Exploring Policyholder Behavior in the Extreme Tail

A Process of Modeling and Discovery with Extreme Value Theory

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ABSTRACT

Policyholder behavior risk should be treated as a long-term strategic risk not only because its trend emerges slowly and its impact can only be recognized far in the future. More importantly, failing to recognize a change in trend can lead to inadequate capitalization or missed opportunities of strategic importance. Actuaries and risk officers have an obligation to employ more forward-looking techniques to better understand and mitigate this risk. This paper demonstrates that extreme value theory (EVT) can be used as such a tool to model policyholder behavior in the extreme tail, an area where judgment has been constantly applied. EVT is a mathematical theory that explores the relationship of random variables in the extremes. It is capable of predicting behavior in the extremes based on data in the not-so-extreme portions of the distribution. This paper applies EVT to the study of variable annuity dynamic lapse behavior in the extreme tail. It illustrates a process whereby a company can fully model policyholder behavior, including the extreme tail, with existing data. No judgment about the extremal behavior is necessary. To this end, a variety of copulas are fitted to find the best model that describes the extremal dependency between in the moneyness (ITM) and lapse rate. The actual data combined with data simulated by the model in the extreme tail is then used to fit a dynamic lapse formula that displays different characteristics compared to the traditional methods.

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