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The Impact of Industrial Transfer on Green Total Factor Productivity: A Literature Review

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Abstract

With the vigorous development of the economy in industrialized regions, industrial transfer (IT) has become an important way to alleviate economic pressure and enhance industrial competitiveness. By elucidating the relationship between IT and Green Total Factor Productivity (GTFP), valuable insights can be gained to guide the formulation of industrial introduction policies with sustainable development thinking in mind for the transferring-in regions, thus improving GTFP. This paper, through a systematic literature review method, comprehensively reviews the impact of IT on economic development and the environment, discusses the calculation methods and influencing factors of GTFP, and analyzes the impact of IT on GTFP. By reviewing and integrating existing research, the paper emphasizes that the impact of IT on economic development is phased, the impact of IT on the environment is dual, and the impact of IT on GTFP varies by industry and region. Although the paper has certain limitations, as an indispensable resource, it provides theoretical depth and practical acumen for scholars and decision-makers, making insightful contributions.

Keywords: Industrial Transfer, Economic Growth, Environmental Effects, Green Total Factor Productivity, Systematic Literature Review

Introduction

With the booming development of the economy in industrially advanced regions, the constraints of environmental regulations, market capacity, capital efficiency, operating costs, and other factors have become increasingly significant. Therefore, in order to evade these restrictions, companies transfer some or all of their production to other regions, resulting in industrial transfer (IT) (He Yun et al., 2018). For the transferring-out region, although IT can lead to negative effects such as reduced employment opportunities and weakened industrial competitiveness, it can also stimulate the region to cultivate and develop new emerging industries at a higher level, thereby achieving an upgrade in the industrial structure (Zhang & Huang, 2017). For the transferring-in region, IT is beneficial for alleviating employment pressure and promoting economic development, but it can also easily lead to environmental pollution and resource waste issues (Kong & Li, 2017; Sun et al., 2018). Therefore, for the transferring-in region, it is worth studying how to balance the benefits and drawbacks of IT.

Previous scholars have mostly focused on the impact of IT on traditional Total Factor Productivity (TFP). The traditional TFP measurement method only considers labor and capital as input factors, without taking into account issues such as energy consumption and environmental pollution. But as environmental issues have become increasingly severe, scholars have begun to incorporate indicators such as environmental pollution and energy consumption into the traditional TFP measurement model, forming Green Total Factor Productivity (GTFP), which serves as an important indicator for measuring green sustainable economic development (Zhou, 2022).

Therefore, studying the impact of IT on GTFP contributes to a better understanding of the phase-specific effects of IT on economic development, the dual impact of IT on the environment, and the industry and regional differences in the impact of IT on GTFP. Analyzing the pros and cons of industrial introduction can help the transferring-in regions' governments to better select industries and formulate and adjust related industrial policies, such as tax incentives, financial support, talent introduction, and environmental protection, to promote sustainable economic growth while achieving green development.

Methods

In order to achieve the research objectives, this study utilized the Systematic Literature Review (SLR) method. SLR emphasizes the rigor and transparency of the research process to ensure that other researchers can directly utilize the research results. Following the SLR process recommended by Tranfield et al. (2003), we systematically searched and collected relevant secondary data from databases such as Web of Science, CNKI, and Google Scholar, maintaining consistency with the previous research methodology.

Result

Research on IT

The economic effects of IT

In the early stages of IT, scholars introduced the TFP indicator to evaluate the impact of IT on the economic development efficiency of the transferring-in region. They found that IT can enhance the TFP of the transferring-in region (Zhao, 2021). Furthermore, related agglomeration effects, competitive adaptation effects, and employee mobility effects can also promote the improvement of TFP in both the transferring-out and transferring-in regions (Blomstrom et al., 1994; Ma et al., 2015; Wang, 2021).

However, in the middle and later stages of IT, the primary factor promoting TFP improvement shifted from technological progress to technological efficiency. Due to the weaker autonomous innovation capability of transferring-in regions, the problems brought about by IT gradually became prominent. The "only enterprises, no industries" style of IT did not achieve the expected effects on industrial structural upgrading and economic growth (Fan et al., 2014; Song, 2010; Cheng et al., 2013; Hu & Zhang, 2015). Zhang and Huang (2017) further found that the transfer of resource-consuming industries can increase the TFP of transferring-out regions while reducing the TFP of transferring-in regions.

The Environmental Effects of IT

The introduction of industries has become an effective way for underdeveloped areas to overcome backwardness and emerge from development difficulties. However, as the pollution problems caused by IT have become increasingly serious, scholars have conducted in-depth discussions on the environmental effects of IT.

Firstly, IT promotes the improvement of environmental quality in transferring-in regions through technological spillover. By employing advanced production processes and environmentally friendly technologies, the technological level of transferring-in regions is enhanced, the efficiency of production factors is improved, energy and resource consumption is reduced, local environmental quality is improved, and positive environmental effects are generated. This is known as the "pollution halo" effect (Grossman & Krueger, 1995; Mao & Sun, 2015; Li, 2016; Chen et al., 2019; Zhu, 2022).

Secondly, IT increases environmental pressure in transferring-in regions through structural effects. In order to avoid the increasingly strict environmental regulations in the region of origin, enterprises transfer industries with higher pollution levels to less developed areas. This leads to an increase in the number of pollution-intensive enterprises in the transferring-in regions, resulting in greater environmental pressure. There is a trend for underdeveloped areas to become "pollution havens" for developed regions (Walter & Ugelow, 1979; Liu et al., 2011; Dai, 2013; Chen et al., 2020; Ren, 2023).

Research on GTFP

Methods for Calculating GTFP

Using TFP to evaluate the achievements of IT can easily lead to problems such as excessive energy consumption and severe environmental pollution (Li, 2014). In 1983, Pittman first considered undesirable output in data envelopment analysis, revealing the impact of undesirable output on TFP (Pittman, 1983). Building on this, Chung et al (1997) proposed a directional distance function and constructed the Malmquist-Luenberger index. Fukuyama and Weber (2009) established a generalized SBM directional distance function based on non-radial and non-oriented methods, effectively overcoming measurement errors. Oh (2010) constructed a global production possibility set and proposed using the GML index to evaluate changes in GTFP. Scholars use the SBM-GML model to calculate the GTFP and its decomposition index for each region, observe the development trends and regional differences of GTFP, and analyze the roles of technological progress and technological efficiency in enhancing GTFP (Cui and Lin, 2019; Wang, 2022; Su et al., 2022; Zhou, 2022).

Factors Influencing GTFP

Green development has become a consensus and a focus of research in both the political and academic spheres. Research on GTFP focuses on pathways to enhancement and the study of influencing factors and their relationships. The main factors influencing GTFP include environmental regulations, agglomeration effects, human capital, foreign direct investment, and financial development, among others.

In terms of environmental regulations, Yu et al (2022) analyzed the impact mechanism of environmental regulations on technological innovation and GTFP, finding that environmental regulations can guide manufacturing to accelerate technological innovation and improve manufacturing GTFP. He (2022) pointed out that environmental regulations mainly affect the GTFP of enterprises through channels such as cost effects, innovation compensation effects, and energy allocation effects. There are significant differences in the impact of environmental regulations on GTFP of enterprises of different scales, ownerships, and pollution levels. It is believed that the government should formulate differentiated environmental regulations policies according to different regulatory targets.

Regarding agglomeration effects, Wang (2022) suggested that industrial agglomeration mainly promotes the improvement of GTFP by enhancing technological efficiency. The impact of agglomeration of clean industries on GTFP shows a "U"-shaped pattern, while the impact of agglomeration of polluting industries on GTFP is not significant. Li et al (2023) proposed that the synergistic agglomeration of manufacturing and productive service industries has not produced positive external effects, and it still has a significant negative impact on technological innovation and GTFP; technological innovation is an important way for the synergistic agglomeration of the two industries to influence the level of GTFP.

In terms of human capital, Zheng et al (2022) found that there is a threshold effect of R&D investment on the promotion of green technology progress by human capital in coastal areas of China, showing a non-linear characteristic of diminishing marginal efficiency. Xiao and You (2021) explored the heterogeneous effects of human capital on GTFP. The results indicate that the average efficiency of GTFP shows an inverted U-shaped pattern, with significant geographical differences. Accumulation of human capital and education fiscal expenditure have a positive impact on GTFP efficiency; however, innovation has a negative impact on it.

Concerning foreign direct investment (FDI), Wang et al (2022) proposed that the coordinated development of two-way FDI has a significant promoting effect on GTFP, and industrial structure upgrading as an intermediate variable can strengthen this effect. By improving the level of green technological progress, two-way FDI significantly promotes the growth of GTFP. Two-way FDI in the eastern region has a significant promoting effect on GTFP, while two-way FDI in the central and western regions has a significant inhibitory effect on GTFP; further research found that the impact of two-way FDI on GTFP shows an inverted U-shaped relationship, and two-way FDI has a significant inhibitory effect on GTFP only when the commodity market segmentation index and the factor market segmentation index exceed certain threshold values (Zhang, 2023).

In terms of financial development, Hui (2022) pointed out that the promulgation of China's "Green Credit Guidelines" is conducive to guiding the allocation of credit resources towards environmental protection and green industries. However, it has a significant inhibitory effect on GTFP of heavily polluting enterprises. The green credit policy has an inhibitory effect on GTFP of heavily polluting enterprises by changing the debt maturity structure, reducing commercial credit, and other channels. In the central and western regions, areas with low financial development levels, and non-state-owned and small-scale enterprises, the inhibitory effect of the green credit policy is more significant.

The Relationship between IT and GTFP

Scholars have conducted in-depth research on how IT affects TFP and the environment. However, there is still relatively little research on the mechanism and effects of IT on GTFP.

Regarding the direction of impact, Hou (2022) proposed that under different levels of environmental regulations, IT in the Yangtze River Economic Belt has a nonlinear impact on GTFP. When environmental regulations are below a threshold level, IT has a promoting effect on GTFP. Conversely, IT inhibits the improvement of GTFP. Wang (2020), using the GMM model, inferred that IT between regions has a significant negative impact on the GTFP of transferring-in regions and a positive impact on transferring-out regions. IT in China has promoted the improvement of GTFP in transferring-out regions but led to a decline in GTFP in transferring-in regions.

Regarding the differences in impact, Ouyang Hua (2018) pointed out that different industries have varying degrees of environmental damage, and the technological level of each region determines the different environmental impact of the same industry in different regions. Hou (2022) proposed that IT affects GTFP through scale effects, resource allocation effects, and technology spillover effects, which can either promote or inhibit GTFP. However, the effects also vary depending on the conditions of transferring-in regions, including its industrial structure, absorption capacity, and development level. Wang (2020) found that industries with high levels of technology intensity and efficient use of energy have a relatively small negative effect on the GTFP of transferring-in regions, as they have lower energy consumption and environmental impact during production.

Conclusion

Firstly, the impact of IT on economic development is phased. Research shows that in the early stages of IT, transferring-in regions can improve production efficiency and TFP by absorbing advanced technology and management experience, thus promoting economic growth. However, over time, the role of technological progress in enhancing TFP gradually diminishes, and technological efficiency becomes the main factor affecting TFP. Therefore, transferring-in regions need to increase their efforts in independent innovation, reduce reliance on external technology, and achieve sustainable economic growth.

Secondly, the impact of IT on the environment is dual-sided. On the one hand, IT promotes the improvement of environmental quality in transferring-in regions through technology spillover. Adopting advanced production processes and environmental protection technologies improves the efficiency of production factors, reduces energy and resource consumption, and produces positive environmental effects. On the other hand, in order to evade increasingly strict environmental regulations in transferring-out regions, companies transfer industries with higher pollution levels to transferring-in regions, leading to increased environmental pressure in transferring-in regions and turning them into "pollution havens."

Lastly, the impact of IT on GTFP varies by industry and region. Influenced by factors such as the technological level, energy utilization efficiency, and resource endowment of transferring-in regions, the impact of IT on GTFP varies across regions and industries. The relocation of technologically advanced industries can bring more efficient production methods and cleaner production processes to transferring-in regions, thereby promoting the improvement of GTFP. The relocation of industries with high energy efficiency can reduce the energy consumption and pollutant emissions in transferring-in regions, thus improving GTFP. Regions rich in natural resources are very attractive to resource-intensive enterprises, but these enterprises may have a significant impact on the environment, thereby limiting the improvement of GTFP.

Therefore, governments play a key role in guiding IT. Governments need to formulate and implement relevant policies, including environmental regulations and industrial policies, to balance the relationship between economic growth and environmental protection, strengthen technological innovation, talent training, and introduction, and achieve a win-win situation for the economy and the environment.

Research Contributions and Limitations

This paper comprehensively discusses and analyzes the relationship between IT and GTFP. The main contributions of the paper are reflected in several aspects. Firstly, through a systematic literature review method, it comprehensively reviews the impact of IT on economic development and the environment, as well as the calculation methods and influencing factors of GTFP, providing important references for research in related fields. Secondly, it extends the traditional TFP to GTFP, considering factors such as economic growth, energy consumption, and environmental pollution, providing a new indicator and perspective for measuring sustainable economic development. Finally, this paper can serve as a valuable reference for government industrial introduction, providing profound insights and inspirations for future research and practice.

In summary, this paper provides important theoretical support and practical guidance for the academic research and practical work of IT effects, with high academic and practical value. Although this paper provides in-depth reviews and analysis, there are still some limitations worth noting. Firstly, the research is limited by the availability of data, which may not cover all relevant literature and data, potentially impacting the comprehensiveness and universality of the research conclusions. Secondly, while it is known that the impact of IT on GTFP varies by industry and region, the characteristics and key factors leading to these differences have not been summarized. Future research can be expanded in several aspects: Firstly, future research can consider incorporating more recent research results and interdisciplinary perspectives. Secondly, further exploration can be conducted on the differences in impact among different industries and regions, to help governments formulate targeted industrial introduction policies, as well as further exploration of the pathways to provide GTFP in different regions.

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References

Blomstrom, M., Kokko, A., & Zejan, M. (1994). Host Country Competition, Labor Skills, and Technology-Transfer by Multinationals. *Weltwirtschaftliches Archiv-Review of World Economics, 130*(3), 521–533.

Chung, Y. H., Färe, R., & Grosskopf, S. (1997). Productivity and undesirable outputs: a directional distance function approach. *Journal of Environmental Management, 51*(3), 229-240.

Fukuyama, H., & Weber, W. L. (2009). A directional slacks-based measure of technical inefficiency. *Socio-Economic Planning Sciences, 43*(4), 274-287.

Grossman, G., & Krueger, A. (1995). Economic-Growth and the Environment. *Quarterly Journal of Economics, 110*(2), 353–377.

Oh, D. H. (2010). A global Malmquist-Luenberger productivity index. *Journal of Productivity Analysis, 34*, 183-197.

Pittman, R. W. (1983). Multilateral productivity comparisons with undesirable outputs. *The Economic Journal, 93*(372), 883-891.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207-222.

Walter, I., & Ugelow, J. (1979). Environmental Policies in Developing Countries. *Ambio, 8*(2–3), 102–109.

Xiao, H., & You, J. (2021). The heterogeneous impacts of human capital on green total factor productivity: Regional diversity perspective. *Frontiers in Environmental Science, 9*, 713562.

Yu, D., & Yan, Y. (2022). Environmental regulation, technological innovation and green total factor productivity in manufacturing. *Urban and Environmental Research, 02*, 58-79.

Chen, F., & Zhou, M. (2019). Does the national industrial transfer demonstration zone exacerbate regional environmental pollution? *Social Sciences in China, 09*, 47-49.

Chen, F., & Zhou, M. (2020). Does the national industrial transfer demonstration zone promote industrial structural transformation and upgrading? *Yunnan Social Sciences, 01*, 104-110.

Cheng, L., Zhuang, J., Li, C., & Chen, C. (2013). Spatial evolution of industrial chain and breakthrough of western industrial transfer "trap". *China Industrial Economics, 08*, 135-147.

Cui, X., & Lin, M. (2019). How does FDI affect firms' green total factor productivity? An empirical analysis based on Malmquist-Luenberger index and PSM-DID. *Economic Management, 03*, 38-55.

Dai, D. (2013). Industrial transfer, environmental regulation and carbon emissions (Doctoral dissertation, Hunan University).

Fan, J., Feng, M., & Li, F. (2014). Industrial agglomeration and enterprise total factor productivity. *World Economy, 05*, 51-73.

He, L., & Qi, X. (2022). Environmental regulation and green total factor productivity: Evidence from Chinese industrial enterprises. *Economic Dynamics, 06*, 97-114.

He, J., He, Y., & Jiang, Z. (2018). A study on the deep-seated influencing factors of interregional industrial transfer in China: Based on the dynamic panel data of interprovincial regions in the Yangtze River Economic Belt. *Ecological Economy, 06*, 117-121+162.

Hou, R. (2022). Industrial transfer, environmental regulation and green total factor productivity (Master's thesis, Nanchang University).

Hu, W., & Zhang, Y. (2015). Effectiveness of central and western China in undertaking industrial transfer: A spatial analysis based on geographic information system. *Contemporary Finance & Economics, 02*, 97-105.

Hui, X. (2022). Green credit policy, financial resource allocation and enterprise green total factor productivity: Evidence from China's heavily polluting enterprises. *Southwest Finance, 10*, 65-77.

Kong, F., & Li, H. (2017). Analysis on industrial gradient transfer and its environmental effects in the Yangtze River Economic Belt: Based on the statistical data of 11 provinces (cities) along the river from 2006 to 2015. *Guizhou Social Sciences, 09*, 87-93.

Li, H. (2014). Foreign direct investment, import trade and total factor productivity: An empirical study based on provincial manufacturing. *Special Zone Economy, 05*, 197-198.

Li, Y., Liu, S., & He, Z. (2023). Industrial synergy agglomeration, technological innovation and green total factor productivity. *Systems Engineering, 01*, 1-14.

Li, Z. (2016). Regional differences, foreign direct investment sources and FDI environmental regulation effects. *China Soft Science, 08*, 89-101.

Liu, H., Liu, W., & Liu, Z. (2011). Quantitative measurement of interregional industrial transfer: Analysis based on interregional input-output table. *China Industrial Economics, 06*, 79-88.

Ma, Y., Zhang, F., & Su, X. (2015). Research on the improvement path of technological innovation ability of enterprises in underdeveloped areas from the perspective of interregional industrial transfer. *Science & Technology Progress and Policy, 21*, 120-125.

Mao, M., & Sun, J. (2015). Research on the interactive relationship between FDI, industrial structure and carbon emissions based on simultaneous equation model. *Journal of Chongqing University of Technology (Social Science), 04*, 28-34.

Ren, Y., Li, W., & Zhang, K. (2023). Policy effect evaluation of undertaking industrial transfer demonstration zones: An investigation based on the two-dimensional perspective of environment and economy. *Industrial Economic Research, 06*, 16-28.

Song, K. (2010). Research on the efficiency of Suzhong undertaking Sunan industrial transfer: Based on Malmquist index method. *Journal of Xidian University (Social Science Edition), 01*, 41-46.

Su, H., Yang, F., & Zhang, Y. (2022). Spatial econometric analysis of city-level green total factor productivity in China. *Economic Geography, 09*, 138-146.

Sun, X., Guo, X., & Wang, Y. (2018). Industrial transfer, factor agglomeration and regional economic development. *Management World, 05*, 47-62+179-180.

Wang, K., Xue, M., & Zhao, B. (2022). Coordinated development of two-way FDI and improvement of green total factor productivity: Analysis and verification based on the perspective of industrial structural upgrading. *Business Research, 05*, 46-57.

Wang, Q. (2020). The impact of industrial transfer on regional green total factor productivity in China (Master's thesis, Jiangxi University of Finance and Economics).

Wang, P., & Guo, S. (2021). Formal environmental regulation, human capital and green total factor productivity. *Macroeconomic Research, 05*, 155-169.

Wang, W. (2022). Industrial agglomeration, urban agglomeration and green total factor productivity: A case study of urban agglomerations in the Yangtze River Economic Belt. *Resources and Industries, 06*, 75-89.

Wang, Y., Zhang, Q., & Bai, Y. (2022). Dynamic measurement and spatial-temporal evolution of agricultural green total factor productivity in China. *Statistics and Decision, 20*, 98-102.

Zhang, X., & Huang, X. (2017). Does regional manufacturing industry transfer promote the improvement of total factor productivity? A study based on Chinese prefecture-level city data. *Macro Quality Research, 03*, 62-75.

Zhang, Z., Tang, L., & Sun, L. (2023). Coordinated development of two-way FDI, market segmentation and green total factor productivity. *Business Research, 05*, 81-89.

Zheng, Y., & Chen, Y. (2022). The impact of human capital and R&D investment on green technological progress. *Productivity Research, 10*, 17-22+106+161.

Zhou, Y., & Nie, Y. (2022). Dynamic measurement of China's green total factor productivity and decomposition of regional characteristics. *Statistics and Decision, 20*, 37-42.

Zhu, Y., & Ding, L. (2022). Spatial effects and influencing factors of carbon emission intensity in the Yangtze River Delta urban agglomeration: Based on the perspective of industrial transfer. *Resource Science, 07*, 1373-1387.