"FOMC Targets, Base Drift and Inflationary Expectations"
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I. INTRODUCTION

The purpose of the present paper is to study the effect on the expected inflation rate of two practices the Federal Open Market Committee (FOMC) currently engages in the setting of its monetary targets. The first is the FOMC's present procedure for housing its yearly monetary targets. Currently, those targets are computed as follows: (1) First, a range of percentage growth values for a particular monetary aggregate is chosen (e.g. 4%–8% growth in M1); (2) Second, the targets for any given year are computed as percentages about the value of the given aggregate for the fourth quarter of the previous year. This target-setting procedure results in a fan of implicit money stock targets emanating from the fourth-quarter value of the monetary aggregate.

The second FOMC practice to be examined is that of "rebasings." With rebasing, a new sequence of monetary target values is computed during the calendar year, frequently when the money supply has been behaving erratically relative to its earlier target values. This procedure for rechoosing targets is similar to the FOMC's procedure for initial target choice, since the new target values are again based on the most recent value of the money supply.

The FOMC's procedure of initiating its targets at the beginning of the calendar year has for some time come under criticism, since it results in "base drift." [Broddus and Goodfriend (1984), Clark (1985), Lembra and Straubel (1975), Poole (1976, 1985)]. The criticism is that when the FOMC links its aggregate targets to a base value of the money supply at a point in time, it runs the risk of having its entire sequence of monetary targets being abnormally high or abnormally low, depending on short-run disturbances to the base value. This results in market participants being uncertain about the FOMC's commitment to its monetary targets, with the uncertainty having effects on, among other things, inflationary expectations.

A similar criticism has been made against the practice of rebasing. [Poole (1976), Broddus and Goodfriend (1984), Hetzel (1984), Clark (1985)]. In switching to a new set of operating guides during the calendar year, the FOMC runs the risk of causing market uncertainty about its commitment to its monetary targets, with this uncertainty having effects on price expectations. Although not clear, in addition to the unpredictable behavior of the velocity of M1, the FOMC's frequent need to rebase and the resulting uncertainty could have played a role in its placing M1 on a monitoring rather than a targeting status beginning in 1984.

In the present paper, we address the question of the effects of these two FOMC practices on inflationary expectations. To do this, we build a simple model in which prices and the expected inflation rate are linked through the supply and demand for money. The model is then used to study the implications for the expected inflation rate of several stylized versions FOMC target-setting strategy. Particular attention will be paid to addressing two issues. First, we will

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The author would like to thank the anonymous referees for their helpful suggestions on earlier versions of this paper. Any remaining shortcomings of the paper are, of course, my own.
address the question of whether it is optimal to build a target-based strategy around a single period's value of the money supply, where the behavior of inflationary expectations is the criterion for evaluation. Second, we examine the effects of rebasing on the expected inflation rate.

Part II of the paper presents our model of price determination. The price level, and therefore the expected inflation rate, is determined through the supply and demand for money. Disturbances to the demand for money are assumed to be auto-correlated over time. The supply of money, on the other hand, is assumed to follow an autoregressive moving average process. The notion that the paper tries to capture is that of two types of money supply responses. The autoregressive component of the money stock models the FOMC's long-run strategy by determining the rate at which disturbances to the money supply are offset. Whether the FOMC offsets disturbances which accumulate during a single short-run period or more than one short-run period is captured by the moving average component of the money supply process. This models the FOMC's target-based strategy.

Using this model, Part III of the paper examines the effects of the FOMC's target-based strategy on the behavior of inflationary expectations. In particular, we examine the implications of alternative target-based strategies on the variance of the expected inflation rate when a current money supply announcement is received. Three key conclusions are reached.

First, a scheme in which the FOMC offsets disturbances in the long run over an average of more than one period's short-run disturbance is generally preferred to responding to a single period's short-run disturbance. This holds provided that the proper weights are chosen in determining the short-run averaging response. Second, not correcting for target base drift in this manner is optimal only under restricted conditions. The conditions are that the FOMC accommodate its long-run money supply strategy to long-run changes in the demand for money. Finally, there are some implications for target rebasing on the expected inflation rate. Rebasings results in inflationary expectations being essentially dominated by long-run changes in the demand for money.

These results are summarized in Section IV of the paper.

II. A SIMPLE MODEL OF THE EXPECTED INFLATION RATE

To determine the relation between FOMC strategy and inflationary expectations we begin with a discrete-time model linking the demand for money to the expected inflation rate. The money demand function is

\[ M_t - M^e_t + P_t + \beta \left( E(P_{t+1}) - P_t \right) + d_t, \]

where \( M_t \) is the logarithm of the nominal quantity of money demanded at time \( t \); \( P_t \) is the logarithm of the current price level; \( E(P_{t+1}) - P_t \) is the expected inflation rate from \( t \) to \( t + 1 \), conditional on the information set \( I_t \) to be discussed later; \( d_t \) is a disturbance term; and \( \beta < 0 \) is a parameter. As the sign of \( \beta \) implies, the nominal demand for money decreases with the expected inflation rate from \( t \) to \( t + 1 \), because of the higher costs of holding cash balances due to expected inflation. This effect on the demand for money is likely that of an increase in nominal interest rates. All other factors affecting the demand for money over the holding period are subsumed in the constant term, \( M^e \) (based on permanent income), plus the log of the price level. Following this specification allows us to abstract from other variables that might affect the demand for money in the short run, such as real income. On the other hand, it allows for a complete enough interaction between the demand for money and inflationary expectations to draw some interesting policy implications for monetary policy on these expectations.

\[ (M_t - M^e_t) = \alpha (M_{t-1} - M^e_{t-1}) + \epsilon_t, \]

\[ M^e_t = M^e_{t-1} + \lambda \epsilon_{t-1}, \]

where \( 0 < \alpha < 1, |\lambda| < 1 \), and \( \epsilon_t \) is a white noise component with finite variance, \( \epsilon^2_t \). The money supply consists of two components, a stock adjustment equation, and a target-setting response. The parameters \( \alpha \) and \( \lambda \) in equations (3) and (4) are aimed at capturing two types of FOMC behavior. The stock-adjustment \( \alpha \) captures the speed with which the authority offsets past disturbances to the money stock, and therefore governs the rate at which future disturbances to the money supply are allowed to accumulate. This parameter governs long-run monetary policy.

The parameter \( \lambda \) controls the number of periods' as well as magnitude of monetary disturbances the FOMC allows into its current target, and therefore, into its future monetary response. As an example, when \( \lambda = 0 \) in equation (4), future values of the money supply are allowed to accumulate about the current disturbance \( \epsilon_t \). This is similar to the current FOMC strategy of basing its yearly sequence of monetary targets on a single quarter's value of the money supply. When \( \lambda \neq 0 \), future values of the money supply will be allowed to accumulate about an average of the disturbances \( \epsilon_t \) and \( \epsilon_{t-1} \). This would be the case if the FOMC, instead, based its yearly sequence of monetary targets on a two-quarter average of the money supply, with the relative weight on the earlier quarter's money stock value being \( \lambda \).

Substituting equation (4) into equation (3) and solving recursively obtains

\[ M_t = \left( 1 - \alpha \right) \sum_{i=1}^{\infty} \alpha^i M^e_{t-i} + \sum_{i=0}^{\infty} \alpha^i (\epsilon_{t-i} + \lambda \epsilon_{t-i-1}), \]

This reduces to the following model, consisting of a deterministic plus first-order autoregressive moving average process for the money supply.

\[ M_t = M^e_t + \epsilon_t, \]

\[ s_t = -\alpha \epsilon_{t-1} + \lambda \epsilon_{t-2} + \epsilon_t, \]

\[ M^e_t = \left( 1 - \alpha \right) \sum_{i=1}^{\infty} \alpha^i M^e_{t-i}. \]

To see the response of the expected inflation rate to alternative monetary strategies, we determine \( E(P_{t+1}) - P_t \) both before and after the announcement of the current money stock \( M_t \). This requires determination of the equilibrium price level \( P_t \) both before and after the announcement of \( M_t \). At all times \( t \), the market participant's information set \( I_t \) will include the current price level \( P_t \) as well as all lagged values of the price level and money stock. The monetary process defined in equations (6) through (8) will also be known to the economic agents. Finally, market participants will be assumed to form rational expectations at all times based on this information.

Since \( P_t \) is in the participant's information set, the assumption \( E(P_t) = P_t \) can be used in determining the equilibrium price level. Use of this assumption and equations (1), (6), (7) and
Substituting (17) into (9), and equating the resulting expression to (16) results in the following P-coefficients for the equilibrium value of $P_1$ after the announcement

$$\Pi_1 = -\frac{1}{1-\beta} \frac{\beta}{1-\beta} \Pi_0,$$

(18)

$$\Pi_1 = -\frac{1}{1-\beta} \frac{\beta}{1-\beta} \Pi_0,$$

where $\Pi_0$, $\Pi_1$, $\Pi_2$, and $\Pi_3$ appear as in equation (14). The expected inflation rate upon announcement of $M_0$ is then obtained using equations (16), (17), and (18), and the assumption $E(P_1) = P_1$.

$$E(P_{1+1}) = E(P_1) + \Pi_0 \delta_{1,n-1} + \Pi_1 \delta_{n-1} + (\Pi_2 + \Pi_3) \delta_{n-1} + (\Pi_3 + \Pi_3) \delta_{n-1}.$$  

III. MONETARY TARGETING AND THE VARIANCE IN INFLATIONARY EXPECTATIONS

The change in the expected inflation rate upon the announcement of $M_0$ is obtained from equation (14), (15), (18) and (19), and the property $\theta_1 + \delta_1 = 1$.

$$E(P_{1+1}) = E(P_1) + \Pi_0 \delta_{1,n-1} + (\Pi_2 + \Pi_3) \delta_{n-1} + (\Pi_3 + \Pi_3) \delta_{n-1},$$

(20)

$$E(P_1) + \Pi_0 \delta_{1,n-1} + (\Pi_2 + \Pi_3) \delta_{n-1} + (\Pi_3 + \Pi_3) \delta_{n-1}.$$  

Its variance is

$$E[(P_{1+1} - E(P_{1+1}))^2] = \frac{1}{1-\beta} \left[ \left( \frac{\alpha + \lambda}{1-\beta(1-\alpha)} \right)^2 + \frac{\rho}{1-\beta(1-\rho)} \right].$$

Equation (21) is to be used in our model as a welfare loss due to inflationary uncertainty. Some explanation of this measure is warranted.

Our choice of welfare loss due to uncertainty is made on grounds of consistency with Barro's (1976, 1980) and King's (1982) definition of welfare loss as a variation in aggregate supply under incomplete information relative to full information aggregate output. Our definition of uncertainty rests on its consistency with Barro's and King's framework, and alternative modeling assumptions would lead to alternative definitions of uncertainty and different policy conclusions than those to be derived.

The central idea for these authors is that supply decisions made by firms with complete information will be optimizing, and that deviations in aggregate supply from full information will therefore result in welfare loss. Since output supplied in Barro's and King's framework is proportional to the difference between the current actual and expected future aggregate price levels, output variation in their class of models is proportional to variation in the expected inflation rate about its full-information value. This definition of uncertainty is consistent with the variation in price expectations defined in equation (21). As our derivation of equations (14) and (18) suggests, with the announcement of the current moneystock, $M_0$,
agents have sufficient information to determine the complete-information expected inflation rate \( E(\Pi_1 - \Pi_0) \). In contrast, before the announcement, the expected inflation rate \( E(\Pi_1 - \Pi_0) \) is determined without knowledge of the current money stock and therefore based on less complete information.

In attempting to minimize the variance defined in equation (21), policy is set so that the expected inflation rate before the announcement will not be too different from the full-information response that will occur after the announcement. Because of the cost involved in providing earlier money stock information to market participants, an alternative to providing this information might be the intelligent choice of monetary targets and money supply control strategy. Under these conditions, minimization of equation (21) is a reasonable policy objective.

Assuming decreased inflationary uncertainty in the above sense is the policy objective, equation (21) can be minimized with respect to \( \lambda \) to obtain

\[
\lambda^* = \frac{(\rho - \alpha)(1 - \rho)}{1 - \rho(1 - \rho)}
\]

Some interesting implications about the relationship between the FOMC's targeting procedures and inflationary expectations are revealed by equation (22).

First, as the equation suggests, the FOMC's targeting procedures will generate less inflationary uncertainty (measured by the variance in the expected inflation rate about its full information value) if an optimal or near-optimal averaging scheme for selecting the target bases is used than with no base averaging. In our model, this scheme is determined by choosing the weights \( \lambda^* \) and \( \lambda^* \) for the disturbances \( v_1 + v_2 \) and \( v_1 \) in the moving average components of the money supply process.

This result is intuitive, given agent's response to information in our model. Before the announcement of the money supply \( M_0 \), agents cannot distinguish between the current money supply \( v_1 \) and current disturbance to money demand \( v_2 \). With the announcement of \( M_0 \), and information about the disturbance, agents will adjust their expectations \( E(\Pi_1 - \Pi_0) \) of inflation in a manner consistent with their newly-acquired information about future monetary policy. That is, long-run monetary policy will be expected to offset future disturbances accumulated about the value \( v_2 \) as well as about the past money supply disturbance \( v_1 \).

When target averaging is used, long-run monetary policy is expected to offset future disturbance about the value \( v_1 + \lambda v_2 \) as well as about \( v_1 \). In this case a larger proportion of expected future monetary policy is determined before the announcement. Market participants incorporate this information into their expectations before the announcement (see equation (13)) and respond less to \( v_2 \) when \( M_0 \) is announced. In essence, their response to \( M_0 \) is smaller when there is target-base averaging because they have prior information that the FOMC is taking a more gradualistic approach to monetary policy.

Whether or not the use of a base averaging scheme for choosing monetary targets will generate less inflationary uncertainty than allowing future money stock values to accumulate about the value \( v_1 + \lambda v_2 \) will, of course, depend on the weighing scheme chosen for the disturbances \( v_1 \) and \( v_2 \). Equation (21) does suggest, though, the factors the FOMC should consider in choosing such a weighing scheme. The relative weight \( \lambda^* \) for the disturbance \( v_1 \) depends on equation (22) on the difference \( (\rho - \alpha) \). In other words, when it chooses its targets, the Federal Reserve should consider how fast it plans on offsetting disturbances to the money stock in the long run relative to the rate at which disturbances to money demand dissipate. Being more gradualistic in its setting of the targets through the choice of \( \lambda \) allows the FOMC more latitude in its long-run monetary policy, since this information can be provided to market participants through the target itself.

Equation (22) also reveals that if the FOMC does not prefer to use a gradualistic approach in biasing its targets, and inflationary uncertainty is a concern, it may be forced to be more accommodative in its long-run monetary policy. The analog of base drift occurs in our model when \( \lambda = 0 \), so that future money stock disturbances are allowed to accumulate about the single-period's disturbance \( v_1 \). As equation (22) suggests, the assumption that \( \lambda^* = 0 \) equivalently implies that \( \alpha = \beta \). In other words, the same variation in inflationary expectations in equation (21) can only be obtained when base drift is not offset by target-base averaging in the short run, if money supply disturbances are offset in the long run at the rate at which money demand disturbances dissipate. What this suggests is that when more information is contained in the announcement of \( M_0 \), it reveals values of \( v_2 \) and \( v_1 \) rather than the target, markets adjust their expectations more rapidly. The FOMC is, then, forced to offset this uncertainty by accommodating its long-run money supply strategy to changes in money demand.

Finally, equation (22) suggests some implications for the FOMC practice of money supply target rebasing. Rebasings differs from choosing a single period's value for the money stock target in that not only does the FOMC choose a single period target base, but the long-run targeting period changes. This is because rebasing is done during the calendar year to determine new targets for the remainder of the calendar year. In our model, a version of rebasing is to assume \( \lambda = \alpha = 0 \). In other words, the long-run policy horizon is shortened from a one period lag to a zero period lag, as the FOMC recalculates its targets. As equation (22) suggests, when \( \lambda = \alpha = 0 \), \( \lambda^* = 0 \) only if \( \rho = \beta \). Rebasings is therefore optimal only under the assumption that money demand disturbances accrue entirely in the short run.

This result is intuitive. When the FOMC rebases its targets it, at least temporarily, relinquishes both short and long-run control of the money stock. This, in itself, imparts a particular type of uncertainty to market participants. With any information about future money supply strategy, market participants will only obtain information about money demand from the current announcement of \( M_0 \). As equation (21) suggests, if the change in expected inflationary expectations is at the current announcement of \( M_0 \), and will be entirely dominated by long-run changes in the demand for money. Unless changes in the demand for money are confided entirely to the current market period, rebasing will, then, in general, be optimal in terms of behavior of the expected inflation rate.

IV. CONCLUSIONS

The strength of these results, clearly, depends on two factors: 1) first, our use of a relatively simple model in which inflationary expectations were determined entirely through the supply and demand for money; 2) second, our use of a simplistic model of the money supply target-setting and long-run monetary control process. This latter assumption has been particularly helpful in that it has allowed our presentation of a potentially complex process as a simple first-order autoregressive moving average scheme.

In spite of its simplicity, the model has been useful in pointing out some important points about the relationship between the FOMC's target-setting behavior and the behavior of inflationary expectations. It is worthwhile mentioning these results.

First, some type of averaging scheme for determining the FOMC's money stock target bases will, in general, generate less inflationary uncertainty than no averaging. The notion we
demand for money might be undesirable in being inconsistent with other FOMC objectives, for instance, the state of the balance of trade.

REFERENCES


NOTES

1. This response, if conceptually separate from the response of interest rates to the announcements of the current money supply, has been extensively treated in the literature (see Cornell and Kozy 1982, 1983a, 1983b; 1985a, 1985b; 1983b; Cullen and Kozy 1986; Engel and Frankel 1984; Gavin and Karamouzis 1986; Hein 1986; Roley and Telfi (1985); Roley and Walsh 1984; Uriah and Wachtel 1981, to mention a few). The related issue of whether interest rate responses to monetary announcements are, in part, due to inflationary expectations has been studied by Cullen and Kozy (1983b). Cullen and Kozy (1986), and Gavin and Karamouzis (1986). The conclusion of these latter studies is that the source of interest rate response to monetary announcements depends on the sample period under consideration.

2. An alternative way in which the inflation rate can affect the demand for money is through the variance in inflation rate, e.g. EIP = P0 - P0. Inclusion of such a term in equation (1) would be along the lines of Kline (1977), and would capture the effect of inflation on the quality of cash balances. We neglect this type of money demand specification, since Marcus (1976) and Carlson and Frensen (1980) have demonstrated that there are problems in empirically measuring the demand for money using Kline’s specification.

3. Since similar target-setting procedures have, until the recent abandonment of M1 targets, been used by the Federal Reserve for M1, M2, and M3, in equation (3) will refer to any of these three monetary aggregates.

4. Another interpretation of the moving average component of equation (7) is that the money supply process is subject to statistical observation error. In this case, v, represents the current period’s observation error to the money stock, while v, is the data revision, i.e., the update of the previous period’s error.

5. Under the assumption of the observability of P, the only sign reversal problem in the model becomes that of obtaining the expected future price level EIP, and therefore inflation rate, before and after the observation of the announced money stock M.

6. The model is solved using the method of undetermined coefficients introduced by Lucas (1972, 1975). The reader familiar with this method is referred to p. 11 for the principal conclusions of the paper. A more detailed derivation of the paper’s results is also available to the interested reader upon request.

7. A point of clarification to the reader not familiar with the signal extraction problem might at this point be helpful. The expectation EIP (P0) in equation (13) which depends on r and a, defined in equations (11) and (12) is obtained as follows. Equation (10) is led one period ahead and its expectation is obtained using equations (2) and (7). This results in an expression in the expected values E[(Pu-P0)], and hence in the expression on the left-hand side of (10). The innovation v, to these equations, which depend on the proportions in price variation r and a, stemming from the current money supply and money demand disturbances.

8. A related problem is if monetary policy is not based on v, there is no opportunity for data revision, so the error will remain the observation error. Using a targeting strategy on data subject to such observation error conveys a sensitivity to market participants. See Poole (1976).

9. Although not explicitly allowed for in our model, such accommodation of the money supply to the
Minimum Wage and Pure Discrimination: A Note

Robert Cherry*

For the first time in a number of years, there is strong interest in raising the minimum wage. One can expect that among the criticisms of this policy initiative, many economists will argue that the minimum wage harms black workers disproportionately.¹ Some economists (Byrnes and Stone 1982; Gwartney and Stroup 1982; Sowell 1981; Williams 1977) assert that the minimum wage makes pure discrimination less costly, which exacerbates discrimination against black applicants.² This note demonstrates that this proposition is not necessarily true, even in competitive models.

Competitive models generally assume that workers have the same exact productive in each labor market and hence, are perfect substitutes for each other. In this situation, black workers find employment in markets where all employers have a “preference for white workers” only if they will work for lower wages. As a result, each employer takes as given the differential wages between equally productive black and white workers. Employers hire each additional white worker as long as psychic benefits derived outweigh the wage differential. In Arrow’s (1972) model, owing to the law of diminishing marginal utility, optimal employment occurs when the psychic benefits from the last white worker hired just equal the wage differential.

Labor market equilibrium is generated when racial wage differentials are sufficient to balance supply and demand in both black and white labor markets. Within this framework, a decrease in the racial wage differential employers face increases their willingness to hire more expensive white workers.³ Since the minimum wage reduces the ability of black workers to lower their wages to compensate for employer preferences, it follows that the minimum wage increases discriminatory hiring practices.⁴

While Gary Becker generally discussed pure discrimination in markets with perfect substitutability, he did address the impact of pure discrimination when black and white workers are not perfect substitutes.⁵ In this alternative model, we will find that the cost of discrimination is measured by productivity losses rather than higher labor costs. Figure 1 is a reproduction of Becker’s (1971, p. 42) analysis where XX represents all of the combinations of black and white workers capable of producing the same level of output. The price line CC reflects the differential wages which would exist in society. Thus any nondiscriminatory firm would face \( w_b > w_w \), where these represent the market wages for white and black workers respectively. An employer with a taste for discrimination would adjust upward his/her “cost” of employing a black worker by a discrimination coefficient, \( d \), which shifts the price line to DD. As a result, black employment declines from B to B’ while white employment increases from W to W’.

While it was not his intention, Becker’s framework could be used to analyze the effects of pure discrimination even if firms were forced to pay the same wage to black and white workers; i.e. even if the slope of CC was –1. In particular, we could assume that firms are required to

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¹Brooklyn College of the City University of New York 11210 would like to acknowledge the important suggestions of Yuli Amshberg.