The Network Structure of the â€œBelt and Roadâ€• Value Chains: Considering Transnational and Chinaâ€™s Inter-Provincial Input-Output Linkages

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The Belt and Road Initiative (BRI), a large-scale international cooperation effort, aims to foster deeper regional integration and extend global value chains (GVCs). With rapid development, over 140 countries and regions have joined this initiative. In order to provide better understanding of the nature and structure change of BRI value chains, various Multi-Regional Input-Output (MRIO) analyses have been conducted. However, the existing MRIO based studies lack clear visualizations of the increasing complexity of BRIâ€™s value chains. Additionally, they often overlook the impact of country size in measuring production networks. For example, China, as the largest developing country with 31 provinces, in which some of these provinces have already surpassed the economic size of more than half of BRI countries in average and now hold key positions in GVCs due to Chinaâ€™s rapid domestic infrastructure development and provincial level policy supporting. Consequently, it becomes crucial to treat Chinese provinces as distinct entities and explore their roles and relationships with other BRI countries through both international and domestic-inter-provincial production linkages.

To analyze the spatiotemporal patterns and network evolution of BRI value chains, this paper pioneers the integration of annual Chinese inter-provincial input-output tables (covering 17 sectors and 30 provinces) into the global MRIO tables (specifically, the ADB MRIO tables) for the years from 2007 to 2021 using the double proportional scale method (RAS method). This newly extended MRIO dataset enables us to establish a systematic analytical framework and apply topological network analysis to reveal the intricate nature of BRI value chains.

Our research findings reveal the following key points:

1) Increased Network Density: Since the inception of the BRI Initiative, there has been a significant rise in network connections between domestic provinces and BRI economies.

2) Central Role of Guangdong and Zhejiang: Guangdong and Zhejiang provinces now occupy central positions within the BRI value chains. Their roles are comparable to those of developed countries like Italy, South Korea, and Russia.

3) Evolution of the European Region: The European region has transitioned from a single-centered network, primarily led by Italy, to a multi-centered network. Provinces such as Yunnan, Chongqing, and Shaanxi have emerged as crucial intermediary hubs, facilitating connections between the East Asian region and China within the BRI value chains.

4) Supply and Demand Hubs: Guangdong province remains the largest supply and demand hub in the electronics manufacturing industryâ€™s division of labor network in the BRI value chains. Simultaneously, Chongqing city has risen as a new supply center, while Shanghai has advanced to become the second major core hub in the service industry network within BRI value chains.

Additionally, we conducted an analysis of the impact of international tariffs and both international and domestic non-tariff barriers, on the BRI value chains. Using a transnational and inter-provincial Gravity model, we found that the construction of Chinaâ€™s unified large market contributes to eliminating domestic transaction costs among provinces, thus significantly promote stronger connections not only between Chinese provinces and BRI countries, but also even the increasing connection across BRI counties via spillover effects.

Our work establishes a robust foundation for diverse innovative research based on input-output analysis and econometric causal studies, taking into account the heterogeneity of domestic-subnational information in the existing country level MRIO frameworks.