

Porter, White & Company

Considering Optimal Maturities of Municipal Bonds

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I. Purpose

Fixed income investments are used to reduce the risk of the overall portfolio, particularly portfolios containing a large equity weighting. Issues of fixed income investments selected for client portfolios have typically been shorter duration (<5 years) and issued by the federal government and corporations with investment grade credit quality (AAA to BBB-). In the White Paper, *Optimizing the Fixed Income Component of a Portfolio*, we demonstrate that extending duration to the intermediate term range with Treasury securities improves the risk-adjusted performance of a portfolio with a large equity allocation. This document assesses whether including intermediate term municipal bonds enhances the risk-return relationship of portfolios that contain equity. We conclude that intermediate term municipal bonds can be more effective than short term municipal bonds at increasing the risk-adjusted performance of portfolios that can assume a moderate amount of risk exposure (standard deviation of 5% or more) and have intermediate to long term time horizons.

II. Municipal Bonds Defined

Municipal bonds are bonds issued by state and local governments to fund projects to build roads, bridges, hospitals, schools, sewer systems, and other local government needs. Municipal bond issuers include cities, counties, redevelopment agencies, school districts, and other governmental entities below the state level. Municipal bonds may be general obligation or revenue bonds. A general obligation municipal bond is backed by the taxing authority of the issuer, while a revenue bond is backed by the revenues generated by the project being funded. Municipal bonds receive special consideration as a fixed income investment because interest payments are exempt from federal taxes as well as state and local taxes if the investor resides in the same state as the issuer; however, capital gains taxes must be paid on municipal bonds purchased at a discount under certain circumstances.

III. Municipal Bond Returns

Historical municipal and Treasury bond returns of comparable maturity are shown in Table 1. Investors usually require a higher return on Treasury securities because, unlike municipal bonds, they must pay taxes on interest payments received.

Table 1: Historical Treasury and Municipal Bond Returns (%)

(Annualized monthly returns, January 1990 to September 2009)

	Mean	Std. Deviation	Mean/Std. Deviation
Barclays Capital Municipal Bond Index 3 Years	5.05	1.98	2.55
Barclays Capital Treasury Bond Index 1-5 Years	6.03	2.42	2.49
Barclays Capital Municipal Bond Index 7 Years	6.20	3.90	1.59
Five-Year US Treasury Notes	6.75	4.58	1.47

The term premium on municipal bonds is 1.15%, the approximate difference between the Barclays Capital Municipal Bond Index 7 Years and the Barclays Capital Municipal Bond Index 3 Years. The term premium on Treasury bonds is 0.72% and is represented as the difference between Five-Year US Treasury Notes and the Barclays Capital Treasury Bond Index 1-5 Years. These term premiums are not perfectly comparable because of duration and average quality differences illustrated in Table 2. The decrease in average quality between the municipal indexes will cause the yield to be higher in the Barclays Capital Municipal Bond Index 7 Years due to greater credit risk; however, the difference in duration is smaller between the municipal indexes compared to the Treasury indexes, which should cause the term premium to be larger for the Treasury indexes. The duration and average credit quality of the indexes change over time; therefore, the average duration and credit quality may have been different throughout the period. Differences between the term premium in the taxable and municipal bond market will be addressed in a future white paper.

Table 2: Treasury and Municipal Bond Term and Credit Characteristics

(As of September 30, 2009)

	Duration	Avg Quality
Barclays Capital Municipal Bond Index 3 Years	2.6	AA1/AA2
Barclays Capital Treasury Bond Index 1-5 Years	2.7	AAA
Barclays Capital Municipal Bond Index 7 Years	5.1	AA2/AA3
Five-Year US Treasury Notes	4.8	AAA

Another important risk indicator is the historical minimum returns over the period for each index, which is shown in Table 3.

Table 3: Historical Minimum Returns (%)

(Total returns, January 1990 to September 2009)

	Monthly	Quarterly	Annual
Barclays Capital Municipal Bond Index 3 Years	-1.49	-1.67	0.07
Barclays Capital Treasury Bond Index 1-5 Years	-1.65	-2.56	-0.88
Barclays Capital Municipal Bond Index 7 Years	-3.41	-4.08	-2.77
Five-Year US Treasury Notes	-3.34	-6.08	-5.55

For monthly and quarterly periods, each index posted a loss. For monthly, quarterly, and annual periods, the magnitude of the loss was larger for the Barclays Capital Treasury Bond Index 1-5 Years as compared to the Barclays Capital Municipal Bond Index 3 Years. Five-Year US Treasury Notes have lost more than the Barclays Capital Municipal Index 7 Years at quarterly and annual periods, but not for monthly periods.

Investors realize greater diversification benefits within their portfolios as the correlation between funds moves closer to -1. The historical correlations are illustrated in Table 4 using the following indexes to represent four fixed income asset classes:

<u>Abbreviation</u> Form	<u>Full</u> Name
Barclays Short Term Municipal	Barclays Capital Municipal Bond Index 3 Years
Barclays Short Term Treasury	Barclays Capital Treasury Bond Index 1-5 Years
Barclays Intermediate Municipal	Barclays Capital Municipal Bond Index 7 Years
Intermediate Treasury	Five-Year US Treasury Notes

Table 4: Historical Correlation Matrix

(Monthly returns, January 1990 to September 2009)

	S&P 500	ST Municipal	ST Treasury	Interm. Municipal
Barclays Short Term Municipal	0.06			
Barclays Short Term Treasury	-0.07	0.67		
Barclays Intermediate Municipal	0.11	0.93	0.62	
Intermediate Treasury	-0.05	0.65	0.96	0.65

The Barclays Short Term Treasury has the lowest correlation with equities, while the Barclays Intermediate Municipal has the highest correlation with equities. The fixed income and equity correlation is higher for the municipal indexes compared to the Treasury indexes. As the maturity of the fixed income asset class increases, the equity and fixed income correlation increases as well. The Treasury indexes will offer a greater diversification benefit with equities than with municipal indexes. The correlation between equity and fixed income when equity returns are negative is presented in Table 5.

Table 5: Historical Correlation Matrix when Equity Returns are Negative

(Monthly returns, January 1990 to September 2009)

	S&P 500	ST Municipal	ST Treasury	Interm. Municipal
Barclays Short Term Municipal	-0.02			
Barclays Short Term Treasury	-0.22	0.56		
Barclays Intermediate Municipal	0.03	0.96	0.54	
Intermediate Treasury	-0.17	0.56	0.97	0.57

Because many investors use fixed income investments to reduce the risk of their overall portfolio, the correlation between equity and fixed income is of particular importance when equity returns are negative. The correlation between equity and each fixed income asset class falls when

equity returns are negative, resulting in a greater diversification benefit if volatility is held constant. The municipal bond indices correlation with equity falls by a smaller amount than the Treasury indices correlation with equity when the equity return is negative.

IV. Sample Portfolios

To better understand the impact of adding municipal bonds to portfolios, we look at historical results for model portfolios with a predominantly equity allocation. The return data is summarized in Table 6. We also show two measures of risk: standard deviation and maximum loss (minimum monthly return).

Table 6: Historical Returns (%)

(Annualized monthly returns, January 1990 to September 2009)

	Average Return	Standard Deviation	Min. Monthly Return
S&P 500	8.0	15.1	-16.8
Barclays Short Term Municipal	5.1	2.0	-1.5
Barclays Intermediate Municipal	6.2	3.9	-3.4

Equity provided a greater return over the time period, but had a much higher standard deviation. As expected, the Barclays Intermediate Municipal index had a higher return than the Barclays Short Term Municipal index, but also had higher volatility as measured by the standard deviation.

A comparison of sample portfolios with equity and different weightings of short and intermediate term municipal indexes is shown in Table 7. Adding the Barclays Short Term Municipal index hurts both the absolute and risk adjusted performance of the portfolio as compared to the Barclays Intermediate Municipal index.

Table 7: Sample Model Portfolios

(January 1990 to September 2009)

Portfolio	1	2	3
S&P 500	70%	70%	70%
Barclays Short Term Municipal	30%	15%	0%
Barclays Intermediate Municipal	0%	15%	30%
<i>Performance</i>			
Average Return	7.4%	7.5%	7.7%
Standard Deviation	10.6%	10.7%	10.7%
Sharpe Ratio	0.33	0.34	0.36
Min Monthly Return	-11.7%	-11.8%	-11.9%

Note: Average Return and Standard Deviation are annualized from monthly returns.

V. Portfolio Optimization

A portfolio optimizer that maximizes expected return for a given level of volatility can be used to determine whether short or intermediate term municipal bonds are preferred in efficient portfolios. The optimizer uses the equations of Modern Portfolio Theory and requires expected return, standard deviation, and correlation assumptions to determine the optimal weighting of each asset class in the portfolio. The optimal weighting result depends upon the expected return, standard deviation, and correlation input assumptions explained below. Short and intermediate term municipal bonds are considered along with equities in the analysis.

The expected return for equities (10.1%) was determined by taking the “market” return (7.2%), primarily based on the dividend yield and earnings growth (Bogle, 2006), and adding a small cap and value premium (2.9%). The historical short term municipal bond returns (5.0%) were assumed in the analysis. The intermediate municipal bond return was assumed to be the historical short term municipal bond return plus the current term premium (1.5%), represented by the current difference in yields between the Barclays Capital Municipal Bond Index 7 Years and Barclays Capital Municipal Bond Index 3 Years.

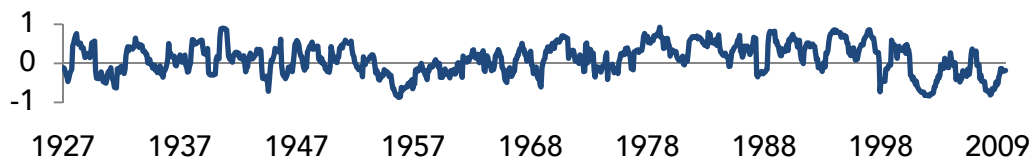
The expected volatility of each asset class was estimated by scaling the historical standard deviation by the ratio of the assumed return to the historical return over the sample period, as follows:

$$\text{Expected Volatility} = \text{Historical Standard Deviation} \times \frac{\text{Assumed Return}}{\text{Historical Return}}$$

This method follows from the fundamental relationship between risk and return, which says that investors must be compensated for the level of risk they take.

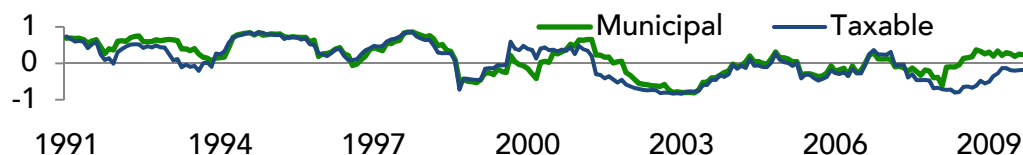
Finally, the correlation between asset classes is extremely variable as shown in Figure 1 and Figure 2. The correlation between fixed income and equity can quickly move from a strong, positive correlation to a strong, negative correlation for both taxable and tax exempt bonds. Returns dating back to the beginning of the municipal bond indexes (January 1990) are used to calculate correlations.

Figure 1: Historical Correlation between Stocks and Taxable Bonds



Note: The S&P 500 and 5-Year Treasury Notes were used for stock and bond data, respectively. The trailing 12 month correlation is shown. Period from January 1926 to September 2009.

Figure 2: Historical Correlation between Stocks and Bonds



Note: The S&P 500, Barclays Capital Municipal Bond Index 7 Years, and 5-Year US Treasury Notes were used for equity, municipal and taxable bond data, respectively. The trailing 12 month correlation is shown. Period from January 1990 to September 2009.

The return and volatility assumptions used in the optimizer analysis for each asset class are shown in Table 8. Return and volatility increase as the municipal bond term risk increases. Equity is assumed to have a higher return and volatility than municipal bonds.

Table 8: Asset Class Return and Volatility Assumption Inputs

	Short Term Municipal	Intermediate Term Municipal	Equity
Expected Return	5.0%	6.5%	10.1%
Standard Deviation	2.0%	4.1%	17.2%

Note: Volatility is scaled based on returns from January 1990 to September 2009. The Short Term Municipal fixed income risk-return relationship is based off the Barclays Capital Municipal Bond Index 3 Years historical returns. The Intermediate Term Municipal fixed income return was derived by adding the current term premium (1.5%), represented as the difference in the yield to maturity between the Barclays Capital Municipal Index 7 Years and 3 Years. The volatility was derived by scaling the historical volatility by the ratio of the assumed return to the historical return. The equity risk-return relationship is based off the S&P 500.

The correlation assumptions used in the optimizer analysis for each asset class are shown in Table 9. Historically, intermediate term municipal bonds have been more highly correlated with equities as compared to short term municipal bonds. Short term municipal bonds should provide a greater diversification benefit compared to intermediate term municipal bonds in a portfolio with equity.

Table 9: Correlation Assumption Inputs

(January 1990 to September 2009)

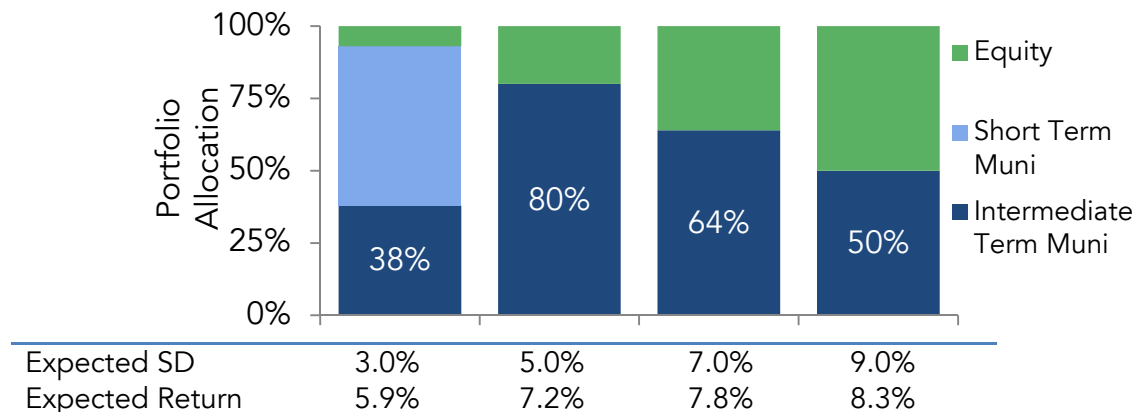
	Short Term Muni	Intermediate Term Muni
Short Term Muni	1.00	0.93
Intermediate Term Muni	0.93	1.00
Equity	0.06	0.11

Note: The Short Term Muni, Intermediate Term Muni, and Equity are represented by the Barclays Capital Municipal Bond Index 3 Years, Barclays Capital Municipal Bond Index 7 Years, and the S&P 500, respectively.

The optimal weighting of short and intermediate term municipal bonds and equity in a portfolio under various volatility constraints is shown below in Figure 3. The figure shows that short term municipal bonds are preferred over intermediate term municipal bonds only at stringent volatility

constraints. Only intermediate term municipal bonds and equity are included in efficient portfolios when the expected standard deviation constraint is five percent or more.

Figure 3: Optimal Portfolio Allocations Varying Volatility and Marginal Tax Rate



VI. Conclusion

Short term municipal bonds have lower returns, volatility, and correlation with equity than intermediate term municipal bonds; however, the incremental return provided by extending duration on municipal bonds supersedes the incremental diversification benefit of short term municipal bonds for portfolios that can assume a moderate amount of risk (standard deviation of 5% or more). The preference for intermediate over short term municipal bonds in diversified portfolios is consistent with previous research on taxable bonds, which recommended increasing the duration of bonds from short to intermediate term for diversified portfolios containing at least 30% equity (See White Paper, *Optimizing the Fixed Income Component of the Portfolio*).

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IMPORTANT NOTICE

This paper is intended to provide information to investors. Whether to invest in the intermediate municipal bond asset class is a decision to be made on the basis of current market conditions and the circumstances of each investor. In addition, investors should be aware of the investment principles listed below.

- i. Past performance is not a guarantee of future results. Values change frequently and past performance may not be repeated. There is always the risk that an investor may lose money. Even a long-term investment approach cannot guarantee a profit. Economic, political, and issuer-specific events will cause the value of securities, and the portfolios that own them, to rise or fall.
- ii. Different types of investments involve varying degrees of risk, and there can be no assurance that any specific investment will either be suitable or profitable for a client's investment portfolio. In this document, risk is equated to standard deviation, which may be an incomplete measure of risk.
- iii. Fixed income securities are subject to interest rate risk because the prices of fixed income securities tend to move in the opposite direction of interest rates. In general, fixed income securities with longer maturities are more sensitive to these price changes and may experience greater fluctuation in returns.
- iv. The returns and other characteristics of the allocation mixes contained in this presentation are based on models and back-tested simulations to demonstrate broad economic principles. They were achieved with the benefit of hindsight and do not represent actual investment performance.
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- x. Economic factors, market conditions, and investment strategies will affect the performance of any portfolio and there are no assurances that it will match or outperform any particular benchmark.

VII. Appendix

A. Bibliography

Bogle, J. C. (2006, April 6). *Investment Wisdom and Human Values*. Retrieved August 6, 2008, from John C Bogle Website: http://johncbogle.com/speeches/JCB_West%20Point%2004-06.pdf

B. Sources & Descriptions of Data

The S&P 500

Total returns net of all fees in US\$

The S&P Data are provided by Standard & Poor's Index Services Group

Barclays Capital Municipal Bond Index 3 Years

November 2008 - present: Barclays Capital Municipal Bond Index 3 Years Source: Barclays Capital, total returns in USD

January 1990 - October 2008: Lehman Brothers Municipal Bond Index 3 Year Maturity

Barclays Capital Municipal Bond Index 7 Years

November 2008 - present: Barclays Capital Municipal Bond Index 7 Years January 1990 - October 2008: Lehman Brothers Municipal Bond Index 7 Years

Total Return in USD

Source: Barclays Capital

Barclays Capital Treasury Bond Index 1-5 Years

November 2008 - present: Barclays Capital Treasury Bond Index 1-5 Years Total returns in USD

January 1976 - October 2008: Lehman Brothers Treasury Bond Index Range 1-5 Years

Source: Barclays Capital

Five-Year US Treasury Notes

Total returns net of all fees in USD

January 1926 - Present: Five-Year US Treasury Notes

Source: Ibbotson Intermediate Five Year Treasury Notes