Reducing Estimation Risk Using Bayesian Approach: Application to Stress Testing Mortgage Loan Default

Zheqi Wang, Jonathan Crook, Galina Andreeva

Abstract

We propose a new stress testing method to reduce estimation risk by using Bayesian approach. We model stress coming from both macroeconomic shocks and coefficient uncertainty. Based on the U.S. mortgage loan data, we model probability of default at account level using discrete time hazard analysis. We employ both frequentist and non-informative Bayesian methods in parameter estimation and default rate stress testing. The Bayesian method is employed in order to simulate the posterior distribution of the model parameters. The parameter posterior distribution obtained in the Bayesian approach is subsequently applied in stress testing to form the Bayesian simulated default rate (DR) distribution to reduce the estimation risk coming from using point estimates in stress testing. The Bayesian simulated DR distribution is compared with the frequentist simulated DR distribution which uses parameter mean estimates. We find that the simulated DR distribution obtained using the Bayesian approach with parameter posterior distribution has larger variance than that using the frequentist approach with parameter mean estimates. Moreover, the 95% and 99% value at risk (VaR) of the estimated DR using the Bayesian approach is higher than the VaR of the same probability levels using the frequentist approach.

Keywords: Stress testing, Estimation risk, Bayesian simulation, Survival analysis, Probability of default, Mortgage loan