Mean Field Games and Systemic Risk

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Abstract

Due to the recent financial crisis, systemic risk is becoming a central research topic. In this study, we propose a simple model of inter-bank borrowing and lending where the evolution of the log-monetary reserves of N banks is described by a system of diffusion processes coupled through their drifts in such a way that stability of the system depends on the rate of inter-bank borrowing and lending. Systemic risk is characterized by the non-negligible probability of a large number of defaults. In order to study the behavior of this coupled system, we discuss the comparison of the coupled diffusions not only coupled through the drift and non-drift but correlated through Brownian motions. In addition, we introduce a game feature in the lending and borrowing system where each bank controls its own rate of borrowing from or lending to the central bank under a quadratic cost. The optimization reflects the desire of each bank to borrow from the central bank when its monetary reserve falls below a critical level or lend if it rises above this critical level which is chosen here as the average monetary reserve. The equilibria with finitely many players are solved explicitly and the financial implication is that the central bank acts as a clearing house, adding liquidity to the system without affecting its systemic risk. We also study the corresponding Mean Field Game in the limit of large number of banks in the presence of a common noise.