



Study and Concepts about Economic Growth and Environmental Quality from the Perspective of Spatial Effect

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Abstract: The rapid development of Bangladesh's economy and excessive has caused environmental problems, threatening residents' health and the ecological environment's safety. In this process, in addition to the increase in environmental pollution caused by local economic growth and spatial spillover factors cannot be ignored. Due to the spatial spillover of environmental pollution and the increasingly close inter-regional connections, environmental quality is not only affected by the economic development of the region but also by neighboring regions. Environmental governance cannot rely solely on a single local government but is also affected by the policies of surrounding areas. Are there spatial spillover effects of socioeconomic factors affecting environmental quality? How is the space overflow size? Ignoring these problems will not only bring difficulties to local government pollution control but also directly affect the realization of Bangladesh's energy conservation and emission reduction goals. This paper studies the concept of the economic growth, and environmental quality from the perspective of spatial effect to provide a good reference for the environmental bureau more effective environmental policies.

Index Terms – environmental development, economic growth, environmental quality and spatial effect.

1.0. INTRODUCTION

Based on domestic and foreign research, from the perspective of spatial effect, a theoretical framework for the study of the relationship between economic growth and environmental quality are constructed, and analyzed. Using the exploratory spatial data analysis method to measure the spatial correlation of Bangladesh's economic growth and environmental quality indicators, and use the spatial measurement method to empirically study the impact of economic growth and on environmental quality. The influence of the three factors was examined from the perspective of feedback. On this basis, the economic growth and environmental quality are comprehensively evaluated from the perspective of systems science, and the spatial-temporal coupling evolution characteristics of the three and the spatial spillover effect of innovation-driven coupling and coordinated development are investigated, thereby providing suggestions for regional environmental governance and coordinated development policy recommendations. First, the theoretical research on the relationship between economic growth and environmental quality from the spatial effect perspective is carried out using logical reasoning. The thesis starts from the analysis of the classical theoretical basis and the construction of the influence mechanism. Concepts such as space and space effects are defined and based on the environmental Kuznets curve theory, space economics theory, economic growth theory, and system science theory, and it profoundly analyzes economic growth and from the perspective of local and spatial effects through scale, structure and technological effects on environmental quality. It constructs a theoretical analysis framework for the interaction of economic growth, and environmental quality, laying a theoretical foundation for studying the full text.

The spatial spillover effect of high-tech industries helps to improve environmental quality. It expands the research on environmental quality impacts and lays the foundation for subsequent research based on economic structure effects and spatial effects.

2.0. RESEARCH BACKGROUND

Worldwide, environmental pollution poses a serious threat to the ecological environment in the economic development of various countries. Bangladesh also faces the problem of deteriorating environmental quality. Bangladesh's economic growth has achieved remarkable results, with significant achievements in economic development, and the demand for resources for residents' living and production has multiplied. During this process, the resources, environment, and social systems have developed rapidly problem such as energy shortage and severe environmental pollution have gradually emerged, and the contradiction between economic development and resources and the environment has become increasingly prominent. Water, air and soil pollution have become serious threats to the production and life of residents. The haze weather phenomenon frequently occurs in some areas, and the

phenomenon of water and soil pollution is becoming more serious. Environmental pollution discharges have chronic effects on human health, agricultural crop yields, forestry, fish, and building materials. For example, air pollution induces respiratory diseases, and water and soil pollution endanger food safety and human health. The issue of global warming caused by the greenhouse effect caused by carbon emissions has also received widespread attention from society.

The temporal and spatial background of these problems lies in the rapid unbalanced development of Bangladesh's economy and excessive energy consumption. The extensive economic development mode of high energy consumption, high emission, and high pollution in the past has brought a series of environmental problems. Bangladesh's economy has entered a new normal, and it is necessary to shift from high-speed growth to high-quality development. In the context of promoting the implementation of supply-side structural reforms, Bangladesh has maintained sound economic growth in recent years, which also provides an opportunity to achieve high-quality economic development, energy conservation, and emission reduction through economic structure and energy structure adjustment. The 2030 Agenda for Sustainable Development was adopted at the 2015 United Nations Development Summit. The Paris Agreement, adopted at the 21st UN Climate Change Conference in 2015, reached a political consensus on the issue of rising global temperatures by the end of the 21st century. Bangladesh's 13th Five-Year Plan also proposes to control carbon emissions. Against this background at home and abroad, to achieve high-quality economic development and fulfill international commitments, implementing energy conservation and emission reduction strategies and developing a low-carbon economy has become the only way for Bangladesh's sustainable development. Poor environmental quality and excessive are significant problems facing Bangladesh's economic development. The contradiction between economic prosperity, environmental and ecological threats, and unbalanced regional development have attracted widespread attention from the public and academia.

Economic growth and not only affect the region's environmental quality but also significantly impact the environmental quality of neighboring regions through spatial spillover effects. Therefore, the spatial spillover of economic growth, and environmental pollution is not only a practical problem that urgently needs to be solved in formulating energy conservation and emission reduction policies and environmental governance by governments at all levels but is also a hot topic of academic attention. Due to the lack of empirical research tools, traditional economic research ignores the study of the spatial dimension. Based on traditional econometrics, spatial econometrics introduces the spatial dimension, which is helpful for the study of the relationship between economic growth, and environmental quality from the perspective of spatial effects.

3.0. RESEARCH PURPOSE AND SIGNIFICANCE

RESEARCH PURPOSE

The main objective of this paper is to explore the spatial relationship between regional economic growth and environmental quality and the interrelationship between economic development and environmental quality from the perspective of spatial effects.

1. Analyze the interaction process and internal mechanism of economic growth and environmental quality, establish a theoretical analysis framework, and study the relationship between economic growth and environmental quality from the perspective of spatial impact. Based on research results at home and abroad, comprehensively apply the theory of environmental Kuznetts curve, economic growth theory, systems science and other theories to systematically explain the internal process of the interaction between economic growth and environmental quality, and develop theories that consider the spatial impact analysis framework.
2. According to the theoretical analysis model of the effect of economic growth on environmental quality, from the perspective of spatial effect, the effect of economic growth on environmental quality is investigated through total effect, direct effect and indirect effect. The spatial correlation between economic growth and environmental quality in Bangladesh is investigated through exploratory spatial data methods, and then a spatial panel data model is developed to empirically examine the spatial effects of economic growth and environmental quality.
3. According to the interaction between economic growth and environmental quality, the correlation between economic growth and environmental quality is examined from the perspective of spatial effects. From the perspective of spatial effects, the spatial and temporal evolution characteristics of integrated development of economic growth and environmental quality driven by technological innovation, and the spatial spillover effects of integrated economic-energy-environmental development are studied.

This paper aims to explore the spatial correlation and spatial spillover effects of Bangladesh's economic growth and environmental quality through research to provide a decision-making basis for the government's regional economic development planning, energy planning strategy, and environmental governance policy formulation.

RELATED CONCEPTS

SPACE

Traditional economics studies three significant issues: "for whom production", "what to produce," and "how to produce". Spatial economics introduces a spatial dimension to examine the question of "where to produce". Economic and social activities need to be completed in spatial units, and economic relations also need to examine spatial locations. Therefore, the spatial dimension becomes a vital research object. The definition of the concept of space is the precondition and foundation for the analysis of social and economic activities from the perspective of space effects.

At present, scholars have defined the concept of space from the perspectives of physics, geography, philosophy, economics, and other disciplines. Geography defines space as the relationship between the set of solar markers on the Earth's surface that defines a space. The form of matter, the structural process, and the distribution and pattern of functional relationships are all forms of existence in space. Spatial economics believes that the spatial dimension causes the transportation cost of social and economic activities. Through the entry point of transportation cost, the spatial dimension is incorporated into the general equilibrium theory research framework. The basic unit of analysis of *Wu Jigui* is the area, that is, the surface element. When dividing regions, Bangladesh's provincial administrative regions are used to define them, which is also the most common research method.

4.0. SPATIAL SPILLOVER AND SPATIAL EFFECT

Spatial spillover is an essential concept in spatial economics. Scholars have carried out a lot of research on spatial spillover in the field of environmental economics from the perspective of theoretical research and empirical research. In economic theory, spillovers arise from externalities. For example, *Samuelson (2007)* believes that the influence of a rational person's behavior on the welfare of others, this externality is a spillover. This externality of economic activity is not captured in market transactions, so spillover is an additional benefit not included in market transactions. And spillovers can lead to reduced economic efficiency.

Some scholars believe that economic spillover is manifested as the diffusion of social and economic activities and the results of actions at the spatial level and is the interaction between spatial unit variables. Many types of research revolve around knowledge spillovers and technology spillovers. *Wu Jigui (2016)* believes that spatial spillover is not limited to knowledge spillover, and spillover refers to the extra income or welfare loss that an individual's economic behavior produces for others. The resulting externalities may be positive or negative, described as external economics and diseconomies.

At a practical level, there are often significant spatial correlations between economic activities in different spatial units. The spatial effect is a factor that cannot be ignored in the research on the impact of economic growth and on environmental quality. Scholars have also begun to investigate the impact of economic growth and on environmental quality from the perspective of spatial effect. The spatial econometrics research method developed by *Anselin* considers spatial effects, including spatial heterogeneity and spatial correlation, and has contributed significantly to fields such as energy economics and environmental economics. Spatial heterogeneity refers to the irregularity in the spatial distribution of spatial data.

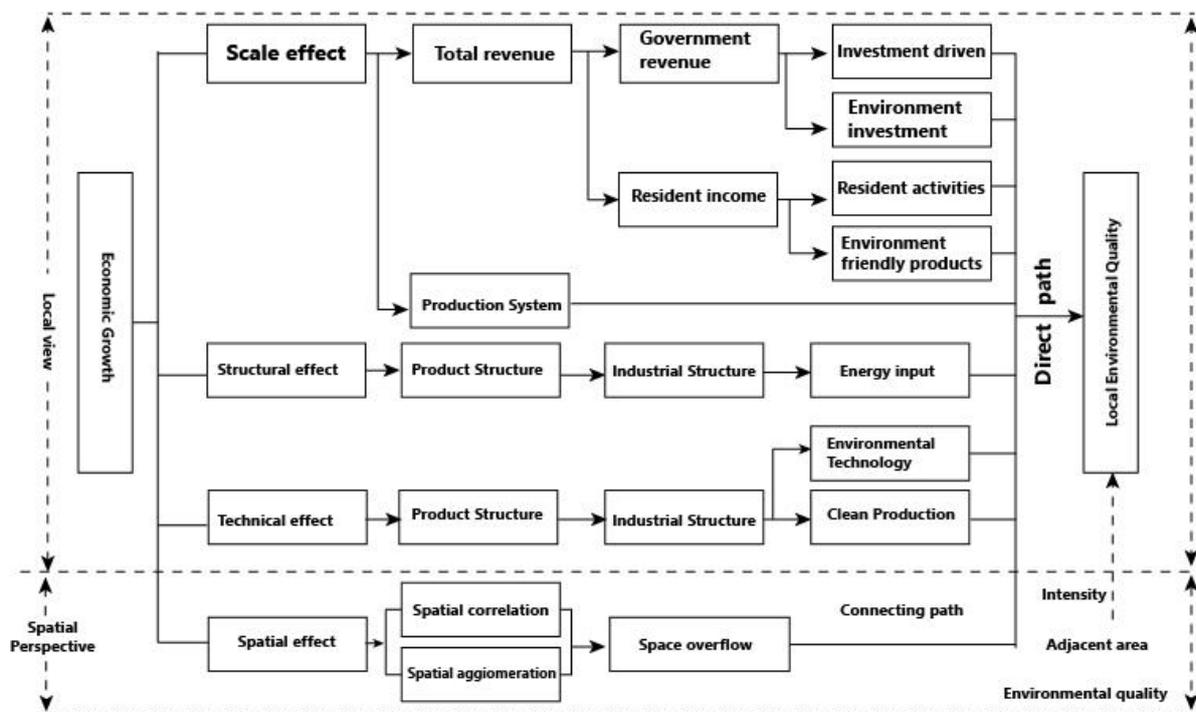


Figure 1: The impact path of economic growth on environment quality with spatial effects

The investigation of spatial spillover effects needs to be based on the interaction of economic activities between regions. Specific to the interrelationship of variables in regions, spatial effects examine the interaction of variables between spatial units, including spatial autocorrelation and spatial spillover effects. Adopting the definition of *Wu Jigui (2016)*, he believes that spatial spillover refers to the external impact of social and economic activities that cross borders and their scopes based on a specific relationship, such as geographic relationships, economic relationships, and other relationships.

ENVIRONMENTAL QUALITY

Environmental quality is the suitability of the overall environment or elements to human life, production, and social development. Environmental quality includes natural environment quality and social environment quality. Environmental quality is divided into broad and narrow environmental quality. In a broad sense, environmental quality refers to the overall suitability of natural or artificially transformed natural factors such as air, water, land, forest, and organisms for human life, production, and social development. In a narrow sense, environmental quality mainly refers to the discharge of air pollution, soil and water pollution, solid waste pollution, etc., that cause pressure or damage to the environment. Environmental quality can be described qualitatively or quantitatively. Quantitative description can use environmental pollution indicators to measure environmental quality. This paper adopts the concept of environmental quality in a narrow sense. The environmental quality involved refers to the quality of the natural environment, and the degree of environmental pollution or damage is used to reflect the quality of the environment.

Environmental pollution is a phenomenon in which the substances added to the environmental system by human activities exceed the carrying capacity of the environmental system, the state and typical indicators of the environmental system change, the environmental quality declines, and the average production and living conditions of residents and the ecosystem are destroyed. In a narrow sense, pollution refers to environmental additives that harm human production and life in the short term. Although carbon dioxide is not a pollutant that causes direct damage, considering its essential role in global climate change, it has caused massive environmental pressure. As a final product sector, carbon dioxide emissions are also consumed by the environment, resulting in the deterioration of environmental quality. In the traditional sense, pollutant emissions that harm production and life in the short term,

and emissions that bring long-term negative externalities, such as carbon emissions that cause global warming, will both cause damage and pressure to the environment and deteriorate the environment quality.

Water pollution is the artificial introduction of harmful substances into the water body, reducing the value of water resources and destroying the water ecological environment. These harmful substances include acids, alkalis, oxidants, copper, cadmium, mercury, arsenic, benzene, dichloroethane, ethylene glycol, and the like. Water pollution is watershed pollution. That is, it spreads with water flow. The area through which the water flows is geographically adjacent, such to the Dhaka Turag River Economic Belt. Water pollution has a spatial effect in this local area, but the spatial effect in the province is not apparent. Solid waste includes hazardous waste, industrial waste, domestic waste, construction waste, agricultural waste, etc. Solid waste belongs to local pollution, and the spatial effect of geographical distance is not apparent. Air pollution refers to the entry of substances produced by social and economic activities into the atmosphere, impacting human life and the ecological environment. Air pollution is a kind of global pollution that is highly mobile and easy to spread among regions, with apparent spatial effects. Compared with water pollution and solid pollutants, the fluidity and diffusivity of air pollutant emissions are more vital, the diffusion speed is faster, and the impact range is more comprehensive. Air pollution is also environmental pollution that needs to be urgently addressed in Bangladesh. Therefore, from the perspective of spatial effects, air pollution emissions are mainly selected as environmental quality indicators.

Table 01: Variables descriptive statistical results

Variable name	Symbol	Company	Max	Min	Mean	Std.
CO ₂ emissions	ce	Ton/10000 persons	12.96	9.12	11.03	0.63
SO ₂ emissions	se	Ton/10000 persons	6.47	2.73	5.03	0.66
Economic growth	pgdp	Taka/person	160.72	115.5	138.11	8.56

Industrial production and residents' life are the main sources of air pollutants, of which industrial production is essential. In 2014, the proportion of SO₂ emissions from industrial production was as high as 88.0%, and the proportion of soot and dust emissions from industrial production was also as high as 80.7%, while the proportion of SO₂ and soot emissions from residential life was relatively small. Air pollution is related to unfavorable meteorological factors and a large number of pollutants emitted by industrial production, motor vehicles, and coal combustion. releases carbon monoxide, sulfur dioxide, and nitrogen oxides, which aggravate air pollution. Soot emissions are mainly from coal combustion, and dust emissions are mainly from industrial production. These two types of emissions constitute soot emissions. Industrial smoke and dust constitute the main source of primary fine particles and the main component of atmospheric smog.

STUDIED ON TECHNOLOGICAL EFFECTS AND ENVIRONMENTAL QUALITY IN ECONOMIC GROWTH

In the research on environmental effects from the perspective of technological progress, some scholars believe that technological progress is conducive to energy conservation and emission reduction. For example, *Stokey (1998)* believes that technological progress promotes the formation of the environmental Kuznets curve. *Jaffe et al. (2000)* believed that technological progress would help to change traditional production methods and achieve energy conservation and emission reduction. *Bruvoll and Medin (2000)* analyzed environmentally harmful emissions in the air. They found that economic growth promotes emissions per unit of production, while clean energy substitution and other technological advancements inhibit emissions growth. Among them, technological changes are the main reasons for reducing sulfur dioxide and lead emissions. In economic development, technological progress has become an essential factor affecting emission reduction. *Ang (2009)* found the inhibitory effect of technological progress on carbon dioxide emissions. (2015) found that technological progress can help curb, and technological progress is an essential factor in carbon dioxide emission reduction. Another research by some scholars believes that the current technological progress is applied chiefly to the production process and has not yet alleviated the contradiction between economic growth and environmental pollution.

5.0. RESULTS AND DISCUSSION

STUDIED ON ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY FROM THE PERSPECTIVE OF SPATIAL EFFECTS

This paper studies the relationship between economic growth and environmental quality from the perspective of spatial effects. Firstly, the process and internal mechanism of the interaction between economic growth, and environmental quality are theoretically analyzed; secondly, the time evolution and spatial distribution characteristics of economic growth and environmental indicators are analyzed; based on the rules, exploratory space technology is used to examine the spatial effects of the three indicators; a spatial econometric model is constructed to examine the impact of economic growth and on regional environmental quality; a spatial simultaneous equation model is constructed to examine economic growth and energy under the feedback effect. Finally, based on theoretical and empirical results analysis, policy recommendations for regional environmental governance are put forward.

The main research contents include:

- (1) Theoretical research on the relationship between economic growth and environmental quality from the perspective of spatial effects.

Using the theory of environmental Kuznets curve, economic growth theory, system science theory, and space theory, based on logical analysis and mechanism analysis, systematically expounds on the impact path of and economic growth on environmental quality and examines economic growth and energy from the perspective of spatial effect Interaction between consumption and environmental quality; systematically expound the mechanism of economy-energy-environment coupling, analyze the influence process and mechanism of external factors on the coordinated development of economy-energy-environment coupling, and construct the relationship between economic growth, and environmental quality The theoretical analysis framework provides a theoretical basis for further research and provides theoretical basis and guidance for empirical testing and analysis..

- (2) Research economic growth's temporal and spatial evolution characteristics and environmental quality indicators. Based on theoretical analysis, the changing trend and evolution law of economic growth and environmental quality indicators are analyzed, and the spatial correlation and spatial agglomeration characteristics of economic growth, energy intensity, energy structure, and environmental quality indicators are analyzed by experimental spatial techniques. Analyze the spatial

differences of the regional economy-energy-environment coupling coordination degree over time, and conduct a mathematical analysis of the spatial correlation and spatial accumulation of the regional economy-energy-environment coordination degree.

- (3) Empirical research on the impact of economic growth on environmental quality from the perspective of spatial effects. Firstly, the spatial correlation and spatial accumulation of regional economic growth and environmental quality are analyzed using exploratory spatial techniques. Then, based on the theory of the mechanism of economic growth affecting environmental quality and the research hypotheses formed through specific impact mechanisms such as scale effect, structural effect, and technological effect, exploratory spatial data analysis tools are used to investigate the spatial correlation, and spatial-temporal distribution of economic growth and regional environmental indicators feature. According to the test results, considering the spillover of social and economic factors, construct a regional environmental spatial panel data model to examine the spatial spillover effect of economic growth on regional environmental quality.
- (4) Empirical research on the impact on environmental quality from the perspective of spatial effects. Based on the mechanism theory that energy intensity, and energy structure affect regional environmental quality, research hypotheses are formed through specific impact mechanisms. The spatial correlation and spatiotemporal distribution characteristics of regional environmental indicators were analyzed using exploratory spatial techniques. According to the results of spatial exploratory testing, a spatial Dobin panel data model of environmental impact is constructed to investigate the spatial spillover effects of energy intensity, and energy structure on environmental emissions.

Empirical research on the interactive effects of economic growth and environmental quality from the perspective of spatial effects. Research hypotheses are formed based on the process and theoretical research on the interaction between economic growth and environmental quality from the perspective of spatial effects. Reuse exploratory spatial techniques to analyze the spatial correlations of economic growth and regional environment. According to the results of spatial exploratory testing, using the output model considering energy and environmental constraints, construct a spatial simultaneous panel model that economic growth and affect environmental quality from the perspective of spatial effects and empirically test the interaction between economic growth and environmental quality.

ACKNOWLEDGMENT

This research was not financially funded.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest for this research.

REFERENCES

- [1] Kang Y, Zhao T, Yang Y. Environmental Kuznets Curve for CO₂ Emissions in Bangladesh: A Spatial Panel Data Approach[J]. *Ecological Indicators*, 2016, 63:231- 239.
- [2] Grossman G M, Krueger A B. Economic Growth and the Environment[J]. *Nber Working Papers*, 1995, 110(2): 353-377.
- [3] He J. What is the Role of Openness for Bangladesh's Aggregate Industrial SO₂ Emission A Structural Analysis based on the Division Decomposition Method[J]. *Eco- logical Economics*, 2010, 69(4): 868-886.
- [4] Grossman G, Krueger A. Environmental Impacts of a North American Free Trade Agreement[J]. *Social Science Electronic Publishing*, 1991, 8(2): 223-250.
- [5] Jebli M B, Youssef S B, Ozturk I. Testing Environmental Kuznets Curve Hypothesis: The Role of Renewable and Non-renewable and Trade in OECD Countries[J]. *Ecological Indicators*, 2016, 60: 824-831.
- [6] Bernard J T, Gavin M, Khalaf L, et al. Environmental Kuznets Curve: Tipping Points, Uncertainty and Weak Identification[J]. *Environmental & Resource Eco- nomics*, 2011, 60(2): 285-315.
- [7] Wang K. The Relationship between Carbon Dioxide Emissions and Economic Growth: Quantile Panel Type Analysis[J]. *Quality & Quantity*, 2013, 47(3): 1337- 1366.
- [8] Ma S, Shi L. The Micro-foundations of the Environmental Kuznets Curve[J]. *Fudan Journal of the Humanities and Social Sciences*, 2014, 7(3): 471-482.
- [9] Al-mulali U, Weng-Wai C, Sheau-Ting L, et al. Investigating the Environmental Kuznets Curve (EKC) Hypothesis by Utilizing the Ecological Footprint as an Indicator of Environmental Degradation[J]. *Ecological Indicators*, 2015, 48: 315-323.
- [10] Apergis N, Ozturk I. Testing Environmental Kuznets Curve Hypothesis in Asian Countries[J]. *Ecological Indicators*, 2015: 16-22.
- [11] Perman R, Stern D I. Evidence from Panel Unit Root and Cointegration Tests that the Environmental Kuznets Curve does not Exist[J]. *Australian Journal of Agricul- tural & Resource Economics*, 2003, 47(3): 325-347.
- [12] Paudel K P, Schafer M J. The Environmental Kuznets Curve Under a New Frame- work: The Role of Social Capital in Water Pollution[J]. *Environmental & Resource Economics*, 2009, 42(2): 265-278.
- [13] Marsiglio S, Ansuategi A, Gallastegui M C. The Environmental Kuznets Curve and the Structural Change Hypothesis[J]. *Environmental and Resource Economics*, 2016, 63(2): 265-288.
- [14] Cheng Z, Li L, Liu J. Industrial Structure, Technical Progress and Carbon Intensity in Bangladesh's Provinces[J]. *Renewable and Sustainable Energy Reviews*, 2018, 81: 2935-2946.
- [15] Hao Y, Zhang Q, Zhong M, et al. Is There Convergence in Per Capita SO₂ Emissions in Bangladesh. An Empirical Study Using City-level Panel Data[J]. *Journal of Cleaner Production*, 2015, 108(A): 944-954.

- [16] Jaffe A B, Newell R G, Stavins R N. Technological Change and the Environment[J]. Environmental Resource & Economics, 2000, 22(03): 461-516.
- [17] Bruvoll A, Medin H. Factoring the Environmental Kuznets Curve Evidence from Norway[J]. Statistics Norway, 2000: 275.
- [18] Ang J B. CO2 Emissions, Research and Technology Transfer in Bangladesh[J]. Ecological Economics, 2009, 68(10): 2658-2665.
- [19] Liddle B, Lung S. Revisiting β and GDP Causality: Importance of a Priori Hypothesis Testing, Disaggregated Data, and Heterogeneous Panels[J]. Applied Energy, 2015, 142: 44-55.
- [20] Dogan E, Seker F. Determinants of CO2 Emissions in the European Union: The Role of Renewable and Non-Renewable Energy[J]. Renewable Energy, 2016, 94: 429-439.
- [21] Ahmad A, Zhao Y, Shahbaz M, et al. Carbon Emissions, and Economic Growth: An Aggregate and Disaggregate Analysis of the Indian Economy[J]. Energy Policy, 2016, 96: 131-143.

