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Exploratory Empirical Evidence of the Impact of Economic Freedom on the Real Interest Rate Yield on High-grade Municipal Bonds*

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Abstract: Adopting a loanable funds model, this exploratory empirical study investigates the impact of economic freedom on the real interest rate yield on high-grade tax-exempt municipal bonds in the U.S. The AR/2SLS and FMOLS estimations imply that greater economic freedom leads to a lower ex post real interest rate yield on tax-exempt municipal bonds. Other interesting findings include the following: the real interest rate yield on tax-frees was an increasing function of both the ratio of the national debt to GDP and the ratio of the budget deficit to GDP while being a decreasing function of quantitative easing policies. Policy implications of these results include the need to limit the extent of the federal budget deficits in the U.S. lest there will be, among other things, significant limitations placed on the ability of towns, cities, counties, and states to finance outlays in response to changing demographic and economic circumstances and/or maintaining existing infrastructure.

Keywords: real interest rate yield on municipal bonds; economic freedom; ratio of the national debt to GDP; budget deficit; quantitative easing

JEL Codes: H26, G41, G12, R51, R53

1. INTRODUCTION

During the War of 1812 and the financial challenges resulting from that war, the possibility of establishing a federal personal income tax in the U.S. had been seriously discussed (but unaccompanied by substantive action). With the onset of the Civil War, however, President Lincoln, in concert with Congress, legislatively established an income tax in August of 1861 to enable financing of the military campaign against the Confederacy. That law was subsequently replaced with a higher progressive income tax structure in 1862. That income tax system was ultimately terminated in 1872, seven years after the end of the Civil War.

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Following the ratification of the 16th Amendment to the U.S. Constitution on February 3, 1913, The Revenue Act of 1913, was implemented on October 3, 1913,¹ This statute legally codified exemption of interest on municipal bonds from federal income taxation. Indeed, as a consequence of this statute, the general rule in the U.S. has been that the interest income earned from bonds issued by one [level of] government is not taxable by another [level of] government. Hence, the federal government is precluded from taxing interest paid on municipal bonds.

Consequently, across the U.S., towns, cities, counties, and states have for more than a century found the existence of tax-free status on their qualified bond issues, which enables these governmental units to borrow at a lower cost in the financial markets, to be a key consideration in the financing of a wide variety of capital improvement projects.

A market for tax-exempt municipal bonds on the order of nearly 4 trillion dollars has evolved over time (U.S. Census Bureau, 2024). Given the magnitude of this market, as well as the importance of tax-exempt interest rates to sub-state as well as state governments, this study seeks to provide new empirical evidence identifying key factors that influence the level of the ex post real interest rate yield on high-grade municipal bonds, with a focus on potential influences that have been largely or often overlooked in the published scholarly literature to date, especially economic freedom and perceived default risk from elevated national debt-to-GDP ratios. Focusing on high-grade municipals, as opposed to lower quality tax-free bonds, creates a relatively high degree of quality homogeneity among the bonds being studied here. The study adopts annual data for the 1985-2020 period and undertakes VAR estimates in the form of AR/2SLS and Cointegrating regression estimation in the form of FMOLS.

2. BACKGROUND ON THE MUNICIPAL BOND MARKET

Tax-exempt/tax-free bonds can be characterized according to whether or not they are issued by state or sub-state government established bodies (counties, cities, and so forth), general obligation bonds (GOs), revenue bonds, insured bonds, pre-refunded bonds, ETM (escrowed to maturity) bonds, and so forth. The rating of tax-exempt municipal bond issues by Standard & Poor's, Moody's, Best and Company, Fitch, and other bond rating services is determined in part according to such designations.

From another perspective, tax-free bonds can be categorized, as follows:

1. Simple tax-exempt, i.e., simply not subject to federal income taxation;
2. Dual tax-exempt, i.e., not subject to federal or state income taxation; and
3. Triple tax-exempt, i.e., not subject to federal or state or city/local income taxation.

In each of these three classifications, there is a simple formula to convert the tax-free interest rate yield into its taxable equivalent yield.

¹What would ultimately become the 16th Amendment to the U.S. Constitution was passed by Congress in July 1909 and subsequently sent to the states for ratification.

For instance, assume that there are two tax-frees that are equally rated in terms of quality, including default risk, Bond A (the interest on which is fully taxable by the IRS) and Bond B (the interest upon which is free from taxation by the IRS). The interest rate yield on Bond A is expressed as R_A , whereas the interest rate yield on Bond B is expressed R_B . The conversion of R_B into R_A is expressed as:

$$R_A = \frac{R_B}{1 - FTAX} \quad (1A)$$

where $FTAX$ is the relevant federal marginal personal income tax rate. Clearly, the higher this federal income tax rate is, the higher the equivalent taxable interest rate yield. Equation (1A) can be easily modified to reflect either dual- or triple tax-exemption status, which will depend upon one's legal geographic residence and the geographic location where a given tax-free bond was issued. For example, the conversion formula for the dual exempt case is given by:

$$R_A = \frac{R_B}{1 - FTAX - STAX} \quad (1B)$$

where $STAX$ is the relevant marginal state income tax rate used in conjunction with $FTAX$ to compute the dual tax exemption. Regarding the triple exempt case, the conversion formula becomes:

$$R_A = \frac{R_B}{1 - FTAX - STAX - LTAX} \quad (1C)$$

where $LTAX$ is the relevant marginal local marginal income tax rate.

Interestingly, of the 50 states, 42 impose state personal income taxation (Tax Policy Center, 2024). In the aggregate, state income tax receipts constitute approximately 37% of state tax collections per se (Tax Policy Center, 2024). One of these 42 states, Maine, does not tax wage income, whereas the remaining 41 states do. Maine taxes only interest and dividends. Of these 41 states, eight impose a flat-tax rate system, whereas 33 impose a progressive tax rate system. California and Missouri have the largest number of tax brackets (ten). The lowest (positive) marginal state personal income tax rate is 2.9% (North Dakota), with the highest state personal income tax being 13.3% (California) (Tax Policy Center, 2024).

Most states derive their "taxable income base" predicated at least in part on IRS Schedule 1040, inclusive of other IRS forms such as Forms B, C, and D. Indeed, Indiana, Illinois and Colorado impose their respective state income tax liabilities as a percentage of federal taxable income per se. Michigan and Georgia impose their state taxable income as a percentage of a modified federal adjusted gross income.

3. FRAMEWORK AND STUDY OBJECTIVES

3.1. The Basic Model and Two Principal Hypotheses

In order to provide insights into the factors influencing the ex post real interest rate yield on tax-exempt bonds, *EPRTFR*, a loanable funds model based on (Barth et al., 1984, 1985; Hoelscher, 1986; Poterba and Rueben, 2001; Cebula, 2024) is adopted, in which the ex post real interest rate yield on municipal bonds is, assuming all other bond markets are in equilibrium, determined by:

$$PD + QEY = S + DEFY \quad (2)$$

where *PD* is private domestic demand for high-grade municipal bonds, expressed as a percentage of GDP; *QEY* is the ratio of quantitative easing to GDP, expressed as a percentage (adopted as a measure of monetary policy actions resembling open market operations); *S* is market supply of high-grade municipal bonds as a percentage of GDP; and *DEFY* is the total federal budget deficit, expressed as a percentage of GDP. The value of the ex post real interest rate yield on tax-exempt bonds *EPRTFR* is simply the nominal tax-free yield minus the actual inflation rate.

The demand function for tax-exempt bonds is expressed as:

$$PD = D(EPRTFR, EPRAAA, EPR6, UNRATE, MAXMTR, ECONFREE, DEBTY) \quad (3)$$

$$\begin{aligned} \frac{\partial PD}{\partial EPRTFR} &> 0, & \frac{\partial PD}{\partial EPRAAA} &< 0, & \frac{\partial PD}{\partial EPR6} &< 0, \\ \frac{\partial PD}{\partial UNRATE} &> 0, & \frac{\partial PD}{\partial MAXMTR} &> 0, & \frac{\partial PD}{\partial ECONFREE} &> 0, & \frac{\partial PD}{\partial DEBTY} &< 0 \end{aligned} \quad (4)$$

and the supply of high-grade municipal bonds is expressed as:

$$S = S(EPRTFR) \quad (5)$$

$$\frac{\partial S}{\partial EPRTFR} < 0 \quad (6)$$

where: *EPRTFR* is the ex post real tax-free interest rate yield on high-grade municipal bonds; *EPRAAA* is the ex post real interest rate yield on Moody's Aaa-rated corporate bonds; *EPR6* is the ex post real interest rate yield on 6-month U.S. Treasury bills; *UNRATE* is the percentage unemployment rate of the civilian labor force; *MAXMTR* is the maximum marginal federal personal income tax rate; *ECONFREE* is an index measure of economic freedom (Gwartney et al., 2024); and *DEBTY* is the ratio the national debt to the GDP, expressed as a percent. According to the model, the private sector demand for high-grade tax-exempt municipals is an increasing function of *EPRTFR*, ceteris paribus; this is because

rational investors (bond buyers) clearly prefer a higher real rate of return on their investment over a lower rate of return.

On the other hand, bond suppliers/issuers of tax-frees (state, county, and municipal governments) would supply/issue fewer high-grade municipal bonds in response to a higher *EPRTFR* since such a condition would raise the debt service costs on their bond issues, *ceteris paribus*, and hence the total cost of their public investment undertakings.

Next, the higher the ex post real interest rate yield on Moody's Aaa-rated corporate bonds (*EPRAAA*) or the higher the ex post real interest rate yield on 6-month U.S. Treasury bills, the lower the private sector demand for high-grade tax-free municipal bonds, as investors substitute these Aaa-rated issues and/or Treasury bills for the tax-frees, *ceteris paribus*.

Furthermore, the higher the percentage unemployment rate (*UNRATE*), the greater the market demand for high-grade tax-free municipal bonds and consequently the higher the price on said bonds, *ceteris paribus*, and, as a result, the lower the ex post real interest rate yield on those tax-exempt bonds.

Additionally, the tax benefits from qualified municipal bonds are logically greater for investors in the highest tax bracket. Arguably, then, the higher the maximum marginal federal personal income tax rate (*MAXMTR*), the greater the demand for and hence the higher the price of tax-exempt bonds, and, as a consequence, therefore the lower the real yield on those bonds, *ceteris paribus*.

Next, and from the perspective of this study, of potentially even greater interest, it is hypothesized here that the private sector demand for high-grade munis is an increasing function of economic freedom (*ECONFREE*), whose value ranges from a potential low of 0.0 to a potential high of 100.0 (Gwartney et al., 2024). A higher level of economic freedom implies a diminished degree of government regulation, fewer governmental/agency rules, and generally fewer impediments to financial transactions involving bonds, equities, and ETFs in the marketplace. Additionally, greater economic freedom implies less interference in and lower pecuniary transactions costs in the financial decision process and in the subsequent execution process, as well as fewer impediments in the exercise of free judgment and free will as economic agents, be they individuals, households, non-profit corporations, or for-profit organizations, or other types of enterprise. Thus, the private sector demand for high-grade municipal bonds is hypothesized to be positively related to the level of economic freedom, *ceteris paribus*.

Hence, the first of the two central hypotheses being investigated in this study is the following: **H1: The greater the level of economic freedom, the greater the demand for and price of high-grade municipal bonds and hence the lower the real interest rate yield on those bonds.**

Finally, with respect to the demand function for municipal bonds, the greater the ratio of the national debt to the GDP, the greater the perceived risk of debt obligation default. In support of this perspective, witness the recent lowering by Moody's of the rating on U.S. Treasury bonds from Aaa to Aa1, which was based in part upon the rapid growth in government spending as well as the growing debt service on the national debt. This additional risk factor implies that the bond markets require higher interest rates.

This set of circumstances leads to our second primary hypothesis, namely: **H2: The**

greater the ratio of the national debt to the GDP, the lower the demand for high-grade municipal bonds and hence the lower the price on said bonds and the higher the real interest rate yield on them.

In addition, there is the budget deficit. Following the conventional wisdom, it is hypothesized that the greater the federal budget deficit relative to the GDP (*DEFY*), the greater the upward pressure on interest rates generally (including *EPRTFR*) as a reflection of the federal government's competing with the remainder of the economy for funds, *ceteris paribus* (Barth et al., 1984, 1985; Cebula et al., 2016; Choi and Holmes, 2014; Ewing and Yanochik, 1999; Gale and Orszag, 2003; Gisse, 1999; Hoelscher, 1986; Johnson, 1992; Swamy et al., 1990; Tanzi, 1985; Quayes and Jamal, 2007; Laubach, 2009). Interestingly, the most recent such deficit-interest rate evidence is effectively a decade old. Furthermore, the related literature largely excludes considerations such as quantitative easing per se (*QEY*) and thus may be dated and less dependable.

Given the growth in magnitude of budget deficits in recent years, and the experience of quantitative easing (which is largely related to the Great Recession of 2007-2009 as well as to COVID), the impacts of these two variables are potentially of especially great interest to policymakers and researchers.

3.2. Two Federal Statutes Regarded as Control Variables

Before specifying the complete final model to be estimated, this study also endeavors to allow for the potential interest rate effects of two federal statutes, one a banking industry statute and the other a major piece of tax legislation. The major banking statute in question is one that in certain ways changed the landscape for the banking industry in the U.S. during the study period, namely, the CRA (the Community Reinvestment Act of 1977 and its major revisions in 1995 and 2005), whose objectives included, among other things, putting an end to the practice of "red-lining" (Madura, 2008). According to (Cebula et al., 2016), there is strong empirical evidence that the bank failure rate was increased by statutory provisions in the Community Reinvestment Act of 1977. These provisions arguably imposed greater risks or costs on banks and thereby led to increased bank failures. To the extent that such failures reduced banking competition, it is hypothesized here that the CRA acted to elevate interest rates, including the *EPRTFR*. This statute is reflected in the dummy variable $CRA = 1$ for 1977 and thereafter and $CRA=0$ otherwise.

As for the tax statute, (Musgrave, 1987) observed that "The Tax Reform Act of 1986 is the most sweeping reform since the early 1940s..." Indeed, the TRA did introduce a number of reforms, many of which are outlined in broad terms in (Ott and Vegari, 2003). For example, as observed in (Ott and Vegari, 2003), "The Act introduced major cuts in the personal tax rate. When fully effective (1988) only two tax brackets set at 15 and 28 percent were to replace the 14-bracket tax schedule with rates in the range of 11 to 50 percent...[while it] broadened the tax base by reducing the itemized deduction." A lowering of the personal income tax rates would reduce the demand for and price of tax frees. Accordingly, it is hypothesized here that this statute exercised a positive impact on *EPRTFR*. This statute is reflected by the dummy variable *TRA*, with $TRA=1$ for 1986 and 1987 and $TRA=0$ otherwise. In any case, it is expected that *EPRTFR* is positively impacted by *CRA* and

TRA.

3.3. Synthesis

Substituting equations (3) through (8) into equation (2) and then solving for EPRTFR yields the following function:

$$EPRTFR = f(EPRAAA, EPR6, UNRATE, MAXMTR, ECONFREE, DEBTY, DEFY, QEY, CRA, TRA) \quad (7)$$

with the following expected signs:

$$\begin{aligned} f_{EPRAAA} &> 0, f_{EPR6} < 0, f_{UNRATE} < 0, \\ f_{MAXMTR} &< 0, f_{ECONFREE} < 0, f_{DEBTY} > 0, \\ f_{DEFY} &> 0, f_{QEY} < 0, f_{CRA} > 0, f_{TRA} > 0 \end{aligned} \quad (8)$$

4. THE EMPIRICAL MODEL AND FINDINGS

Based on the model presented in equation (7) and in (8) above, the following autoregressive model is to be estimated (Greene, 1997; Neusser, 2016):

$$\begin{aligned} EPRTFR_t = & a_0 + a_1 EPRAAA_t + a_2 EPR6_t + a_3 \log(UNRATE_{t-1}) + a_4 \log(MAXMTR_{t-1}) \\ & + a_5 ECONFREE_t + a_6 DEBTY_t + a_7 DEFY_t + a_8 QEY_{t-1} + a_9 CRA_t \\ & + a_{10} TRA_t + a_{11} AR(1) + a_{12} AR(2) + \varepsilon_t \end{aligned} \quad (9)$$

where the stochastic error term and AR(1) and AR(2) are the autoregressive terms. Given data limitations, e.g., with the economic freedom index, which is available only in annual form, the data for this exploratory empirical analysis are all annual and cover the period 1985–2020. The economic freedom data were obtained from (Gwartney et al., 2024), whereas the remaining data were obtained from (Federal Reserve Bank of St. Louis, 2024), the (Tax Policy Center, 2024), the (Council of Economic Advisors, 2002, 2010, 2013), and the (U.S. Census Bureau, 1994, 1998, 1999, 2001, 2009, 2024).

Based upon prior research, four of the explanatory variables are lagged one period (Johnson, 1992; Swamy et al., 1990; Tanzi, 1985; Quayes and Jamal, 2007; Cebula, 2024). Given that four of the non-dummy explanatory variables are unlagged, however, the possibility of simultaneity bias arises. This is addressed by adopting instrumental variables. The latter, each of which is lagged by two periods, have the trait of being highly correlated with the explanatory variables with which they are associated while being unlagged with the error term. In any case, the instrument set-up is as follows: (1) the real Moody's Baa-rated bond yield with EPRAAA; the real yield of 30-year Treasury bonds and the real Fed Funds rate with ECONFREE; the growth rate of real GDP with DEFY; and the real yield on 3-month Treasury bills with EPR6. The AR/2SLS estimation of equation (9) is found in Table 1.

Table 1: AR/2SLS Estimation of Equation (9)

Variable	Coefficient	t-Statistic	Prob.
EPRAAA	0.920	20.69	0.0000
EPR6	-0.028	-0.93	0.3602
Log(UNRATE)	-0.351	-2.06	0.0503
Log(MAXMTR)	0.352	1.57	0.1301
ECONFREE	-0.980	-3.54	0.0018
DEBTY	0.0229	5.50	0.0000
DEFY	0.0526	3.26	0.0034
QEY	-0.058	-3.21	0.0039
CRA	0.317	4.20	0.0003
TRA	0.237	2.31	0.0303
AR(1)	0.55	4.94	0.0001
AR(2)	-0.49	-4.45	0.0002
Constant	4.605	1.69	-0.1038

Notes: DW = 2.25; with the inverted AR roots being $0.28 + 0.64i$ and $0.28 - 0.64i$.

As shown in Table 1, eight of the estimated coefficients exhibit the hypothesized signs; of these, all are statistically significant, with six being significant at the 1% level and two being significant at the 5% level. The J-Statistic (34.74) is statistically significant at beyond the 2.5% level, attesting to the exogeneity of the instrumental variables adopted in the estimate. Based on these results, it is inferred that the ex post real interest rate yield on tax-exempt bonds in the U.S. over the 1985–2020 time period was an increasing function of EPRAAA, CRA, TRA, and DEFY, the lattermost variable being the total federal budget deficit scaled by the GDP level. In addition, the ex post real interest rate yield on tax-exempt bonds over the study period was a decreasing function of UNRATE and QEY. Finally, and most relevantly in view of the objectives of this exploratory study, there is compelling evidence in support of hypotheses H1 and H2. Thus, the real interest rate yield on tax-exempt bonds was a decreasing function of economic freedom and an increasing function of the national debt-to-GDP ratio.

As a robustness test of the findings reported in Table 1, the model is re-estimated without the ARIMA terms by FMOLS (fully modified least squares). These results are provided in Table 2.

Clearly, these results are compatible with those found in Table 1. Of greatest interest for purposes of this study, hypotheses H1 and H2 both receive strong empirical support, although the remaining results in Table 2 are also largely consistent with those in Table 1.

5. CONCLUDING OBSERVATIONS

This exploratory study investigates two hypotheses which have heretofore been overlooked in the literature on tax-free municipal bonds. Namely, it has tested the following:

H1: The greater the level of economic freedom, the greater the demand for and

Table 2: Fully Modified Least Squares Estimate of Equation (9)

Variable	Coefficient	t-Statistic	Prob.
EPRAAA	0.804	31.75	0.0000
EPR6	0.022	1.11	0.2762
Log(UNRATE)	-0.166	-1.58	0.1256
Log(MAXMTR)	0.273	1.30	0.2053
ECONFREE	-0.445	-5.33	0.0000
DEBTY	0.0299	9.54	0.0000
DEFY	0.081	11.20	0.0000
QEY	-0.095	-5.88	0.0000
CRA	0.288	3.87	0.0005
TRA	0.551	4.71	0.0010

price of high-grade municipal bonds and hence the lower the real interest rate yield on those bonds, and

H2: The greater the ratio of the national debt to the GDP, the lower the demand for high-grade municipal bonds and hence the lower the price on said bonds and the higher the real interest rate yield on them.

Thus, we can reasonably infer that the ex post real interest rate yield on tax-exempt bonds was a decreasing function of economic freedom (Gwartney et al., 2024), and an increasing function of the national debt-to-GDP ratio over the 1985–2020 study period. Furthermore, the estimations find that the federal budget deficit as a percentage of GDP exercises a positive impact of this interest rate yield. Accordingly, policymakers should take whatever reasonable steps are necessary to limit the growth of the national debt and to reduce unnecessary and over-reaching rules and regulations that interfere with the financial market operations and decisions that fall under the rubric of economic freedom.

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