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Blue sky, cold heart: The political cost of environmental regulations

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Abstract

The economic costs of environmental regulations are well documented, but their political cost is still unclear, especially in cases of substantial pollution reduction. This study presents empirical evidence for the unexpected political costs of China's war on air pollution. Using a clean energy regulation as a case, we demonstrate that it significantly reduces air pollutants over a short period; however, exposure to the regulation erodes local political support and trust in government officials. In addition, we show that stringent environmental regulations significantly reduce local political trust when it entails high policy costs for local residents and had weak policy participation. Our results indicate that stringent regulations may improve environmental quality at the cost of local political legitimacy.

Chinese Abstract

摘要:环境规制实施的经济成本已有充分的研究，但其政治成本仍不明确，特别是在涉及大幅度污染减少的情景下。本研究提供了对中国空气污染治理的意外政治成本的实证证据。以清洁能源规制为例，我们证实了能源规制可在短期内显著地减少空气污染，但是规制的快速实施也降低了当地居民对地方政府官员的政治支持与信任。此外,我们还表明,当严格的环境规制对当地居民带来高昂政策成本且居民的政策执行参与较弱时，规制的实施会显著降低地方的政治信任。我们的结果表明,严格的环境规制具有地方政治合法性的成本。

1 | INTRODUCTION

Environmental issues pose challenges to the well-being of citizens; in fact, exceedingly high pollutant concentration could engender considerable health costs (Ebenstein et al., 2017). In response to popular pressure, governments are incentivized to enact and enforce environmental regulations. The positive effects of regulation on environmental quality and public health are well documented (e.g., Chen et al., 2018; Tanaka, 2015); however, unintended negative economic consequences may result from environmental regulations. A rising literature depicts their economic cost. Strict environmental regulations can reduce job opportunities at manufacturing firms (Liu et al., 2021), lower firm productivity and economic growth (Du & Yi, 2022; He et al., 2020), decrease the output of polluting industries (Greenstone, 2002), shrink firms' profit and capital (Fan et al., 2019), and cut foreign direct investment (Cai et al., 2016).

We currently have a limited understanding of the political consequences of environmental regulations, and their role remaining mixed. On the one hand, environmental regulations may have positive political consequences. Severe pollution incites wide public concern and undermines satisfaction with governments, even fueling social unrest (Alkon & Wang, 2018; Stern, 2013). Citizens typically demand better environmental quality, the improvement of which may meet their demands and increase their political support. On the other hand, environmental regulations may incur unintended negative consequences. Stringent environmental regulations are more likely to rely on coercive tools to enforce compliance, yet their enforcement can be counterproductive (May & Winter, 1999), with citizens blaming governments for excessive stringency.

In this study, we address the gap by investigating the political cost of environmental regulations in China. To reduce serious air pollution, the central government has recentralized control of environmental governance and initiated tight top-down enforcements to incentivize local bureaucrats in recent years. Local governments tend to aggressively implement environmental regulations in response to severe political pressure from above.

To estimate the effects of environmental regulation, we use the clean heating renovation policy as a case. Specifically, the clean heating renovation policy is a key environmental regulation to control air pollution in Northern China. Different from ordinary regulations targeting firms, the policy aims to replace coal with clean energy for winter heating in households. Local governments resorted to stringent policy measures, providing a unique opportunity for us to estimate their consequences.

We compiled comprehensive city-level and individual-level datasets. We first constructed a city-level dataset for 2012–2019 and employed a difference-in-differences (DID) estimation to identify the environmental effect of the environmental regulation. Then, we used five rounds of China Family Panel Studies (CFPS) data for 2012–2020 to estimate the political effect of environmental regulation. Finally, we designed and conducted an original survey of 2,658 residents in 338 villages to explore possible mechanisms.

Our results demonstrate that this environmental regulation improves air quality at the cost of local political support. First, we show that the clean heating renovation policy significantly reduces pollutants, including $PM_{2.5}$ and SO_2. This policy is environmentally effective and achieves its intended aims. Second, our analysis indicates that this policy significantly decreases citizens' local political support and trust in local officials. Our mechanism analysis shows that stringent environmental regulations are more likely to reduce local political support when entailing high policy burdens for local residents and having weak policy participation.

Our study contributes to the literature on political support in China, a country that relies on performance legitimacy, a key source of political stability (Treisman, 2011), by providing social assistance, public goods, and economic interest to citizens (Dickson et al., 2016; Huang & Gao, 2018; Zhao, 2009), who in turn link good policy outcomes with support of governments and reduce their support with negative government performance (Alkon & Wang, 2018). A rising line of research, however, reflects the limitation of performance legitimacy; for example, scholars demonstrate that social policy benefits may be inadequate to win local political support (Lü, 2014; Yang & Shen, 2021), and corruption investigation undermines regime support and reduces the supply of political candidates (Wang & Dickson, 2022; Yang, 2021). We extend this line of research by examining the unintended political cost of environmental regulations. The results demonstrate that positive environmental performance may not translate into the higher political legitimacy of governments if policies entail high burdens. Instead, stringent policy regulations could harm local political support.

This study adds to the literature on environmental governance in developing countries, which usually have weak capacity and resources to monitor local environmental performance (Duflo et al., 2013). To hold local officials accountable, political leaders often use "blunt force regulation" to increase oversight and enforcement (van der Kamp, 2021). Following this line of research, we show that governments confront a trade-off between environmental protection and political legitimacy. "Blunt force regulation" may be environmentally effective but falls short on legitimacy. Developing countries may confront a dilemma in environmental governance: weak environmental regulations are inadequate to curb pollution, but stringent environmental regulations could improve environmental quality while sacrificing local political legitimacy. To deal with the dilemma, developing countries may need to involve more citizens in the policy decision-making process and allow them to express and safeguard their interests before policy implementation.

2 | THE POLITICAL COST OF ENVIRONMENTAL REGULATION

Political leaders often use stringent regulations to deal with the principal–agent problem in the bureaucracy. In hierarchical bureaucratic systems agents' interests and targets are not always consistent with those of their principals (Downs, 1967). The principal–agent problem is more severe in authoritarian regimes, where rulers often have limited resources and capacity to monitor and motivate local governments to implement policies (Mann, 2008). Although judicial institutions are useful instruments in dealing with principal–agent problems (Peerenboom, 2002), these institutions lack sufficient independence and are easily captured by local governments (Lubman, 1999). To resolve bureaucratic noncompliance, authoritarian regimes are more likely to strengthen bureaucratic control and use coercive enforcement to implement policies (Van Rooij, 2016). Blunt force enforcement is widely used to overcome principal–agent problems in environmental governance (van der Kamp, 2021).

Stringent environmental regulations may have several typical characteristics in China. First, policy regulations involve the extraordinary mobilization of administrative resources (Liu et al., 2015; van der Kamp, 2021). Second, environmental regulations involve a nonparticipatory approach, resorting to a top-down political mobilization; and state authority is concentrated to promote the rapid formulation and implementation of policies (Zhou, 2012). Third, local governments may adopt stringent measures in responding to severe political pressure from above (Kostka & Nahm, 2017; Ran, 2017), distorting policy implementation.

We argue that stringent environmental regulation may improve environmental quality at the cost of local political legitimacy. Positive environmental outcomes may not translate into higher local political legitimacy.

2.1 | Environmental regulation and air pollution

On the environmental side, stringent environmental regulations can be environmentally effective. In a centralized political system like China, the central government has lately exerted strong control and recentralizes environmental decision-making (Kostka & Nahm, 2017). It conducts regular environmental inspections, punishes or rewards local officials, and empowers environmental agencies. In recent years environment-related performances have carried more weight in local responsibility and in the cadre evaluation system (Wong & Karplus, 2017). The one-vote-veto is used in some areas to push local leaders to hit air pollution control targets. The central government publicly summoned and criticized some local mayors because of severe local air pollution. In response to increasing pressure from above to curb air pollution, some regulations target local residents by restricting the usage of private cars, prohibiting straw burning and fireworks, and setting up no-coal areas. Some local governments target firms by relocating industrial facilities or even forcibly shutting down entire industries (van der Kamp, 2021).

An emerging literature demonstrates that the stringent environmental regulation is blunt but effective in enforcing regulations and improving environmental quality in China (e.g., Jia & Chen, 2019; Xiang & van Gevelt, 2020). Top-down pressure could enhance the enforcement of local environmental regulations and increase their efficiency. As a result, stringent environmental regulations can reduce pollutants in a short period of time; for example, such regulations led to short-term, considerable improvement in air quality during the Beijing 2008 Olympic Games (Chen et al., 2013).

2.2 | Environmental regulation and political support

Stringent environmental regulations could, however, undermine local political support. Trust in government is an important aspect of regime legitimacy because it endows governments with the moral foundation of compliance (Citrin & Stoker, 2018). High political trust is a critical source of authoritarian resilience (Nathan, 2003), but low political trust may reflect public dissatisfaction and threaten political stability (Paige, 1971). Devoid of valid electoral legitimacy, government performance is a critical source of legitimacy in authoritarian regimes. In a centralized political system, the central government initiates top-down environmental regulations and mobilizes administrative resources to enforce local implementation. Local governments may aggressively implement central initiatives in response to top-down policy pressures, and citizens may blame local governments for blunt policy measures, possibly undermining their support of local governments.

Stringent environmental regulations are more likely to weaken citizens' trust in local governments than the central government. Political hierarchies, which comprise multiple levels of government, may allow the central government to avoid the blame of its citizens (Lieberthal, 2004). The divided state power could allow the central authority to deflect blame when local authorities repress the masses and harshly implement policies (Cai, 2008). Consequently, citizens blame local governments much more than they do the central government when political problems arise (Tang, 2016, 36). The blame game in China's environmental regulation is captured by a popular saying: "The central government invites guests, but the local government has to pay the bill" (Ran, 2017). Thus, we may expect that strict environmental regulation may undermine local political trust.

The reduction effect of environmental regulation on local political trust may be driven by two possible mechanisms: policy cost and policy participation.

First, high policy cost is a possible mechanism through which stringent environmental regulations undermine local political trust. A rich literature documents economic well-being as a pillar of political attitudes. Individuals may condition their support for a policy on the financial burdens it entails (Bechtel et al., 2019). Ignorance of and encroachment upon citizens' economic interests are the main sources of complaint and dissatisfaction. For instance, heavy taxes fueled peasants' grievances and discontent (Bernstein & Lü, 2000), and land takeovers with low compensation gave rise to social unrest and undermined villagers' political trust (Cui et al., 2015).

Environmental regulations may entail high policy burdens, but citizens have not only limited institutional channels to express their interests but also have weak bargaining power in the policy-making system. Local governments aggressively implement policies without considering local conditions and preferences and may sacrifice flexibility while generating high localized costs (Wong & Karplus, 2017). Citizens must then bear the financial burdens entailed by those policies, which fuel their political discontent and grievances.

Second, stringent policy regulation tends to invite weak public participation. The justification of decisions is assumed to create legitimacy through "public argument and reasoning among equal citizens" (Cohen, 1997), and public participation is the critical source of legitimacy for policy decisions. Citizens may be less inclined to accept policies when decisions follow weak public participation; however, in China, when high-level authorities put forth an issue priority and propose initiatives, the policy can be promoted in a determined, forceful fashion (Lieberthal, 2004, 299). The local decision-making process can be highly compressed, and routine public participation can be substantially undermined (Xue & Zhao, 2020). Governments are wary of bottom-up participation, and the scope of participation is constrained (van der Kamp, 2021). Citizens are less likely to be involved in the decision-making process, where they can express their preferences and further their interests.

Weak public participation in policy regulations may reduce political support. First, public participation matters for procedural fairness. Citizens may evaluate governments on the basis of the perceived fairness of decision-making processes (Lind & Tyler, 1988). They are more likely to support governments when they perceive them, conforming to fair decision-making procedures (Whiting, 2017; Yang & Zhao, 2022). Participation in the regulatory design process leads to more positive views toward regulatory authority (Malesky & Taussig, 2019). In contrast, authoritarian policy regulations are less likely to involve citizens in decision-making processes; citizens may perceive unfairness in the procedures and reduce their support of governments. Second, public participation is an important channel for citizens to safeguard their economic interests. Weak public participation may exclude them from policy-making procedures and bias the allocation of benefits and costs. Consequently, policy regulations with weak public participation could undermine local political support.

Overall, stringent environmental regulation can be useful to enforce local policy implementation and improve environmental governance; however, local bureaucrats may aggressively implement environmental policies in response to severe top-down pressure. The stringent measures they use may engender high policy burdens for local residents and invite weak public participation. As a result, stringent environmental regulation improves environmental quality at the cost of local political trust.

3 | THE CLEAN HEATING RENOVATION POLICY IN CHINA

Environmental regulations are commonly used to induce incentives to use clean energy sources, and China is no exception. In recent years, China has initiated a large-scale policy scheme to switch coal to clean energies in households. In 2017, in particular, 10 central ministries announced a five-year plan to shift to clean heating energy in Northern China. Aiming to switch households and businesses from coal to natural gas or electricity for winter heating, the plan targeted the improvement of air quality in Northern China, setting ambitious policy targets. According to the plan, half the households in Northern China would convert to clean heating by 2019, and 70% of them would adopt clean heating by 2021. By 2020, 25 million households had adopted clean energy in Northern China.

Beginning in 2017, the central governments selected three rounds of pilot cities to enforce the implementation of this policy. Figure 1 shows the geographic distribution of pilot cities in Northern China. The policy gradually diffused to a wide range of cities, 11 were selected in 2017 as pilot cities by the central government; 23 more in 2018, and three more in 2019, by which time pilot cities for the implementation of the policy numbered 37 of 66 cities in Northern China. Pilot cities received subsidies from both the central and local governments to implement the policy and set mandatory targets to complete the adoption of clean energy in a certain number of households; however, numerous obstacles arose. Coal has been the dominant energy source in Northern China for a long time. Northern provinces like Shanxi and Inner Mongolia are its largest coal-producing regions, with coal-related industries serving as the backbone of local development; so reducing reliance on coal could weaken local economies and result in backlash.

The clean heating renovation policy is a typical case of stringent environmental regulation. To enforce this ambitious policy, local governments applied some brutal measures. A number of local governments canceled coal markets and restricted the use of coal in areas with heavy air pollution. Some residents were even arrested in Hebei province for using coal in winter.[1] The stringent regulation engendered widespread complaints. This backlash pushed the Ministry of Environmental Protection to issue a document allowing local residents to use coal in areas where clean energy furnaces had not been installed.

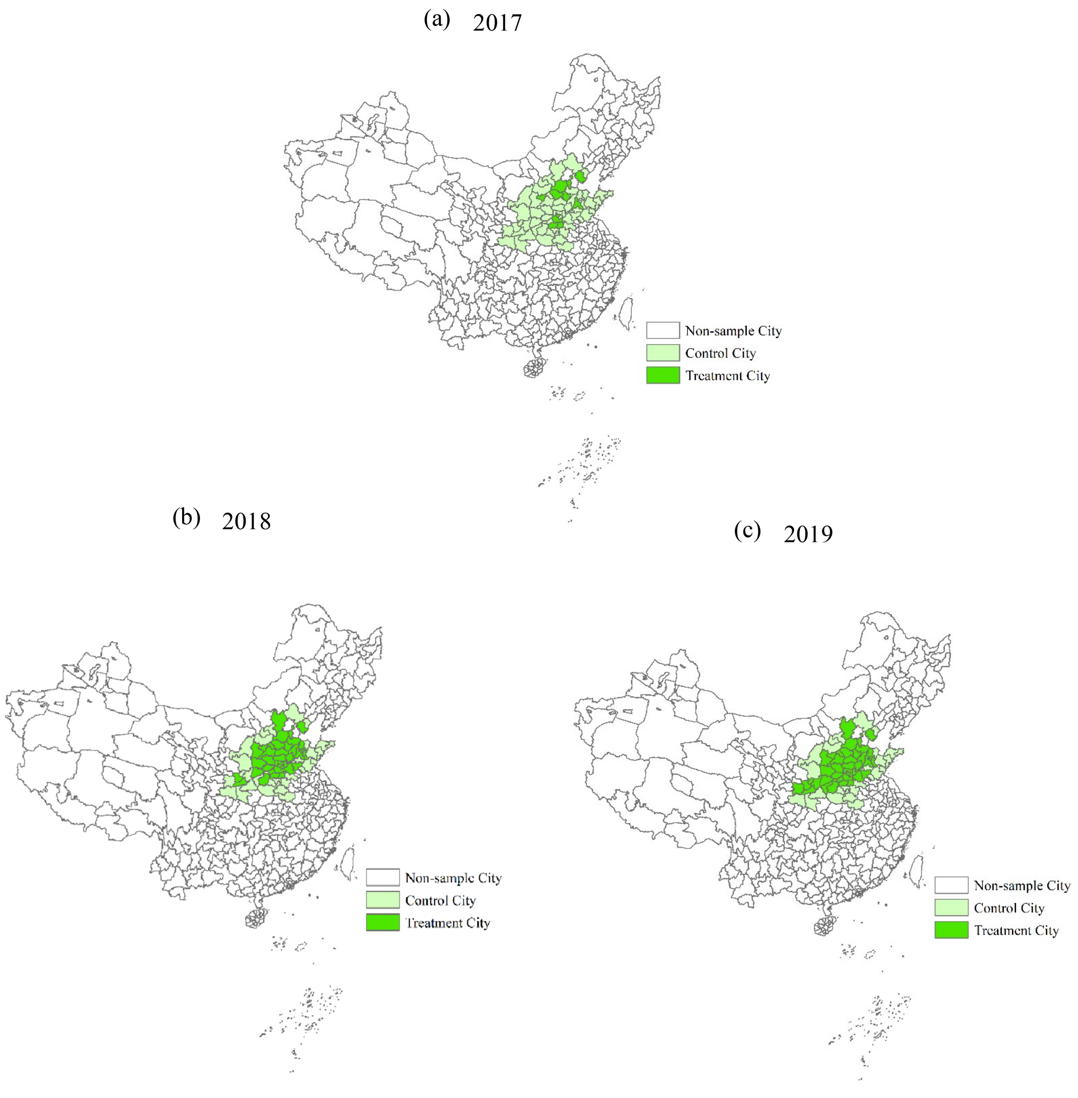

FIGURE 1 Geographic Distribution of Samples in Northern China. In our analysis, we include all prefecture-level cities in five Northern provinces including Shanxi, Shaanxi, Shandong, Hebei, and Henan. "Treatment city" refers to a city selected as a pilot in year t and afterward in these provinces; "control city" refers to a city not selected as a pilot city for the clean heating renovation policy in year *t*. "Nonsample city" refers to a city in other provinces. [Color figure can be viewed at wileyonlinelibrary.com]

The policy may be environmentally effective because the switch from coal to clean energies in Northern China improves household energy structure, reduces ambient and indoor $PM_{2.5}$ concentrations, and results in health benefits for rural residents (Meng et al., 2019). Local residents, however, directly paid the price for clean air. They had to pay extra money to install clean energy equipment, the cost of which was high and not fully covered by government subsidies. In addition, the cost of using natural gas or electricity is more expensive than coal in China; coal is cheap because China has a rich endowment of it but less oil and natural gas. Switching from coal to natural gas or electricity increased the usage costs for local residents, and the rushed adoption of clean energy worsened the situation. The sudden spike in demand for natural gas pushed prices skyward and generated fuel shortages, leaving local residents to face more energy expenses in winter.

4 | BLUE SKY: ENVIRONMENTAL REGULATION AND AIR POLLUTION

To evaluate the impact of environmental regulations on air quality, we construct a city-level dataset between 2012 and 2019. This policy aimed to improve air quality in Northern provincial units, including Shanxi, Shaanxi, Shandong, Hebei, Henan, Beijing, and Tianjin. To make the estimation comparable, our analysis focuses on 66 cities at the prefecture level in Northern China, thus excluding provincial-level cities, including Beijing and Tianjin.[2]

The key independent variable is the adoption of the clean heating renovation policy. To identify the adoption of this policy, we use whether a city was selected as a pilot city in year *t* and afterward. Figure 1 depicts the expansion of the clean heating renovation policy in Northern China between 2017 and 2019.

Our outcome variable is air pollution, identified by two major air pollutants: $PM_{2.5}$ and SO^2. The pollution data derived from Tracking Air Pollution in China (TAP) and comprised multiple sources of pollution data at a spatial resolution of 10 km (Geng et al., 2021). We obtained city-year annual average concentration data by overlaying the $PM_{2.5}$ and SO_2 grids on Chinese city-level administrative boundaries in ArcMap and calculating the average concentration amounts of all grids within each city polygon.

Several variables are included to capture confounding factors. Economic development and fiscal capacity may matter for the implementation of environmental regulations and air pollution. Cities with dense populations and large urban areas may produce more air pollutants and may be severely polluted. Thus, we control GDP per capita, fiscal revenue per capita, population density, and urban build-up area, collected from the *China City Statistical Yearbook*. Wind speed may affect dispersion of pollutants, so we control annual average wind speed, collected from the China Meteorological Administration.[3] Table A1 shows summary statistics for key variables.

We employ a difference-in-differences (DID) analysis reliant on the spatial and temporal variation of adopting the environmental regulation. The DID specification is as follows:

$$Yit = \alpha_0 + \alpha_1 CEP_{it} + \alpha_2 X_{it} + \gamma_i + \delta t + \varepsilon_{it}, \quad (1)$$

where Y_{it} is a vector of outcome variables for air pollution in city *i* in year *t*. Air pollution variables include logarithmic values of $PM_{2.5}$, SO_2. CEP_{it} denotes a dummy variable, indicating a city's policy status. It is equal to 1 if city *i* adopted the clean energy policy (CEP) in year *t* and afterward, otherwise 0. X_{it} indicates a vector of time-variant control variables, including GDP per capita, population density, fiscal revenue per capita, green space area, urban build-up area, and wind. γ_i denotes city fixed effect, capturing all time-invariant unobservable city-specific characteristics. δ_t indicates year-fixed effects, which capture annual macro policy shocks affecting all cities similarly. ε_{it} is the error term. Robust standard errors are clustered at the city level.

Table 1 presents the estimated results using the DID specification. First, we show the baseline results without controlling time-variant covariants. In Columns (1) and (4), we add the clean heating renovation policy dummy as the only regressor while including city and year fixed effects. The baseline results show that the clean heating renovation policy significantly reduces the amount of $PM_{2.5}$ and SO_2.

After adding time-variant covariants in Columns (2) and (5), the estimated coefficients of clean heating renovation policy are negative and significant. Specifically, the introduction of the clean heating renovation policy is associated with a 3.4% decrease in the amount of $PM_{2.5}$ and a 4.4% decrease in SO_2. The policy had the largest reduction effect in SO_2. That the clean energy policy aims to replace coal with natural gas and electricity is reasonable, and SO_2 is a product of burning coal.

China has strengthened its environmental regulations in recent years. Many new policies are frequently introduced, including numerous provincial environmental policies, which may affect local environmental governance at the same time, perhaps weakening the validity of our estimation. To deal with the concern, we add province-by-year fixed effects into the model to capture any province-specific policy shocks. After adding province-by-year fixed effects in Columns (3) and (6), the estimated coefficients of clean heating renovation policy remain negative and significant at 1% level. The results are robust and consistent.

TABLE 1 Environmental regulation and air pollutants in Northern China (city-level).

	PM2.5			SO_2		
	(1)	(2)	(3)	(4)	(5)	(6)
Clean heating renovation policy	−0.035***	−0.034**	−0.027***	−0.050**	−0.044**	−0.034***
	(0.012)	(0.013)	(0.008)	(0.020)	(0.017)	(0.011)
GDP per capita		0.030	−0.007		0.222***	−0.002
		(0.034)	(0.032)		(0.055)	(0.043)
Population density		−0.032**	−0.018		−0.046**	−0.003
		(0.013)	(0.011)		(0.022)	(0.013)
Green space area		−0.004	−0.013		−0.004	−0.006
		(0.023)	(0.018)		(0.033)	(0.020)
Fiscal revenue per capita		−0.015	−0.008		−0.135***	−0.035
		(0.028)	(0.025)		(0.044)	(0.031)
Built-up area		−0.007	0.001		−0.028	−0.014
		(0.020)	(0.010)		(0.031)	(0.015)
Wind		−0.126***	−0.057**		0.057**	0.049**
		(0.023)	(0.024)		(0.022)	(0.022)
City FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Province FE × Year FE			Y			Y
N	528	512	512	520	505	505
R^2	0.829	0.847	0.931	0.907	0.918	0.959

Note: The sample includes 66 cities in Northern China between 2012 and 2019. Robust standard errors in parentheses are clustered at the city level. All outcome variables are in logarithmic values. $PM_{2.5}$, SO_2, GDP per capita, fiscal revenue per capita, green space area, and built-up area are in logarithmic values. Constants are not reported.
$^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

To verify the validity of DID's parallel trends assumption, we conducted an event study. Figure 2 plots the event-study estimates under a 95% confidence interval, and Table B1 shows estimated coefficients. Panel A depicts no evident pre-trend in $PM_{2.5}$ before the adoption of the policy. After the implementation of the policy, the estimated coefficients of the event become negative and significant in Years 1 and 2. Panel B shows no significant pretends in SO_2 before the policy implementation. The only exception occurred 3 years before the policy implementation: the estimated coefficient is positive and significant, which indicates that cities heavily polluted by SO_2 may more likely be selected as pilot cities, yet the trend is reversed after the implementation of the clean energy policy. The estimated coefficients turn negative and become significant after the policy is implemented for 2 years. Overall, the event study confirms that our DID specification meets the parallel trends assumption.

One concern is the measurement of air pollution. We use an annual average of air pollutants to capture air pollution. The heating system, however, operates in the winter; so the clean heating renovation policy is more likely to affect air pollutants during the winter heating season. Cities in Northern China have distinct heating seasons (Fan et al., 2020). We construct two variables to capture air pollutants in winter: the first is the average air pollutants during the fourth quarter; and the second is the average air pollutants between October and March during the following year. Table B2 indicates that the estimated coefficients of clean heating renovation policy become larger and remain significant and negative. The results confirm that this policy has a larger reduction effect on air pollutants in winter.

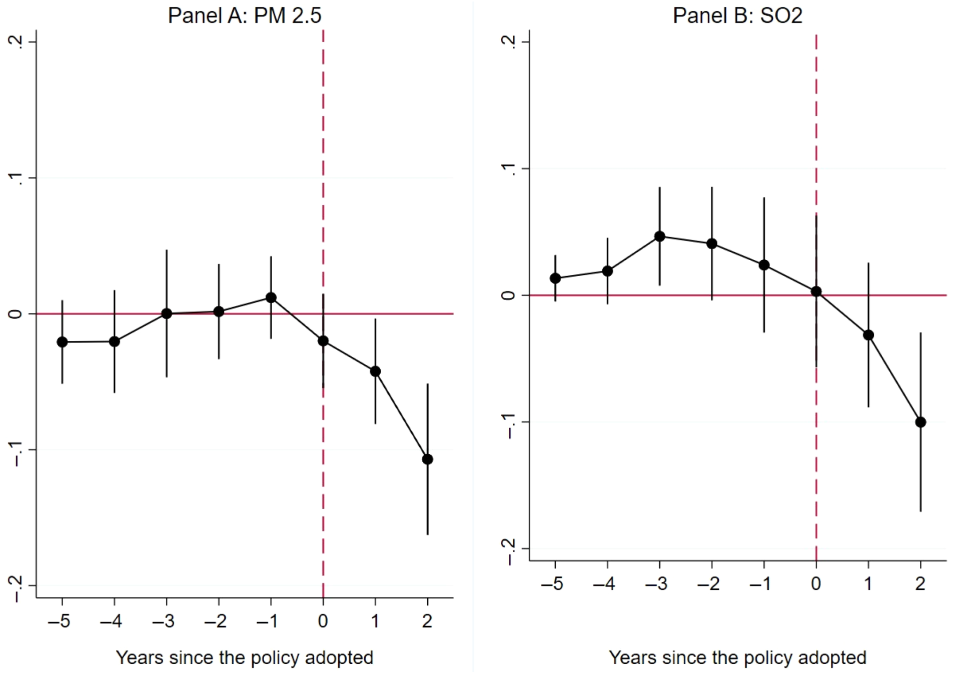

FIGURE 2 The dynamic effect of environmental regulation on air pollution. The figure shows the estimated coefficients of the event study under 95% confidence intervals. The horizontal axis measures the number of years before and after the adoption of the clean heating renovation policy. The omitted time category is more than 5 years before adopting the clean energy renovation policy. Panel (a) shows the estimated coefficients of Column (1) in Table B1. Panel (b) shows the estimated coefficients of Column (2) in Table B1. [Color figure can be viewed at wileyonlinelibrary.com]

In sum, the clean heating renovation policy achieves the intended policy goals of improving air quality in Northern China, evidently reducing air pollutants in the short run. On the environmental side, this policy is successful in the improvement of air quality, resulting in more blue skies.

5 | COLD HEART: ENVIRONMENTAL REGULATION AND POLITICAL TRUST

To evaluate the political consequences of environmental regulation, we employ five waves of China Family Panel Studies (CFPS) data from 2012, 2014, 2016, 2018, and 2020, which are retrospective individual panel data and include national representative samples. The survey covers 36 of 66 prefecture-level cities in Northern China.

We use two variables to measure individuals' political attitudes toward local governments and officials. Although the central government initiated the Clean Heating Renovation Policy, local governments are responsible for implementing its policy. Confronting severe pressure from above, local governments may aggressively implement policies, incurring citizens' discontent (van der Kamp, 2021). CFPS contains two questions on political attitudes: trust in local cadres and support of local governments. The former measures the level of trust in local officials, ranging from 0 (*no trust at all*) to 10 (*considerable trust*). The latter captures how citizens evaluate local governments' performance, ranging from 1 (*performed worse than before*) to 5 (*improved a lot*).

The panel characteristic of CFPS data allows us to use the two-way fixed effect linear model to estimate our results. Individual fixed effect allows us to control time-invariant individual characteristics, and year-fixed effect captures year-specific macro policy shocks. The policy was implemented at the city level, so we also control the city-fixed effect to capture time-invariant city characteristics. We rely on the following model to estimate the political consequences of stringent environmental regulation:

$$Y_{ict} = \beta_0 + \beta 1 CEP_{ct} + \beta 2 X_{it} + \beta 3 X_{ct} + \tau_i + \nu_c + \delta t + \varepsilon_{it}, \quad (2)$$

where Y_{ict} is a vector of outcome variables of political attitudes for individual i in city c in year t. CEP_{ct} indicates a city's policy status, equal to 1 if city c adopted the clean energy policy (CEP) in year t and afterward, otherwise 0. X_{it} captures individual characteristics, including age, gender, urban hukou (household registration status), years of schooling, and Communist Party membership. X_{ct} denotes the vector of city-level time-variant covariants, including GDP per capita, population density, green space area, fiscal revenue per capita, built-up area, and wind. v_c indicates the city-fixed effect, τ_i indicates the individual-fixed effect, and δ_t denotes the year-fixed effect. Robust standard errors are clustered at the individual level.

Table 2 shows the estimated results using Equation (2). First, Columns (1) and (4) present baseline results with individual-, city-, and year-fixed effects. The baseline results demonstrate that the clean heating renovation policy significantly reduces citizens' trust in local officials and support for local governments. After adding individual characteristics in Columns (2) and (5), the estimated coefficients of the clean heating renovation policy remain negative and significant. In Columns (3) and (6), we control both individual and city characteristics and draw similar conclusions. As shown in Columns (3) and (6), the adoption of the clean heating renovation policy reduces citizens' trust in local officials by 18.10% and lowers their assessment of local governments by 4.4%. Furthermore, trust in local officials and local government support are discrete variables. As a robustness check, we use ordinal logistic models to replicate the results. Table B2 shows estimated results, which are consistent across specifications.

We demonstrate that the clean heating renovation policy significantly lowers citizens' trust in local officials and support of local governments. Although this policy evidently improves air quality, it reduces local residents' evaluation of local governments and officials. The adoption of the clean heating renovation policy improves air quality at the cost of local political legitimacy.

6 | MECHANISM

Why this stringent environmental regulation improves environmental quality at the cost of political legitimacy is puzzling. To further explore underlying mechanisms, we designed and conducted an original survey. Because of resource and time constraints, we selected only one pilot city in Northern China to conduct our survey. Appendix D.1 explains why this city was appropriate for us to examine possible mechanisms.

To conduct the survey, we randomly selected villages among populous towns in the city[4] and then randomly selected eight households in each village. We asked heads of households to complete our survey, which was conducted in February 2019; and ultimately, 2,658 respondents in 338 villages were surveyed. The response rate was 86.52%. Figure 3 depicts the geographic distribution of samples.

First, we verify that the adoption of stringent environmental regulation reduces local political trust. CFPS data identify only the adoption of the clean heating renovation policy at the city level. To precisely capture the adoption of this policy, we designed a self-reported question in our survey to ask respondents directly whether or not their family had adopted the clean heating renovation policy. The progress of local residents in installing clean energy equipment differed. A total of 40.5% of our respondents had adopted clean heating renovation. In addition, we asked respondents to rate the extent to which they trust both local and central governments, ranging from 1 (*strongly distrust*) to 5 (*strongly trust*). Tables C1 and D1 presents estimated results, demonstrating that the adoption of clean energy has no pronounced effect on the trust of rural residents in the central government but significantly reduces their trust in local government.

TABLE 2 Environmental regulation and political trust (individual level).

	Trust in local officials			Local government support		
	(1)	(2)	(3)	(4)	(5)	(6)
Clean heating renovation policy	−0.191***	−0.207***	−0.181***	−0.039*	−0.040*	−0.044**
	(0.057)	(0.057)	(0.061)	(0.021)	(0.021)	(0.022)
Age		0.023	0.018		−0.001	0.001
		(0.043)	(0.050)		(0.013)	(0.015)
Female		1.113	1.109		−0.028	−0.019
		(0.754)	(0.755)		(0.208)	(0.212)
Urban		−0.105	−0.146		−0.030	−0.027
		(0.100)	(0.101)		(0.040)	(0.040)
Years of schooling		0.019	0.018		0.011**	0.011*
		(0.015)	(0.015)		(0.006)	(0.006)
Communist party member		0.115	0.098		0.051	0.061
		(0.121)	(0.123)		(0.044)	(0.044)
GDP per capita			0.324			−0.090
			(0.217)			(0.081)
Population density			−0.188*			−0.007
			(0.105)			(0.037)
Green space land			−0.297**			0.052
			(0.120)			(0.045)
Fiscal revenue per capita			−0.007			0.222***
			(0.158)			(0.055)
Built-up area			−0.096			−0.014
			(0.083)			(0.033)
Wind speed			0.197**			0.164***
			(0.094)			(0.033)
Individual FE	Y	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	37,359	36,510	35,815	36,311	35,482	34,792
R-squared	0.021	0.022	0.020	0.007	0.007	0.009

Note: The sample includes CFPS data from 2012, 2014, 2016, 2018, and 2020. In the analysis, we adopt two-way fixed linear models. Robust standard errors in parentheses are clustered at the individual level. GDP per capita, fiscal revenue per capita, green space area, and built-up area are in logarithmic values. Constants are not reported.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

6.1 | Policy cost

We explore possible reasons for respondents to withhold support for the clean energy renovation policy. In the survey, we directly asked respondents about their support of the policy. Figure D1 shows that 27.77% of respondents did not support the clean energy renovation switch from coal to natural gas, and 21.71% of respondents did not support the switch from coal to electricity. Then those not supporting the clean renovation were asked to select possible reasons for their rejection of this policy.[5] Figure 4 shows the descriptive results. Among the 683 respondents not

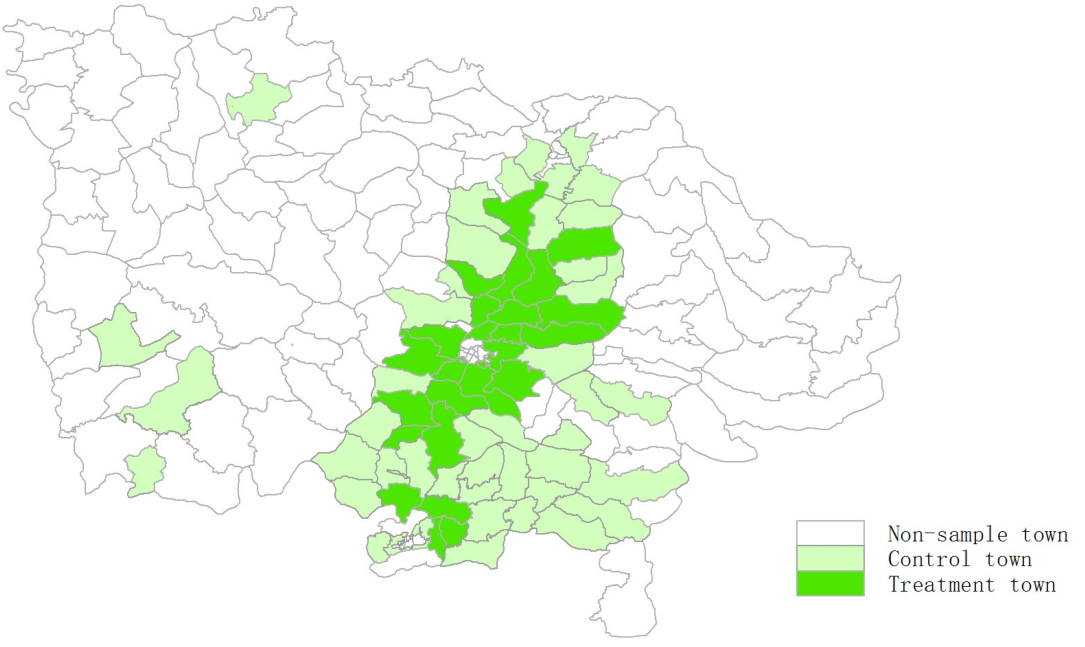

FIGURE 3 Geographic distribution of samples in the local city. To geographically depict the distribution of our sample, we divided it into two groups at the township level. "Treatment town" refers to a town in which more than half the respondents adopted the clean heating renovation; "control town" indicates a town in which less than half the respondents adopted the clean heating renovation. "Nonsample town" refers to a town with no survey respondents. The map includes all the towns in Linfen city. [Color figure can be viewed at wileyonlinelibrary.com]

supporting the clean energy renovation policy, the first two reasons are high usage cost and high installation cost. In particular, 62.23% of them thought that the usage cost of clean energy renovation was too high.

Furthermore, we calculate the average cost of clean energy renovation for those installing clean energy equipment. Figure 5 shows that the average annual economic cost of using clean energy is more than 3,000 yuan (around USD450). After receiving subsidies from governments, local residents must still bear extra expenses. In particular, the average out-of-pocket expense for using gas equipment is 2,513 yuan (around USD370) per year, and the average expense for using electricity is 1,194 yuan (around USD180) per year. In our sample, the average annual household income is 21,775 yuan (around USD3200). On average, households must spend 11.54% or 5.48% of their annual income to switch from coal to natural gas or electricity, separately. The economic cost is high even with government subsidies.

We examine whether policy cost can explain the decline of local political trust after policy implementation. Table 3 shows the estimated results. In the survey, we asked respondents to rate their acceptance of policy cost, ranging from 1 (*unacceptable*) to 4 (*acceptable*). Column (1) indicates that the implementation of the clean heating renovation policy significantly reduces local residents' acceptance of the policy at the 1% level. Citizens may have incomplete information about the clean heating renovation policy before policy implementation. After it occurs, they can obtain more information on policy costs and become less likely to accept the cost of this policy. Column (2) verifies that acceptance of policy cost is positively related to local political trust. When local residents perceive that policy cost is unacceptable, they lower their trust in local governments.

In the analysis, we restrict our sample to households adopting clean energy renovation. Column (3) indicates that government subsidy is positively and significantly related to the acceptance of policy cost. More government subsidies can reduce the policy burden and increase citizens' acceptance of policy cost. Column (4) demonstrates that

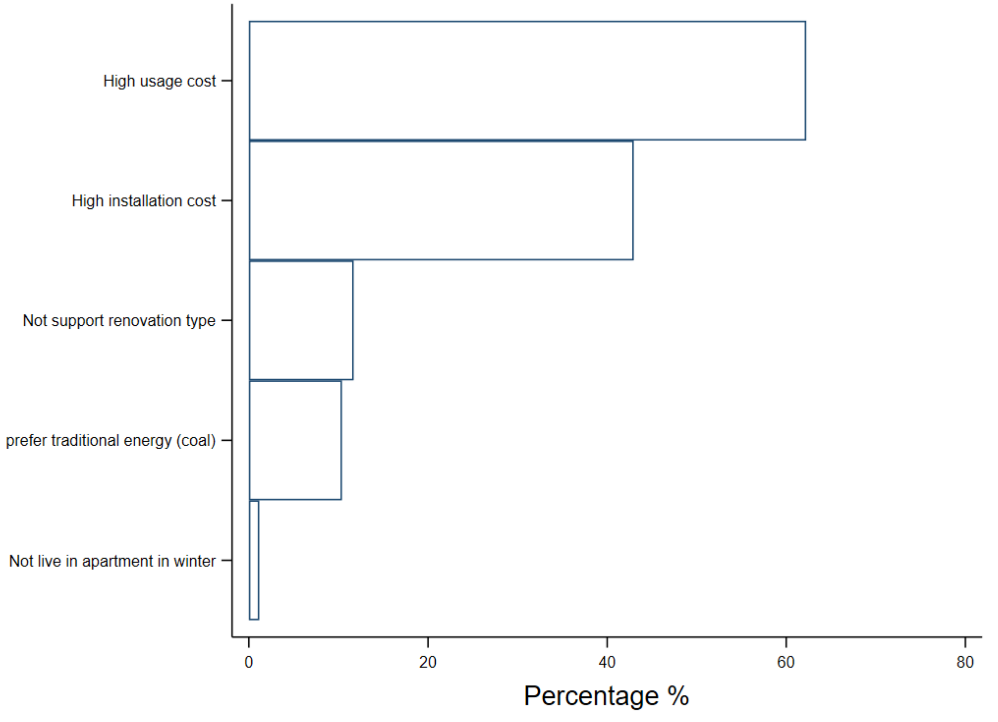

FIGURE 4 Reasons for not supporting the clean energy renovation policy. One concern is that the perception of policy burdens is a subjective measurement and may reflect individuals' political attitudes, which may be biased. To mitigate this concern, we use objective government subsidies to capture the policy burden. We surveyed the amount of the subsidies respondents received from the government for the clean heating renovation. Government subsidies could relieve local residents' financial burdens; in fact, more subsidies indicate lower financial burdens for rural residents. [Color figure can be viewed at wileyonlinelibrary.com]

government subsidies significantly increase local political trust. These results illustrate that citizens are more likely to complain that policy cost is unacceptable after the adoption of this policy, lowering their trust in local governments. In contrast, government subsidies can mitigate local residents' policy burdens and alleviate their political support.

In sum, the adoption of the clean heating renovation policy entails high costs for local residents. Environmental regulation significantly reduces local political trust when it entailed high financial burdens for local residents. Government subsidies can mitigate their financial burden and alleviate its negative consequences. Compared with urban residents, rural residents have lower income and weaker willingness to pay for clean air yet bear higher out-of-pocket expenses, which may be an important reason that environmental regulation reduces local political trust.

6.2 | Policy participation

Building on insights in the theoretical section, we argue that stringent environmental regulations with weak public participation may reduce local political legitimacy. To test the mechanism, we designed a question for the survey, asking villagers what entity had made the decision to adopt the clean heating renovation policy in their village. Weak public participation is coded 1 when villagers' committees made the decisions and coded 0 when the villagers' assembly or representative assembly made the decision.

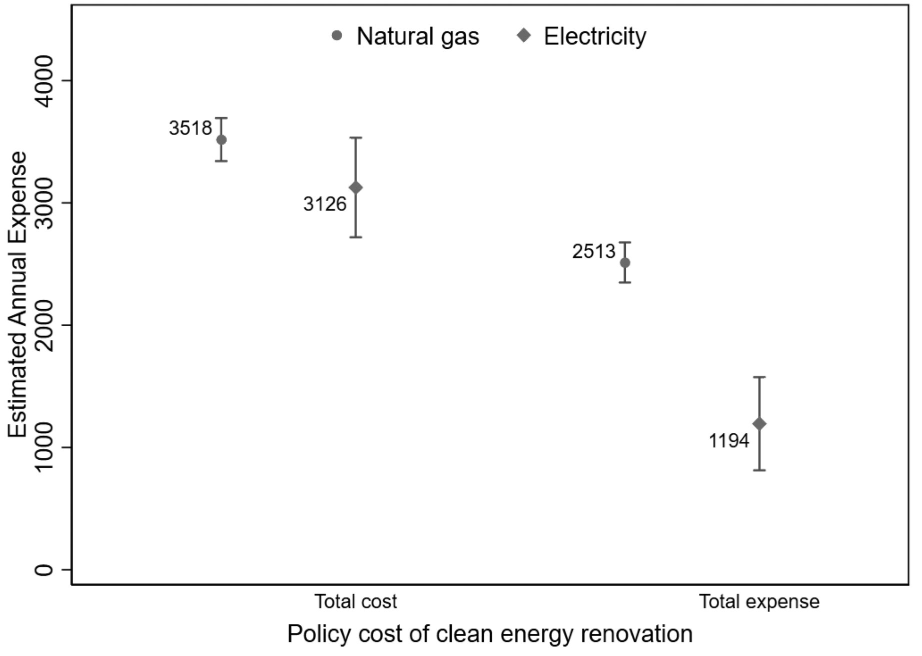

FIGURE 5 Estimated cost of clean energy renovation. We use those installing clean energy equipment to calculate the average economic cost in 2018. Total cost includes increased usage costs compared with using coal and equipment costs. Total expense refers to out-of-pocket expenses after subtracting government subsidies. The vertical bars show 95% confidence intervals.

TABLE 3 Mechanism: political cost.

	Acceptance of cost (1)	Political trust (2)	Acceptance of cost (3)	Political trust (4)
Clean heating renovation policy	−1.131***			
	(0.149)			
Acceptance of cost		0.540***		
		(0.079)		
Government subsidy (logged)			2.698***	0.902**
			(0.405)	(0.361)
Controls	Y	Y	Y	Y
N	1992	1989	616	622
pseudo-R^2	0.048	0.029	0.055	0.014

Note: The sample includes individual-level data from a survey conducted in 2019. In the analysis, we adopt ordered logistic regression. Robust standard errors in parentheses are clustered at the village level. Controls include respondents' household income, age, gender, year of schooling, agriculture work, Communist Party membership, participation in village elections, and the frequency of the use of political news and traditional media. Constants are not reported.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

The measurement of public participation is rooted in China's institutional contexts. Chinese villages typically have two decision-making bodies: the villagers' assembly or representative assembly and the villagers' committee (Oi & Rozelle, 2000), the former more representative than the latter. The villagers' representative assembly is a proxy

TABLE 4 Mechanism: policy participation.

	Local government trust		Government subsidies	
	(1)	(2)	(3)	(4)
Weak public participation	−0.733***	−0.647***	−0.248***	−0.242***
	(0.198)	(0.205)	(0.068)	(0.069)
Controls		Y		Y
N	1055	927	695	616
R^2			0.111	0.120
Pseudo-R^2	0.007	0.017		

Note: The sample involves individual-level data from a survey conducted in 2019. In Columns (1) and (2) we adopt ordered logistic regression; in Columns (3) and (4), linear regression. Robust standard errors in parentheses are clustered at the village level. Controls include respondents' household income, age, gender, years of schooling, agriculture work, Communist Party membership, participation in village election, and frequency of political news and traditional media. Constants are not reported.
*p < 0.1; **p < 0.05; ***p < 0.01.

for the villagers' assembly that deliberates and makes decisions on village affairs (Chan, 2003). Villagers' committees are supposed to be subordinate to the villagers' assembly and implement policies. In practice, elected village committees are under the shadow of upper-level governments and village party branches, and local governments exert significant influence over village leaders (Kung et al., 2009). During policy regulations, villagers' committees face severe pressure from above and tend to prioritize state tasks and circumvent villagers' representative assemblies to make decisions. As a result, villagers are less likely to be involved in the decision-making process and voice their preferences if decisions are made by the villagers' committee. Most villages had weak policy participation in the implementation of environmental regulation. Among villages implementing clean heating renovation policy, 84.23% of respondents reported that villagers' committees made the decision, and the proportion of decisions made by villagers' assembly or representative assembly was 15.77%.

We restrict our analysis to respondents implementing the clean heating renovation policy. The rationale is that respondents implementing the clean energy policy have complete information on types of policy decision-making. Table 4 depicts how weak public participation shapes political trust in villages adopting the clean heating renovation. As shown in Columns (1) and (2), weak public participation significantly lowers rural residents' trust in local government at the 1% level, demonstrating that weak policy participation evidently undermines local political legitimacy.

Furthermore, we assess the direct consequence of weak public participation in policy outcomes. Under such participation, village leaders may become less likely to act in the interest of local villagers. During the implementation of clean heating renovation, subsidies provided by upper-level governments are vital resources to mitigate residents' policy burdens. Columns (3) and (4) in Table 4 demonstrate that villagers received fewer government subsidies under weak public participation, suggesting that village leaders may be less accountable to villagers under this level of participation, may tend to follow instructions from above, and may be less likely to safeguard the interests of villagers. As a result, weak public participation in policy undermines local political trust.

7 | CONCLUSION

In this study, we illustrate the trade-off between environmental quality and local political legitimacy. Our results reveal that stringent environmental regulations significantly improve air quality but undermine political trust in local governments. We show that stringent environmental regulations tend to entail high policy burdens. Citizens must bear extra financial burdens for clean air; as a result, environmental regulations fuel citizen dissent and lower their political support.

This study prompts reflection on stringent environmental regulations. We demonstrate that stringent policy regulations may generate more problems than they are intended to solve. Under severe top-down political pressure and intense horizontal competition, local governments may deviate from regular laws and rules, and aggressively implement policies. They may neglect local conditions and citizens' preferences. Thus, citizens may not be involved in the policy decision-making process but must bear high policy burdens, which could lower their support of local governments. Furthermore, high policy costs could reduce rural residents' disposable income and lower quality of life in developing countries. In addition, because higher-income households show a greater willingness to pay for clean air (Ito & Zhang, 2020), the government may shift energy subsidies from large cities to subsidize rural areas. The central government may need to monitor the implementation of policies by local governments and punish "blunt force" regulations.

Stringent environmental regulations may weaken the belief of individuals that central government leaders have good intentions to further their interests. Trust in local government has a dual meaning: it indicates how citizens evaluate the commitment and capacity of local governments to serve their interest and captures how they assess the commitment and capacity of the central government to ensure that local governments serve the public interest (Li, 2016). Although we show that environmental regulation has no pronounced reduction effect on trust in the central government, the distrust in local governments could reduce citizens' compliance with future policies and indirectly undermine political support of the central government. If governments regularly rely on stringent measures and coercive tools to enforce policy implementation in various policy domains, doing so may undermine both local and central political legitimacy, fuel citizen dissent, and threaten political stability in the long run.

Our study has broad policy implications beyond China. Scholars explore reasons that governments initiate campaign-style enforcement in environmental governance (Liu et al., 2015; Liu et al., 2018; van der Kamp, 2021), and we demonstrate the negative political consequences of stringent environmental regulation, highlighting the limitation of campaign-style enforcement. When governments fail to involve citizens in the policy decision-making process and unequally distribute policy costs and benefits, policy regulation may generate unintended negative consequences. Regulatory negotiation and policy participation should be incorporated in the policy process.

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CONFLICT OF INTEREST STATEMENT

The authors claim that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

Replication code and files are available in Harvard Dataverse at: https://doi.org/10.7910/DVN/C5GTZV.

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ENDNOTES

[1] The Paper. 2018. "Residents were arrested because of using bulk coal in Hebei," available at www.thepaper.cn/newsDetail_forward_2746470 (accessed December 20 2020).

[2] The two provincial-level cities have higher political status and enjoy larger economic autonomy and political resources, which may bias our results.

[3] The China Meteorological Administration runs the National Climatic Data Center, which discloses climatic data: data.cma.cn.

[4] Populous towns have lower economic costs for clean energy infrastructures (power grids and pipelines). Local governments are more likely to select such towns for clean heating renovation. To achieve a representative sample, we sorted all China's towns by population density in 2017. More than 70% of them have population density equal to or larger than 184 people/km^2. Those towns have a greater chance of selection for clean heating renovation. We thus selected all towns above the threshold in the city.

[5] Before the survey, we conducted several interviews and asked rural residents their attitudes toward clean energy renovation. They proposed several main reasons for their lack of support of clean energy renovation. We listed these reasons in our survey.

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APPENDIX A: DATA

TABLE A1 Summary statistics.

	City-level variables					
	Time	N	Mean	Std. Dev.	Min	Max
$PM_{2.5}$(logged)	2012–2019	512	3.984	0.321	3.138	4.690
SO_2 (logged)	2012–2019	505	2.379	0.324	1.532	2.998
Clean heating renovation policy	2012–2019	512	0.150	0.358	0	1
GDP per capita (logged)	2012–2019	512	10.726	0.443	9.782	12.165
Population density (logged)	2012–2019	512	8.114	0.707	6.390	9.619
Green space area (logged)	2012–2019	512	8.321	0.821	5.989	10.618
Fiscal revenue per capita (logged)	2012–2019	512	8.020	0.695	6.193	9.612
Built-up area (logged)	2012–2019	512	4.558	0.732	2.552	6.554
Wind speed	2012–2019	512	2.221	0.409	1.313	4.009
Individual-level variables (CFPS)						
Trust in local officials	2012–2020 (biennial)	36510	5.158	2.670	0	10
Local government support	2012–2020 (biennial)	35356	3.461	0.907	1	5
Age	2012–2020 (biennial)	36510	47.134	16.262	18	95
Female	2012–2020 (biennial)	36510	0.515	0.500	0	1
Urban hukou	2012–2020 (biennial)	36510	0.414	0.493	0	1
Year of schooling	2012–2020 (biennial)	36510	7.622	4.593	0	22
Communist party member	2012–2020 (biennial)	36510	0.075	0.264	0	1

APPENDIX B: EMPIRICAL RESULTS FOR CITY-LEVEL ANALYSIS

TABLE B1 Event study: the effects of environmental regulation and air pollutants.

	(1) $PM_{2.5}$	(2) SO_2
5 years before	−0.021	0.013
	(0.015)	(0.009)
4 years before	−0.020	0.019
	(0.019)	(0.013)
3 years before	0.000	0.047**
	(0.024)	(0.020)
2 years before	0.002	0.041*
	(0.018)	(0.022)
1 year before	0.012	0.024
	(0.015)	(0.027)
Year of change	−0.020	0.003
	(0.017)	(0.030)
1 years after	−0.042**	−0.031
	(0.019)	(0.029)
2 years after	−0.107***	−0.100***
	(0.028)	(0.035)
Controls	Y	Y
City FE	Y	Y
Year FE	Y	Y
N	512	505
R^2	0.853	0.923

Note: The sample uses city-level data between 2012 and 2019. The analysis adopts two-way fixed linear models. Robust standard errors in parentheses are clustered at individual level. Controls include GDP per capita, population density, fiscal revenue per capita, green space area, and built-up area and wind. GDP per capita, fiscal revenue per capita, green space area, and built-up area are in logarithmic values. Constants are not reported.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

TABLE B2 Robustness check: environmental regulation and air pollutants in the winter (city-level).

	(1) PM2.5 Q4	(2) PM2.5 October–March	(3) SO2 Q4	(4) SO2 October–March
Clean heating renovation policy	−0.110***	−0.066***	−0.125***	−0.136***
	(0.025)	(0.019)	(0.046)	(0.045)
GDP per capita	−0.048	−0.013	−0.357*	−0.256
	(0.107)	(0.080)	(0.206)	(0.174)
Population density	−0.074*	−0.105***	0.114	0.090*
	(0.037)	(0.033)	(0.092)	(0.052)
Green space area	0.043	−0.028	0.119	0.090
	(0.066)	(0.039)	(0.107)	(0.095)

TABLE B2 (Continued)

	(1) PM2.5 Q4	(2) PM2.5 October–March	(3) SO2 Q4	(4) SO2 October–March
Fiscal revenue per capita	−0.020	0.067	−0.097	−0.044
	(0.113)	(0.067)	(0.214)	(0.170)
Built-up area	0.005	−0.022	0.039	0.034
	(0.051)	(0.036)	(0.058)	(0.056)
Wind	−0.065	−0.048	−0.232**	−0.232**
	(0.082)	(0.056)	(0.116)	(0.093)
City FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Province FE × Year FE		Y		Y
N	382	382	382	382
R^2	0.708	0.718	0.890	0.925

Note: The sample includes 66 cities in Northern China between 2014 and 2019. Robust standard errors in parentheses are clustered at city level. All outcome variables are in logarithmic values. $PM_{2.5}$, SO_2, GDP per capita, fiscal revenue per capita, green space area, and built-up area are in logarithmic values. Constants are not reported.
$^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

APPENDIX C: EMPIRICAL RESULTS FOR INDIVIDUAL-LEVEL ANALYSIS

TABLE C1 Robustness check: environmental regulation and political trust using ordinal logistic model.

	Trust in local officials			Local government support		
	(1)	(2)	(3)	(4)	(5)	(6)
Clean heating renovation policy	−0.140***	−0.141***	−0.107***	−0.122***	−0.122***	−0.096**
	(0.037)	(0.038)	(0.040)	(0.042)	(0.043)	(0.045)
Age		0.016***	0.016***		0.012***	0.012***
		(0.001)	(0.001)		(0.001)	(0.001)
Female		0.128***	0.124***		0.033	0.034
		(0.026)	(0.026)		(0.027)	(0.027)
Urban		−0.215***	−0.214***		−0.066**	−0.064**
		(0.030)	(0.030)		(0.031)	(0.031)
Year of schooling		0.007**	0.008**		0.022***	0.024***
		(0.004)	(0.004)		(0.004)	(0.004)
Communist party membership		0.250***	0.246***		0.424***	0.425***
		(0.047)	(0.047)		(0.049)	(0.049)
GDP per capita			0.301**			0.124
			(0.145)			(0.168)
Population density			−0.023			0.044
			(0.069)			(0.074)
Green space area			−0.123			0.049
			(0.079)			(0.089)
Fiscal revenue per capita			0.055			0.408***
			(0.107)			(0.110)

(Continues)

TABLE C1 (Continued)

	Trust in local officials			Local government support		
	(1)	(2)	(3)	(4)	(5)	(6)
Built-up area			−0.054			−0.002
			(0.057)			(0.067)
Wind			0.127**			0.288***
			(0.063)			(0.068)
City FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	37359	36510	35815	36311	35482	34792
Pseudo-R^2	0.009	0.015	0.015	0.017	0.022	0.024

Note: The sample uses CFPS data in 2012, 2014, 2016, 2018, and 2020. The analysis adopts ordinal logistic model. Robust standard errors in parentheses are clustered at individual level. GDP per capita, fiscal revenue per capita, green space area, and built-up area are in logarithmic values. Constants are not reported.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

APPENDIX D: MECHANISM

D.1 | Area selection

The clean heating renovation policy was mainly implemented in rural areas in Northern China. Because of resource and time constraints, we select Linfen, a city in Shanxi province, to conduct our survey for several reasons.

First, Linfen is one of the most polluted cities in China, listed among the world's top 10 most polluted cities in 2012.[1] The average concentrations of sulfur dioxide in Linfen increased by 29.7% from 2015 to 2016.[2] Sulfur dioxide in the city even exceeded 1,000 micrograms per cubic meter for several days in January 2017. Coal is the largest source of air pollutants in this city, but coal and related industries constitute important parts of the local economy. The clean heating renovation policy could reduce coal consumption and exert considerable negative economic consequences. Local governments may be only minimally willing to implement the clean heating renovation policy.

Second, Linfen confronted considerable pressure from above to reduce air pollution. Because of the frequent high concentrations of sulfur dioxide, the mayor of Linfen was summoned by the Ministry of Environmental Protection. A wide range of national and social media reported and criticized the severe sulfur dioxide pollution in the city. Under intense pressure, the mayor of Linfen publicly claimed that the government would do everything possible to reduce emissions of sulfur dioxide and improve air quality at any cost or sacrifice.[3] Between 2016 and 2018, the directors of the local environmental protection agency was changed three times. Two of them were dismissed because of severe air pollution. In China's contexts, the punishment of local officials is a typical top-down hold-to-account practice to pressure local officials to follow mandates from above.

Third, great pressure from above motivates local officials to adopt environmental regulation to reduce air pollution. Linfen was selected as one of the national pilot cities for clean heating renovation policy in 2018.

Finally, the single-area study enhances internal validity. We surveyed respondents in the same city, allowing us to hold many institutional, geographic, and economic factors constant, reducing the concern of unit heterogeneity.

[1]Scientific American. 2012. "World's top 10 most polluted places," available at https://www.scientificamerican.com/article/body-worlds-top-10-most-polluted-places/
[2]China Daily. 2017. "Linfen mayor summoned over pollution," available at https://www.chinadaily.com.cn/china/2017-01/20/content_28006644.htm.
[3]Xinhua News Agency. 2017. "Mayor of Linfen: Improve air quality at any costs," available at https://www.xinhuanet.com//2017-01/16/c_1120323048.htm.

D.2 | Environmental regulation and trust in governments

TABLE D1 Environmental regulation and political trust

	Central government trust			Local government trust		
	(1)	(2)	(3)	(4)	(5)	(6)
Clean heating renovation policy	−0.232**	−0.189	−0.171	−0.496***	−0.482***	−0.465***
	(0.115)	(0.119)	(0.120)	(0.096)	(0.099)	(0.100)
Household income		0.030	0.027		0.002	0.002
		(0.024)	(0.024)		(0.017)	(0.017)
Age		0.030***	0.026***		0.004	0.002
		(0.005)	(0.005)		(0.004)	(0.004)
Gender		0.142	0.038		−0.171**	−0.245***
		(0.107)	(0.111)		(0.083)	(0.085)
Year of schooling		0.043**	0.021		0.061***	0.039**
		(0.021)	(0.021)		(0.016)	(0.016)
Agricultural work		0.173	0.148		0.295***	0.258**
		(0.119)	(0.122)		(0.100)	(0.101)
Party member			0.160			0.595***
			(0.214)			(0.134)
Participate village election			0.421***			0.481***
			(0.143)			(0.113)
Frequency of political news			−0.153***			−0.049*
			(0.033)			(0.026)
Traditional media			−0.133			−0.157*
			(0.114)			(0.085)
N	2658	2446	2422	2656	2444	2420
Pseudo-R^2	0.002	0.021	0.032	0.006	0.010	0.017

Note: The sample uses individual−level survey data conducted in 2019. The analysis adopts ordered logistic regression. Robust standard errors in parentheses are clustered at village level. Constants are not reported.

$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

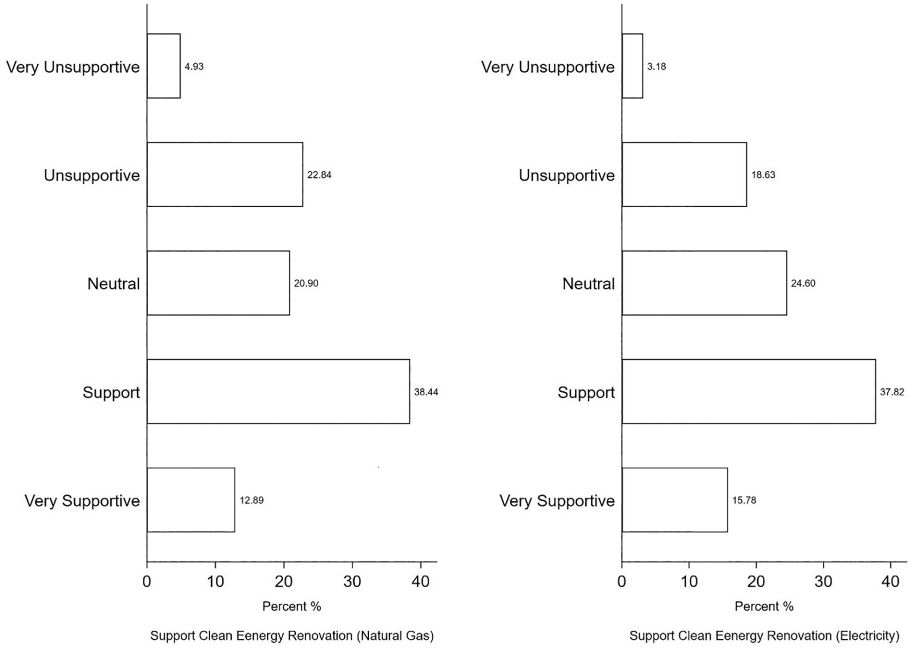

FIGURE D1 Support level of clean energy renovation policy.