Recursion

The strategic and extensive forms are ideal representations for understanding the structure of games, and for explaining principles used to solve them. However they are cumbersome for defining and solving more complex games. The explains why most games played for entertainment or as competitive sport do not use either representation to define the rules. The next two chapters depart from using the strategic and extensive forms to analyze games that have elements of repetition, or more generally recursion.

Chapter 13 introduces Markov games. Finite Markov games are defined by a finite number of stages linked together through probability transitions that determine both the order and the frequency for playing the stages. Players can affect which stage will be played next if and only if their choices affect the probability distribution that determines which stage will follow the current one.

In Chapter 13 we analyze examples of games where a player's choices does affect both his current payoffs and the probability transition matrix. They all seem to be investment issues: Providing high quality service is good advertising; practising conservation helps maintain renewable resources; larger research budgets improve the odds of winning a patent race and capturing the ensuing rents from licensing the technology; research and development expenditure leads to new products; military prowess bolsters defence and opens up possibilities for profitable territorial conquest; incurring enter costs is the price of becoming an incumbent firm; increasing plant capacity enlarges market share potential. The investment chapter gives some guidance how to solve these dynamic optimization problems. However the strategic elements introduced by the existence of rivals and self interested partners confounds the incentives of players, and complicates and the solution to the game.

Stage games, by definition, limit the role that choices have in determining future play. In a finite stage game the probability transitions are exogenous. This narrows the scope of behavioral dynamics, because players cannot influence which stage will be played next, or the number of times a stage will be played, but can only affect what happens within a stage. Although this restriction limits players' opportunities for strategic investment, it helps us to isolate the role of strategy, as opposed to technology, in generating dynamic behavior endogenously. The easiest example of a stage game is a repeated game, where the same game is repeated a finite or an infinite number of times with each subject playing the same role throughout. Thus much of Chapter 14 is devoted to the study of repeated games. We investigate when opportunities for leadership and coordination are likely to arise, and how reputations are created and destroyed.