Aggregating default risk information from equity and debt markets: Time-series and cross-sectional implications

Abstract

While default risk has been widely studied in finance, the recent financial crisis makes it important to better understand such risk. This thesis empirically investigates a measure of credit risk - the ratio of the risk-neutral probability of default (RNPD) to the actual probability of default (APD) of a bond – that has so far been insufficiently researched.

In Chapter 2 of this thesis, we empirically construct the RNPD/APD ratio for 721 U.S. firms every month over the 1998-2011 time period. The RNPD of a bond is proxied by its yield spread divided by its loss given default, as is standard. Merton (1974)'s model for pricing risky debt, as implemented by Vassalou and Xing (2004) and Bharath and Shumway (2008), is used along with stock price data to measure APDs. Thus, a simple interpretation of an RNPD/APD ratio is that it captures the bond market's view, relative to that of the stock market, of a bond's default prospects. The cross-sectional mean of these ratios across firms is termed the "aggregate ratio", which we interpret as a measure of the market price of default risk. (The "aggregate APD" and "aggregate RNPD" are defined analogously).

Our motivation is based on Hull, Predescu and White (2005) who show that highrated corporate bonds typically have larger ratios than low-rated debt. This pattern is consistent with asset pricing theory, as Murthy (2011) explains, since a bond's RNPD/APD ratio is proportional to an investor's marginal utility of consumption in the default event. Thus, a Aarated bond's RNPD/APD ratio would exceed that of a B-rated bond since default of the former is more likely to be due to bad macroeconomic conditions (when marginal utility is higher than average) relative to default of the latter which is more likely due to idiosyncratic reasons. This suggests the intuition that increases in the aggregate ratio signal future bad macro times and consistent with this, Chapter 2 presents time series plots that show that that the aggregate ratio leads the aggregate APD, aggregate RNI and S&P 500.[1]

Chapter 3 shows that the aggregate ratio distinguishes current good times from bad times. Defining high (low) ratio credit event months according to whether the aggregate ratio is abnormally high (low), we find that the high (low) ratio credit events are bad (good) news for investment and non-investment grade bond returns, and S&P 500 returns. Similar characterizations of credit events based on aggregate RNPDs and aggregate APDs do not distinguish poor asset return states from good ones. More robust regression analysis supports the preceding t-tests.

Chapter 4 conducts formal time-series tests of the predictive power of the aggregate ratio. We show that the aggregate ratio predicts levels, and growth rates, of aggregate distress risk measured as the aggregate APD, at forecast horizons of 3 to 18 months, in the presence of macroeconomic control variables. Thirdly, we show that the aggregate ratio predicts innovations in the aggregate APD series derived from an autoregressive model. These results are consistent to those of Gilchrist and Zakrajsek (2012) who show that future economic activity can be forecasted by a new credit spread index they construct, and also show that is significantly due to a risk premium component in spreads that is comparable to our aggregate ratio measure. We next use quantile regressions to show that the predictive power of the aggregate ratio is higher for the right extreme tails, relative to the other quantiles, of the aggregate APD

[1] Our academic study of the ratio is also of timely relevance to real-world traders and portfolio managers. A prominent credit risk data vendor, Kamakura, has recently begun attempts to popularize the use of a "rewardtorisk" measure which is close to our RNPD/APD ratio.

distribution. We also establish that the aggregate ratio Granger-causes the aggregate APD and that reverse causality does not hold. Furthermore, the aggregate ratio also significantly predicts average spreads at various forecast horizons.

An RNPD/APD ratio can also be interpreted as the sensitivity of a bond's yield spread to changes in its APD. If likely changes in APD (total default risk) were the same across all bonds, then one could conclude that bonds with the largest ratios may have the greatest systematic risk. This may also imply that equity in the high ratio firms is riskier than that in low ratio firms. While the distribution of possible changes in APD is unlikely to be the same across all bonds, and risks other than default may matter to pricing equities, based on the preceding intuition we go on in Chapter 5 to investigate if ratios play a role in the crosssection of equity returns.

When the full sample of firms is used, we find that portfolios of stocks with high ratios have an insignificant relation with returns. But firms in the top 10^{th} percentile of the APD distribution (highly distressed firms) may be very different from others. Their equity returns may be more affected by corporate finance phenomena (e.g. takeovers) rather than asset pricing implications of diversified investors' portfolio decisions. We find that 72% of firm-months in the $90\text{-}100^{th}$ percentiles of the APD distribution also had M&A activities during the same month or the previous month. Further support for treating the most distressed firms differently comes from Moody's KMV's truncation (from above) of default probabilities at 20%.[2] We therefore separately examine a sub-sample of firms whose APDs are in the $0\text{-}90^{th}$ percentiles, and obtain a positive relation between firms' RNPD/APD ratios and their stock returns.

In conclusion, this thesis shows that ratios of risk-neutral to actual probabilities, obtained by combining bond and stock market information, have useful empirical implications in the context of predicting future distress conditions and in the context of understanding the variation in equity returns.

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[2] Moody's KMV is a division of Moody's which markets Merton (1974)-style APDs which they term "expected default frequencies" or EDFs.