# Cyber risk prevention under risk averse spectral criteria

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**Abstract**

This work introduces a model for the prevention and mitigation of cyber risks in networked systems using a risk-averse approach based on spectral criteria. An initial graph is subject to external cyber attacks, modeled by a Susceptible-Infected-Susceptible (SIS) Markov process with controlled infection and recovery rates. We consider the problem of minimizing the risk associated with the evolving structure of the network by employing self-protection and self-insurance efforts, as well as purchasing insurance coverage. We introduce spectral criteria—dependent on the eigenvalues of the graph Laplacian at final time $T$—for which we establish monotonicity in the sense of first-order stochastic dominance and continuity with respect to the Wasserstein distance. This framework enables us to prove the existence of minimizers for two general optimization problems under consideration: the cases of global and local self-protection. We illustrate our theoretical findings by numerical simulations.

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