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Status, Fiscal and Taxation Policy Adjustment of Air Pollution in China

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ABSTRACT

The air pollution, which is caused by high consumption and high emissions has been intensifying with the development of industrialization and urbanization. Fiscal and taxation policy is one of the main macroscopic regulating tools of the government and is indispensable in promoting air pollution prevention and control. Firstly, relevant literature was reviewed in this study to explore fiscal and taxation policies related to environmental pollution governance. Then, the variation trends, constitution, and sources of main air pollutants were analysed. Finally, deficiencies of fiscal and taxation policies in air pollution prevention and control were summarized. Results demonstrate that air pollution in China can be to some extent appeared in four aspects: continuously intensified air pollution in large and medium-sized cities, enlarged difficulty in air quality improvement caused by enormous energy consumption, dynamic change of industrial waste gas emission, and strengthened effect of greenhouse gas emission on the environment. Fiscal and taxation policies have obvious effect on the improvement of air pollution governance, but there are typical problems such as insufficient investment, low efficiency, unreasonable structure, and inadequate governmental spending on the governance of air pollution. Governance and improvement of air pollution can be effectively realized by fiscal and taxation policies, such as by increasing investment on air pollution governance, improving utilization efficiency of financial fund, enlarging fiscal transfer to heavily polluted regions, reforming the tax system related to air pollution prevention, optimizing existing policies of fiscal subsidies and so on. The obtained conclusions can be used as a positive reference for further understanding air pollution status in China and establishing a set of comprehensive and reasonable fiscal and taxation policy system in order to improve the atmospheric environment.

INTRODUCTION

The environmental problems of China, the largest developing country in the world, have been to some extent exacerbated since the last few decades. These problems are characterized by aggravated environmental degradation trends and frequent pollution accidents. Serious air pollution recently appeared in many regions of China, such as Beijing city, Shandong province, and Henan province. Haze weather not only damages bodily health and causes all types of diseases, but also triggers deeper atmospheric pollution problems, such as acid rain, photochemical smog, ozone hole, and the greenhouse effect. Fiscal and taxation policies are important means of the governance of air pollution. As the main tools of macroeconomic regulation and control of the government, fiscal and taxation policies realize the governance of air pollution in two aspects, namely, positive incentive and negative constraints. Positive incentives mainly rely on financial subsidies, tax incentives and other means and forms to encourage enterprises and other social entities to reduce air pollution. Negative constraints refer to collecting relevant taxes and fees, which will increase the operating costs of polluting companies, in order to constrain and limit the development of various types of high-pollution, high-emission, and high-consumption industries. According to the theory of market failure, atmospheric pollution which is caused by production and life is one of the important manifestations of market failures. Air pollution goes against the realization of optimal resource allocation, and thus corresponding measures should be adopted to solve it. Among many countermeasures proposed by economists, fiscal and taxation policies are important means. Research on the promotion of air pollution prevention and control from the perspective of fiscal and taxation policies will not only be helpful to enrich China's environmental protection policies, but also be conducive to China's improvement in the atmospheric environment, the development of low-carbon economy and circular economy, and the realization of sustainable economic development. Therefore, it is of great practical significance to study the fiscal and taxation policies that promote air pollution prevention and control.

EARLIER STUDIES

Fiscal and taxation policy is an important economic regulation tool that can exert important effects on macroscopic control and microscopic regulation for pollutant reduction. The following literatures focus on the use of fiscal and taxation policies to realize environmental

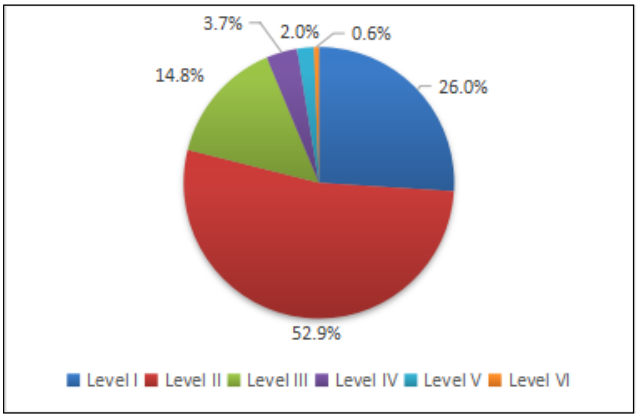

Fig. 1: Proportions of ambient air quality levels among 338 Chinese cities in 2016 (Data source: 2016 Bulletin on Chinese Environmental Status).

pollution governance. Milliman et al. (1989) found that sewage tax system could generate great incentive effect on technological innovation and diffusion in enterprises, whereas direct control, free licensing system, and pollution subsidy policy had low effects on the reduction of pollutant discharge in enterprises. Magat et al. (1990) verified whether environmental regulation influenced the biological oxygen demand (BOD) discharges of US paper pulp enterprises; research showed that environmental regulation could reduce discharge by approximately 20%. Laplante et al. (1996) examined whether environmental regulation measures exerted influence on suspended solid discharge of Canadian paper article companies; this study also found that the regulation and deterrence generated could reduce pollutant discharges by about 28%. Bovenberg et al. (1996) believed that the influence of carbon tax policies on pollution reduction may be more significant than other taxes. Panayotou (1997) analysed statistical data from over 30 countries with different levels of development; results showed that fiscal and taxation policies for environmental protection could significantly reduce pollution caused by sulphur dioxide to air environment. According to Peterson (1977), elevated pollutant discharge fee standards could increase the cost of pollutant discharge of enterprises; thus enterprises increased investment on scientific and technological equipment to reduce pollutant discharge. Andersen (1999) found that the Netherlands designated environmental taxation, which not only contributed to pollutant discharge reduction, but also levied environmental taxes. Montero (2002) analysed the effects of the incentive method of pollution reduction from the industrial layer; he found three methods that indicated the strongest incentive effect on enterprise technological innovation and pollution reduction, namely, the auction licensing system, emission tax, and free license system. Kumbarolu (2003) analysed the influence of environmental tax or effluent charge on pollution reduction and economic development; this study found that effluent charge could promote pollution reduction and contribute to employment. Rauscher (2005) found that local governments always selected a loose supervising environment to attract enterprises to settle for production; the government would relieve the enterprise from tax burden to introduce enterprises with reduced cost; this approach resulted in insufficient supply of public service and aggravated environmental quality coupled with economic development. Andre et al. (2005) found that CO_2 tax and SO_2 tax could promote the reduction of pollutant discharge, boost economic development, and improve employment rate. Takeda (2007) constructed a multi-department dynamic CGE CO_2 tax model and investigated the influence of carbon tax policies; this study found that carbon tax policy could promote employment while realizing pollution reduction when carbon tax income was used to replace capital tax. Bagayev et al. (2017) analysed the effect of EU air pollution regulation measures to explore whether these measures could bring fresh air to Eastern Europe. Li et al. (2017) conducted an empirical research to analyse the convergence effect of air pollution laws and regulations on CO_2 emission in Chinese manufacturing industry. Zheng (2017) conducted an empirical analysis of the influence of multiple environmental protection policies on energy conservation and emission reduction, using data from China's polluting industries.

The literature review indicates that most scholars observe a close link between the current status of air pollution and fiscal and taxation policies related to the governance of air pollution. These research achievements are abundant and comprehensive, but related literature is mainly concentrated in taxation policies for pollution reduction, and few mechanism studies are conducted on the effect of fiscal and taxation policies on pollutant discharge reduction. Some scholars investigated the effect of fiscal and taxation policies on the pollution reduction, but only a few scholars designed comprehensive fiscal and taxation policies and measures for pollution reduction from fiscal expenditure and taxes. Therefore, fiscal and taxation policies for the governance of air pollution are proposed in this study on the basis of an analysis of present air pollution in China and time-space differences in air pollution. This study will provide reference opinions for reform, adjustment, and innovation of fiscal and taxation policies for the governance of air pollution in China.

AIR POLLUTION STATUS IN CHINA

Continuously Intensified Air Pollution in Large and Medium-sized Cities

According to the stipulations in Technical Regulations on

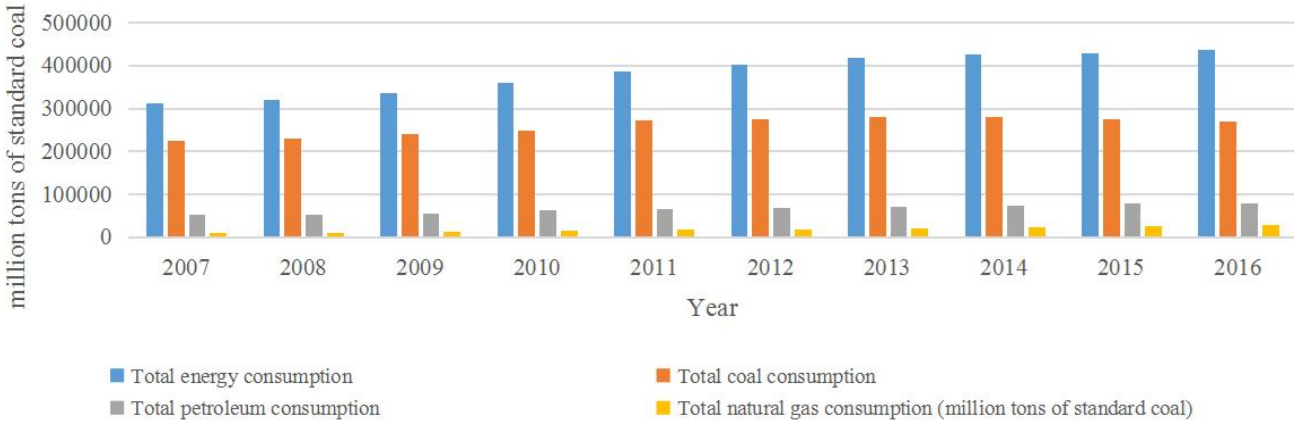

Fig. 2: Chinese energy consumption during 2007-2016 [Data source: China Statistical Yearbook (2017)].

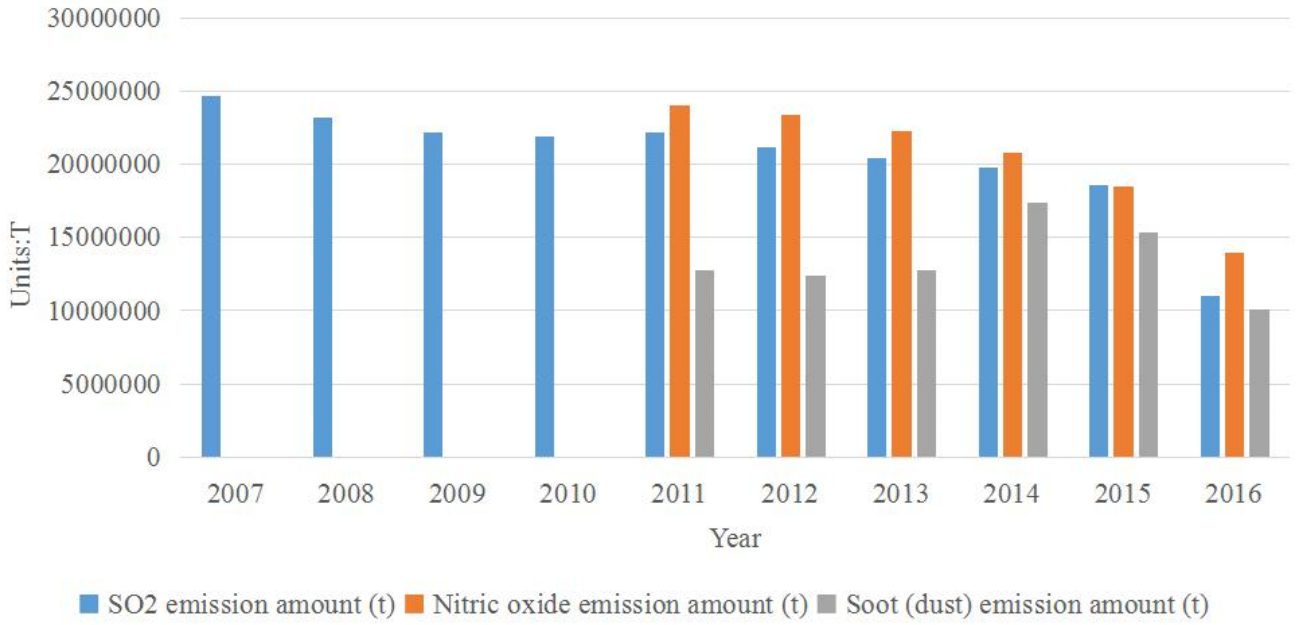

Fig. 3: Three industrial wastes (SO_2, nitric oxides and soot (dust)) emissions during 2007-2016 [Data source: China Statistical Yearbook (2017)].

Ambient Air Quality (AQI) (Trial Implementation) (HJ 633-2012), Fig. 1 shows that the ambient air qualities of 84 cities among 338 prefecture-level cities in China reached the standard in 2016, occupying 24.9% of the total number of the cities; air qualities of 254 cities exceeded the standard, 75.1% of the total. The proportion of average good-air days in 228 cities was 78.8%, which increased by 2.1% comparing with 2015; the proportion of average standard-exceeding days was 21.2%. The proportion of good-air days of 8 cities was 100%, that of 169 cities was within 80%-100%, that of 137 cities was within 50%-80%, and that of 24 cities was lower than 50%. Urban air quality has been improved since 2015, but the standard-exceeding phenomena of urban ambient air quality in Chinese cities were still extensive, with air pollution problems taking a prominent position. Large and medium-sized Chinese cities have been continuously expanded with the continuously increasing population density. All types of automobiles, including private cars, rapidly increase in number. Suspend matter concentrations in the sky over the cities commonly exceed the standard; SO_2 concentration is maintained at a high level; motor vehicle exhaust discharge continuously increases; nitric oxide pollution level is continuously elevated. Those things above mentioned exist in the air and degrade the air quality, so air pollution in large and medium-sized cities is continuously intensified.

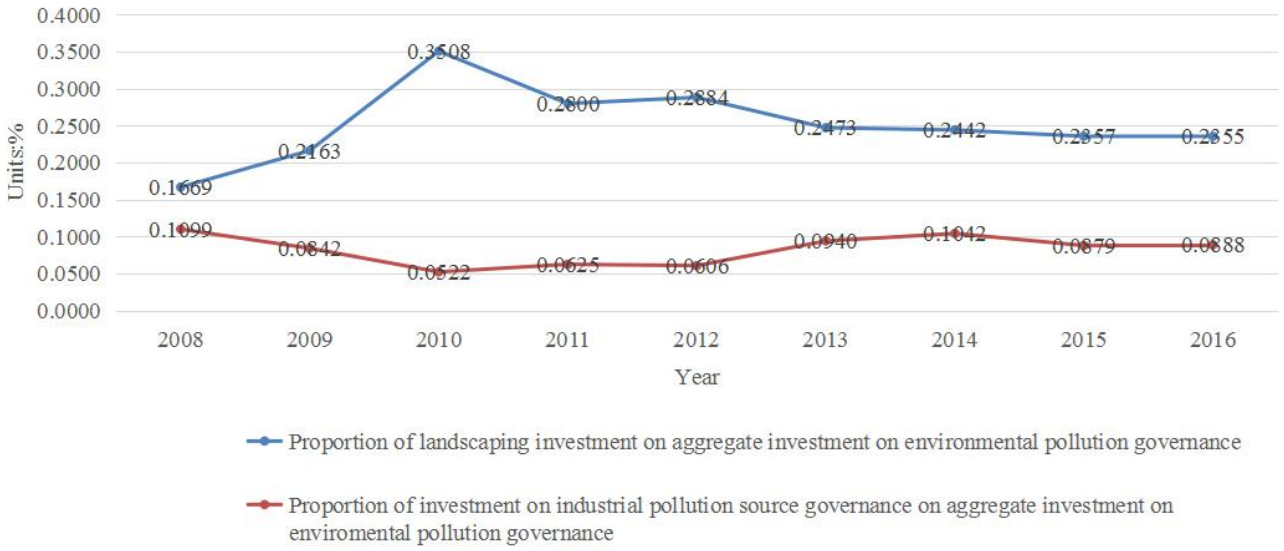

Fig. 4: Change curve proportions of investments on landscaping and industrial pollution source governance in aggregate investment on environmental pollution governance during 2008-2016 [Data source: China Statistical Yearbook (2017)].

Enlarged Difficulty in the Air Quality Improvement Being Caused by Enormous Energy Consumption

China demonstrated an increased consumption and demand for energy given the sustainable growth of population size and GDP scale. The Chinese energy consumption structure in Fig. 2 shows that polluting resources, such as coal, petroleum, and natural gas, occupy over 90% of total energy consumption, whereas the proportion of clean energies, such as hydropower, wind power, and solar power, is low. The energy consumption structure in China is unreasonable. A low energy utilization ratio exists simultaneously on enormous energy consumption. Exhaust gas generated by energy consumption is the main source of air pollutants.

Fig. 2 also shows the total energy consumption in China has been increasing annually from 2007-2016. The emission level of SO_2, nitric oxides, and soot (dust) in exhaust gas increased, which was caused by enormous energy consumption centering on coal, petroleum, and natural gas. The pollutants existed in the atmospheric environment will be more and more complex and the quantity of the pollutants will increase annually with further promotion of urbanization and continuous expansion of industrial scale. It will become harder and harder to improve the air quality under the heavy pollution burden.

Dynamic Change of Industrial Waste Gas Emissions

Fig. 3 shows that the change trend of emission amounts of SO_2, nitric oxides and soot (dust) from 2007-2016. SO_2 emission increased yearly before 2006 mainly because of extensive economic growth. After 2006, SO_2 emission presented a slowly descending trend because the government strengthened the protection for the atmospheric environment. However, the statistical data of nitric oxides was initially high and nitric oxides exceeded SO_2 to become the first major exhaust gas pollutant. Annual emissions of SO_2 and nitric oxides presented a descending trend from 2011 to 2013 given the accelerated construction of a resource-saving and environmentally friendly society. By contrast, the statistical data of soot (dust) was low and the change trend of annual emission amount of soot (dust) was not obvious, which indicated the improvement of air quality in China.

Strengthened Influence of Greenhouse Gas Emission on the Environment

Greenhouse gases mainly include CO_2, vapour, CH_4, N_2O, O_3, HFCs and PFCs. This type of substance can absorb IR rays and preserve heat. An enormous quantity of greenhouse gases has been emitted due to global industrialization development. This situation results in global warming, climatic anomalies, elevated sea level, glacial recession, thawing of frozen soil, delayed river (lake) freezing and early melting, and prolonged growing seasons at middle and high latitudes. Other phenomena include extension of animal and plant distribution scope toward polar regions and high-altitude regions, reduced quantity of some animals and plants, and advanced florescence of some plants. Similarly, a large quantity of urban greenhouse gases has been emit-

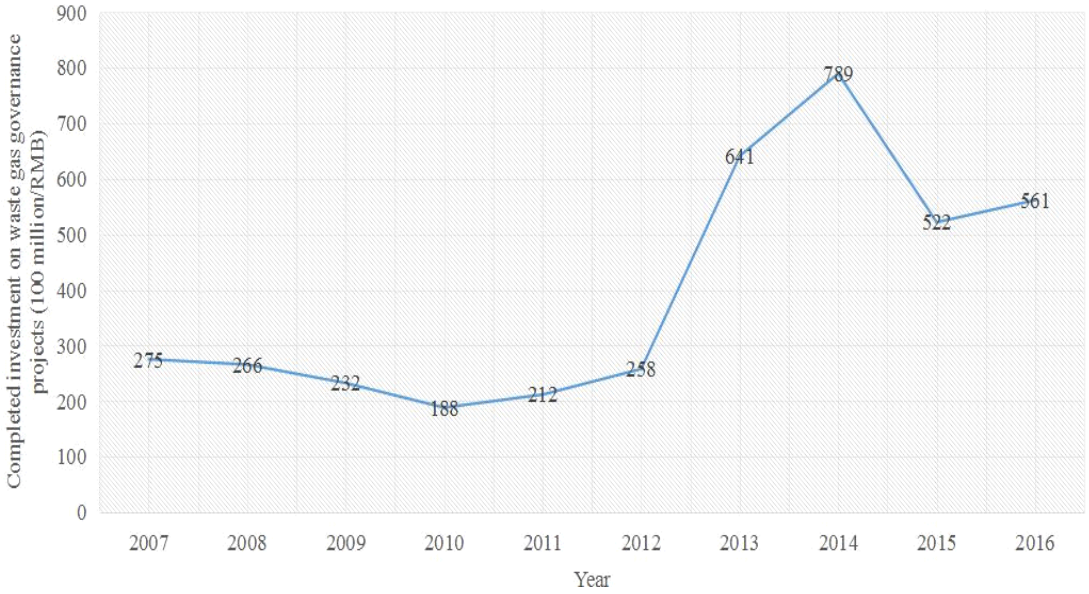

Fig. 5: Investment completion on waste gas governance during 2007-2016 [Data source: China Statistical Yearbook (2017)].

ted, accompanied by increased absorptivity and smaller specific heat capacity in dense urban buildings, bituminous streets, and cement pavements, thereby resulting in higher temperature in urban regions than peripheral regions.

PROBLEMS IN FISCAL AND TAXATION POLICIES FOR AIR POLLUTION PREVENTION AND CONTROL

Insufficient Investment on the Governance of Air Pollution

Investment on environmental governance is divided into investment into urban environmental infrastructure construction (including landscaping and other subdivisions), investment on industrial pollution source governance and investment of environmental protection on "three simultaneous" factors (simultaneous design, simultaneous construction, and simultaneous putting into production) of construction projects. Among all these investments, investment into landscaping and investment on industrial pollution source governance are directly related to air pollution prevention and control. In 2010, the proportion of investment on landscaping in aggregate investment on environmental pollution governance was approximately 35.0%, which decreased annually before reaching 23.55% in 2016. The proportion of investment on industrial pollution source governance was below 11%, which was the lowest in 2010 (5.22%). From 2008 to 2016, investment on environmental pollution governance increased by 1.88 times, but investment on industrial pollution source governance increased by 1.51 times, which lagged behind growth of investment on environmental pollution governance. Insufficient investment on industrial pollution source governance will contradict the governance of air pollution.

Low Investment Efficiency on the Governance of Air Pollution

Investment on industrial pollution governance is mainly allocated for pollution governance projects, such as exhaust gas, waste water, industrial solid wastes, and noise. Fig. 5 shows that investment on exhaust gas governance presented a mild rising trend, but obvious fluctuations from 2007 to the present. Investment in 2007 reached CNY 27.5 billion. Capital input in waste gas governance decreased annually from 2008 to 2010 because of economic and fiscal revenue slowdown caused by the economic crisis. Investment on exhaust gas governance slowly increased from 2010 to 2012 and then rapidly increased from 2012 to 2014, and reached CNY 78.9 billion in 2014 (2.86 times that of 2007 and 4.19 times that of 2010). The capital used for air pollution prevention and control in China increased consistently, but a large gap remained between input and realistic demand on the governance of air pollution. Realistic demand for pollution governance formed because of air pollutants discharged by production and life. Key engineering projects in air pollution governance require large capital with public welfare property. Main market players lack initiative, thereby resulting in narrow capital sources for prevention and control. They mainly rely on fiscal appropriation while lacking participation. Capital usage efficiency is at a low level given the lack of supervision and embezzlement. Corresponding

evaluation and feedback mechanisms and responsibility assigning mechanisms are lacking. With strengthened governance of air pollution in China in recent years, pollutant discharge appears repeatedly The investment of environment protection on the "three simultaneous" factors of construction projects is not strictly executed. In particular, pollution prevention and control measures do not occur when new projects are being constructed. Consequently, new projects become new pollution sources.

Unreasonable Investment Structure on the Governance of Air Pollution

Main air pollutants come from industrial pollution. Capital in the governance of air pollution is mainly allocated into industrial pollution sources. The completed investment on industrial pollution governance increased annually from 2007-2014. The growth rate of completed investment on industrial pollution governance from 2008-2013 was lower than the growth rate of GDP, which indicates that a gap existed between investment on industrial pollution governance and realistic governance. China's investment scale on industrial pollution source governance is narrower than governance scope. Industrial pollution sources that have not been governed still exist in large quantities. The investment scale used in urban environmental infrastructure occupies over a half of the aggregate investment scale on environmental pollution governance. Some projects that are subordinate to urban environmental infrastructure construction (fuel gas expenditure, centralized heating expenditure and so on) are not closely related to environmental pollution governance. Compared with the "three-simultaneous" environmental protection investment on construction projects, the proportion of investment in industrial pollution source governance is significantly lower. China's capital investment in the treatment of environmental pollution places too much emphasis on the investment in new infrastructure and new buildings, and disregards the treatment of existing industrial pollution sources. The irrational investment structure of pollution control is extremely unfavourable to the current severe air pollution problem in China.

Insufficient Governmental Expenditure on the Governance of Air Pollution

Concrete fiscal expenditure subjects on energy conservation and environmental protection indicate that air pollution prevention and control is only a small subject among numerous subjects. The special capital allocated for air pollution prevention and control only occupies a small proportion in fiscal expenditures on energy conservation and environmental protection by local governments at all levels. Compared with the international society, China's fiscal expenditure on energy conservation and environmental protection occupies an insufficient proportion of the GDP and remains elevated. The proportion of fiscal expenditure on energy conservation and environmental protection in total public fiscal expenditures is small. Thus, fiscal expenditures on air pollution prevention and control are weak. Fiscal support on the governance of air pollution is insufficient under the Chinese environmental status, especially under increasingly severe atmospheric conditions. Fiscal expenditures on air pollution prevention and control by local governments at all levels present an obvious dynamic change trend given the restraint imposed by local financial power and the actual situation of regional atmospheric status. This situation radically contradicts the goal of solving air pollution problems.

ADJUSTMENT STRATEGIES FOR FISCAL AND TAXATION POLICIES IN PROMOTING AIR POLLUTION PREVENTION AND CONTROL

Increasing Investment in the Governance of Air Pollution and Optimizing Investment Expenditure Structure

Pollutant discharges governance actions taken by industrial enterprises under the restriction of atmospheric pollution prevention law and environmental tax will be conducted step by step. Air pollution is a manifestation of market failure, and governments at all levels should increase and strengthen investment in the air pollution prevention, appropriately adjust investment structure of environmental protection, provide material supports for implementation of various air pollution prevention policies, and ensure that comprehensive air pollution governance measures can be smoothly implemented. Current investment in the governance of air pollution still centres on governmental investment with the assistance of the market. In terms of future air pollution prevention, financing channels for environmental protection should be enriched while governmental investment on environmental protection is continuously increased. The market should participate and the vitality of non-governmental capital should be motivated to relieve governmental fiscal pressure and compensate for limitations of governmental regulation means by market means.

Improving Utilization Efficiency of Financial Fund of Air Pollution Prevention and Control

The input/output ratio of air pollution control in China is low, which greatly reduces utilization efficiency of financial funds of air pollution governance. Funding for air pollution governance in China has been increased annually, but the improvement in atmospheric environmental quality in China cannot be attributed to enlarged capital input in

the air pollution prevention and control. In order to radically improve air quality, governments at all levels should improve utilization efficiency of the fund of air pollution prevention and control and elevate input/output ratio. The government should formulate strict and complete special capital budget management mechanisms and order subordinate governments to strictly conduct related policies. Strict and complete special capital budget management mechanisms should include the following measures: budget should be compiled according to specific objectives and approved by a vote of the National People's Congress and made public to the public; budget execution should be tracked, and results evaluation and feedback should be implemented after completion of the budget execution. If feedback results do not adhere to related standards, related personnel should be held responsible and strictly punished. If feedback results reach related standards, awards should be granted to improve initiatives of governments at all levels and various units in order to further improve atmospheric environmental quality.

Strengthening Fiscal Transfer to Heavily Polluted Regions

Serious haze weather has appeared in various regions across China in recent years. Emission of all types of pollutants, such as SO_2, NO, and CO_2, rank first in the world. China's air pollution differs from regions, where Beijing city and Hebei province are represented. The Beijing-Tianji-Hebei region is one of the regions in the world with the most serious pollution. Air pollution not only seriously affects local economy and social development, but also brings about a serious negative influence on production and life in peripheral regions because of air flow. Environmental integrality and regional differences in economic development must be fully considered in the governance of air pollution. Fiscal transfer payment can be enlarged on regions with serious air pollution through longitudinal (central to local) and transverse (between local governments) transfer payment to form mutual support between different regions and different industries and jointly boost improvement of air environmental quality in the regions.

Further Reforms in the Existing Tax System Related to Air Pollution

In April 2018, China began levying an environmental tax and formulated corresponding standards and limits to air pollutant emissions. As a newly levied tax category, the environmental tax marked an important step of tax reform in China. Present tax categories related to air pollution in China also include resource tax and consumption tax. To further improve atmospheric environmental quality, the existing tax system should be improved and the regulating effects of these tax categories on air pollution prevention and control should be continuously strengthened. The tax levying effect of the recently implemented environmental tax is not yet obvious. Coordination and close cooperation between tax bureau and environmental protection department are needed to establish, and the cooperation mechanism between the two departments will improve levying efficiency. Based on the environmental protection law, various regions have formulated a base of taxation and limits that conforms to their own conditions. In terms of existing resource tax, the quantity of resource taxes should be increased and the rates of resource tax should be elevated to limit excess resource exploitation by enterprises. The reform of resource tax will facilitate enterprises to improve production technology, update manufacturing equipment, enhance resource utilization efficiency, promote economic resource utilization, and reduce pollutant emissions.

Optimizing Existing Fiscal Subsidy Policies and Implementing Different Carbon Tax Policies

Emission of pollutants from industrial production occupies a major proportion of existing air pollutant composition in China. The pollutant emissions reduction effect is the highest in fields such as coal, heavy industry, oil, gas, transportation industry, and electric power, whereas that in the service industry and agriculture is the poorest. Energy consumption coefficients in the above industries are high; thus, they have a more sensitive reaction to fiscal subsidy policies and carbon tax rate. Hence, different fiscal subsidies and carbon tax policies can be implemented to maximize of fiscal subsidies and tax policy effect on pollutant emissions reduction. The concrete idea is to give fewer fiscal subsidies and levy relatively high carbon tax rate for industries such as the heavy industry, coal, oil, gas, transportation industry, and electric power while implementing more fiscal subsidies and a low carbon tax rate for industries with insignificant pollutant emissions reduction effect like service industry and agriculture.

CONCLUSION

The extensive economic development pattern of high energy consumption and high pollution greatly damaged the atmospheric environment in China. The governance of air pollution relies on non-market factors like fiscal and taxation policies. Fiscal and taxation policies related to environmental pollution governance were investigated in this study. Variation trends, composition, and sources of main air pollutants were analysed. Present deficiencies of fiscal and taxation policies existing in the air pollution preven-

tion and control were then summarized. This study's findings show that air pollution status in China is mainly manifested at four aspects, namely, continuously intensified air pollution in large and medium-sized cities, enlarged difficulty in the air quality improvement caused by enormous energy consumption, dynamic change of industrial waste gas emission, and strengthened effect of greenhouse gas emission of the environment. Insufficient investment, low investment efficiency, unreasonable investment structure and insufficient governmental expenditure are the main problems related to fiscal and taxation policies on the governance of air pollution. Finally, this study proposed the adjustment strategies for fiscal and taxation policies, such as enlarged investment on the governance of air pollution, strengthened fiscal transfer to heavily pollutant regions, reformed tax policies related to air pollution prevention and control, and optimization of existing fiscal subsidy policies. This study is expected to help relieve serious air pollution in China and develop the existing fiscal and taxation system in China to facilitate sustainable development in the country.

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