

# Re-estimating Total Factor Productivity with Consumption Based Energy Depletion and Carbon Damage: A Time Series Multi-regional Input-output Analysis of China

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Value-added tax (VAT) plays an essential role in the economic development and the performance of government. The horizontal distribution mechanism for VAT is vital for motivations of economic growth and promoting the balanced development of regional economy and equitable access to public services. Currently, China's VAT is allocated among local governments based on the origin principle, which means that the VAT revenue is submitted to the producers' tax authority. However, this approach leads to issues such as tax transfer and exacerbates fiscal disparities between regions. It also causes local governments to prioritize production over consumption, potentially worsening China's overcapacity problem. China's industrial overcapacity causes resource misallocation, environmental degradation, corporate debt risks, and delayed industrial upgrades, undermining sustainable economic growth. Globally, it has triggered significant global trade tensions due to dumping of cheap exports, distorting markets and straining international relations. Some scholars have argued that the destination principle, namely that the VAT revenue is submitted to the consumers' tax authority, can help transfer to a new pattern of coordinated development among regions and avoid over-investment and duplicated construction. Therefore, the research on the shift of the VAT horizontal distribution mechanism and China's industrial overcapacity has great theoretical and policy significance.

This study proposes a new approach to estimate consumption by regions and detailed sectors, taking provincial inflow and outflow and international trade into account. This study uses the time-series China's multi-regional input-output tables, from 2000 to 2017, to calculate the regional and sectoral consumption data. Thus, this study simulates the VAT allocation situations under both the origin principle and the destination principle. This allows for the measurement of the VAT distortion across regions and sectors between two allocation mechanisms.

The findings indicate that: (1) Compared to the destination principle, the origin principle results in significant tax inflows to economically developed eastern regions, while underdeveloped central and western regions, as well as sectors with a large agricultural share, suffer severe tax losses. (2) The distortion in the VAT allocation exacerbates China's overcapacity issue significantly, particularly in state-owned enterprises, large firms, and saturated industries, where rigid structures and policy biases hinder efficient resource reallocation. (3) The distortion in the VAT allocation hinders enterprises' participation in the domestic value chains, increases transaction costs and inter-provincial trade friction, leading to overcapacity and market fragmentation, thereby obstructing the development of the dual circulation strategy.

This study makes the following three main contributions. First, to our knowledge, this study is the first to use the multi-year interprovincial input-output tables to simulate and compare province-industry-level VAT allocations under the origin principle and the destination principle, quantifying systemic interregional VAT distortions. Second, this study is the first to provide the empirical evidence linking VAT distortions to industrial overcapacity, demonstrating how tax-driven incentives for output maximization directly exacerbate resource misallocation. Third, this study uncovers mechanisms exacerbating China's overcapacity issue. The origin principle hinders domestic value chain participation by rewarding local embeddedness over specialization. Meanwhile, the origin principle intensifies interregional trade barriers as provinces prioritize tax retention over comparative advantages. These findings critically inform China's fiscal decentralization reforms and global debates on tax design's unintended industrial

consequences.