Deficits and Real Interest Rates: A Note Extending the Hoelscher Model

Richard Cebula and Gerald Scott

Jacksonville University, Florida Atlantic University

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DEFICITS AND REAL INTEREST RATES: A NOTE EXTENDING THE HOELSCHER MODEL

RICHARD J. CEBULA* AND GERALD SCOTT*

I. Introduction

In a recent paper, Hoelscher (1986) finds that the federal budget deficit exercises a positive and significant impact on the nominal ten year Treasury note rate. Hoelscher (1986) works with a loanable funds model and estimates reduced-form equations by OLS, using the Cochrane-Orcutt procedure to correct for serial correlation.

The purpose of this brief note is to extend the Hoelscher (1986) analysis in at least two ways. First, we seek to examine the impact of the federal budget deficit on the ex post real (rather than nominal) long term interest rate. Second, unlike Hoelscher (1986), we allow for the endogeneity of the budget deficit and the real short term rate of interest.

II. Model

The basic Hoelscher (1986) model is given by:

\[ NR = f (P, ERSR, Y, D, C) \]  \hspace{1cm} (1)

where \( NR \) is the nominal interest rate yield on ten year Treasury notes; \( P \) is expected inflation; \( ERSR \) is the expected real interest rate yield on short term Treasury obligations (bills); \( Y \) is the change in per capita real GNP; \( D \) is the federal deficit, measured either in per capita real terms or as a percentage of aggregate income; and \( C \) is real net capital flows from other countries into the United States.

The Hoelscher (1986) model, modified so as to enable us to examine the ex post real interest rate, is given by:

\[ RR_t = a_0 + a_1 ERSR_t + a_2 Y_t + a_3 D_t + a_4 C_t + \mu \]  \hspace{1cm} (2)

*Department of Economics, Florida Atlantic University, P. O. Box 3091, Boca Raton, Florida 33431—0991.

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This model is quarterly, so that "t" refers to quarter "t". \( R_{R_t} \) is the ex post real interest rate yield in quarter \( t \) on ten year Treasury notes. \( R_{R_t} \) is computed by subtracting the actual inflation rate (\( p_t \)) from the nominal average interest rate yield on ten year Treasury notes (\( Ten_t \)). The term \( a_0 \) is a constant. Variable \( ARSR_t \) is the ex post real interest rate yield in quarter \( t \) on three month Treasury bills, computed by subtracting \( p_t \) from the nominal average interest rate yield on three month Treasury bills (\( Bill_t \)). \( R_{R_t} \) and \( ARSR_t \) are both expressed as percents per annum. \( Y_t \) is the change in the per capita \( GNP \) in quarter \( t \), expressed in 1982 dollars. \( D_t \) is the ratio of the federal budget deficit in quarter \( t \) (\( Def_t \)) to the middle-expansion trend \( GNP \) in quarter \( t \) (\( G_t \)), expressed as a percent. \( C_t \) is the ratio of the net flow of foreign capital into the United States in quarter \( t \) (\( Cap_t \)) to the middle-expansion trend \( GNP \) in quarter \( t \) (\( G_t \)), expressed as a percent. Finally, \( \mu \) is a stochastic error term. \( G_t, Cap_t, \) and \( Def_t \) are all expressed as seasonally adjusted annual rates. The time period examined runs from 1971 : 4 through 1987 : 4. We begin with 1971 : 4 because it is during this quarter that the system of fixed exchange rates (Bretton Woods) began to collapse.

The data for variable \( P_t \) come from the Business Conditions Digest, March 1988, p. 98. The data for \( Ten_t \) and \( Bill_t \) come from the Economic Report of the President, as do the data for \( Y_t \) and \( Def_t \). The data for \( Cap_t \) were obtained from the Flow of Funds Accounts of the Federal Reserve System. Finally, the trend \( GNP \) data (\( G_t \)) come from Holloway (1986, Table 2) and the Survey of Current Business.

III. Results

Naturally, with the federal budget deficit included in the analysis, there arises the possibility of simultaneous-equation bias. This is because the budget deficit—by its very nature—is partly endogenous. Accordingly, equation (2) 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 one-quarter lag of the seasonally adjusted unemployment rate of the civilian labor force, \( U_{t-1} \). The choice of instrument is based on the fact that \( U_{t-1} \) systematically explains the budget deficit, whereas the contemporaneous error terms in the system are not correlated with \( U_{t-1} \). In addition, to allow for endogeneity of the variable \( ARSR_t \), we adopt a second instrumental variable: the one-quarter lag of the ex post real interest rate yield on Moody’s Aaa-rated corporate bonds, \( RMood_t \). The data for \( U_{t-1} \) and the nominal Moody’s Aaa-rated corporate bond rate were obtained from the Economic Report of the President.
The 2 SLS estimate of equation (2) is given by:

\[ RR_t = -3.37 + 0.785 A R S R_t + 0.0003 Y_t + 0.942 D_t - 0.699 C_t, \ldots (3) \]

\((+ 7.43) \quad (+1.19) \quad (+3.96) \quad (-2.84)\)

\[ DW = 1.74, \; Rho = 0.09 \]

where terms in parentheses are t-values.

As shown in equation (3), the estimated coefficient on variable \( D_t \) is positive and statistically significant at beyond the one percent level. In addition, the estimated coefficient on variable \( C_t \) is negative and statistically significant at the one percent level. Thus, despite the interest-rate effects of international capital inflows, the budget deficit raises the \( \text{ex post} \) real interest rate yield on ten year Treasury notes.

Further more, this same conclusion is reached for other long term rates. For example, estimating equation (2) for the \( \text{ex post} \) real interest rate yield on 20 year Treasury bonds \((RTR_t)\), rather than ten year Treasury notes, yields:

\[ RTR_t = -3.27 + 0.627 A R S R_t + 0.0003 Y_t + 1.01 D_t - 0.592 C_t, \ldots (4) \]

\((+ 5.07) \quad (+1.14) \quad (+3.47) \quad (-2.02)\)

\[ DW = 1.87, \; Rho = 0.03 \]

As shown in equation (4), we observe that, despite the interest rate effects of capital inflows, the \( \text{ex post} \) real interest rate yield on 20 year Treasury bonds is an increasing function of the budget deficit.

**IV. Concluding Remarks**

Using a modified version of the Hoelscher (1986) model, this brief note provides evidence that the federal deficit exercises a positive and significant impact upon the \( \text{ex post} \) real long term rate of interest. Furthermore, it should be noted that estimates of alternative versions of Hoelscher’s (1986) model yield this same conclusion. For instance, it can be shown that dropping variable \( A R S R_t \) from the system and/or expressing \( D_t \) and \( C_t \) in billions of 1982 dollars and/or adding a variable to reflect Fed open market operations leaves intact our conclusion that the budget deficit raises the \( \text{ex post} \) real interest rate. Moreover, we can also generate this conclusion if we estimate in first difference form.

To illustrate these claims, consider the following system:

\[ RR_t = b_0 + b_1 Y_t + b_2 D_t + b_3 C_t + b_4 M_t + \mu^* \]

\( \ldots (5) \)
where $RD_t$ is the deficit expressed in billions of 1982 dollars; $RC_t$ is the net capital inflow expressed in billions of 1982 dollars; $Y_t$ and $RR_t$ are as above; and $M_t$ is the net acquisition of credit market instruments by the Fed (expressed in billions of 1982 dollars). This version of the Hoelscher (1986) model drops variable $ARSR_t$, expresses the deficit and capital flow variables in real terms, and follows an earlier paper by Hoelscher (1983) by adding variable $M_t$ to the system. Having dropped variable $ARSR_t$, we now deal with only one instrument, $U_{t-1}$.

Estimating equation (5) in first difference form by 2 SLS yields:

$$
\begin{align*}
\Delta RR_t = & 0.02 + 0.0004 \Delta Y_t + 0.034 \Delta RD_t - 0.008 \Delta RC_t \ldots \\
( + 1.15) & ( + 2.3) ( - 1.25) \\
- & 0.002 \Delta M_t, \; DW = 1.76, \; Rho = 0.11 \\
( - 1.67)
\end{align*}
$$

where "\( \Delta \)" is the first difference operator. Once again, we observe that the coefficient on the deficit variable is positive and statistically significant and hence that the deficit raises the ex post real long term interest rate.

References


