

THE SUPPLY ELASTICITY OF TAX-EXEMPT BONDS*

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INTRODUCTION

THE TAX REFORM ACT OF 1986 IMPOSED numerous restrictions on tax-exempt state and local (S&L) bonds that sharply curtailed their issuance. Since then, many of those restrictions have been relaxed, and the scope of tax-exempt financing has been expanded. As in the recent American Recovery and Reinvestment Act of 2009, the federal government has frequently sought to lower the cost of capital to stimulate spending on many targeted S&L projects.

This raises the critical question of whether state and local jurisdictions respond to the cost of capital, and whether lowering that cost stimulates additional borrowing and spending. Several studies, such as Metcalf (1991, 1993) and Holtz-Eakin (1991), examine the interest rate sensitivity of tax-exempt bond issuance prior to or just following the 1986 tax reform (TRA86). However, little is known about the post-TRA86 supply response, rendering estimation of the likely effects of changes to S&L borrowing costs difficult. This study attempts to fill that gap using a new dataset on S&L bond issuance and yields. To gauge the size of the supply elasticity of municipal bonds, panel data on aggregate issuance of public-purpose bonds are assembled from information reported on IRS Form 8038-G, Information Return for Tax-Exempt Governmental Obligations, for the years 1987-2006. The findings suggest that S&L bond issuance is sensitive to borrowing costs, such that new funding instruments offering a deeper interest rate subsidy should result in positive stimulus to S&L borrowing.

The following section describes recent federal policy changes impacting state and local borrowing costs. The third section reviews the literature pertaining to the relationship between federal interest rate subsidies, S&L borrowing, and public investment. The fourth section describes the estimation strategy and the data. It also lays out the empirical results. The fifth section concludes by drawing inferences from the results to

estimate the impact of Build America Bonds on S&L borrowing.

RECENT FEDERAL POLICY INNOVATIONS AFFECTING MUNICIPAL BORROWING COSTS

Traditionally, U.S. state and local governments have had the privilege of issuing debt with interest exempt from federal income taxation. This income tax exemption, subject to some restrictions (Zimmerman, 1990), enables S&L governments to pay a lower rate of interest on their bonds. Since 1986, the marginal implied tax rate on municipal debt (MITR), equal to the difference between the taxable (Treasury) interest rate and the tax-exempt interest rate as a percentage of the taxable rate, has averaged about 20 percent. The tax exemption of local government debt is widely recognized as an inefficient subsidy because it costs more in federal revenue than the reduction in interest costs for the states. The difference between its costs and benefits accrues to municipal bond investors in tax brackets higher than the MITR, who receive a higher interest rate than they require to make them willing to hold tax-exempt debt.

An alternative federal subsidy for subnational investment, tax credit bonds yield a tax credit in lieu of or in addition to cash interest. The credit, C , is first added to taxable income and then deducted from taxes owed, such that the net change in taxes is $-C(1 - T')$, where T' is the investor's marginal tax rate. The investor's after-tax income from a tax-credit bond is $(1 - T')C$, the same as it would be if $C = r_t$, the taxable bond rate. Tax credit bonds are an efficient subsidy in the sense that the cost to the federal government equals the subsidy to subnational governments.

Federal tax-credit bonds were pioneered in 1997 with the creation of the Qualified Zone Academy Bond (QZAB) program, designed to support school improvement in low-income districts. The QZAB legislation called for the federal income tax credit on the bonds to replace 100 percent of cash interest, and for the Treasury Department to set the rate of the tax credit so that all QZABs would be issued at par. Other tax-credit bond programs with admin-

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istered rates ensued, including Clean Renewable Energy Bonds (CREBs), Gulf Tax Credit Bonds, Qualified Energy Conservation Bonds (QECBs), and Qualified School Construction Bonds (QSCB).

The American Recovery and Reinvestment Tax Act of 2009 (ARRA) introduced two new types of federally subsidized public-purpose bonds for state and local governments, both under the heading of Build America Bonds (BABs).¹ Investors in tax-credit BABs receive tax credits equal to 35 percent of whatever taxable market yield the bonds carry; thus, unlike QZABs, no administrative rate-setting is required. With a 35 percent tax credit rate, a tax-credit BAB will carry a market yield equal to 74 percent of the interest rate on a comparable taxable bond. ARRA provides an even deeper subsidy for BABs issued within two years of its passage: a direct payment from the federal government to the issuer of 35 percent of the interest paid on any taxable bond issues that would otherwise qualify as tax-exempt public-purpose (not private activity) debt.

The various types of tax credit bonds and subsidized taxable bonds described above all seek to lower state and local government borrowing costs in hopes of stimulating state and local investment. But how responsive to such costs is public investment, and what is the effect of lower interest costs on state and local bond issuance? The following section reviews the relevant literature.

LITERATURE REVIEW

There is a well-developed theoretical literature on the effect of federal interest tax-exemption on state and local borrowing costs. The traditional view, expressed by Pechman (1987) and Musgrave and Musgrave (1980), is that by exempting investors from federal income tax liability on the interest paid on municipal bonds, the federal government makes investors willing to accept a lower yield on those bonds, thereby lowering municipal borrowing costs. Based on this view, both municipal bond issuance and state and local investment should be negatively correlated with tax-exempt bond interest rates. Inevitably, a “new view” arose to challenge this “old view.” Southwick (1979) and Gordon and Metcalf (1991) argue that the federal tax-exemption for municipal bond interest does not generally stimulate municipal investment; it just shifts its financing from taxes to debt. Unless all of a jurisdiction’s investment is financed out of

debt, a decrease in the municipal borrowing rate therefore shifts financing from taxes to debt, but does not stimulate municipal investment at the margin. Fortune (1998) presents a “neo-traditional view,” which restores many of the predictions of the old view and encompasses the new view as a special case. Both the old and new views predict that municipal bond issuance should be responsive to tax-exempt interest rates.

A number of empirical studies analyze the effect of interest rates on state and local debt issuance, most written in the early 1990s. The majority find a positive relationship between municipal debt issuance and some measure of the spread between taxable and tax-exempt financing rates. Holtz-Eakin (1991), looking at aggregate national data for 1951-1984, finds a significant effect of the interest rate spread on the share of state and local investment financed by municipal bond issuance. Metcalf (1991, 1993), examine data for 1978-1988 and 1980-1986, respectively, and find a robust positive relationship between municipal debt and the new-view interest spread. He finds a semi-elasticity of 1.23 between the spread and long-term bond issuance, and calculates that eliminating the federal tax exemption would result in a 30 percent reduction in the stock of outstanding bonds.

Evidence of a link between the interest rate spread and the level of public investment is more tenuous, since municipalities have the option of switching from debt to tax finance. Holtz-Eakin (1991) finds no significant impact of interest rates on overall public investment. Conversely, Coronado (1999), examining state-level data for 1990-1998, finds that state-level public investment is generally responsive to the yield spread. These studies do not distinguish between changes in the spread due to shifts in the taxable or tax-exempt interest rate, and thus do not differentiate between the old and new views.²

In order to evaluate the fiscal impact of the recent federal policy changes for state and local investment finance, three findings are necessary: (1) the elasticity of the municipal bond supply with respect to the tax-exempt interest spread; (2) the elasticity of municipal investment to interest rates, or the amount of municipal shifting into tax finance; and (3) the extent to which any state and local tax increment is deducted from federal taxes. This paper focuses on the first question, with the latter two left to further research.

MODELING THE DETERMINANTS OF BOND SUPPLY

This paper seeks to determine the sensitivity of the supply of public-purpose, tax-exempt bonds to state and local borrowing costs. These costs are measured in two ways: tax-exempt interest rates, and taxable interest rates plus the spread between taxable and tax-exempt interest rates. The sign of the coefficient on the level of interest rates, whether tax-exempt or taxable, is expected to be negative, since lower interest rates make borrowing more affordable. The sign of the coefficient on the spread between taxable and tax-exempt interest rates is expected to be positive, since for a given level of (taxable) interest rates, an increase in the spread ($r_t - r_m$) results in lower municipal borrowing costs.

Municipal interest rates are potentially endogenous to the supply of bonds: An increase in bonds offered will likely drive up equilibrium tax-exempt interest rates. The empirical studies cited earlier use various instruments to correct for this endogeneity, including Treasury bond rates, corporate dividend yields (Coronado, 1999), financial characteristics of bank and insurance company investors in tax-exempt debt (Holtz-Eakin, 1991), and state fiscal and demographic characteristics (Metcalfe, 1991, 1993). This study uses the 10-year Treasury bond rate, assuming (as in the cited studies) that its rates are exogenous to issuance activity in the municipal bond market.

Analysis is performed on a panel of aggregate state-level (both state and local bonds) public-purpose bond issuance for the years 1988-2006. Year fixed effects are included to capture macro-economic conditions affecting all states within a given year. State fixed effects are also included to capture all state-specific, time-invariant features relevant to bond issuance, such as debt limits and balanced-budget rules.³

In order to prevent detection of a spurious positive correlation between bond supply and equilibrium interest rates due to shifts in investment demand, time-varying state-level factors affecting investment demand must be controlled for. New per capita bond issuance likely depends on the stock of bonds outstanding; other things equal, states with lower levels of outstanding bonds per capita may be more likely to issue additional bonds than states with large outstanding stocks. Since public investment is assumed to be a normal good, state per capita personal income should have a positive correlation with bond issuance. State-specific business conditions, as measured by the local

unemployment rate, may also affect bond issuance. The expected sign of the coefficient on unemployment is ambiguous: States may cut back on investment during times of economic stress; on the other hand, they may face increased budgetary pressures that they must borrow to cover. The demand for public investment may also depend on scale or "zoo" effects, so that states with larger populations invest more per capita. Since the largest share of public-purpose bond issuance is for education, the share of the population below the age of 18 is also expected to be positively related to bond issuance.

The primary specification of interest is:

$$ISSUE_{st} = \alpha + \alpha_t + \alpha_s + \beta_1 YIELD_{st} + \gamma X_{st} + \varepsilon_{st}$$

where $ISSUE_{st}$ is the annual issuance of S&L bonds issued by state s in year t , $YIELD_{st}$ is the corresponding municipal bond yield, and X is a vector of other state-year control variables including the existing bond stock and personal income. All dollar variables are stated in real per capita terms.

The Data

Data on public-purpose (governmental) bonds are obtained from information reported on Form 8038G for the years 1987-2006. Each bond issuer is required to file the form (and information return), showing the issue volume, the yield (coupon rate), and maturity, among other features. The volume is aggregated by state, creating a panel of 51 jurisdictions (50 states plus the District of Columbia). For each state and year, the yield is defined as that of each issuer weighted by the share of the volume issued.

Bonds are typically issued with two general purposes in mind. First, to fund planned and ongoing expenditures, capital projects in particular. And second, to refund outstanding volume. A locality may recall existing bonds and reissue new bonds if prevailing interest rates are lower. This reduces the cost of capital but does not fund new expenditures. We are able to distinguish between the two and focus on long-term, new issuance bonds.

Since the yield of tax exempt bonds is likely to be endogenous to the supply, we use as an instrument the return on taxable bonds, specifically, 10-year Treasury bonds. When controlling separately for taxable yield and the municipal interest spread, two different measures of the taxable yield are used: the 10-year Treasury rate and the interest rate on Treasury bonds with maturity matching that of the state's weighted average bond maturity.

Data on the outstanding state and local government stock of long-term, public purpose bonds are from the U.S. Census Bureau. Stock data were lagged one year, resulting in the year 1987 being dropped from the analysis. Missing stock data for 2001 and 2003 also resulted in the years 2002 and 2004 being dropped from the analysis. Data on population, school-age population and personal income are also from the U.S. Census Bureau. Data on the state-level unemployment rate and the consumer price index, which is used to deflate all dollar-denominated variables, are from the U.S. Bureau of Labor Statistics.

Table 1 reports descriptive statistics of the key variables of interest. Mean per capita S&L bond issuance, in 1983 dollars, is \$172, with a maximum value of \$907. The mean per capita stock of out-

standing bonds, also in 1983 dollars, is \$1,801, with a maximum value of \$8,538. The average yield on total state and local municipal bond issuance was 5.46 percent, with a minimum yield of 2.94 percent and a maximum yield of 7.92 percent. The average municipal yield spread – the maturity-matching Treasury bond rate less the municipal yield – was 0.72 percent, with a minimum value of -1.1 percent (i.e., despite their tax exemption, some municipal bond yields exceed the corresponding Treasury rate due to high perceived credit risk) and a maximum value of 3.18 percent.

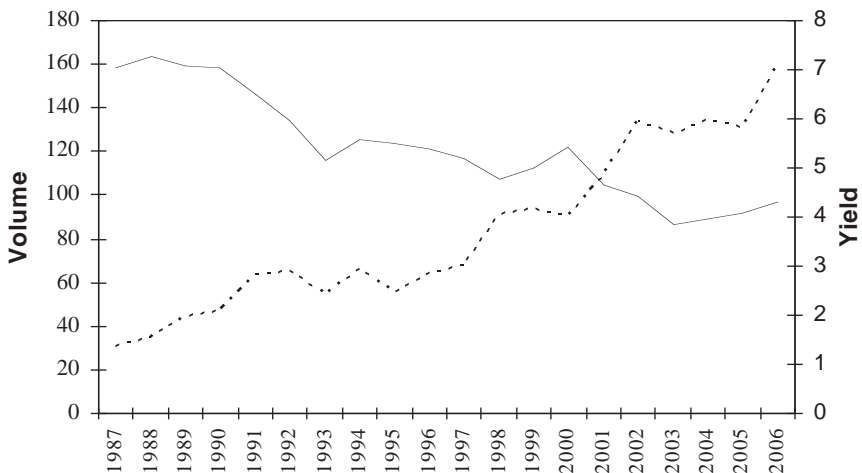
Empirical Findings

Figure 1 depicts a negative relationship between the volume of new debt issued by S&L governments and the yield on such instruments, suggest-

Table 1
Summary Statistics on Regression Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Real per capita bond issuance	864	172	103	0	907
Weighted average municipal bond yield	864	5.46	1.04	2.94	7.92
Real per capital stock of bonds outstanding	864	1,801	950	435	8,538
Real per capita personal income	864	15,355	2,688	9,775	29,184
Unemployment rate	864	5.17	1.48	2.26	11.29
10-year Treasury rate	864	6.37	1.43	4.01	8.85
Maturity-matching Treasury rate	711	5.82	1.04	3.79	8.07
Treasury-municipal yield spread	711	0.72	0.66	-1.11	3.18

Figure 1: Yield and Volume of New Bonds Issued (\$Billions)



ing that the cost of capital has a depressing effect on municipal borrowing. But this may not be informative if the growth in borrowing is influenced by other factors not controlled for. These may include economic growth or increases in demand for public goods, among others. Of course, the yield itself may be endogenous to the volume issued (Marlin, 1991). Also differences in yields over time (and across states) may be explained by differences in the underlying maturity of bonds issued, which may be chosen due either to the nature of the projects being financed, to capital market conditions, or to financing constraints related to issuer creditworthiness.

The raw correlation between the two variables of interest, issuance and yield, is weakly negative (-0.19), while the correlation between issuance and outstanding bond stock is positive (0.57). Interestingly, the municipal bond yield correlates more strongly with the 10-year Treasury bond rate (0.93) than with the maturity-matched Treasury rate (0.77). The 10-year bond yield is therefore used as an instrument in the two-stage least squares regres-

sion; it is also arguably less endogenous to issuance than the maturity-matched rate, since bond maturity is subject to the issuer's choice.

Table 2 provides fixed-effects (state and year) estimates of the effect of interest rates on the real annual per capita volume of S&L municipal bonds issued. The first column reports OLS estimates on the coefficients on bond yield and control variables. The estimated coefficient on yield is -7.11 ($t=2.04$) suggesting that a 1 percentage point increase in yield would reduce the volume (per capita) by some \$7.11 capita.

Moving to the control variables, the existing stock of bonds has the expected negative relationship to issuance: A \$1 increase in the outstanding per capita stock reduces per capita issuance by three cents. An additional dollar of per capita personal income, conversely, increases per capita issuance by three cents. Finally, state unemployment is strongly positively correlated with bond issuance: An increase of 1 percentage point in the unemployment rate is associated with a nearly \$15 increase in per capita bond issuance. Population

Table 2
Fixed-Effects Estimates of Real Per Capita Issuance of Long-Term Bonds
(*t* statistics reported below coefficients)

	(1) OLS	(2) 2SLS	(3) OLS	(4) OLS
Interest rate	-7.11*	-11.50*		
Treasury yield*	2.04	3.10		
Treasury 10-yr yield			-2.75	
			0.51	
Interest Spread				-8.90*
				2.24
Stock of bonds			5.30	3.66
			0.83	0.88
Personal income	-0.03*	-0.03*	-0.02*	-0.03*
	5.43	5.39	2.49	2.75
Unemployment rate	0.03*	0.03*	0.04*	0.03*
	10.43	9.25	9.61	7.93
Intercept	14.79*	14.16*	16.41*	15.52*
	5.76	5.49	5.56	5.23
	-315*	-245	-401*	-283*
	4.58	3.42	4.73	3.33
Number of observations	864	864	711	711
R-squared	0.19	0.61	0.20	0.20

* Significant at least at the 5 percent level.

and the share of school age population were also introduced as controls, but since they were never significant, they were omitted.

Column (2) presents 2SLS estimates where the municipal yield is instrumented with the 10-year Treasury rate. The coefficient on yield now becomes -11.5 ($t = 3.1$), suggesting that a one-point decrease in the interest rate is again associated with increased borrowing of about \$11 per capita in 1983 dollars (\$24.70 in 2009 dollars). The coefficients on personal income, the unemployment rate, as well as on the outstanding stock of bonds steepens are little affected.

The weighted average yield on Treasuries with maturities matching those of municipal bond issuance over the past 20 years is 5.8 percent. Based on the average MITR on municipal bonds of 20 percent,⁴ the above finding suggests that the tax-exemption of state and local debt have increased the issuance of public-purpose municipal debt by $5.8 \times .2 \times \$24.70 = \28.66 per capita, or a total stimulus of \$8.7 billion using 2008 Census population estimate of 304 million. The marginal interest rate subsidy created by introducing taxable BABs in addition to tax-exempt bonds is 15 percent. As such, and using the above finding, taxable BABs provide a marginal stimulus to state and local borrowing of $5.8 \times .15 \times \$24.70 = \21.49 per capita, or a total of \$6.5 billion.

Columns (3) and (4) present results from the second specification, in which the level of the risk-free rate and the municipal yield-spread are controlled for separately. In column (3), the risk-free rate is represented by the matching-maturity Treasury rate, while column (4) shows results using the 10-year Treasury bond rate. While the coefficient on the maturity-matching Treasury yield is insignificant, the result in column (4) appears qualitatively similar to those in columns (1) and (2), with an estimated coefficient of -8.9 ($t = 2.24$). The coefficients on the municipal yield spread are not significant, indicating that the level of interest rates dominates the yield wedge in determining issuance. Because it contains the municipal yield and maturity-matching Treasury rates, the yield spread should be instrumented; however, a suitable instrument remains to be determined.

CONCLUSIONS AND AREAS FOR FURTHER RESEARCH

This paper finds a robust negative relationship between the state and local cost of borrowing and municipal bond issuance. Controlling for state and

year fixed effects, local economic characteristics and yield endogeneity, a 1 percentage point drop in interest rates is associated with an increase in per capita bond issuance of some \$11.50 in 1983 dollars, or \$24.70 in current dollars for a total of \$8.7 billion.

The implied stimulus from taxable BABs introduced in 2009 is substantially lower than the volume of bonds reported for the first seven months after ARRA was enacted. Some of this issuance volume was likely shifted out of tax-exempt bond issuance. Indeed, in theory, state and local governments should switch entirely out of tax-exempt bond issuance and into taxable BABs issuance, since the latter instrument offers a much deeper subsidy. However, this has not been observed: Taxable BABs accounted for only about 20 percent of total state and local debt issuance since the program's inception. BABs were frequently issued by municipalities in tandem with traditional tax-exempt bonds. From a market practitioners' point of view, the continued issuance of tax-exempt debt is not surprising, however, given the novelty of the taxable BABs program and the uncertainty of investor demand for the new instruments.

Questions remaining to be addressed in this research are (1) what are the relationships among interest rate subsidies, state and local bond issuance, and public investment? (2) how do state and local budgeting practices influence these relationships over the course of the economic cycle? (3) how do state and local financial characteristics influence bond yield and maturity, and what instruments can they provide for bond yields and spreads?

Acknowledgments

The authors are grateful to comments from Leslie Papke and other participants at the 2009 NTA Conference.

Notes

- ¹ For the period April 17 through October 2, 2009, about \$36 billion in BABs were issued, representing 20 percent of all S&L bonds issued. See <http://www.treas.gov/press/releases/tg312.htm>
- ² See Poterba (1986) for the determinants of yield, and Poterba and Samwick (1997, 2003) for the profile of holders of tax exempt bonds.
- ³ Given that the time frame under study covers two decades, some states significantly altered their budgetary and debt rules during this period. Further research to develop better control variables for these factors may therefore be useful.

⁴ Poterba and Verdugo (2008) make the case that the tax rate is 26.8 percent when measured relative to taxable municipal bonds.

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