

# Structural Evolution and Driving Mechanisms of China's Intercity HSR Connectivity Network

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## Introduction

High-speed rail (HSR) has reshaped the spatial organization of cities in China. It not only improves intercity accessibility but also influences the **flow of knowledge, capital, and innovation**.

In this paper, we ask: *How has the structure of China's intercity HSR connectivity network evolved, and what mechanisms drive its formation?*

As an overview see Figure 1.

## Methods

We adopt a **Temporal Exponential Random Graph Model (TERGM)** to capture the dynamics of intercity connectivity networks, following the formulation(Dai, Derudder, and Liu 2018).

The probability function is given by Eq. Equation 1:

$$P(N^t | N^{t-k}, \dots, N^{t-1}, \theta) = \frac{\exp(\theta^T h(N^t, N^{t-1}, \dots, N^{t-k}))}{c(\theta, N^{t-k}, \dots, N^{t-1})} \quad (1)$$

Where  $P(\cdot)$  is the probability that the network  $N^t$  is observed at time  $t$ ,  $h(\cdot)$  is the vector of network statistics,  $\theta^T$  are the parameters, and  $c(\theta, N^{t-k}, \dots, N^{t-1})$  is the normalizing constant ensuring that all probabilities sum to 1.

Key elements:

- **Data source:** train schedules and travel times (2008–2023)
- **Network construction:** weighted edges based on frequency and shortest travel time
- **Modeling strategy:** node-level, dyad-level, and endogenous structural effects

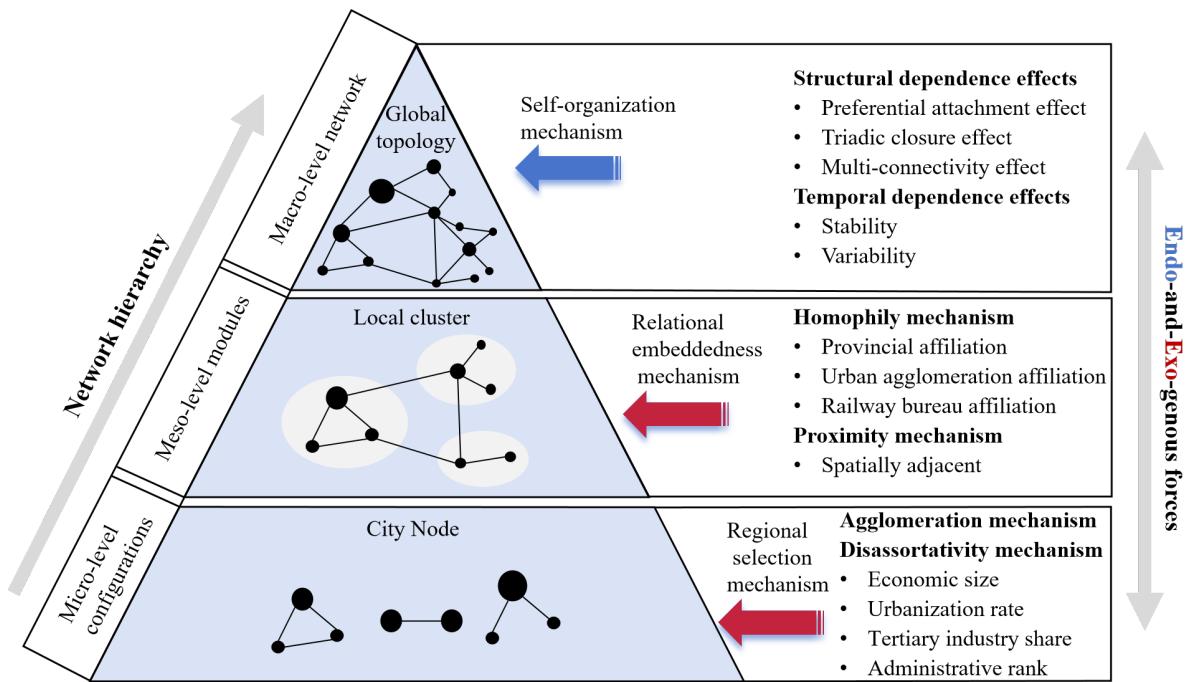
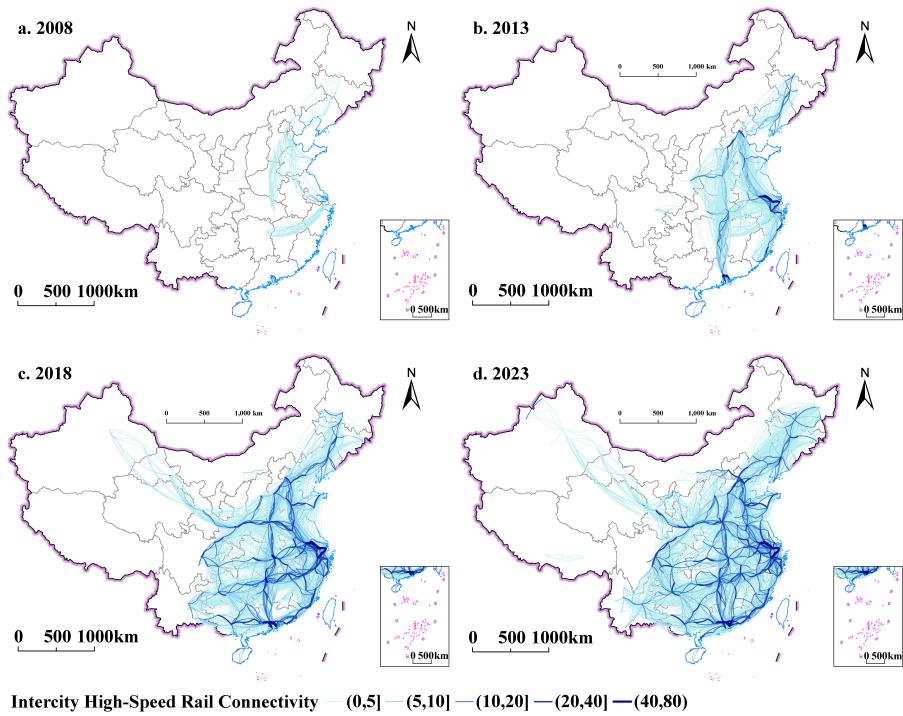


Figure 1: Mechanism diagram

## Result



## References

- Dai, Liang, Ben Derudder, and Xingjian Liu. 2018. "Transport Network Backbone Extraction: A Comparison of Techniques." *Journal of Transport Geography* 69 (May): 271–81. <https://doi.org/10.1016/j.jtrangeo.2018.05.012>.