Options theory in credit evaluation: performance

Following on from his first article in last month's issue, Dr Andrew Bagley of www.FirstKnow.It explores further the theoretical background to credit analysis.

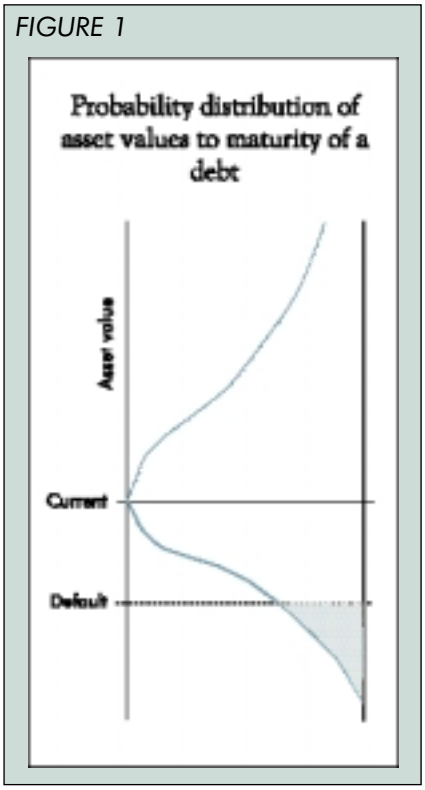
In the previous article on credit evaluation in last month's issue we outlined how default risk can be modelled using an options methodology. It identified the event of default as exercise by the debtor of a down-and-out put option on his assets, written in his favour by the creditors, which permits full settlement of the debts. We also looked at the practical variable definitions to enable the option – and hence credit risk – to be evaluated. Here, we will discuss further developments of the options approach and the methodology's performance versus traditional rating techniques.

Developments from the options model

One of the main objectives of the early work on options theory was to devise mechanisms for hedging options through positions in the underlying securities. This is usually done by calculating the amount of the underlying security which has the same sensitivity to price changes as the option. It can be thought of as the option's equivalent position in the underlying security. Shorting this amount of the underlying security (for a put) enables the price risk from writing the option to be neutralised. Facing a price fall, the gain on the short security position equals the loss from the short put position. The amount of stock to short is determined by the sensitivity of the option to movement in the underlying asset and is termed the 'delta' of the option.

The options methodology of credit evaluation creates a mathematical link between the stock market capitalisation of a company's equity and the value of the down-and-out put option. A change in stock capitalisation is automatically reflected in the put value. In the same way as it is possible to calculate the sensitivity of an option to the underlying, it is possible to calculate the sensitivity of the put to the capitalisation of the firm's equity. This 'equity delta' is the amount of the listed equity in the debtor company which has the same sensitivity to changes in its share price as the put option on its debt.

FIGURE 1



Andrew Bagley

The feasibility of using this equity delta for shorting the firm's stock to hedge credit risk is determined by the delta's linearity. It is probably not viable for companies to hedge trade receivables simply by shorting stock, as the equity delta is highly non-linear for firms with significant credit risk and it also increases as the stock price falls. The increase in the short position is doubly difficult to accomplish because an existing short position will reduce in value as the stock price falls compounding the non-linearity[1]. Using the equity delta for hedging is perhaps an 'ideal', but it can also impart very useful information. In the credit situation, we can consider the equity delta to be the position in the quoted equity which has equivalent risk (equity exposure) to the credit risk of the debt. This enables us to understand credit risks in terms of equivalent stock market exposures.

Knowing, say, that the credit risk on a £1m three-month receivable from a well-known automotive distributor is equivalent to the risk on £80,000 invested in its listed equity is much more informative than knowing it has a C– short-term rating.

Put value or expected default frequencies (EDF™)?

The put value can be thought of as the expected default cost (EDC) on a debt, whereas the EDF[2] is the probability that a default will occur. The two concepts are strongly linked, through the equation:

EDC = EDF x LGD
Where
LGD = Loss given default

Figure 1 provides a probability distribution of asset values to maturity of a debt. The EDF provides the probability that the asset value declines at some point during the term of the debt to a point within the shaded area below the default barrier.

The EDC, or put value, takes each of these probabilistic default events and multiplies it by the LGD to produce the EDC. Therefore, the EDF differs markedly from the put value because it excludes any estimate of LGD and provides no information on the actual default costs a lender should expect to incur. In keeping with ratings agencies' focus on default probability, rather than expected default cost, KMV provides only the EDF leaving creditors (banks in its case) to apply their own LGD factors, perhaps based on their own experience. It remains the case, however, that the EDF is only a partial analysis of the credit situation and does not provide creditors with a complete estimate of their expected default costs – the number which is ultimately required.

Performance of option-derived ratings versus traditional ratings

Theoretical issues. The options versus traditional ratings dialogue has a strong analogy in the indexed versus managed fund debate and the efficient markets hypothesis. Most objective academic analysis concludes that fund managers cannot consistently outperform the stock market index. This suggests that market prices adjust more rapidly to new information than mispricings can be accessed even by expert opinion – profit opportunities vanish before they can be seized. A similar argument can be proposed for option derived ratings. If the options model of default is correctly specified and stock prices accurately incorporate available information, how can the analyst using traditional rating methodologies hope to provide better ratings?

Counter-arguments again reflect the indexed versus managed fund debate: preferred access to management thinking and plans, experience of corporate financing and general experience of converting situations 'in the round' to estimate default risk.

Market hype. Notwithstanding arguments of stock market efficiency, it might be argued that stock market bubbles undermine the options approach. Certainly, the boom and bust of the dot-coms and telecoms give ammunition to sceptics. Through its use of stock volatilities, however, the options approach has an in-built self-adjustment for speculation. Speculation causes high volatility, for example, volatilities of internet assets tend to be several multiples of those for traditional assets, and the disadvantages of a high asset volatility more than outweigh the benefits of an over-valued stock price.

FIGURE 2

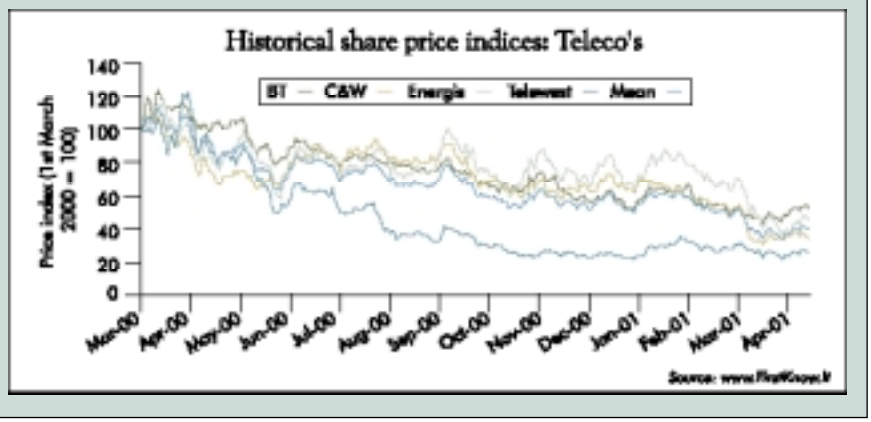
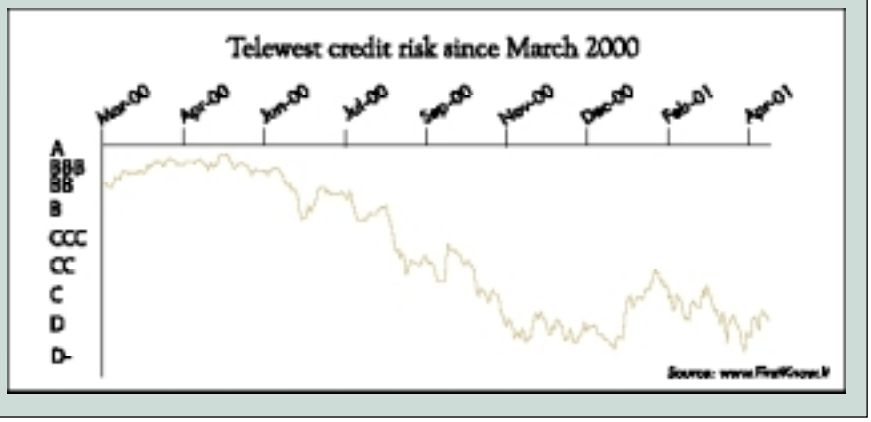


FIGURE 3



Empirical findings. Comparing KMV with Standard & Poor's data, Miller (1998) performed non-parametric tests to determine whether measuring credit risk using option valuation represents a refinement over traditional rating methods. He concludes the options approach:

> "…has very strong predictive value for as many as 18 months prior to default. The predictive power remains statistically significant out to 36 months. At 48 months the significance level finally drops below 95%… a quantitative credit rating system is a refinement of a traditional rating system, ie, it provides additional information."

> The options model leverages the information processing effectiveness of the stockmarket to produce ratings which out-perform highly regarded rating agencies

The telecoms sector has recently received much attention, particularly BT with speculation of possible rating downgrades. *Figure 2* plots price indices of the principal terrestrial telecos quoted in London since the sector's peak in March 2000. The arithmetic mean of the four firms shows prices have since fallen 64%. The options approach to credit evaluation picks up the rating impact of this decline in equity capitalisation as it occurs. Telewest shows the biggest decline, falling 75% in just four months.

Some 85% of the price decline occurred over the four months to end July 2000. The result on Telewest's credit rating using FirstKnow.It's options approach is shown in *Figure 3*.

The graph shows that from being relatively low risk in March 2000, the company's debts were subject to substantial risk by end-July 2000 with a D rating. On 19 March 2001, Moody's announced a downgrade in Telewest's senior unsecured debt rating. In this case, the options approach was eight months ahead of Moody's in adjusting its ratings. The impact of the decline of BT's share price on its FirstKnow.It credit rating is as indicated in *Figure 4*.

In the case of BT, a substantial price decline occurred over the period to November 2000. During this period, BT's FirstKnow.It rating went from a BB to CC using the options approach, whereas traditional agencies are still in the process of revising their ratings. Vodafone, has a AAA credit rating and has more than twice the asset capitalisation of BT. This increases the average sector credit quality and FirstKnow.It is assigning telecoms an average sectoral rating of B–, indicating a moderate average risk of defaults.

Moody's and Standard & Poor's principally target the banking sector and maintain a very focussed coverage in comparison with ratings agencies commonly found in the corporate sector. This author has maintained an informal record of the performance of one of the largest corporate sector agencies by obtaining their reports on significant corporate casualties on the day they declared insolvency. Instances are Independent Energy, Save Group and Cammell Laird, which went into receivership in September 2000, March 2001 and April 2001 respectively.

- Independent Energy was rated 'low risk' and 'better than average for this industry', with a recommended £1.2m credit limit.
- Save Group was rated 'low risk' and 'average for this industry', with a recommended £2.55m credit limit.
- Cammell Laird was rated 'minimal risk' and 'better than average for this industry', with a recommended credit limit of £1.25m.

Cammell Laird is particularly surprising given that the Italian contract, which is the cause of its immediate problems, has been regularly reported on the television news since November 2000.

FIGURE 4

Independent Energy went into insolvency before FirstKnow.It launched its service. Save Group and Cammell Laird have both been rated D– since inception of the service in February 2001 indicating the riskiness of their credit position was clearly available through their stock prices.

Taking the options approach

This series of two articles has sought to outline the theoretical background of using options theory in credit evaluation, to provide insights into practical issues relating to implementation and analysis of performance compared to traditional rating systems. Options theory provides a cogent model for credit evaluation whose primary inputs can be accessed either directly or inferred from market data. The model leverages the information processing effectiveness of the stock market to produce ratings which evidence suggests outperform ratings produced even by highly regarded ratings agencies such as Standard & Poor's.

Services already exist to trade credit exposure, and the options approach to credit evaluation and availability of equity deltas reinforce this trend. The end-point appears to be understanding credit for listed companies as a risk which treasurers can actively manage perhaps ultimately with adaptations of instruments traditionally used in managing equity positions. ■

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www.FirstKnow.It launched its service providing credit ratings from stock prices for 850 UK-listed companies in February 2001.

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[1] This non-linearity may technically be overcome through positions in traded equity options. Alternatively, very active traders, such as investment banks with very low transaction costs and large positions, may be able to maintain an effective delta hedge into the equity.

[2] EDF™ is a Trademark of KMV LLC