

How does environmental pollution erode political trust in China? A multilevel analysis

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ABSTRACT

The impacts of environmental pollution extend beyond the issue of health. Using Chinese survey and administrative data, this study sheds new light on the political costs of environmental pollution. We show that citizens' trust in government officials declines significantly with higher levels of measured pollution, perceptions of increased pollution, and a greater degree of willingness to support environmental protection. Political trust is particularly low when measured as well as perceived pollution are severe. However, the effect of greater willingness to support environmental protection on the erosion of political trust is independent of measured pollution. Our findings suggest that there is a tipping point at which legitimacy acquired primarily through economic achievements could be undermined by environmental degradation, which is a byproduct of economic achievements. It is imperative for the Chinese government to achieve a balance between fast-paced growth and environmental sustainability, to pay attention to the potential political consequences of environmental issues, and to permit more public dialogues and deliberations on the topic of environmental governance.

1. Introduction

Since the onset of the Industrial Revolution, the issue of environmental pollution has been a major and abiding concern relating to human development (Hill, 2010). In light of its rapid industrialization and urbanization processes that began in the early 1980s, China has emerged as the largest emitter of industrial air pollutants (Vennemo et al., 2009) and the quality of the water in major rivers and lakes in the country is also deteriorating (Ebenstein, 2012; Wang et al., 2008). Therefore, it is imperative for China to address emerging environmental issues that could undermine what is acknowledged to be its economic miracle.²

Polluted air and water are known to cause irreparable damage to

people's physical health, cognitive abilities, and psychological well-being (Calderón-Garcidueñas et al., 2015; Chen et al., 2013). However, it is important to realize that the impacts of environmental pollution extend beyond the issue of health. Since the late 1960s, the environment has featured prominently on the political agenda of countries worldwide (Catter, 2018). The findings of recent studies suggest that China's deteriorating environment is undermining its economic achievements as well as the legitimacy of the ruling party (Gong et al., 2017; Alkon and Wang, 2018; Shi and Guo, 2019).³

This study provides further insights into the political costs of environmental pollution. Specifically, we investigated whether and how measured pollution, environmental perceptions, and pro-environmental values affect political trust in China. Accordingly, we performed a

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² Despite China's "iron fist" stand against pollution in recent years (Wong and Karplus, 2017; Hao et al., 2018; Chen et al., 2018; Cao et al., 2019; Ravetti et al., 2019), it ranks among the bottom one-third of assessed countries globally in terms of its Environmental Performance Index, which is well below the average of all of the assessed countries and of countries with comparable per capita incomes. See Table A1 in the appendix for more details.

³ Using data from the China Family Panel Study for 2012 and 2014, Gong et al. (2017) show that the occurrence of adverse environmental events leads to lower levels of trust in local officials and that this effect is mediated by environmental awareness. Through a daily survey in Beijing over a period of eight weeks, Alkon and Wang (2018) find that public satisfaction with both central and local governments declines with worsening air quality. Shi and Guo (2019) reveal that in China, the frequency of the appearance of "corruption" as a keyword in online searches increases on polluted days, indicating that the public has negative impressions of China's environmental administration.

multilevel analysis using survey data combined with prefectural-level statistics. We found that citizens' trust in government employees declined significantly with higher levels of measured pollution, perceptions of increased pollution, and a greater degree of willingness to support environmental protection. Political trust was found to be particularly low when measured as well as perceived pollution were severe. However, willingness to support environmental protection was found to be independent of measured pollution in affecting political trust. Our findings indicate that environmental pollution is politically costly in China.

This study, through its focus on the roles of measured pollution, environmental perceptions, and pro-environmental values, contributes to the rapidly expanding literature on the political costs of environmental pollution (Gong et al., 2017; Alkon and Wang, 2018; Shi and Guo, 2019). It also sheds new light on the debate over the origins of political trust. Institutional theory posits that political trust is endogenous to the political system's performance (Mishler and Rose, 1997, 2001). By contrast, the assumption within cultural theory is that political trust is determined by cultural characteristics that are broader and deeper than politics alone (Almond and Verba, 1963; Norris, 1999). Our findings accommodate both arguments, suggesting that these two seemingly opposed views may actually complement each other.

The remainder of this paper is organized as follows. In light of a review of the existing literature and a discussion of the Chinese institutional context, Section 2 presents a theoretical framework and the hypotheses of our study. Section 3 presents our data and methods, followed by a discussion of the results in Section 4. Section 5 offers concluding remarks.

2. Theoretical framework

2.1. Pollution, environmental perceptions, and political trust: an institutional perspective

Environmental degradation in China is closely linked with inappropriately assigned responsibilities and inconsistencies in the implementation of policies by central and local governments (Economy, 2007; Ran, 2013). A target-based system for assigning responsibilities and measuring performance is applied at all levels of the Chinese government to enable higher-level authorities to monitor the implementation of party-state policies by local officials (Gao, 2015). Because economic performance plays an important role in the promotion tournament, local officials tend to engage in excessive consumption of resources to stimulate a rise in the gross domestic product (GDP) despite incurring massive costs in terms of energy consumption and environmental pollution (Chen et al., 2005; Jia, 2017).

From an institutional perspective (Mishler and Rose, 1997, 2001), ineffective environmental administration may prompt the corrosion of political trust in the following ways. First, as the center delegates more power to local governments, the transaction costs of collusion between environmental regulators and polluting firms, such as coal miners, are lowered. Consequently, increased environmental destruction and more incidences of injuries and deaths occur (Jia and Nie, 2017), which generally lead to immediate losses of life and have enduring societal repercussions (Gong et al., 2017).

Second, local governments in China frequently seek to attract business investments by lowering environmental standards (Zhang and Fu, 2008). Citizens who oppose the entry of industrial polluters into their locations are likely to be skeptical of or even to protest against government officials and industrial policies (Hoffman and Sullivan, 2015; Hung, 2014).

Third, under the party-state system, the pace of progress toward the establishment of judicial independence has lagged behind that of socioeconomic development. Victims of environmental accidents still find it difficult to claim their rights and entitlements in cases of civil litigation and arbitration, especially when strong government-business

connections prevail (Clarke et al., 2008). Dissatisfaction with the outcomes of environmental lawsuits tends to influence citizens' acceptance of the government (Gong, 2004).

According to institutional theory, governance deficits associated with structural imbalances and inappropriate mechanisms relating to service delivery induce lower levels of trust in political institutions and in government officials (Norris, 2011). Applying this rationale, we posited the following pollution-deficit hypothesis (H1): *Ceteris paribus*, an increasing quantity of measured pollution corresponds to a lower level of political trust.

Moreover, institutional theory suggests that environmental perceptions and political trust are linked at the individual level. There is evidence that citizens living under conditions of severe pollution tend to pay more attention to and have a stronger demand for environmental protection (Gelissen, 2007). Given the deteriorating quality of their living environments and inadequate government attention to this issue, their perceptions of pollution are likely to induce political distrust.

Individuals' environmental perceptions may also be shaped by their participation in public debates on environmental issues. For example, heated debates about the environmental risks of para-xylene occurred following protests by residents of Xiamen (in Fujian Province), Zhenhai (in Zhejiang Province), and Maoming (in Guangdong Province) against the implementation of para-xylene projects in these areas in 2007, 2012, and 2014, respectively (Hung, 2014). As a result of such open discussions, there is growing recognition within the Chinese public that environmental pollution is not simply an economic or technical problem; it is an institutional and political phenomenon (Ran, 2013). In the face of real life-threatening pollution, citizens may also choose to piggyback on political agendas to voice their environmental grievances (Deng and Yang, 2013).

In light of our review of the literature on environmental politics and public perceptions, we proposed the perception-response hypothesis (H2): *Ceteris paribus*, a perception of increased pollution is associated with a reduction in political trust. In addition, we conjectured that the effect of environmental perceptions on political trust would be strengthened by the quantification of pollution. Consequently, we introduced the interaction hypothesis (H3): *Ceteris paribus*, increases in pollution, both measured and perceived, correspond to a reduction in political trust.

2.2. Pollution, pro-environmental values, and political trust: a cultural perspective

According to cultural theory, post-materialists are more likely to prioritize environmental protection over economic growth and thus more willing to support environmental protection than materialists (Abramson and Inglehart, 1995).⁴ In both developed and developing countries, pro-environmental values are found to be a crucial and dynamic component of shaping people's attitudes toward environmental protection (Inglehart, 1995). With continuous socioeconomic development, a self-expressive or self-emancipative political culture emerges and is shared within the public domain. Increasing affluence is also prompting an intergenerational shift from materialist to post-materialist values in some industrialized and post-industrialized countries (Inglehart, 1997; Inglehart and Welzel, 2005).

Materialists care primarily about their material gains from economic growth and political order, whereas post-materialists take their economic well-being as a given and express strong support for environmental protection. In the current context, post-materialist values are a

⁴ Post-materialists' willingness to support environmental protection is rooted mainly in pro-environmental values and not necessarily involved with practical actions against pollution. Compared to general post-materialists, environmentalists are more committed to pro-environmental values and most likely to take actions such as citizen participation in environmental policy formation.

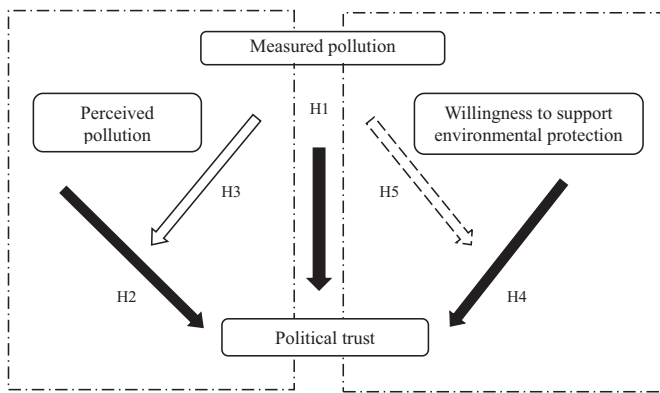


Fig. 1. Environmental pollution and political trust: A theoretical framework. Notes: H1–H5 are five hypotheses to be tested. Based on institutional theory, H1–H3 concern an external mechanism by which pollution and perceptions of it have both direct and interactive effects on political trust. Based on cultural theory, H4 and H5 concern an internal mechanism that willingness to support environmental protection has the effect of reducing political trust and this effect is not moderated by measured pollution.

significant cause of growing environmental concerns, especially in developed countries (Franzen and Meyer, 2010). Troubled by increasing environmental degradation, post-materialists willing to save the environment are more likely than materialists to express their distrust of political institutions and government officials (Norris, 2011).

There is evidence that the rise of liberal democratic and post-materialist values has led to a decline in political trust among Chinese citizens and among Internet users in particular (Lei, 2011). Another research finding is that in China, environmentalists are more skeptical of the government than non-environmentalists (Yao, 2008). Thus, we introduced the value-evaluation hypothesis (H4): *Ceteris paribus*, greater willingness to support environmental protection corresponds to declining political trust.

A particular focus of this study was to determine whether pro-environmental values interact with existing pollution. Willingness to support environmental protection, which reflects pro-environmental values, may be shaped over time by cultural factors, such as formative security within the family of origin, socialization, and schooling (Inglehart, 1995; Gelissen, 2007; Marks, 1997). Once formed, pro-environmental values are likely to have an enduring effect on an individual's orientation toward political issues and trust in state institutions (Inglehart, 1997; Fairbrother, 2019; Geys et al., 2020). It has been suggested that individuals' opinions on environmental protection are more likely to be affected by cultural factors and are less likely to be determined by actual pollution (Geys et al., 2020).

These findings would suggest that compared with materialists, post-materialists tend to be less tolerant of pollution and more supportive of protection, irrespective of the actual environmental quality. Accordingly, we formulated our final independence hypothesis (H5) as follows: *Ceteris paribus*, the effect of greater willingness to support environmental protection on the erosion of political trust is independent of measured pollution.

Fig. 1 presents a summary of our research hypotheses that depicts the underlying external and internal mechanisms. On the one hand, external pollution and perceptions of it have both direct and interactive effects on political trust (H1–H3). On the other hand, internal support for environmental protection has the effect of reducing political trust and this effect is not moderated by measured pollution (H4 and H5). The five hypotheses presented above and the two mechanisms through which environmental pollution undermines political trust were formally tested using the data and methods described in the next section.

3. Data and methods

The *Chinese Social Survey* (CSS) is a nationally representative survey of Chinese citizens, covering a variety of topics, such as labor and employment, family and social life, and societal attitudes. Commencing from 2005, the Chinese Academy of Social Sciences has implemented this survey approximately every two years. The 2013 CSS, in particular, included several questions for assessing environmental perceptions and attitudes among the general public in contemporary China.

We pooled together data from the 2013 CSS and the *China Urban Statistical Yearbook* published in 2013 to construct a dataset covering individual-level attributes and environmental and socioeconomic conditions at the prefectural level.⁵

3.1. Dependent variables

In the 2013 CSS, a four-point scale was used to measure degrees of citizens' trust in four categories of government employees: the police, judges, party-state cadres, and party-state staff. The four points in the measuring scale, ranging from low to high, corresponded to "complete distrust," "distrust," "trust," and "complete trust." We measured political trust, our main dependent variable, by averaging the ratings obtained for the four categories.⁶ We also simultaneously assessed citizens' trust in each group to verify the robustness of our findings in relation to the choice of the dependent variable.

3.2. Key independent variables

The 2013 CSS also applied a four-point scale to measure perceptions of pollution, which was a key independent variable in our analysis. The degree of air and water pollution perceived by the respondents was assessed on the basis of their answers to the question of whether pollution was "non-existent," "not severe," "severe," or "very severe".

Willingness to support environmental protection, another key independent variable in this study, was determined on the basis of the responses to the following statements: "Considering the nation as a whole, do you agree with the following statements based on your daily life experiences? (1) Economic development is more important than environmental protection to China. (2) I will oppose the building of a chemical factory in my neighborhood." The 2013 CSS applied a four-point scale with the following options for responding to the above statements: "completely agree", "agree", "disagree", and "completely disagree". Respondents who strongly supported environmental protection chose "disagree" or "completely disagree" in response to the first statement, whereas those who chose the same responses for the second statement did not demonstrate pro-environmental values. We recoded the responses to the second statement so that higher scores corresponded

⁵ There are four levels of subnational governments in mainland China, namely provincial, prefectural, county, and township. Because of the nature of air and water pollutants, which are dispersive, as well as a lack of county-level data on environmental pollution, we selected the prefectural level as the scale for our analysis. If two counties within a prefecture were included in the sample, they were considered to share the same prefectural-level data. We obtained the natural logarithms for these data prior to conducting our analysis.

⁶ Political trust may be diffuse (e.g., trust in systems) or specific (e.g., trust in institutions or officials) (Easton, 1979; Norris, 2011). Diffuse and specific forms of political trust are strongly correlated (Wang, 2005; Wang and You, 2016). The CSS did not include any explicit questions on political trust in Chinese central or local governments. However, because the police, judges, party-state cadres, and party-state staff are involved in environmental administration, these four categories of government employees can be considered broadly representative of China's environmental administration (Deng and Yang, 2013; Steinhardt and Wu, 2016; van Rooij, 2010; Zhang and Fu, 2008). Thus, we deemed that political trust in China was adequately represented by citizens' trust in government employees.

Table 1
Summary statistics.

Variable	Obs.	Mean	SD	Min.	Max.
Individual level					
Political trust	6551	2.713	0.675	1	4
Trust in the police	8194	2.848	0.761	1	4
Trust in judges	7093	2.798	0.755	1	4
Trust in party-state cadres	7972	2.618	0.786	1	4
Trust in party-state staff	7882	2.601	0.753	1	4
Perceived air pollution	9316	2.065	0.947	1	4
Perceived water pollution	9222	2.010	0.939	1	4
Willingness to support environmental protection	8415	2.308	0.494	1	4
Age	9379	45.878	13.647	18	72
Male	9379	0.445	0.497	0	1
Urban residency	9378	0.296	0.457	0	1
CPC membership	9369	0.098	0.298	0	1
Years of education	9369	14.244	5.591	0	19
ln(Yearly income)	8991	8.402	3.001	0	14.613
Interpersonal trust	6379	2.487	0.690	1	4
Internal efficacy	8680	1.983	0.754	1	4
External efficacy	8742	2.625	0.794	1	4
Prefectural level					
ln(Industrial SO ₂ emissions)	103	10.734	0.906	7.494	13.111
ln(Industrial dust emissions)	103	10.010	0.923	7.115	12.239
ln(Industrial wastewater discharges)	103	8.808	0.923	6.116	11.111
ln(GDP per capita)	103	10.161	0.698	9.219	12.579
ln(Population density)	103	6.012	0.711	3.348	7.869

to a stronger pro-environmental attitude. We subsequently obtained the average of the total scores for the two statements to measure the respondents' willingness to support environmental protection.

As additional independent variables of interest, prefectural-level industrial SO₂ emissions, dust emissions, and wastewater discharges in the form of the natural logarithm were used to measure environmental pollution.⁷ Industrial SO₂ and dust emissions are the main sources of air pollution, whereas industrial wastewater discharges are largely responsible for water pollution in China. The Chinese government has published data on these three pollutants over several decades to keep track of industrial pollution. These indicators are also commonly used in studies on Chinese environmental issues (Shi and Guo, 2019; Vennemo et al., 2009; Zheng and Kahn, 2013).

3.3. Control variables

Control variables at the individual level included age, sex, urban residency, as defined on the basis of the Chinese household registration system, membership of the Communist Party of China (CPC), years of education, annual income in the form of the natural logarithm, interpersonal trust, and the respondents' internal and external efficacy relating to their environmental knowledge and willingness to engage in environmental protection (Finkel, 1985; Kenski and Stroud, 2006). In addition to the.

prefectural-level GDP per capita and population density in the form of the natural logarithm, we applied dummy variables to control for differences across provincial-level divisions.

The degrees of internal and external efficacy were revealed by the options selected by respondents in relation to the following statements: (1) "I neither know of any environmental issues nor can I comment on them" and (2) "I have my own opinion about environmental protection, but the government will not listen to me." The options provided were "completely agree", "agree", "disagree", and "completely disagree". The existing literature suggests that higher internal efficacy scores are

associated with greater confidence relating to environmental knowledge, a greater ability to influence environmental policies, or a stronger tendency to get involved with environmental protection, privately or publicly. Thus, individuals with high internal efficacy scores are also likely to demonstrate high levels of political distrust (Hu, 2016). Conversely, citizens with higher external efficacy scores tend to hold the view that the government is responsive to environmental concerns and thus have higher levels of political trust (Catterberg, 2006; Craig et al., 1990).

Table 1 presents a summary of the descriptive statistics for the above-described variables.

3.4. Empirical strategy

Our preliminary analysis revealed a strong and negative correlation between environmental pollution and political trust.⁸ It should be noted that environmental pollution and political trust were measured at the prefectural and individual levels, respectively. If individual political trust formed clusters at the prefectural level, ordinary least squares (OLS) would produce inaccurate standard errors for significance testing. While we added perceived pollution, willingness to support environmental protection, and control variables to the regression, we also applied multilevel analysis to address prefectural effects on individuals' political trust.

We also performed three robustness tests. First, listwise deletion was conducted to remove observations with missing values, which can lead to less efficient or even biased estimates (King et al., 2001). To address this potential problem, we performed multiple imputations for missing values of key variables such as political trust, perceived water pollution, and willingness to support environmental protection. Second, to reduce potential bias arising from self-selection, we conducted entropy balancing (Hainmueller, 2012) to weight the original data and revisited the four research hypotheses. Third, we ran seemingly unrelated regressions (Zellner, 1962) on respondents' trust in the four categories of government employees to assess whether the results were sensitive in relation to the choice of indicators of political trust.

4. Results

4.1. Main findings

Prior to conducting a formal analysis, we applied a two-level null model to determine whether clusters of individual political trust existed at the prefectural level. As revealed in Column 1 of Table 2, the value of the intraclass correlation coefficient (ICC) in the null model was large (0.165) and thus multilevel modeling was deemed necessary.⁹

Columns 2–10 of Table 2 show the results of the formal multilevel analysis. We found that industrial SO₂ emissions and wastewater discharges had statistically significant negative effects on political trust (see Columns 2 and 4 of Table 2), whereas the impact of industrial dust emissions was weak (see Column 3 of Table 2). In general, the motion of SO₂ and wastewater is more diffusive than that of dust particles and the former are more difficult to contain. Compared with industrial SO₂,

⁸ Figure A1 in the appendix depicts the correlation between environmental pollution and political trust.

⁹ The ICC is the variance in the outcome variable explained by higher-level clustering effects as a percentage of all variance explained by random effects. An ICC with a value close to 0 suggests that the outcome variable at a lower level is likely to be independent of the clustering variable at a higher level. As a rule of thumb, multilevel modeling is appropriate when an ICC has a value greater than 0.06.

⁷ The mean values of variables for measured pollution were used to enable subsequent measures of interaction effects (Hayes, 2018).

Table 2
Environmental pollution and political trust: Main findings.

Political trust	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Perceived air pollution		−0.034*** (−3.18)	−0.034*** (−3.19)	−0.034*** (−3.17)	−0.038*** (−3.50)	−0.034*** (−3.14)	−0.033*** (−3.06)	−0.034*** (−3.11)	−0.034*** (−3.12)	−0.034*** (−3.10)
Perceived water pollution		−0.076*** (−8.27)	−0.077*** (−8.30)	−0.077*** (−8.36)	−0.060*** (−5.72)	−0.060*** (−5.71)	−0.063*** (−5.66)	−0.060*** (−5.70)	−0.060*** (−5.71)	−0.061*** (−5.78)
Willingness to support environmental protection		−0.073*** (−5.09)	−0.073*** (−5.09)	−0.071*** (−4.93)	−0.061*** (−4.25)	−0.060*** (−4.20)	−0.059*** (−4.13)	−0.058*** (−3.80)	−0.058*** (−3.88)	−0.060*** (−4.14)
ln(Industrial SO ₂ emissions)		−0.039** (−2.63)			−0.024 (−1.26)			−0.024* (−1.81)		
ln(Industrial dust emissions)			−0.008 (−0.47)			−0.015 (−0.34)			−0.017 (−0.49)	
ln(Industrial wastewater discharges)				−0.012** (−2.35)			−0.014 (−1.23)			−0.014 (−1.24)
Perceived air pollution × ln(Industrial SO ₂ emissions)					−0.033*** (−3.26)					
Perceived air pollution × ln(Industrial dust emissions)						−0.028*** (−2.92)				
Perceived water pollution × ln(Industrial wastewater discharges)							−0.017** (−2.32)			
Willingness to support environmental protection × ln(Industrial SO ₂ emissions)								0.006 (0.34)		
Willingness to support environmental protection × ln(Industrial dust emissions)									0.012 (0.77)	
Willingness to support environmental protection × ln(Industrial wastewater discharges)										−0.005 (−0.38)
Age		0.004*** (6.15)	0.004*** (6.14)	0.004*** (6.16)	0.004*** (6.15)	0.004*** (6.11)	0.004*** (6.10)	0.004*** (6.11)	0.004*** (6.11)	0.004*** (6.13)
Male		−0.087*** (−5.05)	−0.087*** (−5.05)	−0.087*** (−5.05)	−0.086*** (−5.04)	−0.087*** (−5.05)	−0.087*** (−5.08)	−0.088*** (−5.16)	−0.088*** (−5.14)	−0.088*** (−5.13)
Urban residency		−0.096*** (−5.04)	−0.096*** (−5.03)	−0.093*** (−4.86)	−0.084*** (−4.36)	−0.084*** (−4.36)	−0.083*** (−4.31)	−0.084*** (−4.36)	−0.084*** (−4.36)	−0.081*** (−4.21)
CPC membership		0.110*** (4.17)	0.110*** (4.17)	0.111*** (4.19)	0.109*** (4.15)	0.108*** (4.12)	0.110*** (4.16)	0.110*** (4.19)	0.109*** (4.17)	0.110*** (4.19)
Years of education		0.000 (0.06)	0.000 (0.06)	0.000 (0.10)	0.000 (0.10)	0.000 (0.10)	0.000 (0.07)	0.000 (0.19)	0.000 (0.20)	0.000 (0.16)
ln(Yearly income)		0.000 (0.14)	0.000 (0.14)	0.001 (0.28)	0.000 (0.12)	0.000 (0.08)	0.001 (0.28)	0.000 (0.13)	0.000 (0.14)	0.001 (0.28)
Interpersonal trust		0.421*** (34.10)	0.421*** (34.10)	0.420*** (33.89)	0.419*** (33.92)	0.419*** (33.93)	0.418*** (33.76)	0.420*** (33.93)	0.419*** (33.92)	0.417*** (33.67)
Internal efficacy		−0.062*** (−5.41)	−0.061*** (−5.40)	−0.059*** (−5.13)	−0.063*** (−5.50)	−0.062*** (−5.45)	−0.059*** (−5.14)	−0.061*** (−5.38)	−0.061*** (−5.40)	−0.059*** (−5.16)
External efficacy		0.002 (0.17)	0.002 (0.17)	0.002 (0.15)	0.001 (0.06)	0.001 (0.08)	0.001 (0.11)	0.001 (0.13)	0.002 (0.14)	0.002 (0.15)
ln(GDP per capita)		−0.038* (−1.86)	−0.038* (−1.79)	−0.052** (−2.53)	−0.031 (−1.43)	−0.034 (−1.61)	−0.046** (−2.24)	−0.034 (−1.60)	−0.033 (−1.63)	−0.047** (−2.29)
ln(Population density)		−0.004 (−0.22)	−0.001 (−0.08)	0.001 (0.05)	−0.002 (−0.10)	−0.004 (−0.22)	0.003 (0.17)	−0.001 (−0.08)	−0.003 (−0.18)	0.002 (0.10)
Provincial dummies	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant term	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations	6551	4739	4739	4706	4739	4739	4706	4739	4739	4706
Intraclass correlation coefficient	0.165	0.120	0.128	0.138	0.116	0.119	0.128	0.120	0.116	0.130
Wald statistic		1701.00	1700.1	1678.6	1685.9	1682.17	1633.75	1655.03	1656.64	1653.5

Notes: (a) *t* statistics are given in parentheses. (b) *, **, and *** correspond to statistical significance at 10%, 5%, and 1% levels, respectively.

industrial dust is monitored more closely to achieve better compliance with emission limits in China.¹⁰ The above considerations shed some light on the reasons why industrial dust emissions alone did not result in significant political distrust. Overall, our results supported the pollution-

deficit hypothesis (H1).

Another finding of our study was that when citizens perceived the situation regarding either air or water pollution to be grave, they expressed greater political distrust (see Columns 2–4 of Table 2). This finding is consistent with the perception–response hypothesis (H2). Environmental perceptions may be formed on the basis of individuals' daily observations. At the same time, factors such as media coverage of environmental risks, participation in discussions on environmental issues, and social protests to support environmental protection contribute to raising public concern about the environment. If the government fails to alleviate the grave issue of pollution, citizens, in turn, are likely to develop political distrust.

¹⁰ According to the *China Statistical Yearbook on the Environment*, since 2004, the level and intensity of industrial dust emissions have remained consistently lower than those of industrial SO₂ emissions. Crane and Mao (2015) attribute the sharp reduction in dust emissions to local governments' initiatives "mandating covers for dump trucks and watering down construction sites and streets (Page 8)."

A further finding was that citizens with lower levels of political trust were likely to be those in favor of environmental protection (see Columns 2–4 of Table 2), thus confirming the value–evaluation hypothesis (H4). As revealed in the existing literature, individuals whose support for environmental protection is rooted in post-materialist values tend to be more critical of environmental issues and of the government's performance in this regard and are therefore more likely to demonstrate political distrust.¹¹

The results shown in Columns 5–7 of Table 2 suggest that measured pollution shaped perceptions of pollution and ultimately eroded political trust. Fig. 2 further illustrates the marginal effect of pollutants released on political trust when perceived pollution was held constant. Thanks to faster and more frequent information sharing in the Internet era, pollution is now more clearly apparent (You and Wang, 2020; Zhong and Hwang, 2016). Given the deteriorating quality of the living environment and inadequate green infrastructure to address this issue, perceived pollution among citizens is likely to fuel political distrust. Our findings are thus in line with the interaction hypothesis (H3).

The results shown in Columns 8–10 of Table 2 suggest that the abatement of political trust as an effect of individuals' willingness to support environmental protection was largely driven by post-materialist values and was not moderated by the volume of pollutants actually released, which supports the independence hypothesis (H5). With continuing economic growth, citizens' demands for improved environmental quality and the prioritization of a cleaner environment are expected to increase. If the government ignores the rising political costs of environmental deterioration, sooner or later its legitimacy, established through economic growth, will be undermined.

The results relating to the control variables are consistent with those of previous studies (e.g., Li, 2004; Yang and Tang, 2010). Specifically, older women in rural areas and CPC members demonstrated higher levels of political trust, interpersonal trust “overflowed” into political trust, and citizens with lower efficacy of environmental protection expressed lower levels of political trust.

4.2. Robustness tests

To compensate for lost observations resulting from the listwise deletion of missing values, we performed multiple imputation by chained equations with 25 imputations.¹² As shown in Table 3, the number of observations rose from over 4700 to approximately 8900. The estimates shown in Table 3 remained robust and supported all of the hypotheses established and depicted in Table 2.

There could be uncontrolled factors that affect individuals' perceptions of pollution or their willingness to support environmental protection, such as participation in environmental movements. In this case, our estimates would have entailed self-selection bias. Therefore, we recoded perceived air and water pollution and willingness to support environmental protection into binary variables and weighed the dataset using the entropy balancing method. As shown in Table 4, the results obtained after performing entropy balancing confirmed the perception–response, interaction, independence, and value–evaluation hypotheses (H2–H5).

In the preceding analysis, we applied a composite measure of political trust based on the aggregation of four categories of government employees. In the final robustness test, we ran seemingly unrelated regressions on the four categories using individual covariates and

prefectural dummies. Consistent with our main findings, the results shown in Table 5 indicate that trust in the police, judges, party-state cadres, and party-state staff declined with an increase in perceived pollution and with greater willingness to support environmental protection.

5. Concluding remarks

Considerable scholarly attention has focused on the direct or indirect consequences of China's rapid economic growth (e.g., Chen and Fleisher, 1996; Sun et al., 2019; Zheng and Kahn, 2013). Environmental pollution caused by industrial emissions and discharges is a byproduct of China's economic miracle that has indirect consequences beyond damaging human health, including reduced political trust, as revealed by this study.

We tested five hypotheses and found evidence to support them. First, we found that pollution reflected structural imbalances in environmental administration and undermined political trust, thus confirming the pollution-deficit hypothesis (H1). Second, our finding that stronger perceptions of pollution aggravated citizens' discontent with government employees confirmed the perception–response hypothesis (H2). Third, the negative effect of environmental perceptions on political trust was intensified by measured pollution, confirming the interaction hypothesis (H3). Thus, the external mechanism by which environmental pollution undermines political trust was elucidated through the testing and validation of these three hypotheses.

We also found that the internal mechanism whereby political trust is eroded entailed critical evaluations of government employees by citizens who were more willing to support environmental protection, thus confirming the value–evaluation hypothesis (H4). The further finding that their political trust was not likely to be moderated by external changes in the environment within a short period of time confirmed the independence hypothesis (H5).

Despite China's economic success, deteriorating environmental quality that has accompanied the process of economic growth is undermining the legitimacy of its authoritarian regime. The findings of this study suggest that there is a tipping point at which legitimacy acquired primarily through economic achievements could be undermined by environmental degradation, which is a byproduct of economic achievements. This effect could occur as a result of the external mechanism associated with direct measures or perceptions of pollution. As living standards continue to improve, citizens' increasing demands for improved environmental quality will take precedence over extensive economic growth, constituting the internal mechanism behind the erosion of political trust.

A policy implication of these findings is that there is an urgent need for China to transform its economic growth model from one that is extensive to one that is intensive and to achieve a balance between fast-paced growth and environmental sustainability. In addition, public opinions and attitudes can serve as a “soft” indicator that is both meaningful and feasible in environmental impact assessments. Therefore, policy makers in China should not ignore or overlook the potential political consequences of environmental issues; rather, these consequences should be addressed in advance. Furthermore, to accommodate the positions of more pro-environmental citizens and to ensure their political support, the Chinese government should permit more public dialogues and deliberations on the topic of environmental governance. As our findings suggest, simply reducing pollutant emissions does not guarantee satisfaction with the government among environmental activists.

Declaration of Competing Interest

None.

¹¹ The use of individual-level OLS regressions with prefectural dummies revealed the same effects of environmental perceptions and pro-environmental values on political trust (see Table A2 in the appendix).

¹² Multiple imputation by chained equations does not require the assumption of multivariate normality. Given the nature of the variable to be the imputed, a linear, logit, or ordered logit regression may be applied. See Schafer (1997) for a detailed discussion on multiple imputation.

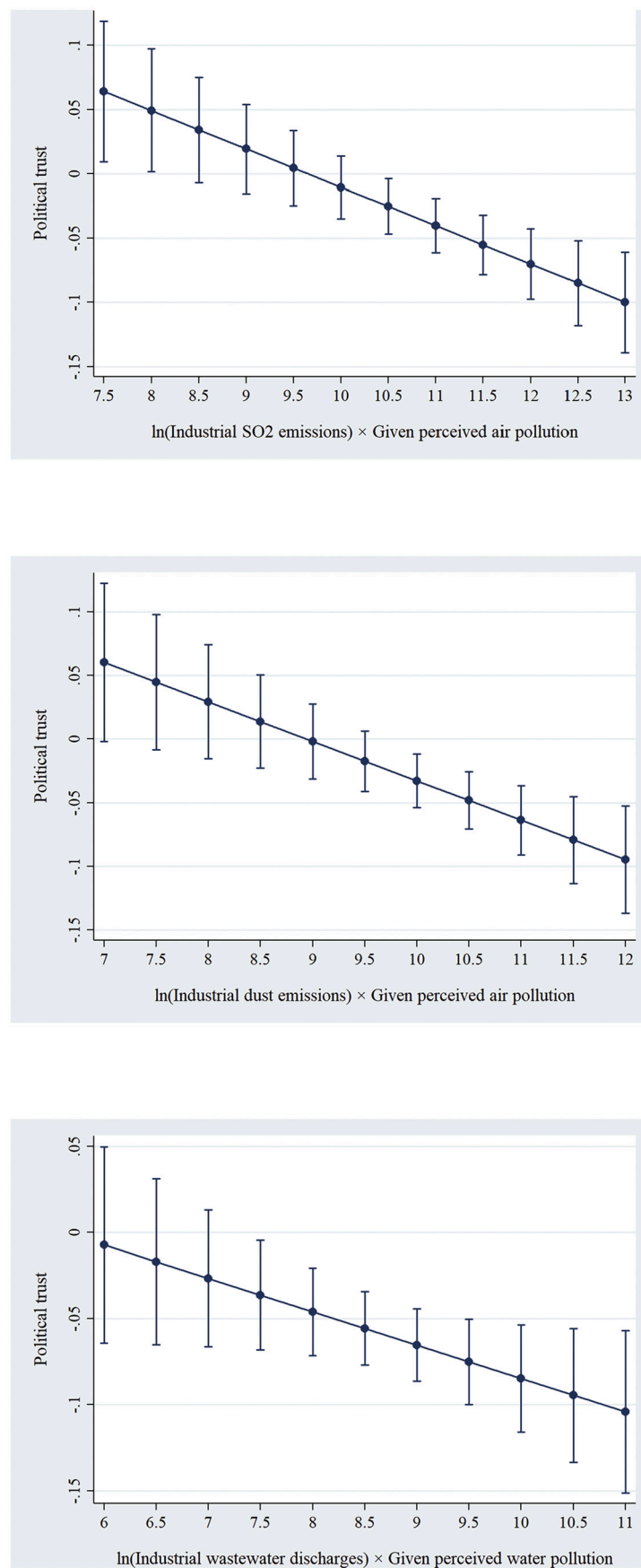


Fig. 2. The marginal effect of measured pollution on political trust with perceived pollution held constant.

Notes: (a) Plots are based on the results in Columns 5–7 of Table 2. (b) Capped spikes indicate 95% confidence intervals.

Table 3
Environmental pollution and political trust: A robustness test using multiple imputation.

Political trust	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Perceived air pollution	−0.054*** (−6.76)	−0.054*** (−6.78)	−0.054*** (−6.76)	−0.054*** (−6.75)	−0.054*** (−6.77)	−0.058*** (−6.67)	−0.054*** (−6.73)	−0.054*** (−6.78)	−0.054*** (−6.79)
Perceived water pollution	−0.054*** (−6.62)	−0.056*** (−6.63)	−0.055*** (−6.70)	−0.056*** (−6.83)	−0.054*** (−6.60)	−0.054*** (−6.53)	−0.055*** (−6.62)	−0.055*** (−6.65)	−0.054*** (−6.58)
Willingness to support environmental protection	−0.064*** (−5.98)	−0.065*** (−6.00)	−0.065*** (−6.01)	−0.065*** (−6.03)	−0.065*** (−5.99)	−0.064*** (−5.90)	−0.064*** (−5.81)	−0.065*** (−5.98)	−0.064*** (−5.84)
ln(Industrial SO2 emissions)	−0.049** (−2.50)			0.033 (1.49)			−0.041** (−2.26)		
ln(Industrial dust emissions)		−0.020 (−1.28)			0.023 (1.23)			0.043 (0.96)	
ln(Industrial wastewater discharges)			−0.030** (−1.99)			0.041 (1.40)			0.035 (0.72)
Perceived air pollution × ln(Industrial SO2 emissions)				−0.033*** (−3.36)					
Perceived air pollution × ln(Industrial dust emissions)					−0.023*** (−3.04)				
Perceived water pollution × ln(Industrial wastewater discharges)						−0.019** (−1.99)			
Willingness to support environmental protection × ln(Industrial SO2 emissions)							0.011 (1.03)		
Willingness to support environmental protection × ln(Industrial dust emissions)								0.008 (0.78)	
Willingness to support environmental protection × ln(Industrial wastewater discharges)									−0.002 (−0.19)
Individual controls	Included	Included	Included	Included	Included	Included	Included	Included	Included
Prefectural controls	Included	Included	Included	Included	Included	Included	Included	Included	Included
Provincial dummies	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant term	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations	8973	8973	8900	8973	8973	8900	8973	8973	8900
Intraclass correlation coefficient	0.118	0.116	0.111	0.123	0.128	0.101	0.131	0.132	0.127
Wald statistic	2099.23	2103.58	2109.66	2118.53	2100.61	2030.65	2109.29	2091.61	2066.99

Notes: (a) *t* statistics are given in parentheses. (b) *, **, and *** correspond to statistical significance at 10%, 5%, and 1% levels, respectively.

Table 4
Environmental pollution and political trust: A robustness test using entropy balancing.

Political trust	(1)	(2)	(3)	(4)	(5)	(6)
Perceived air pollution	−0.067*** (−3.25)	−0.069*** (−3.60)	−0.067*** (−4.91)	−0.070*** (−4.55)	−0.070*** (−4.58)	−0.070*** (−4.53)
Perceived water pollution	−0.025** (−2.29)	−0.030** (−2.55)	−0.030** (−2.17)	−0.023** (−2.37)	−0.023** (−2.39)	−0.023** (−2.37)
Willingness to support environmental protection	−0.057** (−1.97)	−0.043 (−1.58)	−0.043** (−2.05)	−0.041** (−2.07)	−0.041** (−2.03)	−0.047** (−2.26)
ln(Industrial SO2 emissions)	0.017 (1.45)			−0.026** (−2.01)		
ln(Industrial dust emissions)		−0.038 (−1.06)			−0.014 (−0.84)	
ln(Industrial wastewater discharges)			0.007 (−0.33)			−0.003 (−0.16)
Perceived air pollution × ln(Industrial SO2 emissions)	−0.057*** (−3.37)					
Perceived air pollution × ln(Industrial dust emissions)		−0.068*** (−2.87)				
Perceived water pollution × ln(Industrial wastewater discharges)			−0.012** (−2.34)			
Willingness to support environmental protection × ln(Industrial SO2 emissions)				0.004 (0.17)		
Willingness to support environmental protection × ln(Industrial dust emissions)					0.014 (0.58)	
Willingness to support environmental protection × ln(Industrial wastewater discharges)						−0.028 (−1.17)
Individual controls	Included	Included	Included	Included	Included	Included
Prefectural controls	Included	Included	Included	Included	Included	Included
Provincial dummies	Included	Included	Included	Included	Included	Included
Constant term	Included	Included	Included	Included	Included	Included
Observations	4776	4776	4719	4795	4795	4762

Notes: (a) *t* statistics are given in parentheses. (b) *, **, and *** correspond to statistical significance at 10%, 5%, and 1% levels, respectively.

Table 5

Environmental pollution and political trust: A robustness test using four categories of government employees.

	(1)	(2)	(3)	(4)
	Trust in the police	Trust in judges	Trust in party-state cadres	Trust in party-state staff
Perceived air pollution	−0.061*** (−5.34)	−0.069*** (−6.13)	−0.071*** (−6.23)	−0.051*** (−4.69)
Perceived water pollution	−0.044*** (−3.86)	−0.031*** (−2.73)	−0.040*** (−3.52)	−0.049*** (−4.46)
Willingness to support environmental protection	−0.074*** (−4.74)	−0.061*** (−4.05)	−0.087*** (−5.69)	−0.085*** (−5.82)
Individual controls	Included	Included	Included	Included
Prefectural dummies	Included	Included	Included	Included
Constant term	Included	Included	Included	Included
Observations	8973	8973	8973	8973

Notes: (a) *t* statistics are given in parentheses. (b) *, **, and *** correspond to statistical significance at 10%, 5%, and 1% levels, respectively. (c) Breusch-Pagan test of independence: $\chi^2(6) = 10,996.545$, $p < 0.01$.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.eiar.2021.106553>.

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