In contrast to the classic assumption of i.i.d. shocks, most economic activities in reality are connected and their influences propagate to others through economic networks in an uneven way. This dissertation studies how the connections among economic entities affect each individual firm, industry and city in the production network, and how the difference in production networks affects the performance of the system as a whole.

The first chapter, *A tale of many cities: industrial networks and urban productivity*, examines how changes in urban industrial network structures explain the growth rates of labor productivity in cities. I formulate a multi-sector general equilibrium model with input-output networks of firms within a city and trade across cities. A key input to this framework is an entropy-style city network sparsity index. It serves as a concise summary of urban industrial structures and describes the concentration level of inputs for an average firm in a given city. The major theoretical result is that the improvement of urban industrial structures, indicated by an increase in city network sparsity, leads to an increase in the urban labor productivity growth rate. This is because changes in city network sparsity are results of both city-specific technological shocks and the evolution of the nationwide input-output structure. When these two forces align in a way that increases city network sparsity, production activities in a city become better organized, and its labor productivity grows faster. In MSA-level data from BEA, I verify the theory by showing that changes in network sparsity are positively correlated with a city's productivity growth. In two sets of counterfactuals, I demonstrate how the interaction between technology changes and urban industrial networks determine urban labor productivity. First, I find that the presence of urban industrial networks explains 54.7% of the variance in changes in urban labor productivity caused by local sectoral shocks. Second, I demonstrate that the variance in city network sparsity can explain 45.3% of the variance in growth rates of urban labor productivity caused by shifts in the national I-O structure.

The second chapter, *Industrial Productivity and Urban Human Capital Spillovers*, demonstrates that human capital spillovers in urban industrial networks are important factors to explain the productivity variance in industries across cities. I propose a novel human capital network index to measure the level of spillovers from skilled workforce to the urban environment of an industry. For a target industry, the index achieves high values not only when the city has a large quantity of educated workers, but also when local human capital is concentrated on industries that are economically close to the target industry. The investigation of human capital spillovers' impact on industries also requires the knowledge of city-specific industrial productivity. Therefore I build a general equilibrium model with multiple industries within cities and competitive trade among firms across cities. Then I calibrate the model with the U.S. data to acquire city-specific industrial productivity. With the calibrated industrial productivity and human capital network index data, empirical analysis are done to verify the existence and extent of human capital spillovers in cities.

The empirical results show that there are three factors that decide the influence of urban human capital spillover on the productivity of an industry: 1) the general quantity of educated workforce in the city, 2) the
concentration of human capital in an industry's input-output network, 3) the ability of an industry to absorb the spillover. While the majority of sectors benefit from a more educated urban environment, certain industries experience negative human capital spillover from the rest of the city.

The third chapter, *Credit Risks in Production Network*, explores the empirical evidence that traces credit risk propagation in an inter-sectoral I-O network. The major finding is that after ranking the supplier-industries for a specific target industry based on the weight of input shares from IO tables, the average probability for firms in an industry to default, get delisted and go bankrupt has higher and more significant correlations with more important supplier-industries than with less important supplier-industries. This relationship is robust to controls and both linear and nonlinear specifications of the model.

Our conjecture for the cause of the observed financial contagion through the production network is that risk of firms passes to upstream suppliers through the heavy usage of trade credit. Once customers default or go bankrupt, net worth of suppliers will shrink and therefore the chance for insolvency for upstream firms increase. Moreover, we argue that firms have incentive to rely more on trade credit when purchasing major inputs that counts for a larger share of production costs than buying minor categories of inputs. Therefore, the credit risk contagion should be higher for major supplier-industries than for minors ones.