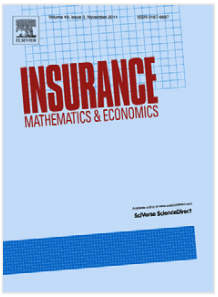

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Computing best bounds for nonlinear risk measures with partial information

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Abstract

Extreme events occur rarely, but these are often the circumstance where an insurance coverage is demanded. Given the first, say, n moments of the risk(s) of the events, one is able to compute or approximate the tight bounds for a risk measures in the form of $\mathbb{E}(\psi(x))$ through semidefinite programmings (SDP), via distributional robust optimization formulations. Existing results in the literature have already demonstrated the power of this technique when $\psi(x)$ is linear or piecewise linear. In this paper, we extend the technique in the case where $\psi(x)$ is a polynomial or fractional polynomial.

Keywords: moment bounds, semidefinite programming (SDP), robust optimization, worst-case scenario, nonlinear risk, risk management

MSC: 60E05, 62P05, 90C22

1. Introduction

1.1. Motivation

Without knowing the distribution of a random variable x, is it possible to estimate the expectation of the variable $\psi(x)$? As we shall see later, such problems are pervasive in risk management and financial engineering. To a lesser extent, we are interested in a confidence interval $[a, b]$ where $\mathbb{E}[\psi(x)] \in [a, b]$. In case $\mathbb{E}[\psi(x)]$ refers to a risk measure, we raise a particular concern on its (worst) upper bound. If some partial information of x is available, say its moment(s), then we show in this paper that it is possible to compute such a 100% confidence interval.

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