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Capital requirements with defaultable securities

The adequacy of the capitalization of a financial institution is typically defined in terms of acceptance sets of financial positions. Risk measures are used to determine the minimum amount of capital - the so-called capital requirement - that has to be raised and invested in a portfolio of a prespecified class of tradable assets to make a position acceptable. We allow for general acceptance sets and general positive eligible (or "reference") assets, which include defaultable bonds, options, or limited liability assets. Since the payoff of these assets is not bounded away from zero the resulting capital requirements cannot be transformed into cash-invariant risk measures by a simple change of numeraire. However, extending the range of eligible assets is important because, as exemplified by the recent financial crisis, the existence of default-free securities may not be a realistic assumption to make. We study finiteness and continuity properties of capital requirements in this general context. We show how to reduce risk measures with respect to multiple eligible assets to the risk measures with respect to a single eligible asset by properly enlarging the acceptance set. Risk measures with respect to multiple eligible assets are shown to be non-trivial when no acceptability arbitrage is possible, i.e. when not every position can be made acceptable by adding a zero-cost portfolio of eligible assets. We derive a theorem on the structure of closed convex acceptance sets based solely on the external characterization of general closed convex sets. A distinguishing feature of our approach is that convex risk measures are represented as the supreme of an objective function that depends exclusively on the acceptance set, where the supremum is taken over a set that varies with the choice of the class of eligible assets. We apply our results to capital requirements based on Value-at-Risk and Tail-Value-at-Risk acceptability, the two most important acceptability criteria in practice.

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