RESEARCH ON INDUSTRIAL COMPOSITION RESTRUCTURING OF RESOURCE-DEPENDENT AND NON-RESOURCE-DEPENDENT URBANS DEPENDENT ON PANEL THRESHOLD REGRESSION

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Abstract. With the continuous promotion of emission reduction and energy conservation in China, how to realize integrated development and environment is a serious problem facing many resource-dependent urbans. The restructuring and the industrial composition upgrading will gradually reduce the excessive resource consumption and environmental damage. Urban restructuring hinges on the restructuring of industrial composition (*RIC*). This research divides it into the optimization of industrial composition (*OIC*) and upgrading of industrial composition (*UIC*). Drawing on the panel data of 264 urbans in China from 2010 to 2021, this research categorizes them into resource-dependent and non-resource-dependent urbans, and uses panel threshold regression to examine the threshold effects of environmental regulation and resource endowment on industrial composition restructuring of urbans and the quantitative relationships between variables. The results show that both optimization of industrial composition and upgrading of industrial composition pose substantial threshold effects on resource-dependent and non-resource-dependent urbans. Environmental regulation promotes both industrial composition optimization and upgrading. The resource endowment has little impact on non-dependent urbans, but it hinders the development of industrial composition restructuring of resource-dependent urbans.
Keywords: *environmental regulation (ER), restructuring of industrial composition (RIC), resource endowment (RE), panel threshold regression*

Background

Resource-dependent urbans are dominated by the exploitation and processing of natural resources (Liu et al., 2022; Song et al., 2022). As resources continue to develop, some urbans in China have experienced resource depletion and economic stagnation, which has a serious impact on the sustainable development of resource-dependent urbans (Zhang et al., 2022a; Guo et al., 2022). As most resource-dependent urbans are highly dependent on natural resources, and resource-dependent industries are typified by high emissions and high energy consumption, many resource-dependent urbans confronted with a pressing issue of how to realize integrated development and environment with the continuous advancement of emission reduction and energy conservation in China (Zhou et al., 2021; Gu et al., 2022). The industrial composition restructuring will gradually decrease unsustainable resource exploitation and ecological damage. Therefore, the industrial composition restructuring is the key to realize the sustainable economic advancement of resource-dependent urbans (Yang et al., 2021; Zhang et al., 2022b). Chinese governments at all levels take a leading role in industrial composition restructuring, but administrative intervention leads to the lack of internal incentives in industrial composition restructuring (Douglas et al., 2021; Pan and Mee, 2022). As environmental legislation becomes more stringent, enterprises' production costs will

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increase. To maximize profits, enterprises will offset the rise in production costs by means of technological innovation or adjustment of product composition (Zhao et al., 2021a; Zhu et al., 2021). Therefore, environmental regulations can enable enterprises to adjust production behaviors to internalize environmental costs, mitigate the negative externalities of environmental pollution through emission reduction and energy conservation, and stimulate the industrial composition restructuring of resource-dependent urbans (Peng et al., 2021; Wang et al., 2022a). As a characteristic indicator of resource-dependent urbans, the formulation of environmental policies in distinct regions is invariably influenced by variations in resource endowment levels. which in turn exerts an indirect influence on industrial structure restructuring by affecting environmental regulations (Song et al., 2020; Zhang et al., 2021). Therefore, it is of great practical value in the study of environment regulation, resource endowment and industrial composition restructuring of resource-dependent urbans.

Literature review

First, investigate the effect of environment regulations on industrial composition restructuring. It primarily centers on verifying the “pollution refuge hypothesis”, which holds that disparities in environmental regulation standards caused the relocation of pollution-intensive industries. Zhang et al. (2022a) proved that the applicability of the pollution paradise hypothesis is intertwined with the classifications of environmental policies and the traits of industries, based on the empirical evidence from China’s provincial-level panel data. Chen et al. (2021) and Zhang et al. (2022b) analyzed the correlation between environmental regulation and industrial change and confirmed the coexistence of “Porter hypothesis” and “pollution refuge hypothesis” with the data of polluting enterprises in China. Liu et al. (2020) explored the influence of environmental regulations on the location choices of manufacturing enterprises. Their research revealed that there was a “paradise effect” of pollution during the site-selection process. Chen et al. (2022) and Wang et al. (2022b) also obtained similar research results. Other researchers have explored the industrial restructuring effect of environmental regulation, which promotes the transfer of polluting manufacturing industries (Chen and Qian, 2020; Chen et al., 2022; Xu et al., 2022).

Second, research on the industrial composition restructuring and upgrading of resource- dependent urbans. Zhao et al. (2021b) evaluate the industrial composition restructuring planning scheme by establishing a system dynamics model to provide a reference for formulating policies. Li et al. (2019) provided a method to select alternative industries for resource-exhausted urbans by establishing a two-dimensional matrix model. In light of the circumstances faced by urbans relying on coal resources, Liu et al. (2020) proposed ideas for such urbans to choose alternative industries. From the perspective of industrial upgrading, Song et al. (2021) explored the influence of environmental regulations on economic growth. The findings indicated that environmental regulations led to the transfer of production factors from the secondary industry to the tertiary industry.

Third, research on the impact of resource endowment on economic growth. Whether natural resources is a “gospel” or a “curse” for promoting economic development, many literature have found that there is a resource curse (Tang et al., 2022; Gai et al., 2022; Dou et al., 2022; Alycia et al., 2022). However, the opposite conclusion has been reached by some studies (Veli et al., 2022; Yu et al., 2022).

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To sum up, many literature have studied the influence of environmental regulations on industrial composition restructuring without taking resource-dependent urbans as the research object in China (Qian et al., 2021; Sun et al., 2022; Zhang et al., 2021). In fact, resource-exhausted urbans in China face particularly prominent pressure of industrial composition restructuring. Industrial structure restructuring encompasses both the optimization and upgrading of industrial composition, but there are few literature from this perspective. Some scholars have studied the industrial composition restructuring of resource-dependent urbans, but have not analyzed it from the perspective of environmental regulation (Zhang et al., 2021; Qian et al., 2021). There are few literature on the comparative study of resource-dependent and non-resource-dependent urbans. Based on the preceding points, this paper analyzes the influence of environmental regulations and resource endowments on industrial composition restructuring in 132 resource-dependent urbans in China, and uses 132 non-resource-dependent urbans for comparative analysis to draw more valuable conclusions. This study employs the data from 264 urbans spanning 2010 to 2021, utilizes the entropy method to compute the comprehensive index of environmental regulation, and applies panel regression analysis to quantify the relationships among variables. Considering that environment is a distinct factor of production, enterprises will adjust the input composition of factors to reduce production costs under different levels of environmental regulations, which is nonlinear depending on environmental regulations.

Therefore, the contribution of this research is to take environmental regulations and resource endowments as threshold variables, analyze whether there is threshold effect among environmental regulations, resource endowment and industrial composition restructuring, and obtain the quantitative correlation among threshold values and variables. The research conclusions can provide reference for the governments to enact environmental regulations and industrial composition restructuring policies.

Method and data sources

Method

This paper adopts a research design where the entropy method is utilized to compute the comprehensive index of environmental regulations. The calculation is based on data from 264 cities spanning the period from 2010 to 2021. In this paper, environment is regarded as a special factor of production. Under different levels of environmental regulations, enterprises will seek the optimal production path by adjusting the input composition of factors. The impact of environmental regulations on industrial composition restructuring is dependent on the adjustment of production behavior of enterprises caused by the increase of factors price of pollution-oriented production caused by the enhancement of environmental regulations. The impact of environmental regulations on industrial composition appears non-linear according to the cumulative degree of environmental regulations. Thus, within the analytical framework of the panel threshold regression model, this study employs environmental regulations and resource endowment as threshold variables to explore the existence of threshold effects between these factors and industrial restructuring. Additionally, it aims to derive the quantitative relationship between the threshold values and the variables.

This paper intends to explore the influence of industrial structure restructuring on urban transformation. Given that industrial composition restructuring serves as the core of urban transformation, the research framework is primarily structured to analyze how

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environmental regulation (ER), resource endowment (RE), and control variables (X) affect restructuring of industrial composition (RIC). The constructed model is as follows:

$$\text{IST} = \text{f (ER, RE, X)} \quad \text{(Eq.1)}$$

Explained variables

The industrial composition restructuring is the coordination between industries and the unification of the reasonable proportion of various industrial sectors (Su and Fan, 2022). From the dynamic point of view, the change of industrial composition of the economy includes two dimensions: optimization of industrial composition and upgrading of industrial composition. The optimization of industrial structure implies the coordinated development among industries and the effective allocation of resources. Optimization of industrial composition can be measured through four primary approaches, namely the structural benefit index, standard composition method, Tel index, and industrial composition deviation degree. Due to the significant disparities in economic foundations, resource endowments, and industrial composition among urbans, the standard industrial structure composition approach and the degree of industrial composition are not applicable to this study. Meanwhile, the absence of capital input data across different industries renders the measurement via structural efficiency indices unfeasible. Thus, drawing on the methodologies of Wang et al. (2021) and Liu et al. (2021), this study employs the Theil index to characterize optimization of industrial composition, with the formula specified as:

$$ISR = \sum_{i=1}^{n}\left(\frac{Y_i}{Y}\right)\ln\left(\frac{Y_i}{L_i}\Big/\frac{Y}{L}\right) = \sum_{i=1}^{n}\left(\frac{Y_i}{Y}\right)ln\left(\frac{Y_i}{Y}\Big/\frac{L_i}{L}\right) \quad \text{(Eq.2)}$$

where i denotes the i-th industry, n represents the number of industrial sectors, Y and L denote output value and the number of employed persons, respectively, so Y/L represents the productivity level. According to classical economic theory, when economic development reaches its final equilibrium state, the productivity levels across all industrial sectors are identical. Thus, $Y_i/L_i = Y/L$, so $OIC = 0$. Conversely, if the industrial composition deviates from the equilibrium state, the Theil index is not 0, signifying an irrational industrial composition. Simultaneously, the optimization of industrial composition can also serve to illustrate the coupling between output and employment composition. Constrained by data accessibility, this paper employs data on primary, secondary, and tertiary industries in urban areas to compute indicators for industrial composition optimization.

The upgrading of industrial composition is characterized by a continuous downward trend in the proportion of primary industry in GDP. Although the proportion of non-agricultural output value in the total economic volume is increasing, the “service-oriented economic composition” driven by informatization after the last century is the main characteristic of the current industrial composition upgrading (Su and Fan, 2022). In this process, the growth rate of the tertiary industry is higher than that of the second industry (Sulaman et al., 2022). Therefore, the ratio of the tertiary industry to the secondary industry is suitable for measuring industrial composition upgrading. Dependent on the above, referring to Su and Fan (2022) and Ma and Cai (2019), the ratio of the tertiary industry to the secondary industry is used to measure upgrading of industrial composition.

Core explanatory variables

(1) Environmental regulation (*ER*). The measurement methods of environmental regulation can be categorized into four types as follows. First, the single index method. Using a single index to assess the intensity of environmental regulation, encompassing environmental regulation, investment in environmental governance, environmental policy assessment indices, etc. (Zhu et al., 2021; Liu et al., 2020; Gu et al., 2022). Additionally, certain scholars employ indirect indicators like per capita income to gauge the intensity of environmental regulation (Zhang and Chen, 2022; Jia.2024).

Second, the comprehensive index method. (1) Comprehensive indicators of pollution emissions, for example, Chen et al. (2020) selected indices including SO_2 removal efficiency and industrial soot removal efficiency to compute the comprehensive index, which was used to reflect the intensity of environmental regulation. (2) Comprehensive index method from multiple perspectives, such as the comprehensive index reflecting the sustainable development and environmental protection of countries by constructing the environmental performance index system (Gu et al., 2022).

Third, the classification inspection method. Dependent on different means and subjects of environmental regulations, such as Chen et al. (2020) categorized environmental regulations into three types: public participation type, command-and-control type, and market-incentive type. They also analyzed how different environmental regulations impact the efficiency of emission reduction and energy conservation.

Fourth, the assignment scoring method. The evaluation of assignments is influenced by the stringency of environmental regulations. For example, Su and Fan (2022) constructed an index system to assess the intensity of environmental regulations across different regions. To sum up, the single index approach is prone to causing deviations in research conclusions. The assignment scoring method involves a certain degree of human subjectivity. Moreover, the restricted availability of urban data hinders the ability to analyze the intensity of environmental regulations from multiple angles.

As per the preceding information, this research adopts the comprehensive index method to evaluate the level of environmental regulation. It encompasses indicators including the elimination rate of productive dust, the elimination rate of industrial SO_2, the rate of comprehensive industrial solid waste utilization, the harmless disposal rate of household garbage, and the rate of centralized treatment for sewage treatment plants. The process is outlined as follows: firstly, each index is standardized; secondly, the weight of indicators is determined by adopting the entropy method, and the comprehensive index of environmental regulation is estimated based on the indexes weight and standardized values. The higher the score of the comprehensive index, the stricter the environmental regulation.

(2) Resource endowment (*RE*). It denotes the aggregate value of natural resource wealth owned by an economy a at a specific moment in time (Zhang et al., 2022c). Resource abundance denotes the amount of accessible natural resources for social advancement of a specific region, which is generally measured by indexes such as energy output, energy reserves and per capita resource usage, etc. (Su and Fan, 2022; Zhang and Chen, 2022). Resource dependence denotes the degree of dependence of the economy on resources, which is generally measured by indexes such as the ratio of employees in resource industries in all employees and the ratio of output value of resource industries in GDP, etc. (Yang et al., 2021; Zhang and Chen, 2022).

This research uses the ratio of employees in the extractive industry to the total population at the end of the year to measure the resource endowment. The reasons are as

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follows. First, higher resource abundance has a positive impact on regional economic growth, abundant natural resources do not cause “resource curse” (Gai et al., 2022; Dou et al., 2022), but resource reliance will cause the “resource curse” (Alycia et al., 2022). Second, the extractive industry includes those directly linked to natural resources such as natural gas, oil, coal, non-metal mining and metal and beneficiation, timber harvesting, etc. They are capable of comprehensively evaluating the economy’s reliance on natural resources. The employees of the extractive industry can better measure the resource endowment than GDP.

Control variables

(1) Investment scale (*IS*). It is evaluated in terms of the fixed-asset investment of the whole society across various regions. The current development goals of China’s economy are stable economic growth, industrial upgrading and restructuring, elimination of backward and excess production capacity, technological innovation, infracomposition construction, and enhancement of people’s well-being, etc. To achieve these, a large amount of investment is necessary.

(2) Degree of government intervention (*DGI*). The government’s industrial policies will have a profound effect on the regional industrial composition. The indicators for measuring the extent of government intervention mainly consist of labor mobility index, marketization index, The share of state-owned enterprise assets in total enterprise assets, and the proportion of government expenditure to total social expenditure, etc. (Li et al., 2019). However, the lack of data makes the above indexes unavailable. Therefore, this research assesses the degree of government intervention by comparing the ratio of private-sector workers to individual workers in the total urban employment population. The larger the value of this index is, the more vigorous the urban private economy is. As a result, this index can also reflects the intervention degree of government policies on the economy to a certain extent.

(3) Economic development level (*EDL*). The measurement of it relies on the GDP per capita. With the sustained expansion of the economy, the industrial composition of the regions will be transformed from the bottom up, and the labor force will be transferred from agriculture with low labor productivity to industry with high labor productivity (Douglas et al., 2021). With the enhancement of labor productivity and per capita income, labor will first gradually shift from agriculture to industry, and then to the service industry (Pan and Mee, 2022).

(4) Economic openness (EO). It is measured by the degree of trade openness. Following the adoption of free trade policies, due to the disparities in resource endowments between different countries, production cost disparities among countries can give rise to the cross-border migration of industries on a global level (Zhao et al., 2021b). China’s open economic development strategy has driven the growth and upgrading of its domestic industries (Zhu et al., 2021).

Data sources

The data of this research are from “China Urban Statistical Yearbook”, “China Regional Economic Statistical Yearbook”, “provincial statistical yearbooks”, “Statistical Bulletins of national economic and social development of urbans”, etc.

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Results

When environmental regulations are the threshold variable, no matter for resource-dependent or non-resource-dependent urbans, the increase in the severity of environmental regulations will be conducive to the optimization and upgrading of industrial composition, and environmental regulations can be used as a backforcing mechanism to promote the industrial composition restructuring and development of Chinese urbans. When resource endowment is taken as the threshold variable, its influence on non-resource-dependent urbans is not obvious. With the increase of "resource endowment" level, it will hinder the optimization and upgrading of the industrial composition of resource-dependent urbans. The reason is that when environmental regulations are taken as the threshold variables, for enterprises pursuing profit maximization, environmental regulations have a favorable impact on industrial composition restructuring because they can bear certain pollution discharge costs according to cost-benefit comparative analysis. However, the above results ignore the resource endowment status of resource-dependent urbans, while most resource-dependent urbans in China are dependent on resources in their development, which leads to a single urban industrial composition, a large ratio of resource-dependent industries, and prominent environmental pollution problems, etc. Therefore, when the factor of resource endowment is included, the results also change.

Panel regression results

Multicollinearity test results of variables

(1) Correlation coefficients analysis. The test findings demonstrate that the correlation coefficients of environmental regulation (*ER*) and investment scale (*IS*) are all the highest at 0.4309 among the six explanatory variables.

(2) Variance inflation factor (VIF) analysis. The maximum VIF value is 1.49, which is much less than 10 (*Table 1*). Therefore, by analyzing the correlation coefficients and VIF test results of explanatory variables, it is concluded that there is no multicollinearity among the variables (Amr et al., 2020).

Table 1. *The results of VIF test of explanatory variables*

	ER	RE	IS	DGI	EDL	EO	Average value
VIF	1.3100	1.1600	1.4800	1.0700	1.4900	1.1700	1.2800
1/VIF	0.7633	0.8620	0.6757	0.9345	0.6711	0.8547	0.7936

The regression results of panel data

This research used a combination of regression model, fixed effect (FE) model and random effect (RE) model to analyze the quantitative interrelationships among variables. To derive more precise conclusions, Hausman and LM test serve as tools for the selection of the aforementioned three models. Compared with non-resource-dependent urbans, resource-dependent urbans are characterized by resource endowment, such as the mean value of resource endowment of 264 urbans in 2021 is 0.6274, among which the average value of resource endowment of resource-dependent and non-resource-dependent urbans are 1.4078 and 0.1401, respectively. Therefore, 264 urbans are split into resource-dependent and non-resource-dependent urbans for regression analysis. Meanwhile, to reduce the heteroscedasticity of the data, *Equation 1* is regressed by natural logarithm (*Table 2*).

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Table 2. *The regression results of panel data*

Variables	Explained variables: lnOIC		Explained variables: ln UIC	
	Resource-dependent urbans	Non-resource-dependent urbans	Resource-dependent urbans	Non-resource-dependent urbans
	Fixed effect model	Fixed effect model	Fixed effect model	Fixed effect model
Intercept C	7.9789***(20.01)	9.3989***(21.94)	-2.1968***(-5.72)	-1.0398***(-5.84)
lnER	0.1401*(1.71)	0.2697***(3.62)	0.1198***(3.51)	0.2104***(6.09)
lnRE	0.1295***(7.39)	0.0441***(3.64)	-0.0549***(-3.86)	-0.0331***(-6.21)
lnIS	0.4201***(12.98)	-0.0272(-0.93)	-0.1498***(-6.47)	0.0473***(3.91)
lnDGI	0.0197(0.51)	0.0034(0.08)	0.0087(0.45)	0.0181(1.02)
lnEDL	-0.7714***(-15.98)	-0.2304***(-4.97)	0. 2914***(5.79)	0. 0342*(1.73)
lnEO	-0.1897***(-10.02)	-0.1402***(-8.51)	-0.0771***(-5.45)	-0.0252***(-3.50)
LM Test (P value)	4309.78(0.0000)	1838.07(0.0000)	2403.05(0.0000)	6828.62(0.0000)
Hausman test (P value)	50.98(0.0000)	32.02(0.0000)	95.47(0.0000)	32.03(0.0000)

***, ** and * denote significance tests at the 1%, 5% and 10% levels, respectively

(1) Selection of regression method. When resource-dependent urbans are studied, ln OIC is the explained variable. LM test findings demonstrate that the probability of rejecting the hypothesis is 0.0000, so the random effect model ought to be chosen between the mixed regression model and the random effect model. Hausman test findings show that the probability of rejecting the hypothesis is 0.0000, so the fixed effect model ought to be chosen between random effect and fixed effect model. In conclusion, the fixed effect model ought to be chosen for investigation. The rest of the models are selected as above.

(2) The regression findings of industrial composition optimization. When the explained variable is lnOIC, the regression findings of resource-dependent and non-resource-dependent urbans are compared as follows. First, the regression coefficients of lnER and lnRE are both positive, which means that environmental regulation and resource endowment have negative effect on the optimization of industrial composition. Second, the regression coefficients of lnEDL and lnEO are both negative, indicating that the more advanced the economic development level and the degree of regional economic openness, the further optimized the industrial structure will be. Third, the influence of lnDGI on the optimization of industrial composition has failed the significance test. Fourth, LnIS has an adverse impact on the optimization of industrial composition of resource-dependent urbans, while the influence on the optimization of industrial composition of non-resource-dependent urbans is not obvious.

(3) Regression results of industrial composition upgrading. When the explained variable is lnUIC, the regression findings of resource-dependent and non-resource-dependent urbans are compared as follows. First, the regression coefficients of lnER are all positive, which means that environmental regulations are beneficial to the upgrading of industrial composition of resource-dependent and non-resource-dependent urbans. Second, the regression coefficients of lnRE are all negative, which means that resource endowment has a negative effect on the upgrading of industrial composition. Third, the effect of lnDGI on the upgrading of industrial composition has not passed the significance test. Fourth, lnEDL brings about positive effect on the upgrading of industrial composition; lnEO is on the contrary, the higher the degree of economic openness, the more it hinders the upgrading of

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industrial composition. Fifth, lnIS exerts a detrimental influence on the upgrading of industrial composition of resource-dependent urbans, and has a positive influence on the upgrading of industrial composition of non-resource-dependent urbans. The reason may be that the investment of resource-dependent urbans is mainly concentrated in resource-dependent industries, which leads to a negative impact on lnUIC.

The regression results of panel threshold

The panel regression findings indicate that both environmental regulations and resource endowment exert a significant linear influence on the optimization of industrial composition and upgrading. Because the influence of environmental regulations and resource endowment on the industrial composition restructuring may be different with the intensity of environmental regulation, and the level of resource endowment. In other words, the variables might have a non-linear correlation. To test whether there is a non-linear relationship between variables, this research adopts the panel threshold regression model proposed by Sun et al. (2022) to test the non-linear relationship. The panel threshold regression model is set as follows.

$$\ln RIC = \beta_0 + \beta_1 \ln ER \cdot 1(\ln ER \leq \gamma) + \beta_2 \ln ER \cdot 1(\ln ER > \gamma) + \alpha \ln X + \mu_1 \quad \text{(Eq.3)}$$

$$\ln RIC = \emptyset_0 + \emptyset_1 \ln ER \cdot 1(\ln RE \leq \delta) + \phi_2 \ln ER \cdot 1(\ln RE > \delta) + \lambda \ln X + \mu_2 \quad \text{(Eq.4)}$$

where 1(•) represents an indicative function, when 1 (false expression) = 0, otherwise, 1(true expression) = 1. According to whether the lnER and lnRE of threshold variables are higher than the threshold values of γ and δ, the samples are divided into two intervals with slopes of β_1 and β_2, ϕ_1 and ϕ_2, respectively. X represents the control variable, which includes the investment scale (IS), the "economic development level" (EDL), the "degree of government intervention" (DGI), and the "economic openness" (EO). Similarly, there may also multiple thresholds. This research takes two thresholds as an example, and the models are set as follows:

$$\ln RIC = \beta_0 + \beta_1 \ln ER \cdot 1(\ln ER \leq \gamma_1) + \beta_2 \ln ER \cdot 1(\gamma_1 < \ln ER \leq \gamma_2) + \beta_3 \ln ER \cdot 1(\ln ER > \gamma_2) + \alpha \ln X + \mu_1 \quad \text{(Eq.5)}$$

$$\ln RIC = \phi_0 + \phi_1 \ln ER \cdot 1(\ln RE \leq \delta_1) + \phi_2 \ln ER \cdot 1(\delta_1 < \ln RE \leq \delta_2) + \phi_3 \ln ER \cdot 1(\ln RE > \delta_2) + \lambda \ln X + \mu_2 \quad \text{(Eq.6)}$$

where $\gamma_1 < \gamma_2$, $\delta_1 < \delta_2$, the estimated values of the two-threshold model are similar to that of the one-threshold model. First determines one threshold values, and then estimates the second threshold values.

Panel threshold regression findings of optimization of industrial composition

(1) Environment regulation is the threshold variable

When lnOIC is the dependent variable, indicating to the "bootstrap approach" of Sun et al. (2022), 132 resource-dependent and 132 non-resource-dependent urbans are sampled 1000 times to estimate the "no threshold value, one threshold value, and two threshold values" of lnER. The P value associated with the test statistic is obtained to estimate the presence of a threshold effect (*Table 3*).

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Table 3. *The test results of threshold effect*

City categories	Threshold number	F-value	P-value	10% threshold	5% threshold	1% threshold
Resource-dependent urbans	One threshold	4.1056	0.0498	2.8951	4.2997	7.2032
	Two thresholds	6.4014	0.0149	2.9016	4.1072	7.5078
	Three thresholds	6.3115	0.0147	2.6014	3.5910	7.1043
Non-resource-dependent urbans	One threshold	10.5972	0.0000	2.8104	3.9016	6.8042
	Two thresholds	10.7051	0.0000	2.5811	3.9014	5.4021
	Three thresholds	5.0151	0.0198	2.8018	3.6102	5.8976

Through 1000 iterations of bootstrap resampling, P-values are calculated to gauge the statistical significance of F-values in the threshold effect test, reflecting the likelihood of obtaining such values under the null hypothesis

As indicated in *Table 3,* it is clear that for resource-dependent and non-resource-dependent urbans, when lnER is the threshold variable, the F-values can be obtained in the one threshold, two thresholds and three thresholds model, which are at least significant at the level of 10%, that is, P-values are all less than 0.1. Therefore, there are three threshold values in the model (*Table 4*).

Table 4. *Threshold estimation results*

City categories	Threshold value	lnEL values	95% confidence interval
Resource-dependent urbans	-0.7597	0.4707	(-1.1989, -0.1898)
	-0.4701	0.6314	(-0.5601, -0.3013)
	-0.1397	0.8702	(-0.1634, -0.1398)
Non-resource-dependent urbans	-0.5414	0.6017	(-0.6098, -0.5092)
	-0.2697	0.7591	(-0.2799, -0.2694)
	-0.2167	0.8104	(-1.1902, -0.1319)

The threshold values are the corresponding γ values when the likelihood ratios approach 0. *Figure 1* shows the likelihood ratios of the three threshold values -0.7597, -0.4701 and -0.1397 in resource-dependent urbans under the 95% confidence interval. *Figure 2* shows the likelihood ratios of the three threshold values -0.5414, -0.2697 and -0.2167 in non-resource-dependent urbans under the 95% confidence interval. The likelihood ratios are the threshold values of the lowest point, and the dotted lines indicate that the critical value is 7.40, which is obviously larger than the three threshold values, so the above threshold values are valid.

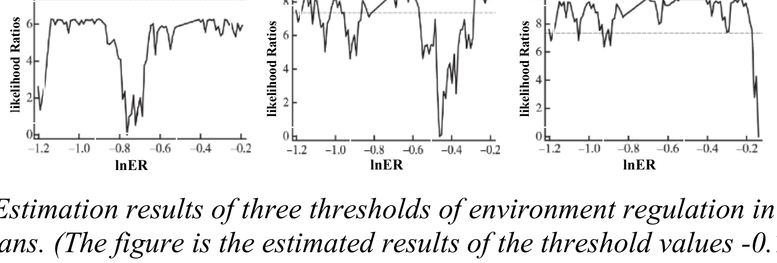

Figure 1. *Estimation results of three thresholds of environment regulation in resource-dependent urbans. (The figure is the estimated results of the threshold values -0.7597, -0.4701 and -0.1397 in order)*

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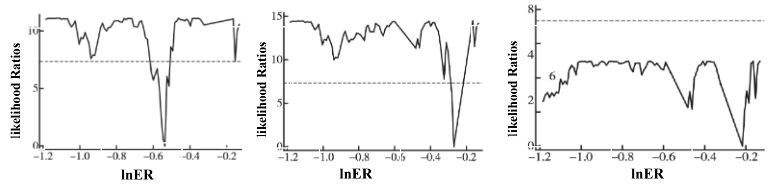

Figure 2. *Estimation results of three thresholds of environmental regulation in non-resource-dependent urbans. (The figure is the estimated results of the threshold values -0.5414, -0.2697 and -0.2167 in order)*

First, the regression findings of resource-dependent urbans. When the threshold variables are lnER, the impact of different lnER values on the optimization of industrial composition is quite different (*Table 5*). When lnER ≤ -0.7597, the regression coefficient of environmental regulation on the optimization of industrial composition is 2.4506; when -0.7597 < lnER ≤ -0.4701, the regression coefficient of environmental regulation on optimization of industrial composition is 0.6014; when -0.4701 < lnER ≤ -0.1397, the regression coefficient of environmental regulation on optimization of industrial composition is 0.2903; and with the further tightening of environmental regulations lnER > -0.1397, the regression coefficient of environmental regulation on optimization of industrial composition is -0.1397; and the above four regression coefficients are significant at least at the level of 10%. Therefore, the negative influence of environmental regulations on the optimization of industrial composition in resource-dependent urbans will gradually decrease with the rise of the intensity of environmental regulation. When the threshold values exceed -0.1397, environmental regulations will promote the optimization of industrial composition.

Table 5. *The parameter estimation findings of panel threshold model*

Resource-dependent urbans	Regression coefficients	T-value	Non-resource-dependent urbans	Regression coefficients	T-value
lnIS	0.1598	0.4021	lnIS	-0.0689	-1.2495
lnDGI	0.0369	1.2389	lnDGI	0.0169	0.3662
lnEDL	-0.2102**	-2.4697	lnEDL	-0. 0068***	-5.6497
lnEO	-0.1063***	-4.4602	lnEO	-0. 0241***	-2.6702
lnER·1 (lnER ≤ -0.7597)	2.4506***	3.6092	lnER·1 (lnER ≤ -0.5414)	1.5513***	4.2605
lnER·1 (-0.7597 < lnER ≤ -0.4701)	0.6014***	3.3201	lnER·1 (-0.5414 < lnER ≤ -0.2697)	0.7682	1.5459
lnER·1 (-0.4701 < lnER ≤ -0.1397)	0.2903***	2.6195	lnER·1 (-0.2697 < lnER ≤ -0.2167)	0.1513	1.4302
lnER·1 (lnER > -0.1397)	-0.1397*	-1.9398	lnER·1 (lnER > -0.2167)	-0.5998**	-2.8702

***, ** and * represent the statistical significance at the 1%, 5% and 10% levels, respectively

Second, regression results of non-resource urbans. With the increase of environmental regulation intensity, the impact of environmental regulations on the industrial composition optimization of non-resource-dependent urbans has changed from negative to positive. Compared with the regression results of resource-dependent urbans: when the values of environmental regulations are small (-0.5414 < lnER ≤ -0.2697) or larger (-0.2697 < lnER ≤ -0.2167), the regression coefficients are not statistically significant. However, the change trend of the regression coefficients are consistent with the regression coefficients of resource-dependent urbans, and the regression coefficients show a gradual decline from positive to negative.

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(2) Resource endowment is the threshold variable

Whether there is “no threshold value, one threshold value and two threshold values” for resource endowment (lnRE) of resource-dependent and non-resource-dependent urbans are estimated, respectively (*Table 6*).

Table 6. *The test findings of threshold effects*

City categories	Threshold numbers	F-value	P-value
Resource-dependent urbans	One threshold	20.7987	0.0000
	Two thresholds	39.1127	0.0000
	Three thresholds	13. 8729	0.0000
Non-resource-dependent urbans	One threshold	16.7988	0.0000
	Two thresholds	8.3057	0.0000
	Three thresholds	7.6993	0.0000

The threshold effect test is the same as *Table 3*

It can be observed from *Table 6* that resource endowments (lnRE) are taken as the threshold variables, there are three threshold values in both resource-dependent and non-resource-dependent urbans in the model. *Table 7* shows the estimation results of panel threshold values.

Table 7. *The threshold estimation results*

City categories	Threshold values	lnRE value	95% confidence interval
Resource-dependent urbans	-1.9902	0.1381	(-2.6397, -1.8972)
	1.2801	3.5902	(1. 2779, 1. 2779)
	1.5272	4.6297	(1. 5294, 1. 5294)
Non-resource-dependent urbans	-5.8912	0.0029	(-5.5414, -5.1908)
	-5.5897	0.0036	(-5.6038, -5. 4551)
	-0.3098	0.7310	(-0.7714, -0.3024)

The panel threshold regression findings demonstrate that the likelihood ratios of the three threshold estimation findings of resource-dependent and non-resource-dependent urbans under 95% confidence intervals are obtained. The test results show that the threshold values of resource-dependent and non-resource-dependent urbans are valid.

The panel threshold regression results of resource-dependent and non-resource-dependent urbans are shown in *Table 8*.

First, the regression findings of resource-dependent urbans. When LnRE ≤ -1.9902, the regression coefficient of environmental regulation (LnER) on the optimization of industrial composition (LnOIC) is 0.1801, but it fails to pass the significance test. When -1.9902 < LnRE ≤ 1.2779, the regression coefficient of LnER on LnOIC is 0.1089, which passed the significance test. When 1.2779 < LnRE ≤ 1.5272, the regression coefficient of LnER on LnOIC is 0.1497, which passed the significance test. When LnER > 1.5272, the regression coefficient of LnER on LnOIC is 0.7059, which passed the significance test at the 1% level. This suggests that the impact of LnER on LnOIC increases gradually. In summary, when analyzing the impact on the optimization of industrial composition of resource-dependent urbans from the standpoint of environmental regulation, which on the

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optimization of industrial composition gradually changed from a negative impact to a positive impact. From the standpoint of resource endowment, when the level of resource endowment is very low, the effect of environmental regulations on the optimization of industrial composition has not passed the significance test. As the level of resource endowment continues to rise, environmental regulations will exert a negative effect on the optimization of industrial composition, and the negative impact will intensify in tandem with the growth of resource endowment. The reason is that the higher the resource endowment level of the urbans, the higher the dependence of the urbans' economic development on resources, which hinders the optimization of industrial composition.

Table 8. *The regression findings of panel threshold*

Resource-dependent urbans	Regression coefficients	T-value	Non-resource-dependent urbans	Regression coefficients	T-value
lnIS	0.0039	0.1053	lnIS	0.0654	1.1879
lnDGI	0.0389	1.3497	lnDGI	0.0127	0.2768
lnEDL	-0.1869^{**}	-2.3168	lnEDL	-0.0095^{***}	-3.0792
lnEO	-0.1098^{***}	-4.7029	lnEO	-0.0359^{***}	-4.0105
$\ln ER \cdot 1$ ($\ln RE \leq -1.9902$)	0.1801	1.3873	$\ln ER \cdot 1$ ($\ln RE \leq -5.8903$)	0.2867	1.4095
$\ln ER \cdot 1$ ($-1.9902 < \ln RE \leq 1.2779$)	0.1089^{*}	1.8279	$\ln ER \cdot 1$ ($-5.8903 < \ln RE \leq -5.5897$)	0.9492^{***}	4.3219
$\ln ER \cdot 1$ ($1.2779 < \ln RE \leq 1.5272$)	0.1497^{*}	1.7299	$\ln ER \cdot 1$ ($-5.5897 < \ln RE \leq -0.3098$)	-0.1065	-1.1895
$\ln ER \cdot 1$ ($\ln RE > 1.5272$)	0.7059^{***}	6.1498	$\ln ER \cdot 1$ ($\ln RE > -0.3098$)	-0.3541^{**}	-1.9591

Second, the regression findings of non-resource urbans. When LnRE is the threshold variable, LnRE ≤ -5.8903 and -5.5897 < LnRE ≤ -0.3098, the regression coefficients of environmental regulations do not pass the significance test; -5.8903 < LnRE ≤ -5.5897, environmental regulations exert a negative effect on the optimization of industrial composition, and LnRE > -0.3098, environmental findings exert a positive impact on the optimization of industrial composition. Therefore, the three thresholds of non-resource-dependent urbans are far smaller than the corresponding thresholds of resource-dependent ones.

The regression results of panel threshold of industrial composition upgrading

When lnUIC is the dependent variable, the threshold effects of environmental regulation (LnER) and resource endowment (LnRE) are estimated, respectively.

(1) Environmental regulation (LnER) is the threshold variable

When lnER is the threshold variable, the test findings of the threshold effects of resource-dependent and non-resource-dependent urbans are demonstrated in *Table 9*.

Table 9. *The test findings of threshold effects*

City categories	Threshold numbers	F-value	P-value
Resource-dependent urbans	One threshold	84.1305	0.0000
	Two thresholds	32.7936	0.0000
	Three thresholds	14.9019	0.0000
Non-resource-dependent urbans	One threshold	139.8769	0.0000
	Two thresholds	84.9854	0.0000
	Three thresholds	49.2281	0.0000

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As shown in the estimated findings of *Table 9,* when lnER is the threshold variable, there are three threshold values for both resource-dependent urbans and non-resource-dependent ones. *Table 10* shows the estimated findings of threshold and 95% confidence interval. As indicated by the test results of likelihood ratio, the threshold values of resource-dependent and non-resource-dependent urbans are valid.

Table 10. *The threshold estimation findings*

City categories	Threshold values	lnRE value	95% confidence interval
Resource-dependent urbans	-1.1458	0.3198	(-1.1587, -1.0197)
	-0.6878	0.4978	(-0.7084, -0.6779)
	-0.1399	0.8714	(-0.1409, -0.1409)
Non-resource-dependent urbans	-1.0987	0.3413	(-1.1309, -1.0779)
	-0.7712	0.4713	(-0.7803, -0.7589)
	-0.5038	0.5985	(-0.5359, -0.5039)

First, the regression results of panel threshold of resource-dependent urbans. *Table 11* shows that when LnER ≤ -1.1458, the regression coefficient of LnER on lnUIC is -0.6773; when -1.1458 < LnER ≤ -0.6878, the regression coefficient of LnER on lnUIC is 0.1897; when -0.6878 < LnER ≤ -0.1399, the regression coefficient of LnER on lnISU is 0.3186; when LnER > -0.1399, the regression coefficient of LnER on lnUIC is 0.6097; and the above four regression coefficients all passed the significance test. In summary, the lower level of environmental regulations exert a negative effect on the upgrading of industrial composition. However, the upgrading of industrial composition is promoting as the level of environmental regulations exceed the threshold value -1.1458. The reason is that with the sustained improvement of the level of environmental regulation, the investment of enterprises in pollution control will gradually increase. When the level of environmental regulations exceed the threshold value of -1.1458, enterprises invest more and more funds for pollution control. To maximize profits, enterprises will choose industrial restructuring to promote the upgrading of industrial composition.

Table 11. *The regression findings of panel threshold*

Resource-dependent urbans	Regression coefficients	T-value	Non-resource-dependent urbans	Regression coefficients	T-value
lnIS	-0.1536^{***}	2.8391	lnIS	0.1067^{***}	2.8997
lnDGI	0. 0159	0.1298	lnDGI	0.0071	0.3014
lnEDL	0.2401^{***}	3.5891	lnEDL	0.2267^{***}	3.4417
lnEO	$-0. 0791^{***}$	1.1879	lnEO	-0.0179	-1.2987
lnER·1(lnER≤-1.1458)	-0.6773^{*}	-1.8912	lnER·1 (lnER≤-1. 0988)	0.0735^{***}	3.0749
lnER·1 (-1.1458<ln ER≤-0.6878)	0.1897^{***}	5.1997	lnER·1 (-1.0988<ln ER≤-0.7702)	0.2801^{***}	9.8989
lnER·1 (-0.6878<lnER≤-0.1399)	0.3186^{***}	7.7449	lnER·1 (-0.7702<ln ER≤-0.5039)	0.4429^{***}	12.4910
lnER·1(lnER>-0.1399)	0.6097^{***}	9.4012	lnER·1 (lnER>-0.5039	0.6795^{***}	12.5693

Second, the regression findings of panel threshold of non-resource-dependent urbans. The regression findings indicate that all levels of environmental regulation exert a positive impact on the upgrading of industrial composition, which is different from resource-dependent urbans. With the increasing influence of environmental regulations on the upgrading of industrial composition, the regression coefficients increased from 0.0735 to 0.6795.

(2) Resource endowment (LnRE is the threshold variable

Table 12 shows that the threshold variable is LnRE, there are three threshold values for both resource-dependent and non-resource-dependent urbans.

Table 12. *The test results of threshold effect*

City categories	Threshold numbers	F-value	P-value
Resource-dependent urbans	One threshold	38.2987	0.0000
	Two thresholds	20.2834	0.0000
	Three thresholds	14.5390	0.0000
Non-resource-dependent urbans	One threshold	53.9795	0.0000
	Two thresholds	5.6502	0.0130
	Three thresholds	4.0765	0.0270

Table 13 demonstrates the estimated findings of threshold and 95% confidence interval. As indicated by the findings of the likelihood ratio test, the threshold values of resource-dependent and non-resource-dependent urbans is valid.

Table 13. *The threshold estimation findings*

City categories	Threshold values	LnRE value	95% confidence interval
Resource-dependent urbans	-1.9734	0.1380	(-2.0334, -1.8901)
	0.7568	2.1456	(0.7675, 0. 8695)
	1.6463	5.1157	(1.6463, 1.6463)
Non-resource-dependent urbans	-3.3524	0.0359	(-5.9293, -0.3134)
	-2.8024	0.0598	(-3.0394, -2.1235)
	-1.0530	0.3498	(-1.1079, -1.0487)

The panel threshold regression findings of resource-dependent and non-resource-dependent urbans are demonstrated in *Table 14*.

Table 14. *The regression findings of panel threshold*

Resource-dependent urbans	Regression coefficients	T-value	Non-resource-dependent urbans	Regression coefficients	T-value
lnIS	-0.1375^{***}	-5.7861	lnIS	0.1019^{***}	7.2336
lnDGI	0.0049	0.2821	lnDGI	0. 0187	1.6456
lnEDL	0.2662^{***}	5.4398	lnEDL	$0. 2054^{***}$	7.0513
lnEO	$-0. 0795^{***}$	-5.8564	lnEO	-0.0456^{***}	-4.9459
lnER·1 (lnRE≤-1.9734)	0.6684^{***}	7.5158	lnER·1 (lnRE≤-3.3524)	0.2061^{***}	5.8229
lnER·1 (-1.9734<lnRE≤0.7705)	0.2783^{***}	5.8572	lnER·1 (-3.3524<ln RE≤-2.8024)	0.0476	1.4543
lnER·1 (0.7705<lnRE≤1.6431)	0.0531	1.4388	lnER·1 (-2.8024<ln RE≤-1.0530)	-0.0279	-1.1389
lnER·1 (lnRE>1.6431)	-0.1031^{***}	-2.0176	lnER·1 (lnRE>-1.0530)	-0.0288	-1.0911

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First, the regression findings of resource-dependent urbans. When lnRE ≤ -1.9734, the regression coefficient of lnER to lnISU is 0.6684 which is significant at the 1% level; -1.9734 < LnRE ≤ 0.7705, the regression coefficient of lnER to LnISU is 0.2783 which is significant at the 1% level; 0.7705 < LnRE ≤ 1.6431, the regression coefficient of lnER to LnISU is 0.0531 which does not pass the significance test; LnRE > 1.6431, the regression coefficient of lnER to LnUIC is -0.1031 which is significant at the 1% level. The above shows that urbans economic development is highly dependent on resources. When LnRE exceeds the threshold value of 1.6463, the improvement of environmental regulation level will hinder the urban industrial restructuring and upgrading. The reasons are as follows. (1) The larger the regression coefficients of resource endowment, the more abundant resources in the urban areas, and the cost of resources exploitation and utilization is lower. The rich resources in the urban areas have a negative impact on industrial restructuring and upgrading. The smaller the regression coefficients of resource endowment, the less resources in the urban areas. Improving the level of environmental regulations will promote industrial restructuring and upgrading. (2) The higher the level of resource endowment, the more employees in the resource industries, the industrial restructuring and upgrading may cause the unemployment and re-employment of some employees and hinder the industrial composition upgrading of resource-dependent urbans. At the same time, a higher level of resource endowment indicates that the resource industries play an important role in the economic development of resource-dependent urbans. Due to the high pollution emission intensity of the resource industries, improving the level of environmental regulations have a greater impact on the economic development of resource-dependent urbans, which will hinder the industrial restructuring and upgrading of ones.

Second, the regression findings of non-resource-dependent urbans. When the resource endowment level is low (LnRE ≤ -3.3524), the regression coefficient of environmental regulation (LnER) to the upgrading of industrial composition (LnUIC) is 0.2061 and passes the significance test at the level of 1%. But when LnRE exceeds the threshold value of -3.3524, the regression coefficient of LnER to LnUIC fails to pass the significance test. The reason is that due to the low level of resource endowment in non-resource-dependent urbans, resource endowment has little impact on environmental regulation policies in urban areas. Therefore, environmental regulations do not exert a negative effect on the upgrading of industrial composition.

Discussion

When optimization of industrial composition is the explained variable, comparing the regression findings of resource-dependent and non-resource-dependent urbans, our findings are that the similarities: the effects of environmental regulations and resource endowment on optimization of industrial composition are both negative; as the degree of economic development becomes higher, and the higher the degree of openness, it will promote the industrial composition to become more reasonable; the extent of government policy intervention has a small influence on industrial composition optimization. Our findings are that the differences: the impact of investment has a negative impact on industrial composition optimization of resource-dependent urbans, while the impact on non-resource-dependent urbans is not evident.

When upgrading of industrial composition is the explained variable, our findings are that the similarities: environmental regulations exert a positive impact on the industrial

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composition upgrading in resource and non-resource-dependent urbans; resource endowment exerts a negative effect on the upgrading of industrial composition; the extent of government policy intervention exerts little effect on upgrading of industrial composition; the level of economic development exerts a positive effect on the upgrading of industrial composition; and the degree of regional openness hinders industrial composition upgrading. Our findings are that the differences: the investment scale exerts a negative effect on the upgrading of industrial composition in resource-dependent urbans and a positive effect on non-resource-dependent urbans, owing to the fact that investment in resource-dependent urbans is mostly concentrated in resource-dependent industries.

Our finding in this study is that environmental regulation is used as a back-force mechanism to promote industrial restructuring and development in Chinese urbans. When environmental regulation is the threshold variable, for resource-dependent and non-resource-dependent urbans, the increase of environmental regulation intensity will exert a positive impact on the optimization and upgrading of industrial composition. Other studies on the impact of environmental regulation on industrial restructuring focus on the test of the "pollution refuge hypothesis", which suggests that differences in environmental regulation standards lead to the relocation of pollution-intensive industries.

When resource endowment is the threshold variable, its influence on non-resource-dependent urbans is not evident. With the increase of resource endowment level, it will hinder the optimization and upgrading of the industrial composition of resource-dependent urbans. Consistent with the findings of this study are studies on the mechanisms of the resource curse, including the gradual deterioration of the terms of trade of primary commodities, the "Dutch disease", the crowding-out effect, and the reduction of efficiency due to government intervention.

Conclusions

The Chinese government takes the lead in promoting the restructuring of industrial composition. The administrative intervention of the government leads to the lack of intrinsic incentive in the restructuring of industrial composition. However, with the increase of environmental control degree, the production costs for enterprises are set to increase. Enterprises must offset the growth of production costs through technological innovation or adjustments to product composition in order to maximize profits. Therefore, environmental regulation can urge enterprises to adjust their production behavior to internalize environmental cost and reduce negative externalities of environmental pollution by imposing energy-saving and emission reduction constraints. So as to provide the corresponding incentive for regional industrial composition restructuring. Simultaneously, the difference of resource endowment level will exert an effect on the formulation of regional environment policies, and then have an indirect effect on the restructuring of industrial composition.

Drawing on the analysis of the impact of environmental regulations and resource endowment on the restructuring of industrial composition, this study takes 264 urbans as the research object, and classifies them into resource-dependent and non-resource-dependent urbans in China from 2010 to 2021. The regression method of panel threshold is used to discuss the threshold characteristics of environmental regulation and resource endowment on the restructuring of urban industrial composition and the quantitative relationships between variables.

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The main conclusions of this research are summarized below. First, environmental regulations and resource endowment exerts a significant threshold effect on the industrial composition optimization and upgrading of resource-dependent and non-resource-dependent urbans. Second, when environmental regulation is the threshold variable, the improvement of environmental regulation level exerts a positive effect on the industrial composition optimization and industrial composition upgrading of resource-dependent or non-resource-dependent urbans. Third, when resource endowment is the threshold variable, the rising level of resource endowment has little impact on non-resource-dependent urbans, but it will hinder the growth of industrial composition optimization and upgrading of resource-dependent urbans. Fourth, the economic growth level promotes the growth of industrial composition optimization and upgrading of resource-dependent and non-resource-dependent urbans; economic openness exerts a positive effect on the optimization of industrial composition and a negative impact on the industrial composition upgrading of resource-dependent and non-resource-dependent urbans; degree of government intervention has little impact on the industrial composition optimization and upgrading of resource-dependent and non-resource -dependent urbans; investment scale exerts a negative impact on the industrial composition optimization and upgrading of resource-dependent urbans, but it promotes the development of industrial composition upgrading of non-resource-dependent urbans. To sum up, environmental regulations exert a positive effect on the industrial composition optimization and upgrading, while for resource endowment which hinders the restructuring and development of resource-dependent urbans' industries in China.

Policy implications

The implications of the research findings for policies making are as follows. First, the governments should pay attention to using environmental regulations to adjust industrial composition and give full play to the positive effect of environmental regulations in the industrial composition restructuring. Second, the current environmental regulation policies vary widely among Chinese urbans. When formulating environmental regulation policies, the governments should adopt appropriate environmental protection policies dependent on their own actual situation, give full play to the effect of environmental regulation, and realize urban economic growth, restructuring and upgrading of industrial composition and improvement of ecological environment. Third, the resource endowment of resource-dependent urbans exerts a negative effect on the restructuring and growth of the industrial composition. Some resource-dependent urbans have formed an economic development model that is excessively dependent on resources, so the governments should vigorously develop non-resource-dependent industries to gradually decrease the over-dependence on resources. Fourth, the governments should adjust the investment composition, enact policies to guide more funds to flow to the high-tech industries and service industry, and accelerate the restructuring and upgrading of the urban industrial composition. Simultaneously, the industrial composition restructuring should be included in the performance assessment of local governments, and the guidance and service functions of government policies should be highlighted, so that governments policies can play a promoting role in the restructuring of industrial composition.

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