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EXAMINING THE PROPOSITION THAT
FEDERAL BUDGET DEFICITS MATTER

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While politicians generally express much concern over large and persistent federal budget deficits, economists generally do not. This difference of views was very evident, for example, in the recent congressional debate over the proposed balanced budget amendment to the U.S. Constitution. Even though economists commonly counseled against the amendment, the Senate passed it anyway.^{1/}

Elected federal officials have valid political reasons to worry about deficits. One reason is that, according to opinion polls, voters worry about them. But another reason is that persistent deficits result in an escalation of net interest expense on the debt. The need to service the burgeoning debt then limits future policy options.^{2/}

Contrary to what many economists seem to think, there are also valid economic reasons to worry about deficits; large and persistent federal budget deficits do matter. The purpose of this paper is to defend that proposition. I develop my argument by confronting five basic questions asked of any economic proposition:

- . What does the proposition really claim?
- . What features should a theory have in order to address the validity of the proposition?
- . What are the positive economic implications of an acceptable theory?
- . What are its normative implications?
- . How well do the implications of the theory agree with actual experience?

Differences in economists' opinions on the deficits matter proposition can be reduced to differences in answers to these questions. While this paper focuses on my answers, the discussion expands beyond that focus where differences of opinion seem to be sharpest.

A General Model of Deficits

To begin, I posit a general model^{3/} which can serve as a frame of reference for the basic questions.

The state of the economy at time t , X_t , is described by the rate of real output, Y_t ; the aggregate price level, P_t ; and the nominal interest rate on one-period bonds, R_t :

$$X_t \equiv \begin{pmatrix} Y_t \\ P_t \\ R_t \end{pmatrix}. \quad (1)$$

The state of the economy depends on people's forecasts of two federal government policies: budget policy, which is identified by a path of total outside federal debt, $\langle D_t, D_{t+1}, \dots \rangle$; and monetary policy, which is identified by a path of outside money, the value of D purchased by the monetary authority, $\langle M_t, M_{t+1}, \dots \rangle$. We define the policy vector as

$$Z_t \equiv \begin{pmatrix} D_t \\ M_t \end{pmatrix}. \quad (2)$$

The policy rule is specified as

$$Z_t = a + bt + c(L)X_{t-1} + d(L)Z_{t-1} + \epsilon_t \quad (3)$$

where a, b, c, and d are coefficient matrices; ϵ is a white-noise stochastic process; and L is the lag operator. In longhand, we have

$$\begin{aligned}
 D_t = & a_1 + b_1 t + \sum_{j=1}^{\infty} c_{11}(j) Y_{t-j} + \sum_{j=1}^{\infty} c_{12}(j) P_{t-j} \\
 & + \sum_{j=1}^{\infty} c_{13}(j) R_{t-j} + \sum_{j=1}^{\infty} d_{11}(j) D_{t-j} \\
 & + \sum_{j=1}^{\infty} d_{12}(j) M_{t-j} + \epsilon_{1t}
 \end{aligned} \tag{3a}$$

$$\begin{aligned}
 M_t = & a_2 + b_2 t + \sum_{j=1}^{\infty} c_{21}(j) Y_{t-j} + \sum_{j=1}^{\infty} c_{22}(j) P_{t-j} \\
 & + \sum_{j=1}^{\infty} c_{23}(j) R_{t-j} + \sum_{j=1}^{\infty} d_{21}(j) D_{t-j} \\
 & + \sum_{j=1}^{\infty} d_{22}(j) M_{t-j} + \epsilon_{2t}.
 \end{aligned} \tag{3b}$$

It is assumed that the economic process can be written as

$$X_t = f + gt + h(L)X_{t-1} + i(L)Z_{t-1} + k(L^{-1})\bar{Z}_t + \mu_t \tag{4}$$

where f, g, h, i, and k are coefficient matrices; μ is a white-noise process which may be contemporaneously correlated with ϵ ; \bar{Z}_t is individuals' forecast of Z_t conditional on information at time t, which is assumed to consist of all lagged values of all variables; and $L^{-j}\bar{Z}_t \equiv \bar{Z}_{t+j}$.

The economic process (4) builds in the implication from standard microeconomic theory that individuals' decisions depend on their forecasts of policies. It is assumed here that those forecasts are ra-

tional expectations subject to (3) and (4); that is, $\bar{Z}_{t+j} \equiv E_t Z_{t+j}$. In longhand, the system can be written

$$\begin{aligned}
 Y_t = f_1 + g_1 t + & \sum_{j=1}^{\infty} h_{11}(j) Y_{t-j} + \sum_{j=1}^{\infty} h_{12}(j) P_{t-j} & (4a) \\
 & + \sum_{j=1}^{\infty} h_{13}(j) R_{t-j} + \sum_{j=1}^{\infty} i_{11}(j) D_{t-j} \\
 & + \sum_{j=1}^{\infty} i_{12}(j) M_{t-j} + \sum_{j=0}^{\infty} k_{11}(j) E_t D_{t+j} \\
 & + \sum_{j=0}^{\infty} k_{12}(j) E_t M_{t+j} + \mu_{1t}
 \end{aligned}$$

$$\begin{aligned}
 P_t = f_2 + g_2 t + & \sum_{j=1}^{\infty} h_{21}(j) Y_{t-j} + \sum_{j=1}^{\infty} h_{22}(j) P_{t-j} & (4b) \\
 & + \sum_{j=1}^{\infty} h_{23}(j) R_{t-j} + \sum_{j=1}^{\infty} i_{21}(j) D_{t-j} \\
 & + \sum_{j=1}^{\infty} i_{22}(j) M_{t-j} + \sum_{j=0}^{\infty} k_{21}(j) E_t D_{t+j} \\
 & + \sum_{j=0}^{\infty} k_{22}(j) E_t M_{t+j} + \mu_{2t}
 \end{aligned}$$

$$\begin{aligned}
 R_t = f_3 + g_3 t + & \sum_{j=1}^{\infty} h_{31}(j) Y_{t-j} + \sum_{j=1}^{\infty} h_{32}(j) P_{t-j} & (4c) \\
 & + \sum_{j=1}^{\infty} h_{33}(j) R_{t-j} + \sum_{j=1}^{\infty} i_{31}(j) D_{t-j} \\
 & + \sum_{j=1}^{\infty} i_{32}(j) M_{t-j} + \sum_{j=0}^{\infty} k_{31}(j) E_t D_{t+j} \\
 & + \sum_{j=0}^{\infty} k_{32}(j) E_t M_{t+j} + \mu_{3t}
 \end{aligned}$$

The economic process (4) is not in estimable form, since it includes expectations terms. Those terms are functions of lagged values of all variables and are determined by (3) and (4). Replacing the expectations terms with these functions yields

$$X_t = \alpha + \beta t + \zeta(L)X_{t-1} + \delta(L)Z_{t-1} + \mu_t \quad (5)$$

where α , β , ζ , and δ are coefficient matrices of dimensions 3×1 , 3×1 , 3×3 , and 3×2 , respectively. [In longhand, the system is like equations 4(a)-(c), with $\alpha = f$, $\beta = g$, $\zeta = h$, $\delta = i$, and $0 = k$.]

The Deficits Matter Proposition

The questions raised in this section relate to the forms of restrictions which theory places on the policy rule (3) and the economic process (4) and to some preliminary statistical tests of the restrictions.

What Does Deficits Matter Mean?

The proposition that deficits matter means that the economic process is not invariant to a change in the deficit policy rule. In terms of our model, the proposition is that the coefficients α , β , ζ , and δ of equation (5) are not invariant to a change in the coefficients a_1 , b_1 , c_1 , and d_1 of equation (3a).

Examination of the system reveals two necessary conditions for this proposition to be true. One is that people care about future deficits; that is, not all $k_{1j} = 0$. The other is that people's forecasts of deficits are not merely adaptive; they incorporate information about the policy rule (3a).

Economists who are skeptical about deficits mattering might ask why people should care about future deficits. A response is that future deficits are properly viewed as shorthand for future federal tax and expenditure policies, and these policies affect individual budget sets. These skeptics might rebut that, if all feasible deficit policies imply that the present value of real government expenditures equals the present value of real tax receipts, then deficits per se have no independent effect on the economy. That is, if deficits shift taxes over time and leave the present value of taxes unchanged, then a change in the pattern of deficits need not change individuals' budget sets (Barro 1974). If these skeptics are right, then deficits matter only if people suffer from wealth illusion (Barth and Morrell 1982; Seater 1982). A response to this line of reasoning is that equality between present values of expenditures and tax receipts need not be an equilibrium condition in models of valued fiat money and debt (Sargent 1982; Wallace 1980). An ongoing deficit policy is therefore feasible. Since in these models the government can collect seignorage on its money and bonds, a higher deficit today need not imply a higher surplus in the future. When the government's deficit policy can affect the present value of its privately held real debt, then that policy certainly affects individual budget sets.

Examination of the system also reveals a fundamental misinterpretation of the deficits matter proposition. Contrary to what many people seem to think, this proposition does not refer to the relationships between realized deficits and other economic variables. A regres-

sion of X on D , for example, has little to say about the proposition. Even if deficit policies matter, the true coefficients in δ_1 of equation (5) can be anything. If a single deficit policy is in effect over the sample period, then the true δ_1 will be composed of complicated expressions in the coefficients of both equations (3) and (4). If more than one deficit policy is in effect over the sample period, the true δ_1 will have different values under different policies, so that estimates of δ_1 will confound the effects of deficits under given policies with the effects of different deficit policies. For the same reasons, the dynamic responses of the system to a deficit impulse have little to say about the proposition. Determining how the system of equations (3) and (5) evolves given a drawing of ϵ_{1t} requires the assumption that the coefficients in equations (3) and (5) remain invariant.

It should be emphasized that theories which indicate deficits matter relate to very simple economies and very simple policy experiments. The experiments consist of changing only a_1 or b_1 in the policy rule (3a), assuming the policies are immediately known and understood-- E_t is conditioned on the new policy--and examining the changes in steady-state outcomes, $E_t[\Delta X_{t+n}]$ as $n \rightarrow \infty$. The theories provide information on k_1 , and the contention is that this knowledge often permits the determination of the signs of changes in steady-state outcomes.

What Features Must a Theory Have to Determine Whether Deficits Matter?

An acceptable theory of deficit policies must be dynamic, explicitly micro-based, and capable of explaining valued fiat money and debt. These three features are minimum requirements.

Dynamic

The theory must be dynamic, because the economic consequences of a given deficit depend on the intended means of servicing the resulting debt, and debt servicing is a dynamic concept. The government can service its debt in essentially four ways: by applying the return on capital spending financed by the debt issue, by raising taxes, by printing money, and by issuing new bonds. In general, these different ways of servicing debt imply different streams of money and debt over time [different policy rules (3a) and (3b)] and, thus, different economic effects [different (4)].

The government's first two options imply that the present value of additional real expenditures is matched by the present value of additional receipts. However, since these options also imply different equilibrium paths for Y , P , and R for a given increase in the deficit, they must imply different deficit policy rules (3a).

In the case of spending on capital account, the government debt is backed by the return on investment, just as private debt is. If the government investment earns the market rate of return, the investment and debt issue need have no effect on equilibrium output, Y ; prices, P ; or interest rates, R (Wallace 1981).

In the case of spending on current account, the government debt is backed by higher taxes in the future. Although the debt does not change the present value of taxes, it does change their distribution over time. The change in distribution of taxes may or may not have an effect on the economy [on (4)], depending on assumptions about individual utility functions and markets (which determine k_1).^{4/} Aside from this consideration, an increase in the present value of government current expenditures matched by an increase in the present value of taxes will tend to drive out some private capital investment and thereby raise the real rate of return on capital. In general, output and prices will also change.

Any combination of the other two options, money creation and new bond issue, need not imply equality between the present values of expenditures and receipts (Miller 1982b; Sargent 1982). The path of nominal debt (3a) will be higher under either of these options or some combination of the two than it will be under either of the first two options. Even if money creation alone is used to produce the same real debt path as could be achieved by explicit taxation, the policy rules (3a) and (3b) are very different under these two options and can be expected to have different economic effects. Intuitively, that is because the incidences of the inflation tax and explicit taxes generally are very different.

Micro-based

An acceptable theory of deficit policies also must be explicitly micro-based. There are three reasons for this. First, only

a theory of individual optimizing behavior can solve the problem of the noninvariance of the economic process (5) with respect to a change in policy rules (3). It does this in our model by allowing statistical identification of the coefficients in k .

Second, a micro-based theory is necessary to investigate the existence of equilibria under different deficit policies. Because the existence of equilibria with valued fiat money tends to be tenuous, this investigation is very important (Wallace 1980). No equilibrium with valued fiat money exists under a given deficit policy, for example, when the maximal taxation of real money and bond holdings does not permit budget balance in a real sense. That is, no equilibrium exists when the inflation tax applied to real money holdings and the depreciation in bond values applied to real bond holdings do not provide the government with enough resources to finance its real expenditures net of real explicit taxes. Since the inflation and depreciation tax bases are the private demands for real fiat money and bonds, taxing at too high a rate easily can drive tax revenue to zero by reducing the asset demands to zero.

Third, a micro-based theory is required to examine the welfare effects of alternative deficit policies. Deficit policies are properly subjects of public finance theory. Relevant questions concern the relative efficiency and incidence of alternative inflation and depreciation taxes to finance given deficits. The desirability of alternative tax policies generally cannot be evaluated by examining only their effects on aggregate economic variables.

Able to Explain Valued Fiat Debt

Finally, an acceptable theory of deficit policies must explain valued fiat debt, both interest-bearing and noninterest-bearing. An ongoing deficit policy, one for which the present value of taxes is less than the present value of expenditures in real terms, is possible only if fiat debt has value. And different explanations for why the debt has value generally imply different effects of deficit policies (3a) on the economy (4).

A crucial issue in this area is why valued fiat money and bonds coexist. Fiat bonds are promises to pay sums of fiat money at specific dates in the future. Since bonds have value for every state of the world in which money has value and since in these states bonds pay a certain, positive rate of return over the investment period while money does not, why do people hold both money and bonds? (I first saw this question posed in Wallace 1979.) The answer one gives to this question can have very different implications about the effects of deficit policies on the economy.

To see why that is so, suppose that money and bonds are issued in the same denominations and that the government in no way restricts or regulates the use of either instrument. The two then will become perfect substitutes, and arbitrage will guarantee that they will both be held only if they pay the same rate of return. If an n-period bond pays a positive interest rate while money doesn't, for instance, a trader can profit by breaking the bond into n one-period bonds, each paying a positive rate of return. The one-period bonds then will dominate money.

If money and bonds are perfect substitutes, it follows that monetary policy is irrelevant ($k_2 = 0$) and deficits are directly inflationary. That is because deficits determine the growth of total debt, while monetary policy determines the distribution of debt between two perfect substitutes.

In the real world, however, money and bonds are both held and their rates of return differ. Two explanations have been offered for this fact. One is that imperfect substitutability is due to real transaction costs (Bryant and Wallace 1979). According to this explanation, bonds are issued in large denominations, and real resources are absorbed when the private sector breaks bonds down into smaller denominations. One implication of this explanation is that the interest rate on bonds is a real rate and reflects the real cost of breaking down large-denomination bonds. Another implication is that bond financing is inefficient. Resources could be preserved if all deficit financing were done by money creation. Deficits always would be inflationary but would be less so if the debt were monetized.

The other explanation for the imperfect substitutability of money and bonds--the one I adopt here--is that the government has imposed restrictions on the use of bonds to reduce their liquidity (Bryant and Wallace 1980; Miller 1982a). Banks are prohibited, for example, from buying government bonds and issuing bearer notes backed by the bonds. These restrictions result in money circulating as a medium of exchange, while bonds compete with private capital as a store of value. A rationale for the restrictions is that they allow the govern-

ment to finance a wider range of deficit paths and to finance given deficits more efficiently. By providing two distinct debt instruments paying different returns, the restrictions allow the government to tax-discriminate in financing deficits.

This second explanation for the imperfect substitutability of money and bonds can generate some common monetarist propositions: prices proportional to money, a Fisher effect on interest rates, and expansiveness of open market purchases (Miller 1982a). Unlike common monetarist doctrine, however, this explanation implies deficit policy (3a) and monetary policy (3b) must be coordinated [that is, there are restrictions across the coefficients of (3a) and (3b)].

What Are the Positive Economic Implications of This Restrictions Theory?

Theory which assumes government restrictions on bonds implies that the economic effects of alternative deficit policies come about by changes in inflation and real interest rates.

Some economists seem to argue that when bonds are close substitutes for capital, deficits need not be inflationary. Here I argue that, when the close substitution is due to government restrictions on the liquidity of bonds, deficits still can lead to more inflation in three ways: monetary accommodation, crowding out, and private monetization of government debt.

Monetarists commonly acknowledge that deficits lead to more inflation when the Federal Reserve accommodates by purchasing some of the debt. They tend to view the Fed's accommodation either as a lack of resolve or as shortsightedness (Friedman 1981a; Hein 1981; Weintraub 1981). Theory, however, suggests that the Fed may have no choice.

Again, a key implication of theories of deficits with restrictions on bonds is that fiscal and monetary policies must be coordinated (Sargent and Wallace 1981; Miller 1982a, b). If the allocation of goods in the economy is efficient initially, it is not feasible to finance a larger deficit--even temporarily--by bond issue alone. In such a situation, an increase in bonds without an increase in money will cause real interest payments on bonds to grow without limit and will force the government into insolvency. Monetary accommodation, then, is necessary at some point to prevent the insolvency.

This theoretical result has an intuitive interpretation. If the Federal Reserve sticks to a predetermined path of money, then the federal government is denied the option of creating money to finance deficits above some limit. Additional debt issue becomes like that of state and local governments: it must be backed by higher revenue in the future. Trying to service the debt by issuing new debt only causes the interest on the debt and, thus, total debt to snowball.

Crowding out is another way that deficits lead to more inflation. Different degrees of monetary accommodation are feasible for a given increase in deficits. Less monetary accommodation requires more bonds to be sold on the open market to private investors, and in general this drives more private capital out of the market. That is because bonds compete with private capital in individual portfolios. When there are decreasing returns to capital, the substitution of government current expenditures for private capital expenditures raises the rate of real interest and lowers the rate of real economic growth (Friedman

1981b; Miller 1982c). With a given path of money, this results in a higher price path.

Finally, deficits can lead to more inflation by encouraging individuals to circumvent the restrictions on bonds and so, in effect, to privately monetize government debt. A plausible explanation of how this happens is the following. Suppose the restrictions can be broken down in successive steps at only successively higher costs. The profit from breaking down the restrictions is the arbitrage revenue less these costs. The arbitrage revenue is the income which can be earned by substituting bond holdings for money holdings, for example, private notes backed by government bonds for government fiat money. This revenue then is related directly to the difference in returns on money and bonds: the nominal interest rate. So a policy of higher deficits raises interest rates, and that causes the private sector to seek ways to circumvent the restrictions on bonds. This makes bonds more liquid by making them closer substitutes for money. Their greater liquidity implies more inflation for given deficits and money growth.

Casual observation suggests that this third way deficits lead to inflation is more than a theoretical possibility. In recent years in the United States there have developed demand deposit accounts at money market mutual funds which are backed by Treasury securities and deep-discount insured bank certificates of deposit that are backed by Treasury securities, issued in denominations of as little as \$250, and assured of purchase by a broker (Sloane 1982). In Brazil, which has run high deficits for years, the average turnover on government debt is now less than three days (Sargent 1982).

The effects of deficit financing on real interest rates depend on the magnitude of crowding out and the curvature of the aggregate production function. The higher is the inflation tax associated with a given deficit policy, the less is the need to raise real revenue through bond issue and the less is the crowding out of private capital. The increase in real interest rates which results from a given amount of crowding out, meanwhile, depends on how much the marginal productivity of capital rises as the capital stock is reduced.

What Does This Theory Suggest About How Policies Should Be Coordinated?

What theory suggests about how monetary and fiscal policies should be coordinated depends on both political and economic considerations. The political consideration concerns the nature of the policy game being played by the Fed, on the one hand, and the Treasury and Congress, on the other. If the game is cooperative, then the result that monetary and fiscal policies must be coordinated obviously suggests that some accommodation is desirable. In such a game, if the monetary and fiscal policy authorities jointly decide to raise the path of deficits, for example, then they should also decide to raise the path of money to some degree.

If the policy game is not cooperative, however, then the political consideration on the desirability of accommodation depends on which of the players has the last move. If budget policy is firmly set, so that the Fed always has the last move, then desirability is irrelevant; the Fed has no choice but to accommodate. If, in contrast, budget policy is not firmly set, then a nonaccommodative monetary policy may

make sense. The Fed can then control the size of deficits which can be financed by placing an unconditional limit on the amount of bonds it will purchase (Miller 1982b).

The economic consideration for policy coordination has to do with the optimal tax structure. Inflation is a distorting tax, as are all the taxes in the Treasury's arsenal. Generally, the optimal tax structure for a given level of expenditures spreads the burden over many taxes. If the Fed attempts to minimize the inflation tax for a given deficit policy, too little of the inflation tax may be used. When there are decreasing returns to capital in production, for instance, the minimal inflation rate which allows a given deficit stream to be financed could result in an overaccumulation of capital. Welfare for all could be improved by increasing inflation, reducing capital accumulation, and thereby increasing the rate of return on capital (Miller 1982c).

What Does U.S. Experience Suggest About the Effects of Deficit Policies?

Macroeconometric studies of the United States generally find that federal budget deficits hurt the economy little, if at all. Large macroeconometric models suggest, in fact, that policies which permanently raise budget deficits, policies such as a reduction in tax rates or a liberalization of eligibility rules for transfer payments, actually raise the path of real output while having only slight effects on inflation and interest rates (Miller and Rolnick 1980; U.S., Congress, CBO 1982b, pp. 79-84). The effect on inflation comes entirely from a movement along a (flat) Phillips curve; the effect on interest rates re-

flects an increased demand for money stemming from a higher level of nominal income. Vector autoregressive models estimated over U.S. post-war data generally suggest weak relationships between deficits and major economic indicators (Miller 1982d), as do studies which estimate those relationships individually (Hein 1981; Perry 1978; Weintraub 1981). Altogether, these findings seem so overwhelming that Beryl Sprinkel, Under Secretary of the Treasury for Monetary Affairs, has claimed that he knows of no evidence that deficits matter for either inflation or interest rates.^{5/}

The evidence, however, is not as overwhelming as it first appears. Whether deficits matter in the sense of this paper cannot be determined by standard macroeconometric studies, because those studies do not distinguish between a change in deficits and a change in deficit policies. Those studies attempt to estimate δ_1 in equation (5) under the assumption that equation (3) is fixed over the sample period. In order for their estimation techniques to be valid, they must assume that (5) is stationary, and according to the model [equations (3)-(5)], that assumption is itself valid only if (3) is unchanged.

Studies done in the standard way thus offer very little evidence about whether deficit policies matter. If the stationarity assumption is valid, then they offer no evidence about the effects of a change in deficit policies. If the assumption is not valid, then neither are the estimates.

An acceptable attempt to determine the effects of deficit policies can be divided into two parts. The first is to test for a

change in policies (3) and see whether or not the relationships in (5) change. The second is to quantify how much these relationships change. The first part is decidedly easier than the second.

Testing for Changes

I approach the first part of the task by estimating a vector autoregression (VAR) [a version of (5)], testing for a break in the budget policy rule (3a), and then reestimating the VAR separately over each subperiod beginning and ending with the break in policy (Miller 1982d). I qualitatively assess the significance of the differences between the two subperiod models by comparing impulse response functions, decompositions of variance, within-sample fits, and out-of-sample predictions conditioned on identical information. By these measures, the estimated relationships among the economic variables in (5) are dramatically different under the different budget policies (3a).

The VARs contain five quarterly time series: real GNP (RGNP), GNP deflator (GNPD), 90-day Treasury bill rate (RTB), bank reserves (TR), and federal debt (DEBT). The measure of bank reserves is the St. Louis Federal Reserve Bank's total reserves, adjusted for seasonal factors and changes in reserve requirements. It is intended as a measure of outside money.^{6/} The measure of federal debt is constructed by adding the accumulated, quarterly NIA deficit (not annualized) to the total public debt net of government account holdings in 1948. It is intended as a measure of outside federal debt. In the regressions, all series except the bill rate are logged.

This limited set of variables is intended to be the smallest system able to capture major channels of policy influence: monetary and fiscal policies together determine the inflation rate and the interest rate, which in turn affect real output by their impact on the rate of investment. Monetary and fiscal policies are represented as feedback rules which determine the current levels of bank reserves and federal debt, respectively, as functions of lagged values of all the variables in the system.

Each variable in the system is regressed on a constant and on m lags of all five variables. Thus, the system [a merging of equations (3) and (5)] can be written as

$$X_t = C + \sum_{i=1}^m A_i X_{t-i} + \mu_t \quad (6)$$

where

$$X \equiv \begin{pmatrix} \ln (\text{RGNP}) \\ \ln (\text{GNPD}) \\ \text{RTB} \\ \ln (\text{DEBT}) \\ \ln (\text{TR}) \end{pmatrix} \quad (7)$$

$$\mu \equiv \begin{pmatrix} \mu_1 \\ \cdot \\ \cdot \\ \cdot \\ \mu_5 \end{pmatrix} \quad (8)$$

and C and A_i are 5×1 and 5×5 matrices of coefficients, respectively, and $m = \text{lag length}$. The coefficients in the matrices C and A_i are estimated by OLS, and $E\mu\mu' = \Sigma$ is estimated by the variance-covariance matrix of residuals.

In the test for a break in the budget policy rule, the entire postwar period is divided into two subperiods: from 1948:1 to 1966:4 and from 1967:1 to 1981:4. The test statistic is distributed as $F(n,k)$, where n is the number of regressors and k is the number of degrees of freedom in the subperiod regressions (the number of observations minus $2n$). The marginal significance level indicates the probability that the residuals from the subperiod regressions were drawn from the same distribution.

Table 1 reports the marginal significance levels (to four significant digits) for the DEBT equation in the VARs for lag lengths $m = 1$ through 8. For all lag lengths except 8, structural stability can be rejected at a 95 percent confidence level.

TABLE 1 about here

The next two tables illustrate some of the more dramatic differences in the VARs estimated over different time periods. The VARs have lag length $m = 3$. The model estimated over the full postwar period (1948:1-1981:4) is denoted VAR(F); the model estimated over the first subperiod (1948:1-1966:4) is denoted VAR(I); and the model estimated over the second subperiod (1967:1-1981:4) is denoted VAR(II).

Table 2 reports part of the decomposition of variance for the GNP deflator according to the three different models. The part is the proportion of the standard error of forecast in the deflator which is attributable to innovations in DEBT and TR. According to the decomposi-

tions of variance, monetary policy is less important in explaining movements in inflation when each subperiod is viewed separately than when the data are pooled. Fiscal policy is more important in explaining inflation in the second subperiod than in the first.

TABLE 2 about here

Table 3 shows the deterministic forecasts of the VARs for the eight-quarter horizon beginning with 1982:1. The forecasts were made by using the estimated coefficients of each model with actual data for 1981:2-1981:4.

The differences among the models in predicting NIA debt and real GNP are striking. Comparison of the debt forecasts suggests that the current level of debt is much higher than would have been predicted based on the experience through 1966. A similar, though not quite as strong, statement can be made about the forecasts of total reserves. Thus, VAR(I) interprets recent policy as being very expansionary. Since VAR(I) also implies that an innovation in policy variables of given magnitude has an impact on real GNP greater than that in either VAR(F) or VAR(II), it predicts a much higher path of real GNP than does either of those models.

TABLE 3 about here

Measuring the Changes

The second part of the empirical task, quantifying the effects of different deficit policies, is difficult. There seem to be two valid ways to approach it. One is to estimate a structural model. However, structural here means that the model must be constructed from an explicit theory of individual behavior and must include estimation of parameters in individual objective functions. That is because, as Lucas and Sargent (1979) have so convincingly argued, neither aggregate nor individual excess demand functions can be expected to remain invariant to a change in policies which impinge on individual budget constraints. The econometric challenge of this approach is to identify the parameters of individual objective functions and budget constraints and then determine analytically how the demand functions change when policies change.^{7/}

The other valid approach to quantification is to directly examine the effects of different deficit policies that have actually been used. The challenge here is to identify breaks in the policy rule and then examine how the economic system behaved on average over the periods before and after the breaks.

While these two approaches seem valid for examining the deficits matter proposition, neither is likely to provide decisive results soon. The first approach appears to exceed current research capabilities. It requires the formulation and estimation of general equilibrium models with endogenous roles for money and bonds. While models of this type now are being constructed, they are probably still too simple to confront the data (Kareken and Wallace 1980). Most, for example, ab-

stract from business cycle movements and focus on steady states. Moreover, the identification and estimation problems associated with models that have a sizable number of equations are likely to be very severe (Hansen and Sargent 1980).

Although the second, direct approach is less demanding, it is also more limited, because of an inadequate number of observations. Under this approach, an observation covers a period of time for which a single deficit policy has been in place. Thus, one observation is likely to be measured in units of ten years or more.^{8/} To get enough observations to be able to directly estimate the effects of different deficit policies, therefore, one must go way back in time or go across countries. In either case, the observations are likely to be contaminated by important differences in economic structure.

The method I use here to estimate the effect of deficits is a crude application of the second approach. I conjecture that differences in economic performance over substantial periods of time can largely be explained by differences in federal monetary and budget policies. The method is crude for at least two reasons: first, no attempt is made to estimate policy rules and test statistically for breaks in the rules; and second, the number of observations is so small that the estimates must be considered very unreliable. Despite the crudeness of the method, however, the results suggest the view that deficits matter should not be rejected without further study.

My method is to estimate a reduced-form model of the average performance of the five variables in the VAR over equal subperiods of

postwar data. I add an equation for the real Treasury bill rate, which is defined by an identity. The average performance measure for real GNP, the GNP deflator, debt, and total reserves is the average annual growth rate $[g(\cdot)]$, while the measure for the bill rate and the real bill rate is the average level over the subperiod. There are four subperiods of 8 1/2 years each. The year 1948 is the base. Values of variables for 1982 are taken from the Congressional Budget Office's baseline forecast made in the spring of 1982 (U.S., Congress, CBO 1982a).

The estimated model is presented in Table 4. There are four observations and thus only one degree of freedom. R-squared adjusted for degrees of freedom is reported after each equation, and t-statistics are reported in parentheses under each coefficient.

TABLE 4 about here

The actual values and the model's predicted values of each variable over the sample period are given in Table 5. The predictions are generated by using the model in Table 4 with the actual values of the independent variables.

TABLE 5 about here

Finally, the model is used to forecast the next four-year period, assuming that the NIA deficit is \$150 billion per year and that the growth in total reserves is 4 percent per year. The deficit assumptions are in the range of the estimates in the Congressional Budget Office's 1982 midyear update (U.S., Congress, CBO 1982a). The total reserves assumption is taken to be roughly consistent with the Federal Reserve's stated objectives. An implicit assumption is that the experience of the next four years will be representative of the entire 8 1/2 year period.

According to this model, budget deficits matter. (See Table 5.) Higher deficits, which result in faster growth of government debt over a period of time, result in lower real growth, higher inflation, higher nominal interest rates, and higher real interest rates. Except for the effect of deficits on real interest rates, all relationships are highly statistically significant. The small effect of deficits on real interest rates may indicate that in the aggregate there are only slightly decreasing returns to capital in production. The model assigns little explanatory power to monetary policy, except with regard to nominal interest rates. The statistical explanation for why relatively more weight is given to budget policy than to monetary policy is apparent. The accelerating growth in total debt comes much closer to matching the accelerating deterioration in the dependent variables.

The model's predictions for the next four years are very pessimistic. That is hardly surprising given the large weight the model gives to deficits. If NIA deficits average \$150 billion per year over

the next four years, the annual average growth in outside debt over this period will be nearly twice that of the preceding 8 1/2 year period.

Summary: Deficits Do Matter

Theory suggests that deficits matter, if we interpret deficits to mean deficit policy and if we recognize that in a fiat money economy the present values of real government expenditures and receipts need not be identically equal. In such an economy, deficits determine the growth of outside debt: money and bonds. If the demands for these two instruments are separate, then fiscal and monetary policies must be coordinated. A higher deficit policy requires faster money growth.

Separateness of demands for the two instruments is not natural. Government restrictions on the use of bonds cause them to be imperfect substitutes for money. Larger deficits increase private incentives to circumvent the restrictions. As the private sector breaks down the restrictions, bonds become more liquid, so more inflation results from the same monetary and budget policies.

Empirical evidence on the effects of federal budget deficits is not conclusive. However, this paper shows that the data are not inconsistent with the view that deficit policies do matter in the way theory suggests.

Footnotes

*/The views expressed herein are those of the author and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

1/According to the New York Times (Roberts 1982), on July 29 Senator John Chafee of Rhode Island in a floor speech "pointed out that more than 200 prominent economists had signed a letter denying the basic premise of the amendment: 'that deficits are bad and that balanced budgets are good.'"

2/See, for example, the U.S. Senate Budget Committee's report on the "First Concurrent Resolution on the Budget" for fiscal year 1983, which points out that

net interest payments have grown rapidly in recent years. For the three years ending in FY 1982, net interest has grown at an average annual rate of 26 percent per year. Even after adjustment for the effects of inflation, net interest payments have grown by an average of 16 percent per year. The rapid growth in real interest payments is reflected in the sharply rising share of the Federal budget that is absorbed by interest, which has risen from less than 8 percent before 1979 to 11.6 percent of 1982 outlays. To the extent that interest costs for financing the Federal deficits rise in real terms, resources absorbed by interest requirements will "crowd out" other government program objectives. (U.S., Congress, Senate 1982, p. 36)

3/This model is loosely motivated by Miller 1982a, Sargent 1982, and Sargent and Wallace 1981.

4/If a complete set of contingent markets exists and people care appropriately about the welfare of future generations, then changing the distribution of taxes over time will not affect equilibrium output, prices, or interest rates (Barro 1974). If, however, either complete markets do not exist or people do not care adequately about the welfare of future generations, then changing the distribution of taxes over time will affect equilibrium outcomes (Sargent 1982).

5/In congressional testimony (U.S., Congress, House 1981), Sprinkel said, "But that still leaves the first question as to whether deficits cause inflation. The evidence is very clear that they do not" (p. 469). Then to Representative D'Amours' statement, "And when you eliminate deficits, you have declining interest rates," Sprinkel responded, "I would appreciate it if you could show me the evidence on it, because I have looked and I can't find it" (p. 474).

6/I use this measure of outside money instead of the Board of Governors' series on the monetary base and total reserves or the St. Louis Fed's series on the monetary base because it is the only series that has data back to 1948.

7/In general, all coefficients in (4) change when policies change. In my formulation, however, those coefficients remain invariant, but all coefficients in (5) change.

8/In the last section, one break in the deficit policy rule is found for the whole postwar period.

TABLE 1

Stability of the DEBT Equation

<u>Lag Lengths</u>	<u>Marginal Significance Levels</u>
1	.0000
2	.0129
3	.0176
4	.0049
5	.0019
6	.0002
7	.0020
8	.0702

TABLE 2

Percentages of the Standard Errors of the Three Models' GNPD Forecasts
Due to Innovations in DEBT and TR

<u>Step</u>	VAR(F)		VAR(I)		VAR(II)	
	<u>DEBT</u>	<u>TR</u>	<u>DEBT</u>	<u>TR</u>	<u>DEBT</u>	<u>TR</u>
2	0.24	1.72	0.48	1.77	0.09	6.40
5	0.52	28.57	0.57	19.15	5.98	18.88
10	1.16	57.67	0.48	25.74	23.07	21.61
15	6.55	68.37	1.70	26.39	32.58	19.76
20	12.13	70.47	3.43	25.43	28.50	17.04

TABLE 3

The Three Models' Forecasts

	RGNP (bills. of 1972 \$)		GNPD (1972 = 100.0)		RTB (percent)		DEBT (bills. of \$)		TR (bills. of \$)	
	VAR(F)	VAR(I)	VAR(F)	VAR(I)	VAR(F)	VAR(I)	VAR(F)	VAR(I)	VAR(F)	VAR(I)
Actual 1981:4	1,497.6	1,497.6	200.0	200.0	12.0	12.0	641.0	641.0	46.6	46.6
Forecast 1982:1	1,490.5	2,214.8	204.1	210.3	11.5	9.6	671.0	582.7	47.7	41.4
2	1,497.5	2,915.5	208.3	224.9	12.6	10.4	703.0	485.6	48.6	38.1
3	1,509.1	3,375.8	212.6	232.2	12.7	13.7	733.9	400.8	49.2	39.6
4	1,515.2	3,439.1	216.7	227.8	12.2	16.7	764.6	344.9	49.8	41.1
1983:1	1,522.0	3,312.4	221.0	220.0	12.2	17.4	796.3	313.7	50.7	42.8
2	1,532.4	3,155.8	225.5	212.7	12.6	16.0	828.2	298.3	51.5	44.3
3	1,543.4	3,047.5	230.3	207.7	12.9	14.0	859.1	292.7	52.3	45.7
4	1,552.5	3,005.6	235.1	204.2	13.1	12.5	889.6	292.5	53.1	47.1
				229.5		12.5		900.0		51.4

TABLE 4
A Reduced-Form Model

Equations (and t-Statistics)					\bar{R}^2		
$g(\text{RGNP})$	=	3.83 (36.53)	-	.18g(DEBT) (-10.19)	+	.05g(TR) (1.59)	.972
$g(\text{GNPD})$	=	1.97 (4.16)	+	.56g(DEBT) (7.26)	+	.13g(TR) (0.89)	.953
RTB	=	2.02 (9.08)	+	.70g(DEBT) (19.07)	+	.33g(TR) (4.69)	.994
Real R	\equiv	RTB	-	g(GNPD)			
	=	.05 (0.08)	+	.13g(DEBT) (1.17)	+	.20g(TR) (0.90)	.260

TABLE 5
Predictions of a Reduced-Form Model

Period	Average Annual Growth Rates (%)			Average Levels (%)			Average Annual Growth Rates (%)							
	RGNP	GNPD	RTB	Real R	DEBT	TR	Actual	Assumed						
	Act.	Pred.	Error	Act.	Pred.	Error								
1948 - 1956 1/2	3.9	3.9	0.0	2.2	1.8	0.4	1.7	1.8	-0.1	-0.3				
1956 1/2 - 1965	3.8	3.9	-0.1	1.8	2.2	-0.4	2.9	2.7	0.2	0.6	0.1	1.8		
1965 - 1973 1/2	3.6	3.6	0.0	4.7	4.5	0.2	6.0	6.1	-0.1	-0.3	3.2	5.6		
1973 1/2 - 1982	2.2	2.2	0.0	7.8	7.8	0.0	9.7	9.7	0.0	0.0	9.9	2.3		
1982 - 1986		0.8		12.6			16.0				3.4		18.1	4.0

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