On the calibration of distortion risk measures to bid-ask prices

We investigate the calibration of a non-linear pricing model to quoted bid-ask prices and show the existence of a solution in a broad class of distortion risk measures, following the frameworks of [Cherny and Madan 2010] and [Bannör and Scherer 2011a]. We present an approximation of distortion risk measures by a piecewise linear approximation of concave distortions. This is used to construct a tractable non-parametric calibration procedure to bid-ask prices based on piecewise linear concave distortion functions. For an empirical proof of concept, we calibrate quoted bid-ask prices non-parametrically and w.r.t. parametric families and obtain a jump-linear structure. To conclude, we suggest using the parametric family of esssup-expectation convex combinations as a suitable family of distortion functions, allowing for fast and efficient calibration.