Summary: In this paper we present results on dynamic multivariate scalar risk measures, which arise in markets with transaction costs and systemic risk. Dual representations of such risk measures are presented. These are then used to obtain the main results of this paper on time consistency; namely, an equivalent recursive formulation of multivariate scalar risk measures to multiportfolio time consistency. We are motivated to study time consistency of multivariate scalar risk measures as the superhedging risk measure in markets with transaction costs (with a single eligible asset) (Jouini and Kallal (1995), Löhne and Rudloff (2014), Roux and Zastawniak (2016)) does not satisfy the usual scalar concept of time consistency. In fact, as demonstrated in (Feinstein and Rudloff (2021)), scalar risk measures with the same scalarization weight at all times would not be time consistent in general. The deduced recursive relation for the scalarizations of multiportfolio time consistent set-valued risk measures provided in this paper requires consideration of the entire family of scalarizations. In this way we develop a direct notion of a “moving scalarization” for scalar time consistency that corroborates recent research on scalarizations of dynamic multi-objective problems (Karnam, Ma and Zhang (2017), Kováčová and Rudloff (2021)).

MSC:
91G70 Statistical methods; risk measures
26E25 Set-valued functions
46A20 Duality theory for topological vector spaces
91B30 Risk theory, insurance (MSC2010)

Keywords:
dynamic risk measures; time consistency; set-valued risk measures; scalarizations

Full Text: DOI


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