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THE CAPITALIZATION OF THE STATE TAX EXEMPTION BENEFIT IN MUNICIPAL BOND YIELDS

C. Steven Cole[*] , Pu Liu[**] and Stanley D. Smith[**]

Abstract

Thirty-three states treat in-state municipal bond interest income differently from out-of-state municipal bond interest income. While they tax the interest income of out-of-state bonds, they exempt interest income of in-state bonds from state taxes. This differential treatment in taxes creates a demand for in-state bonds and provides a disincentive for holding out-of-state bonds. *A priori*, this preferential treatment of in-state bonds would lower the interest yields on in-state bonds. This paper examines the degree to which the personal state tax exemption benefit is reflected in bond prices or yields in the secondary market for municipal bonds. The evidence suggests that the tax exemption benefit is fully capitalized in the bond's yield.

INTRODUCTION

The tax structure facing municipal bond investors has an impact on the interest yields on municipal bonds. While interest income received from municipal bonds is exempt from federal income tax, whether the interest income is exempt from state tax depends on the law of the state in which the investor resides. Some states tax interest income received from both in-state and out-of-state municipal issues and some states exempt interest income from taxes on both in-state and out-of-state issues. There are, however, many states which tax interest income from out-of-state municipal issues but exempt some or all of the interest income from taxes on bonds issued inside the state.

The differential treatments of interest income may apply to corporate as well as individual taxes. In practice, a state can create a demand for bonds issued within the state by legislating a law that exempts interest income paid by its own municipalities from taxes while taxing interest income from out-of-state municipalities. The creation of such a demand for in-state bonds is not costless. The cost involved is the loss of state government tax revenue due to the tax exemption on in-state bonds. However, investors residing in a state with such a differential tax treatment will have an incentive to purchase bonds issued within the state and have a disincentive to purchase bonds issued by other states. Thus, the existence of such a differential tax treatment should lower the interest yields on the bonds issued within the state. In an efficient market the present value of the tax benefits should be fully reflected in the price or yield of the bond.

If 100 percent of the present value of the expected state tax exemption benefit is reflected in the bond price or yield, then the benefit is referred to as being fully capitalized into the price. On the other hand, if less than 100 percent of the present value of the expected state tax exemption benefit is reflected in the bond price, then the benefit is only partially capitalized. The degree of capitalization is the percentage of the expected benefit that is

[*]University of North Texas
[**]University of Arkansas
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reflected in the bond price. The objective of this study is to examine the degree of capitalization of the state tax exemption benefit.

An earlier study by Kidwell, Koch and Stock (1984) using 1980 data implicitly found that the tax exemption benefits were only partially capitalized in the bond yield, while this study finds that the tax exemption benefit is fully capitalized for the three years 1985, 1986, and 1987. The increase in the degree of capitalization of the tax exemption benefit may reflect many changes in the financial marketplace leading to an increased reliance on individual investors since 1980. As Kidwell, Koch and Stock (1984, p.552) suggest:

> Individuals represent the marginal investors in long-term municipal securities. Commercial banks and property-casualty insurance companies that pay federal income taxes at the full corporate rate are not rate-sensitive as yields on municipals always exceed the after-tax yields on comparable taxable securities. . . . Because the volume of municipals issued exceeds the amount that these firms acquire, state and local government must place the excess with individuals paying taxes at lower rates.

The major changes that lead to an increased reliance on individual investors in the municipal bond market include changes in federal tax laws. The 1986 Tax Reform Act eliminated or restricted the tax exemption status of many investments. For instance, the Act imposed several restrictions on the tax deferral and tax deduction status for individual retirement accounts. These eliminations and restrictions make municipal bonds the only tax-exempt investment available to many individuals. In addition, the interest expense deductions of financial institutions are denied to the extent allocable to tax-exempt obligations after August 7, 1986. These limitations reduced the incentive for financial institutions to invest in municipal securities. This reduction in tax arbitrage, coupled with significant losses suffered by property and casualty insurance companies during the 1985-1987 period have increased the relative importance of individual investors in the municipal bond market. Furthermore, the growth of municipal bonds insured against default risk may have also prompted individuals to invest in municipal securities.[1] The financial and accounting information for municipalities is generally less reliable, less timely and less comparable cross-sectionally than information regarding corporations (Ingram, Brooks and Copeland, 1983). Municipals are exempt from the disclosure and registration requirements that apply to other securities. Thus individual investors, who have less resources to produce information about the credit quality of municipalities than financial institutions, may be unwilling to invest in municipal bonds. However, with the introduction of default risk insurance, individual investors can invest in insured bonds and rely on the default risk insurers to produce information about the creditworthiness of bond issuers.

With the increasing participation of individuals in the municipal bond market, one might expect the degree of capitalization of the state tax exemption benefit to increase. This study finds a 100 percent capitalization of the state tax exemption benefit. In addition, we also find that the costs to the state in the form of the lost tax revenues due to tax exemptions is significantly greater than the benefit in the form of reduced yields for in-state bond issues. In other words, the tax exemption is not a beneficial way to stimulate demand for in-state bond issues.

The rest of the paper is organized as follows. Section II discusses the state tax exemption benefit. Section III addresses the methodology used in the analysis. Section IV describes the data collection technique, while Section V presents the empirical results of the analysis. Finally, Section VI summarizes the conclusions and implications.

THE STATE TAX EXEMPTION BENEFIT

Essentially a state tax differential is established when a state provides a tax advantage to individual investors who purchase in-state bonds. States that have an individual income tax may generate this advantage by taxing interest income from out-of-state municipal bonds while exempting some or all of the interest income generated by in-state municipal bonds. States that tax the interest income from out-of-state municipal bonds have effectively segmented the market by creating a tax incentive for in-state investors to purchase in-state bonds. Table 1 presents those states which exempt taxes on in-state bonds while taxing bonds issued in other states. The table also presents the maximum individual income tax rates in those states.

State tax differentials may segment tax-exempt investors into two groups. The first group is investors in states where interest on in-state bonds is taxed at a lower rate (usually zero percent) than out-of-state bonds.

Let ρ_i be the tax-exempt yield on bonds issued in state i which taxes in-state bonds at a lower rate, ρ be the equilibrium tax-exempt yield on an identical bond that is issued in a state with no tax differentials between in-state and out-of-state bonds, and τ_i be the effective state tax rate on out-of-state tax-exempt bonds in state i. The existence of arbitrage for two bonds equivalent in all respects except the tax exemption status ensures that for state i investors who invest in state i bonds:

Equation 1

$$\rho_i \geq \rho (1 - \tau_i)$$

The lower limit obtains when state i investors find out-of-state bonds have higher after-tax yields than state i bonds. If an equality is assumed,

Equation 2

$$\rho_i = \rho - (\tau_i\rho)$$

The value of $(\tau_i\rho)$ should be reflected in lower interest rates for state i bonds by the amount $(\tau_i\rho)$ if $\tau_i > 0$. If $\tau_i = 0$, $\rho_i = \rho$ and no interest rate differential would be expected. If all investors in state i bonds are state i tax-payers and $\tau_i > 0$, one would expect 100 percent of $(\tau_i\rho)$ to be reflected in a lower ρ_i or 100 percent of the tax benefit would be capitalized into ρ_i.

The discussion so far has ignored the second group, out-of-state investors for state i bonds. Out-of-state investors from state j would require a return greater than or equal to ρ on state i bonds.[2] If out-of-state investors are needed to purchase state i bonds, the marginal yield on state i bonds should be ρ and interest differential $(\tau_i\rho)$ in equation (2) should drop to zero.

The benefit to states of exempting interest on domiciled state and local securities from state taxes is that it lowers the borrowing costs of those units. If the markets are efficient and the marginal investor is an in-state investor, the benefit to investors should be equal to $(\tau_i\rho)$ in equation (2). The cost to the state would be $(\tau_i\rho)$. In a marginal analysis the cost would be equal to the benefit. This presumed equality rests on two assumptions. First, $(\tau_i\rho)$ must be fully reflected in a lower yield for the state and local units. If the reduction in yields for in-state issuers is less than $(\tau_i\rho)$, then the state's lost tax revenues are greater than the benefit to in-state issuers.

Second, this analysis assumes that the effective tax rate for in-state investors is equal to the state tax rate. This assumption does not appear to be true. If one assumes the marginal in-state investor itemizes deductions for federal taxes, then the effective state tax rate for the investor is $[\tau_s(1-\tau_f)]$, where τ_s is the marginal state tax rate and τ_f is the marginal federal tax rate. Therefore, if the benefit to the investor is $[\tau_s(1-\tau_f)\rho]$ and the cost to the state is $(\tau_s\rho)$, then the cost to the state is greater than the benefit to the in-state issuers and investors. The state's net cost [i.e., $\tau_f(\tau_s)\rho$], is transferred to the federal government. This probably would not be the desired effect by the state government. In this study, we examine whether the expected state tax exemption benefit $[\tau_s(1-\tau_f)\rho]$ is fully reflected in the yield.

METHODOLOGY

We use ordinary least squares regression analysis to examine the impact of the state tax exemption benefit on interest yields. Other factors that may have an impact on interest yields need to be controlled in order to measure the "net" impact of tax exemption status.[3] These control variables include the bond's duration, the call risk of the bond, type of bond (revenue versus general obligation bond), the credit quality of the bond issuer as measured by Moody's bond ratings, and the insured status. A more detailed discussion of the control variables as well as the test variable is presented later in this section. The regression equation used to control for these factors and examine the test variable is estimated as follows:

Equation 3

$$OY = \beta_0 + \beta_1 DUR + \beta_2 CALLRISK + \beta_3 REV + \beta_4 Aa + \beta_5 A + \beta_6 Baa + \beta_7 Ba$$
$$+ \beta_8 Y86 + \beta_9 Y87 + \beta_{10}(DUR*Y86) + \beta_{11}(DUR*Y87) + \beta_{12} INS + \beta_{12} STAX$$

where:

OY	=	the bond's offer yield;
DUR	=	the bond's duration (which reflects coupon rate and maturity)[4];
CALLRISK	=	a measure of the bond's call risk calculated as [(CALL)(COUPON RATE)(e^{-SPR})] where CALL is 1 if the bond is callable and 0 otherwise. SPR = i_{t+n} - i_t where i_{t+n} is the rate of a U.S. government bond maturing on the same date as the municipal bond and i_t is the rate of a U.S. government bond maturing on the date of the first call of the municipal bond. In cases where a U.S. government with the exact date could not be found, a U.S. bond with the closest date was chosen;
REV	=	a dummy variable (1 if a revenue bond, 0 otherwise);
Aa, A, Baa, Ba	=	Moody's credit ratings, a series of dummy variables with Aaa-rated bonds as the omitted set;
Y86, Y87	=	a series of dummy variables indicating if the bond was an element of the 1986 or 1987 sample set with 1985 as the omitted set;
(DUR*Y86), (DUR*Y87)	=	interaction terms between duration (DUR) and the dummy variables for 1986 (Y86) and 1987 (Y87);
INS	=	a default risk insurance dummy variable, with 1 indicating an insured bond (i.e., insured by American Municipal Bank Assurance Corporation) and 0 otherwise; and
STAX	=	the difference between the state income tax rate on out-of-state municipal bonds and in-state municipal bonds for each state and each time period.

Discussion of Independent Variables

Duration is positively related to bond price volatility and, in a world of risk-aversion, bond price volatility is positively related to bond interest yields. Thus, a higher duration implies a higher offer yield. The effect of duration on yields is also a direct function of the yield curve during the sample period. Since duration is positively related to term to maturity, and term to maturity is positively related to interest yield when the yield curve is upward sloping, interest yield is a positive function of duration when the yield curve is upward sloping. A positively sloped yield curve occurs during the sample period. Duration as positively related to price volatility and a positively sloped yield curve during the sample period both suggest the duration coefficient should be positive.

The variable, CALLRISK, attempts to capture the elements of call risk. Besides considering whether a bond is callable or not, the variable considers the coupon rate. As the coupon rate increases the issue has a higher probability of being called. Furthermore, as the expectations theory of interest rates suggests, the larger the spread (SPR) the greater the probability the interest rates would increase between the first call date and the maturity date and thus the lower the probability that an issue will be called. Since the greater the spread, the less likely an issue will be called, the variable SPR appears in the form of a negative exponential in the CALLRISK variable to reflect the relationship.[5] With the probability of being called reflected in the CALLRISK variable, a positive coefficient is expected.

The REV variable should have a positive coefficient because a revenue bond is not supported by the taxing authority in the same way as a general obligation bond and thus is considered more risky than a general obligation bond.

The Moody's credit rating variables should be positive because the Aaa-rated bonds are the basis of the comparison and as the ratings decline the coefficients should increase.

According to Yawitz's (1978) portfolio equilibrium hypothesis, the yields on municipal bonds will vary directly with shifts in the level of the risk free interest rate. During the 1985-1987 sample period the level of interest rates was falling. The terms (DUR*Y86) and (DUR*Y87) are designed to capture the impact on yield of the interaction between duration and the trend in the general interest rate levels.

Our sample includes both bonds insured by the American Municipal Bond Assurance Corporation (AMBAC) and non-insured bonds. The default risk insurance variable, INS, is expected to lower the yields on insured bonds.

The state tax differential variable, STAX, is expected to have a negative coefficient. A higher tax rate on out-of-state bonds would lead to a preference for in-state bonds and a lower yield on the in-state bonds would be expected.

DATA

Empirical tests were conducted on offer yields[6] in the secondary municipal bond market and incorporated information taken from *The Blue List of Current Municipal and Corporate Offerings* and supplemented by data from *Moody's Municipal Manual* and *The Wall Street Journal*. The test used data from three dates: January 30, 1985, January 22, 1986, and January 23, 1987. We use secondary market data in the study since previous research has documented evidence that initial public offering prices of newly issued securities are below the market equilibrium prices but that the aftermarket is efficient. These studies include both the stock market (Allen and Faulhaber 1989; Ibbotson 1975; and Rock 1986) and the bond market (Weinstein 1978). A review of market information indicates these dates are relatively free of destabilizing influences in the bond market that might lead to distortion of the values of the regression coefficients.

Previous studies of municipal bonds (Broadus and Cook 1981; Hopewell and Kaufman 1977; Kessel 1971; Kidwell, Koch, and Stock 1984; and Kidwell, Sorenson, and Wachowicz 1987) indicate that bond yields depend on the characteristics of the specific bond and market segmentation influences. To estimate equation (1), the information required for each observation was the offer yield, state of issuance or issuer domicile, purpose of issue, Moody's rating, coupon rate, date of maturity, revenue or general obligation, call information, and whether the bond was insured against default risk. The final sample contained 474 observations: 110 observations from January 30, 1985, 196 observations from January 22, 1986, and 168 observations from January 23, 1987. Approximately half of the observations had no tax differentials.

EMPIRICAL RESULTS

The results of estimating equation (3) for the combined dates are shown in Table 2. The combined model for the 1985-1987 period explains 77% of the variation in the offer yields. A review of the coefficients indicates that duration (DUR), A, Baa, Y87, (DUR*Y86), (DUR*Y87), insurance (INS), and state tax differential (STAX) were significant at the .01 level of confidence and Ba was significant at the .10 level. The signs of the significant regression coefficients were as expected.

INS reduced offer yields 31.1 basis points, on average, for the period 1985-1987. As the quality of the bonds, as measured by Moody's bond ratings, declined from Aaa to Ba, the yields were significantly higher than Aaa bonds with the exception of Aa bonds. Interest rate levels fell between January, 1985 and January, 1987 and were reflected in the significance of the Y87, (DUR*Y86), and (DUR*Y87) variables. The Y86 variable was not significant.

CALLRISK as a measure of callability was not statistically significant.[7] Revenue bonds comprised 39.7% of the sample. While REV did have the expected sign, it was not statistically significant.

To test the effect of the state tax differential as federal and state tax rates decreased during the sample period, separate regressions were estimated for each of the subsample dates. A review of the regression results in Table 2 reveals model R^2's of .85, .42, and .54 for the three years 1985, 1986, and 1987, respectively. The coefficients for DUR, INS, and STAX are statistically significant with the anticipated signs for all three periods.

The coefficients associated with insurance show that insured bonds had lower offer yields than uninsured bonds by 47 basis points, 29 basis points, and 21 basis points for 1985, 1986, and 1987, respectively. The decrease may reflect the decline in the level of interest rates from 1985 to 1987 and a tendency toward lower risk premia at

reduced term structure levels. This reduction in risk premia is consistent with Yawitz (1978). The estimate for REV was statistically significant with expected positive sign in 1987, but REV was not statistically significant in the 1985 and 1986 regressions.[8] The rating variables had positive coefficients in all three years and most were significant in 1985 and 1987. None of the rating variables were significant in 1986.[9] The CALLRISK coefficients were not statistically significant during any of the three years.

The yield reduction due to the state tax exemption benefit should be a function of three factors: 1) the marginal state income tax rate, 2) the interest return on the bond, and 3) the marginal federal income tax rate. For example, in a state which exempts in-state interest from taxes, but taxes out-of-state interest, if the state's income tax rate is 8%, the interest return is 7% on a $1,000 in-state bond, then the 8% state tax on the $70 of interest is avoided. But state income tax is deductible for those itemizing deductions for their federal income tax; therefore, the benefit to the investor of avoiding state income tax may be reduced by the loss of the federal deduction. Assuming the marginal federal income tax rate is 40%, the benefit of the state tax exemption would be $3.36 [i.e., 8% X $70 (1 - .40)] or 33.6 basis points on the $1,000 bond.

Although the Kidwell, Koch and Stock (1984) study does not directly comment on the degree of capitalization of the benefit, it can be examined. The Kidwell, Koch and Stock (1984) study (using 1980 data) states (page 555) that, "municipal securities in states with a positive tax differential carried net interest costs averaging almost 14 basis points less (calculate at the mean) than comparable securities from states with no tax differential." This statement is generally consistent with the data provided in their study. The TAX variable is defined as "the effective marginal income and property tax rate on bonds issued outside the state minus the comparable effective tax rate on bonds issued in-state by the state." In footnote three, KKS define a taxpayer's "effective marginal state tax rate" as the state tax rate adjusted for the federal tax [i.e., state rate times (1 - federal tax rate)] and they use this approach in Table 2. The TAX coefficient of -.036 and the mean of the TAX variable of 3.66% is -13.18 basis points or approximately -14 basis points. The expected benefit can be defined as the average effective positive marginal state tax rate (3.66%) times the average net interest cost (7.75%) which equals 28.37 basis points. In other words, the estimated benefit of almost 14 basis points is approximately half of the expected benefit of 28 basis points. The TAX coefficient of -0.036 is significantly different from zero with a t-statistic of -5.4. For 100% of the expected benefit to be capitalized a TAX coefficient of -.0776 would be needed (i.e., TAX coefficient X average positive effective tax differential of 3.66% = expected benefit of 28.37 basis points). The -.0776 coefficient lies outside a 99% confidence interval around KKS's TAX coefficient of -.036. This analysis indicates that the estimated benefit is significantly less than the expected benefit or that 100% of the expected benefit is not being capitalized into the yields.

Table 3 provides the expected net benefits associated with the state tax differential and the empirical estimates of the net benefits. The expected benefit is calculated according to $[\tau_s(1-\tau_f)\rho]$ (See our discussion in Section II). The estimated benefits are found by multiplying the coefficient associated with the STAX variable for each year times the average state tax (See footnote 4 of Table 3). The estimated benefits were 83, 80, and 96 percent of the expected net benefits for 1985, 1986, 1987, respectively. In each year the expected benefit was within a 90 percent confidence interval around the estimated benefit.[10] These results indicate that the estimated benefit is not significantly different from the expected benefit and the hypothesis that 100 percent of the expected benefit is being capitalized can not be rejected in any of the three years.[11]

The nonsignificant difference between the estimated benefits and the expected benefits also indicates that for bonds from states with positive tax differentials, the marginal investor is an in-state investor capturing the value of the tax differential benefit. If the STAX coefficient or the estimated benefit had not been significantly different from zero, the results would indicate that the marginal investor for bonds from states with positive tax differentials was an out-of-state investor.

To examine the states' cost-benefit relationship we can restructure the information in Table 3. The cost to the state would ignore the federal tax rate and the cost would be the state rate times the interest return. The average costs for 1985, 1986, and 1987 are 0.506%, 0.429% and 0.160%, respectively. Each of these costs is greater than the respective estimated benefits. The 1985 and 1986 estimated benefits are significantly different from the average costs at the .01 level and the 1987 benefits are significantly different from the average costs at the .10 level. These results suggest that the states' costs are significantly greater than the benefits.

CONCLUDING REMARKS

Many changes have occurred in the financial markets since 1980. These changes have led to more sophisticated individual investors and increased reliance on them in the municipal bond market. The purpose of this study is to examine the degree of capitalization of the state tax exemption benefit by investors in the secondary market.

Kidwell, Koch and Stock (1984) implicitly found less than full capitalization while examining the effect of the state tax exemption in the primary market for municipal bonds during 1980. This study finds that investors in the secondary market during the 1985-87 period were capitalizing the estimated tax exemption benefit at approximately 100%. This hypothesis of 100% capitalization could not be rejected in any of the individual years. The results also indicated that the marginal investor in bonds from states with positive tax differentials were in-state investors or that the municipal bond market has become more efficient in that it now appears to value the benefit correctly. Many changes have occurred in the financial markets since 1980. These changes have led to more sophisticated individual investors and increased reliance on them in the municipal bond market. The purpose of this study is to examine the degree of capitalization of the state tax exemption benefit by investors in the secondary market.

Another implication is that states can use personal tax exemptions to lower the borrowing costs of in-state municipalities. This is consistent with the Kidwell, Koch and Stock study. However, the results indicate that the cost to the states in the form of lost tax revenues is significantly greater than the estimated benefit of reduced interest costs to in-state issuers.[12]

TABLE 1

Schedule Of Maximum State Individual Income Tax Rates For States Which Exempt Taxes On In-State Bonds While Taxing Bonds Issued In Other States

STATE	1985	1986	1987
Alabama	.05	.05	.05
Arizona	.08	.08	.08
Arkansas	.07	.07	.07
California	.11	.11	.11
Colorado	.08	.08	.0175
Connecticut	.13	.12	.12
Delaware	.107	.097	.088
Georgia	.06	.06	.06
Hawaii	.11	.11	.10
Idaho	.075	.075	.082
Kentucky	.06	.06	.06
Louisiana	.06	.06	.06
Maryland	.05	.05	.05
Maine	.10	.10	.10
Massachusetts	.10	.10	.10
Michigan	.0535	.046	.046
Minnesota	.099	.099	.099
Mississippi	.05	.05	.05
Montana	.11	.11	.11
Missouri	.06	.06	.06
North Carolina	.07	.07	.07
North Dakota	.09	.09	.12
New Hampshire	.05	.05	.05
New Jersey	.035	.035	.035
New York	.1375	.135	.085
Pennsylvania	.0235	.022	.021
Ohio	.09025	.0855	.069
Oregon	.10	.10	.09
Rhode Island	.1112	.1066	.08211
South Carolina	.07	.07	.07
Tennessee	.06	.06	.06
Virginia	.0575	.0575	.0575
West Virginia	.13	.13	.065

Sources: *An Investors Guide: Tax-Exempt Securities* New York:Public Securities Association, 1984 and *Statistical Abstract of the United States* Washington D.C.: U. S. Department of Commerce.

TABLE 2
Regression Results
With Offer Yields As The Dependent Variable (Basis Points)

COMBINED MODEL PARAMETER	1985-1987	1985	1986	1987
INTERCEPT	588.0 (27.45)* 	563.0 (19.64)* 	617.8 (18.30)* 	408.9 (20.04)*
DUR	38.4 (15.18)* [6.174]	39.4 (18.23)* [6.488]	21.0 (8.93)* [5.215]	18.8 (10.80)* [7.087]
CALLRISK	-32.8 (-0.36) [.030]	-100.7 (-0.67) [.027]	40.0 (0.21) [.026]	-92.4 (-0.73) [.037]
REV	0.9 (0.12) [.397]	-8.3 (-0.59) [.436]	-13.4 (-0.99) [.408]	54.2 (3.65)* [.357]
Aa	19.1 (0.84) [.021]	69.0 (2.37)** [.055]	--[2]	39.9 (1.29) [.024]
A	30.6 (2.68)* [.354]	61.4 (2.64)* [.382]	28.3 (0.83) [.388]	63.1 (3.93)* [.298]
Baa	39.3 (3.22)* [.490]	85.9 (3.42)* [.527]	18.7 (0.56) [.520]	92.0 (4.91)* [.429]
Ba	35.9 (1.86)*** [.038]	--[2]	22.4 (0.58) [.061]	81.9 (2.82)* [.036]
Y86	11.9 (0.61) [.414]	--	--	--
Y87	-130.5 (-6.07)* [.354]	--	--	--
DUR*Y86	-17.4 (-6.04)* [2.157]	--	--	--
DUR*Y87	-19.0 (-6.39)* [2.512]	--	--	--

TABLE 2
Regression Results
With Offer Yields As The Dependent Variable (Basis Points)

(CONT'D)

COMBINED MODEL PARAMETER	1985-1987	1985	1986	1987
INS	-31.1 (-5.37)* [.500]	-47.4 (-5.70)* [.500]	-29.3 (-2.71)* [.500]	-21.2 (-2.46)** [.500]
STAX	-249.7 (-4.15)* [.048][1]	-349.2 (-3.74)* [.060][1]	-284.9 (-2.88)* [.060][1]	-387.5 (-3.01)* [.027][1]
R^2	.77	.85	.42	.54
ROOT MSE	63.0	43.6	75.1	55.5
N	474	110	196	168

Coefficients and root MSE are shown in basis points.
Values in parentheses are t-statistics.
Values in brackets are parameter means.
* Indicates significance at the .01 level.
** Indicates significance at the .05 level.
*** Indicates significance at the .10 level.

1. For the combined, 1985, 1986, and 1987 observations, the positive observations were 55, 58, 62, and 44 percent of the respective samples of observation and the nonpositive observations were zero.
2. There were no Ba and Aa observations in the 1985 and 1986 samples, respectively.

TABLE 3
Estimates Of Net Benefit Due To State Tax Differential

SAMPLE PERIOD	STATE[1] TAX RATE	×	1 - FEDERAL[2] TAX RATE	×	INTEREST[3] RETURN	=	EXPECTED BENEFIT	ESTIMATED[4] BENEFIT
1985	6.02%	×	(1-.50)	×	8.40%	=	0.253%	0.210%
1986	6.01%	×	(1-.50)	×	7.13%	=	0.214%	0.171%
1987	2.66%	×	(1-.33)	×	6.00%	=	0.107%	0.103%

1. The state tax rate is the average of maximum state individual income tax rates for the observations where the tax differential was positive and zero for approximately half of the observations that had no tax differentials. Although corporate tax exemption existed in 22 of the 33 states listed in Table 1, most of the flow of funds into the municipal bond market was from the household sector during the 1985-1987 period. These flows led to the use of the individual income tax alone.
2. The federal tax rate is the maximum federal individual income tax rate. The maximum in 1987 was 38.5% but the rate would fall to 33% in 1988 and beyond. Given the average maturity of nine years in 1987 the lower rate was used.
3. Offer yields were used as the interest return because, on average, the bonds were selling at a premium and the offer yields were more reflective of the interest return than coupon rates.
4. The average empirical estimate of the benefit can be found by multiplying the STAX coefficient for each year times the average state tax rate in column one (e.g., for 1985 the empirical estimate is .03492 X 6.02% = .210%).

ENDNOTES

1. In 1980 only three percent of new tax-exempt bond issues were insured against default risk. But by first quarter of 1987 this percentage had increased to 24 percent (Hirtle, 1987). Furthermore, in 1980 there were only two major private insurers as compared to four in the 1985-1987 period.

2. This statement does not depend on the tax differential in state j. If $\tau_j = 0$, then $\rho_j = \rho$. If $\tau_j > 0$, then state j investors will be indifferent between state j bonds and out-of-state bonds when $\rho_j = \rho(1 - \tau_j)$. Thus, the out-of-state investor will be indifferent to state i bonds at a yield of ρ and will invest in state i bonds if $\rho_i \geq \rho$.

3. A number of supply and demand variables were tested. These variables include transactions size, amount of public deposits, and state pledging requirements for securing public deposits. None of the supply and demand variables tested were significant in the model.

4. Macauley's duration was used for this variable and calculated as:

$$BOND\ DURATION = \frac{\sum_{t=1}^{N} \frac{CR \cdot FV \cdot t}{(1+i)^t} + \frac{FV \cdot N}{(1+i)^N}}{\sum_{t=1}^{N} \frac{CR \cdot FV}{(1+i)^t} + \frac{FV}{(1+i)^N}}$$

where:

CR = coupon rate,
FV = face value,
N = periods Until Maturity, and
i = the appropriate yield-to-maturity.

5. Broadus and Cook (1981) found the variable e^{-SPR} useful in measuring the risk of call.

6. The yields used in this study are offer yields. Ideally, we could have preferred actual transaction yields. However, we were severely constrained by data availability. In previous research Ingram, Brooks and Copeland (1983) performed a test of conformity between offering yields obtained from *The Blue List* and actual transaction yields taken from *The Wall Street Journal* and found a strong correspondence for municipal revenue bonds. This supports using offer yields as effective proxies for transaction yields.

7. A dummy variable (CALL) for callable bonds was substituted for CALLRISK. The general results were almost identical because the correlation coefficient between CALL and CALLRISK was 0.95.

8. Cole and Officer (1981) found revenue bonds to command a small but not significant premium in the 1976-1978 new insured issue market.

9. The significance of REV and the ratings variables in 1987 suggest the market may have been more concerned about municipal default risk in 1987 than in 1985 and 1986.

10. The 90 percent confidence interval around the estimated benefit was found by multiplying the average state tax rate by [STAX coefficient +/- ((1.658) (standard error of the STAX coefficient))]. For example, the 90 percent confidence interval for 1985 was from 11.7 basis points (i.e., 6.02% × ((.03492) - (1.658(.00934)))) to 30.3 basis points (i.e., 6.02% × ((.03492) + (1.658(.00934)))).

11. Failure to include a specific variable to measure a marketablity effect could result in a bias in our STAX coefficients. Larger issues of municipal bonds have greater demand in national markets and this are not as

segmented due to state income tax effects. Transaction size as a measure of marketability in the secondary market was tested in the regression and found to be not significant.

12. The implications about costs to in-state issuers rests on the assumption that these results based on the secondary bond market are generalizable to the primary market.

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