The Radical Complexity of Rewiring Production Networks

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Abstract

This paper questions the dynamic stability of production networks. We investigate a generic rewiring process through which firms change suppliers to reduce costs, within a classical Cobb-Douglas production network model. The resulting systems exhibit extremely vast sets of path-dependent, locally stable configurations where firms have no interest in changing suppliers. Following a shock, they undergo cascades of rewirings and reach new stable configurations. However, the duration of these cascades quickly increases with network size, suggesting that in real networks composed of millions of firms, locally stable configurations are unlikely to ever be reached. Additionally, when firms have limited visibility into their supply chain, networks do not stabilize and continue to change indefinitely. In contrast, increased visibility stabilizes the rewiring dynamics and helps firms reduce costs. Our results align with the well-known combinatorial problems characterized by rugged dynamical landscapes. Due to such radical complexity, the assumption that real production networks are in equilibrium is unwarranted.

Keywords: input–output, endogenous network, general equilibrium, rough landscape, path dependency, limited information, rewiring

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