

Resource-based Industries and Regional Economic Growth Under Carbon Peaking and Carbon Neutrality Constraints

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Abstract. The article has improved the contrast rate decomposition method, and based on this, it has compiled the 2007 and 2017 non supplementary input-output table of Shanxi Province. After deducting the influence of other provinces, it measures the role of various industries in economic growth. Through comparative analysis with the traditional input-output table, it is found that the role of resource industries in local economic growth has been seriously overestimated.

1 Introduction

Achieving the goal of carbon peaking and carbon neutrality is a major strategic decision made by China based on the responsibility of promoting the construction of a community with a shared future for mankind and the inherent requirements of achieving sustainable development. In the process of striving to achieve the goal in China, the major raw coal producing provinces represented by Inner Mongolia, Shanxi, Shaanxi, Xinjiang, etc. will face the pressure of increasingly stringent policy, capital, market environment and public opinion environment, as well as the huge pressure and pain of structural adjustment and production mode transformation.

At this time, the provinces with large raw coal production also need to make full use of their power to ensure coal supply, and tilt the industrial focus to coal and other resource industries. Even with the development of digital economy, there is still a huge demand for traditional energy. And because of the instability of non renewable energy, non renewable energy can only be used for the non core and non-technical parts of the data center, and the core part still needs to rely on traditional energy to provide power. Many big data centers have settled in regions with abundant resources, requiring stable energy supply in resource regions.

This kind of transition pressure is intertwined with the supply guarantee, the short-term measures deviate from the long-term strategy, and the imbalance and mismatch between the market and the policy bring huge pressure to the industrial transformation and upgrading of resource based regions.

2 Literature Analysis

Abundant natural resource endowments can promote economic growth, and early industrialization can not be

achieved without the role of natural resources. However, the practice of world economic development shows that the economic development of some resource rich regions is not always good, and even slower than that of resource poor regions. This negative correlation between natural resources and economic development is called the "resource curse" phenomenon.

A large number of scholars have discussed the causes of the resource curse from different levels and formed many insightful and policy inspired research results, mainly including: "Dutch disease" effect (Liu et al., 2020) ^[1], crowding out effect (Oduyemi et al., 2021) ^[2], institutional weakening effect (Zhang et al., 2021) ^[3], and deteriorating terms of trade (Shammari & AL Obaid, 2018) ^[4]. The deteriorating terms of trade theory mainly focuses on international trade, and in the process of analysis, it ignores the exchange of products between domestic regions, that is, cross provincial trade. Inter provincial trade is an important support to realize the domestic big cycle, so it is necessary to conduct in-depth research on the role of regional economy. Inter provincial trade has two impacts on the regional economy: (1) Inter provincial trade can ease local economic fluctuations, improve the use efficiency of resource allocation, thereby improving the comparative advantage of China's products, achieving economies of scale (Li et al., 2021) ^[5], reducing production costs, and improving the international competitiveness of the industry. As time goes by, inter provincial trade will continue to increase its contribution to the regional economy (Zhang & Li, 2017) ^[6]. And the role of inter provincial trade in regional economic development will also be increasingly enhanced (Sun, Gao, Xuan, 2018) ^[7]. (2) Widen the regional economic gap. The asymmetry and imbalance of inter provincial trade in terms of outflow and inflow are not conducive to the coordinated development of China's regional economy. The eastern region requires open markets, while the central and western regions require closed markets to enhance their

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domestic economic initiative. The benefits of China's inter-regional trade are mostly obtained by developed regions, while the underdeveloped regions benefit little from such trade, and even suffer damage to varying degrees (Cui&Zhou, 2020) [8].

Taking coal, oil and gas, non-metallic mining and other resource industries as examples, in the input-output analysis method, through the calculation of intermediate input rate and intermediate demand rate, these resource industries are intermediate product based basic industries, which are industries with large intermediate demand rate and small intermediate input rate. That is to say, these industries have low dependence on other industries in the development process. On the contrary, its products are used as intermediate inputs of other industries, resulting in great demand from other industries. For example, during the development of the coal industry, in addition to the local production, the use of intermediate products is more from the purchase of other provinces. In addition, the products produced by the coal industry may also flow out, which has not played a real role in promoting regional economic growth (Xiang & Meng, 2011) [9]. Yu, Gan, Zheng (2011) [10] analyzed the correlation characteristics of 51 industries in China through the static structure decomposition technology of input and output, and found that the coal mining and washing industry is an industry with poor growth, weak correlation, relatively short industrial chain and insignificant correlation characteristics, and has limited effect on regional industrial growth and economic development. Deng & Wang (2014) [11] believed that the impact of the abundance of natural resources on economic growth is negatively related to a country's domestic openness, that is, when a country's domestic economic openness is small, the marginal impact of resource abundance on economic growth is positive, showing a situation of resource dividend; On the contrary, it presents a resource curse. In fact, the "resource curse" is more of a "dependent resource curse" than a "abundant resource curse". For resource-based provinces, the abundance of their resources can promote the rationalization and upgrading of the regional industrial structure, but excessive dependence will have a negative impact. Therefore, resource-based provinces should avoid excessive dependence when using natural resources to avoid falling into the predicament of resource curse.

With China's economy entering the stage of high-quality development and the escalation of Sino US trade frictions, investment and export can no longer effectively promote the high-quality development of China's economy. China has a vast territory, and the division of labor and trade among provinces is enough to support high-quality economic development. However, for resource rich provinces, whether the development of resource-based industries under the dual carbon constraint is a blessing or a curse to regional economic growth, and how much it affects the local economy, is urgent to explore.

3 Preparation of Regional Non Supplementary Input-Output Table

Regional non-supplementary input value input-output table can overcome the traditional supplementary value input-output table can not completely separate local products from local products, which is easy to focus on only on the local industry in the analysis.

There are two common preparation methods: investigation method and non-investigation method. Survey method is also known as direct table compilation method. The key is to design the basic survey table, which is compiled through the basic survey. This method has high requirements for human, material and financial resources. Non-survey method is compiled based on supplementary input regional value input and output table. The total data of the provincial input and inflow are obtained through the data of the supplementary input regional value input and output table, the inflow ratio outside the province is calculated, and then the data of relevant departments in the supplementary input input and output table can be adjusted, so that the impact of the inflow outside the province on the regional economic development can be removed.

The formula for the ratio of provincial inflow in non-survey method is proposed:

$$r_i^g = G_i / (X_i - G_i) \quad (1)$$

r_i^g , Where, indicates the foreign province inflow ratio of the i th product; G_i , indicates the foreign purchase volume, $i=1,2 \dots, n$.

According to this ratio, intermediate input data and final use data in the input-output table. That is, the intermediate input data of ① local products is: $X_{ij}(1-r_i^g)$. Among them, for the intermediate input data of the original supplementary input input-output table, $i, j=1,2 \dots, n$. ② The final usage data for local products are: $Y_{Di}(1-r_i^g)$, $(1-r_i^g)$ and $E_i(1-r_i^g)$. Among them, Y_{Di} , F_i , E_i indicate local final use, sales to foreign and export, respectively, $i, j=1,2 \dots, n$.

However, the above ratio decomposition method will expand the intermediate use in practice, seriously distorting the calculation results. Take the input and output table of Shanxi Province in 2012 as an example, the total output of many industries is very small, and the intermediate use is actually more about inventory consumption. According to the preparation of input-output table, there are three sources of a product in the region: local production, inflow (including import and foreign purchase) and inventory in the previous year; the uses of this product include intermediate use, consumption, fixed asset formation, inventory, outflow (including export and sale to other places). Based on this situation, this paper decomposes the inflow ratio outside the province (r_i^g) into two situations: inventory increase and inventory reduction in the current year. The specific formula and the derivation are as follows:

① increase in stocks:

$$r_i^g = I_i / (X_i + I_i) \quad (2)$$

② inventory liquidating:

$$r_i^g = I_i / (X_i + I_i + S_i) \quad (3)$$

Considering the source of inventory is also the early local production, early inflow (import and foreign purchase), can further decompose its inventory into early local production and early inflow, but the absolute proportion between the two is uncertain, assuming in a certain period, the total production and inflow will not change greatly, the proportion is equivalent to the proportion of production and inflow. From this decomposition, the above formula becomes:

$$r_i^g = (I_i + I_{i-t}) / (X_i + I_i + S_i) \quad (4)$$

Equation (2) to Equation (4), I_i Represents the i product inflow, I_{i-t} Represents the early inflow of i products, X_i Represents the i product output, S_i Represents the i -product inventory reduction.

4 Change in Total Output of Various Industries

The input-output table can be adjusted accordingly according to the adjusted inflow ratio formula outside the province, and then a non supplementary input-output table can be obtained. The input-output table is a balance table that reflects the interrelationship and balanced proportion among various departments in a certain period. It is prepared every five years, and the latest one is the 2017 input-output table. Therefore, this paper analyzes it based on the 2017 input-output table.. In order to facilitate comparative analysis, this paper selects Shanxi Province in 2007 and 2017 as an example for analysis. This can not only avoid the problems discussed at the beginning, but also overcome the lag of the input-output table. Table 1 lists the overestimated total output of various industries in Shanxi Province in 2007 in the presence of inter provincial trade.

Table 1. Changes of the total output of various industries in Shanxi Province in 2007 and 2017

2007		2017	
trade	Total output (total input) is overestimated	trade	Total output (total input) is overestimated
Metal smelting and calendering industry	15309125.82	Transportation and storage industry	46681695.3
Coal mining and washing industry	9287468.58	Coal mining and washing industry	31975408.91
construction business	8597298.85	Metal smelting and calendering industry	21168113.72
Petroleum processing, coking, and nuclear fuel processing industry	4814636.71	Information transmission, computer service and software industry	10629532.46
Production and supply of electricity and heat	4089097.90	Instrument and cultural office machinery manufacturing	10509885.14
chemical industry	3746603.94	Wholesale and Retail	7671218.978
Non-metallic mineral products industry	2736329.81	Gas production and supply industry	6681279.99
General-purpose, special-purpose equipment manufacturing industry	2674566.52	chemical industry	6013340.143
Transportation and storage industry	1916110.90	Agriculture, forestry, animal husbandry and fishery	5934716.44
Agriculture, forestry, animal husbandry and fishery	1563527.44	Electrical machinery and equipment manufacturing	5469069.942

Source: drawn by the author

From the situation in 2007, under the terms of inter provincial trade, the total output of each industry has changed to varying degrees. The total output of the financial industry is the least overestimated, only 368.02, which can be almost ignored; The metal smelting and rolling processing industry has the most high valuation,

reaching 15309125.82, more than 40000 times that of the financial industry, which means that the metal smelting and rolling processing industry actually plays a small role in promoting the local economy. Four of the 10 industries with the highest total output and high valuation belong to the resource industry, which is

followed by coal mining and washing industry, petroleum processing, coking and nuclear fuel processing industry, metal smelting and rolling processing industry, and non-metallic mineral products industry. After deducting the influence outside the province, the average overestimated value of the total output (total input) of each industry is 1621399.44, while the average overestimated value of the total output (total input) of the resource industry is 4403810.47, which is far greater than the average overestimated value of the total output of each industry.

According to the situation in 2017, under the terms of inter provincial trade, the total output of various industries has changed to varying degrees, and the industry with the lowest output overestimation has become the research and experimental development industry, which is 18971.61, and the transportation and warehousing industry is the highest, reaching 46681695.3. Three of the 10 industries with the highest total output valuation involve the resource industry, namely, coal mining and washing, metal smelting and rolling processing, and gas production and supply. After deducting the influence outside the province, the average overestimated value of the total output (total input) of each industry is 4867524.93, while the average overestimated value of the total output (total input) of the resource industry is 6690660.55, which is far greater than the average overestimated value of the total output of each industry.

5 Conclusion

It can be seen that due to the existence of inter provincial trade, the total output of some industries has been overestimated, especially the resource industry: on the one hand, primary products represented by coal resources have provided resource guarantee for the economic development of other provinces through external transfer; on the other hand, in the development of local resource industries, some intermediate inputs have been realized through the use of intermediate products transferred from other provinces. This pattern of inter provincial trade has further promoted the growth of Shanxi's resource industry, while other industries have gradually shrunk, relying more on the inflow from outside the province. Therefore, this paper believes that under the existence of inter provincial trade, the role of the resource industry in the national economy of Shanxi Province has been overestimated, which means that the development of the resource industry has a limited role in the regional economic growth.

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