

## **Characteristics and Performance of U.S. Bond Funds in Index Investing**

C. Edward Chang, George S. Swales, Jr. and John S. Bowdidge

### **Introduction**

A well-diversified investment portfolio should contain an appropriate mix of cash, stocks, and bonds. Adding bond index funds that charge minimal fees is a good way to build a bond component (Berry, 2002; Papier, 2002; Philpot et al., 1998). Indexing in bond funds is simply an extension of the concept of indexing which has become familiar for stock funds. Bond index funds are relatively recent phenomena. Vanguard, which pioneered equity index funds, also pioneered bond index funds. The concept of indexing has spread and several other groups now offer similar bond index funds. Bond index funds constitute a small group of mutual funds and were first confined to the taxable bond fund sector. In the past several years, new varieties of bond funds began to appear: bond funds investing in inflation-linked bonds and new types of bond funds --- exchange-traded funds (ETFs).

This paper examines characteristics and performance measures of all available vehicles, in the form of mutual funds and exchange-traded funds (Madlem and Edwards, 2002), for index investing in the U.S. bond markets. In this study, bond mutual funds include not only pure index funds, but also their close substitutes – enhanced index funds and “almost” index funds as identified by Ferri (2002). Enhanced index funds are funds that make adjustments to indexed portfolios in an effort to increase returns relative to the benchmark market index (Volpert, 1997; Riepe and Werner, 1998). The “almost” index funds used here, according to Ferri (2002), do not follow a published benchmark exactly, but they come close. These funds are an acceptable alternative to index funds because they are low-cost, no commission funds, and the fund manager does not drift from the stated investment style. These “almost” index funds enable exploration of indexing issues in the area of tax-free bond funds, which were not possible before this study.

### **Index Funds in Bond Investing**

Like equity index funds, bond index funds are managed passively to mirror a specific benchmark index. All index funds have two advantages: a low expense ratio and low turnover of assets. As in the case for stock funds, few managers of actively-managed bond funds have consistently outperformed specific benchmark indices (Thau, 2001, page 331). The anticipation is that, over long holding periods, bond index funds will have higher total returns than most actively-managed bond funds because they will match the total return of the benchmark and expenses for managing the fund will be low (Faerber, 2000, page 270).

---

C. Edward Chang, George S. Swales, Jr., and John S. Bowdidge are Professors at Missouri State University.

Nevertheless, bond index funds confront some issues that stock index funds don't address (Gudikunst, 1992; Mossavar-Rahmani, 1991; Reichenstein, 1998; Lochhoff, 1998). It is actually more difficult for mutual fund companies to manage a bond index fund than a stock index fund (Granito, 1987). Most of the bond indexes are not designed with the objective of being used as a benchmark for index funds. Rather, the indexes have historically been used as a guide to measure the movement of the broad bond market. This is evidenced by the fact that most of the indexes hold thousands of bonds, many of which are illiquid. Index funds need access to all bonds in the index to fully replicate an index. Since full replication is not possible, index fund managers resort to sampling. Consequently, bond index funds have higher turnover than stock index funds or ETFs (Baer and Gensler, 2002; Para and Dasgupta, 2004; Ptak, 2003).

### Data

All bond index funds in the U.S., with data available on September 30, 2005, were collected from Morningstar and Yahoo! Finance. Table I shows that out of 2,902 taxable bond mutual funds, 35 pure index funds, 24 enhanced index funds, and 12 "almost" index funds were found. These funds were supplemented by six bond ETFs for this study. No pure index or enhanced index funds, and only six "almost" index funds were found out of 1,938 tax-free bond funds reviewed. There are currently no ETFs available in this category.

### Results

Expense ratios and annual turnover rates are shown in Table II. As anticipated, bond index funds are less expensive than average bond funds in their respective categories. Bond ETFs have the lowest expense ratios (0.17%), followed by "almost" index funds (0.22%) and pure index funds (0.39%). Enhanced index funds have higher than category-average expense ratios (1.21% vs. 1.07%). "Almost" index funds have the lowest turnover (36%), followed by pure index funds (79%) and bond ETFs (148%, higher than the 134% for average bond funds). Enhanced index funds, especially in the long-term government category, behaved just like actively-managed funds and have very high turnover (938%).

Morningstar return, risk and "star" (or risk-adjusted return) ratings are shown in Table III. Morningstar rates mutual funds from 1 to 5 stars based on how well they have performed (after adjusting for risk and accounting for sales charges) in comparison with similar funds. Within each Morningstar category, the top 10% of funds receive 5 stars and the bottom 10% receive 1 star (the next 22.5% receive 2 and 4 stars, the middle 35% receive 3 stars). Funds are rated for up to three time periods (three-, five-, and 10-years) and these ratings are combined to produce an overall rating. Return and risk are assessed in a similar manner. This study finds that, over the past 10 years, "almost" index funds and pure index funds exhibit above-average return (4.01 and 3.89), risk (3.16 and 4.37), and risk-adjusted return (4.14 and 3.83) ratings. Enhanced index funds, with average risk levels (2.99), exhibit below-average return (2.30) and risk-adjusted return (2.10) ratings.

Annualized NAV returns over the past three-year period ended September 30, 2005 are shown in Table IV. Morningstar calculates NAV total return by taking the change in a fund's NAV (assuming the reinvestment of all income and capital gains distributions on the actual reinvestment date used by the fund during the period), and then dividing by the initial NAV. This study finds most bond index funds exhibit lower average NAV returns than average bond funds in their respective categories except for the short-term pure index, intermediate-term government ETF, and long-term government ETF segments. "Almost" index funds, on the contrary, exhibit mostly higher average NAV returns than average bond funds, except in the high yield bond category.

Table IV also shows results of standard deviations (risk) and Sharpe ratios (risk-adjusted return) over the same three-year period. Standard deviation is a statistical measure of the dispersion of a fund's performance. When a fund has a high standard deviation, the predicted range of performance is wide, implying greater volatility. At Morningstar, the standard deviation is computed using the trailing monthly total returns for the appropriate time period. All monthly standard deviations are then annualized. The Sharpe ratio is calculated for the past 36-month period by dividing a fund's annualized excess returns over the risk-free rate by its annualized standard deviation. The ratio is then recalculated on a monthly basis and the higher the Sharpe ratio, the better the fund's historical risk-adjusted performance.

"Almost" index funds have the lowest standard deviation (4.30%), followed by pure index funds (5.59%) and bond ETFs (6.82%). Enhanced index funds exhibit the highest standard deviation (7.04%) among these four groups of funds. "Almost" index funds have the highest Sharpe ratios (0.56%), followed by pure index funds (0.36%), bond ETFs (0.25%), and enhanced index funds (0.19%). "Almost" index funds exhibit the best measures (the lowest risks and the highest risk-adjusted returns), followed by pure index funds and bond ETFs. Enhanced index funds exhibit the worst measures among these four groups of funds. "Almost" index funds are also the only group of index funds that outperform average bond funds with lower standard deviation (4.30% vs. 4.55%).

Additional three-year results of market risk, measured by beta coefficients, and risk-adjusted returns, measured by Alphas, are shown in Table V. Beta is a measure of a fund's sensitivity to market movements. Alpha measures the difference between a fund's actual returns and its expected performance, given its risk level as measured by beta. A positive alpha indicates the fund has performed better than its beta would predict.

"Almost" index funds exhibit the lowest market risk (0.89 against standard index; 0.85 against best fit index), followed by pure index funds (1.30 against standard index; 1.02 against best fit index) and bond ETFs (1.57 against standard index; 1.10 against best fit index). Enhanced index funds exhibit the highest market risk (1.59) against standard index but the second lowest market risk (0.98) against best fit index among these four groups of funds. "Almost" index funds have the highest Alphas (0.65% against standard index; -0.13% against best fit index), followed by pure index funds (-0.73% against standard index; -0.29% against best fit index), bond ETFs (-1.12% against standard index; -0.41% against best fit index), and enhanced index funds (-1.95% against standard index; -1.32% against best fit index). These results are very similar to Table IV. "Almost" index funds, again, exhibit the best measures (the

lowest risks and the highest risk-adjusted returns), followed by pure index funds and bond ETFs. Enhanced index funds exhibit the worst measures among these four groups of funds. Only the “almost” index funds outperformed average bond funds with lower risk and higher risk-adjusted returns.

### Conclusion

A well-diversified portfolio should contain bonds. This study has identified all bond index funds and ETFs currently available as avenues to diversify portfolios. The authors of this study find the “almost” index funds identified by Ferri (2002) turn out to be gems: they have low expense ratios and the lowest turnover, while exhibiting mostly the lowest risk and highest risk-adjusted returns. Pure index funds, with low expense ratios and turnover, have performed well in the past ten years based on Morningstar’s ratings, but below average in the past three years. Enhanced index funds have the highest expense ratios, extremely high turnover, average or high risk and always the lowest risk-adjusted returns. As newcomers, bond ETFs have the lowest expense ratios and comparable returns, but they underperformed “almost” and pure index funds in the areas of turnover, risks and risk-adjusted returns.

### References

- Baer, G. and G. Gensler. 2002. *The Great Mutual Fund Trap*. New York: Broadway Books.
- Berry, S. 2002. “Why You Need a Bond Index Fund.” *Morningstar Bond Squad* (November 6).
- Faerber, E. 2000. *All About Bonds and Bond Mutual Funds*. New York: McGraw-Hill.
- Ferri, R. 2002. *All About Index Funds*. New York: McGraw-Hill.
- Granito, M. 1987. “The Problem with Bond Index Funds.” *Journal of Portfolio Management* 13 (4): 41-48.
- Gudikunst, A. 1992. “Determinants of Bond Mutual Fund Performance.” *Journal of Fixed Income* 2 (1): 95-101.
- Lochoff, R. 1998. “Fixed-Income Indexing.” In A. Neubert (ed.). *Indexing for Maximum Investment Results*. New York: AMACOM.
- Madlem, P. and L. Edwards. 2002. *Power Investing with Basket Securities: The Investor’s Guide to Exchange-Traded Funds*. Boca Raton: St. Lucie Press.
- Mossavar-Rahmani, S. 1991. *Bond Index Funds*. Chicago: Probus Publishing Company.
- Papier, A. 2002. “Indexing Works for Bonds, Too.” *Morningstar Bond Squad* (June 5).

- Para, E. and P. Dasgupta. 2004. "Managing Fixed-Income Index Funds." In S. Schoenfeld. *Active Index Investing*. New York: Wiley.
- Philpot, J., D. Hearth, J. Rimbey and C. Schulman. 1998. "Active Management, Fund Size, and Bond Mutual Fund Returns" *Financial Review* 33 (2, May): 115-125.
- Ptak, J. 2003. "Bond Fund Turnover: Why So High?." *Morningstar Ask the Analyst* (April 2).
- Reichenstein, W. 1998. "Bond Fund Returns and Expenses: A Study of Bond Market Efficiency." *Journal of Investing* 8 (4, Winter): 8-16.
- Riepe, M. and M. Werner. 1998. "Are Enhanced Index Mutual Funds Worthy of Their Name?." *Journal of Investing* 7 (2, Summer): 6-15.
- Thau, A. 2001. *The Bond Book*. New York: McGraw-Hill.
- Volpert, K. 1997. "Managing Indexed and Enhanced Indexed Bond Portfolios." In F. Fabozzi (ed.). *Selected Topics in Bond Portfolio Management*. New Hope, PA: Frank J. Fabozzi Associates.

Table I  
The Number of Bond Funds and Bond Index Funds as of September 30, 2005

Morningstar Category*	Bond Mutual Funds				Bond ETFs
	Total	Pure Index Funds	Enhanced Index Funds	Almost Index Funds	
Taxable Bond Funds	2,902	35	24	12	6
Short-Term Bond	350	3	5	1	0
Intermediate-Term Bond	916	24	14	1	1
Long-Term Bond	84	1	0	0	1
Short-Term Government	167	0	0	2	1
Intermediate-Term Government	348	7	0	5	1
Long-Term Government	71	0	5	1	2
High Yield Bond	444	0	0	2	0
Others	522	0	0	0	0
Tax-Free Bond Funds	1,938	0	0	6	0
Muni National Short	115	0	0	3	0
Muni National Intermediate	207	0	0	1	0
Muni National Long	250	0	0	2	0
Others	1,366	0	0	0	0

\* Definitions are available at [http://search.morningstar.com/Glossary/Glossary\\_M.html#16c](http://search.morningstar.com/Glossary/Glossary_M.html#16c).

Table II  
Expense Ratio and Annual Turnover

Morningstar Category	Expense Ratio (%)					Annual Turnover (%)				
	AMFs	PIFs	EIFs	AIFs	ETFs	AMFs	PIFs	EIFs	AIFs	ETFs
<b>Taxable Bond Funds</b>										
Short-Term Bond	1.00	0.27	0.89	0.18		131	99	103	37	
Intermediate-Term Bond	1.06	0.37	1.19	0.20	0.20	202	111	290	40	457
Long-Term Bond	1.15	0.18			0.15	103	62			32
Short-Term Government	1.00			0.22	0.15	148			79	106
Intermediate-Term Government	1.10	0.74		0.32	0.15	207	45		51	121
Long-Term Government	1.15		1.53	0.24	0.18	354		2,421	38	25
High Yield Bond	1.28			0.28		79			47	
<b>Tax-Free Bond Funds</b>										
Muni National Short	0.87			0.28		43			9	
Muni National Intermediate	0.96			0.14		42			10	
Muni National Long	1.13			0.15		33			18	
<b>Averages</b>										
Taxable Bond Funds	1.11	0.39	1.20	0.24	0.17	175	79	938	49	148
Tax-Free Bond Funds	0.99			0.19		39			12	
All Above Categories	1.07	0.39	1.21	0.22	0.17	134	79	938	36	148

AMFs: Average of All Bond Mutual Funds

EIFs: Enhanced Index Funds

ETFs: Bond Exchange-Traded Funds

PIFs: Pure Index Funds

AIFs: Almost Index Funds

Table III  
Morningstar Return, Risk and Star Ratings

Morningstar Category	Return Rating			Risk Rating			Star Rating		
	PIFs	EIFs	AIFs	PIFs	EIFs	AIFs	PIFs	EIFs	AIFs
<b>Taxable Bond Funds</b>									
Short-Term Bond	4.00	2.00	4.00	4.00	2.60	3.00	4.00	2.00	5.00
Intermediate-Term Bond	3.57	2.64	4.00	3.48	2.36	5.00	3.57	2.79	4.00
Long-Term Bond	4.00			5.00			4.00		
Short-Term Government			4.00			3.00			4.00
Intermediate-Term Government	4.00		4.40	5.00		3.60	3.75		4.60
Long-Term Government		2.25	4.00		4.00	3.00		1.50	4.00
High Yield Bond			3.50			2.50			3.50
<b>Tax-Free Bond Funds</b>									
Muni National Short			3.67			2.33			3.67
Muni National Intermediate			4.00			3.00			4.00
Muni National Long			4.50			3.00			4.50
<b>Averages</b>									
Taxable Bond Funds	3.89	2.30	3.98	4.37	2.99	3.35	3.83	2.10	4.18
Tax-Free Bond Funds			4.06			2.78			4.06
All Above Categories	3.89	2.30	4.01	4.37	2.99	3.16	3.83	2.10	4.14

PIFs: Pure Index Funds

EIFs: Enhanced Index Funds

AIFs: Almost Index Funds

Table IV  
Three-Year Average Annual Return, Standard Deviation and Sharpe Ratio

Morningstar Category	Annual Return (%)					Standard Deviation (%)					Sharpe Ratio (%)			
	AMFs	PIFs	EIFs	AIFs	ETFs	AMFs	PIFs	EIFs	AIFs	ETFs	PIFs	EIFs	AIFs	ETFs
Taxable Bond Funds														
Short-Term Bond	2.13	2.47	1.40	3.03		1.99	2.47	1.64	1.84		0.31	-0.18	0.69	
Intermediate-Term Bond	4.01	3.77	3.95	4.72		4.13	4.45	3.95	4.96		0.47	0.57	0.61	
Long-Term Bond	7.27	6.65			5.80	6.63	10.01			6.69	0.52			0.62
Short-Term Government	1.45			1.76	1.41	2.10			1.93	1.47			0.04	-0.19
Intermediate-Term Government	2.47	2.37		3.81	2.77	3.59	5.44		4.09	7.38	0.15		0.52	0.18
Long-Term Government	5.11		3.60	5.10	5.71	10.53		15.53	10.00	11.73		0.20	0.38	0.39
High Yield Bond	13.93			12.31		5.77			5.33				1.87	
Tax-Free Bond Funds														
Muni National Short	1.59			1.85		1.74			1.39				0.05	
Muni National Intermediate	2.74			3.08		4.21			4.14				0.34	
Muni National Long	3.49			4.21		4.82			5.02				0.53	
Averages														
Taxable Bond Funds	5.20	3.82	2.98	5.12	3.92	4.96	5.59	7.04	4.69	6.82	0.36	0.20	0.69	0.25
Tax-Free Bond Funds	2.61			3.05		3.59			3.52				0.31	
All Above Categories	4.42	3.81	2.98	4.43	3.92	4.55	5.59	7.04	4.30	6.82	0.36	0.19	0.56	0.25

AMFs: Average of All Bond Mutual Funds  
EIFs: Enhanced Index Funds  
ETFs: Bond Exchange-Traded Funds

PIFs: Pure Index Funds  
AIFs: Almost Index Funds

Table V  
Beta Coefficients and Alphas

Morningstar Category	Against Standard Index										Against Best Fit Index							
	Beta Coefficient					Alpha (%)					Beta Coefficient				Alpha (%)			
	AMFs	PIFs	EIFs	AIFs	ETFs	AMFs	PIFs	EIFs	AIFs	ETFs	PIFs	EIFs	AIFs	ETFs	PIFs	EIFs	AIFs	ETFs
Taxable Bond Funds																		
Short-Term Bond	0.43	0.57	0.36	0.41		-0.56	-0.51	-1.12	0.38		0.99	0.62	0.72		-0.02	-0.80	0.72	
Intermediate-Term Bond	0.95	1.05	0.93	1.17		0.15	-0.29	0.15	0.39		1.01	0.83	0.78		-0.33	-0.17	0.45	
Long-Term Bond	1.45	2.32			1.57	2.23	-0.02			0.61	1.00			1.18	-0.26			-0.72
Short-Term Government	0.46			0.44	0.31	-1.29			-0.93	-1.00			0.82	0.62			-0.07	-0.38
Intermediate-Term Gov't	0.82	1.27		0.90	1.71	-1.05	-2.09		0.09	-2.58	1.08		0.93	1.46	-0.54		0.20	-0.50
Long-Term Government	2.33		3.49	2.30	2.67	-1.41		-4.89	-1.45	-1.51		1.49	0.97	1.13		-3.00	0.01	-0.04
High Yield Bond	0.39			0.48		10.67				9.01			0.93					-1.95
Tax-Free Bond Funds																		
Muni National Short	0.35			0.29		-0.98			-0.59				0.68					-0.06
Muni National Intermediate	0.93			0.91		-1.22			-0.86				0.78					-0.23
Muni National Long	1.05			1.10		-0.78			-0.20				1.08					-0.21
Averages																		
Taxable Bond Funds	0.98	1.30	1.59	0.95	1.57	1.25	-0.73	-1.95	1.25	-1.12	1.02	0.98	0.86	1.10	-0.29	-1.32	-0.11	-0.41
Tax-Free Bond Funds	0.78			0.77		-0.99			-0.55				0.85					-0.17
All Above Categories	0.92	1.30	1.59	0.89	1.57	0.58	-0.73	-1.95	0.65	-1.12	1.02	0.98	0.85	1.10	-0.29	-1.32	-0.13	-0.41

AMFs: Average of All Bond Mutual Funds

EIFs: Enhanced Index Funds

ETFs: Bond Exchange-Traded Funds

PIFs: Pure Index Funds

AIFs: Almost Index Funds