Article

The Role of Public Participation in Environmental Governance: Empirical Evidence from China

Jin Guo * and **Junhong Bai**

School of Business, Nanjing Normal University, Nanjing 210023, China
* Correspondence: guojin0901@njnu.edu.cn; Tel.: +86-025-8589-8095

check for updates

Abstract: As an essential stakeholder of environmental resources, the public has become the third force which assists in promoting environmental governance, together with local governments and polluting enterprises. In this paper, we construct a mediation model and a 2SLS (Two Stage Least Square) model to illustrate the role of public participation based on inter-provincial panel data of China from 2011 to 2015. The results indicate that the advantages of handling informational asymmetry and enhancing social supervision are the two logical starting points of involving public participation in environmental governance. As the public has no executive power, they can participate in environmental governance in an indirect way by lobbying local governments' environmental enforcement of polluting enterprises. In addition, their deterrent of polluting enterprises can also generate effects similar to local governments' environmental enforcement, and such a deterrent will help promote environmental governance directly. At the present time in China, the effects of public participation in environmental governance are mainly reflected in the form of back-end governance, while the effects of front-end governance are not remarkable enough. This research is of great significance in perfecting China's environmental governance system by means of arousing and expanding the public's rights to participate in environmental governance.

Keywords: public participation; environmental governance; information asymmetry; social supervision; back-end governance; front-end governance; Chinese case

---

1. Introduction

Environmental problems are troubling the sustainable economic development of the whole world. Following the theory of public economics, government intervention serves as an appropriate way to avoid a "tragedy of the commons" in the environmental area caused by market failure. Therefore, a kind of top-down environmental governance system led by the government and accompanied by the participation of polluting enterprises has been established in many countries [1,2]. However, the effects of this practice in many regions are far from satisfactory. Instead, this authoritarian environmentalism is suffering from a low efficiency caused by government failure [3,4]. Environmental problems are typically complex, and have an effect on multiple actors and agencies. Therefore, it is necessary to clarify other stakeholders' involvement so as to rebuild the environmental governance system [5]. An optional and widely mentioned stakeholder is the public [5–8].

The industrial revolution has not only brought great progress to human society, but also brought increasingly severe environmental pollution problems. Thereupon, the practices of public participation in environmental governance are staged in many countries. Here are some typical cases: During the four days from December 5 to December 8 in 1952, the Great Smog of London caused thousands of people to suffer from lung diseases or even die. After that, the public's environmental awareness played a leading role in the air pollution control campaign. Finally, the promulgation of the Clean Air Act in 1956 marked that the residents' supervision of polluting enterprises had obtained a formal legal

status [9]. In the 1960s, Japan's industrialization triggered serious environmental pollution, which brought about various public diseases, such as mercury poisoning and asthma. The affected masses launched large-scale protest marches and legal proceedings, and even spontaneously established civil organizations to oppose polluting enterprises and lobby local governments. Eventually, the 64th interim parliament, also known as the congress on public diseases, was convened in 1970 and a series of laws and regulations were issued to put restrictions on the behaviors of enterprises. In the year of 1962, a book titled "Silent Spring" written by Rachel Carson was published in America and aroused an enormous public response. On 22 April 1970, an environmental protection parade involving 20 million citizens was regarded as the prologue of public participation in environmental governance in America, and later, this day was celebrated worldwide as Earth Day [10].

After China's reform and opening-up in 1978, more emphasis was put on government-oriented regulations concerning environmental governance [11,12]. However, this situation is changing with the awakening of its people's environmental consciousness. In 2011, a tropical storm caused a dam break in a chemical industry park in the city of Dalian, leading to pollution of the p-Xylene. A few days later, a large-scale demonstration broke out, which forced the relocation of this chemical industry park [13]. In 2012, in protest against a sewage disposal project that was dumping wastewater into the sea, a public petition broke out in the city of Nantong, which forced the local government to permanently cancel this kind of sewage disposal project [14]. In response to the public's enthusiasm, the Chinese government has also come to recognize the considerable role of public participation in environmental governance. In 2014, China's newly revised environmental protection law was promulgated, and it clearly pointed to setting up a litigation system for public interest in environmental protection. According to this litigation system, the Supreme People's Court of China had tried 1635 environmental public interest lawsuits by the end of 2017 [15]. In 2015, its Ministry of Ecology and Environment also promulgated a politic document titled "Measures for Public Participation in Environmental Protection", aimed at protecting the rights of public participation in environmental governance. Two years later, in the report of the 19th National Congress of the Communist Party of China, its state leaders pronounced the construction of a multi-agent environmental governance system with the participation of all stakeholders, including local governments, enterprises, social organizations, and the public [16].

According to the statements above, it is explicitly shown that public participation functions as an indispensable force in environmental governance. However, there are still many questions to answer. Firstly, as the public has no executive power, what are the logical starting points and paths of public participation in environmental governance? Secondly, as there are great debates concerning the consequences of public participation [6], how can we effectively evaluate its effects in environmental governance? In order to respond to these questions, this paper illustrates the role of public participation by constructing a mediation model and a Two Stage Least Square (2SLS) model based on inter-provincial panel data of China from 2011 to 2015.

The structure of this paper is as follows. Section 2 briefly reviews previous studies. Section 3 describes the theoretical foundation and path hypotheses. Section 4 explains the empirical strategy and data. Section 5 carries out empirical analyses. Section 6 presents the conclusions. Section 7 provides discussions for policy design.

2. Literature Review

2.1. Concept and Developing Stages of Public Participation

Public participation in governance covers either the direct or indirect involvement of stakeholders in decision-making of policies, plans, or programs that appeal to them [17]. Its development has gone through two stages, including the stage of passive participation and the stage of active participation. To some extent, the public's passive participation means voting with their feet. Tiebout [18] held the view that the public could express their dissatisfaction with local public services by migration to choose a better living environment. Banzhaf and Walsh [19] provided strong empirical support for the notion

that households voted with their feet in response to changes in environmental quality. In fact, passive participation is a kind of threaten-to-leave mechanism, which has played a central role in the theory of local public affairs for centuries.

With the rise of democracy, Hirschman [20] proposed another form of public participation by means of petition and protest, namely, voting with their hands. The public's active participation is functioning as a major part of the environmental justice movement [21]. Compared with the threaten-to-leave mechanism, this appealing mechanism can contribute to similar governance effects. More importantly, through active participation, the public can transfer the negative externality of environmental pollution to polluting enterprises, instead of bearing it by themselves.

2.2. Advantages and Challenges of Public Participation

A large number of theoretical studies have emerged to elaborate the multiple advantages of involving public participation in environmental governance, such as improving the understanding of environmental events [22,23], enhancing social cohesion [24,25], and advancing the rationality and quality of decision-making [26,27]. Kanu et al. [28] argued that greater attention to public participation during the Environmental Impact Assessment (EIA) process can lead to the formulation of projects that deliver more social benefits, fewer environmental costs, and greater economic and financial benefits. Chen and Han [29] claimed that public participation could enhance the public's environmental awareness, mobilize multiple forces to reconcile the conflicts among multiple interest groups, supervise corporate environmental behavior, and overcome the shortcomings of government unilateral decision-making. In short, the involvement of public participation is beneficial to enhancing environmental governance's effectiveness by improving the quality of decisions and perfecting their implementation [30–32].

There are also some case studies supporting the success of public participation in environmental governance. Based on the thematic reports and policy recommendations of the China Council for International Cooperation on Environment (CCICED), Enserink and Koppenjan [33] verified the correlation between environmental governance and public participation, indicating that public participation would bring about a sustainable urbanization process. By citing a case in Poland, Cent et al. [34] reached a conclusion similar to Enserink and Koppenjan [33]. Based on 239 typical cases around the world, Beierle [31] demonstrated that public participation could not only improve environmental policy, but also played an important educational role in helping resolve the conflicts and mistrust related to environmental issues. By studying three energy and natural resource management cases (i.e., sustainable energy systems in Austria, energy transition in Southeast England, and sustainable management of the Urdaibai River Basin in Northern Spain), Garmendia and Stagl [22] presented the framework of public participation for sustainability and social learning. Using the data from a survey administered to 215 stakeholder groups worldwide and separately, 69 case studies of specific stakeholder engagement, Akhmouch and Clavreul [35] shared the experiences and lessons that had emerged from engaging stakeholders in the OECD (Organization for Economic Co-operation and Development) Water Governance Initiative. By reviewing the motivations, purposes, designs, and outcomes of public engagement in climate change policy and water resource management in Alberta, Canada, Adkin et al. [36] pointed out that political leadership and the interactions between civil society actors were shown to be important to promote environmental governance.

Public participation in environmental governance also faces many challenges. Fischer and Young [37] pointed out that a lack of expertise prevented the public from effectively participating in the debate on environmental governance decision-making. As a result, their opinions would be over ruled by existing privileges and groups [38,39]. Due to the lack of a systematic approach and an inadequate public administration system, Marzuki [40] also claimed that the public participation process was sometimes threatened by bureaucratic constraints, which contributed to the exclusion of the public from the process of participatory governance. Fung [41] listed three challenges for successful participatory governance: the absence of systematic leadership, the lack of a popular or elite consensus,

and the limited scope and power of participatory innovations. Yakubu [42] insisted that successfully achieving public participation goals relied on an equitable process, but it faced many barriers, such as a lack of financial resources and participation skills.

2.3. Opposite Views of Involving Public Participation

During the past decades, the governance of environmental problems has evolved to cover a wider range of stakeholders in more extensive open discussions. However, there have also been great debates concerning the consequences of public participation [6], and there have been signs that the participatory agenda has started to lose its momentum and justification because of the disappointment of actual achievements [43]. From an empirical perspective, Newig and Fritsch [27] and Drazkiewicz et al. [44] pointed out that more effective policy-making cannot be guaranteed with the involvement of public participation, which might even lead to inferior decisions and poor implementations when citizens without professional knowledge or experience are involved. Wang and Di [45] carried out a survey covering 85 townships and interviews with 151 township leaders in China, whose statistical results showed that no significant improvement was seen in environmental quality with the involvement of public participation. He et al. [46] used panel data in China to test the relationships between external pressures and corporate environmental behaviors, but the results did not confirm that social pressure was a statistically significant source of environmental improvement. Fung [41] evaluated the three potential values of public participation to advance democratic governance (i.e., effectiveness, legitimacy, and social justice). Nevertheless, the results did not exhibit an obvious effect of public participation. Based on panel data of 31 Chinese provinces from 2004 to 2015, Wu et al. [47] investigated the impact of public participation on environmental performance, showing that environmental petitions were significantly correlated with environmental pollutants, but the conclusions were not robust.

In response to the inconsistency between theoretical studies and empirical studies, some scholars have provided explanations for the unremarkable effects of public participation in environmental governance. Webler and Tuler [7] revealed that there might have been different perspectives as to what was viewed as appropriate, indicating that limited agreements and strong differences in opinions caused huge obstacles to the efforts of achieving social justice through public participation. According to interviews with professionals involved in participation in environmental governance, Wesselink et al. [43] also found that differences and potential conflicts had restricted the development of public participation. Although public participation could be used as an important goal in formulating responses to the risks of environmental pollution, Few et al. [48] still argued that there would be fundamental challenges to be faced in its practice, many of which were related to power. Eden [49] pointed out that the scientific construction of environmental issues often meant that such participation in policy-making was difficult when the public was not considered as scientifically "expert".

It can be seen that theoretical studies and some case studies both support the effectiveness of public participation in environmental governance, while the findings of many empirical studies have failed to prove its success. That is to say, the methodology of empirical studies may not be applicable enough. By introducing a mediation model and a 2SLS model to modify the methodology, this paper has confirmed the role of public participation with empirical evidence from China. The contributions of this paper lie in the following aspects: firstly, we expound the theoretical logic of involving public participation in environmental governance by analyzing its advantages of handling informational asymmetry and enhancing social supervision; secondly, the public's indirect participation path and direct participation path are proposed and examined by constructing a mediation model; thirdly, the endogeneity bias is alleviated by choosing public participation's instrumental variables to carry out a 2SLS regression; and fourthly, we further classify public participation into Complaints and Proposals to discuss their heterogeneity.

3. Theoretical Foundation and Path Hypotheses

3.1. Theoretical Foundation

3.1.1. Solving Information Asymmetry

Enterprises' discharge of industrial pollutants is the primary cause of environmental pollution [50,51]. However, enterprises' polluting behaviors are usually concealed, such as late-night blowdown, underground blowdown, and trans-regional blowdown [52]. Despite the installation of devices to dispose industrial pollutants, they are just used for dealing with the government's environmental inspections, which have also been constantly reported by news media [53,54]. Although new environmental monitoring methods, such as big data, drones, and remote control systems, have been piloted in some areas [47,55], regular inspections and sudden inspections remain the two major approaches for local governments to obtain enterprises' discharge information [56]. However, in practice, regular inspections tend to be formalistic, resulting in inadequate substantial deterrent effects on polluting enterprises, while the high cost of sudden inspections restrains both the frequency and the scope of monitoring.

In view of these issues, it is difficult for local governments to obtain real-time information on enterprises' emissions. Severe information asymmetry arises between polluting enterprises and local governments [57], revealing the first defect in the top-down environmental governance system [58].

Public participation has multiple advantages in dealing with information asymmetry [59], and therefore, public participation will function as an optimal means to make up for this defect for the following reasons [60]. Firstly, compared with the limited members in local governments' environmental protection department, public participation involves a much broader mass base. Secondly, in contrast to the high cost of local governments' monitoring, public participation can operate at almost zero cost. Monitoring polluting enterprises does not have to be the public's intentional or systematic behavior, but instead, it can be viewed as an incidental part of their daily life. Thirdly, in comparison to the hysteresis of local governments' monitoring, public participation presents better timeliness, which can even prevent pollution before the outbreak of environmental problems.

Based on the above statements, we argue that the first logical starting point of involving public participation in environmental governance is that it can effectively deal with the problem of informational asymmetry between polluting enterprises and local governments [58].

3.1.2. Improving Social Supervision

There are three supervision forms of environmental governance, namely administrative supervision by local governments, judicial supervision by judiciary authorities, and social supervision by the public. As a kind of authoritarian environmentalism, the top-down environmental governance system has to rely on administrative supervision.

However, the administrative supervision also faces government failure. For example, in China, the assessment and promotion system for local officials is mainly based on indicators related to GDP, and consequently, the promotion needs of local officials are likely to overlap with the profit demand of polluting enterprises [61]. As a result, this government failure may result in institutional rent-seeking and collusion between polluting enterprises and local governments and weaken the effectiveness of local governments' administrative supervision, revealing another defect in the top-down environmental governance system [56].

Making up for this defect depends on social supervision, which mainly originates in public participation [62]. Compared with local governments' administrative supervision, social supervision by the public has the following advantages. Firstly, social supervision is characterized by external monitoring. Therefore, public participation can function as an external force to break the collusion between local governments and polluting enterprises [63]. Secondly, social supervision is characterized by numerous participants and multiple channels, so that polluting enterprises are unable to avoid

supervision by rent-seeking or cutting off the diffusion of public opinions [24]. Thirdly, social supervision can permanently keep polluting enterprises under the high pressure of environmental protection [22].

Based on the above statements, we argue that the second logical starting point of involving public participation in environmental governance is that it can effectively improve social supervision, which can be used as a necessary supplement for the administrative supervision of local governments [64].

3.2. Path Hypotheses

3.2.1. Indirect Path Relies on Local Governments' Environmental Enforcement

Owing to the advantages of handling informational asymmetry and enhancing social supervision, public participation has consolidated its theoretical foundation in environmental governance. However, it should be noted that as the public does not have any executive power, public participation may not directly bring about real constraints on polluting enterprises.

Fortunately, in practice, polluting enterprises still pay much attention to public opinions. This is because the public can lobby local governments' attention by disclosing the information of enterprises' polluting behaviors. Under the pressure of public opinion, local governments will impose severe environmental enforcement on polluting enterprises. Therefore, we propose the first path hypothesis of public participation in environmental governance and we will prove it using empirical evidence in Section 5.

Hypothesis 1: As the public does not have any executive power, they can participate in environmental governance in an indirect way by lobbying local governments' environmental enforcement of polluting enterprises.

3.2.2. Direct Path Relies on Deterring Enterprises from Pollution

Meanwhile, we also argue that local governments' value should be reflected not only in its real environmental enforcement, but also in its potential enforcement capability. In other words, polluting enterprises are well aware that once their polluting behaviors are exposed by the public, they are bound to be punished by local governments' severe environmental enforcement. In that case, polluting enterprises will optimize their producing behaviors in advance so as to prevent the occurrence of these predictable punishments. Therefore, we propose the second path hypothesis of public participation in environmental governance and we will prove it using empirical evidence in Section 5.

Hypothesis 2: Under the premise of effective local governments, public participation's deterrent of polluting enterprises can also generate effects similar to local governments' environmental enforcement, which will then promote environmental governance directly.

Based on the above theoretical foundation and path hypotheses, the framework of public participation in environmental governance is plotted in Figure 1, from which we can clearly see modification to the top-down environmental governance system by public participation.
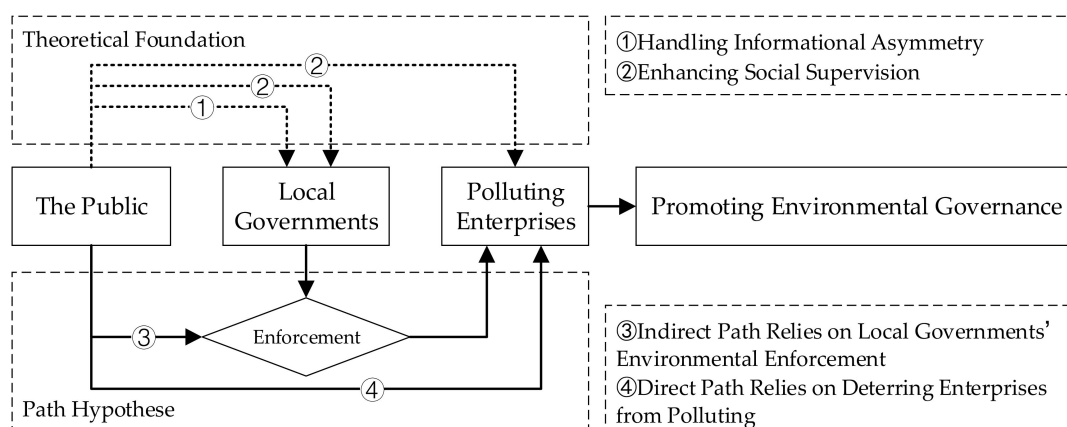

Figure 1. The framework of public participation in environmental governance.

4. Empirical Strategy and Data

4.1. Empirical Strategy

4.1.1. Benchmark Model

To demonstrate the effects of public participation in environmental governance, we need to begin with a benchmark model. The regression is given by the following:

$$\ln(pollution_{it}) = \alpha + \beta \ln(public_{it}) + \sum \Upsilon X + \lambda_i + \eta_t + \varepsilon_{it} \tag{1}$$

where $pollution_{it}$ denotes the level of environmental pollution in province i at time t, $public_{it}$ denotes the level of public participation, X refers to a set of control variables, λ_i is the province dummy, η_t is the time dummy, and ε_{it} is an error term. The logarithm of all variables is applied to alleviate heteroscedasticity and nonlinearity.

Parameter β captures the elasticity of public participation to environmental pollution, which is expected to be significantly negative, indicating that public participation can reduce environmental pollution and improve environmental governance.

The basic formula to quantify $pollution_{it}$ is given by the following:

$$pollution_{t,j} = \sum_{j=1,2,3} \left. \frac{pollutant_{it}^j}{\sum_{j=1}^{j=30} pollutant_{it}^j} \right/ 3 \tag{2}$$

where $j = 1, 2, 3$, denotes the three major industrial pollutants, i.e., industrial wastewater, industrial waste gas, and industrial waste residue. It has to be noted that the three pollutants are weighed by the industrial added value to avoid overestimating parameter β in heavily industrialized provinces.

4.1.2. Two Sub-Types of Public Participation

It is obvious that there are two forms for the public to create a better environment, which are Complaints and Proposals. The difference between them is that the former focuses on the back-end governance of erupted environmental issues, while the latter focuses on the front-end governance of pollution threats that have not yet erupted.

In order to shed light on the heterogeneity between the two sub-types of public participation, Equation (1) can be reconstructed as follows:

$$\ln(pollution_{it}) = \alpha + \beta_1 \ln(complaint_{it}) + \beta_2 \ln(proposal_{it}) + \sum \Upsilon X + \lambda_i + \eta_t + \varepsilon_{it} \tag{3}$$

Parameters β_1 and β_2 capture the heterogeneous effects of environmental governance between Complaints and Proposals.

4.1.3. Local Governments' Mediation Effect

In Section 3.2, we pointed out that the public can participate in environmental governance in an indirect path by lobbying local governments' environmental enforcement of polluting enterprises. In order to verify this hypothesis, we take local governments' environmental enforcement as a path variable and the mediation model is constructed as follows:

$$\ln(pollution_{it}) = \alpha + \beta' \ln(public_{it}) + \rho \ln(government_{it}) + \sum \Upsilon X + \lambda_i + \eta_t + \varepsilon_{it} \tag{4}$$

where $government_{it}$ denotes the level of local governments' environmental enforcement in province i at time t, and parameter ρ captures its impact on environmental pollution. Parameter β' captures the new elasticity of public participation to environmental pollution after the path variable is added to the model.

The mediation model has been widely adopted in psychological research [65]. Moreover, due to its good performance in analyzing functional routes between economic variables, the mediation model has also been applied to recent economic studies [66,67]. In this paper, the variation between parameter β' and parameter β is taken into account. If the absolute value of parameter β' decreases after the addition of the path variable, i.e., $|\beta'| < |\beta|$, and parameter ρ is also significantly negative, it indicates that the public relies on local governments' environmental enforcement to participate in environmental governance.

In fact, the mediation effect of the path variable in Equation (4) is the sharing of public participation's effect in Equation (1). Therefore, if parameter β' still passes the significance test after the addition of the path variable, it means that local governments' environmental enforcement cannot completely replace the effect of public participation, which suggests that public participation can also participate in environmental governance without lobbying local governments' environmental enforcement. As mentioned in Hypothesis 2, the effect of the deterrent of public participation on polluting enterprises is also likely to promote environmental governance directly.

In addition, to verify the mediation effect, it is also necessary to examine the relationship between public participation and local governments' environmental enforcement by Equation (5).

$$\ln(government_{it}) = \alpha + \delta \ln(public_{it}) + \sum \boldsymbol{\Phi Z} + \lambda_i + \eta_t + \varepsilon_{it} \tag{5}$$

Parameter δ should be significantly positive, indicating that a higher level of public participation tends to cause harsher environmental enforcement by local governments.

4.1.4. Instrumental Variables to Alleviate Endogeneity Bias

Heavy pollution may trigger the public's stronger willingness to participate in environmental governance. In consequence, there may be a bidirectional causality between public participation and environmental pollution. Meanwhile, as public participation is an abstract concept with difficulties in quantification, measurement errors are inevitable in public participation. Taking these problems into consideration, we adopt instrumental variables (IV) to alleviate endogeneity bias.

Since public participation has been sub-divided into Complaints and Proposals, we choose the level of residents' education as the instrumental variable for Complaints, and choose the number of each province's National People's Congress (NPC) deputies as the instrumental variable for Proposals. The two instrumental variables are selected on the basis of the following reasons. Firstly, residents with a higher education tend to pay more attention to environmental quality and have a better sense of social responsibility to prevent enterprises from polluting the environment. The National People's Congress is a landmark for the public to make proposals to governments. Therefore, the two instrumental variables satisfy the correlation hypotheses with the endogenous variables. Secondly, there is no direct causal relationship between residents' education level and industrial pollutants. The number of each province's NPC deputies is distributed based on the population size, ethnic groups, and genders, as well as some other demographic characteristics. Therefore, the two instrumental variables satisfy the exogenous hypotheses with the explained variable.

Based on the two instrumental variables, a Two Stage Least Square (2SLS) model is constructed as follows:

$$first\ stage:\ \ln(public_{it}) = \alpha + \theta_1 \ln(education_{it}) + \theta_2 \ln(deputy_{it}) + \varepsilon_{it} \tag{6}$$

$$second\ stage:\ \ln(pollution_{it}) = \alpha + \beta'' \ln(\widehat{public_{it}}) + + \sum \boldsymbol{\Upsilon X} + \lambda_i + \eta_t + \varepsilon_{it} \tag{7}$$

where $education_{it}$ denotes the level of residents' education and $deputy_{it}$ denotes the number of each province's NPC deputies. In the first stage, the regressions of the two instrumental variables to the endogenous variables are carried out, in which the fitted values of public participation are obtained, i.e., $\widehat{public_{it}}$. In the second stage, the fitted values of public participation are employed to conduct

the regression to environmental pollution. Parameter β'' captures the amendatory impact of public participation on environmental pollution by alleviating endogeneity bias.

4.2. Data

4.2.1. Public Participation

Data concerning public participation among China's 30 provinces has been collected and kept by the Ministry of Ecology and Environment (MEE) in the China Environmental Yearbook [68]. In this paper, five indicators are selected to measure the level of public participation in each province. Respectively, they are complaints by telephone and the Internet, accusation letters, petitions, proposals from the NPC, and proposals from the CPPCC.

Specifically, the level of each province's public participation is measured by the sum of all the five indicators. In terms of the two sub-types of public participation, the sum of the first three indicators is used to measure Complaints and the sum of the last two indicators is used to measure Proposals. It has to be noted that the five indicators are weighed by their population in each province to avoid the overestimation of small provinces.

The year of 2011 is set as the starting year, because in the previous years, complaints from the Internet were not included in the China Environmental Yearbook [68]. However, at present, the Internet has become an increasingly important channel for the public to participate in environmental governance.

4.2.2. Environmental Pollution

Data concerning the three industrial pollutants (i.e., wastewater, waste gas, and waste residue) is extracted from the database of the Institute of Public and Environmental Affairs (IPE), which is a non-profit environmental research organization registered in Beijing, China. This created a database of environmental information since 2006. The basic formula employed to quantify each province's environmental pollution is given by Equation (2) in Section 4.1.1.

4.2.3. Path Variable, Instrumental Variables, and Control Variables

As for the path variable, the proportion of enterprises subject to environmental penalties is used to measure the level of local governments' environmental enforcement. The records of enterprises' environmental penalties are extracted from the IPE Database.

As for the two instrumental variables, the ratio of residents with a college diploma or above to the population aged 6 or above is used to measure the level of residents' education in each province. Data concerning residents' educational background is collected from the annual sample survey of population carried out by the National Bureau of Statistics of China. The number of each province's NPC deputies is extracted from the 11th and 12th NPC reports.

Previous studies have indicated that deindustrialization tends to reduce the discharge of pollutants to improve environmental quality [69], but local governments' investment in environmental governance will be restrained by budgetary deficits [70]. Therefore, these factors are included as control variables in this paper. Respectively, they are measured by the annual change in the proportion of industrial added value to each province's GDP, and the ratio of the fiscal gap to fiscal revenue. Table 1 presents the descriptive statistics of all variables.
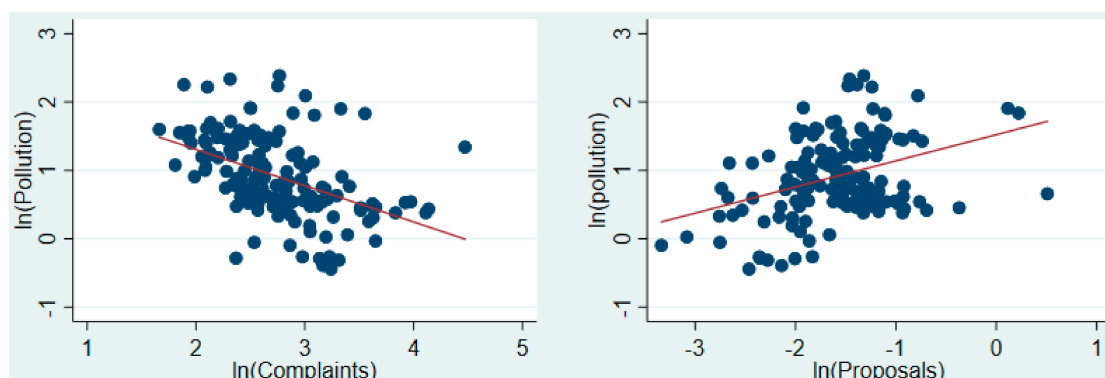
Figure 2 presents the unconditional correlation between public participation and environmental pollution, showing that there is an obvious negative correlation between them. Figure 3 presents the unconditional correlations between the two sub-types of public participation and environmental pollution. The finding in Figure 1 is still true for Complaints, but is not suitable for Proposals. In contrast, there is a positive correlation between Proposals and environmental pollution.

Table 1. The descriptive statistics of variables.

Indicator	Obs.	Mean	S.D.	Min.	Max.
public participation (per 10,000 persons)	150	18.093	11.820	5.441	87.802
complaints (per 10,000 persons)	150	17.848	11.801	5.272	87.490
telephone or Internet complaints	150	40,042.53	42,664.02	1190	267,461
accusation letters	150	4198.74	4142.214	110	25,272
petitions	150	1648.393	1279.466	58	6852
proposals (per 10,000 persons)	150	0.245	0.191	0.036	1.662
proposals from NPC	150	229.967	181.567	11	1196
proposals from CPPCC	150	353.933	490.309	11	5567
environmental pollution	150	3.00	1.963	0.643	10.849
industrial waste water (million tons)	150	711.825	570.685	67	2463
industrial waste gas (billion cubic meters)	150	2240.691	1607.14	167.6	7912.1
industrial waste residue (million tons)	150	108.785	96.858	3.86	455.76
government enforcement	150	30.149	18.084	3.145	93.477
education level	150	11.731	6.217	4.992	39.939
NPC deputies	150	87.873	42.800	19	181
industrial structure	150	−1.272	1.790	−8.722	3.153
budgetary deficit	150	0.113	0.031	0.064	0.220
provinces	30				
years	5				
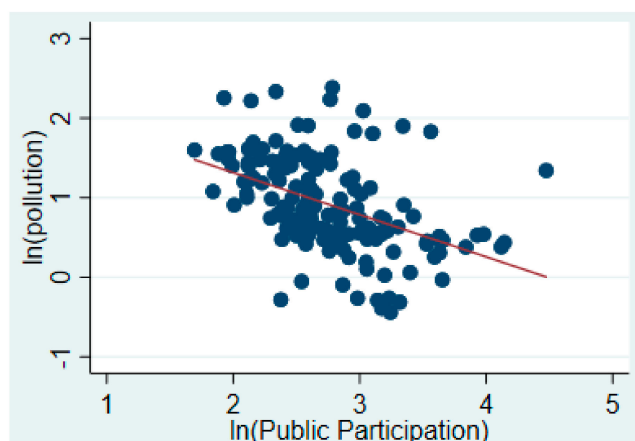
Figure 2. The unconditional correlation between public participation and environmental pollution.

Figure 3. The unconditional correlations between the two sub-types of public participation and environmental pollution.

5. Empirical Findings

5.1. Benchmark Estimation Results

The benchmark estimation results are reported in Table 2. In Model (1)–(2) and Model (3)–(4), different lag periods of the explained variable are considered. Public participation is sub-divided into Complaints and Proposals in Model (2) and Model (4). The robust standard error is applied to alleviate heteroscedasticity and control the fixed effects of each province.

Table 2. The baseline estimation results of public participation to environmental pollution.

Variable	Pollution		Lag1. Pollution	
	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
public participation	−0.1163 ** (−2.63)		−0.1464 *** (−2.81)	
complaints		−0.1025 ** (−2.14)		−0.1477 ** (−2.73)
proposals		−0.0532 (−1.13)		0.0074 (0.16)
industrial structure	0.0033 (0.38)	0.0017 (0.19)	0.0281 *** (3.41)	0.0280 *** (3.31)
budgetary deficit	0.0138 (0.18)	0.0001 (0.00)	−0.0068 (−0.11)	−0.0053 (−0.09)
_cons.	1.1811 *** (3.31)	1.1163 *** (3.15)	1.4176 *** (5.58)	1.4228 *** (5.45)
F.E.	YES	YES	YES	YES
obs.	150	150	120	120
R-sq.	0.0887	0.1039	0.2861	0.2899

Note: *t*-value in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

In Model (1), it can be seen that public participation has a negative and significant estimated coefficient, i.e., $\beta = -0.1163$, which indicates that improving public participation significantly contributes to reducing the discharge of industrial pollutants. In terms of the marginal effect, a one-standard-deviation improvement (i.e., 4.43%) in public participation causes a 0.52% reduction in the discharge of industrial pollutants. In Model (2), the estimated coefficient of Complaints is negative and statistically significant at the level of 5%, i.e., $\beta_1 = -0.1025$, while the estimated coefficient of Proposals does not pass the significance test. These results indicate that the two sub-types of public participation present heterogeneous effects on environmental governance, which are almost consistent with the pattern shown in Figures 1 and 2.

At the present time in China, back-end governance is the major form of public participation in environmental governance, while the form of front-end governance remains at a low level and fruitless. It implies that the public has paid much more attention to the environmental issues that have erupted and seriously affected their daily lives. On the other hand, as to environmental threats that have not yet erupted, the public has not shown an active willingness of participation. There are two possible explanations for this. Firstly, from the perspective of the public, back-end governance has a better mass foundation because polluting enterprises interfere with the public's interests and environmental pollution reduces the quality of their lives. Secondly, from the perspective of polluting enterprises, they will not take the public's proposals seriously because these proposals are not compulsory. As a result, the form of front-end governance has limited constraints on polluting enterprises.

Compared with Model (1)–(2), similar results are demonstrated in Model (3) and Model (4) with one-period-lagged environmental pollution, but their estimated coefficients are much higher and

more significant. In Model (3), the same increase (i.e., 4.43%) in public participation causes a 0.65% reduction in the discharge of industrial pollutants, which is much higher than the result of 0.52% in Model (1). This finding is consistent with the reality. In practice, there is a hysteresis between the public's participation and the acquisition of practical results. Meanwhile, in Model (4), the estimated coefficient of Complaints remains negative and statistically significant, while the estimated coefficient of Proposals does not pass the significance test. This finding has further verified that the form of back-end governance is much more efficient than the form of front-end governance in contemporary China.

In terms of the control variables, the regression results indicate that deindustrialization is conducive to improving environmental quality, which implies that China's industrialization has overly depended on the resource input and has exhibited a serious negative externality on the environment. However, there is no direct causal relationship between the budgetary deficit and environmental governance.

5.2. Estimation Results of the Mediation Effect

In Table 3, we examine the relationship between public participation and local governments' environmental enforcement. In Model (5) and Model (6), the regression results indicate that a higher level of public participation and Complaints tends to bring about tougher environmental enforcement by local governments. However, no significant impact of Proposals is exerted on local governments' environmental enforcement. According to these findings, it is shown that, compared with front-end governance, the form of back-end governance has a greater potential to arouse a more significant response from local governments.

Table 3. The estimation results of public participation to local governments' environmental enforcement.

Variable	Environmental Enforcement	
	Model (5)	Model (6)
public participation	0.3292 ** (2.23)	
complaints		0.2721 * (1.70)
proposals		0.2309 (1.25)
_cons.	2.3037 *** (5.67)	2.8298 *** (4.39)
F.E.	YES	YES
obs.	150	150
R-sq.	0.0488	0.0718

Note: *t*-value in parentheses. *, **, and *** denote significance at a 10%, 5%, and 1% level, respectively.

Table 4 reports the mediation effect of local governments' environmental enforcement. In Model (7) and Model (8), the estimated coefficients of local governments' environmental enforcement do not pass the significance test. Considering the hysteresis between public participation and practical results, we take one-period-lagged environmental pollution as the explained variable in Model (9) and Model (10). Indications based on the estimation results are as follows: Firstly, the estimated coefficients of local governments' environmental enforcement are negative and statistically significant at the level of 5%, which implies that tougher environmental enforcement by local governments is beneficial to reducing the discharge of industrial pollutants; secondly, the regression of public participation in Model (9) has a significantly negative estimated coefficient, i.e., $\beta' = -0.1298$, and the absolute value of parameter β' shows a slight decline compared with $\beta = -0.1464$ in Model (3). At the same time, the estimated coefficient of Complaints in Model (10) is significantly negative, with its absolute value declining similarly when compared with that in Model (4), i.e., $|\beta'_1 = -0.1298| < |\beta_1 = -0.1477|$.

The results above have verified Hypothesis 1 proposed in Section 3.2.1. As the public has no executive power, they can participate in environmental governance in an indirect way by means of lobbying local governments' environmental enforcement of polluting enterprises.

Table 4. The mediation effect of local governments' environmental enforcement.

Variable	Pollution		Lag1. Pollution	
	Model (7)	Model (8)	Model (9)	Model (10)
public participation	−0.1103 *** (−3.01)		−0.1265 *** (−3.69)	
complaints		−0.0985 *** (−2.68)		−0.1298 *** (−3.77)
proposals		−0.0491 (−1.33)		0.0175 (0.53)
local governments' enforcement	−0.0254 (−0.99)	−0.0207 (−0.80)	−0.0570 ** (−2.37)	−0.0583 ** (-2.41)
industrial structure	0.0015 (0.20)	0.0003 (0.04)	0.0217 ** (2.52)	0.0215 ** (2.50)
budgetary deficit	0.0265 (0.33)	0.0114 (0.14)	0.0054 (0.07)	0.0097 (0.12)
_cons.	1.1873 *** (3.37)	1.1261 *** (3.19)	1.4821 *** (4.30)	1.5007 *** (4.32)
F.E.	YES	YES	YES	YES
obs.	150	150	120	120
R-sq.	0.0963	0.1088	0.3299	0.3352

Note: *t*-value in parentheses. *, **, and *** denote significance at a 10%, 5%, and 1% level, respectively.

In addition, despite the significant mediation effect of local governments' environmental enforcement, parameter β' still passes the significance test after adding the path variable to Model (10). It means that local governments' environmental enforcement is unable to completely replace the effect of public participation in environmental governance, which further verifies the reasonability of Hypothesis 2 proposed in Section 3.2.2. That is to say, the effect of the deterrent of public participation on polluting enterprises can also generate effects similar to local governments' environmental enforcement, which will help promote environmental governance directly.

5.3. 2SLS Estimation Results with IV

Based on Hausman's test of the endogeneity, it can be found that there is a significant endogenous relationship between public participation and environmental pollution. Therefore, instrumental variables (IV) are applied to alleviate endogeneity bias. Table 5 reports 2SLS estimation results with instrumental variables, and the first stage regressions are reported in its lower half. In addition, we take one-period-lagged environmental pollution in Model (11)–(13) in view of the hysteresis.

In Model (11), by taking the level of residents' education and the number of each province's NPC deputies as instrumental variables, the significance test of public participation's estimated coefficient achieves further improvement. Its absolute value also realizes a large rise from $|\beta = -0.1464|$ in Model (3) to $|\beta'' = -0.4542|$. However, the F statistic of the weak IV test is less than the threshold of 10, which means that the two instrumental variables fail to pass the weak identification test. In addition, the regression results in the first stage show that the estimated coefficient of NPC deputies does not pass the significance test. In Model (12), public participation is sub-divided into Complaints and Proposals, but their estimated coefficients to environmental pollution also fail to pass the significance test and the F statistic of the weak IV test still fails to pass the threshold.

Due to the facts above, the sub-type of Proposals is eliminated in public participation, and accordingly, the instrumental variable of NPC deputies is also removed from Model (13). After that, the F statistic of the weak IV test increases to 14.28, indicating that residents' education level passes the weak identification test. In Model (13), the estimated coefficient of Complaints is significantly negative, with an absolute value realizing a large increase from $|\beta_1 = -0.1477|$ in Model (4) to $|\beta_1'' = -0.4442|$. The same increase (i.e., 4.43%) in public participation causes a 1.97% reduction in the discharge of industrial pollutants, almost three times more than that in Model (4). Based on this finding, a conclusion is drawn that the effect of public participation on promoting environmental governance can be further enhanced by introducing residents' education level as the instrumental variable to alleviate its endogeneity bias.

Table 5. The Two Stage Least Square (2SLS) estimation results of public participation to environmental pollution with instrumental variables.

Variable	Pollution		
	Model (11)	**Model (12)**	**Model (13)**
public participation	−0.4542 *** (−3.07)		
complaints		0.0036 (0.00)	−0.4442 *** (−3.07)
proposals		−2.0138 (−0.05)	
industrial structure	0.0261 ** (2.23)	0.0063 (0.01)	0.0256 ** (2.21)
budgetary deficit	0.1170 (0.93)	−0.3632 (−0.03)	0.1128 (0.90)
_cons.	1.7199 *** (3.38)	−0.5334 (−0.01)	1.7024 *** (3.39)
F.E.	YES	YES	YES
obs.	120	120	120
R-sq.	0.3661	0.2891	0.3677
Hausman Endogeneity Test	0.00	0.00	0.00
Weak IV Test	7.29	0.00	14.28
Anderson-Rubin Wald Test	0.00	0.00	0.00
The First Stage of Regression			
Variable	**Public Participation**	**Complaints**	**Proposals**	**Complaints**
education level	0.7523 *** (3.15)	0.7637 *** (3.15)	0.1711 (0.66)	0.7559 *** (3.16)
NPC deputies	−0.3117 (−0.33)	−0.2827 (−0.29)	−0.1105 (−0.11)	
industrial structure	0.0107 (0.41)	0.0099 (0.38)	−0.0075 (−0.27)	0.0107 (0.41)
budgetary deficit	0.3523 (1.44)	0.3527 (1.42)	−0.1604 (−0.60)	0.3669 (1.52)
_cons.	0.7825 (0.18)	0.6085 (0.13)	−0.7610 (−0.16)	−0.6609 (−0.56)
F.E.	YES	YES	YES	YES
obs.	120	120	120	120
R-sq.	0.1355	0.1358	0.0093	0.1349

Note: *t*-value in parentheses. *, **, and *** denote significance at a 10%, 5%, and 1% level, respectively.

6. Conclusions

Based on inter-provincial panel data of China from 2011 to 2015, the present study has confirmed the role of public participation in environmental governance by constructing a mediation model and a 2SLS model. The results indicate that the advantages of handing information asymmetry and enhancing social supervision have become the two logical starting points for involving public participation in environmental governance. As the public has no executive power, they can participate in environmental governance in an indirect way by means of lobbying local governments' environmental enforcement of polluting enterprises. In addition, public participation's deterrent effect on polluting enterprises can also generate effects similar to local governments' environmental enforcement, which will help promote environmental governance directly. At the present time in China, the effects of public participation in environmental governance are mainly reflected in the form of back-end governance, while the effects of front-end governance are not remarkable.

Regarding the puzzle of some other empirical studies that fail to prove the effectiveness of public participation in environmental governance [41,44–46], this paper also provides relevant explanations. Firstly, due to the heterogeneous effects on environmental governance between back-end governance and front-end governance, we argue that taking different types of public participation as a whole, while neglecting their differences, may be an important reason for this inconformity. Secondly, as the public relies on local governments' enforcement to participate in environmental governance, we also argue that neglecting this indirect participation path may also serve as an important explanation for the puzzle. Thirdly, as the bidirectional causality between public participation and environmental pollution tends to cause serious endogeneity bias, we hold the opinion that inadequate treatment of this endogeneity bias may essentially account for public participation's ineffectiveness.

7. Discussions

The present study contributes to a better understanding of the role of public participation in environmental governance in China. However, as a case exemplar of authoritarian environmentalism, the participation of Chinese citizens in its environmental governance remains inadequate [71–73]. In particular, unless environmental pollution has broken out and seriously affected their daily life, Chinese citizens will not take the initiative to participate in environmental governance [41]. Our findings are of great significance in perfecting China's environmental governance system by means of arousing and expanding the public's rights to participate in environmental governance.

Firstly, the present study points out that handling information asymmetry and enhancing social supervision are the two logical starting points for involving public participation in environmental governance. Therefore, we suggest that the Chinese government should standardize the disclosure of environmental information to ensure the public's right to know about, participate in, and supervise environmental issues. For example, interactive channels between the public and local governments should be expanded, particularly by widely applying smart phones, computers, and many other network terminal devices.

Secondly, the present study also reveals that residents' education level has a significant positive correlation with public participation. Hereby, it is necessary to stress the importance of improving residents' education level in China. As China is a populous country, this will be an arduous project and may not achieve a remarkable effect in a short period of time. We suggest that implementing this project should not be only restricted to compulsory education. Other methods, such as community publicity, Internet platforms, and public service advertising, should be fully utilized.

Thirdly, as a kind of pollutant source control, front-end governance is majorly exhibited in pollution pre-warning and cost saving. However, our conclusions indicate that the effects of front-end governance are not remarkable enough at the present time in China. Therefore, we hold the opinion that the Chinese government should attach more importance to cultivating its people's awareness of active participation. There is a lot of work to do, such as creating a ritual sense of making recommendations for its citizens, and establishing a visual platform for the public to check the progress of their suggestions.

Fourthly, it has to be noted that placing an emphasis on the role of public participation does not mean that we can neglect the roles of local governments and polluting enterprises. Therefore, to involve the public in the environmental governance system, the Chinese government also needs to pay attention to the coordination between the public, local governments, and polluting enterprises. In particular, tensions between the public and polluting enterprises have to be handled in an appropriate way. We suggest establishing a regular dialogue mechanism among all stakeholders. Under this mechanism, the public will be able to exercise their supervisory rights, and polluting enterprises will be offered adequate time to modify their production behaviors.

In addition, the present study also contains some defects, one of which is that the modes of public participation in environmental governance are far beyond the five indicators we have considered. In Section 5.3, the sub-type of Proposals and the instrumental variable of NPC deputies are eliminated from the 2SLS model due to the weak identification test. However, this elimination prevents us from shedding light on the effect of front-end governance. In Section 4.2, we constructed a comprehensive indicator by three major industrial pollutants to measure the level of environmental pollution. However, the public's feeling on different types of industrial pollutants may be different, then leading to different levels of public participation and different effects on environmental governance. Public participation in China may take on specific characteristics, forms, and degrees due to its own institution and culture, but the present study fails to make a comparative study between China and other countries. These defects will be further addressed in our subsequent studies.

References

1. Kostka, G.; Nahm, J. Central-local relations: Recentralization and environmental governance in China. *China Q.* **2017**, *231*, 567–582. [CrossRef]
2. Lo, K. How authoritarian is the environmental governance of China? *Environ. Sci. Policy* **2015**, *54*, 152–159. [CrossRef]
3. He, G.; Lu, Y.; Mol, A.P.J.; Beckers, T. Changes and challenges: China's environmental management in transition. *Environ. Dev.* **2012**, *3*, 25–38. [CrossRef]
4. Liu, L.; Zhang, B.; Bi, J. Reforming China's multi-level environmental governance: Lessons from the 11th Five-Year Plan. *Environ. Sci. Policy* **2012**, *21*, 106–111. [CrossRef]
5. Bäckstrand, K. Civic science for sustainability: Reframing the role of experts, policy-makers and citizens in environmental governance. *Glob. Environ. Politics* **2003**, *3*, 24–41. [CrossRef]
6. Bulkeley, H.; Mol, A.P.J. Participation and environmental governance: Consensus, ambivalence and debate. *Environ. Values* **2003**, *12*, 143–154. [CrossRef]
7. Webler, T.; Tuler, S. Four perspectives on public participation process in environmental assessment and decision making: Combined results from 10 case studies. *Policy Stud. J.* **2006**, *34*, 699–722. [CrossRef]
8. Newig, J. Does public participation in environmental decisions lead to improved environmental quality? Towards an analytical framework. *Int. J. Sustain. Commun.* **2007**, *1*, 51–71.
9. Zhang, D.; Liu, J.; Li, B. Tackling air pollution in China—What do we learn from the great smog of 1950s in London. *Sustainability* **2014**, *6*, 5322–5338. [CrossRef]
10. Taylor, B. Wilderness, spirituality and biodiversity in North America: Tracing an environmental history from Occidental roots to Earth Day. *Wilderness Myth. Relig. Approaching Relig. Spat. Cosmol. Ideas Wild Nat.* **2012**, *55*, 293.

11. Guo, J.; Xu, Y.; Pu, Z. Urbanization and its effects on industrial pollutant emissions: An empirical study of a Chinese case with the spatial panel model. *Sustainability* **2016**, *8*, 812. [CrossRef]

12. Wu, J.; Song, M.; Yang, L. Advances in energy and environmental issues in China: Theory, models, and applications. *Ann. Oper. Res.* **2015**, *228*, 1–8. [CrossRef]

13. Ravesteijn, W.; Liu, Y.; Yan, P. Responsible innovation in port development: The Rotterdam Maasvlakte 2 and the Dalian Dayao Bay extension projects. *Water Sci. Technol.* **2015**, *72*, 665–677. [CrossRef] [PubMed]

14. Jian, L.; Chan, C.K.C. Collective identity, framing and mobilisation of environmental protests in urban China: A case study of Qidong's Protest. *China Int. J.* **2016**, *14*, 102–122.

15. Zhou, Q. Report on the Work of the Supreme People's Court of China. Available online: http://news.cyol.com/content/2018-03/26/content_17051712.htm (accessed on 26 March 2018).

16. Zheng, S.; Kahn, M.E. A new era of pollution progress in urban China? *J. Econ. Perspect.* **2017**, *31*, 71–92. [CrossRef]

17. Quick, K.S.; Bryson, J.M. *Public Participation: Handbook on Theories of Governance*; Edward Elgar Publishing: Cheltenham, UK, 2016.

18. Tiebout, C.M. A pure theory of local expenditures. *J. Political Econ.* **1956**, *64*, 416–424. [CrossRef]

19. Banzhaf, H.S.; Walsh, R.P. Do people vote with their feet? An empirical test of environmental gentrification. *RFF Discuss. Paper No. 06-10* **2006**. [CrossRef]

20. Hirschman, A.O. *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*; Harvard University Press: Cambridge, MA, USA, 1970.

21. Taylor, D.E. The rise of the environmental justice paradigm: Injustice framing and the social construction of environmental discourses. *Am. Behav. Sci.* **2000**, *43*, 508–580. [CrossRef]

22. Garmendia, E.; Stagl, S. Public participation for sustainability and social learning: Concepts and lessons from three case studies in Europe. *Ecol. Econ.* **2010**, *69*, 1712–1722. [CrossRef]

23. Jolibert, C.; Wesselink, A. Research impacts and impact on research in biodiversity conservation: The influence of stakeholder engagement. *Environ. Sci. Policy* **2012**, *22*, 100–111. [CrossRef]

24. Innes, J.E.; Booher, D.E. Reframing public participation: Strategies for the 21st century. *Plan. Theory Pract.* **2004**, *5*, 419–436. [CrossRef]

25. Muro, M.; Jeffrey, P. Time to talk? How the structure of dialog processes shapes stakeholder learning in participatory water resources management. *Ecol. Soc.* **2012**, *17*. [CrossRef]

26. Hogl, K.; Kvarda, E.; Nordbeck, R.; Pregernig, M. *Environmental Governance: The Challenge of Legitimacy and Effectiveness*; Edward Elgar Publishing: Cheltenham, UK, 2012.

27. Newig, J.; Fritsch, O. Environmental governance: Participatory, multi-level-and effective? *Environ. Policy Gov.* **2009**, *19*, 197–214. [CrossRef]

28. Kanu, E.J.; Tyonum, E.T.; Uchegbu, S.N. Public participation in environmental impact Assessment (EIA): A critical analysis. *Archit. Eng.* **2018**, *3*, 1.

29. Chen, C.X.; Han, L. Public Participation in water environment control: The status and experience of Shenzhen, Southern China. *Meteorol. Environ. Res.* **2018**, *9*, 70–79.

30. Bai, X.; McAllister, R.R.J.; Beaty, R.M.; Taylor, B. Urban policy and governance in a global environment: Complex systems, scale mismatches and public participation. *Curr. Opin. Environ. Sustain.* **2010**, *2*, 129–135. [CrossRef]

31. Beierle, T.C. *Democracy in Practice: Public Participation in Environmental Decisions*; Routledge: London, UK, 2010.

32. Reed, M.S. Stakeholder participation for environmental management: A literature review. *Biol. Conserv.* **2008**, *141*, 2417–2431. [CrossRef]

33. Enserink, B.; Koppenjan, J. Public participation in China: Sustainable urbanization and governance. *Manag. Environ. Qual. Int. J.* **2007**, *18*, 459–474. [CrossRef]

34. Cent, J.; Grodzińska-Jurczak, M.; Pietrzyk-Kaszyńska, A. Emerging multilevel environmental governance—A case of public participation in Poland. *J. Nat. Conserv.* **2014**, *22*, 93–102. [CrossRef]

35. Akhmouch, A.; Clavreul, D. Stakeholder engagement for inclusive water governance: "Practicing what we preach" with the OECD water governance initiative. *Water* **2016**, *8*, 204. [CrossRef]

36. Adkin, L.E.; Hanson, L.L.; Kahane, D.; Parkins, J.R.; Patten, S. Can public engagement democratize environmental policymaking in a resource-dependent state? Comparative case studies from Alberta, Canada. *Environ. Politics* **2017**, *26*, 301–321. [CrossRef]

37. Fischer, A.; Young, J.C. Understanding mental constructs of biodiversity: Implications for biodiversity management and conservation. *Biol. Conserv.* **2007**, *136*, 271–282. [CrossRef]

38. Blackstock, K.L.; Kelly, G.J.; Horsey, B.L. Developing and applying a framework to evaluate participatory research for sustainability. *Ecol. Econ.* **2007**, *60*, 726–742. [CrossRef]

39. Vedwan, N.; Ahmad, S.; Miralles-Wilhelm, F.; Broad, K.; Letson, D.; Podesta, G. Institutional evolution in Lake Okeechobee management in Florida: Characteristics, impacts, and limitations. *Water Resour. Manag.* **2008**, *22*, 699–718. [CrossRef]

40. Marzuki, A. Challenges in the public participation and the decision making process. *Sociol. I Prost. Sociol. Space* **2015**, *53*, 21–39.

41. Fung, A. Putting the public back into governance: The challenges of citizen participation and its future. *Public Adm. Rev.* **2015**, *75*, 513–522. [CrossRef]

42. Yakubu, O. Delivering environmental justice through environmental impact assessment in the United States: The challenge of public participation. *Challenges* **2018**, *9*, 9. [CrossRef]

43. Wesselink, A.; Paavola, J.; Fritsch, O.; Renn, O. Rationales for public participation in environmental policy and governance: practitioners' perspectives. *Environ. Plan. A* **2011**, *43*, 2688–2704. [CrossRef]

44. Drazkiewicz, A.; Challies, E.; Newig, J. Public participation and local environmental planning: Testing factors influencing decision quality and implementation in four case studies from Germany. *Land Use Policy* **2015**, *46*, 211–222. [CrossRef]

45. Wang, H.; Di, W. The World Bank. In *The Determinants of Government Environmental Performance: An Empirical Analysis of Chinese Townships*; World Bank Publication: Washington, DC, USA, 2002.

46. He, Z.X.; Xu, S.C.; Shen, W.X.; Long, R.Y.; Chen, H. Factors that influence corporate environmental behavior: Empirical analysis based on panel data in China. *J. Clean. Prod.* **2016**, *133*, 531–543. [CrossRef]

47. Wu, J.; Xu, M.; Zhang, P. The impacts of governmental performance assessment policy and citizen participation on improving environmental performance across Chinese provinces. *J. Clean. Prod.* **2018**, *184*, 227–238. [CrossRef]

48. Few, R.; Brown, K.; Tompkins, E.L. Public participation and climate change adaptation: Avoiding the illusion of inclusion. *Clim. Policy* **2007**, *7*, 46–59. [CrossRef]

49. Eden, S. Public participation in environmental policy: Considering scientific, counter-scientific and non-scientific contributions. *Public Underst. Sci.* **2016**, *5*, 183–204. [CrossRef]

50. Li, G.; Fang, C.; Wang, S.; Sun, S. The effect of economic growth, urbanization, and industrialization on fine particulate matter (PM2.5) concentrations in China. *Environ. Sci. Technol.* **2016**, *50*, 11452–11459. [CrossRef] [PubMed]

51. Stern, D.I.B. The Environmental Kuznets Curve. In *Companion to Environmental Studies*; Routledge: London, UK, 2018.

52. Bai, Z. Study on cross-boundary governance of water pollution in Huaihe River in China. *J. Sustain. Dev.* **2015**, *8*, 241. [CrossRef]

53. Hu, S.; Tang, W. Analysis on the formation and legislative prevention and control measures of groundwater pollution: A case study from Xinjiang, China. *Nat. Environ. Pollut. Technol.* **2017**, *16*, 393.

54. Luo, W.; Guo, X.; Zhong, S.; Wang, J. Environmental information disclosure quality, media attention and debt financing costs: Evidence from Chinese heavy polluting listed companies. *J. Clean. Prod.* **2019**, *231*, 268–277. [CrossRef]

55. Wu, Y.; Zhang, W.; Shen, J.; Mo, Z.; Peng, Y. Smart city with Chinese characteristics against the background of big data: Idea, action and risk. *J. Clean. Prod.* **2018**, *173*, 60–66. [CrossRef]

56. Zhang, X. Implementation of pollution control targets in China: Has a centralized enforcement approach worked? *China Q.* **2017**, *231*, 749–774. [CrossRef]

57. Martínez-Ferrero, J.; Ruiz-Cano, D.; García-Sánchez, I.M. The causal link between sustainable disclosure and information asymmetry: The moderating role of the stakeholder protection context. *Corp. Soc. Responsib. Environ. Manag.* **2016**, *23*, 319–332. [CrossRef]

58. Zhang, L.; Mol, A.P.J.; He, G. Transparency and information disclosure in China's environmental governance. *Curr. Opin. Environ. Sustain.* **2016**, *18*, 17–24. [CrossRef]

59. Hart, R.A. *Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care*; Routledge: London, UK, 2013.

60. Tian, X.L.; Guo, Q.G.; Han, C.; Ahmad, N. Different extent of environmental information disclosure across Chinese cities: Contributing factors and correlation with local pollution. *Glob. Environ. Chang.* **2016**, *39*, 244–257. [CrossRef]

61. Wu, M.Q.; Chen, B. Assignment of provincial officials based on economic performance: Evidence from China. *China Econ. Rev.* **2016**, *38*, 60–75. [CrossRef]

62. Burton, P. Conceptual, theoretical and practical issues in measuring the benefits of public participation. *Evaluation* **2009**, *15*, 263–284. [CrossRef]

63. Jiang, D.; Zhang, J. Policy Analytics, Modelling, and Informatics. Public Administration and Information Technology. In *Competition and Collusion between Government and Businesses in Pollution Management: Analysis Based on Stochastic Differential Game*; Gil-Garcia, J., Pardo, T., Luna-Reyes, L., Eds.; Springer: Cham, Germany, 2018; pp. 407–427.

64. Kadushin, A.; Harkness, D. *Supervision in Social Work*; Columbia University Press: New York, NY, USA, 2014.

65. Judd, C.M.; Kenny, D.A. Process analysis: Estimating mediation in treatment evaluations. *Eval. Rev.* **1981**, *5*, 602–619. [CrossRef]

66. Cutler, D.M.; Lleras-Muney, A. Understanding differences in health behaviors by education. *J. Health Econ.* **2010**, *29*, 1–28. [CrossRef] [PubMed]

67. Reimer, M.N.; Haynie, A.C. Mechanisms matter for evaluating the economic impacts of marine reserves. *J. Environ. Econ. Manag.* **2018**, *88*, 427–446. [CrossRef]

68. Ministry of Ecology and Environment of the People's Republic of China. *China Environmental Yearbook*; China Forum of Environmental Journalists: Beijing, China, 2011–2015.

69. Yu, S.; Zheng, S.; Zhang, X.; Gong, C.; Cheng, J. Realizing China's goals on energy saving and pollution reduction: Industrial structure multi-objective optimization approach. *Energy Policy* **2018**, *122*, 300–312. [CrossRef]

70. Cheung, G.; Davies, P.J.; Trück, S. Transforming urban energy systems: The role of local governments' regional energy master plan. *J. Clean. Prod.* **2019**, *220*, 655–667. [CrossRef]

71. Beeson, M. The coming of environmental authoritarianism. *Environ. Politics* **2010**, *19*, 276–294. [CrossRef]

72. Gilley, B. Authoritarian environmentalism and China's response to climate change. *Environ. Politics* **2012**, *21*, 287–307. [CrossRef]

73. Zhu, X.; Zhang, L.; Ran, R.; Mol, A.P.J. Regional restrictions on environmental impact assessment approval in China: The legitimacy of environmental authoritarianism. *J. Clean. Prod.* **2015**, *92*, 100–108. [CrossRef]