Bayesian Networks for Modeling and Assessment of Credit Concentration Risks

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Credit concentration risk modeling and assessment have become increasingly important issues for financial institutions. The destructive power of credit concentrations essentially depends on the amount of correlation among borrowers. Until recently, however, borrower companies correlation and concentration of risk exposures have been difficult for the banking industry to measure in an objective way as they are riddled with uncertainty. As a result, banks do not manage to make a quantitative link to the correlation driving risks and fail to prevent concentrations from accumulating. In this research, we explore the Bayesin network (BN) methodology, a very promising modeling technique that provides a unified framework for representing, quantifying and managing the uncertain knowlegde in concentration of credits risk exposures. We focus on the data from a private midsized bank and set a BN based framework for improving credit risk assessment.

The contribution of our paper is twofold. Firts, is advocates a BN modeling approach to the study of credit risk concentration in which a specific role for related borrowers is required. With this approach we can incorporate expert-based initial beliefs regarding the risk exposure of a group of related borrowers and then update these beliefs through the whole graph structure with new information as it is learned. Second, it explores a special graph structure, a tree-augmented BN, which allows for better understanding of the credit risk accumulating due to interaction between the borrowers, formal properties of the posterior credit risk and applications of the BN based risk model for decision-making process.

In addition, we examine two different approaches for the model assessment, both of which are based on the mutual information measure. The first one is simpler and adopts the threshold-based approach to the average mutual information where the averaging is performed over all possible graph edges. The second one is some what more complex and is based on the bootstrap-based technique for approximating the distribution of the average mutual information.