The Dynamic Relationship between Trade Opening and China's Industrial Transformation and Upgrading -- PVAR Analysis Based on Inter provincial Panel Data

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Abstract: Based on the provincial panel data of China from 2003 to 2020, this paper uses the PVAR model to empirically study the dynamic relationship between trade openness and industrial transformation and upgrading in China and the eastern, central and western regions. The research finds that: at the national level, the negative impact of trade opening on industrial transformation and upgrading is dominant; The industrial transformation and upgrading have promoted the trade opening in the short term, but the long-term impact is inconsistent.

Keywords: open trade; Industrial transformation and upgrading; Dynamic relationship; PVAR model

1. Introduction

Since the reform and opening up, China has vigorously developed foreign trade, effectively promoting the development of the national economy. In 2020, China's total import and export of goods will be 4.65 trillion US dollars, ranking first in the world. At the same time, China's industrial development has also made remarkable achievements. After the industrial added value exceeded 30 trillion yuan in 2018, the industrial added value in 2020 will exceed 37 trillion yuan, ranking the first manufacturing country in the world. Especially in recent years, with the comprehensive innovation of the concept of economic development, the strengthening of resource and environmental constraints, and the increasingly fierce international competition, the pace of China's industrial transformation and upgrading, quality and efficiency improvement has been accelerating. Then a realistic question worth further exploring is, in the process of China's expanding opening up and participating in economic globalization, what is the relationship between trade openness and industrial transformation and upgrading? Does trade opening promote China's industrial transformation and upgrading? Does industrial transformation and upgrading have a feedback role in promoting trade openness? Answering the above questions has important theoretical and practical significance for accurately evaluating the interaction between the two, formulating targeted trade policies and industrial policies accordingly, and taking advantage of the momentum to accelerate the high-quality development of China's industrial economy.

2. Research Design

2.1 Variable selection

This paper mainly examines the dynamic relationship between trade openness and industrial transformation and upgrading, involving two variables: trade openness (Open) and industrial transformation and upgrading level (Ind):

(1) Open. Drawing on the practices of Cai Haiya, Xu Yingzhi, Ma Shuqin, etc. [8], this paper uses the ratio of the total import and export of goods of each province to GDP to measure the openness of trade.

(2) Industrial transformation and upgrading level (Ind.). On the basis of existing research, this paper establishes an indicator system to measure the industrial transformation and upgrading level of each province (district, city) from four aspects: innovation driven, green development, structural optimization, and benefit improvement. Among them, innovation drive mainly sets evaluation indicators from two aspects of innovation factor input and innovation drive performance; Green development mainly sets evaluation indicators from three aspects: reduction of production energy consumption, reduction of pollution emissions and changes in fossil energy consumption; The structure optimization mainly sets up evaluation indicators from the two aspects of industrial structure upgrading and development vitality; The benefit improvement mainly sets evaluation indicators from two aspects of production efficiency and economic benefits. In order to eliminate the influence of different dimensions, the range method is used to standardize the data. In terms of index weight determination, CRITIC method is used for objective combination weighting.

2.2 Data source

In view of the availability of data, this paper selects 30 provinces (autonomous regions and municipalities) in China from 2003 to 2020 as the objects of investigation, without considering the Tibet Autonomous Region and Hong Kong, Macao and Taiwan regions with more missing data. For some variables with missing data, we use linear interpolation to make up according to the growth rate of the data.

The data involved in the above variables are from China Statistical Yearbook, China Science and Technology Statistical Yearbook, China Industrial Statistical Yearbook, China Hi tech Industrial Statistical Yearbook, China Energy Statistical Yearbook, China Environmental

Statistical Yearbook, China Population and Employment Statistical Yearbook and statistical yearbooks of provinces (districts and cities) in the corresponding years. All indicators that need to adopt index deflations have been deflated with 2003 as the base period.

3. Analysis of Empirical Results

3.1 Empirical results of national samples

(1) Data stability test

Before PVAR analysis, in order to prevent "false regression", it is generally necessary to test the stationarity of variables in the model. Otherwise, PVAR estimation of unstable variables may not accurately reflect the logical relationship between variables.

(2) Determination of optimal lag order

Before building PVAR model, it is necessary to determine the lag length order of the model system. To judge the optimal lag time of PVAR model, there are mainly three information criteria: AIC, BIC and HQIC

(3) Parameter Estimation of PVAR

The generalized moment estimation GMM method is used to estimate the parameters, and the PVAR model estimation results between trade opening and industrial transformation and upgrading are obtained,

a. From the estimation results, when h_ When Open is used as the interpreted variable, it lags behind h_ The estimation coefficient of Open is positive, the coefficient is as high as 1.1957, which is significant at 1% significance level; Lagging Phase II h_ The coefficient of Open is -0.4300, which is significant at the level of 1% significance, and the intensity is less than that of lag phase h_ Open□ Phase III lag and Phase IV lag h_ The coefficients of Open are all positive, but not significant. This shows that the current trade opening is affected by the early stage, and there is a development inertia, which is most obvious in the lag stage.

b. When h_ When Open is used as the interpreted variable, it lags behind h_ The coefficient of Ind is 0.3621, which is significant at 10% significance level; Lagging Phase II h_ The coefficient of Ind is -0.6217, which is significant at 1% significance level; Phase III lag h_ The coefficient of Ind is 0.2985, which is significant at 5% significance level; Phase IV lag h_ The coefficient of Ind is -0.0067, not significant. It shows that industrial transformation and upgrading have a significant role in promoting trade opening in the short term, but in the long run, the impact is not consistent.

c. When h_ When Ind is taken as the explained variable, it lags behind a period of h_ The coefficient of Open is -0.0625, which is significant at the 1% significance level, indicating that the trade opening lagging behind by one period has an inhibitory effect on industrial transformation and upgrading; Lagging Phase II h_ The coefficient of Open is significantly positive, the coefficient lagging behind three periods is significantly negative, and the coefficient lagging behind four periods is again significantly positive. This shows that the impact of trade opening on industrial transformation and upgrading is long-term. Although the positive and negative effects alternate, in general, the negative effects dominate.

d. When h_ When Ind is taken as the explained variable, it lags behind a period of h_ The estimated coefficient of Ind is 0.6076, which is significant at 1% significance level; But lag behind Phase II, Phase III and Phase IV h_ Although the coefficients of Ind are positive, they are not significant. It shows that industrial transformation and upgrading depends on its own inertia, but this inertia effect does not last long, and it is significant only when it lags behind for a period.

(4) Variance decomposition

Through variance decomposition of prediction error, the contribution of orthogonalization impact of related variables to prediction error of one of the variables can be obtained, so that the interaction between variables can be deeply investigated. The results of the variance decomposition of the forecast error of the two variables of trade opening and industrial transformation and upgrading are listed in the results of the 1st to 10th periods respectively.

a. From the perspective of the variance contribution of industrial transformation and upgrading to trade opening, the contribution of industrial transformation and upgrading to the forecast error of trade opening is not large in general, and it is only 0.5% in the tenth period. The contribution of the second period is the largest, but only 0.9%, indicating that the overall impact of industrial transformation and upgrading on trade opening is still small. Correspondingly, from the variance decomposition of trade opening itself, although the variance contribution in each forecast period has declined, the decline is not significant. By the tenth forecast period, the variance contribution is still as high as 99.5%. It shows that compared with industrial transformation and upgrading, the biggest factor affecting trade opening is itself, and trade opening has its own development inertia.

b. From the perspective of the variance contribution of trade openness to industrial transformation and upgrading, the contribution of trade openness to the prediction error of industrial transformation and upgrading is significantly greater than that of industrial transformation and upgrading to trade openness, and its contribution gradually increases from 1.4% in the first phase to 19.0% in the tenth phase. At the same time, the contribution of industrial transformation and upgrading to itself has gradually declined from 98.6% in the first phase to 81.0% in the tenth phase, but the contribution of each phase is still far greater than that of trade opening. It shows that compared with trade opening, the influencing factors of industrial transformation and upgrading also mainly come from itself.

3.2 Specific empirical results

The PVAR model is used to test the relationship between trade openness and industrial transformation and upgrading in the three regions, and the GMM estimation results of the PVAR model in the three regions.

From the GMM regression results of trade opening to industrial transformation and upgrading in the three regions, it lags behind by a period of h_ The estimation coefficients of Open are significantly negative, among which, the negative effect in the central region is the largest, followed by the western region, and the eastern region is the smallest; Lagging Phase II h_ The estimation coefficients of Open are all positive, but the central region is not significant, the eastern region has the largest effect, followed by the western region; Phase III lag h_ The estimation coefficients of Open are all negative, but only significant in the eastern region; The eastern region lags behind Phase IV h_ The estimation coefficient of Open is 0.0577, which is significant at the 1% significance level, showing a relatively continuous effect. Looking back at the GMM regression results of the industrial transformation and upgrading of the three regions and opening to trade, only the eastern region lags behind Phase I and Phase II h_ The estimated coefficients of Ind are significant at 10% and 1% significance levels, with coefficients of 0.9581 and -1.2761 respectively. In other cases, they are not significant, which is quite different from the regression results of national samples. The data and significant changes show that the dynamic impact of industrial transformation and upgrading in the three regions on trade openness is weaker than the national sample.

From the perspective of the variance contribution of industrial transformation and upgrading to trade opening in the three regions, the performance of the three regions is relatively consistent, with little regional difference. During the period, the variance contribution of industrial transformation and upgrading to trade opening showed a small growth trend, but by the tenth period, the variance contribution was only 2.5%, 2.9% and 2.0%, indicating that trade opening was much more affected by itself than by industrial transformation and upgrading. From the perspective of the variance contribution of trade openness to industrial transformation and upgrading in the three regions, the eastern region has the largest contribution, followed by the central region, and the western region has the smallest. Specifically, the variance contribution of trade openness in the eastern region to industrial transformation and upgrading has increased from 5.2% in the first phase to 52.2% in the tenth phase, which has exceeded the industrial transformation and upgrading itself. The variance contribution of trade opening to industrial transformation and upgrading in the central region is lower than that of industrial transformation and upgrading itself, and the two are in an interactive state of trade-off. The contribution of trade opening gradually increased from 1.1% in the first phase to 22.2% in the tenth phase, while the contribution of industrial transformation and upgrading itself gradually decreased from 98.9% in the first phase to 77.8% in the tenth phase. The variance contribution of trade opening in the western region to industrial transformation and upgrading is the smallest, with an average contribution of only 8.2% during the period. By the tenth period, the contribution reached the maximum, but only 13.0%, which is lower than the national sample, the central region, and even lower than the eastern region. This is consistent with the pulse function result of trade opening to industrial transformation and upgrading.

4. Conclusions and Suggestions

Based on the experience of typical countries, using China's provincial panel data from 2003 to 2020 and the PVAR model, this paper empirically explores the dynamic relationship between trade opening and industrial transformation and upgrading in China, the east, the middle and the west. From the national level, the impact of trade opening that lags behind one phase and three phases on industrial transformation and upgrading is negative, while the impact of lagging behind two phases and four phases is positive, although the impact effect is positive and negative, However, in general, the negative effect of trade opening on industrial transformation and upgrading is dominant. The impact of industrial transformation and upgrading lagging behind Phase I and Phase III on trade opening is positive, while that of Phase II is negative. In the short term, the impact of industrial transformation and upgrading on trade opening is promotion, but in the long term, the impact is not consistent.

In the future, China's industry should, on the basis of continuing to give play to its comparative advantages, actively and proactively improve the professional division of labor and technology level, transform to capital and technology intensive industries, extend to the upstream of the global industrial chain, transform from low-cost competition relying on cheap factors to innovative competition driven by talent and technological progress, and force enterprise innovation by high-end competition [15], In the process of competing with developed countries on the same platform, we learn to grow and achieve transcendence. Third, actively construct a new paradigm of "information technology+industry". China's industrial scale is among the top in the world, and its infrastructure and industrial supply chain are relatively sound. In the future, we should further increase investment in Internet applications, industrial robots, artificial intelligence, chip manufacturing, e-commerce, and industrial integration, and guide industrial enterprises to develop in the direction of detailed division of labor and close cooperation, so as to make flexible manufacturing, network manufacturing, green manufacturing Service manufacturing has gradually become the mainstream production mode, thus promoting the transformation and upgrading of traditional industries.

References

[1] Huang Jingbo, Xiang Tiemei. Research on the Relationship between Trade Openness and Industrial Productivity -- Analysis Based on China's Manufacturing Panel Data [J]. Guangdong Social Sciences, 2010 (02): 5-12

[2] Zhang Shaojun, Liu Zhibiao. International trade and industrial upgrading of domestic enterprises - organizational and governance forces from the global value chain [J]. Finance and Trade Economics, 2013 (02): 68-79
[4] Liu Dexue, Liu Weitao. Trade openness and innovation performance of manufacturing industry from the perspective of positive and negative list [J]. Science and Technology Progress and Countermeasures, 2016, 33 (23): 57-61
[5] Chen Weitao, Yan Weitao, Zhang Guofeng. Trade Opening, Import Competition and China's Industrial Productivity [J]. Economist, 2017 (08): 40-48
[6] Huang Lijiang, Li Changying. Does Opening up Narrow the Technology Gap between China and the United States in Manufacturing Industry [J]. International Trade Issues, 2020 (01): 110-126
[7] Cai Haiya, Xu Yingzhi. Does the trade opening affect the upgrading of China's industrial structure? [J] Research on Quantitative Economy and Technical Economy, 2017, 34 (10): 3-22
[8] Ma Shuqin, Dai Jun, Wen Huaide Trade Opening, Environmental Regulation and Green Technology Progress -- Spatial Econometric Analysis Based on China's Inter provincial Data [J]. International Trade Issues, 2019 (10): 132-145
[9] Ma Jing, Yan Chaodong. Effect Evaluation of China's Industrial Transformation and Upgrading, Regional Disparities and Their Dynamic Evolution [J]. Modern Economy Discussion, 2020 (08): 78-89
[10] Zhai Lu, Liu Chunzhi. Research on performance evaluation of industrial transformation and upgrading from the perspective of supply side structural reform -- taking Liaoning Province as an example [J]. Journal of Northeast Normal University (Philosophy and Social Sciences Edition), 2018, (02): 45-54
[11] Zhong Kaiyang. The Dynamic Relationship between Foreign Trade, FDI and Environmental Pollution -- Research Based on PVAR Model [J]. Ecological Economy, 2016, 32 (12): 58-64

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