

Returns-Based Style Analysis of High-Yield Bonds

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It is widely accepted that high-yield bonds are hybrid assets. That is, their returns are sensitive to high-grade bond returns and stock returns (Blume and Keim [1991]; Cornell and Green [1991]; Ramaswami [1991]; Fridson [1994]; Shane [1994], and Reilly and Wright [2001]). But, when it comes to asset allocation purposes, should we view high-yield (HY) bonds as 80% high-grade bonds and 20% stocks, or 60% bonds and 40% stocks, or perhaps 40% bonds and 60% stocks? For asset allocation decisions, this separation is too crude. Investors also want to know the bond and stock exposures of their specific HY bond funds and whether that stock exposure is related to small-cap or large-cap stocks and growth or value stocks.

In this study, we present results of returns-based style analysis of four HY bond indexes and 60 HY bond funds. The HY bond index results imply that the bond component decreases and the stock component increases as the index's credit rating declines. The HY bond fund results explicitly separate these funds into high-grade bond, stock, and, sometimes, cash components. Furthermore, they separate their stock exposures into small-cap and large-cap components and growth and value components. The bond fund results reveal substantial differences among HY bond funds. These results should help investors better understand HY bond funds' styles. Therefore, the results should help investors better manage portfolios that contain HY bond funds.

Separately, we show that in their model portfolios, academics and professionals usually consider HY bonds to be 100% bonds. Since the recommended HY bond allocations tend to be small (e.g., 5%), this mischaracterization of HY bonds produces only a small misrepresentation of the model portfolios' true asset allocations. Nevertheless, it is better to inform investors that HY bonds are a hybrid asset with high-grade bond components and stock components. When it comes to calculating the asset allocation and managing funds, HY bonds are best thought of as part stocks, part bonds, and, sometimes, part cash.

The next section discusses returns-based style analysis. Later sections discuss the embedded options in high-yield bonds and present results for the style analysis. The final section concludes.

RETURNS-BASED STYLE ANALYSIS

Sharpe [1988, 1992] developed returns-based style analysis (RBSA) to determine a mutual fund's investment style. For example, RBSA might determine that a stock fund's style is 70% Russell 1000 Value and 30% Russell 2000 Value (70/30). Although Morningstar might place this fund in its large-cap value category, a better reflection of its style is to say that its style-based returns follow the returns on the 70/30 portfolio. Similarly, the better measure of the returns attributable to the fund

manager's ability would be the difference between the fund's returns and returns on this 70/30 portfolio.

RBSA estimates the following asset class factor model:

$$R_{i,t} = [b_{i1}F_{1,t} + b_{i2}F_{2,t} + \dots + b_{in}F_{n,t}] + e_{i,t} \quad (1)$$

$R_{i,t}$ denotes the return on asset i for period t . In this study, the dependent variable, $R_{i,t}$, is a HY bond fund or a HY bond index. $F_{1,t}$ denotes the return on factor 1 for period t , $F_{2,t}$ the return on factor 2 for period t , $F_{n,t}$ the return on factor n for period t , and $e_{i,t}$ the non-factor component of the return on asset i for period t . The values b_{i1} through b_{in} denote the sensitivities of $R_{i,t}$ to factors $F_{1,t}$ through $F_{n,t}$. In RBSA, the factors are asset class returns, and the goal of RBSA is to determine a mutual fund's effective allocation across asset classes.

To be operational, we must define the asset classes. From Sharpe [1992], each asset class should 1) be mutually exclusive, 2) be exhaustive, and 3) have returns that differ. Each asset class should be a capitalization-weighted portfolio of securities, with as many securities as possible considered, but no security should be included in more than one asset class. Furthermore, it is important that investors could feasibly attain the (approximate) return on each asset class.

Exhibit 1 presents the factors or asset classes used to evaluate HY bond returns. There are four stock and five fixed-income asset classes. The stock asset classes are Russell 1000 Value, Russell 1000 Growth, Russell 2000 Value, and Russell 2000 Growth. These are components of the Russell 3000, a measure of the total U.S. stock

market which is especially popular for institutional investors. These four components separate the Russell 3000 into four exhaustive and non-overlapping indexes by size and style. The fixed-income market is separated into five segments: Lehman Brothers (LB) Corporate, LB Long-term Government, LB Intermediate-term Government, LB Mortgage-backed Securities, and one-month Treasury bills. These indexes satisfy the goals of being non-overlapping and exhaustive, and investors could feasibly attain the approximate return on each index.

HY bonds trade infrequently. Consequently, these bonds are often priced using matrix pricing. Basically, the price is estimated based on yields of traded bonds with similar features, such as maturity, coupons, ratings, and so forth. Due to infrequent trading, the observed returns on HY bonds in month t could be related to the returns on some of the nine asset classes in month t and the returns on some of the nine asset classes in the prior month. Therefore, RBSAs for HY bond returns use 18 independent variables—the current monthly return and the lagged monthly return on each of the nine asset classes.

RBSA requires minimizing the sum of squared errors, where each error is

$$e_{i,t} = R_{i,t} - [b_{i1}F_{1,t} + b_{i2}F_{2,t} + \dots + b_{in}F_{n,t}] \quad (2)$$

The b_i coefficients in Equation (2) are constrained as $0 \leq b_i \leq 1$ for all b_i , and $\sum b_i = 1$. In words this means that there is no short selling (b_i cannot be negative) and the sum of the coefficients must equal 1. R^2 denotes the percent of the variance of $R_{i,t}$ that is explained by the style-based shadow portfolio (the bracketed expression in Equation (2)). In common usage, R^2 denotes the percentage of returns attributed to the mutual fund's style, while $(1 - R^2)$ denotes the return attributed to selection.¹

EXHIBIT 1

Asset Classes Used in Return-Based Style Analysis of High-Yield Bonds

Asset Class	Index (Abbreviation)
Large- and mid-cap value stocks	Russell 1000 Value (R1000 Value)
Large- and mid-cap growth stocks	Russell 1000 Growth (R1000 Growth)
Small-cap value stocks	Russell 2000 Value (R2000 Value)
Small-cap growth stocks	Russell 2000 Growth (R2000 Growth)
High-grade corporate bonds	Lehman Brothers Corporate Bond (Corp)
Long-term government bonds	LB Long-term Government (LT Gov)
Intermediate-term government bonds	LB Intermediate-term Government (IT Gov)
Mortgage-backed securities	LB Mortgage-backed Securities (MBS)
Cash	One-month Treasury bills (Tbills)

Due to infrequent trading on high-yield bonds, the returns-based style analysis uses current and one-month lagged values of each asset class return.

EMBEDDED OPTIONS IN HIGH-YIELD BONDS

Consider the values of bonds and stocks of a firm that has HY bonds. Due to embedded options, the values of both the firm's HY bonds and stocks should be sensitive to the value of the firm's assets.

Exhibit 2 illustrates the embedded put option in a HY bond. See Bookstaber and Jacob [1986] and Kihn [1994] for more on options embedded in HY bonds.

In theory, the payoff to a long position in a HY bond looks like the payoff to a short put option on the firm's assets. For simplicity, assume the debt consists of a pure-discount bond with $\$D$ in principal due n years hence. The payoff to this HY bond is akin to a short put option on the firm's assets with a strike price of $\$D$ and expiration date in n years. At expiration, if the value of the assets exceeds $\$D$ then bondholders are paid the $\$D$ and stockholders retain the remaining assets' value. If the value of the assets is less than $\$D$ then the firm files for bankruptcy; that is, stockholders exercise their limited liability option and hand the firm over to the bondholders. The value of the HY bonds is the value of the assets. At expiration, the value of the HY bond is $\text{Min}(D, A_n)$ and the value of the stock is $\text{Max}(A_n - D, 0)$, where A_n is the value of the assets at expiration. At expiration, the value of the bond is illustrated by the bold line in Exhibit 2. This payoff has the same shape as the payoff to a short put option. Today (before expiration), the value of the bond is illustrated by the curved line.

Point AA illustrates the value of a high-grade bond today. Since the value of the firm's assets far exceeds $\$D$, the put option is far out of the money and the slope of the option curve at Point AA (i.e., the option's delta) is (approximately) zero. For a firm with high-grade debt, a dollar decrease in its asset value should produce (almost) a dollar decrease in its stock value, but it should have no (or negligible) impact on its bond value. Changes in the asset value affect the stock value but not the bond value. This sensitivity of stock value to the firm's asset value is called stock exposure. In this sense, the high-grade bond

has no stock exposure.

Points BB, B, and CCC may illustrate the positions of HY bonds of firms with credit ratings of BB, B, and CCC. As the credit quality decreases, the value of the HY bond becomes more sensitive to the asset value (i.e., the option's delta increases).² A dollar decrease in the asset value is shared between the values of the bonds and stocks. In this sense, the HY bond has stock exposure.

In summary, for a firm with high-grade bonds, changes in its asset value are borne by the stockholders but not by the bondholders. For a firm with HY bonds, changes in its asset value are borne by both stockholders and bondholders, and the lower the HY bond's credit rating, the more equity risk is borne by the bondholders.

DATA

This study examines returns-based style analysis for four HY bond indexes and 60 HY bond funds over the period 1997–2006. The HY bond indexes come from Merrill Lynch. Most of our analysis uses Merrill's indexes for three separate ratings classes: BB, B, and "CCC & lower." The last index is usually called just CCC, both for conciseness and because bonds below CCC have little impact on the index due to their low market value. We also discuss results obtained from the Merrill Lynch 100 Index, which represents bonds from all of the lower-grade ratings classes.

The fund sample includes all HY bond funds with monthly returns from January 1997 through December 2006. The returns data come from Morningstar. Some bond funds have multiple share classes with different load structures. In these cases, we include the share class with the longest returns history. There are 60 separate HY bond funds that meet the criteria.

Morningstar defines HY bond funds as those that "primarily invest in U.S. high-income debt securities where at least 65% or more of bond assets are not rated or are rated by a major agency such as Standard & Poor's or Moody's at the level of BB and below." Exhibit 3 presents the average allocation for the 2001–2003 period of each HY bond fund across cash, stocks, bonds, preferreds, convertibles, and other assets. The average HY bond fund held 88% of assets in bonds, 5.5% in cash, and another 3.6% in preferred and convertible securities, which can also be considered hybrid combinations of high-grade bonds and stocks. The average fund held 1.6% in common

EXHIBIT 2

Payoff to Bonds with $\$D$ Principal

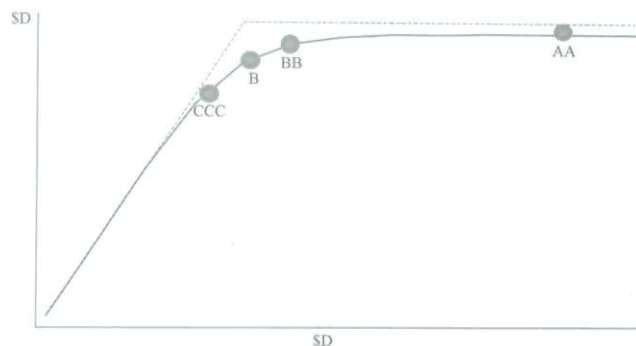


EXHIBIT 3

Expense Ratios and Average Allocations to Asset Classes, 2001-2003

HY Bond Fund	Ticker	Exp.	Cash	Stock	Bonds	Pref.	Conv.	Other
AIM High-Yield A	AMHYX	1.05	2.9	1.5	92.3	2.8	0.2	0.2
American Funds American Hi Inc Tr A	AHITX	0.67	7.3	1.4	82.0	2.7	3.7	2.9
AXA Enterprise High-Yield Bond A	ENHYX	1.30	3.0	0.3	94.8	0	1.4	0.7
BlackRock High Income I	MAHIX	0.64	3.4	1.0	86.0	4.3	0.6	4.7
Buffalo High-Yield	BUFHX	1.03	25.7	4.6	48.4	2.7	17.3	1.4
CMG High Yield Bond	COHYX	0.40	2.7	0	97.3	0	0	0
Columbia Conservative High Yield Z	CMHYX	0.77	7.5	0	92.1	0	0	0.4
Columbia High Yield Opportunity A	COLHX	1.19	3.9	1.1	90.6	2.9	0.4	1.1
Credit Suisse Global High-Yield	RBSFX	0.70	1.5	1.2	95.3	0.9	0.1	1.0
Delaware Delchester A	DETWX	1.34	2.3	0.2	91.0	3.2	0	3.3
Delaware High-Yield Opportunities In	DHOIX	0.83	4.6	0.1	90.7	2.1	0	2.5
Delaware Pooled High-Yield Bond	DPHYX	0.59	5.8	0.2	90.3	1.7	0	2.0
Diversified High Yield Bond Inv	DVHYX	1.10	4.8	0.4	91.1	1.0	0.9	1.8
Dryden High-Yield A	PBHAX	0.90	0.8	0.9	91.6	5.0	0.7	1.1
DWS High Income A	KHYAX	0.97	0.2	0.3	96.3	0.8	0.6	1.8
Eaton Vance High-Income B	EVHIX	1.80	1.3	0.8	91.8	2.9	1.0	2.2
Eaton Vance Income Fund of Boston A	EVIBX	1.06	4.5	0.8	89.2	2.2	1.0	2.3
Evergreen High-Yield Bond B	EKHBX	1.72	6.9	1.3	89.5	1.3	0	1.0
Federated High-Income Bond A	FHIIX	1.21	1.9	0.1	96.1	1.3	0	0.6
Federated High-Yield	FHYTX	0.96	2.9	0.2	94.9	1.5	0.1	0.5
Fidelity Advisor High Income Advntg T	FAHYX	1.06	4.7	9.1	78.2	4.1	2.4	1.6
Fidelity Capital & Income	FAGIX	0.78	14.3	9.0	70.3	3.4	1.2	1.9
Fidelity High Income	SPHIX	0.77	8.0	1.5	82.7	3.5	2.6	1.8
First Investors Fund for Income A	FIFIX	1.34	5.0	0.6	90.3	3.4	0.0	0.6
Franklin High Income A	AGEFX	0.75	5.9	1.6	88.3	2.9	0.8	0.4
Heritage High-Yield Bond A	HRIDX	1.10	6.8	0.7	91.2	0.8	0.4	0.1
Janus High-Yield	JAHYX	0.95	16.5	0	82.6	0.5	0.3	0.1
JHancock High-Yield B	TSHYX	1.72	11.2	9.3	68.4	5.7	3.1	2.3
Legg Mason High-Yield Prim	LMHYX	1.41	5.0	1.4	90.5	2.2	0.7	0.2
Legg Mason Partners High Inc B	SHIBX	1.55	3.2	0.1	95.4	0.3	0.9	0.1
Lehman Brothers High Inc Bond Inv	LBHBX	0.90	10.1	0	85.6	0	4.3	0
Loomis Sayles High Income A	NEFHX	1.65	2.9	0.1	89.2	1.4	6.2	0.2
Lord Abbett Bond-Debenture A	LBNDX	1.00	0.4	5.2	83.4	2.8	7.7	0.5
MainStay High-Yield Corp Bond B	MKHCX	1.76	9.0	4.6	78.6	1.1	4.4	2.3
MFS High Income A	MHITX	0.99	7.0	0.8	87.8	2.1	0.6	1.7
Morgan Stanley High-Yield Secs D	HYLDX	0.85	3.0	2.6	90.6	2.3	0.9	0.6
Nicholas High Income I	NCINX	0.60	2.4	5.1	88.0	0	4.5	0
Nicholas-Applegate US High-Yield Bd I	NAHYX	0.64	2.8	0	96.7	0.1	0	0.5
Northeast Investors	NTHSX	0.67	18.6	7.3	72.5	0.5	0.4	0.7

EXHIBIT 3 (Continued)

HY Bond Fund	Ticker	Exp.	Cash	Stock	Bonds	Pref.	Conv.	Other
Oppenheimer Champion Income A	OPCHX	1.07	7.6	1.7	88.8	1.4	0	0.4
Phoenix High-Yield A	PHCHX	1.32	3.0	0.1	87.5	2.1	3.6	3.6
PIMCO High Yield Instl	PHIYX	0.50	14.8	0.1	78.3	1.1	1.9	4.0
Putnam High Yield A	PHIGX	0.99	3.9	1.0	86.8	3.8	0.8	3.7
Putnam High Yield Advantage A	PHYIX	1.03	3.5	0.7	89.1	2.8	0.8	3.0
RiverSource High Yield Bond A	INEAX	1.04	2.9	0.4	89.5	4.5	0.1	2.6
Security High Yield A	SIHAX	1.28	3.2	0.6	90.1	1.9	2.6	1.6
SEI Instl Mgd High-Yield Bond A	SHYAX	0.85	3.1	0	94.9	1.0	0.1	0.9
Seligman High-Yield A	SHYBX	1.30	3.0	0	95.8	1.2	0	0
STI Classic High Income C	STHIX	1.40	2.6	0.1	96.1	0	0	1.2
T. Rowe Price High-Yield	PRHYX	0.78	4.8	3.4	86.7	2.8	0.6	1.8
TA IDEX Transamerica High Yld Bd A	IHIYX	1.22	6.3	0	91.6	1.7	0	0.3
TCW High-Yield Bond I	TGHYX	0.89	0.9	0	98.6	0	0	0.5
Thrivent High Yield A	LBHYX	1.02	2.9	1.4	90.0	3.8	1.4	0.5
Value Line Aggressive Income	VAGIX	1.43	18.8	3.4	71.2	0.8	5.5	0.3
Van Kampen High Yield A	ACHYX	1.06	3.7	0.5	90.4	2.6	1.2	1.6
Vanguard High-Yield Corporate	VWEHX	0.17	1.5	0	98.3	0	0	0.2
Waddell & Reed Adv High-Income A	UNHIX	1.15	6.0	0.2	91.9	1.2	0.3	0.5
Wells Fargo Advantage High Inc Inv	STHYX	0.90	4.0	0.4	92.0	2.3	0.4	0.9
Westcore Flexible Income	WTLTX	0.85	1.2	7.6	77.5	10.9	1.1	1.7
Western Asset Global High Yield Bd	SIHYX	0.55	1.9	1.3	95.0	1.1	0.5	0.2
Averages		1.03	5.5	1.6	88.0	2.1	1.5	1.3

stocks, but five funds held more than 7% in stocks including three with more than 9%.

Our data also include monthly returns for the asset classes described in an earlier section. The asset classes include four stock indexes: Russell 1000 Value, Russell 1000 Growth, Russell 2000 Value, and Russell 2000 Growth. Their monthly returns include dividends. There are also returns from five fixed-income segments: Lehman Brothers (LB) Corporate, LB Long-term Government, LB Intermediate-term Government, LB Mortgage-backed Securities, and one-month Treasury bills. Because the RBSAs use both current and lagged monthly returns for these asset classes, the series are obtained for December 1996 through December 2006.

COMPARATIVE STATISTICS

Panel A of Exhibit 4 presents average monthly returns, standard deviations, and other statistics for four HY bond indexes, four stock series, four high-grade bond series, and Treasury bills for the period January 1997 through December 2006. Average monthly returns for the four HY bond series are between 0.56% and 0.59%. As expected, this is less than average returns on the stock series, but more than the average returns on high-grade corporate bonds (0.54%) and IT Gov (0.45%), the intermediate-term Treasury series.

The standard deviations of the HY bond series increase from 1.64% for BB to 2.13% for B and to 3.32% for CCC-rated bonds. These exceed the standard deviations of Corp (1.33%) and IT Gov (0.86%), but are less than the standard deviations of the stock series. The stan-

EXHIBIT 4

Summary Statistics on Monthly Returns

Panel A: Bonds and Stocks

Series	Mean	Standard Deviation	Auto-correlation	Skewness	Kurtosis
BB	0.59%	1.64%	0.16	-1.75	7.00
B	0.56	2.13	0.02	-0.18	2.76
CCC	0.57	3.32	0.25*	-0.50	2.28
ML 100	0.58	2.26	0.06	-0.53	2.90
R1000 Value	0.96	4.12	-0.01	-0.54	1.66
R1000 Growth	0.60	5.58	0.02	-0.58	0.52
R2000 Value	1.15	4.54	0.15	-0.75	1.90
R2000 Growth	0.68	7.51	0.05	-0.22	0.57
Corp	0.54	1.33	-0.02	-0.40	1.13
LT Gov	0.65	2.44	-0.01	-0.69	1.55
IT Gov	0.45	0.86	0.08	-0.43	0.86
MBS	0.50	0.75	0.10	-0.50	0.46
Tbills	0.30	0.15	0.96*	-0.26	-1.39

Panel B: High-Yield Bond Funds

HY Bond Fund	Ticker	Mean	Standard Deviation	Auto - correlation	Skewness	Kurtosis
AIM High-Yield A	AMHYX	0.17%	2.55 %	0.28*	-0.79	2.17
American Funds American Hi Inc Tr A	AHITX	0.62	2.30	0.14	-0.90	4.18
AXA Enterprise High-Yield Bond A	ENHYX	0.50	1.93	0.07	-0.61	2.29
BlackRock High Income I	MAHIX	0.50	2.56	0.10	-0.78	3.65
Buffalo High-Yield	BUFHX	0.54	1.58	0.23*	-0.55	2.15
CMG High Yield Bond	COHYX	0.55	1.34	-0.02	-0.44	1.45
Columbia Conservative High Yield Z	CMHYX	0.50	1.31	-0.02	-0.64	1.57
Columbia High Yield Opportunity A	COLHX	0.42	2.21	0.12	-0.67	3.31
Credit Suisse Global High-Yield	RBSFX	0.49	1.94	0.22*	-0.88	2.01
Delaware Delchester A	DETWX	0.31	2.57	0.26*	-0.68	1.74
Delaware High-Yield Opportunities In	DHOIX	0.64	2.27	0.17	-0.47	1.82
Delaware Pooled High-Yield Bond	DPHYX	0.67	2.26	0.16	-0.35	1.38
Diversified High Yield Bond Inv	DVHYX	0.54	1.88	0.07	-0.33	1.70
Dryden High-Yield A	PBHAX	0.46	2.20	0.09	-0.65	3.49
DWS High Income A	KHYAX	0.48	2.06	0.10	-1.00	3.90
Eaton Vance High-Income B	EVHIX	0.53	2.39	0.16	-0.84	3.13
Eaton Vance Income Fund of Boston A	EVIBX	0.62	2.25	0.12	-0.76	3.13
Evergreen High-Yield Bond B	EKHBX	0.45	1.86	0.08	-0.70	3.25
Federated High-Income Bond A	FHIIX	0.46	2.13	0.03	-0.76	3.33
Federated High-Yield	FHYTX	0.43	2.11	0.04	-0.88	3.12
Fidelity Advisor High Income Advntg T	FAHYX	0.66	3.16	0.20*	-0.49	3.06

EXHIBIT 4 (Continued)

HY Bond Fund	Ticker	Mean	Standard Deviation	Auto - correlation	Skewness	Kurtosis
Fidelity Capital & Income	FAGIX	0.70	3.04	0.14	-0.49	3.04
Fidelity High Income	SPHIX	0.48	2.58	0.11	-0.91	4.45
First Investors Fund for Income A	FIFIX	0.47	1.93	0.08	-0.53	2.98
Franklin High Income A	AGEFX	0.52	2.36	0.10	-0.50	3.07
Heritage High-Yield Bond A	HRIDX	0.49	1.74	0.12	-0.67	2.97
Janus High-Yield	JAHYX	0.57	1.56	0.11	-0.81	1.35
JHancock High-Yield B	TSHYX	0.58	2.57	0.36*	-1.16	4.03
Legg Mason High-Yield Prim	LMHYX	0.40	2.58	0.24*	-0.97	2.38
Legg Mason Partners High Inc B	SHIBX	0.36	2.32	0.15	-0.51	2.29
Lehman Brothers High Inc Bond Inv	LBHBX	0.56	1.09	0.01	-0.91	3.59
Loomis Sayles High Income A	NEFHX	0.32	2.90	0.15	-0.33	3.01
Lord Abbett Bond-Debenture A	LBNDX	0.52	1.72	0.06	-0.72	2.88
MainStay High-Yield Corp Bond B	MKHCX	0.60	2.24	0.22*	-0.97	3.98
MFS High Income A	MHITX	0.49	2.05	0.08	-0.71	3.61
Morgan Stanley High-Yield Secs D	HYLDX	-0.12	2.87	0.32*	-1.61	4.77
Nicholas High Income I	NCINX	0.34	2.21	0.11	-0.37	2.78
Nicholas-Applegate US High-Yield Bd I	NAHYX	0.65	1.91	0.11	-0.38	2.14
Northeast Investors	NTHSX	0.48	1.86	0.31*	-1.19	4.65
Oppenheimer Champion Income A	OPCHX	0.48	2.06	0.09	-0.60	2.97
Phoenix High-Yield A	PHCHX	0.29	2.31	0.21*	-1.11	4.76
PIMCO High Yield Instl	PHIYX	0.59	1.75	0.09	-0.55	2.60
Putnam High Yield A	PHIGX	0.46	2.14	0.12	-1.24	5.12
Putnam High Yield Advantage A	PHYIX	0.45	2.19	0.13	-1.36	5.70
RiverSource High Yield Bond A	INEAX	0.44	2.09	0.17	-0.57	2.17
Security High Yield A	SIHAX	0.51	1.75	0.09	-0.28	2.51
SEI Instl Mgd High-Yield Bond A	SHYAX	0.53	1.69	0.13	-0.54	1.99
Seligman High-Yield A	SHYBX	0.18	2.21	0.16	-0.80	2.96
STI Classic High Income C	STHIX	0.41	1.85	0.11	-1.00	7.04
T. Rowe Price High-Yield	PRHYX	0.60	1.73	0.07	-0.34	2.71
TA IDEX Transamerica High Yld Bd A	IHIYX	0.50	1.40	0.09	-0.10	0.61
TCW High-Yield Bond I	TGHYX	0.48	1.87	0.03	-0.52	2.13
Thrivent High Yield A	LBHYX	0.34	2.43	0.18	-0.87	3.26
Value Line Aggressive Income	VAGIX	0.34	2.33	0.29*	-0.88	2.20
Van Kampen High Yield A	ACHYX	0.32	2.20	0.16	-0.94	3.33
Vanguard High-Yield Corporate	VWEHX	0.49	1.58	0.01	-0.57	1.60
Waddell & Reed Adv High-Income A	UNHIX	0.47	1.54	0.12	-0.61	2.58
Wells Fargo Advantage High Inc Inv	STHYX	0.49	2.45	0.11	-0.71	5.20
Westcore Flexible Income	WTLTX	0.67	1.79	0.13	-0.24	0.78
Western Asset Global High Yield Bd	SIHYX	0.56	1.85	0.01	-0.69	2.93
Averages		0.48	2.09	0.13	-0.71	2.98

* Denotes significance at 5% level.

dard deviation of the Merrill Lynch 100 index, at 2.26%, is very close to that of the B-rated bonds.

The autocorrelation coefficient measures the correlation between a series' monthly returns and one-month lagged returns for that series. Because HY bonds trade infrequently and are often priced based on matrix pricing, prior studies have suggested that HY bond returns will be positively autocorrelated. Due to infrequent trading, it may take two months for HY bond prices to fully reflect the economic impact of an event. So, returns in adjacent months should be positively correlated. The autocorrelation coefficient for CCC rated bonds is significant at the 5% level, while the coefficients for BB and B rated bonds are positive but insignificant. This suggests that infrequent trading may be a problem for HY bonds, especially for lower-rated junk bonds. As expected, none of the autocorrelation coefficients on the stock or high-grade bond series is significant, which is consistent with the absence of infrequent trading problems for these series.

Swedroe [2008] does not recommend HY bonds as an alternative asset class because he believes they tend to lose money during difficult economic times such as the 2007 credit crisis. During these crises when stocks are falling, high-grade bonds usually provide safety, but HY bonds do not provide such safety. He claims the correlation coefficient between HY bonds and stocks tends to increase during these crises. If he is right, HY bond returns should have negative skewness and positive kurtosis. The positive kurtosis implies fat tails in the distribution, and the negative skewness implies a tendency for more large losses than expected from normally distributed returns. As shown in Panel A of Exhibit 4, HY bond returns exhibit strong kurtosis,³ while BB rated bonds exhibit strong negative skewness. In mean-variance analysis, investors are assumed to care only about the mean and variance (or standard deviation, the square root of the variance). Since investors dislike negative skewness and positive kurtosis, HY bonds should be less desirable than is implied by mean-variance analysis.

Panel B of Exhibit 4 presents statistics for the 60 HY bond funds. The average *net* monthly return on the HY funds is 0.48%. Since the average *gross* monthly return on BB and B rated bond series is about 0.575%, the average fund underperformed the costless series by about 1.14% per year. Not surprisingly, this is close to the average HY bond fund's expense ratio of 1.03%.⁴ These statistics suggest that, as a group, HY bond fund managers produced

gross returns consistent with those available on the passive BB and B bond series.⁵

Of the 60 HY bond funds, 58 have a positive autocorrelation coefficient and 12 of the autocorrelation coefficients are significant at the 5% level. These results suggest that infrequent trading affects HY bond returns as a group.

All 60 HY bond funds' returns exhibit negative skewness and positive kurtosis. The average fund has a skewness of -0.71 and kurtosis of 2.98. These statistics suggest that HY bond funds tend to be prone to more large losses than would occur if returns were normally distributed.

RETURNS-BASED STYLE ANALYSIS OF INDEXES AND BOND FUNDS

Based on option theory, a HY bond is a hybrid asset, that is, its returns are similar to that of a combination of high-grade bonds and stocks. The returns on a HY bond should be sensitive to returns on stocks, bonds, and, perhaps, cash. This section examines RBSA results for four HY bond indexes and 60 HY bond funds.

HY Bond Indexes

Exhibit 5 presents RBSA results for four HY bond indexes. The returns on BB rated bonds are similar to those achievable with a portfolio of 22.3% stocks, 73.2% bonds, and 4.5% Treasury bills. To be more precise, the stock portion consists of 2.9% large-cap value, 7.3% large-cap growth, 11.5% small-cap value, and 0.6% small-cap growth stocks, while the bond portion consists of 63.3% corporate, 6.2% long-term government, and 3.7% intermediate-term government bonds.⁶ As Sharpe [1992] stated, "style analysis provides measures that reflect how returns act, rather than a simplistic concept of what the portfolios include" (p. 13).

Based on the embedded put option in HY bonds, we would expect the sum of bond components to decrease and the sum of stock components to increase as the credit rating decreases from BB to B to CCC. The results in Exhibit 5 confirm this expectation. The sum of bond components decreases from 73.2% for BB, to 68.0% for B, and to 48.4% for CCC rated bonds. The sum of stock components increases from 22.3% for BB, to 32.0% for B, and to 51.6% for CCC rated bonds.

EXHIBIT 5

Returns-Based Style Analysis of High-Yield Bond Indexes

HY Index	R1000 Value	R1000 Growth	R2000 Value	R2000 Growth	Sum Stocks	Corp	LT Govt	IT Govt	MBS	Sum Bonds	Tbills	R ²
BB	0.029	0.073	0.115	0.006	0.223	0.633	0.062	0.037	0	0.732	0.045	0.540
B	0.049	0.136	0.089	0.047	0.320	0.481	0	0.200	0	0.680	0	0.463
CCC	0.003	0.127	0.287	0.100	0.516	0.484	0	0	0	0.484	0	0.388
ML100	0.048	0.149	0.081	0.051	0.329	0.556	0.041	0.074	0	0.671	0	0.499

The column "Sum Stocks" reports sums of the coefficients on the four Russell stock indexes.

The column "Sum Bonds" reports sums of the coefficients on Corp, LT Govt, IT Govt, and MBS.

The Merrill Lynch 100 bond index contains a sampling of bonds that is designed to reflect returns on the overall HY bond market. The RBSA for this series is similar to that of the B rated series. The sums of stock coefficients and bond coefficients are within 1% of the corresponding sums for B rated bonds. Furthermore, the sensitivities to individual stock series are also similar.

The patterns among bond and stock coefficients in Exhibit 5 provide additional insights. The investment returns on BB and B rated bonds are sensitive to returns on high-grade corporate and, to a lesser degree, Treasury securities, while the returns on CCC rated bonds are only sensitive to corporate bonds. Mortgage-backed securities carried no weight in the style-based analysis of any HY index.⁷

The RBSA results suggest that roughly half of the stock sensitivities on BB and B rated bonds and three-fourths of the sensitivities of CCC rated bonds are associated with small-cap stocks. Since the Russell 2000 represents about 10% of the value of the Russell 3000, this indicates that all HY indexes have a strong small-cap tilt. This conclusion is consistent with Reilly and Wright [2001] who found high-yield bond returns were more highly correlated with small-cap than large-cap stock returns. Gudikunst and McCarthy [1997] report evidence of a January effect in HY bond returns, which is consistent with the evidence that the January effect is strongest among small-cap stocks. The RBSA results suggest that HY bonds tend to be issues of small-cap firms, and the weaker the credit rating the more likely it is that the bonds were issues of small-cap firms.

Exhibit 6 presents the correlation coefficients between HY bond index returns and returns on stocks, high-grade bonds, and cash. Although the RBSA methodology is more powerful, the correlations tests

support the conclusions from the RBSA results. For reference, correlation coefficients of 0.18 or higher and 0.24 or higher are significant at the 5% and 1% levels, respectively.

The correlation coefficients in Exhibit 6 for the period 1997–2006 are economically similar to the correlation coefficients reported in Reilly and Wright [2001] for the period 1986–2000. It is useful to separate the series into HY bonds (i.e., BB, B, and CCC rated bonds), stocks (Russell series), and high-grade bonds (i.e., Corp, LT Gov, IT Gov, and MBS). The correlations suggest that HY bonds are hybrid securities that reflect a combination of high-grade bonds and stocks. All correlation coefficients between HY bonds and stocks are significant at the 1% level. The correlation coefficients between BB and Corp (0.54) and between B and Corp (0.35) are also significant at the 1% level. In general, the correlations are stronger between HY bonds and stocks than between HY bonds and high-grade bonds. Also, as the HY bond rating weakens from BB to B to CCC, the correlation coefficients with high-grade bonds weaken. Reilly and Wright [2001] found these same patterns for the period 1986–2000.

None of the correlation coefficients between stocks and high-grade bonds is positive and significant, which suggests that high-grade bonds have, at most, a minimal equity component. Studies using other time periods reach similar conclusions. Fridson [1994] concluded that "bonds rated triple-B or higher have no equity component." Cornell and Green [1991] wrote "high-grade bond returns respond primarily to changes in interest rates." Reilly and Wright [1994] concluded that "[t]he returns of investment-grade bonds are almost completely determined by fluctuations in interest rates."⁸

EXHIBIT 6

Correlation Coefficients

	HY Bonds				Stocks				High-Grade Bonds				
	BB	B	CCC	ML 100	R1000 Value	R1000 Growth	R2000 Value	R2000 Growth	Corp	LT Govt	IT Govt	MBS	Tbills
BB	1	0.82	0.72	0.86	0.41	0.38	0.50	0.43	0.54	0.23	0.11	0.25	-0.02
B		1	0.83	0.96	0.44	0.46	0.51	0.51	0.35	0.03	-0.11	0.07	-0.14
CCC			1	0.83	0.37	0.31	0.49	0.43	0.19	-0.07	-0.23	-0.09	-0.24
ML 100				1	0.48	0.52	0.53	0.54	0.38	0.06	-0.05	0.11	-0.10
R1000 Value					1	0.70	0.73	0.54	0.04	-0.17	-0.23	-0.07	0.04
R1000 Growth						1	0.57	0.80	0.05	-0.16	-0.22	-0.07	0.02
R2000 Value							1	0.79	0.07	-0.15	-0.23	-0.10	-0.04
R2000 Growth								1	0.04	-0.18	-0.25	-0.12	-0.05
Corp									1	0.88	0.82	0.81	0.05
LT Govt										1	0.89	0.80	0.06
IT Govt											1	0.89	0.19
MBS												1	0.19
Tbills													1.00

Correlation coefficients of ≥ 0.18 and ≥ 0.24 are significant at the 5% and 1% levels, respectively.

The high correlation coefficients (0.80 to 0.89) between high-grade bond returns suggest that they are all one asset class.⁹ Blume and Keim [1991] and SEI Capital Markets Research [1994] reported correlation coefficients between Treasury bonds and investment-grade corporate bonds of about 0.95, while Reilly and Wright [2001] reported a correlation coefficient of 0.88 between Treasury and BBB rated bonds. In Exhibit 6, the correlation between Corp and LT Gov is 0.88. These results also suggest that all high-grade bonds, including investment-grade corporate bonds, are one asset class.

The correlation coefficients are consistently higher between HY bonds and Russell 2000 (small-cap) returns than between HY bonds and Russell 1000 (large-cap) returns. Reilly and Wright [2001] used Ibbotson Associates' small-cap stocks and S&P 500 for their stock series, but reached the same conclusion. Finally, the correlation coefficients between HY bonds and, respectively, value and growth stocks are similar.

In short, as predicted by theory, HY bond returns are sensitive to high-grade bond and stock returns. Furthermore, as the credit rating decreases from BB to CCC the sum of bond components decreases from about 73% to 48%, while the sum of stock components increases from about 22% to 52%. There is also a strong small-cap tilt in HY bond index returns.

HY Bond Funds

Exhibit 7 summarizes the RBSA results for the 60 HY bond funds. The average results are presented at the bottom of the exhibit. On average, HY funds' returns behave as if 33.2% is invested in stocks, 62.8% in high-grade bonds, and 4.0% in cash. On average, 43.4% of the stock sensitivity is on small-cap stocks. Since the Russell 2000 represents some 10% of the weight in the stock market, the average HY bond fund clearly has a small-cap style. Separately, the average HY bond fund has a growth stock tilt with 63% of the stock sensitivity associated with Russell 1000 Growth or Russell 2000 Growth.

The primary value of Exhibit 7 is not in the average statistics. Rather, it is that it provides style sensitivities for 60 separate HY bond funds. The broad asset class and style sensitivities vary sharply among funds. Four funds had sums of stock sensitivities less than 20% (in order with sums in parentheses, TA IDEX Transamerica (0.152), Columbia Conservative (0.179), CMG High Yield (0.179), and LB High Income (0.185)). Not surprisingly, these funds' holdings reflect this low stock sensitivity. Based on information in Morningstar Principia Pro, over the 2001–2003 period, these funds held no stocks. TA IDEX Transamerica held, on average, over 40% of assets in investment grade or better bonds and had few investments in below B and unrated bonds. Columbia Conservative and CMG High both avoid below B and unrated bonds. LB High Income averaged 27% in investment grade or better bonds and 70% in BB or better bonds.

The three funds with the highest sums of stock sensitivity were John Hancock High Yield B (0.546), Fidelity Advisor High-Income Advantage (0.501), and Fidelity Capital and Income (0.467). Not surprisingly, these were the only three funds that had average stock exposures in the period 2001–2003 of at least 9%. Moreover, the Morningstar prospectus summaries for John Hancock High Yield B and Fidelity Advisor High-Income Advantage state that they may invest up to 20% of assets in stocks and emphasize below B and non-rated debt. The prospectus summary for Fidelity Capital and Income indicates that it invests in equity and debt securities with an emphasis on lower-quality debt securities.

The three funds with the lowest sums of bond sensitivities are Northeast Investors (0.224), John Hancock High Yield B (0.325), and Morgan Stanley High Yield (0.405). For the 2001–2003 period, Northeast Investors

EXHIBIT 7

Returns-Based Style Analysis of High-Yield Bond Funds, 1997–2006

Fund	Ticker	R1000 Value	R1000 Growth	R2000 Value	R2000 Growth	Sum Stocks	Corp	LT Govt	IT Govt	MBS	Sum Bonds	T-bills	R ²
AIM High-Yield A	AMHYX	.003	.197	.031	.142	.375	.460	.003	.162	.000	.625	.000	.471
American Funds American Hi Inc Tr A	AHITX	.016	.085	.000	.136	.383	.498	.003	.117	.000	.617	.000	.603
AXA Enterprise High-Yield Bond A	ENHYX	.056	.113	.058	.069	.297	.499	.000	.205	.000	.703	.000	.563
BlackRock High Income I	MAHIX	.071	.157	.093	.119	.441	.477	.000	.083	.000	.559	.000	.535
Buffalo High-Yield	BUFHX	.019	.002	.238	.044	.303	.279	.000	.235	.000	.514	.183	.596
CMG High Yield Bond	COHYX	.022	.076	.061	.021	.179	.476	.000	.312	.032	.821	.000	.605
Columbia Conservative High Yield Z	CMHYX	.035	.077	.046	.021	.179	.480	.000	.306	.034	.821	.000	.611
Columbia High Yield Opportunity A	COLHX	.009	.199	.071	.072	.351	.457	.000	.192	.000	.649	.000	.494
Credit Suisse Global High-Yield	RBSFX	.000	.097	.073	.130	.301	.390	.000	.000	.189	.579	.121	.524
Delaware Delchester A	DETWX	.008	.203	.063	.089	.363	.495	.001	.141	.000	.637	.000	.414
Delaware High-Yield Opportunities In	DHOIX	.025	.160	.067	.080	.332	.474	.012	.182	.000	.668	.000	.435
Delaware Pooled High-Yield Bond	DPHYX	.051	.153	.075	.073	.353	.448	.001	.198	.000	.647	.000	.427
Diversified High Yield Bond Inv	DVHYX	.054	.136	.088	.030	.307	.440	.000	.252	.000	.693	.000	.470
Dryden High-Yield A	PBHAX	.136	.112	.035	.086	.370	.546	.000	.084	.000	.630	.000	.543
DWS High Income A	KHYAX	.084	.103	.066	.087	.341	.489	.000	.170	.000	.659	.000	.530
Eaton Vance High-Income B	EVHIX	.014	.183	.025	.140	.362	.449	.000	.190	.000	.638	.000	.534
Eaton Vance Income Fund of Boston A	EVIBX	.042	.160	.026	.126	.353	.446	.000	.202	.000	.647	.000	.526
Evergreen High-Yield Bond B	EKHBX	.029	.114	.091	.065	.299	.457	.000	.244	.000	.701	.000	.513
Federated High-Income Bond A	FHIIX	.078	.145	.036	.074	.333	.504	.000	.163	.000	.667	.000	.485
Federated High-Yield	FHYTX	.079	.148	.043	.073	.342	.496	.000	.162	.000	.658	.000	.495
Fidelity Advisor High Income Advntg T	FAHYX	.190	.114	.012	.185	.501	.499	.000	.000	.000	.499	.000	.566
Fidelity Capital & Income	FAGIX	.166	.138	.000	.163	.467	.533	.000	.000	.000	.533	.000	.547
Fidelity High Income	SPHIX	.102	.175	.005	.120	.402	.500	.063	.035	.000	.598	.000	.530
First Investors Fund for Income A	FIFIX	.065	.135	.067	.061	.328	.429	.000	.111	.047	.587	.085	.515
Franklin High Income A	AGEFX	.085	.156	.101	.058	.400	.534	.040	.026	.000	.600	.000	.540
Heritage High-Yield Bond A	HRIDX	.070	.082	.107	.028	.288	.492	.000	.212	.000	.704	.008	.491
Janus High-Yield	JAHYX	.007	.079	.051	.074	.211	.394	.000	.000	.251	.646	.143	.453
JHancock High-Yield B	TSHYX	.128	.104	.232	.083	.546	.325	.000	.000	.000	.325	.129	.582
Legg Mason High-Yield Prim	LMHYX	.044	.239	.000	.084	.366	.393	.000	.000	.240	.634	.000	.402

EXHIBIT 7 (Continued)

Fund	Ticker	R1000 Value	R1000 Growth	R2000 Value	R2000 Growth	Sum Stocks	Corp	LT Govt	IT Govt	MBS	Sum Bonds	T-bills	R ²
Legg Mason Partners High Inc B	SHIBX	.040	.179	.057	.079	.355	.555	.000	.090	.000	.645	.000	.503
Lehman Brothers High Inc Bond Inv	LBHBX	.042	.061	.081	.001	.185	.356	.000	.188	.096	.639	.175	.552
Loomis Sayles High Income A	NEFHX	.108	.208	.015	.107	.438	.516	.047	.000	.000	.562	.000	.480
Lord Abbett Bond-Debenture A	LBNDX	.080	.106	.050	.075	.312	.448	.000	.240	.000	.688	.000	.694
MainStay High-Yield Corporate Bond B	MKHCX	.092	.123	.094	.112	.421	.436	.000	.143	.000	.579	.000	.587
MFS High Income A	MHITX	.049	.161	.034	.080	.325	.470	.000	.205	.000	.675	.000	.510
Morgan Stanley High-Yield Secs D	HYLDX	.002	.270	.000	.145	.417	.405	.000	.000	.000	.405	.178	.423
Nicholas High Income I	NCINX	.059	.124	.138	.048	.368	.475	.000	.157	.000	.632	.000	.482
Nicholas-Applegate US High-Yield Bd I	NAHYX	.030	.164	.067	.058	.319	.400	.000	.188	.094	.681	.000	.499
Northeast Investors	NTHSX	.056	.125	.227	.000	.407	.113	.000	.000	.111	.224	.369	.506
Oppenheimer Champion Income A	OPCHX	.074	.139	.044	.085	.341	.469	.000	.190	.000	.659	.000	.535
Phoenix High-Yield A	PHCHX	.097	.130	.010	.137	.374	.385	.000	.147	.000	.533	.093	.494
PIMCO High Yield Instl	PHIYX	.086	.070	.049	.057	.262	.587	.000	.151	.000	.738	.000	.562
Putnam High Yield A	PHIGX	.104	.069	.055	.120	.349	.495	.003	.102	.000	.601	.050	.514
Putnam High Yield Advantage A	PHYIX	.107	.066	.056	.120	.350	.485	.023	.024	.000	.531	.119	.490
RiverSource High Yield Bond A	INEAX	.107	.136	.009	.088	.341	.420	.000	.239	.000	.659	.000	.437
Security High Yield A	SIHAX	.030	.134	.135	.012	.311	.428	.000	.261	.000	.689	.000	.504
SEI Instl Mgd High-Yield Bond A	SHYAX	.023	.111	.078	.060	.273	.398	.000	.205	.110	.714	.013	.489
Seligman High-Yield A	SHYBX	.086	.208	.000	.073	.367	.400	.056	.000	.000	.456	.178	.481
STI Classic High Income C	STHIX	.083	.000	.035	.097	.215	.376	.000	.226	.000	.603	.182	.333
T. Rowe Price High-Yield	PRHYX	.047	.120	.060	.063	.290	.424	.000	.286	.000	.710	.000	.536
TA IDEX Transamerica High Yield Bond A	IHIYX	.027	.047	.064	.014	.152	.674	.000	.099	.000	.773	.075	.595
TCW High-Yield Bond I	TGHYX	.033	.121	.090	.049	.293	.465	.000	.152	.071	.688	.019	.484
Thrivent High Yield A	LBHYX	.018	.190	.017	.146	.371	.480	.000	.149	.000	.629	.000	.552
Value Line Aggressive Income	VAGIX	.011	.104	.000	.200	.315	.471	.000	.000	.183	.655	.031	.501
Van Kampen High Yield A	ACHYX	.077	.167	.014	.097	.355	.476	.000	.124	.000	.601	.045	.503
Vanguard High-Yield Corporate	VWEHX	.027	.126	.075	.022	.250	.522	.000	.228	.000	.750	.000	.585
Waddell & Reed Adv High-Income A	UNHIX	.040	.107	.044	.061	.252	.413	.000	.229	.000	.642	.106	.547
Wells Fargo Advantage High Income Inv	STHYX	.074	.178	.014	.109	.375	.492	.012	.121	.000	.625	.000	.489
Westcore Flexible Income	WTLTX	.000	.011	.196	.000	.207	.672	.063	.000	.000	.735	.058	.542
Western Asset Global High Yield Bond	SIHYX	.026	.082	.125	.034	.267	.528	.000	.186	.000	.714	.019	.457
Minimum		.000	.000	.000	.000	.152	.113	.000	.000	.000	.224	.000	.333
Maximum		.190	.270	.238	.200	.546	.674	.063	.312	.251	.821	.369	.694
Average		.059	.128	.063	.081	.332	.460	.005	.139	.024	.628	.040	.514

held on average over 7% of assets in stocks and 32% in below B and non-rated debt. Its cash holdings varied dramatically, but for 2002 and 2003 it averaged 30% and 23%. As previously noted, the John Hancock fund may invest up to 20% of assets in stocks and emphasizes below B and non-rated debt. The prospectus summary for Morgan Stanley High Yield indicates that it maintains no minimum credit-quality restriction and may invest up to 20% of assets in stocks. Although its cash holdings varied by year, it averaged 26.6% and 11.6% in 1997 and 1998, respectively.

Four funds had sums of bond sensitivities of 75% or higher. They are CMG High Yield (0.821), Columbia Conservative (0.821), TA IDEX Transamerica (0.773), and

Vanguard High-Yield Corporate (0.750). Over the period 2001–2003, these funds invested virtually all assets in bonds or cash and nothing in common stocks. On average, CMG held 63% in BB or higher bonds, 37% in B rated bonds, and 0% in below B bonds. The corresponding averages for Columbia Conservative are 53%, 42%, and 4%, respectively. The averages for Vanguard are 57%, 43% and less than 1%, respectively. The holdings of TA IDEX Transamerica were less concentrated. On average, it held 44% in BBB or better bonds, but also 6% in below B bonds.

Thirty-eight HY bond funds had no cash sensitivity. Eleven had positive cash sensitivities of less than 10%. Eleven funds had cash sensitivities exceeding 10%. Not surprisingly,

the funds with high average cash allocations in the period 2001–2003 tended to have larger cash sensitivities.

The results suggest that several HY bond funds have a strong preference for bonds of either growth firms or value firms. HY bond funds at Morgan Stanley, Value Line, AIM, Thrivent, Legg Mason, Delaware Delchester, and two at Eaton Vance have over 80% of their stock sensitivities in growth stocks, while HY funds at Westcore and Buffalo have over 80% in value stocks.

Since small-cap stocks represent about 10% of the value of all U.S. stocks, every HY bond fund has a small-cap tilt with at least 20% of their stock exposure in small caps. HY funds at Westcore and Buffalo have more than 90% of their stock exposures in small caps and 13 others have between 50% and 68% in small caps.

INVESTMENT IMPLICATIONS

There are two major investment implications from this research. One has to do with asset allocation and the other with asset location.

Asset Allocation

The RBSA results suggest that HY bond funds are, indeed, hybrid assets consisting of stocks, high-grade bonds, and sometimes cash. Moreover, the stock component of returns has a small-cap tilt and may have either a value or growth tilt. When calculating an individual's or institutional investor's asset allocation, each HY bond fund should be viewed as a combination of small-cap and large-cap stocks, high-grade bonds, and sometimes cash.

Let us contrast this treatment with the treatment of HY bonds within model portfolios. Exhibit 8 summarizes the model portfolios by age in life-cycle funds at AllianceBernstein, Fidelity, and T. Rowe Price. Each fund family recommends allocations to HY bonds for investors at most ages. However, in each case they summarize their recommended allocations as if HY bonds are 100% bonds. Given the modest sizes of the recommendations to HY bonds, the measurement error may not be great. Nevertheless, the results in this study imply that the conventional treatment of HY bonds is wrong. Instead of viewing HY bonds as 100% bonds, this study implies that they are better viewed as a hybrid asset.

Asset Location

The second major investment implication deals with asset location. HY bonds are best held in retirement accounts. Dammon, Spatt, and Zhang [2004] and Reichenstein [2007] among others concluded that individual investors should hold bonds, REITs and other tax-inefficient assets in retirement accounts and stocks in taxable accounts, while attaining their target asset allocation. HY bonds are an inefficient asset class in that most of their long-run return comes as interest payments that are taxed at high ordinary-income rates. It is better to hold such tax-inefficient assets in retirement accounts. Stocks, especially tax-managed stocks, should be held in taxable accounts, where they can benefit from lower tax rates on long-term capital gains. In addition, stocks can best benefit from tax deferral of unrealized gains, the potential to avoid taxes on gains by awaiting the step-up in basis at death or donating the appreciated asset to charity, and the opportunity to harvest tax losses to reduce current taxes.

The research by Elton, Gruber, Agrawal, and Mann [2001] suggested another reason to locate HY bonds in retirement accounts such as tax-exempt Roth IRA and Roth 401(k) and tax-deferred 401(k). They concluded that a substantial part of the yield spread between corporate and Treasury yields is due to a tax premium. This tax premium is the additional yield on corporate bonds due to the fact that corporate bonds' interest is taxable at state and federal levels, while Treasury bonds' interest is taxable at the federal level only. For an average individual who holds corporate bonds in taxable accounts, this tax premium is indeed offset by higher taxes. But for individuals who hold the bonds in retirement accounts, this tax premium is not lost to higher taxes.

The goal of the Elton et al. study is to explain the determinants of the yield spread between investment-grade bonds (i.e., AA, A, and BBB) and Treasury securities with maturities of 2 to 10 years. Although they do not study the HY bond–Treasury spread, their results have implications for this relationship. They separate the yield spreads into three sources: 1) a default premium denoting the expected loss due to default; 2) a tax premium, due to the fact that corporate bonds' interest is taxable at state and federal levels, while Treasury interest is taxable at the federal level only; and 3) a risk premium.

To understand the significance of their results, consider the spread between 10-year BBB industrial and

EXHIBIT 8

Broad Asset Allocations across Life Cycle Funds (%)

AllianceBernstein Retirement Funds

	Retirement Date											
	15 Yrs After	10 Yrs After	5 Yrs After	2005	2010	2015	2020					
U.S. Stocks	17.5	24.5	31.5	38.5	43.5	48	53	58	63	63	63	63
International Stocks	7.5	10.5	13.5	16.5	18.5	21	23	25	27	27	27	27
Real Estate (REITs)	10	10	10	10	10	10	10	10	10	10	10	10
High-Yield Bonds	0	2.5	5	7	7	7	7	5	0	0	0	0
High-Grade Bonds	37.5	34.5	31	28	21	14	7	2	0	0	0	0
Cash and Short-Term Bonds	27.5	18	9	0	0	0	0	0	0	0	0	0

Fidelity Freedom Funds*

	Retirement Date											
	Income	2000	2005	2010	2015	2020	2025					
U.S. Stocks	20	27	40	40	47	55	58	66	66	68	69	70
International Stocks	0	1	10	10	12	14	14	16	17	17	19	20
High-Yield Bonds	5	3	5	5	6	7	8	8	8	10	10	10
High-Grade Bond	35	32	35	35	31	23	20	10	9	5	2	0
Short-Term Bonds	40	37	11	10	5	0	0	0	0	0	0	0

T. Rowe Price Retirement Funds

	Retirement Date										
	Income	2005	2010	2015	2020	2025	2030				
U.S. Stocks	37.5	50.5	57	62	67	72.5	78.5	78.5	78.5	78.5	78.5
International Stocks	6	8	10	11	12	13	15	15	15	15	15
High-Yield Bonds	6.5	7	7	7	7	6	3	3	3	3	3
High-Grade Bonds	20	24.5	18	16	12.5	8.5	3.5	3.5	3.5	3.5	3.5
Cash and Short-Term Bonds	30	10	8	4	1.5	0	0	0	0	0	0

*The asset allocations are as of September 30, 2006, except for the Income Fund. We show the new target allocation for the latter, which the actual allocation was approaching. Numbers may not add to 100 due to rounding.

Source: Jennings and Reichenstein [2007].

"High-Grade Bonds" denotes investment grade or better bonds of intermediate or longer maturities.

"Short-Term Bonds" denotes investment grade or better bonds of short-term maturities or short durations.

Treasury yields, which averaged 1.18% for the period 1987–1996. They conclude that about 0.48% of this spread is due to the tax premium. The BBB yield must be about 0.48% higher to compensate for the additional taxes on BBB rated bonds due to their taxation at the state level. But the after-tax value of these bonds grows without taxation if held in a tax-exempt account like a Roth IRA or Roth 401(k) or a tax-deferred account such as a 401(k).¹⁰ Therefore, the tax premium represents a windfall gain if these bonds are held in these retirement accounts. Similarly, the tax premium represents a windfall gain for tax-exempt institutional investors.

Since a tax premium should also exist in the HY bond market, there are two reasons to locate HY bonds in retirement accounts. First, as noted by Dammon, Spatt, and Zhang [2004] and Reichenstein [2007], tax-inefficient assets should be held in retirement accounts and tax-efficient assets like passively managed stocks should be held in taxable accounts, while attaining the target asset allocation. Second, part of the additional returns on HY bonds appears to be due to a tax spread. This spread represents a windfall return to the individual who holds these bonds in a tax-exempt or tax-deferred retirement account.

SUMMARY AND CONCLUSIONS

This study presented returns-based style analysis of four high-yield bond series and 60 HY bond funds. The results imply that HY bonds are hybrid assets. They should be viewed as part high-grade bonds, part stocks, and, sometimes, part cash. As expected from theory, as the credit rating decreases from BB to B to CCC, the bond component of returns decreases from about 73% to 48%, while the stock component increases from about 22% to 52%. Furthermore, there is a strong small-cap tilt in HY bond index returns.

The RBSA of HY bond fund returns separates the returns into stock, high-grade bond, and cash returns. Moreover, it separates the returns into four stock styles (large-cap value, large-cap growth, small-cap value, and small-cap growth), up to four high-grade bond styles, and cash. Furthermore, we show that differences across funds in style weights are consistent with differences in the funds' holdings and investment styles. Returns of funds that invest more heavily in stocks, below B rated debt, and non-rated debt are more sensitive to stocks than funds which refrain from stocks and invest more heavily in BB or better bonds. Although all HY bonds are tilted toward small-cap stocks, there are notable differences in the strength of the small-cap tilts. Some HY bond funds' returns are more sensitive to growth stocks, while others show a value tilt. The RBSA should help investors better understand their true asset allocations and better manage their portfolios.

Finally, HY bond returns are tax inefficient because most of their returns come from interest. Therefore, individual investors should hold HY bonds in their retirement accounts, while attaining their target asset allocation. Elton et al. [2001] concluded that part of corporate bonds' higher returns, as compared to Treasuries' returns, is due to a tax premium; that is, corporate bonds must pay higher interest because, if held in taxable accounts, the interest is taxable at the state as well as the federal level. If such a tax premium exists on HY bonds then this tax premium would be a windfall after-tax profit to an individual who holds these bonds in tax-exempt or tax-deferred retirement accounts. Similarly, it would be a windfall for a tax-exempt institutional investor.

ENDNOTES

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¹Atkinson and Choi [2001] provided a useful guide for researchers trying to perform returns-based style analysis.

²We are describing the option's delta as a positive number because we are considering a short put option. The delta is negative for a long put option.

³These reported values are formally known as excess kurtosis. Values greater than 1.0 are considered large.

⁴This average expense ratio reflects the average expense ratio from January 2005 Morningstar Principia Pro.

⁵The major goal of this study is to provide RBSAs of HY bond series and funds, so we are concerned with HY bond funds that have survived through the years. However, due to a survivorship bias, the average return among the 60 funds that survived until today likely exceeds the average return produced by all HY bond funds in 1997–2006—survivors and non-survivors. This bias does not affect the major goal of this study. However, since the 60 survivors could not match the returns on the indexes, we can conclude that HY bond funds, as a group, could not match the market's returns.

⁶The 2.9% large-cap value weight reflects the sum of coefficients for the current and lagged monthly returns. The same procedure is used for the other eight asset classes. The results for all current and lagged coefficients are available upon request.

⁷Although not reported, when the independent variables are limited to four stock series, corporate bonds, Treasury bills, and their lagged values, the RBSA results are similar for BB and B rated bonds and identical for C rated bonds. We examined these results because the strong correlation coefficients between Corp and, respectively, LT Gov, IT Gov, and MBS (see Exhibit 6) raise the possibility that the influence of Corp is being picked up by the other high-grade bond series. As credit quality decreases from BB to B to CCC, the Corp coefficient (which is also the total bond coefficient) falls from 0.727 to 0.625 to 0.484, while the sum of stock coefficients rises from 0.216 to 0.327 to 0.516. These results tell the same economic story as the results in Exhibit 5.

⁸In separate RBSA with Corp as the dependent variable and the four stock series and four other fixed-income series as independent variables, the combined exposure to LT Gov, IT Gov, and MBS was 0.935 and the combined stock exposure was 0.065 with an R^2 of 0.849. These results also suggest that high-grade corporate bonds have minimal stock exposure.

⁹According to Fridson and Sterling [2006], a correlation coefficient of 0.8 or higher is commonly taken to indicate that two assets constitute the same asset class.

¹⁰Although beyond the scope of this article, returns on tax-exempt accounts are clearly tax free. The *after-tax* value of funds in tax-deferred accounts such as a 401(k) also grows tax free. Suppose each dollar in a tax-deferred account will even-

tually be taxed at t . The after-tax asset allocation literature implies that the \$1 should be considered $(1-t)$ dollar of the individual's after-tax funds plus t dollars, which is the government's share of the current principal. The after-tax value of the individual's $(1-t)$ grows effectively tax exempt; it is like $(1-t)$ of after-tax funds in a tax-exempt account. For more, see Dammon, Spatt, and Zhang [2004] and Reichenstein [2007], and references therein.

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