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Can reducing carbon emissions improve economic performance? Evidence from China

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Abstract
As the problem of carbon emissions is becoming increasingly more serious around the world, how to balance carbon emissions reduction and economic growth has become an important issue in the field of ecological economics. China is the world's largest carbon dioxide emitter, and China's Low-Carbon Pilot (CLCP) policy has significantly reduced carbon dioxide emissions and achieved expected benefits. However, is environmental quality improving at the expense of economic growth? Based on panel data from 286 Chinese prefecture-level cities and from Chinese micro-industrial enterprises from 2001 to 2013, this article focuses on the causal effect of environmental policy on regional economic growth and the benefits and changes in the behavior of enterprises through a quasi-natural experiment and the difference-in-differences (DID) method. The results are as follows. First, the CLCP policy significantly promotes regional economic growth. Moreover, as the implementation time of the policy continues, environmental regulation has a greater effect of promoting economic growth. Second, although the CLCP policy significantly increases various production costs, it also promotes the growth of enterprises' output and benefits. Third, under the pressure of the significant increase in enterprise cost caused by environmental regulation, enterprises choose the positive way of strengthening internal management, improving efficiency and increasing innovation instead of choosing the negative way of trans-regional transfer to exit the market; accordingly, enterprises finally achieve an improvement in output and benefits.

JEL O12 O13 Q38
Keywords CLCP policy; economic growth; behavior of enterprise; DID

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1. Introduction

With the continuous expansion of human activities, climate change and environmental conditions are greatly affected, which has become an important issue that restricts human survival and further development. This is especially true in China where the economy is growing fast. According to the World Bank, 16 of the 20 most polluted cities in the world are in China, and 58% of Chinese cities average a PM10 concentration in the atmosphere of more than 100 micrograms per cubic meter; meanwhile, only 1% of China's urban population is in areas where the average annual PM10 concentration is less than 40 micrograms per cubic meter (Wang and Huang, 2015) [1]. Severe air pollution has not only a negative impact on economic growth but also a significant influence on the safety of human life. Statistically, two-thirds of the 338 Chinese cities with air quality monitoring are polluted, and two-thirds of these cities are rated as moderate or severe. In addition, China scored 65.1 in the World Environmental Performance Ranking in 2016, which was jointly released by Yale University and Columbia University, and ranked 109th out of 180 countries and regions, which means that China's environmental performance is at the bottom of all countries and regions. Among all the gas emissions, the global warming caused by CO_2 emissions is one of the current social concerns and urgent problems. Faced with massive emissions of greenhouse gases and the increasingly obvious trend of global warming, many countries have actively issued countermeasures through regulation to attempt to curb the increasingly serious environmental deterioration. Among these countries, the European Union was the first to put forward the famous "The EU Emission Trading System" (EU ETS), which restricts enterprises' carbon emissions behavior by pricing pollution emissions and requiring them to buy carbon emission quotas. The implementation of EU ETS has attracted the collective attention of various countries and regions and achieved success to some extent.

At the same time, China's environmental problems, such as climate change and greenhouse gas emissions, attracts attention not only from the Chinese people but also from people in other parts of the world. Currently, China has become the world's largest carbon emitter, and its emissions are in urgent need to be solved. In 2009, the Chinese government first announced a clear and quantifiable target for controlling greenhouse gas emissions, which is that China will reduce CO_2 emissions per unit of GDP by 40-50% from 2005 levels by the year 2020. To achieve this goal, the National Development and Reform Commission of China (NDRC) issued "the notice of the national development and reform commission on the pilot work of low-carbon provinces and cities" on 19 July 2010 (hereinafter referred to as China's Low-Carbon Pilot policy, namely, CLCP). Five provinces (Guangdong, Hubei, Liaoning, Shaanxi and Yunnan) and eight cities (Chongqing, Tianjin, Shenzhen, Xiamen, Hangzhou, Guiyang, Nanchang and Baoding) were selected to be the pilot areas.

It is undeniable that the implementation of the CLCP policy is a difficult step for the Chinese government to carry out carbon emission governance. Through the implementation of the CLCP policy, the Chinese government attempts to explore a beneficial governance path to further reduce carbon emissions, improve environmental quality and transform the extensive development mode of China's economy that features high energy consumption, pollution and emissions to thoroughly realize a green and clean development mode. This policy is an important tool of environmental regulation for China. Since the implementation of the policy, a large number of studies have been conducted concerning, for example, the implementation of the policy, the planning of the development path of the policy, and carbon emission measurement (Xue et al., 2012; Liu et al., 2012; Jia et al., 2013) [2-4]. In addition, studies have shown that the CLCP policy can significantly reduce the regional per capita carbon emissions, which suggests that there are obvious environmental benefits of the policy (Dai and Cao, 2015) [5]. However, an assessment of the environmental benefits of the CLCP

policy does not provide an overall basis for the decision of the Chinese government to further introduce the policy nationally. At the same time, a one-sided assessment that ignores the economic benefits of the CLCP policy may mislead decision makers and cause them to make irrational choices. Therefore, studying the economic benefits of the CLCP policy, both for policy makers and for researchers, is a very important task. Do environmental benefits come at the expense of sacrificing economic development? Can environmental regulation and economic growth achieve a "win-win" situation? If the CLCP policy can achieve economic benefits, what is the underlying mechanism? All of these questions are worth studying.

To answer the above questions, based on the data of Chinese prefecture-level cities and of Chinese microindustrial enterprises from 2001 to 2013, this article analyzes the effects of environmental regulation on economic growth and explores its underlying mechanism from the perspective of microenterprise behavior. The results show that the CLCP policy, as an effective tool of environmental regulation, can significantly improve regional GDP and per capita GDP, but the effect has an obvious time-lag. In addition, as the implementation time continues, the effects become stronger. From the analysis of the microenterprises level, it is found that although the implementation of the CLCP policy has increased various production costs, it has also promoted the output and income of enterprises. This finding is completely consistent with the conclusion of the macroanalysis, which is the microfoundation of macroeconomic growth. The reason for improvement of the output of enterprises is that under the pressure of an increase in production costs caused by environmental regulation, enterprises do not choose the negative ways of trans-regional transferring and exiting from the market; instead, they adopt positive measures of strengthening management, improving efficiency and increasing investment in innovation activities. Therefore, they overcome the negative impact brought by environmental regulations and increase their income.

The structure of this article is arranged as follows. Section 2 reviews the relevant literature. Section 3 introduces the policy background and theoretical analysis. Section 4 introduces the model and data. Specific empirical results and robustness tests are provided in Section 5. Section 6 analyzes the underlying mechanism of the economic benefits of environmental regulation from the perspective of enterprise behavior. The last section is the conclusion of the article.

2. Literature Review

Studying the relationship between environmental regulation and economic growth is always an important issue in ecological economics. It has been analyzed by many studies, most of which mainly explain economic growth from the perspective of microenterprises (Siegel, 1979; Pickman, 1998; Brunnermeier and Cohen, 2003) [6-8]. However, studies on the relationship between environmental regulation and economic growth have not come to a unified conclusion. At first, scholars believed that environmental regulations can significantly hinder economic growth by increasing production costs and reducing enterprise profits (Gray, 1987; Gray and Shadbegian, 2003) [9-10]. Chrisstainsen and Haveman (1981) [11] find that the inhibitory effect of environmental regulations may explain 0.27% of the labor efficiency and 0.5% of the production level; there is also time heterogeneity. Löfgren Å et al. (2013) [12] find through a Swedish business survey that carbon dioxide regulations do not have an impact on businesses' productive behavior and economic profits. With the development of the research, studies represented by the "Porter Hypothesis" proposed by Porter and van der Linde (1995) [13] further improve the internal mechanism between environmental regulation and economic growth. The hypothesis holds that environmental regulation may encourage enterprises to innovate, improve their productivity and reduce their costs, which will offset the additional costs of environmental regulation and thus further promote economic growth (Johnstone et al., 2010; Feng et al., 2017) [14,15]. Meanwhile,

other scholars hold that innovation may not only completely offset the cost caused by environmental regulation but also improve competitiveness and increase enterprise profits (Hamamoto, 2006; Aghion et al., 2016) [16,17]. Moreover, the “Porter Hypothesis” is further improved and strengthened. Many subsequent studies focus on whether the “Porter Hypothesis” exists. Mazzanti and Zoboli (2009) [18] find that environmental regulations can affect economic benefits by improving the productivity of enterprises through an analysis of environmental regulation efficiency and labor productivity. Taylor (2012) assesses the American "Acid and Plan" policy, and the results show that the policy curbed the development of SO_2 control technology after 1995 [19]. Similarly, Shi et al. (2018) [20] analyze the effects of environmental regulations on innovation and find that the policy would be negative for enterprise innovation and that there is an obvious migration effect. In addition, other scholars research the economic benefits of environmental regulation from the perspective of regional heterogeneity and believe that the effect should be different in different regions. Through the study of the panel data of prefecture-level cities from 2004 to 2009, Zhao (2014) [21] investigates the correlation among environmental regulation, regulation competition and regional industrial economic growth. The results show that environmental regulation is negative for regional economic growth, and the effect of regulation competition on economic growth is heterogeneous in different regions; specifically, it is positive in the eastern region, negative in the central region, and there is no significant impact in the western region. In addition to the above static study, some scholars have explored the dynamic relationship between environmental regulation and economic growth. Xie et al. (2012) [22] use the Simultaneous Equation Model to test the dynamic relationship between environmental regulation and economic growth from 1996 to 2010 and find that the relationship between environmental regulation and economic growth has obvious heterogeneity among different regions. For the entire country, there is no causal relationship, while there is a two-way causality link for developed areas.

There are three research trends in the current literature on the relationship between environmental regulation and economic growth. First, increasingly more scholars have begun to shift from the whole to the types and aim at exploring the impact of different types of environmental regulations on economic growth (Böcher, 2012) [23]. Yuan and Liu (2013) [24] believe that existing studies only study the relationship between environmental regulation and economic growth while ignoring the different effects of different types of environmental regulations. Therefore, they subdivide environmental regulation into two types, namely, a cost type and investment type, and investigate the impact of the two types on economic growth from 2004 to 2010; they find that the cost type had no effect on economic growth, while the investment type can significantly promote economic growth. Second, scholars have modified the traditional theory's bias that was limited only to the quantity of economic growth and have begun to analyze the impact of environmental regulations on the quality of economic growth. Based on the provincial panel data from 2001 to 2013, Huang and Gao (2016) [25] use the simultaneous equations model to investigate the impact of environmental regulations on economic growth quantity and quality, and they find that environmental regulations have a significant inhibiting effect on the quantity of economic growth, while they have a promoting effect on the quality of economic growth. Finally, one of the tasks of social science is to explain the causality of social phenomena, especially in economics. In view of this task, a few scholars have begun to use the policy assessment method of the "quasi-natural experiment" to analyze the causal relationship between environmental regulation and economic growth. Based on quasi-natural experiments of China's "two control zones" environmental policy, Hering and Poncet (2013) and Jefferson et al. (2013) analyze the impact of the policy on Chinese enterprise profits, costs and foreign direct investment (FDI) and believe that strict environmental regulation would increase

enterprise profits and reduce foreign capital inflows; the causal effect is greater in countries with lower levels of environmental regulation.

It can be seen from the literature that the existing research focuses more on the effect and experience of developed countries in the governance of the environment, especially on EU ETS (Jiang and NovákM, 2004; Gagelmann and Frondel, 2005; Grubb et al., 2005; Hoffmann, 2007) [28-31]. However, due to the large differences between developed countries and developing countries in terms of economic development degree and social systems, the analysis of environmental regulations in developed countries cannot provide a practical reference for developing countries, which is one of the existing research defects and deficiencies. Second, in terms of the CLCP policy proposed by the Chinese government, the current research on this policy is only limited to the analysis of its environmental benefits but ignores its economic benefits. Such a one-sided policy assessment is not conducive to the government's comprehensive understanding of the overall effect of CLCP and is bound to affect the promotion of CLCP nationwide and to further affect the process of China's emissions reduction. Moreover, most of the studies on the economic benefits of environmental regulation are based on the perspectives of the performance, productivity and innovation of microenterprises (Stavins, 2007; Tomás et al., 2010; Anderson et al., 2011) [32-34]. These studies ignore the impact of the migration effect of the changes in enterprise behaviors on regional economic growth. This disregard is undesirable. In addition, due to the different research methods and objectives, each study adopts different indicators to measure environmental regulation (Ederington and Minier, 2003) [35], and the conclusions obtained are quite different. Furthermore, the existing research is only a discussion and analysis of correlation, and the existence of endogenous problems makes the causal relationship between environmental regulation and economic growth to not be fully demonstrated.

Considering the defects in the existing research literature, this article attempts to compensate for the above deficiencies. The potential marginal contribution of this study follows. First, considering the current research that focuses too much on the environmental regulations implemented in developed countries, this study, based on the CLCP policy implemented in China, which is the world's most typical developing country, analyzes the economic benefits of the policy and its impact on microenterprise behavior to provide useful experience for the environmental governance of other developing countries. Second, in view of the one-sidedness of CLCP policy assessment, this article analyzes the impact of CLCP policy on macroeconomic growth and microenterprise behavior from the perspective of economic benefits. Based on the existing research on environmental benefits, this article discusses the CLCP’s economic benefits to fully grasp the effects of the policy and to lay a decision-making foundation for the Chinese government to popularize the CLCP policy nationwide. Third, to evaluate the economic benefits more comprehensively, this article, based on macro= and microdata, explores a reliable microbasis for the conclusions of the macroanalysis and accurately assesses the macro-effects of enterprise behaviors. This article abandons the isolation between macro- and microanalysis in the previous literature and therefore deepens the understanding of the environmental regulation for decision makers. Finally, how to better address the endogeneity between environmental regulation and economic growth is the crux of the existing research. It requires an accurate extrapolation of the causal relationship between environmental regulation and economic growth for China, as the world's largest carbon emitter, concerning how to fulfill its commitments to global emissions reduction and simultaneously, how to develop its economy. China's CLCP policy in eight cities and five provinces provides a perfect opportunity to analyze this problem. Therefore, this article attempts to use the implementation of the CLCP policy as a "quasi-natural experiment" and use the difference-in-differences (DID) method to make a clear determination on the causal relationship between environmental regulation and

economic growth to make up for the lack of existing research and to provide an empirical basis for the government to further regulate the environment.

3. Policy Background and Theoretical Analysis

3.1 Policy Background

For 40 years, China's economy has attained remarkable achievements. Although the rapid economic growth has improved the national income, it has also made the environmental quality deteriorate day by day. Environmental problems have become the focus of social attention. The extensive, energy-intensive mode of economic development made China the world's largest emitter of carbon dioxide in 2006, and its emissions continue to grow at a rate of approximately 6%. Therefore, large amounts of greenhouse gas emissions directly result in global warming and determine the survival and development of human beings. Therefore, actively addressing climate change is not only a major challenge faced by all countries in the world but also a major mode for China to achieve green development. In addition, China is currently in the critical period of building a well-off society, industrialization and urbanization. At this stage, energy demand will continue to grow. How to effectively control greenhouse gas emissions and properly manage climate change while developing the economy and improving people's livelihood is a new issue.

Therefore, the State Council of China has proposed a target for controlling greenhouse gas emissions by 2020 and has selected five provinces (Guangdong, Liaoning, Hubei, Shaanxi, and Yunnan) and eight cities (Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang and Baoding) to carry out low-carbon pilot (LCP) projects. The specific geographical distribution of LCP areas is shown in Figure 1. These pilot areas are asked to complete the following tasks. First, these pilot areas are required to compile a low-carbon development plan. This requires the pilot areas to fully incorporate climate change work into the "12th Five-Year" plan and to combine the work of adjusting the industrial structure and of optimizing the energy structure and energy conservation and efficiency. Moreover, the pilot areas should identify the target, major tasks and specific measures of controlling greenhouse gas emissions. Second, policies of supporting low-carbon and green development should be formulated. Pilot areas should exert the synergistic effect of coping with climate change, energy conservation, environmental protection, new energy development, and ecological construction. They are also required to actively explore mechanisms that are conducive to energy conservation, emissions reduction and the development of low-carbon industries. In addition, they also need to implement a responsibility system and explore effective policies of government guidance and economic incentives and market mechanisms to control greenhouse gas emissions. Third, the pilot areas should establish an industrial system that features low carbon. On the one hand, they should carry out low-carbon technological innovation consistent with local industrial characteristics and promote the research and development, demonstration and industrialization of such technologies. Moreover, the pilot areas should actively use these new technologies to upgrade traditional industries. On the other hand, the strategic emerging industries of energy conservation and environmental protection should also be strengthened and developed, such as low-carbon buildings and transportation. Fourth, data statistics and a management system of greenhouse gas emissions should be established. On the one hand, the pilot areas are asked to establish a complete data collection and accounting system. On the other hand, the pilot areas should strengthen capacity building by providing institutional and personnel support. Fifth, low-carbon and green lifestyles and consumption patterns should be actively advocated. The pilot areas should vigorously carry out a campaign to popularize low-carbon lifestyles and behaviors

and the concept of a low-carbon life. In addition, the use of low-carbon products should be encouraged.

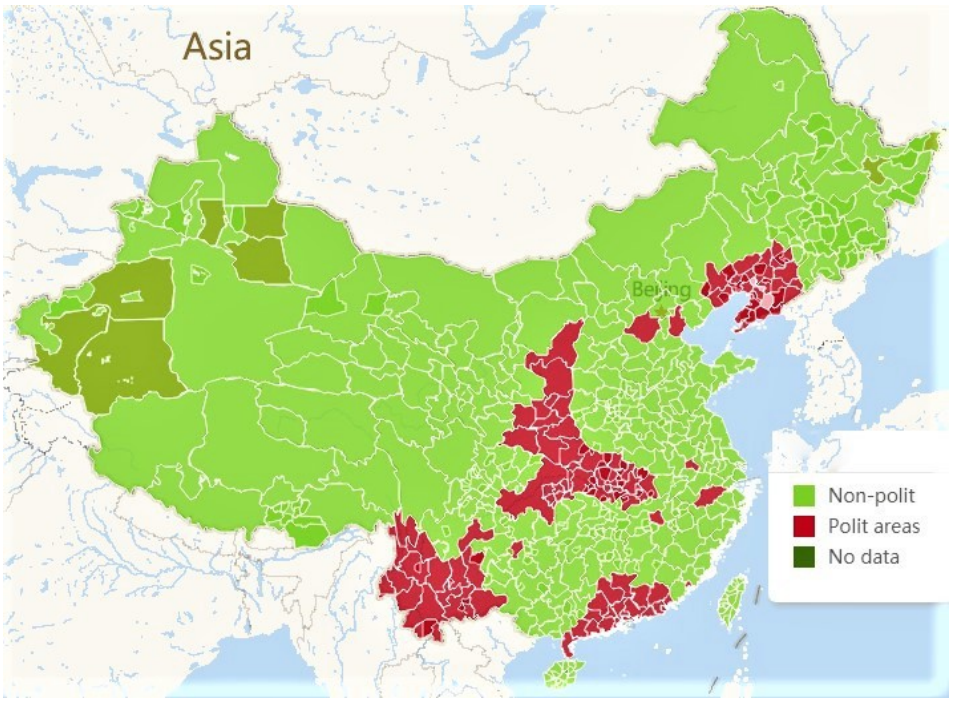

Figure 1. Geographical Distribution of Low-carbon Pilot Areas (mainland China)

It can be seen from the above discussion that the government is attempting to explore a low-carbon development path through the CLCP policy to transform the traditional extensive mode and to improve environmental quality. Although the environmental effects of the CLCP policy have been proved by a large number of literature, its economic benefits have been ignored by scholars. Therefore, an analysis of the economic benefits of the CLCP policy is the main task of this article.

3.2 Theoretical Analysis

Although the CLCP policy is an important tool of environmental regulation by the Chinese government to reduce carbon emissions and improve environmental quality, the relationship between environmental regulation and economic growth is not clear. Through the internal mechanism of environmental regulation that acts on economic growth, environmental regulation has an impact on economic growth mainly in the following ways.

First, from the macroeconomic structure of the entire region, environmental regulation can change the existing industrial structure and layout. On the one hand, environmental regulations raise the standards of pollution emissions. They prompt pilot areas to gradually eliminate the enterprises that fail to meet the standards and provide opportunities for other enterprises in the clean industry. On the other hand, environmental regulations can create a good external environment for higher-end industries to improve environmental quality and build green development. This substitution effect can promote the adjustment and optimization of the regional industrial structure and therefore inject new impetus into regional economic growth. Second, the implementation of environmental regulations directly affects the decision-making of enterprises in the industry. The increase of cost affects the entry and exit of enterprises, changes the original market structure, and intensifies the level of competition in the market. Such market competition promotes enterprises to strengthen management, improve efficiency and input more resources for innovation to gain greater competitiveness and avoid being eliminated. When all the enterprises in the entire industry

adopt a positive strategy, there is no doubt that the productivity of the whole industry and technological innovation can be improved. Third, for the trade that drives economic growth, environmental regulations are conducive to the export competitiveness of the clean industry and do not lead to the loss of the export advantage of the pollution-intensive industry. Therefore, environmental regulations can drive the growth of regional export trade in the long run and promote the economy. In addition, environmental regulation can improve the accumulation of regional human capital, effectively promote enterprises to carry out environmental technology innovation and reduce the cost of environmental regulation, which thus promotes economic growth.

Environmental regulation accordingly promotes economic growth by industrial restructuring, market structure optimization, the spillover of technological innovation, the improvement of productivity and the accumulation of regional human capital. Therefore, this article considers that environmental regulation does not impede regional economic growth, but that on the contrary, it can significantly promote regional economic growth and achieve a "win-win" situation between environmental governance and economic growth. However, because it takes some time to change factors such as enterprise decision-making, strategy adjustment and innovation input, the implementation of the CLCP policy cannot exert its positive promotion effect immediately but has a time-lag effect. As the policy is implemented steadily and effectively, its role becomes increasingly more obvious. The specific hypothesis is as follows:

Hypothesis 1(H1): *The* CLCP *policy promotes local economic growth at the macrolevel, and the promotion effect can be gradually strengthened over time.*

Although the CLCP policy can promote economic growth at the macroregional level, microenterprises are most directly affected by the policy, and the implementation of the policy is bound to change the original living environment of enterprises. As the CLCP policy sets out new requirements on the carbon emissions of enterprises, enterprises need to adjust existing products, production processes and pollution emissions to meet the new standards. However, no matter which path the enterprise chooses, the production costs of the enterprise will increase, which will force the enterprise to make new choices. When enterprises are faced with changes in external environment constraints, they are either forced to stop and exit from the market by local governments for failing to reduce environmental pollution in the production process or carry out technological innovation through enterprise R&D investment. As the preferred development strategy of enterprises, innovation in clean technology alleviates the pressure of environmental regulation on enterprises and overcomes the negative impact of the external cost increase to realize the "Porter Hypothesis". Second, in addition to technical innovation, enterprises also conduct management reform of the internal production process to attempt to improve the production efficiency of enterprises by strengthening management to increase the output per unit input and to offset the cost of environmental regulation, which promotes economic growth. Enterprises can also choose to transfer across regions or exit from the market to completely avoid the impact of environmental regulation on enterprises. However, the existence of transfer costs does not force the enterprise to exit from the market but to compensate for the increase of enterprise cost and to improve enterprise income by strengthening the internal management, improving operating efficiency and carrying out innovation. Therefore, based on the above analysis, we propose the second hypothesis of this article, which is as follows:

Hypothesis 2(H2): *The implementation of the CLCP policy encourages enterprises to compensate for the increase in production costs by strengthening the internal management,*

improving efficiency and increasing innovation input, which improves the output and income of enterprises.

In the following context, we conduct an empirical analysis of these assumptions.

4. Model and Data

4.1 Model

To assess the impact of the CLCP policy on regional economic growth, this article considers the CLCP policy as a quasi-natural experiment. Five provinces and eight cities are selected to be the treatment group, and the other prefecture-level cities are the control group. We select the variable Pilot to represent whether this province or city is the pilot or not. If it is a pilot, the value is 1; otherwise, the value is 0. At the same time, the variable Time indicates whether the time is after 2010 or not, and if it is after 2010, the value is 1; otherwise, it is 0. Thus, this study constructs a two-way fixed effects model to conduct DID, thereby evaluating the net effect of CLCP policy on regional economic growth. The specific model is shown below.

$$GDP_{it} = \alpha + \beta Pilot_i \times Time_t + \gamma Control_{it} + \delta_t + \mu_i + \varepsilon_{it}, \quad (1)$$

where i and t represent the i th pilot and the t th year, respectively, GDP_{it} is the dependent variable, that is, regional economic growth, which is measured by the GDP of the city and per capita GDP, δ_t is the time fixed effects, μ_i is the individual fixed effects in the province, ε_{it} is the error term, and $Control_{it}$ is the selected series of control variables. For the above model, the estimator of coefficient β is the focus of our concern. It measures the net effect of the CLCP policy on economic growth. If $\beta > 0$, it shows that the CLCP policy promotes economic growth; otherwise, the policy hinders regional economic growth.

Equation (1) only evaluates the average effect of CLCP on urban economic growth. In fact, the implementation of the CLCP policy has a long-term promoting effect on the local economic development mode, technology research and development, etc. Therefore, environmental regulation is not necessarily effective in the current period and may have a long-term promoting effect on economic development. To test this expectation, equation (2) is extended on the basis of equation (1) to test the dynamic effect of the CLCP policy on economic growth. The specific equation is as follows:

$$GDP_{it} = \alpha + \sum_{k\in\{1,2,3,4\}} \beta_k Pilot_i \times Time_k + \gamma Control_{it} + \delta_t + \mu_i + \varepsilon_{it}, \quad (2)$$

In the above equation, the variable $Pilot_i \times Time_k$ expresses the annual dummy variable (where k = 1, 2) after the implementation of the CLCP policy in the pilot province. For example, this policy was issued in 2010;

thus, k =1 in 2011, the variable $Pilot_i \times Time_k = 1$ and is 0 for the rest of the year. β_k measures the impact of this policy on economic growth after the policy implementation for the k th year. The explanation of the other variables in equation (2) is the same explanation as in equation (1).

The above model is used to evaluate the effect of environmental regulation on economic growth by the DID method. However, there is an important premise in the application of the DID method, namely, the parallel trend hypothesis. That is, in the absence of a CLCP policy,

the difference in economic growth between the treatment group and the control group does not change significantly over time. If the factors before the implementation of environmental regulation make the economic growth level between the treatment group and the control group change significantly, then the parallel trend hypothesis will not be satisfied, which will lead to a bias of the regression results. Therefore, to more accurately evaluate the real effect of environmental regulation on economic growth, the parallel trend hypothesis needs to be tested in this article. This article uses methods commonly used in a large number of the literature, and the specific model is as follows:

$$GDP_{it} = \alpha + \beta Pilot_i \times Time_t + \sum_{j\in\{-7,-6,\cdots,-2,-1\}} \beta_j Treat_j + \gamma Control_{it} + \delta_t + \mu_i + \varepsilon_{it}, \quad (3)$$

In equation (3), $Treat_j$ is a dummy variable, which represents the interaction between the dummy variables of the different years before the implementation of CLCP and the dummy variables of the pilot to examine the policy effect of different years before CLCP. If the coefficients β_{-7}, β_{-6},..., β_{-2} and β_{-1} are not significant, then there is no systematic difference between the treatment group and control group before the CLCP was implemented. Otherwise, there is a systematic difference, and the evaluation that uses the DID is biased.

4.2 Data

4.2.1 Data Source

To more comprehensively test the above assumptions, this article selects the panel data of China prefecture-level cities and China's Industrial Enterprise Database from 2001 to 2013. The reasons for the end date of 2013 are as follows. First, China started the carbon emission trading pilot program in five cities (Beijing, Tianjin, Shanghai, Chongqing, and Shenzhen) and two provinces (Guangdong and Hubei) in 2013. This pilot covers some of the same areas where the CLCP policy is implemented. If the investigation period is extended beyond 2013 at this time, the two policies will interact with one another, and it is difficult to separate the net effects of the CLCP policy. Second, China's economy entered a new normal after 2013. Both the domestic economic situation and the international economic environment underwent major changes. Many external factors are difficult to quantify and are included in the model for control, which inevitably affects the policy effect to be evaluated. Therefore, to avoid the interference of more factors and the pollution of the samples in the control group, the time of investigation was selected from 2001 to 2013 to evaluate the economic effects of the CLCP policy more accurately. This article uses China's 286 prefecture-level cities as subjects, and the macrodata come from the "China City Statistical Yearbook". As FDI is expressed in dollars, the annual exchange rate conversion adjustment is used. The relevant contents of the implementation time, city and specific measures of the CLCP policy come from the "notice of the office of national development and reform commission on the pilot work of carbon emission trading". The microdata come from China's Industrial Enterprise Database. The processing of the microdata is as follows. First, the abnormal samples with missing codes, missing indicators and the incorrect year of enterprise establishment are eliminated. Second, generally accepted accounting standards are used in this article to eliminate the sample with total assets, total fixed assets, net fixed assets, total current assets and an employment number less than 0.

4.2.2 Variables

This article aims to analyze the effect of environmental regulations on regional economic growth. Therefore, based on the relevant literature, this article selects regional GDP and per capita GDP to measure economic growth and conducts a price adjustment and logarithm to maintain the comparability of the research conclusions. This article takes whether the city is pilot city or not as the explanatory variable. If the city has implemented the CLCP policy, the value is 1; otherwise, it is 0.

In addition, several other factors are selected as control variables. Among them, investment level is a key factor that influences regional economic growth. Therefore, this article selects the logarithm of social fixed asset investment to measure it. China's demographic dividend produced by labor force input plays an important role in economic growth; accordingly, this article chooses the logarithm of total employment to measure the labor input in this area. On the macrolevel, government size can influence economic growth through public services and public fiscal expenditure channels. The proportion of government budget expenditures to GDP is chosen to measure government size. At the same time, this article chooses the ratio of the output value of the secondary industry to GDP to measure the level of industrialization. The education level of the region is expressed by the ratio of the number of students in the general colleges and universities to the total population of the region, which reflects the level of human capital accumulation in the region. At the same time, considering the impact of the savings rate on economic growth, we choose the ratio of the total savings of urban and rural residents to GDP to measure the total savings rate of the region. In addition, FDI promotes regional growth by reducing inefficient domestic production and accelerating technological progress. Therefore, through the calculation of “total foreign direct investment/regional GDP”, this article measures regional openness.

To further interpret the results of the macroanalysis, this article also analyzes the changes in enterprise behavior caused by the CLCP policy based on the microenterprise data. Therefore, this article selects different indicators to measure the costs and benefits of the enterprises to illustrate the impact of environmental regulations on enterprise output and income. In addition, this article also compares the results of the microanalysis with the results of the macroanalysis to explain the differences in the impact of environmental regulation on the macroeconomy and income of microenterprises. Furthermore, to deeply investigate the impact of environmental regulations on enterprise behavior, this article investigates the effect of the CLCP policy on various behaviors of enterprises, such as analyzing enterprises' cross-regional transfer, strengthening internal management, improving productivity and increasing innovation. In addition, existing studies show that factors such as enterprise size, the asset-liability ratio, age and owner's equity have important effects on enterprise income and decision-making. Therefore, this article selects the logarithm of total assets to measure enterprise size. The level of enterprise debt is measured by the logarithm of total enterprise debt, and the level of labor input in the production process is illustrated by the logarithm of the number of employees. At the same time, considering the influence of subsidy income on decision-making, the dummy variable of whether enterprises receive a government subsidy or not is used to represent government subsidy. A description of the specific variables and statistics are shown in Table 1.

Table 1. A description of specific variables and the descriptive statistics

Variable	Description	Calculation method	Mean	Min	Max
A: Macroregional-level variables					
gdp	Regional GDP	Regional GDP (in log)	15.06	10.74	18.754
pergdp	Regional per capita GDP	Regional per capita GDP (in log)	9.217	5.106	12.393
firmnumber0	Number of new enterprises	Number of new enterprises under the age of one year	4.397	0	273
firmnumber1		Number of new enterprises under the age of two years	13.673	0	665
pilot	CLCP policy	Dummy variable (0,1)	0.248	0	1
investment	Fixed asset investment	Fixed asset investment (in log)	14.849	11.147	18.522
labor	Labor input	Total regional employment (in log)	3.392	1.399	6.828
government	Government size	(Government budget expenditure / GDP) ×100	13.23	0.275	234.876
open	Regional openness	(Total foreign direct investment / GDP) ×100	2.335	0.003	47.627
industry	Level of industrialization	(Output value of the secondary industry / GDP) ×100	48.36	9	90.97
education	Human capital	(Number of students in the general colleges and universities/Total population of the region) ×100	56,062.4	17.246	926,660.3
save	Total savings rate	Total savings of urban and rural residents/GDP	0.651	0.009	7.751
B: Microenterprise-level variables					
income	Enterprise income	Main business income (in log)	10.774	7.849	14.722
revenue		Enterprise operating profit (in log)	7.739	0	12.304
profit		Total enterprise profits (in log)	7.609	0	12.206
salestax	Enterprise cost	Product sales tax and surcharge	3.991	0	8.912
salesfee		Product sales expenses	7.101	0	11.680
tax		Enterprise payable VAT	6.868	0	11.160
paytax		Enterprise payable income tax	5.834	-1.238	10.193
wage		Enterprise payable total wages	8.089	4.868	11.674
managemcosts	Enterprise management	Enterprise management costs	7.593	3.258	11.384
laborprofitratio	Enterprise efficiency	Operating profit/Number of employees	33.976	-3263	27,584
capitalprofitratio		Operating profit/Total assets	0.0998	-19.351	163.581
newproduct	Enterprise innovation	Output value of new products (in log)	9.490	0	12.251
newproductrate		New product output/Main business income	0.035	0	81.611
exportsize		Total export volume of enterprises (in log)	9.845	0	13.691
size	Enterprise size	Total assets (in log)	10.493	7.207	14.497
age	Enterprise age	Enterprise age (in log)	2.168	0.693	3.332
labor	Labor input	Number of employees (in log)	5.152	2.079	8.074
debt	Enterprise debt	Total enterprise debt (in log)	9.665	3.970	14.047
right	Owner's equity	Enterprise owner's equity (in log)	9.714	0	13.682
subsidy	Government subsidy	If the enterprise is subsidized, the value is 1; otherwise, 0	0.385	0	1

5. Empirical Test

5.1 The impact of the CLCP policy on regional economic growth

In this article, model (1) is regressed based on the two-way fixed effects to investigate the effect of the CLCP policy on economic growth. The specific results are shown in columns (1) – (4) in Table 2. It can be seen from the table that regardless of whether regional economic growth is measured by regional GDP or per capita GDP, the implementation of the CLCP policy has a promoting effect on the economic growth of pilot cities, and the effect is significant at the 1% confidence level. This result shows that environmental regulation can promote regional economic growth while improving urban environmental quality to thus achieve a "win-win" situation between environmental governance and economic development. In addition, it can also be seen that fixed asset investment plays a significant role in promoting the local economy, which also provides empirical evidence for China's growth mode that relies on investment in the past decades. At the same time, the industrialization level measured by the ratio of the output value of the secondary industry to the regional GDP has a significant promoting effect on economic growth, which indicates that industrialization makes an important contribution to China's economic transformation.

5.2 The dynamic effect test of the CLCP policy on regional economic growth

Columns (1) – (4) in Table 2 show that environmental regulation has a significant promoting effect on economic growth, but it suggests only the average effect of the CLCP policy on economic growth. In fact, the implementation of the CLCP policy has a certain continuity. Environmental regulation will have a long-term effect on economic growth by transforming the local economic development mode, changing resource allocation and carrying out technological innovation. Moreover, the effect of the policy on economic growth is not necessarily effective currently. Therefore, it can be concluded that the implementation of the CLCP policy has a certain long-term impact on regional economic growth. To prove the theoretical expectation, we perform a regression analysis in model (2), and the specific results are shown in columns (5) – (8) in Table 2. It can be seen from the dynamic effect test that the CLCP policy has a long-term promoting effect on economic growth, and column (7) in Table 2 indicates that the promoting effect is not effective in the current period, but there is a significant time lag in its effect. At the same time, it can be seen from the evaluation coefficient that with the implementation time of the CLCP policy, the promotion effect of the policy on regional economic growth is gradually strengthened. The dynamic effect test shows that the CLCP policy has a significant long-term promoting effect on economic growth, and this effect gradually increases over time.

5.3 Robustness Tests

To further guarantee the reliability of the results, this article uses the parallel trend assumption required by the DID method, adopts a counter factual test, removes heterogeneous samples, removes policy interference and introduces covariates to test the robustness of the results as follows.

Table 2. The impact of the CLCP policy on regional economic growth

	gdp		pergdp		gdp		pergdp	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
$Pilot \times Time$	0.026***	0.019***	0.032***	0.034***				
	(0.006)	(0.005)	(0.007)	(0.007)				
$Pilot \times Time_1$					0.017*	0.018**	0.020	0.025**
					(0.010)	(0.008)	(0.013)	(0.012)
$Pilot \times Time_2$					0.022**	0.019**	0.030**	0.034***
					(0.010)	(0.008)	(0.013)	(0.012)
$Pilot \times Time_3$					0.021**	0.015*	0.030**	0.033***
					(0.010)	(0.008)	(0.013)	(0.012)
$Pilot \times Time_4$					0.043***	0.023***	0.049***	0.044***
					(0.010)	(0.008)	(0.013)	(0.012)
investment		0.081***		0.074***		0.081***		0.073***
		(0.005)		(0.007)		(0.005)		(0.007)
labor		-0.005		-0.049***		-0.005		-0.049***
		(0.006)		(0.009)		(0.006)		(0.009)
government		-0.006***		-0.005***		-0.006***		-0.005***
		(0.000)		(0.000)		(0.000)		(0.000)
open		-0.001**		0.001		-0.001**		0.001
		(0.001)		(0.001)		(0.001)		(0.001)
industry		0.004***		0.004***		0.004***		0.004***
		(0.000)		(0.000)		(0.000)		(0.000)
education		0.000***		0.000***		0.000***		0.000***
		(0.000)		(0.000)		(0.000)		(0.000)
save		-0.032***		-0.021***		-0.032***		-0.021***
		(0.005)		(0.007)		(0.005)		(0.007)
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
_cons	14.317***	13.160***	8.526***	7.568***	14.317***	13.162***	8.526***	7.571***
	(0.004)	(0.068)	(0.006)	(0.096)	(0.004)	(0.068)	(0.006)	(0.096)
N	3,354	3,218	3,343	3,218	3,354	3,218	3,343	3,218
F	12,378.433	11,636.537	6,422.702	5,020.031	10,062.851	10,110.290	5,218.625	4,363.066
r2	0.981	0.988	0.965	0.972	0.981	0.988	0.965	0.972

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

5.3.1 Parallel Trend Test

There is an important precondition, namely, the parallel trend assumption, when using the DID method to evaluate the impact of the CLCP policy on local economic growth. Accordingly, if the CLCP policy has no external impact, the development trend between the treatment group and the control group should be parallel, and there should be no systematic differences over time. Therefore, this article conducts a regression analysis in model (3). Specifically, we assume that the time for policy intervention of CLCP is advanced, and this is included in the model. If the policy effect of the hypothetical year is significant, then it indicates that there are other random factors between the treatment group and the control group, that is, it does not meet the parallel trend.

Table 3. Parallel Trend Test

	gdp			pergdp		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Pilot×*Time*	0.017**	0.013*	0.014*	0.022**	0.028***	0.048***
	(0.008)	(0.007)	(0.008)	(0.011)	(0.010)	(0.011)
$Treat_{-1}$	-0.007	-0.014	-0.018	-0.010	-0.018	-0.031*
	(0.012)	(0.010)	(0.012)	(0.015)	(0.014)	(0.016)
$Treat_{-2}$	-0.008	-0.002	-0.009	-0.001	0.003	-0.012
	(0.012)	(0.010)	(0.011)	(0.015)	(0.014)	(0.016)
$Treat_{-3}$	-0.016	-0.009	-0.012	-0.014	-0.007	-0.016
	(0.012)	(0.010)	(0.011)	(0.015)	(0.014)	(0.016)
$Treat_{-4}$	-0.018	-0.010	-0.016	-0.039**	-0.029**	-0.038**
	(0.012)	(0.010)	(0.011)	(0.015)	(0.014)	(0.016)
$Treat_{-5}$	-0.016	-0.008	-0.008	-0.015	-0.006	-0.004
	(0.012)	(0.010)	(0.011)	(0.015)	(0.014)	(0.016)
$Treat_{-6}$	-0.011	-0.006	-0.002	-0.010	-0.002	0.007
	(0.012)	(0.010)	(0.011)	(0.015)	(0.014)	(0.016)
$Treat_{-7}$	-0.003	-0.001	0.002	-0.002	0.004	0.017
	(0.012)	(0.010)	(0.011)	(0.015)	(0.014)	(0.016)
Control variables	NO	YES	YES	NO	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES
_cons	14.317***	13.158***	12.917***	8.526***	7.566***	7.527***
	(0.004)	(0.069)	(0.085)	(0.006)	(0.097)	(0.117)
N	3,354	3,218	2,414	3,343	3,218	2,414
F	8,038.846	8,608.421	5,668.951	4,176.565	3,719.185	2,562.552
r2	0.981	0.988	0.986	0.965	0.972	0.969

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

The contrary situation proves that the parallel trend is satisfied, and the specific results are shown in Table 3.In Table 3, $Treat_i$ represents the year effect before the policy implementation. From the results it can be seen that the advance of the year of policy intervention did not bring a significant effect. At the same time, the policy effect is still significant, and the effect of the control variables do not change significantly; thus, it is not reported here. Given that urban growth in eastern China is higher than in the central and western regions, this geographical advantage may further affect the parallel trend. Therefore, the cities in the eastern region are excluded. The results that are shown in columns (3) and (6) in Table 3 suggest no significant differences. Therefore, the regression results in Table 3 indicate that the treatment group and the control group maintain a common development trend and that there is no systematic difference, which also indicates that the results of evaluating the effect of the CLCP policy on local economic growth with the DID method are credible.

In addition, to further test the parallel trend, this article estimates the policy effect of all years before and after the implementation of the CLCP policy. The specific results are shown in Figures 2 and 3. Figure 2 mainly shows the dynamic effect of the CLCP policy on gdp, and Figure 3 mainly shows the dynamic effect of the CLCP policy on pergdp. In the figures, the horizontal axis represents the year, and the vertical axis represents the impact of the CLCP policy on economic growth in this year. As seen from the figures, the effect of year before 2010 is not significant, which indicates that the parallel trend hypothesis is satisfied, while after 2010, the policy effect gradually increased, which indicates that the policy has a long-term promoting effect on economic growth. These results are completely consistent with the conclusions in Table 3.

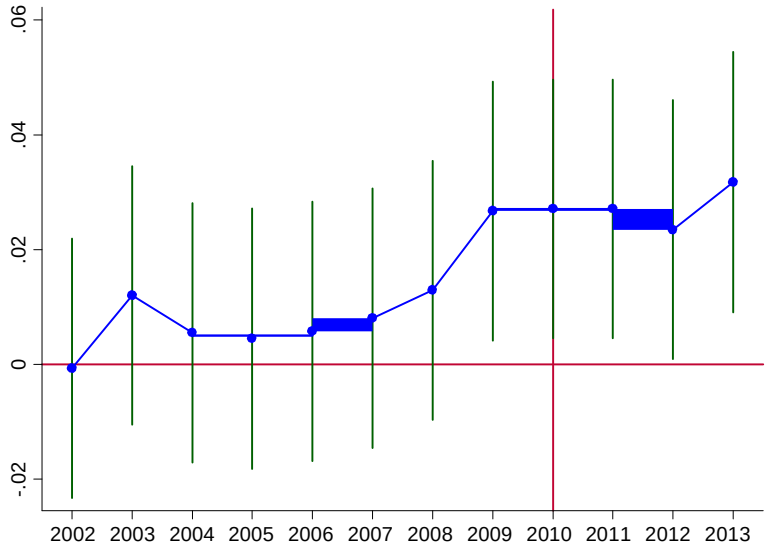

Figure 2. Dynamic Effect of the CLCP Policy on gdp

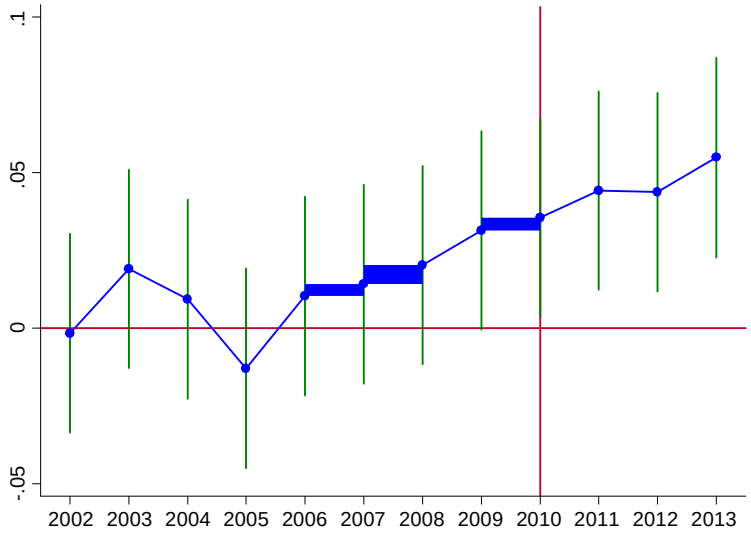

Figure 3. Dynamic Effect of the CLCP Policy on pergdp

5.3.2 PSM-DID Method Test

From the parallel trend test in Table 3, we know that there is no significant difference in economic growth between the treatment group and the control group before the implementation of the CLCP policy. However, to further reduce the evaluation bias and potential endogeneity caused by DID, the robustness test of PSM-DID is also adopted in this study. The specific matching process is as follows. First, a probit regression was performed on all control variables to the variable pilot, and the trend score was calculated.

Table 4. PSM-DID Robustness Test

	Prepilot Treatment Group	**Prepilot Control Group**	**Differences between Prepilot Control Group and Prepilot Treatment Group**	**Postpilot Treatment Group**	**Postpilot Control Group**	**Differences between Postpilot Control Group and Postpilot Treatment Group**	**DID Test Results**
lngdp	15.301	15.087	0.213	15.063	15.216	0.153	0.169
standard error			0.077			0.062	0.059
t Value			2.77			2.46	2.88
p>|t|			0.000***			0.000**	0.000***
lnpergdp	9.469	9.297	0.172	9.15	9.326	0.176	0.175
standard error			0.066			0.058	0.053
t Value			2.63			3.07	3.28
p>|t|			0.000***			0.000***	0.000***

Note: (1) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

The regression results show that investment, government, industry, education and savings rate have a significant influence on the explained variable pilot. Second, the nearest neighbor match was used to evaluate the differences between the treatment group and the control group in the impact of the CLCP policy on economic growth based on the calculated trend score. The specific results are shown in Table 4. It can be seen from Table 4 that the CLCP policy still has a significant promoting effect on regional economic growth. The results of the

robustness test by using PSM-DID can effectively overcome the bias of policy evaluation results caused by systematic differences between the treatment group and the control group, which also indirectly proves that the results in Table 2 have good robustness.

5.3.3 Removal of the Samples with Regional Heterogeneity

In addition to the parallel trend test, the imbalance of regional economic development may also cause great differences among the selected samples. The differences may cause the parallel trend hypothesis to be questioned and produce bias in the model's evaluation results. To solve this problem, eastern and western cities are eliminated from the sample in this article to reduce the differences among the samples. The reason for choosing the eastern and western regions is that there is a large imbalance between the east and west in China's economic development. Removing the two extreme samples of economic development can allow a better comparison to ensure the robustness of the results. The specific regression results are shown in Table 5.

Table 5. Removal of the Samples with Regional Heterogeneity

	gdp		pergdp		gdp		pergdp	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Pilot×*Time*	0.020***	0.020***	0.035***	0.056***	0.033***	0.028***	0.039***	0.042***
	(0.007)	(0.006)	(0.008)	(0.008)	(0.006)	(0.005)	(0.007)	(0.007)
investment		0.084***		0.070***		0.075***		0.065***
		(0.006)		(0.009)		(0.005)		(0.007)
labor		-0.018**		-0.087***		0.005		-0.039***
		(0.008)		(0.011)		(0.006)		(0.010)
government		-0.006***		-0.004***		-0.008***		-0.006***
		(0.000)		(0.001)		(0.000)		(0.001)
open		-0.001		0.002		-0.002***		0.000
		(0.001)		(0.001)		(0.001)		(0.001)
industry		0.004***		0.005***		0.005***		0.005***
		(0.000)		(0.000)		(0.000)		(0.000)
education		0.000***		0.000***		0.000***		0.000
		(0.000)		(0.000)		(0.000)		(0.000)
save		-0.035***		-0.031***		-0.020***		-0.013*
		(0.006)		(0.008)		(0.005)		(0.008)
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
_cons	14.049***	12.925***	8.344***	7.546***	14.455***	13.270***	8.590***	7.691***
	(0.005)	(0.084)	(0.007)	(0.117)	(0.004)	(0.067)	(0.006)	(0.101)
N	2,548	2,414	2,538	2,414	2,860	2,822	2,852	2,822
F	8,293.464	7,659.366	4,401.176	3,445.904	11,729.392	11,774.172	5,779.939	4,537.172
r2	0.979	0.986	0.961	0.969	0.983	0.989	0.966	0.972

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

In Table 5, columns (1) - (4) are the regression results after culling the samples from the eastern regions, while columns (5) - (8) are the regression results after culling the samples from the western regions. It can be seen from the table that the elimination of the eastern sample does not change the promoting effect of the CLCP policy on regional economic growth. The effect was significant at a confidence level of 1% for both regional and per capita GDP. By comparing the regression results in Tables 5 and 2, it can be seen that although the effect of the CLCP policy on economic growth varies, the fluctuation range is relatively small, which further illustrates the robustness of the regression results in Table 2.

Table 6. Counterfactual Test

	gdp		pergdp		gdp		pergdp	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
random1	0.004	0.003	0.002	0.002				
	(0.004)	(0.004)	(0.006)	(0.005)				
random2					-0.005	-0.004	-0.008	-0.009
					(0.005)	(0.004)	(0.006)	(0.006)
investment		0.081***		0.073***		0.081***		0.073***
		(0.005)		(0.007)		(0.005)		(0.007)
labor		-0.003		-0.045***		-0.003		-0.045***
		(0.006)		(0.009)		(0.006)		(0.009)
government		-0.006***		-0.005***		-0.006***		-0.005***
		(0.000)		(0.000)		(0.000)		(0.000)
open		-0.001**		0.001		-0.001**		0.001
		(0.001)		(0.001)		(0.001)		(0.001)
industry		0.004***		0.004***		0.004***		0.004***
		(0.000)		(0.000)		(0.000)		(0.000)
education		0.000***		0.000***		0.000***		0.000***
		(0.000)		(0.000)		(0.000)		(0.000)
save		-0.033***		-0.022***		-0.033***		-0.022***
		(0.005)		(0.007)		(0.005)		(0.007)
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
_cons	14.317***	13.156***	8.526***	7.559***	14.317***	13.157***	8.526***	7.562***
	(0.004)	(0.068)	(0.006)	(0.097)	(0.004)	(0.068)	(0.006)	(0.096)
N	3,354	3,218	3,343	3,218	3,354	3,218	3,343	3,218
F	12,301.189	11,578.750	6,382.972	4,977.314	12,302.741	11,580.558	6,386.475	4,981.685
r2	0.981	0.987	0.964	0.971	0.981	0.987	0.964	0.971

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

5.3.4 Counterfactual Test

Are other random factors influencing the promotion effect of the CLCP policy on economic growth? This article uses regional counterfactuals to eliminate this problem and answer this question. Therefore, half of the samples are randomly selected from both the sample population and the control group as the hypothetical treatment group, and the imaginary effect is estimated by using the DID method. If the significant effect is the same as the real result, it indicates that other random factors influence the evaluation results in this article. In the contrary situation, no random factor interferes with the effect of the CLCP policy on economic growth. The specific results are shown in Table 6. Columns (1) - (4) in Table 6 are the regression results of randomly selected samples in the entire sample as the hypothetical treatment group (random1), while columns (5) - (8) in Table 6 are the regression results of randomly selected samples in the control group as the hypothetical treatment group (random2). It can be seen from the regression results that no significant effect is obtained, which indicates that no other random factors influence the results in this article. This finding further proves that the promotion effect of the CLCP policy on economic growth is not caused by other random factors.

5.3.5 Elimination of policy interference

Although the above tests have further guaranteed the reliability of the evaluation results in this article, due to the complexity of the real social system, the implementation of any economic policy is inevitably affected by other policies or historical shocks, which potentially affects the evaluation of policy effects. Therefore, a series of policy shocks that affect economic growth are excluded in this section to ensure the robustness of the estimated results in this article. The specific test process is as follows. First, considering the fluctuations of China's economic growth affected by the global financial crisis in 2008, we compress the time period from 2008 to 2011 by excluding the years before the financial crisis and then compare the samples after the financial crisis to obtain the net effect. The specific results are shown in columns (1) and (2) in Table 7. The results show that the CLCP policy still has a significant promoting effect on economic growth when the impact of financial crisis is removed. Second, considering China's reform of the exchange rate system in 2005, the exchange rate reform is bound to affect the inflow of foreign capital and import and export trade. Accordingly, the assessment results that cannot effectively eliminate the interference of this policy are biased. Therefore, this article selected the investigation period from 2007 to 2012 for evaluation and analysis. The specific results are shown in columns (3) and (4) in Table 7. It can be seen that policy exclusion does not affect the significant promoting effect of the CLCP policy on economic growth. Third, the CLCP policy was implemented in 2010, but the investigation period selected in this article was set from 2001 to 2013. Considering that the imbalance of the investigation period before and after the implementation of the policy may lead to doubt in the assessment results, this article sets the investigation period from 2006 to 2013 to maintain the balance of the time before and after the implementation of the policy. The specific results are shown in columns (5) and (6) in Table 7. The results show that the change of investigation period does not affect the significant promoting effect of the CLCP policy on regional economic growth. Thus, compared with the results in Table 2, the exclusion of policy interference did not make the evaluation coefficient fluctuate significantly. Therefore, the results in Table 7 strongly demonstrate that the choice of study period does not affect the policy effect evaluated in this article and further show the robustness of the above results.

Table 7. Elimination of Policy Interference: Change Time Window

	2007<year<2012		2006<year<2013		2005<year<2014	
	gdp	**pergdp**	**gdp**	**pergdp**	**gdp**	**pergdp**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Pilot×*Time*	0.012***	0.018***	0.016***	0.024***	0.019***	0.030***
	(0.003)	(0.005)	(0.003)	(0.005)	(0.004)	(0.005)
investment	0.027***	0.011	0.042***	0.031***	0.051***	0.036***
	(0.007)	(0.012)	(0.006)	(0.009)	(0.006)	(0.008)
labor	-0.013	-0.060***	-0.015**	-0.058***	-0.000	-0.039***
	(0.008)	(0.014)	(0.007)	(0.011)	(0.006)	(0.008)
government	-0.001*	-0.001	-0.002***	-0.001**	-0.002***	-0.001***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
open	-0.000	0.001	-0.000	0.001	-0.001	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
industry	0.004***	0.004***	0.005***	0.005***	0.006***	0.006***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
education	-0.000*	-0.000	0.000	-0.000	0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
save	-0.004	-0.005	-0.009**	-0.010	-0.018***	-0.020***
	(0.003)	(0.006)	(0.004)	(0.006)	(0.005)	(0.007)
Individual fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES
_cons	14.728***	9.221***	14.359***	8.766***	14.003***	8.473***
	(0.106)	(0.182)	(0.088)	(0.133)	(0.084)	(0.115)
N	996	996	1,494	1,494	1,992	1,992
F	4,032.311	1,165.957	6,359.920	2,434.957	8,061.100	3,742.317
r2	0.984	0.946	0.985	0.963	0.986	0.970

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

5.3.6 Adding Covariates Test

The results of the above tests indicate that the CLCP policy has a significant and steady promoting effect on regional economic development. However, considering that omitted variables may cause bias in the evaluation results, to further control the factors at the district level, this article refers to the practice of Moser and Voena (2012) [36] to add the change trend of the region over time and the interaction term of the region dummy variable and year dummy variable (district-by-year) based on model (1). At the same time, considering the problem of freedom, this article does not address it directly at the prefecture level but at the provincial level. Specifically, we separately added the interaction term of the province dummy variable and year dummy variable $\gamma_p \times \delta_t$, primary variable of a province over

time $\gamma_p \times t$ (t=year-2001) and quadratic variable of a province over time $\gamma_p \times t^2$ in the model to control the nonlinear trend changes of economic growth in different regions, which makes the results assessed by the DID method more convincing. The specific results are shown in Table 8. Columns (1) - (4) in Table 8 are the regression results of the model after adding the interaction terms of region and time, and columns (5) - (8) in Table 8 are the regression results of the model after adding the primary and quadratic variables of a province over time. It can be seen from the results that considering regional and time factors, the CLCP policy still has a significant promoting effect on economic growth. However, compared with the evaluation effect in Table 2, the evaluation coefficient in Table 8 decreases slightly.

Table 8. Adding Covariates Test

	gdp		pergdp		gdp		pergdp	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pilot×*Time*	0.022***	0.011*	0.018*	0.016*	0.015***	0.015***	0.030***	0.030***
	(0.007)	(0.006)	(0.010)	(0.009)	(0.005)	(0.005)	(0.007)	(0.007)
investment		0.074***		0.076***	0.078***	0.078***	0.069***	0.069***
		(0.004)		(0.006)	(0.005)	(0.005)	(0.007)	(0.007)
labor		0.021***		-0.028***	-0.011*	-0.011*	-0.055***	-0.055***
		(0.006)		(0.008)	(0.006)	(0.006)	(0.009)	(0.009)
government		-0.005***		-0.003***	-0.006***	-0.006***	-0.005***	-0.005***
		(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
open		-0.001**		-0.001*	-0.001**	-0.001**	0.001	0.001
		(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
industry		0.005***		0.005***	0.004***	0.004***	0.004***	0.004***
		(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
education		0.000***		0.000**	0.000***	0.000***	0.000***	0.000***
		(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
save		-0.019***		-0.007	-0.030***	-0.030***	-0.019***	-0.019**
		(0.004)		(0.006)	(0.005)	(0.005)	(0.007)	(0.007)
$\gamma_p \times \delta_t$	YES	YES	YES	YES	NO	NO	NO	NO
$\gamma_p \times t$	NO	NO	NO	NO	YES	YES	YES	YES
$\gamma_p \times t^2$	NO	NO	NO	NO	NO	YES	NO	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
_cons	-228.512***	-193.177***	-217.829***	-181.233***	13.234***	13.234***	7.655***	7.658***
	(0.872)	(2.393)	(1.147)	(3.422)	(0.068)	(0.068)	(0.097)	(0.097)
N	3,354	3,218	3,343	3,218	3,218	3,218	3,218	3,218
F	5,907.623	7,309.502	2,993.642	3,108.212	7,217.757	5,165.889	3,085.538	2,207.124
r2	0.988	0.992	0.976	0.981	0.988	0.988	0.972	0.972

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

6. Further Analysis: Source of Economic Growth?

The above analysis strongly proves that the CLCP policy has significantly promoted the economic growth at the regional level, and the promoting effect has good robustness. However, only analyzing the economic benefits of the CLCP policy at the macrolevel does not effectively and intuitively explain its internal mechanism. To test the internal

Table 9. The Impact of the CLCP Policy on Enterprise Benefits

	2001< year<2014			2005< year<2014		
	income	**revenue**	**profit**	**income**	**revenue**	**profit**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Pilot×*Time*	0.130***	0.141***	0.083***	0.089***	0.112***	0.065***
	(0.004)	(0.010)	(0.010)	(0.003)	(0.010)	(0.010)
size	0.264***	0.216***	0.702***	0.214***	0.177***	0.759***
	(0.003)	(0.006)	(0.006)	(0.002)	(0.006)	(0.006)
age	0.483***	0.171***	0.038***	0.538***	0.317***	0.236***
	(0.008)	(0.014)	(0.014)	(0.007)	(0.021)	(0.021)
labor	0.311***	0.247***	0.177***	0.242***	0.190***	0.112***
	(0.002)	(0.004)	(0.004)	(0.002)	(0.005)	(0.005)
debt	0.093***	0.074***	-0.087***	0.114***	0.104***	-0.091***
	(0.002)	(0.003)	(0.003)	(0.001)	(0.004)	(0.004)
right	0.144***	0.434***	0.239***	0.161***	0.419***	0.182***
	(0.002)	(0.004)	(0.004)	(0.002)	(0.005)	(0.005)
subsidy	0.053***	0.081***	0.087***	0.045***	0.091***	0.087***
	(0.002)	(0.006)	(0.006)	(0.002)	(0.007)	(0.007)
Individual fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES
_cons	3.027***	-1.249***	-2.375***	3.535***	-0.852***	-2.328***
	(0.029)	(0.048)	(0.048)	(0.023)	(0.068)	(0.068)
N	600,147	455,595	460,422	391,015	303,743	305,244
F	1,1514.275	3,777.860	3,864.871	15,939.209	2,508.265	3,142.254
r2	0.497	0.161	0.163	0.414	0.131	0.158

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

mechanism of the policy effect, this article investigates the impact of the implementation of the CLCP policy on enterprise behavior from the perspective of microenterprises and uses this as the microbasis for the conclusions obtained at the macrolevel. There are two reasons why this study chooses the perspective of the enterprise, and the details are as follows. First, the microcosmic reflection of regional economic development is the growth of enterprise output. An analysis of enterprise output is conducted not only to further consolidate and confirm the conclusions of the above macroanalysis but also to deepen the understanding of

the CLCP policy's effect on economic growth. Second, environmental regulation mainly affects enterprise income by influencing enterprise behavior and decision-making, and then it changes the overall output level of the region. Therefore, microenterprise data provide a good opportunity to solve this problem.

6.1 The Impact of the CLCP Policy on the Costs and Benefits of Enterprises

6.1.1 The Impact of the CLCP Policy on Enterprise Benefits

From the macroanalysis, it can be seen that the CLCP policy can significantly promote regional economic growth and has a lasting impetus. Does this significant promotion effect also exist at the enterprise level? This section mainly answers this question. Under the premise of data availability, this article selects the logarithm of main business income (income), the logarithm of enterprise operating revenue (revenue) and the logarithm of enterprise total profit (profit) to measure enterprise output and income and then uses the DID method to evaluate the results at the microlevel. The specific results are shown in columns (1) - (3) in Table 9. At the same time, considering the interference of other macro-policies, this study excludes the year of investigation. The regression results after elimination are shown in columns (4) - (6) in Table 9. The regression results show that the implementation of the CLCP policy promotes the benefits of enterprises, and the effect is significant at the 1% confidence level, regardless of which indicator is used to measure enterprise output or the division of the investigation period. At the same time, the assessment results in Table 9 are completely consistent with the analysis results in Table 2 on the macrolevel, which fully shows that the increase of output at the enterprise level is the microbasis for economic growth at the regional level.

6.1.2 The Impact of the CLCP Policy on Enterprise Costs

In Table 9 it can be seen that the implementation of the CLCP policy does not reduce enterprise performance, but significantly increases the enterprise output and income. The conclusion seems to indicate that environmental regulation has no negative impact on enterprises. However, in fact, compared with the absence of environmental constraints, environmental constraints have significantly changed the production costs of enterprises. This increased cost affects macroeconomic growth by changing enterprise behavior and decision-making. To conduct a detailed empirical test of enterprise cost, this article uses product sales tax and surcharge (salestax), product sales expenses (salesfee), enterprise payable VAT (tax), enterprise payable income tax (paytax) and enterprise payable total wages (wage) to measure the various costs of enterprises. There are two reasons for choosing sales costs and taxes. On the one hand, due to environmental regulation, enterprises' environmental pollution emissions standards become higher, which increases enterprises' production costs by increasing enterprises' additional costs. On the other hand, in the process of environmental governance, local governments change the previous subsidies and preferential policies for enterprises, which has a significant impact on the tax level of enterprises. The specific results are shown in Table 10. It can be seen from columns (1) - (4) in Table 10 that although the implementation of the CLCP policy causes the growth degree of different types of costs of enterprises to vary, it is undeniable that the policy significantly increases the production costs of enterprises. This is largely because of the additional costs associated with the level of technology, tax reduction and exemption and policy tilt required by environmental regulations. Column (5) in Table 10 shows that the CLCP policy reduces the wage costs payable by enterprises, and the effect is significant at the 1% confidence level, which indicates that enterprises have adjusted their internal management and personnel structure, eliminated surplus personnel and strengthened management to respond to the

external pressure from environmental regulation. Overall, the implementation of the CLCP policy significantly increases the production costs of enterprises.

Table 10. The Impact of the CLCP Policy on Enterprise Costs

	salestax	**salesfee**	**tax**	**paytax**	**wage**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Pilot×*Time*	0.071***	0.032*	0.409***	0.136***	-0.035***
	(0.020)	(0.018)	(0.009)	(0.012)	(0.005)
size	0.149***	0.401***	0.151***	1.356***	0.217***
	(0.011)	(0.016)	(0.006)	(0.008)	(0.004)
age	-0.001	0.479***	0.548***	0.102***	0.303***
	(0.035)	(0.024)	(0.014)	(0.022)	(0.006)
labor	0.468***	0.316***	0.192***	0.082***	0.532***
	(0.009)	(0.008)	(0.004)	(0.005)	(0.002)
debt	0.028***	0.057***	0.086***	-0.312***	0.025***
	(0.007)	(0.007)	(0.003)	(0.004)	(0.002)
right	0.145***	0.060***	0.257***	-0.115***	0.047***
	(0.008)	(0.008)	(0.004)	(0.006)	(0.002)
subsidy	-0.032**	0.060***	0.087***	0.018**	0.042***
	(0.013)	(0.010)	(0.006)	(0.007)	(0.002)
Individual fixed effects	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES
_cons	-1.672***	-1.153***	0.045	-5.252***	1.382***
	(0.100)	(0.085)	(0.046)	(0.070)	(0.020)
N	145,332	136,359	456,541	289,017	457,387
F	716.614	2,417.534	3,176.420	3,537.057	30,160.397
r2	0.102	0.286	0.139	0.235	0.573

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

6.2 The Impact of the CLCP Policy on Enterprise Decision-Making

The cost-benefit analysis of enterprises shows that although the CLCP policy increases the production costs of enterprises, it does not cause the decline of enterprise output and performance. In contrast, this policy has a significant promoting effect on enterprise performance. What strategies do enterprises adopt to cope with the cost pressure brought by environmental regulations while also improving their performance? Answering this question helps not only to further explore the internal mechanism of the impact of the CLCP policy on economic growth but also to have a deeper understanding of the enterprise strategy selection under changes of the external environment, which further provides a more comprehensive analysis of the economic benefits of the CLCP policy. Therefore, from the perspective of the specific behaviors of enterprises, this article respectively examines the impact of CLCP policies on the trans-regional transfer, management, efficiency and innovation activities of

enterprises. The reasons for choosing these three major enterprise behaviors are as follows. As a means of environmental regulation, the implementation of CLCP inevitably raises the production costs of microenterprises and forces them to adopt positive strategies to manage the increase of costs. How should managers make decisions to improve business performance in this context? For this, there are two strategies for enterprises. First, enterprises can reduce costs by adopting innovative activities such as improving production processes and cleaner production standards to create opportunities for enterprises to survive. Enterprises move directly from CLCP areas to nonpilot areas to reduce the negative impact of the increased costs caused by environmental constraints on enterprises. The specific analysis follows.

6.2.1 The Impact of the CLCP Policy on Enterprise Migration

Compared with nonpilot regions, enterprises in pilot regions are regulated by environmental governance. The results in Table 10 also show that the environmental regulations increase the production costs of enterprises. To cope with the increase of production costs, do enterprises adopt the strategy of trans-regional transfer to avoid the cost repression that is caused by environmental regulations, that is, from low-carbon pilot areas to nonpilot areas? Then, the next question to consider is whether there is a "pollution paradise hypothesis" among regions. If it is true, the transfer of pollution enterprises caused by environmental regulations will lead to severe sample selection bias that will affect the net effect estimation of the above policy assessment. To conduct an empirical test for the rational behavior of enterprises, this study selects the number of new enterprises whose age is less than one year (firmnumber0) and the number of new enterprises aged one year (firmnumber1) in each region to measure the enterprise transfer behavior. If the CLCP policy leads to the cross-regional transfer of enterprises, then the CLCP policy has a significant impact on the number of new enterprises. Otherwise, there is no cross-regional transfer. The specific results are shown in Table 11. It can be seen from the regression results that the implementation of the CLCP policy has no significant impact on the number of newly established foreign-funded enterprises. This result indicates that environmental regulation has not led to the cross-regional transfer of enterprises. It also shows that environmental regulation has no obvious effect on enterprises' settling in this area, that is, there is no factual basis for the hypothesis of pollution paradise and the empirical dilemma of sample self-selection. The most reasonable explanation is the transfer cost and silence cost of enterprise transfer, which forces enterprises to adopt more rational choices to manage the external pressure and cost increase brought by environmental regulations.

6.2.2 The Impact of the CLCP Policy on Enterprise Management and Efficiency

In the context of a significant increase in production costs, enterprises do not choose cross-regional transfer to avoid the trouble caused by environmental regulations. How does an enterprise realize the benefit enhancement? Column (5) in Table 10 indicates that the implementation of the CLCP policy does not increase the wage costs of enterprises but rather reduces these costs. It can be seen that under the constraint of environmental regulation, enterprises choose methods such as strengthening management, improving operation and improving efficiency to relieve external pressure. To conduct a powerful empirical test for this, this article selects management costs (managemcosts) to measure the degree of enterprise management. In addition, the ratio of operating profit to the number of employees and the ratio of operating profit to total assets are used to explain the rate of return on labor and the rate of return on assets, respectively, which are used to measure the efficiency of the enterprise. The specific results are shown in Table 12. The regression results in Table 12

show that the implementation of the CLCP policy not only improves the management costs paid by enterprises but also the efficiency of enterprises. This shows that rational enterprises, under the constraint of environmental regulation, are more inclined to adopt methods of strengthening internal management and improving operating efficiency to manage the increase in production costs.

Table 11. The Impact of the CLCP Policy on Enterprise Migration

	firmnumber0			**firmnumber1**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Pilot×*Time*	0.248	0.129	0.399	0.958	1.308	2.552
	(0.955)	(0.962)	(0.985)	(2.303)	(2.313)	(2.371)
investment		2.327***	3.068***		9.881***	9.713***
		(0.784)	(0.928)		(1.885)	(2.233)
labor		2.600**	2.859**		2.365	5.161*
		(1.066)	(1.226)		(2.564)	(2.951)
government		-0.013	-0.138***		0.014	-0.135
		(0.031)	(0.047)		(0.074)	(0.113)
open			0.053			0.329
			(0.108)			(0.259)
industry			0.023			0.100
			(0.056)			(0.134)
education			-0.000			-0.000***
			(0.000)			(0.000)
save			5.655***			8.794***
			(0.927)			(2.230)
Individual fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES
_cons	1.900***	-37.459***	-50.696***	6.419***	-132.147***	-146.438***
	(0.644)	(11.495)	(12.831)	(1.553)	(27.640)	(30.881)
N	3,261	3,249	3,140	3,261	3,249	3,140
F	26.687	22.272	19.984	28.764	25.060	21.857
r2	0.097	0.102	0.118	0.104	0.113	0.128

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

Table 12. The Impact of the CLCP Policy on Enterprise Management and Efficiency

	managemcosts		laborprofitratio		capitalprofitratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Pilot×*Time*	0.358***	0.656***	24.818***	2.314*	0.102***	0.070***
	(0.004)	(0.005)	(1.320)	(1.404)	(0.003)	(0.004)
size		0.384***		18.829***		-0.322***
		(0.003)		(0.832)		(0.002)
age		0.287***		28.386***		0.110***
		(0.007)		(1.995)		(0.005)
labor		0.026***		-57.893***		0.048***
		(0.002)		(0.575)		(0.001)
debt		0.014***		4.761***		0.087***
		(0.002)		(0.467)		(0.001)
right		0.097***		21.742***		0.147***
		(0.002)		(0.552)		(0.001)
subsidy		0.082***		1.918**		0.018***
		(0.003)		(0.873)		(0.002)
Individual fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES
_cons	7.195***	1.694***	21.749***	-167.242***	0.079***	0.759***
	(0.004)	(0.022)	(1.172)	(6.636)	(0.003)	(0.017)
N	676,257	600,090	623,489	600,048	676,149	600,048
F	26,890.945	25,280.410	167.678	883.827	1,008.589	2,470.414
r2	0.377	0.483	0.004	0.032	0.022	0.084

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

6.2.3 The Impact of the CLCP Policy on Enterprise Innovation

In addition to strengthening management and improving operating efficiency, as a major innovation subject in the modern economic system, the innovation function of an enterprise cannot be ignored. In view of this, this article also considers that enterprises engage in innovative activities in response to increased costs caused by environmental constraints. On the one hand, an enterprise realizes the transformation of production products through innovation to win greater market competitiveness and gain more profits. On the other hand, through the innovation of clean production technology, enterprises can overcome the decline of benefits caused by the increase of costs and seek lasting impetus for their survival. In this regard, this study refers to the innovation indicators used by Long and Wan (2017) [37] and measures the innovation of enterprises by the logarithm of the output value of new products (newproduct) and the logarithm of the total export volume of enterprises (exportsize). At the same time, the relative value of innovation ability is measured by the

proportion of new product output to the main business income (newproductrate). The specific results are shown in columns (1) - (3) in Table 13. In addition, considering the interference of relevant policies, this analysis also excludes the year of investigation. The specific results are shown in columns (4) - (6) in Table 13. The results show that the implementation of the CLCP policy promotes the innovation activities of enterprises, and the promotion effect is significant at the 1% confidence level. This conclusion shows that under environmental constraints, enterprises tend to choose innovation activities in the face of a significant increase in costs and to realize the maximization of enterprise earnings through innovation to avoid the negative impact of environmental regulations on enterprises.

Table 13. The Impact of the CLCP Policy on Enterprise Innovation

	2001< year<2014			**2005< year<2014**		
	newproduct	**newproductrate**	**exportsize**	**newproduct**	**newproductrate**	**exportsize**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Pilot×*Time*	0.534***	0.013***	1.018***	0.361***	0.009***	0.848***
	(0.030)	(0.001)	(0.008)	(0.028)	(0.001)	(0.008)
size	0.133***	0.003***	0.049***	0.028	-0.001	-0.110***
	(0.018)	(0.001)	(0.005)	(0.018)	(0.001)	(0.005)
age	0.013	-0.024***	0.518***	-0.039	-0.045***	0.616***
	(0.050)	(0.002)	(0.012)	(0.060)	(0.003)	(0.019)
labor	-0.062***	-0.004***	0.101***	-0.261***	-0.009***	-0.139***
	(0.016)	(0.001)	(0.003)	(0.018)	(0.001)	(0.004)
debt	0.120***	-0.001*	0.137***	0.120***	0.002***	0.173***
	(0.015)	(0.000)	(0.003)	(0.018)	(0.001)	(0.004)
right	0.311***	0.002***	0.303***	0.375***	0.003***	0.413***
	(0.015)	(0.001)	(0.003)	(0.020)	(0.001)	(0.004)
subsidy	0.001	0.003***	0.111***	-0.005	0.006***	0.111***
	(0.020)	(0.001)	(0.005)	(0.023)	(0.001)	(0.006)
Individual fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES
_cons	3.959***	0.060***	3.614***	5.796***	0.146***	5.060***
	(0.213)	(0.006)	(0.042)	(0.310)	(0.010)	(0.066)
N	38,009	420,871	362,525	26,826	266,620	230,592
F	362.150	162.060	8,850.050	602.805	240.459	11,781.941
r2	0.203	0.008	0.357	0.324	0.015	0.479

Note: (1) The values in brackets are standard errors; (2) *, **, and *** indicate significance at the confidence levels of 10%, 5%, and 1%, respectively.

7. Conclusion

The global warming problem has become increasingly serious and is the focus of governments worldwide. Governments have introduced policies to reduce carbon emissions in response to climate change. As the world's largest emitter of carbon dioxide, China's economic development has also had a tremendously negative impact on global climate governance. In view of this, in the face of the reality of global warming, the Chinese government has the responsibility and obligation to actively participate in global climate governance and make efforts to reduce carbon emissions. The CLCP policy is an important step for the Chinese government to fulfill its responsibilities, and it is also an important measure taken by the Chinese government to respond to greenhouse gas emissions. An analysis of the economic benefits of the policy is beneficial for researchers and policy makers to fully understand the effects of environmental regulation, which has great practical significance for the Chinese government in introducing the policy nationally. Based on the panel data of Chinese prefecture-level cities and of Chinese microindustrial enterprises from 2001 to 2013, this article constructs a quasi-natural experiment by using the CLCP policy implemented in eight cities and five provinces. This article then assesses the impact of environmental regulations on local economic growth and enterprise behavior and makes clear inferences about the causality between environmental regulation and economic growth by using the DID method.

The results show that the CLCP policy significantly promotes the economic growth of local cities. At the same time, the dynamic effect test shows that environmental regulation has a long-term promoting effect on economic growth, but there is a significant time-lag. According to the analysis of microenterprises, it can be seen that although the CLCP policy can increase the production costs of enterprises, it also significantly promotes the output and income of enterprises. Instead of exiting from the market, enterprises address the increased costs in a more proactive way. On the one hand, enterprises constantly strengthen internal management and improve productivity; on the other hand, enterprises constantly input more resources to conduct innovative activities to overcome the increase in cost and to realize the improvement of enterprise income. The root cause of environmental regulation to promote economic growth lies in the change of enterprise behavior, which provides a good explanation for the economic benefits of the CLCP policy. The research conclusion of this article shows that environmental regulation and economic development can achieve a "win-win" situation and fundamentally revises the traditional concept that environmental regulation restrains economic growth, that is, economic growth is bound to be at the expense of the environment. The results show that the government can achieve the rapid growth of a regional economy while implementing environmental regulation.

The conclusions of this article provide strong theoretical support and a practical foundation for the environmental distress and economic structural transformation faced by developing countries. The specific policy implications are as follows. First, in the face of deteriorating environmental pressures, governments should abandon the traditional misconceptions and attempt to improve environmental governance, thereby achieving economic growth. Second, it is found that environmental regulation has a long-term role in local economic growth, but there is a time-lag. This conclusion suggests that the government should pay considerable attention to the long-term effectiveness of policies and not merely only focus on the short-term benefits. Third, when economic development enters a transition period, how to realize the transfer of industries with high energy consumption, pollution and emissions is the key issue faced by local governments. The results of this article show that environmental regulation can be used to measure the impact of various industries on the environment. According to this, governments can construct environmentally friendly

industrial structures suitable for green development. Therefore, environmental regulation is a powerful tool for economic structural transformation to thus further promote regional environmental governance and economic development. Fourth, considering the changes of enterprises' behavior in the process of environmental regulation, the government should subsidize enterprise innovation, encourage internal adjustment and productivity improvement and restrict transregional transfers, thereby resolving the dilemma of local environmental governance and overall environmental degradation. Thus, the environmental regulation represented by the CLCP policy provides a feasible path for more developing countries to choose low-carbon green development, enhances the possibility to further realize a "win-win" situation between environmental governance and economic development, creates opportunities to explore new ways of economic development, and explores useful opportunities for developing countries to seek environmental governance and develop sustainable roads.

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