On a Generalization of the Expected Discounted Penalty Function to Include Deficits at and Beyond Ruin

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April 1, 2015

Abstract

In this paper we propose an extended concept of the expected discounted penalty function (EDPF) that takes into account new ruin-related random variables. In the well-known EDPF introduced in seminal papers by Gerber and Shiu (1997, 1998) and Gerber and Landry (1998), we consider the expectation of a sequence of discounted penalty functions (ESDPF) of new record minima reached by a claim of the risk process after ruin (and before recovery). Inspired by results of Huzak *et al.* (2004) and developments in fluctuation theory for spectrally negative Lévy processes, we provide a characterization for this extended EDPF in a setting involving a cumulative claims modelled by a subordinator, and Brownian perturbation. We illustrate how the extended EDPF can be used to compute the expected discounted value of capital injections (EDVCI) for the Brownian perturbed risk model.

Keywords: ruin, spectrally negative Lévy process, scale function, Gerber-Shiu function, Laplace transform, capital injections.

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