A Note on Federal Budget Deficits and the Term Structure of Real Interest Rates in the United States

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I. Introduction

The impact of the federal budget deficit upon interest rates has been investigated extensively in recent years [1; 2; 3; 6; 7; 8; 9; 10; 11; 13; 15; 16; 23]. The objective of this note is to investigate empirically the impact of the federal budget deficit upon the term structure of real interest rates. This is because, although there is a rich literature on the term structure [4; 5; 14; 17; 18; 19], the empirical impact of the budget deficit on the term structure has been essentially ignored.

The focus in this analysis is on the real three month U.S. Treasury bill rate and the real 20 year U.S. Treasury bond rate. Following a number of other recent studies, we couch our analysis within the IS-LM framework. The analysis uses quarterly data for the period 1971:4–1985:4.

II. The Model

The empirical analysis is couched within the familiar IS-LM framework. This model is so well known that its workings need not be formally developed here. Rather, following [6; 7; 8; 3; 13], it is simply asserted that the ex post real rate of interest ($EPRR$) is principally determined by real government purchases of goods and services (G), the real budget deficit (D), and the real exogenous money stock (MS):

$$EPRR = R(G, D, MS) \tag{1}$$

where, according to conventional macroeconomic analysis, it is expected that:

$$R_G > 0, \quad R_D > 0, \quad R_M S < 0 \tag{2}$$

with subscripts denoting partial derivatives.

In this study, we focus upon the following two ex post real rates of interest:

$RTBR_t$, the ex post real average interest rate yield in quarter t on three month U.S. Treasury bills, expressed as a percent per annum

$RTWR_t$, the ex post real average interest rate yield in quarter t on 20 year U.S. Treasury bonds, expressed as a percent per annum.

Given our focus upon $RTBR_t$ and $RTWR_t$ and based upon the IS-LM model expressed in equations (1) and (2), the following two regressions are suggested:

$$RTWR_t = a_0 + a_1 G_t/Y_t + a_2 D_t/Y_t + a_3 B_t/Y_t + u_1 \tag{3}$$

$$RTBR_t = b_0 + b_1 G_t/Y_t + b_2 D_t/Y_t + b_3 B_t/Y_t + u_2 \tag{4}$$

where:

a_0, b_0 = constant terms;

G_t/Y_t = the ratio of the seasonally adjusted federal government purchases of goods and services in quarter t to the seasonally adjusted middle-expansion trend GNP in quarter t, expressed as a percent;

D_t/Y_t = the ratio of the seasonally adjusted total federal budget deficit (N.I.P.A.) in quarter t to the seasonally adjusted middle-expansion trend GNP in quarter t, expressed as a percent;

B_t/Y_t = the ratio of the seasonally adjusted monetary base in quarter t to the seasonally adjusted middle-expansion trend GNP in quarter t, expressed as a percent;

u_1, u_2 = stochastic error terms.

The model is quarterly and covers the period 1971:4–1985:4. Following Zahid [23], we begin the study with 1971:4 because this is the period during which the system of fixed exchange rates (Bretton Woods) began to collapse.

The federal budget deficit, D_t, is the seasonally adjusted total federal budget deficit in quarter t, expressed in billions of current dollars. The variable D_t of course consists of an exogenous component, the so-called "structural deficit," and an endogenous component, the so-called "cyclical deficit." The analysis also includes variable B_t, which is used to reflect monetary policy; like D_t, B_t is expressed in billions of current dollars. The variable G_t consists strictly of seasonally adjusted federal government purchases of goods and services and does not include transfer payments. Variable G_t is also expressed in billions of current dollars. Finally, the seasonally adjusted middle-expansion trend GNP data (Y_t) are expressed in billions of current dollars. As shown in equations (3) and (4), we in principle follow a number of earlier studies and divide G_t, D_t, and B_t by Y_t; this is because it can be reasonably argued that the level of government purchases of goods and services, the budget deficit, and monetary policy actions should all be judged relative to the size of the economy.

To investigate the impact of the federal budget deficit upon the term structure of real interest rates, we subtract equation (4) from equation (3) and obtain the following:

$$RD_t = c_0 + c_1 G_t/Y_t + c_2 D_t/Y_t + c_3 B_t/Y_t + u_3 \tag{5}$$

where:

$RD_t = RTWR_t - RTBR_t$

$c_j = a_j - b_j, \quad j = 0, \ldots, 3$

$u_3 = u_1 - u_2.$

Regression equation (5) models the slope of the yield curve as a function of federal purchases of goods and services, the federal deficit, and the monetary base. The term RD_t is expressed as a percent per annum.

According to the purely theoretical analysis of the IS-LM model by Turnovsky [21, 338], it is expected that ". . . an increase in government expenditures raises the long term real rate . . . by an amount which exceeds the effects on the short term real rate. . . . In fact, the response of the short term real rate is ambiguous. . . ." According to this argument, the expected sign on c_1 is positive. It is also argued by Turnovsky [21, 336] that "An . . . increase in the money supply will lower both the short term and long term real interest rates, with the effects on the

former being . . . greater. . . ." This argument implies that monetary expansion raises the slope of the yield curve, i.e., that c_3 is positive. Finally, within the IS-LM framework, it is also argued (in purely theoretical terms) by Turnovsky and Miller [22, 33] that a government budget deficit ". . . causes the long rate to rise more than the short rate . . . indeed, in certain circumstances the latter may fall." Thus, it is argued that budget deficits act to raise the slope of the yield curve, i.e., that $c_2 > 0$.

III. Empirical Results

Since the federal budget deficit is partly endogenous, its inclusion in the analysis introduces the possibility of simultaneous-equation bias. Accordingly, equation (5) is estimated using an instrumental variables technique (as well as the Cochrane-Orcutt procedure, to correct for first-order serial correlation), with the instrument being the seasonally adjusted quarterly unemployment rate of the civilian labor force, lagged one quarter, UL. The choice of instrument is based upon the fact that the lagged seasonally adjusted unemployment rate of the civilian labor force systematically explains the budget deficit, whereas the contemporaneous error terms in the system are not correlated with the lagged unemployment rate.

The IV estimate of equation (5) is given by:

$$RD_t = -7.72 + \underset{(+1.79)}{0.28}G_t/Y_t + \underset{(+4.31)}{0.83}D_t/Y_t + \underset{(+1.99)}{0.12}B_t/Y_t,$$

$$\mathrm{DW} = 1.81, \quad \mathrm{Rho} = 0.06 \tag{6}$$

where terms in parentheses are t-values.

As shown in equation (6), the estimated coefficient on the deficit variable is positive and statistically significant at beyond the one percent level. As argued on purely theoretical grounds by Turnovsky and Miller [22], the budget deficit acts to raise the slope of the yield curve.

IV. Conclusion

Using quarterly data and dealing with the ex post real rates on three month U.S. Treasury bills and 20 year U.S. Treasury bonds, this note has estimated an IS-LM based regression by 2SLS. The results indicate that the budget deficit raises the slope of the yield curve. Furthermore, to the extent that private sector capital formation is sensitive to longer term real interest rates in the United States, federal budget deficits lead to crowding out of private investment and hence to slower economic growth over the longer run.

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References

1. Barth, James R., George Iden, and Frank S. Russek, "Do Federal Deficits Really Matter?" *Contemporary Policy Issues*, Fall 1984–85, 79–95.

2. ———, "Federal Borrowing and Short Term Interest Rates: Comment." *Southern Economic Journal*, October 1985, 554–59.

3. Cebula, Richard J., "Federal Government Budget Deficits and Interest Rates: A Brief Note." *Southern Economic Journal*, July 1988, 206–10.

4. Cox, J., J. Ingersoll, and S. Ross, "A Re-examination of Traditional Hypotheses About the Term Structure of Interest Rates." *Journal of Finance*, September 1981, 769–99.

5. ———, "A Theory of the Term Structure of Interest Rates." *Econometrica*, March 1985, 385–407.

6. Evans, Paul, "Do Budget Deficits Raise Nominal Interest Rates? Evidence from Six Countries." *Journal of Monetary Economics*, September 1987, 281–300.

7. ———, "Do Large Deficits Produce High Interest Rates?" *American Economic Review*, March 1985, 68–87.

8. ———, "Interest Rates and Expected Future Deficits in the United States." *Journal of Political Economy*. February 1987, 34–55.

9. Feldstein, Martin and Otto Eckstein, "The Fundamental Determinants of the Interest Rate." *Review of Economics and Statistics*, May 1970, 363–75.

10. Hoelscher, Gregory, "Federal Borrowing and Short Term Interest Rates." *Southern Economic Journal*, October 1983, 319–33.

11. ———, "New Evidence on Deficits and Interest Rates." *Journal of Money, Credit, and Banking*, February 1986, 1–17.

12. Holloway, Thomas M., "The Cyclically Adjusted Federal Budget and Federal Debt: Revised and Updated Estimates." *Survey of Current Business*, March 1986, 11–17.

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

14. Malkiel, Burton G. *The Term Structure of Interest Rates*. Princeton: Princeton University Press, 1966.

15. Mascaro, Angelo and Allan H. Meltzer, "Long and Short Term Interest Rates in a Risky World." *Journal of Monetary Economics*, March 1983, 151–200.

16. McMillin, W. Douglas, "Federal Deficits and Short Term Interest Rates." *Journal of Macroeconomics*, Summer 1986, 403–22.

17. Modigliani, Franco and Robert Shiller, "Inflation, Rational Expectations, and the Term Structure of Interest Rates." *Economica*, February 1973, 12–43.

18. Roll, Richard. *The Behavior of Interest Rates*. New York: Basic Books, 1970.

19. ———, "Investment Diversification and Bond Maturity." *Journal of Finance*, March 1971, 51–66.

20. Thies, Clifford, "Business Price Expectations, 1947–1983." *Journal of Money, Credit, and Banking*, February 1986, 234–50.

21. Turnovsky, Stephen J., "The Term Structure of Interest Rates and the Effects of Macroeconomic Policy." *Journal of Money, Credit, and Banking*, August 1989, 321–47.

22. ———, and Marcus H. Miller, "The Effects of Government Expenditure on the Term Structure of Interest Rates." *Journal of Money, Credit, and Banking*, February 1984, 16–33.

23. Zahid, Khan, "Government Budget Deficits and Interest Rates: The Evidence Since 1971, Using Alternative Deficit Measures." *Southern Economic Journal*, April 1988, 725–31.