

Pollution Regulation for Electricity generators in a transmission network

Alejandro Jofré

Universidad de Chile

In this paper, we study a pollution regulation problem in an electricity market with a network structure. The market is governed by an independent system operator (ISO) that aims to reduce the pollutant emissions of energy providers within the network by promoting the use of cleaner technologies. The problem of the ISO is formulated as a contracting problem involving each of the providers, who interact with one another by playing a stochastic differential game. The actions of the providers are not observable by the ISO, which faces the moral hazard. By using the dynamic programming approach, we represent the value function of the ISO as the unique viscosity solution to the corresponding Hamilton–Jacobi–Bellman equation. We prove that this solution is smooth and characterize the optimal controls for the ISO. Numerical solutions to the problem are presented and discussed. We also consider a simpler problem for the ISO, with constant production levels, that can be solved explicitly in a particular setting.

In Special Session 61 on Recent Advances in Mathematical Finance and Related Fields at the Mathematical Congress of the Americas 2025.