

Haze Control from the Perspective of Microeconomics

Yi Ren

School of Economics and Management, Xidian University, Xi'an, Shaanxi 710071, China

Abstract: *In recent years, most cities in our country often fall into the dilemma of "haze", and many cities become "fog capitals". The increasingly serious problem of haze has attracted great attention from all walks of life and the international community. From the perspective of economics, the haze problem is a typical case of "tragedy of the Commons", and the most important way to deal with "tragedy of the Commons" is the determination of property rights. Based on the theory of "tragedy of the Commons" and the method of microeconomic model analysis, this paper concludes that under the condition of clear property rights, the haze problem will gradually improve, and puts forward the economic method of haze control.*

Keywords: haze, "tragedy of Commons", clear property rights

1. Introduction

In December 2016, many places in China were affected by haze. According to satellite monitoring and analysis by China meteorological administration, the areas affected by haze in north China, Huanghuai and Jianghuai regions were about 1.01 million square kilometers, accounting for about one ninth of the national area. Twenty-three cities, including Beijing and Tianjin, have issued red alerts and 17 have issued yellow alerts. This is another large-scale haze disaster in China after the occurrence of large-scale haze in 2013. The harm of haze to human body mainly comes from inhalable particulate matter. Since 2013, the continuous large-scale haze weather has aroused public and media attention on the health effects of pm10. This paper discusses the causes of haze from the perspective of microeconomics, and proposes relevant policies for haze control from different perspectives, in order to provide some enlightenment for haze control in China.

1) The haze situation in China

In recent years, the occurrence of haze weather in China shows an upward trend, and the duration is prolonged. During the 55 years from 1961 to 2016, the frequency of haze weather was on the rise, especially the number of haze days increased significantly. According to the study, 2013 was the worst year for haze, with the Beijing-Tianjin-Hebei region, the Yangtze river delta region, the southwest region and the Guangxi, and Guangdong provinces being the worst affected areas. Not only the scope of haze weather is expanding, but also the degree of air pollution is increasing. The number of haze days is increasing significantly, which is almost a normal situation. With the rapid development of urbanization, a large number of people are attracted to flood in. Chemical elements and heavy metals released in the production and living process enter the atmosphere, causing frequent occurrence of haze. Compared with the suburbs with small population, the incidence of haze weather in urban densely populated areas is higher and more serious. At the end of 2016, the haze phenomenon reached a new "height", Beijing, Tianjin, Hebei, Shanxi, Shaanxi and other provinces and cities have more than a week of continuous orange haze

warning phenomenon, many kindergartens, primary and secondary schools were forced to holiday, haze phenomenon has become the focus of social attention.

The formation of haze weather is the result of the combined action of natural factors and human factors.

In terms of natural factors, in winter, the air pressure is low, humidity is high, and the air circulation is poor, so fine particles are concentrated in the air. In such a natural environment, haze weather is easy to happen. Since January 2013, China's frequent occurrence of haze weather is caused by such natural reasons. From the perspective of human factors, during the 16 years from 1999 to 2015, China's output value of heavy industry increased from 58.1% to 76.9%, while the proportion of light industry output value decreased from 41.9% to 28.1%.

At present, China's industrial consumption is still dominated by coal burning. "China consumes 970 million tons of standard coal every year, which accounts for 75.8% of energy consumption, 17% of oil and 4.9% of natural gas. The burning of these fossil fuels mainly produces carbon dioxide, sulfur dioxide, carbon monoxide, soot and so on. At the same time, urban vehicle exhaust emissions are also the "main force" of urban air pollution.

2) The harm of haze

Winter fog is known as "winter killer", haze is mainly water vapor containing industrial waste gas, dust on the ground, also attached to some bacteria and viruses, etc., will cause great harm to people's body, especially respiratory diseases. Due to the poor resistance of children, the growth and development of children and the system are affected, the specific harm is shown in the table below.

The object	Impact and harm
Respiratory system	The composition of haze is very complex, including hundreds of atmospheric chemical particles, for patients with respiratory diseases, haze weather can make the illness acute attack or acute aggravation
The cardiovascular system	Haze days also have a serious impact on cardiovascular and cerebrovascular diseases, which will hinder the normal blood circulation, lead to frequent cardiovascular diseases, hypertension, coronary heart disease and other diseases, and may lead to angina pectoris, myocardial infarction and heart failure
Mental health	Continued foggy days have an impact on people's psychology and body, that is, foggy days can cause dull, depressed feelings that can stimulate or exacerbate the state of psychological depression. In addition, due to the weak light and low air pressure caused by fog, some people may feel lazy and depressed in the fog.
Traffic	The haze weather has low visibility and poor air quality, which is likely to cause traffic jams and traffic accidents.

2. Economic Theory in Environmental Pollution

2.1 The definition of property rights in the commons

The "tragedy of the commons" theory was proposed by Professor Garrett Harding in the "Tragedy of the Commons" published in the journal Science in 1968. Harding believes that "as long as many people use a scarce resource together, environmental degradation will occur." If there are no constraints, in the case of limited resources, each enterprise pursues the maximization of interests, only cares about the interests of its own enterprises, and ignores the public interests, which ultimately leads to the damage of the interests of all people. Once the environmental carrying capacity exceeds the critical value. It will happen. The root cause of the tragedy of the environmental commons is that the atmospheric resources or environmental property rights are unclear or difficult to achieve complete clarity.

The public domain has many owners as a resource or property, and each of them has the right to use the commons, but has no right to prevent others from using it. As a result, the use of public resources is overused and eventually leads to depletion. Excessively felled forests, overfished fisheries resources, and heavily polluted rivers and air are typical examples of "tragedy of the commons". It is called "tragedy" because every user of the commons knows that the resources of the commons will be exhausted due to excessive use, but each user is powerless to prevent this deterioration. And the deterioration of this resource depletion has been exacerbated for the best interests of the individual. It is an inevitable result that the common land is difficult to define due to property rights (defining the transaction cost of property rights is too high) and being over-used or occupied by competition.

2.2 Properties of public resources

Public resources refer to naturally occurring or naturally occurring resources, that is, natural materials and natural conditions that provide survival, development, and enjoyment for human beings. The ownership of these resources is shared by all members of society and is the basic condition for the social and economic development of mankind.

Public resources have the following three characteristics: First, the commonality of public resources. This means that it does not have exclusiveness in possession and use, that is, any member of its society can use it. Second, public resources are competitive, and if one uses public resources, it reduces the use of it by others in the entire community. Third, the scarcity of public resources. Before the industrialized society, various resources were abundant, and people even thought that public resources were inexhaustible. However, with the rapid economic development brought about by industrialization, the advancement of science and technology, and the rapid increase in the population, people realized that public resources are also scarce.

Combining the characteristics of public resources, we try to analyze the following two economic problems: First, public resources are available for free in most cases. When an item has no price, the market cannot guarantee the proper production and consumption of the item. The number, the baton of resources allocated in the economy, that is, the "invisible hand", will not work. In this case, the government must pass some effective policies to solve the market failure problem. The second plus fruit everyone can freely use public resources, according to a basic assumption in economics: everyone is self-interested, that is, to pursue their own maximum economic interests. Each rational behavioral individual will tend to consume public resources from the individual's best interests. This kind of self-interest will lead to the optimal profit of the individual being much lower than the optimal profit of the whole society, leading to the general poverty of the society trapped in the economy, that is, the above-mentioned "tragedy of the commons." At this time, only the government's management of public resources, that is, clearly defining its property rights, can improve the total economy of the society to compensate for the tragedy caused by individual private interests.

2.3 The problem of smog - the typical "tragedy of the commons"

Extending the proposition of "the tragedy of the commons" can be described as follows: First, multiple economic units and even the entire society share a certain scarce public resource, the economic subject with management rights and the individual with the right to control It can benefit from the use of public resources, but does not have to pay the corresponding costs, which leads to every rational "economic man" having enough power to use the relatively scarce public resources indefinitely until the public resources are quickly exhausted. Or through the use of public resources, damage to public resources to obtain personal benefits, and ultimately

the entire society suffered losses. Second, the clear property rights of public resources and the vague asymmetry of property rights in actual use make public resources often in a tragic situation where no one is responsible and at the same time.

Therefore, in the general consciousness of people, air is not only a kind of public land resources, but also a public good. The outbreak of large-scale haze is undoubtedly the biggest "tragedy of the commons" phenomenon and external disequilibrium in China and the world. In this process, air is a shared resource for everyone, and there is no power to prevent others from using it. However, due to the optimal strategy of individual game, everyone will not give up the opportunity to use more. Private car owners will not consider environmental protection. Without driving, companies will not consider environmental protection and stop production. City managers will not consider environmental protection and eliminate backward production capacity. The selfish character of each individual's personality is maximized here, and together they brew a "smog tragedy."

3. Model Analysis of Clear Effects of Property Rights

The haze weather is essentially a "tragedy of the commons". The way to solve the "tragedy of the commons" and the external uneconomic is to clarify the issue of property rights. In the case of clear and stable property rights, contracts and regulations will regulate people's behavior, so Rational "economic man" will consider and weigh the consequences of its economic behavior before action, that is, it will be constrained when using public resources. The model will be used to analyze the impact of property rights on haze. That is to say: property rights and environmental protection can make internal costs stable and internalized without causing large fluctuations in balanced output and prices, thus indicating that we can achieve the unification of benefits and protection for the development of ecological environment.

3.1 Assumptions

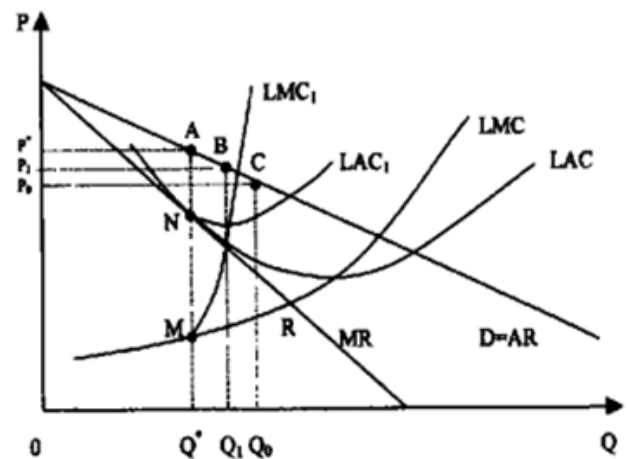
Hypothesis 1: The demand curve faced by the farm is the demand curve of the entire market ($D=AR$). The ranch in the initial state of the "tragedy of the commons" is a public-owned, small-scale decentralized operation, with a large number of herders and a state of complete competition.

Hypothesis 2: Yield Q^* is the ideal grazing amount of the commons (here, "the ideal grazing amount of the commons" refers to the maximum grazing that can be achieved under the premise of the commons, where many herders graze have zero negative environmental impact. Quantity, but this "ideal grazing amount" is not necessarily an economically efficient social production). The market price corresponding to Q^* is P^* .

Hypothesis 3: In the case of ranch-owned, the cost of stocking a livestock unit by dispersed herders is fixed at P_0 (so its marginal cost MC is equal to the average cost AC , both P_0).

Since individual herders are passive recipients of market prices, their marginal returns are equal to the field price (ie, the average return AR of the entire ranch). According to the law that the marginal cost is equal to the marginal benefit ($MC=MR$), the equilibrium output at this time is Q_0 , and the corresponding price is P_0 . Obviously, the grazing amount of Q_0 is in the ideal grazing amount Q^* , and the pasture at this time is in a state of severe overgrazing.

Hypothesis 4: Now, through some measure, the pasture is transformed into private ownership and centralized management. At this time, the rancher realized a monopoly on the market, because Hypothesis 1 stipulates that the demand curve faced by the ranch is the demand curve of the entire market.



3.2. External negative effects are steadily internalized as personal costs

First, we will look at the maximization of benefits: at this time, the long-term average cost curve and long-term marginal cost curve faced by private ranchers are LAC and LMC , respectively. These two curves together with the market demand curve $D=AR$ and the marginal return curve MR determine the equilibrium output and the equilibrium price. We can see that the equilibrium yield determined by the intersection point of LMC and MR is greater than Q^* , and even greater than Q_0 . This is because the scale effect has occurred after centralized operation (in the figure, the left half of the LAC curve shows a downward trend). However, this kind of investigation is obviously still incomplete. Then look at the externalization of external costs: when we add the factors of clear property rights, operators must consider avoiding excessive grazing damage, so external costs are converted into internal costs, long-term marginal cost curves (LMC) faced by private ranchers and The long-term average cost curve (LAC) is converted into LMC_1 and LAC_1 respectively. When the grazing amount is less than or equal to Q^* , the external negative effect is 0, then LMC_1 and LAC_1 coincide with LMC and LAC respectively. When the amount of grazing exceeds Q^* , the external negative effect begins to appear and increases with the increase of grazing amount, which indicates that the ecological environment of the pasture is destroyed. At this time, for the rancher, its marginal cost and average cost will rise rapidly. This shows that LMC_1

risers faster than LMC when QQ starts to increase production, and LAC1 is higher than LAC. It can be seen that the internalization of external negative effects in the tragedy of the commons is realized by the mechanism that the marginal cost and average cost of the operators are rapidly rising through overloading and grazing. For long-term interests and sustainable development, the operators will consciously suppress overgrazing. The design of this interest-driven mechanism enables the operator's self-interested motivation and altruistic effect, that is, environmental protection, to achieve endogenous unity. We also found that after considering the external costing factors of external negative effects, the equilibrium production combined with MR and AR represented by LMC1 and LAC1 is Q1, and the corresponding equilibrium price is P1. Q1 is less than Q0 because the external cost is internalized and the production cost is increased; Q1 is greater than Q* is the result of scale effect and technical effect. When the property rights of the pastures are clearly defined in the legal provisions and practical applications, the improvement of operating profits cannot be achieved by overgrazing, but can only be achieved by moderate scale operation, environmental protection technology advancement and scientific management. Operators can only benefit from scale, technology, cooperation and management. This not only compensates for the external negative effects of Q greater than Q*, but also makes balanced production and prices not change significantly due to changes in the property rights system. The negative effects are smoothly internalized into personal costs.

The above analysis proves that if the property rights are clearly defined, the external economy faced by the individual includes environmental protection factors, thus achieving an effective endogenous environmental protection drive.

4. The countermeasures to Control Smog

Smog is a national and even a global issue. It requires both macro policy support and specific micro-policy implementation. Below I will propose three aspects: clear property rights, "carbon trading market" and government macro-control. some advices.

4.1 Definition of property rights

Transform the economic development mode, adjust the economic structure, encourage the development of advanced production capacity and eliminate backward production capacity. Establishing a system of rewards and punishments for protecting the atmosphere, that is, enterprises with less air pollution should encourage their development through financial subsidies and tax cuts. For enterprises with large air pollution, raise tax burdens and environmental pollution control fees. Fines are imposed and even sanctioned by law. In the case of clear rewards and punishments, enterprises will take into account the environmental damage costs caused by excessive emissions during cost accounting, that is, internalization of external economy. As a rational economic individual, we will work hard to develop and improve

efficiency technology. We will not care about the company's profits as much as the "public land", regardless of environmental protection, so some high energy consumption, high pollution, low efficiency and low internal costs. Under such pressure, enterprises with high external costs will strive to gradually shift from highly polluting enterprises to low-pollution enterprises, and in the process will also eliminate some backward production capacity. In short, the property rights in the common land are clearly implemented in each. When the enterprise is in the enterprise, the external negative effect in the "tragedy of the commons" will be transformed into the internal cost of the enterprise. In this way, the enterprise will actively protect the environment driven by the interests, thus forming personal and social costs, pursuing interests and protection. Harmony of the environment.

4.2 "Carbon Trading Market"

Now the international "carbon trading market" is still in a state of trial. The operating mechanism of this market is: a certain amount of pollutant discharge quota is allocated to enterprises each year, and excessive polluting enterprises can purchase the required amount of sewage through the carbon trading market, and enterprises with less pollutants can sell excess sewage. Then, this carbon trading market will reflect the level of fresh air information that people need, and the price of the air will have a market price. Under the influence of the "invisible hand" of the market, the market price of air will automatically adjust the emissions of corporate pollutants, so as to achieve the purpose of controlling the amount of sewage.

4.3 Government role

In recent years, the government has paid enough attention to promoting environmental protection technology, strengthening environmental protection, and calling for environmental protection in environmental protection, but has neglected the fundamental crux of the defects of the property rights system. One of the major mistakes here is that there is no fundamental analysis of the institutional factors of environmental degradation, but only a lot of efforts are made from the level of palliative treatment, so the effect is not good. From the perspective of microeconomics, the government should withdraw from the smog governance in some aspects and let the market carry out smog governance. The government must do the role of legal supervisor of property rights, safeguard environmental property rights and prevent infringement. behavior. In this way, the market will be able to continue to improve steadily in the context of clear and stable property rights; on the other hand, the government should pay more attention to the promotion and promotion of environmental protection technology and innovation, as well as environmental protection. The construction and improvement of the property rights system. Because only under the system of clear and stable environmental legal property rights, enterprises will have a continuous stream of technological innovation. In addition, the government can also cultivate environmental protection markets and large-scale ecological enterprises. As with the formation of a

market economy, the formation of an environmentally friendly market and the development of an ecological enterprise must also be supported by a sound legal system provided by the government. To obtain the effect of property rights and environmental protection, the government needs to provide a fair, standardized, transparent and effective legal environment for enterprises and society. Only the system with clear property rights, the legal system without corresponding property rights protection, and the law-abiding and illegal laws must be investigated. The legal environment, as well as the difficulty of attracting idle capital, private capital and even international capital investment in the ecological industry, is also difficult to form a strong ecological enterprise.

References

- [1] Garrett Hardin, 1968, The Tragedy of the Commons ,Science 162 :1243 -1248 ;
- [2] Coase, Ronald C, 1960 , The Problem of Social Cost ,Journal of Law and Economics 3, No.1 ;
- [3] Chen Xingang. Research on the Application of the "Tragedy of the Commons" and "The Tragedy of the Anti-Common Land" in China [J]. Shandong Social Sciences, 2005, (3).
- [4] Qu Kai. The "tragedy of the commons" behind the haze [J]. Business Forum, 2014, (08)
- [5] Zhao Yue. On the Influence of the "Tragedy of the Commons" on the Sustainable Development of China's Economy [J]. Management Manager. 2015(8);
- [6] LiuXinjing, Zhang Shucheng. The Roots of the "Fog Capital" Trap in the Background of Urbanization and Its Governance Approaches [J]. Chinese Famous City, Critique of Urban Issues. 2015;
- [7] Lu Dina. The current situation and governance of smog [J]. Zhifu Times. 2016 (08);
- [8] Ren Yunxia. Economic Analysis and Solution of Haze[J].Education and Teaching Forum. 2016(09)