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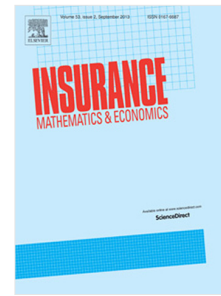
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Conditional expectiles, time consistency and mixture convexity properties

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Abstract

We study conditional expectiles, defined as a natural generalisation of conditional expectations by means of the minimisation of an asymmetric quadratic loss function. We show that conditional expectiles can be equivalently characterised by a conditional first order condition and we derive their main properties. For possible applications as dynamic risk measures, we discuss their time consistency properties.

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Keywords: Conditional expectiles, dynamic risk measures, mixture concavity, time consistency, sequential consistency, supermartingale property.

1 Introduction

Expectiles have been introduced in the statistical literature by [Newey and Powell \(1987\)](#) as a one parameter family of statistical functionals that includes the mean as a special case. They are defined, for a random variable X in $L^2(\Omega, \mathcal{F}, \mathbb{P})$, by the following minimisation problem:

$$e_\alpha(X) = \operatorname{argmin}_{x \in \mathbb{R}} \mathbb{E} [\alpha(X - x)_+^2 + (1 - \alpha)(X - x)_-^2],$$

where $\alpha \in (0, 1)$ and $x_+ = \max(x, 0)$, $x_- = \max(-x, 0)$. Expectiles have many similarities with the left and right quantiles $q_\alpha^-(X)$ and $q_\alpha^+(X)$, that are defined by the minimisation of an asymmetric piecewise linear function (see e.g. [Koenker, 2005](#)):

$$[q_\alpha^-(X), q_\alpha^+(X)] = \operatorname{argmin}_{x \in \mathbb{R}} \mathbb{E} [\alpha(X - x)_+ + (1 - \alpha)(X - x)_-].$$

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