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Research article

The impact of federal income tax rate cuts on the municipal bond market in the U.S.: A brief exploratory empirical note

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Abstract: Using annualized data for the 1974–2015 period, this study adopts a loanable funds approach to investigate empirically the impact of U.S. federal government fiscal policy of income tax rate cuts on the *ex ante* real interest rate yield on high grade municipal bonds. Empirical appears to show that the *ex ante* real interest rate yield on high grade tax free municipal bonds is a decreasing function of the maximum marginal federal personal income tax. Based upon this very preliminary, exploratory study, it follows that reducing federal income tax rates may act to raise the cost of borrowing to cities, counties, and states across the U.S.

Keywords: *ex ante* real yield on municipal bonds; maximum marginal federal personal tax rate
JEL classification numbers: G41, G12

1. Introduction

In excess of a full century ago, federal government legislation in the U.S. entitled "The Revenue Act of 1913" formally established the exemption of interest paid on municipal bonds from federal income taxation. In passing this statute, Congress created a *de facto* financial derivative that currently constitutes a multi-trillion dollar market, in which, as Cecchetti (2006) observes "…the federal government [in the U.S.] is precluded from taxing interest on municipal bonds". Since 1914, cities, counties, and states have found the tax-free status of municipal bond issues to be an important feature in the attractiveness of this category of fixed-income investments. Municipal bonds provide financing for a wide variety of capital improvement projects such as highway construction, infrastructure repairs, and sewerage and drain water system construction. It is relevant to emphasize that the form of the tax-exempt

interest rate that is most relevant to these public investments is the *ex ante real* interest rate yield on municipal bonds because the latter adjusts for expected future inflation (Madura, 2008). Hence, it is presumably of the upmost importance to seek to find factors that have a direct impact on the *ex ante* real interest rate yield on the "municipal" bonds in the U.S. This factor identification process is the essential focus of this exploratory empirical research note.

Relevant to this empirical study, there is a somewhat controversial public policy issue in the U.S. that involves the 2017 "Tax Cuts and Jobs Act". This statute includes provisions that cut not only corporate tax rates (from 35% to 21%) but also cut personal income tax rates across the income spectrum. To the extent that lower federal personal tax rates may reduce the benefits of and hence reduce the demand for tax-exempt bonds, it follows that there will likely be ramifications from this legislation in terms of the interest rate yield (including the *ex ante* real yield) on these bonds.

Consequently, the goal of this brief exploratory empirical note is to provide insights into the determinants of the *ex ante* real tax-free interest rate yield on high grade municipal bonds and in so doing to seek evidence especially as to whether lower federal personal income tax rates actually do act to elevate the *ex ante* real tax-free interest rate yield on municipal bonds. In pursuit of this objective, this study uses annual data for the period 1974–2015 in order to provide *contemporary* insights. Section 2 of this study provides the framework/model adopted, whereas Section 3 defines and describes the specific variables and data in the empirical model. Section 4 provides the empirical results of the AR/2SLS (autoregressive two-stage least squares) estimation. A summary and concluding observations are found in Section 5 of the study.

2. The theoretical model in this study

Based upon such studies as Cebula (1997, 2014B), Fortune (1998), and Poterba and Rueben (1999, 2001), in order to identify determinants of the *ex ante* real interest rate yield on tax-free municipal bonds, an open-economy loanable funds model is adopted in which this yield is, assuming all other bond markets are in equilibrium, determined within the following construct:

$$D + NCI/GDP = S \tag{1}$$

In which: D = private domestic demand for high grade tax-free municipal bonds; NCI/GDP = the ratio of net international capital flows to the GDP level; and S = public sector (state plus county plus municipal) supply of/issuance of high-grade municipal bonds.

In this particular model, it is expected that: D = D (EARTFREE, MAXTAX, EARTHIRTY, EARMORT, Y):

$$D_{EARTFREE} > 0,\ D_{MAXTAX} > 0,\ D_{EARTHIRTY} < 0,\ D_{EARMORT} < 0,\ D_{Y} > 0 \tag{2}$$

$$S = S\ (EARTFREE),\ S_{EARTFREE} < 0 \tag{3}$$

With: EARTFREE = the *ex ante* real interest rate yield on high grade tax-free municipal bonds; MAXTAX = the maximum marginal federal personal income tax rate; EARTHIRTY = the *ex ante* real interest rate yield on thirty-year Treasury bonds; EARMORT = the *ex ante* real interest rate yield on new 30-year fixed-rate home mortgages; and Y = the growth rate of real GDP.

To convert nominal interest rate yields into *ex ante* real interest rate yields, this study expresses the expected inflation variable as a simple weighted average of present and past *actual* inflation, namely:

$$P^e_t = (2 \text{ x } P_t + P_{t-1})/3 \quad (4)$$

With Pt being the actual inflation rate of the CPI (consumer price index) in year t and P_{t-1} being the actual inflation rate of the overall consumer price index in year t−1. Hence, the value of each of the *ex ante* real interest rate yields in this study is merely the nominal interest rate yield minus the expected inflation rate, P^e_t.

The demand for tax-free bonds is postulated as being an increasing function of EARTFREE, *ceteris paribus*. Naturally, bond suppliers/issuers of tax-free bonds would be expected to supply high-grade municipal bonds to a lesser degree in response to a higher EARTFREE since this would raise the debt service costs of their new bond issues, *ceteris paribus*. Next, the higher the maximum marginal federal personal tax rate, the greater the demand for tax-free bonds because of the resulting greater tax benefits of those bonds; consequently, the greater the value of MAXTAX, the greater the price of and correspondingly the lower the *ex ante* real interest rate yield on those tax-exempt bonds. For the interested reader, the maximum marginal federal personal income tax rate was at 70% over the years 1974–1980, while being at the 28% rate for the years 1988–1990. The higher the *ex ante* real interest rate yield on thirty-year U.S. Treasury bonds (EARTHIRTY), the lower the demand for high grade tax-free municipal bonds, because investors substitute the thirty-year Treasuries for the tax-frees, *ceteris paribus*. The higher the *ex ante* real interest rate yield on new mortgages (EARMORT), the greater the degree to which investors would purchase those mortgages as opposed to tax-frees, *ceteris paribus*. Furthermore, the greater the growth rate of real GDP (Y), the greater the demand for tax-free bonds and therefore the higher the price on those bonds and, concomitantly, the lower the *ex ante* real interest rate yield on those tax-frees, *ceteris paribus*.

Inserting Equation (2) and (3) into Equation (1) and then solving the resulting equation for EARTFREE generates the following:

$$\text{EARTFREE} = f(\text{MAXTAX, EARTHIRTY, EARMORT, Y, NCI/GDP})$$

Such that:

$$f_{MAXTAX} < 0,\ f_{EARTHIRTY} > 0,\ f_{EARMORT} > 0,\ f_Y < 0,\ f_{NCI/GDP} < 0 \quad (5)$$

The expected signs on the first four of these explanatory variables are predicated on Equation (2) and (3) above. The last of these signs is negative to reflect the conventional wisdom that the greater the extent of net capital inflows, the greater the extent to which debt issues are absorbed and hence the less the upward pressure on the interest rate yield, *ceteris paribus*.

3. The formal model and the data

Based on the model presented above in Equation (5), the AR/2SLS estimation involves the following specification:

$$\text{EARTFREE}_t = \alpha_0 + \alpha_1 \text{ MAXTAX}_{t-1} + \alpha_2 \text{ EARTHIRTY}_t + \alpha_3 \text{ EARMORT}_t + \alpha_4 \text{ Y}_t + \alpha_5 (\text{NCI/GDP})_t + \alpha_6 \text{ AR (1)} + \varepsilon_t \quad (6)$$

Where: EARTFREE_t = the *ex ante* real interest rate yield on high grade tax-free municipal bonds in year t, as a percent per annum; α_0 = constant term; MAXTAX_{t-1} = the maximum marginal federal personal income tax rate in year t−1, as a percent; EARTHIRTY_t = the *ex ante* real average

interest rate yield on thirty-year Treasury bonds in year t, as a percent per annum; $EARMORT_t$ = the *ex ante* real average interest rate yield on thirty-year new home mortgages in year t, as a percent per annum; Y_t = the percentage growth rate of real GDP over year t; $(NCI/GDP)_t$ = the ratio of net financial capital inflows to the domestic GDP level in year t, as a percent; AR (1) = autoregressive term; and ε_t = stochastic error term.

The net capital inflows variable is scaled by GDP because the magnitude of the capital inflows needs to be judged relative to the size of the economy (Cebula, 1997). The dependent variable, $EARTFREE_t$, is expressed as contemporaneous with four of the explanatory variables: The *ex ante* real average annual interest rate yield on thirty-year Treasury bonds, $EARTHIRTY_t$; the *ex ante* real average annual interest rate yield on new home mortgages, $EARMORT_t$; the percentage growth rate of real GDP, Y_t; and the ratio of net capital inflows to GDP, $(NCI/GDP)_t$.

The instrumental variable chosen for $EARTHIRTY_t$ was the *ex ante* real average annual interest rate on ten-year Treasury notes, lagged two periods, $EARTEN_{t-2}$. The instrument for $EARMORT_t$ was the two year lag of the Fed Funds Rate, FED_{t-2}. The instrumental variable for Y_t was the change in the ratio of the M2 money stock to the GDP level lagged, two years, $\Delta(M2/GDP)_{t-2}$. Finally, the instrumental variable for the variable $(NCI/GDP)_t$ was the *ex ante* real interest rate yield on six-month T-bills, lagged two years, $EARSIX_{t-2}$. The selection of instrument variables was based on the fact that each explanatory variable's instrument specification was highly correlated with it, while these instruments were uncorrelated with the error term.

The data for the variables in this estimation were obtained from Federal Reserve Bank of St. Louis (2017) and the Council of Economic Advisors (2017). Variance Inflation Factors (VIFs) for the explanatory variables can be found in Table 1, where it is shown that all of the VIFs are less than 4, so that it can be inferred that multi-collinearity was not a problem (Neusser, 2016).

Table 1. Variance Inflation Factors.

Variable	VIF
MAXTAX	1.46
EARTHIRTY	2.25
EARMORT	2.16
Y	1.43
NCI/GDP	1.27

4. The estimation results

Adopting the Newey and West (1986) correction, the AR/2SLS estimate of Equation (6) is provided in Table 2, where coefficients, t-values, and values for "prob" are all found. In Table 2, four of the five of the estimated coefficients exhibit the expected signs and are statistically significant at either the 1% level or the 5% level; only the capital inflows variable is statistically insignificant at the 10% level. The J-statistic is statistically significant at the 2.5% level, affirming the exogeneity of the instruments. Furthermore, with an inverted AR root of 0.31 [and DW = 1.99], the estimated AR process is stationary. Finally, the instrument rank is 12, which attests further to the strength of the estimated model.

As shown in Table 2, at the 1% statistical significance, the *ex ante* real tax-free interest rate yield is an increasing function of the *ex ante* real yields on both new thirty-year fixed-rate mortgages

and thirty-year Treasury bonds, while being at the 5% statistical significance level a decreasing function of the growth rate of real GDP.

Of greatest pertinence to the present study, the coefficient on the tax rate variable, $MAXTAX_{t-1}$, is negative and statistically significant at beyond the 1% level. Thus, the higher (lower) the maximum marginal federal personal income tax rate, the lower (higher) the *ex ante* real interest rate yield on tax-free municipal bonds. Given the fact that the 2017 Tax Cuts and Jobs Act includes tax rate reductions, it should come as no surprise should the *ex ante* real rate on high grade (as well, potentially, as other) municipal bonds should react with increases in order to attract the same level of investment. Ironically, this outcome may serve to help restore "normalcy" to the interest rate in U.S. financial markets, especially given the high level of quantitative easing in the U.S. implemented by Federal Reserve from 2008–2013 (Cebula, 2014B).

Table 2. Autoregressive Two-Stage Least Squares Estimation Results, 1974–2015. Dependent Variable: EARTFREE.

Variable	Coefficient	t-value	Prob.
MAXTAX	−0.033***	−3.85	0.0005
EARTHIRTY	0.752***	10.15	0
EARMORT	0.252***	3.5	0.0012
Y	−0.135*	−2.11	0.0418
NCI/GDP	0.203	1.53	0.1345
AR (1)	0.31	2.02	0.0512
Constant	0.222	0.36	0.7193
Inverted Root	0.31		
J-statistic	14.19**	0.0143	
Instrument Rank	12		

Note: ***Statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level.

5. Summary and concluding remarks

This brief exploratory empirical study adopts an open loanable funds model to examine the impact of the maximum percentage federal personal income tax rate on the *ex ante* real interest rate yield on high grade municipal bonds in the U.S. An AR/2SLS estimate for the 1974–2015 study period reveals that the *ex ante* real interest rate yield on high grade municipal bonds is a decreasing function of the maximum marginal federal personal income tax rate. Indeed, in this initial exploratory empirical estimation, it appears that a two percentage point reduction in the maximum marginal federal personal income tax rate might well elicit approximately a seven basis points increase in the *ex ante* real interest rate yield on high grade municipal bonds. Clearly, it remains to be seen whether the strength of this conclusion will be maintained or whether the effect in question will be stronger or weaker when future estimations involving more robust models and/or more elaborate econometric techniques remains to be seen. Moreover, to the extent that the tax cuts resulting from the Tax Cuts and Jobs Act elevate the real interest rate yield, there will be wealth effects as a consequence of bond price decreases.

It is observed in closing that cuts (increases) in the maximum federal personal income tax rate do

appear to act in such a way as to elevate (decrease) the real cost of funds to towns and cities, counties, and states planning to fund new infrastructure or infrastructure improvements and repairs in the near future. Given the 40 year time period studied, this relationship may well be a persistent and important challenge for both federal and sub-federal policy-makers in the U.S. Of course, future research involving more robust modeling, additional variables, and Cebula (2014) more powerful econometric techniques will be necessary in order to have confidence in this conclusion.

Conflict of interest

The authors declare no conflict of interest.

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