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Municipal Bond Demand Premiums and Bond Price Volatility: A Note

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ABSTRACT

The behavior of different components of municipal bond yields may have a significant impact upon bond price behavior. Specifically, demand premiums created by banks may stabilize bond yields in some maturity ranges but not in others; for example, short-term municipals may be stabilized but not long-term. This research implies that bank demand behavior may create demand premiums that stabilize prices of short-term municipal bonds relative to those of Treasury bonds of like maturity. While this implication is inconsistent with the residual theory of bank demand, it is consistent with the tax-shield theory attributed to Hendershott and Koch [3, 4].

RECENT RESEARCH ON FLUCTUATIONS in debt instrument yields has frequently emphasized such possible causes as changes in the expected rates of inflation and in the default risk. Kane et al. [7] and Jaffee [6] provide examples of these emphases. However, relatively little attention has been given to the impact of individual bond market features upon bond yields. One type of feature, demand behavior by important groups over time, may create demand premiums that have a significant impact on yield changes and bond price volatility.[1] Our purpose in this note is first to analyze the behavior of implied demand premiums for municipal bonds of different maturities relative to United States Treasury yields, and then to measure their price volatility relative to United States Treasury bonds of like maturity. Finally, we discuss the implications of these results for the residual and tax-shield theories of municipal bond demand.

I. Analysis of Premium Behavior and Impact on Price Volatility

The demand of some investor groups for municipal bonds may be related to such factors as investor income, investor tax rates, and general trends in interest rates.

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[1] Price volatility in municipal markets may also differ from the volatility in other bond markets because of differences in marketability and market efficiency. The lower marketability of municipals relative to Treasuries may increase price volatility of municipals. Also, due to differing accounting procedures and standards, the municipal market may not anticipate information as well as other bond markets. Thus, patterns of price volatility around the release date for new information on municipals may show relatively large price changes. For example, Ingram et al. [5] find that the release of municipal bond rating changes provides important information that causes price changes, whereas corporate bond rating changes may provide little information and, thus, have little effect on prices.

For the purpose of our research, the demand premium is approximated by calculating the difference between the municipal yield and the after-tax yield on a Treasury bond of like maturity.[2] In order to analyze the behavior of demand premiums as related to general trends in interest rates, we calculated the covariance between monthly changes in the demand premium and the coincident monthly changes in after-tax Treasury yields. Table I shows this covariance between changes in demand premiums for prime (Aaa) municipals and changes in after-tax Treasury yields. The covariances are statistically significant for both short-term and long-term maturities; interestingly, the covariances are negative for short-term but positive for long-term.

The fact that the covariance follows this pattern has important implications for the price volatility of municipals relative to that of Treasuries. To illustrate these implications, a model developed by Yawitz [14] is useful. The relative price volatility (RPV) of two bonds, i and j, is given by

$$\text{RPV}_{ij} = \left[\frac{D_i/(1 + r_i)}{D_j/(1 + r_j)}\right]\left[\frac{dr_i}{dr_j}\right] \tag{1}$$

where D is duration, r is yield to maturity, and d is the differential operator.[3] For comparisons between a class of municipal bonds, i, with Treasuries, T, the expression may be modified as

$$\text{RPV}_{iT} = \left[\frac{D_i/(1 + r_{si} + r_{pi})}{D_T/(1 + r_T)}\right]\left[\frac{dr_{si} + dr_{pi}}{dr_T}\right] \tag{2}$$

where r_{si} represents components of municipal yields separate from demand premiums, and r_{pi} represents demand premiums. If the covariation between changes in r_{si} and r_{pi} is negative, the price volatility of municipals relative to Treasury securities of like maturity will be small. Obviously, if the covariance is positive, the price volatility relative to Treasuries will be larger.

The apparent impact of this pattern of covariances on relative price volatility of municipals is shown in Table II. The sixth column shows the relative durations of like-maturity municipals and Treasuries, while the seventh column shows the relative mean absolute changes in yield (MACY). Note that the yield changes for municipals relative to Treasuries rise as the maturities increase. Finally, the eighth column, the product of the preceding two columns, shows the RPV of each type of bond as compared to that of a Treasury of like maturity. An entry of less than 1.000 indicates a price volatility lower than that of the Treasury.

The table shows that the prices of short-term municipals are less volatile than those of Treasuries, while long-term municipal prices are more volatile than

[2] Of course, this premium takes into account default and marketability risks but these are probably minimal for prime (Aaa) municipals.

[3] The model used here differs from Leibowitz's model [9] in that it uses the ratio of MACYs, mean absolute changes in yield, instead of Leibowitz's average ratio of observed municipal to observed Treasury rates. The Leibowitz technique does not use rate changes and assumes that shifts in Treasury and municipal yield curves will be parallel, but this parallelism is frequently not the case. Municipal yield curves are almost always upward sloping, whereas Treasury yields are sometimes downward sloping. Because of this lack of parallelism, the results reported here are substantially different from Leibowitz's results.

Table I

Covariances and Correlations between Monthly Changes in Prime (Aaa) General Obligation Municipal Bond Demand Premiums and Like-Maturity, After-Tax[a] Treasury Yields for 1966–1980[b]

Maturity	Covariance	Correlation	Significance Level of Correlation
1 year	−0.01977	−0.24220	0.0011
2 years	−0.08894	−0.12501	0.0945
5 years	0.00046	0.00840	0.9109
10 years	0.00879	0.21911	0.0031
20 years	0.00831	0.24074	0.0011
30 years	0.00791	0.25903	0.0004

[a] The tax rate used to obtain the after-tax Treasury yield was 48% for all maturities as suggested by Miller [10] and tested by Trzcinka [13]. Lower marginal tax rates, such as 35% and 30%, were also used for 20- and 30-year maturities. This procedure was followed because Hendershott and Koch [3, 4] and others [8, 9] have found that the ratio of municipal to Treasury yields rises with maturity. The resultant covariances were a little lower than those shown in this table, but they were still positive.

[b] Yield series obtained from Salomon Brothers [11], *An Analytical Record of Yields and Yield Spreads*, 1966–1980.

those of Treasuries. For example, 1-year prime grade municipals are only 60.8% (RPV of 0.608) as volatile, whereas 30-year prime grade municipals are 122.5% (RPV of 1.225) as volatile. It is also important to note the increases in price volatility due to lengthening maturity for each type of bond. This increase is measured by calculating the RPVs using the 1-year maturity for each type of bond as the base measure of price volatility which produces results for Treasuries consistent with those of Yawitz [14]. For example, a 30-year Treasury is only 5.478 times as volatile as a 1-year Treasury while a prime 30-year municipal is 11.824 times as volatile as a 1-year municipal.[4]

II. Implications for Demand Theories and Conclusion

There are two widely-used theories explaining bank investment demand for municipals. The residual theory of bank demand maintains that short-term municipal purchases by banks are a low priority use of funds [1, 2, 3, 4, 12]. That

[4] These results will not hold for discount municipals because the capital gain is taxable. See Leibowitz [9] for a discussion of the net yield factor.

Table II

Price Volatility of Different Grade Par and Premium General Obligation Municipals Relative to Treasuries for the Period January 1966–December 1980[a] (Monthly)

(1) Type	(2) Maturity	(3) Coupon	(4) Duration	(5) (MACY) Mean Absolute Change in Yield	(6)[b] $\frac{D_i/(1+r_i)}{D_T/(1+r_T)}$	(7)[c] $\frac{\text{MACY}_i}{\text{MACY}_T}$	(8) Price Volatility Relative to Treasury
Treasury	1	4.85	0.998	0.436	1.000	1.000	1.000
Prime Municipal	1	2.90	0.993	0.259	1.024	0.594	0.608
Good Municipal	1	3.00	0.993	0.263	1.023	0.602	0.615
Medium Municipal	1	3.15	0.992	0.273	1.021	0.625	0.638
Treasury	5	4.85	4.499	0.299	1.000	1.000	1.000
Prime Municipal	5	3.10	4.670	0.232	1.055	0.778	0.821
Good Municipal	5	3.25	4.655	0.240	1.051	0.804	0.844
Medium Municipal	5	3.35	4.645	0.266	1.047	0.890	0.932
Treasury	10	4.60	8.126	0.229	1.000	1.000	1.000
Prime Municipal	10	3.15	8.655	0.232	1.080	1.013	1.095
Good Municipal	10	3.35	8.579	0.238	1.068	1.042	1.113
Medium Municipal	10	3.50	8.523	0.254	1.060	1.111	1.178
Treasury	30	4.45	16.837	0.185	1.000	1.000	1.000
Prime Municipal	30	3.60	18.582	0.203	1.113	1.101	1.225
Good Municipal	30	3.75	18.254	0.208	1.091	1.127	1.230
Medium Municipal	30	3.95	17.831	0.214	1.064	1.157	1.232

[a] Source for data was *An Analytical Record of Yields and Yield Spreads*, Salomon Brothers [11].
[b] D_T denotes duration of like-maturity Treasury, and r_T denotes yield of like-maturity Treasury.
[c] MACY_T denotes mean absolute change in yield for Treasury bond.

is, banks first meet basic liquidity needs with cash reserves and Treasuries, and then they satisfy loan demand. Finally, if all available funds have not been allocated, banks will purchase short-term municipals. The residual theory implies that in an economic expansion, when interest rates are generally rising and loans are in high demand, banks should demand few short-term municipals and may even be net sellers. This lack of bank demand, the theory suggests, should cause short-term municipal yields to rise even more than those of other bonds. However, in a recession, when interest rates typically decline, the theory suggests that bank demand for municipals should be high and that short-term municipal yields should decline more than others. Thus, this theory implies that short-term municipals should be more price volatile than Treasuries.

On the other hand, the tax-shield theory, developed and tested by Hendershott and Koch [3, 4], maintains that bank demand is derived from the tax-shield that municipals offer. Thus, in an economic expansion, when interest rates generally rise and banks are likely to have large profits subject to the maximum corporate tax rate, banks should demand large numbers of short-term municipals. Therefore, any rise in short-term municipal yields that would otherwise accompany

the expansion should be limited. In a recession, when interest rates are generally declining, banks should have lower levels of profits to shield from taxes and should demand fewer municipals. Consequently, short-term municipal yields should fall less than other yields. This theory suggests that short-term municipals are less price volatile than Treasuries.[5]

Although this research is not a direct test to determine the correct theory of bank demand, the results given in Table II tend to support the tax-shield theory, demonstrating that short-term municipals are less price volatile than like-maturity Treasuries. The results of our research are inconsistent with the residual theory, which suggests that short-term municipals are more price volatile than like-maturity Treasuries.

[5] The positive covariance for longer maturities may be caused by individual investors substituting common stocks for municipal bonds in economic expansions and vice versa in contractions, as suggested by Hendershott and Koch [3]. Further, Yawitz [15] maintains that default risk on municipals rises with the general level of interest rates because of the lower safety margins for guaranteeing a municipality's interest payments. However, this behavior of default risk premiums is apparently dominated by bank demand premiums for short-term municipals.

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