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Research on Internalization of environmental costs of Economics

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Abstract

From the beginning of the industrial society, the problem of environmental pollution has been accompanied by economic development, there is a growing emphasis on the internalization of environmental costs to solve the problem of environmental pollution. Overall, the internalization of environmental costs helps to improve the level of welfare effect of the whole society, the internalization of environmental external costs is necessary. The measurement of environmental costs is the most important part of the internalization of environmental costs, and it is a prerequisite for internalization of environmental costs. In practice, we can use the general principles of measurement of environmental costs and general measurement model to correctly measure the environmental costs. Doing a reasonable estimate on the value of natural environmental resources of an industry helps to meet the objective requirements of social and economic benefit balance.

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1. Source of the internalization of Environmental costs theory

The substance of the internalization of environmental costs is to resolve the external effect in the economic of environment as resources having public goods characteristics. Externality refers to the effect of the producers' production behavior (or consumers' consuming behavior) on the welfare of a third party. It is an additional effects of non-market that an economic force does on another, including the positive externality and negative externality. If this resource is scarce, meaning that different subjects are incompatible with each other, then the negative externality will inevitably occur. The environment is just a typical kind of scarce resource, and certain economic entities in the use of the environment will affect the use of other economic entities on

the environment. Therefore, environment pollution in the use of environment has the typical negative externality.*

On how to solve the environmental impact of negative externalities, back in the early 20th century, Pigou pointed out in his book -- "welfare economics", the basic idea to solve the externality is to take the state's tax. He believes that a tax on polluters for the damage caused by environmental pollution can equalize the gap between the private and social costs, ultimately benefit to the development of the environment. According to Pigou's theory, make the negative external effects caused by market failures internalize to the true costs of production of goods, then we will be able to correct the situation in which people turned a blind eye to the damage of social pollution. Different with Pigou, Coase pointed out in the article "Problem of Social Cost" in the 1970s that we should let the market or the property to solve the negative externality problem, There is no need for the Government to intervene the market. His basic point is: if the market transaction costs are zero, the distribution of the legal ownership of the property will not affect the efficiency of economic operation. He argued that property rights, no matter how it is allocated, as long as it is clearly defined, will be able to solve the problem of low environmental efficiency of resource allocation. As zero transaction cost is impossible, Coase clearly pointed out that, as long as the value of market transactions is higher than the transaction costs, the transaction is worthy or is likely to be carried out. In the 1990s, people advocated to establish the new environmental-economic system based on the concept of "eco", taking into account the environmental ethics, the economic interests of market players, the environmental value and the social value. Based on this theory, a number of emerging environmental and economic policy and means can be utilized. Therefore the theory of the internalization of environmental costs has been fully expanded.

We can see that if we can eliminate the external environmental costs, make the price of the product contain the environmental costs, which is called the internalization of environmental costs, then the market can allocate resources efficiently by the correct price signals.

2. Welfare Effects of the internalization of environmental costs

The internalization of environmental costs means taking the external costs of pollution of the environment as part of the producer costs included in the total costs of the product to make the environment as important as capital, labor, resources, technology and other factors of production. The reason of external diseconomies of environmental issues is that private costs is translated into social costs, the most effective way to solve this problem is making the private costs of the producers transformed into its own production costs, named the internalization of private costs. As the social costs far outweigh the private costs, the internalization of the private costs is the best choice for the society to reduce the economic loss.

The influence of the internalization of the private costs on producers: For a producer, its production costs consist of two parts, one is the cost of production, denoted by C_p ; the other is the cost of pollution control, denoted by C_c ; if the producers do not control pollution and pollution will cause damage to the society, the social costs denoted by C_s . We mark the production as Q and the price as P .

If the negative externality was not considered, the companies will not control pollution, and corporate earnings are recorded as R_1 :

$$R_1 = PQ - C_p \quad (1)$$

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At this time enterprises' social welfare contributions are recorded as F_1 :

$$F_1 = R_1 - C_s = PQ - C_p - C_s \quad (2)$$

If we taking into account the negative externalities and make it internal, then the enterprises will increase the cost of pollution control-- C_c . At this time the level of profitability is recorded as R_1' (assumption production and price remain unchanged):

$$R_1' = PQ - C_p - C_c \quad (3)$$

As the enterprise control the production of pollutants, it will not cause social harm, so $C_s' = 0$. Then the enterprises' contributions to social welfare are recorded as F_1' :

$$F_1' = R_1' - C_s' = R_1' = PQ - C_p - C_c \quad (4)$$

If we compare R_1 with R_1' :

$$R_1 - R_1' = (PQ - C_p) - (PQ - C_p - C_c) = C_c \quad (5)$$

It means that companies which do not control pollution will get overprofits of C_c .

If we compare F_1 with F_1' :

$$F_1 - F_1' = (PQ - C_p - C_s) - (PQ - C_p - C_c) = C_c - C_s \quad (6)$$

Generally speaking, $C_c < C_s$, thus $F_1 < F_1'$. This indicates that the internalization of negative externalities (ie, the corporate control environmental pollution) will help raise the level of welfare of the whole society.

3. Measurement of the internalization of environmental costs

3.1. General principles of the measurement of the internalization of environmental costs

The Internalization of environmental costs needs scientific measurement of the environmental costs, In theory, this principle must follow the basic measurement principles in the general accounting standards. Meanwhile, it also should be based on the objective characteristics of the environmental costs, increasing meaningful principles.

(1) the principle of caring about both economic and environmental benefits. This is the basic principle of the measurement of environmental costs, it requires taking into account both the economic and environmental benefits. In the process of measurement of environmental costs, we should make sure that all types of environmental protection are taken into account, not only consider environmental protection costs that have impact on short-term economic interests, but also the cost of long-term cost of resource depletion and environmental maintenance.

(2) the principle of reliability and relevance. Traditional accounting principles emphasis more on reliability, but due to the characteristics of both the accuracy and fuzzy of the environmental costs, its measurement should focus on the combination of both reliability and relevance.

(3) the principle of both flexibility and normative. Traditional costs measurement focus on the normative, but the measurement of environmental costs is still in the initial stage, the specific norms is not yet reflected and

many complex issues have not been settled. So the principle should have some flexibility based on the actual situation in compliance with the accounting rules.

(4) the principle of cost-effective. Based on the principle of cost-effective, when we measure the environmental costs, it shall not exceed the revenue generated by measuring and reporting the information. As the environmental cost objects are more complex with a wide range and the form of existence is not standardized, so its accurate measurement needs to pay the high cost.

The traditional accounting measurement was built up on the basis of the labor theory of value, but this method is very difficult to effectively measure the various elements of the environmental costs. Therefore the measurement methods of environmental costs must establish theories that can measure the value of non-commutative and non-labor goods. Taking into account the characteristics of the environmental costs, the measurement methods of environmental costs can be built on the basis of the theory of the marginal value and labor value. As for environmental costs, its measurement standards are on the basis of the currency. If necessary, we can use physical and labor indicators, a mathematical model or words to explain the size of the losses caused to the environment and environmental performance. Its measurement attributes historical cost or original consuming level, sometimes we use the replacement cost, current cost or future cost to measure. That is to say we insist on the historical costs as basic measurement methods, also introduce the replacement cost, current cost or future cost to measure.

3.2. The classification of environmental costs and the general measurement model

Measuring the internalization of environmental costs is first asked to classify the environmental costs. while the internalization of environmental costs was mainly focused on the environmental damage caused by the production, as for an industry, the environmental costs can be sub-divided into four categories: resource consumption costs of the industry, environmental pollution loss costs of the industry, environment maintenance costs of the industry and environmental protection costs of the industry.

Environmental costs can be measured in various ways, but there are various difficulties for these methods in practical application. Choosing possible measurement methods based on different types and characteristics of the environmental costs and establishing accounting system for environmental costs facilitates the internalization of environmental costs into production costs.

As environmental costs of the industry include four types, the total environmental costs equal to:

$$C_t = C_{1t} + C_{2t} + C_{3t} + C_{4t} \quad (7)$$

Among them: C_t -- environmental costs of an industry in one year
 C_{1t} -- resource consumption costs of an industry in one year
 C_{2t} -- environmental pollution costs of an industry in one year
 C_{3t} -- environmental protection costs of an industry in one year
 C_{4t} -- environmental protection costs of an industry in one year

(1) measurement of resource consumption costs of the industry (C_{1t})

Resource consumption costs of the industry refers to the value of reducing the number of resources entities caused by industry development. In accordance with its use, a part of resources is transformed to the value of the product with the production activities as a direct raw material. The other part is not included in the costs of the product, it is handled as the cost of fuel and power in the traditional accounting without considering the environmental costs. The environmental costs here we referred to do not include the resource value

transferred to the value of goods as raw materials. They should be included in the costs of the product in the approach.

Natural resources are the necessary conditions for industrial development, but with rapid GDP growth, a lot of consumption of resources has caused a huge loss to the environment, this loss will inevitably lead to decrease in economic benefits. However these non-productive resources assets were often ignored in traditional economic accounting, such as land, mineral resources, water resources and ecosystem. Therefore in order to ensure the sustainable growth of the national economy, we must fully consider the number of resources consumed, resource efficiency and used methods. The price of a variety of resources will be inevitably involved in order to confirm the value of resources , there are two main viable ways: the net price method and the cost subsidy approach .

The net price method assumes that future losses of net profit stream for future resource depletion is zero, this assumption is based on the long-run equilibrium state, generally used for the calculation of the value of non-renewable resources. We believe that the value of the resource is a product of the resource changes in the amount with the difference between the average market price of the unit resource and unit marginal cost of the product, expressed as a formula:

$$C_{1t}=(P_t- MC_t) \cdot \Delta Q_t \quad (8)$$

Among them: C_{1t} -- consumption costs of the resource in one year;
 P_t -- the average market price of the resource in one year;
 MC_t -- the marginal cost of the resource in one year;
 ΔQ_t -- changes of the stock of the resource in one year.

Cost subsidy approach assumes that the resources can completely replace the other factors of production, it divide exploitation and sales profits of resources into two parts, one part is the capital element or called the user cost, the other part is the added value elements, namely, the real income. The user costs is on behalf of the part of profits which must be re-investing in order to compensate for the reduction in future profits from the resources. We think that a part of income received from resource extraction and sale belong to the user cost of using resources, which need to be deducted. Its accounting formula is as follows:

$$C_{1t}=R- X=R/(1+r)^{T+1} \quad (9)$$

Among them: R -- normal profits of resource development;
 X -- profit conversion constant revenue stream;
 R -- margin;
 T -- mine life.

Net method tends to overestimate the consumption of resources, which can be considered as an upper limit of the estimated environmental costs; user cost subsidy approach is a lower limit of the estimated environmental costs. Specific to certain environmental resources, we should deform the model based on the actual situation before measurement accounting.

(2) measurement of environmental pollution loss costs of the industry(C_{2t})

The loss cost of environmental pollution means that pollutant emissions from industry damage or pollute the environment, which leads to degradation of some of the environmental function, and it brings harm to the society and other stakeholders, resulting in economic losses. It mainly includes the economic losses caused by air pollution,water pollution, solid waste pollution and noise pollution which do harm to the society and other stakeholders. This part is completely ignored in the traditional accounting. The measurement of environmental pollution loss costs of the industry is a process from description of the environmental damage

situation to the monetary expression of the environmental losses. The basis data come from environmental monitoring data published by the national environmental protection department.

Industry losses of air pollution include human health losses, losses of lower the quality of atmospheric environment, agricultural losses and losses of construction materials corrosion. Calculation of the loss of human health uses the modified human capital approach, which means that losses of human health include the loss of human health caused by air pollution and the loss of mortality change caused by air pollution. We can use the shadow price to account for losses of lower the quality of atmospheric environment, we can select the minimum of the foreign shadow price as the unit price for researching the decreasing of quality of atmospheric environment. Agricultural losses caused by air pollution can use the market price method, there is a corresponding relationship between the reduction yield in agriculture and agricultural losses, so we can measure the agricultural losses according to the data from the department of agriculture. As for the construction materials corrosion losses, we can use the cost-recovery method to calculate the value of its loss.

Industry loss from water pollution include the losses of human health, agricultural losses, water pollution and industrial economic losses of the other industries caused by water pollution. The losses of human health still use the modified human capital approach, including the increase of incidence of the disease resulting in medical costs and days lost. Industry water pollution in agricultural losses could be obtained by the market value method. Industrial economic losses in other industries mainly refers to losses caused by plant shutdowns and water shortages in other industries due to the water pollution, and it can be calculated by the opportunity cost method.

The loss of industry solid waste pollution mainly refers to the economic losses of environmental pollution caused by stockpiling and emissions of solid waste. Loss of noise pollution can not be estimated now.

(3) environment maintenance costs of the industry (C_{3t})

Industry maintenance costs refer to the cost that should be put to eliminate pollutants in order to maintain the original quality of the environment not degrade, including the governance costs of the pollutants and sewage charges. Pollutant treatment costs are the total sum of the unit treatment cost for each pollutant and the pollutant emissions of each pollutant, sewage charges are calculated by the sum of the types of pollutants and the unit sewage charges of the pollutant.

(4) environmental protection costs of the industry (C_{4t})

Environmental protection costs of industry are the actual costs undertaken by the departments in the form of environmental protection expenditures, Accounting of this environmental costs can be directly obtained by related Yearbook, including an annual investment in environmental protection in the industry as well as the environmental management costs in response to changes in environmental standards and export policy.

4. The Conclusion

This paper studies related theories about the internalization of environmental costs, the main contents include: the source of the theory of the internalization of environmental costs, economic welfare of the internalization of environmental costs and the general principles and models of measurement of the internalization of environmental costs. This article draws on research findings of scholars on the environmental costs measurement, combines with the definition and classification of environmental costs, uses the structural decomposition method, at last establishes the content that environmental costs should include, and puts forward quantitative method of practical operation for each item. Measurement accounting of environmental costs has been reflected in traditional accounting system, but the connotation and the approach of this paper is not entirely consistent. Resource consumption examined in the text is the non-productive resources. In the processing of sewage charges, they are not carried out in accordance with the

total emissions of pollution, and this is not the same as the modalities for the accounting of the enterprise sewage charges. The internalization of environmental costs in this paper is to include the environmental gains and losses in the cost of the product, reflected in the product prices, on the one hand, in order to explain that their environmental costs should be included in the cost of the product as an independent individual to truly reflect the cost of the product, on the other hand to keep environmental cost accounting system integrity.

In the measurement process of the internalization of environmental costs in each industry, we must fully consider the actual situation of the environmental costs of the industry, be sure to choose the best method to measure environmental costs to avoid the possibility of overestimation and underestimation of the environmental costs, truly reflect the environmental costs in the most objective manner. Due to personal capacity constraints and the objective conditions, we strive to further deepen and improve the measurement of internalization of environmental costs.

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