Accepted Manuscript

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PII: S0378-4371(18)31194-4
DOI: https://doi.org/10.1016/j.physa.2018.09.062
Reference: PHYSA 20123

To appear in: *Physica A*

Received date : 24 April 2018
Revised date : 22 August 2018

Please cite this article as: X.-j. He, et al., Factors affecting evolution of the interprovincial technology patent trade networks in China based on exponential random graph models, *Physica A* (2018), https://doi.org/10.1016/j.physa.2018.09.062

Factors Affecting Evolution of the Interprovincial Technology Patent Trade Networks in China Based on Exponential Random Graph Models

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Highlights:

- Five China's interprovincial patent trade networks over the period 2012–2016 are established.
- Temporal exponential random graph model is introduced to explore the factors affecting networks evolution.
- 6 of the 10 hypotheses regarding network evolution are supported.
- The pivotal driving factors and inhibitory factors for network evolution are revealed.

Abstract Five China's interprovincial patent trade networks over the period 2012–2016 are established on the basis of patent transfer information collection, transfer entity identification, and regional mapping. Based on the analysis of patent trade trends and the characteristics of the network structure, endogenous structural effects and exogenous factors affecting the evolution of the trade networks are proposed, and exponential random graph models (ERGMs) constructed to select the most parsimonious model. Based on the variables in the most parsimonious model, temporal ERGM is used to determine the factors of trade networks evolution among provinces. The results provide six key factors affecting network evolution over the period 2012–2016, i.e., reciprocity, eastern output effect, intensity of technological R&D, proximity to economic center, and technology openness. Moreover, analysis reveals that the concentration of technology in provinces is the key factor inhibiting evolution, while differences among provinces on economic levels, technology trade experience, the technology receiving of western provinces, and the geographical proximity of provinces exhibit a weak effect on the evolution process. Finally, suggestions to promote interprovincial patent trade are proposed.

Keywords Interprovincial patent trade network (IPTN); Factors affecting evolution; Temporal exponential random graph model

1 Introduction

With the gradual decline in the demographic dividend in China, increased investments in capital, labor, and natural resources cannot maintain the rapid economic growth experienced in past years. Nowadays more than 90% of small and medium-sized enterprises (SMEs) are weak in their ability to promote independent innovation in the industrial transformation and upgrading process in China. Interprovincial production factors and scientific and technological resources are unevenly distributed. To accelerate technological resource allocation, technological development, and innovation efficiency, it has been found that the diffusion of technology among provinces is more important than technical cooperation and knowledge sharing [1,2,3]. Therefore, continued growth in the interprovincial technology trade has become a new driver of regional technological innovation and industrial development that cannot be ignored [4]. Analysis of the spatial network pattern and the factors affecting the evolution of the interprovincial technology trade networks are therefore of profound interest to both academia and industry.

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