pp 589-610

oretical insights emerging from this literature differ little from those of the earlier literature and are achieved only at the cost of analytical assumptions that are difficult to sustain empirically. Moreover, outside of a few extraordinary episodes, it is very difficult to find any concrete illustrations of the recent literature's key policy prediction that a credible disinflation can be relatively costless.

**Some terminology**

The recent literature on optimal monetary policy is difficult for nonspecialists to read, in part because the terminology is difficult. This section reviews the terminology and puts it in the context of the issues to be discussed in greater detail subsequently[5]

In common language, a "consistent" policy is one that follows a well-defined set of rules over time It would normally be viewed as superior to an "inconsistent" policy. Because the new literature on monetary policy emerged out of the earlier optimal control literature, the common usage has been altered. A *time consistent* policy is one that results from solving a long-term dynamic optimization problem *without* incorporating the effect of current policy actions on the public's expectations of the future.[6] The "consistency" that emerges in solving such problems is that the optimal policy in all future periods conforms to the policy determined in the initial period, provided that there are no unexpected occurrences or shocks to the economy Put yet another way, in the absence of shocks, the optimal policy path laid out in time period 0 continues to appear optimal in period 1, period 2, and so on.[7] In no future period do policy makers have any reason to alter the policy path that they devised in period 0, again assuming that no shocks have occurred If such shocks do occur, the time consistent policy path has the property that no currently anticipated developments would lead policy makers to contemplate changing their program in the future

This type of consistency does not necessarily mean that the resultant policy path is desirable, only that policy makers see themselves as unable to do better. Whether the outcome is desirable in fact depends on how the public formulates its expectations. The assumption made by policy makers following a time consistent policy is that the public's behavior in each period depends on past policy decisions only If the public's expectations are rational, however, so that on average the public correctly anticipates and reacts to future policy actions, the policy makers' decisions and the public's actions may be based on different views of the impact of the policy decisions. The public may correctly (on average) anticipate future policy moves because it recognizes the incentives faced by policy makers and incorporates these expectations into its current behavior, while policy makers assume that the public's decisions are independent of their future actions In this situation, policy makers are aware of the public's current expectations but ignorant of how those expectations respond to policy actions. In this respect, the assumption of rational expectations on the part of the public provides it with an informational advantage over the policy makers.

The equilibrium that emerges is the outcome consistent with *both* views of the public's inflation expectations, it maximizes the policy makers' objective function, contingent on the public's current expectations It is not necessarily the best outcome by any means. The public may base its expectations on worst case assumptions, and policy makers may find that the "optimal" policy in this case has the effect of validating these assumptions

An example may illustrate this point. Assume that the public correctly believes that policy makers wish to lower the unemployment rate as much as possible provided that inflation does not exceed some critical threshold. For policy makers, the time consistent policy is to remain expansionary as long as inflation is below this critical value. The public, knowing that this is the policy makers' rule, will quickly adjust inflation expectation to the critical level, since it recognizes that government policy will quickly bring inflation there Hence, the time consistent outcome is that inflation expectations and actual inflation adjust upward to the critical level, leaving the authorities little room in fact to implement the expansionary policy—that is, to lower the unemployment rate below some "natural rate."

In this example, the time consistent outcome has the following properties.

[5]The terminology and literature begin with Finn E Kydland and Edward C Prescott, "Rules Rather Than Discretion The Inconsistency of Optimal Plans," *Journal of Political Economy*, vol 85, no 3 (June 1977), pp 473-91, and Guillermo A Calvo, "On the Time Consistency of Optimal Policy in a Monetary Economy," *Econometrica*, vol 46, no 6 (November 1978), pp 1411-28 Willem H Buiter, "The Superiority of Contingent Rules over Fixed Rules in Models with Rational Expectations," *Economic Journal*, vol 91, no 363 (September 1981), pp 647-70, discusses the relationship between the new literature on monetary policy design and the older optimal control literature

[6]Such models are often referred to as "causal" models since behavior can be traced directly to past events By contrast, "noncausal" models allow expectations of future events to affect current behavior

[7]Buiter, "The Superiority of Contingent Rules," citing Kydland and Prescott, "Rules Rather Than Discretion," and R Bellman, *Dynamic Programming* (Princeton, N J Princeton University Press, 1957), states that "a sequence of policy actions is time consistent if, for each time period, the policy action in that period maximizes the objective function, taking as given all previous policy actions and private agents' decisions and as given that all future policy actions will be similarly determined

a) Policy makers always follow their perceived optimal rule of expanding output until inflation hits a critical level
b) The public is not fooled; it correctly predicts the policy makers' action.
c) The outcome, characterized by a rapid jump in inflation expectations to the equilibrium level (the policy makers' threshold level), is unlikely to produce the output gains sought by policy makers.
d) At the equilibrium inflation rate, policy makers have no incentive to alter their policy.

By contrast, a *time inconsistent* policy path, which may in fact represent the optimal long-term policy path, does not necessarily appear optimal to policy authorities on a period-by-period basis.[8] As a result, each period policy makers would be tempted to renounce the initial time inconsistent policy path and substitute a new one. In the example above, the time inconsistent policy is to resist the temptation to lower the unemployment rate below the natural rate, even when the public's expectation is for zero inflation and expansionary policy would appear desirable from the policy makers' viewpoint.

The distinction between time consistent and time inconsistent policies can be illustrated further in the context of game theory. Consider the policy makers' payoff matrix, which specifies the value of a given outcome under a variety of circumstances and which is assumed to be known by the public (see the table).[9] From the policy makers' viewpoint, the best option is to inflate when the public expects no inflation, thereby gaining the benefits of faster growth (outcome C).[10] The worst option is to disinflate when inflation expectations are high, thereby producing a loss of output (outcome B)

In between these extremes are equilibrium outcomes. When the policy and the public's expectations are noninflationary (outcome D), the outcome is slightly worse than when the inflation takes the public by surprise, but better than when both public expectations and policy are inflationary (outcome A).

The key point is that the public recognizes that the government has an incentive to generate inflation

**Payoff Matrix from the Policy Makers' Viewpoint**

| Public's Expectation | Policy Decision: High Inflation | Policy Decision: No Inflation |
|---|---|---|
| High inflation | 2 (A) | 1 (B) |
| No inflation | 4 (C) | 3 (D) |

Note Higher numbers represent preferred outcomes

whether the public expects high or low inflation. Outcome A is preferred to outcome B, and outcome C is preferred to outcome D—that is, the high-inflation strategy dominates.

The time consistent outcome is A: policy and expectations match, creating an equilibrium, and the authorities can do no better given the public's expectations. Outcome D, however, is the time inconsistent equilibrium and is clearly superior to A, but this outcome may be unsustainable. Once the public's expectations are decided, policy makers can do better by inflating. The public will also recognize that if inflation expectations are low, the authorities will choose C Hence, the public will never expect the low-inflation equilibrium because policy makers' optimizing behavior consistent with that expectation yields high inflation.

Thus, in some instances adhering to a time inconsistent policy path is superior to following a time consistent path, provided that the public can be made to believe that policy makers are sincere in their pursuit of a policy that forgoes short-run optimization. In the game theory example, the superior time inconsistent outcome D could be achieved if policy makers could guarantee that they would not try to achieve C, their true optimum. Much of the policy makers' problem consists of convincing the public of their resolve to follow the time inconsistent path, when the public realizes the temptation to reoptimize. The problem resembles that of the Prisoner's Dilemma in that the outcome without cooperation between the players (in this case, the policy makers and the public) is likely to be inferior to that with cooperation. The absence of a mechanism to guarantee the cooperative solution rules out the superior outcome when cheating promises a better result for policy makers acting on their own.

A key element of the coordination problem is that the public is assumed to arrive at its expectation of current period policy before policy makers reach their decision. If the authorities moved first, the coordination problem

[8] In *Lectures in Macroeconomics* (Cambridge MIT Press, 1989), Olivier J Blanchard and Stanley Fischer offer the following definition "A policy is dynamically inconsistent when a future policy decision that forms part of an optimal plan formulated at an initial date is no longer optimal from the viewpoint of a later date, even though no relevant new information has appeared in the meantime "

[9] Keith Blackburn, "Macroeconomic Policy Evaluation and Optimal Control Theory A Critical Review of Some Recent Developments," *Journal of Economic Surveys*, vol 1 (1987), pp 111-48, provides a comprehensive review of the game theoretic aspects of this literature

[10] The policy makers' objective function will be discussed below in greater detail

would be mitigated because there would be no opportunity to fool the public. Paradoxically, the time consistency problem would be resolved because there would be no incentive to deviate from preannounced plans Many of the proposed solutions to the time consistency problem amount to removing "surprise" as a policy tool. In the context of the table, they amount to forcing policy makers to choose between the no-inflation equilibrium (D) and high-inflation equilibrium (A)

To resolve the coordination problems that arise if the time inconsistent policy path is superior, policy makers may wish to commit or precommit themselves to the time inconsistent policy, which they know to be superior in the long term, and renounce the possibility of reoptimization. By committing themselves to the time inconsistent policy, they may hope to convince the public that they will not inflate, even when it would be advantageous to do so A further difficulty may arise, however If policy makers face no sanctions for violating their commitment or if the public cannot monitor on a timely basis policy makers' commitment, any commitment may lack credibility. Both the public and the policy makers may agree that the committed policy is best, but the public will not believe that the policy makers will follow through because of the period-by-period temptation to renege.

In practice, it may often be difficult to determine whether policy makers are adhering to the precommitted policy. Targets can be missed either because of random shocks to the economy or because policy makers are reneging on their commitments Because of this ambiguity, advocates of precommitted policies often argue that following fixed rules makes it easier for the public to observe adherence to announced policies [11] The rules can be very simple (for example, constant money growth rules) or more complicated, but they have to be understandable, and compliance has to be readily visible

The requirement of ready visibility may make rules with *no feedback (open loop rules)* at times superior to rules in which policy actions are contingent on actual events. The public may lose confidence in its ability to monitor adherence to a rule if the rule permits action in response to events not readily observable For example, assume that a particular monetary aggregate deviates from its precommitted path. The central bank may claim that it is merely accommodating a money demand shock. But the public, having no way to ascertain that such a shock has occurred, may assume that the deviation represents a policy easing and may therefore adjust inflation expectations upward.

[11]See the papers in Federal Reserve Bank of New York, *Intermediate Targets and Indicators for Monetary Policy A Critical Survey*, 1990, for extensive references to the literature on monetary policy rules

To sum up, the long-run optimal policy may be time inconsistent if the public can understand and predict future policy responses (that is, if the public has rational expectations). It may be preferable for policy makers *not* to optimize on the basis of expectations that they view as fixed, but rather to anticipate the negative effect that such optimization will have on expectations of future policy actions More concretely, in the monetary policy case, policy makers who are expected to take advantage of low inflation expectations in order to pursue expansionary (and inflationary) policies may find that expectations are extremely sticky at undesirable levels in subsequent periods. Recognizing this, the policy makers may wish to commit themselves to a series of policy actions that may not be optimal on a period-by-period basis, but that are consistent with low inflation expectations in the long run To succeed in the long run, such a commitment must be credible, and credibility in turn may depend on adherence to readily visible fixed rules Fixed rules with no feedback make it easiest for the public to observe that policy is following its precommitted path.

**Is there an inflationary bias to monetary policy?**

This section considers the conditions under which positive inflation may emerge as an equilibrium, even when both the public and the policy makers view the outcome as inferior to one of zero inflation [12] It examines the circumstances under which dynamic optimization by policy makers will produce an inferior result to a policy following relatively fixed rules After the presentation of the basic model, a critical discussion of the assumptions needed to yield the equilibrium inflation result is presented The section concludes with possible approaches to mitigating the alleged inflationary bias of policy

*How do inflationary biases emerge?*

The basic structure of the models under discussion is very simple.[13] Policy makers try to achieve inflation and output goals that are inconsistent The desired output level is greater than could be achieved at stable infla-

[12]For convenience of exposition and in common with the rest of the literature, this article will treat zero as the inflation target In practice, measurement problems or nominal wage and price stickiness may make a positive but low level of inflation preferable What is essential for the analysis is that the public view policy makers as willing to inflate above the target, whether it is zero or positive

[13]Robert J Barro and David Gordon, "Rules, Discretion and Reputation in a Model of Monetary Policy," *Journal of Monetary Economics*, vol 12, no 1 (July 1983), pp 101-21, Barro, "Recent Developments in the Theory of Rules versus Discretion", and Blanchard and Fischer, *Lectures in Macroeconomics*, provide clear descriptions of the analytical model underlying this section

tion.[14] Policy makers face the choice between maintaining stable inflation at an output level lower than they would otherwise try to achieve or achieving desired output levels at the cost of ever-increasing inflation. Higher inflation emerges in the second case because a positive inflation surprise is the only mechanism bywhich policy makers can increase output to desired levels. In a multiperiod context, inflation surprises would be needed each period to maintain desired output, hence, spiraling inflation would emerge

It is assumed that policy makers are less willing to tolerate additional inflation when inflation rates are already high For example, going from 0 to 2 percent inflation will cause policy makers some discomfort, which may be offset by the temporary output gain. Each successive increment of inflation causes additional discomfiture, until inflation ultimately reaches a point at which policy makers are unwilling to accept the higher levels, even if output can thereby be maintained above the level corresponding to the natural rate Thus, under these assumptions, there is a strict upper limit to the inflation rate policy makers would engineer, even if the public's inflation expectations were set naively. In many cases this upper limit will also be the public's equilibrium inflation expectation since the public knows that policy makers would not intentionally raise inflation any further.

It is also assumed that the public cannot be systematically fooled or surprised by inflation. The public knows policy makers' preferences and the structure of the economy, and knows that policy makers have an incentive to try to produce surprise inflation. The public also knows the increasing discomfiture of policy makers at high inflation rates. (The public's preference function is often assumed to be the same as the policy makers'—that is, to eliminate conflicting preferences as an underlying cause of equilibrium inflation )

The public tries to predict the inflation rate by evaluating how policy makers are likely to act. The public recognizes that if policy makers observe low inflation expectations, they will have an incentive to create surprise inflation in order to reap output gains from the surprise But the public also knows that at sufficiently high expected inflation levels, policy makers, by their own choice, will never inflate further, even by surprise, and might even choose to disinflate because of the perceived costs of a high level of inflation

Using this knowledge, the public forms its expectations It will never expect inflation to be so low that policy makers will have an incentive to create surprise inflation. Nor will the public expect the government to produce an inflation rate that is so high that the government would subsequently be tempted to engineer a recession (that is, create surprise disinflation) to reduce inflation to more acceptable levels. The rational expectation is thus for an inflation rate just high enough to eliminate the incentives for policy makers to surprise inflate and low enough to remove the incentive to surprise deflate From the viewpoint of policy makers, losses from additional surprise inflation at this inflation rate just balance the perceived benefit of the additional output. The government, facing this expectation, has no incentive to produce any surprise. This outcome is characterized by inflation that is positive in equilibrium and output that is at the natural rate (but below the government's desired level) Nothing is gained on the output side from the additional inflation, but a welfare loss is incurred because of inflation. Thus, the outcome that emerges is inferior to the one that could be attained at zero inflation

Although the extent of the knowledge attributed to the public by these models strains credulity, many of the specific assumptions are analytically convenient without being essential What is essential is the public's assumption that policy makers are willing to use surprise inflation as a tool to generate higher employment. It is not necessary that the public know the exact form of the policy makers' preferences or the exact structure of the economy

*Underlying assumptions*

The basic ingredients creating a conflict between short- and long-term policy making are (i) irreconcilable output and inflation goals, (ii) forward-looking or rational expectations on the part of the public (but not the policy makers), and (iii) a perceived ability on the part of policy makers to "surprise" the public with unexpected inflation.

Although these assumptions seem technical in nature, assessing their realism will clarify the realism of the entire analysis In particular, the sensitivity of the analysis and the results to changes in the assumptions will help us to evaluate the claim that the structure of policy making is the source of persistent inflation in recent times. Indeed, one of the major contentions of

[14]Economists usually attribute this to some distortion that lowers output below its potential The most common example is the distortionary tax that lowers supplies of labor and capital Alternatively, political considerations may lead to a greater emphasis on short-term output gains as elections approach See Alberto Alesina, "Macroeconomic Policy in a Two-Party System as a Repeated Game," *Quarterly Journal of Economics*, vol 102, no 3 (1987), pp 651-78, Alberto Alesina and Jeffrey Sachs, "Political Parties and the Business Cycle in the United States, 1948-1984," *Journal of Money, Credit, and Banking*, vol 20 (1988), pp 63-82, and William D Nordhaus, "Alternative Approaches to the Political Business Cycle," *Brookings Papers on Economic Activity*, 2 1989 In theory, the government's objective function could be strictly rising with output, but this would imply a willingness to trade leisure for output that would not be consistent with utility maximization by the public

this article is that the implications of the time consistency literature are virtually indistinguishable from those of a standard backward-looking adaptive expectations framework. The additional theoretical elegance of the time consistency models is achieved only at the cost of assumptions whose empirical robustness is dubious.

*Incompatible targets.* The assumption of incompatible goals is essential [15] In particular, policy makers are assumed to strive for an unemployment rate that is inconsistent with the natural rate. By assumption, the natural rate is the only unemployment rate at which inflation is stabilized, hence, policy makers must balance approaching their targeted unemployment rate against the extra inflation generated in getting there. There is no conflict between time consistent and time inconsistent policies if policy makers have only a single goal or multiple goals that are mutually supportive If policy makers aim only at stabilizing inflation (at zero or any other value) or at stabilizing the unemployment rate at the natural rate (that is, the rate consistent with stable inflation), the time consistent policy path produced by dynamic optimization is fully consistent with the time inconsistent policy path toward the equilibrium of zero inflation (or any desired rate). Hence, the structure of policy making is irrelevant if policy makers are perceived as pursuing only a zero inflation target or a sustainable output target. It is only when the public views policy makers as regarding favorably the prospect of trading additional inflation for additional output that the inflationary bias emerges.

The reason that time consistency problems do not emerge when the output target is the natural rate is that the public has no reason to question the willingness or ability of policy makers to achieve their inflation and output goals. Because there is no conflict among goals, there is no question of commitment or credibility and no policy trade-off to exploit.[16]

As to the policy makers' objective function, the theoretical elegance of time consistency models appears greatly oversold Undesirably high inflation as an equilibrium is derived at the cost of assuming that policy makers pursue targets that they know to be inconsistent. Often the pursuit is justified as a necessary consequence of the political process or as a way of offsetting other output-reducing distortions in the economy In general, however, scant attention is paid to motivating the policy makers' assumed objective function empirically or theoretically.

*Rational expectations* The second requirement for time consistency problems to emerge is rational expectations by the public That is, the public knows enough about the preferences of policy makers and the structure of the economy to forecast policy accurately on average.[17] Under rational expectations, policy makers cannot systematically fool the public and so cannot gain the extra output that is sought, even temporarily There is an asymmetry here in that while both the public and the policy makers know the structure of the economy and the policy makers' preference, only the public optimizes on the basis of future events. Indeed, in the earliest models that developed the time consistency problem, it was explicit that the public reacted to both past and future policies, while policy makers optimized only on the basis of past events.[18] Such myopia on the part of policy makers is often attributed to their susceptibility to short-term political influences Policy makers do not recognize that the public discerns and reacts to their incentives If policy makers recognized that the public cannot be fooled, they would not make the effort to do so. Furthermore, in many cases, even if policy makers assumed (incorrectly) that the public had backward-looking expectations, they would nevertheless be deterred from inflating opportunistically as long as their discount rate was not too high and they viewed the public's expectations as responding reasonably promptly to actual inflation [19] By implication, in those

[15]This assumption dates back to Kydland and Prescott, in "Rules Rather Than Discretion " It is used in Barro and Gordon, "Rules, Discretion and Reputation", Barro and Gordon, "A Positive Theory of Monetary Policy", Alex Cukierman and Allan H Meltzer, "A Theory of Ambiguity, Credibility and Inflation Under Discretion and Asymmetric Information," *Econometrica*, vol 54, no 5 (September 1986), pp 1099-1128, and virtually every other paper on the subject

[16]Brian Hillier and James M Malcomson, in "Dynamic Inconsistency, Rational Expectations and Optimal Government Policy," *Econometrica*, November 1984, pp 1437-51, argue that the essence of the time consistency problem is that policy makers have two targets, inflation and output, but only one instrument Surprise inflation becomes a second instrument that the policy makers are attempting to utilize

[17]Rational expectations are not strictly required As long as the public's behavior responds somewhat to its expectation of future policy, a time consistency problem can emerge However, virtually all of the literature assumes rational expectations

[18]For example, see Kydland and Prescott, "Rules Rather Than Discretion " In equilibrium, expectations are fulfilled, so both the policy makers' and the public's expectations are rational ex post

[19]For example, the low-inflation equilibria discussed in Barro and Gordon, "Rules, Discretion and Reputation," can be interpreted as emerging because policy makers recognize that inflation expectations respond quickly to actual policies Also see V V Chari and Patrick J Kehoe, "Sustainable Plans," Federal Reserve Bank of Minneapolis, Research Department Working Paper no 377, 1988, and Herschel I Grossman, "Inflation and Reputation with Generic Policy Preferences," *Journal of Money, Credit, and Banking*, May 1990, pp 165-77 In "Credible Disinflation in Closed and Open Economies," Queens University Discussion Paper no 660, 1986, David Backus and John Driffill find that the response of expectations even with Fischer-Taylor-type overlapping wage contracts is sufficiently quick to avoid the bulk of the costs associated with time inconsistent policies

models where high inflation equilibria emerge, policy makers believe that they can fool most of the people for a long time

The assumption that the public holds rational expectations can also be challenged on empirical grounds Most empirical tests of the rational expectations hypothesis reject it. In particular, inflation expectations appear to be more backward- than forward-looking and inflation "surprises" can last for a long time [20] If such is the case, the premise that adherence to a credible policy rule will produce costless disinflation may prove to be far off the mark In practice, policy makers may find it risky to adopt a policy path whose success depends crucially on the assumption that the public will both anticipate correctly and react immediately to the effects of future policies.

In considering the robustness of policy conclusions to be drawn from the models under review, it is important to recognize that backward-looking (for example, adaptive) expectations on the part of the public can yield many of the same results produced by rational expectations in these models. Adaptive or backward-looking expectations in a multiperiod context would not be strictly "rational," but in regimes of moderate or low inflation the results would not diverge greatly from rational expectations. As long as expectations eventually catch up to actual inflation, any systematic inflation surprise can only be transitory. During this transition, policy makers could temporarily generate higher output (a course not open to policy makers if strictly rational expectations are assumed), but long-run output growth would be unaffected as long as policy makers were unwilling to accept ever-increasing inflation. Equilibrium inflation would be higher and output temporarily higher.

With such backward-looking expectations, however, it makes no difference if policy makers are credible, and there is no conflict between the time consistent and time inconsistent solutions. From the policy makers' point of view, they are obtaining the best solution given their preferences and the structure of the economy That is, they may feel that if inflation is running at very low levels, the short-run increase in output can justify a small, but long-run, increase in inflation In practice, however, if inflation expectations react quickly to increases in inflation, the willingness to inflate is likely to be extremely curtailed

The key point is that in the absence of rational expectations, policy makers, perhaps reflecting the tastes of the public, have preferences that lead them to exploit the inflation/output trade-off and that make them unwilling to accept the output losses required for a return to zero inflation In this case, it is probably better to choose better policies or better policy makers than to impose a structure of rules that may respond inflexibly, and thus suboptimally, to economic shocks or changes in priorities.

*Surprise inflation as a policy tool.* The final critical assumption of these models is that policy makers can generate surprise inflation to exploit an inflation/output trade-off temporarily While this assumption is commonplace in the literature, the process by which the inflation/output trade-off is exploited in practice is not clearly described Indeed, it seems to rest on two assumptions: 1) that anticipated policy moves (such as an expected easing in monetary policy) should have little or no effect on output, and 2) that policy makers can manipulate the surprise component of inflation to alter the path of output temporarily.

Surprise inflation is not a tool directly at the disposal of policy makers Some other instrument—interest rates, money growth, reserve requirements—must be used to implement policy. By common consensus, however, long and variable lags separate movements in these potential instruments from changes in inflation or output It is doubtful whether the degree of surprise experienced by the public when inflation rates change is any greater than that experienced by policy makers or whether economic behavior is greatly affected because of ignorance of the price level [21] Hence, it is unlikely that mistaken beliefs about the level of real wages or relative prices can generate significant output fluctuations

How surprise inflation affects aggregate output may appear to be an arcane question But it can help us to determine whether the structure of policy making is the key factor inducing persistently high inflation expectations. If policies that have been previously announced, or for some other reason are already expected, nevertheless can have an effect on real output, the structure of the problem assumed in the time consistency literature is altered fundamentally.[22] The reason is that policy makers can achieve output gains, at least in the

[20]See A Steven Englander and Gary Stone, "Inflation Expectations Surveys as Predictors of Inflation and Behavior in Financial and Labor Markets," Federal Reserve Bank of New York *Quarterly Review*, Autumn 1989

[21]As discussed below, Barro and Gordon, "A Positive Theory of Monetary Policy," and Finn E Kydland, "Monetary Policy in Models with Capital," in Frederick van der Ploeg and Aart de Zeeuw, eds , *Dynamic Policy Games in Economics*, pp 267-87 (Amsterdam North Holland, 1989), argue that the effects of surprise inflation on nominal asset values and capital accumulation are of greater empirical significance than the effects of wage or relative price surprises on output

[22]See Frederic S Mishkin, *A Rational Expectations Approach to Macroeconometrics* (Chicago University of Chicago Press, 1983), for example Both his original work and his reworking of Robert J Barro and M Rush, "Unanticipated Money and Economic Activity," in Stanley Fischer, ed , *Rational Expectations and Economic Policy*

short run, without resorting to policy moves that fool the public. Policy makers would optimize subject to their knowledge that unsustainable expansionary policies lead to inflation. Depending on the policy makers' objective function, they might tend to choose inflationary or noninflationary policies, but the source of the inflation would be the policy makers' actions rather than the structure of policy making or expectations conditioned on future policies

The public might revise its inflation expectation upward when it observed expansionary policy being implemented, but it would not do so in the absence of such policy Again, the conduct of policy making, rather than its structure, appears to be the underlying determinant of inflation.

Recognizing that ignorance of the level of prices or real wages is unlikely to produce major output effects, some analysts have argued that the effects of inflationary policy moves are seen immediately in asset values and capital accumulation decisions (but before the inflationary effects show up in actual prices). Hence, the policy surprise operates through wealth rather than inflation. The empirical consequences of such redistributions of wealth, however, are difficult to pin down. Some authors contend that inflation leads to higher output because the lower real value of government debt allows the government to engage in further spending. In contrast, others argue that price inflation may actually lead to a reduction in output by lowering the incentives to accumulate capital [23]

While the issue appears abstract, the considerable uncertainty attending the effects of surprise asset inflation makes it unlikely that such surprises are the mechanism by which an inflation/output trade-off is consciously exploited by policy makers. Yet the structure of such models and the policy conclusions that they yield presuppose that surprise inflation is the only means by which policy can affect outcomes. If this assumption is false, it is hard to make the argument that the mere presence of discretionary policy making yields an inflationary bias. Again the time consistency problem seems less important than systematic policy errors or preferences in generating inflation

*Credibility*

If the zero inflation outcome is preferable to the equilibrium outcome in the eyes of both parties, why do they not agree to maintain the preferred alternative? The time consistency literature argues that the answer to this question involves the credibility issue The public recognizes that policy makers have every incentive to assert that they will maintain low inflation, but it also recognizes that policy makers have a greater incentive to renege if the public accepts the assertion at face value According to this view, the public in general will not believe that low inflation will be maintained unless policy makers are viewed as strong adherents of low inflation or policy makers can provide evidence that they are following a policy rule that will yield low inflation. It is in this latter context that adhering to an intermediate target path believed consistent with low inflation, for example, may reduce inflation expectations

This is where credibility issues become important A commitment can be credible either because policy makers have a reputation for backing their commitments or because a way of enforcing the commitment exists Among the suggested strategies for achieving commitment are

i) requiring commitment through legislation
ii) ensuring that any breaches are obvious
iii) choosing policy makers whose sole objective is low inflation

The mechanisms by which these proposals provide credibility are discussed below This analysis concludes that the strategies, while possessing some attractive features, are extremely difficult to implement and may carry concomitant disadvantages that could greatly outweigh their potential benefits. Moreover, if inflation expectations are essentially backward-looking, such policies may be redundant and potentially damaging if they tie policy makers' hands unnecessarily The discussion concludes with an analysis of a fourth consideration that may encourage commitment

iv) The adverse consequences of a reputation for opportunism may encourage policy makers to adopt low inflation policies even in the absence of a specific policy rule

*Legislation.* By mandating a specific inflation goal or an intermediate target, legislation has the appearance of eliminating discretion by policy makers and substituting prescribed behavior [24] In this way, the authorities'

*Footnote 22 continued*
(Chicago University of Chicago Press, 1980), suggest that, if anything, anticipated policy moves have more impact on output than unanticipated policy

[23] In "Rules, Discretion and Reputation," Barro and Gordon emphasize the revenue-generating function of inflation, in "Monetary Policy in Models with Capital," Kydland emphasizes the effect of inflation on capital accumulation decisions

[24] Legislation can be viewed as imposing a severe penalty on policy makers for pursuing inflationary policies Mats Persson, Torsten Persson, and Lars E O Svensson, "Time Consistency of Monetary and Fiscal Policy," *Econometrica*, vol 55, no 6 (November 1987), pp 1249-73, and Mats Persson, Torsten Persson, and Lars E O Svensson, "Time Consistency and Monetary Policy," *Econometrica*, vol 55, no 6 (November 1987), pp 1419-31, suggest an alternative.

conduct of policy may gain credibility in the eyes of the public

One problem with legislated solutions, however, is the difficulty of ensuring an adequate degree of flexibility Legislation can permit deviations from the rule under certain specified circumstances, such as war or deep depression, but there may be other circumstances, more difficult to identify or foresee, that would also justify a deviation, even at the risk of higher inflation. If the set of exceptions is made too general, however, the entire legislation may lose its credibility Moreover, if the legislation is predicated on the assumption that disinflation can be achieved costlessly, a conflict between the explicit inflation goals and implicit output targets may well emerge The public may discount legislation that does not state explicitly whether output losses are an acceptable cost of disinflation In much of the time consistency literature this problem is "eliminated" by the assumption that a sufficiently "credible" disinflation will be costless, but the literature offers no set of criteria by which to predict in advance whether the costs of disinflation have in fact been lowered.

A second role for legislation might be to reduce or eliminate the conflict among final goals A definite statement that price stability is the primary goal for monetary policy and that any output target ought to be consistent with this goal on average might mitigate the time consistency problem because it might reduce any temptation to exploit the inflation/output trade-off

*Making dissonant behavior obvious—intermediate targets* A second possible way of ensuring adherence to the announced path is to remove the possibility of surprise inflation from the hands of policy makers. In practice this could be achieved by tying policy to a particular nominal aggregate. Deviations from target would, at least in theory, be readily visible and viewed as reneging on the commitment Policy makers would be able to comply with the rule and benefit from the low inflation equilibrium Once they deviated from the rule, the public would recognize their lack of commitment, and expectations would immediately shift upward Faced with these two possible outcomes, policy makers would adhere to the rule.

Obviously this strategy requires that the aggregate in question be controllable and predictably related to the final objectives If the first condition does not hold, it is impossible to determine whether deviations from target represent a willful effort by policy makers to create inflation, that is, to renege.[25] If the second condition does not hold, the credibility will be achieved at the cost of being unable to respond to shifts in the velocity of the aggregate in question. Unless an intermediate target satisfying both these criteria can be found, it will be impossible to have both credibility and control over final objectives. These trade-offs are crucial to determining the desirability of an intermediate target rule. The controllability criterion points to a narrow aggregate—if control is limited, then the observation that an intermediate target is conforming to, or deviating from, a desired path brings little information With a narrow aggregate, however, the link to final targets may be long and uncertain, and adherence to the intermediate target may lead to shocks to the final target.[26]

By and large, there appears to be scant evidence that strict observance of an intermediate target would yield better control over final targets.[27] This raises an important practical question about the use of such intermediate targets. Would a poorly selected intermediate target itself lack credibility because the public would recognize

*Footnote 24 continued*
but not very practical, way of penalizing inflationary behavior They argue that if the government is a net creditor (and bound by some restrictions on the term structure of its holdings), the reduction in the real value of its assets from inflation would provide a disincentive to inflate opportunistically

[25]In fact, Torben M Andersen, "Rules Versus Discretion in Monetary Policy The Case of Asymmetric Information," *Journal of Economic Dynamic Control*, vol 10 (1986), pp 169-74, argues that if policy makers have better information than the public about the source of money demand shocks, they would have an incentive to dissemble even under a constant growth rate rule

[26]See, for example, Bennett T McCallum, "Targets, Indicators and Instruments of Monetary Policy," in William S Haraf and Philip Cagan, eds , *Monetary Policy in a Changing Financial Environment* (Washington, D C American Enterprise Institute Press, 1990), and, in the same volume, Benjamin J Friedman, "Is the Monetary Base Related to Income in a Robust Way? A Commentary" These authors come to opposite conclusions about the suitability of the monetary base as an intermediate target David Currie, "Macroeconomic Policy Design and Control Theory—A Failed Partnership," *Economic Journal*, vol 95 (June 1985), pp 285-306, provides a discussion of the ill effects of what he perceives to be a poorly chosen intermediate targeting strategy in the United Kingdom in the early 1980s Some analysts argue that strict control of monetary aggregate growth over long periods would reduce the drift in velocity of the monetary aggregates, they claim that many of the velocity changes seen in the last generation were themselves induced by the high inflation rates of the 1970s and early 1980s See Barro, "Recent Developments in the Theory of Rules versus Discretion", and John J Judd and John L Scadding, "The Search for a Stable Money Demand Function A Survey of the Post-1973 Literature," *Journal of Economic Literature*, September 1982, pp 993-1023 The alternative view is that much of the shift in velocity was exogenous to inflation and caused by improved technology, which allowed much greater control by firms and individuals of assets, and by financial deregulation

[27]An extensive survey of intermediate targets is found in Federal Reserve Bank of New York, *Intermediate Targets and Indicators* A summary of the findings appears in Richard G Davis' introduction to the volume and is reprinted in the summer 1990 issue of the Federal Reserve Bank of New York *Quarterly Review* under the title "Intermediate Targets and Indicators for Monetary Policy An Introduction to the Issues "

that adherence requires compromising the final targets for long periods of time? Knowing that the relationships between intermediate and final targets are by no means tight and unchanging, the public may well discount adherence to such targets as being unsustainable, just as legislation predicated on a costless disinflation is likely to be discounted.

To get around the problem of achieving credibility under shifting relationships between intermediate and final targets, it has been proposed that there be some feedback from final targets to policy instrument settings or that final objectives themselves (inflation or nominal income growth) be targeted [28] Various contingent rules have been proposed to increase the stability of real output. As more contingencies are built into the rules, the performance in historical simulations appears to improve, but the public may view adherence to a complicated rule as being too difficult to monitor and hence little better than discretion

A second mechanism that has been proposed to make reneging obvious is to release the record of policy deliberations and decisions immediately after they are made The argument is that the public could then promptly recognize the inflationary consequences of policy changes, rendering surprise inflation unfeasible However, such proposals depend critically on the assumption that the lags between policy deliberations and their public release are used by policy makers to generate surprise inflation or disinflation In fact, lags between monetary policy decisions and their public release are currently so short—about six weeks—that it is hard to believe that such lags could be a source of inflation surprises. Moreover, a plausible argument could be made that immediate release would be counterproductive. If immediate release of deliberations made them more subject to political pressures, inflation expectations might rise rather than fall [29]

*Choosing conservative policy makers* By choosing policy makers of impeccably noninflationary tastes, the public is relieved of the need to monitor policy makers' decisions. The literature conventionally describes these policy makers as "conservative." In other words, the public can choose policy makers who attach far greater weight to low inflation than high output and who are thus more likely to err on the low inflation side.[30] Indeed, the assumption is that they are more averse to inflation than is the public

In an economy subject to random shocks, this approach is likely to be inferior to a policy combining discretion with output targets that are consistent with low inflation For example, if there is a supply shock, policy makers who pursue both output and price targets will wish to distribute the shock between the two, while policy makers who focus only on inflation will allow output to take the complete shock in order to attain inflation targets Choosing conservative policy makers is equivalent to selecting the latter In doing so, society forgoes the flexibility embodied in the former It is not possible to determine in advance whether the gain in credibility from choosing conservative policy makers offsets the resulting loss in flexibility In general, the gain from flexibility is higher when policy makers use their discretion to smooth output and inflation in an economy subject to large shocks By contrast, the gains from discretion could be small in a relatively placid economy, and strongly noninflationary policy makers might be preferable to more flexible ones in that setting.

If society prefers stability in both inflation and real output, it is preferable to allow policy makers discretion in spreading shocks between prices and output An inflation bias would not emerge if policy makers were aiming on average at consistent inflation and output targets Again, a trade-off between discretion and rules emerges only if the public knows that the ultimate output target is not feasible without inflation

*Reputation* Although formal rules seem most direct in constraining inflationary proclivities, the need to maintain a noninflationary reputation can be almost as effective in constraining opportunistic policy makers. If policy makers have a long time horizon and do not discount the future too heavily, they may be reluctant to exploit an inflation/output trade-off opportunistically because this will raise inflation expectations in subsequent periods. A long time horizon is necessary because it increases the period during which policy makers would be "punished" by higher inflation expec-

[28]Implicit in some of these rules is the assumption that inflation expectations and actual inflation rates will be more responsive to policy under a rule than under discretion If factors other than the structure of policy lead to sluggish adjustment of actual and expected inflation, this presumption would not be justified The inflation and real output growth engendered by such rules might then not be desired by either the public or the policy makers R Spence Hilton and Vivek Moorthy review a variety of such rules in "Targeting Nominal GNP," in Federal Reserve Bank of New York, *Intermediate Targets and Indicators*

[29]See William Poole, "Central Control of Interest Rates A Commentary," in Haraf and Cagan, eds , *Monetary Policy in a Changing Financial Environment* The political business cycle literature, which treats political influences on economic policy making, is beyond the scope of this survey For recent discussions and further references, see Nordhaus, "Alternative Approaches to the Political Business Cycle", and Alesina and Sachs, "Political Parties and the Business Cycle in the United States "

[30]Kenneth Rogoff discusses the implication of selecting policy makers with an unusually strong aversion to inflation in "Reputational Constraints", "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics*, vol 100, no 4 (1985), pp 1169-90, and "Reputation, Coordination and Monetary Policy," in Robert Barro, ed , *Handbook of Modern Business Cycle Theory* (Cambridge University Press, forthcoming)

tations. The moderate time discount rate is necessary because the policy makers would otherwise put much more emphasis on short-run optimization, an approach which might lead to opportunistic behavior. Analysts have pointed to the long and overlapping terms of central bankers as a way of promoting an institutional long horizon.

The precise degree of restraint that reputational factors impose on policy makers depends in large part on how the public forms its expectations, how fast expectations respond to a change in policy, and whether, once policy has been opportunistic, expectations revert back to low inflation without a loss of output However, the following general conclusion is robust: unless policy makers are extremely short-sighted, valuing short-term output gains very heavily, their own willingness to inflate may be greatly constrained by the prospect of a long period of high inflation and inflation expectations. Knowing that the penalties from a loss of reputation are severe, policy makers may even choose zero inflation Indeed, in the context of these models the public may lower its inflation expectations because it knows that policy makers view these penalties as a deterrent. Hence, even where there is a willingness to behave opportunistically, discretionary time consistent optimization may not produce significantly higher inflation than time inconsistent policies aimed at zero inflation

Reputation may be important in a different way even when policy makers do not have full credibility Much of the literature compares results when policy makers have full credibility at zero inflation with results when there is no credibility at all—that is, when policy makers are expected to inflate to their maximum tolerable inflation level Under such circumstances, zero inflation is not a credible result because policy makers have too much incentive to renege However, there may be an inflation level that is above zero but below that of the no credibility level to which policy makers could make a credible commitment [31] While the policy makers may wish to behave opportunistically, they may be deterred by the possibility that the public's inflation expectations would revert as a result to the fully noncredible level. Hence, policy makers may find it preferable to adopt policies consistent with this intermediate level of expectations rather than try to achieve additional output gains.

Such considerations may help explain why announcements of near-term zero inflation targets often carry little credibility The public may feel that policy makers will too readily jettison the zero inflation target if there is the opportunity to obtain extra output. While this logic would appear to argue in favor of announcing more credible gradualist disinflation policies, there does not appear to be much evidence that such announcements themselves produce more credible and less painful disinflation The reason may be that the short-run policy moves are often too small to be convincing The public may also doubt the medium-term political sustainability of the gradualist policy if it could imply persistent restraint

[31]Barro and Gordon, "Rules, Discretion and Reputation", and Barro and Gordon, "A Positive Theory of Monetary Policy" See also John B Taylor's comments on Barro and Gordon in "Rules, Discretion and Reputation in a Model of Monetary Policy Comments," *Journal of Monetary Economics*, vol 12, no 1 (July 1983), pp 123-25

**Uncertainty**

Much of the previous discussion has been deterministic. The public knows with precision the aims of policy makers and the structure of the economy (including the linkages of intermediate targets to final outcomes). Loosening these assumptions of precise knowledge affects the results as intuition would suggest: in the short run, the public is less categorical in its interpretation of apparent policy moves; in the long run, it will interpret a string of positive inflation results as an indication that policy makers are willing to exploit an inflation/output trade-off.

Two types of uncertainty are discussed below The emphasis is less on modeling than on exploring intuitively how uncertainty affects the results discussed earlier.

*Uncertainty about the structure of the economy*

When there are structural changes in the economy, rigid adherence to a policy rule may be less desirable even than the time consistent (discretionary) outcome Simply stated, the benefits from allowing policy makers to offset shocks may well outweigh the losses from higher inflation expectations due to time consistency problems.[32]

In some cases the optimal strategy may be mixed: follow a rule during normal times when shocks are relatively small, but switch to discretion in the presence of large shocks [33] The reasoning is that it is expensive for policy makers to specify behavior under important but relatively rare events, just as it is difficult for the public to specify behavior under all possible contingencies in its private contracts. In the event of a crisis, such as a war or major downturn, both the public and the policy makers are likely to view a rule as inferior to

[32]In general, it has to be assumed that only policy makers are able to recognize the shock Otherwise the public would be able to incorporate the shock into its expectations Buiter, "The Superiority of Contingent Rules," has a comprehensive discussion of how informational advantages may tip the scale in favor of discretion

[33]See Robert P Flood and Peter Isard, "Monetary Policy Strategies," *IMF Staff Papers*, vol 36 no 3 (September 1989), pp 612-32

discretion Rather than adhere to imperfect rules or attempt to determine rules for all contingencies it may be preferable to allow discretion but require some ex post justification for invoking it [34] According to this reasoning, however, the benefits from adhering to a rule may outweigh the benefits of discretion during normal periods, provided that an adequate rule can be formulated.

When the economy is subject to shocks, however, the public may be more inclined to expect higher inflation because it knows that in the short run policy makers could disguise policy moves by claiming that they are actually random shocks to the economy As a consequence, policy makers may find it more difficult to acquire a reputation for noninflationary policies if they are not adhering to a verifiable rule Over the medium term, however, discretion may remain compatible with noninflationary behavior by policy makers For example, while uncertainty may mean that a given positive inflation shock cannot be interpreted as opportunistic behavior, negative and positive shocks should, on average, offset each other over the medium term By considering whether an observed sequence of inflation rates is more consistent with stable inflation than with opportunistic behavior, the public may be able to establish with fair precision the true objectives of the policy makers. In one such model, policy makers maintain credibility as long as inflation remains within a certain range but lose credibility if inflation rates stray outside [35] Again, the proof of the pudding emerges in the eating—in the presence of uncertainty, the past record of inflation performance is more useful than an imperfect proxy for policy as an indicator of policy makers' targets.

It has also been suggested that an explicit trade-off can be made between the loss of flexibility due to strict intermediate targeting and the risk that policy makers may turn out to be more opportunistic than expected. One such model argues that in an economy with weak ties between intermediate and final targets, the inflation record of policy makers with a strong noninflationary record ought to be judged over a longer period than in an economy where intermediate targets are closely tied to final goals and the policy makers' reputations are not as well established [36] That is, policy makers of good reputation should be given more medium-term discretion when intermediate targets are unreliable indicators of the stance of policy.

*Uncertainty about policy makers' preferences*

A large literature analyzing how the public forms its expectations when it is uncertain of policy makers' preferences has emerged in recent years Time consistency problems are replaced in this literature by the problem of identifying policy makers who are more (or less) willing to inflate opportunistically [37] Once policy makers are found to be weak on inflation, they lose credibility and inflation expectations move up to the time consistent level

This literature focuses on the incentives prompting opportunistic policy makers to look like inflation fighters Revealing themselves to be opportunistic carries a permanent cost of higher expected inflation, so they have an incentive to look tough on inflation for some period of time. (If their time horizon is infinite, the effect may be absolute ) By and large, an incentive for opportunistic policy makers to adopt noninflationary policies emerges under a wide variety of conditions

If there is uncertainty about the state and structure of the economy, as well as about policy makers' preferences, the advantages accruing to a noninflationary reputation diminish, however The reason is that when the public sees an apparently inflationary outcome, it may be uncertain whether the outcome results from a policy action or from a random shock [38] Policy makers can do little in the short term to convince the public of their noninflationary intent Because of this ambiguity, opportunistic policy makers may inflate early because it may take some time for the public to catch on While the formation of the public's inflation expectations would obviously be influenced by such ambiguities, the use of

[34]Flood and Isard point to the requirement in many countries that central bankers testify periodically before elected officials as an example of a mechanism that will limit abuse of discretion As part of this testimony, the bankers are closely questioned about their policies

[35]See Matthew B Canzoneri, "Monetary Policy Games and the Role of Private Information," *American Economic Review*, vol 75 (1985), pp 1056-70 The decision rule is analogous to the rule used in quality sampling If an unusual number of defectives emerges in a small sample of a larger lot, the entire lot is rejected There is a finite chance that a few atypical defectives will lead to rejection of a basically good lot, similarly, there exists the chance that random shocks beyond the policy makers' control will lead to their acquiring a reputation as inflation-prone

[36]See Michelle R Garfinkel and Seonghwan Oh, "Strategic Discipline in Monetary Policy with Private Information Optimal Targeting Periods," Federal Reserve Bank of St Louis, mimeo

[37]The seminal papers are David Backus and John Driffill, "Rational Expectations and Policy Credibility Following a Change in Regime," *Review of Economic Studies*, vol 52, no 2 (April 1985), 211-22, and Backus and Driffill, "Inflation and Reputation," *American Economic Review*, vol 75, no 3 (June 1985), pp 530-38 See also Robert J Barro, "Reputation in a Model of Monetary Policy with Incomplete Information," *Journal of Monetary Economics*, vol 17, no 1 (January 1986), pp 3-20, and John Driffill, "Macroeconomic Policy Games with Incomplete Information Some Extensions," in *Dynamic Policy Games in Economics*, pp 289-323 (1989)

[38]See Driffill, "Macroeconomic Policy Games", and Kazuo Mino and Shunichi Tsutsui, "Reputational Constraints and Signalling Effects in a Monetary Policy Game," New York University, mimeo, 1989

a policy rule in this case has the same problem as in the situations described earlier—that is, where economic shocks are large, discretion plus noninflationary policy makers dominates rules.

**Empirical evidence and conclusions**

There is little firm empirical evidence on many of the issues discussed in this article. The optimal structure of monetary policy clearly depends on many factors whose importance is difficult to measure. These factors include a) the public's ability to predict policy makers' actions, b) the policy makers' goals, c) the predictability of linkages between policy tools and final goals, d) the extent of shocks to the economy, and e) the perceived credibility of policy makers. Although much of the literature has been written by authors who hold strong views on the qualitative importance of these factors, actual measurement is so difficult that theoretical analysis has been far more common than empirical work.

As a result, most of the empirical work has focused on measuring whether the output costs of disinflation respond to the perceived credibility of policy.[39] Credible disinflationary policies, supported by verifiable rules, should carry a lower output cost than less credible discretionary disinflationary policies. Yet efforts to distinguish credible from noncredible disinflations have not met with great success. Most empirical work has not found any significant decline in the output costs of disinflation either in the United States or in the rest of the OECD through the early 1980s, and, indeed, these relations appear to have been stable in most OECD countries since the 1960s.[40] This apparent stability has persisted despite the view of many that anti-inflationary policies became more "credible" in the early 1980s.

It is difficult to state with any confidence that a particular set of policies will generate a credible disinflation with low output costs. The countries that disinflated in conjunction with a "rule"—which took the form of tying their currencies to stronger currencies in the European Monetary System—generally experienced high unemployment in the process. A possible interpretation of these 1980s disinflations, one that would be in line with the time consistency literature, is that the policies put in place were not in fact credible. Thus, the public may have questioned the commitments of the policy makers to low inflation and hence may have refrained from altering behavior and expectations in response to the announced policies.

A problem with this interpretation is that it is difficult, if not impossible, to find alternative independent tests of the presence or absence of credibility. There are few examples of countries adhering to monetary targeting rules that might provide a baseline test of whether such rules produce credibility and lower the cost of disinflation. In the view of many authors, the low-inflation OECD countries do not appear to follow an explicit rule.[41] To the extent that low inflation is built into expectations in these countries, it is because of the countries' recent success in maintaining low inflation, rather than their adherence to an explicit rule.

A second possible interpretation of the 1980s experience is that disinflation is expensive because expectations are largely backward-looking and do not readily incorporate the effects of policy changes. Most studies have found this characterization to be broadly accurate—at least as it applies to labor markets—as long as inflation is low or moderate.[42] If this is so, policy makers and society have to accept the output costs if they wish to disinflate to very low inflation rates. With this backward-looking, rather than rational, view of expectations formation, the kind of time consistency problem described in the literature under discussion does not exist in reality.

Although most analyses have not found any empirically significant credibility effects, there are a few exceptions, primarily in cases of disinflating from hyperinflation. Disinflations in Central Europe in the 1920s and in Chile and Denmark more recently appear more successful, although economists still debate whether these disinflations were indeed painless.[43] What char-

[39] William Fellner, "The Credibility Effect and Rational Expectations: Implications of the Gramlich Study," *Brookings Papers on Economic Activity*, 1 1979, pp 167-89, first suggested this approach.

[40] For the United States, see A. Steven Englander and Cornelis A. Los, "The Stability of the Phillips Curve and Its Implications for the 1980s," Federal Reserve Bank of New York, Research Paper no. 8303, 1983, Olivier J. Blanchard, "The Lucas Critique and the Volcker Deflation," *American Economic Review*, vol. 74, no. 2 (May 1984), pp. 211-15, and Robert J. Gordon and Stephen King, "The Output Cost of Disinflation in Traditional and Vector Autoregressive Models," *Brookings Papers on Economic Activity*, 1 1982, pp. 205-43. For other OECD countries, see James Chan-Lee, David T. Coe, and Menahem Prywes, "Microeconomic Changes and Macroeconomic Wage Disinflation in the 1980s," *OECD Economic Studies*, no. 8 (Spring 1987), pp. 121-57.

[41] See, for example, Michael M. Hutchinson, "Japan's 'Money Focussed' Monetary Policy," Federal Reserve Bank of San Francisco *Economic Review*, Summer 1986, pp. 33-46, and Bharat Trehan, "The Practice of Monetary Targeting: A Case Study of the West German Experience," Federal Reserve Bank of San Francisco *Economic Review*, Spring 1988, pp. 30-44.

[42] See Englander and Stone, "Inflation Expectations Surveys."

[43] See Thomas J. Sargent, "The Ends of Four Big Inflations," in Robert E. Hall, ed., *Inflation: Causes and Effects* (Chicago: University of Chicago Press, 1982), Michael Christensen, "Disinflation, Credibility and Price Inertia," *Applied Economics*, vol. 19, no. 10 (1987), pp. 1353-66, Michael Christensen, "On Interest Rate Determination, Testing for Policy Credibility and the Relevance of the Lucas Critique," *European Journal of Political Economy*, vol. 3 (1987), pp. 369-88, and Marianne Baxter, "The Role of Expectations in Stabilization Policy," *Journal of Monetary Economics*, vol. 15, no. 3 (1985), pp. 343-62. Keith Blackburn and Michael Christensen

acterizes these credible disinflations is that monetary, fiscal, and, in some cases, exchange rate policies were all subordinated to the disinflationary goal In particular, it has been argued that fiscal tightening, which would make future monetization of government debt less tempting, was a key factor in convincing the public that the low-inflation path was sustainable

Two other characteristics of these disinflations are noteworthy, however, and cast doubt on the relevance of these examples to the task of disinflating from moderate inflation First, it may be easier to move from high to moderate inflation rates because both the policy makers and the public clearly desire to lower inflation There is a high real output cost of hyperinflation in terms of time and energy spent exchanging "money" whose value drops daily into assets with more stable value. Hence, the ambiguity whether the policy objectives are in fact consistent is not as profound as at lower inflation rates Also, hyperinflation in many cases greatly reduced the real value of government debt As a result, fiscal policy could start de novo with little or no debt service burden Whether disinflation from moderate to low levels of inflation can occur with so little cost is not clear Other instances of disinflation from more moderate inflation levels have generally resulted in substantial output costs [44] Indeed, even the cases of successful disinflation from hyperinflation involved some apparent output cost What makes them seem painless is the low output cost per percentage point of inflation reduction

Second, the key reform in each of these cases was generally not an explicit attachment to a monetary policy rule but rather the creation of a set of mutually consistent monetary and fiscal policies The consistency of policies may also have served to convince the public that lower inflation was the preeminent goal Moreover, in several cases of disinflation with relatively small output costs, a coordinated structure of wage bargaining may have been important in unwinding a wage/price spiral [45] Although credibility may have been important, these considerations suggest that it is not rules per se that create credibility but policies that will lead to disinflation irrespective of the underlying economic model

A final consideration is that, in practice, policy may be more credible in one market than another In the case of Ireland's disinflation in the 1980s, it has been argued that a reduction in long-term interest rates reflected a policy credibility in financial markets that did not exist in labor markets, as reflected in the sharp rise in unemployment rates [46] As long as labor market expectations are slow to adjust, it is unlikely that the output cost of disinflation can be eliminated

*Footnote 43 continued*
provide a concise survey of this literature in "Monetary Policy and Policy Credibility Theories and Evidence," *Journal of Economic Literature* (March 1989), pp 1-45

[44]Robert J Gordon reviews several such instances of disinflation in the United States and abroad in 'Why Stopping Inflation May be Costly Evidence from Fourteen Historical Episodes in Inflation " in Robert E Hall, ed , *Inflation Causes and Effects* (Chicago University of Chicago Press 1982)

[45]Robert J Gordon, "Why Stopping Inflation May be Costly," argues strongly for this interpretation in several OECD disinflations in the 1960s and 1970s

[46]See Jeroen J M Kremers, "Gaining Policy Credibility for a Disinflation," *IMF Staff Papers*, vol 37 no 1 (March 1990), and Rudiger Dornbush, "Credibility, Debt and Unemployment Ireland's Failed Stabilization " *Economic Policy*, no 8 (April 1989) Christensen "Disinflation, Credibility and Price Inertia," also provides evidence on the sluggishness of price expectations in labor markets