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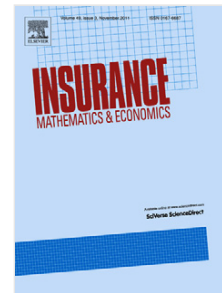
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# Computing best bounds for nonlinear risk measures with partial information

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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

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## 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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