

Study on Ecological Compensation for Coal Mining Activities Based on Economic Externalities

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Abstract

The development and exploration mode of coal resource activities in China result in tremendous waste of resources and ecological environment pollution problems. This article analyzed the use of economic theory of externalities of coal mining activities from the point of environmental economics principles, proposed the ecological compensation connotation of coal mining activities, and analyzed the feasibility of the implementation of ecological compensation from economic viewpoint.

Keywords

Ecological Compensation; Economic Externalities; Coal Mining Activities

1. Introduction

In terms of economic category, ecological compensation belongs to Kaldor-Hicks improvement. Using Kaldor-Hicks efficiency, an outcome is more efficient if those that are made better off could in theory compensate those that are made worse off, so that a Pareto improving outcome results. Ecological compensation aims to improve the quality of eco-system by the method that compensate for ones who contribute to ecological protection to regional places and industries (Gert Van Hecken & Johan Bastiaensen, 2010).

This property results in consultation between different areas, apartments, fields, and economic subjects. And also it should rely on readjustment and control of regulatory authorities.

With the rapid development of global economic and society, energy and environment becomes the crucial problem for a country that whether it could maintain sustainable development or not. Ecological compensation is one of the most popular hot issues in academic fields of environment economy and ecological economy. In a context of continued environmental degradation of coal mining cities and its landscapes, the concept of Payments for Ecosystem Services (PES) has been attracting growing attention in both academic and policy circles. Payment for ecological services plays an important role in compensation plans, which means that beneficiaries of ecological services pay for providers or administrators of these services.

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Since 1990, China attempted to carry out a large number of ecological compensation practices and legislations. Most of the ecological compensation plans are biased for the financial transfer mechanism which aimed at ecological environment protectors and constructors. In 2005, China Council for International Cooperation on Environment and Development established a scientific research team which called “Ecological Compensation Mechanism and Policy Research Team” and made a series of systematic research on China’s ecological compensation mechanisms and policies. This team made a conclusion that ecological compensation is an institution that regulates interests by using economic methods between related individuals so as to protect and utilize ecosystem services sustainably (The Research Group on Eco-Compensation Mechanism and Policies in China, 2007). That is to say that ecological compensation actually is a public system which regulates interests between related individuals by utilizing economic methods and authorities according to ecosystem services price (Quan Dong, 1999), cost of the ecological protection and opportunity cost for development (Weiguang Xie & Xiong Chen, 2008).

Compared with the definition of the concept explained by ecological scholars on ecological compensation (Bergstrom J. C., 1990), (Berg L. V., & Braun E., Otaar A. H. J., 2003). Chinese researchers believe that the core of the compensation is environmental destruction, which mainly emphasize compensation for damaged ecosystem rather than ecological service value provided by ecosystem. Moreover, charge for ecological service emphasis on financial compensation of ecosystem services and the recovery and management of ecosystem environment destruction. Ecological compensation mechanism has become an efficient comprehensive policy tools which promoted ecological protection and exceed different departments, different regions, different specific resources or ecological laws and regulations.

2. Connotation of Ecological Compensation for Coal Mining Activities

In recent years, ecological problems which had caused by mineral resources exploitation in China become more and more serious. The establishment of ecological compensation mechanism of coal mining is the national policy demand and national practice requirements of China. Coal resource production and processing is the leading industry of coal resource cities and just because of the extensive economic growth coal mining industry leads to tremendous waste of natural resources and deterioration of ecosystem so exacerbated the pressure on urban ecosystem. The coal resource type cities depend on local coal resource intensively because of its relatively simple industrial structure and its ecological environment by coal mining activities. In this article, the compensation for coal mining activities mainly focus on “ecosystem” and “environment”, which includes funding supports, government subsidies, tax exemption, policy supports so as to recover from pollution and ecological service function depression because of coal mining.

3. Economic Externalities of Coal Mining Activities

In economics, an externality is the cost or benefit that affects a party who did not choose to incur that cost or benefit (Buchanan James, 1962). Economic externality includes negative externality and positive externality. A negative externality (also called “external cost” or “external diseconomy”) is an action of a product on consumers that imposes a negative effect on a third party; it is “external cost”. A positive externality (also called “external benefit” or “external economy”) is an action of a product on consumers that imposes a positive effect on a third party (Burton Weisbrod, 1964). In early 1990s, two British economists are credited with having initiated the formal study of externalities. Henry Sidgwick is credited with first articulating, and Arthur C. Pigou is credited with formalizing, the concept of externalities, or spillover effects (Mc Connell Campbell R., & Brue Stanley L., 2004).

From the aspect of resources allocation, economic externality presents a phenomenon of low efficiency which beyond the scope of decision makers (Mc Connell Campbell R., & Brue Stanley L., 2004). In ecosystem of coal resource city, external economy refers to that the coal mining promote the development of the city’s economy rapidly and improve people’s living standards with the cost of coal resources depletion. External diseconomy mainly refers to environmental pollution and ecological damage which accompany with coal mining activities and the absence of appropriate environmental compensation which should be paid by those who assumed the responsibility.

The usual economic analysis of externalities can be illustrated using a standard supply and demand diagram if the externality can be valued in terms of money. An extra supply or demand curve is added, as in the diagrams

below. One of the curves is the private cost that consumers pay as individuals for additional quantities of the good (here represents coal products), which in competitive markets, is the marginal private cost (MPC). The other curve is the true cost that society as a whole pays for production and consumption of increased production of the good, or the marginal social cost (MSC). Similarly there might be two curves for the demand or benefit of coal products. The social demand curve would reflect the benefit to society as a whole, while the normal demand curve reflects the benefit to consumers as individuals and is reflected as effective demand in the market.

Figure 1 shows the effects of a negative externality of coal mining activities. In the graph, the coal industry is assumed to be selling in a competitive market—before pollution-control laws were imposed and enforced (e.g. under *laissez-faire*). The marginal private cost is less than the marginal social cost by the amount of the external cost, i.e., the cost of air pollution, water pollution and ecological damage. It is assumed that there are no external benefits, so that marginal social benefit (MSB) equals marginal private benefit (MPB). If the consumers only take into account their own private cost, they will end up at price P^0 and quantity Q^0 , instead of the more efficient price P^* and quantity Q^* . These latter reflect the idea that the marginal social benefit should equal the marginal social cost, that is that production should be increased only as long as the marginal social benefit exceeds the marginal social cost. The result is that a free market is inefficient since at the quantity Q^0 , the social benefit is less than the social cost, so society as a whole would be better off if the coal yield between Q^0 and Q^* had not been produced. The problem is that people are buying and consuming too much coal product. Coal mining enterprises only paid for coal mining, processing, sailing and management. Thus, the government has to take charge of recovery and clean task that should be charged by those coal corporations.

As we all know, coal mining activities will pollute air, soil and water. This discussion implies that negative externalities (such as environmental pollution and degradation by coal mining activities) are more than merely an ethical problem. Hence, when $MSC > MPC$ and its curve move above MPC intersection of curves, the cross point B correspond with production Q^* , which represents the optimal maximum social welfare. Because of the existence of the external cost of environmental pollution and ecological damage caused by coal mining, the coal enterprises would yield quantity Q^0 rather than quantity Q^* . And corporation would improve coal yield progressively, which could maximize their private benefit. So the pollution which created by coal enterprises would be emitted excessively.

4. Economic Analysis of Ecological Compensation on Negative Externality of Coal Mining Activities

According to ecological economy theory, the internalization of negative externality of coal mining activities is the most essential thing to establish ecological compensation mechanism. The negative externality of coal mining activities refer to those adverse effects which includes environmental pollution, ecological damage and some restrictions on survival and development of the residents in coal mining area. Generally, ecological service function has particular economic value and can freely exchange in a perfectly competitive market (Kelsey, Jack. B., 2009). In this case, we can define the ecological compensation foundations of the negative externalities of coal mining activities only when we examine the production process and the marginal costs and benefits of ecosystem services function.

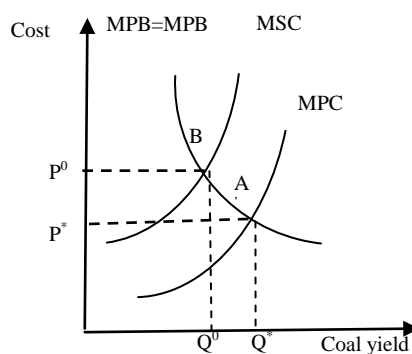


Figure 1. External diseconomy analysis for coal exploitation.

Figure 2 illustrates the relationship between marginal costs of coal mining company and loss of ecological service, it indicates the ecosystem destruction during coal mining activities. Similar to the theoretical analysis of Pigou tax, if we assumed that MPC stands for external diseconomy without considering coal mining cost and MSC stands for external diseconomy after considering coal mining cost. And in the circumstance, Q_1 and Q stand for ecological service losses caused by coal mining respectively and P_1 and P represent coal price respectively. Here, Q represents optimal ecological losses of social service and Q_1 represents actual amount of environment caused by coal mining company. Then just as the figure illustrated, the shaded area (ABC) represents ecological compensation which should be paid by coal enterprises and the purpose of compensation is to repair the ecological service losses between Q_1 and Q . In practice, the amount that we get from Q_1 subtracts Q includes ecological value losses caused by ecological function damage and some adverse effects that influence the daily life and development of residents in coal area caused by those losses.

But, we can observed that the coal mining activities still result ecological service damage(Q) even after the coal enterprises paid the compensation which indicated by shaded area in **Figure 2**. For this part of damage, the coal miners should pay for pollution charges and ecological damage charges according to the “polluter pays principle” and also can restore environment and control mining activities by themselves. In this way, the ecological compensation and pollution charges could exist in parallel and coordinated. That is the important theoretical and practical significance of **Figure 2**.

5. Feasibility Analysis of Ecological Compensation on Coal Mining Activities

In China, the ecological damage and environmental pollution problems in coal resource cities are serious severely and ecological compensation as an effective economic incentive method can supervise resource developers to restore damaged environment and pay for the direct victims, improve the environment quality, regulate the relationship between resource development and environmental protection. It is also the effective way to solve “market failure” problem and “policy failure” problem (Kenneth. J. Arrow, 1969). To implement ecological compensation in coal resource type cities can effectively solve the dual relationship of material compensation and value compensation of coal resources. Meanwhile, the compensation system also can eliminate the external non-economy phenomenon by applying finance measures and other economic policy instruments.

Currently, the financing channels of ecological compensation in China are very single which mainly depend on central financial transfer payment and thus increase the pressure of central finance. The ecological compensation fee collection system and ecology compensation fund operational procedures are not standardized, and the supervision system and restraint mechanisms still imperfect. In China, many local governments often pay less attention on how effectively applied ecological compensation fund in environment construction system and how to improve efficiency of funds utilization. The coal resource type city can raise enough funds to construct and protect the city and provide basic conditions for the development of new environmental technologies by establishing ecological compensation mechanism. Meanwhile, this mechanism also can standardize and improve the financial security of ecological compensation system, and increase the funds utilization efficacy and ecological protection efficiency which avoid separation between ecological protection and benefit.

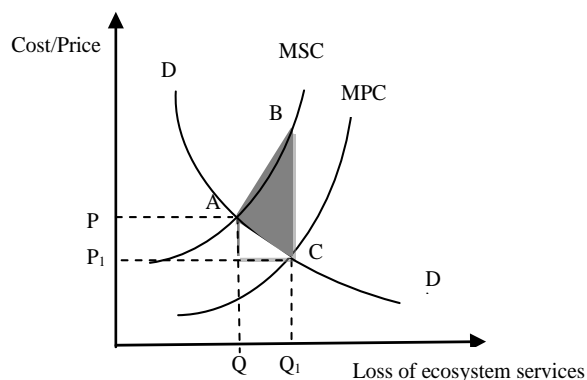


Figure 2. Compensation analysis for negative externality.

China has initially established a legal system of environmental protection and management, but the existing environment legislation is fragmented, lack of systematic legal system and measures regulations, such as there are no clear definition of responsibilities, insufficient laws enforcement, the lower legal status of departmental regulations and some other issues. Therefore, a prefect and unified compensation system for coal mining and to integrate existing taxes measures may make positive effects on the ecosystem of coal resources cities and maximize ecological compensation as an economic environment means which could promote environmental protection and sustainable development in resources city by adjust interests between various individuals. The ecological compensation which was engaged in investigating in this article indicates the marginal environment cost (MEC) of the ecological damage and environmental pollution as a consequence of coal resource exploitation. In China, the central government has not yet prosecute the implement of the ecological charge fee. Meanwhile, the collection efforts of effluent and disposal charges in many coal mining areas are inadequate. Thus, the ecological charge fee can be unified into the ecological compensation fee in order to avoid repeated collection of the costs. Therefore, the ecological compensation on coal mining does not belong to duplicate charges and there exist prerequisites for the establishment of ecological compensation research.

6. Conclusion

This paper briefly elaborates the ecological environment currently situation of the coal resource type cities in China and analysis the feasibilities of ecological compensation on coal mining activities based on its economic externalities. Economic factors in fact are the origin sources of ecological damage and environmental pollution. From the aspect of environment economics, it is the ecological service value created by ecological protection activities that called positive externality or the ambient pollution and ecology damage caused by economic activities that called negative externality result the inconsistency of social cost and private cost. Thus, the adjustment object of the ecological compensation and the establish direction of ecological compensation mechanisms are to correct the distribution relationship between environmental benefits and economic profits.

The approaches for implementing compensation may include active restoration, recreation, enhancement or improvement of resources. In this paper, compensation can be viewed as a mechanism to ensure the ecosystem services of coal resource type cities over time which, from an economic prospective, is often referred to as “maintaining the urban natural capital” upon which our economy depends. Ecological compensation on coal mining activities could be developed further as a tool in the China environmental policy framework. Through the establishment of ecological compensation mechanism can coordinate the concerns of different elements in the system and also can improve the matter energy flowing of the system as well as promote the benignity circulation of ecological system to achieve the optimization of the wholly urban ecological system.

References

- Arrow, K. J. (1969). *The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Non-Market Allocations* (pp. 1-16). Washington DC: Joint Economic Committee of Congress.
- Baumol, W. J., & Oates, W. E. (2004). *The Theory of Environmental Policy*. Beijing: Economic Science Press.
- Berg, L. V., & Braun, E., Otgaar, A. H. J. (2003). *Corporate Community Involvement in European and US Cities. City and Enterprise*. Hampshire: Ashgat.
- Bergstrom, J. C. (1990). Concepts and Measures of the Economic Value of Environmental Quality: A Review. *Journal of Environmental Management*, 31, 215-228.
- Dong, Q. (1999). The Biological Conditions and Ecological Supports Necessary for the Development of Human Societies. *Chinese Journal of Applied Ecology*, 10, 233-240.
- James, B. (1962). Externality. *Economics*, 29, 371-384.
- Kelsey Jack, B. (2009). Upstream-Downstream Transactions and Watershed Externalities: Experimental Evidence from Kenya. *Ecological Economics*, 68, 1813-1824.
- Mc Connell Campbell, R., & Brue Stanley, L. (2004). *Economics*. Beijing: China Financial & Economic Publishing House.
- The Research Group on Eco-Compensation Mechanism and Policies in China (2007). *Eco-Compensation Mechanisms and Policies in China*. Beijing: Science Press.
- Van Hecken, G., & Bastiaensen, J. (2010). Payments for Ecosystem Services: Justified or Not? *Environmental Science and Policy*, 13, 785-792.

Weisbrod, B. (1964). *External Benefits of Public Education*. Princeton: Princeton Industrial Relations Section.

Xie, W. G., & Chen, X. (2008). Theory and Mechanism of Ecological Compensation. *Journal of Anhui Agricultural Science*, 36, 6018-6019.