FEDERAL DEFICITS, MACROSTABILIZATION GOALS, AND FEDERAL RESERVE BEHAVIOR

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The effects of federal deficits on Federal Reserve behavior as proxied by changes in the growth rate of the monetary base are analyzed in this study. Multivariate Granger-causality tests are employed in the analysis. The deficit measure that is the focus of the analysis is the change in the real market value of privately held federal debt. The tests indicate that the deficit Granger-causes the monetary base. Additionally, concerns for financial market stability, real output, and exchange rate movements in the period of floating rates also affect Federal Reserve behavior.

I. INTRODUCTION

The impact of federal government deficits on the money supply has received increased attention in recent years. In part this heightened interest stems from the large federal deficits that began to emerge in the mid-1970s and the surge in the inflation rate during the decade of the 1970s. In addition to any direct effects on inflation, deficits may have an inflationary impact if rising deficits induce higher money growth. The available empirical evidence provides mixed estimates of the impact of these deficits on the money supply. Some studies suggest that deficits are monetized, at least to some degree, while others suggest no impact of the deficit on the money supply.[1]

The aim of this study is to analyze empirically the impact of federal deficits on the money supply. The approach taken in this paper is substantially different from that of previous analyses. The focus is upon a deficit measure that adjusts for the inflation tax on outstanding government bonds; multivariate Granger-causality tests are employed to determine whether Federal Reserve actions, as proxied by changes in the growth rate of the monetary base, are significantly influenced by federal deficits as well as by macrostabilization goals and financial market stability concerns. The one-sided distributed lag test suggested by Granger (1969) is employed. But, rather than employing a common lag length for all variables, an atheoretical statistical technique is used to determine the appropriate lag length for each

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1. The studies of Froyen (1974), Barro (1977; 1978), Niskanen (1978), McMillin-Beard (1980), McMillin (1981), Hamburger-Zwick (1981), Levy (1981), Dewald (1982), Barth, Sickles, and Weist (1982), Blinder (1982), and Allen and Smith (1983) suggest some monetization. The studies of Wood (1967), Friedlaender (1973), Gordon (1977), McMillin-Beard (1982), Dwyer (1982), and Joines (forthcoming) suggest nonaccommodation by the Federal Reserve.

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variable. The additional variables used in the tests are those typically employed in Federal Reserve reaction function estimates.[2]

A multivariate approach rather than a bivariate monetary base-federal deficit framework is employed in order to reduce the potential problems that omitted variables present for the Granger-causality tests. A bivariate analysis may lead to inappropriate conclusions about the causal relations between the monetary base and federal deficits if relevant variables are omitted from consideration.[3] Thus, in addition to providing evidence on the relation between federal deficits and the monetary base, the tests performed here provide evidence of whether or not the monetary base has responded to macrostabilization concerns such as fluctuations in real output or the inflation rate, as well as to financial market stability concerns.

Federal deficits may influence the money supply through several channels. Three of these channels can be examined within the context of a money supply function with a positive interest elasticity. One channel is suggested by the frequently advanced argument (see, for example, Francis (1974) and Buchanan and Wagner (1977)) that the sale of bonds to finance a deficit puts upward pressure on market interest rates, and that the Federal Reserve, because of an hypothesized overriding concern with stabilizing interest rates, counters this pressure by open market purchases. The money supply function is shifted out. In this view, the debt issued to finance the deficit is, at least to some extent, monetized.

This first channel is premised upon an overriding concern by the Federal Reserve with stabilizing interest rates. If the Federal Reserve has macrostabilization goals as well as a financial market stability goal, then there is a second channel and monetization of the debt issued to finance a deficit is no longer obvious. To see this, consider the simple example given in McMillin-Beard (1980). Assume that the Federal Reserve has concern for inflation as well as interest rate stabilization. Expansionary fiscal actions that increase the deficit will tend, at least in the short-run, to raise the inflation rate as well as the interest rate. If Federal Reserve concern for inflation is sufficiently stronger than its concern for stabilizing interest rates, the debt issued to finance the deficit will not be monetized. Instead, the money supply may actually decline (or its growth rate may drop). Thus consideration of macrostabilization goals along with an interest rate stabilization goal leaves one uncertain as to whether the Federal Reserve response to the deficit shifts the money supply function out or in.

Even if the Federal Reserve does not take actions that shift the money

2. Of the studies cited in footnote 1, only Dwyer (1982) uses causality tests to analyze the effects of deficits on Federal Reserve behavior. His analytic framework is quite different; his analysis is performed in the context of a vector autoregression with a common lag length for all variables. The use of the common lag length is discussed later in this paper.

3. The effects of omitted variables are discussed briefly in Sims (1972). For a more detailed treatment, see Lutkepohl (1982).

supply function, a deficit-finance induced increase in interest rates may alter the money supply through a third channel. Financial institutions will alter their holdings of excess and borrowed reserves and the public will rearrange its portfolio of assets in response to the higher interest rates. The money supply will increase as the higher interest rates lead to a movement along the money supply function. However, the magnitude of this effect may not be large because of the low estimated interest elasticity of the money supply function.[4]

A fourth link between federal budget actions and the money supply has been suggested by Barro (1977). Barro considers a model in which federal government expenditures are financed by a mix of taxes and money creation. The particular combination of taxes and money creation is designed by the government to minimize the total costs of raising revenue. For a given amount of tax collection capital (which is determined in part by the long-run or permanent level of government expenditure), an increase in current federal expenditures typically induces an increase in both taxes and the money supply. Barro's model suggests that temporary government spending rather than the deficit best captures the relation between federal budget actions and the money supply. This proposition is also tested.

The next section of the paper describes the data employed and the specification of the equations used in the multivariate Granger-causality tests. The results of the tests are presented and analyzed in section III. A summary and conclusions follow in section IV.

II. DATA DESCRIPTION AND TEST EQUATION SPECIFICATION

The growth rate of the monetary base is chosen as the monetary policy variable for several reasons. Presumably an aggregate like the monetary base is more appropriate than an aggregate like M1 to the Barro linkage where the government finances expenditures by a mixture of taxes and money creation. Furthermore, consideration of an aggregate such as the monetary base reduces problems when distinguishing between the first and second channels discussed above and the third channel. A finding that the federal deficit Granger-causes an aggregate like M1 may be explained by movement along a given money supply function. Since Federal Reserve actions dominate movements in the monetary base over the quarterly intervals examined here, a finding that deficits Granger-cause the monetary base is less likely to be the result of private sector response to the effects of the deficit and is more likely to reflect Federal Reserve reaction to the deficit. Finally, the recent reaction function studies of Froyen (1974), Barth, Sickles, and Wiest (1982), and Allen and Smith (1983) employed the monetary base as the Federal Reserve policy variable.

4. See, for example, Anderson-Rasche (1982).

The deficit measure that is the focus of most of the analysis in this paper is the change in the real market value of privately held federal debt, scaled by real potential GNP. This measure is employed since other commonly used deficit measures, for instance, funds raised in credit markets by the federal government, scaled by nominal potential GNP, or the national income accounts deficit, scaled by nominal potential GNP, do not adequately account for the effects of inflation on the federal budget—even though they are measures of the real deficit. In particular, the inflation tax on outstanding government bonds is not incorporated into these measures. Inflation tends to raise market interest rates and thereby to reduce the real market value of outstanding government debt. Thus, a transfer of wealth from bondholders to the government takes place and, it is argued, this wealth transfer should be counted as government revenue. The change in the real market value of government debt does incorporate this effect. For further discussion of the measurement of the deficit, see Siegel (1979), Dwyer (1982) and Eisner-Pieper (1984). Even though it is held that the change in the real market value of the government debt is the proper deficit measure, the sensitivity of the results to the measurement of the deficit is also checked. In particular, the two measures mentioned earlier in this paragraph were employed in the tests described below.

Since Barro's analysis suggests that temporary government spending is the preferred measure of the link between fiscal actions and the money supply, a temporary spending measure, considered alone and together with the deficit measure, was employed in the tests described below. This measure was constructed by regressing real federal expenditures on a constant, time, and one-period-lagged real federal expenditures. The residuals from this equation were then employed as a measure of temporary federal expenditures. The FPE procedure described below was employed to determine the optimal lag on real federal expenditures in this equation; it suggested the optimal lag was one period.

The macrostabilization goal variables and the financial market stability proxy variables are drawn from previous reaction function studies. A concise summary of these studies may be found in Barth, Sickles, and Wiest (1982). The three-month Treasury bill rate is chosen as a proxy for Federal Reserve concern for financial market stability. The inflation rate and the gap between real output (measured by real GNP) and real potential output (measured by real potential GNP), as a proportion of real potential output, are proxies for the macrostabilization goals of the Federal Reserve. Federal Reserve response to international variables is also tested. Following Abrams, Froyen, and Waud (1980), two variables are employed to test for a response of the monetary base to international events. The first—the balance of payments on current account—is assumed to have influenced monetary policy from the beginning of the sample to the beginning of the period of floating rates (March 1973). The second—the effective devaluation of dollar—is assumed to have influenced policy from the beginning of the float to the end of the sample.[5]

A variable (X) is said to Granger-cause another variable (Y) if the past values of X in conjunction with the past values of Y can be used to predict Y's future values more accurately than if just past values of Y are used. Several procedures have been suggested for empirically implementing the Granger-causality tests. These include the two-sided distributed lag test of Sims (1972), in which a variable is regressed on future as well as past values of another variable; the cross-correlation function method of Pierce-Haugh (1977); and the one-sided distributed lag test of Granger (1969). Based upon the recent Monte Carlo study of Geweke, Meese, and Dent (1983) which compares these three procedures, the one-sided distributed lag test of Granger is used. The test presumes the use of stationary data and, typically, some transformation of the data must be made in order to achieve stationarity. The specific transformations used in this study are discussed in the next section. In a multivariate context, the test is implemented in the following way. The variable of interest (the monetary base) is regressed on its own lagged values and the lagged values of the other variables. Typically, the same lag length is employed for all variables. F-tests are used to test for the presence of Granger-causal relations. For example, if an F-test of the joint significance of the coefficients on the lagged values of inflation suggests these coefficients are jointly significantly different from zero, then inflation is said to Granger-cause the monetary base. If the test indicates that the coefficients are not jointly significantly different from zero, then inflation is said to not Granger-cause the monetary base. Separate F-tests are performed for each variable included in the equation.

Using a common lag for all variables presents a potential problem in the one-sided distributed lag test. There is typically no *a priori* reason to believe

5. Data sources are: Citibase-nominal GNP, implicit GNP deflator, federal expenditures, federal purchases, national income accounts deficit, balance of payments on current account, weighted average exchange value of the U.S. dollar (March 1973 = 100), and three month Treasury bill rate. The monetary base adjusted for reserve requirement changes was obtained from the Federal Reserve Bank of St. Louis, as was real potential GNP. The change in the real market value of privately held federal debt was constructed from the series in Table 6 of Cox-Hirschorn (1983). The series in Table 6 was deflated by the implicit GNP deflator. Data for 1981 were provided to the author by Cox. Total funds raised in credit markets by the federal government was supplied by the Flow-of-Funds Division, Board of Governors of the Federal Reserve System. All data with the exceptions of the three-month Treasury bill rate, the weighted average exchange value of the U.S. dollar, and the stock of government debt are seasonally adjusted at the source.

Following Froyen (1974), the balance of payment surplus was set equal to zero. During the period of floating rates, the deficits in the balance of payments were also set equal to zero. The tests were also run with a series in which the balance of payments deficits were *not* set to zero in the period of floating rates. The results were unchanged, and only the results for the measure with the deficits set to zero in the floating rate period are reported in the text. The weighted average exchange value of the U.S. dollar took on non-zero values only during the period of floating rates.

that the same lag length is appropriate for all variables. If the lag length for one or more variables is under-specified, the coefficient estimates will be biased. In an attempt to avoid this problem, an alternative to the standard procedure outlined above is employed. The technique used here to specify the equation within which the Granger-causality tests are performed involves the use of Akiake's final prediction-error criterion to specify the lag length for all right-hand side variables. This procedure allows the lag for each right-hand side variable to differ and is described more fully later in this section. Once the equation is specified, F-tests are employed to test the joint significance of the distributed lag coefficients for each variable.

After transformation of the variables to achieve stationarity, the first step in the procedure described above is the determination of the own lag length for the monetary base. This is done by varying the lag in the autoregression $m_t = a_0 + a_1(L)m_t + e_t$ from 1 to n where m_t = monetary base transformed to be stationary, $a_1(L)$ is a distributed lag polynomial such that

$$(1) \qquad a_1(L) = \sum_{k=1}^{n} a_{1k}L^k,$$

L is the lag operator so that $L^k m_t = m_{t-k}$, n = highest order lag,[6] and e_t = zero mean white-noise error term. The final prediction error (FPE) is calculated for each autoregression and is defined for lag k, $k = 1, \ldots, n$ as

$$(2) \qquad FPE_{(k)} = (T + k + 1)/(T - k - 1) \cdot (SSR_{(k)}/T)$$

where T = number of observations used in estimating the autoregression, and SSR = sum of squared residuals. The lag length that minimizes the FPE is selected as the order of $a_1(L)$.

Hsiao (1981) points out that the FPE criterion is equivalent to using an F-test with a varying significance level. As Judge *et al.* (1982) note, an intuitive reason for using the FPE is that an increase in the lag length increases the first term but decreases the second term and these opposing forces are balanced when their product reaches a minimum. Thus, according to Hsiao (1981, p. 88), the FPE criterion is "... appealing because it balances the risk due to the bias when a lower order is selected and the risk due to the increase of variance when a higher order is selected."

Once the order of $a_1(L)$ is found, bivariate equations of the following type are estimated for each of the other variables under consideration:

$$(3) \qquad m_t = a_0 + a_1(L)m_t + a_2(L)X_t + e_t$$

where $a_2(L)$ is a distributed lag polynomial defined in a similar manner to $a_1(L)$, and X_t = other variables transformed to be stationary (considered one at a time in this step). $a_1(L)$ is fixed at its previously determined order (k), and the lags in $a_2(L)$ are varied over l, $l = 1, \ldots, n$. The FPEs for the resulting equations are defined for lag l, $l = 1, \ldots, n$ as

6. An n=10 was predetermined.

(4) $$FPE_{(k,l)} = (T + k + l + 1)/(T - k - l - 1) \cdot (SSR_{(k,l)}/T).$$

The lag length for X_t that yields that minimum FPE is selected as the lag order for that variable.

The next step is the estimation of trivariate equations involving the lagged valued of m and lagged values of two of the other variables under consideration. A problem emerges at this point since the specification of the equation within which the Granger-causality testing will be performed is not, in general, invariant to the order in which the variables are added to the equation. A mixture of practical considerations and a specific criterion is used to determine the order in which the variables are added to the equation. To reduce the cost of specifying the equation, the alternative deficit variables and the temporary spending variable are the last to be added to the equation. A particular criterion—the specific gravity criterion of Caines, Keng, and Sethi (1981)—is used to determine the order in which the macrostabilization and financial market stability goal variables are added to the equation. The specific gravity of m with respect to, for example, inflation, is defined as the reciprocal of the FPE in the bivariate m-inflation equation. The specific gravities of m with respect to the other variables are defined analogously. These variables are ranked in order of decreasing specific gravity. The variable with the highest specific gravity is added to the m equation with the lag order from the relevant bivariate equation.

Trivariate equations for the remaining variables are estimated, the FPEs are calculated, and the variables are ranked in order of their specific gravities. The variable with the highest gravity is added to the equation, and the procedure continues until all macrostabilization variables are added to the equation. At this point we have an equation that contains lagged values of m as well as lagged values of the other variables under consideration with the exception of the deficit and temporary spending variables. The FPE criterion is again used to specify the lag length for these variables. The end result is an equation with the non-deficit variables and with the deficit variable and the temporary spending variable. F-tests of the joint significance of the lagged values for each variable can now be performed within the context of this equation.

III. EMPIRICAL RESULTS

The results from the specification of the monetary base equation are presented in this section as are the results of the Granger-causality tests. The equation is estimated using quarterly data over the period 1961:1-1979:3. The start of the sample period marks the beginning of the "Keynesian" period in macrostabilization policy as defined by Buchanan-Wagner (1977). The end of the sample period reflects the October, 1979 change by the Federal Reserve from a federal funds-rate operating guide to a reserves-oriented operating guide. The stability of the equation when the sample includes data prior to the beginning of the "Keynesian" period and when the sample includes data after 1979:3 is examined later in the paper using familiar Chow tests.

Based upon the procedure described in the previous section, the following equation was specified and estimated using ordinary least squares:

$$\begin{aligned}(5)\qquad m_t &= a_0 + a_1^{4}(L)m_t + a_2^{1}(L)TB_t + a_3^{3}(L)GAP_t + a_4^{1}(L)P_t\\ &+ a_5^{8}(L)E_t + a_6^{1}(L)BP_t\\ &+ a_7^{1}(L)DEF_t + a_8^{1}(L)TS_t + e_t\end{aligned}$$

$R^2 = .40 \quad \mathrm{SE} = .0031$

where SE = standard error of the regression, $m_t = (1-L)\dot{MB}_t$, $TB_t = (1-L)\ln RTB_t$, $GAP_t = (1-L)[RY_t - RYP_t)/(RYP_t)]$, $P_t = (1-L)\dot{P}_t$, $BP_t = (1-L)(BOP_t/NYP_t)$, $E_t = (1-L)we_t$, $DEF_t = (1-L)(DRMV_t/RYP_t)$, $TS_t = (1-L)(TRS_t/RYP_t)$, L = lag operator, $\dot{MB}$ = growth rate of monetary base $((1-L)\ln MB)$, RTB = three-month Treasury bill rate, RY = real GNP, RYP = real potential GNP, $\dot{P}$ = inflation rate ((1−L)ln implicit GNP deflator (IPD)), BOP = balance-of-payments on current account, $we = (1-L)\ln WEXR$, $WEXR$ = weighted average exchange value of the U.S. dollar, $DRMV$ = change in the real market value of privately held federal debt, TRS = temporary real federal spending, and NYP = nominal potential GNP constructed by multiplying *IPD* times *RYP*. The first difference operator was applied to all series to transform them to stationary series. A regression of these transformed series on a constant and time yielded insignificant coefficients while similar regressions of the untransformed series indicated the presence of trend. The coefficient estimates have not been presented in order to conserve space but are available upon request from the author. Box-Pierce Q-statistics were computed from the residuals of this equation, and no evidence of serial correlation was found.

The results of the Granger-causality tests are presented in Table 1, part A. We note the hypothesis that the deficit measure does not Granger-cause the monetary base is rejected, while the hypothesis that the temporary spending measure does not Granger-cause the monetary base cannot be rejected. The results of the tests are somewhat mixed for the other variables. The hypothesis that the Treasury bill rate does not Granger-cause the monetary base is rejected, as are similar hypotheses for the real output gap variable and the weighted exchange rate variable. However, the hypothesis that inflation does not Granger-cause the monetary base cannot be rejected, and the same is true for the balance-of-payments variable.

The results in Table 1 thus suggest that the deficit Granger-causes the monetary base while the temporary federal spending variable does not. The latter result is not sensitive to the inclusion of the deficit measure together with the spending measure. When the deficit variable is omitted, temporary federal spending still does not Granger-cause the monetary base. Furthermore, when the temporary spending variable is omitted, the deficit is still found to Granger-cause the monetary base, and the Granger-causality impli-

TABLE 1
Multivariate Granger-Causality Tests
Sample Period: 1961:1–1979:3

	A. Multivariate Granger-Causality Tests Hypothesis	**F-Statistic**[a]
1.	The deficit does not Granger-cause the monetary base (MB).	8.11 (1, 54)*
2.	Temporary real federal spending does not Granger-cause MB.	0.30 (1, 54)
3.	The Treasury bill rate does not Granger-cause MB.	6.73 (1, 54)*
4.	The real output gap does not Granger-cause MB.	2.92 (3, 54)*
5.	Inflation does not Granger-cause MB.	2.31 (1, 54)
6.	The exchange rate does not Granger-cause MB.	2.12 (8, 54)*
7.	The balance-of-payments does not Granger-cause MB.	1.78 (1, 54)

	B. Coefficient Stability Tests Time Period	**F-Statistic**
1.	1961:1–1970:2 1970:3–1979:3	0.81 (21, 33)
2.	1956:1–1979:3	2.93 (20, 54)*
3.	1961:1–1981:4	2.20 (9, 54)*

a. An * indicates significance at the 5% level. The degrees of freedom for the *F*-tests are in parentheses beside the calculated *F*-statistic.

cations for the other variables are identical to those reported in Table 1. When the national income accounts deficit and funds raised in credit markets by the federal government are used in place of the change in the real market value of privately held federal debt, the deficit is still found to Granger-cause the monetary base. This result is thus not sensitive to how the deficit is measured. Details of the results for the alternative deficit measures and for the equation containing only temporary government spending have not been presented in order to conserve space, but are available upon request.

Finally, it was mentioned in the initial discussion of why the deficit might affect the monetary base that the monetary authority may respond to the deficit because of a concern for the effects of fiscal actions on inflation and unemployment, as well as because of a concern for the financial market effects of the fiscal actions. The drawbacks of using the deficit as an index of the thrust of fiscal policy are well-known. In a typical Keynesian model, the government purchases multiplier is greater than the tax multiplier, but using the deficit as an index of the thrust of fiscal policy constrains these multipliers to be the same. In a world in which the Ricardian equivalence hypothesis holds, the deficit has no impact upon aggregate demand since government debt is not net wealth. However, even in such a model, variations in real government purchases do affect aggregate demand. Based upon these considerations, real government purchases by itself and together with the deficit are considered in an equation that contains the macrostabilization and financial market stability variables described earlier. We find that real government purchases do not Granger-cause the monetary base either when purchases are considered alone or in conjunction with the deficit. These results are also available upon request.

As indicated earlier, the beginning of the sample period (1961:1) was chosen to coincide with the beginning of the "Keynesian" period in macro policy making, while the end of the sample period (1979:3) was chosen to reflect the October, 1979 switch by the Federal Reserve from a federal funds rate to a nonborrowed reserves operating target. The stability of equation (5) was evaluated using Chow tests within the sample period, and over periods that include data prior to the "Keynesian" period and that include data subsequent to 1979:3.[7] The sample 1961:1-1979:3 was first split into two equal parts with the first subperiod ending in 1970:2. Next, data for the period 1956:1-1960:4 were added to the sample, and equation (5) was estimated over the period 1956:1-1979:3. Finally, data for the period 1979:4-1981:4 were added to the basic sample and equation (5) was estimated over the period 1961:1-1981:4. The F-statistics for the tests of coefficient stability are presented in Table 1, part B. We see that the equation does not exhibit coefficient instability when the basic sample is split into two subperiods of equal numbers of observations. However, when the sample is extended to periods prior to 1961:1 or to periods after 1979:3, the equation does exhibit signs of coefficient instability. The same pattern of stability results emerges when temporary federal spending is omitted from the equation and when the alternative deficit measures are employed. One interpretation of these results is that policy regimes changed in 1961:1 and again in 1979:3, while essentially the same regime characterized the period from 1961:1-1979:3.[8]

7. There is some evidence from reaction function studies like that of Froyen (1974) that Federal Reserve behavior has varied across presidential regimes. Two eight-year regimes (Kennedy-Johnson and Nixon-Ford) are covered by the sample as is part of a third regime (Carter). The number of parameters to be estimated and the fact that the portion of the Carter regime covered by the sample does not contain enough observations to estimate equation (1) prevents the use of a standard Chow test to test for stability across regimes. Furthermore, the number of parameters to be estimated prevents the use of interaction dummy variables for different presidential regimes. However, several crude tests that are suggestive of stability across presidential regimes were employed. The first test checks for intercept shifts by including 0, 1 dummy variables for the Nixon-Ford and Carter regimes. The coefficients on these dummy variables were not significant. The second set of tests employs the Chow test for the case where one subset of the sample does not contain enough observations to estimate the parameters of the equation. The sample was first divided into two subsets—one comprising the Kennedy-Johnson and Nixon-Ford regimes and the second comprising the Carter regime. The calculated F-statistic was 1.21 while the critical F-statistic for 11,43 degrees of freedom is approximately 2.01. The sample was again divided into two subsets—one comprising the Kennedy-Johnson regime and the second comprising the Nixon-Ford and Carter regimes. The calculated F-statistic was 0.92 while the critical F-statistic for 32,22 degrees of freedom is approximately 1.97. These crude tests are thus suggestive of stability across presidential regimes.

8. Given the actual size of federal deficits since 1979, the response of monetary base growth to deficits since 1979:3 is of considerable interest. However, the limited number of observations available after 1979:3 prevents a respecification of the equation using quarterly data and the FPE criterion at this time.

IV. CONCLUSION

This study analyzes empirically the effects of federal deficits on Federal Reserve behavior as proxied by changes in the growth rate of the monetary base. Multivariate Granger-causality tests are employed in the analysis. The deficit measure that is the focus of the discussion in the paper is the change in the real market value of privately held federal debt. Funds raised in credit markets by the federal government and the national income accounts deficit are also considered. A variable based upon Barro's argument that temporary federal spending is financed in part by money creation is also considered, as is the proposition that real federal purchases as well as the deficit affect the behavior of the Federal Reserve. In addition to the deficit measures, proxies for Federal Reserve concern for inflation, real output, financial market stability, and international variables are used in the multivariate tests. Quarterly data for the period 1961:1-1979:3 are employed in the tests. The beginning of the sample is chosen to coincide with Buchanan-Wagner's (1977) definition of the start of the "Keynesian" period in macro policy making; the end of the sample coincides with the Federal Reserve's October, 1979 switch from a federal funds rate operating guide to a reserves-oriented guide.

The multivariate Granger-causality tests suggest that the deficit—regardless of how it is measured—Granger-causes the monetary base. Temporary federal spending is not found to Granger-cause the monetary base, contrary to Barro's argument. Furthermore, no evidence of Granger-causality from real federal purchases of goods and services to the monetary base is found. The multivariate Granger-causality tests also suggest that concerns for financial market stability and real output affect Federal Reserve behavior. However, it does not appear that the balance-of-payments on current accounts has significantly influenced Federal Reserve behavior, although it appears that the effective dollar devaluation influenced Federal Reserve behavior in the period of floating exchange rates.

Finally, tests for stability of the coefficients in the equations used in the multivariate Granger-causality tests suggest that no shift occurred within the sample period. However, when data prior to 1961 are added to the sample, coefficient instability is indicated. Likewise, when data subsequent to 1979:3 are added to the sample, coefficient instability is again indicated. That monetary policy regime changes occurred in 1961:1 and again in 1979:4 is an interpretation of these results.

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