HIGH YIELD INVESTING DURING ECONOMIC RECOVERY

Lev Dynkin, Jay Hyman, Vadim Konstantinovsky,CFA, and Sandeep Mody

As of August 30, 2002, high yield credits have significantly underperformed their investment grade counterparts. The year-to-date return on the U.S. High Yield Index was -6.40%, compared with +5.23% for the U.S. Investment Grade Index. Within high yield, the suffering was worse in the lower ratings categories. For example, the Caa component has returned -20.13% YTD. Yet for investors who feel that a recovery is imminent, there may be good reason to increase allocations to high yield in general and to the Caa-rated portion in particular. We look into the historical performance of high yield in various economic environments, particularly when there is anticipation of positive developments. In addition, we investigate techniques to replicate the returns of the High Yield Index and its Caa component and take a close look at diversification issues.

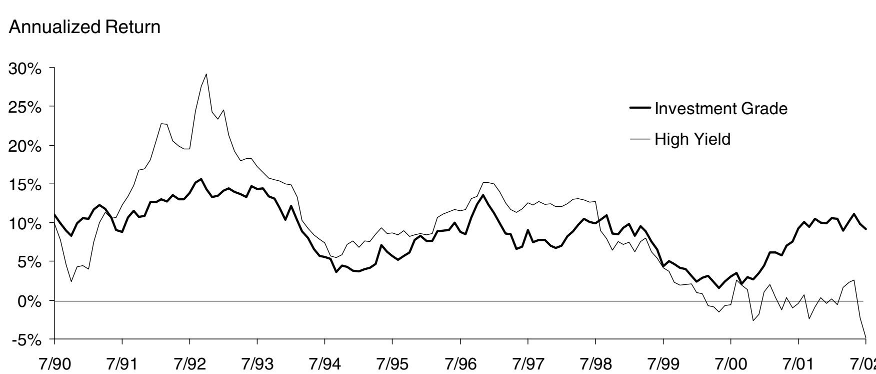
Risk and Performance of the U.S. High Yield Index

Relative Performance of Lower- and Higher-Quality Credits at Different Stages of the Economic Cycle

Historically, high yield has underperformed investment grade credit in periods of recession and outperformed during recoveries. This behavior was clearly demonstrated in the early nineties. As Figure 1 shows, during the recession of 1990, high yield underperformed investment grade significantly. However, when the economy rebounded in 1991-1992, high yield came back strongly, outperforming investment grade by an even wider margin. Over the past two years, as the economy has been struggling, high yield once again fell behind. If history is any indication, once we see the long-awaited upturn, high yield assets should deliver returns superior to those of higher-quality credits.

Within the high yield market, the trend of lower qualities outperforming in an expanding economy is repeated. Caa tends to be the best-performing class in recoveries. The downside, of course, is that Caa is usually the worst-performing

Figure 1. **Total Returns for Investment Grade and High Yield Credit over Rolling Two-Year Periods,** August 1988-July 2002



group of the high yield markets in recessions. Figure 2 plots annualized total returns averaged over a rolling two-year window for the Ba, B, and Caa ratings in the High Yield Index. It is apparent that Caa underperformed the others significantly during the 1990 recession and has been lagging over the recent two years as well. Yet during the recovery of 1991-1992, Caa outperformed by a wide margin, even relative to the stellar returns produced by high yield as a whole. Historically, high yield portfolio managers who were overweighted in Caa just prior to economic upturns produced superior results.

Systematic and Bond-Specific Risk in Caa Portfolios

The relative importance of idiosyncratic risk relative to systematic risk tends to increase for lower credit qualities. While total returns of Aa-Aaa and, to a smaller extent, A credits are driven mostly by Treasury rates and industry-wide spread movements, issuer-specific risks take on greater importance in Baa and become dominant in high yield. Within high yield, the major risk consideration for Caa portfolios should be issuer-specific risk. To illustrate the relationship between the systematic and non-systematic risks in the Caa class, for each month from January 1995 through July 2002, we computed the average and standard deviation of total returns for all non-defaulted bonds in the Caa component of the High Yield Index. Using two-year rolling windows, we computed the volatility of average total returns over time (a proxy for systematic risk), as well as the average cross-sectional standard deviation of total returns (a proxy for non-systematic risk). The comparison of the two time series shows that in a portfolio containing a few Caa bonds, bond-specific risk dominates the systematic (sector) risk by far. The cross-sectional standard deviation of individual bonds' total returns averaged 12.8% per month over the whole time period, while the volatility of average returns (systematic risk) was "only" 3.8% per month. Non-systematic risk can be reduced by diversification. A Caa replicating portfolio with enough issuers will have approximately the risk of the index.

Figure 3 plots the two types of risk computed over a rolling two-year window. Both systematic and non-systematic risk in Caa have increased dramatically over the past few years. Interestingly, while there was a marked increase in systematic volatility in

Figure 2. **High Yield Total Returns over Rolling Two-Year Periods**
August 1988-July 2002

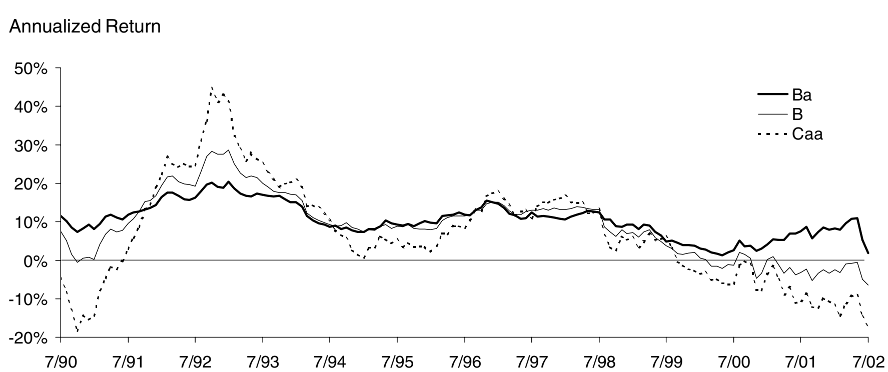
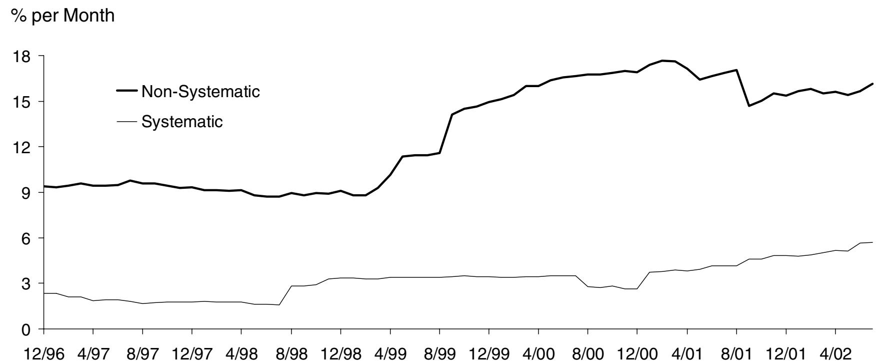


Figure 3. **Systematic versus Nonsystematic Risk in Caa: Volatility over Rolling Two-Year Periods,** August 1988-July 2002



the second half of 1998, the non-systematic risk was not affected by the crisis. Non-systematic volatility picks up later, with a pronounced jump in 1999 and continued increase through 2000 and 2001. This confirms the intuition that while the crisis of 1998 was a market-wide event, the extreme cross-sectional volatility that we have lived through recently is driven by events specific to individual issuers.

"Fat Tails" in the High Yield Market

It is well known that the distribution of spread movements (and excess returns) of individual securities across the credit market is not normal. Events outside of multiple standard deviations are more likely than in the normal distribution, giving the empirical distribution "fat tails." While this is true for all quality ratings, higher-quality securities have asymmetrical tails with "fatness" observed primarily at the negative end. The nature of the game in high-grade credit is, roughly speaking, that investors earn a relatively small outperformance (spread) over Treasuries with a high probability in compensation for taking on the risk of a very large underperformance (downgrade or default) with a low probability. The higher the quality, the more limited is the upside potential, and, indeed, credit disasters in Aa or A happen more often than disproportional outperformance of a particular issuer. In lower qualities, though, the upside potential is significant. Distressed debt is priced based on the recovery value of the issuer's assets. If the issuer suddenly regains its financial health, the returns can be enormous. The analysis in Figure 4 shows that the return distribution for high yield bonds displays fat tails on the positive side as well as on the negative. In fact, for the overall High Yield Index, as well as its Caa component, the extreme positive events (five or more standard deviations) outnumber the extreme negative ones.

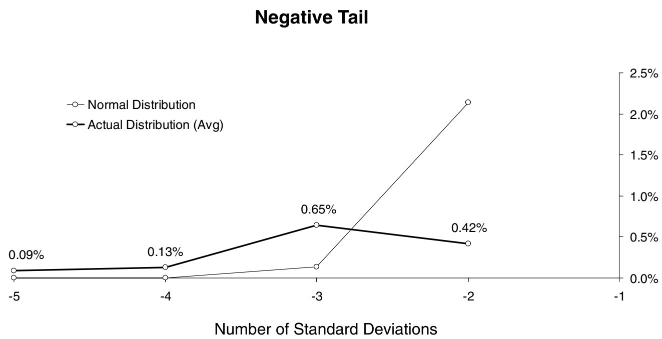
Replication of the U.S. High Yield Index

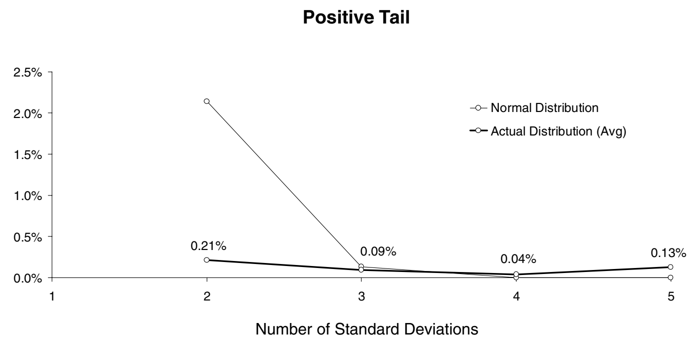
Replication of the Full High Yield Index

We have developed a flexible method for constructing replicating portfolios for the U.S. High Yield Index. The method consists of partitioning the index into buckets based on industry, quality, or price levels and constructing portfolios whose allocations to the various buckets match those of the index within certain tolerances.

Figure 4. **"Fat Tails" in the Distribution of Total Returns in the High Yield Market,** January 1990-July 2002

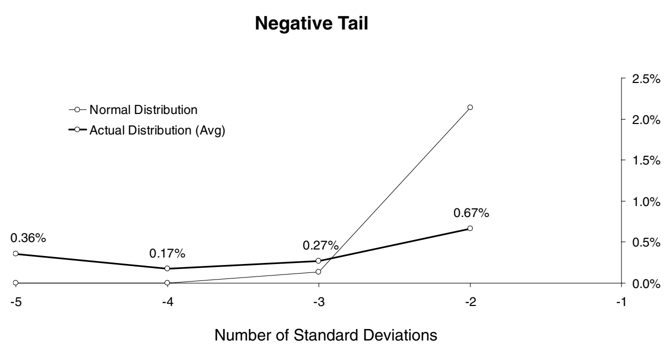
The High Yield Index

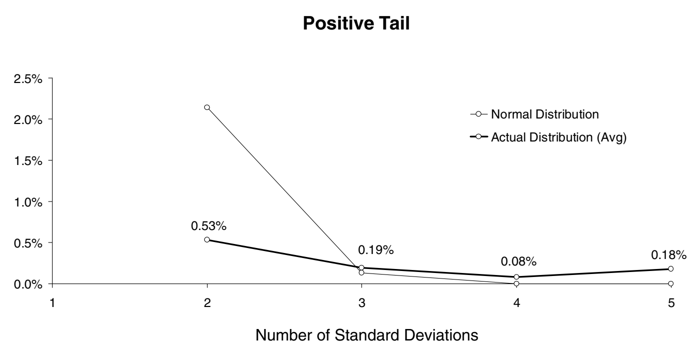




	Percentage of Bonds Outside of N StDev										
	-5	**-4**	**-3**	**-2**	**-1**	**Within 1**	**1**	**2**	**3**	**4**	**5**
Normal Distribution	0.00%	0.00%	0.13%	2.14%	13.59%	68.27%	13.59%	2.14%	0.13%	0.00%	0.00%
Actual Distribution (Avg)	0.09%	0.13%	0.65%	0.42%	1.70%	95.73%	0.81%	0.21%	0.09%	0.04%	0.13%
Overall Mean (%/mo)	1.46										
Overall Stdev (%/mo)	18.37										

Ba Only

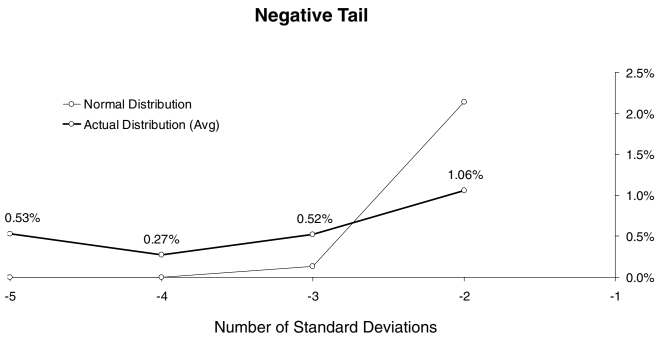


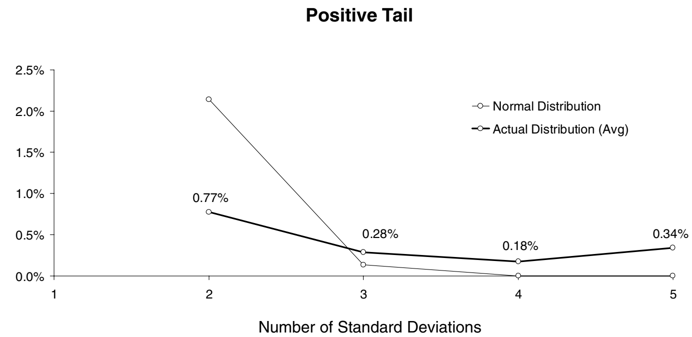


	Percentage of Bonds Outside of N StDev										
	-5	**-4**	**-3**	**-2**	**-1**	**Within 1**	**1**	**2**	**3**	**4**	**5**
Normal Distribution	0.00%	0.00%	0.13%	2.14%	13.59%	68.27%	13.59%	2.14%	0.13%	0.00%	0.00%
Actual Distribution (Avg)	0.36%	0.17%	0.27%	0.67%	2.66%	92.62%	2.27%	0.53%	0.19%	0.08%	0.18%
Overall Mean (%/mo)	0.85										
Overall Stdev (%/mo)	5.02										

Figure 4. **"Fat Tails" in the Distribution of Total Returns in the High Yield Market,** January 1990-July 2002 *(continued)*

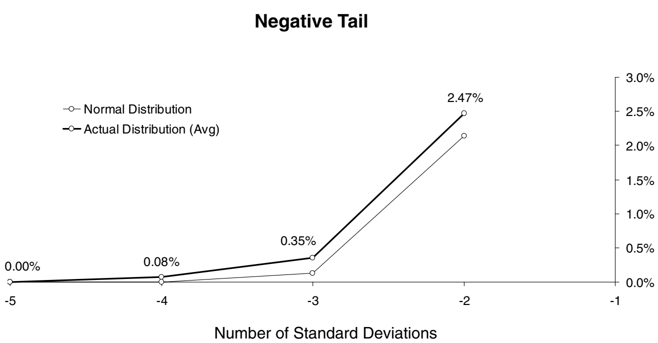
B Only

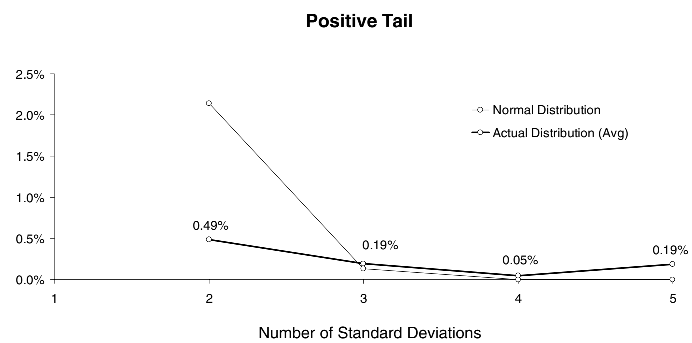




	Percentage of Bonds Outside of N StDev										
	-5	**-4**	**-3**	**-2**	**-1**	**Within 1**	**1**	**2**	**3**	**4**	**5**
Normal Distribution	0.00%	0.00%	0.13%	2.14%	13.59%	68.27%	13.59%	2.14%	0.13%	0.00%	0.00%
Actual Distribution (Avg)	0.53%	0.27%	0.52%	1.06%	3.24%	89.83%	2.98%	0.77%	0.28%	0.18%	0.34%
Overall Mean (%/mo)	0.71										
Overall Stdev (%/mo)	6.31										

Caa Only, January 1990-July 2002





	Percentage of Bonds Outside of N StDev										
	-5	**-4**	**-3**	**-2**	**-1**	**Within 1**	**1**	**2**	**3**	**4**	**5**
Normal Distribution	0.00%	0.00%	0.13%	2.14%	13.59%	68.27%	13.59%	2.14%	0.13%	0.00%	0.00%
Actual Distribution (Avg)	0.00%	0.08%	0.35%	2.47%	2.51%	91.78%	1.89%	0.49%	0.19%	0.05%	0.19%
Overall Mean (%/mo)	1.75										
Overall Stdev (%/mo)	22.58										

Because idiosyncratic risk plays such an important role in the high-yield class, the method also ensures that the portfolio's allocation to any issuer matches that of the index within a given tolerance.

The number of bonds chosen for the portfolio varies from month to month and can be further varied by changing the tolerances. The tighter the tolerances, the more bonds are needed to satisfy them. The number of bonds can be controlled more precisely by setting the tolerances in such a way that a few more bonds than desired are chosen in order to satisfy the tolerances and then removing the smallest bonds in the portfolio until it has the desired number of bonds. For example, if we wish to construct portfolios with exactly 50 bonds, we can set our tolerances in such a way that the method will choose 60 to 80 bonds and then choose the 50 largest bonds in the portfolio. Of course, removing even small positions from the portfolio increases the tracking error.

Figure 5 shows the performance of different strategies, i.e., different combinations of tolerances and bucketing schemes. Eight strategies were created by varying the parameters as follows:

- Four different sets of tolerances were chosen, each resulting in a different average number of bonds per month.
- With each set of tolerances, one strategy uses a combination of industry buckets and quality buckets, the type of partition scheme that is considered standard within investment grade. A second strategy uses a combination of industry buckets and price buckets. The rationale for this is that in the high yield sector, price can be considered as a market assessment of creditworthiness.

Each strategy was applied on a monthly basis from January 1994 through July 2002. The results are shown in Figure 5. As expected, tracking errors are higher for strategies using fewer bonds. The strategies using a combination of price buckets and industry buckets produce performance almost identical to that using industry and quality buckets. While a tracking error of 1.47% per year (the smallest number shown) may not seem small on an absolute basis, when considered relative to the index volatility of 7.13% it can be seen to capture over 95% of index variance. Even the coarsest replication strategy (using the smallest number of bonds) explained 78% of the variance of the index.

Replication of the Caa Component of the High Yield Index

As we have shown above, with the decrease in quality, systematic risk becomes gradually less important, with non-systematic or issuer-specific risk becoming the

Figure 5. **Replication of the High Yield Index,** January 1994-July 2002

Parameter	Average # of Bonds		Index Volatility	Tracking Error (%/Yr)			% of Variance Explained	
Set	Price	Quality	(%/Yr)	Price	Quality	Diff	Price	Quality
1	146	148	7.13	1.47	1.52	-0.04	95.7	95.5
2	89	95	7.13	2.60	2.72	-0.12	86.7	85.4
3	48	49	7.13	2.97	3.05	-0.08	82.6	81.7
4	39	40	7.13	3.34	3.07	0.27	78.0	81.4

main source of return volatility. Clearly, any portfolio manager who attempts to take advantage of the perceived economic upturn by overweighting Caa should be cognizant of the increased idiosyncratic risk in the portfolio. This consideration led us to look into replication of only the Caa portion of the High Yield Index. We performed historical simulations of such replication under various constraints. As in the full index replication, index exposures to industry groups were matched, and the tightness of the constraints determined the number of bonds selected and the resulting tracking error. Figure 6 summarizes the results of the historical simulations. The strategies presented here differ by the "global issuer tolerance" constraint. This constraint sets the maximum portfolio versus benchmark exposure to a single issuer. This tolerance may vary from issuer to issuer and is a function of the quality and industry buckets that the issuer belongs to, but is never greater than the global threshold. Strategies with tighter limits will have to buy more securities and will better match index allocations, as well as have lower non-systematic risk. Over the time period of the study (January 1993 through June 2002), the Caa index has had an annualized volatility of 12.24%. The strategy with the lowest global issuer tolerance, averaging 63 bonds in the portfolio (~75% of the bonds in the index), achieved a tracking error of 1.65% per year; this replication captures 98.2% of index return variance. For the most relaxed constraint strategy, with only 36 bonds on average (~38% of the bonds in the index), the observed tracking error was 4.06%/year; yet still as much as 89% of index variance was captured.

Sufficient Diversification in the U.S. High Yield Market

We recently published a study on sufficient diversification in the U.S. investment grade credit market. In that work, we focused on losses due to downgrades as the main manifestation of idiosyncratic risk. We also computed "natural" variance that reflects issuer-specific factors that do not result in a rating change. Applying the same methodology to the high yield market, we quantify the risks due to downgrades (and default) and determine the optimal diversification levels.

For each downgraded bond in the High Yield Index, we lined up its returns relative to the peer group (quality/industry cell) during the twelve months prior to (and including) the month of downgrade. Then we computed the mean and variance of the peer group underperformance for each of the four quarters separately for Ba, B, and Caa-C rating categories.

Unlike investment grade, where downgrades almost never lead straight to default, in the high yield market this happens frequently. Because of this, we made two assumptions unique for the high yield study. First, we assumed -60% total return in the month of default, based on the industry-average 40% recovery rate. For each

Figure 6. **Replication of the Caa Component of the High Yield Index,** January 1993-June 2002

Issuer Tolerance	Index Avg Return (%/Yr)	Index Volatility (%/Yr)	Strategy Avg Return (%/Yr)	Strategy Volatility (%/Yr)	Outperf (%)	Ann Tracking Error (%)	Number of Bonds Avg	Number of Bonds Min	Number of Bonds Max	Avg Monthly Turnover (%)	Variance Explained (%)
1.25%	2.09	12.24	2.63	12.59	0.55	1.65	63	22	132	11.6	98.2
2.50%	2.09	12.24	2.87	12.84	0.78	2.29	49	14	120	12.7	96.5
5.00%	2.09	12.24	2.51	12.97	0.42	3.43	41	11	116	14.8	92.1
10.00%	2.09	12.24	1.75	13.62	-0.34	4.06	36	9	114	17.8	89.0

bond, this total return was converted into an appropriate excess return. Second, we had to address the issue of double downgrades. In the investment grade study, we ignored the second downgrade happening within twelve months from the first. However, in high yield, a scenario in which a downgrade is followed quickly by the second one leading into default is fairly typical, with most of the loss incurred in the second leg. For this reason, we defined the four-quarters study window as the twelve months prior to the *second* downgrade.

Figure 7 summarizes the return consequences of downgrades in the high yield market. As in the investment-grade market, the loss magnitude increases as the downgrade approaches, culminating in the quarter of the downgrade. As expected, both the magnitude and the volatility of loss increase sharply for lower qualities. In all cases, the standard deviation of loss far exceeds the mean; therefore, underperformance of individual bonds relative to their peers can be truly devastating.

Using the approach developed for the investment grade sufficient diversification study, we constructed a simple model for the distribution of losses due to downgrades in a high yield portfolio. This model is based on the downgrade statistics presented in Figure 7 and on the rating transition probabilities published by Moody's Investors Services. Figure 8 summarizes the resulting model of single-bond returns. This model is extended further from a single security to a portfolio and can

Figure 7. **Average Underperformance due to Downgrades**
January 1990-May 2002

			Underperformance (%)				
			Monthly		**Quarterly and Annual**		
Mos Prior to Downgrade	**Initial Quality**	**# of Observations**	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**T-Stat**
0-2	Ba	297	-3.53	15.53	-10.58	26.90	-6.74
	B	617	-9.65	25.39	-28.95	43.98	-16.35
	Caa-C	46	-21.05	31.27	-63.15	54.15	-7.91
3-5	Ba	297	-0.85	7.11	-2.55	12.32	-2.98
	B	617	-3.71	14.85	-11.14	25.72	-3.06
	Caa-C	46	-5.69	16.55	-17.08	28.66	-10.76
6-8	Ba	297	-0.77	5.85	-2.30	10.13	-3.48
	B	617	-1.33	11.20	-3.98	19.40	-5.09
	Caa-C	46	0.25	12.63	0.76	21.87	0.24
9-11	Ba	297	-0.29	5.17	-0.86	8.95	-1.78
	B	617	-0.52	10.90	-1.56	18.88	-2.05
	Caa-C	46	-0.38	13.54	-1.14	23.46	-0.33
Full Year	Ba	297	-1.36	10.36	-16.28	35.87	-7.57
	B	617	-3.80	17.27	-45.62	59.84	-18.94
	Caa-C	46	-6.72	20.50	-80.61	71.02	-7.70

Figure 8. **Parameters of the Model for Downgrade Risk (Annualized)**

		Statistics of Losses Experienced by Downgraded Bonds		**Resulting Statistics for Expected Losses on a Single Bond**	
Initial Rating	**Downgrade Probability**	**Avg**	**Std Dev**	**Avg**	**Std Dev**
Ba	8.44%	-16.32%	35.87%	-1.38%	11.45%
B	9.36%	-45.62%	59.84%	-4.27%	23.03%
Caa-C	25.63%	-80.61%	71.02%	-20.66%	54.39%

be used to compute tracking error due to downgrades versus a benchmark (e.g., the Lehman High Yield Index).

We started with construction of a naïve 100-bond portfolio that mirrored the benchmark's allocation to qualities and was assumed to match its systematic risk exposures. In this portfolio, we use a uniform position size of $10 million for each of our 100 bonds, so that the number of bonds chosen in each credit quality is proportional to the percent of the index in that quality. Applying our portfolio-level model of downgrade risk, we computed tracking errors due to downgrades for each quality rating, as well as for the whole portfolio. Figure 9 illustrates this portfolio.

It is intuitively clear that this tracking error could be reduced if the portfolio were structured differently. Given that the volatility of downgrade losses is much higher in lower qualities, it seems reasonable to spread this risk wider in these qualities. Thus, we formulated the following optimization problem: minimize tracking error due to downgrades solving for the number of bonds in each quality. The outcome of this optimization is shown in Figure 10. In the optimized portfolio, the number of bonds in Ba is reduced from 48 to 27, while the number of bonds in Caa-C more than doubled, increasing from 11 to 28. The recommended position ratio is now 5:2:1, which means that a single position in Ba can be five times larger than a position in Caa-C. Note that unlike the investment grade result, in which the majority of names in the optimal portfolio are selected from the lowest quality level (Baa), Figure 10 shows that only 28 out of 100 issues were chosen from Caa-C. This is because this sector constitutes only 10.7% of the index. The key measure of diversification is the position size limit and, consistent with our investment grade result, in the optimal allocation, the smallest position size is imposed in the lowest qualities.

Figure 9. **$1 Billion High Yield Index Proxy (Equal Weights to All Securities)**

Quality	Percent of Index	Number of Bonds	Tracking Error due to Downgrades (bp/yr)	Position Size $ Million	Position Size Ratio
Ba	48.3	48	175	10.0	1
B	41.0	41	552	10.0	1
Caa-C	10.7	11	1860	10.0	1
Total	100.0	100	240		

Figure 10. **$1 Billion High Yield Index Proxy (Optimal Allocation to Qualities)**

Quality	Percent of Index	Number of Bonds	Tracking Error due to Downgrades (bp/yr)	Position Size $ Million	Position Size Ratio
Ba	48.3	27	214	17.9	5
B	41.0	45	328	9.1	2
Caa-C	10.7	28	1028	3.8	1
Total	100.0	100	202		

Conclusion

There is no denying that high yield is a risky asset class. High index return volatility is accompanied by even larger deviations among the returns of individual high yield credits. However, there is a certain predictability in the behavior of this asset class at particular stages of the economic cycle. Historically, high yield underperformed during recessions and outperformed at economic upturns. Investors confident in their economic views can exploit this trend to generate superior returns. A similar pattern is evident within the high yield market. Lower qualities (i.e., Caa) tend to outperform higher qualities (i.e., Ba) during recoveries.

For passive high yield investors, we developed and presented a sampling method for replication of the High Yield Index with a reasonably small number of securities. Depending on the size of the replicating portfolio, the achieved annualized tracking error was between 1.5 and 3 percent per year, which is just a fraction of the index return volatility of more than 7 percent per year for the same period.

One concern for investors moving into high yield in anticipation of a recovery is to avoid being hurt by idiosyncratic risk while participating in the asset class as a whole. Using the sufficient diversification method, we have demonstrated that by ensuring higher levels of issuer diversification in lower qualities, the nonsystematic risk can be kept at reasonable levels. The optimal position size ratio for Ba, B, and Caa was found to be 5:2:1.

Finally, we showed that the cross-sectional return distribution in the high yield market displays a tendency to have "fat tails" on both the negative and the positive side. This gives high yield an advantage over investment grade, where extreme negative events vastly outnumber the extreme positive ones.

Publications—L. Pindyck, A. DiTizio, B. Davenport, W. Lee, D. Kramer, J. Threadgill, R. Madison, A. Acevedo, K. Kim, C. Rial, J. Batstone