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Authors	R. W. Hafer
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Federal Reserve Bank of St. Louis, Research Division, P.O. Box 442, St. Louis, MO 63166

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FURTHER EVIDENCE ON CHOOSING AN OPERATING
TARGET FOR MONETARY POLICY

R.W. HAFER

Federal Reserve Bank of St. Louis

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I. Introduction

In a recent article in this Journal, Sivesind and Hurley (hereafter SH) argue that the federal funds rate is superior to nonborrowed reserves as the policy variable in conducting monetary policy. Using Pierce and Thomson's [1972] static money model SH find that during the period January 1969 to June 1974 the variance of money around its target is less under a federal funds rate regime than under an adjusted nonborrowed reserves regime.

The purpose of this paper is to reexamine the evidence concerning the choice of the policy variable. More specifically, the adjusted monetary base, in addition to the federal funds rate and nonborrowed reserves, is examined as a monetary policy variable. It has been argued [Burger 1972,1975] that the adjusted monetary base is a viable policy variable. Consequently, it also should be tested before a reserves aggregate regime is rejected.

The format of the paper is as follows. Section II presents the Pierce-Thomson model of money stock determination and the relevant error variance formulas. Section III presents the empirical results. In addition to reestimating the model over the SH sample period, the model is tested over the more recent period July 1974 to September 1979. The latter results suggest that the money stock could be more closely controlled by using the adjusted monetary base, not the federal funds rate, as the policy variable. Summary remarks are presented in Section IV.

II. The Model

The model of money stock determination developed by Pierce-Thomson and used by SH consists of three equations; a money demand equation, a money supply equation and an equilibrium equation:

(1) $M^d = a_1 Y + a_2 I + e_d$, $a_1 > 0;\ a_2 < 0$

(2) $M^s = b_1 R + b_2 I + e_s$, $b_1,\ b_2 > 0$

and

(3) $M^s = M^d$

where

M^d = money demanded,

M^s = money supplied,

Y = income,

R = reserve aggregate (corrected for reserve requirement changes)

I = federal funds rate,

e_d = money demand stochastic term, $E(e_d) = 0$, $V(e_d) = \sigma_d^2$,

and

e_s = money supply stochastic term, $E(e_s) = 0$, $V(e_s) = \sigma_s^2$.

In this short-run model it is assumed that income is determined exogenously. Moreover, because of its short-run nature (i.e., monthly), prices are assumed to be constant. Consequently, all terms in equations (1) -(3) are expressed in nominal terms.

It is possible to evaluate the errors arising from controlling the money stock via a federal funds rate regime or a reserves aggregate regime given the preceding model. Presumably, the approach producing the smallest error variance would be chosen by the monetary authority. As noted by SH, two important assumptions are necessary to evaluate the competing policy regimes: the policy variable is perfectly controlled and it is adjusted to cause the expected level of the money stock to be equal to its desired, or target level

(M^T). [1/] The control errors realized arise from errors in forecasting money demand, money supply and income. Let $V_R(M-M^T)$ and $V_I(M-M^T)$ be the variance of actual money around its target level for a reserves aggregate regime and federal funds rate regime, respectively. With Y' denoting the current income prediction, the variances are calculated as

$$V_R(M-M^T) = \left[\frac{b_2}{a_2 + b_2}\right]^2 V_I(M-M^T) + \left[\frac{a_2}{a_2 + b_2}\right]^2 V(e_s) \tag{4}$$
$$+ 2\left[\frac{a_2 \; b_2}{(a_2 + b_2)^2}\right] \text{COV} \left[a_1(Y-Y') + e_d; \; e_s\right]$$

and

$$(5) \quad V_I(M-M^T) = a_1^2 \, V(Y-Y') + V(e_d) + 2a_1 \text{COV}\left[(Y-Y'), \; e_d\right].$$

Equations (4) and (5) indicate that the error variance under a federal funds rate regime depends only on the errors of the money demand equation (e_d) and the income forecast error ($Y-Y'$). The variance under a reserves regime, however, includes not only the errors from predicting money demand and income, but also the errors associated with predicting the money supply (e_s). Given these variances, if $V_R(M-M^T) < V_I(M-M^T)$, a reserves control regime is preferred to the federal funds rate regime and vice versa.

III. Empirical Results.

Equations (1) and (2) were estimated over the sample period examined by SH (January 1969 to June 1974) using an instrumental variables approach.[2/] This technique allows us to incorporate an information set thought to have influenced monetary policy makers and to identify the money demand and money supply parameters. Consistent with the notion that money demand adjusts with a lag, equation (1) is estimated with a lagged dependent variable. Given the recent redefinitions, we use the M1B definition of money. 3/ Finally, the money supply equation is estimated using nonborrowed reserves and the monetary base as the reserve aggregates, both adjusted for reserve requirement changes.

Treating income as exogenous, the regression results for January 1969 to June 1974 are presented in table 1. The regression results are generally consistent with those presented by SH. The most striking feature is the change in the estimated relationship between the federal funds rate and the money stock when adjusted nonborrowed reserves are replaced by the adjusted monetary base. In the latter equation, the federal funds rate is insignificantly different from zero and the regression standard error is halved.

Using the necessary data from table 1, the relevant control variances can be calculated. Following SH, the simple model $Y' = Y_{t-1} + \Delta Y_{t-1}$ is used to generate the income forecast errors $(Y-Y')$. The calculated variances for the SH sample period are

$$V_I(M-M^T) = 9.10 \times 10^{-6},$$

$$V_R^{NBR}(M-M^T) = 11.00 \times 10^{-6},$$

and

$$V_R^{AMB}(M-M^T) = 12.20 \times 10^{-6}.$$

The results support the SH finding that, during the period January 1969 to June 1974, an interest rate control policy is superior to controlling reserves.

We extend the SH sample to include recent data, making the sample period Jaunary 1969 to September 1979.4/ This is done to test the robustness of their findings. Preliminary tests revealed, however, that the money demand and supply equations were structurally unstable: Choosing the endpoint of the SH sample as the hypothesized break, Chow tests revealed that the null hypothesis of stability is easily rejected at the one percent level for the money demand and money supply equations. Consequently, we shall examine the evidence for the sample period July 1974 to September 1979.

Using the same instrumental variables estimation technique as before, equations (1) and (2) are estimated for the July 1974 to September 1979 sample period. The results are presented in table 2. The regression results are generally quite different between the two sample periods. For example, the income elasticity in the money demand equation more than doubles in the second sample period. Moreover, the federal funds rate variable is not statistically significant and incorrectly signed. With regard to the money supply equations, the level of adjusted nonborrowed reserves is not statistically related to the level of the money stock. This suggests, rather suprisingly, that the money stock is determined independently of actions taken by the monetary authorities to influence adjusted nonborrowed reserves. The money supply equation employing the adjusted monetary base variable is not, however, plagued by such problems. Indeed, the estimated coefficient on the adjusted base variable is highly significant and close to the value estimated for the earlier sample period, the federal funds rate variable takes the hypothesized sign and is statistically significant, and the standard error of the equation is reduced relative to the competing specification.

Using the appropriate information from table 2 and the Y' estimates for the recent sample, the respective control variances for July 1974 to September 1979 are

$$V_I(M-M^T) = 12.49 \times 10^{-6}$$

$$V_R^{NBR}(M-M^T) = 12.49 \times 10^{-6}$$

and $$V_R^{AMB}(M-M^T) = 12.20 \times 10^{-6} .$$

These results indicate that, in contrast to the previous finding, a reserve aggregate strategy using the adjusted monetary base is preferable to one that controlls the federal funds rate to achieve a desired money stock.

Recall the money supply regression using the level of nonborrowed reserves: that variable was statistically insignifcant. This finding in conjunction with the variance result presents a paradoxical result. Even though the level of nonborrowed reserves is not statistically related to the money stock level, the error variance for that control strategy is equal to that for a federal funds rate strategy. The difference in the federal funds rate strategy and the adjusted monetary base error variances are not, however, subject to such problems. The empirical results using the adjusted monetary base indicate that using the adjusted monetary base as the policy variable would yield better control over the money stock than a federal funds rate targeting procedure.

IV. Summary

Sivesind and Hurley present evidence supporting the position that control of the federal funds rate yields better control over the money stock vis-a-vis a strategy targeting on some reserve aggregate. We have reexamined this conclusion by comparing results using the adjusted monetary base as well as adjusted nonborrowed reserves as the reserve target variable over SH's sample period of January 1969 to June 1974 and the more recent period of July 1974 to September 1979. The results presented in this paper, in contrast to those of SH, indicate that controlling the adjusted monetary base during the recent sample period would produce better control of the money stock than one targeting on the federal funds rate. The reversal of policy conclusions between the two sample periods clearly indicates the need for further study.

Footnotes

1/ Sivesind and Hurley [1980], p. 200. See also Pierce and Thomson [1972], pp. 119-121.

2/ The instruments used are two lagged values of nominal income, contemporaneous and two lagged values of the unemployment rate, a current and lagged value of the inflation rate over the previous three months and the money stock lagged two periods. Note that all variables are expressed in logarithms. I would like to thank Kevin Hurley for providing the instrumental variable definitions used in the SH article.

3/ SH use the M1 definition. We use the M1B definition based on the general belief that it represents a superior measure. This is true in areas such as money demand and in comparisons using simple reduced form income equations. See Bennett, et. al. [1980] and Hafer and Hein [1981].

4/ September 1979 was chosen as the sample endpoint because of policy changes initiated in October 1979. Because no evidence of policy change exists for the period from 1974 to September of 1979, this sample should be similar to the SH period in terms of actual Fed behavior.

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Table 1
Regression Results*
January 1969-June 1974

Variables	Estimated Equation: Money Demand	Money Supply: Nonborrowed Reserves	Money Supply: Adjusted Monetary Base
Constant	0.029 (0.87)	2.680 (33.74)	1.684 (16.54)
ln Y	0.071 (2.29)		
ln FF	-0.005 (4.13)	0.054 (6.83)	-0.001 (0.23)
$\ln (M1B)_{t-1}$	0.908 (20.75)		
ln NBR		0.828 (34.01)	
ln AMB			0.858 (36.18)
SE	0.004	0.008	0.004
D.W.	2.03	2.03	2.14
$\hat{\rho}$	-0.03	0.63	0.83

*Notes: The variables are defined as follows: Y is the level of personal income; FF is the federal funds rate; NBR is the level of nonborrowed reserves adjusted for reserve requirement changes; and AMB is the St. Louis Federal Reserve Bank's adjusted monetary base. Absolute values of t-statistics appear in parentheses. SE is the regression standard error, D.W. is the Durbin-Watson statistic and $\hat{\rho}$ is the estimated first-order serial correlation coefficient.

Table 2
Regression Results*
July 1974-September 1979

	Estimated Equation		
		Money Supply	
Variables	Money Demand	Nonborrowed Reserves	Adjusted Monetary Base
Constant	0.182 (1.63)	5.120 (6.71)	1.667 (42.40)
ln Y	0.162 (2.29)		
ln FF	0.004 (0.23)	0.093 (4.97)	0.020 (5.27)
ln $(M1B)_{t-1}$	0.763 (6.97)		
ln NBR		0.174 (0.84)	
ln AMB			0.846 (95.77)
SE	0.004	0.006	0.004
D.W.	1.98	1.83	2.23
$\hat{\rho}$	-0.12	0.97	0.49

*Notes: See table 1.