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Relative Risk in Municipal and Corporate Debt

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Introduction

THE YIELDS OF municipal bonds and corporate bonds are often compared. The ratios of municipal bond yields to corporate bond yields are thought by many to be indicative of the marginal tax bracket of the marginal holder of the bonds. If, for example, the ratio is .60, the implication is that an investor in the forty-percent tax bracket will be indifferent between the fully-taxed corporate and the fully tax-exempt municipal. (This assumes that the two bonds are currently selling at par.) Such comparisons have attracted increased attention since the publication of Merton Miller's seminal "Debt and Taxes". In this work Miller indirectly suggests that the marginal tax bracket at work across tax-exempt and taxable bonds is equal to the corporate tax rate. While the ratio of yields seems to indicate that this is true for short-term bonds, the yields of long-term tax-exempts seem too high relative to long-term taxables to confirm Miller's hypothesis.

Implicit in these comparisons and the conclusions drawn from them is the tenuous notion that the compared bonds are identical except for the taxability of the coupon. For example, some authors have questioned whether municipals and corporates are equally risky. (See Trzcinka [1982]). The purpose of this paper is to present preliminary evidence on the relative riskiness of the two classes of bonds.

Relative Risk

Why might the risks of municipal bonds differ from those of similar corporate bonds? Several plausible explanations are possible. Suppose, for example, increases in taxable interest rates lead to reduced demand for tax-sheltered investments by the holders of tax-exempt bonds. If this is the case, changes in taxable bond prices may be accompanied by even-larger changes in tax-exempt bond prices. Consider the following illustrations.

Commercial banks hold approximately one half of the municipal bonds outstanding. Banks have a unique opportunity to arbitrage across short-term tax-exempt and taxable bond markets; that is, they are allowed a deduction for interest paid on CD's while, at the same time, receiving tax-exempt coupon payments. This privilege ensures that short-term municipal yields are normally very near to the after-corporate-tax yield on CD's. But this arbitrage by banks is not always profitable or possible. In order for the deduction for interest expense to be valuable, the bank must have sufficient taxable income and when interest

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rates are unexpectedly high, bank income is normally reduced. Casualty insurance companies hold approximately 15 percent of the municipal bonds outstanding. When inflation and interest rates are unexpectedly high, casualty claims are normally unexpectedly high and underwriting losses typically result. Individuals hold approximately 35 percent of the municipal bonds outstanding. A change in government monetary policy can have the effect of simultaneously increasing taxable interest rates and lowering taxable income. In each of these examples increases in taxable interest rates lead to a decline in taxable income and, therefore, a decline in the demand for tax-sheltered investments.

Municipal bonds may also have different inherent default risk than corporate bonds. In one sense municipals have more default risk because the assets of municipal governments are not accessable to bondholders in default. (Normally, default results in a renegotiation of the terms of municipal debt.) In another sense municipals may be less risky because the taxing authority of a municipality may be a more reliable source of cash flows than the assets of firms.

Robinson [1960] reports that municipals display about 1.5 times the risk of similarly rated corporate bonds (as measured by the standard deviation of return) for the 1950's. Skelton [1980] reports similar results for the 1960's. But both of these studies rely on returns imputed from yield indexes, and for this reason they may be suspect. Yield indexes often do not change from month to month even though the individual bonds which are supposedly represented by the index change in price. In addition yield indexes often represent a dealer's notion of the appropriate yield for a newly-issued par bond rather than following the price histories of particular bonds. Thus, a reliable comparison of risks should employ measured returns on actual bonds rather than imputed returns from yield indexes.

Table 1

Sample Bonds

Issuer	Coupon	Maturity
1. Jacksonville Expressway Authority	4.00	1992
2. Jacksonville Expressway Authority	4.10	2003
3. Kansas Turnpike Authority	3.375	1994
4. Illinois State Toll Authority	4.75	1998
5. Kentucky Turnpike Authority	4.85	2000
6. Oklahoma Turnpike Authority	4.70	2006
7. Fairfax County Water Authority	5.00	2007
8. Kentucky Turnpike Authority	5.50	2006
9. Dade County Aviation Authority	5.50	2007
10. Hillsborough County	5.875	1999
11. Port Authority of New York, New York	5.00	2003
12. New Madrid Poser Authority	5.75	2003
13. Grant County Public Utility District	3.875	2005
14. NY State Urban Development Authority	6.60	2011
15. Nebraska Public Power	6.60	2004
16. Douglas County Public Utility District	4.06	2018
17. Port Authority of New York, New Jersey	5.80	2007
18. Toledo Lucas Port Authority	4.00	2004
19. Chelan County Public Utility District	5.25	2023
20. Battery Park City Authority	6.375	2014

The Data

The data for this study are taken from the microfilm records of a leading municipal bond pricing service. This service provides portfolio valuation for several hundred unit trust funds on either a daily or weekly basis. Most of the bonds that are valued by the service are priced by a "matrix" model which assigns yields to bonds based on quality, maturity, call provisions, and other characteristics. A small percentage of the bonds valued by the service are priced by placing calls to municipal bond dealers and asking for "the market". These bonds, called dollar bonds, are the few municipals which are regularly traded.

The municipal bonds in this study are twenty investment grade dollar bonds for which dealer quotes were continuously available for the months November 1972 through December 1979. The issuing authorities, coupons and maturities for the bonds are given in Table 1. All but one of the bonds are revenue bonds, secured by the receipts of a particular project such as a toll road or electric utility. The remaining bond is a general obligation bond, secured by tax revenues. Four of the bonds are related to the city or the state of New York.

For the purpose of comparison, returns on corporate bonds and common stocks are taken from the Salomon Brothers Total Performance Index for High-Grade Long-Term Corporate Bonds and the Standard and Poors Composite Index.

Sample Statistics for Individual Municipal Bonds

Table 2 displays maximums, minimums, means, and standard deviations of monthly returns for the twenty municipal bonds. The minimum risk bond is the

Table 2

Sample Statistics for Individual Bonds
(Monthly Returns 11/1972–12/1979)

Bond	Minimum	Maximum	Mean	Standard Deviation
1	−.109	.060	.0032	.023
2	−.072	.125	.0035	.026
3	−.126	.079	.0037	.030
4	−.090	.109	.0024	.030
5	−.183	.097	.0037	.032
6	−.102	.118	.0031	.033
7	−.047	.061	.0021	.019
8	−.128	.113	.0036	.030
9	−.083	.092	.0037	.023
10	−.077	.047	.0032	.018
11	−.112	.118	.0031	.040
12	−.066	.070	.0033	.023
13	−.084	.142	.0037	.032
14	−.236	.232	.0061	.063
15	−.078	.066	.0033	.022
16	−.073	.072	.0045	.026
17	−.108	.166	.0030	.042
18	−.110	.072	.0050	.021
19	−.084	.147	.0032	.029
20	−.205	.210	.0044	.065

single general obligation bond in the sample. The four highest-risk bonds are the New York-related bonds. The standard deviation of return for the highest-risk bond (Battery Park City Authority) is more than 3.6 times that of the lowest-risk bond (Hillsborough County). In addition, toll road bonds appear to be slightly riskier than power bonds.

Differences in mean return are somewhat less pronounced. The highest-return bond is a New York-related bond (New York State Urban Development Authority) with a return 2.9 times that of the lowest-return bond (Fairfax County Water Authority). No differences in mean return are discernable between toll road bonds and power authority bonds.

Problems with the Measurement of Variance

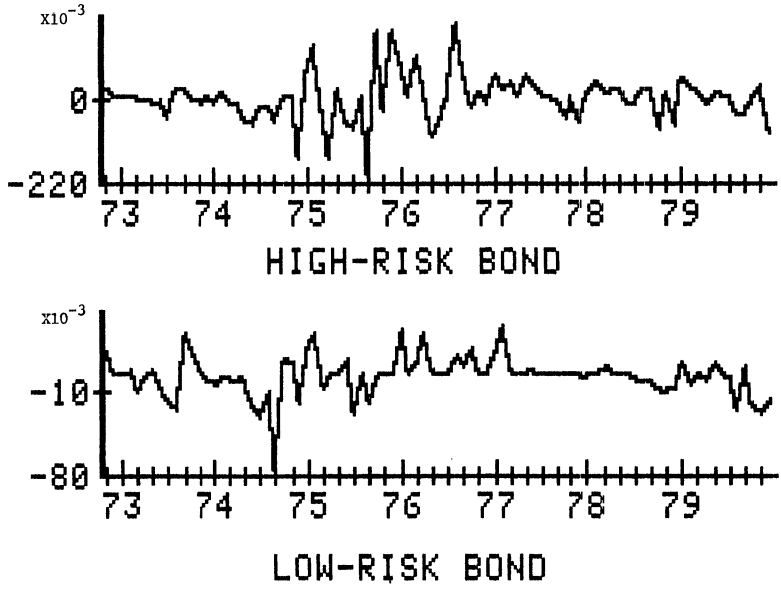
The returns measured for the sample municipal bonds are calculated from quoted dealer "ask" prices. These prices are changed by dealers in increments never smaller than one quarter of a point. This means that although the economic value of a bond may change by less than a quarter of a point, the reported price will not change. Thus, in a period in which bond prices change very little, the sample may include a number of successive identical returns.

For example, in 1977 the quoted prices of many of the municipal bonds in the sample do not change for a number of months. The dollar return on these bonds, is only the constant accrued interest from the coupon payments, and therefore, in 1977 the measured variance of return is low. In effect, small price changes are truncated to zero. The larger the trading increment relative to the true variance of the asset, the more likely is the truncation to zero.

This effect is illustrated in Exhibit 1. At the top of the page the time series of

EXHIBIT 1

MUNICIPAL BOND RETURNS



returns for the highest-variance municipal bond is displayed. At the bottom of the page the time series of the lowest-variance municipal bond is displayed. Notice that successive returns are rarely identical for the high-variance bond but are frequently so in 1977 for the low-variance bond. Thus the measured variance for the low-risk bond may be biased low relative to the measured variance for the high-risk bond.

It is possible to imagine a scenario under which this effect might produce a biased-high measure of variance, as well. For example, the economic value of the bond may oscillate across some critical value which produces a price change. If the oscillations are smaller than the trading increment, the estimated variance will be too high.

Comparison of Return Indexes

If the twenty municipal bonds in the sample are combined in an equally-weighted portfolio, the returns on the portfolio may be considered representative of high-quality municipal bond returns. Table 3 displays sample statistics for the portfolio of municipals, the corporate bond return index and the common stock return index. Exhibits 2, 3 and 4 display the time series of returns for the three indexes.

For the entire sample period, November 1972 to December 1979, the standard deviations of return for the two bond indexes differ by only .001 per month. The standard deviation of the common stock index is roughly twice that of the two bond indexes. In the first half of the sample period the bond index risks are identical. In the second half corporate bonds appear to be somewhat risker than municipals, although this comparison may be affected by the large number of zero price changes in 1977 for the municipals.

Thus, municipals and comparably rated corporate bonds seem to be (at least for the mid to late 1970's) about equally risky. This may be because the elimination of Regulation *Q* from large bank CD's in 1973 ensured that banks could freely arbitrage across tax-exempt and taxable bond markets. The extra

Table 3

Sample Statistics for Indexes
(Monthly Returns)

	Minimum	Maximum	Mean	Standard Deviation
11/1972–12/1979				
Common Stock	−.117	.166	.0045	.047
Corporate Bonds	−.089	.089	.0034	.023
Municipal Bonds	−.062	.075	.0036	.022
11/1972–6/1976				
Common Stock	−.117	.165	.0033	.056
Corporate Bonds	−.048	.089	.0046	.026
Municipal Bonds	−.062	.075	.0023	.026
7/1976–12/1979				
Common Stock	−.089	.087	.0059	.036
Corporate Bonds	−.089	.035	.0021	.020
Municipal Bonds	−.061	.052	.0050	.017

EXHIBIT 2

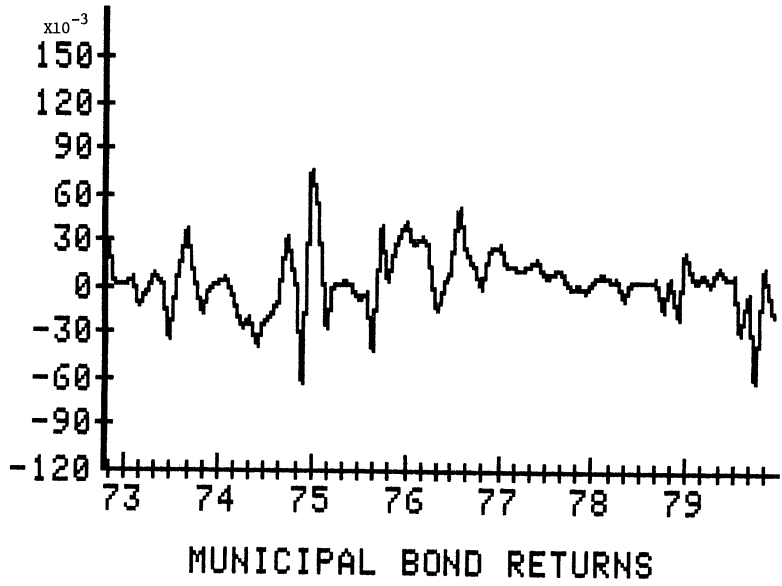
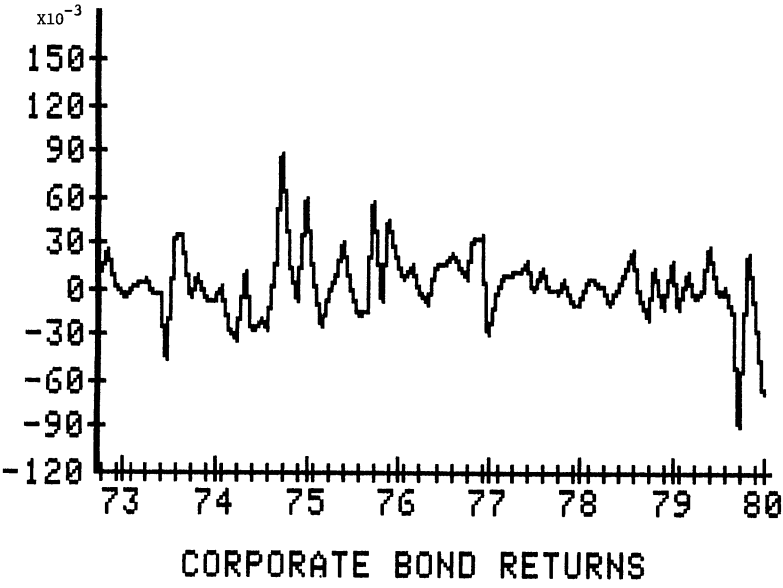
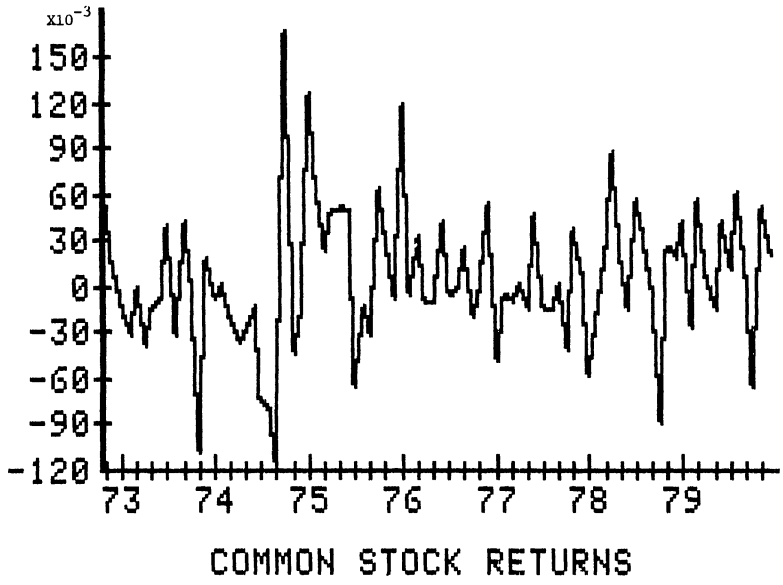


EXHIBIT 3



volatility of municipal yields associated with the occasional inability of banks to arbitrage (as in the 1960's and early 1970's) may have thus been eliminated. (See Skelton [1980] for a discussion of these effects.) It must be noted, as well, that the portfolio of municipal bonds may not be truly representative of the high-

EXHIBIT 4



quality tax-exempt market. In particular, the New York-related bonds seem far riskier than the average bond in the sample. If these bonds are removed from the portfolio, the standard deviation of return for the municipal index for the entire sample period is .0185.

Covariance of Bond Returns with Stock Returns

The results given above seem to indicate that the variances of return for corporate and municipal bonds are not very different. Much of the theory of finance, however, is concerned with the risks of assets in portfolios rather than the risks of assets alone. In particular, much of the literature in capital asset pricing is concerned with the covariance of asset returns with some market index. The measurement of these covariances is normally carried out by regressing the individual asset's return on the index of market returns.

To put this study in a similar context, the returns on the twenty sample municipal bonds are regressed on the index of common stock returns. The slope term from the simple time-series regression is the covariance of the municipal return with the stock return scaled by the variance of the stock return.

At first glance there is a temptation to refer to this statistic as a "beta" in the sense of the capital asset pricing model of Sharpe, Lintner, and Black. But in these models the market index contains all assets, and in the simple regressions performed in this paper the "market" is only the index of common stocks. Nevertheless, because common stocks are among the riskiest assets in the market portfolio, an index of stock returns probably captures much of the variation of the market. This notion is consistent with the recent empirical work of Stambaugh [1982].

If municipal bonds are exposed to risks arising from decreased tax receipts to the government, their prices might well be expected to covary with the prices of common stocks. For example, when business is expected to be bad, tax receipts are also expected to be low. Fewer municipals will be demanded as tax shelters, and cities will have fewer dollars with which to repay debts. Hence, stock prices and municipal bond prices will fall simultaneously.

Table 4 displays the results of the simple time-series regression of the twenty municipal bonds on the index of common stocks. The slope term or "beta" for each of the bonds is positive, and almost all are significantly different from zero. The three lowest-beta bonds are the general obligation bond, the water authority bond and the aviation authority bond. These bonds are also the three lowest-variance bonds. The Durbin-Watson statistics for two of the three indicate that the regression residuals are autocorrelated. The significance of the beta estimates, therefore, is somewhat overstated. The four highest-beta bonds are the New York related bonds.

For comparison purposes the returns on the equally-weighted portfolio of municipal bonds and the returns on the corporate bond index are regressed on the common stock index. Table 5 displays the results of these regressions for the entire sample period and for two subperiods. For the entire period and the estimated betas for the two bond indexes differ by only .007. Again, it should be noted that the New York-related bonds may not belong in an index of high-quality municipal bonds. If they are eliminated, the estimated beta for the

Table 4

Regression of Municipal Returns on Common Stock Index

$R_m = \alpha + \beta R_s + \epsilon$

(Monthly Returns, 11/1972–12/1979)

Bond	α	$t(\alpha)$	β	$t(\beta)$	R^2	$D\,W$
1	.0028	1.02	.175	3.57	.121	1.76
2	.0023	.98	.205	3.66	.127	2.09
3	.0030	.95	.121	1.78	.024	1.96
4	.0009	.42	.257	4.13	.158	2.23
5	.0021	.77	.272	4.07	.154	2.63
6	.0013	.53	.297	4.40	.177	2.33
7	.0019	.90	.033	.75	.009	1.57
8	.0022	.82	.244	3.91	.144	2.00
9	.0031	1.33	.098	1.91	.030	1.94
10	.0023	1.39	.157	4.15	.160	1.52
11	.0007	.33	.402	4.90	.213	2.04
12	.0021	1.07	.201	4.19	.163	1.76
13	.0021	.77	.274	4.06	.154	2.09
14	.0043	.71	.301	2.13	.039	1.92
15	.0021	1.08	.199	4.35	.174	1.84
16	.0032	1.31	.216	3.84	.139	2.18
17	.0009	.34	.350	3.95	.146	2.25
18	.0043	2.00	.120	2.57	.061	1.78
19	.0019	.75	.213	3.36	.107	2.14
20	.0022	.40	.374	2.59	.062	2.09

Table 5

Regression of Bond Indexes on Common Stock Index

$R_i = \alpha + \beta R_s + \epsilon$

(Monthly Returns)

	α	$t(\alpha)$	β	$t(\beta)$	R^2	$D\,W$
11/1972–12/1979						
Corporate Bonds	.0024	.60	.232	4.71	.195	1.70
Municipal Bonds	.0026	1.19	.225	5.00	.220	1.80
11/1972–6/1976						
Corporate Bonds	.0038	1.10	.239	3.90	.248	2.11
Municipal Bonds	.0014	.42	.280	4.78	.337	2.15
7/1976–12/1979						
Corporate Bonds	.0003	.13	.301	4.13	.281	1.46
Municipal Bonds	.0044	1.65	.090	1.25	.013	1.53

municipal index becomes .192 for the entire period, .04 less than the estimated beta for the corporate index.

For the first subperiod, November 1972 to June 1976, small differences in the estimated slope are again revealed. But for the second subperiod corporate bonds appear to covary much more strongly with common stocks than do municipal bonds. Part of the explanation for this result may be that for much of 1977 many of the quoted prices for the sample municipal bonds did not change. Thus, the trading increment problem will bias measured covariance toward zero in periods when price changes are small.

Conclusions

This preliminary investigation of relative risk in municipal and corporate bonds reveals that in at least two respects they are remarkably similar. First, the measured variances of return for portfolios of comparably rated bonds are virtually identical. Second, the covariances of comparably rated bond portfolios with an index of common stock returns are also very close to one another.

Some have argued that because municipals are risker than corporates, the yield ratio (municipal to corporate) understates the actual marginal tax bracket at work across the bonds. But since these risk differences are not discernable, the relative yields may be truly informative about the tax brackets of the marginal holders of the bonds. Of course, the standard deviation of return and the covariance of return with a common stock index are not necessarily proper measures of risk. A complete answer to the relative risk question will only be possible in the context of a complete model of risk and return.

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