DOES CLEAN HEATING IMPROVE AIR QUALITY? EVIDENCE FROM CHINESE CITIES

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Overview

Air pollution in China brings economic and health issues across the country. The coal-based heating supply in China leads to substantial increase in pollution concentrations and pollution days in winter. To improve the air quality, Ministry of Ecology and Environment of China proposed to implement clean heating in "2+26" pilot cities of Beijing-Tianjin-Hebei by replacing coal by electricity or gas in 2016. The central government provides financial subsidies of different amounts for 12 cities in 2017. At present, its implementation is still under the experimental stage, but it is possible and necessary to evaluate the effects of clean heating. In this paper, we evaluate the impact of clean heating and its financial subsidies on air quality by difference-in-difference method and also analyzed the role of clean coal consumption or gas consumption on the air pollutants reduction.

The paper is organised as follows: Besides the introduction part, section 2 is about difference-in-difference methodology where we presented the data and sample selection, and also tested the hypotheses used for DiD. Then we employed DiD method to evaluate the effect of clean heating on air pollutants and pollution days in Chinese cities, analyzed the role of financial subsidies mechanism and discussed the effective of replacing coal by gas in Section 3. In the final section, conclusions and relevant policy implications are outlined.

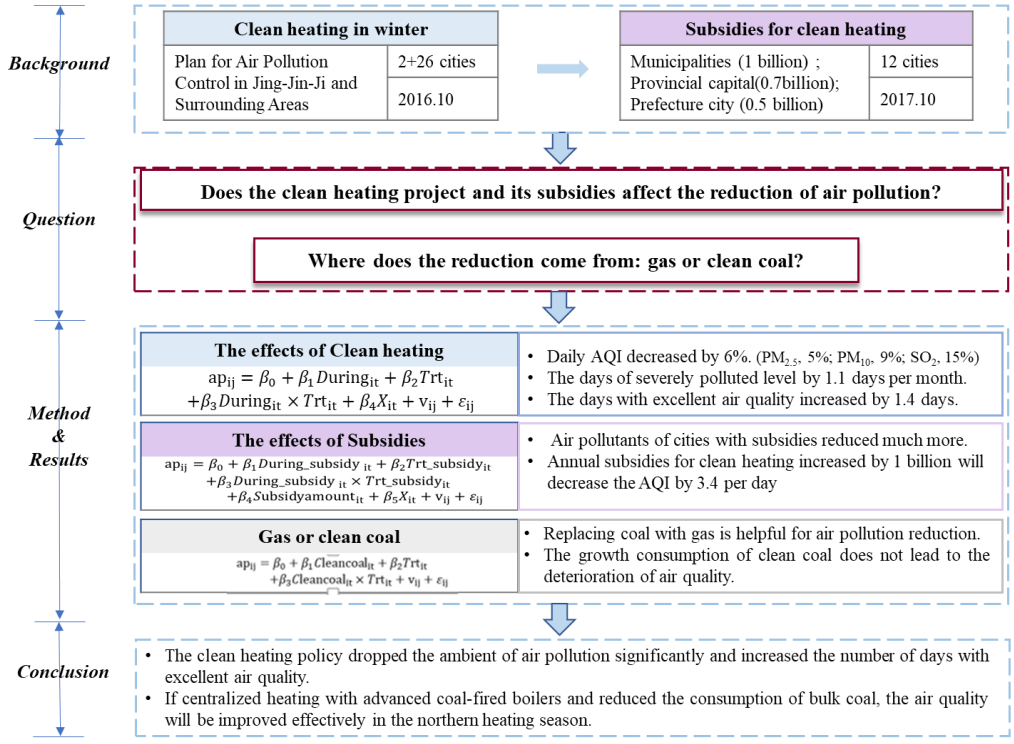

Figure 1 Research Design and Main Content

Methods

To examine whether the clean heating policy is helpful for improving air quality, we compare the effects of "2+26" cities and that of control group from November 2014 to March 2018 with two city-level linear difference-in-differences models. The model is

$$ap_{ij} = \beta_0 + \beta_1 During_{ij} + \beta_2 Trt_i + \beta_3 During_{ij} \times Trt_i + \beta_4 X_{ij} + v_{ij} + \varepsilon_{ij}$$

where ap_{ij} is the dependent variable associated with city i's air pollution at date j. We use five different dependent variables in our analysis: the air quality index, the concentrations of $PM_{2.5}$, PM_{10}, SO_2, NO_2. Independent dummy variables $During_{ij}$ indicate whether date j is during the period of clean heating. Trt_i is another dummy variable and has a value of 1 if city i belongs to "2+26" cities in the treatment group and 0 if city is in the control group. β_3 is the coefficients for the interaction terms measure the clean heating treatment effects after the changing from coal to gas or to electricity. We collect the weather characteristics and social and economic factors in X_{ij} as controls. v_i reflects the individual fixed effects to flexibly control for city heterogeneity. ε_{ij} is the random error term.

Results

First, the clean heating dropped the air pollution of "2+26" cities significantly. The daily air quality index decreased by 6.1%. Besides, there is significant decline in the days of severely polluted level by 1.131 days per month. The number of days with excellent air quality increased by 1.376 days per month.

Second, the results show that the air pollutants of cities with subsidies reduced much more than that of cities without subsidies. For example, the clean heating and subsidies dropped the $PM_{2.5}$ by 19.2 $\mu g/m^3$, while the effects of clean heating was only 5.12$\mu g/m^3$. Moreover, we also found that the annual subsidies for clean heating increased by 1 billion will decrease the AQI, $PM_{2.5}$, PM_{10}, SO_2 by 3.35, 2.49$\mu g/m^3$, 11.48μg/m3 and 6.03mg/m^3 per day.

Third, we found replacing coal with gas is really helpful for air pollution reduction. The growth consumption of clean coal does not lead to the deterioration of air quality.

Conclusions

The clean heating policy dropped the ambient of air pollution significantly and increased the number of days with excellent air quality. If centralized heating with advanced coal-fired boilers and reduced the consumption of bulk coal, the air quality will be improved effectively in the northern heating season. It is more in line with China's coal-rich and gas-short resource endowment.

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