Cascades and Fluctuations in an Economy with an Endogenous Production Network[*]

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Abstract

This paper studies an economy in which the production network is endogenously determined by the firms' extensive margin of production. Because of the presence of fixed costs, a firm might decide not to produce, thereby severing connections with potential suppliers and customers. Every stable equilibrium in this economy can be characterized as the solution to a social planner's problem. But because of the discrete decisions involved in the formation of the network, standard optimization techniques can take an infeasibly long time to find a solution. To overcome this issue, I propose a novel solution method that involves reshaping the planner's problem. Analytic results and numerical simulations show that the method rapidly finds the planner's solution in a class of economies that were considered particularly challenging. To illustrate how this approach works in practice, I show that a basic calibration of the model can capture how the U.S. production network changes over the business cycle. The calibrated model also features cascades of firm shutdowns that resemble those observed in the data. In addition, I find that the endogenous reorganization of the network leads to substantially smaller variations in aggregate output.

1   Introduction

Production in modern economies involves a complex network of specialized producers, each using inputs from suppliers and providing their own output to downstream production units. In such an environment, the way in which shocks to individual producers aggregate to affect macroeconomic variables depends on the shape of the production network (Acemoglu et al., 2012). But the network itself is also constantly changing in response to these shocks. In the data, a key driver behind these changes is the firms' entry and exit decisions. For instance, in the U.S. a large fraction of all link destructions