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Carbon Taxes from an Economic Perspective

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Carbon taxes from an economic perspective

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Claudia Kettner and Daniela Kletzan-Slamanig

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Economic literature generally favours market-based instruments for regulating environmental externalities since they ensure compliance at the least cost to society. Emission taxes have been increasingly introduced internationally, with the focus shifting to CO_2 after the adoption of the Kyoto Protocol in 1997. In this paper, the theoretical economic literature on energy and emission taxes is reviewed. The focus is on theoretical recommendations regarding the optimal design of environmental and especially carbon taxes, their performance relative to other instruments, the concept of a double dividend as well as potential competitiveness and distribution effects. Carbon taxation can play a key role in climate policy and for achieving long term emission reductions. This overview of economic considerations may help in creating a sustainable, effective and efficient regulatory system for reducing emission.

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Keywords

climate policy, carbon pricing, instrument choice, market-based instruments, environmental tax reform

1 Motivation

Taxes are primarily raised to generate income needed to defray the expenses for the fulfilment of government functions, e.g. the provision of public goods or the promotion of the general welfare of citizens. Form a theoretical point of view taxes have to conform to three basic principles: they should be adequate to the purpose of raising necessary revenues; they should be equitable, i.e. the tax burden should be proportionate to the taxpayer's ability to pay and they should be administratively feasible, i.e. designed in a way to minimise compliance costs and tax laws should be capable of convenient, just and effective administration.

In addition to these basic principles the tax system can also be used to deliver price signals in order to reduce socially undesired behaviour and negative externalities and thus generate a steering effect. This idea to equate private and social costs through a tax is based on the work of Pigou (1920) and has been developed further in the second half of the 20th century with various theoretical approaches. It also has been applied increasingly with respect to goods or activities that cause negative environmental effects in the past decades. In this case beside adequacy, equity and administrative feasibility the environmental impact of taxation constitutes an additional principle for the tax instrument.

Since the 1970's economic instruments like environmental taxes have been increasingly used for the mitigation of various ecological problems. In contrast to classical command and control regulation the fiscal instruments make use of market forces and offer the advantage of providing a source of revenue and reducing emissions in a cost-effective way (Williams, 2016; Milne and Andersen, 2014).

Energy is an essential good with relatively inelastic demand. Taxing such a good thus provides stable revenue for the government while minimising the efficiency losses (Harding, 2016)[1]. The revenue raising motive was the predominant driver for introducing energy taxes. As the need for mitigating the negative environmental effects of energy use – especially greenhouse gas emissions – became obvious, the role of market based incentives as a lever for influencing energy use patterns gained in importance.

In order to design a carbon tax that is environmentally effective and complies with the basic principles of taxation various theoretical aspects have to be considered. Economic theory is concerned with the adjustment of prices that reduces environmental externalities while still delivering economically efficient and equitable results. It also

[1] According to the Ramsey rule higher tax rates should be imposed on goods for which demand is inelastic in order to raise a given amount of revenue at the lowest cost in terms of market distortions.

delivers suggestions on how to deal with the trade-offs with other policy objectives that have to be taken into account when implementing a tax instrument.

The remainder of this paper is organised as follows: Section 2 reviews the economic concept of taxing externalities and discusses the distinction between Pigouvian taxes and real life environmental taxes. Section 3 gives a brief overview of the double dividend debate. The trade-offs for an environmental tax reform and the crucial design issues that have to be targeted in the practical implementation are discussed in Section 4. Section 5 offers concluding remarks.

2 Taxing externalities

The fundamental idea of using a tax to correct negative externalities[2] dates back to 1920, to the work of A.C. Pigou. He provided a framework for research about externalities that he referred to as uncompensated social services and disservices. Production activities may for instance be related to negative pollution effects that cause social costs. In the absence of a price for pollution, the polluter does not have to pay for the external effects. Thus, the marginal private and social interests diverge, leading to a market failure that could be corrected through a government intervention. Taxes can thus be used to internalise the social costs resulting from the production activity, for instance the damage from the emission of CO_2[3]. The rate of such "Pigouvian" or corrective taxes should be set to equal the marginal social cost of the pollution damage in order to offset the negative effects, corresponding to the equivalence principle[4]. As the price of the activity causing the externality rises, demand falls, as illustrated in Figure 1, which shows a graphical representation of a negative externality problem using a polluting factory as an example.

The horizontal axis measures the amount of output produced by the polluting factory and the vertical axis measures the market price of the output. The marginal benefit curve (MB) represents the declining marginal benefit of the factory for each level of production. The marginal private cost curve (MPC) shows the marginal cost of production for the factory. The marginal social cost (MSC) represents the total marginal cost for the whole society, i.e. the private cost plus the cost created by the externality.

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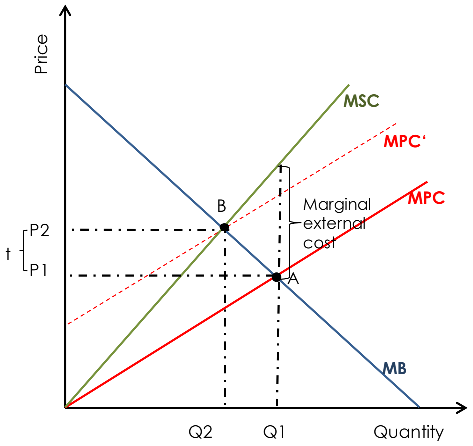
2 Externality is usually understood as a situation in which the effect of someone's decision (positively or negatively) influences someone else without a specific contractual agreement (Caldari and Masini, 2011, p. 716).

3 A different way of solving the externality problem was put forward by Coase (1960) who argued that under certain conditions a negotiated settlement between the polluter and the injured party is preferable to a tax on the externality.

4 I.e. the environmental tax should be equivalent to the external cost inflicted (Herrera Molina, 2014).

The starting point A (market equilibrium) is not socially optimal because the cost to others, i.e. the negative externality resulting from the production of Q1, is not accounted for. To compensate for the externality a tax (t) at the level of the marginal damage is introduced raising the price from P1 to P2 and shifting the marginal private cost (MPC) up to the marginal social cost (MSC) at point B (social optimum). This entails that production is reduced to Q2 and pollution is reduced to the socially optimal level.

Figure 1: Pigouvian taxes – taxing a negative externality



Source: own illustration.

In contrast to command-and-control regulation that prescribes specific technologies or abatement measures for each regulated entity taxes leave each polluter to choose its own least-cost abatement technology and abatement level. In addition, under the strict assumptions used in theory taxes automatically equate marginal abatement costs across firms.

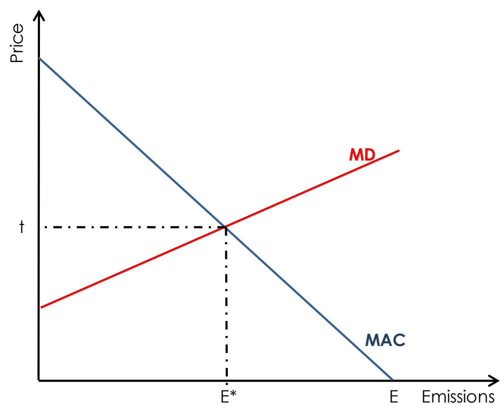
For achieving a reduction in a negative externality like carbon emissions via a market signal the policy maker faces the choice whether to rely on price based instruments (taxes) or quantity based instruments (tradable permits). The characteristics of these instruments and their respective advantages have been extensively discussed in economic literature.

In a first best, theoretical setting[5] price based instruments and quantity based instruments yield the same results. The Pigou tax signals the true social cost to the emitter who has a financial incentive to reduce emissions up to the point where the value

[5] It is usually assumed that external costs of emissions from different sources are equal, that there is no uncertainty about costs and benefits, that there are no interaction effects with other policy instruments and that there is perfect competition in the market (Norregaard and Reppelin-Hill, 2000).

of another unit of emission reduction is equal to the environmental damage (Norregaard and Reppelin-Hill, 2000). In emission trading systems, in contrast, the regulator allocates a given quantity of emission permits to the polluters, preferably by auction since this allocation procedure generates government revenue. Trading will result in a market price for emissions that again signals damage costs. Given the abatement cost functions of participants and the emission price they can decide whether to abate emissions on site or to buy emission permits on the market. This is illustrated in Figure 2 with the intersection of the marginal damage function (MD; the costs associated with one additional unit of pollution) and the marginal abatement cost function (MAC; the costs associated with reducing one additional unit of pollution). Without regulation firms would produce up to the point where marginal abatement costs are equal to zero (E). E* denotes the optimal level of pollution where marginal damage of pollution and marginal cost of abatement are equal. This optimum can be achieved either by applying a tax (t) on every unit of pollution or by determining the permissible amount of pollution in an emission trading system. In a competitive market the price of emission permits would converge to t.

Figure 2: Emission taxes and tradable permits



Source: own illustration.

However, in the real world as the basic assumptions are not fulfilled the instruments deliver results different from the theoretical first best setting.

A major difference regards the information about marginal abatement costs as well as marginal damage from pollution and the effects of uncertainty for determining the optimal policy instruments. Under uncertainty it will not be feasible to reach the socially optimal level of emissions. Instead the policy should aim at minimising the efficiency losses related to the regulatory intervention in the case of asymmetric information, i.e. when polluters know their abatement costs and the regulator does not. As Weitzman (1974) and White and Wittmann (1983) have shown, the optimal choice of policy instrument in terms of efficiency losses depends on the steepness of the marginal abatement cost and marginal damage curves. Taxes minimise efficiency losses if the marginal cost function is steeper than the marginal damage function, whereas tradable permit schemes are preferable if the damage function is steeper (Norregaard and Reppelin-Hill, 2000).

However, in a real world setting most likely both marginal abatement costs and marginal damages will not be known with sufficient certainty by the regulatory authority that will be at risk of receiving biased information from the polluting firms. Under circumstances when the optimal solution is not achievable Baumol and Oates (1971) have argued that instead a certain emission standard, i.e. an acceptable level of pollution should be targeted in a least-cost approach. That is total abatement costs in the economy should be minimised[6] by setting a tax to achieve the predetermined emission reduction (least-cost abatement).

Another aspect that was introduced by OECD (1972) is the polluter-pays principle, i.e. "the principle according to which the polluter should bear the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level of pollution". Polluters should pay for their emissions in order to promote an economically efficient use of resources on the one hand and to prevent trade distortions occurring if pollution control measures were subsidised by the government.

One key challenge for implementing a Pigouvian tax is determining the marginal damage of pollution. In the case of greenhouse gas emissions estimates for the social cost of carbon have yielded results in a broad range between \$10 and several hundred \$ per ton of CO_2[7]. The divergences are mainly due to different approaches regarding the estimation of the social cost of carbon (Pindyck, 2013). This comprises the way risk and uncertainty regarding the timing and extent of future damages is taken into account, the assumptions concerning adaptation and technological change and not least the choice of discount rates to value impacts in the distant future. This is the main reason why environmental taxes usually are not optimal Pigouvian taxes. Still, following the least-cost abatement theory and the polluter pays principle also "second-best taxes" can deliver positive environmental effects and represent important policy instruments (Milne and Andersen, 2014). Thus, a carbon tax rate could also be set in order to meet a certain future target for CO_2 emissions or concentrations (Marron and Toder, 2014). The

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6 In such a case emission trading schemes seem to be of advantage as the emission target is built into the policy instrument and no quantity risk is involved. Reaching the same emission level with taxes would probably require adapting the tax rate until the target is met.

7 Tol (2013) surveyed 75 studies that included a total of 588 estimates. The mean social cost of carbon was \$196 (2010 prices) with a standard deviation of \$322. At a real discount rate of 3% the mean social cost was only \$25.

resulting tax might not be socially optimal but would represent a cost-effective way for achieving the set target (e.g. the outcome of international climate negotiations).

3 Environmental tax reform and the double dividend

As environmental taxes were used increasingly in environmental policy they were also discussed in a broader fiscal context (Milne and Andersen, 2014). The argument revolved mainly around the question how the revenues from significant environmental taxes could be used, e.g. to lower other tax burdens. The term "double dividend" was introduced by David Pearce (1991) who proposed a revenue-neutral introduction of e.g. a carbon tax with revenues used to "finance reductions in incentive-distorting taxes such as income tax or corporation tax" (Pearce, 1991). Pearce assumes that environmental taxes deliver a positive environmental effect through raising the prices of environmentally harmful substances or activities and thus reducing demand. This is the *first dividend*. The *second dividend* relates to positive economic effects that can be achieved if revenue neutrality is ensured[8].

In the literature a lively discussion about the validity of the double dividend hypothesis and the extent of the potential effect has been taking place (see Jaeger, 2014, for a summary). The results from theoretical models largely depend on underlying assumptions regarding specific characteristics of the economy (e.g. the elasticity of labour supply, the level of pre-existing taxes etc.). Apart from these technical debates other considerations have been made. For instance the distinction between a weak and strong form of the double dividend hypothesis can be found[9]. The weak double dividend (as described by Bovenberg, 1999) implies that the efficiency costs of a revenue-neutral environmental tax reform are lower if the additional revenues from the environmental taxes are recycled via lower distortionary taxes compared to the case that these revenues are recycled in a lump-sum fashion, where the compensation is a fixed amount. Thus, given the revenues that can be recycled, a tax is a more efficient instrument for environmental policy than other non-revenue-raising alternatives. In the strong form the double dividend hypothesis states that an environmental tax reform not only improves environmental quality but also non-environmental welfare. Thus, the gross effects (i.e. the efficiency effects abstracting from environmental benefits) of substituting an environmental tax for a distortionary tax are positive. In the latter case, a green tax

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8 For a detailed discussion see Jaeger (2014).

9 Goulder (1995) summarises the two forms as follows: "By using revenues from the environmental tax to finance reductions in marginal rates of an existing distortionary tax, one achieves cost savings relative to the case where the tax revenues are returned to taxpayers in lump-sum fashion (Weak Form)" and "The revenue-neutral substitution of the environmental tax for typical or representative distortionary taxes involves a zero or negative gross cost (Strong Form)".

reform would be "a so-called 'no-regret' option: even if the environmental benefits are in doubt, an environmental tax reform may be desirable" (Bovenberg 1999, p. 421). There is widespread consensus that environmental taxes can deliver the first dividend, although the extent of the environmental improvement is uncertain. The possibility or likelihood of a second dividend remains contested in theory. However, the idea of reaching an environmental target by introducing a tax in a way that is 'costless' makes it interesting for policy makers[10].

The revenue-neutral shift in the tax burden from labour to the use of resources and environmental harmful activities has been discussed in environmental economics and policy for more than two decades and is usually referred to as ecological tax reform[11].

The main aspect is to set a price for a negative externality (e.g. greenhouse gas emissions) through fiscal instruments that results in higher costs for environmentally harmful activities. The cost increase should then trigger a change in consumption and production processes towards sustainable and low carbon patterns.

4 Design Issues from an Economic Perspective

The tax base of an environmental tax can be chosen according to different criteria depending on the externality that is to be regulated. If environmental harmful processes are limited to certain economic sectors or if the externality is regional, a sectoral tax can be implemented that burdens a specific input or activity (e.g. tax on pesticides or fertilizers). In case of an environmental damage caused by different sectors a uniform, economy wide tax should be implemented (e.g. energy or carbon tax). However, in order to generate substantial revenue to enable a significant reduction in other taxes a broad-based environmental tax e.g. on carbon emissions or energy should be chosen.

Before implementing environmental taxes or an ecological tax reform the particular objectives and design criteria as well as the results of any ex-ante analysis of costs and benefits related to that measure should be made transparent. While environmental taxes can play an important role in the policy mix as instruments for achieving environmental targets at least societal cost, existing conflicts in policy objectives – as described in the following section – not only constitute a barrier for the implementation of fiscal

[10] For the restrictions on practical implementation see Section 3.

[11] A broader and more recent approach is referred to as environmental fiscal reform. It regards not only the shifting of taxes or tax burdens but encompasses the reform of subsidies that while targeting other policy areas may unintentionally be harmful to the environment. The redistribution of revenues cannot only be achieved via a reduction in other distortionary taxes, e.g. taxes on labour. Funding of environmentally relevant investment projects (e.g. public transport, use of renewable energy sources, R&D) or subsidizing private investment in emission abatement or energy efficiency are other ways of redistribution that should result in stimulated economic performance.

instruments but can also lead to suboptimal incentive structures when the instrument is applied.

Environmental and energy taxation in the EU Member States shows pronounced differences with respect to tax bases, tax rates as well as redistribution and use of tax revenues (Kettner and Kletzan-Slamanig, 2018). The reason for these differences can be seen in competing objectives that have to be accounted for when introducing an environmental/energy tax or implementing an ecological tax reform. These are (Bach et al., 1996):

- Ecological effectiveness
  This relates to the questions which tax rate is chosen, whether it is capable of triggering the required changes in behaviour in order to meet for instance a set climate policy target, and how the tax rate will change over time.
- Economic efficiency
  Does the design of the tax ensure a least-cost achievement of the policy target and does the tax shift reduce the deadweight loss related to other taxes, e.g. consumption, capital income or labour taxes?
- Avoiding negative effects on distribution
  Energy/CO_2 taxes tend to be regressive as low income households spend a larger share of their disposable income on energy or energy-intensive goods and activities. What short-term substitution options are available to households? Hence, the design of the tax shift is central for alleviating the undesired distributional impact.
- Avoiding negative competitiveness effects for energy intensive firms/sectors
  The unilateral implementation of a carbon tax can deteriorate the international competitiveness of energy intensive manufacturing by raising production costs and lead to carbon leakage[12]. Again, the design of the tax reform and potential temporary compensation mechanisms can help avoid these concerns.
- Compatibility with the existing regulatory framework
  Other environmental or climate policy regulations may be influenced or rendered unnecessary by the CO_2 tax. Interaction effects, i.e. synergies and conflicts with existing regulation like the EU ETS, should therefore be taken into account.
- Administrative feasibility
  This aspect concerns the level of monitoring and enforcement costs that are related to a new tax. This is i.a. determined by the number of emitters that are

[12] From an environmental point of view a rapid structural change or the relocation of production activities can turn out to be counterproductive for global environmental problems like climate change. Domestic emission reductions that result from production relocation may result in higher emissions in countries with no or lower environmental standards.

taxed (in case of a CO_2 tax), i.e. whether it is an upstream or downstream approach. If emissions are not taxed directly but via a proxy (fossil fuels) the administrative costs can be reduced if the CO_2 component is incorporated into an existing tax (excise duties on fuels).

One central ratchet in connection with an ecological tax reform is the use of the tax revenue from the environmental or CO_2 taxes. On the one hand the new revenues can be used to reduce distortionary taxes, what could contribute to achieving a second dividend. On the other hand the occurrence of undesired negative impacts on income distribution and competitiveness may call for the implementation of compensation mechanisms in order to ease the adaptation to the new regulation. However, the compensation should only be provided temporarily and by other means than reductions or exemptions from the CO_2 tax, such as investment subsidies. By providing specific investment support for energy efficient technologies (for households as well as firms) or R&D subsidies the price signal of the tax and the incentive for investments in new technology remain intact. In the following sections the main issues that impede the introduction of environmental/carbon taxes are discussed.

4.1 International competitiveness

In reality, particularly the concern about the impacts of unilateral energy/carbon taxation on the competitiveness of exposed sectors or energy intensive industries has led to the creation of exemptions or reduced tax rates for manufacturing sectors and energy supply[13]. Such differentiations in the tax burden are contrary to the polluter pays principle and reduce the incentive for investments in new technologies. Thus, it is likely that not the entire potential of emission reductions is realised. This could be associated with overall higher costs in order to reach a certain environmental objective, if sectors with relatively higher abatement costs have to reduce emissions to a larger extent. Alternatively, the environmental objective might not be reached (Böhringer and Schwager, 2004; Böhringer, 2002; Kohlhaas, 2003). Nevertheless economic theory puts forward certain arguments for (temporary) tax exemptions for the manufacturing sector in order to ease the adaption (Kohlhaas, 2003; Köppl et al., 1995).

A unilateral implementation of environmental taxes affects competitiveness of energy intensive industries especially in (small) open economies (Richter and Schneider, 2003; Bjærtnes and Fæhn, 2004; Schleininger, 2002). This may lead to premature retirement of capital as well as carbon leakage if production is transferred to countries with less

[13] Tax exemptions or reliefs can be designed according to various approaches: general tax reliefs for certain sectors, gradual reliefs based on energy intensity (above a fully taxed base energy use), tax exemptions (e.g. for the energy use of a best practice benchmark), specific refunds (based on criteria like payroll or value added, as in the Austrian case of energy tax refunds to energy intensive companies).

(strict) environmental regulation. Besides, the reduction in production capacity could result in unwanted distributional effects with corresponding employment losses. The implementation of environmental taxes and respectively the elimination of tax exemptions multilaterally (e.g. on EU level) could mitigate the presumed negative effects on competitiveness. To which extent individual industries are affected by negative competitiveness effects depends on whether or to which extent increasing production costs caused by environmental regulation can be passed on to consumers. It also depends on the extent to which industries are exposed to international competition as well as on the availability of alternative production technologies[14]. Negative competitiveness effects can be reduced through a redistribution of tax revenues e.g. a reduction in labour costs or the granting of specific investment or R&D subsidies for an adaptation period. But in this case one has to keep in mind that not necessarily those companies benefit the most from revenue recycling that make the largest contribution in terms of tax revenue (labour intensive versus energy/capital intensive industries). Thus, different firms even within a given sector will be affected differently by an environmental/carbon tax (OECD, 2006).

In order to minimize adaptation costs of an environmental tax reform for companies, tax rates can be increased gradually over time. In this case it is important to determine the increase in tax rates as well as the time path in advance. Denmark e.g. took this approach when implementing an ecological tax reform over a five year period in the 1990s.

A step-wise phasing-in of environmental taxes can on the one hand lower the price incentives for behavioural change in the beginning and thus reduce environmental effectiveness and structural change. On the other hand the ex ante fixed time path for an increase in tax rates raises planning reliability and might induce early adaptation in anticipation of price and cost increases. Which effect dominates depends on the availability of technological options and their costs as well as the companies' investment cycle.

4.2 Income distribution

A further relevant aspect that has to be taken into account is the distributional incidence of environmental taxes. Several studies (e.g. Brännlund and Nordström, 2004; Cornwell and Creedy, 1997; Symons et al., 1994; Tiezzi, 2005; Labandeira and Labeaga, 1999; Flues and Thomas, 2015) show that environmental taxes – as a price increase for fossil

[14] For an overview of case studies regarding the effects of the introduction of price instruments (environmental taxes, emissions trading) on sector level see OECD (2006).

fuels – tend to be regressive with respect to the income distribution of households[15]. Households with lower income spend a larger share of their disposable income on daily necessities such as energy or transport as compared to high-income households (Kosonen, 2014). Again in this context the redistribution of tax revenues is of central importance. A recycling of tax revenues via the social security system or a reduction in other taxes can minimize or eliminate the regressive impact. The distributional impacts arise from several directions (OECD, 2006):

- direct effects through payment of the tax;
- indirect effects through price increases of taxed products;
- effects through the use of tax revenues; as well as
- effects related to benefits from improved environmental quality.

Thus, for the full assessment of the impact on income distribution several aspects have to be considered (Kosonen, 2014). First of all, the economic incidence, i.e. who bears the burden of the tax. This depends on the elasticities of demand and supply that determine to which extent the tax can be shifted to consumer prices. Furthermore, the greater the market power of producers, the easier it is for them to shift the tax burden to the consumers. In addition to this direct effect, the tax could increase input costs and lead to rising prices of other goods or services. These indirect effects can increase the regressivity of the environmental/carbon tax. The opposite effect on distribution could be caused by the behavioural changes following the introduction of the tax. With higher prices consumers will tend to reduce their consumption of the taxed commodity. However, the extent of the reaction depends on the availability of substitutes or possible technological adaptation options and their costs (e.g. a new heating system).

Finally, the use of tax revenues and the potential compensation measures have to be taken into account. The recycling of the additional tax revenue has strong impacts on the final distributional outcome. Reductions in other taxes that are specifically targeted at low-income groups can alleviate the undesired distributional impacts, while maintaining the price signal of the environmental tax. As described above in the context of the double dividend discussion tax revenues from environmental taxes can be used to lower labour or capital taxes and thus obtain efficiency gains (as environmental taxes are assumed to be less distortionary than labour or capital taxes). From a distributional point of view this recycling mechanism would not necessarily improve the distributional equity. If marginal income tax rates were reduced equally for all income brackets, this would benefit high-income households more in absolute terms (Kosonen, 2014). The same holds true for reductions in capital taxes. Therefore, in order to mitigate a regressive impact of

[15] Although some empirical studies suggest that regressivity is lower for transport taxes as compared to other energy taxes (Kosonen, 2014; OECD, 2006; Røed Larsen, 2004).

environmental taxes compensation mechanisms could be targeted to low-income households specifically. Alternatively, the compensation could be granted via a lump-sum transfer to all households or specific support for adaptation measures.

5 Concluding remarks

The long lasting discussion of environmental taxation in economic theory is mainly concerned with the internalisation of negative externalities. The main rationale being the adjustment of prices that reduces environmental externalities while still delivering economically efficient and equitable results. Following the work of Pigou the tax ought to correct the difference between the private and social cost thus resulting in an internalisation of a negative externality and a subsequent reduction in the detrimental activity. However, as the social cost of pollution for instance is difficult to determine other approaches have been developed for setting a tax rate like the standard price approach by Baumol and Oates. Accordingly, the tax rate is set at a level that guarantees that a certain environmental standard is obtained.

Furthermore, economic debate in the last decades centred around the notion of a double dividend, i.e. positive economic effects in addition to environmental improvements that could be generated by environmental taxation. Key to the realisation of positive economic effects is however the use of tax revenues. The recycling offers the opportunity to lower other distortionary taxes, like payroll taxes, thus altering relative input prices and contributing to increased labour demand. The revenue recycling is a key aspect of the concept of ecological tax reforms. It is also of relevance with respect to other points of discussion, i.e. the potential negative effects of environmental taxes on income distribution and international competitiveness. These impacts can be mitigated by targeted approaches to revenue recycling either via lowering labour related taxes or funding environmental investments and R&D.

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