SOCIETY OF ACTUARIES

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Learning Curve—Credit Default Options

by Geoff Chaplin

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Suppose you won XYZ Company bonds. I could write default protection. If XYZ defaults, you can deliver the bonds to me and I will pay you par plus accrued interest. In return you would have to pay me a premium for the contract—either up-front or a regular premium during the life of the option, when it is a default swap. There are many variations on this basic theme. The payoff may be par, par plus accrued, the value of the cash-flows promised on the bond (either at the risk-free rate or plus a spread); the actual cashflows on the due dates but paid by me instead of XYZ; or there may be no offset (a digital or binary option). But the basic concept is a payment by me to you, on default of XYZ, in return for a premium. The contract is very similar to life insurance.

Applications

Going long a default option can be an alternative to selling the underlying risk and it can allow the user to manage the risk independently. For example, short-term insurance can be obtained on long-term debt, or insurance can be obtained when there is no underlying risk—an alternative to going short the underlying. Options can be written as a means of obtaining premium income. Buying a default option rather than selling the debt may be for relationship reasons—your customer may not be impressed if they see you selling their debt.

Why All The Fuss About Credit Derivatives?

These contracts offer new ways to manage credit risk. As in other markets, such as fixed income and equity, the derivatives may become more liquid than the underlying contracts. But one of the main reasons for interest arises from the identification of counterparty risk in the contract. If I default before XYZ, then your protection has gone. If you are paying a periodical swap premium, this may not necessarily be a bad thing: you may be able to buy a default swap more cheaply than the original terms.

Counterparty risk is not unique to default options. Any contract with another party involves some form of counterparty risk; it percolates through, not only the banking business, but all commercial businesses. One reason for the interest in credit derivatives is the framework it gives for looking at counterparty risk generally.

Pricing

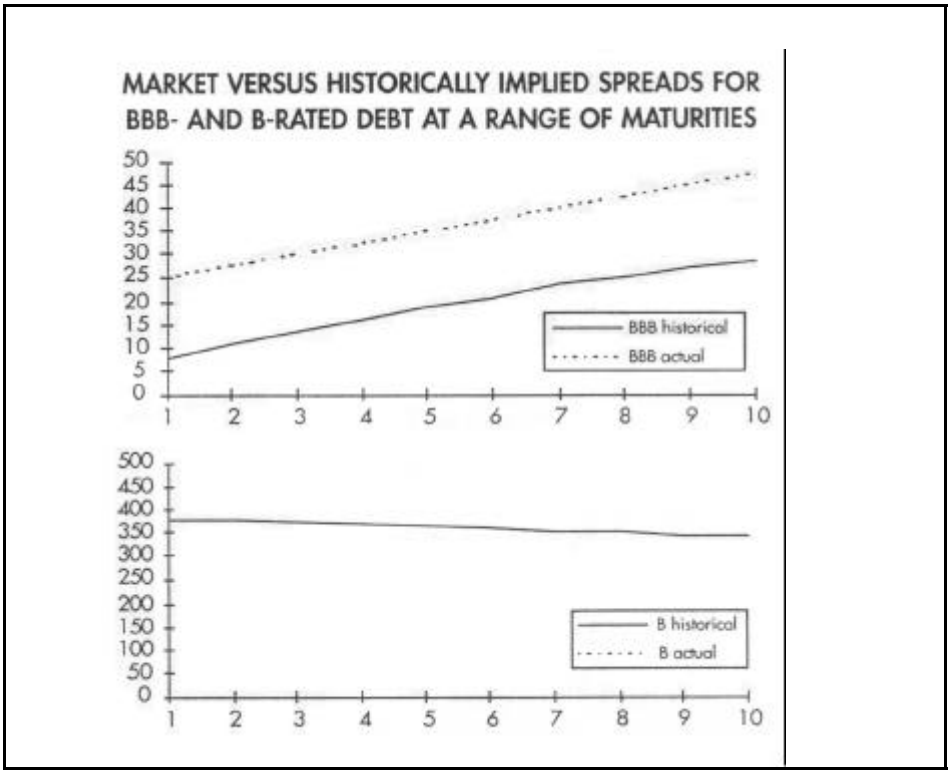
Let's concentrate on the XYZ default risk. There are two approaches we could take—anticipated default and expected default. For anticipated default we might take historical default rates based, say, on similarly rated bonds as a guide. Or we might make some option theoretical analysis based on corporate accounts and share price information (see Learning Curve, 5/18). For expected default—and this word is used in a deep financial economics sense—we take the spreads at which XYZ market debt trades.

The key question is, am I pricing the derivative off a hedge I am going to put in place, or am I trying to decide if XYZ debt is cheap or expensive? In the former case I am arbitrage pricing and I should use market-traded debt as my guide—the expected default rate. In the latter case I am trying to beat the market—my assessment of anticipated default rates will partly drive the decision.

Hedging

If you buy five-year default protection on your five-year XYZ fixed coupon bond, then the default risk is now largely hedged out. There is interest rate risk in the XYZ fixed coupon debt which, if you were financing off LIBOR rates you probably hedged out via a fixed-floating swap. Thus interest rate risk is largely hedged out.

(continued on page 17, column 1)



Arbitrage Pricing VS. Pricing Off Historical Default Rates

Typically, spreads exceed historical default rates. Why is there a difference between anticipated and expected default rates? This is because one is taking on credit risk which is different from interest rate, currency, or even equity risk, and this requires an additional reward for risk.

Figure 1 shows some typical spread curves for BBB-rated debt, the lower end of investment grade, and B-rated debt. We have used historical default rates to calculate what spread would be required to compensate purely for default risk. The calculation is simple and introduces some key concepts, so it is worth looking at an example in detail. Let's take a one-year annual XYZ bond with a 6% coupon, and suppose the company is rated BBB. If the company survives—with probability of one minus the one-year default rate for BBB debt; roughly 0.998—we get 106. If XYZ defaults—probability of 0.002—there typically will be a recovery on the debt. Recovery tends to be related to seniority rather than rating, but there is a wide range of levels. If the particular debt we are looking at is senior unsecured, we would expect about 50% recovery. If default is half way through the year the payment will be 0.5% recovery. If default is half way through the year the payment will be 0.5x(100 + 0.5 x 6). So, if for example, risk-free rates are 5% the bond price should be

$$price = 0.998 \times 106 / 1.05 + 0.002 \times 0.5 \times 103 / 1.025$$

and having calculated the price, we can now calculate the yield and then the spread. Figure 1 shows the result of this and similar calculations for a range of maturities.

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Investment Section Council Meeting in New York

Investing their time in Section activities, the Investment Section Council members plan for the coming year—

L-R—Frank Sabatini, Christian-Marc Panneton, David Li, Peter Tilley, Judy Strachan (1997-98 Chairperson), Rick Jackson, Joe Tan (1998-99 Chairperson)

An Actuary Looks at Financial Insurance

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8) Ruark, T. J. 1996. "Variable Annuities: What Goes Up, Must Come Down." Contingencies, (March/April):35-37.

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