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The credit premium

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In this section, we review the theory and empirical evidence of the credit premium. The credit premium is the excess return that an investor obtains for holding bonds issued by entities other than governments. A natural starting point for this objective is to discuss the so-called "credit spread puzzle" and different attempts to resolve it.

Main findings

- The spread of BBB-rated (three- to five-year maturity) corporate bonds over Treasuries (the credit spread) averaged 170 basis points p.a. during the period 1997-2003, while the total loss from default for the same bonds averaged 20 basis points p.a. for the same period. Clearly, the credit spread has historically compensated for more than the expected loss from default.

- The credit spread puzzle refers to the observation that structural models such as the one proposed by Merton (1974) have failed to explain the high excess returns received by corporate bondholders historically. Key assumptions of the structural models from which the puzzle arose were time-invariant default probabilities and recovery rates. The puzzle suggests either that the static assumptions of the Merton model may be too restraining or that components other than default and recovery risk affect the credit spreads.

- Broadly, the academic literature can be classified into approaches based on reduced-form models and approaches based on structural models.

- Reduced-form models have attempted through statistical analysis to identify factors, including non-default-related factors, that can account for the observed credit spreads, such as liquidity, tax, equity volatility and interest rate structure.

- Structural models combine economic theory, measurements and identification to quantitatively account for observed credit spreads.

- Recent structural models argue that credit spreads can be accounted for by extending the standard models along the same dimensions that have previously been used to account for the equity premium puzzle. These structural models incorporate time-varying reward-to-volatility ratios and can capture both the level and time-variation of historical spreads. This strand of literature suggests that credit spreads are not primarily driven by credit-specific idiosyncratic risk, but rather by the same common systematic risk factors that drive other security prices like equity.

- The academic literature finds that there is a positive and time-varying credit premium. This premium is typically seen as compensation for two main types of risk: default risk and recovery risk. The former refers to the risk of an issuer defaulting, while the latter is the risk of receiving less than the promised payment if the issuer defaults.

The credit spread puzzle

Normally corporate bonds trade at a higher rate than government bonds. This is what is referred to as the credit spread, which is typically seen as compensation for two main types of risk: default risk and recovery risk. The former refers to the risk of an issuer defaulting, while the latter is the risk of receiving less than the promised payment if the issuer defaults. The spread of BBB-rated (three- to five-year maturity) corporate bonds over Treasuries averaged 170 basis points p.a. during the period 1997-2003, while the total loss from default for the same bonds averaged 20 basis points p.a. for the same period. This illustration, which is given by Amato and Remolona (2003), shows the existence of a significant credit spread which has historically compensated for more than the expected loss from default.

The term "credit spread puzzle" can be traced back to the work done by Huang and Huang (2003). They estimated credit spreads using a range of different traditional structural models and historical company data on leverage, default and recovery. The authors compared the results with historical spreads and found consistent evidence of underestimation in the models. The term "credit spread puzzle" was thus coined. The reason for this puzzle must either be misspecification in the traditional structural models or that additional factors drive the empirically observed credit spreads.

Attempts by academics to explain the historical credit spread have employed different analytical tools. Broadly, this academic literature can be classified into two approaches:

- The reduced-form approach is based on statistical analysis aiming at explaining the spread by suggesting possible explanatory factors in a factor model regression.
- The structural-model approach combines economic theory, measurements and identification to quantitatively account for observed credit spreads.

Findings from reduced-form models

Credit risk models and the desire to resolve the credit spread puzzle have been a frequent theme in empirical research. While credit and recovery risk are considered the principal factors in accounting for credit spreads, several non-default-related factors have been suggested as possible components of the credit spread. One such non-default-related factor is liquidity. This effect reflects the fact that corporate bonds are less actively traded than Treasuries, and thus corporate bond investors are dealing with relatively wider bid-ask spreads for which they are compensated with a liquidity premium.

Houweling, Mentink and Vorst (2005) use a sample of 999 investment-grade bonds in a reduced-form setup and conclude that liquidity risk accounts for a significant portion of credit spreads and that this liquidity premium is time-varying. However, as liquidity effects cannot account for the entire spread, this still leaves a portion of the variation in credit spreads unexplained. A factor representing tax effects is another plausible factor to account for the residual spread. The tax effect comes from the fact that corporate and government bonds are taxed differently in the United States. In particular, government bonds are taxed at a lower rate and thus corporate bond investors require compensation for this disadvantage.

Elton, Gruber, Agrawal and Mann (2001) investigate the explanatory power of the tax factor together with the Fama-French risk factors[1] in a reduced-form regression. The authors conclude that the spread can be explained by the loss from expected defaults, taxes and a systematic risk factor. The size and significance of the tax effect has been debated and Grinblatt (2001) argues that tax-exempt investors like pension funds or international investors would arbitrage away the tax effect.

1 The Fama-French factors are a set of risk factors identified by Fama and French (1993) to help explain asset returns. Five factors are identified: three equity factors and two bond factors. According to Fama and French (1993), the three equity factors can be decomposed into "an overall market factor and factors related to firm size and book-to-market equity", while the bond factors are "related to maturity and default risks".

A study by Driessen (2005) investigates the combined explanatory power of tax and liquidity effects through a regression on a sample of 104 US corporate bonds, and concludes that these factors account for more than half of observed credit spreads. Still, the remainder of the spread continues to be unaccounted for.

A study by Collin-Dufresne, Goldstein and Martin (2001) challenges the view that factors such as default, recovery and liquidity drive credit spreads. The authors employ a reduced-form framework and estimate a regression in order to assess the significance of these factors. Their results suggest that a single market-wide component has been the driving force behind historical spreads. This component is not identified but the authors argue that "monthly credit spread changes are principally driven by local supply/demand shocks that are independent of both credit-risk factors and standard proxies for liquidity." (Collin-Dufresne, Goldstein and Martin, 2001, p. 1).

On the other hand, Boss and Scheicher (2002) claim that interest rate dynamics, liquidity and volatility in stock and debt markets can account for observed credit spreads. They find these results by running an ordinary-least-squares regression on a sample of European market data. The authors confirm their findings from the European markets with similar results from the same analysis carried out on US market data.[2] Much like the study by Collin-Dufresne, Goldstein and Martin (2001), Boss and Scheicher (2002) find a sizeable and unobserved market-wide component.

Campbell and Taksler (2004) is another study that finds that equity volatility can help explain the magnitude and time-variation of historical credit spreads. They employ monthly corporate bond data for the period 1995-1999 within a reduced-form framework. The authors sample the variation of high-frequency stock returns and find that this can account for both short-term movements and long-term trends in credit spreads on investment-grade bonds.

Hibbert, Pavlova, Dandapani and Barber (2009) use a sample of investment-grade and high-yield bonds to examine changes in credit spreads in the US corporate bond market. The authors specify a regression on daily data and argue that systematic bond and equity market factors as well as idiosyncratic equity market factors drive daily variations in credit spreads. In particular the authors find a positive relationship between equity volatility and changes in the credit spread of investment-grade bonds. This relationship is even stronger for high-yield bonds. The authors argue further that decreasing company returns and increasing stock volatility translate into an increase in credit spreads that is larger than what is captured by the traditional credit models. Moreover, the authors find that there exists "an almost contemporaneous inverse relationship between changes in the bond yield spread and the stock return of the issuing firm" (Hibbert, Pavlova, Dandapani and Barber, 2009, p. 1). This has important implications for risk management and asset allocation decisions.

Findings from structural models

The first version of the structural credit risk model, often referred to as the Merton model or asset-value model, was put forward by Merton (1974), who applied the option-pricing theory developed by Black and Scholes (1973) to the modelling of a firm's value. Structural models price debt and equity as contingent claims on firm value and use the evolution of these structural variables to determine the point of default.

Structural models offer an economically intuitive framework for credit risk pricing and have been widely used to analyze corporate bond spreads. Within the framework of the structural model, Huang and Huang (2003) find that credit risk accounts for a smaller portion of the credit spread for investment-grade than for non-investment-grade bonds.

2 The majority of the literature has focused on the US markets for investment-grade and high-yield debt, while less emphasis has been put on the European credit markets. Still, similar results have been found for both the EU and US debt markets, and in particular Boss and Scheicher (2002) and Jong and Driessen (2006) confirm their findings from the EU debt market with similar results from the US markets.

Delianedis and Geske (2001) estimate a structural model in order to assess the spreads for a sample of US corporate bonds for the period 1991-1998. Factors such as default and recovery risk have little explanatory power, while a sizeable unidentified residual together with tax and liquidity effects can account for the majority of credit spreads in their model. The authors make the observation that residual spreads are larger and more volatile for lower-rated corporate bonds. Finally, Delianedis and Geske analyse the characteristics of their residual, and find that this is mainly driven by systematic market risk factors such as equity risk. Amato and Remolona (2003) also find a sizeable portion of credit spreads that cannot be explained within their framework. They claim that this residual should be interpreted as compensation for the risk of unexpected losses which are difficult to diversify away due to significantly negative skewness.

Tang and Yan (2006) study a structural model that incorporates macroeconomic dynamics. Within this framework, consistent asset prices result from an equilibrium that jointly determines the market price of risk and the risk-free rate. The findings of Tang and Yan (2006) suggest that macro factors can account for most of the level and variation in credit spreads over time. The authors conclude that they have managed to find the factors that can account for the sizeable unidentified residual observed by, among others, Collin-Dufresne, Goldstein and Martin (2001).

Chen, Collin-Dufresne and Goldstein (2009) further break the credit spread puzzle into two puzzles: the credit spread level puzzle and the credit spread time-variation puzzle. This refers to the observation that structural models not only fail to generate the average level, but also the volatility, in particular the high degree of default clustering that occurs during recessions.

Recent structural models, like Chen, Collin-Dufresne and Goldstein (2009), argue that credit spreads can be accounted for by extending the standard models, such as the Merton model, along the same dimensions that have previously been used to account for the equity premium puzzle. This is a particularly interesting and relevant question since it might shed some light on the issue of whether credit risk and equity risk are two distinctly different risk factors or whether they are rather two different manifestations of the same fundamental risk factor.

The equity premium puzzle[3] is another well-known puzzle in financial economics which has received much attention during the last couple of decades. Since the puzzle was first stated by Mehra and Prescott (1985), a lot of progress has been made in exploring the puzzle and indentifying the dimensions along which structural models must be extended in order to resolve it.

One critical assumption in the Merton framework is the assumption of constant reward-to-volatility ratios[4]. As noted by Mehra and Prescott, the equity premium puzzle refers to the difficulty of reconciling the smooth, low-growth consumption series with the more volatile, high-growth equity series, and not the equity premium as such. Thus, the equity premium puzzle results from the fact that the standard model gives, via the consumption series, a constant and (too) low reward-to-volatility ratio (Hansen and Jagannathan, 1991).

Hansen and Jagannathan developed a measure to evaluate whether an asset-pricing model can account for observed financial time series. A necessary requirement for passing this measure is that a model-generated reward-to-volatility ratio is greater than a certain lower bound defined by movements of observed time series. The Hansen and Jagannathan bound gives an alternative representation of the equity premium puzzle. It highlights the fact that the standard model from which the equity premium puzzle was defined gives an almost constant and (too) low reward-to-volatility ratio. Hence, in order to account for observed asset-price movement, including the equity premium puzzle, the model's market prices of risks (discount factor) must be highly volatile. The Hansen and Jagannathan bound evaluates whether a model meets this requirement, or, more specifically, whether the reward-to-

3 The equity premium puzzle is based on comparison of time series for aggregate consumption and equity returns. In order to reconcile these two series and account for why individuals on the margin will be indifferent between their observed consumption process and a consumption process with higher growth and higher variance resulting in a higher equity share, their aversion to consumption fluctuations must be implausibly high.

4 The reward-to-volatility ratio, also called the Sharpe ratio, is a measure of a risk premium relative to an actual degree of risk, where risk is represented by the standard deviation of the asset return.

volatility ratios generated by the model are large and volatile enough. Two widely cited papers on resolving the equity premium puzzle are Campbell and Cochrane (1999) and Bansal and Yaron (2004). Both methods are based on raising the reward-to-volatility ratio of market prices of risks, satisfying the Hansen-Jagannathan bound.

Employing the same extensions, Chen, Collin-Dufresne and Goldstein (2009) explore to what extent these structural models can also account for the credit spread premium. Their paper is motivated by the fact that at the core of both the equity premium puzzle and the credit spread puzzle are the stochastic properties of the reward-to-volatility ratio. Their logic states that if structural models incorporate strongly time-varying reward-to-volatility ratios (risk premium per unit of risk), and take into account the greater likelihood of default during recessions, they can capture both the level and time-variation of historical spreads.

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