

Quantitative Portfolio Strategy

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ISSUER-CAPPED AND DOWNGRADE-TOLERANT U.S. CORPORATE INDICES

Introduction

The Lehman Brothers indices are rules-based: issues are added and removed from an index according to a set of rules. In addition, in standard Lehman indices, individual securities contribute to index averages in proportion to their market value weight. Given the advancements in Lehman's index technology, investors can now request a wide array of made-to-order indices that follow a *customized* set of rules. In reaction to the recent credit market dynamics, many investors have examined adding two customized rules: imposing an issuer cap and having a more flexible quality requirement that allows downgraded bonds to remain in the index for a period of time. The purpose of this article is to examine the implications of these suggested rules for the return performance of the Corporate Index.

Two important Lehman Brothers U.S. Corporate Index rules are the liquidity constraint and the quality requirement. The liquidity constraint states that a bond must have a minimum current par amount outstanding to be index eligible. For the Lehman U.S. Corporate Index, the liquidity constraint is currently \$150 million.¹ There is no maximum issue size limit. In addition, there is no *issuer*-level minimum or maximum. The liquidity constraint ensures that the index contains only issues that are large enough for investors to obtain. Obviously, it is not realistic for all investors to buy a given index issue. However, an index issue is typically large enough to be actively traded and, more important, to allow Lehman to obtain a market price for index calculations.

The absence of a minimum issuer-level constraint helps ensure that the Corporate Index is a well-diversified index of issuers. As of January 31, 2003, the U.S. Corporate Index contained 668 issuers, with more than 500 of them having a weight less than 0.2% in the index. This high level of diversification facilitates security selection (*i.e.*, it is easy to overweight and underweight many different names), which is a potentially rewarding portfolio management activity.² Figure 1 presents a histogram of the issuer weights in the Corporate Index for the past three years.

The absence of a minimum or maximum issuer-level constraint is also important, as it allows the index to adapt automatically to changes in the corporate marketplace. In other words, the composition of the Corporate Index reflects what is reasonably available in the marketplace, and the performance of the index accurately captures the overall performance of the credit market.

The past few years have served as a painful reminder of the presence of idiosyncratic risk in the credit markets, as some of the largest issuers have been among the biggest relative

¹ The index liquidity constraint is infrequently revised. The constraint was raised from \$100 million to \$150 million on July 1, 1999. For more information about the liquidity constraint, see "Amount Outstanding Constraint for the U.S. Corporate Index," *Global Relative Value*, Lehman Brothers, November 2000.

² For the importance of security selection as an outperformance strategy see *Value of Security Selection versus Asset Allocation in Credit Markets: Part II—An "Imperfect Foresight" Study*, Lehman Brothers, June 2000.

underperformers. Figure 2 shows the cumulative returns of the top decile (by market value)³ of the Corporate Index, the remaining 90% of the Corporate Index, and the Corporate Index itself. Figure 2 shows that the top decile was a severe relative underperformer during much of 2002.

Given the sharp underperformance of a few large issuers, some investors (*e.g.*, plan sponsors and insurance companies) have raised questions about “uncapped indices,” *i.e.*, indices without a per-issuer maximum, as benchmarks. These investors are asking whether it is appropriate from a risk management perspective for a plan’s assets to have,

³ Over this period, the top decile contained an average of four issuers.

Figure 1. **Histogram of Issuer Market Value Weights in the Corporate Index**
As of January 31, 2001, 2002, and 2003

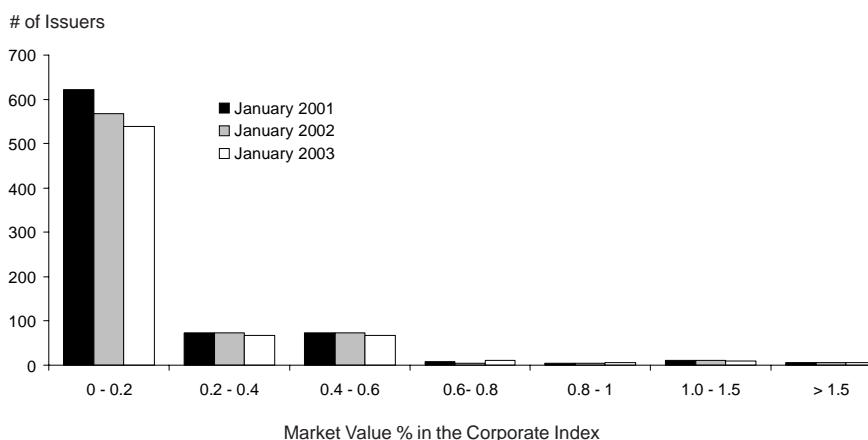
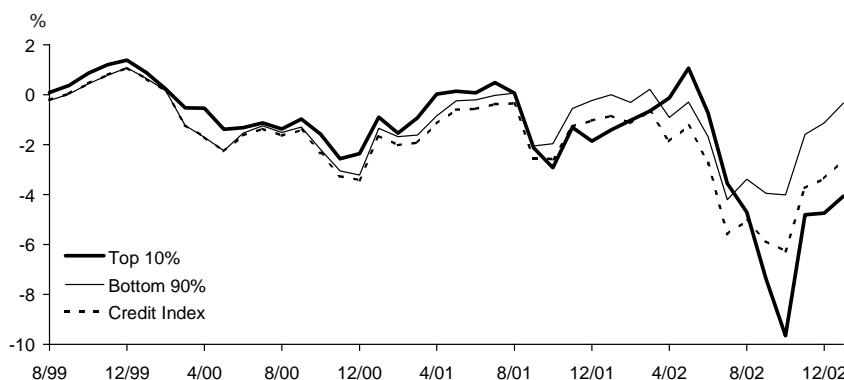


Figure 2. **Cumulative Excess Returns: Top 10% and Bottom 90% by MV Weight in Corporate Index**
August 1999-January 2003



for example, a 2% exposure to a particular issuer due to the plan's exposure to the benchmark. As a result, some investors are considering adopting customized "issuer-capped" indices as benchmarks to limit any issuer's total return impact on the index.

Compounding the poor performance of large issuers in the index has been the recent downgrading of some large issuers to below investment grade. This involves a second key index rule: the quality requirement. The quality requirement states that an issue must be rated investment-grade to be index eligible. If, at some point during the month, an index issue is rated below investment-grade, it is removed from the index at the end of that month. The quality requirement ensures that the index maintains a certain minimum quality level over time. Consistency of an index's quality is important for plan sponsors who make strategic asset allocation decisions and select indices as their benchmarks.

When a large issuer leaves the index due to a downgrade, a portfolio manager must sell the issue at the end of the month in order to be neutral to the index with respect to the issuer. 'Tis easier said than done, especially for large issuers. In practice, some managers feel that they have no alternative but to hold a downgraded issue for several months after the downgrade as they try to find buyers in the relatively small high-yield market.⁴ Since the portfolio manager often has no choice but to continue to hold the downgraded bond that leaves the index in the downgrade month, some investors feel that the index has a positive "survivorship bias" that puts the manager at an inherent disadvantage. These investors argue that the index would be more replicable if it were somewhat "downgrade tolerant," allowing a downgraded bond to remain in the index for a period of time after downgrade.

The goal of this article is to examine the risk and return behavior of issuer-capped and downgrade-tolerant indices. Among the questions we address are: Do issuer-capped indices have lower volatility and better excess returns? And is there a survivorship bias to the Corporate Index that would make a downgrade-tolerant index more replicable for the investment manager?

Issuer Concentration in the Lehman U.S. Corporate Index

What is the degree of issuer concentration in the U.S. Corporate Index? Figure 3 shows that there are only a handful of issuers in the index that have relatively large market value weights. As of January 2003, the four largest issuers (F, GM, C, and GE) each have a market value weight that exceeds two percent of the index's market value. The largest issuer is F, with a current weight of 3.58%. Ford's weight exceeded 4% in early 2001 and has recently come down as the issuer has increased its reliance on the asset-backed market for financing. BAC is currently the fifth-largest issuer, with a weight of 1.76%.⁵

⁴ As of February 28, 2003, the market value of the investment-grade Corporate Index was \$1,792 billion, compared with \$412 billion for the High-Yield Index.

⁵ Our issuer concentration charts begin in August 1999, when the Lehman index database adopted tickers to identify issuers. For large issuers, the market value percentage weights likely jumped upward in July 1999, when the liquidity constraint increased from \$100 million to \$150 million. Of course, large issuers may also lose issues from the index due to the increased liquidity constraint. However, the larger issuers typically have issue sizes that easily exceed the constraint. Interestingly, while most discussions regarding raising the liquidity constraint typically revolve around the impact of a large number of smaller issues excluded from the index, less attention is paid to the potential impact on issuer concentration.

Figure 4 presents the market value weights for the sixth- through tenth-largest issuers. As of January 2003, the sixth- through tenth-largest issuers, VZ, HI, AOL, MWD, and JPM, all had market value weights of approximately 1.5%.

Figure 5 shows that the market value weight of the top ten issuers as a group is approximately 21%, at the high of its range over the past three and a half years. Figure 5 also shows that the weight of the ten largest issuers increased sharply at the end of 2000, due primarily to the acquisition of Associates by Citicorp.

Issuer-Capped Indices

An issuer-capped benchmark imposes a maximum on the market value weight that an issuer can have in the index. For example, an issuer-capped benchmark could impose a requirement that an issuer's weight not exceed 1% of the index. The motivation for capping an issuer's market value weight is to limit the index's exposure to the idiosyncratic risk of the issuer. Given the large negative excess returns experienced by large

Figure 3. **MV Weights of Top 5 Issuers in the Corporate Index**
August 1999-January 2003

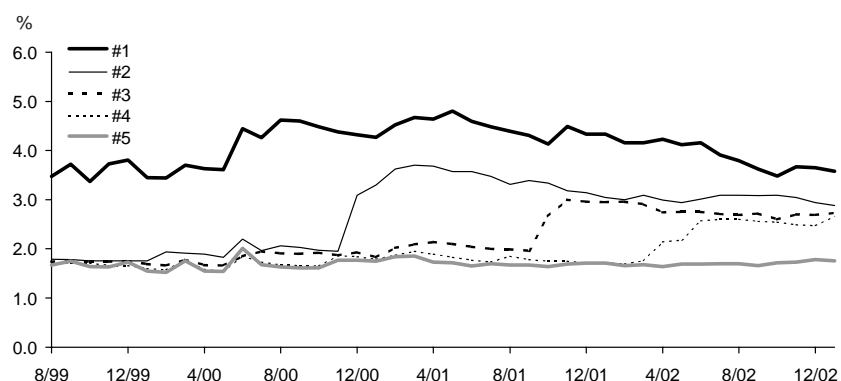


Figure 4. **MV Weights of Top 6 -10 Issuers in the Corporate Index**
August 1999-January 2003

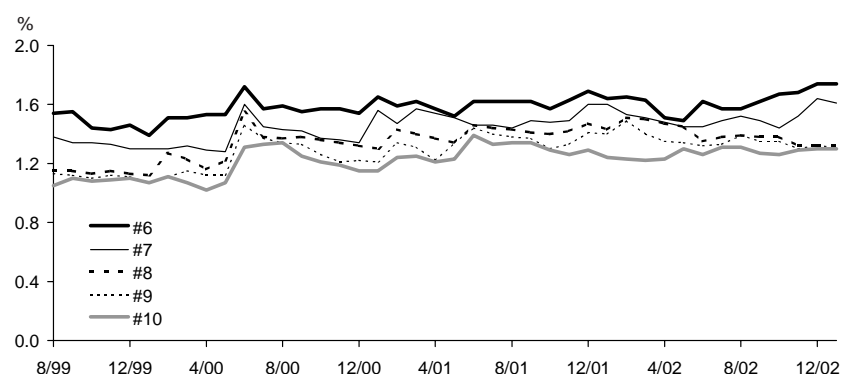
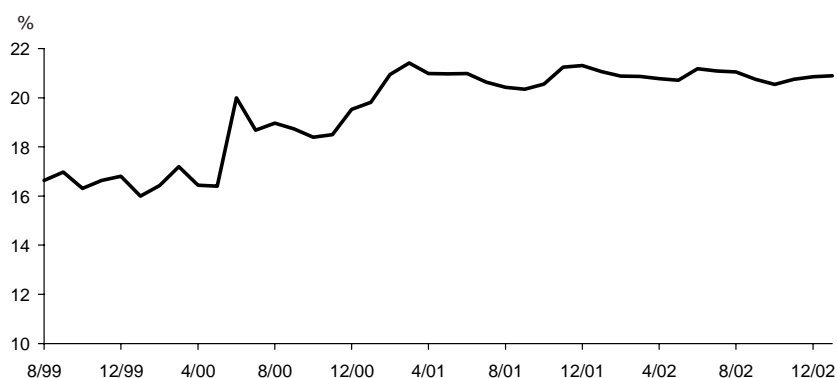


Figure 5. **Total MV Weight of Top Ten Issuers in the Corporate Index**
August 1999-January 2003



issuers in recent years, an issuer-capped benchmark presumably would have higher excess returns and lower excess return volatility than an uncapped index. The goal of this section is to describe what the behavior of issuer-capped indices would have been in recent years.

Constructing an issuer-capped index requires two decisions. First, how low should the cap be? The answer depends on setting a cap level that is low enough to limit the impact of idiosyncratic risk on the index, but not so low that many issues will be capped. Limiting the size of a large issuer in the index is equivalent to boosting the size of all the other issuers so that the large issuer becomes a smaller percentage of the whole. If too many large issuers are capped, the weights of very small issuers increase disproportionately to their availability in the marketplace, making the index not investable. To be practical, this section analyzes issuer cap levels that are greater than or equal to 1%.

An issuer cap works as follows. Suppose the cap level is set at 3% and the market value of a single issuer exceeds 3% by 0.5%. The issuer's market value is reduced 0.5% by "shaving off" a sufficient *pro rata* share from each of the issuer's issues in the index so that the shavings add up to 0.5% of the Corporate Index. In other words, if the issuer had two issues outstanding, one with a market value weight of 2% and the other 1.5%, then the weight of the first issue would be reduced 0.29%, to 1.71%, and the second by 0.21%, to 1.29%. How is the 0.5% "excess" market value reassigned to the other issues in the Corporate Index? To answer this question, we need to make a second decision on what redistribution rule to use.

We analyze two redistribution rules: "index-wide" redistribution and "quality-sector neutral" redistribution. Index-wide redistribution takes any "excess" market value and distributes it across all issues of non-capped issuers in the index in proportion to their weights in the index. In the example above, the large issuer under consideration originally constituted 3.5% of the index. Suppose that all the other issuers, which together constitute 96.5% of the index, do not need to be capped, and the 0.5% we shaved off the large issuer must therefore be divided among all of them. If one of the other issuers

constitutes 2% of the index, then it will receive $0.0104\% = 0.5\% \times 2\% \div 96.5\%$ of the weight of the index as a result of the redistribution of the large issuer's weight.

The “quality-sector neutral” redistribution rule works as follows. The entire index is divided into sector-quality buckets. When a large issuer is capped, we look at each of the issuer's bonds to determine in which bucket it belongs. The weight shaved off that bond is redistributed among bonds in the same bucket issued by other issuers. In the previous example, one of the large issuer's bonds, which we will call issue A, was reduced by 29 bp. Suppose that no other issuers need to be capped and that the sum of the weights of all bonds in the same bucket as issue A but issued by other issuers is 15%. Suppose issue B is in the same bucket as issue A but issued by a different issuer, and issue B constitutes 0.5% of the index. Then the amount of index weight added to issue B as a result of the redistribution is $0.93 \text{ bp} = 29 \text{ bp} \times 0.5\% \div 15\%$. This redistribution rule has the effect of preserving the market value weights of each quality-sector combination in the Corporate Index. As we show below, both the choice of the cap level and the redistribution rule have important implications for the relative performance of an issuer-capped index versus the uncapped index.⁶

Either redistribution rule may require several iterations until all issuers satisfy the cap level. In the first iteration, all issuers exceeding the cap are identified and their excess market value is then redistributed, depending on the redistribution rule, across all remaining issues. As a result of the redistribution, issuers that were below the cap before may be above the cap now, requiring another round of redistributions. The capping procedure is applied repetitively until all issuers satisfy the issuer cap.

We first examine the impact of the cap level assuming we follow the “index-wide” redistribution rule. Figure 6 shows the impact of various issuer cap levels, beginning at 1%, on the annualized excess return performance of the Corporate Index for the period from August 1999 through December 2002. This period also happens to cover a period of intense idiosyncratic risk in the credit markets, especially for large issuers. If issuer caps were to affect the excess return performance of the Corporate Index dramatically, it would likely appear during this period.

Figure 6 shows that the impact on the average excess return is negligible for issuer cap levels down to approximately 1.5%—less than 3 bp per year. However, once the issuer cap is reduced below 1.5%, the average excess return increases more rapidly. For an issuer cap of 1.0%, the average annual excess return is approximately 7 bp higher (-0.98% versus -1.05%). Nevertheless, this result is surprising and very disappointing. Given the very negative excess returns of large issuers, it is remarkable that a 1% issuer cap improves annualized excess returns by only 7 bp per year.

Another motivation for issuer caps is to reduce the excess return volatility of the benchmark. By removing the potential impact of idiosyncratic events affecting large issuers, an issuer-capped index should be expected to have less excess return volatility.

⁶ While an issuer-capped index can use a variety of redistribution rules (e.g., keep subsector weights unchanged), it is important to remember that the redistribution rule must be such that there are enough small issues remaining in each peer group so that the “excess” weight can be fully redistributed.

Figure 7 shows the excess return volatility of the Corporate Index for various issuer cap levels using index-wide redistribution.

With index-wide redistribution, an issuer cap level of 1% reduces excess return volatility by only 5 bp compared to the uncapped Corporate Index. Again, this result is both surprising and disappointing. Issuer-capped indices, even at very reasonable cap levels, do not seem to provide much improvement in risk and return performance compared to uncapped indices.

Figure 6. **Annualized Excess Return of Issuer-Capped Corporate Index as a Function of the Issuer Cap Level**

Index-Wide Redistribution of Excess Weight
August 1999-December 2002

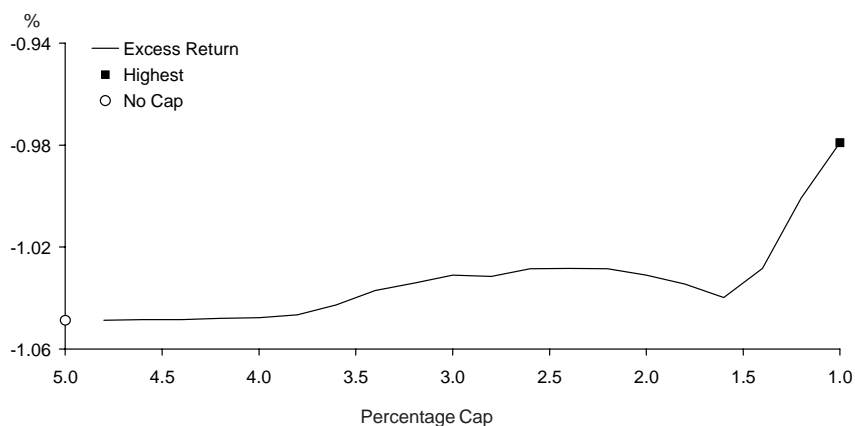
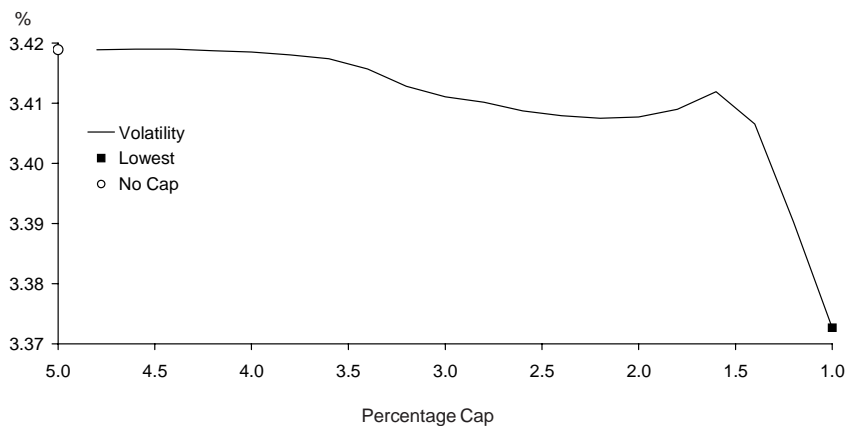


Figure 7. **Average Annualized Excess Return Volatility of the Issuer-Capped Corporate Index as a Function of the Issuer Cap Level**

Index-Wide Redistribution of Excess Weight
August 1999-December 2002



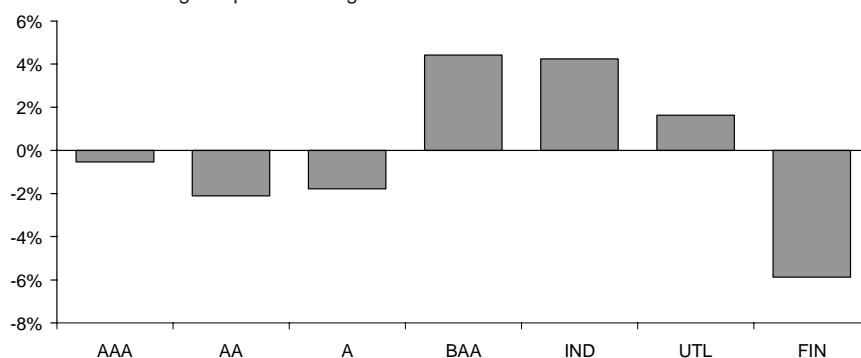
Why do we observe only a modest improvement in the risk and return characteristics of the issuer-capped index versus the uncapped Corporate Index? As discussed at the outset, issuer-capped benchmarks require a decision on how to redistribute the “excess” market value weight. The results in Figures 6 and 7 are based on the rule that the excess is redistributed across all uncapped issues in the index in proportion to their weights in the index. However, as we will show, such a rule can produce an index that has very different sector and quality exposures than the uncapped index. For example, if the large issuers in the uncapped index are A-rated financials, then a 1% issuer-cap using the index-wide redistribution rule may unintentionally produce a capped index with a higher weighting to Baa-rated and industrial issues than the uncapped Corporate Index. In fact, this is exactly what happens. For the period from August 1999 through December 2002, we calculated the average sector and quality exposures for the 1% issuer-capped index (with index-wide redistribution) and the Corporate Index. Figure 8 shows that the 1% issuer-capped index had a higher weighting in Baa-rated and industrial issues than the Corporate Index and a significant underweight to financials.

During the historical period under consideration, Baa-rated and industrial issues generally had lower excess returns and higher excess return volatility, while financials outperformed other sectors.⁷ Consequently, a 1% issuer-cap (with index-wide redistribution) index may not show much improvement versus the Corporate Index, as the increased exposure to Baa-rated and industrial issues offsets much of the reduction

⁷ Average annualized excess returns and annualized excess return volatility, August 1999 through December 2002.

Quality/Sector	Average Excess Return	Excess Return Volatility
Industrial	-1.35%	3.97%
Utility	-4.31%	6.88%
Financial	0.38%	2.61%
Aaa-rated	0.09%	1.67%
Aa-rated	0.80%	1.97%
A-rated	-0.62%	3.14%
Baa-rated	-2.55%	4.94%
Corporate Index	-1.05%	3.42%

Figure 8. Relative Sector and Quality Exposures
 1% Issuer-Capped Index (with Index-Wide Redistribution)
 versus Uncapped Corporate Index
 Average Exposures: August 1999-December 2002



in idiosyncratic risk due to the issuer cap. The lesson learned is that the redistribution rule can undo much of the benefit of an issuer cap. Investors who seek issuer caps most likely do not wish their issuer-capped indices to have different quality and sector weightings from the Corporate Index. Investors want to reduce the impact of large issuers but not necessarily change their market value exposures to the various quality and sector buckets in the credit marketplace.

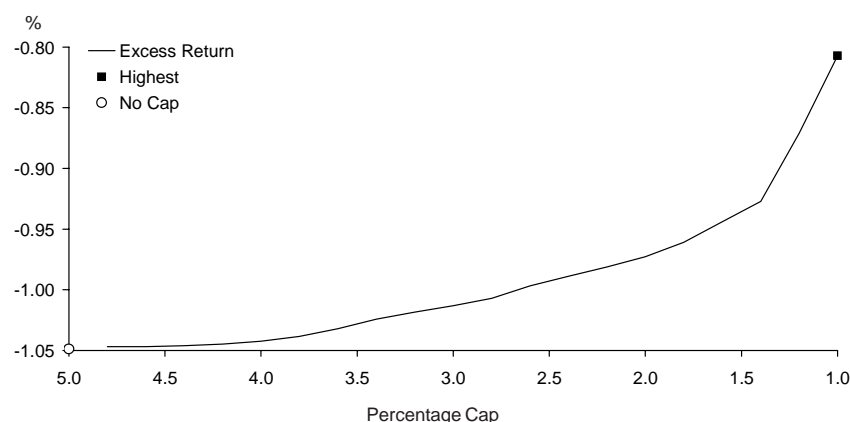
As stated earlier, the quality-sector neutral redistribution rule avoids introducing any unintended quality-sector biases as a result of the issuer-capping process. Figure 9 shows that using a quality-sector neutral redistribution rule significantly improves the average excess return of the issuer-capped index relative to the uncapped index. Specifically, the average excess return of the 1% issuer-capped index (quality-sector neutral) is approximately 24 bp better than the uncapped Corporate Index.

The benefits of issuer-capped indices using the quality-sector neutral redistribution rule are also apparent in terms of excess return volatility (Figure 10). At a 1% cap, the excess return volatility of the issuer-capped index is approximately 3.24%, compared with 3.42% for the Corporate Index.

We also examined the performance of another sector-quality neutral variant in which we impose lower caps on lower-quality issuers than on higher-quality issuers. Adjusting the issuer cap level according to the quality of the issuer is in keeping with the principle that lower-quality issuers are subject to greater idiosyncratic risk than higher-quality issuers and therefore require greater diversification.⁸ Specifically, we examined a sector-quality neutral capping of the Corporate Index that imposes a 2.5% cap on Aaa/Aa issuers, a 1%

⁸ For an analysis on how the idiosyncratic risk varies with quality, see *Sufficient Diversification in Credit Portfolios*, Lehman Brothers, May 2002.

Figure 9. **Average Annualized Excess Return of 1% Issuer-Capped Index**
Quality-Sector Neutral Redistribution
August 1999-December 2002



cap on single-A issuers, and a 0.5% cap on Baa issuers.⁹ Over the period August 1999 to December 2002, this index had an average annualized excess return 15 bp better than that of the unconstrained index and an annualized volatility of excess returns 22 bp lower than that of the unconstrained index.

Figure 11 provides a summary of the results.

⁹ Another difference between this index and the 1% sector-quality neutral index is related to the handling of issuers that have issues in more than one sector-quality bucket. The 1% index considers all the issuer's bonds, regardless of which buckets they are in, when deciding whether the issuer exceeds the cap or not. In contrast, this index effectively treats the issuer's bonds in two different buckets as belonging to two separate issuers and applies the appropriate caps separately to the issuer's bonds in one bucket and its bonds in the other bucket.

Figure 10. **Average Annualized Excess Return Volatility of the Issuer-Capped Corporate Index as a Function of the Issuer Cap Level**
Quality-Sector Neutral Redistribution of Excess Weight
August 1999-December 2002

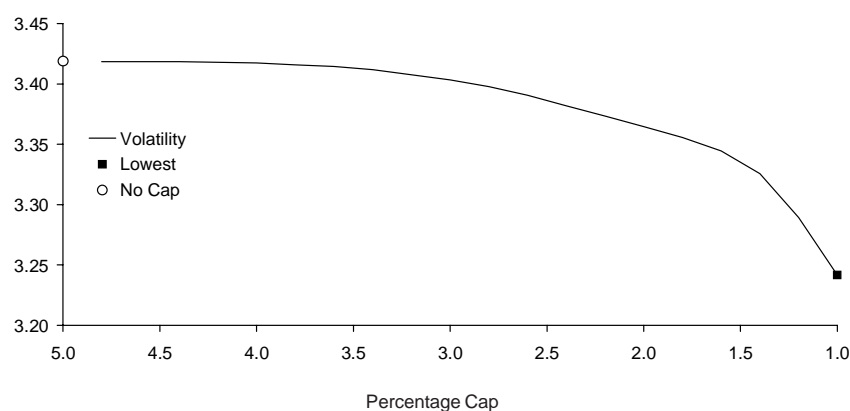


Figure 11. **Average Annualized Excess Returns and Volatility as a Function of the Issuer Cap Level and the Rule for Redistribution of Excess Weight**
August 1999-December 2002

	Avg. Excess Return	Excess Ret. Vol.	Diff. from Corporate Index	
			Avg. Excess Return	Excess Return Vol.
Corporate Index	-1.05%	3.42%	-	-
1% Issuer-Cap (Index-Wide)	-0.98%	3.37%	7 bp	-5 bp
1% Issuer-Cap (Sector-Quality Neutral)	-0.81%	3.24%	24 bp	-18 bp
2.5%/1%/0.5% Issuer-Caps Sector-Quality Neutral (Cap Varies with Quality)	-0.89%	3.20%	15 bp	-22 bp

To examine the potential benefits of issuer capping and different methods of redistribution further, we examined what would happen to the Corporate Index and its issuer-capped variants in the event of default by a major issuer. To simulate such an event, we examined these indices during the period from August 1999 until Enron's bankruptcy in November 2001 and "imagined" what the returns of these indices would have been during this time if the amounts outstanding of all of Enron's bonds had been ten times larger than they were. This would have given Enron up to a 3.76% market value weight in the Corporate Index in some months, making Enron one of the largest issuers, but still not the largest. The results, shown in Figure 12, indicate that imposing a 1% cap on the Corporate Index would have boosted annualized average excess return significantly at the expense of a slight increase in excess return volatility and that sector-quality neutral redistribution would have been somewhat better than index-wide redistribution in this regard.

Prevalence and Performance of "Fallen Angels"

Occasionally, investment-grade bonds are downgraded below investment grade. Issuers of these bonds are often referred to as "fallen angels." For purposes of this study, we define a "fallen angel" issue as a bond downgraded below investment grade and removed from the Corporate Index. We consider the fallen angel to be "outstanding" until it a) is called; b) goes into default; c) is upgraded to investment grade; or d) violates another criterion for inclusion in the Corporate Index (such as liquidity or time to maturity). Figure 13 shows the average number of fallen angel issues outstanding, per month, over trailing six-month intervals. For January 2003, the average number of fallen angels outstanding per month over the trailing six-month period was 30, for a total of 180 fallen angel issues over the six-month period.

Figure 12. **Performance of Corporate Index With and Without 1% Caps**
With Enron Amounts Outstanding Multiplied by 10
August 1999-November 2001

	Corp. Index	1% Cap (Index-Wide)	1% Cap (Sector- Quality Neutral)
Average Excess Return (annualized)	-1.39%	-1.12%	-0.99%
Excess Return volatility (annualized)	2.63%	2.71%	2.65%

Figure 13. **Average Number of Fallen Angel Issues Outstanding per Month**
Trailing Six-Month Periods, January 1990-December 2002

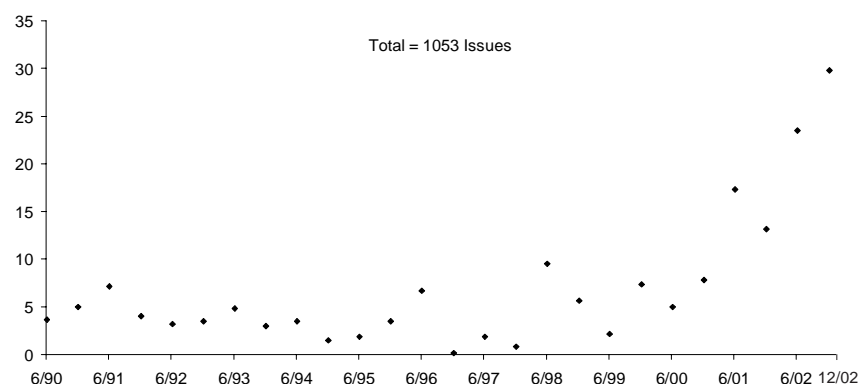


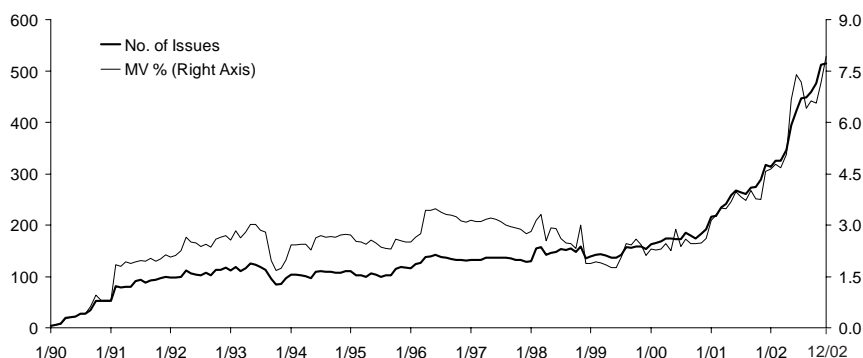
Figure 14 shows the cumulative total number and market value as a percentage of the Corporate Index of all outstanding fallen angel issues that dropped out of the Corporate Index since January 1990. As of January 2003, there were 515 such issues outstanding, representing 7.9% of the market value of the Corporate Index on that date.

While the Corporate Index simply removes fallen angels at the end of the downgrade month, a portfolio manager must find a willing buyer. This is particularly problematic for large fallen angels. Since the high-yield market is much smaller than the investment-grade credit market, when a large investment-grade issue is downgraded, investors must locate high-yield investors and entice them to buy a very large holding in a new credit. The Corporate Index prices fallen angel issues at the end of their downgrade month at levels that reflect where bonds can be sold at the margin. However, this price is unlikely to reflect where all outstanding bonds of the issuer could be sold. In fact, the prices for fallen angel issues often continue to fall after the downgrade month as the high-yield market is further encouraged to absorb the full supply of the fallen angel's debt.¹⁰

While some portfolio managers are required to sell fallen angels immediately at whatever price they can find, other investment-grade portfolio managers have discretion to hold the bonds (perhaps with increased monitoring requirements). As a practical matter, managers may have little choice but to hold on to fallen angels for at least several months until willing buyers can be located and the price stabilizes. Some investment-grade investors suspect that their inability to sell downgraded bonds immediately gives the Corporate Index an inherent performance advantage, a "survivorship bias," since the index can "sell" bonds immediately without suffering the painful task of finding buyers. These investors are considering a custom index that is "downgrade-tolerant," allowing fallen angel issues to remain in the index for a fixed period of time after downgrade.

¹⁰ Some high-yield managers have adopted customized high-yield indices that exclude "fallen angel" debt for some of the following reasons: high-yield managers' lack of familiarity with new fallen angel issues inhibits discovery of an equilibrium price; the issuers are so large that they dominate the high yield indices; and they have volatile prices, which adds to the volatility of the index.

Figure 14. Total Number and Market Value Percentage of Fallen Angel Issues Outstanding Since January 1990

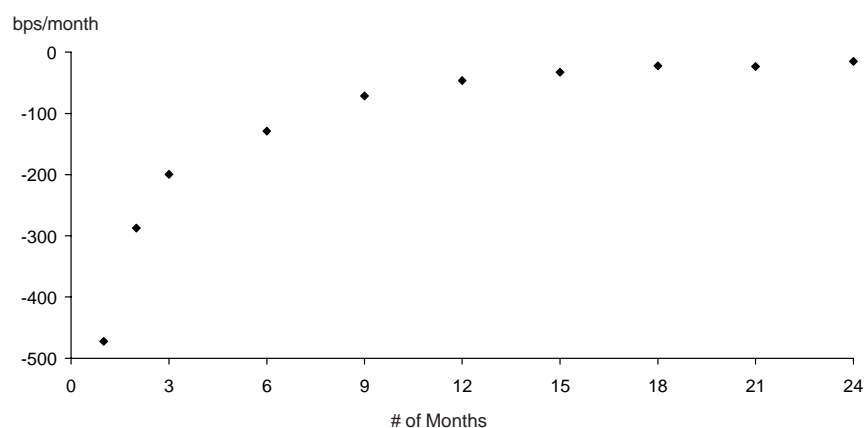


A downgrade-tolerant index might be a more replicable performance benchmark for investment managers. Of course, a key decision is how long a fallen angel issue should remain in the index.

To measure the performance of a downgrade-tolerant Corporate Index, we first construct a fallen angel index. A key parameter of the fallen angel index is the “tolerance period”—the time that a fallen angel is permitted to remain in the index. For example, a six-month fallen angel index includes only those fallen angel issues that were dropped from the Corporate Index less than six months earlier. So an issue dropped in January 2002 will be included in the six-month fallen angel index until the end of June 2002. The “unconstrained” fallen angel index allows fallen angels to remain in the index until they are no longer outstanding.

Figure 15 shows that an index of issues that were downgraded only within the last month had an average monthly excess return of -472 bp for the period from January 1990 through December 2002. By contrast, an index of issues that were downgraded within the last three months had a better average monthly excess return of -199 bp over the same period. This improvement in average monthly excess returns indicates that allowing downgraded bonds to remain in the index longer improves the performance of the fallen

Figure 15. **Performance of Fallen Angel Issues**
Excess Returns (bp) per Month as a Function of the Tolerance Period
January 1990-December 2002



Tolerance Period since Leaving Corporate Index (Months)	Mean (bp/Month)	Volatility (bp/Month)
1	-472	1073
2	-287	797
3	-199	664
6	-129	529
9	-71	431
12	-46	391
15	-33	380
24	-22	366
Unconstrained	-8	315

angels index.¹¹ However, this performance improves only up to a point. As shown in Figure 15, by the twelfth month, the fallen angels index has seen most of its improvement in average monthly excess returns.

Not unexpectedly, the index of fallen angel issues performed very differently than the Corporate Index over the period. Figure 16 presents the mean monthly excess return and standard deviation for both the unconstrained fallen angels index and the Corporate Index. For the period from January 1990 to December 2002, the unconstrained fallen angels index had an average monthly excess return of -8.5 bp, compared with +0.2 bp for the Corporate Index. The standard deviations of the monthly excess returns were 315.7 bp and 62.7 bp, respectively, for the fallen angels and Corporate Indices.

Figure 16 also subdivides the period, using July 1998 as the breakpoint, and presents the same statistics for both sub-periods. The performance of both the fallen angels and the Corporate Indices were much worse in the latter period. However, in either sub-period, the fallen angels index underperformed the Corporate Index.

Downgrade-Tolerant Corporate Index— Measuring the “Survivorship Bias”

Our goal is to use the fallen angel index to estimate what the performance of the Corporate Index would have been if downgraded bonds were allowed to remain in the Corporate Index for the tolerance period. To do so, we construct a market value combination of the fallen angels index for a given tolerance period and the Corporate Index and define this combination as the downgrade-tolerant Corporate Index. We then define the “survivorship bias” as the difference in excess returns between the Corporate Index and the downgrade-tolerant Corporate Index. If the performance of the Corporate Index is greater, then the fact that the Corporate Index discards fallen angel issues produces a

¹¹ In an earlier report, we highlighted that distressed investment-grade debt tend to improve in the second year after their initial distress month. See “Return Performance of Investment-Grade Bonds After Distress,” *Global Relative Value*, Lehman Brothers, July 2002.

Figure 16. **Excess Returns: Means and Standard Deviations** (bp/Month)
Unconstrained Fallen Angels Index and Corporate Index

Period	Unconstrained Fallen Angels Index	Corporate Index
January 1990-December 2002		
Mean	-8.5	0.2
Standard Deviation	315.7	62.7
January 1990-July 1998		
Mean	18.8	4.3
Standard Deviation	260.6	29.1
August 1998-December 2002		
Mean	-61.5	-8.0
Standard Deviation	399.5	99.8

“survivorship bias” in favor of the Corporate Index. We now examine the performance of a downgrade-tolerant Corporate Index for various “tolerance” periods.

First, we show in Figure 17 the performance of the downgrade-tolerant Corporate Index assuming an unconstrained tolerance period. The downgrade-tolerant index underperforms the Credit Index in the January 1990-December 2002 period by +0.38 bp per month—our measure of survivorship bias.

Figure 18 presents the monthly excess return difference between the Corporate Index and the unconstrained downgrade-tolerant index from January 1990 through December 2002. As illustrated, since the latter half of 1999, the bias has been quite volatile, exhibiting a peak in June 2002 with the downgrade of WorldCom. However, Figures 17 and 18 also show that while the survivorship bias is positive for the period as a whole, there are periods in which the survivorship bias is negative—at least in the case of the unconstrained downgrade-tolerant index.

Figure 17. **Average Excess Returns and Survivorship Bias** (bp/Month)
Corporate Index and Unconstrained Downgrade-Tolerant Index

Period	Unconstrained Downgrade- Tolerant Index	Corporate Index	Survivorship Bias
January 1990-December 2002 Mean	-0.23	0.15	0.38
January 1990-July 1998 Mean	5.28	4.34	-0.93
August 1998-December 2002 Mean	-10.93	-8.00	2.93

Figure 18. **Monthly Excess Return Difference** (bp)
Corporate Index and Unconstrained Downgrade-Tolerant Index
January 1990-December 2002

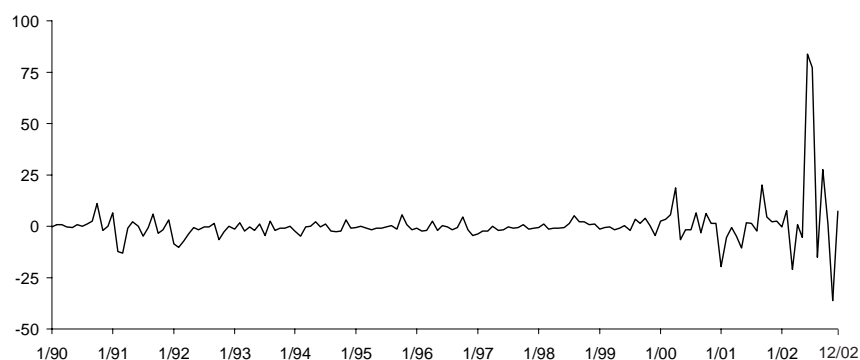


Figure 19 shows the magnitude of the survivorship bias as a function of the tolerance period. We examine the one-, two-, and three-month tolerance periods, as well as all three-month increments out to two years.

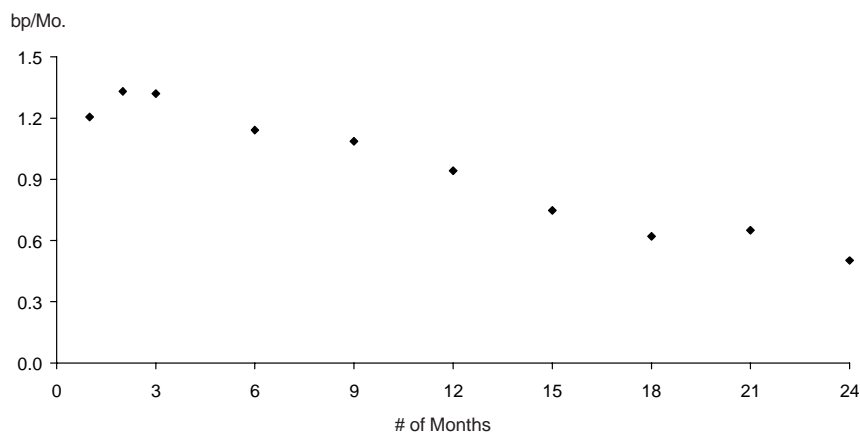
Figure 19 illustrates that the survivorship bias is a significant issue. If portfolio managers were unable to sell downgraded bonds for a month after they left the Corporate Index, then they underperformed their benchmark by 1.2 bp per month over the past thirteen years. Figure 19 also shows that the survivorship bias is generally a decreasing function of the tolerance period.¹² If fallen angels are permitted to remain in the Corporate Index for a longer period of time, then the general partial recovery of fallen angels helps to reduce the survivorship bias. For example, if downgraded bonds are allowed to remain in the Corporate Index for twelve months, then the survivorship bias is only 0.94 bp. The important lesson from these results is that if plan sponsors are going to allow their managers to hold on to fallen angels, they should give their managers at least twelve months to work out of their positions.

Conclusion

The Lehman Corporate Index is composed of issues that meet certain rules. The two most important of these rules are the liquidity constraint and the quality requirement. However, the past few years in the credit markets have been stressful, and recent credit events have caused investors to reevaluate the Corporate Index rules. To address these market stresses, we have advanced our index technology to an extent that allows investors

¹² One might expect Figure 19 to be the “mirror image” of Figure 15 and therefore to decrease monotonically. This is not the case. As we lengthen the tolerance period, the market value of the fallen angels index increases (*i.e.*, there are more fallen angel issues in the index), which increases its relative weight in the downgrade-tolerant Corporate Index. Consequently, the improvement in the average excess return of the fallen angels index with the lengthening tolerance period can be offset by the increased weight the index has in the downgrade-tolerant index.

Figure 19. **Survivorship Bias as a Function of the Fallen Angels Tolerance Period**
January 1990-December 2002



to request a wide array of made-to-order indices that follow a customized set of rules. In particular, investors have sought to impose a cap on the maximum weight that any one issuer may have in the Corporate Index and to make the quality constraint more flexible to allow for temporary retention of downgraded issues. In this article, we have examined the risk and return behavior of indices with issuer caps, as well as those that are tolerant of downgraded issues.

We saw that imposing a 1% cap on the market value weight that an issuer may have in the Corporate Index would have improved the index's average excess return and excess return volatility over the past few years. It would also improve average excess returns, at the expense of a slight increase in excess return volatility, in the event of a default by a major issuer. The magnitude of these improvements, however, depends on the rules used for redistributing index weight from large issuers to small ones. The "index-wide" redistribution rule tends to lessen the benefits of capping by introducing unfavorable sector-quality exposures relative to the uncapped index. The "sector-quality neutral" redistribution rule, which preserves the sector and quality weights of the index, achieves much better results.

We also examined relaxing the quality requirement by first constructing a fallen angels index. Our results indicate that as the tolerance period for the fallen angels index is extended, the average monthly return performance improves up to the twelfth month, with less dramatic improvement afterward. Furthermore, by combining the fallen angels indices (with various tolerance periods) with the Corporate Index, we are able to create the corresponding downgrade-tolerant Corporate Indices. We then measure the survivorship bias that may be inherent in the Corporate Index versus quality-tolerant corporate indices. The results indicate that the survivorship bias is particularly acute when the tolerance period is less than three months. After this point, the bias diminishes, demonstrating the recovery of fallen angels over this lengthening tolerance period. Our evidence suggests that plan sponsors should consider a time horizon of at least twelve months to allow managers to unwind their positions of fallen angel debt.