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# The Role for Active Monetary Policy in a Rational Expectations Model

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The role of monetary policy as it affects available information is examined in an equilibrium model of the business cycle. Exogenous, uncertain changes in the expected return to capital assets relative to money holding are shown to induce revisions in investors' desired portfolios. Under a passive policy, asset market equilibrium requires a change in the value of money, which, if imperfectly perceived, detracts from the signaling aspect of observed prices. Active money growth feedback rules are examined as altering the prospective return to money holding. A policy may be designed to maintain the relative attractiveness between real capital and money even if the controlling authority has no informational advantage. Such a policy is shown to obviate the need for portfolio revisions to assure informational efficiency.

What is the role of monetary policy in achieving efficient resource allocation in a competitive economy? Through what channels does policy operate, and how should it be conducted to contribute the most? These questions have a long and noble ancestry, but there is little consensus among economists on correct answers or even the proper framework for analysis.

Recent controversies can be traced back to Milton Friedman's 1968 American Economic Association presidential address. As a pragmatic issue of policy, rather than as an ineluctable theoretical conclusion, Friedman advocated "adopting publicly the policy of achieving a steady growth in a specified monetary total"—what was later called a

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"$k\%$ rule." This idea received analytic support through the application of the rational expectations hypothesis to monetary theory as embodied in the models of Lucas (1972, 1975), Sargent and Wallace (1975, 1976), and Barro (1976). These works purport to show that *no* systematic monetary policy, once anticipated and understood, can have *any* real effects, because optimizing private agents offset them in order to remain at their preferred positions. In this framework a $k\%$ rule is as good as any other possible enunciated policy response. The general message of such models is that efficiency is best served by avoiding unpredictable monetary injections which can only contaminate observed price signals.

The results of these models depend on a number of key assumptions in addition to that of rational expectation formation. Allocations are assumed to be determined in competitive equilibrium—agents take market-clearing prices as given and choose optimal quantities to transact. The assumption of continuous market clearing as an adequate description of modern economies is not universally endorsed (Tobin 1978). A third common assumption is that information is imperfect in the sense that agents do not have access to knowledge of the current state of the economy. This assumption permits the model to replicate the Phillips curve relationship between output and inflation, even though there is no way that output might be permanently increased by permanently increasing the rate of inflation.

The assumption of incomplete information, or, more precisely, of different information among agents, has implications for the role of policy through channels not considered by earlier writers. For once it is admitted that no agent knows the state of the economy in all relevant aspects, the question arises, What exactly do observed price signals communicate? Rational expectation theorists have advanced the idea that monetary policy can affect the informational content of observed price signals and thereby affect real variables, but only adversely. This power is taken to be capable only of obfuscating the "true" set of price signals generated by monetary market economies free of unanticipated monetary injections. This paper addresses the question of how monetary policy can be conducted so that observed price signals communicate best those factors which influence efficient resource allocation. It will be shown that, if different agents have access to different exogenous (i.e., nonprice) sources of information, the informational content of observed price signals may be "improved" by use of a particular money growth feedback rule in strict preference to a $k\%$ rule.

A model of the economy is presented. The model shares the central features of the analytical work of Lucas (1972, 1975), Sargent and Wallace (1975, 1976), and Barro (1976). It is an equilibrium model, and expectations are formed with full knowledge of the process generating prices; such expectations may be described as "rational." There is only one nominal asset, called "money," and it is supplied exclusively by the government. "Policy," in this context, is monetarily financed government deficits, and there is no independent role for monetary as opposed to fiscal policy. The government is capable of knowing only what is known by the least informed private agent. The main innovations of the model are (i) the type of exogenous uncertainty considered and (ii) the fact that information is asymmetric. Policy is examined as primarily influencing the state-dependent return to money holding.[1] The source of exogenous uncertainty responsible for unexpected movements of real output is changes in expectations of the profitability of investment, what Keynes (1936) called "the state of long term expectations." Capitalists are assumed to know the profitability of new investment one period in advance of workers. Postulating a conventional liquidity preference schedule, the price level under a passive policy will be shown to respond positively to the profitability of new investment. If workers are unaware of general price movements, this will be misperceived as affecting real relationships with adverse implications for economic efficiency.

The benefits of active monetary policy will be shown to depend not on current period injections of money but, rather, on anticipations of future monetary injections contingent on the particular realization of current period events. This will alter the real return to money holdings in a way which is fully anticipated. Just as it has been demonstrated (Tobin 1965) that altering the mean return to holding money may have real effects on portfolio composition and capital intensity,[2] changing the state dependent return attached to money holding may affect real variables by altering the informational content of nominal price signals.

The first section sets up the model and derives the equilibrium time paths of prices and quantities under the assumption of complete information, which would occur if workers learned of the profitability of investment at the same time as capitalists. Section II introduces the idea that new information diffuses slowly and analyzes the structure of information available to workers from knowledge only of local wages under a monetary policy which holds constant the nominal money supply. Section III derives the optimal monetary growth feed-

[1] The assumption of a single form of government debt is a possible source of confusion. In a model with a more complete asset menu, the role of stabilization policy might be to influence the real ex post return to government bond holding.

[2] The model does not, in fact, exhibit these nonneutralities; long-run capital intensity is independent of monetary policy. The possibility of systematic stabilization policy is shown to be logically distinct from the effects of monetary policy on long-term growth.

back rule. The principal result here is that policy can achieve the same real allocation as would occur if information were complete. Section IV provides some interpretation of the principal analytical results.

## I. The Model under Complete Information

It is most simple to describe the model under the assumption that all agents have access to the same information. In this context monetary policy will be assumed to have no influence on real variables.

The aggregate production opportunities at time $t$ are given a Cobb-Douglas function

$$Y_t = \beta K_t + (1 - \beta)L_t + \gamma_t, \qquad (1)$$

where $Y_t$ = log of income, $K_t$ = log of capital stock, and $L_t$ = log of labor force. The parameter $\gamma_t$ is a zero mean random variable, distributed independently and identically over time. In this section only, it is assumed that all agents know the particular realization of $\gamma_t$ in the immediately preceding period.

Output may either be consumed or invested. It is assumed that a constant fraction ($e^{s_0}$) of income is saved:

$$S_t = s_0 + Y_t. \qquad (2)$$

Capital lasts only one period, so that

$$K_{t+1} = S_t. \qquad (3)$$

The log of labor supply in period $t$, ($L_t$), is positively related to the (log) real wage ($w_t$),

$$L_t = aw_t, a > 0. \qquad (4)$$

The log of one plus the interest rate from period $t$ to $t + 1$ is the yield available to investment in period $t$.

$$r_t = (\beta - 1)K_{t+1} + (1 - \beta)L_{t+1} + \gamma_{t+1} + \log \beta. \qquad (5)$$

An equilibrium is defined as a mapping from the state of the economy ($\gamma_t$, $\gamma_{t+1}$, $K_t$) to the values of the three endogenous variables of interest ($Y_t$, $r_t$, $K_{t+1}$) satisfying equations (1) through (5). This equilibrium is given by

$$Y_t = K_t \frac{\beta(1 + a)}{1 + a\beta} + \gamma_t \frac{1 + a}{1 + a\beta} + \text{constant}; \qquad (6)$$

$$K_{t+1} = K_t \frac{\beta(1 + a)}{1 + a\beta} + \gamma_t \frac{1 + a}{1 + a\beta} + \text{constant}; \qquad (7)$$

$$r_t = K_t \frac{\beta(\beta - 1)(1 + a)}{(1 + a\beta)^2} + \gamma_t \frac{(\beta - 1)(1 + a)}{(1 + a\beta)^2} + \gamma_{t+1} \frac{1 + a}{1 + a\beta} + \text{constant} \tag{8}$$

(constant terms may be ignored in the subsequent analysis).

It is noted that $\gamma_{t+1}$ affects neither labor supply nor current period income but does influence the real rate of interest in the current period.

The monetary side of this economy may be described by a simple liquidity preference function of the form

$$M_t^D = P_t - m_1 R_t + m_2 Y_t, \tag{9}$$

where $m_1$ = interest elasticity of money demand, $m_2$ = income elasticity of money demand, and $R_t$ = log of the nominal interest rate, defined as the log of one plus the real rate of interest plus the log of one plus the expected inflation rate or

$$R_t \equiv r_t + (P_{t+1}^e - P_t). \tag{10}$$

The model is closed by specifying a money supply rule. In this section it is assumed that the aggregate nominal money supply is fixed at one unit, or in terms of the logarithm,

$$M_t^S \equiv 0. \tag{11}$$

Equilibrium in the money market implies that

$$\begin{aligned} P_t &= m_1 R_t - m_2 Y_t \\ &= m_1 r_t - m_2 Y_t + m_1 (P_{t+1}^e - P_t), \end{aligned} \tag{12}$$

where $P_{t+1}^e$ is the rational expectation of the price level in period $t + 1$.

An equilibrium is defined as a mapping from the state of the economy $(K_t, \gamma_t, \gamma_{t+1})$, to the price level, $P_t$, satisfying equation (12). It may be shown[3] that this mapping is given by

[3] Assume that $P_t = \pi_1 K_t + \pi_2 \gamma_t + \pi_3 \gamma_{t+1}$; then, since $E_t(\gamma_{t+2}) = 0$, $E(P_{t+1} - P_t) = \pi_1(K_{t+1} - K_t) + \pi_2(\gamma_{t+1} - \gamma_t) + \pi_3(-\gamma_{t+1})$. Substituting the preceding in eq. (12) yields

$$\begin{aligned} P_t = {} & \frac{m_1}{(1 + a\beta)^2} [\beta(\beta - 1)(1 + a)K_t + (\beta - 1)(1 + a)\gamma_t + (1 + a)(1 + a\beta)\gamma_{t+1}] \\ & - \frac{m_2}{1 + a\beta} [\beta(1 + a)K_t + (1 + a)\gamma_t] \\ & - m_1[\pi_1(K_{t+1} - K_t) + \pi_2(\gamma_{t+1} - \gamma_t) + \pi_3(-\gamma_{t+1})]. \end{aligned}$$

Substituting $(K_{t+1} - K_t) = [(\beta - 1)/(1 + a\beta)]K_t + \gamma_t[(1 + a)/(1 + a\beta)]$ in the equation above yields eq. (13).

$$P_t = \pi_1 K_t + \pi_2 \gamma_t + \pi_3 \gamma_{t+1}, \tag{13}$$

where

$$\pi_1 = \frac{-m_1\beta(1-\beta)(1+a) - m_2\beta(1+a)(1+a\beta)}{(1+a\beta)^2 + (1-\beta)m_1(1+a\beta)},$$

$$\pi_2 = \frac{-m_1(1-\beta)(1+a)}{(1+a\beta)^2(1+m_1)} - \frac{m_2(1+a)}{(1+m_1)(1+a\beta)} + \frac{m_1(1+a)}{(1+m_1)(1+a\beta)}\pi_1,$$

$$\pi_3 = \frac{m_1}{1+m_1}\left(\frac{1+a}{1+a\beta} + \pi_2\right).$$

The coefficients of $K_t$ and $\gamma_t$ are both clearly negative; an increase in current income raises the demand for money both directly and indirectly by suppressing the interest rate and, hence, lowers the equilibrium price level. Of central interest is the sign of $\pi_3$, the influence of expectations of productivity next period on the current equilibrium price level. In general, this coefficient is ambiguous since the effects of a rise in the current period interest rate are offset by the prospect of subsequent deflation. A necessary and sufficient condition for this term to be positive is that $m_2$, the income elasticity of real money demand, be less than one.[4] This will be assumed to be the case in the subsequent analysis.

Thus the equilibrium price level is influenced not only by current period real income but by expectations of the profitability of current period investment. In the next section it will be demonstrated that if some agents do not have complete information but must infer the state of the economy from knowledge of local prices only, unanticipated changes in the equilibrium price level may have an adverse effect on resource allocation.

[4] If $m_2 < 1$, then

$$\begin{aligned}\pi_3 &= \frac{m_1}{1+m_1}\left(\frac{1+a}{1+a\beta} + \pi_2\right)\\ &> \frac{m_1}{1+m_1}\left\{\frac{1+a}{1+a\beta} - \frac{m_1(1-\beta)(1+a)}{(1+a\beta)^2(1+m_1)} - \frac{(1+a)}{(1+m_1)(1+a\beta)}\right.\\ &\quad\left. + \frac{m_1(1+a)}{(1+m_1)(1+a\beta)}\left[\frac{-m_1\beta(1-\beta)(1+a) - \beta(1+a)(1+a\beta)}{(1+a\beta)^2 + (1-\beta)m_1(1+a\beta)}\right]\right\}\\ &= \frac{m_1^2(1+a)}{(1+a\beta)^2(1+m_1)^2}[1 + a\beta - (1-\beta) - \beta(1+a)]\\ &= 0.\end{aligned}$$

## II. The Model under Incomplete Information

In this section it is assumed that workers do not know $\gamma_{t+1}$ in period $t$ but learn of it only in period $t + 1$. Capitalists, however, continue to predict $\gamma_{t+1}$ one period ahead. For analytical simplicity, workers will be assumed not to carry money between periods, so that the price level is dictated solely by the demand for real cash balances by capitalists. All agents know the current period capital stock.

To capture the idea that unperceived price level movements may have real consequences, it is necessary that there be an additional source of uncertainty transmitted through nominal price signals which, if known, would affect resource allocation. Thus it is assumed that production takes place in distinct markets, or "islands," of the type first proposed by Phelps et al. (1970). Aggregate productivity in market $z$ is augmented by a random variable log $(\epsilon_t)$, so that $Y_t(z) = \beta k_t(z) + (1 - \beta)L_t(z) + \epsilon_t(z) + \gamma_t$. The (geometric) mean of this variable across markets in each period is zero. Workers do not know the realization of this variable when labor supply commitments must be made. Labor supply is determined by knowledge only of $K_t$, $\gamma_t$, and $w_t(z) + P_t$, the money wage in market $z$. Workers cannot observe directly the price level, $P_t$, nor the money wage in other markets. Otherwise, as Lucas (1975) points out, "there is 'too much' information in the hands of traders for them ever to be 'fooled' into altering real decision variables." These modifications imply that workers are unable to distinguish between real and monetary phenomena which influence nominal wage signals. A statistical Phillips curve is generated.

At the beginning of a period, workers are immobile and are distributed equally over each market. Each market has the same amount of capital in place, as determined by the preceding period's trading.

In market $z$ labor supply is given by

$$L_t^S(z) = aE[w(z) \mid K_t, \gamma_t, w(z) + P_t]. \quad (14)$$

Labor supply is a function of the expected real wage, conditional on knowledge available. Let $\bar{w}_t$ be the expected real wage prior to having observed the nominal wage rate. This is given by

$$\bar{w}_t = \frac{\beta}{1 + a\beta} K_t + \frac{1}{1 + a\beta} \gamma_t. \quad (15)$$

It will be shown that equation (14) is of the form

$$L_t^S(z) = a\bar{w}_t + \lambda_1 a\gamma_{t+1} + \lambda_2 a\epsilon_t(z), \quad (16)$$

where $\lambda_1$ and $\lambda_2$ are as yet undetermined coefficients. The influence of $\gamma_{t+1}$ on labor supply will alter the time paths of income, interest rates, capital accumulation, and prices. The real variable may be specified for a particular $\lambda_1$:[5]

$$Y_t = K_t \frac{\beta(1+a)}{1+a\beta} + \gamma_t \frac{1+a}{1+a\beta} + \gamma_{t+1}[a\lambda_1(1-\beta)], \tag{17}$$

$$r_t = K_t \frac{\beta(\beta-1)(1+a)}{(1+a\beta)^2} + \gamma_t \frac{(\beta-1)(1+a)}{(1+a\beta)^2} + \gamma_{t+1}\left[\frac{1+a}{1+a\beta} - \frac{a\lambda_1(1-\beta)^2}{1+a\beta}\right], \tag{18}$$

$$K_{t+1} = K_t \frac{\beta(1+a)}{1+a\beta} + \gamma_t \frac{1+a}{1+a\beta} + \gamma_{t+1}[a\lambda_1(1-\beta)]. \tag{19}$$

Money supply and money demand are as in the previous section. However, because real variables are affected by assuming information is incomplete, the equilibrium price level will also be altered from that in the previous section. The equilibrium price mapping is given by

$$P_t = \hat{\pi}_1 K_t + \hat{\pi}_2 \gamma_t + \hat{\pi}_3 \gamma_{t+1}, \tag{20}$$

where

$$\hat{\pi}_1 = \pi_1, \tag{21}$$

$$\hat{\pi}_2 = \pi_2, \tag{22}$$

$$\hat{\pi}_3 = \pi_3 - \frac{a\lambda_1(1-\beta)m_1}{1+m_1}\left[\frac{(1-\beta)}{1+a\beta} - \pi_1 + \frac{m_2}{m_1}\right]. \tag{23}$$

Thus, because of the assumed linear structure of the model, the coefficients on the variables $K_t$ and $\gamma_t$ are unaltered. However, the influence of expectations on current period prices is unambiguously reduced. This is because aggregate price movements call forth real responses to income and interest rates, dampening the movement in prices for any shock to expected productivity of investment.

The influence of $\gamma_{t+1}$ on aggregate labor supply arises from the inability to distinguish between the real and monetary shocks which are communicated by knowledge of the nominal wage. The real wage in market $z$, equal to the marginal product of labor, is

$$w_t(z) = \beta K_t - \beta L_t(z) + \gamma_t + \epsilon_t(z). \tag{24}$$

Substituting labor supply equation (16) into the above yields

$$w_t(z) = \bar{w}_t + (1 - \beta a\lambda_2)\epsilon_t(z) - \beta a\lambda_1\gamma_{t+1}. \tag{25}$$

[5] The average log of real output across markets in period $z$ is now $Y_t$, and $r_t$ is to be interpreted as the expected log of the return to a unit of capital.

The expected price level, prior to having observed the nominal wage, is given by

$$\bar{P}_t = \hat{\pi}_1 K_t + \hat{\pi}_2 \gamma_t. \tag{26}$$

The discrepancy between the expected nominal wage $(\bar{P}_t + \bar{w}_t)$ and the actual nominal wage $[P_t + w_t(z)]$ is a linear function of the two unknown disturbances,

$$w_t(z) + P_t - (\bar{w}_t + \bar{P}_t) = (1 - \beta a \lambda_2)\epsilon_t(z) + (\hat{\pi}_3 - \beta a \lambda_1)\gamma_{t+1}. \tag{27}$$

Workers attempt to discover the component of this discrepancy due to real wage changes. If the two disturbances are independent normal variables, the minimum mean square error estimate of this is given by

$$\begin{aligned} &E[w_t(z) - \bar{w}_t \mid w_t(z) - \bar{w}_t + P_t - \bar{P}_t] \\ &= b_1[(1 - \beta a \lambda_2)\epsilon_t(z) + (\hat{\pi}_3 - \beta a \lambda_1)\gamma_{t+1}], \end{aligned} \tag{28}$$

where

$$b_1 = \frac{\sigma_\epsilon^2(1 - \beta a \lambda_2)^2 + \sigma_{\gamma_{t+1}}^2(\beta^2 a^2 \lambda_1^2 - \hat{\pi}_3 \beta a \lambda_1)}{\sigma_\epsilon^2(1 - \beta a \lambda_2)^2 + \sigma_{\gamma_{t+1}}^2(\hat{\pi}_3 - \beta a \lambda_1)^2} \tag{29}$$

is the coefficient of a linear regression of unanticipated real wage changes on unanticipated nominal wage changes.

Substituting equation (28) into (14) yields

$$L_t^S(z) = a\bar{w}_t + ab_1(1 - \beta a \lambda_2)\epsilon_t(z) + ab_1(\hat{\pi}_3 - \beta a \lambda_1)\gamma_{t+1}, \tag{30}$$

which agrees with equation (16) if $\lambda_1 = b_1\hat{\pi}_3/(1 + a\beta b_1)$ and $\lambda_2 = b_1/(1 + a\beta b_1)$. Substitution of $\lambda_1$ and $\lambda_2$ into equation (29) permits $b_1$ to be expressed as a function only of the exogenous parameters and statistics of the distributions of the unknown disturbances.

It may be shown that

$$\lambda_1 = b_1\pi_3/\left\{1 + a\beta b_1 + \frac{b_1 a(1 - \beta)m_1}{1 + m_1}\left[\frac{(1 - \beta)}{1 + a\beta} - \pi_1 + \frac{m_2}{m_1}\right]\right\} \tag{31}$$

$$\hat{\pi}_3 = \pi_3/\left\{1 + a\beta b_1 + \frac{b_1 a(1 - \beta)m_1}{1 + m_1}\left[\frac{(1 - \beta)}{1 + a\beta} - \pi_1 + \frac{m_2}{m_1}\right]\right\}. \tag{32}$$

Equation (31) implies that income increases with $\gamma_{t+1}$ under imperfect information if and only if the price level increases with $\gamma_{t+1}$ under complete information. Equation (32) implies that the price level increases with $\gamma_{t+1}$ under incomplete information if and only if it does so with complete information.

The degree to which information is reduced by unexpected changes in the price level may be expressed by the variance of the residuals of the regression predicting real wages. This is given by

$$E\{w_t(z) - \bar{w}_t - b_1[w_t(z) - \bar{w}_t + P_t - \bar{P}_t]\}^2 = \frac{\sigma_\epsilon^2\sigma_{\gamma_{t+1}}^2\hat{\pi}_3^2(1-\beta a\lambda_2)^2}{\sigma_\epsilon^2(1-\beta a\lambda_2)^2 + \sigma_{\gamma_{t+1}}^2(\hat{\pi}_3 - \beta a\lambda_1)^2}. \quad (33)$$

It is difficult to formulate a welfare criterion to assess alternative information structures[6] since the model does not include a specification of individuals' preferences. It will be assumed outright that failure to observe those real factors which would alter real variables, if known costlessly, is a source of economic inefficiency.[7]

## III. The Role of Policy

Monetary policy can be used to prevent unperceived movements in the aggregate price level. In this way, observed prices will communicate real disturbances and produce an allocation identical to that achieved when all agents know the true state.

A monetary policy is defined as a function mapping those variables currently observed by the monetary authority to the change in the current period nominal money supply. It is assumed that the government has access only to the same information as workers; in particular, it cannot observe the expectations of capitalists. Only nonstochastic policies are considered. Thus each agent can infer exactly the current period money stock, $M_t$, from his knowledge of the money supply function and the current realization of its arguments.

Let money demand be as before (eq. [9]), so the price level in period $t$ is given by

$$\begin{aligned} P_t &= M_t + m_1R_t - m_2Y_t \\ &= M_t + m_1r_t - m_2Y_t + m_1(P_{t+1}^e - P_t). \end{aligned} \quad (34)$$

Let the known money supply rule be

$$M_{t+1} = M_t + \theta_1\gamma_{t+1}, \quad (35)$$

where $\theta_1$ is an undetermined coefficient.

The reduced form equation for prices is given by

$$P_t = \bar{\pi}_1K_t + \bar{\pi}_2\gamma_t + \bar{\pi}_3\gamma_{t+1} + M_t, \quad (36)$$

which implies that

$$P_{t+1}^e - P_t = \bar{\pi}_1(K_{t+1} - K_t) + \bar{\pi}_2(\gamma_{t+1} - \gamma_t) + \bar{\pi}_3(-\gamma_{t+1}) + \theta_1\gamma_{t+1}, \quad (37)$$

[6] Barro (1976) uses a consumer surplus criterion.

[7] This criterion is not always consistent with the preferable welfare measure of expected utility (Polemarchakis and Weiss 1977).

and substituting into equation (34),

$$P_t = M_t + m_1 r_t - m_2 Y_t + m_1[\bar{\pi}_1(K_{t+1} - K_t) + \bar{\pi}_2(\gamma_{t+1} - \gamma_t) - \bar{\pi}_3\gamma_t + \theta_1\gamma_{t+1}]. \quad (38)$$

If workers know the true state, then the real economy can be described independently of the time path of the nominal money supply (which influences only the price level). In this case, the time paths of aggregate real income and the real interest rate are as described in the first section (eqq. [6]–[8]), and equation (38) may be written as

$$P_t = M_t + \pi_1 K_t + \pi_2\gamma_t + \pi_3\gamma_{t+1} + \frac{m_1}{1 + m_1}\theta_1\gamma_{t+1}, \quad (39)$$

where the $\pi$ coefficients are identical to those of the full information, constant nominal money supply rule regime as specified in equation (13).

From equation (39) it can be seen that if $\theta_1$ is set equal to $[-\pi_3(1 + m_1)]/m_1$, the price level in period $t$ will not be affected by the realization of $\gamma_{t+1}$. In this way both workers and capitalists will be able to know the current period price level exactly, even though they have access to different information. An active monetary policy can be used to offset the informational asymmetry. Nominal wages in market $z$ will communicate exactly the current local shock to productivity $\epsilon(z)$.[8]

## IV. Conclusion

The model presented here assumes continuous market clearing and optimal forecasts by agents, given their exogenous (nonmarket) sources of information. However, in several aspects it is similar to both traditional Keynesian macroeconomic analysis and the more recent "disequilibrium" theories.

The source of exogenous uncertainty responsible for unexpected movements of real output is changes in expectations of the profitability of investment, what Keynes (1936) called "the state of long term expectations." Keynes wrote (1936, p. 73) that "these are subject to sudden revision" and made this point central to this *General Theory:* ". . . thus the fact that a collapse in the marginal efficiency of capital

[8] The type of informational asymmetry proposed in the model is admittedly a crude description of reality. The policy advocated here will be beneficial whenever (i) different agents hold different beliefs about $\gamma_{t+1}$, (ii) traders cannot infer the beliefs of others from their observations of a limited set of prices, and (iii) $\gamma_{t+1}$, if perceived identically, would have no implications for current resource allocation. This would be the case, e.g., if in an otherwise similar model, each agent observed the true $\gamma_{t+1}$ with a zero mean observation error.

tends to be associated with a rise in the rate of interest may seriously aggregate the decline in investment. But the essence of the situation is to be found, nevertheless, in the collapse in the marginal efficiency of capital. . . . Liquidity-preference . . . does not increase until after the collapse in the marginal efficiency of capital" (1936, p. 316). Keynes, of course, did not really address the sources of such expectations embedded in marginal efficiency of capital calculations, "determined, as it is, by the uncontrollable and disobedient psychology of the business world" (1936, p. 319) and attributed in the final analysis to "spontaneous optimism." The present analysis shows that such expectations need not be irrational nor neurotic to cause undesirable fluctuations in income.

Recent disequilibrium theories have emphasized that slow diffusion of information implies that the prevailing vector of wages and prices may be very different from those necessary to produce a full employment equilibrium. This theme is developed in Leijonhufvud (1968): "In Keynes' theory . . . the *'right' price information* required for the perfect coordination of the economic activities of innumerable traders is *not guaranteed* in the short run . . . from this point the analysis of the Keynesian process starts" (p. 390). He goes on to reject the notion of equilibrium because *"the informational requirements* for keeping the system on an equilibrium path are fulfilled only by purest luck" (p. 392). However, the model presented demonstrates that if agents have access to different information and observe only a limited number of price signals at any time, the assumption of continuous market clearing is not inconsistent with the view that aggregate disturbances stem from the failure of money price signals to disseminate the correct information.

The role of policy as altering agents' anticipations of the future price level is not novel. As early as 1923 Keynes wrote,

> The *actual occurrence* of price changes profits some classes and injures others . . . but that a *general fear* of falling prices may inhibit the productive process altogether. . . . The best way to cure this mortal disease of individualism must be to provide that there shall never exist any confident expectation either that prices are going to fall or that they are going to rise. . . . The remedy lies in so controlling the standard of value that whenever something occurred which, left to itself, would create an expectation of a change in the general level of prices, the controlling authority should take steps to counteract this expectation by setting in motion some factor of a contrary tendency. Even if such a policy were not wholly successful, either in counteracting expectations or in avoid-

> ing actual price movements, it would be an improvement on the policy of sitting quietly by whilst a standard of value, governed by chance causes and deliberately removed from central control, produces expectations which paralyse or intoxicate the government of production. . . . For these grave causes we must free ourselves from the deep distrust which exists against allowing the regulation of the standard of value to be the subject of *deliberate decision*. [Pp. 102–4]

The model presented conforms to one form of "natural rate hypothesis"; the rate of output is invariant to the expected inflation rate. In addition, it does not deny either that unanticipated monetary injections can have large and adverse effects, or that some fluctuations in income may be best explained by innovations to current policy. It does illustrate, however, that the validity of such propositions does not rule out a theoretical role for active stabilization policy in an economy of rational, optimizing agents.

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