Monetary Policy during a Transition to Rational Expectations

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In standard macroeconomic models incorporating the natural rate hypothesis and rational expectations, monetary policy has no effect on real variables. But the rational expectations assumption that economic agents have learned from their mistaken predictions of the past ignores the transition period during which new information is combined with old information in the formation of new beliefs. The purpose of this paper is to examine the possible effects of monetary policy during this transition period. Using a simple momentary Phillips curve model and a particular characterization of monetary policy, it is shown that real variables (in this case unemployment) can be controlled. Further, an optimal monetary policy is computed by simple variational methods. This policy is a randomized rule which matches the marginal gain from future reductions in unemployment to the marginal loss of increased uncertainty about the price level. Unlike the rational expectations equilibrium, this rule will dominate purely deterministic rules, even if the latter are possible.

I. Introduction

One of the important policy implications that has emerged from the recent research on rational expectations is the ineffectiveness of monetary policy on real variables in standard macroeconomic models incorporating the natural rate hypothesis.[1] This "monetarist" conclusion is due to the assumption that economic agents can make unbiased predictions of the future course of monetary policy. Since biased predictions are the only

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[1] See Sargent (1973) and Sargent and Wallace (1975).

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source of systematic deviations from the exogenously given natural rate, monetary policy is rendered ineffective.

An immediate reaction to this result is to question the assumption that the public can predict the decisions of monetary policymakers without bias. Such predictions would be possible if people had observed the reactions of the policymakers to various economic conditions over a long period of time.[2] But in the early stages of this policy watching, previously held public beliefs about past policy could lead to biased predictions which might enable monetary policy to have effect. This would be the case, for example, immediately after a structural shift in monetary policy. Of course, these biased predictions would only be temporary. Eventually peoples' guesses would converge, on the average, to the actual policy being used.

The purpose of this paper is to examine the possible effects of monetary policy during this transition period. Using a simple momentary Phillips curve model and a simple characterization of monetary policy, it is possible to show that real variables (in this case unemployment) can be controlled during the transition. These objectives are accomplished by a monetary policy under which the public's optimal prediction of the inflation rate follows an adaptive expectations scheme, with a time-dependent coefficient of expectation determined by the monetary authorities. An optimal policy can be computed by variational methods and is shown to satisfy a condition analogous to the Ramsey-Keynes optimal savings rule. It is a randomized policy which matches the marginal gain from future reductions in unemployment to the marginal loss of increased uncertainty about the price level. During the period of transitional expectations, this policy will dominate purely deterministic policies even if the latter are feasible.

As will become evident, a crucial assumption behind these results is that the public has specific beliefs about monetary policy which are different from the actual monetary policy undertaken. If there are no prior beliefs about monetary policy, then the important policy conclusions of rational expectations continue to hold in this model even during the transition period. Some of the practical implications of this requirement are discussed below in Section V.

II. The Ineffectiveness of Policy under Rational Expectations

Suppose that the relationship between inflation and unemployment can be represented[3] by

$$f = \phi(u) + x, \qquad \phi'(\cdot) < 0, \qquad \phi(u^*) = 0, \qquad u > 0, \tag{1}$$

[2] Or, alternatively, if the policy were announced to the public.

[3] This model and problem were introduced by Phelps (1967) and are discussed further in Phelps (1972). The notation used in this paper corresponds to Phelps (1972).

where f and x are the actual and expected rates of inflation, respectively, and where u^* is the natural rate of unemployment.[4] Further, suppose that the monetary authorities—through changes in the money supply—can control the actual rate of inflation so that a particular monetary policy is defined solely in terms of an inflation path $f(t)$. For this assumption to make sense in terms of a growing economy, it is necessary to further assume that the fiscal authority can flawlessly control private investment so as to keep the rate of growth of the capital stock equal to the exogenously given rate of growth of the augmented labor supply. Without such an assumption the changes in capital intensity which accompany changes in the inflation rate would complicate the analysis.

Although the momentary Phillips curve in equation (1) does not allow for any long-run monetary effects on unemployment ($f = x$ in the long run), short-run effects are possible if x differs from f in some systematic way. For example, Phelps (1967) makes the adaptive expectations assumption

$$x'(t) = \beta[f(t) - x(t)] \tag{2}$$

and considers an optimal inflation policy which maximizes

$$\int_0^\infty e^{-\rho t} W(x, u)\, dt, \tag{3}$$

where $W(x, u)$ is the instantaneous rate of social utility. The utility function $W(x, u)$ is assumed to be strictly concave and to reach a maximum as a function of u at some value less than the natural rate, decreasing monotonically as unemployment rises above that value. Although recent research has emphasized the informational inefficiences that arise when unemployment is too low, it seems safe to assume that an increase in the unemployment rate above the natural rate would not bring a gain in efficiency. When $u = u^*$ we assume that W attains a unique maximum as a function of x at $x = x^*$. This latter maximum is the highest *sustainable* rate of utility because only when $u = u^*$ is there no tendency for the rate of inflation to continue to rise or fall. This welfare effect of the expected rate of inflation is derived from the liquidity effects of the money rate of interest. Given the fiscal policy described at the end of the last paragraph, a particular money rate of interest implies an expected inflation rate.

[4] The function $\phi(\cdot)$ is normally thought to be convex. If this is true and there is uncertainty in the system such that $E\,\phi[u(t)] = 0$ for all t, then from the Jensen inequality, $E[u(t)] \geq u^*$ for all t. If there is a "natural" amount of uncertainty in the economy, it might be more accurate to call $E[u(t)]$ the natural rate, rather than the root of $\phi(\cdot)$.

But, as has been pointed out in the rational expectations literature, it is unlikely that the public would form expectations according to the adaptive expectations assumption in the face of a particular optimal inflation-unemployment strategy planned by the monetary authorities. Over a period of time people would begin to see that expectations based on (2) were biased and modify the adaptive scheme. In other words, computing optimal policy on the basis of (2) assumes that people do not learn from their mistakes.

The rational expectations hypothesis assumes that people have already learned from their mistakes and are thus able to make unbiased predictions of the inflation policy. If $I(t_0)$ represents the information available to the public at time t_0, then under rational expectations

$$x(t|t_0) = E[f(t)|I(t_0)], \tag{4}$$

where E is the mathematical expectation operator.[5] Included in the public's information set are past observations on $f(t)$ as well as a knowledge of the monetary authority's future inflation strategy. If this inflation strategy is deterministic and there are no errors in the system, then the public is assumed to know $f(t)$ for all t, so that $f(t) = x(t|t_0)$ regardless of the $f(t)$ chosen. Thus under a deterministic policy with no uncertainty in the economy, $\phi[u(t)] = 0$ and therefore $u(t) = u^*$ for all t.

If the inflation policy is random, or if there are unavoidable uncertainties in the execution of the inflation policy, then the public is assumed to know the probability distribution of $f(t)$ for all t. Under these conditions the prediction error, or innovation, $f(t) - x(t|t_0)$ is uncorrelated with the elements of $I(t_0)$ for all $t > t_0$, so that the conditional expectation of $\phi[u(t)]$ is zero regardless of what randomized inflation policy is used. However, as mentioned in footnote 4, this does not mean that $E[u(t)] = u^*$ for all t, because of the possible nonlinearity of $\phi(\cdot)$. Further, any increase in the variance of the inflation rate over that given by the characteristics of the economy will only raise $E[u(t)]$ because of the increase in the variance of the prediction error. Since $E[u(t)] \geq u^*$, this increase will reduce utility, because W decreases monotonically in u for unemployment rates above u^*. Thus, the deterministic policy of the last paragraph dominates any randomized policy under the assumption of rational expectations.

[5] The expected rate of inflation in eq. (1) refers to the instantaneous prediction of (t); that is,

$$x(t_0) = \lim_{t \to t_0} x(t|t_0).$$

For the discussion in this section, however, we emphasize the viewpoint date t_0.

In this sense, monetary policy has no effect on unemployment, even in the short run.[6]

But the rational expectations assumption that people have already learned from their mistaken predictions of the past ignores the transition period during which new information is combined with old beliefs in the formation of new beliefs. The next section examines this transition period in the context of a specific monetary policy.

III. Transitional Expectations

In order to simplify the description of the public's accumulation of monetary experience during the transition to rational expectations, the monetary authority is assumed to follow a simple inflation policy in which the rate of inflation has a constant mean and a changing variance and is uncorrelated over time. More specifically, the inflation policy is such that the logarithm of the price level $p(t)$ follows a diffusion process with instantaneous mean μ and instantaneous variance $\sigma^2(t)$ per unit time. The stochastic differential equation describing this process is

$$d[\log p(t)] = \mu dt + \sigma(t)\, dv, \qquad t \geq 0, \tag{5}$$

where $v(t)$ is a Wiener process with zero mean and unit variance. Because the path of a diffusion process is not differentiable, the instantaneous means and variances are defined in terms of stochastic differentials or increments.[7] In order to make the notation compatible with the deterministic inflation problem mentioned in Section II above, the stochastic differential $d[\log p(t)]$ will be represented by $f(t)\, dt$ with the warning

[6] A further complication, pointed out to me by Robert Barro, is that $\phi(\cdot)$ may depend on the variance of the inflation rate. For example, in the case where $\phi(\cdot)$ is *linear*, Lucas (1973) has shown that its slope increases (in absolute value) with the variance of the inflation rate, with the natural rate u^* remaining fixed. (This result requires that the variance of relative prices does not increase in the same proportion as the general price level.) However, if $\phi(\cdot)$ is linear, then our result still holds, since $E[\phi(u)] = 0$ implies that $E(u) = u^*$ regardless of the slope of ϕ. Although the results of the above paragraph do not concern the variance of u, this steepening of the Phillips curve could reduce this variance despite the increase in the variance of the inflation rate. Using Lucas's result a sufficient condition for this reduction is that the variance of the general price level be greater than the variance of relative prices. However even if this condition holds, the benefits of an unemployment variance reduction must be weighed against the costs of an inflation variance increase. If ϕ is nonlinear, then it is not clear from Lucas's results how the variance of the inflation rate affects $\phi(\cdot)$. Intuition would suggest that $\phi'(\cdot)$ is uniformly increased in absolute value. Such a steepening of the Phillips curve could offset the otherwise worsening effect of an increase in the variance of f on $E(u)$, but further assumptions would be necessary to insure that the total effect is unambiguous. Because these variance effects on $\phi(\cdot)$ do not alter our results in the linear case, and are unknown in the nonlinear case, we will assume for the remainder of this paper $\phi(\cdot)$ is invariant to such changes. This assumption is also made by Sargent (1973) and Sargent and Wallace (1975).

[7] See, for example, Chernoff (1968) or Astrom (1970).

that $f(t)$ alone has no meaning since the derivative of log $p(t)$ does not exist. With such a notation, equation (5) implies that

$$E[f(t)\,dt] = \mu dt, \tag{6}$$

$$\text{var}\,[f(t)\,dt] = \sigma^2(t)\,dt. \tag{7}$$

Heuristically, this means that the rate of inflation has a constant mean and a variance which may depend on time.

The uncertainty in the inflation rate may be due to unavoidable policy errors, public observation errors, or planned randomization by the monetary authorities. If the unplanned uncertainty is assumed to be constant over time, then we require that $\sigma^2(t) \geq m > 0$, where m is the unplanned and unavoidable variance. Subject to this lower bound on the variance, the monetary authorities are assumed to be able to choose μ and a path $\sigma^2(t)$, $t \geq 0$ in implementing policy.

However, although the monetary authorities know both μ and $\sigma^2(t)$, the public is assumed to know only the path $\sigma^2(t)$ and not the chosen value of μ. This lack of public information about μ is what distinguishes the transitional period from the final state of rational expectations where μ is known. Instead of knowing the mean rate of inflation, people are assumed to have a prior guess at time $t = 0$, which can be described by a normal distribution with mean μ_0 and variance σ_0^2. This prior knowledge might be based on observations from a previous monetary plan which differs from the policy of equation (5) undertaken at $t = 0$. Alternately, if it is known that a new policy is being instituted, μ_0 might be based on an analysis of other factors such as the previous background of new policy makers.

The assumption that μ is not known to the public implies some further propositions about the public information set. As is discussed below, the monetary authorities choose μ and the path $\sigma^2(t)$ so as to maximize the expected value of the discounted integral of $W(x, u)$. Presumably the public will be aware of the technical aspects of this maximization. If this is the case then public ignorance of μ implies public ignorance of the functional form, or at least the parameters, of the social welfare function used by the policymakers. Now, to the extent that there has been much public agreement in the economy as to the form of W (perhaps W is announced), this latter form of ignorance will be unrealistic because the average beliefs about W will correspond to the W chosen by the policymakers. In such a situation μ will also be known and we will again be in the world of rational expectations. But general agreement about the parameter weights or even the form of W seems unlikely in most modern economies. Because different economic and political philosophies imply different social welfare functions, not only will average public belief about W differ from the policymakers', but the policymakers themselves will disagree and be forced to compromise in deciding on W. Thus, unless the actual weighted average of the philosophies of the policymakers, and the translation of these philosophies into parameter values for W, are known to the public, it is realistic to assume that the social welfare function chosen for policy computation is not perfectly known by the public. In any case such an imperfect information assumption is made in this paper so that μ_0 will in general differ from μ.

Some defense of the government policy in equation (5) is in order. The primary virtue of public policy analyses which derive expectations from specific policy plans is that the beliefs and reactions of the public are consistent with the actual policy undertaken. However, in order to utilize this approach when public learning is involved, the policy must be kept fairly simple. As an illustration of the kind of difficulties which may otherwise arise, consider a slight variation of (5) where the government announces the policy of (5) but actually undertakes a policy with a different variance path $\sigma(t)$, say $\sigma(t) = m$ for all t. With this policy the government will find it difficult to determine public expectations. What structure for $\sigma(t)$ will the public use on the average for estimating the parameters of $\sigma(t)$? In other words, the less that the public knows about the policy, the more difficult it is to describe public reaction. The policy of this paper allows the public to know everything about policy, except the single parameter μ. Other policies involving parametric estimation could also be analyzed, but this one both preserves technical simplicity and illustrates the nature of the problem. The computational aspects of determining public reaction to policy is a further argument for the *practical* use of simple rules such as the μ percent rule considered here.

It will be convenient in what follows to use the precision, the reciprocal of the variance, rather than the variance itself for both the diffusion process and the prior distribution. The instantaneous precision of the inflation policy will be denoted by $y(t) = \sigma^{-2}(t)$ and the precision of the public's prior knowledge by $\omega = \sigma_0^{-2}$.

If the public's expectation of inflation is equal to the minimum mean-square estimator of the inflation rate,[8] then $x(0) = \mu_0$. Further, under the above assumptions, as new information accumulates, the expected rate of inflation follows the stochastic differential equation,[9]

$$dx(t) = \frac{\omega}{\omega + z(t)} [f(t)\, dt - x(t)\, dt], \tag{8}$$

where

$$z(t) = \int_0^t y(s)\, ds, \tag{9}$$

[8] Klein (1974) uses this assumption to investigate the effects of recent changes in the variance of the inflation rate in the U.S. economy.

[9] This is a simple continuous time version of a Kalman filter applied to Bayesian estimation (see, for example, Athans [1974]).

and is a measure of the amount of information accumulated by the public. It is interesting that (8) is similar to the adaptive expectations assumption (2), except that the coefficient of expectation, $\omega/[\omega - z(t)]$, decreases with time at a rate determined by the monetary authorities' precision path $y(t)$. For a fixed t, this coefficient is negatively related to the precision of the public's prior knowledge and positively related to the instantaneous value of the precision of the inflation policy.

By integrating equation (8), the expected rate of inflation is

$$x(t) = \left[\frac{\omega}{\omega + z(t)}\right] x(0) + \left[\frac{z(t)}{\omega + z(t)}\right] \bar{f}(t), \tag{10}$$

where

$$\bar{f}(t) = \frac{\int_0^t y(s) f(s)\, ds}{\int_0^t y(s)\, ds}. \tag{11}$$

Thus, $x(t)$ is a weighted average of the initial expectation $x(0)$ and the weighted sample mean $\bar{f}(t)$. As t grows, the weight on the initial expectations converges to zero and $x(t)$ converges to μ in probability, if the precision $y(t)$ of the inflation process does not converge to zero. Since under rational expectations $x(t) = \mu$ (μ is known), it is clear that these transitional expectations converge to rational expectations.[10]

Although the public does not know the mean inflation rate, the monetary authorities do, so that the actual distribution of the inflation rate (and therefore the unemployment rate from a stochastic differential version of eq. [1]) can be calculated in computing optimal policy. The optimization problem confronting the monetary authorities is therefore: choose μ and $y(t)$ to maximize

$$E \int_0^\infty e^{-\rho t} W[x(t), u(t)]\, dt, \tag{12}$$

subject to the constraint $0 \leq y(t) \leq M \equiv 1/m$, where the expectation is with respect to the distribution of the particular inflation policy chosen. Unlike the policy objective posed in equations (2) and (3), this objective allows people to learn from their mistakes.

IV. Optimal Policy during the Transition

This policy problem is one that engineers have called "parameter optimization,"[11] since a deterministic path of parameters $y(t)$ is chosen to optimize stochastic performance. Such problems are usually concerned

[10] The term "transitional" does not mean these expectations are suboptimal predictors of inflation (despite the semantic confusion that such expectations are not rational).

[11] See James, Nichols, and Phillips (1947) or Astrom (1970, chap. 5) for a more recent discussion.

with finding time-varying gains to minimize the variance of a linear system and are different from other stochastic control problems where a random function is chosen to optimize performance. Rather than utilize exciting techniques of parameter optimization to derive rigorous optimization conditions, we will convert the problem into a simple deterministic calculus of variations problem, which clearly illustrates the important properties of the optimal inflation strategy.

Since W is a function of x and u it will follow a diffusion process with an instantaneous mean depending on the instantaneous mean and variance of x and of the prediction error $f(t)\,dt - x(t)\,dt$. These moments, evaluated from the assumptions in the previous section, are

$$E[x(t)] = \frac{\omega}{\omega + z(t)}\, x(0) + \frac{z(t)}{\omega + z(t)}\, \mu, \tag{13}$$

$$\mathrm{var}\,[x(t)] = \frac{z(t)}{[\omega + z(t)]^2}, \tag{14}$$

$$E[f(t)\,dt - x(t)\,dt] = \frac{\omega}{\omega + z(t)}\,[\mu - x(0)]\,dt, \tag{15}$$

$$\mathrm{var}\,[f(t)\,dt - x(t)\,dt] = y^{-1}(t)\,dt + \frac{z(t)\,dt}{[\omega + z(t)]^2}. \tag{16}$$

Equation (15) clearly illustrates how monetary policy can have effect during the transition period. From the analysis of Section II, the expected value of this prediction error is zero under rational expectations, and thus monetary policy is ineffective. But under transitional expectations this expected value depends on both the mean and the precision path of the inflation policy. Therefore, the expected unemployment rate can be reduced during the transition period, by choosing μ larger than the initial public expectation of inflation and by reducing the precision of the inflation policy. Note that because the expected prediction error depends on the accumulation of past precisions, if $\mu > x(0)$, a current reduction in the precision of the inflation policy reduces unemployment in all future periods. However, because of the strict concavity of W the monetary authorities are not free to reduce the precision of the inflation policy to zero. Doing so would, at some point, begin to reduce utility by increasing the variance of both unemployment and inflation as expressed in equations (14) and (16). Further, there is a limit to how much μ can be increased, because eventually the expected rate of inflation will converge to μ, and the maximum sustainable rate of utility occurs when $x = x^*$.

To determine the characteristics of the optimal policy, first consider the case of no future discounting. Since the precision of the optimal inflation policy will not converge to zero as t grows large, the limits of the moments in equations (13)–(16) can be evaluated. The limits of (14) and (15) are zero, while

$$\lim_{t\to\infty} E[x(t)] = \mu \quad \text{and} \quad \lim_{t\to\infty} \text{var}\,[f(t)\,dt - x(t)\,dt] = \lim_{t\to\infty} y^{-1}(t)\,dt.$$

Under the above assumptions about W, the expectation of W will be maximized in the steady state if $\mu = x^*$ and

$$\lim_{t\to\infty} y(t) = M.$$

The optimal choice for the limit of the path of $y(t)$ follows from the concavity of W and the fact that its expectation depends only on the moments in (13)–(16). Thus, a lower variance of the prediction error is preferred to larger variance. The convexity of $\phi(\cdot)$ only strengthens this preference.

Having determined the optimal mean inflation rate and the optimal steady-state value of the precision, it remains to specify the path of the precision over time. For a given μ and $x(0)$, the moments of the expected inflation rate and of the prediction error depend only on $y(t)$ and $z(t)$. Hence, the expected value of W can be written as a function of these two variables. Let this function be $V[z(t), y(t)]$ and assume,[12] without loss of generality, that the units of V are such that $V(\infty, M) = 0$. Then, the policy problem defined in equation (12) can be written as the following calculus of variations problem (recalling $\rho = 0$),

$$\max_{y(t)} \int_0^\infty V[z(t), y(t)]\,dt, \tag{17}$$

subject to $z'(t) = y(t)$ and

$$\lim_{t\to\infty} y(t) = M,$$

where V is measured in units such that

$$\lim_{t\to\infty} V[z(t), y(t)] = 0.$$

It is assumed that V has the following properties in addition to concavity,

$$V_y > 0, \tag{18}$$

$$V_z \begin{cases} < 0 & \text{if} \quad \mu > x(0) \\ > 0 & \text{if} \quad \mu \leq x(0). \end{cases} \tag{19}$$

Assumption (18) follows directly from the previous assumptions that an increase in the precision of the inflation rate increases expected utility

[12] This implies that V will be negative valued. As in Ramsey (1928) the assumption is made so that the integral in eq. (17) exists.

because of the reduction in uncertainty. To derive (19) from previous assumptions would require some additional assumption about the partial derivatives of W. Roughly speaking, assumption (19) requires that, when $\mu > x(0)$, the positive effects on unemployment, brought about by an increase in the expected prediction error, outweigh any negative effects of an increase in the variance of $x(t)$. When $\mu \leq x(0)$, an increase in accumulated precision is good on all accounts.

If the expected inflation rate x^*, which maximizes sustainable utility, is less than the initial expected inflation rate $x(0)$, then the monetary authorities should aim at minimizing the public's prediction error by choosing $y(t) = M$, the highest precision possible. Such a policy will minimize the transitional increases in unemployment, which must be incurred if the expected inflation rate is to be reduced. In this case, an increase in current and accumulated precision both lead to an increase in expected utility.

On the other hand, if $x^* > x(0)$, then it is possible to have transitional reductions in unemployment as the expected inflation rate is increased. In this case, an increase in current precision has positive effects today but negative effects in the future, because the higher accumulated precision increases unemployment. The Euler equation for this optimization problem is $V_z = (d/dt)\, V_y$, with the solution satisfying $y(t) \cdot V_y = -V$. Hence, the optimal instantaneous precision of the inflation rate is equal to the positive deviation of current expected utility from its maximum sustainable level divided by the marginal expected utility of precision. Starting from an initial precision less than M, the optimal precision path increases monotonically toward M.

Some intuition behind this result is gained by an analogy with the optimal savings problem. Let precision be represented by consumption and let the negative of accumulated precision be represented by capital. Then the more precision that is "consumed" today, the less "capital" will be available for lower expected unemployment in the future. The optimal rate of precision consumption is then given by the Ramsey–Keynes rule which corresponds to the condition stated above.

The analysis for a positive discount rate is analogous, except that the optimal μ will be larger than x^* and the optimal

$$\lim_{t \to \infty} y(t)$$

will be smaller than M. How much larger and smaller, respectively, will depend on the size of the discount rate. Once these parameters have been determined the optimal path $y(t)$ can be determined by calculus of variation methods depending on whether the optimal μ is less than or greater than $x(0)$.

V. Indefinite Public Beliefs

In addition to describing an optimal monetary policy under transitional expectations, the previous section demonstrates how monetary policy regains the potency it lost under rational expectations. A crucial assumption for this result is that ω, the precision of the public's prior information about future monetary policy, be nonzero. As can be seen from equation (15), if $\omega = 0$, then the expected value of the prediction error is zero, public expectations are unbiased, and the rational expectations results of Section II are reinstated even under transitional expectations.

In other words, in order to make biased predictions about the inflation rate it is necessary that the public have some opinion about inflation policy in the first place. If there is no prior opinion (represented by a flat prior distribution), then the predictions will not be biased. This result is equivalent to the familiar result of estimation theory, that Bayesian estimators are biased unless the prior distribution is noninformative. Thus, if new policymakers take over monetary planning, and if the public is completely ignorant as to their objectives and puts no weight on past inflation policy, then their monetary policy will be ineffective in changing unemployment. Keeping the planned rate of inflation a monetary secret is not enough to bring about desirable effects on real variables in this case. If the monetary authorities feel that such effects are desirable in this situation, then they must make a conscious effort to convince the public they will do one thing (by press releases or monetary signals), but actually do something else. This type of deception, where the monetary authorities disappoint the expectations that they themselves create, may seem more politically repugnant than the neutral deception of disappointing the public's self-created expectations.[13] Such deception has not been foreign to monetary planners,[14] but its obvious political disadvantages should be weighted against the benefits of reduced unemployment.

It should be emphasized that these qualifications depend on the expectational and informational assumptions of this paper—in particular that the variance of the inflation policy is known. If a policy with both an unknown mean and variance were undertaken, then the public must estimate two parameters. It would then be possible to steer expectations as in Sections III and IV, even if $\omega = 0$, though the analysis would be considerably more complicated.

[13] See Phelps (1972) pp. 265–67 for a further discussion of these two types of deception.

[14] For example, in an effort to reduce inflationary expectations, the Fed engaged in such "bob and weave" tactics in April 1969. By increasing reserve requirements, they hoped to signal a noninflationary policy, while in fact the inflationary increase in money growth was continued (see Maisel [1973], pp. 243).

VI. Conclusion

The central theme of this paper has been that monetary policy can influence real economic variables during periods in which inflationary expectations are transitional. Though the public's optimal predictions of the inflation rate eventually converge to a rational expectations equilibrium, in the interim these predictions behave like adaptive expectations with a time-varying coefficient of expectation depending on the precision of the monetary policy. Thus, by choosing a suitable time path for policy, the monetary authorities can achieve desired levels of unemployment during the transition. The optimal path will depend on the policymakers' relative dislikes for unemployment versus a variable price level and on their rate of time preference.

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