The Federal Reserve Reaction Function: Does Debt Growth Influence Monetary Policy?

Richard G. Sheehan

HE prospect of federal government deficits total-
ing $907 billion between 1985 and 1990 has renewed
doubts about the Federal Reserve's ability to conduct
independent monetary policy. Often implicitly under-
lying these doubts is the fear that increases in federal
debt will drive up interest rates and slow economic
growth in the absence of expansionary monetary pol-
icy. Given the magnitude of projected federal deficits,
many analysts are concerned that the Federal Reserve
may feel obliged to increase the money stock faster
than it otherwise would to keep interest rates from
rising.[1]

It is the purpose of this paper to offer some evidence
on the extent to which the Federal Reserve has altered
monetary policy in response to federal deficits.[2] The
focus here is to determine if monetary policy has re-
acted to federal deficits in a consistent manner over
time. The sensitivity of monetary actions to debt
growth is considered over different time periods and

under alternative measures of monetary actions and
debt.

MONETARY POLICY AND DEBT

The textbook view of the relationship between mon-
etary policy and federal debt can be demonstrated in
the context of a simple comparative static money mar-
ket model, which is summarized in figure 1. Let us
assume that money demand (MD) is a function of the
interest rate and the level of income and that the
Federal Reserve can effectively fix the money supply
(MS). With some initial level of income, money de-
mand and supply functions may be represented by
MD_o and MS_o, respectively. Given a structural (or exog-
enous or active) change in fiscal policy, say, an expan-
sionary action increasing the deficit, income will rise
in the short run.[3] This increase in income, in turn, will
lead to an increase in money demand, shifting the
money demand curve from MD_o to MD_1 in figure 1 and
driving up interest rates. If the Federal Reserve is
operating with a monetary aggregate target, monetary
policy will not respond to the deficit. The structural

Richard G. Sheehan is an economist at the Federal Reserve Bank of
St. Louis. Larry J. DiMariano provided research assistance.

[1]Sargent and Wallace (1981) have gone so far as to argue that the
Federal Reserve has only a choice between increasing the money
stock sooner or later. While Darby (1984) has disputed this conten-
tion, the issue apparently remains unresolved. See Miller and
Sargent (1984).

[2]The process of a debt increase directly leading to expansionary
monetary policy is often labeled "monetizing the debt." Given the
ambiguities surrounding that phrase, it is not used here. See Thorn-
ton (1984) for a detailed explanation of alternate definitions of the
phrase.

[3]A change in fiscal policy, that is, a change in the behavior of fiscal
policymakers, is considered structural, exogenous or active. Thus, a
fiscal-policy-induced change in the deficit, as one measure of fiscal
policy, also is considered exogenous. It is assumed that the fiscal
policy change and resulting deficit change are not prompted by a
change in the business cycle. A change in the deficit resulting from a
change in, say, real GNP is considered cyclical, endogenous or
passive. See Tatom (1984) for a more extensive discussion of the
distinction between active and passive deficits.

Comparative Static Money Market Model
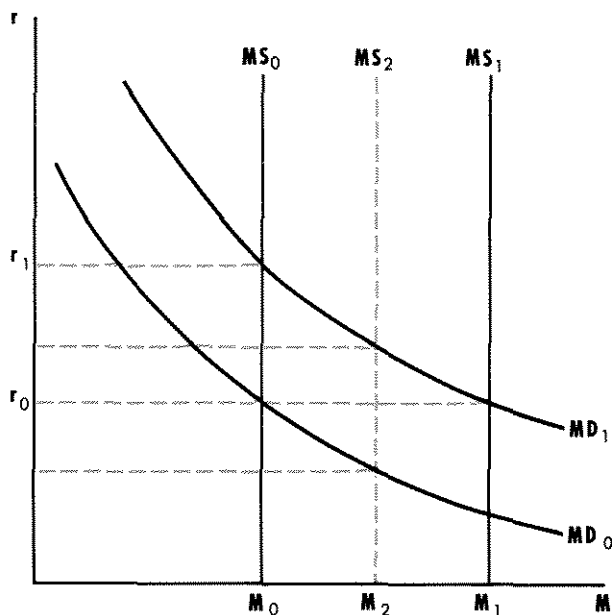
deficit will not alter the money stock but will increase the interest rate from r_o to r_1.[4]

With cyclical (or endogenous or passive) fiscal policy changes, however, the impact of changes in the structural deficit is quite different. Assume the economy enters a recession as a result of a non-policy shock to the system. The automatic stabilizing properties of federal taxes and expenditures will lead to a cyclical increase in the deficit as income declines. Further, the decline in income will reduce the demand for money, shifting the money demand schedule, say, from MD_1 to MD_o in figure 1. Again, if the Federal Reserve is using a monetary aggregate as its target, the money stock will remain constant. An increase in the cyclical deficit will now be accompanied, however, by a reduction in the interest rate from r_1 to r_o. With a monetary aggregate target, this model implies that structural deficits will lead to increases in the interest rate, while cyclical deficits will be accompanied by decreases in the interest rate.

In contrast, if the Federal Reserve is using the fed-

eral funds rate as its target, the increase in the structural deficit and the resulting increase in money demand will prompt it to respond differently. The increase in interest rates as money demand increases from MD_o to MD_1 would lead the Federal Reserve to increase the money supply (from MS_o to MS_1) sufficiently to drive interest rates in general and the federal funds rate in particular back to their original levels.[5] With an interest rate target, the exogenous deficit increase would not influence the interest rate but would increase the money stock.

If the Federal Reserve has not followed a pure interest rate or monetary aggregate target but instead has followed a mixed strategy using both, a structural deficit would still shift the money demand curve out as before, but the money supply curve would shift out only partially, say, from MS_o to MS_2.[6] Thus, the structural debt increase would lead to both higher interest rates and higher money growth.

With a federal funds target and an increase in the cyclical deficit leading to a decrease in money demand from MD_1 to MD_o, the Federal Reserve would decrease the money stock from MS_1 to MS_o to keep the interest rate unchanged. With a mixed targeting strategy and an increase in the cyclical deficit, the money supply would be expected to shift partially downward from MS_1 to MS_2. Thus, the increased deficit would be accompanied by a lower interest rate and a lower money supply.

Whether an increase in the deficit is accompanied by increases or decreases in the money stock and interest rates depends on the source of the deficit and on the manner in which the Federal Reserve is conducting policy. The alternatives are summarized in table 1.

It should be noted that a given deficit may combine structural and cyclical elements. In that case, the impact of the deficit on the interest rate is ambiguous if the Federal Reserve targets on a monetary aggregate; its impact on the money supply is ambiguous if the Fed targets on interest rates. Both impacts would be ambiguous with a mixed targeting procedure. Further, there is no guarantee that the Federal Reserve has followed (or will follow) a consistent pattern of target-

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[4]This discussion assumes loanable funds demand is not completely elastic. It further assumes the Federal Reserve is focusing on a monetary aggregate and will not change its desired value of that aggregate in the face of temporary fluctuations in income.

[5]If the Federal Reserve is operating with an interest rate target, it is also necessary to assume that the Federal Reserve believes that money changes can alter interest rates — as they do in this simple model — and that the Fed has a willingness to alter the money stock based on that belief.

[6]Lombra and Moran (1980) cite evidence suggesting this is typical of Federal Reserve behavior.

Table 1

Expected Coefficient on Debt Term in Measures of Monetary Policy

	Structural debt increase		Cyclical debt increase		Combination debt increase	
Monetary	M	0	M	0	M	0
aggregate target	r	+	r	–	r	?
Interest rate	M	+	M	–	M	?
target	r	0	r	0	r	0
Mixed targeting	M	+	M	–	M	?
procedure	r	+	r	–	r	?

ing on either. Thus, the debt coefficient need not be stable over time.

From 1958 to 1984, the Federal Reserve intermediate policy targets apparently underwent substantial revision. For example, through the 1960s, it is generally assumed that the Federal Reserve's primary concern was controlling interest rates.[7] Monetary aggregates began to receive more attention in the early 1970s. From October 1979 to October 1982, there was an emphasis on monetary aggregate targeting; since then aggregate targeting has become more flexible with less prominence given to M1.[8] Thus, at least four regimes can be identified: (1) from 1958 to approximately 1970, characterized by interest rate targeting, (2) from the early 1970s to October 1979, a mixed targeting strategy, (3) from October 1979 to October 1982, a monetary aggregate target, and (4) from October 1982 to the present, again a mixed targeting strategy. While it would prove fruitful to examine "reaction functions" estimated separately over each of these periods, the short time frames of the latter two periods preclude that option. Thus, the sample is divided into two subperiods, the first prior to 1971 characterized by interest rate targeting and the second from 1971 with a greater focus on monetary aggregates.

THE "REACTION FUNCTION" APPROACH

There have been a number of previous studies that have examined the relationship between monetary

[7]See Lombra and Moran (1980) and Wallich and Keir (1979).

[8]See Thornton (1983) and the sources cited there.

policy and federal deficits. Most of these studies fall under the general heading of estimating a "reaction function" for the Federal Reserve.[9] The reaction function approach assumes that the Federal Reserve's policy actions are based on its goals, its model of the economy and the constraints that the model implies. Thus, the estimated reaction function is based implicitly — or explicitly in the case of McMillin and Beard (1980) — on output and financial market models, together with a rule (that is, an assumption about how the Fed will react to disturbances to reach its goals) for determining Federal Reserve behavior. Combining the behavioral assumptions of the policy rule with the output and financial market models predicts how the Federal Reserve will react to disturbances to the economic system — hence, a "reaction function."

Previously estimated reaction functions have differed with respect to the choice of dependent and independent variables, the functional form employed, the time period used for estimation and the conclusions based on that estimation. They also have reached different conclusions about the stability of the estimated reaction function. Thus, it is useful to briefly survey previously estimated reaction functions.

Three variables commonly have been employed as the dependent variable, that is, as the measure of monetary policy. Niskanen (1978) and Barro (1977) among others use a measure of the money stock, M1, assuming that the money stock is the best indicator of monetary policy during the period of estimation. Froyen (1974), Levy (1981), and Barth, Sickles, and Wiest (1982) use the monetary base instead, contending that the base corresponds more closely to open market operations and is a good measure of exogenous monetary policy actions. The third alternative, used by Abrams, Froyen, and Waud (1980), DeRosa and Stern (1977), and Havrilesky, Sapp, and Schweitzer (1975), is the federal funds rate. They argue that this variable is a more appropriate measure of monetary policy in periods in which the Federal Reserve is targeting on interest rates. They further contend that the Federal Reserve, in fact, has targeted interest rates during most of the post-World War II period.

Previously estimated reaction function estimates also have used a wide range of independent variables and have assumed alternate goals of the Federal Re-

[9]For example, see Allen and Smith (1983), Barth, Sickles, and Wiest (1982), Froyen (1974), Hamburger and Zwick (1981, 1982), Levy (1981), McMillin and Beard (1980, 1982). Two studies that do not use the reaction function approach are Dwyer (1982) and Thornton (1984). For a detailed statement of the deficit problem, see Tatom (1984).

serve (e.g., price stability, low unemployment, high real growth rates and financial market stability). Most previous studies have used ordinary least squares (OLS) estimation techniques, and independent variables generally are included with no more than one lag.[10]

The estimation results have been inconsistent in a number of respects. For example, using the monetary base as the policy measure, Allen and Smith (1983) found that the unemployment rate was significant, while Levy (1981) found it insignificant. On the impact of the debt, included as a measure of financial market stability, Levy concluded that debt growth influenced monetary policy, while Hamburger and Zwick (1981) reached exactly the opposite conclusion. On the stability of the estimated reaction function, Allen and Smith (1983) argued in favor of a stable relationship; Abrams, Froyen, and Waud (1980) reported findings of instability. It is unclear to what extent these differences are due to different sample periods, the choice of independent variables, the specification of the monetary policy variable or the use of different functional forms.[11]

EMPIRICAL METHODOLOGY

The basic reaction function approach is also employed here. Two alternative monetary policy measures are used as dependent variables: the money stock (M1) and the federal funds rate (i_{FF}), given that the Federal Reserve has alternately focused on interest rates and the money stock.[12] To further allow comparison of the estimation results with the potential relationships between monetary policy and deficits as presented in table 1, we employ two measures of debt growth in the following empirical analysis: the net federal debt (NFD) and the high employment deficit (HEBD).[13]

Neither of these two measures is a perfect indicator of the pressure on the Federal Reserve to alter policy in response to changes in federal debt. NFD is potentially influenced by macroeconomic shocks, which may also have an impact on (or be the result of) monetary policy. Thus, NFD includes both structural and cyclical components. NFD does have the advantage of including off-budget items, and the recent growth in off-budget items may represent substantial additional pressure on monetary policymakers.[14] The HEBD measure is adjusted for real income changes.[15] Thus, it may be considered a measure of structural policy changes. HEBD, however, does not include off-budget items.

The equations are estimated over the interval from I/1958 to III/1984 (except where noted) as well as over the subperiods from I/1958 to IV/1970 and from I/1971 to III/1984. The entire period is best characterized in terms of table 1 as a mixed targeting procedure. The early subperiod is basically a time of interest rate targeting, while the latter conforms most closely to a monetary aggregate targeting procedure.

The estimated equations are of the form presented below, a specification similar to that of Froyen (1974):

$$(1)\ X_t = \alpha_o + \sum_{i=1}^{I} \alpha_i X_{t-i} + \sum_{j=0}^{J} \beta_j Z_{t-j} + \sum_{k=0}^{K} \gamma_k D_{t-k}$$

where X = a measure of monetary policy;

Z = a vector of measures of the goals and constraints of the Federal Reserve;

D = a measure of debt;

and α, β, and γ are the estimated parameters.

The right-hand-side variables include lags of the dependent variables as well as current and lagged values of the stabilization objectives or goals used by the Federal Reserve.[16] Included in the specification are the general price level (P), the unemployment rate (UR), and alternately each of the two measures of federal debt. Following the previous reaction function

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[10]Levy (1981) used instrumental variables and Abrams, Froyen, and Waud (1980) used 3SLS. Froyen (1974) and studies using Barro's (1977) basic specification used more than one lag.

[11]See Barth, Sickles, and Wiest (1982) or McMillin and Beard (1981) for a more extensive review of the reaction function literature.

Thornton (1984) uses a different framework focusing on the "causal" relationships between monetary policy and debt rather than using a reaction function approach. His results are consistent with the findings of the reaction function literature. There apparently exists a relationship between monetary policy and federal debt, but this finding is sensitive to the period of analysis chosen as well as the precise measure used for debt.

[12]The monetary base is not used as a measure of monetary policy since Thornton (1984) has shown the linkage between debt growth and the monetary base is influenced by a number of other factors.

[13]Previous reaction functions have generally used either NFD or HEBD although Froyen (1974) used both in the same equation.

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[14]For example, off-budget items totaled $17.3 billion in fiscal year 1982.

[15]See deLeeuw and Holloway (1982).

[16]Froyen has noted that the estimated reaction function actually represents a joint test of the influence of the chosen stabilization goals and constraints together with the appropriateness of the chosen dependent variable. Lags of the dependent and independent variables are included (1) to allow gradual adjustment to goals so that monetary policy is not a source of instability and (2) to capture the effect on monetary policy of variables omitted from the model.

literature, interest rate terms are included in the money equation, while money terms are included in the interest rate equation.

All variables were included in log difference form except for HEBD, which is included in level form. Maximum lag lengths were arbitrarily restricted to 12 lags on the dependent variables and six lags for the other right-hand-side variables. The choice of appropriate lag length was then determined by Akiake's final prediction error (FPE) criterion.[17] When the FPE search for the preferred lag specification indicated that no values of a right-hand-side variable improved the specification, that variable was dropped from the basic equation. Except when noted, a variable was included in the estimated equation only when an F-test on its joint coefficients indicated it was significant at the 10 percent level. Two-stage least squares was used as the estimation technique to avoid problems of simultaneity.[18]

ESTIMATION RESULTS

The reaction function results estimated over the 1958–84 period are presented in tables 2 and 3. Tables 4 and 5 include the results of equations estimated from 1958 to 1970, while tables 6 and 7 present results of equations estimated over the 1971–84 interval. The focus of the following discussion is on the debt variable and the extent to which federal deficits have influenced monetary policy. The debt coefficients are interpreted in light of the predicted coefficient signs from table 1.

Full Period Results

Table 2 presents the equations estimated initially with NFD as an independent variable. The top part of the table presents the coefficient sums and the t-statistics on whether that sum is significantly different from zero. At the bottom of table 2, the significance

Table 2
Basic Results Using NFD: I/1958–III/1984

	M1	i_{FF}
c	.003 (2.01)	-.011 (-.33)
ΣM	.833 (6.76)	3.316 (.93)
ΣUR	-.043 (-2.60)	-1.256 (-2.97)
Σi_{FF}	-.021 (-2.34)	-.144 (-.86)
ΣP		2.746 (.77)
ΣNFD		-2.555 (-1.97)
R^2	.39	.54
RMSE	.0065	.122
Q(20)[1]	9.09	17.90
Significance levels [2]		
M	.0001 (9)	.0102 (1)
UR	.0110 (0)	.0001 (2)
i_{FF}	.0056 (2)	.0214 (2)
P		.0001 (4)
NFD		.1175 (1)

[1] The Q-statistic tests for autocorrelation in the presence of lagged dependent variables. It follows a chi-square distribution and is calculated for 20 degrees of freedom. The critical value at the 95 percent level is 31.41.
[2] Given the varying degrees of freedom, the significance levels of the joint F-statistics are presented. The number of lags are included in parentheses.

[17]See Batten and Thornton (1984). In one instance below, the FPE chose the maximum lag length allowed. In that case, the maximum lag length was increased but further lags were insignificant.

[18]Only one equation is estimated, and this period's inflation, unemployment rate, etc., may be influenced by this period's monetary policy. In the first stage, each of the dependent variables was regressed on 10 lags of itself and four lags of all other variables in the model. The maximum lag lengths were arbitrarily restricted. The second stage, reported in the text, replaces the current values of the independent variables with the first stage estimates. If HEBD were an exogenous policy tool, the use of an instrument for HEBD would be unnecessary. There is no reason, however, to assume that current fiscal policy is independent of, say, current monetary policy actions.

values are presented for the joint hypothesis that all the coefficients for a particular variable are equal to zero. These significance levels are presented since the lag lengths and corresponding degrees of freedom vary from one specification to another. The lag lengths are included in parentheses. Zero indicates that only the contemporaneous variable is included.

Since net federal debt, on average, had no significant impact on money during the 1958–84 period, it was omitted from the M1 equation. NFD is included in the

Table 3 Basic Results Using HEBD: I/1958–III/1983[1]	M1	i_{FF}
c	.007 (3.74)	.003 (.10)
ΣM	.399 (2.50)	1.279 (.39)
ΣUR	−.029 (−1.94)	1.389 (−3.12)
Σi_{FF}	−.012 (−1.68)	−.149 (−.85)
ΣP		.214 (.06)
ΣHEBD	.00026 (4.08)	
$\bar{R}^2$	.45	.53
RMSE	.0063	.125
Q(20)	14.47	23.14
Significance levels		
M	.0392 (5)	.0058 (1)
UR	.0554 (0)	.0001 (2)
i_{FF}	.0379 (1)	.0965 (2)
P		.0001 (4)
HEBD	.0003 (1)	

NOTE: See footnotes to table 2.
[1]Equations including HEBD are estimated only through III/1983 since the data series has been discontinued.

the hypothesized mixed targeting procedure.[19]

The HEBD results presented in table 3 apparently yield conclusions at odds with these results. With the HEBD measure, the deficit has a significant positive impact on the money stock but no impact on the federal funds rate; consequently, it was omitted from the final estimated federal funds equation. Given HEBD as a measure of the structural deficit, the impact of HEBD on M1 and i_{FF} is consistent with the Federal Reserve, on average, pursuing an interest rate targeting strategy during the 1958–84 period.

The conditions presented in table 1, however, represent only sufficient conditions for the structural deficit to have no impact on the federal funds rate. In other words, it is not necessary for the Federal Reserve to be targeting interest rates in order to generate the result that HEBD does not influence i_{FF}. For example, if HEBD is small relative to the loanable funds market or if the supply of loanable funds is interest-elastic, then HEBD would have little influence on i_{FF} even with, say, a mixed targeting strategy.

Further, there is evidence to suggest that the structural deficit represents a relatively small fraction of the total demand for loanable funds. For example, in 1982, HEBD averaged $32.6 billion while net credit market borrowing by nonfinancial sectors was $404.1 billion. Thus, the HEBD component of federal borrowing was only 8.1 percent of funds borrowed. In contrast, on average from 1975 to 1981, similar figures indicate HEBD was only 4.6 percent of net funds borrowed. HEBD may have little or no impact on interest rates not because of the particular targeting procedure used by the Federal Reserve, but rather because of the small relative size of the structural deficit. Given this interpretation, the results in table 3 are also consistent with a mixed targeting strategy.

federal funds rate equation since the sum of its coefficients is significant at the 10 percent level. A 1 percent increase in NFD lowers the federal funds rate by an estimated 2.56 percent. Since NFD contains both structural and cyclical components, based on table 1, it appears that the cyclical component of NFD dominates the structural component in the federal funds rate equation. Further, since NFD significantly enters the federal funds rate equation, the Federal Reserve apparently did not follow a pure interest rate strategy over the 1958–84 period. This result is consistent with

[19]The coefficients on the non-debt terms in table 2 deserve comment. Inflation does not significantly enter the M1 equation and unemployment enters with a negative coefficient.

While the negative coefficient on the unemployment rate is significant in all equations, its economic impact is minor. For example, a reduction in the unemployment rate from 7.5 percent to 7.0 percent would increase the growth rate of money by only 0.2 percent. The procyclical response of monetary policy to the unemployment rate is certainly not intuitive; it is, however, consistent with the findings of Abrams, Froyen and Waud (1980).

Although the sum of the coefficients on the inflation term in the federal funds rate equation is not significant, the joint impact is significant. The short-run impacts are large in magnitude although approximately offsetting over a year. Similarly, the sum of the coefficients on money growth in the federal funds rate equation are not significantly different from zero. Again, it is the result of offsetting individual coefficients.

Table 4 Interest Rate Target Using NFD: I/1958–IV/1970	M1	i_{FF}
c	.001 (.27)	−.008 (−.23)
ΣUR	−.064 (−2.86)	−1.860 (−5.60)
Σi_{FF}	.065 (−5.15)	.159 (−1.29)
ΣP	1.164 (6.83)	6.861 (1.58)
ΣNFD	.281 (2.29)	−.842 (−.32)
$\bar{R}^2$	.67	.67
RMSE	.0038	.110
Q(20)	23.05	11.41
Significance levels		
UR	.0001 (4)	.0001 (0)
i_{FF}	.0001 (2)	.0001 (2)
P	.0001 (1)	.0024 (1)
NFD	.0275 (0)	.0045 (1)

NOTE: See footnotes to table 2.

Table 5 Interest Rate Target Using HEBD: I/1958–IV/1970	M1	i_{FF}
c	.005 (3.02)	−.019 (−.54)
ΣUR	−.031 (−1.42)	−2.017 (−5.72)
Σi_{FF}	.053 (−4.03)	.044 (−.35)
ΣP	.789 (3.60)	6.757 (1.42)
ΣHEBD	.00029 (3.09)	
$\bar{R}^2$	.69	.59
RMSE	.0037	.121
Q(20)	30.54	17.69
Significance levels		
UR	.0001 (4)	.0001 (0)
i_{FF}	.0002 (2)	.0031 (2)
P	.0001 (1)	.0136 (1)
HEBD	.0132 (1)	

NOTE: See footnotes to table 2.

Subperiod Results

The reaction function results estimated over the interval from I/1958 to IV/1970, which corresponds to what is commonly thought to be a period of interest rate targeting, are presented in tables 4 and 5. The estimation procedures are identical to those employed for the entire period results above. When NFD is used as the debt measure, its coefficients are jointly significant in both the money stock and federal funds rate equations. A 1 percent increase in NFD would result in a permanent 0.28 percent increase in the money stock. In contrast, in the federal funds rate equation, while the NFD coefficients are jointly significant, their sum is not significantly different from zero. An increase in NFD this period will be accompanied by lower interest rates this period, but that decline in the federal funds rate will be offset next period, with the funds rate returning to its previous level. Thus, the NFD results are consistent with interest rate targeting, assuming a one-quarter lag before the Federal Reserve can effectively offset interest rate changes.

The HEBD results in table 5 generally are consistent with the NFD results. HEBD is significant in the money equation but insignificant in the federal funds rate equation. An increase in the structural deficit leads to an increase in the money stock during the early period but has no effect on the federal funds rate. This HEBD result is also consistent with interest rate targeting. The NFD and HEBD results differ only in their timing. NFD has a slightly faster impact on the money stock

Table 6

Mixed Targeting Procedure Using NFD: I/1971–III/1984

	M1	i_{FF}
c	.020	−.146
	(4.69)	(−1.08)
ΣM		8.246
		(1.20)
ΣUR		−1.372
		(−3.01)
Σi_{FF}	−.006	−.547
	(−.77)	(−2.06)
ΣP	−.350	8.549
	(−1.65)	(1.59)
ΣNFD	.087	−3.613
	(1.14)	(−2.28)
$\bar{R}^2$	.21	.58
RMSE	.0072	.111
Q(20)	9.81	11.34
Significance levels		
M		.0097
		(6)
UR		.0052
		(1)
i_{FF}	.0202	.0228
	(1)	(2)
P	.1047	.0967
	(0)	(3)
NFD	.2616	.0882
	(0)	(1)

NOTE: See footnotes to table 2.

Table 7

Mixed Targeting Procedure Using HEBD: I/1971–III/1983

	M1	i_{FF}
c	.020	−.210
	(3.87)	(−1.35)
ΣM		9.589
		(1.22)
ΣUR		−1.562
		(−3.23)
Σi_{FF}	−.005	−.427
	(−.64)	(−1.59)
ΣP	−.298	5.611
	(−1.17)	(1.06)
$\Sigma HEBD$	.00014	
	(1.64)	
$\bar{R}^2$	.25	.57
RMSE	.072	.116
Q(20)	9.06	6.38
Significance levels		
M		.0089
		(6)
UR		.0047
		(1)
i_{FF}	.0542	.0551
	(1)	(2)
P	.2474	.0663
	(0)	(3)
HEBD	.1083	
	(0)	

NOTE: See footnotes to table 2.

and a temporary effect on the federal funds rate. HEBD takes one quarter longer in reaching its full impact on money and has no effect on the federal funds rate.[20]

Equations estimated only over the 1971–84 period, which corresponds to a period of greater reliance on a monetary aggregate target, are presented in tables 6 and 7. The NFD and HEBD equations both imply that debt growth did not influence the money stock over this period. Again, when the federal funds rate equa-

tion is estimated with NFD, that variable is significant; when it is estimated with HEBD, the deficit measure is insignificant. As in the discussion of the complete period results, the finding that HEBD has not influenced the federal funds rate may be due more to the small size of the structural deficit vs. total credit demand than it is to the targeting procedures of the Federal Reserve.[21] Thus, the later period estimation results are

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[20]With respect to the non-debt terms, there are some interesting differences between the early period and the full period results, in particular for the money stock equation. The money stock continues to respond countercyclically to unemployment, but it also responds countercyclically to inflation in the early period. Also, lagged money terms are insignificant.

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[21]Even for the first three quarters of 1983, the last period for which HEBD is available, the structural deficit increases to only 10.4 percent of net credit market borrowing. Of course, the insignificance of HEBD could also be a result of other causes. For example, believers in currency substitution would argue that any increase in HEBD leading to increased real interest rates would also lead to foreign capital inflows that could drive interest rates back to approximately their original levels.

consistent with the Federal Reserve following a monetary aggregate target.

The federal funds rate equations estimated over the later period were similar to those for the early and the full periods. In contrast, the money stock equations were substantially different in the later period. The money stock equations chosen by Akiake's FPE and F-tests consistently imply that virtually all variables entered, with the possible exception of the federal funds rate and the inflation rate, are insignificant.

From the perspective of estimating a reaction function that "explains" much of the variation in the money stock, the 1971–84 results leave much to be desired. They are, however, consistent with two very different theories of Federal Reserve behavior. First, it is possible that over this period the goals of the Federal Reserve or the weights on those goals were changing frequently, perhaps due to shifts in money demand, deregulation or financial innovations. If true, it would be impossible to estimate a consistent relationship between goals and the money stock. In the extreme, the money stock after detrending would be a random walk. Alternately, the Federal Reserve, on average, may have followed a constant money growth rate rule. In this case, the money stock after detrending would also be a random walk. Either of these hypotheses would be consistent with a poorly performing short-run reaction function for the money stock.

SUMMARY AND CONCLUSIONS

This paper has examined whether federal debt growth has influenced alternate measures of monetary policy. It was demonstrated that a structural deficit would have very different implications than a cyclical deficit. A structural deficit in the static model presented here could lead to an increase in money growth and/or interest rates. In contrast, a cyclical deficit could be accompanied by a decrease in money growth and/or interest rates. Whether debt alters money growth or interest rates depends on the nature of the targeting strategy used by the Federal Reserve.

The results of a reaction function, developed and estimated over alternate intervals, suggest that prior to 1971 debt growth did lead to money growth but did not influence interest rates. Since then, debt growth has not altered money growth but may have been associated with interest rate changes. Net federal debt growth, which combines both structural and cyclical debt changes, is accompanied by a lower federal funds rate for the 1971–84 period. This result suggests that cyclical debt changes dominate structural in NFD's

effect on interest rates. In contrast, the high-employment budget deficit, a measure of structural debt changes only, has had no impact on the federal funds rate over any time period. This result may be due to HEBD's small size in comparison with total credit demands.

The results presented here are consistent with monetary policy being independent of federal deficits even though money market variables do apparently respond to those deficits. During the period when the Federal Reserve was targeting interest rates, the assumed policy measure, the federal funds rate, was unaffected by federal deficits. While the money stock does respond to deficits in the early time period, 1958–70, the money stock was not being used as a policy target in that interval. Conversely, in the later period, 1971–84, the Federal Reserve paid more attention to the money stock and less to interest rates. In that interval, the primary policy variable, the money stock, was again unaffected by federal deficits while those deficits may have had an impact on interest rates.[22]

REFERENCES

Abrams, Richard K., Richard Froyen and Roger N. Waud. "Monetary Policy Reaction Functions, Consistent Expectations, and The Burns Era," *Journal of Money, Credit and Banking* (February 1980), pp. 30–42.

Allen, Stuart D., and Michael D. Smith. "Government Borrowing and Monetary Accommodation," *Journal of Monetary Economics* (November 1983), pp. 605–16.

Barro, Robert J. "Unanticipated Money Growth and Unemployment in the United States," *American Economic Review* (March 1977), pp. 101–15.

Barth, James R., Robin Sickles and Philip Wiest. "Assessing the Impact of Varying Economic Conditions on Federal Reserve Behavior," *Journal of Macroeconomics* (Winter 1982), pp. 47–70.

Batten, Dallas S., and Daniel L. Thornton. "How Robust Are the Policy Conclusions of the St. Louis Equation?: Some Further Evidence," this *Review* (June/July 1984), pp. 26–32.

Darby, Michael R. "Some Pleasant Monetarist Arithmetic," Federal Reserve Bank of Minneapolis *Quarterly Review* (Spring 1984), pp. 15–20.

deLeeuw, Frank, and Thomas M. Holloway. "The High-Employment Budget: Revised Estimates and Automatic Inflation Effects," *Survey of Current Business* (April 1982), pp. 21–33.

DeRosa, Paul, and Gary H. Stern. "Monetary Control and the Federal Funds Rate," *Journal of Monetary Economics* (April 1977), pp. 217–30.

Dwyer, Gerald P., Jr. "Inflation and Government Deficits," *Economic Inquiry* (July 1982), pp. 315–29.

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[22]One hypothesis not tested here is that the Federal Reserve has shifted targets, say, from monetary aggregates to interest rates, in response to federal deficits. This change would represent another way in which debt growth could influence monetary policy.

Eisner, Robert, and Paul J. Pieper. "A New View of the Federal Debt and Budget Deficits," *American Economic Review* (March 1984), pp. 11–29.

Froyen, Richard T. "A Test of the Endogeneity of Monetary Policy," *Journal of Econometrics* (July 1974), pp. 175–88.

Hamburger, Michael J., and Burton Zwick. "Deficits, Money and Inflation," *Journal of Monetary Economics* (January 1981), pp. 141–50.

_____ . "Deficits, Money and Inflation: Reply," *Journal of Monetary Economics* (September 1982), pp. 279–83.

Havrilesky, Thomas, Robert H. Sapp and Robert L. Schweitzer. "Tests of the Federal Reserve's Reaction to the State of the Economy," *Social Science Quarterly* (March 1975), pp. 835–52.

Hoffman, Dennis L., Stuart A. Low and Hubert H. Reineberg. "Recent Evidence on the Relationship between Money Growth and Budget Deficits," *Journal of Macroeconomics* (Spring 1983), pp. 223–31.

Levy, Mickey D. "Factors Affecting Monetary Policy in an Era of Inflation," *Journal of Monetary Economics* (November 1981), pp. 351–73.

Lombra, Raymond E., and Herbert M. Kaufman. "The Money Supply Process: Identification, Stability, and Estimation," *Southern Economic Journal* (April 1984), pp. 1147–59.

Lombra, Raymond and Michael Moran. "Policy Advice and Policymaking at the Federal Reserve," in Karl Brunner and Allan H. Meltzer, eds., *Monetary Institutions and the Policy Process,* Carnegie-Rochester Conference Series on Public Policy (Autumn 1980), pp. 9–68.

Makin, John H. "Real Interest, Money Surprises, Anticipated Inflation and Fiscal Deficits," *Review of Economics and Statistics* (August 1983), pp. 374–84.

McMillin, W. Douglas, and Thomas R. Beard. "Deficits, Money and Inflation: Comment," *Journal of Monetary Economics* (September 1982), pp. 273–77.

_____ . "The Impact of Fiscal Policy on the Money Supply in the U.S.: Theory and Empirical Evidence," *Rivista Internazionale di Scienze Economiche e Commerciali* (1981), pp. 941–57.

_____ . "The Short Run Impact of Fiscal Policy on the Money Supply," *Southern Economic Journal* (July 1980), pp. 122–35.

Miller, Preston J., and Thomas J. Sargent. "A Reply to Darby," Federal Reserve Bank of Minneapolis *Quarterly Review* (Spring 1984), pp. 21–26.

Niskanen, William A. "Deficits, Government Spending, and Inflation: What is the Evidence?" *Journal of Monetary Economics* (August 1978), pp. 591–602.

Plosser, Charles I. "Government Financing Decisions and Asset Returns," *Journal of Monetary Economics* (May 1982), pp. 325–52.

Potts, Glenn T., and Dudley G. Luckett. "Policy Objectives of the Federal Reserve System," *Quarterly Journal of Economics* (August 1978), pp. 525–34.

Sargent, Thomas J., and Neil Wallace. "Some Unpleasant Monetarist Arithmetic," Federal Reserve Bank of Minneapolis *Quarterly Review* (Fall 1981), pp. 1–17.

Tatom, John A. "A Perspective on the Federal Deficit Problem," this *Review* (June/July 1984), pp. 5–17.

Thornton, Daniel L. "Monetizing the Debt," this *Review* (December 1984), pp. 30–43.

_____ . "The FOMC in 1982: De-Emphasizing M1," this *Review* (June/July 1983), pp. 26–35.

Wallich, Henry C., and Peter M. Keir. "The Role of Operating Guides in U.S. Monetary Policy: A Historical Review," *Federal Reserve Bulletin* (September 1979), pp. 679–90.