Discrimination-free pricing in motor insurance

Qi Lin[*]

September 2023

Abstract

The main objective of this thesis is to analyze the effects of discriminationfree pricing (DFP) on avoiding direct and indirect discrimination in insurance with respect to gender. This is done by comparing the DFPs to standard insurance prices that both include and exclude gender as a covariate. Using a French motor thirdparty liability insurance dataset, we explore two methods: Generalized Additive Models (GAM) and Gradient Boosting Machines (GBM), to build a model for claim frequency. A grid search with 10-fold cross-validation selects the optimal parameters of GBMs. Generalized cross-validation is adapted to find smoothing parameters for the GAMs. We evaluate the predictive performance of the models using concentration curves, Root Mean Square Error (RMSE) and deviance loss. The DFPs are also compared to the standard insurance prices w.r.t partial dependence plots (PDPs) and a certain type of coefficient of determination. We investigate the impact of nondiscriminatory pricing based on the GAM and GBM models that include gender as a discriminatory variable. In the analyses, we find DFPs lie closer to unawareness prices for GBM than GAM. The best-estimate prices have the best predictive performance. Differences in DFPs compared to the best-estimate prices are less for GBM than GAM.

---

[*]Postal address: Mathematical Statistics, Stockholm University, SE-106 91, Sweden. E-mail: levxy@hotmail.com. Supervisor: Mathias Lindholm.