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An Empirical Study on the Impact of Industrial Structure Change on Environmental Level in China

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Abstract: The development experience of major developed countries in the world shows that there is an inverted U-shaped relationship between economic growth and environmental pollution, namely the environmental Kuznets curve. China has entered the stage of middle-income development, and in order to achieve sustainable development, China attaches great importance to environmental issues. As China effectively combines industrial structure transformation with ecological environment protection, changes in industrial structure will play an important role in improving the environment. In order to explore the relationship between the industrial structure and China's environmental level, this paper constructs environmental level indicators to measure the degree of comprehensive environmental pollution, and uses industrial structure rationalization and upgrading to express the level of industrial structure optimization. Based on the provincial Panel data of 30 provinces in China from 2011 to 2017, this paper studies the relationship between industrial structure changes and environmental level by constructing a regression model. The results indicate that the optimization of industrial structure plays a positive role in promoting environmental levels. Therefore, each province should adjust measures to local conditions and optimize industrial structure to reduce adverse factors of environmental pollution, in order to achieve the goal of effectively integrating innovation and green.

Keywords: Environmental Level, Industrial Structure Rationalization, Industrial Structure Upgrading

1. Introduction

The development experience of major developed countries in the world shows that there is an inverted U-shaped relationship between economic growth and environmental pollution, which is known as the Environmental Kuznets Curve. Since China has now entered the middle-income development stage, the inflection point of Environmental Kuznets Curve may have arrived. Solving the environmental quality problem is a necessary condition for the healthy development of the national economic and a key issue for achieving sustainable development. China has paid close attention to environmental issues, and the ability to effectively coordinate the contradiction between environmental pollution and economic development and achieve the win-win balance between environmental benefits and economic benefits can be achieved has become the focus of the attention of the whole society. In the process of China's economic prosperity and development, the economic development drives the change of industrial structure, and the development of unreasonable industrial structure will bring load to the environment, making the issue of environmental level a hot spot for theoretical research. How to combine industrial structure transformation and ecological environmental protection effectively, and how the industrial structure change acts on the environmental level, will become the urgent concern in the future.

Many scholars believe that a reasonable industrial structure can reduce the pollution of the environment. Kofi Adom et al. argues that economic growth and technical efficiency will affect carbon dioxide (CO_2) emissions by examining the relationship between CO_2 emissions, economic growth, technical efficiency, and industrial structure in three African countries [1]. Zhao studied the relationship between CO_2 emission intensity, energy consumption structure, energy intensity and industrial structure in China during 1980-2009 by econometric methods and concluded that there is a causal relationship between CO_2 emission intensity and industrial structure [2]. Zhang et al.

quantified the effects of economic growth, industrial structure and urbanization on carbon emission factors based on data from 1978-2011, showing that both industrial structure and economic growth play an important role in curbing carbon emissions [3]. Zhao argued that structural adjustment is a potential factor to unleash the effect of energy structure and industrial structure by using an LMDI-based approach to carbon emissions in the Yangtze River Delta for the period 2001 to 2012 [4]. Xiao et al. suggested that the development of secondary industries can produce emission reductions and the development of tertiary industries can stimulate the economy and help reduce carbon emissions. It was found that changing the industrial structure and forming industrial clusters would reduce CO_2 emissions [5]. Chuai and Feng conducted a study on the carbon emission intensity of Nanjing and found that the central urban area showed a significant intensity change, but the emission intensity was much lower than the surrounding areas of industrial land, and adjustment of industrial structure and efficient improvement of energy use would reduce the carbon emission intensity [6]. Ma et al. suggested that economic aggregate was the main growth factor affecting carbon emissions and that most of the carbon emissions were due to the use of large-scale infrastructure [7]. Zhou et al. found that technological progress and energy restructuring can improve carbon emission efficiency [8]. Zeeshan et al. used secondary data from 29 provinces, showed that total retail goods consumption and urban population increased pollution intensity and the structure of tertiary sector would contribute to the control of pollution intensity [9]. Li et al. constructed a STRIPAT-Durbin model based on 30 provinces in China from 2004 to 2016, arguing that high-tech industries, foreign direct investment, population, and carbon emissions all have spatial dependence and spatial agglomeration effects, and that high-tech industries, foreign direct investment, and population all have spatial spillover effects on carbon emissions [10]. In Benjamin and Lin's study, he argues that carbon intensity has the greatest impact on CO_2 emissions, followed by energy intensity, labor productivity, industrial structure, and energy structure [11]. Zhu and Shan studied the industrial transformation of Beijing from 2018-2020 through an envelope analysis model and concluded that the change of industrial structure would affect the efficiency of energy conservation and emission reduction. In summary, a reasonable industrial restructuring can effectively restrain environmental pollution [12].

In China, many scholars have also conducted numbers of studies on this issue. Li-confirmed the existence of an inverted U-shaped relationship between total environmental pollution emissions and adjustment of industrial structure [13]. Han and Yu found that an increase in the proportion of secondary industry will aggravate environmental pollution [14]. Han et al. found that the rationalization and upgrading of industrial structure interacting with environmental regulations would be more conducive to ecological efficiency improvement in the province [15]. Tao and Fang, Tao and Peng, Wei and Yu, on the other hand, analyzed the impact of industrial structure on carbon emissions through provincial panel data [16-18]. Li and Zhang argued that the optimization of industrial structure will reduce carbon dioxide emissions [19]. Zhang and Cui demonstrated the impact of industrial structure optimization on carbon emissions in the middle reaches of Yangtze River urban cluster [20]. Wu and Hu believed that both rationalization and industrial structure upgrading would have a more significant contribution to the green growth of China's economy [21]. Qin et al. found that the proportion of primary industry, secondary industry output value and sulfur dioxide (SO_2) emissions, nitrogen oxide emissions, and annual average sulfur dioxide concentration are positively correlated, while the proportion of tertiary industry output value is negatively correlated with them [22]. Lv and Chen, Luo and Li demonstrated the impact of industrial structure upgrading on energy efficiency in China [23, 24]. Ding et al. used Tapio model to argue that pollution-intensive industries are the main factors affecting pollution emissions in each region based on data related to 35 industrial sectors in the Yangtze River Economic Zone from 2000 to 2015 [25]. Gong and Liu argued that industrial structure rationalization and industrial structure upgrading have a significant inhibitory effect on environmental pollution [26]. Zhang and Chen demonstrated that the analysis of industrial structure upgrading can positively promote the energy efficiency of the Yangtze River Economic Belt in China based on the panel data of 11 provinces in the Yangtze River Economic Belt from 2001 to 2017 [27]. However, some scholars also put forward a different viewpoint. Hu proposed that industrial structure upgrading has some effect on curbing environmental pollution in the eastern and central regions of China through a study of environmental pollution in the eastern and central regions of China, but the effect is limited [28].

In order to explore the relationship between the industrial structure and China's environmental level, this paper constructs environmental level indicators to measure the degree of comprehensive environmental pollution, and uses industrial structure rationalization and upgrading to express the level of industrial structure optimization. Based on the provincial Panel data of 30 provinces in China from 2011 to 2017, this paper studies the relationship between industrial structure changes and environmental level by constructing a regression model. Compared to existing research, the contribution of this article is mainly reflected in establishing environmental level indicators, measuring the comprehensive level of environmental pollution, using industrial structure rationalization and upgrading to represent industrial structure optimization, which can better reflect the transformation status of industrial structure. The study of industrial structure and environmental level is an important basis for guiding industrial structure adjustment, formulating environmental policies, and achieving sustainable development strategies.

2. Theoretical Modeling and Indicators Interpretation

2.1. Mechanism

This paper focuses on the impact of industrial structure change on the environmental level and uses industrial structure rationalization indicator and industrial structure upgrading indicator to measure the industrial structure change, so as to explain the specific situation of industrial structure change more clearly. The mechanism of industrial structure change on environmental level is discussed from two aspects (as shown in Figure 1).

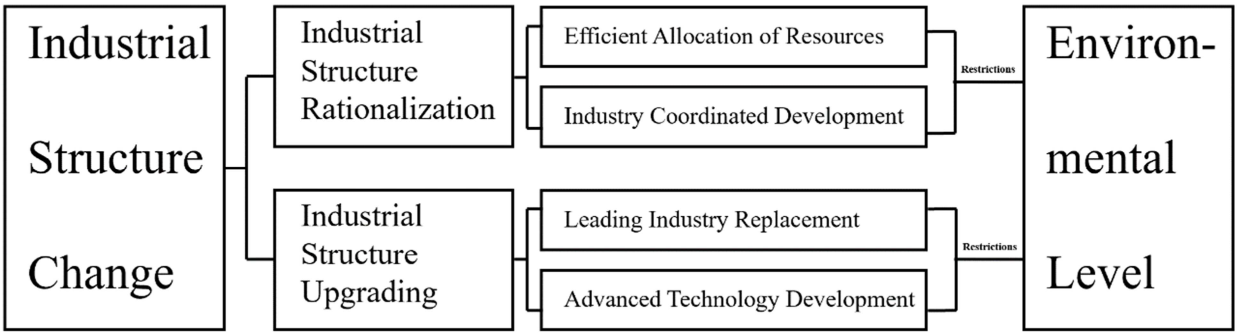

Figure 1. *Mechanism of Industrial Structure Change on Environmental Level.*

The rationalization of industrial structure is manifested in the effective allocation of resources and the coordinated development of industries. When the industrial structure tends to be rationalized, resources are effectively allocated, which improves labor productivity, improves the efficiency of resource utilization, avoids waste of resources, and obtains the maximum utilization of resources, thus achieving the effect of restricting the environmental level. The benign competition and synergistic development of industries forms an industrial aggregation, reduces the waste of resources caused by vicious competition, thus achieving the effect of restricting the level of the environment.

The upgrading of the industrial structure is manifested in the replacement of leading industries and the development of advanced technologies. When the industrial structure tends to be upgraded, the industrial structure will shift from the primary industry to the secondary and tertiary industries, and the leading industry is no longer the primary industry and heavy industry. And the gradual transition to the high-tech industry and tertiary industry has reduced the industrial pollution emissions, thus achieving the effect of restricting the environmental level. The development of advanced technology industry has promoted the development of productivity and the change of labor structure, which has reduced the number of workers in primary and secondary industries and increased the number of workers in tertiary industries, eliminating the relatively backward technology and allowing the new manufacturing technology to develop in the direction of cleanliness and integration, thus playing a restraining role on the environmental level.

Although there are many studies on the relationship between industrial structure and environmental level, however, there are still some shortcomings. Specifically, scholars all over the world are in the exploratory stage of research on the impact of industrial structure changes on the pollution of environmental level. The reason is that few scholars are able to express the changes in environmental level by a quantitative indicator, and few scholars study the environmental level by the indicator of changes in industrial structure based on provincial panel data. Most of the existing studies, when exploring the relationship between industrial structure and environmental level in China, only focus on the relationship between the overall industrial structure optimization and an environmental pollution condition, but few studies on the relationship between industrial structure change and the overall environmental level.

In summary, compared with the existing studies, the contributions of this paper are as follows: first, the establishment of environmental level indicators to measure the level of comprehensive environmental pollution. Second, the use of industrial structure rationalization and industrial structure upgrading to indicate industrial structure optimization, which can better reflect the industrial structure transformation status. In this way, a regression model is constructed to reveal the relationship between industrial structure and environmental level indicators, and the study of industrial structure and environmental level is an important basis for guiding industrial restructuring, formulating environmental policies, and realizing sustainable development.

2.2. Variable Selection

2.2.1. Core Explanatory Variables

The level of environmental pollution is used to measure the environmental level indicator. The environmental pollution index is the weighted arithmetic mean of various pollutants, shown as Formula 1.

$$Y_{ij} = \sum_{i=1}^{n} \beta_{ij} X_{ij} \tag{1}$$

Y_{ij} represents the environmental level indicator in i year of j province; X_{ij} represents various pollutants in i year of j province and β_{ij} is their corresponding weight.

The main reference in selecting the environmental level indicator system is the comprehensive environmental pollution degree indicator system of Wang Yuandi [29], which are shown as Formula 2.

$$Y_{ij} = 10.17X_{1j} - 54.52X_{2j} + 63.05X_{3j} + 7.5X_{4j} - 28.97X_{5j} + 44.01X_{6j} \tag{2}$$

Among them, Y_{ij} represents the comprehensive environmental pollution indicator system in *i* year of *j* province, X_{1j} is the industrial wastewater emissions (10,000 tons), X_{2j} is the industrial chemical oxygen demand (10,000 tons), X_{3j} is the industrial sulfur dioxide emissions (10,000 tons), X_{4j} is the smoke and dust emissions or industrial dust emissions (10,000 tons), X_{5j} is the industrial solid waste emissions (10,000 tons) and X_{6j} is per capita CO_2 emissions (tons).

Based on such environmental pollution indicator model and according to the pollution discharge situation of each city, the environmental level indicator Y_i of each province is constructed.

2.2.2. Explained Variable

The explained variable is an indicator to measure changes in industrial structure, for how to measure industrial structure change Wang et al. and Xie et al. proposed to construct industrial structure upgrading index IS [30, 31], but this indicator cannot explain the specific situation of industrial structure change, so industrial structure rationalization and industrial structure upgrading are used to explain industrial structure change in this paper.

(1) Industrial Structure Rationalization Indicator (*TL*)

Industrial structure rationalization refers to the process of achieving optimal allocation of production factors and coordinated development among industries. Different scholars have put forward different views on industrial structure rationalization indicators, among them the widely used ones are Theil-index, industrial structure deviation degree, standard structure method and so on. To reflect the relative importance between each industry, this paper uses the Theil-index.

In recent years, more scholars such as Gan et al. and Fu et al. have chosen the Thiel-index to measure the rationalization of industrial structure [32, 33]. The Thiel index reflects the relationship between the output value and the number of employees, and takes relative weights of each industry into account, therefore, this paper uses the Thie-index to measure the rationalization of industrial structure, and the calculation formula is shown as Formula 3.

$$TL_j = \sum_{t-1}^{T} \frac{V_t}{V} Ln(\frac{V_t}{L_t} / \frac{V}{L}) \tag{3}$$

Among them, TL_j is the industrial rationalization indicator of *j* province, *V* and *L* denote the total output value and number of employees in each province, m and n denote the number of industries and their sectors in each province, and *V/L* denotes the productivity level of each province. Based on the classical economic theory, when the economy is in final equilibrium, the productivity levels among sectors are equal, $V_t/L_t = V/L$, at this time $TL= 0$, if the industrial structure deviates from the equilibrium, the Thie-index is not 0 at this time and the industrial structure is irrational. It is pointed out that the greater the deviation of their index from 0, the more unreasonable the industrial structure, and the closer the Thei-index is to 0, the more reasonable the industrial structure.

(2) Industrial Structure Upgrading Indicator (*TS*)

The industrial structure upgrading refers to the process of advancing the center of industrial structure from primary industry to secondary and tertiary industries, which represents the level of economic development. And the industrial structure upgrading indicator visualizes this process. The existing measurement indicators for advanced industrial structure include the following methods: Li and Deng, Wang and Sun argue that since China has entered into new industrialization, the development of high-tech industries has been significantly faster than that of traditional industrial industries [34, 35]. Therefore, it is proposed to adopt the weighted average ratio of the output value of the secondary and tertiary industries and the ratio of the output value of high-tech industries and secondary industries. However, this option is not considered in this paper because the adjustment of the industrial structure has led to the absence of relevant data in some years. Fu and Chen argue that the industrial structure upgrading is manifested by the continuous increase in the proportion of value added of the three industries and propose to divide GDP into three components based on the division of the three industries, where the proportion of each component in GDP is spatial [36, 37]. Then, the angle of these three vectors is calculated, and the final indicator of industrial structure upgrading is the sum of the three angles. However, in recent years, more scholars believe that along with the development of information technology, the trend of economic service-oriented trend is increasing. Therefore, Gan and others believe that the ratio of the output value of the tertiary industry to the output value of the secondary industry should be used as the indicator of industrial structure upgrading a measure of advanced industrialization [32]. The calculation formula is shown in Formula 4.

$$TS_j = V_3 / V_2 \tag{4}$$

Among them, TS_j refers to the industrial structure ungrading of province j, and the distribution of V_3 and V_2 represents the output value of tertiary industry and secondary industry in each province, the larger the TS value, the higher the degree of industrial structure upgrading, and vice versa.

(3) Industrial Structure Change Indicator (*S*)

In order to confirm the direct relationship between industrial structure change and environmental level, the indicator of industrial structure change from Cha and Zheng were introduced to detect the correspondence between industrial structure change and environmental level, which means, the entropy weighting method was used to assign weights to industrial structure rationalization and industrial structure upgrading [38], shown as Formula 5.

$$S = 0.52\ TL + 0.48TS \tag{5}$$

2.3. Construction of Regression Model

The rationalization of industrial structure and industrial structure upgrading are important factors affecting the environmental level. In order to better test the actual effect of industrial structure rationalization and industrial structure upgrading on the current environmental level, this paper constructs a multiple linear regression model based on the existing studies from Peng [39] and Wang [40], shown as Formula 6.

$$LnY_j = \lambda + \alpha LnTL_j + \beta LnTS_j + \varepsilon_j \tag{6}$$

Among them, Y_i denotes the environmental level indicator of province j, TL_i denotes the industrial structure rationalization indicator of province j, TSi denotes the industrial structure upgrading indicator of province j, and ε_j denotes the random error term of province j.

3. Empirical Analysis

3.1. Data Source

This paper mainly involves three types of control variables: environmental level variables, industrial structure rationalization variables and industrial structure upgrading variables. The data in this paper are obtained from China Economic and Social Development Statistical Database, China Environment Yearbook, China Statistical Yearbook, China High Technology Industry Statistical Yearbook, and the statistical yearbooks of each province in corresponding years. Regarding the selection of the sample, 30 provinces, municipalities directly under the Central Government and autonomous regions were chosen for this paper (as various data from Tibetan regions were seriously missing, they were not included in this study). Regarding the selection of the sample period, since after the China Statistical Yearbook 2012, the statistical caliber of industrial solid waste emissions has been changed and the data have been significantly reduced, so the data in this paper started in 2011, and in order to reduce the volatility of the data, all indicators are logarithmically processed in the measurement.

3.2. Data Processing

3.2.1. Explained Variables

Based on the above model, the environmental level indicators for 30 provinces in China are calculated in this paper. In the calculation of environmental levels, it is found that when the 30 provinces are divided into eastern, central and western regions, the calculated results of environmental levels in the eastern and central regions show an inverted U-shaped curve trend with respect to years, and the environmental levels experience a process of rising and then falling, while the calculated results of environmental levels in the western region still show a linear increase. The inverted U-shaped curve of environmental level indicators from increasing to decreasing shows that China is paying more and more attention to the impact of environmental ecology.

3.2.2. Explanatory Variables

When measuring the indicators of industrial structure rationalization, it was found that most of the indicators of industrial structure rationalization in each province tend to be close to zero with the increment of the year, implying that the industrial structure gradually tends to be reasonable. When measuring the indicators of industrial structure upgrading, it is found that most of the indicators of industrial structure upgrading in each province increase with the increment of the year, implying that the industrial structure of each province gradually transitions from the primary industry to the secondary and tertiary industries.

3.3. Test Analysis

3.3.1. Panel Analysis and Curve Fitting

Using Stata to make a scatter plot of industrial structure change and environmental level, and draw the fitted line, the results are shown in Figure 2, which shows that the environmental level and industrial structure change are negatively related, and the transformation and upgrading of industrial structure will drive the reduction of environmental level.

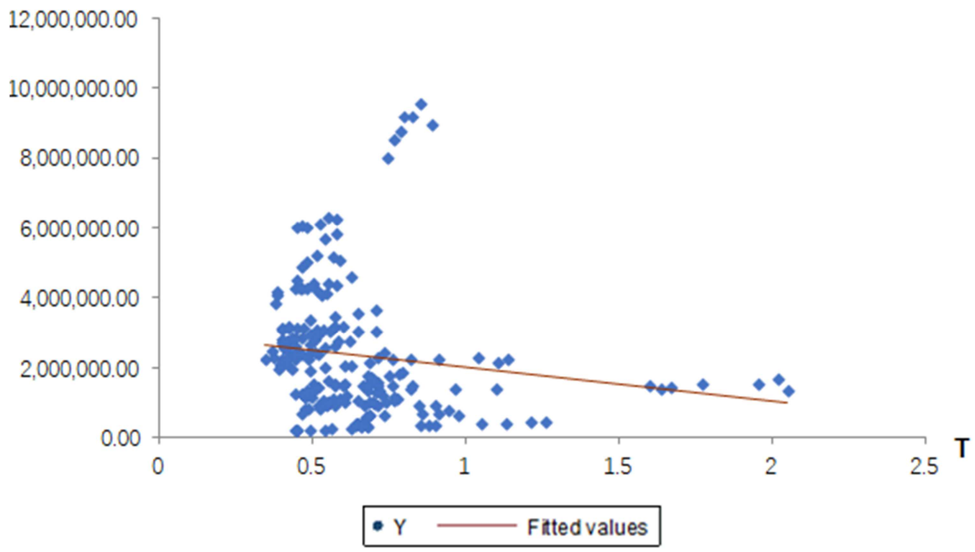

Figure 2. *Scatter Plot of Industrial Structure Change and Environmental Level.*

To further investigate the relationship between industrial structure change and environmental level, the rationalization of industrial structure and environmental level are modeled.

3.3.2. Descriptive Statistics

The descriptive statistics about the main variables involved in this paper are shown in table 1.

Table 1. *Descriptive Statistics.*

Variables	N	mean	sd	min	max
lnTS	210	-0.0146	0.396	-0.658	1.444
lnTL	210	-1.795	0.939	-4.336	-0.254
lnY	210	14.38	0.821	12.29	16.07

3.3.3. Correlation Test

Using Stata to test the correlation of the data, it is obvious through table 2 that the correlation coefficients between the data two by two are less than 0.5 and the correlation coefficient between industrial structure rationalization TL and industrial structure upgrading TS is -0.117 and the p-value of the correlation coefficient is significant at 0.1, which confirms that the correlation between TL and TS is small and can be used for regression analysis. And the correlation results show that the environmental level has a significant negative correlation with the indicators of industrial structure rationalization and industrial structure upgrading.

Table 2. *Correlation Test Result.*

	lnY	lnTL	lnTS
lnY	1		
lnTL	-0.198***	1	
lnTS	-0.117*	-0.426***	1

Notes:*** p<0.01,** p<0.05,* p<0.1.

3.3.4. Regression Analysis

To examine the impact of industrial structure optimization on environmental level, a linear regression model was set, and the model was regressed using Stata software (see Formula 6 for details). The regression results are shown in the following table 3.

Table 3. *Regression Analysis Result.*

VARIABLES	lnY
lnTL	-0.265***
	(-4.13)
lnTS	-0.508***
	(-3.35)
Constant	13.900***
	(108.53)
Observations	210
R-squared	0.089
F test	6.70e-05
r2_a	0.0799
F	10.07

Notes: t-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 3 shows the results of the regression analysis of Formula 7, and the P-values of the coefficients of the model pass the test of significance level of 0.01, which proves that the model is statistically significant as a whole.

The regression equations of industrial structure rationalization and industrial structure upgrading on environmental level are obtained and shown as Formula 7.

$$LnY_j = 108.53 - 4.13LnTL_j - 3.35LnTS_j + \varepsilon_j \quad (7)$$

The main explanatory variables are the industrial structure rationalization indicator TL and the industrial structure upgrading indicator TS. The following conclusions can be drawn: first, the regressions of industrial structure rationalization and upgrading at the provincial level have coefficients of -4.13 and -3.35, respectively, and are significant at the 1% statistical level, indicating that the optimization of industrial structure significantly curbs the pollution trend of environmental level. Second, in terms of economic significance, the value of the regression coefficient shows that every change of one value in the indicator of industrial structure rationalization will bring about a change of -4.13 values in the indicator of environmental level, indicating that the more reasonable industrial structure and the more coordinated development of industries will lead to a reduction in the level of environmental pollution;, every change of one value in the indicator of industrial structure upgrading will bring about a change of -3.35 values in the indicator of environmental level, indicating that the more advanced industrial structure will lead to the increase of the proportion of tertiary and secondary industries, which will reduce the pollution level of the environment.

3.3.5. Robustness Test

To ensure the reliability of the conclusions and to confirm the robustness of the model, the paper adopted the approach of Lu, which is to replace the core explanatory variables for robustness testing [41].

First, the degree of structural deviation was used as an indicator of industrial structure rationalization, shown as Formula 8.

$$TL_J = \sum_{t=1}^{n} \left| \frac{V_t}{L_t} / \frac{V}{L} - 1 \right| \quad (8)$$

The recalculated data were regressed with the environmental level and shown as table 4.

Table 4. *Robustness Regression Analysis Result.*

VARIABLES	*lnY*
lnTL	-0.643***
	(-5.46)
lnAIS	-0.388***
	(-2.85)
Constant	14.715***
	(181.17)
Observations	210
R-squared	0.138
F test	2.13e-07
r^2_a	0.130
F	16.56

Notes: t-statistics in parentheses;*** p<0.01, ** p<0.05, * p<0.1

New empirical results were obtained, and it was found that the direction of the coefficients of the empirical results and the significance of the data showed a certain degree of robustness. Thus, the conclusions drawn have good robustness.

3.4. Summary

With the development of industrial structure transformation, the rationalization of industrial structure is reflected in the reasonable allocation of resource factors and the coordinated development between industries. The industrial structure has changes from relatively unreasonable to relatively reasonable, and the structural distortion formed by the unreasonable configuration of industrial structure is gradually corrected. The benign coordinated development between various industrial sectors make the most effective use of resource factors, improves the productivity of the province, promotes economic growth and restrict the environmental level. The upgraded industrial structure is reflected in the conversion of leading industries, and the reasonable adjustment of industrial structure and the transition to advanced industrial structure are mostly beneficial to energy saving, emission reduction and environmental protection in various provinces. Empirical analysis shows that optimizing the industrial structure can significantly reduce the pollution to the environment and reduce the emissions.

4. Conclusions and Policy Recommendations

4.1. Conclusions

Economic development drives the change of industrial structure, the development of unreasonable industrial structure will bring loads to the environment, as China effectively combines the transformation of industrial structure with ecological environmental protection, and the change of industrial structure will play a positive role in environmental improvement.

The rationalization of industrial structure is manifested in the effective allocation of resources and the synergistic development of industries. The benign competition and coordinated development of industries has formed industrial agglomeration and reduce the waste of resources caused by the vicious competition of industries, thus achieving the effect of restricting the environmental level.

The upgradation of the industrial structure is manifested in the replacement of leading industries and the development of advanced technologies. When the industrial structure tends to upgrade, the leading industries are gradually transitioning to high-tech industries and tertiary industries, which promotes changes in the labor structure and realizes new manufacturing. The technology is developing in the direction of cleanliness and integration, thus restricting the environmental level.

By constructing a regression model to study the relationship between the rationalization and upgradation data and environmental level in each province of China, the results of empirical analysis show that the optimization of industrial structure plays a positive role in promoting environmental level.

4.2. Policy Recommendations

(1) Accelerate the Development of High-tech Industries

Accelerate the development of high-tech industries and strive to solve the existing problems of weak technical capability and convergence of high-end technology industries. Efforts to research and develop low-carbon economy, interconnection technology, artificial intelligence and other high-tech and the continuous movement from low-end to the high-end in the industrial chain can liberate China's original low-end labor force, improve China's existing employment structure, promote the employees in the primary industry and secondary industry employment to shift to the tertiary industry, so as to drive China's industrial structure to adjust and upgrade. The development of high-tech has reduced the cost and price of products and reducing the waste of resources due to capital flow and capital transportation, which has a positive impact on ecological environment. The rapid development of high-end technology has promoted the research and development of new products, expanded the original production scale, stimulated consumption, and investment, which drives the change of demand structure and influences the industrial structure to form constraints on the environmental level.

(2) Accelerate China's Industrial Restructuring and Upgrading

The original industrial structure of China is based on the secondary industry, supplemented by the tertiary industry, and the proportion of the output value of the primary and secondary industries is positively correlated with environmental pollution, while the proportion of the output value of the tertiary industry is negatively correlated with it, and the tertiary industry is mostly energy-intensive, which requires the emission of large amounts of carbon dioxide. If the ecological environment is constrained, it is necessary to promote the development of industries in the direction of rationalization and advanced, promote the industrial structure from labor-intensive to capital-intensive and eventually to knowledge-intensive, promote the industrial structure from low value-added, high energy consumption and high emissions to high value-added, low energy consumption and low emissions, so that the secondary industry will be transformed and adjusted and upgraded from low-end manufacturing to high-tech industries. The eastern and central regions should increase the optimization of industrial structure and transfer part of the manufacturing industry to the central and western regions to narrow the development distance between the east and west. Based on the original resource endowment and environmental advantages, the western region should introduce industries with purpose to adjust and upgrade the industry. All these efforts will make China's industrial structure shift to the direction of economic services, greatly enhance labor efficiency and resource utilization efficiency, and reduce industrial pollution emissions, thus achieving the role of restricting the level of the environment.

(3) Actively Build Industrial Parks

The construction of industrial park allows industrial industries to gather together and cultivate new industrial clusters suitable for the current economy, thus forming industrial gathering, giving play to the gathering effect of industrial park, and realizing scientific, orderly and high-quality development, making benign competition and synergistic development among industries, reducing the waste of resources and repeated construction caused by vicious competition among industries, and eliminating destructive development. The industrial park construction can also promote technological innovation and increase the mobility of resources, thus achieving the effect of constraining the level of the environment.

(4) Formulate Reasonable and Effective Industrial Policies

The government should encourage the development of low-carbon economy, increase the proportion of high-tech industries, and strive to build a resource-saving and environment-friendly society. Therefore, internally, it should improve the market operating environment, increase the investment in research and development of high-tech industries, pay attention to the issue of intellectual property rights, and realize technological change. The government should pay attention to accelerate the technological upgrading of traditional manufacturing industries, vigorously develop high-tech industries and service industries, expand their production scale, make industrial policies suitable for local development needs according to local conditions, cultivate leading industries, and guide the optimization of economic structure. It is required to develop market demand, expand consumer market, deepen industrial reform, expand market access, and drive industrial structure adjustment and optimization, transformation and upgrading. Placed in the international environment, the government should pay attention to international trade barriers, integrate with international trade, and introduce foreign high-tech industries into China. In this way, it will be able to optimize and upgrade the industrial structure, build green ecology, and reduce environmental pollution caused by unreasonable industrial structure.

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