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Background Risk Models: Theory and Applications

Let the coordinates of the non-negative $m(\in \mathbf{N})$-variate r.v. $\mathbf{Y} = (Y_1 \ldots, Y_m)'$ be interpreted as possibly dependent risk factors (r.f.'s), and denote by $\mathbf{X} = (X_1, \ldots, X_n)'$ risk portfolio (r.p.), whose risk components X_i are exposed to (sub)sets $\mathcal{S}_i \subseteq \{1, \ldots, m\},\ i = 1, \ldots, n$ of the r.f.'s $Y_j,\ j = 1, \ldots, m$. Let $\mathcal{Y}$ and $\mathcal{X}$ be collections of the r.f.'s and the r.p.'s, respectively. I will discuss maps $T : \mathcal{Y} \to \mathcal{X}$ and hence r.p.'s $X = T(Y)$ that yield additive and multiplicative background risk models. More specifically, I will examine connections between the two, derive the underlying dependencies formally and explore the implications, state characteristic results and touch on some well-known special cases, formulate admissible classes of distributions of the r.f.'s. I will conclude with a number of applications to actuarial pricing and risk measurement.