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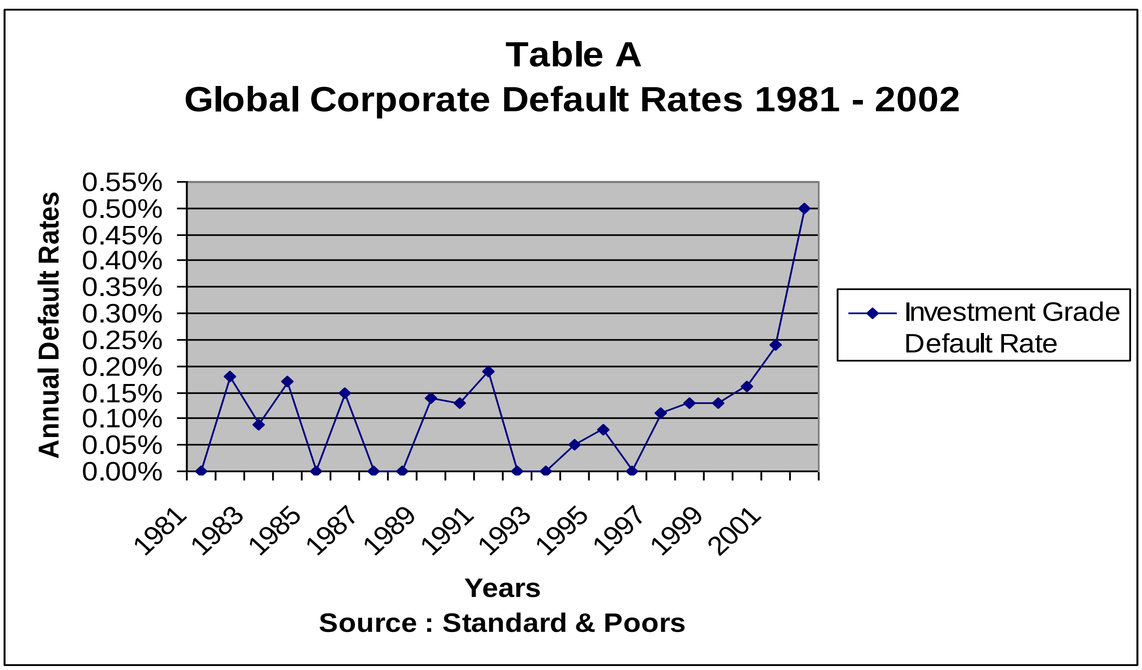
Quantitative Credit Risk Modeling

"Probable impossibilities are to be preferred to improbable possibilities"
Aristotle

Introduction

Aristotle highlights a key consideration in risk management – how to derive asymmetric probabilities of outcome that can be utilized to avoid pitfalls and take advantage of opportunities. The ability to weigh risk versus reward is a paramount skill needed in allocating capital. Although anything is possible, many people throughout history have asked the question: how do you identify glaring risks and opportunities? More importantly in today's world, how are these observations applied towards portfolio management? This continues to be the challenge for the investment community as investment managers adapt their investment processes to analyze new and emerging risks.



Taking a closer look at this phenomenon within the corporate bond market, corporate bonds have experienced a significant increase in volatility over the past few years. Table A maps out global investment grade default rates from

1981 to 2002. As you can see, the level of investment grade corporate bond defaults skyrocketed in 2002, far surpassing default rates during the previous economic recession of 1990-1991. Similarly, earnings and equity volatilities for corporate issuers have increased, resulting in heightened corporate bond spread volatility. Add to this several secular changes in the corporate market that include the increased use of credit default swaps for hedging and arbitrage purposes, and the sharp reduction in dealer inventories, and one begins to appreciate how the risk of a corporate security has changed over time.

Issue selection in the corporate sector is made on the basis of superior credit profiles versus a peer group and upward credit momentum as evidenced by significant positive earnings announcements. Credit quality is gauged by three measures which emphasize cash flow and liquidity. These measures are (1) interest coverage by earnings before interest, taxes and depreciation (EBDIT coverage), (2) interest coverage by earnings before interest, taxes and depreciation less capital expenditures (EBDIT - CapX coverage), and (3) debt maturing in the next three years to total debt. In addition, issuers are selected which have displayed a pattern of earnings above consensus expectations. The unexpected earnings component captures the quasi-equity properties that corporate bonds tend to exhibit. Research indicates that such positive as well as negative announcements, relative to consensus expectations, tends to exhibit recurring patterns. In this fashion, we are able to construct corporate portfolios which exhibit solid, and improving credit fundamentals. Once purchased, issuers are continually monitored for any deterioration in credit measures or earnings significantly below consensus expectations. Such deterioration or negative earnings announcements would signal a sell candidate from the portfolio.

With the changing nature of risk in corporate bonds, investment managers are being forced to adapt to new risks. At Vanderbilt, we believe that superior performance starts with solid defense. In that vein, we have augmented our fundamental investment screens with a quantitative credit risk modeling tool known as BondScore. Before describing BondScore in more detail, it may be helpful to understand how credit risk modeling works.

Quantitative Credit Risk Modeling

Quantitative credit risk modeling involves using statistical regression models (specifically, discrete-time exponential hazard models) to quantify the probabilities of default for corporate issuers over a fixed time period, usually the next 12 months. These default probabilities can be translated into letter ratings that can be compared to credit ratings provided by Standard & Poors, Moody's and Fitch Investors. Probabilities of default or credit risk estimates can be calculated by identifying statistically significant characteristics that have been proven to be predictive in determining the likelihood of a corporate default. Factors that can be quantified are typically broken down into two areas: fundamental and structural.

The fundamental factors are those financial ratios that describe the credit quality of a particular issuer and that have been shown empirically to be predictive in determining whether an issuer will default in the near future. These factors include: leverage, interest coverage, operating and net margins, size, and net liquidity of assets. Edward Altman of New York University has done extensive empirical default studies over several decades that demonstrate the predictive nature of these types of financial ratios.

On the other end of the spectrum are theoretically structural factors, which utilize equity volatility measures to determine the probability of default for an issuer. This is done by first computing the market value of the liabilities and equity for an issuer and then comparing the volatility of the equity value to determine the probability with which this equity value will fall to a point where the issuer will default. This method uses a theoretical framework developed by Robert Merton of the University of Chicago to determine the point at which an issuer will default.

Along this spectrum of default probability calculation, there are various forms of hybrid models that assign differing weights to different factors. BondScore uses seven factors to calculate short term default probabilities, including:

1. Debt / Market Value
2. EBITDA / Sales
3. Sales / Assets
4. Quick Ratio (Current Assets - Inventory ÷ Current Liabilities)
5. Log of Relative Asset Size
6. Volatility of EBITDA / Assets
7. Equity volatility

BondScore combines on a parity basis fundamental and structural factors, thereby equally balancing information contained in a firm's stock price with information from a firm's financial statements. This is an important distinction because if a model relies too much on just one source, it is thereby ignoring information from another source, which has a direct bearing on the accuracy of the model.

The BondScore tool employed by Vanderbilt was developed by an independent credit research firm known as CreditSights, Inc. The modeling tool was developed over three years ago using 25 years of financial data, default history and equity volatility for the corporate bond universe. Several members of Vanderbilt's investment team originally beta tested BondScore to determine an efficient and disciplined application of this tool within the overall investment process. Also, BondScore is a dynamic model that allows the user to adjust factors on an ad hoc basis for sensitivity analysis.

Application of Quantitative Credit Risk Modeling

At Vanderbilt, we have developed a proprietary credit model known as CreditTracker to efficiently monitor credit risk. The CreditTracker model downloads financial information from Bloomberg and sorts this information through Vanderbilt's core investment screens. CreditTracker also downloads BondScore credit risk estimates from CreditSights and sorts corporate issuers in terms of credit strength and variability in credit risk estimates. CreditTracker maps out trends in credit risk estimates for corporate issuers over time and calculates the divergence in these credit risk estimates compared to an issuer's peers within the industry. CreditTracker highlights significant credit risk estimate trends and large divergence in credit risk estimates, which are then analyzed further by Vanderbilt's corporate team.

The quantitative rankings and screens within CreditTracker highlight significant early warning and opportunity signals that provide a disciplined approach towards credit risk management and focus our investment staff's time and resources in an efficient manner. CreditTracker warehouses this data in one central model that is located on Vanderbilt's server, thereby providing an easy desktop reference guide for all of Vanderbilt's investment professionals. A visual example of a credit profile contained within the CreditTracker model is attached for illustrative purposes.

Vanderbilt Research Team