"Solving Dynamic Stochastic Competitive General Equilibrium Models"

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The Scarf algorithm was the first almost surely convergent method for computing general equilibrium of competitive models. The current focus of much computational research is computing equilibrium of dynamic stochastic models. While many of these models are examples of Arrow-Debreu equilibria, Scarf's algorithm and subsequent homotopy methods cannot be applied directly since these models involve an infinite number of commodities. Many methods have been proposed to solve dynamic equilibria and work well on simple dynamic models. However, they may not converge and are not likely to perform well in models with heterogeneous agents, multiple goods, joint production, and other features often present in general equilibrium models. This paper presents methods which combine convergent methods for solving finite systems of equations with convergent dynamic programming methods to produce algorithms which will be almost surely convergent. We use the Negishi approach for solving dynamic stochastic competitive general equilibrium. For each instance of Negishi weights over a finite number of agents (or agent types) we solve a dynamic programming problem. This task presents difficulties since many dynamic programming methods have convergence problems. We handle convergence problems with shape-preserving approximations of value functions and asymptotically valid approximations. The solutions to the dynamic programming problems imply a price process and a consumption process for each agent. Equilibrium requires that the value of the endowments equals the value of consumption plans. We use convergent methods to solve for a set of Negishi weights which satisfy these equilibrium conditions. Combining reliable methods for solving dynamic programming problems with reliable methods for solving nonlinear equations produces convergent methods for dynamic competitive equilibria.