Sufficient Diversification in Credit Portfolios: Balancing Two Approaches

This version updates the original, published January 24, 2011, to account properly for a 2003 change in the handling of index bonds with split ratings. The overall results and conclusions of the study are not affected.

- We extend our earlier study of the effect of rating downgrades on bond returns relative to their peer groups. Market experience during the 2007-08 credit crisis argues for stricter controls on position sizes in higher-rated securities.
- In addition to our previous event-driven methodology, we offer an alternative approach to setting issuer limits, based on Duration Times Spread (DTS) - an improved measure of excess return risk in credit portfolios.
- Applying the DTS concept to the task of setting credit quality-dependent issuer limits, we find that the conclusions agree quite well with those of our downgrade-focused study. Changes in the spread curve over time are consistent with the observed changes in the performance effect of downgrades.
- We discuss the pros and cons of the two approaches, paying attention to implementation issues, and recommend combining the two approaches to the extent possible.

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Introduction

In the management of all but the most passive credit portfolios, the sizing of credit exposures requires finding the right balance between two opposing needs. To control risk, it is important not to take concentrated positions in a single issuer. Conversely, to generate alpha based on analyst recommendations, the recommended names must have sufficient weight in the portfolio to affect outperformance; an over-emphasis on diversification dilutes the value of issuer selection skills. As a result, investors often seek guidance on the "correct" level of diversification for a given portfolio.

In our past research, we carried out two distinct studies that offered such guidance based on two different approaches and methodologies. In our 2002 paper, *Sufficient Diversification in Credit Portfolios,*[1] we addressed this question head-on, relying on a model of portfolio downgrade risk and an empirical study of the performance cost of downgrades. The main conclusion was that the historically observed performance cost of a downgrade was typically much greater for Baa securities than for those rated single A or above and that the level of downgrade risk depended strongly on credit rating. Therefore, while precise issuer limits depend on each investor's appetite for risk, we recommended that they should differ by credit quality, according to the ratios of downgrade risk among the different quality groups.

In 2005, we published a paper on the measurement of credit spread risk, in which we espoused the use of Duration Times Spread (DTS) as the key measure of credit exposure.[2] The main principle is that higher-spread credits have higher spread volatility and excess return volatility. This relationship was found to be very close to linear. These conclusions were supported by theory and extensive empirical evidence. Portfolio diversification was not the main focus; nevertheless, its findings directly apply to this question as well. The portfolio's contribution-to-DTS exposure to a particular issuer was found to be proportional to the excess return volatility produced by that exposure. Furthermore, the spread-based approach to estimating risk (in which the spread volatility projected for a given period is linearly proportional to the spread level at the start of the period) often gives a much more timely response to credit events than does a ratings-based approach. Our work with DTS suggests a completely different approach to controlling portfolio concentrations: rather than imposing a limit on the portfolio market weight in a given issuer (possibly making that limit dependent on the issuer's rating), set a limit on the DTS contribution of any issuer, regardless of credit quality. While this idea is attractive in principle, its implementation creates several practical problems, as we shall discuss later.

Throughout 2010, investors asked us to update our research on sufficient diversification. In this paper, we address this in two different ways. First, we extend our original study based on downgrade event risk to include the 2007-08 credit crisis and see how the conclusions change. Second, we ask what our research on DTS might add to the downgrade-centric analysis of issuer diversification. How do these two approaches relate to each other? What are the strengths and weaknesses of each? Can they be integrated into a single consistent scheme?

[1] Dynkin, L., J. Hyman, and V. Konstantinovsky, *Sufficient Diversification in Credit Portfolios*, reprinted by Barclays Capital, December 14, 2010.
[2] Ben Dor, A., L. Dynkin, P. Houweling, J. Hyman, E. van Leeuwen, and O. Penninga, *A New Measure of Spread Exposure in Credit Portfolios*, reprinted by Barclays Capital, February 3, 2010.

Downgrade Risk before and after the Credit Crisis

Our original approach to optimal diversification placed the emphasis on downgrade risk. There was a strong motivation for this approach. What we wanted to prevent was a single issuer-specific event causing a large loss in the portfolio. So we needed to model both the frequency and intensity of such events. Ultimately, the key issuer-specific risk in credit portfolios is default and, theoretically, one could approach diversification using models of default risk. In practice, however, this is not the most effective route for investment grade portfolios, for several reasons. First, most distressed issuers do not go directly to default from an investment-grade rating; it is much more typical for an issuer to be downgraded below investment grade, after which it may eventually default or recover. Immediate defaults are rare events, and their probability is very hard to estimate. Downgrades are a more likely cause of significant losses in such portfolios - and more easily modeled.

We therefore chose to use ratings downgrades as proxies for issuer events in the corporate market. This does not imply that rating agency actions themselves are the primary source of risk; rather, we expect a significant change in an issuer's credit-worthiness eventually to be reflected in its rating. In many cases, the market reacts to this change before the rating shift is announced. One aspect of our research is an empirical study of the performance of downgraded bonds, in which we measure both the magnitude and the time course of their underperformance relative to their peer groups. The results of this study, combined with rating agency data on the historical frequency of ratings transitions, allow us to model the risk of portfolio losses from downgrades.

Not surprisingly, the results change significantly with the inclusion of the credit crisis of 2007-08. To demonstrate this, we limit the data sample to the time shortly before the onset of the crisis, then we compare the results to those based on the data extending through the end of 2010.

Figure 1 shows the performance of downgraded bonds relative to their peer groups from August 1988 through December 2007. We find that most of the effect from a downgrade is absorbed in the final few months before the event, with the largest underperformance in the month of the downgrade and the two months preceding it. As we look further back, we find a noticeable underperformance three to five months before a downgrade. The effect can be felt as far back as eight months before a downgrade. Nine or more months before a downgrade, bonds do not significantly underperform their peer groups.

For example, securities downgraded from Baa experienced an average peer group underperformance of -14.28% during the year leading up to the downgrade. This amount accumulates unevenly through the year. The average quarterly underperformance was -9.35% in the quarter immediately preceding a downgrade, but only -2.99% and -1.69%, respectively, in the previous two quarters. The t-statistic shows all of these numbers to be highly significant; the much smaller average underperformance of -0.25% in the quarter furthest away from the downgrade is barely significant.

Severe return consequences are usually limited to downgrades from lower-rated credits. The most drastic underperformance is found when bonds are downgraded from Baa to below investment grade. The crossing of the investment grade boundary can create major price dislocations because many portfolios (forced, for example, by the investment policy) must sell into a falling market.[3] For bonds downgraded from single A, the resulting

[3] Two recent articles from our group focus on the performance of bonds downgraded from investment grade to high yield, both before and after the downgrade. In *Capturing Credit Spread Premium: Alternative Benchmarks for Credit*

underperformance in the two to three quarters preceding the event is less than one fourth of the losses in the Baa sector. The time distribution of these losses roughly mirrors the Baa pattern. For securities rated Aaa and Aa, we did not detect any statistically significant underperformance due to downgrades.

In all cases, the standard deviation of underperformance exceeds the mean underperformance. This means that a downgraded bond may do much worse than the average. In fact, several bonds downgraded from Baa lost more than half of their value during the year preceding the downgrade.

Figure 1: Average Underperformance due to Downgrades, August 1988-December 2007

			Monthly		Quarterly and annual		
Months Prior to Downgrade	Initial Quality	Observations	Mean	Std Dev	Mean	Std Dev	t-Stat
0 - 2	Aaa-Aa	791	-0.06	1.37	-0.18	2.29	-2.2
	A	1,328	-0.80	3.76	-2.39	6.83	-12.7
	Baa	1,058	-3.12	10.41	-9.35	20.90	-14.6
3 – 5	Aaa-Aa	791	-0.04	1.13	-0.13	1.47	-2.5
	A	1,328	-0.27	1.71	-0.81	2.67	-11.1
	Baa	1,058	-1.00	5.20	-2.99	7.50	-13.0
6 – 8	Aaa-Aa	791	-0.06	0.91	-0.18	1.50	-3.4
	A	1,328	-0.10	1.35	-0.29	2.21	-4.7
	Baa	1,058	-0.56	2.80	-1.69	5.04	-10.9
9 – 11	Aaa-Aa	791	0.00	0.87	0.01	1.28	0.1
	A	1,328	0.03	1.20	0.09	1.93	1.8
	Baa	1,058	-0.08	1.94	-0.25	3.52	-2.3
Full year	Aaa-Aa	791			-0.49	2.79	-4.9
	A	1,328			-3.39	7.81	-15.8
	Baa	1,058			-14.28	22.29	-20.8

Source: Barclays Capital

The historical losses realized by downgraded bonds can be combined with the probabilities of downgrades to build a simple model of downgrade risk for a single bond or a portfolio. The details may be found in our earlier study[4]; the results, using the full-year data from the bottom section of Figure 1, are summarized in Figure 2. These numbers can be interpreted as follows. For any Baa rated bond, the expected loss due to downgrades over a one-year horizon is 82bp, but with a very large standard deviation of 636 bp. The risk of downgrade loss is much smaller for A rated bonds and nearly non-existent for Aa rated debt. We use this model to define an optimal portfolio structuring problem in which we seek to track the Barclays Capital US Corporate Index using a given number of bonds, such that the volatility of portfolio downgrade loss is minimized. The portfolio is assumed to match the index exposures to all systematic risk factors, including yield curve, sector, and quality. We further assume that the portfolio matches the market weights of the benchmark in each quality group, and that both the portfolio and the benchmark allocate equal weight to each bond within a given credit quality. The goal of the optimization was to determine how many bonds

Investors, June 2010, we trace the effect on credit index excess returns of rules that require selling bonds immediately after downgrades to high yield. Indices and other forced sellers incur significant losses on such bonds but never enjoy the benefits of a subsequent recovery. In *Fallen Angels: Characteristics, Performance and Implications for Investors*, December 2010, we study the price dynamics of fallen angels over a three-year period around the downgrade date.

[4] *Sufficient Diversification in Credit Portfolios*, reprinted December 14, 2010.

(out of the given total) the portfolio should have in each credit quality to minimize the risk from downgrades. We showed that the optimal solution requires greater diversification in the higher-risk quality groups; in particular, the optimal position sizes in different quality groups should be inversely proportional to the volatility of the downgrade risk. Thus, because the standard deviation of downgrade loss for a single Baa bond is 8.9x that of an Aaa-Aa bond, the portfolio position limits for Aaa-Aa bonds should be 8.9x as large as those for Baa bonds. All of the numbers in Figures 1 and 2, based on data through the end of 2007, are quite consistent with those we published in 2002. The approximate ratios shown here for the optimal position sizes in Aaa-Aa, A, and Baa issuers are 9 : 3 : 1 respectively.

Figure 2: Downgrade-Based Model for Diversification, August 1988 – December 2007

Initial Rating	Downgrade probability	Statistical losses from downgrades		Expected loss on a single bond		Inverse vol
		Mean	St Dev	Mean	St Dev	
Aaa - Aa	6.35	-0.49	2.79	-0.03	0.71	8.9
A	5.79	-3.39	7.81	-0.20	2.05	3.1
Baa	5.78	-14.28	22.29	-0.82	6.36	1

Source: Barclays Capital

In Figure 3, we extend the analysis shown in Figure 1 through the end of December 2010. Our conclusions regarding the time course of downgrade losses do not change. The majority are incurred in the quarter preceding the downgrade; significant additional losses are observed two quarters preceding the downgrade, and for Baa issuers, up to nine months ahead. But in the magnitudes of losses shown for different qualities in Figures 1 and 3, we find some striking differences. The mean and standard deviation of downgrade loss for Baa rated issuers do not change much with the addition of the data from the credit crisis; however, those for the two higher-rated categories show substantial increases in both columns. The average annual underperformance of issuers downgraded from single A increased from 3.39% to 5.55%; for Aaa-Aa issuers, the increase was from 0.49% to 2.10%.

In Figure 4, we show the implications of the increase in realized downgrade losses for portfolio structuring. The ratio of downgrade loss volatilities between issuers with different ratings has become markedly smaller; so has the recommended ratio of position sizes. Whereas the main conclusion of the prior historical study was that diversification constraints should be applied very unevenly to differently rated issuers, recent events emphasize that even higher-rated issuers can suffer large losses. The optimal position size ratios have, therefore, become much less skewed.

Figure 3: Average Underperformance due to Downgrades, August 1988 – December 2010

			Monthly		Quarterly and annual		
Months Prior to Downgrade	Initial Quality	Observations	Mean	Std Dev	Mean	Std Dev	t-Stat
0 - 2	Aaa-Aa	1,036	-0.37	3.40	-1.12	6.36	-5.7
	A	1,635	-1.30	7.86	-3.89	13.46	-11.7
	Baa	1,217	-2.82	10.66	-8.46	20.95	-14.1
3 – 5	Aaa-Aa	1,036	-0.19	1.80	-0.57	2.76	-6.6
	A	1,635	-0.48	3.30	-1.44	5.77	-10.1
	Baa	1,217	-1.07	5.58	-3.20	8.36	-13.4
6 – 8	Aaa-Aa	1,036	-0.08	1.08	-0.24	1.79	-4.3
	A	1,635	0.01	2.72	0.02	4.58	0.2
	Baa	1,217	-0.59	3.42	-1.76	5.56	-11.1
9 – 11	Aaa-Aa	1,036	-0.06	0.97	-0.17	1.55	-3.6
	A	1,635	-0.08	2.25	-0.24	3.56	-2.7
	Baa	1,217	-0.13	2.60	-0.40	4.66	-3.0
Full year	Aaa-Aa	1,036			-2.10	7.83	-8.6
	A	1,635			-5.55	15.01	-14.9
	Baa	1,217			-13.83	21.79	-22.1

Source: Barclays Capital

Figure 4: Downgrade-Based Model for Diversification, August 1988 – December 2010

Initial Rating	Downgrade probability	Statistical losses from downgrades		Expected loss on a single bond		Inverse vol
		Mean	St Dev	Mean	St Dev	
Aaa - Aa	8.24	-2.10	7.83	-0.17	2.33	2.6
A	6.12	-5.55	15.01	-0.34	3.96	1.6
Baa	5.66	-13.83	21.79	-0.78	6.14	1

Source: Barclays Capital

It is not particularly surprising that an empirical study of the credit markets which includes 2008 assigns greater risk to single A rated securities. After all, the headline event of this crisis was the default of Lehman Brothers, which still carried a single A rating when it was declared insolvent. Could it be that this single event is sufficient to explain the differences between the results in Figures 2 and 4? To address this question, we excluded the Lehman Brothers event from the dataset. While there was a noticeable change in the results for A rated debt, the overall conclusion is the same; the position size ratios in went from 2.6 : 1.6 : 1 to 2.9 : 1.9 : 1. Even after excluding the performance effect of the Lehman Brothers default, the optimal ratings remain far less skewed than followed from data through the end of 2007.

Performance of downgraded issuers varies over time, reflecting different credit market environments. In the yearly numbers from 1989 through 2010, shown in Figure 5, one can recognize the major disturbances and crises of the past two decades. For example, the crisis of 2000-02 began with unusually large underperformance due to downgrades of Baa bonds in 2000 and grew to affect a large number of single A and Baa bonds in 2001-02. By contrast, in the credit crisis of 2007-08, the leading role was played by Aa and single A-rated bonds (mostly financials, as we know).The magnitude of the underperformance in these qualities was unprecedented both in absolute terms and relative to Baa.

Figure 5: Average Underperformance due to Downgrades, Yearly Results, 1989-2010

	Observations			Mean			Std Dev		
	Aaa-Aa	A	Baa	Aaa-Aa	A	Baa	Aaa-Aa	A	Baa
1989	15	30	18	-0.34	-0.20	-0.35	1.42	1.22	1.97
1990	100	85	24	0.02	-0.26	-1.62	0.69	1.56	6.52
1991	134	86	52	-0.05	-0.09	-0.85	0.70	1.38	3.74
1992	85	129	29	0.02	-0.09	-0.30	1.13	1.08	2.35
1993	33	14	35	0.06	0.02	-0.28	1.00	0.72	1.57
1994	8	38	15	-0.08	-0.08	-0.37	0.41	0.96	1.84
1995	51	59	25	0.05	-0.08	-0.45	0.67	1.23	2.52
1996	32	56	35	0.01	-0.05	-0.50	0.51	0.76	4.01
1997	5	77	9	-0.05	-0.16	-0.12	0.43	0.64	0.76
1998	44	59	46	-0.10	-0.27	-0.53	0.86	1.19	2.83
1999	37	58	45	0.00	-0.12	-0.96	1.00	1.23	3.40
2000	46	89	49	-0.05	-0.46	-3.13	0.56	1.80	8.70
2001	30	135	111	-0.26	-0.44	-1.92	1.98	2.78	10.20
2002	68	178	222	-0.14	-0.63	-2.08	2.04	4.50	8.74
2003	59	78	72	-0.03	-0.40	-0.80	1.42	3.03	5.07
2004	8	39	59	0.07	-0.08	-0.13	0.71	1.19	2.28
2005	8	31	99	-0.03	-0.21	-0.95	0.30	1.08	2.86
2006	4	18	45	-0.01	-0.09	-0.37	0.21	0.72	2.65
2007	24	69	68	-0.11	-0.40	-0.66	0.51	1.46	2.48
2008	192	158	61	-0.66	-1.95	-1.47	3.81	9.93	5.10
2009	46	134	71	-0.32	-0.66	-0.79	3.34	9.53	10.57
2010	7	15	27	-1.21	1.11	0.13	3.81	3.61	6.12

Source: Barclays Capital

Of course, the possibility of downgrades is not the only source of non-systematic risk. Even securities that do not experience rating changes exhibit "natural" spread volatility. This source of return variance may also motivate portfolio diversification. In our original study of portfolio diversification, we investigated how the results would change if this type of risk were considered as well. From the same dataset used to quantify downgrade risk, we isolated a set of bonds whose ratings remained unchanged for at least the next six months. Every month, we measured the cross-sectional standard deviation of spread changes across all the bonds within each peer group and averaged this quantity over time. The resulting spread volatilities were found to be higher for lower-rated credits, as was the case for downgrade risk, but in a much less drastic manner. After adjusting these spread volatilities to put them in the same units as our measure of downgrade risk (excess return, in percent per year), we combined the two sources of risk by adding the variances.

Figure 6 shows the results of this analysis, for the period up to December 2007 and including all data through December 2010.[5] For the data not including the 2007-08 crisis, the overall non-systematic risk volatilities, including both downgrades and natural spread volatility, are much less differentiated by quality than those from downgrade risk alone. A comparison shows that while downgrade risk dominates in Baa, natural spread volatility may dominate in the higher qualities. When based on the pre-crisis data, the recommended position size ratios are 9.2 : 3.1 : 1 if we base them on downgrade risk alone and 4.0 : 2.5 : 1 if we include all the sources of non-systematic risk.

[5] Historical spread data were available only from April 1990. This explains the different starting point and the small differences in the downgrade risk between this figure and Figures 2 and 4.

When the analysis is extended through December 2010, this distinction is no longer significant. The increase of the estimated downgrade risk for Aaa-Aa and A rated issuers, as noted before, has already greatly reduced the differentials in risk estimates for different credit ratings. The optimal position size ratios from the full-set downgrade-based analysis are less skewed than those using the pre-crisis set, even with the natural spread volatility included. Including spread now makes only a very minor difference, bringing the ratios from 2:6 : 1.5 : 1.0 to 2.4 : 1.6 : 1.0.

Figure 6: Downgrade Risk versus Other Non-systematic Risk

	Downgrade Risk	Other Non-systematic Risk	Total Non-systematic Risk
April 1990 - December 2007			
Aaa-Aa	0.70	1.60	1.75
A	2.08	1.90	2.81
Baa	6.42	2.94	7.06
Position Size Ratio	9.2 : 3.1 : 1.0	1.8 : 1.5 : 1.0	4.0 : 2.5 : 1.0
April 1990 - December 2010			
Aaa-Aa	2.37	1.76	2.95
A	4.02	2.42	4.69
Baa	6.19	3.63	7.17
Position Size Ratio	2.6 : 1.5 : 1.0	2.1 : 1.5 : 1.0	2.4 : 1.5 : 1.0

Source: Barclays Capital

The changes in the results of our model in the aftermath of the credit crisis reflect tensions that have been widely discussed in the industry. The credibility of the ratings agencies has been called into question, as investors in highly rated instruments suffered large losses, particularly in structured products. The industry's dependence on credit ratings has been criticized by many, and regulators have sought ways to diminish it. However, finding a suitable alternative is difficult. Investment mandates need concise, transparent and reasonably stable mechanisms for specifying what instruments may be included in a portfolio; credit ratings were developed to fill this role and, despite their shortcomings, remain the primary reference for investment policy.

In the following section, we investigate the use of a model that focuses on spread as the key indicator of risk in credit markets. The model can be applied to the task of setting issuer limits in a framework that may or may not consider credit ratings.

Using DTS to Set Position Size Ratios

Extensive research on DTS[6] has indicated that spread volatility depends on spread level in a near-linear fashion and that excess return volatility therefore has a similar dependence on DTS. This holds true for systematic risk exposures to industry groups and for non-systematic exposures to individual issuers. We have therefore suggested that a prudent way to limit the risk exposure to issuers could be to impose a cap on the total DTS contribution of an issuer (duration times spread times market weight), rather than a cap on market weight. This would allow a portfolio to have large concentrations in low-spread issuers while enforcing stricter constraints on high-spread issuers.

[6] Ben Dor, A., L. Dynkin, P. Houweling, J. Hyman, E. van Leeuwen, and O. Penninga, *A New Measure of Spread Exposure in Credit Portfolios*, reprinted by Barclays Capital, February 3, 2010.

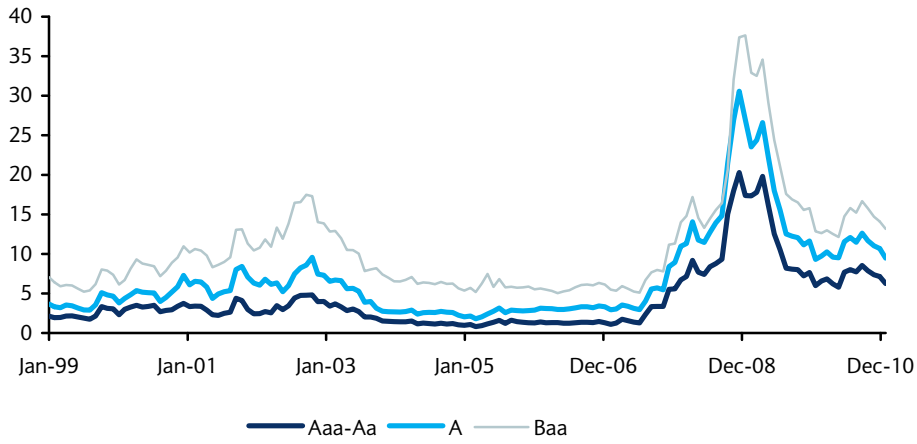
This DTS-based approach is in some ways quite similar to our original approach, in which issuer caps are specified in terms of market weights that depend on credit quality; yet there are some crucial differences. In both schemes, the fundamental principle is to allow greater concentrations to issuers perceived to be less risky and require more diversification where risk is greater. The fundamental difference between the two methods is the choice of the risk indicator: the quality assigned by the ratings agencies or the spread assigned by the market. This gives advantages to each. Ratings are more stable and more transparent; spreads react to market events much more quickly. As the credit quality of a particular issuer deteriorates, a spread-based indicator will register the increase in risk much faster than a ratings-based indicator. Nevertheless, while this may give a clear advantage when measuring risk, managers should not be forced to transact on price gyrations; the cost of such a policy could be prohibitive. A rigid cap on DTS exposure would make the limits dependent on pricing and could lead to inefficient forced selling.

How can we incorporate the insights of our DTS research into a practical approach to setting issuer limits? One modest step in this direction would be to maintain the structure of the original scheme, but use DTS periodically to recalibrate the limits in response to market conditions. That is, issuer caps can be specified as limits on market weight that can differ by quality – but the ratios of position limits for different ratings groups can be periodically updated to market conditions rather than rely on a long-term historical study of the performance effect of downgrades.

The key conclusion of our work on sufficient diversification is that the desired ratio of portfolio position sizes in two qualities is given by the inverse of the ratio of their volatilities, where volatility is defined as the projected volatility of monthly return relative to the peer group for a bond of a given initial credit quality. In the previous section, we calculated this ratio based on our empirical model of downgrade risk; however, the relationship could be based on other estimates of risk, as well.

We can therefore maintain the grouping by credit quality and use a simple DTS-based approach to measure the relative risks in different credit ratings. The ratio of the projected non-systematic volatilities of two asset classes can be approximated by the ratio of their DTS. In Figure 7, we show the average DTS level of different quality subsets of the US Corporate Index and how they have evolved. We see how spreads were widening in 2000-02, tightening steadily over the next several years, and exploding in 2008.

Figure 7: Average DTS of Corporate Index by Quality, January 1999-December 2010

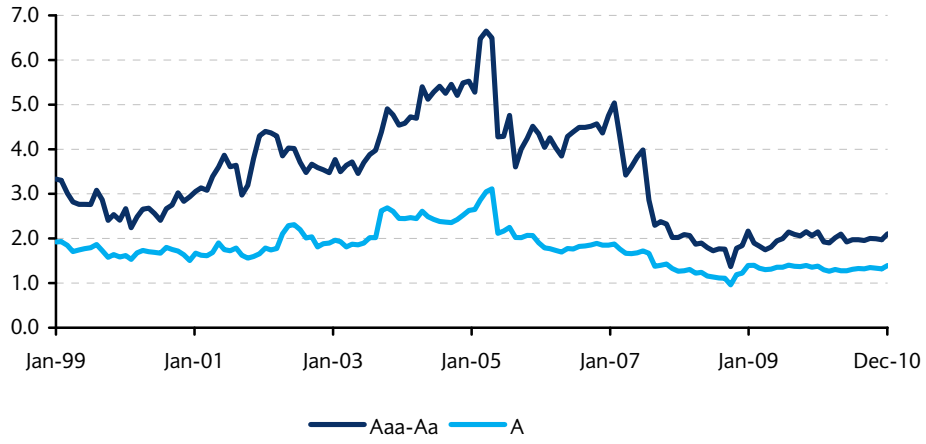


Source: Barclays Capital

We have used these numbers to calculate the optimal position size ratios by inverting the ratio of DTS levels. Figure 8 shows the resulting position limits for bonds rated Aaa-Aa and A, respectively, as multiples of the Baa position limit. For example, as of December 2001, the ratio of the largest allowed positions in the three quality groups was 4.3:1.7:1.0, approximately in line with what we published around that time (that is, a position in a Aa bond 4.3x as large as one in a Baa bond will carry the same amount of non-systematic risk). As market volatility (and spreads) ground lower in the following years, these ratios increased, peaking in March 2005 at 6.6 : 3.0 : 1. However, when spreads skyrocketed in 2008, the ratio was not preserved, and no credit quality was deemed free of risk. Even as all spreads rose, the ratio of position sizes got smaller, down to 1.4 : 1.0 : 1.0 as of September 2008. The most recent measurement, as of December 2010, indicates a ratio of 2.1 : 1.4 : 1.

Comparing these results to those in Figure 6, we find quite a good agreement between the two models. Given that DTS has been shown to be a good predictor of excess return volatility, not just downgrade risk, we focus on the total non-systematic return volatility from the rightmost column of Figure 6. Figure 8 shows that the DTS approach would have justified position size ratios of about 4:2:1 from 2005 through early 2007, based on the tight spreads prevalent at the time. This is in line with Figure 6, based on historical experience through the end of 2007. However, by the end of 2007, the DTS model would have already signaled a shift to a less skewed ratio closer to 2:1.5:1, which agrees fairly well with the updated results Figure 6 reflecting performance through the end of 2010. This very clearly highlights the difference between the two approaches. Typically for analyses based on long-term historical averages, downgrades-based assumptions necessarily lag market events. A portfolio manager who in summer 2007 was deciding on allocation limits across qualities would have been better served by relying on DTS-implied ratios.

Figure 8: Ratios of Position Limits of Aaa-Aa and A Issuers Relative to the Limits for Baa Issuers, as per DTS Model, January 1999-December 2010



Source: Barclays Capital

Lastly, we would like to warn against misinterpreting the position size ratios discussed here. In all cases, the Baa limit is shown as 1. This does not imply that the position limit for Baa bonds in market weight terms remained constant throughout this period. It highlights our focus on the *ratio* of the limits in different quality groups, rather than absolute constraints. A ratio of 4 : 2 : 1, for example, means only one thing: if the manager decides to limit the allocation to a single Baa issuer to 0.5% of the portfolio, the maximum allocations to Aaa-Aa and A single issuers should be 1% and 2%, respectively. The precise sizing of these limits needs to reflect the plan sponsor's risk appetite, and may be adjusted from time to time to reflect the market environment.

Comparing and Combining the Two Approaches to Issuer Limits

In this article, we have presented two very different approaches to setting issuer limits. In the first approach, issuer limits are expressed in terms of market weights and vary by credit quality. This corresponds to the way many plan sponsors specify investment policy constraints to their portfolio managers. The second approach is based on our prior research suggesting that to maintain a desired limit on the risk exposure to any given issuer, one should ensure that all issuer DTS contributions remain below some threshold. However, as this approach leads to some practical difficulties in implementation, the main thrust of our treatment was to see how DTS might be used periodically to recalibrate the issuer limits in the market-weight scheme. In this section, we discuss these issues in more detail.

The sufficient diversification approach to setting limits on issuer market weights has some clear advantages and is very well suited for specifying an investment policy. A permitted position is easy to identify and is not subject to debate. Furthermore, because ratings change rather slowly, the guidelines are stable and do not force a manager to churn the portfolio as markets move.

This is not true for a strict implementation of a policy that limits DTS contributions. Suppose the maximum allowed DTS contribution from any issuer is 3.0 and the manager establishes a 0.5% position in issuer XYZ with a spread of 100bp and a duration of 5 years, for a DTS contribution of 100 x 5 x 0.5% = 2.5. If the spread widens to above 120bp, the manager would be required to sell off some of the position to stay within the limits. This simple

example highlights difficulties with this arrangement. First, pricing uncertainty can make it unclear whether a given position is within the guidelines. Second, the need to adjust positions as spreads change imposes an undue hardship on managers and increases transaction costs for investors.

Another difficulty with a policy based exclusively on DTS contributions is that it can potentially allow very large exposures to short-maturity bonds. While the risk of such a position may not be large in terms of spread volatility or excess return volatility, it is clearly undesirable from a tail-risk point of view. A prudent approach to tail risk is to limit the overall portfolio exposure to any single name.

Nevertheless, it is hard to ignore the evidence that credit ratings do not always present the full, or even true, picture. The broad-brush treatment that allows the same position size for all A rated issuers, even with large differences in spreads across this peer group, clearly leaves room for improvement. There is no question that incorporating information on issuer DTS contributions improves our ability to estimate issuer risk; the difficulty is how to set up rules or guidelines that incorporate this information without causing unreasonably high turnover. With some ingenuity, it might be possible to reap the benefits of DTS-based risk controls without imposing too much of an operational burden. For example, one could establish a two-tiered constraint with different thresholds for new and existing positions. For instance, in the above example, if the DTS contribution limit were 3.0 for new purchases and 4.0 for existing positions, the XYZ position would remain within the guidelines unless the spread widened from 100 to beyond 160. Presumably, the requirement to reevaluate the exposure to an issuer after a spread move of this magnitude would not be perceived as overly intrusive.

A more difficult challenge for a system of limits on issuer DTS contributions would be a general rise in corporate spreads, as in 2008. In a crisis environment, virtually every issuer in the credit portfolio might exceed the previously established caps on issuer exposures. Should managers be forced to rebalance their portfolios massively into a market with no liquidity?

Forced selling is never a good thing. In recent studies[7], we have called attention to the performance effect on corporate bond indices from the forced selling of bonds downgraded to below investment grade. We have concluded that investors would be better served by holding onto fallen angels well beyond the downgrade month, because on average they tend eventually to recoup the unjustifiably large losses they sustain when managers of investment-grade portfolios are forced to sell them at once. How might these results apply to a policy of selling upon a spread widening, even without any change in ratings? This is not at all clear. One might argue that this could help reduce the losses from eventual downgrades or, conversely, that this would just serve to lock in losses in many bonds that will recover immediately and never suffer a downgrade. Generally, a momentum strategy like this one does well in trending markets and poorly in choppy markets. If enough market participants adopt this approach, it could lead to destabilizing behavior in which spread widening and asset sales reinforce each other in a vicious cycle.[8]

[7] See footnote 3 for detailed references.

[8] This danger that de-risking trades in cash markets could create a destabilizing force is probably very small compared with the corresponding danger from speculative activity in the CDS market. Furthermore, if portfolio managers respond to a general widening of spreads by attempting to diversify, no net selling pressure will develop. Imagine two similar portfolios, one with a position in issuer XYZ and another with a position in ABC; while the first manager sells half his XYZ to buy ABC, the other might be happy to take the other side of the trade.

Even when DTS limits are in place, one would probably want to include a hard limit on market value weights, to prevent extremely large concentrations even in short-maturity or low-spread securities.

In short, we recommend that when specifying hard limits on issuer exposures in a portfolio, plan sponsors should retain the time-honored tradition of market-weight limits. Including the effects of the credit crisis suggests that the differentials between the concentrations for different ratings brackets should be less skewed than in our earlier findings. However, we also believe that managers should track and control the DTS exposures to issuers and ensure that no single exposure grows too large. Rather than implementing this rule via a hard cutoff, managers should have a roughly defined upper limit for issuer DTS exposures and use their judgment in managing these exposures according to market conditions.

Conclusion

The credit crisis of 2007-08 reminded us yet again to be wary of issuer concentrations. Plan sponsors may no longer wish to allow positions in higher-rated credits to be much greater than those in lower-rated credits.

Keeping track of the DTS exposures to individual issuers within a portfolio is a good way to monitor issuer risk and can often highlight problem issuers before they are subject to rating agency actions. While there are some practical issues with explicitly setting limits on DTS exposures in an investment policy, we recommend that both managers and sponsors employ this valuable tool as part of their efforts to control issuer risk.

Analyst Certification(s)

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