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Study on the direct impact of environmental regulation policy on carbon emission intensity in China

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Abstract: The assessment of the effectiveness of differentiated environmental regulation policies on China's carbon emissions is an important research topic to accelerate the transformation of China's low-carbon economy. This paper uses the systematic GMM method to investigate the heterogeneous effects of three environmental regulation policies. The results show that: (1) the direct impact of emission fee on carbon emission intensity is inverted U-shaped, but the impact is not significant. (2) The investment in industrial pollution control directly suppresses carbon emission without "green paradox".;(3) The direct impact of local environmental protection standards on carbon emissions has produced a "green paradox" effect. The above results show that China's current environmental regulation policies can effectively curb carbon emissions. Identifying the differences in the effectiveness and impact paths of different environmental regulation policies can provide reference for government departments to formulate, and maximize the carbon emission reduction effect of different environmental regulation policies, and promote China's implementation Now we are committed to carbon emission reduction in the world.

Keywords: Environmental regulation; Green paradox; Backward emission reduction

INTRODUCTION

The public attributes and negative externalities of the environment will lead to "market failure", and it is difficult to achieve the emission reduction goal only by relying on the market. Therefore, in order to achieve the above commitments, the Chinese government has formulated a series of environmental policies and adopted a variety of environmental regulation tools to promote carbon emission reduction and make up for "market failure".

But scholars have different views on the necessity of environmental regulation and the effectiveness of carbon emission reduction. Some scholars think that environmental policy is redundant. Schou [Schou, *et. al.*, 2002] believes that pollution emissions will automatically reduce as natural resources continue to be consumed. Sinn [Sinn, *et. al.*, 2008] puts forward the "green paradox" theory that increasing the intensity of environmental regulation can not promote carbon emission reduction. Because energy suppliers expect that the future environmental regulation policies will be increasingly strict, the current period will accelerate energy development, and then accelerate energy consumption, resulting in rapid growth of carbon emissions. Some scholars believe that strict environmental regulations can reduce carbon emissions and promote regional economic growth.

The main contributions of this paper are as follows: Firstly, in order to more accurately and comprehensively evaluate the effectiveness of different environmental regulation policies on carbon emission intensity, this paper brings the issued local environmental protection standards, industrial pollution control investment and emission fee income into the same analysis framework. Secondly, this paper uses 30 provincial panel data from 2000 to 2016 in mainland China as research samples, constructs a dynamic panel model, uses the System GMM method, introduces the square terms of different environmental regulations, tests the non-linear impact of environmental regulation tools on carbon emission intensity, and empirically compares the heterogeneous effects of different environmental regulation policies on carbon emission reduction. Third, in order to compare the effectiveness of carbon emission reduction before and after the implementation of environmental regulation policies, this paper further divided into two different periods: 2000-2006 and 2007-2016, and compared and evaluated the effectiveness of different environmental regulations on carbon emission reduction, laying the foundation for identifying the effectiveness and transmission path of different environmental regulation policies.

DIRECT TRANSMISSION MECHANISM AND RESEARCH HYPOTHESIS

The formulation of environmental regulations comes from the negative externalities of environmental pollution caused by production activities of enterprises. It is necessary for the government to formulate corresponding policies and measures to regulate the production and operation activities of enterprises, so as to realize the sustainable and coordinated development of economy and environment[Van, *et. al.*, 2012].Zhao Yumin divides environmental regulation into three types:

command control type, market incentive type and public participation type [Smulders, *et. al.*, 2012].The purpose of all kinds of environmental regulation policies is to protect the environment and reduce the impact of

carbon emissions. Specifically, the government can adopt incentive regulatory policies, such as levying taxes on fossil energy suppliers and demanders, so as to increase the production costs and environmental costs of enterprises, thus reducing energy demand and carbon emissions. The government can also adopt an order controlled environmental policy, that is, to implement strict control standards for enterprises with high energy consumption and high pollution, such as shutting down some heavy polluting enterprises, or forcing some enterprises to adopt low-carbon technology, etc., which can also reduce the demand for fossil energy, and then inhibit or reduce carbon emissions. However, a different situation may arise. Sinn, a German economist, thinks that good intentions do not always lead to good behaviors, and puts forward the "green paradox" effect, which is also the possible impact of environmental regulations on carbon emissions. This result comes from the dynamic response of the energy supply side [Green, 2001].This leads to the "green paradox" effect of environmental regulation on carbon emissions. But this conclusion is worth considering [Li, 2015]. Some scholars believe that due to the constraints of the production scale and cost of enterprises, the demand of fossil energy demanders for fossil energy in a short period of time is certain, and the current period will not increase the consumption of fossil energy due to the decrease of energy prices [Shao, *et. al.*, 2010]. Even if the purchase of fossil energy is increased, it does not mean direct consumption in the current period. So carbon emissions don't increase rapidly as energy prices fall. Therefore, the direct effect of environmental regulation on carbon emission is embodied in "backward forcing emission reduction" and "green paradox"[Zhang, *et. al.*, 2014].Based on this, this paper proposes the following research hypotheses:

H1:local environmental standards can directly affect carbon emissions, showing U-shaped or inverted U-shaped characteristics.

H2:investment in industrial pollution control can directly affect carbon emissions, showing U-shaped or inverted U-shaped characteristics.

H3:emission fee income can directly affect carbon emissions, showing U-shaped or inverted U-shaped characteristics.

RESEARCH DESIGN AND MODEL CONSTRUCTION

Data Sources

This paper uses panel data from 30 provinces of China (excluding Tibet, Hong Kong, Macao and Taiwan) for empirical analysis. The number of local environmental protection standards and investment in industrial pollution control are both from the Environmental Statistics Yearbook of China over the years. The regional GDP, population, industrial added value, proportion of tertiary industry, urban population and number of patent applications are from China Statistical Yearbook. The energy consumption structure comes from China Energy Statistical Yearbook and provincial statistical yearbook. The consumption data of different kinds of fossil energy involved in the calculation of carbon emissions are from China Energy Statistical Yearbook. In order to eliminate the influence of inflation, this paper will adjust the variables related to price index to constant price based on 2000.

3.2Variable Specification

Carbon Dioxide Emission Intensity

To measure the intensity of carbon dioxide emissions, we first need to measure carbon dioxide emissions, which is the starting point of carbon emission reduction research. Since China does not have officially published carbon dioxide emission data, it needs to adopt corresponding methods to measure. This paper mainly refers to the calculation method recommended in the IPCC, adopts the carbon emission coefficient recommended by the Energy Research Institute of the national development and Reform Commission of China, and uses eight major energy types of coal, coke, crude oil, gasoline, diesel, fuel oil and natural gas to calculate the carbon dioxide emissions of 30 provinces in China from 2000 to 2016 in detail. The calculation formula of carbon emission is shown in Table 1.

$$CO_2 = \sum_{i=1}^{8} E_i \times R_i \times K_i \qquad (1)$$

Among them, CO2 — the carbon emission generated by energy consumption; Ei-the ith energy consumption; Ri — the standard coal conversion coefficient of the ith energy; Ki—the carbon dioxide emission coefficient of the ith energy.

Table1 Standard coal conversion coefficient and carbon dioxide emission coefficient of different energy

Energy	Coal	Coke	Crude Oil	Fuel Oil	Gasoline	Kerosene	Diesel Oil	Gas
R	0.7143	0.9714	1.4286	1.4286	1.4714	1.4714	1.4571	1.3300
K	2.7716	3.1305	2.1476	2.2678	2.0306	2.0951	2.0951	1.6438

Environmental Regulation

This paper mainly studies the carbon emission reduction effect of three kinds of environmental regulation policies:

(1)Issued local environmental protection standards. With cer, the higher the value is, the stronger the order environment regulation is.

(2)Investment in industrial pollution control.

$$S_{i,t}* = \frac{M_{i,t}}{Y_{i,t}} \quad (2)$$

Among them, $M_{i,t}$—Total investment in industrial pollution control in the ith Province in year t; $Y_{i,t}$—Total industrial output value of the ith Province in year t.

(3)Emission fee income. Emission fee income refers to the total amount paid in, and the source of emission fee income is the statistical yearbook of each province over the years. The index is measured by the ratio of pollution charge income to GDP. The higher the ratio, the stronger the regulation [Xu, *et. al.*, 2015].

(3)Other Variables

Advanced level of industrial structure ($lndu$).

Technological innovation($lntech$).

FDI($lnfdi$).

Energy ($lnen$).

GDP per capita(lny).

Population scale(lnp).

Urbanization rate(u).This paper also introduces it as a variable into the measurement mode.

3.2 Model

in order to test hypothesis 1 and verify the direct impact of environmental regulations on carbon emission intensity, this paper takes local environmental protection standards and industrial pollution control investment per unit output value as the core explanatory variables, and takes carbon emission intensity as the explanatory variable, and constructs the following benchmark model:

$$lnc_{i,t} = \beta_0 + \beta_1 lnc_{i,t-1} + \beta_2 cer_{i,t} + \beta_3 cer_{i,t}^{\ 2} + \varphi X_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (3)$$

$$lnc_{i,t} = \beta_0 + \beta_1 lnc_{i,t-1} + \beta_2 S_{i,t} + \beta_3 S_{i,t}^{\ 2} + \varphi X_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (4)$$

$$lnc_{i,t} = \beta_0 + \beta_1 lnc_{i,t-1} + \beta_2 M_{i,t} + \beta_3 M_{i,t}^{\ 2} + \varphi X_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (5)$$

i,t represent province and year respectively, lnc is the logarithmic carbon dioxide emission intensity, β_1 is the lag multiplier, indicating the impact of the previous strong carbon dioxide emission team on the current period, α_i represents the regional non observation effect, reflecting the persistent differences between provinces, $\varepsilon_{i,t}$ represents a specific heterogeneous effect, assuming a normal distribution, cer is the local environmental standards, M stands for the agent variable of pollution charge income, S stands for investment in industrial pollution control per unit output value after revision, $X_{i,t}$ refers to other variables of cer ,including energy consumption structure, advanced industrial structure, technological innovation, foreign direct investment, per capita GDP, population scale and urbanization rate. At the same time, referring to the "Environmental Kuznets curve (EKC)", the per capita reality and its square term are also introduced into the model to investigate whether there is a carbon emission Kuznets curve.

EMPIRICAL ANALYSIS

Analysis on the Effectiveness of Direct Impact Mechanism in Carbon Emission Reduction

Table2 reports the direct effect of three environmental regulation tools on carbon emissions. According to all regression results, it is found that AR (1), AR (2) and sargan statistics are effective in reporting instrumental variables, which shows that the model established in this paper is reasonable and the regression results are reliable.

The models (1) and (2) are the regression results of the first and second power terms of the emission fee income ($ER = M$), which reflect the direct impact of the emission fee income on carbon emissions. It can be seen that the first and second power terms of model (1) and model (2) are not significant, indicating that the emission fee income does not play a role in inhibiting carbon emission reduction. The reason lies in the fact that the legal collection standard of pollution charge is far lower than the cost of pollution control of enterprises, which prefer to pay pollution charge rather than take environmental protection investment or upgrade technology. This shows that the emission fee system has increased the cost pressure of enterprises, and has a "cost effect", but failed to effectively curb carbon emissions.

The models (3) and (4) are the regression results of the first and second power terms of introducing industrial pollution control investment ($ER = S$), reflecting the direct impact of industrial pollution control investment on carbon emissions. In the model (3), the first power coefficient of industrial pollution control investment is significantly negative (- 0.025) at the level of 10%, which indicates that industrial pollution control investment effectively suppresses carbon emissions and exerts the "backward emission reduction" effect. In the model (4), the coefficient of the first power is positive and the coefficient of the second power is significantly negative at the level of 10%, indicating that there is a significant inverted U-shaped relationship between investment in industrial pollution control and carbon emissions, that is, there is a threshold between the two. When the investment of industrial pollution control per unit output value is less than the threshold value, improving the intensity of environmental regulation will promote carbon emissions, and there will be a "green paradox" effect. On the contrary, when it is greater than the threshold value, it will restrain carbon emission and form the "backward emission reduction" effect, so as to achieve the expected emission reduction purpose. According to the regression results of model (4), the inflexion of inverted U-shaped curve is 0.248.According to the descriptive statistical results in Table 2, it is found that the current industrial pollution control investment is on the left side of the inflection point (0.24), which is in the stage of "green paradox" effect, and is very close to the inflection point. Once more than 0.248, the "green paradox" will transition to the "backward emission reduction" effect, and industrial pollution control investment will effectively curb carbon emission reduction. At the same time, under the influence of industrial pollution control investment, it can effectively promote technological innovation of enterprises, the coefficient is significantly negative at the level of 1%, which shows that technological progress can effectively inhibit carbon emissions, and verifies the existence of Porter hypothesis. But it can't be shown that China can certainly improve energy utilization and reduce carbon emissions through technological research and development, upgrading and transformation.

Table 2 Direct Effect of Environmental Regulation on Carbon Emissions

Variable	$ER=M$		$ER=S$		$ER=cer$	
	(1)	(2)	(3)	(4)	(5)	(6)
$L.lnc$	0.814***	0.816***	0.881***	0.852***	0.872***	0.817***
	(-13.490)	(-16.320)	(-17.440)	(-15.910)	(-22.030)	(-12.020)
ER	0.110	0.369	-0.025*	0.004	0.003***	0.01***
	(-1.610	(-0.790)	(-2.24)	(-0.140)	(-4.120)	(-4.260)
ER^2		-0.282		-25.13*		-0.001***
		(-0.38)		(-2.05)		(-4.32)
$indu$	-0.128***	-0.122***	-0.134***	-0.124***	-0.128***	-0.131***
	(-10.15)	(-8.16)	(-11.93)	(-9.78)	(-9.04)	(-13.32)
$lntech$	-0.020	-0.020	-0.029**	-0.030***	-0.030***	-0.021
	(-1.90)	(-1.73)	(-3.01)	(-3.62)	(-3.65)	(-1.89)
$lnfdi$	-0.005	-0.001	-0.005	-0.001	-0.003	-0.005
	(-1.07)	(-0.12)	(-1.00)	(-0.19)	(-0.53)	(-1.08)
$ener$	-0.086	-0.075	-0.295	-0.313**	-0.197	-0.134
	(-0.39)	(-0.29)	(-1.48)	(-2.62)	(-0.78)	(-0.67)
lny	0.628	0.482	0.384	0.48*	0.408	0.761*
	(-1.690)	(-1.030)	(-1.520)	(-0.690)	(-1.740)	(-2.030)
$(lny)^2$	-0.027	-0.020	-0.016	-0.008	-0.018	-0.035
	(-1.52)	(-0.86)	(-1.37)	(-0.52)	(-1.51)	(-1.94)
lnp	0.155***	0.144***	0.127***	0.118***	0.126**	0.169***
	(-3.770)	(-4.680)	(-4.950)	(-4.330)	(-3.270)	(-4.860)
u	-0.033	-0.067	-0.059	-0.018	-0.055	-0.013
	(-0.60)	(-1.52)	(-1.32)	(-0.41)	(-1.13)	(-0.19)
$\_c$	-2.384	-1.643	-1.198	-0.310	-1.351	-3.072
	(-1.33)	(-0.74)	(-0.99)	(-0.20)	(-1.14)	(-1.69)
N	480	480	480	480	480	480
$AR(1)$	-2.53	-2.49	-2.45	-2.53	-2.58	-2.56
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$AR(2)$	-0.60	-0.55	-0.54	-0.75	-0.58	-0.652
	(0.55)	(0.58)	(0.59)	(0.45)	(0.56)	(0.52)
$Sargan$	26.62	26.85	28.01	25.58	27.49	26.80
	(0.98)	(0.97)	(0.96)	(0.98)	(0.97)	(0.97)

Noted:***、**、*represents the significance level of 1%, 5% and 10%, respectively. The value in brackets below the coefficient is its standard error.AR (1) and AR (2) represent the Arellano bond autocorrelation test of the first-order and second-order difference residual sequences respectively, and sargan test is the over recognition test.

Model (5) and model (6) are the regression results of the primary and secondary terms of introducing local environmental protection standards ($ER=cer$), reflecting the direct impact of industrial pollution control investment on carbon emissions. The first power coefficient of local environmental protection standard in model (5) is significantly positive at the level of 1%, which indicates that the local environmental protection standard does not effectively restrain carbon emissions, but promotes the increase of carbon emissions, resulting in "green paradox" effect. In the model (6), the first power coefficient is significantly positive at the level of 10% and the second power coefficient is significantly negative at the level of 10%, indicating that there is a significant inverted U-shaped relationship between local environmental protection standards and carbon emissions, that is, there is a threshold between the two.

From the regression results of models (1) - (6), all the models show that the coefficient of industrial structure's influence on carbon emissions is significantly negative at the level of 1%, which shows that the degree of industrial structure's upgrading effectively restrains the increase of carbon emissions, and the environmental regulation policy should continue to incline to service-oriented enterprises such as the tertiary industry. The first power of GDP per capita is positively correlated with carbon emissions, while the second power is negatively correlated. Rapid population growth will seriously adjust the carrying capacity of resources and environment, and population growth will promote energy consumption, which directly leads to the increase of carbon emissions. The influence of energy consumption structure on carbon emission is negative, but not significant, which indicates that energy consumption structure can restrain carbon emission to some extent.

4.2Assessment of Carbon Emission Reduction Effectiveness of Different Environmental Regulations in Different Periods

Table 3 Direct effects of three environmental regulation tools on carbon emission reduction in different periods

Variable	2000-2006			2007-2016		
	$ER=M$	$ER=S$	$ER=cer$	$ER=M$	$ER=S$	$ER=cer$
$L.\ln c$	0.461***	0.611***	0.582***	0.785***	0.764***	0.823***
	(5.47)	(10.71)	(7.01)	(15.66)	(16.30)	(14.80)
ER	-0.138	0.386***	0.007	0.127	-0.121**	0.008**
	(-0.51)	(4.55)	(0.62)	(0.11)	(-3.22)	(3.01)
ER^2	-0.742	-0.368***	0.0004	-0.180	0.040**	-0.001***
	(-1.17)	(-5.70)	(0.11)	(-0.08)	(2.75)	(-3.32)
indu	-0.157***	-0.159***	-0.172**	-0.084***	-0.0935***	-0.077***
	(-3.77)	(-4.44)	(-3.06)	(-6.02)	(-7.44)	(-5.76)
lntech	-0.0193	0.008	-0.007	-0.069***	-0.050***	-0.075***
	(-1.06)	(0.35)	(-0.28)	(-5.36)	(-3.47)	(-5.28)
$\ln fdi$	0.002	0.019	-0.012	0.012	0.018*	0.016*
	(0.23)	(1.74)	(-1.06)	(1.27)	(2.23)	(2.07)
ener	0.511***	0.222	0.454***	-0.002	-0.001	-0.002
	(3.90)	(1.57)	(4.06)	(-1.49)	(-0.98)	(-1.52)
ln y	-0.246	-0.459*	-0.225	1.962***	1.638*	1.682*
	(-1.11)	(-2.22)	(-1.00)	(3.37)	(2.31)	(2.49)
$(\ln y)^2$	0.0204	0.0245*	0.0150	-0.089**	-0.074*	-0.075*
	(1.76)	(2.11)	(1.28)	(-3.00)	(-2.16)	(-2.32)
ln p	-0.304***	-0.313***	-0.216**	0.173**	0.0793	0.170***
	(-4.65)	(-4.93)	(-2.63)	(3.27)	(1.21)	(3.77)
u	-0.458***	-0.240*	-0.298**	0.354	0.367	0.176
	(-4.67)	(-2.20)	(-2.80)	(0.97)	(0.87)	(0.50)
$\_c$	3.947***	5.031***	3.313*	-9.377***	-6.897*	-8.223*
	(3.35)	(5.15)	(2.23)	(-3.34)	(-1.98)	(-2.27)
$AR(1)$	-2.38	-2.45	-2.73	-2.83	-3.30	-3.03
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
$AR(2)$	0.74	0.36	0.64	-1.64	-1.61	0.33
	(0.46)	(0.72)	(0.52)	(0.10)	(0.11)	(0.23)
$Sargan$	16.47	15.30	21.68	22.95	22.56	25.33
Test Value	(0.42)	(0.50)	(0.15)	(0.74)	(0.75)	(0.61)

Noted:***、**、*represents the significance level of 1%, 5% and 10%, respectively. The value in brackets below the coefficient is its standard error.AR (1) and AR (2) represent the Arellano bond autocorrelation test of the first-order and second-order difference residual sequences respectively, and sargan test is the over recognition test.

For the emission fee income, in the first stage and the second stage, the coefficient of carbon emission is not significant, which is consistent with the analysis structure in Table3. The emission fee income has not achieved the expected carbon emission reduction effect. This has a lot to do with the collection standard of local pollution charge and the implementation of local government.

For industrial pollution control investment, there is a significant inverted U-shaped relationship between the first stage and carbon emissions, while in the second stage, the role of industrial pollution control investment on carbon emissions has fundamentally changed, and the relationship between industrial pollution control investment and carbon emissions is still significant, but there is a significant U-shaped relationship. This shows that investment in industrial pollution control effectively curbs carbon emission reduction in the second stage, which is consistent with the analysis conclusion in Table3. It is confirmed that under the appropriate intensity of environmental regulation, the innovation compensation effect of investment in industrial pollution control can make up for or even exceed the negative effect brought by the cost compliance of enterprises, showing a good carbon emission reduction effect. According to the regression results, the inflection point is 0.426, currently 0.241, which indicates that the investment in industrial pollution control in the second stage will play an important role in carbon emission reduction. It also proves that the incentive environmental regulation policy has certain advantages in the long-term effect, flexibility and acceptability of carbon emission reduction.

For local environmental protection standards, in the first stage, the impact on carbon emissions is not significant, while in the second stage, the carbon emissions show a significant inverted U-shape. This shows that carbon emission is promoted first and then suppressed. Some local governments may collude with enterprises in order to promote officials, which will also lead to positive promotion of carbon emission reduction effect of local environmental protection standards. The calculated inflection point is 0.386, but the current value is 0.453, which is on the right side of the inflection point and in the stage of carbon emission control.

CONCLUSIONS AND POLICY IMPLICATIONS

Conclusions

The specific conclusions are as follows:

Firstly, the emission fee income did not directly play the expected role in carbon emission reduction, but it can indirectly inhibit carbon emission reduction by forcing enterprises to upgrade their industrial structure. The reason lies in the fact that the legal collection standard of pollution charge is far lower than the cost of pollution control of enterprises, which prefer to pay pollution charge rather than take environmental protection investment or upgrade technology. This shows that the emission fee system has increased the cost pressure of enterprises, resulting in the "cost following effect" and failed to effectively curb carbon emissions.

Secondly, the investment in industrial pollution control can directly restrain the intensity of carbon emission. After the introduction of the square term, it has a significant inverted U-shaped relationship with carbon emission. This paper estimates that the current investment in industrial pollution control is 0.24, which is close to the inflection point (0.248). It is gradually transiting from the "green paradox" effect to the "forced emission reduction" effect.

Thirdly, the direct impact of local environmental standards on carbon emissions has a "green paradox" effect. After the introduction of the square term, there is a significant inverted U-shaped relationship with carbon emissions. According to the results, the inflection point of the inverted U-shaped curve is 0.223, and the current average value is 1.05, which is far to the right of the inflection point. It shows that the "backward emission reduction" effect is far greater than the "green paradox" effect.

Policy Enlightenment

This paper gets the following policy implications:

Firstly, the government should reasonably determine the intensity of ordered environmental regulation policy according to the level of economic development and the heterogeneity of carbon emission intensity in different regions. The government should actively change the concept of development, and gradually incorporate real energy consumption and environmental protection into the system of official promotion and performance appraisal. Market mechanism should gradually play a decisive role in energy consumption and environmental protection.

Secondly, we should actively promote the sustainable incentive effect of market-based environmental policies such as emission fee income and industrial pollution control investment in a planned and step-by-step way. This is the main economic means to solve environmental protection problems, which can achieve the source control and governance of carbon emission reduction. In the above analysis, the emission fee income did not play a significant and effective role in curbing carbon emissions. However, investment in industrial pollution control can directly restrain carbon emission and indirectly restrain carbon emission through industrial structure and technological innovation.

Thirdly, with the increasing public awareness of environmental protection, the main body of environmental protection should expand from the government to the market and the public, and give full play to the role of public participation regulatory policies. In the face of the emerging negative environmental events, the public demand for environmental quality is higher and higher.

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REFERENCES

Schou P. When environmental policy is super fluous: Growth and polluting resources[J].The Scandinavian. Journal of Economics,4,104,2002.

Sinn H W.Public policies against global warming: Asupply side approach[J].International Tax Public Finance, 4,15,2008.

Van Der Ploeg F, Withagen C.Is there really a green paradox[J].Journal of Environmental Economics and Management, 64,342,2012.

Smulders S, Tsur Y, Zemel A. Announcing climate policy: Can a green paradox arise without scarcity[J].Journal of Environmental Economics and Management,3,64,2012.

Greenstone M. The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 and 1977 Clean Air Act Amendments and the Census of Manufactures[R].NBER Working Paper,2001.

Li cheng-yu. Kyoto15 years later: the phased emission reduction policies and Green Paradox problem[J].China population Resources and environment,1,8,2015.

Shao Shuai, Yang Lili, Cao Jianhua. Study on Influencing Factors of CO2 Emissions from Industrial Energy Consumption: An Empirical Analysis based on STIR PAT Model and Industrial Sectors: Dynamic Panel Data in Shanghai[J].Journal of Finance and Economics,11,16,2010.

Zhang hua, Wei xaoping. Green Paradox or Forced Emission-reduction: Dual Effect of Environmental Regulation on Carbon Emissions. China population Resources and environment[J].2014,24(9):21-29.

Xu Yingzhi, YANG Yingchao, GUO JinThe Paths and Effects of Environmental Regulation on China's Carbon Emissions: An Empirical Study Based on Chinese Provincial Datat[J].Science Of Science And Management Of S. & T.10,135,2015.