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RESEARCH ON THE IMPACT OF INVESTMENT ON GREEN ECONOMIC EFFICIENCY - BASED ON ANALYSIS OF 21 PROVINCES IN MONGOLIA

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ABSTRACT

With globalization and the rapid development of Mongolia's economy, domestic and foreign investment has become an important force to promote Mongolia's economic growth and structural optimization. At the same time, Mongolia is facing severe challenges from increasing environmental pollution and tightening resource constraints. Therefore, it is of great significance to research investment how affects the efficiency of Mongolia's green economy in order to lead economic development and environmental protection in both directions. Based on the panel data of 21 provinces in Mongolia from 2010 to 2023, this study measured the green economic efficiency of each province, and constructs a panel threshold model to comprehensively test the relationship between investment and efficiency. The results show that investment, environmental investment, and technological development have a positive impact on green economic efficiency, while the employment population has a negative impact on green economic efficiency. This study not only enriches the theory of investment and green growth, but also provides a basis for local governments to formulate differentiated incentive policies.
The main conclusions and recommendations are: The characteristics of the relationship between investment and efficiency, with the increase of investment level, the level of technological innovation increases; provinces at different development stages need to adopt differentiated investment policies, and optimize the investment structure and environment, strengthen the guidance and support role of local governments in green development; strengthen the training and introduction of talents in the field of green technology, attract and retain high-tech talents by establishing talent introduction plans, and enhance technological innovation capabilities.

KEYWORDS

Investment, Green Economic Efficiency, Environmental Regulation, Technological Innovation, Green Growth

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Study background. With the deepening development of global economic integration,

domestic and foreign investment has become a key force in promoting world economic growth. Especially in Mongolia, investment is not only an important engine for rapid economic development, but also an important channel for optimizing economic structure and promoting technological innovation.

Green economy refers to a model that achieves economic growth under the premise of effective resource utilization and environmental protection. With global climate change and environmental deterioration, green economy has become a hot topic of global concern. As China's largest mineral exporting developing country, the development of Mongolia's green economy is not only related to its own sustainable development, but also has a profound impact on global environmental governance. In terms of introducing foreign investment, it is necessary to emphasize optimizing the foreign investment structure and encourage investment in Mongolia's domestic manufacturing, industry, education, art and high-tech fields. In this context, companies can take advantage of their rich operational experience to fully grasp and actively integrate into a higher level of opening-up process, such as setting up a research and development center in Mongolia and working with local partners to accelerate technological innovation; to use international environmental protection standards to drive the green transformation of the entire supply chain. By accelerating the integration of the domestic market, we can improve the technology spillover efficiency of investment, significantly improve the efficiency of green economy, and promote green economic growth.

3. Overview of Investment Theory

1. Keynesian Investment Theory

I. Insufficient Effective Demand and Importance of Investment. The core of Keynesian

Investment Theory is to solve the problem of insufficient effective demand. Keynes believed that capitalist economy often has insufficient effective demand, which leads to imbalance between production and consumption, and then leads to economic crisis and unemployment. In order to deal with this problem, investment has become an important means to stimulate the economy. Keynes emphasized the importance of public investment, and stimulated economic activities and promoted employment by increasing government spending and expanding public works.

II. Liquidity Preference and Interest Rates. Keynes proposed the liquidity preference theory, arguing that people prefer to hold highly liquid currencies rather than invest. Under liquidity preference, the interest rate level is affected by the supply and demand of money. Low interest rates will encourage investment, because the cost of investment is reduced and enterprises are willing to increase investment. Therefore, Keynes advocated adjusting interest rates through monetary policy to stimulate investment activities.

III. Uncertainty and Investment Risk. Keynes believed that investment decisions are affected by future uncertainty. When entrepreneurs make investment decisions, they will face uncertainties such as market demand, technological progress, and policy changes. These uncertainties increase investment risks and may cause enterprises to hesitate or reduce investment. Therefore, Keynes advocated that the government should provide a stable policy environment and reduce uncertainty to encourage enterprises to increase investment.

IV. Investment multiplier effect. The investment multiplier effect in investment theory refers to the fact that an investment can leads to several times the increase in economic activities. Through investment, economic growth can be stimulated, employment can be increased, income can be increased, etc., which will then produce a chain reaction and promote the prosperity of the entire economy. Keynes believed that the government should actively use fiscal policy to drive economic growth and achieve full employment by increasing investment. In summary, Keynesian investment theory emphasizes the important role of investment in solving insufficient effective demand, adjusting interest rates, coping with uncertainty and achieving economic prosperity. Keynes advocated that the government should actively intervene in the economy, stimulate economic activities by increasing public investment and providing a stable policy environment, and achieve full employment and economic growth.

2. Enterprise Value Investment Theory

It means buying corporate stocks whose market price is significantly lower than the corporate value. Market prices change all the time during transactions, and corporate value depends on the profits (cash flow) generated during the life cycle of the company. The concept of value investing is very simple, and it is also the basic principle followed by all value investor and there are five aspects:

I. Stocks are partial ownership of a business. Stocks represent the ownership of a company.

Buying stocks mean investing in a company and owning the equity of the company. To invest in a company, you need to fully understand the company's "Business" as well as its assets and financial situation, trust the company's management, and be able to foresee the company's future business value.

II. Safety. Safety is one of the core concepts of value investing, which can be generally understood as the relationship between price and corporate value. Market sentiment is extremely unstable, and market prices often deviate from the true value of companies. The market is either enthusiastic or extremely pessimistic, and the market is always constantly adjusted and changed by various factors and emotions. Value investors tend to try to evaluate the intrinsic value of an excellent company and will only buy it when the price is appropriate or significantly undervalued.

III. Competence circle principle. The competence circle principle is to be able to identify the boundaries of one's own capabilities, do things within one's own competence circle, and be in awe of things that are beyond one's own cognition and ability. We often lack awe, do not understand our own strengths, and are even less aware of our own shortcomings and ignorance. We often feel that we know everything and can do everything. Value investors have awe for things that they are uncertain about, do not understand, and do not know. People's time and energy are limited, and their subjective initiative is also limited. The external environment is complex and changeable. We cannot be familiar with everything, and it is wise to always know our ignorance.

IV. Long-termism. It means taking a long-term perspective, looking for and discovering excellent and outstanding companies, growing and developing with excellent and outstanding companies, and being friends with time. Only excellent and outstanding companies can be friends with time, with continuous growth in revenue and profits, bringing investors a steady stream of growing returns. On the contrary, companies with weak competitiveness will continue to weaken over time and eventually go to extinction. The opposite of long-termism is speculation. Value investors often sell their stocks only when they prove that they made a mistake in buying or when there are better investment opportunities, while speculators often seek to benefit from stock price fluctuations.

V. Continuous learning. Reading and learning is a label for every value investor, and it is also a common label for all successful people. All value investors are lovers of reading and learning, and are also practitioners of lifelong learning and growth. The world is complex and changeable, and complete cognition is impossible. Only by continuous learning and growth can we get closer to the truth. Enterprises are constantly developing and changing. Both people and enterprises are in a complex and changeable environment in the world. Only by continuous learning can we continuously improve our cognitive ability and have the opportunity to see ourselves and the world more realistically. Value investors make themselves better and richer by reading. Continuous learning is a common and persistent concept of all true value investors.

2.1 Value investment system

By adhering to the above five concepts (principles) of value investing, value investing can be simply understood as "Good company" + "Good price" + "Capability circle". The called "Good company" refers to "Good business" + "High moat" + "Good management". "Good business" refers to the company's excellent business model, which is specifically reflected in the company's excellent profitability and cash flow levels. "High moat" means that the company has sustained and significant advantages in market competition. "Good management" means that the company has an excellent corporate culture, an excellent management team and follows the laws and principles of corporate management. The called good price means that the market transaction price is significantly lower than the enterprise value. As the name implies, the competence circle refers to the size of the scope of an investor's personal ability. Investors within the competence circle can identify "Good companies" and "Good prices" and make wise decisions. On the contrary, if it exceeds the investor's "Capability circle", investors cannot effectively analyze and identify "Good companies" or "Good prices" and thus choose to speculate or make wrong decisions. Different people have different capability circle. If investors want to expand and improve their own competence circles, they need to continue to learn and grow, and improve their cognitive and cultivation levels.

3. Foreign direct investment theory

Foreign direct investment theory occupies an important position in the field of international economics, covering a wide range of topics from micro-enterprise decision-making to macroeconomic policies. Hymer first proposed a theory of international operations of multinational corporations, marking the starting point of

modern FDI theory. He believed that enterprises seek control rather than just profit through FDI, and this control can solve market defects and provide multinational corporations with greater market power than local companies. Dunning (1980) further developed the FDI theory and proposed the famous "FDI ecological theory", also known as the ODLI model, which believes that multinational corporations need to have ownership advantages (OD), location advantages (L) and internalization advantages (I) when conducting international production. This theory provides a comprehensive framework for understanding why, how and where enterprises conduct FDI. Porter (1991) analyzed FDI from the perspective of competitive advantage, emphasizing the impact of competitive advantages at the national level on the flow of FDI. He believes that industries with specific competitive advantages are more inclined to invest abroad and improve their global competitiveness in this way. In recent years, with the acceleration of globalization and technological progress, the nature and impact of FDI are also changing. Mathews (2006) proposed the concept of "leading enterprises" and analyzed how multinational corporations from emerging Asian markets succeeded in the global market through FDI. As environmental issues have received increasing attention, FDI theory has also begun to pay attention to its impact on the environment. Alfaro and Charlton (2009) and Sato (2017) showed that FDI not only has a significant impact on the economic growth of the recipient country, but also has an important impact on global greenhouse gas emissions and environmental protection. These studies have expanded FDI theory and combined it with sustainable development and environmental protection. Foreign direct investment theory has evolved from a basic framework to explain the behavior of multinational corporations to a complex interaction that considers environmental sustainability. These theories not only provide a theoretical basis for understanding the economic effects of FDI, but also provide a new perspective for analyzing how FDI promotes or hinders global green transformation. As the global economic landscape continues to change, the development of FDI theory will continue to adapt to new economic and environmental challenges.

4. Green economy trends and implementation in Mongolia

The challenges of the 21st century, such as the rapid depletion of natural resources and climate change, the loss of natural diversity, the increasing pollution of water and soil, and the increasing frequency of natural disasters, are the threats that may arise in the future, and the need to develop lifestyle and traditional development reforms for the future, creating the need and requirement for a green economy. Therefore, in order to implement sustainable development policies and green development on a global scale, several documents and summits have been organized to reflect the concept of "Green Development" in every sector and unit, and to find ways to address the pressing issues of the future, nature, ecology, and economy in a comprehensive manner. In 2012, the United Nations Conference on the Future We Want adopted the document "The Future We Want" in Rio de Janeiro, Brazil, which stated that a green economy is a way to achieve sustainable development and reduce poverty. The United Nations Environment Programme defines a green economy as an economy that significantly reduces environmental risks and ecological degradation while improving human well-being, social equity and inclusion. The simplest definition of a green economy is one that has low greenhouse gas emissions, uses resources efficiently, and ensures social equity and inclusion. Green development is a holistic approach to the global community, taking into account the diversity of nature, economy and society in a holistic manner. The 70th session of the United Nations General Assembly, held on September 25-27, 2015, adopted the 17 Sustainable Development Goals, and in line with this, Mongolia's Green Development Policy, its plan, and implementation, as well as Mongolia's Sustainable Development Policy and National Program, have been adopted and implemented. Mongolia's Green Development Policy was approved by Resolution No. 43 on June 13, 2014, and aims to become a developed country that creates economic growth based on the Green Development ideology, ensures citizen participation, preserves environmental sustainability, passes it on to future generations, and creates conditions for long-term benefits. Within the framework of Mongolia's Green Development Policy, green economy policy analysis, green development criteria, green jobs, green school buildings, green production and consumption, sustainable procurement, waste management, and green development education are being implemented to a limited extent.

Research Methods and variable Selection

4.1 Research Methods

The research methods used in this paper are mainly based on econometric models and techniques. In particular, advanced econometric statistical methods will be used to analyze the impact of investment on green economic efficiency. The following is an analysis of the main research methods and models that may be used in the paper:

Regression analysis: The paper will construct one or more regression models to quantify and analyze the impact of investment on green economic efficiency. These models may include fixed effect models or random effect models to take into account differences between different regions in terms of economic development level, environmental policies, human capital, etc. The regression model will enable researchers to test the relationship between the core variable investment and green economic efficiency and evaluate the impact of other control variables.

4.2 Basic regression model construction.

In order to further explore the impact of foreign direct investment on the efficiency Mongolia's green economy, this study designed a more detailed and detailed study Econometric modeling. The model aims to reveal the direct impact of investment on the efficiency of the green economy and the mechanism of indirect influence through other economic factors. The model is constructed as follows:

$$GEE_{it}=\alpha+\beta_1 INV_{it}+ \beta_2 EPI_{it}+ \beta_3 EDL_{it}+ \beta_4 LAB_{it}+ \beta_5 TECHD_{it}+\gamma X_{it}+\varepsilon_{it}$$

In this equation, GEE_{it} -Represents the green economic efficiency of the i province in t year and is analyzed as the dependent variable; $\beta_1 INV_{it}$ -Represents the inflow of investment into Mongolia, or domestic budget investment province i in t year, taking into account the possible nonlinear impact of investment on green economic efficiency; $\beta_2 EPI_{it}$ -Represents the amount of investment in environmental protection includes the expenditure of each province on pollution control and environmental governance; $\beta_3 EDL_{it}$ -Represents the level of economic development level, usually measured by GDP per capita; $\beta_4 LAB_{it}$ -Represents labor force and reflects provincial production effect; $\beta_5 TECHD_{it}$- Represents an indicator of technological progress, measured by quantities such as research and development investment or the number of internet users; γX_{it} - Represents the other variables that effect the green economy, such as industrial structure, energy consumption structure, policy support; ε_{it}- Represents random error etc.

4.2 Variable Selection

1. Green Economic Efficiency (GEE) – It is a measure of how effectively provinces can manage resource consumption and reduce environmental pollution while achieving economic growth. The GEE measurement indicators of most countries mainly rely on data such as economic output, resource consumption and environmental emissions of each city, so this information is replaced by household indicators living in centralized independent engineering furnished houses. These data are mainly derived from the population infrastructure information of the Mongolian Statistical Yearbook.
2. Investment - Investment is considered to be an important driving force for economic growth, technological progress and industrial upgrading and it used as the main explanatory variable to examine its direct impact on green economic efficiency.
3. Environmental Protection Investment (EPI)- EPI includes the province's financial expenditure on air pollution control and environmental protection, reflecting the province's attention to environmental protection and the intensity of investment. The data of 21 province' s on environmental protection were obtained through the public budget reports released by local governments and financial departments. These data reflect the investment intensity of provincial governments in environmental governance and pollution control.
4. Economic Development Level (EDL)- It is usually measured by GDP per capita to reflect the economic and development level of a province, which has an important impact on the efficiency of the green economy. The economic development level of a city is measured by GDP per capita, and the relevant data is collected from the annual report of the Statistical Yearbook of Mongolia.
5. Labor (LAB)- Reflects the role of human resources in a province's economic activities, measured in terms of employment or labor force participation people of working age rate.
6. Technological Development (TECHD): The improvement of technological level is considered to be a factor in improving the efficiency of the green economy and can be measured by indicators such as research and development expenditure and replaced by information on the number of Internet users.

5. An Empirical Analysis of the Impact of Investment on Green Economic Efficiency

1. Variable descriptive statistics

In this study of the impact of foreign investment on Mongolia's green economic efficiency (GEE), this paper uses descriptive statistical analysis methods to show the basic statistical characteristics of each key variable in detail. The analyzed data set contains comprehensive data covering 21 provinces in Mongolia from 2010 to 2023, with 273 observations for each variable, reflecting the breadth of the study and the richness of the data.

Table1. Variable definitions and descriptive statistical characteristics

Variables	Observations	Mean	Median	Maximum	Minimum	Standard deviation
GEE	273	7.41	7.3	9.6	5.84	0.94
INV	273	42.37	24.54	529.21	1.23	64.47
EPI	273	13.07	6.53	391.18	0.11	31.71
EDL	273	6700.13	5923.2	61024.25	1477.0	5655.5
LAB	273	33535.7	33261.0	68881.3	3223.0	11029.4
TECHD	273	59.28	54.9	157.8	9.8	30.31

The table shows the definitions of variables such as green economic efficiency (GEE), investment, environmental protection expenditure as a percentage of GDP (ENV), GDP per capita level (EDL), employment (LAB), and total number of people using the Internet (TECHD). Number of observations, mean, standard deviation, minimum and maximum values. As can be seen from the table, the average value of green economic efficiency is 7.41, the standard deviation is 0.94, the minimum and maximum values are 5.4 and 9.6 respectively, the investment amount is 52.92 billion Mongolian Tugriks, the standard deviation is 64.47, and the minimum value is the disparity between the maximum and minimum indicates that distribution of investment varies significantly in different cities, which may be due to differences in regional policies, economic environment, and market potential.

2. Regression Analysis

Dependent Variable: GEE
Method: Least Squares
Date: 01/10/25 Time: 00:04
Sample: 1 273
Included observations: 273

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.969913	0.173331	40.21168	0.0000
EDL	1.94E-05	1.05E-05	1.845939	0.0660
EPI	0.003474	0.001579	2.200044	0.0287
INV	0.001548	0.000763	2.029359	0.0434
LAB	-2.12E-05	4.84E-06	-4.382337	0.0000
TECHD	0.015375	0.002210	6.956074	0.0000

R-squared	0.712982	Mean dependent var	7.412868
Adjusted R-squared	0.700117	S.D. dependent var	0.939031
S.E. of regression	0.785584	Akaike info criterion	2.376954
Sum squared resid	164.7769	Schwarz criterion	2.456283
Log likelihood	-318.4542	Hannan-Quinn criter.	2.408798
F-statistic	24.32723	Durbin-Watson stat	1.902847
Prob(F-statistic)	0.000000		

According to regression analysis, the green economy efficiency is affected by factors such as GDP per capita, environmental protection expediture, investment, employment and technological development process with a probability of 70 percent, and the remaining 30 percent is determined by indicators other than these.

6. Conclusions

With the deepening of globalization and the widespread promotion of the concept of green development, while investment is driving national economic growth, its impact on the environment and green economic efficiency has attracted increasing attention from all walks of life. This study takes 21 provinces in Mongolia from 2010 to 2023 as the research object, and deeply explores the impact of internal investment, employment, economic development level, and environmental protection expenditure on green economic efficiency. Based on the above research findings, this chapter aims to put forward a series of specific policy recommendations in order to provide reference and reference for promoting the high-quality development of my country's green economy and building an ecological civilization.

(1) Deepen the policy of supporting technological innovation: The government should increase financial support for technological innovation, provide research and development subsidies, and provide financial guarantees for enterprises to carry out green technology research and development. At the same time, encourage enterprises to increase investment in green technology research and development and application in Mongolia through tax reduction and exemption measures. Strengthen the training and introduction of talents in the field of green technology, attract and retain high-tech talents through the establishment of talent introduction plans, and enhance technological innovation capabilities.

(2) Optimize the structure and environment of investment: Formulate clear investment guidance policies, give priority to attracting and encouraging foreign investment projects that can introduce advanced green technologies, environmental protection concepts and management experience, especially in the fields of new energy, energy conservation and environmental protection. Continuously improve the investment environment, strengthen intellectual property protection, provide a stable, fair and transparent business environment for foreign-funded enterprises, and enhance the investment confidence of foreign-funded enterprises.

(3) Strengthen the guiding and supporting role of local governments in green development: Encourage local governments to formulate and implement green development strategies and action plans that are in line with local characteristics, including green industry development and green infrastructure construction, based on local conditions. Local governments should provide policy support and services for green projects, while strengthening supervision of environmental pollution and resource consumption to ensure that the dual goals of economic development and environmental protection are achieved.

(4) Promote international cooperation and global green development initiatives: Actively participate in international green development projects and initiatives, such as the "OBOR" international green development cooperation, and introduce international advanced green technologies and experiences through international cooperation projects. Strengthen green technology cooperation and exchanges with international organizations and countries, regularly hold international green technology exhibitions and forums, and enhance Mongolia's influence and competitiveness in the field of international green economy. Through the implementation of the above policy recommendations, it is aimed to build a system and mechanism conducive to the development of the green economy, and give full play to the dual role of investment and technological innovation in promoting the efficiency of the green economy. This will not only help achieve the green transformation of economic growth, but also meet Mongolia's strategic goals of long-term development and participation in global environmental governance.

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