Analysis of Spillover Effects of Technological Progress from the Perspective of the Integration of Production and Innovation Networks

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Technological progress is the core driver of economic growth, and an in-depth analysis of its spillover effects contributes to the optimal deployment of innovation and industrial chains. Existing studies largely explore technological spillover from the perspective of production networks, breaking the assumption of independent technological progress, but often overlook the diffusion of knowledge and information, lacking sufficient focus on innovation networks. This paper proposes a method for measuring the spillover effects of technological progress under the integration of production and innovation networks. By introducing new meanings to the spillover effect matrix from three dimensionsâ€”elements, row sums, and column sumsâ€”the method provides an intuitive display of the benefits and contributions of each sector in technological progress. It also deepens the understanding of the complex interplay between production and innovation networks into levels that are explainable, decomposable, and measurable. Based on 2.8 million patent citations between enterprises, this paper constructs an innovation network among sectors according to their industrial classification and empirically tests the theoretical model. The findings reveal that: (1) Technological spillover between sectors can be divided into three modes: spillover through the production network, spillover through the innovation network, and spillover through the interaction of both networks. (2) In terms of benefits, the interaction between production and innovation networks contributes significantly more to economic growth across almost all sectors compared to each networkâ€™s individual impact, although the independent contribution of innovation networks still falls short of the scale benefits of production networks. (3) The spillover and amplification effects of technological progress vary across sectors due to differences in production technology, with the digital economy sector identified as crucial for driving the integration of innovation and industrial chains.