The Real Interest Rate Yield on Long Term Municipals: What is the Role of Budget Deficits?

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Abstract

This study empirically finds, using ECM, that the primary federal budget deficit shares a bi-directional relationship with the ex ante real interest rate yield on long term municipal bonds. That is, the primary budget deficit acts to raise the real municipal bond yield whereas that yield also acts to raise the primary deficit.

Introduction

Recently in the U.S., federal government budget surpluses made a brief appearance. However, given the recession of 2001, the sluggish economy following the 2001 recession, a multi-year federal income tax rate cut statute passed in 2001, budgetary forecasts in light of the war on terrorism in the aftermath of the terrorist attacks on the U.S. on September 11, 2001, and Bush Administration and Democratic economic stimulus packages proposed in early 2003, the specter of federal budget deficits has appeared once again. Moreover, these circumstances in concert with other continuing and evolving military/national-security circumstances would appear to make the prospects for historically huge budget deficits well into the foreseeable future a veritable certainty. This observation was recently affirmed by Alan Krueger (2003), who warns that deficits have re-emerged as a major problem and that with the impending retirement of the first baby boomers, the Ared@ ink is likely to continue as far as the eye can see.

The effect of federal government budget deficits on interest rates in the U.S. has been investigated extensively by a number of researchers, including Barth et al., [1984, 1985], Barth et al., [1989], Carlson and Spencer [1975], Cebula [1988, 1991, 1997, 2000], Cebula and Belton [1993], Cukierman and Meltzer [1989], Evans [1985, 1987], Feldstein and Eckstein [1970], Findlay [1990], Hoelscher [1983, 1986], Holloway [1988], Johnson [1992], Mascaro and Meltzer [1983], McMillin [1986], Ostrosky [1990], Saltz [1998], Swamy et al., [1990], Tanzi [1985], and Zahid [1988]. Most of these empirical studies are couched within open or closed IS-LM or loanable funds models or variants of same. Many of these studies find that the budget deficit raises longer term rates of interest while not significantly affecting short term rates of interest. Because capital formation is presumably much more affected by long term than by short term interest rates, the inference has occasionally been made that these deficits may lead to "crowding out" [Carlson and Spencer, 1975; Cebula, 1985]. Alternatively stated, Alan Krueger (2003) has more recently observed that personal savings declined as the federal budget deficit ballooned during the 1980s and 1990s and has argued that, for the 1980s and 1990s, federal government borrowing both caused interest rates to rise and crowded out private investment.

A large portion of the deficit-interest rate literature neglects net international capital flows, thereby ignoring the potential direct or indirect interest-rate effects of capital flows in the global economy and raising a question of a possible omitted-variable bias [Penner, 1987]. Similarly, an even larger proportion of this literature ignores personal income tax rates, thereby raising the question of a possible omitted-variable bias on yet another level [cf. Cebula and Belton, 1993; Tanzi, 1985]. *Potentially*, this omission may be especially serious since such tax rates arguably can profoundly influence private sector spending and savings decisions (including those *between* taxable and tax free bonds), and hence federal government *tax collections, transfer payments* (such as *unemployment benefits*), and, as a result, *budget deficits* as well.

Potentially even more significant than the two issues identified above is the fact that the federal budget deficit measures adopted most commonly in this literature, namely, the N.I.P.A. (National Income and Product Accounts) total budget deficit, the structural budget deficit, and the cyclical budget deficit, all include interest payments on the national debt. This presence of interest payments on the national debt in the budget-deficit measure raises the question of a possible fundamental mis-specification. This is because the interest rate is typically treated in these studies as the dependent variable, whereas interest payments on the national debt are simultaneously a major component of arguably the *key* right-hand-side variable, i.e., the budget deficit itself, with causality allegedly flowing uni-directionally from the budget deficit to the interest rate. To address this problem, the present study adopts the *primary budget deficit* as the deficit measure, a deficit specification that has received little attention [cf. Cebula and Rhodd, 1993]. Furthermore, changes in *ex ante* real long term interest rates presumably may either directly or *indirectly* alter the pace of real economic activity through changes in real private sector purchases, especially capital formation/investment; therefore, they also may affect tax revenues, government transfer payments, and the government budget deficit. Thus, although the possibility of a bi-directional budget deficit-real interest rate causality usually has been overlooked, it arguably should not have been so readily dismissed.

The present paper seeks to study the federal budget deficit/*ex ante* real long term interest rate relationship after addressing these three potential problems. The study adopts cointegration and error-correction model (ECM) estimation to investigate empirically the *possibility* that the direction of causality between federal budget deficits and the *ex ante* real long term interest rate may be bi-directional rather than simply uni-directional. As stated above, a flow of causality from the interest rate to the primary deficit is plausible because a rise in long term interest rates, especially *ex ante* real long term rates, should--according to the conventional wisdom--lead either directly or indirectly to a decline in real economic activity as aggregate investment outlays (and potentially other real private sector outlays as well) decline [Hoelscher, 1986]. Moreover, aside from obvious implications for the cyclical component of the total budget deficit in terms of diminished tax collections and increased government sector transfers, it follows further that to the extent that policymakers are sensitive to a slowing pace of real economic activity, the federal government budget deficit may also be increased through *discretionary* fiscal policies (such as increased federal government purchases or income tax rate cuts). In addition to examining this bi-directional causality issue, the model formally adopts (as noted above) the federal *primary budget deficit* (which excludes Treasury interest payments) as the deficit variable so as to avoid a possible mis-specification of the deficit measure. Finally, the model includes net international capital inflows as well as a federal personal income tax rate measure so as to avoid omitted-variable bias.

The focus in this study is on the *ex ante* real interest rate yield on Standard and Poors (S&P) high grade long term municipal bonds, whose interest payments are exempt from federal income taxation and, depending upon certain residency requirements, may be free of state and even local government income taxation as well. This interest rate yield has received comparatively little attention in the deficit-interest rate literature [cf. Cebula, 1990, 1991], yet may exercise profound financial, economic, and political impacts on states, counties, and municipalities.

Using seasonally adjusted quarterly data, the study period is 1973:2-1996:4. As recommended in Mayer [1990], the study period begins with 1973:2 because this is the quarter by which time the system of fixed exchange rates (Bretton Woods) had effectively collapsed. Thus, over the entire study period, there effectively is a uniform exchange rate system in place; this of course simplifies the inclusion of net international capital flows in the analysis. Because there was no entirely satisfactory way to allow for the numerous provisions and complexities of The Balanced Budget Act of 1997, the study period ends in 1996:4.

The Empirical Framework

In developing the framework for the empirical analysis, the following intertemporal federal government budget constraint is introduced:

$$ND_{t+1} = ND_t + G_t + F_t + R_tND_t - T_t \qquad (1)$$

where:

ND_{t+1} = the outstanding national debt in period t+1
ND_t = the outstanding national debt in period t
G_t = federal government purchases in period t

F_t = federal government non-interest transfer payments in period t
R_t = average effective interest rate on the national debt in period t
T_t = federal government tax and other revenues in period t

The total federal government budget deficit in period t (TD_t) is the difference between ND_{t+1} and ND_t:

$$TD_t = ND_{t+1} - ND_t = G_t + F_t + R_tND_t - T_t \quad (2)$$

Rather than focusing on the *total* budget deficit, this study focuses on the *primary budget deficit*, which excludes net interest payments made by the Treasury. The primary deficit (PD_t) is given by:

$$PD_t = TD_t - R_tND_t = ND_{t+1} - ND_t - R_tND_t = G_t + F_t - T_t \quad (3)$$

One can incorporate the effects of: I, the federal income tax rate; EALR, the *ex ante* real interest rate yield on Standard & Poors (S&P) high grade long term municipal bonds; C, net international capital inflows; and EASR, the *ex ante* real short term taxable interest rate yield, into the model, as follows:

$$F = f(EALR, C, OF1),\ f_{EALR} > 0,\ f_C < 0 \quad (4)$$

$$T = g(I, EALR, C, EASR, OF2),\ g_I >< 0, g_{EALR} < 0, g_C > 0,\ g_{EASR} > 0 \quad (5)$$

$$G = h(EALR, OF3),\ h_{EALR} >= 0 \quad (6)$$

where OF_z, z=1,...,3, refers to unspecified factors that may in part affect F, T, and G, respectively.

It is hypothesized in this empirical investigation that *plausible* factors influencing F, T, and G may well include long-term interest rates, especially the *ex ante* real long term interest rate yield, EALR. If EALR were to rise, as a practical matter, then other markets competing for long-term loanable funds, including long term Treasury issues and private-sector mortgages, would presumably be faced with higher real interest rates as well, due to competition. To the extent that these higher real long term interest rates lead to reduced real economic activity, tax collections would likely fall and government transfers such as unemployment compensation would likely increase. Even *discretionary* government purchases might be increased and/or tax rates decreased to offset any recessionary trend from a higher EALR, especially in an election year. Furthermore, higher EALR levels *might* act to create interest-induced (negative) wealth effects (presumably in the form of declining bond prices), that themselves might act to reduce private sector spending and thereby to slow real economic activity. To the degree that these additional potential effects of a higher EALR are manifested, they *might* to some degree *further* act to raise F and lower T, if not potentially even affect G and/or I. In any case, a plausible outcome from increased levels of EALR would presumably be an increased primary budget deficit.

In theory, *ceteris paribus*, higher marginal federal personal income tax rates may lead to increased tax receipts. However, to the extent that a higher income tax rate reduces real economic activity (through reducing disposable real income and hence purchases of new goods and services) on the one hand and/or induces increased income tax evasion on the other hand [Feige, 1994; Tanzi, 1982, 1983], tax collections could potentially decline. Accordingly, the net impact of I on PD is (theoretically) unclear. Next, the greater the net inflow of international capital (C), the greater the supply of loanable funds and hence the more rapidly the economy is likely to expand, which presumably would act to lower F and raise T. Finally, the higher the *ex ante* real short term taxable interest rate yield in the economy, the higher the level of taxable income and thus the higher the level of tax collections.

Thus, the primary deficit is likely to be a function of I, EALR, C, and EASR, such that:

$$PD = j(I, EALR, C, EASR,...) \quad (7)$$

where $j_I >< 0,\ j_{EALR} > 0,\ j_C < 0,\ j_{EASR} < 0$ (8)

The intertemporal federal government budget constraint model provided above focuses on determinants of the primary budget deficit. To explain the determination of the *ex ante* real interest rate yield on S&P high grade long term

municipal bonds (EALR), including the impact of the primary deficit on same, an open-economy loanable funds model is adopted in which the *ex ante* real long term interest rate yield on municipal (tax free) bonds is determined by an equilibrium of the following form [Barth et al., 1985; Cebula, 1992, 1997; Hoelscher, 1986; Saltz, 1998]:

$$D + C = S + PD \tag{9}$$

where:

D = real domestic demand for long term high grade municipal bonds
C = real net international capital inflows (as above)
S = real domestic supply of long term high grade municipal bonds
PD = real net borrowing by (the budget deficit of) the federal government, as measured by the primary budget deficit (as above).

In this framework, it is expected that:

$$D = D(EALR,I,EASR,...),\ D_{EALR} >0,\ D_I >0,\ D_{EASR} < 0 \tag{10}$$

$$S = S(EALR,...),\ S_{EALR} < 0 \tag{11}$$

$$C = C(EALR,...),\ C_{EALR} > 0 \tag{12}$$

It is expected that, in principle paralleling Barth et al., [1985], Cebula [1992, 1997], and Hoelscher [1986], the real domestic demand for long term high grade municipal bonds is an increasing function of their *ex ante* real interest rate yield, whereas the real domestic supply of long term high grade municipal bonds is a decreasing function of their *ex ante* real interest rate. Next, the higher the *ex ante* real short term taxable interest rate yield, EASR, the lower the demand for long term municipals as bond demanders substitute the shorter term instruments for the longer term ones at the margin, *ceteris paribus* [Hoelscher (1986)]. In addition, as suggested in Penner [1987, p. 123], it is expected that "...high real interest rates...would attract massive inflows of international capital." This Aattraction@ accounts for the expected positive sign on C_{EALR}. Finally, the demand for long term high grade municipal bonds is an increasing function of income tax rates since higher income tax rates make tax free bonds relatively more attractive than taxable bonds, *ceteris paribus*.

Substituting equations (10), (11), and (12) into equation (9) and solving for EALR yields:

$$EALR = EALR(PD, C, I, EASR) \tag{13}$$

such that: $EALR_{PD} > 0,\ EALR_C < 0,\ EALR_I < 0,\ EALR_{EASR} > 0$ (14)

The first of these three expected signs is positive in order to reflect the traditional argument that when the Treasury attempts to finance a primary budget deficit, it forces interest rates upwards as it competes for funds from the financial markets. The expected sign on the capital flows variable is negative because net capital inflows absorb domestic debt issues and presumably help offset the interest rate effects of primary budget deficits, as suggested in Cebula and Belton [1993]. The negative sign on $EALR_I$ reflects the increased demand and hence increased market price for (and lower yield on) long term high grade municipal bonds as income tax rates are elevated. Finally, the positive sign on $EALR_{EASR}$ reflects competition between the long term municipal market and the short term taxable bond market [Hoelscher (1986)].

Variables and Data

The initial step in the analysis is to develop an appropriate empirical measurement of *expected inflation*. This determination is essential to the computation of the variables EALR and EASR. One possibility is to adopt the well-known Livingston survey data. However, as observed by Swamy et al., [1990, p. 1013], there may be serious problems with the Livingston series:

> *Studies by some psychologists have shown that the heuristics people have available for forming expectations cannot be expected to automatically produce expectations that come anywhere close to satisfying the normative constraints on subjective probability judgments provided by the Bayesian*

theory. The failure of people to obey these constraints makes Livingston=s survey data incompatible with stochastic law...

Accordingly, following the lead by Swamy et al., [1990], rather than using the Livingston series, the study adopts a distributed lag model on actual inflation to construct the values for the *expected inflation rate,* P_t^e, for quarter t. In particular, to construct the values for P_t^e, a four-quarter distributed lag model of actual inflation (as measured by the annualized percent rate of change of the CPI, 1996=100.0) was used. The analysis also experimented with three-, five-, six-, seven-, and eight-quarter distributed lag models of actual inflation to generate the expected inflation values; however, while the empirical results were similar, the four-quarter lag provided the best forecasting model, as in Cebula [1997] and Swamy et al., [1990]. It should be noted that use of the average of actual inflation rate in the most recent four quarters to estimate expected inflation, as suggested in Al-Saji [1993], produces results entirely consistent with, and indeed very similar to, the findings of the present study.

Based on the framework expressed in Section II above, the following variables are included in the empirical analysis:

PDY_t = the ratio of the seasonally adjusted nominal *primary* federal budget deficit in quarter t to the seasonally adjusted nominal GDP in quarter t, as a percent

$EALR_t$ = the *ex ante* real average interest rate yield on S&P long term high grade municipal bonds, as a percent per annum; in particular, $EALR_t$ = the nominal average interest rate yield in quarter t on S&P high grade long term municipal bonds (as a percent per annum) minus the expected inflation rate in quarter t (as a percent per annum, P_t^e)

$EASR_t$ = the *ex ante* real average interest rate yield on shorter term, in this case, 52 week U.S. Treasury bills in quarter t; in particular, $EASR_t$ = the nominal average interest rate yield in quarter t on 52 week U.S. Treasury bills (as a percent per annum) minus the expected inflation rate in quarter t (as a percent per annum, P_t^e)

I_t = the maximum marginal federal personal income tax rate in quarter t, as a percent

CY_t = the ratio of the seasonally adjusted nominal net international inflow of capital in quarter t to the seasonally adjusted nominal GDP in quarter t, as a percent.

The primary budget deficit is scaled by the GDP level, as are net international capital inflows. This is because the primary budget deficit and international capital inflows should both be judged relative to the size of the economy, as in Hoelscher [1986], Evans [1985, 1987], Cebula [1997], Holloway [1986], and Ostrosky [1990]. The EASR variable adopts the 52 week U.S. Treasury bill rate not only because it is relatively shorter term than the long term municipal bond rate but also because it may be regarded as a high quality and therefore viable alternative to high grade municipals. The variable I_t represents the personal income tax rate variable, I, in the model developed above. The maximum marginal rate is chosen because it is the rate at which municipal bonds should be the most appealing. However, it is noted that use of the average effective federal personal income tax rate rather than I_t leaves the results and conclusions nearly unchanged. The study period, using quarterly data, is 1973.2-1996.4.

The data sources are, as follows:
Board of Governors of the Federal Reserve System [2002]:
http://www.federalreserve.gov/Releases/H15/data;
The Council of Economic Advisors [1974, Table C-58; 1979, Table B-65; 1984, Table B-67; 1989, Table B-71; 1992, Table B-69;
1995, Table B-72; 1998, Table B-71; 2002, Table B-73];
Bureau of Labor Statistics [2002, Tables 1.1 and 3.2]:
http://www.bea.doc.gov/bea/dn/nipaweb/SelectTable.asp?Selected=N;
Tax Facts, Urban Institute Brookings Institution [2002]:
http://www.taxpolicycenter.org/TaxFacts/individual/schedule.cfm.

Initial Empirical Analysis

It is necessary in the empirical analysis to test the variables in the analysis for order of integration and cointegration. To begin this process, the results of the Phillips- Perron (P-P) and Augmented Dickey-Fuller (ADF) tests for a unit root were performed. All of the variables in the system were found to be stationary in first differences, as reported in Table 1. The choice of lag length was determined using the SBC criterion.

TABLE 1
P-P and ADF Unit Root Test-Statistics

	P-P Statistics	ADF Statistics
Variable	First Differences	
PDY	-10.09**	-5.06**
EALR	-5.06**	-4.88**
I	-9.56**	-4.36**
EASR	-4.73**	-8.61**
CY	-8.56**	-4.48**

** Indicates rejection of the null hypothesis of unit root atthe 99 percent confidence level (99% critical value = -3.51)

Since all five series in this analysis contain a unit root in levels, but are stationary in first differences, all causality tests must be performed in first differences. Furthermore, to determine the correct specification of the causality test, we must test for cointegration among the variables. This is accomplished using the Johansen [1990] cointegration test. In order to perform the Johansen cointegration test, we must first determine the appropriate lag-length to be used to estimate the VAR (Vector Auto-Regressive) model below:

$$[Y_t] = [a] + \sum_{i=1}^{p} [b_i][Y_{t-i}] + [u_t] \qquad (15)$$

where [ ] indicates a matrix, [a] is the matrix of constant terms, and $[u_t]$ is the matrix of stochastic error terms. The lag length p is so chosen that it minimizes the final prediction error using log-likelihood ratio tests and ensures that all u_t are white noise. In the present model, *p* was determined to be 4.

Empirical testing reveals that CY contains a deterministic trend. Accordingly, the Johansen cointegration procedure was applied to the model with a deterministic trend on the one hand and then alternatively to the model without a deterministic trend in order to test for which form of the model is more appropriate. We find that, according to the likelihood-ratio test, we can at the 95 percent confidence level reject that the VAR contains a deterministic trend. Accordingly, the results of the trace and maximum *eigenvalue* tests, using p = 4 but excluding a deterministic trend, are provided in Table 2.

TABLE 2
Basic Cointegration Test Results

	Trace Test				Maximum *Eigenvalue* Test		
Rank	L.L.R	5% c.v.	1% c.v.		L.L.R.	5% c.v.	1% c.v.
r>=0	121.23**	109.99	119.80	r=0	73.46**	59.46	66.52
r>=1	78.98	82.49	90.45	r=1	39.26*	36.36	41.00

**Indicates rejection of the null hypothesis at the 99% confidence level; *indicates rejection of the null hypothesis at the 95% confidence level.
L.L.R. is log-likelihood ratio and c.v. is the critical value.

Adopting the one percent level of significance as the appropriate criterion, the trace and maximum *eigenvalue* test statistics both indicate that the cointegration matrix is rank 1. Thus, testing for causality among the variables requires the use of the error-correction model (ECM), which in this case must be estimated using one error-correction term in order to avoid mis-specification. The error-correction term is the normalized cointegrating vector, $z1_t$, as given below:[1]

$$z1_t = +1.0\ EALR_t(-1) + 221.4\ PDY_t(-1) + 0.611\ I_t(-1) \text{ B } 16.58\ CY_t(-1) - 1.225\ EASR_t(-1) \quad (16)$$

Testing for causality between PDY_t and $EALR_t$ in the ECM requires not only checking the statistical significance of the lagged independent variables, but also checking the statistical significance of the error-correction term. We proceed with testing for causality by estimating the full ECM used to test for cointegration. This ECM contains 4 lags of each exogenous variable and one error-correction vector. The parameters of the ECM are estimated using OLS, correcting for heteroskedasticity using Newey-West heteroskedasticity-consistent standard errors and covariances. In the interest of efficiency, and given the emphasis in this study on the primary budget deficit and the *ex ante* real interest rate yield on high grade long term municipal bonds, only the ECM estimates for each of these two variables are provided in the following section of this study.[2]

The ECM Results

The estimate for the primary budget deficit variable is:

$$vPDY_t = -0.166 vPDY_{t-1} + 0.175\ vPDY_{t-2} + 0.07\ vPDY_{t-3} + 0.057\ vPDY_{t-4}$$
(-1.48) (+1.49) (+0.59) (+0.52)

$$+ 0.001\ vEALR_{t-1} + 0.00097\ vEALR_{t-2} + 0.0012\ vEALR_{t-3} + 0.0014\ vEALR_{t-4}$$
(+0.96) (+0.93) (+1.15) (+1.36)

$$+0.344\ vCY_{t-1} - 0.183\ vCY_{t-2} - 0.511\ vCY_{t-3} - 0.555\ vCY_{t-4}$$
(+1.56) (-0.83) (-2.30)* (-2.39)**

$$-0.004\ vI_{t-1} + 0.027\ vI_{t-2} + 0.024\ vI_{t-3} + 0.023\ vI_{t-4}$$
(-0.22) (+1.44) (+1.19) (+1.14)

$$-0.0039\ vEASR_{t-1} - 0.0015\ vEASR_{t-2} - 0.0018\ vEASR_{t-3} - 0.0014\ vEASR_{t-4}$$
(-3.67)** (-1.23) (-1.64) (-1.28)

$$- 0.001\ z1_t$$
(-4.35)**

$R^2 = 0.43$, Ll=350.12 (17)

**Indicates statistically significant at 1% level

*Indicates statistically significant at 5% level

where terms in parentheses are t-values and "v" is the first-differences operator.

In equation (17), the estimated coefficient on $z1_t$ is negative and statistically significant at the one percent level, whereas the estimated coefficients on the lagged EALR terms (although all positive) are not statistically significant. Thus, based on error-correction term results, the *ex ante* real interest rate yield on S&P high grade long term municipal bonds positively causes, i.e., exercises a *net* positive and significant impact on the primary budget deficit. Interestingly, from equation (17), based on the negative coefficients on vCY_{t-3} and vCY_{t-4} and based on the negative and significant coefficient on $z1_t$, it also appears that net capital inflows act to negatively cause the primary budget deficit. Next, based on the result for the income tax variable in $z1_t$, it appears that the maximum marginal federal personal income tax rate positively causes the primary budget deficit. Finally, based on the negative, significant coefficient on vEASRt-1 and the negative, significant coefficient on z1t, the primary budget deficit is negatively caused by the *ex ante* real taxable short term interest rate yield, as hypothesized in (8).

The estimate for the *ex ante* real interest rate yield on S&P high grade long term municipal bonds is given by equation (18):

$$EALR_t = +33.73 vPDY_{t-1} + 10.26\ vPDY_{t-2} + 14.76\ vPDY_{t-3} + 23.43\ vPDY_{t-4}$$
(+2.57)** (+0.74) (+1.02) (+2.18)*

$$- 0.o81\ vEALR_{t-1} - 0.03\ vEALR_{t-2} - 0.13\ vEALR_{t-3} - 0.202\ vEALR_{t-4}$$
(-0.64) (-0.25) (-1.07) (-1.67)

$+13.45\ vCY_{t-1} - 42.75\ vCY_{t-2} + 41.54\ vCY_{t-3} - 14.28\ vCY_{t-4}$
(+0.52) (-2.65)** (+1.60) (-0.53)

$+1.622\ vI_{t-1} - 1.447\ vI_{t-2} - 2.586\ vI_{t-3} - 2.91\ vI_{t-4}$
(+0.76) (-0.64) (-1.12) (-2.21)*

$-0.012\ vEASR_{t-1} + 0.054\ vEASR_{t-2} + 0.151\ vEASR_{t-3} + 0.155\ vEASR_{t-4}$
(-0.10) (+0.39) (+1.19) (+1.97)*

$-0.0289\ z1_t$
(-1.04)

$R^2 = 0.29$, Ll=-78.51 (18)

The estimated coefficient on $z1_t$ fails to be statistically significant; hence, inferences from equation (18) are based solely on the lagged coefficients. The estimation shown in equation (18) reveals that the coefficient for $vPDY_{t-1}$ is both positive and statistically significant at the one percent level, whereas the coefficient for $vPDY_{t-4}$ is positive and statistically significant at the five percent level. These results both imply that the primary budget deficit positively "causes" the *ex ante* real interest rate yield on S&P high grade long term municipal bonds, despite the non-significance of the error-correction term. This finding, in combination with the results reported in equation (17), suggests strongly that there exists a ***bi-directional*** causality between the primary budget deficit and the *ex ante* real interest rate yield on S&P high grade long term municipal bonds. The interested reader might note that equation (18) also reveals that capital inflows and the income tax rate both act to negatively cause EALR, and EASR acts to positively cause EALR, as hypothesized in (13) and (14). In closing this section of the paper, it is observed that the ECM results for only one of the variables, PDY, yields a statistically significant error-correction term. Since the error-correction term for the EALR variable is not statistically significant, there should be little concern about serious simultaneity problems in the system.

Conclusion

The Aconventional wisdom@ argues that, *ceteris paribus*, the federal budget deficit acts to elevate the long term rate of interest. Despite the appearance and high visibility of Ricardian Equivalence arguments and studies based thereupon, a number of studies in recent years have provided empirical support for the conventional wisdom.

The present study has used cointegration and error-correction model (ECM) techniques to investigate the causality relationship between the federal budget deficit and the *ex ante* real interest rate yield on high grade long term municipal bonds. To avoid a possible mis-specification, (1) the primary budget deficit, which excludes Treasury net interest payments, is adopted as the federal budget deficit measure, (2) a federal income tax rate measure is included in the system, and (3) net international capital flows are included in the analysis. The use of the primary deficit permits evaluation of whether there may exist *economic* reasons for an impact of the *ex ante* real long term interest rate on the deficit.

In this study, strong empirical support is provided indicating a ***bi-directional*** relationship between the *ex ante* real interest rate yield on S&P high grade long term municipal bonds and the primary budget deficit of the federal government in the U.S. over the 1973:2-1996.4 period. Thus, it appears that factors elevating the primary federal budget deficit act to raise the real cost of borrowing for state, county, and local governments, presumably through increasing the competition for loanable funds. To the extent that *other* real rates of interest are also affected by primary deficits, long term growth and productivity in the private sector may be adversely affected as well. Thus, federal government policies that raise the primary budget deficit cannot be viewed in a vacuum because they may impact profoundly on significant market interest rate yields, state and local government finances, and private sector productivity and growth. Krueger=s (2003) recently expressed concerns are well founded.

Footnotes

[1] The normalized equation is of the form: $z = -b_0 - b_{wj}$ where w is a vector of j right-hand-side variables.
[2] The ECM results for other variables will be provided upon written request.

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