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Original Research

Green Financial Policies, Urban Renewal and Environmental Sustainability: Implications for Achieving Carbon Neutrality Goals

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Abstract

The ecological and environmental subsystem is a core link in the regional sustainable development system and an important path for regional green transformation. From data availability, this paper selects 30 provinces and autonomous regions in China (excluding Tibet, Hong Kong, Macao, and Taiwan) from 2005 to 2022 and adopts the system Generalized Method of Moments (GMM) to explore the impacts of green financial policies and urban renewal policies on regional environmental sustainable development, expecting to provide theoretical reference for China's environmentally sustainable development and dual-carbon goal, and draws the conclusions as follows: (1) Overall, green financial development is conducive to regional environmental sustainable development; from a regional perspective, green finance significantly contributes to environmental sustainability in the eastern region, but not in the central and western regions. (2) Urban renewal can improve environmentally sustainable development at the national level, and the implementation of urban renewal policies in the east and central can also improve environmentally sustainable development, but it does not have a significant impact in the west of the country, which is still insufficient to play a positive role. (3) Economic development can promote environmental sustainability, but is not significant in the west. Resource consumption in all regions has a significant inhibitory effect on ecological and environmental sustainability; the increase of the proportion of the secondary industry has a significant inhibitory effect on ecological and environmental sustainability, except for the eastern region; environmental regulation on regional environmental sustainability at the national level and the eastern region can promote environmental sustainability, while the central and western environmental sustainability the greater the negative effect.

Keywords: urban renewal, green financial policy, environmental sustainability, green development

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Introduction

Global environmental change and sustainable development are two important scientific issues and challenges. In the 21st century, the sustainable development and management of the environment have become a focus of attention for all countries [1, 2]. Rapid economic growth has led to the escalation of carbon emissions, which in turn has triggered many environmental problems, such as global warming, prompting countries to pay more attention to environmentally sustainable development [3]. In China, people have gradually gotten rid of the concept of the single pursuit of economic benefits and turned to emphasizing the importance of environmentally sustainable development. To achieve the goal of sustainable development, China has put forward a "dual carbon" strategy at the national level, i.e., striving to peak carbon emissions by 2030 and to achieve carbon neutrality around 2060. This strategy not only reflects China's strong commitment to global environmental improvement, but also demonstrates China's proactive action and leadership in addressing climate change. Through the implementation of this strategy, China will endeavor to promote the green transformation of its economy and society and contribute Chinese wisdom and strength to global sustainable development. Cities are the providers of the most frugal lifestyles, hotbeds of innovation and employment, and often the root cause of sustainable development problems. The essence of eco-cities is to establish a harmonious symbiotic relationship between human beings and nature. The "dual-carbon" development has become the basic strategy for practicing green ecological goals and has put forward specific energy-saving and emission reduction targets for eco-city construction [4]. Therefore, exploring the sustainable development of urban environments under the dual-carbon goal has become the focus of attention in academia and government.

To realize environmentally sustainable development, we must focus on green transformation and emphasize the dominant role of the market in resource allocation by guiding the effective participation of social capital. In this process, green financial policy shows a broad prospect and importance. Green financial policy influences the ecological process of industrial structure by controlling the capital flow of polluting industries [5]. Green financial policy shows a remarkable role in capital allocation, which can effectively guide the flow of funds to green industries. In order to support environmentally friendly and sustainable projects, green financial instruments have emerged, which focus on areas such as financing renewable energy projects, improving energy efficiency, promoting energy conservation initiatives, and optimizing waste management and water management [6]. Through the implementation of these green financial policies, we are able to accelerate the transformation of old and new kinetic energy and help traditional industries realize green transformation and upgrading, thus injecting new vitality into the sustainable development of society. Analyzing from the industrial level, green financial instruments, with their unique role in capital leverage and resource allocation, can actively guide the efficient allocation of resources and promote the green transformation of traditional industries. These financial instruments help accelerate the elimination of highly polluting and technologically backward energy enterprises in the market while promoting green industries and other emerging industries' development. As an important green support for realizing environmentally sustainable development, green financial instruments are of great significance in reaching the dual-carbon goal. Therefore, it is important to explore the impact of green financial policies on the sustainable development of urban ecosystems to promote green low-carbon development and achieve more significant results.

At the same time, to achieve the dual-carbon goal, China has placed cities at the center of its "dual carbon" strategy. In China, although cities occupy only 1.2% of the country's land area and 28% of its urban and rural construction land, their carbon dioxide emissions account for about 80% of total emissions. These emissions originate mainly from cities. Therefore, cities are not only an important battleground for the implementation of strategies to reduce carbon emissions and combat climate change, but also a key position for the realization of the "dual-carbon" goal, and urban renewal actions have become a key force in promoting the implementation of the strategy, through which it not only improves the urban environment, but also effectively reduces carbon emissions, contributing significantly to the realization of the dual-carbon goal. On the one hand, urban renewal will create conditions for improving the quality of life of residents [7]. At the stage of high-quality development, a better life is one of the important goals for people. In the process of urban renewal, the urban ecological environment can be continuously improved by increasing green space and vegetation; the safety and resilience of the city can be enhanced by updating the aging pipelines for gas, water supply, drainage, and heating [8]; the city can be operated more efficiently by promoting digitalized, networked, and intelligent services; and the urban culture can be continued by preserving urban historical and cultural relics. The implementation of urban renewal actions is of great importance and far-reaching significance to environmentally sustainable development.

The main contributions of this paper are: (1) to systematically construct the evaluation index system of green financial policies, urban renewal, and the environmental sustainability evaluation index system, which improves the theoretical construction of the evaluation index system; (2) to verify the impact of green financial policies, urban renewal, and environmental sustainability on regional policymaking; (3) few scholars have included the three into the same framework to carry out research, and the research in

this paper can fill the gap of the existing research and provide theoretical reference for the research in this field. Therefore, the study explores the incorporation of urban renewal and green financial policies into the same analytical framework and studies the impact of both on urban sustainable development to provide theoretical references for promoting sustainable urban development.

Literature Review

Research on Environmental Sustainability

Environmental sustainability was proposed by the World Bank as the term "environmentally responsible development" and gradually developed into the expression "environmentally sustainable development" before finally forming what we know as the concept of "environmental sustainability" [9, 10]. The core of environmental sustainability is to ensure that the raw material resources needed by human beings are properly protected and, at the same time, to ensure that the emission of waste is controlled within the range of natural tolerance so as to realize the enhancement of human well-being and to avoid potential damage to human beings [11]. Domestic scholar Zhang [12] pointed out that the system of environmental sustainability should consist of indicators of three major categories: pressure, state, and response. He further emphasized that in order to more accurately reveal the interaction relationship between these descriptive indicators and their impacts on sustainable development, they need to be considered together with evaluative indicators. Meanwhile, Huang and Lv [13] proposed a new regional environmentally sustainable development assessment indicator system based on the PSR model. This system aims to provide strong support for the formulation of sustainable development strategies by scientifically and systematically assessing regional environmental conditions [14].

Urban Renewal Impact on Environmentally Sustainable Development

China's urbanization process is gradually shifting from large-scale new construction to the optimization and governance of existing urban space, in which urban renewal plays a crucial role and is an important way to promote sustainable urban development. Keith proposed as early as 1954 that urban renewal is the preservation, restoration, improvement, reconstruction, or removal of built-up areas of a city through planning and construction; a definition that provided a foundation for understanding the meaning of the connotation of urban regeneration [15]. Subsequently, Roberts [16] further emphasized the role of urban renewal in solving complex urban problems and promoting the continuous improvement of physical environments. Entering the new century, Chinese scholars Ding and Wu [17] pointed out that urban regeneration is a coping strategy for declining areas and is an important part of managing and planning the established built environment, rather than mere urbanization planning and development. This view emphasizes the positive role of urban regeneration in coping with urban decay and improving environmental quality. In the context of the "dual-carbon" goal, Li et al. [18] proposed a system of implementation paths for green and low-carbon urban regeneration, including a target system, a technical system, a standard system, and a policy system. This system provides specific guidance and direction for urban renewal in promoting green development. Meanwhile, Zhang and Liu [19], from the perspective of the double-cycle new development pattern, argue that urban renewal is an important force in improving the new development pattern. They emphasized the positive role of urban renewal in promoting the economic cycle and upgrading the quality of urban functions. In terms of mode selection, Leary and McCarthy [20] proposed to solve urban problems through urban renewal. In addition, Qi et al. [21] argued that urban renewal can enhance the quality of the built environment.

Green Finance Policies' Impact on Environmental Sustainability

Scholars have carried our extensive research on green finance and environmentally sustainable development. Sachs et al. [22] pointed out in their study that green finance could promote sustainable development goals and guarantee energy security. They highlighted the key role played by new financial instruments and policies in broadening the financing channels for environmentally friendly investments. Wang et al. [23] showed that green finance has positively contributed to sustainable development over multiple time cycles, further confirming the strong linkage and interdependence between green finance and sustainable development and interdependence. Agirman and Osman [24] and Ronaldo and Suryanto [25] proposed in their study that green finance not only focuses on the enhancement of economic benefits, but also emphasizes the balance and protection of environmental benefits. They believed that green finance was an important way to support sustainable development, thus strongly contributing to the realization of the overall sustainable development goals.

Domestic scholars have also achieved remarkable research results in this field. Zhou et al. [26] tested the effect of green finance on improving environmental quality. Lei and Wang [27] studied the impact of green finance on promoting the improvement of environmental pollution, revealing the important role of green finance in improving the environment. Ma [28], Fang, and Lin [29] explored in detail the positive impact of green credit policy on the ecological transformation of industrial structure and found that green credit policy helps to promote the development of industrial structure in a

more environmentally friendly and sustainable direction. Liu and He [30] found that by increasing the production costs of polluting enterprises, green finance effectively inhibits the development of polluting industries, thus promoting the upgrading of industrial structure. Wen et al. [31] found that green finance reduced environmental damage.

Overall, the previous scholars have provided valuable references for the work, but there are still some aspects that can be improved. First, the research on constructing evaluation index system analysis is still relatively small, with certain exploration space; second, there is less literature on studying urban renewal and environmentally sustainable development, and the research in this paper can make up for the shortcomings of the existing research; third, although domestic academics have already accumulated some results in the exploration of the relationship between green finance and sustainable development, most of these studies lack the deep relationship of excavation, and at the same time, they have not fully considered the synergistic situation with environmentally sustainable development. Therefore, we need to deeply analyze the relationship between them and their internal mechanisms to provide more accurate and scientific guidance for the formulation of relevant policies in China. Based on this, the study selects 30 regions in China from 2005 to 2022 as the research objects and adopts the systematic GMM method to explore the relationship between the three, expecting to provide a theoretical reference for China's environmentally sustainable development and the realization of the dual-carbon target.

Methodology

System GMM Model

Currently, researchers usually use two regression methods, the Tobit model and the generalized moment estimation (GMM) model, when dealing with panel data. The Tobit model is particularly suitable for dealing with truncated data; for example, although some continuous variables can theoretically take the set of positive integers, the data at some moments in the actual observation are all zero. Such a truncation phenomenon may lead to the data not truly reflecting the actual situation, and the Tobit model is therefore used to solve this problem. Dynamic panel models, on the other hand, are used to capture the dynamic changes in individual behavior, which considers the situation where individuals have made historical behavior have an impact on current behavior due to past inertia or partial adjustment behavior. In this case, incorporating the lagged terms of the independent variables into the model is necessary, and dynamic panel models are therefore used to analyze these effects.

After an in-depth study of previous research, this study argues that environmental sustainability activities are a dynamic evolutionary process in which the previous stage of sustainability activities has a significant impact on the subsequent stage. To explore the dynamic characteristics of environmental sustainability in various regions of China, this study incorporates the first-order lagged terms of the explanatory variables as independent variables in the panel data model, thus shifting from a static to a dynamic analysis. In this shift, constructing a dynamic panel model and using the GMM method to estimate the model parameters is an effective way to analyze changes in the dependent variable. Currently, differential GMM and system GMM are two commonly used generalized moment estimation methods. Arellano and Hahn [32] found that system GMM estimation performs better in the finite sample nature. System GMM estimation can address the problem of weak instrumental variables by introducing regression equations with original level values and compensating for the possible shortcomings of difference equations [33-35]. Therefore, the study selects the system GMM estimation method for empirical testing. In applying this method, two preconditions need to be met: first, the residual series in the difference equation do not have autocorrelation of the second and higher orders; second, all instrumental variables must be strictly exogenous. These two conditions can be verified by the Arellano-Bond serial correlation test (i.e., the AR test) and overidentification tests (e.g., Sargan's test or Hansen's test). The modeling can only be justified if the p-value of the AR (2) term of the AR test is greater than 0.1 and the p-value of the overidentification test is also greater than 0.1. Finally, it is worth noting that the dependent variables in dynamic panel data models are often serially correlated. Therefore, it is necessary to include the lag term of the dependent variable when constructing the model, which helps to estimate the dynamic panel data model more accurately.

$$y_{i,t} = \alpha_0 + \alpha_i y_{i,t-1} + \beta_j \sum_j X_{j,i,t} + \eta_i + \nu_{i,t}$$
$$i = 1,2,\cdots,N; j = 1,2,\cdots,M; t = 1,2,\cdots,T \quad (1)$$

In the above, X represents a comprehensive set of vectors or scalars that encompasses all other explanatory variables in the econometric model except for the lagged term of the dependent variable and its corresponding several-period lagged term. Typically, we presuppose that $y_{i,0}$ and $x_{i,0}$ are known data or that they follow some data-generating mechanism based on specific assumptions. η_i denotes an individual effect that does not change over time while $v_{i,t}$ reflects a heterogeneous error term.

This paper focuses on environmental sustainability as an explanatory variable and investigates green finance policies and urban renewal as the core explanatory variables. Given that the explanatory variables often exhibit serial correlation in the time dimension, we specifically incorporate the lagged terms of variables in the model setting. In addition, based on the in-depth

Table 1. Ecological environment sustainable development indicator system.

Level 1 indicators	Level 2 indicators	Level 3 indicators	Direction
Ecologically sustainable development	Stresses	Wastewater emissions	-
		Waste gas emissions	-
		Solid waste emissions	-
		Household garbage emissions	-
		Carbon dioxide emissions per capita	-
		Carbon dioxide emission intensity per unit of GDP	-
	Statuses	Forest coverage rate	+
		Wetland coverage rate	+
		Renewable inland freshwater resources per capita	+
		Cultivated land area per capita	+
		Public green space per capita in cities	+
		Greening coverage rate of built-up areas	+
		Ratio of afforestation area	+
	Responsive	Industrial waste gas treatment capacity	+
		Utilization rate of industrial wastewater	+
		Comprehensive utilization rate of industrial solid waste	+
		Industrial pollution control investment per unit of industrial-added value	+
		Ratio of pollution funds to GDP	+
		Harmless treatment rate of urban domestic waste	+
		Ratio of environmental budget expenditure to GDP	+

exploration of the existing literature, we construct a dynamic panel data model to accurately portray the complex relationships among these variables while controlling for other potential influencing factors. Therefore, the model underlying the empirical analysis in this paper is constructed as follows:

$$ES_{i,t} = \alpha_0 + \alpha_i ES_{i,t-1} + \beta_1 GF_{i,t} + \beta_2 UR_{i,t} + \beta_3 ER_{i,t} + \beta_4 GDP_{i,t} + \beta_5 RC_{i,t} + \beta_6 IS_{i,t} + \eta_i + v_{i,t} \quad (2)$$

In the above equation, i and t in the subscripts denote different provinces and different times, respectively. ES denotes environmental sustainability; GF denotes green finance, UR denotes urban renewal, ER denotes environmental regulation, GDP denotes the level of economic development, RC denotes resource consumption, IS denotes industrial structure, η_i denotes provincial fixed effects, $v_{i,t}$ denotes the error term, and β_i denotes the estimated coefficient.

Variable Selection and Data Sources

Explained Variables

Environmental Sustainability (ES). In the process of constructing China's ecological environment sustainability evaluation index system, we strictly followed the principles of scientific and practicality and thoroughly studied the indicators of the ecological environment in the Sustainable Development Goals (SDGs). At the same time, we fully drew on the research results of our predecessors [36-40] and constructed a unified set of evaluation indicators by considering each provincial administrative region. This set of indicators comprehensively and deeply evaluates the sustainability of China's ecological environment from the three levels of pressure, state, and response. The specific evaluation system is shown in Table 1.

Pressure: The ecological environment covers two core components, namely, ecology and environment, which contain many elements such as water resources, land resources, biological resources, and climate resources. These elements are closely related to the survival and development of human beings and have a profound impact on human life. Therefore, the pressure

Table 2. Green Finance Indicator System.

Level 1 indicators	Level 2 indicators	Level 3 indicators
Green finance	Green Credit	Banks' green credit balance
		Interest Expenditure of Energy-Consuming Industries/Total Interest Expenditure of Industries
	Green Securities	A-share market capitalization of environmental protection enterprises / total A-share market capitalization of listed enterprises
		Market capitalization of energy-consuming industries / Total A-share market capitalization
	Green Insurance	Agricultural insurance income/total agricultural output value
		Agricultural Insurance Expenditure/Total Insurance Expenditure
	Green Investment	Investment in environmental protection and pollution control / GDP
		Fiscal expenditure on energy-saving and environmental protection industry/ Total fiscal expenditure
	Carbon Finance	Carbon emissions/GDP

on the ecological environment mainly comes from the various impacts of human production activities on the environment. To comprehensively assess this pressure, we combine SDGs and screen six key indicators from the pressure system for measurement.

State: In terms of state, the indicators in the SDGs cover a wide range of areas such as agriculture, water resources, sustainable urban development, and soil and water resources, comprehensively reflecting the development of the state of resource environment, soil and water resources, and air quality. To more accurately reflect the state of the ecological environment, this paper selects seven representative indicators for display.

Response: In SDGs, the response of the ecological environment is elaborated in detail from various aspects such as water resources, sustainable urban development, and soil and water resources, covering important contents such as environmental protection and pollution control. To quantify the degree of ecological environment response, we carefully selected seven indicators for measurement.

Core Explanatory Variables

(1) Green Finance (GF)

The study builds the indicator system from the five dimensions of green securities, credit, insurance, investment, and carbon finance based on the core meaning and service scope of green finance while considering important principles such as data accessibility. The system covers five secondary indicators and nine tertiary indicators, as shown in Table 2, aiming to provide a scientific and quantitative assessment basis for green finance.

Green credit, as a key instrument in the field of green finance, has a significant impact on market development. It can not only effectively provide financial support for green industries and promote their development, but also reduce environmental pollution by raising the cost of financing and imposing restrictions on the expansion of high-pollution industries. Based on the principles of data availability and scientific research, the study chose the balance of green credit in banks and the proportion of interest expenses in six high energy-consuming industries to express [41].

Green bonds provide enterprises with diversified financing channels for green projects. The negative impact of the securities market on green financing can be effectively assessed by calculating the ratio of the A-share value of environmentally friendly companies to the total A-share market value of all listed companies, as well as the share of the six high-energy-consuming industries in the A-share value.

Green investment is promoting the implementation of low-carbon environmental protection projects to control environmental pollution. The ratio of the government's financial expenditure on environmental governance to total financial expenditure and the percentage of investment in environmental pollution control are important indicators of the scale of green investment, reflecting the government's commitment and determination to address the issues of economic development and environmental protection.

Green insurance is a means of managing environmental risks and supervising corporate environmental behavior, preventing environmental accidents by providing financial compensation to pollution victims. Although environmental pollution liability insurance started late in China and the participation rate is not high, considering the continuity and availability of data, this paper chooses agricultural insurance as the object of study and refers to the research method of Liu et al. [42], using the ratio of agricultural insurance income to total agricultural output value and the ratio of agricultural insurance expenditures to total insurance expenditures to measure the coverage of green insurance in the agricultural sector and service quality.

Carbon finance. To effectively respond to climate change, a low-carbon economy has become particularly urgent, and the carbon trading market has thus become key. Carbon finance focuses on the trading and investment of carbon emission rights, and unlike other green financial products, it is directly related to the quantitative management of carbon emissions. In the process of promoting ecological civilization construction, China actively promotes the development of the carbon market, especially in the context of achieving the goal of "carbon peak and carbon neutral". This paper measures carbon finance through the ratio of carbon emissions to GDP.

(2) Urban Renewal (UR)

Urban regeneration: with reference to Zhai and Wu [43], urban regeneration not only includes the improvement of the physical environment, but also covers the optimization of the non-physical environment. As an urban space reuse and development strategy focusing on connotation and sustainability, urban regeneration has become the core strategy of urban development nowadays. While upgrading the standard of urban environmental governance, urban renewal incentivizes enterprises to participate in governance by strengthening environmental regulations, reducing non-compliance, and prompting enterprises to increase green investment, thus continuously improving their environmental performance and promoting environmental sustainability. In terms of assessment methods for urban renewal, Huang [44] conducted a comprehensive evaluation of functional areas in the old city of Beijing through hierarchical analysis and qualitative analysis. Wang et al. [45] evaluated the urban regeneration performance of Xicheng District in Beijing using the DEA method. Wang and Zhang [46] assessed the social performance of urban regeneration in specific areas of Chongqing and Shenyang through interviews and questionnaires. Based on previous studies, the study adopts the entropy method to measure urban regeneration, as the method can objectively determine the weights and provide a comprehensive means of evaluation. The specific indicator system is detailed in Table 3.

Control Variables

Economic development level (GDP). Economic development refers to the study of Xu and Wang [47] and is expressed as the annual per capita GDP of each province.

Resource consumption (RC). The efficiency of resource consumption can be reflected by the energy consumption of 10,000-yuan GDP, which reflects the consumption of resources while creating the same economic value [48]. Therefore, this paper chooses the energy consumption of 10,000-yuan GDP as an indicator to measure resource consumption.

Industrial structure (IS). Most studies use the proportion of the tertiary industry in GDP [49]. However, considering that the secondary industry usually causes more pollution to the environment. Therefore, this paper chooses the proportion of secondary industry in GDP as a representative indicator of industrial structure to reflect the actual situation of industrial structure.

Environmental regulation (ER). On the measurement of environmental regulation, scholars have adopted different indicators, which are mainly categorized into two types: one is from the perspective of governance measures, such as sewage charges, environmental taxes, and investment in pollution control, etc.; the other is from the perspective of the effect of regulation, such as the rate of industrial pollution emission [50]. This paper, on the other hand, adopts the government's fiscal revenues on the environment as an indicator of environmental regulation, which includes revenues from interest, fines, penalties, and taxes due to the violation of environmental regulations, in order to reflect the

Table 3. Urban regeneration index system.

Level 1 indicators	Level 2 indicators	Level 3 indicators
Urban renewal	Economic benefit	Updated Increase in Fixed Asset Investment
		Renewal of increased industrial added value Built-up area
		Built-up area
		Completed area of buildings in the construction industry
	Social benefit	Number of employed persons
		Number of medical and health institutions
		Urban road area per capita
	Environmental benefit	Green space in built-up areas
		Green space per capita
		Green coverage rate

Table 4. Cross-sectional dependence test result

Variable	BP-LM test	Pesaran CD test
ES	19.44 (0.16)	4.55 (0.15)
GF	28.35 (0.27)	5.76 (0.25)
UR	28.22 (0.22)	9.88 (0.27)
GDP	61.44 (0.14)	8.53 (0.43)
RC	9.77 (0.36)	8.43 (0.26)
IS	18.56 (0.47)	5.22 (0.12)
ER	54.21 (0.24)	7.15 (0.33)

Note: The values in parentheses are p-values.

government's enforcement of environmental regulation and its effect.

Data Sources

All data come from authoritative statistics, including the China Statistical Yearbook, the China Environmental Statistics Yearbook, the China Population and Employment Statistics Yearbook, and the China Energy Statistics Yearbook, as well as the official website of the National Bureau of Statistics (NBS). For the years with missing data, this study used linear interpolation to estimate the corresponding values. The sample scope of the study covers 30 provinces (including municipalities and autonomous regions) in China, while Tibet, Hong Kong, Macao, and Taiwan are not included in this analysis due to the difficulty in obtaining data.

Determination of Evaluation Index Weights

The study selects the entropy value method among the objective assignment methods to assign weights. The entropy method is a weight determination method based on the concept of information entropy, which measures the uncertainty and variability of indicator data. This method helps to identify and emphasize those key indicators with high variability in the evaluation process. The specifics are as follows:

1. Data standardization processing

Since the unit inconsistency between the indicators is not comparable, the data need to be standardized, i.e., dimensionless, according to the positive or negative impact of the indicators on the system using the following formula:

$$\text{Positive indicators: } X_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (3)$$

$$\text{Negative indicators: } X_{ij} = \frac{\max(x_j) - x_{ij}}{\max(x_j) - \min(x_j)} \quad (4)$$

2. Calculate the weight of the *j*th indicator in year *i*

$$p_{ij} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \quad (5)$$

3. Calculate the information entropy of indicators

$$e_j = -\frac{1}{lnn}\sum_{i=1}^{m} p_{ij} \ln\left(p_{ij}\right) \quad (6)$$

4. Calculate the coefficient of variation for the *j*th indicator

$$d_j = 1 - e_j \quad (7)$$

5. Calculation of indicator weights

$$Z_j = \frac{d_j}{\sum_{j=1}^{n} d_j} \quad (8)$$

Results

Panel Data Dependency Tests

Cross-sectional dependence is an important factor that cannot be ignored when assessing the interrelationships between selected variables in a panel data model. If cross-sectional dependence is ignored, it may lead to significant bias and error amplification in the estimation results (Pesaran, 2006). Therefore, the authors first tested the panel data for cross-sectional dependence before exploring the smoothness of the variables. For this purpose, the authors used two methods, the Breusch-Pagan LM test and the Pesaran CD test. The results in Table 4 showed that the cross-sectional correlation of the variables was not significant and that there was no cross-sectional correlation in the data.

Panel Unit Root and Cointegration Test

In regression analysis of time series and panel data, the so-called "pseudo-regression" problem is sometimes encountered. This phenomenon may cause the regression results to lose their practical explanatory value because pseudo-regression may produce misleading statistical significance, thus affecting the accurate interpretation of data trends and patterns. Therefore, in order to ensure that the regression results are valid, this paper utilizes the ADF method to perform a unit root test on the time series data in order to observe its smoothness. In this paper, the smoothness test of the variables is examined with the help of software Eviews, and the results are shown in Table 5.

Under the Fisher-ADF test, all the variables are highly significant at the 1% level, which indicates that "all" reject the original hypothesis, which means that the variables do not have a unit root and are smooth series. Cointegration analysis can be carried out further. The

Table 5. Unit root test results.

Variable	ADF-fisher test		Smoothness
	Statistic	P-value	
ES	66.37	0.0001	Smooth
GF	99.45	0.0000	Smooth
UR	81.23	0.0000	Smooth
GDP	98.46	0.0000	Smooth
RC	91.77	0.0012	Smooth
IS	111.29	0.0000	Smooth
ER	72.47	0.0002	Smooth

Table 6. Cointegration test results.

Test methods	Statistic	Statistical value
Kao test	ADF	1.89** (0.034)
Pedroni test	Panel-ADF Statistic	-9.921*** (0.0000)
	Group-ADF Statistic	-11.230*** (0.000)

Note: **, *** means $p<0.05$ and $p<0.1$

results of the Pedroni test and Kao test are shown in Table 6.

As shown in Table 6 above, the statistics of the Kao test and the Pedroni test rejected the original hypothesis at 5% and 1% levels of significance. This indicates that there is a long-run trend of equilibrium among the variables examined. Based on this result, we will continue with further empirical analysis using the random effects Tobit model.

Correlation and Multicollinearity Test of Variables

Before proceeding to the empirical analysis, we first executed the correlation test with the aim of exploring the interrelationships between the key variables and assessing whether there is a problem of multicollinearity among them, which may have an impact on the validity of the regression analysis. The results of the correlation test in Table 7, i.e., the matrix of correlation coefficients between variables, are displayed in Table 7. The correlation coefficients between all the variables are below 0.4, which indicates a weak correlation between the variables. To further ensure the accuracy of the regression model estimation, we also calculated the variance inflation factor (VIF) for each variable and presented the results in Table 8. None of the variance inflation factor values exceeded 10, a result that further confirms that there is no multicollinearity problem. Therefore, we can conclude that the regression equation used in this study is reasonable in terms of variable selection.

Panel Data Model Identification

Since this paper selects panel data for empirical research, a Hausman test is needed to identify the measurement model, and the results of the Hausman test are specified as follows:

As shown in Table 9, the test result is 27.89 with a p-value of 0.000, which rejects the original hypothesis, so the fixed effect model is selected as the econometric model for panel regression.

System GMM Model Regression Results

In this study, system GMM is used for the regression test; to enhance the credibility of the regression analysis,

Table 7. Correlation test results.

Variable	GF	UR	GDP	RC	IS	ER
GF	1					
UR	0.121	1				
GDP	0.012	0.243	1			
RC	-0.079	0.094	0.135	1		
IS	-0.033	0.017	0.128	0.308	1	
ER	0.049	0.053	-0.039	-0.257	-0.203	1

Table 8. Results of the multiple covariance test.

	GF	UR	GDP	RC	IS	ER
VIF	2.43	3.44	1.69	2.18	4.66	2.68
1/VIF	0.411523	0.290698	0.591716	0.458716	0.214592	0.373134

Table 9. Panel data model identification results.

	Coef.
Chi-square test value	27.89
P-value	0.0000

this study has rigorously tested the reasonableness of the model setting and the validity of instrumental variables. The results in Table 10 confirm that there is no autocorrelation, and the p-values of Sargan's test also indicate that there is no over-identification problem in the regression model, further verifying the validity of the instrumental variables and the robustness of the regression results. This indicates that the system GMM estimation is valid. The regression results are shown in Table 10.

Impact Analysis of Core Explanatory Variables on Environmental Sustainability

Urban renewal has played a positive role in environmental sustainability nationwide, thanks to its whole-life planning perspective and embedded green and low-carbon concepts. The core of urban renewal lies in changing the traditional development model and seeking a balance between economic growth and reduction of greenhouse gas emissions. Depending on the characteristics of different climatic regions, urban renewal strategies emphasize localized, distinctive, and environmentally friendly management and operation modes in order to establish an efficient urban operation system, optimize low-carbon effects, and thus promote environmental sustainability. In terms of regional differences, the impact in the eastern and central regions is statistically significantly positive, while the Western region is not significant. This difference may stem from the lag in the application of planning techniques and modernization of social governance, especially information technology, in the Western region. In urban governance, the application of information technology

Table 10. Regression results.

Variable	National	East	Central	West
GF	0.247***	0.326***	0.113	0.087
	(4.22)	(6.02)	(1.16)	(0.88)
UR	0.134***	0.268***	0.147***	0.056
	(3.45)	(3.97)	(2.99)	(0.98)
GDP	0.133***	0.176***	0.034*	0.055
	(4.57)	(2.99)	(1.90)	(1.23)
RC	-0.334***	-0.129***	-0.238***	-0.399***
	(-4.56)	(-4.69)	(-3.22)	(-5.93)
IS	-0.158***	-0.094	-0.211***	-0.318***
	(-3.98)	(-1.28)	(-4.66)	(-5.28)
ER	0.024*	0.049*	-0.066***	-0.176***
	(1.99)	(1.97)	(4.37)	(3.98)
AR(1)	0.0345	0.0139	0.0002	0.0013
AR(2)	0.2394	0.7721	0.3521	0.1984
Sargan	0.3452	0.6621	0.1283	0.4577

Note: *, *** means $p<0.01$ and $p<0.1$

can improve the efficiency of energy use and reduce total energy consumption and carbon emissions. The eastern and central regions have better IT development than the western region, which has certain IT deficiencies that limit its potential to promote environmental sustainability. Therefore, strengthening the development of information technology and modernizing urban governance in the Western region is critical to achieving environmental sustainability on a national scale.

Green finance plays a positive role in promoting regional environmental sustainability. In other words, as the level of green finance development increases, the sustainability status of the regional environment is improved accordingly. There are two main reasons for this positive impact. First, green finance provides more diversified financing channels for enterprises committed to environmental protection projects, which not only helps to solve the information asymmetry problem between these enterprises and potential investors, but also helps investors to effectively diversify their investment risks and ensures that the enterprises can obtain the necessary financial support, thus promoting sustainable development. Secondly, green finance plays an important role in resource allocation, which promotes the optimization and transformation of industrial structure and promotes the development of the industrial chain in a higher-end and more environmentally friendly direction through the scale effect of industrial integration. In summary, green finance plays a crucial role in promoting sustainable development, by providing financial support to help green enterprises and optimizing the allocation of resources to promote green transformation.

Analyzed from a regional perspective, green finance can promote environmental sustainability in the eastern region, a role verified at the 1% significance level, while in the central and western regions, this role is less obvious. This difference is closely related to the degree of economic development. Historically, the eastern region has used resource-intensive industries as the main engine of economic growth; however, in the current wave of green development, green finance-promoting environmental protection industries have become increasingly prominent. Thanks to the high level of green finance development, the eastern region is able to provide diversified financial products, which provide the necessary financial support for the green transformation of enterprises and play a positive role in the sustainable development of the environment. In addition, the residents of the eastern region have a stronger awareness of environmental protection, which provides a solid social foundation for the environmental protection industry and enables the effective use and promotion of green financial tools. In contrast, green finance in the central and western regions is relatively lagging behind. The central and western regions are dominated by resource-based economies, and traditional industries such as energy and minerals dominate and the development of these industries is often accompanied by environmental pollution problems, which limits the application of green finance. In addition, the central and western regions are relatively backward in technological innovation and application of environmental protection technology, lacking advanced environmental protection technology and equipment, which limits the promotion and application of green finance. The risk assessment and review process for green projects by financial institutions is more complicated, which may lead them to prefer investing in traditional projects, thus limiting green finance development. With relatively low market demand and a small market for green products and services, enterprises may lack incentives to undergo green transformation. In addition, the concept and awareness of green finance are weak in the central and western regions, and enterprises and individuals are not sufficiently aware of the importance of environmentally sustainable development and lack knowledge of and demand for green finance.

Analysis of the Impact of Control Variables on Environmental Sustainability

Economic development's impact on environmentally sustainable development is significantly positive, indicating that economic development is conducive to environmentally sustainable development. Specifically, it seems that the improvement of economic development is not only conducive to industrial structure, but also advanced technology and equipment, which can improve the utilization rate of resources and promote the improvement of the level of environmentally sustainable development, but the coefficient of the western region test is not significant, which is mainly related to the current western region's resource-based economy.

Resource consumption shows a negative effect at the national level and each of the regions, reflecting the fact that the increase in energy intensity, i.e., the increase in energy intensity, i.e., energy consumption, poses a significant constraint on the sustainable development of the ecological environment. In China, coal, as a major source of energy consumption, generates pollutants such as dust, ash, sulfur dioxide, nitrogen oxides, and carbon dioxide during the combustion process, which seriously damages the atmospheric environment and negatively affects the public's healthy life. In addition, coal mining activities may cause damage to land and water resources, further threatening ecological sustainability.

The regression coefficients for the share of the secondary sector in GDP are negative at the national level and in all its regions, although this trend is not significant in the eastern region. Adding the share of the secondary industry clearly limits the sustainability of the ecological environment. The growth of heavy industry, as an important part of the secondary industry, is often accompanied by large-scale consumption of non-renewable resources such as minerals and energy. Due to the limitations of technology and knowledge level, this development model easily leads to overuse of

resources and generates a large amount of waste, causing serious pollution to the environment. Industry typically accounts for a higher proportion of energy consumption, material use, and pollutant emissions than agriculture (primary sector) and services (tertiary sector).

Environmental regulation can promote regional environmental sustainability at the national level. In the eastern region, the intensity of environmental regulation has not had a significant impact on environmental sustainability in the region due to higher levels of economic development and technological sophistication. In contrast, the central and western regions are more sensitive to environmental regulation. In these regions, stronger environmental regulation may increase the cost of ecological protection for both government and industry, which may lead to a failure to optimize resource and output efficiencies and thus have a negative effect on environmental sustainability. This difference may be due to the fact that the central and western regions are less technologically advanced and economically developed compared to the east and therefore face greater challenges in the implementation of environmental regulations. Overall, the effects of environmental regulation in different regions are influenced by factors such as local economic development and technology. In order to achieve environmental sustainability, appropriate environmental regulation policies need to be developed and implemented according to the specific conditions of each region.

Conclusions and Recommendations

Conclusions

The study adopts the systematic GMM method to explore green financial policies and urban renewal impacts on regional environmentally sustainable development, expecting to provide theoretical reference for China's environmentally sustainable development, and draws the following conclusions:

(1) In general, green finance policies have a positive contribution to regional environmentally sustainable development, i.e., green finance is conducive to regional environmentally sustainable development. From the perspective of different regions, green finance significantly promotes environmentally sustainable development in the eastern region while not significant in the central and western regions, mainly due to the large differences between the eastern, central, and western regions in terms of technology, human resources, industrial structure, and the quality of economic development.

(2) Urban renewal promotes environmentally sustainable development at the national level, mainly because the essence of urban renewal is to realize a win-win situation for both socio-economic development and the reduction of greenhouse gas emissions by transforming the development mode. From the perspective of different regions, the implementation of urban renewal policies in the east and center of the country promotes environmentally sustainable development, while urban renewal does not have a significant impact in the west of the country, which is not enough to play a positive role.

(3) Economic development can improve environmental sustainability, but the coefficient test in the western region is not significant, mainly related to the current resource-based economy in the western region. The increase of resource consumption in all regions inhibits ecological sustainability; except for the eastern region, the increase in the proportion of the secondary industry has a significant inhibitory effect on the improvement of ecological sustainability, but is not significant in the eastern region; environmental regulations on regional environmental sustainability at the national level and the eastern region can promote environmental sustainability. However, environmental regulation inhibits environmental sustainability in the central and western regions.

Recommendations

According to the results of the empirical analysis above, it can be concluded that both green financial policies and urban renewal policies have a greater impact on the sustainable development of the regional environment. Accordingly, this paper puts forward the following policy recommendations to enhance environmental sustainable development and management:

(1) After an in-depth analysis of the above research results, we can clearly recognize that the rapid growth of financial policies promotes the upgrading of industrial structure. Against the background of realizing the goal of "double carbon", green development is expected to become the core trend of economic development. The following measures are recommended: the government should formulate and continuously optimize green financial policies, establish the development direction, basic principles, and specific implementation strategies of green finance, and provide market participants with a clear policy framework; establish and improve the green financial system, including the formulation of standard definitions of green financial products and assessment and certification processes, in order to incentivize financial institutions to increase investment in green industries. Strengthen international cooperation, introduce international advanced concepts and resources to enhance green finance development, and seek international mutually beneficial cooperation in the field of green finance; Strengthen the regulation of the green finance market to ensure the standardization and sustainability of green finance activities while the government should take into account the regional characteristics and industrial realities when formulating policies and implement differentiated policy strategies; Focus on the role of green finance in promoting the

transformation of industrial structure and utilize green finance as a key element in promoting the development of the green industry, as well as in promoting the development of the green industry. The role of green finance in promoting the transformation of industrial structure, using green financial tools to promote the transformation of industries to ecology, supporting the technological upgrading of traditional industries and energy saving and emission reduction, promoting clean production technology, and encouraging green product development. Through these measures, it can be ensured that green finance can promote the development of industrial structures in a more sustainable and environmentally friendly direction.

(2) Environmental impact and energy efficiency standards should be introduced in the vetting process of enterprises' listing to ensure that listed companies follow the principle of green development. In addition, consideration should be given to lowering the issuance threshold in the primary market for projects dedicated to environmental protection and resource conservation so as to incentivize more capital investment in the green sector. Further, innovative green financial derivatives are also essential. Through the continuous development and improvement of the green financial derivatives market and intermediary services, we can provide more diversified financial support and risk management tools for the green industry. We can provide investors with more diversified investment choices, help reduce the risk of the green financial market, and further promote the healthy development of green finance.

(3) Optimize the green tax system, strengthen tax design and innovation, and introduce energy tax and carbon tax in due course. Environmental tax and resource tax, as the core components of green tax, are levied to promote environmental protection with the help of tax leverage. Drawing on the successful experience of developed countries, it is not difficult to find that many countries have introduced the "green tax" system as the problems of excessive resource consumption and environmental pollution in the process of energy extraction and use have become more and more prominent. The original intention of this system is to strengthen the positive role of taxation in promoting environmentally friendly development and enhancing energy efficiency. By optimizing the green tax system, we can not only effectively curb excessive consumption of resources and environmental pollution, but also guide enterprises and individuals to establish the concept of green development. This will help realize sustainable economic and social development and contribute to the construction of a beautiful China.

(4) Constructing a system for assessing the effects of green finance. China’s green financial policy is still in the initial exploration stage; although the promotion of green innovation has shown a positive trend, but compared with the expected goals, there is still a certain gap in its actual effect. In view of this, it is necessary for us to make full use of the government's advantages in guiding green finance development and construct a set of scientific and effective evaluation systems for green financial policies. Specifically, a set of accurate green finance statistical monitoring indicators should be designed to comprehensively reflect the actual situation of green finance activities. In addition, it is crucial to construct a systematic policy assessment framework, which should combine the methods of process assessment and outcome assessment in order to achieve fair and comprehensive monitoring of the investment effects of green financial instruments. At the same time, we should use the feedback loop in the assessment system to quickly identify deficiencies and problematic points in policy implementation and then make timely policy adjustments and optimizations to ensure the continuous improvement and effective implementation of green financial policies. In the process of policy design and implementation, the green financial assessment system should be embedded as an important link to ensure that green financial policies are more scientific and reasonable. Through this series of measures, we can effectively promote the exploration and practice of green financial policies.

(5) Urban renewal focuses on social and environmental benefits and improves overall benefits. At the level of economic benefits, urban renewal contributes to the adjustment of the industrial structure by optimizing the land use structure. Urban planning should be coordinated with the city's economic development planning to ensure that industrial upgrading and urban renewal are synchronized to achieve integrated development. In terms of social benefits, urban renewal is an important way to provide public facilities and improve the living conditions of residents. A people-centered renewal model should be established, with the goal of meeting residents' needs and improving the quality of urban life. At the same time, the public participation mechanism should be improved to coordinate the economic interests of developers with the public interests of society, so as to improve the social benefits of the projects and enhance the residents' sense of well-being. In addition, it is necessary to improve the housing security system to ensure housing stability for low-income groups and to flexibly formulate land contribution policies in order to efficiently and rationally allocate land for public facilities. In terms of environmental benefits, urban renewal projects have a greater impact on the surrounding environment due to the tendency of population and industry to concentrate in urban center areas. Therefore, it is necessary to carry out an environmental impact assessment at the pre-project stage and determine the appropriate plot ratio according to the specific situation in order to realize the sustainable redevelopment of urban construction.

(6) In order to promote the greening process of urban renewal, it is necessary to establish comprehensive and systematic greening indicators and further improve the greening evaluation system of urban renewal projects. By carefully constructing greening indicators for urban

renewal, we aim to clearly define the core elements of greening urban renewal and their evaluation criteria, so as to ensure that the concept of greening runs through the whole process of urban renewal. Specifically, we will conduct an all-round greening assessment of the project by formulating detailed greening indicators and evaluation criteria to ensure that the project meets the greening requirements during design, construction, and operation. At the same time, we will establish an effective monitoring mechanism to track and monitor the project implementation process in real time to ensure that the greening measures are effectively implemented. In addition, we will also focus on post-assessment work to evaluate the greening effect of completed projects and summarize the lessons learned so as to provide a useful reference for future urban renewal projects. In conclusion, through the establishment of a comprehensive greening indicator and evaluation system for urban renewal, we will provide a strong guarantee and support for promoting the greening process of urban renewal and the sustainable development of cities.

Conflict of Interest

The authors declare no conflict of interest.

References

1. ISLAM M.Z., WANG S. Exploring the unique characteristics of environmental sustainability in China: Navigating future challenges. China's Population, Resources and Environment: English Edition, **21** (1), 37, **2023**.
2. KUMAR R., GOEL R., SINGH T. Sustainable Finance Factors in Indian Economy: Analysis on Policy of Climate Change and Energy Sector. Fluctuation and Noise Letters, **23** (02), 2440004, **2024**.
3. TIWARI S., RAZA S.A., GUPTA S.K. Testing the LCC hypothesis by considering environmental sustainability and economic development: Role of green energy and resource management. Geoscience Frontiers, **15** (3), 101666, **2024**.
4. LEE C.C., HUSSAIN J. Optimal behavior of environmental regulations to reduce carbon emissions: A simulation-based dual green gaming model. Environmental Science and Pollution Research, **37** (29), 56037, **2022**.
5. PING S., SHAH S.A.A. Green finance, renewable energy, financial development, FDI, and CO2 nexus under the impact of higher education. Environmental Science and Pollution Research, **30** (12), 33524, **2023**.
6. YADAV A., GYAMFI B.A., ASONGU S.A. The role of green finance and governance effectiveness in the impact of renewable energy investment on CO2 emissions in BRICS economies. Journal of Environmental Management, **358**, 120906, **2024**.
7. HSIEH C.M., YU C.Y., SHAO L.Y. Improving the Local Wind Environment through Urban Design Strategies in an Urban Renewal Process to Mitigate Urban Heat Island Effects. Journal of Urban Planning and Development, **149** (2), 5023003, **2023**.
8. CORDEIRO T.A.A., FERREIRA F.A.F., SPAHR R.W. Enhanced planning capacity in urban renewal: Addressing complex challenges using neutrosophic logic and DEMATEL. Cities, **150**, 105006, **2024**.
9. GOODLAND R. The Concept of Environmental Sustainability. Annual Review of Ecology & Systematics, **26**, 1, **1995**.
10. MOLDAN B., JANOUSKOVA S., HAK T. How to understand and measure environmental sustainability: Indicators and targets. Ecological Indicators, **17**, 4, **2012**.
11. BUI N.T., KAWAMURA A., BUI D.D., AMAGUCHI H. Groundwater sustainability assessment framework: A demonstration of environmental sustainability index for Hanoi, Vietnam. Journal of Environmental Management, **241**, 479, **2019**.
12. ZHANG S.Q. Preliminary Discussion on the Environmental Indicator System for Sustainable Development. World Environment, **3**, 8, **1996**.
13. HUANG B., LV M. Construction of regional environmentally sustainable development index system. Journal of Guangxi Teachers College (Natural Science Edition), **2**, 20, **1999**.
14. YANG C.F. Research on sustainable development of agro-meteorology and ecological environment. Contemporary Agricultural Machinery, **2**, 63, **2023**.
15. KEITH N.S. Rebuilding American cities: The challenge of urban redevelopment. The American Scholar, **23** (3), 341, **1954**.
16. ROBERTS P., SYKES H. Urban Regeneration: A Handbook. London: SAGE Publications, **2000**.
17. DING F., WU J. Research on urban renewal guided by large-scale cultural events in the context of globalization. Urban Development Research, **27** (8), 81, **2020**.
18. LI X., BAI Y., CAO S.Q. Exploration of Urban Renewal Actions under the Goal of "Double Carbon". Urban Development Research, **8**, 58, **2023**.
19. ZHANG N., LIU H. Research on high-quality development of China's inland cities based on the new development pattern of double cycle. Theory Exploration, **1**, 152, **2022**.
20. LEARY M.E., MCCARTHY J. The Routledge Companion to Urban Regeneration. London and New York: Routledge, **2010**.
21. QI D.J., ZHOU J.Y., ZHAO R. Application of cross-section planning ideas in urban renewal--Taking the urban renewal program of the southern section of Guangzhou's new central axis as an example. Urban Planning, **43** (10), 67, **2019**.
22. SACHS J.D., WOO W.T., YOSHINO N. Importance of green finance for achieving sustainable development goals and energy security. Handbook of Green Finance, **6**, 3, **2019**.
23. WANG K.H., ZHAO Y.X., JIANG C.F. Does green finance inspire sustainable development? Evidence from a global perspective. Economic Analysis and Policy, **75**, 412, **2022**.
24. AGIRMAN E., OSMAN A.B. Green finance for sustainable development: A theoretical study. Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi, **6** (1), 243, **2019**.
25. RONALDO R., SURYANTO T. Green finance and sustainability development goals in Indonesian Fund Village. Resources Policy, **78**, 102839, **2022**.
26. ZHOU X.G., TANG X.M., ZHANG R. Impact of green finance on economic development and environmental quality: a study based on provincial panel data from China. Environmental Science and Pollution Research, **27**, 19915, **2000**.

27. LEI H.Y., WANG X.X. Environmental Pollution, Green Finance and High-Quality Economic Development. Statistics and Decision Making, **36** (15), 18, **2020**.
28. MA T.Y. Green credit "lending" for economic transformation. Chinese Financier, **7**, 33, **2010**.
29. FANG J.G., LIN F. Research on the relationship between green finance and sustainable economic development--an empirical analysis based on panel data from 30 provinces in China. Journal of China University of Petroleum (Social Science Edition), **35** (01), 14, **2019**.
30. LIU X., HE P. Research on the influence effect of green finance in the economic development of central region. Industrial Technology Economy, **3**, 76, **2019**.
31. WEN Y., LIN Z.F., LIU X.L. Green finance and the quality of economic growth: with resource and environmental constraints in general equilibrium model construction and empirical test. China Management Science, **30** (03), 55, **2022**.
32. ARELLANO M., HAHN J. Understanding bias in nonlinear panel models: Some recent developments. Econometric Society Monographs, **43**, 381, **2007**.
33. LIU Y., SHI G.F. Digital economy,scientific and technological innovation and industrial layout-Analysis based on system GMM and threshold model. Hubei Social Science, **9**, 58, **2023**.
34. WANG J., QI Z.Y. Research on the impact of digital economy development on urban-rural income gap - based on system GMM and threshold effect analysis. Xinjiang Agricultural Reclamation Economy, **2**, 38, **2023**.
35. YIN J.W. Environmental regulation, new media regulation and the efficiency of green economy development: an empirical analysis based on system GMM and threshold effect model. Henan Science, **41** (9), 1397, **2023**.
36. YANG S.H., GUO H.L. Discussion on the evaluation of sustainable development of urban ecological environment. Journal of South China Normal University: Natural Science Edition, **4**, 74, **2000**.
37. ZHAO T., MI G.F. Research on the evaluation model of sustainable development of ecological environment in Inner Mongolia. Journal of Beijing Institute of Technology: Social Science Edition, **14** (1), 27, **2012**.
38. ZHAO D., LU J.B., MIN H. Establishment of evaluation index system for sustainable development of ecological environment in Zhejiang Province. Environmental Pollution and Prevention, **25** (6), 380, **2003**.
39. YANG S.H. Sustainable development of urban ecosystems: A case study of Chinese cities. Journal of South China Normal University: Natural Science Edition, **1**, 62, **1997**.
40. YANG J.Q. Comprehensive Measurement of Ecological Sustainability and Analysis of Influencing Factors in China. Northwest Normal University, **2024**.
41. SUN S.Y., WANG X.Y., GAO C.Y. Can green credit exert carbon emission reduction effect. China Population-Resources and Environment, **33** (8), 37, **2023**.
42. LIU L., WANG J.Y., ZHANG J. A study on the correlation between carbon finance, green credit and green insurance in China - A perspective based on the internal coordination of green financial system. Finance and Economics, **40** (4), 46, **2024**.
43. ZHAI B.Q., WU M.Q. The concept of urban renewal and the reality of Chinese cities. Journal of Urban Planning, **2**, 75, **2009**.
44. HUANG S.Z. Evaluation of Functional Area Construction in Beijing's Old City. Urban Issues, **11**, 29, **2007**.
45. WANG M., LI Y., ZHANG W.X. Evaluation of Urban Renewal Performance Based on DEA Method- Taking the Former Xicheng District of Beijing as an Example. Urban Development Research, **18** (10), 90, **2011**.
46. WANG Y.B., ZHANG Z.T. Social Performance Evaluation of Urban Renewal under the Perspective of Big Events - An Empirical Investigation Based on Aboriginal Residents after Renewal in Chongqing Main City. Urban Development Research, **24** (9), 1, **2017**.
47. XU K.N., WANG J. Research on the relationship between natural resource abundance and economic development level. Economic Research, **41** (1), 78, **2006**.
48. LU H.Y., WU Z.F. The relationship between energy uses right policy and the transition to decarbonisation of energy consumption structure. Resource Science, **45** (6), 1181, **2023.**
49. TIAN H., ZHANG D.D. Trade openness, industrial structure upgrading and digital economy development: an empirical study based on panel data of the Yangtze River Economic Belt. Research on Business Economics, **1**, 176, **2024**.
50. SHENG Y.C., XU S., ZHOU Y. Can environmental regulation promote factor efficiency in the Yellow River Basin. Arid Zone Geography, **46** (1), 139, **2023**.