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For a Greener Environment: Standards versus Taxes

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Abstract: Emission standards referred as the "command and control" in literature is a legal limit on the amount of pollution of an individual source. Taxes, which are collected by the local or national authorities, are a fee levied on each unit of pollutant emitted into the air and water. Administrators in most cases prefer taxes to standards because of the difficulty to calculate of the relevant marginal costs and marginal benefits, not excluding external costs as well as the estimation of the monetary costs of the environmental damage. The pro and costs of standards and taxes are always discussed by the economists and policy makers. This paper thus aims to give the basic theoretical background of those policy instruments and analyse of practical implementations, which are based on fully literature review.

Keywords: Environment, Taxes, Standards, Command and control

Daha Yeşil Bir Çevre İçin: Vergilere Karşı Standartlar

Öz: Literatürde "komuta ve kontrol" olarak işaret edilen emisyon standartları bireysel kaynaktaki kirlilik miktarındaki yasal bir sınırdır. Yerel ve ulusal otoriteler tarafından toplanan vergiler hava ve su içerisinde emilen kirliliğin her birimi için alınan ücrettir. Çoğu durumda yöneticiler çevresel tahribatın parasal miktarını tahmin etmede olduğu kadar dış giderleri hariç tutmaksızın uygun marjinal fayda ve marjinal zararı hesaplama zorluğundan dolayı vergileri standartlara tercih etmektedirler. Standartlar ve vergilerin avantaj ve dezavantajları her zaman politika yapıcı ve iktisatçılar tarafından tartışılmaktadır. Bu yüzden, bu çalışma bu politika araçlarının teorik arka planını vermeyi ve tamamen literatür özetine dayalı pratik uygulamaları analiz etmeyi amaçlamaktadır.

Anahtar Kelimeler: Çevre, Vergiler, Standartlar, Komuta ve kontrol

1. INTRODUCTION

There are basically two preventive measures with respect to environment which one of these is taxes and the other is standards. The first idea of environmental taxes developed by Arthur Pigeu dates back to 1920. This is essentially more adoptable among the economists than the practitioners/regulators as the calculation of the relevant marginal costs and benefits is quite complicated and difficult to accomplish the desired output (Hodge, 1995). Also, theoretically well designed environmental taxes are directly tended to political manipulation (Pieler, 2000). However, reaching the environmental goals will be more efficient and effective if these are strongly supported by the consistent regulators (Tindale and Holtham, 1996). The second preventive measure is the standards which are the most commonly used approach in environmental policy. It can aim either to set emissions standards or licensing for plants to minimise risk or to create an ambient environmental standard for a region. The policies have proved that the taxes and standards are formulated differently in developed and developing world from 1920`s to date. This paper is structured as follows: the first part is a theoretical concept of taxes and standards, the second part focuses on evaluation and the last part lies on the practices of both policies.

Theoretical Background

Taxes

The tax on environment was suggested by economist Arthur Pigou in a book first published in 1920. Pigouvian taxes raise revenue and respond automatically to changes in the market

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such as lower cost of production or pollution mitigation. There is always an incentive to cut pollution with Pigouvion taxes. Pigou stated that the optimal level of pollution control can be achieved by a tax set at the level where MAC equal MD.

One common principle backed is that the polluter-pays principle. This was firstly adopted by the OECD[1] in 1972 (RCEP, 1998). The principle states that the polluter should bear the costs of any pollution prevention and control measures which are necessary in order to ensure that the environment is in an acceptable state.

While the Polluter-Pays Principle (PPP) may appear straight forward in principle, it is not always so in practice. It is generally assumed that individuals and firms do not have the right to pollute.

As seen in Figure 1, the tax should be set in terms of £ per unit of emissions where MD = MAC. A tax set at the correct level encourages the polluter to reduce emissions to the optimal level e*. It is up to the polluter whether and to what extent s/he responds to the tax. However, it is in the polluter's self-interest to move to e*.

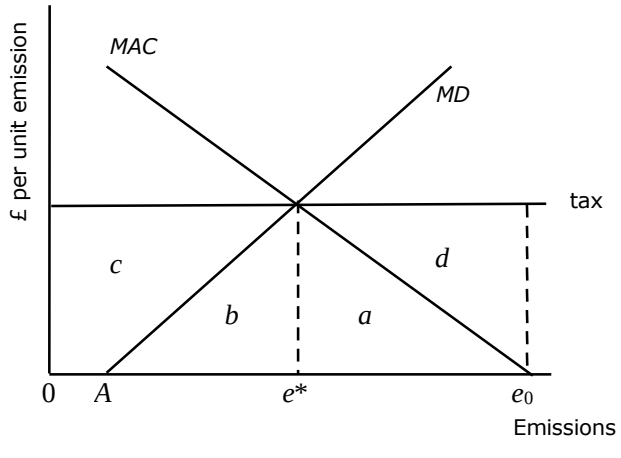

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Figure 1. Optimal level of a tax

Standards

As referred to as the "command-and-control" approach in the literature, emission standards is the most generally used approach in environmental policy. An emission standard has permissible limit on the amount of the pollution for particulate matter, sulphur dioxide, carbon monoxide, nitrogen oxide, ozone, and lead.

In figure 2, it is assumed that the government would want to set the standard at the optimal level of pollution, that is, at the point where

MAC (marginal abatement cost) = *MD* (marginal damage)

The regulator faces two sets of problems in setting the standard at the correct level.

- The positions of the *MD* and *MAC* curves are normally not known, so the regulator would hit the optimum only by coincidence.
- *MAC* curves normally differ between polluters, which implies that there is a separate optimal standard for each individual polluter, according to where $MAC_i = MD$.

In reality, therefore, it is highly unlikely that standards are set at the correct level. The

[1] Member Countries of the Organisation for Economic Co-operation and Development
*****all the graphics used in this paper were compiled from lecture notes

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authority is not in most cases expected to allocate the responsibility for emission reduction in a cost-minimizing way (Tietenberg, 1996). The second best solution is to set the standard at the point where the average marginal control cost of the sources is equal to marginal damage.

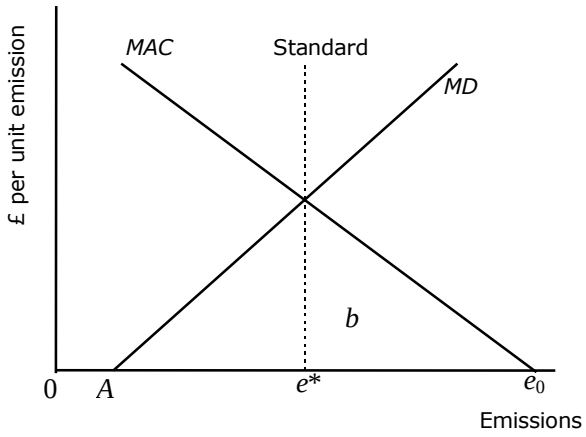

Figure 2. Optimal level of a standard

Evaluation

Taxes

Economic efficiency and cost-effectiveness

Taxing activities which generate pollution provide economic efficiency. Sheffrinn (1999) points out that pollution taxes are more fairly and efficient as all polluters face the same rate of tax.

The policy needs to fulfil two conditions in order to be economically efficient: The first one is to minimize the cost of achieving any given level of aggregate emission reduction (the equi-marginal principle), secondly, it is to balance of the aggregate costs and benefits of control (the *MAC* = *MD* condition)

Both standards and taxes fail to meet the second condition because of information deficiencies. If only the first condition is met, the policy is cost-effective without being economically efficient.

Let`s assume there are two polluters with low and high abatement costs in Figure 3, (LMAC and HMAC respectively) to analyse whether taxes meet the condition for cost-effectiveness.

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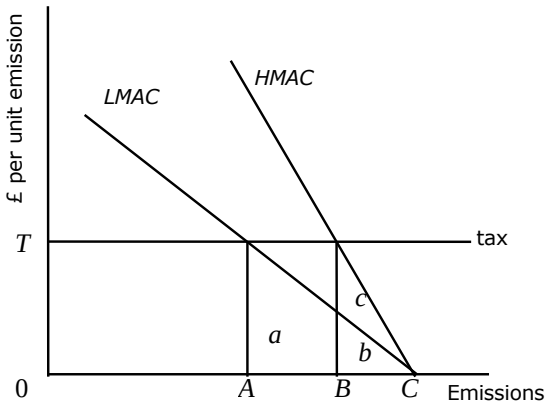

Figure 3. Taxes and cost-effectiveness

After the imposition of the tax, the firm facing LMAC reduces its emissions to A, incurring an abatement cost of a + b, while the firm facing HMAC reduces its admissions to B, incurring an abatement cost of b + c. Note that the two firms respond differently to the introduction of the tax, depending on the abatement cost functions they face. Figure 3 clearly demonstrates that the marginal abatement costs at points A and B are equal for the two firms, namely LMAC = HMAC = T.

Dynamic efficiency

In Figure 4, we observe whether taxes provide dynamic incentives for polluters to introduce new technology and so reduce emissions. MAC0 and MAC1 show the polluter's marginal abatement costs using the old and new (more cost-effective) technologies, respectively. If we compare the total financial costs to the polluter, it is obviously seen that the polluter pays d+e in abatement costs plus the rectangle 0ABe*0 in tax with the old technology and with the new technology, abatement costs are d+f and the tax liability is rectangle 0DEe*1. The gain from adopting the improved technology is represented by the difference between the two areas, that is triangle BEC plus area ABED (shaded area), which represents the incentive to the polluter to invest in new technology.

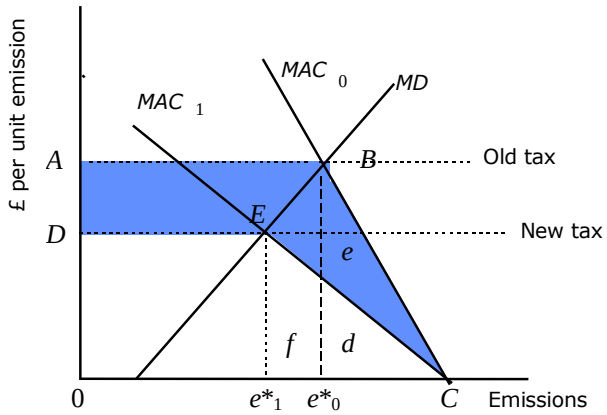

Figure 4. Dynamic incentives and taxes

Standards

Cost-effectiveness

In the following analysis in Figure 5, two sources are taken (from the same industry) with the same initial level of emissions, C. One firm has low abatement costs, LMAC, while the other faces high abatement costs, HMAC.

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Suppose the regulatory body now would set the standard for emissions at E. Both firms must obey the same standard E. The abatement costs that the firm facing LMAC incurs costs equal to area d, while the firm facing HMAC incurs costs of d + e. Therefore, the total (industry) costs of meeting the standard are 2d + e

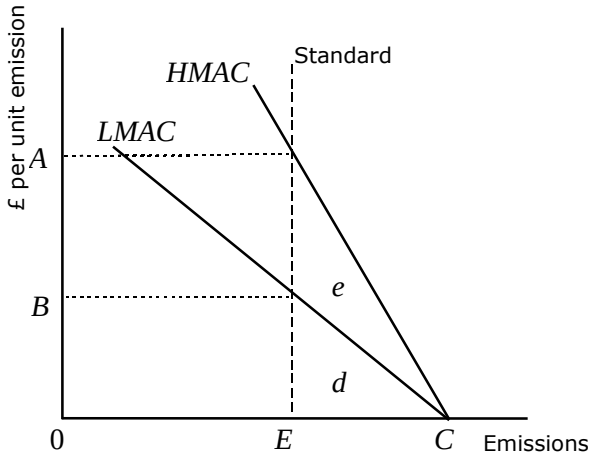

Figure 5. Cost-effectiveness property of a standard

Dynamic incentives

Dynamic efficiency is another important criterion for policy evaluation. Taxes give incentives to reduce emissions (or the harmful taxable activity linked to emissions) in the form of reduced tax payments. As seen in Figure 6, we define MAC0 as the original marginal abatement cost curve (with the old, unimproved technology) and MAC1 as the marginal costs of abating emissions using a better, more cost-effective technology. Under the old technology, total abatement costs = d + e. With the new technology, total abatement costs would be reduced to area d. It is therefore clear that area e represents the financial incentive to implement (or develop) new technology, assuming that the standard is not altered. If area f is greater than area e, then the firm will have been punished for adopting new technology. Thus, if the firm thinks that the standard is likely to be tightened if it introduces new technology, then there is actually a disincentive for improving technology.

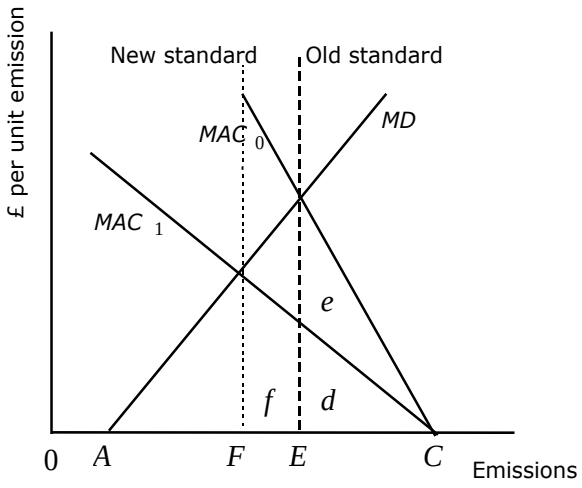

Figure 6. Dynamic incentives and standards

Where the original standard is set at E, the new standard is set at F, the original cost curve

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is MAC_0 ,the new cost curve is MAC_1

Practices

Taxes

Environmental taxes may be presented for a variety of aims which are from economic, to financial and from social to environmental concerns. The Nordic countries launched carbon and energy taxes in the early 1990`s. For instance, in Finland, early Environmental tax reform (ETR) were used as a means to partly compensate the fall in revenues from the reduction in income taxes and employers` social security contributions as well as achieve environmental objectives. ETR in Denmark was introduced in 1999 by gradually increasing existing taxes on transport fuels, natural gas, light heating, heavy oil fuels and introducing a new electricity tax. ETR mostly in Nordic countries has aimed to raise additional revenues (IEEP, 2013). Anderson et al. (2007) pointed out that the ETR can lead to increases in GDP of a country. For instance, an average GDP increase in Finland was found around 0,5 per cent in 2012.

Superfund legislation of 1980 in the U.S.A. was designed to cope with polluted waste sites that posed a threat to public health or environment. Its main purpose was to provide the US Environmental Protection Agency (EPA) with the resources to locate contaminated sites and force firms responsible for the waste to clean them up. For sites where polluters could not be identified, a special fund was created for remedial action to be undertaken by the US EPA financed by a levy on certain chemical products (Howes, 2005).

Figure 1 shows the existing and planning carbon or energy taxes in some countries. It is obviously seen that the Nordic countries were the pioneers of the environmental taxes.

Table 7. Existing or planning carbon or energy taxes in some countries

Existing carbon or energy taxes	- Denmark – CO2 tax introduced in 1992
	- Finland – CO2 tax introduced in 1990
	- Germany – ETR in 1999 by increasing existing energy taxes
	- Norway - CO2 tax introduced in 1991
	- Sweden – CO2 tax introduced in 1991
	- United Kingdom – Climate Change Levy introduced in 2001
Plans to introduce carbon taxes	- France – Failed proposal for carbon tax in 2009
	- Italy – Proposal for a carbon tax as part of General Tax Reform approved in April 2012
	- Japan - "Tax for Climate Change Mitigation" introduced in October 2012
	- United Kingdom - Carbon Price Floor applied from April 2013
	- United States – Draft Bill to tax CO2 emissions proposed in February 2013

Source: IEEP, 2013

The differentiation of the tax rates on diesel in Denmark according to the sulphur content of the fuel helped reduce SO_2 emissions by 6,550 tonnes in 2000. In Sweden, Sulphur tax – reduced sulphur content of fuels by 50% below legal standards and reduced emissions by 80% between 1989 and 1995. The tax on plastic bags applied since 2002 has contributed to a reduction in their use by more than 90% in Ireland.

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Standards

Standards are the most widely used policy instrument in practice. These have been used to control and minimise the environmental impacts of air, water, noise and visual pollution in almost every country. In spite of the fact that the efforts of environmental economists to reduce the excessive dependence on standards as the preferred method of environmental pollution control, policy makers still widely adopt and employ standards in practice.

Case study: nitrogen oxides (NO and NO_2, together NO_x)

There are many forms of pollution such as air, water, land etc. Air pollution is chosen as a case study for standards. Particles, (smoke and soot), SO2, Ozone (O3), Lead, NOx, CO are the forms of air pollution. National Air Quality Standards was set up with the clean air act in 1970 by the US EPA. It was estimated 500 cancers a year could be avoided if the pollutants can be controlled (Sheffin, 1993). Many national and international institutions have established standards and limits for the air quality. Various studies carried out by EC and U.S` institutions showed that the largest population of total air pollution costs come from their health effects, especially mortality (Lomborg, 2001). The same serious problem occurred in Ankara, Turkey in 1980`s and 90`s due to the excessive fossil production in heating and transportation. So the particles in the air measured over 800 µ/m3 at that time. The rate of particles in the air gradually decreased with the severe measures, which are shifting natural gas in mass transportation, banning of using coal in certain time period, taken by the local authorities (Ankara Regional Development Plan, 2011).

2. CONCLUSIONS

Tax and standards have some advantageous and disadvantageous for the countries actively implementing these policies. Though the tax policy could raise revenue and reduce incentives through dynamic incentives, it could lead to inefficient uniform taxes, unintended consequences. Also, environmental protection by incentives would make contamination and depletion of resources more expensive. Low-tax reform would increase economic growth as lower marginal tax rates themselves spur economic activity. So, the Pigou theorem is not followed by many countries. For instance, the EU set taxes lower than social damage costs for energy products. The polluter-pay principle introduced firstly in 1970`s is not easy for implementation. It is assumed that individuals and firms that do not have a right to pollute. However, superfund legislation implemented by the US EPA was designed to force firms responsible for the waster to clean them up.

In contrast to tax, emission standards approach which is a permissible limit on the amount of the pollution is the most generally used approach in environmental policy. The authority is not in most cases expected to allocate the responsibility for emission reduction in a cost-minimizing way. If the firm thinks that the standard is likely to be tightened if it introduces new technology, polluters may have an incentive to hide information about new abatement technologies from the controlling body in order to prevent a tightening of the standard.

In practice, environmental tax reforms may lead to increases in GDP. For instance, Finland which is one of the first country implementing ETR, increased her GDP around 0,5 per cent in 2012. ETR is planned to be implemented in the short run by many developed countries. Moreover, the standards aiming to protect environment are widely accepted by the policy makers.

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