A Strategic Model of Network Formation with Endogenous Link Strength

May 18, 2018

Basak Horowitz

Abstract

This paper analyzes formation of networks when players choose how much time to invest in other players. As opposed to the distance-based utility weighted link formation game by Bloch and Dutta (2009) in which only the most reliable path is considered, this model assumes the information can be transferred using all possible paths in the network. We study the model under two different link strength functions. First, we assume the link strength is the arithmetic mean of agents' investment levels, i.e., the investments are perfect substitutes. This specification allows players to form links unilaterally to other players. Second, we assume the link strength function is Cobb-Douglas in which players have to have bilateral agreement to form links with each other. We show that, when the investments are perfect substitutes, every player is connected to another either directly or indirectly with no more than two links under any Nash equilibrium. Moreover, we find that the strict Nash equilibrium structure is a star network. On the other hand, using the Cobb-Douglas link strength function, we show that paired networks in which players are matched in pairs, are Nash equilibria. However, we also

consider a sequential game in which players choose and announce their investments publicly according to a random ordering. We show that an Assortative Pair Equilibrium, in which players are assortatively matched in pairs according to their information levels, is the subgame perfect equilibrium of the sequential game for all possible orderings of the players. Therefore, we conclude that the Assortative Pair Equilibrium is the only strongly robust Nash equilibrium. Lastly, we find that, for both link strength functions, Nash equilibria may not be strongly efficient.

JEL Codes: D85, C72

Keywords: network formation, communication networks, endogenous link strength