A Note on the New Approach to Credit in the Barclays Capital Global Risk Model

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A previous version of this paper was originally published as "A Note on the New Approach to Credit in the Lehman Brothers Global Risk Model," Rosten, Jeremy and Silva, Antonio, January 23, 2007.

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

The Previous Specification[1]

In the previous version of the Global Risk Model, the spread risk of a particular bond was driven mainly by its industry membership and rating. By and large, the latter served 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 US dollar-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 the 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 drop ratings as a predictor of near-term volatility and unify the treatment of investment grade and non-distressed high yield (Ba/B) asset classes into a single framework. The changes 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.

In addition, we have made some changes to the modeling of idiosyncratic risk. This is now based on both the spread level and the industry to which the bond belongs.

In the new framework, predicted volatilities are conditional on current levels of spreads and react faster to their changes. A simple illustration is shown in Appendix B. A brief description of the new factors and formulae are in Appendix C.

[1] The previous specifications are described in Naldi, Chu and Wang (2002) and Chang (2003).

Why Change?

The previous framework for USD-denominated bonds uses 27 risk factors (nine industries times three ratings) to capture the systematic risk of investment grade credit bonds, plus eleven risk factors (eleven industries) for high yield non-distressed bonds.[2] Although intuitive, this partition is sub-optimal: nine (or eleven) industries capture the diversification across the credit spectrum to a relatively limited extent, which can be improved upon. In addition, spread levels are a better predictor of near-term volatility than 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]

Finally, under the previous setup, the gap between the investment grade and high yield models was too large, partly because Ba and B bonds are pooled in the calibration of the model. This means that the risk model assigned 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 disproportionably high when compared with realized volatilities of the former.

Expected Changes to Predicted Volatilities

The predicted volatility of portfolios under the new risk model is expected to change along several dimensions:

First, we expect the risk numbers to react more quickly to changes in the level of spreads. Second, we expect ratings changes to have a smaller impact to predicted volatilities under the new model. To illustrate, consider a bond that is downgraded, and suppose that the event is fully anticipated by the market (e.g., the downgrade is already incorporated in the bond's spread). Under the new model, there is no effect on expected volatilities because the spread of the bond does not move. Under the old model, the same event would trigger a jump in predicted volatility. More specifically, the predicted risk of the bond would remain stable, even as its spread would widen for some time in anticipation of the downgrade and jump suddenly on the day of the downgrade. This problem is especially acute in the old model for cross-over bonds. Because there is a clear distinction between investment grade and high yield models, any change in rating can trigger large jumps in predicted volatilities, even if fully anticipated. Under the new model, the transition between investment grade and high yield is much smoother, with changes in predicted volatilities coming mainly from changes in spreads.

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.

G. Chang (2003), "The New Lehman Brothers High Yield Risk Model," *Fixed Income Quantitative Credit Research*, November 2003.

M. Naldi, K. Chu and G. Wang (2002), "The New Lehman Brothers Credit Risk Model," *Quantitative Credit Research Quarterly*, May 2002.

[2] We refer here specifically to the treatment of US dollar-denominated securities, but the arguments apply equally to other markets.
[3] See Ben Dor, Dynkin, Houweling, Hyman, van Leeuwen, and Penninga (2005).

APPENDIX A: PREVIOUS AND NEW RISK FACTORS (PARTIAL)

Previous Credit Risk Factors, Loading: OASD

Risk factors	Industry		Ratings
22	GBP IG		
	Banking and Brokerage		AAA/AA, A/BAA
	Financials		AAA/AA, A/BAA
	Industrials		AAA/AA
		Basic Industries	A, BAA
		Consumer Cyclicals	A, BAA
		Consumer Non-Cyclicals	A, BAA
		Communication	A, BAA
	Utilities		AAA/AA, A, BAA
	Non-Corporate		AAA, AA, A, BAA
	Collateralized		AAA/AA, A/BAA
27	USD IG		
	Basic Industries		AAA/AA, A, BAA
	Consumer Cyclicals		AAA/AA, A, BAA
	Communication		AAA/AA, A, BAA
	Energy		AAA/AA, A, BAA
	Consumer Non-Cyclicals		AAA/AA, A, BAA
	Banking		AAA/AA, A, BAA
	Financials		AAA/AA, A, BAA
	Utilities		AAA/AA, A, BAA
	Non-Corporate		AAA/AA, A, BAA
7	JPY IG		
	Financials		AAA/AA, A/BAA
	Industrials		AAA/AA, A/BAA
	Utilities		AAA/AA/A/BAA
	Non-Corporate		AAA/AA, A/BAA

Risk factors	Industry		Ratings
21	EUR IG		
	Banking and Brokerage		AAA/AA, A/BAA
	Financials		AAA/AA, A/BAA
	Industrials		AAA/AA
		Basic Industries	A, BAA
		Consumer Cyclicals	A, BAA
		Consumer Non-Cyclicals	A, BAA
		Communication	A, BAA
	Utilities		AAA/AA, A, BAA
	Non-Corporate		AAA, AA, A, BAA
	Collateralized		AAA, AA, A, BAA
11		GLOBAL NON DISTRESSED HY (BA/B)	
		Basic Industries	BA/B
		Capital Goods	BA/B
		Cyclical	BA/B
		Communication	BA/B
		Media	BA/B
		Technology	BA/B
		Energy	BA/B
		Transportation	BA/B
		Non - Cyclicals	BA/B
		Financials	BA/B
		Utilities	BA/B

Source: Barclays Capital

New Credit Risk Factors

<table>
<tr><th>USD</th><th>EUR</th><th>GBP</th><th>JPY</th><th>Rating</th><th>Loading</th></tr>
<tr><td>UHG Industrials
UHG Utilities
UHG Financials
UHG Non Corporates</td><td>UHG Industrials
UHG Utilities
UHG Financials
UHG Non Corporate
UHG Collateralized</td><td>UHG Industrials
UHG Utilities
UHG Financials
UHG Non Corporate
UHG Collateralized</td><td>UHG Industrials
UHG Utilities
UHG Financials
UHG Non Corporate</td><td>AAA-B</td><td>OASD</td></tr>
<tr><td>Chemicals
Metals
Paper</td><td>Basic</td><td rowspan="2">Industrials</td><td rowspan="2">Industrials</td><td rowspan="18">AAA-B</td><td rowspan="18">DTS</td></tr>
<tr><td>Capital Goods
Diversified Manufacturing</td><td>Capital Goods</td></tr>
<tr><td rowspan="2">Auto
Consumer Cyclical
Retail</td><td>Auto</td><td rowspan="2">Consumer Cyclicals</td><td rowspan="3">Consumer</td></tr>
<tr><td>Consumer Cyclical</td></tr>
<tr><td>Consumer Non-cyclical
Health Care
Pharmaceuticals</td><td>Consumer Non-cyclical</td><td>Consumer Non Cyclicals</td></tr>
<tr><td>Energy</td><td rowspan="2">Energy
Transportation</td><td rowspan="2">Industrials</td><td rowspan="2">Industrials</td></tr>
<tr><td>Transportation</td></tr>
<tr><td>Technology</td><td rowspan="2">Tech. & Communication</td><td rowspan="2">Tech. & Communication</td><td rowspan="2">Tech. & Communication</td></tr>
<tr><td>Media Cable
Media Non-cable
Wirelines
Wireless</td></tr>
<tr><td>Electric</td><td rowspan="2">Utilities</td><td rowspan="2">Utilities</td><td rowspan="2">Utilities</td></tr>
<tr><td>Gas</td></tr>
<tr><td>Banking</td><td rowspan="2">Banking & Brokerage</td><td rowspan="2">Banking & Brokerage</td><td rowspan="5">Financials</td></tr>
<tr><td>Brokerage</td></tr>
<tr><td>Finance Companies</td><td rowspan="2">Finance Companies</td><td rowspan="2">Finance Companies</td></tr>
<tr><td>Reits</td></tr>
<tr><td>Life Insurance
P&C Insurance</td><td>Insurance</td><td>Insurance</td></tr>
<tr><td>Non Corporate</td><td>Non Corporate</td><td>Non Corporate</td><td>Non Corporate</td></tr>
<tr><td></td><td>Collateralized</td><td>Collateralized</td><td></td></tr>
<tr><td>High Yield Industrials
High Yield Utilities
High Yield Financials</td><td>High Yield</td><td></td><td></td><td>BA/B</td><td>DTS</td></tr>
</table>

Source: Barclays Capital

APPENDIX B: PREVIOUS AND NEW RISK FORECASTS

This appendix illustrates the major differences in the two methodologies. Under the previous treatment, spread risk factors represent the average *spread changes* for given peer groups. Under the new formulation, the factors represent the average *proportional spread changes*. If we represent the predicted systematic spread volatility of a particular bond *i* (from industry *I* and rating *R*) in period *t* as $\hat{\sigma}_{it}$, then:

$$\hat{\sigma}_{it}^{old} = OASD_{it} \times \sigma_{IR}$$

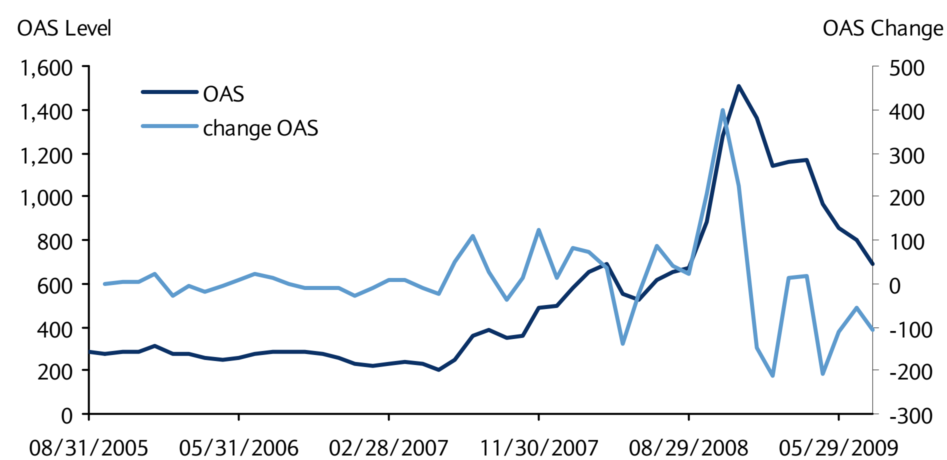
where σ_{IR} is the volatility of the average *spread change* in industry *I* and rating *R,* and

$$\hat{\sigma}_{it}^{new} = OASD_{it} \times OAS_{it} \times \sigma_{DTS,I} =$$
$$= DTS_{it} \times \sigma_{DTS,I}$$

where $DTS_{it} = OASD_{it} \times OAS_{it}$ and $\sigma_{DTS,I}$ is the volatility of the average *proportional spread change* in industry *I*, $\left(\dfrac{OAS_{I,t} - OAS_{I,t-1}}{OAS_{I,t-1}} \right)$. In particular, note that under the new model, the volatilities are conditional on the current spread level of bond *i*, but independent of rating.

For illustration, we apply these two methodologies to the Barclays Capital High Yield Ba/B credit index. Figure 1 shows the monthly OAS level and change. In particular, note the shift between calm and more volatile periods, such as the one after September 2008.

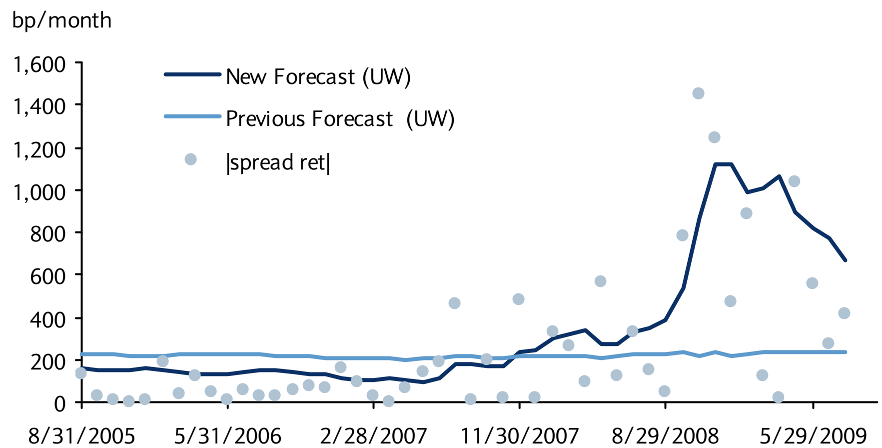
Figure 1: USD HY Ba/B Credit Index OAS and changes in OAS



Source: Barclays Capital

How would the two models predict the volatility of this OAS series? The previous model uses the volatility of the spread changes up to that month as the best predictor for future volatility. The new model uses the historical volatility of percentage spread changes and the current level of spreads to produce the forecast. Figure 2 shows the volatility predictions under the previous and the new methodologies (unweighted estimates). It is clear that the estimates under the new model change faster, increasing after the summer of 2008 and decreasing throughout 2009. In particular, note that as of July 2009, the previous model predicts 237bp/month of spread volatility, against a prediction of 667bp/month from the new model.

Figure 2: USD HY Ba/B Credit Index: Index spread volatility forecasts under the previous and new methodologies and absolute value of spread returns



Source: Barclays Capital

APPENDIX C: NEW RISK MODEL SPECIFICATION

This appendix describes the general formulation of the new credit model. The starting assumption is that the percentage change in spreads is the most relevant invariant in the distribution of spread changes. Therefore, we begin by modelling changes in Libor-OAS as:

$$\Delta LOAS = LOAS \times F^{DTS}$$

where F^{DTS} is the risk factor realization (percentage change in LOAS). In general, however, this expression does not apply to low spread bonds (in particular, bonds with negative spreads). For these bonds, volatility is not proportional to the spread level. We therefore augment the previous expression to accommodate this effect by introducing a non-DTS ultra high grade (UHG) factor:

$$\Delta LOAS = F^{UHG} + LOAS^{+} \times F^{DTS}$$

Here, F^{UHG} drives the volatility of the very low spread bonds (UHG) and $LOAS^{+} = \max(LOAS, 0)$. As the level of spreads increases, the volatility of spreads begins to be driven mainly by the proportional spread factor F^{DTS}.

To this generic description, we add a couple of dimensions to capture diversification across industry, IG/HY market segmentation, and maturity.

Starting with the market segmentation across IG/HY, we extend the model to include a high yield factor:

$$\Delta LOAS = F^{UHG} + LOAS^{+} \times (F^{DTS} + 1_{HY} F^{HY})$$

where 1_{HY} is 1 if the bond is HY and 0 otherwise. This introduces some differentiation in correlations across the two markets without a significant effect on volatilities.

We incorporate any additional slope effect on the bond's volatility by adding slope factors F^{SHORT} and F^{LONG} in the following way:

$$\begin{aligned}\Delta LOAS = {} & F^{UHG} + LOAS^{+} \times (F^{DTS} + 1_{HY} F^{HY}) + \\ & + (OASD - medOASD)^{-} \times F^{SHORT} + (OASD - medOASD)^{+} \times F^{LONG}\end{aligned}$$

where we use the notation $X^{-} = \min(0, X)$.

Finally, we add two subordination factors (mainly for EUR):

$$\begin{aligned}\Delta LOAS_{I} = {} & F^{UHG} + LOAS^{+} \times (F^{DTS} + 1_{HY} F^{HY}) + \\ & + (OASD - medOASD)^{-} \times F^{SHORT} + (OASD - medOASD)^{+} \times F^{LONG} + \\ & + LOAS^{+} \times (1_{SUB\_IG} F^{SIG} + 1_{SUB\_HY} F^{SHY})\end{aligned}$$

where $1_{SUB\_IG/HY}$ is 1 if the bond is subordinated and 0 otherwise.

In its full form, for a security *i* belonging to industry *I(i)* and broad sector *S(i),* the new formulation takes the form (see 0):

$$
\begin{aligned}
\Delta LOAS_i = F_{S(i)}^{UHG} + LOAS_i^{+} \times (F_{I(i)}^{DTS} + 1_{HY(i)} F_{S(i)}^{HY}) + \\
+ (OASD_i - medOASD_{S(i)})^{-} \times F_{S(i)}^{SHORT} + \\
+ (OASD_i - medOASD_{S(i)})^{+} \times F_{S(i)}^{LONG} + \\
+ LOAS_i^{+} \times (1_{SUB\_IG} F^{SIG} + 1_{SUB\_HY} F^{SHY})
\end{aligned}
$$

As an example, and given the description above, a senior IG long maturity cyclical bond has a systematic spread vol driven by:

$$
\begin{aligned}
\Delta LOAS_i = F_{INDUSTRIALS}^{UHG} + LOAS_i^{+} \times F_{CYCLICALS}^{DTS} + \\
+ (OASD_i - medOASD_{INDUSTRIALS})^{+} \times F_{INDUSTRIALS}^{LONG}
\end{aligned}
$$

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