Option-Adjusted Spread (OAS)

Definition

Option-adjusted spread (OAS) is the spread relative to a risk-free interest rate, usually measured in basis points (bp), that equates the theoretical present value of a series of uncertain cash flows of an instrument to its current market price. OAS can be viewed as the compensation an investor receives for assuming a variety of risks (e.g. liquidity premium, default risk, model risk), net of the cost of any embedded options.

General Applications

1. Evaluation of an interest-sensitive fixed-income security (in other words, a security whose future redemption date and payment stream are influenced by interest rates through the presence of an implicit embedded option). For example, is a 50 bp OAS appropriate for an A-rated asset?

2. Facilitates comparison of assets. For example, is a AAA-rated asset at 90 bp over the Treasury curve a better value than a B-rated asset with a 600 bp spread?

3. Profitability analysis. For example, keep OAS constant and see how price varies as various factors are changed. Or, keep price constant and see how a change in various factors impacts the OAS.

4. Product pricing. For example, when discounting interest-sensitive cash flows, what is the appropriate spread over the risk-free interest rate that compensates the company for the risks of the product?

5. Firm valuation or valuation of a book of business. For example, when discounting interest-sensitive cash flows, what spread should be added to the risk-free interest rate in order to compensate the buyer for the risks inherent in the firm or book?

Calculating OAS

1. Interest rate scenarios are generated stochastically, using a model consistent with the current term structure and assumed level of volatility.

2. Free cash flows, reflecting interest-sensitive contractual features, are calculated at each time step along each interest rate path.

3. The free cash flows are discounted at the risk-free interest rate plus a spread (the OAS) to determine a value at time zero for each path.

4. An average of the pathwise values is calculated.

5. Steps 3 and 4 are repeated, and the OAS is solved for which equates the average of the pathwise values to the current market price.

Application to Insurance Companies

The classic life, health or annuity insurance pricing model can be enhanced to reflect the interest-sensitive nature of asset and liability cash flows, and can then be combined with OAS techniques used in the valuation of fixed-income securities to result in option-adjusted pricing measures. The "security" is a single cell, an in-force block, or an entire company. The cash flows are the amounts of after-tax statutory earnings generated by the "security" that can be paid to

shareholders ("distributable earnings" or "free cash flow"). Stochastic techniques for the valuation of interest-sensitive cash flows are applied to the interest-sensitive, path-dependent assets and liabilities to arrive at path-dependent distributable earnings. This will price the "security" to reflect the interest rate risk of embedded options in the assets and liabilities.

Option Adjusted Price = $S^{OA} = (1/P)\ SUM_p\ [SUM_t\ [FCF_{p,t} \div PROD_{j=1}\ (1 + r_{p,j} + oas)\ ]]$

P = Number of arbitrage-free paths for the risk-free rate
$FCF_{p,t}$ = free cash flows for path p at time t
$r_{p,j}$ = risk-free one-period forward rate for path p during period j

In this formula, the *oas* represents the spread over the risk-free rate that can be earned on a single cell, block of insurance, or company in exchange for a given price. Alternatively, S^{OA} is the price to be paid to achieve a desired return of *oas* over the risk-free rate. This enables the pricing actuary to value alternative product designs, investment, and crediting strategies to be compared for their impact on profitability as measured by distributable earnings.

An alternative view of the above formula can be found by replacing $PROD_{j=1}\ (1 + r_{p,j} + oas)$ with $(1 + oay)^t$ (*oay* = option-adjusted yield or hurdle rate of return). Considerations when setting the hurdle rate are as follows: the riskiness of the stream of future cash flows, the return desired based on opportunities available elsewhere for similar risks, and the cost of capital.

OAS techniques can also be helpful for property and casualty insurance companies, especially when analyzing and valuing the assets of the company. Since liabilities in a property and casualty insurance company are generally not as interest-sensitive as in a life insurance company and cash flow models such as that described above are not regularly used, the full OAS analysis described in this section may not be as applicable to property and casualty insurance.

Additional Applications and OAS Measures

OAS techniques can be used to calculate an option-adjusted value of "surplus" by taking the option-adjusted value of the assets minus the option-adjusted value of the liabilities. This allows an analysis of hedging techniques that will immunize the option-adjusted value of "surplus". Option-adjusted duration (measure of price sensitivity to changes in interest rates) and option-adjusted convexity (change in option-adjusted duration with a change in interest rates) can also be applied to distributable earnings and used in the immunization of asset/liability cash flows.

Additional analyses: option-adjusted break-even year, option-adjusted appraisals, option-adjusted value added analysis, enhancement of model to reflect stochastic nature of other pricing risks, determination of amount of risk-based capital required to ensure solvency from a specific risk or combination of risks at a certain confidence level, analysis of internal hedges.

Strengths

1. Allows explicit measurement and representation of risks when pricing products.
2. Stochastic valuation provides a better representation and range of the modeled risk.
3. Stochastic analysis captures the effect of yield curve shape on interest-sensitive variables and reflects the possibility interest rates will vary in the future.

Weaknesses

1. Measure is contingent on quality of model and assumptions.
2. Market price may not be available.
3. Only OAS's of securities with similar "embedded options" can be compared.
4. Need for many scenarios may be time-consuming.

Following are methods for obtaining a market price when not readily available due to an illiquid market: 1. find the price for traded assets that have similar risk, 2. compare to prices offered by other companies on similar products, 3. for blocks of business, determine the price of product portfolios that are selling in the reinsurance market.

References

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