CreditRisk+: Extension and Application

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Summary. The CreditRisk+ [CSFP, 1997] methodology, attractive in its analytic tractability and small data requirement, has limited application because of its sector independency assumption. Attempts have been dedicated to relax this impractical assumption but none of them seems to have reached the goal. This paper proposes a simple way of extending the original model so as to accomodate sector correlation. Our model is flexible enough to cover various covariance structures. One advantage of the approach is that existing numerical algorithms designed for the classical CreditRisk+ model can be reused with little modification.

A simulation technique for the CreditRisk+ model, introduced in [Glasserman, 2003], is also applicable to our model. Then, using the simulated losses as input, we can find an optimal portfolio allocation by minimizing conditional Value-at-Risk (CVaR) as proposed in [Andersson *et al.*, 2001].

Case study shows that our model outperforms other CreditRisk+ variants which allows sector dependency. Simulation error is very small compared to analytic results and the optimization significantly reduces portfolio credit risk.

Keywords: *CreditRisk+, Sector correlation, Simulation, Importance Sampling, Conditional Value-at-Risk, Optimization.*

1 CreditRisk+ for Correlated Sectors

CreditRisk+ model, since its debut in 1997 [CSFP, 1997], has received great attention from the financial industry and improvements have been proposed in the literature. [Gundlach and Lehrbass, 2003] is a good reference to review recent issues.

CreditRisk+ models probability of default as a linear combination of gamma-distributed risk factors, referred to as sectors. So the probability of default, p_i^s, conditional on sectors has the form

$$p_i^s = p_i \left(w_{0i} + \sum_{k=1}^{K} w_{ki} S_k \right)$$