Fixed Income
Quantitative Credit Research

A New Approach to Credit in the Lehman Brothers Global Risk Model

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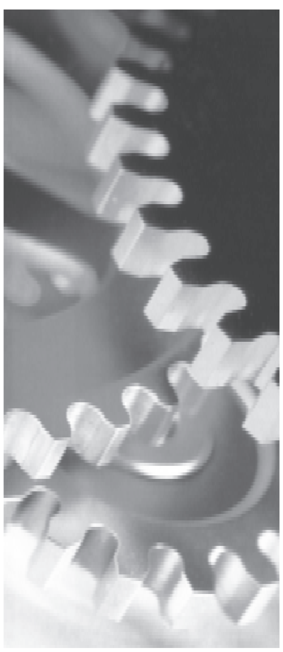

LEHMAN BROTHERS

Global Capital Market Ideas

A New Approach to Credit in the Lehman Brothers Global Risk Model

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We briefly describe the rationale and expected output changes for the new treatment of Credit in the Lehman Brothers Global Risk Model, available to our clients through POINT, our portfolio management platform.

THE OLD SPECIFICATION[1]

In the old version of the Global Risk Model, the spread risk of a particular bond is mainly driven by its industry membership and rating. By and large, the latter serves to capture the increase in volatility that comes with decreasing rating or increasing spread level and the former to capture diversification across industries. The non-distressed high yield (Ba/B) model follows a similar but independent calibration. In particular, Ba and B bonds are pooled within industrial peer groups.

WHAT HAS CHANGED?

In our new treatment, we expand the set of industries. For USD-denominated securities we move from a 9-sector specification to one of 26. For the Euro market we increase the number of sectors from 10 to 14 and for Sterling and Yen markets the corresponding increases are from 9 to 10 and 4 to 6 respectively. In each case these changes will serve to increase the systematic risk diversification available to investors. We also drop ratings in favour of spreads as a predictor of near-term volatility. Finally, we unify the treatment of investment grade and non-distressed high yield (Ba/B) asset classes into a single framework. The changes for the USD-denominated credit bonds are detailed in Appendix A.

To account for some institutional differences between the Investment Grade and (non-Distressed) High Yield markets, we introduce high yield factors. Without them, systematic risk across the two markets would be perfectly correlated. At the same time, the nature of the factors ensures a smooth transition in volatilities between the two markets.

WHY CHANGE?

The old framework for USD denominated bonds uses 27 risk factors (9 industries times 3 ratings) to capture the systematic risk of investment grade credit bonds, plus 11 risk factors (11 industries) for the high yield non-distressed bonds[2]. Although intuitive, this partition is sub-optimal: 9 (or 11 for HY) industries capture the diversification across the credit spectrum to a relatively limited extent which can be improved upon. We come back to this point shortly.

Moreover, spread levels are a better predictor for near-term volatility than are ratings which are slow to react to new market information and are discontinuous. Indeed, recent research indicates a linear relationship between current spread levels and future spread volatilities[3].

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[1] The old specifications are described in Naldi, Chu and Wang (2002) and Chang (2003).
[2] We refer here specifically to the treatment of USD-denominated securities but the arguments cited apply equally to other markets.
[3] See Ben Dor, Dynkin, Houweling, Hyman, van Leeuwen, and Penninga (2005).

Finally, the gap between the Investment Grade and High Yield models is currently too large, partly due to the fact that Ba and B bonds are pooled in the calibration of the model. This means that the risk model assigns to split-rated bonds (or generally high yield bonds with low spreads) a volatility level estimated using historical spread movements of Ba and B bonds. The latter generally appear to be disproportionately high, when compared with realized volatilities of the former.

To illustrate the point made above, that the factor definition under the old model is sub-optimal, we compared it with the one from the new model. The comparison is based on the covariance matrix of systematic credit factors of the two models. Recall that we have 27 (9 industries times 3 ratings) risk factors under the old model and 26 (all industry factors) under the new model. Figure 1 shows the explanatory power of the first 10 eigenvalues of each matrix. Under the old model one could capture around 80% of the total volatility of the 27 factors with only 5 "optimally design" factors. In the new model, we would need at least 10 such factors. This seems to suggest that the new model spans a larger space than the old factors.

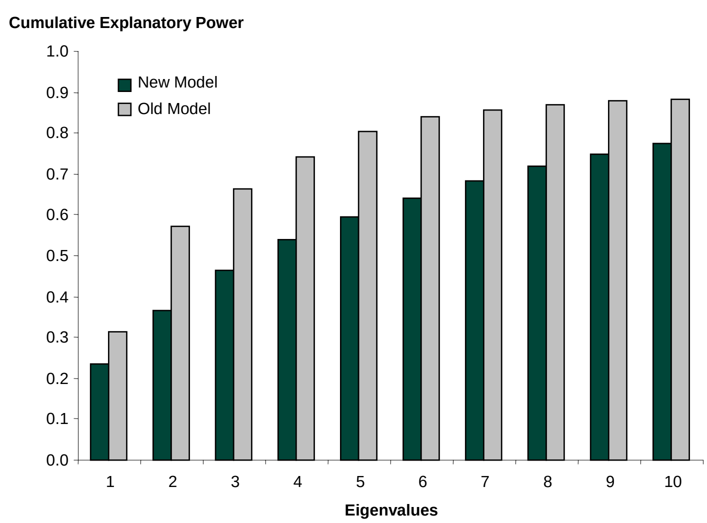
The result documented suggests that the introduction of the much finer industry partition has strong implications for the ability of the model to capture true systematic diversification of portfolios across industries.

EXPECTED CHANGES TO THE OUTPUT

We expect the predicted volatility of portfolios under the new risk model to change mainly along two dimensions: First, we expect the risk numbers to react more quickly to changes in the level of spreads. Second, as of today, we expect the predicted volatility of high yield non-distressed portfolios (Ba/B) to significantly decrease, this being especially the case for Ba and cross-over securities. This is partially the result of the very low spread environment we are experiencing at present in credit.

Below we illustrate the magnitude of the changes for some widely used Lehman Brothers indices. Figure 2 shows the systematic and idiosyncratic tracking error volatility (TEV), in basis points per month, for indices run against cash. All risk dimensions except that of

Figure 1. Explanatory Power of the Covariance Matrix Eigenvalues



Source: POINT, Lehman Brothers

Figure 2. Predicted Volatilities under the New and Old Model

		Systematic TEV			
		Unweighted		Weighted	
Index	**Date**	**New**	**Old**	**New**	**Old**
GBP Credit	11/30/2006	56.4	49.2	47.1	40.58
EUR Credit	11/30/2006	18.1	19.9	13.5	14.3
US Credit	11/30/2006	48.0	58.4	42.7	39.2
US HY Ba/B	11/30/2006	130.1	212.2	129.7	142.8
US CRD Aaa	11/30/2006	23.2	25.5	22.3	16.5
US Credit	11/30/2006	48.0	58.4	42.7	39.2
US Credit	12/31/2004	47.0	57.4	45.2	56.1
US Credit	12/31/2003	52.2	58.8	57.8	76.4
US HY Ba/B	11/30/2006	130.1	212.2	129.7	142.8
US HY Ba/B	12/31/2004	113.4	226.2	109.2	217.0
US HY Ba/B	12/31/2003	147.8	211.7	152.5	263.4

		Idiosyncratic TEV			
		Unweighted		Weighted	
Index	**Date**	**New**	**Old**	**New**	**Old**
GBP Credit	11/30/2006	5.2	5.8	3.9	4.1
EUR Credit	11/30/2006	4.6	5.2	2.8	3.1
US Credit	11/30/2006	6.6	7.0	4.8	4.9
US HY Ba/B	11/30/2006	21.3	43.6	17.4	30.2
US CRD Aaa	11/30/2006	8.5	7.7	7.5	7.6
US Credit	11/30/2006	6.6	7.0	4.8	4.9
US Credit	12/31/2004	9.0	9.1	6.8	8.8
US Credit	12/31/2003	9.1	9.6	7.6	11.5
US HY Ba/B	11/30/2006	21.3	43.6	17.4	30.2
US HY Ba/B	12/31/2004	14.5	36.0	13.0	29.8
US HY Ba/B	12/31/2003	16.9	34.9	14.9	36.1

Source: POINT, Lehman Brothers

spread are hedged. This makes the comparison between the two models easier, as we can focus on the numbers that changed with the new model. For both the systematic and the idiosyncratic TEV we show cross-sectional and time-series numbers of predicted volatilities. Note that the old model takes much longer to adjust the expected volatility downward following the events of the beginning of the millennium (i.e., it has longer memory), even when weighted estimation is used.

REFERENCES

Ben Dor, Dynkin, Houweling, Hyman, van Leeuwen, and Penninga (2005), “A New Measure of Spread Exposure in Credit Portfolios,” *Lehman Brothers Fixed Income Quantitative Portfolio Strategies*, June 2005.

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APPENDIX A: OLD AND NEW RISK FACTORS (PARTIAL)

Old Credit Risk Factors
Loading: OASD

Risk Factor	Ratings	Risk Factor (BA/B)	Ratings
Basic Industries (3)	AAA/AA, A, BAA	Basic Industries	BA/B
Consumer Cyclicals (3)	AAA/AA, A, BAA	Capital Goods	BA/B
Communication (3)	AAA/AA, A, BAA	Cyclical	BA/B
Energy (3)	AAA/AA, A, BAA	Communication	BA/B
Consumer Non-Cyclicals (3)	AAA/AA, A, BAA	Media	BA/B
Banking (3)	AAA/AA, A, BAA	Technology	BA/B
Financials (3)	AAA/AA, A, BAA	Energy	BA/B
Utilities (3)	AAA/AA, A, BAA	Transportation	BA/B
Non-Corporate (3)	AAA/AA, A, BAA	Non - Cyclicals	BA/B
		Financials	BA/B
		Utilities	BA/B

New Credit Risk Factors
Loading: DTS (=OASD*OAS)

RISK FACTORS (IG + BA/B)	Index Classfication
Chemicals	Basic Industries
Metals	
Paper	
Capital Goods	Capital Goods
Diversified Manufacturing	
Auto	Consumer Cyclicals
Consumer Cyclical	
Retail	
Consumer Non-cyclical	Consumer Non-Cyclicals
Health Care	
Pharmaceuticals	
Energy	Energy
Transportation	Transportation
Technology	Technology
Media Cable	Communication
Media Non-cable	
Wirelines	
Wireless	
Electric	Utilities
Gas	
Banking	Banking
Brokerage	Brokerage
Finance Companies	Finance Companies
Reits	Reits
Life Insurance	Insurance
P&C Insurance	
Non Corporate	Non-Corporate

Source: POINT, Lehman Brothers

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