Taxation, Innovation and the Environment

Solving the world's environmental problems could take a significant toll on economic growth if only today's technologies are available. Innovation – the creation and adoption of new, cleaner technologies and know-how – provides a means to achieve local and global environmental goals at significantly lower costs. Environmentally related taxes are increasingly being used in OECD economies. Such taxes can provide significant incentives for innovation, as firms and consumers seek new, cleaner solutions in response to the price put on pollution. These incentives also make it commercially attractive to invest in R&D activities to develop technologies and consumer products with a lighter environmental footprint.

How environmentally related taxes are designed is vital to stimulate innovation, particularly how stable the tax is and how directly it falls on the actual pollution. Although strong empirical results using patent data are difficult to obtain, the effects of innovations can be clearly seen where environmentally related taxes are levied. Other instruments, such as tax advantages for environmentally friendly products or investments, provide fewer incentives for innovation than direct pollution taxes. To harness its full potential, environmentally related taxation sometimes needs to be supported and combined with other measures, such as regulation and information campaigns.

The OECD study, *Taxation, Innovation and the Environment*, uses case studies from a number of economies, including Japan, Korea, Spain, Sweden, Switzerland, the United Kingdom and Israel. These case studies cover a wide set of environmental issues and technologies, as well as economic and policy contexts. The research methods range from econometric analysis to interviews with business owners and executives to investigate how their businesses and industries react in the face of environmentally related taxation. Based on these case studies, a synthesis report is now being prepared for release at the end of 2010.

The world is facing a host of environmental challenges, from global climate change to smog in specific local areas. Many of these environmental challenges seem daunting and the costs of action appear high, given existing technologies and know-how. Yet, the ability of firms and consumers to innovate – finding new means and technologies to reduce pollution – can drastically reduce the costs of environmental policy.

The key is finding environmental policy tools that ensure environmental improvement now, but that also stimulate innovation and development of cleaner technologies for the future. This report specifically explores the ability of price-based policy instruments – taxation and tradable permits – to bring about both of these benefits.

Taxes on pollution provide clear incentives to polluters to reduce emissions and seek out cleaner alternatives. Compared to other environmental instruments, such as emission level or technology prescriptions, environmentally related taxation encourages both the lowest cost abatement and incentives for abatement at each unit of pollution.

Because they impose a direct cost on the polluter, environmentally related taxes also encourage innovation to seek out new products and processes that can reduce the polluter's tax burden. This innovation both reduces pollution levels and the tax burden on the polluter.

The use of environmentally related taxation and emission trading systems is growing in OECD economies. The use of taxes and charges has expanded in areas like waste disposal and on specific pollutants, such as emissions to air of NOx and SOx. Meanwhile, the amount of revenues from environmentally related taxation has been gradually decreasing over the past decade.

Motor fuel taxes still account for the vast majority of these revenues and the revenues from these taxes have been declining as a percentage of total tax revenues. As governments move forward on addressing climate change, the additional revenues generated by carbon taxes and by auctioning tradable permits will likely reverse this trend and increase the role of environmentally related taxation in government budgets.

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The case studies undertaken for this project highlight the ability of environmentally related taxation to induce innovation. Such innovation is not always visible in patent data, the most frequently used indicator of innovation.

As innovation occurs in many different forms, such as knowing better how to optimise equipment or experimenting with existing processes, this information can also be gleaned from interviews and firm-level analysis, where the majority of innovation occurred in this project's case studies.

Taxation is also more likely to induce efficient types of innovation than other forms of environmental policy instruments: cleaner production process innovation over end-of-pipe abatement measures. Taxes that fall more directly on the actual source of pollution (e.g. taxes on CO2 emissions versus taxes on motor vehicles) provide a greater range of possibilities for innovation.

The design of environmentally related taxation plays an important role. A positive environment for innovation, characterised by general stability and credibility in tax rates, is critical to encourage investment in innovative activities. Unlike market uncertainty (such as oil prices), policy uncertainty is more difficult to hedge against.

Political economy issues can influence tax design and lead to differential impacts on innovation. Announcing the implementation of environmentally related taxation to the affected industry well in advance of implementation can provide incentives for innovation without penalising firms for emissions based on historical decisions.

On the contrary, using refunding mechanisms can weaken the incentive to innovate, especially collective innovation. Finally, the use of reduced rates of environmentally related taxation, typically targeted at emission-intensive sectors, has a significant and negative impact on the relative innovation intensities of firms.

While the case for environmentally related taxation is strong, there are some limitations. In some cases, taxes levied directly on pollutants can be difficult to administer, and require monitoring of many disparate sources.

Moreover, environmentally related taxation provides significant incentives for market-ready innovations, but the high-risk, long-term efforts needed for "breakthrough" advances would still face barriers – policy and market uncertainty, access to capital and economies of scale – even if all pollutants were taxed optimally. The potential for nuclear fusion provides a good example.

Combining environmentally related taxation with other environmental policy instruments may help overcome some of these barriers, such as with government funding of basic R&D into the development of breakthrough technologies, and with information campaigns that can help increase the impact of environmentally related taxation with consumers. This can reinforce each instrument, provided that similar instruments do not overlap (for example, taxes and tradable permits on the same emissions).

In addition to taxes levied directly on the pollution source (or some intermediate thereof, such as motor fuel), the tax system is being used in other ways to address environmental problems. Accelerated depreciation allowances and VAT rate reductions for "green" purchases is one set of examples. However, the range of incentives for both innovation creation and adoption that these other instruments encourage is more limited.

R&D tax credits reduce the cost of undertaking innovation but direct pollution taxation may still be needed to create a market demand for clean technologies that guides the direction of R&D and ensures an incentive to adopt the innovations. Moreover, the cost of tax reductions for "green" purchases and R&D credits require governments to find other sources of funds, putting additional pressures on government budgets.

Evidence towards the ability for environmentally related taxation to induce innovation appears to be strong. Environmentally related taxation has many positive attributes, especially when compared to other environmental policy instruments. As use of environmentally related taxation continues to expand within OECD economies, this issue should be explored further.

Case studies will be gradually made available at www.oecd.org/env/taxes.
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