An analysis of credit risk financial indicators

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Abstract

The recent financial crisis has highlighted the importance of one of the main components of the financial risk: the credit risk. Of particular interest in finance has become the modeling of credit risk for measuring portfolio risk and for pricing securities exposed to credit risk, as defaultable bonds and credit derivatives.

In this thesis we focus on modeling the aggregated risk of a portfolio, and on studying the relationship between default risk and yield rates for defaultable bonds. In particular we analyze financial indicators of the default risk of a portfolio of credit risky assets and of a bond.

In the first chapter we develop a dynamic multivariate default model by using a stochastic time change to introduce dependence in a portfolio of credit risky assets. We model default times as random variables with possibly different marginal distributions. By restricting the time change to suitable Lévy subordinators the dependence structure and the marginal default probabilities can be separated and the related survival copula of all default times can be computed. In particular we define a cumulative dynamic hazard process and we model it as a Lévy subordinator, which allows for jumps and induces positive probabilities of joint default. The dependence structure is related to the choice of the subordinator and three different subordinators are considered. We allow the main asset classes in the portfolio to have different cumulative default probabilities and corresponding different cumulative hazard processes. Under this heterogeneous assumption we compute the portfolio loss distribution in a closed form, and we prove an approximation of such loss distribution. By using this approximation we calibrate the model to the tranches of the iTraxx Europe. Once the multivariate default distribution is estimated, we analyze the distress dependence in the portfolio by computing indicators of systemic risk as the Stability Index, the Distress Dependence Matrix and the Probability of Cascade Effects.

In the second chapter we study the relationship between the risk of default and the yield-to-maturity of a bond. We show that the yield rate is influenced not only by the default probability and the recovery rate, but also by the residual life of the bond and the coupon rate. In particular,

we show that the yield term structure, for a given default risk rate, can be either upward sloping or downward sloping depending on the value of the coupon rate. Consequently, the yield rate must be interpreted cautiously as an indicator of the bond default risk. In this chapter we study financial indicators that could be used in presence of credit risk to properly evaluate the relationship between the defaultable bond yield and its default probability.