

IMPACT OF NATURAL GAS CONSUMPTION ON VARIOUS AIR POLLUTANTS: EVIDENCE FROM CHINA'S CITIES

Dongou Hu, China University of Petroleum-Beijing, Phone+86 15910853425, E-mail: 2018317005@student.cup.edu.cn

Yalei Cui, China University of Petroleum-Beijing, Phone +86 18810420097, E-mail: ylcul0304@gmail.com

Renjin Sun, China University of Petroleum-Beijing, Phone +86 13601312558, E-mail: sunrenjin@cup.edu.cn

Kangyin Dong, China University of Petroleum-Beijing; Rutgers University, Phone +1 7329250583, E-mail: dongkangyin@gmail.com

Overview

In the past few decades, due to the rapid development of industrialization and urbanization, China, as the largest developing country, has entered a period of rapid and sustained growth in economic and energy consumption since the implementation of the reform and opening-up policy in 1978. At the same time, the rapid growth of China's energy demand has also raised huge challenges related to environmental pressures. To reduce environmental pollution and adjust the energy consumption structure, natural gas has become an effective alternative to other fossil fuels (such as coal and oil) in China. Under the above background, it is very important to investigate the impact of natural gas consumption on air pollutants in terms of four typical pollutants emissions in China, i.e., sulphur dioxide (SO₂), nitrogen dioxide (NO₂), particles with diameters of 10µm or less (PM₁₀), and fine particulate matter (PM_{2.5}).

In this study, the city-level panel data of 266 Chinese cities over the 1998-2016 period are utilized to investigate the impacts of natural gas consumption on the emissions of four typical pollutants. Specifically, the total effects are divided into two types: direct effects, through which natural gas consumption affects pollution directly; and indirect effects, including the enhancement of urbanization and industrialization levels, gross regional product (GRP) per capita. The panel estimation takes cross-section dependence into account. This study also tested the validity of the environmental Kuznets curve (EKC) hypothesis. A better understanding of the drivers of changes in air pollution is particularly useful not only for policymakers and government officials to formulate long-term and short-term policies to combat air pollution, but also for exploring possible mitigation approaches.

Methods

Environmental Kuznets curve (EKC); Generalized method of moments (GMM) method

Results

The main findings are: Firstly, the natural gas consumption does have a significant effect on air pollutant emissions. According to the estimation results, in the long run, an inverted U-shaped EKC link exists between air pollution emissions and per capita GRP. Secondly, The estimation results indicate that the total effects of natural gas consumption on these four pollutants vary across various cities. Specifically, for SO₂, NO₂, PM₁₀, and PM_{2.5}, the total effects are decreasing, decreasing, inverted-U and U-shaped, respectively. Furthermore, the final finding is that both the inverted U-shaped EKC link between air pollutant emissions and economic growth and the occurrence of positive/negative impacts of natural gas consumption on air pollutant emissions are independent of the individual city urbanization.

Conclusions

Using the panel data of 266 Chinese cities over the 1998-2016 period, this paper explores the relationship between natural gas consumption and four air pollutants and investigates the influence of the relative scale of natural gas consumption on environmental quality. Four different traditional pollutants (SO₂, NO₂, PM₁₀, and PM_{2.5}) are examined, and the GMM approaches are employed. Certain interesting and meaningful results are obtained in the empirical study.

Due to the different characteristics of the four pollutants, they should be treated separately. As the SO₂ and PM_{2.5} are significantly influential to people's health, the government has previously taken certain actions and published related regulations to improve the air quality. Since the higher ratio of natural gas consumption could reduce the emissions of SO₂ and PM_{2.5}, enlarging the proportion may be helpful to the emission reduction.

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