

Case Studies and Its Effectiveness of Environmental Taxation

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Abstract:

We reviewed existing environmental tax scheme of Nordic and European countries and assessed their effectiveness. There are few evidences that the theoretical merits of environmental tax were materialized.

免責事項

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1. Introduction

The environmental tax is to tax energy to reduce CO2 emission.

There is a theory that the greenhouse gas can be reduced in cost-effective manner by using an economical technique such as the environmental tax. However, many of these theories are theoretical consideration and trial calculations based on economics. Whether an economical technique can really achieve such an effect is only understood when ex-post evaluation of a real example is made.

The environmental tax was introduced in Europe in 1990's, and ex-post analysis of the effect has been accumulated after ten years or so. In this paper, it is verified whether the environmental tax effectively functions in terms of reduction of the greenhouse gas emission through the European cases.

First of all, oft-expressed "theoretical merit" of general environmental tax is reviewed. Next, whether these theoretical merits were made true or not is verified, by examining cases of environmental tax introduction in Europe.

2. "Theoretical merit" of general environmental tax

It is assumed that the environmental tax has some theoretical merits (Figure 1). It is explained sequentially.

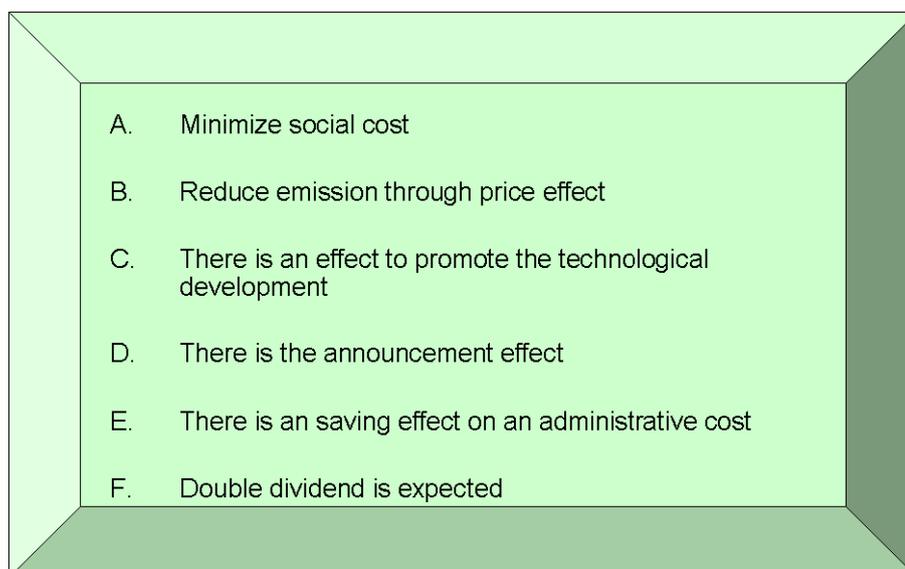


Fig. 1 "Theoretical merit" of environmental tax

A Minimization of social cost

Actual emission reduction means are selected by those who actually emit because the tax just provides the price signal. If emitters will reduce his/her emission with minimum cost, they conduct all measures whose reduction cost is lower than tax rate. As a result, it is expected that efficient emission reduction is possible.

B Price effect

Environmental tax generates cost awareness of the environmental impact. As a result, it is considered that the price of the fuel that emits greenhouse gas (CO₂) such as coal relatively rises and it promotes use of energy with less amount of emissions like natural gas, natural energy, and nuclear power.

C Promotion effect of technological development

It is believed that environmental tax provides incentives to continuously reduce emissions, encouraging technological development.

D Announcement effect

It is thought that introduction of environmental tax being widely informed makes people aware of the tax burden and rouses the concern for environmental problems, that leads to promotion of energy conservation investment and conversion of the lifestyle.

E Effect of reduced administrative cost

It is regarded that the environmental tax can achieve the target of the global warming mitigation by tax rate set at an appropriate level by regulatory authorities. On the other hand, direct policy means such as energy conservation standards needs professional knowledge about negotiation with industry to be controlled, countermeasure techniques and their costs. Therefore, the environmental tax is considered to save an administrative cost compared with direct policy means.

F Effect of double dividend

It is expected "the effect of double dividend" works not only for environmental improvement but also for promotion of employment and boosting economy because the environmental tax becomes new fiscal revenues, which can be used for other uses including the cost of social security load reduction and public investment, etc.

There are economic theories that cast doubts on the achievement of these "theoretical merit" and counterarguments on effectiveness of an economical techniques are actually presented. Let's stop the theoretical topic and examine whether theoretical merit have achieved or not, seeing the real case.

3. Brief summary of environmental tax systems of scandinavian countries

In the following, the case of five countries, Finland, Norway, Sweden, Denmark, and Netherlands that have introduced environmental tax will be examined. These countries introduced the environmental tax earlier than other countries in Europe, so they are comparatively advanced in ex-post analysis concerning effectiveness of the tax effect.

Name of tax (Country)	Introduced year	Main Feature
CO2 tax (Finland)	1990	Initially, it was a uniform low rate tax system (1.44ECU/ton) but revision in 1994, 1997 differentiated tax rate by objective, use and user (reduced load in the industrial sector)
CO2tax (Norway)	1991	High tax rate was applied mainly to oil mining business and gasoline consumption. The targeted sector was expanded by the revision in 1999, and the environment tax system that applied different tax rate in each sector was applied. The raw material in the manufacturing process was tax-free.
CO2tax (Sweden)	1991	Initially, tax rate of 33ECU/ton was applied. However, the tax was exempted in energy-intensive industry. The tax rate in the household sector was raised and that of the manufacturing sector and the gardening sector were lowered by the revision in 1993.
CO2tax (Denmark)	1992-3 (1 year later in the industrial sector)	In household sector, 13ECU/ton and in industrial sector, 6.5ECU/ton were introduced. The tax bracket by usage was set with Green Energy Package in 1996, and the tax rate reduction was introduced combined with voluntary agreement.
Energy control tax (Netherlands)	1996	Heavy tax rate was applied to small-scale energy consumer, depending on annual energy usage. The EU minimum tax rate was applied to the group with the highest consumption.

Fig. 2 Environmental tax systems in Scandinavian countries as analysis objects

Figure 2 summarizes introduction timing and main feature of the environmental tax in each

country and main features. Common feature is that the environmental tax was introduced in the first half of the 1990's, taxation on the residential sector is main, and tax exemption is provided in various ways for the industrial sector.

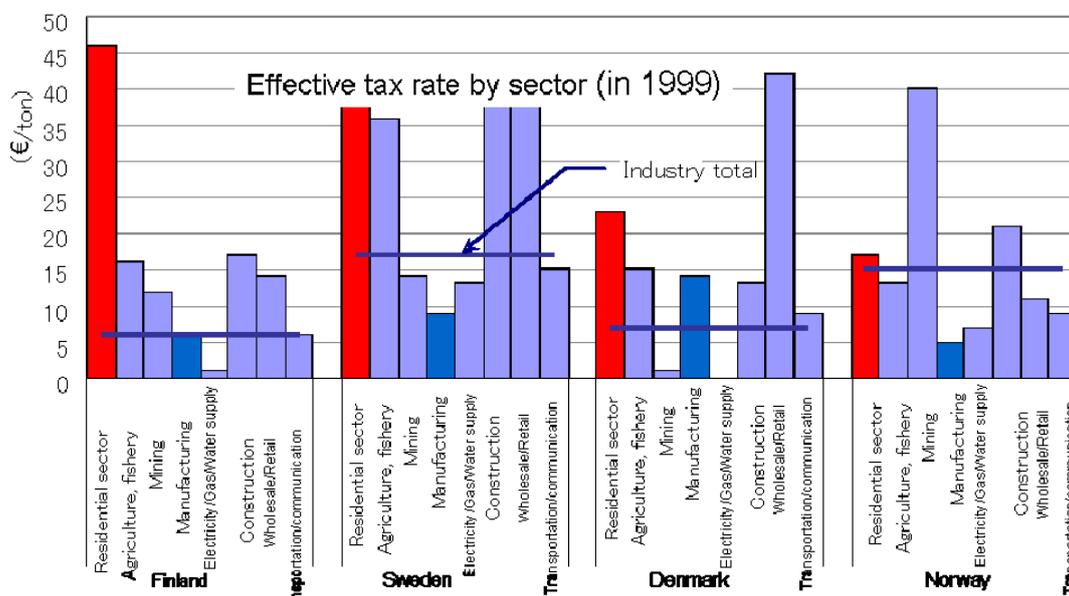
4. Was theoretical merit realized?

Then, let's conduct ex-post evaluation to verify whether the theoretical merit mentioned previously has been achieved or not one by one.

A The environmental tax doesn't minimize social cost.

First of all, as to "minimization of social cost", it is implicitly assumed that the environmental tax has been equally imposed on the whole society. This is based on the idea of economics that a uniform environmental tax works as a price signal, all measures whose cost is lower than a tax rate are implemented, and the cost minimization is made.

However, because a tax rate for each sector has been different, this assumption can not be made. (Figure 3) This Figure shows the effective tax rate by sector in each country. There is two to eight-fold differences in tax rates among sectors. And the tax rate is more reduced for industries consuming more energy. Under such circumstance, cost in the whole society will not be minimized.



(Reference: Eurostat(2003) "Energy Taxes in the Nordic Countries - Does it Polluter Pay?")

Fig. 3 The environmental tax rate was made different by each sector.

The reason why a tax rate is made different by each sector is that a variety of reduction measures

were taken in trading industry, considering the maintenance of price competitiveness in industrial sector.

Actually, in Sweden, a uniform tax rate was applied excluding a partial exception in 1991 when the environmental tax was introduced at first. However, as massive tax reduction measures was taken in the industrial sector in Denmark the following year, in subsequent 1993, a large-scaled review of the tax system was conducted in Sweden, implementing great tax reduction measures in industrial sector following Denmark.

In these two countries which are deeply related in their economies, it was politically impossible that only one country imposed the high rate of environmental tax in the industrial sector. This episode suggests that it be extremely difficult to maintain "uniform tax rate", or a theoretical "good appearance" of the environmental tax in reality.

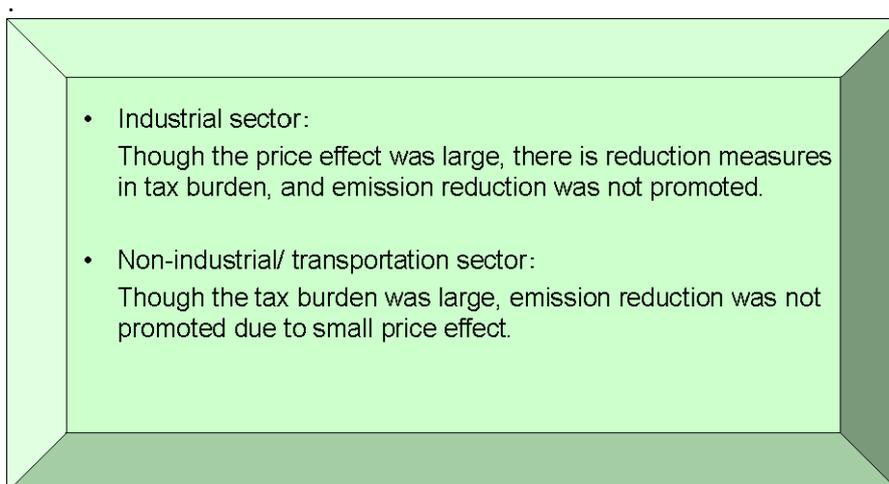
B The price effect has not been achieved.

It seems The price effect has rarely led to CO₂ reduction. Analysis of Norway case clearly indicates the reason. (Figure 4)

To decrease CO₂ emission by the price effect, an energy user is required to react to the price sensitively, that will be the first condition. However, in general, the sensitivity to energy price change for household, a small-scale enterprises, and a service agency is not large.

On the other hand, the industrial sector sensitively reacts to the cost. Especially, the industry that uses great amount of energy is motivated to be engaged in reduction in energy consumption because higher energy prices drive up the production cost, and could potentially affect their business results.

However, as seen before, actual tax rate is suppressed to be low because there are variety of reduction measures taken for the industries who consume great amount of energy. Therefore, emissions reduction did not take place.



Reference: produced based on reference material No. 6

Fig. 4 Price effect of environmental tax

C It does not lead to long-term technological development.

In the theory on the environmental tax, the effect of the incremental technological development is expected. It had effect only on improving an existing technology in short-term, but it was found that the tax did not encourage innovative technological development in long term (Figure 5).

Of course, if taxes with rate higher than environmental tax in place were introduced, long-term and innovative technological development might have been developed. However, it is no use of speaking such an assumption. Because such a high tax rate causes the remarkable rise in energy prices, and increases loads on companies and household, political resistance to the introduction would be large and thus it would not take place. Therefore, the promotion of technological development through the tax did not happen in reality.

Even if a higher tax is successfully introduced, it is difficult to stabilize and maintain such a tax. For example, in the interview study to the company concerning the environmental tax in Sweden, there was a point that "As a rate of the environmental tax was changed suddenly by the political judgment, it did not have a big influence very much on the decision making for a long-term investment strategy". Thus, the environmental tax has not been related to long-term technological development in many cases.



High tax rate necessary for achievement of technological development is politically difficult (priority placed on maintaining competitiveness of domestic industries).



It is considered by companies that tax rate is changed suddenly by political judgment. It does not influence the decision of the company's long-term strategy much (interview study in Sweden)

→Short-term and incremental measures are prioritized.

Source: produced based on reference material No. 2

Fig. 5 The environmental tax doesn't promote long-term technological development.

However, there is some successful examples of promoting technological development by the environmental tax. It will be explained below. (Figure 6)

The first example is an expansion of expanded use of biomass in Sweden. It is reported that use of the biomass expanded after introducing the environmental tax in Sweden.

In Sweden that has abundant forest resources, biomass fuel was cheap, the price difference between the biomass fuel and the fossil fuel was small, and cogeneration facilities were advanced. So there was the situation that biomass can compete economically with the fossil fuel. Therefore, introduction of the environmental tax improved the comparative advantage of the biomass fuel to the fossil fuel even if it was a comparatively low tax rate, and there was a certain effect on the expanded use.

However, this situation doesn't apply to another country. In a country like Japan where procurement cost of the biomass is high, a high tax rate, which is incomparable with Sweden, is needed to spread to the biomass by the relative price change by the tax.

Another successful example is the one that the introduction of high rate environmental tax promoted CCS technology (CO₂ capture and storage technology) in the oil sector in Norway. It could happen because the main oil company in Norway was owned by the government, which is a special case. More specifically, in Norway, there was a suitable circumstance where high rate of environmental tax was exceptionally introduced in the oil sector.

By the way, the governmental initiative on technological development played a major role in advancement of CCS technological development in Norway. It means that environmental tax only played a supplementary role. In reality, the technologies other than CCS that had been promoted by the environmental tax only achieved short-term and incremental improvement after all.



Use of the biomass is expanded in Sweden.

→ The price gap from fossil fuel was originally small, and there was a circumstance in which the relative price was reversed easily.



High rate of the environmental tax was introduced in the Norwegian oil sector, and CO₂ collection and disposal (CCS) was realized.

→ Because the main oil company was owned by government, application of high tax rate was politically possible.

→ A long-term, innovative technology like CO₂ collection and storage was realized under the governmental initiative in its technological development. Many of technical innovation promoted by the environment tax were short-term and incremental improvements.

Source: produced based on reference material No. 3

Fig. 6 Did the environmental tax promote long-term technological development?

D Announcement effect is not verified.

There are two meanings in announcement effect. Both have been used with no clear distinction in Japan. Other than Japan, in general, "Announcement effect" is the effect gotten when introduction of the tax is informed in advance and countermeasures are taken ahead of schedule. This effect is almost always considered as the announcement effect in general other than Japan.

Another meaning of "announcement effect" which appears to be a peculiar usage in Japan, is a psychological effect, so to speak, that people change their action styles through people's interest being aroused on the tax by their awareness of its introduction.

It is reported by a positive analysis that the first of the above "announcement effect" has an impact on the environmental tax. However, this is an effect observed in policies in general, and this is not specific for the environmental tax.

On the other hand, the latter "announcement effect" is not verified in reality and there was just a conceptual expectation that such impact takes place (Figure 7).



What is announcement effect?

- ① The effect of "being executed in advance" by informing introduction of tax in advance.

→ It is not an effect peculiar to the environment tax.

- ② By informing of tax widely and tax being acknowledged, "Psychological effect" to rousing people's concerns for the global warming problem, and promote lifestyle change.

→ It is not verified in real cases.

Fig. 7 Announcement effect is not verified.

E An administrative cost of the environmental tax is not small

In the theory on the environmental tax, targeted emission level can be achieved by adjusting a tax rate and appropriate policy management is possible even if there is no expertise on an individual reduction technology.

However, detailed expertise of reduction technology is needed in reality because, when the tax is introduced, burdens on domestic industries are almost always adjusted with the introduction of a variety of reduction measures and combination of these and other measures.

For instance, in Denmark, there is a system that applies greatly reduced tax rate to the companies that conclude voluntarily agreements on energy efficiency improvement with the government. Therefore, a lot of companies are participating in this agreement to receive the tax reduction. The negotiation to conclude this arrangement took long time by both the companies and the government. Moreover, it is pointed out that if there is no enough expertise on the administrative side, it is not possible to make an appropriate agreement. (Figure 8)



In reality, a system becomes complex because burden adjustment will be attempted by combination of tax reduction, investment subsidy, and voluntary commitment etc.



High expertise and complex negotiation procedure same as direct control are required on administrative side, so these measures may function overall and effectively.

Reference: produced based on reference material No. 5

Fig. 8 An administrative cost related to the environmental tax is not small.

F The effect of a double dividend is not verified

A double dividend means the secondary effect such as employment promotion and boosting of the economy by reduction of other taxes and the government expenses based on new fiscal resources using environmental tax (second dividend) in addition to environmental improvement as initial purpose of environmental tax (first dividend).

The main reason for the environmental tax being actively introduced in Europe during the 1990's is to reduce burden of the cost of social security load. On that occasion, this "a double dividend" was actively said.

Similar movement was also seen in Eastern Europe. It appears that environmental tax was promoted as an effective means to secure tax revenue even during the economic depression.

It is certain that the environmental tax became a stable revenue source. However, there is no ex-post verification that the tax revenue was used effectively without wasteful spending and, as a result, a supplemental effect called "a double dividend" was obtained. Effects of tax revenue and the double dividend should be discussed separately (Figure 9).



Double dividend is:

- **the largest factor that promotes introduction of environment tax in Europe**
- **effective in Scandinavian countries as a reduction measure of social security burden.**
- **Securing of stable tax revenue is a primary objective in Eastern Europe.**

→ It is unknown whether the tax revenue is effectively used and "double dividend" is obtained.

Fig 9 "A double dividend" is not verified

5. Summary

Role of the environmental tax assumed in theoretical consideration is analyzed under the ideal world that ignores various, complex reality, so it does not reflect the background of real politics. Therefore, "theoretical merit" is just an armchair theory and it was found that it did not happen in reality as shown in the case analyses (Figure 10).

	Theoretical merit	Ex-post evaluation
A	Minimization of social cost	It will not be “flat tax rate” due to industrial competition-related concern, and cost is not minimized.
B	Price effect	Emission reduction by the price effect has not been identified.
C	Promoting effect of technological development	Short-term measures are prioritized, and it does not lead to long-term, technological development.
D	Announcement effect	It is not peculiar to the environment tax though there is an effect of measures executed in advance. A psychological effect has not been verified.
E	Saving of administrative cost	The cost is not low because high expertise and negotiation with individual industry are required for domestic burden adjustment.
F	Double dividend	Though there was a tax revenue, the effect of “double dividend” has not been verified.

Fig. 10 Many theoretical merits of the environmental tax have not taken been realized.

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