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About dykes and windmills: Learning from Dutch green fiscal reform

Herman R.J. Vollebergh (Tilburg University)

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About Dykes and Windmills:

Learning from Dutch Green Fiscal Reform

Herman R.J. Vollebergh[1]

CentER and Tilburg Sustainability Centre, Tilburg University

PBL Netherlands Environmental Assessment Agency

CESifo

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[1] Corresponding author. PBL Netherlands Environmental Assessment Agency, P.O. Box 303, 3720 AH Bilthoven, the Netherlands; herman.vollebergh@pbl.nl.

Abstract

The paper discusses the environmental tax base and rate structure from a modern Pigouvian tax perspective and illustrates the practical difficulties involved in providing proper green incentives through green taxes. In particular, tax design through indirect and non-uniform taxation of emissions will be explored in detail. Lessons from older and recent experiments with such environmental tax incentives in water and waste charges as well as in energy and transport taxes will be discussed in detail. These lessons are particular useful as a model for other countries that aim to get the green tax agenda forward. Indeed, the Dutch polder may be nicely protected, but to what extent this will remain true also depends on other countries to join efforts in the future.

Keywords:

JEL Codes:

1. Introduction

Green growth has become a popular concept. It means fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies (OECD, 2011a). The concept fits in with a long tradition focused on economic growth that takes account of issues such as environmental pollution and quality of life. It is widely understood and accepted that unbridled economic expansion which ignores these issues is not possible in the long-term. Offering the right incentives through 'environmental pricing' is a key element of policy aimed at sustainable economic growth (Parry et al., 2014). Providing these incentives is clearly the government's domain, particularly in relation to fiscal policy. The choices made with regard to taxation and spending determine the direction of environmental pricing, and also form an inextricable part of the institutional frameworks within which citizens, organisations and businesses can initiate and benefit from sustainable economic change.

According to the OECD, the Netherlands was one of the first countries to experiment with incentive-based environmental taxes (Opschoor and Vos, 1989), and green taxes, today, still raise about 10% of the overall tax revenue. Despite being a very open and an energy-intensive economy the Dutch environmental tax base includes a broad energy tax, a high level of taxation of the use and ownership of transport vehicles, as well as a several other taxes, such as a landfill tax. In addition, municipalities impose user charges on waste collection and disposal while water management boards raise water charges to clean up the water and prevent the country against flooding (dykes). Interestingly, several of these taxes have been designed in such a way that they also provide(d) successful incentives for abating emissions (windmills).

This long tradition in using environmental taxes to incentivize green economic growth provides interesting lessons, in particular for ambitious developing countries that aim to climb the growth ladder while avoiding as much adverse effects as possible. This paper derives these lessons from a broad overview of the practical experience and difficulties involved in providing proper green incentives in the Netherlands. In particular, old and recent advances in Dutch experiments with Green Fiscal Reform (GFR) in the areas of water, waste, energy and transport will be explored in some detail.

The main lesson is that a key element for welfare improving corrective taxes is the implementation context. One element of this context is the level of the marginal damage in the first place. This level depends on the state of the environment in the status quo. In particular for countries with (very) low environmental quality or on a developing path with large negative impacts on the state of the environment, investment in monitoring for environmental purposes maybe relatively practical (and less costly) while the tax authorities can exploit these investments to directly tax polluting behavior while financing clean up and abatement.

The *second main lesson* relates to the (long run) incentives as triggered by the choice of the tax base. The findings for Dutch taxes suggest that even in the absence of any monitoring system in the beginning, implementation of a new tax on emissions is likely to be welfare improving in the long run. However, this does not imply that no tension exist between increasing environmental tax revenues ('green revenues') and achieving environmental gains ('green results'). The better targeted a tax to a particular tax base, in particular an emission tax base, the less likely the tax can be used to raise stable revenue in the long run. The reason that energy taxes are useful target for tax authorities is precisely its indirect relationship with emissions. [This may even be true for carbon taxes] At present taxation of fuels often weakly reflects the environmental damage even in country that applies energy taxes comprehensively such as the Netherlands.

Finally, you need ability to properly enforce taxation (implementation). Transitions towards fossil fuel based energy use, which usually occurs if countries develop (Fouquet, 2014). The upside of this development is that this also facilitates atmospheric emission regulation ánd tax enforcement because this energy source traded on explicit markets. For water and waste taxation public investment in abatement technology seems key. The Dutch example also shows that proper use of charges or fees maybe a very productive investment of governments to improve environmental quality.

The rest of this paper is organized as follows. The next section describes the theoretical benchmark for this paper, i.e. the theory of corrective taxes and costly implementation. Section 3 presents the long haul in greening Dutch environmental levies from a revenue perspective. Next section 4 discusses the main design issues to implement environmental levies. Section 5 derives lessons from several environmental tax examples, in particular its water, waste and energy taxes. Section 6 concludes.

Our focus is only on environmental levies, i.e. on taxes, excises charges and fees with a relatively close connection to an environmental tax base. So I do not discuss potential environmental incentives in other taxes, such as the income tax. Neither do I pay attention to the use of environmental tax preferences, such as investment credits for particular investments.

2. Pigovian Benchmark: corrective taxes and costly implementation

The most important objective of taxation in general is to generate stable revenues without interfering too much with choices of businesses and citizens. This interference, or distorting effect, depends on the tax base on which particular tax is implemented and at what rate.[2] The main goal of taxes on environmental bads, however, is to *improve* allocative efficiency. Market failures (imperfect, weak or absent markets) create environmental decline, as prices often do not adequately account for the costs of environmental resource use. If a tax corrects for such market failures corrections even need not be harmful to long-term economic growth, provided they are carefully designed and timed (Acemoglu et al. 2012). The tax revenue of corrective taxes is considered as the by-catch offering some options for tax swaps with other distortionary taxes, such as taxes on labor. This potential is also the reason why treasuries usually oppose 'ear-marked' environmental taxes, such as an environmental charge which revenue is used to produce, for instance, emission abatement in return.

According to the well-known Pigouvian principle marginal environmental damage (to the victims of pollution) should be discounted in the tax base and rate of environmental taxes. This implies a tax base *per unit externality* and a rate equal to the *monetary value of the marginal social damage* caused by this externality *in the social optimum* (see for example Bovenberg and Goulder, 2003). For example, if the consumption or production of a given energy product results in emissions and associated environmental damage, this damage should be discounted in its market price, for instance through an environmental tax per unit emission. This environmental tax will drive a wedge between the price that producers receive and the price that consumers pay (market price including taxation). As a result of the higher market price fewer of these polluting products will be sold, which is exactly the objective of the environmental tax. Thus, the pursuit

[2] PM Formula for deadweight loss welfare impact: distortion mainly reflected by the price sensitivity of decisions related to consumption, investment and labour supply.

of green growth often translates into a search for taxes that put an adequate price on negative externalities such as environmental pollution and traffic congestion. Corrective pricing applies to externalities caused by both producers and consumers.

A well-known drawback of all taxes are the transaction cost involved. Like any other tax also corrective taxes, in particular if newly implemented, require *administrative costs* for the government to implement the taxes, i.e. the costs associated with the tax assessment, collection and enforcement on the part of the tax authorities.[3] Administrative costs of a particular tax are closely related to the base to which the tax is applied. The tax base usually varies with the type of tax. For example, an emission tax taxes physical volumes of hazardous substances, while an input tax taxes such substances indirectly, for instance through its use as (intermediate) inputs. If many agents are responsible for emissions collection costs (including administration and audits) of a tax on emissions is likely to be high. This is particularly cumbersome if authorities have to measure emissions separately (Smulders and Vollebergh, 2001; Fullerton et al., 2010).

If several corrective tax instruments are available to the government, the choice between different corrective taxes should be guided by i) gain due to the reduction in environmental damage; ii) cost of implementation. Both the reduction in environmental damage ánd the transaction cost of the implementation of a tax typically depends on the design of a particular tax. [4] Whether a particular corrective tax (proposal) is welfare

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[3] Note, however, that administrative and compliance cost (the cost incurred by the tax payer) turn out to move together in practice. Thus taxes for which compliance costs are relatively important are also associated with relatively high administrative costs (Sandford et.al, 1989).

[4] Smulders and Vollebergh (2001) illustrate the trade-off involved using the formula: $U = Y - T - D(E)$ where U is social welfare of the representative agent, Y is gross private welfare, T is the welfare loss due to transaction (administrative) costs, and D is the damage from pollution. Let t_1 and t_2 be two different tax regimes that yield the same aggregate emissions: $E(t_1) = E(t_2)$. The private costs of t_1 are lower than those of t_2 if: $Y(t_1) > Y(t_2)$. This formula allows to separate out the transaction costs from the total change in welfare associated with the use of a

improving will be guided by the (marginal) environmental damage in the first place. Usually marginal damage of pollution is high if environmental regulation is weak. Moreover, the damage differs considerably across environmental bads. For instance, water pollution and dumping of waste are likely to cause high damage as sanitation and health impacts are likely to be direct and relatively large. Moreover, such health effects are usually of a local nature which allows for a relative local and direct link between pollution and damage. For emissions related to air quality or climate change this link is less clear. Both scale and time characteristics of those externalities are markedly different which makes it harder for regulators to demonstrate welfare improvements of interventions net of transaction costs.

As noted the cost of implementing corrective taxes can be markedly different across taxes, however. If other than environmental tax instruments can also (indirectly) achieve the same emission reduction at lower costs they are likely to render an emission tax with high implementation costs to be a sub-optimal solution (Fullerton and Wolverton, 1999; Smulders and Vollebergh, 2001; Cremer and Gahvari, 2002; Fullerton et al., 2010, p. 13 ff). A suitable alternative for a tax on emissions, for example, would be to impose an indirect tax (excise tax, value-added tax) on 'complementary' goods that are directly related to the pollution in question (see also Kosonen and Nicodème, 2009). This way, environment-friendly goods can be taxed at lower rates than their environmentally harmful substitutes. The widely used differentiated tax rates for unleaded versus leaded petrol are a case in point.

Implementing more indirect corrective taxes on goods instead of bads, however, should be weighted against the *loss of incentives* due to its more indirect impact on abatement options. From an overall welfare point of view the more indirect the corrective tax, the weaker

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certain (tax) instrument. Hence, in a case of environmental taxation, one has (i) administrative (transaction) costs, (ii) the welfare gain from an improvement in the environment, (iii) the "residual" welfare change, that is the gross welfare cost ignoring transaction costs which could be called "private gross welfare cost".

the relation between tax base and emissions, and the greater is its (theoretical) welfare loss due to weaker incentives (see Smulders and Vollebergh, 2001). Depending on their design, corrective taxes engage different substitution mechanisms for emission reduction. Principally, there are three mechanisms through which emissions can be reduced:

- *Emission abatement*: making use of 'add-on' emission abatement technologies and carbon offsetting;
- *Input substitution*: replacing polluting or emission-intensive inputs with less-polluting or low-emission substitutes; e.g. switching from high-sulphur coal to low-sulphur coal, from fossil fuel to renewable fuel – and from energy inputs to labour and capital inputs;
- *Output substitution*: replacing polluting or emission-intensive products with less-polluting, low-emission products.

From a welfare point of view it should be noted that the more indirect the environmental tax, the weaker is the relation between tax base and emissions, and the greater is its (theoretical) welfare loss (see (Smulders and Vollebergh, 2001 and 2015). An emission tax uses all three mechanisms mentioned above at the same time, which explains its relative efficiency vis-á-vis other, more indirect tax options. For instance, output taxes only engage the mechanism of output substitution, while input taxes in addition make use of input substitution (the latter are more effective when the inputs are more directly related to pollution). Furthermore, an *ad valorem* energy tax on fuel may lead to input substitution between energy and labour, but not between various energy sources – unless the tax rate is differentiated according to emission characteristics, e.g. with reduced rates for fuels with lower sulphur and carbon content. So the design of environmental taxes determines which substitution mechanism(s) are engaged. Generally, the more direct the tax (i.e. the more of the above-mentioned mechanisms are engaged), the more efficient it is at reducing emissions. Therefore, in choosing between direct and indirect taxes, the higher implementation costs of direct taxes should be weighed *against* the higher welfare losses associated with indirect taxes.

In this respect emissions taxes may still be more efficient than indirect taxes even if transaction cost would be higher for the emission tax. The benefits of direct incentives through a tax on, for instance, water pollution probably outweigh other tax instruments, such as a tax on outputs or consumption which only indirectly contribute to this type of pollution. Such implications strongly depend on the characteristic of the environmental damage as well as the production processes responsible for the pollution. A carbon tax, for instance, offers a good example of a tax for which the incentive loss is likely to be limited due to the fixed relationship between (fossil) input and emission (see Smulders and Vollebergh, 2001 and 2015; Metcalfe and Weisbach, 2009; Heijne et al., 2012).

Text box 1. Classification of environmental levies

Because corrective taxes can have many different designs serious classification issues arise. Environmental levies (including environmental taxes, charges and fees) can be classified according to tax base and revenue allocation. This classification is shown in Table 1, where $\tau_i > 0$ indicates a positive tax rate and $\tau_i < 0$ a negative tax rate (i.e. a subsidy). In this table, revenue earmarked for specific expenditure (as is the case with hypothecated tax) is also considered a form of subsidy.

The classic *Pigouvian tax* is in fact nothing more than a penalty for emissions ($\tau_E>0$). In Table 1 it is assumed that the revenues of this tax are being returned on a lump sum basis. In practice these revenues are often used to increase overall tax revenue, to reduce other taxes, or as earmarked funds for specific expenditure. The latter is also the case with *earmarked taxes*, an example of which is the environmental charge levied as part of the Dutch Surface Water Pollution Act (*WVO*). This charge is directly based on emissions (into water) and the revenue is earmarked for pollution abatement – which makes it an implicit subsidy ($\tau_A<0$). In fact, this type of charge is a combination of 'stick' (tax on activities that produce emissions) and 'carrot' (subsidy on activities that reduce emissions). In the early 1990s the discussion arose as to whether environmental tax revenue could be used to cut taxes on labour ($\tau_L\downarrow$). This would provide a 'double dividend': environmental gain through reducing pollution levels, *and* a more efficient tax system through reducing distorting taxes on labour.

Table 1 Classification of environmental taxes

c	Choice of tax base					
	Output (Q)	Input (I)	Emission (E)	Emission Abatement (A)	Revenue allocation	Second best solution
Pigouvian tax	0	0	$\tau_E > 0$	0	Lump-sum return	No
Earmarked tax 1	0	0	$\tau_E > 0$	$\tau_A < 0$	0	?
Earmarked tax 2			$\tau_E > 0$	0	Compensation of victims	
Tax with potential 'DoubleDividend'	0	0	$\tau_E > 0$	0	Reduction in labour taxes (τ_L↓)	Yes
Indirect tax 1	$\tau_Q > 0$	0	0	$\tau_A < 0$	0?	Yes
Indirect tax 2	Dirty products: $\tau_{Qd} > 0$ Clean products: $\tau_{Qc} < 0$	0	0	0	0?	Yes
Indirect tax 3	0	$\tau_I > 0$	0	$\tau_A < 0$	0?	Yes

As explained in the main text there is a growing focus on *indirect* taxes to achieve 'second-best' emission levels. Particularly Fullerton has shown in various publications that a tax on emission-intensive 'dirty' products ($\tau_Q > 0$) *in combination with* a subsidy on emission abatement ($\tau_A < 0$) could provide an optimal alternative for an emission tax (e.g. Fullerton and Kinnaman, 1995; Fullerton et al., 2010). This resembles the idea of a 'deposit', that is, pay for the use of scarce environmental resources (with emissions as implicit – and polluting – input), and receive a refund for maintaining or improving the quality of these resources through emission abatement. This deposit idea can be applied more broadly, for example through taxation of 'dirty' products ($\tau_{Qd} > 0$) combined with subsidising 'clean' substitutes ($\tau_{Qc} < 0$), as has been done with leaded versus unleaded petrol. Finally, instead of taxing outputs it is of course also possible to impose a tax on *inputs* that are related to emissions. An evident example of input tax is a tax on energy consumption.

Another aspect to environmental taxation is related to criterion of *distributive justice*. Often 'the polluter pays' is the guiding principle of environmental pricing. In this case the focus is on the contribution to pollution by individual citizens and businesses, not on their 'ability to pay'. A complicating factor is that polluters often have *de facto* property rights over their environmental resource use, and therefore the right to pollute. Environmental tax reform implies a redistribution of de facto pollution rights to the government, and this will undoubtedly be met with resistance (Fullerton and Metcalf, 2001). In term of cost-benefit distribution, environmental tax reform need not necessarily lead to an overall increase of the tax burden, although it will generally change the distribution of the tax burden. For example, revenue from environmental taxes may be returned to citizens and businesses in the form of lower income taxes and corporate taxes. Such welfare improving options, however, only exist in the presence of such taxes and monitoring systems that are enforced competently.

Advocates of (more) green taxes are therefore rightly advised to carefully also consider alternative or complementary policy instruments for environmental pricing, such as subsidies and standards in particular (e.g. Vollebergh and Van der Werf, 2014). In this context the distribution of costs and benefits over the various market participants is also an important factor to consider, as win-win situations will be rare. Much depends on the exact options for meaningful regulation through green taxes. Good design and critical insight into the implementation context is essential here.

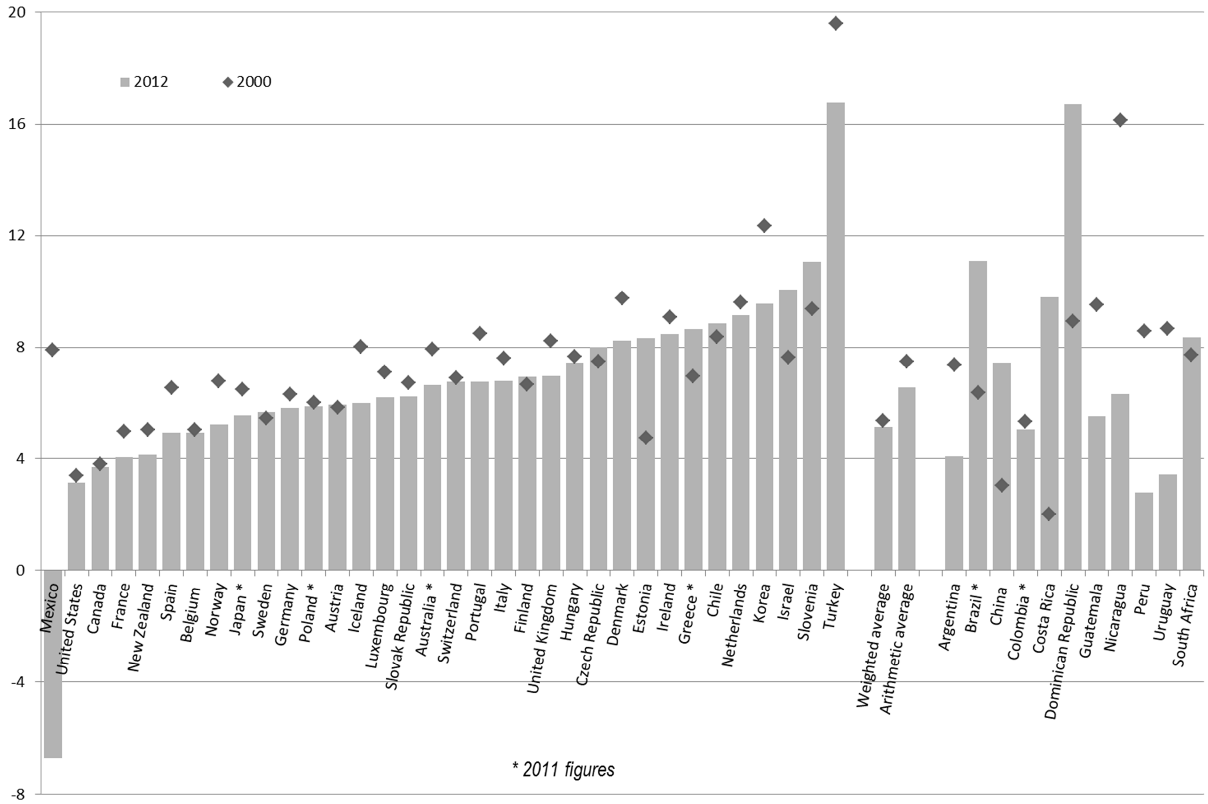
3. The long haul in greening Dutch environmental levies

A lot of confusion exist about the definition of an ‘environmental’ or ‘green’ tax. Whether a tax is called 'green' depends on the tax base in the first place, i.e. the products or goods taxed. The tax base of 'green' or environmental taxes should be directly or indirectly related to negative environmental effects of the products and goods that constitute the tax base. For this reason long existing taxes such as the gasoline and diesel excise are called ‘green’ today (OECD, 2012). This choice reflects the indirect corrective tax concept mentioned in the previous section: a tax on gasoline is also an implicit or indirect tax on emissions of greenhouse gases, such as CO_2, and air pollutants that harm human health, such as particulate matter and NO_x. The same holds for an electricity tax which relation with emissions is quite indirect, because electricity consumption itself does not lead to emissions; only production of electricity leads to emissions, at least if it is based on fossil fuels or biomass.

An indicator often propagated by advocates of green tax reform is the overall amount of green tax revenue. According to OECD data about 10% of total tax revenue in the Netherlands comes from green taxes at present (see Figure 1). This makes the Netherlands one of the front runners in environmental taxation. The EU average is about 7% and declining in most EU Member States. Neighbor countries are lagging behind with over 50% percentage point difference. Germany raises only 5,8%, Belgium 5,0% and France only 4,1%. Moreover, the relative share of green tax revenue shows a downward trend in those countries compared to 2000. By contrast the relative share has stabilized in the Netherlands, while total environmental tax revenue decreased only slightly in recent years.

[PM Discussion of revenue relative to other countries, in particular also outside oecd]

Figure 1 Green taxes across countries (% total tax revenue)

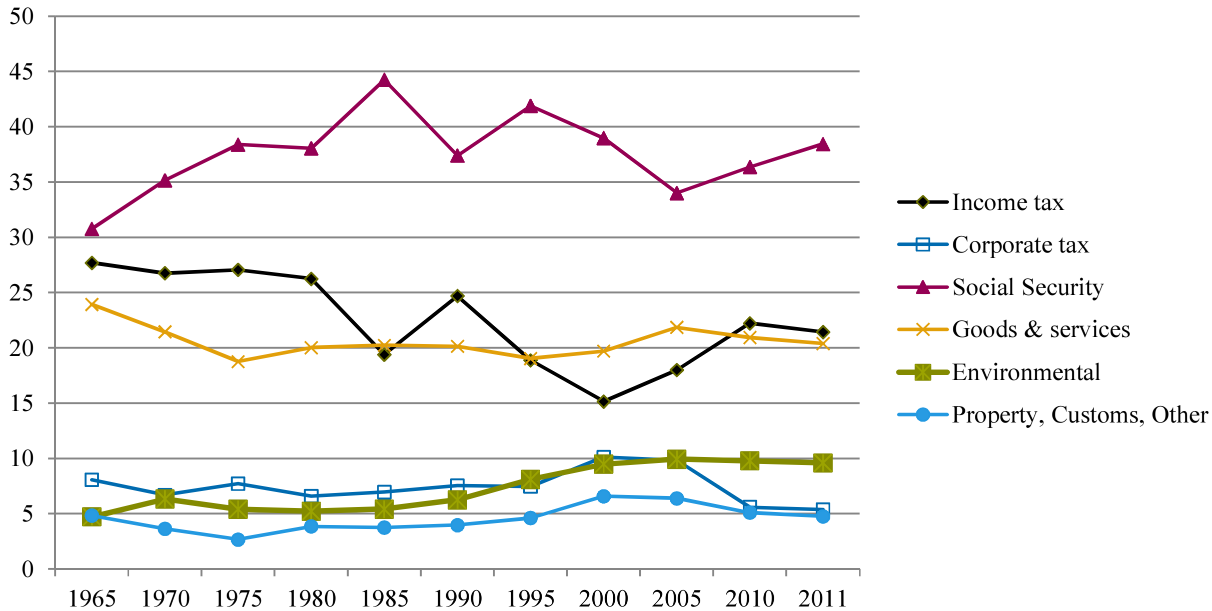


Source: OECD (2014)

Indeed, the Netherlands has always been a frontrunner in the use of environmental taxation (e.g. Opschoor and Vos, 1989). Back in 1965 environmental tax revenue – mainly collected as excises on mineral oil and recurrent taxes on motor vehicles (see also below) – was already responsible for 5% of overall revenue.[5] The total amount of revenue raised by environmental taxes, fees and charges steadily increased in the Netherlands during the past decades, in particular since 1987. At present environmental taxes are an important tax raising category, far before corporate or property taxes (see Figure 2).

[5] The OECD Revenue Statistics only presents taxes collected by the national treasury ánd in the Dutch case, also the regional water boards who are considered as a 'national' body. Local taxes such as the municipal waste fee or the municipal sewerage charge are not included (but see below).

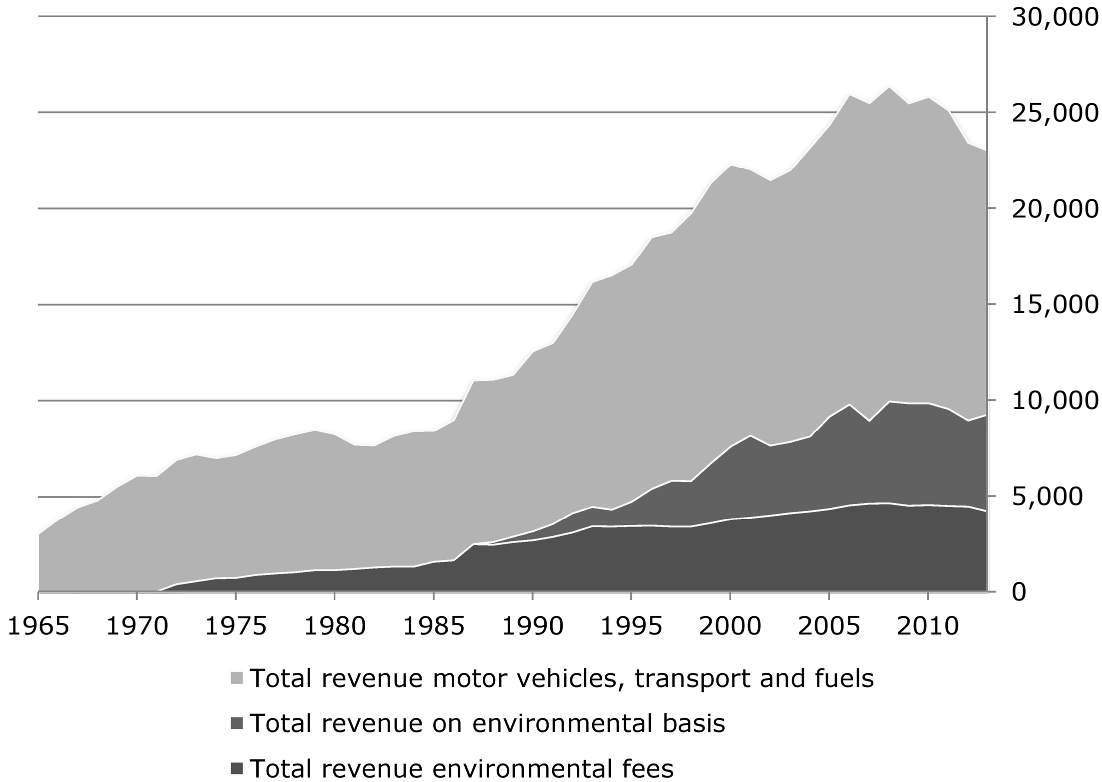
Figure 2 Green taxes in the overall tax mix in Netherlands 1965-2011 (% total tax revenue)



Source: OECD Revenue Statistics

Figure 3 provides further insight in the main underlying environmental tax bases responsible for this change in tax revenue (in constant prices) in the Netherlands between 1965 and 2013. This figure includes revenue *from all green taxes* imposed, i.e. taxes, levies and charges imposed by *any* government legislative body, i.e. the national government, municipalities and water boards. Clearly taxes related to transport and mineral oils dominate the overall revenue since the very beginning. Indeed, the easy to implement gasoline and diesel excises exist already for a very long time. The same holds for sales taxes on motor vehicles. The category of environmental fees (including mostly revenue raised by local municipalities), in particular waste and water charges, also have a long history back to the beginning of the 1970s. The third set of taxes with a green signature are the taxes introduced at the end of the 1980s. The overall contribution to total tax revenue is considerable and reflects – together with the further increase in tax revenue on mineral oils and transport – one of the most impressive green tax reforms in OECD countries although it usually goes completely unnoticed.[6]

Figure 3 Total revenue environmental levies (mln. € 2013)



Note: Total revenue motor vehicles, transport and fuels does not include the provincial duty on motor vehicle registration/road use and the heavy motor vehicle tax. Total revenue environmental fees does include the revenue from the water pollution charge.

Source: Own calculations using Netherlands Statistical Office and OECD (2014a and b)

Indeed the use of taxes as an environmental policy instrument steadily increased in the Netherlands during the past decades. Since 1987 environmental tax receipts have quadrupled,

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[6] Figure 2 shows that the rise in environmental tax revenue in 1990s coincided with a substantial decline of income tax revenue until 2000. Surprisingly little attention is usually paid to this remarkable tax swap within the Netherlands which was mainly motivated by concerns about climate change. The so called energy tax introduced in 1996 was the Dutch response to the EU failure to implement an EU wide carbon/energy tax in the early 1990s. Because this tax has never been labelled as a 'carbon tax', this tax probably goes along almost unnoticed. Vollebergh (2004) provides a comprehensive evaluation of this tax.

roughly from 5 billion euros per year to 20 billion euros per year in the last few years. During these years new tax bases have been added, and in some cases tax rates have been raised, considerably. Furthermore, the instrument of tax differentiation has been introduced and applied to several taxes. Different views appear to exist on how to proceed with environmental taxation in the Netherlands. Some people explicitly advocate further expansion of environmental taxation based on the argument of green growth, while others consider the leading position of the Netherlands a good reason to lower the relative share of environmental taxes in the overall tax system. A third group emphasises the need for better incentives to support green growth, and is less concerned about the consequences for tax revenues. These differences of opinion clearly illustrate the controversies surrounding environmental pricing and green tax reform.

4. Environmental Tax design issues

Implementation of environmental taxes requires answers to important design questions:

- for what *revenue reason* will the tax be imposed?
- what is the tax *base* to be used?
- which *unit of measurement* should be applied?
- what is the appropriate level of tax *rates*?
- is any *tax burden relief* (e.g. exemptions) for specific groups justified?
- who is the *tax payer* and who could collect the tax revenue?

Together the answers to these questions determine not only the incentive effects, but also the transaction costs of the imposed corrective taxes. Table 2 describes the design choices made by the Dutch tax authorities with respect to their environmental taxes in the course of time. The division is more or less similar to Figure 3.

The most important choice is the decision whether to impose an environmental *tax* or an (earmarked) environmental *charge or fee*. Environmental taxes are imposed to raise revenue for the treasury without reference to specific benefits received, i.e. the receipts are not earmarked for particular expenditures. Excise duties on fossil fuels and taxes on the purchase, ownership and use of motor vehicles are commonly considered environmental taxes. Another major category in the Netherlands are taxes imposed directly on *an environmental tax base* such as taxes in the fossil fuel energy domain or taxes on water use or waste. Again receipts are not earmarked for those taxes.

Table 2 Tax design characteristics of Dutch environmental levies since 1960s

	Revenue allocation	Tax base	Unit	Tax rate	Implemen-tation	Tax collection
Taxes						
Transport						
- Recurrent taxes motor vehicles	National Budget	Car Ownership	Car weight	Diff	1969-	Every registered car owner
- Excise on motor vehicles	Budget	Sales of motor vehicle	Price/weight /CO_2	Diff	195x-	Car dealers
- Heavy motor vehicle tax	Budget	Sales of heavy motor vehicles	Number of axis	Diff	1996-	Truck dealers
- Air Passenger tax		Flight	Per ticket	Uniform	2008-2009	Airports
Energy						
- Excise on mineral oils	Budget	Petrol, diesel, other mineral oils	Litre	Uniform	1957-	Refineries
- Fuel tax	Budget	Natural gas Coal	m^3 Ton	Uniform	1988-2003 1988-2006 and 2010-	Gas carriers Electricity plants
- Energy tax	Budget	Natural gas Electricity	m^3 kWh	Diff Diff	1996- 1996-	Energy carriers
- Energy tax surcharge	Renewables subsidy	Natural gas/electr	m^3/kWh	Diff	2013-	Energy carriers
Other						
- Waste tax	Budget	Landfilled waste	Ton	Uniform	1995-	Landfills
- Waste tax	Budget	Packaging waste	Ton		2008-2013	
- Water tax	Budget	Groundwater and tap water	m^3		1995-	Water carriers
Charges and fees						
- Air pollution charge	??	SO2 and NOx	Kg emission	Uniform	1972-1988	??
- Chemical waste charge	Clean up	Chemical waste	Ton	Uniform	1982-1988	??
- Noise charge	Noise abatement	Aviation/Transport/ Industry	??		1980-1988	??
- Municipal waste fee	Local waste expenditure	Waste	Lump-sum / Unit based	Fixed / Variable		Households/ Firms
- Municipal sewerage charge	Sewerage expenditures	Sewerage	Inhabitant	Fixed	?	Households/ Firms
- Water pollution fee	Water pollution abatement	Surface water pollution	Pollution equivalent	Pollution dependent	1970-	Households/ Firms
- Groundwater pollution fee	Clean up fund	?	?		1986-	

Source: Own compilation

Quite a different category are environmental charges and fees which are earmarked to raise revenue dedicated to specific (environmental) expenditures. For example, revenue from the environmental fee levied as part of the Dutch Surface Water Pollution Act (WVO) is spent on mitigating surface water pollution. The same holds for the municipal waste fee and the sewerage charge both of which finance proper treatment of waste and handling of waste water in the first place. The central government of the Netherlands also used to impose a charge on air pollution, noise and chemical waste to finance government expenses for clean-up (noise barriers; sanitation sites) and compensation of victims (e.g. by relocation or isolation).

The choice of the tax *base* determines to what extent a particular tax is – in the terminology of section 2 – an emission, input or output tax (or charge or fee). In other words, this choice determines the substitution processes induced by the tax to a large extent. Indeed,

[Describe shift over time]

The determination of the *unit of measurement* is also important for the substitution processes induced as well.

[PM MutabilityUTABILITY: see Keen, 1998; Vollebergh, 2008]

Choosing the level of tax *rates* determines the amount of revenue raised by the tax.

[PM polluter pays for the abatement cost principle; optimal Pigovian pricing; regulation]

Relief of the *tax burden* for specific groups or activities can be justified or not. Sometimes choices to reduce tax payment by specific groups just reflects lobbying behaviour.

[BUT: also many examples are justified (eg. Coal tax; tax competititon; chp) or reflect distributional concerns (eg. Energy tax]

Transaction cost, in particular the administration cost for the government, are determined to a large extent by the answer to the question who are the *tax payers* whether options exist to collect the tax revenue in a more simple way than just turn to all tax payers. Indeed, likely characteristics which shape the administrative cost function are the number of agents subject to the tax and the transparency and measurability of the tax base. Also the use of highly firm-specific technologies is likely to raise the administrative cost per unit emission, input or output. Furthermore, the level of the tax rate is likely to play an important role: with higher marginal rate tax evasion is likely to be stronger, which, in turn, raises the attractiveness for the regulator to spend resources to reduce tax evasion.[7]

[REFLECT ON TREND: transport taxes relatively cheap, env taxes costly (but high ED), indirect taxes cheaper]

[7] The first type of characteristics can be grasped by assuming a fixed cost component in implementing tax instruments. Furthermore, administrative costs are also likely to vary with the tax rates and the revenue raised. This maybe called the environmental Laffer curve (see Vollebergh, 2015).

5. Assessment and lessons

This sections draws some general lessons from the Dutch green tax experiment. Lessons from older and more recent experiments with environmental tax incentives in water, waste as well as in energy and transport corrective taxes will be discussed in some detail. These lessons are particular useful as a model for other countries that aim to get the green tax agenda forward.

5.1 Lessons from the Dutch environmental water and waste charges

In the theoretical section I show that a key element for welfare improving corrective taxes is the implementation context. One element of this context is the level of the marginal damage in the first place. This level depends on the state of the environment in the status quo. In hindsight one can observe that the new corrective taxes to the overall tax base of the Dutch government are systematically driven by the environmental concerns of the day. With the exception of the motor fuel excises – which have quite a different tradition – the development of the environmental tax base and rate structure clearly reflects this.

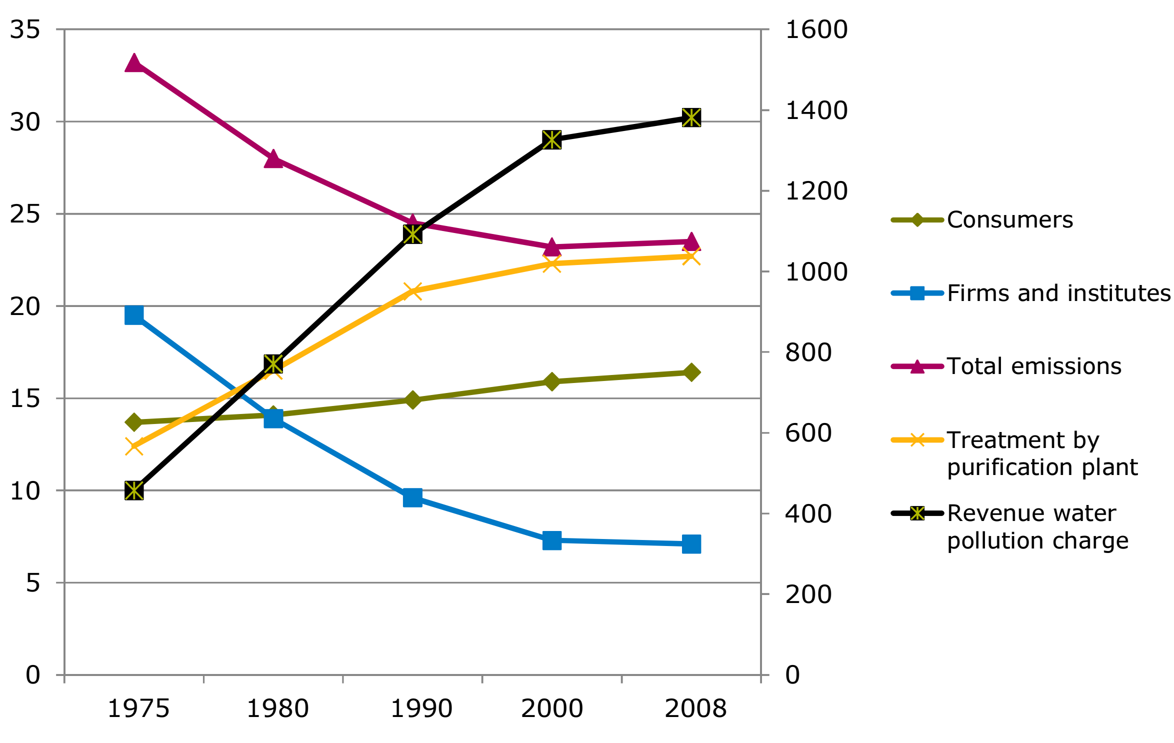
For instance, initial concerns about environmental damage directly targeted health concerns related to water pollution and waste disposal. This is also clearly reflected in both environmental and tax policies of the Netherlands. At the end of the 1960s environmental awareness grew strongly and environmental policies targeted water pollution and waste in the first place. Decentralized environmental charges and fees were introduced to finance local abatement policies according to the famous ‘polluter pays principle’. These policies were implemented by municipalities and the water boards. As a consequence these charges and fees have been set up in such a way that *all* households and firms alike contribute to these charges and fees.

Interestingly the impact of the water pollution charge and municipal waste fee (in combination with other instruments implemented) reflect very different patterns (see Figure 3 and 4).

[EXPLAIN WHY THIS IS THE CASE:

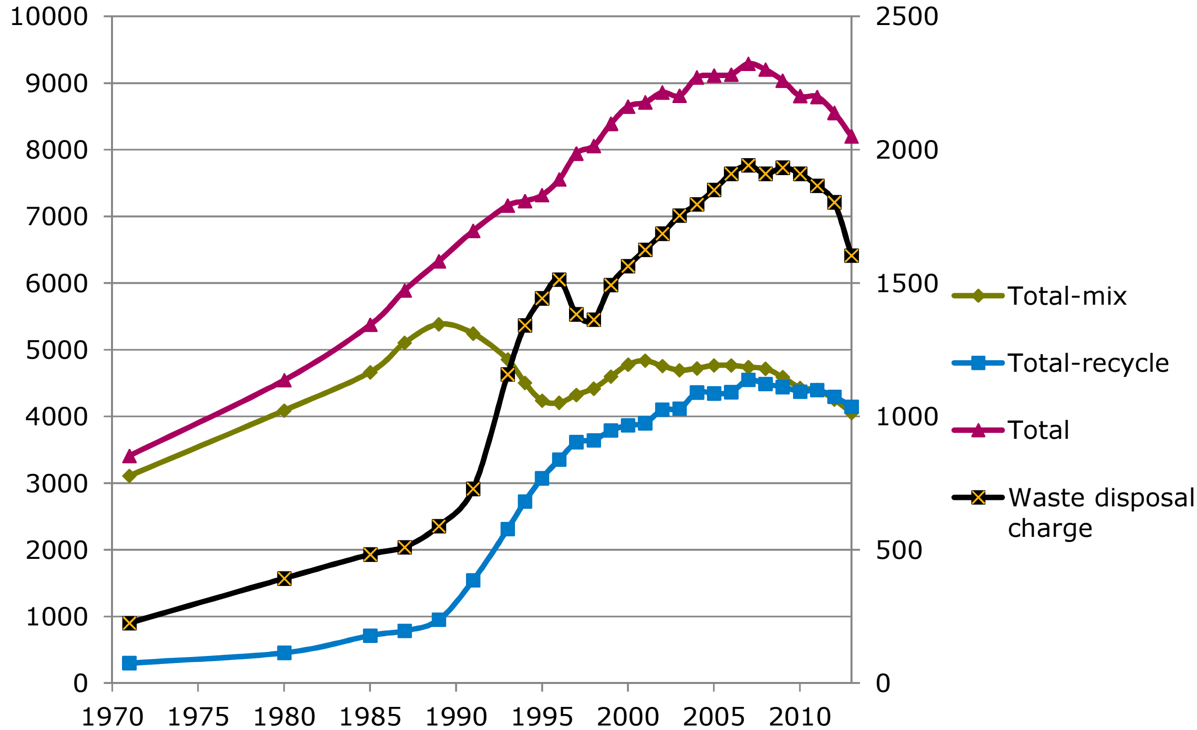
- **clear link exist with difference in tax base and unit of measurement (pollution equivalents);**
- **particularly effective for firm behavior!** In particular firms were able to influence their tax payments by reducing emissions which were specifically targeted by the tax base and its unit of measurement.
- **see also what happened with waste charge after its incentivization!]**

Figure 4 Waste water in the Netherlands (in pollution equivalents and euro 2013[1])



<u>Note</u>: waste water lines in mln pollution equivalents (left axis); revenue in mln 2013 euro (right axis)
<u>Source</u>: http://www.compendiumvoordeleefomgeving.nl/indicatoren

Figure 5 Household waste in the Netherlands (in kton and euro 2013[1])



Note: waste lines in kton (left axis); revenue in mln 2013 euro (right axis)
Source: http://www.compendiumvoordeleefomgeving.nl/indicatoren; Netherlands Bureau for Statistics

One could deduce several important lessons from these examples. The *first lesson* is that there does exist a tension between increasing environmental tax revenues ('green revenues') and achieving environmental gains ('green results'). It is a misconception that raising additional green revenue will automatically always lead to better green results. On the contrary, an important dilemma for green tax reform is the fact that there is a trade-off between raising green revenue and achieving green results at least in the long run. Environmental taxes create an incentive for citizens and firms to reduce their environmental impact, the 'green result' of which is that the environmental tax base will erode. Indeed, the not so impressive raise in the revenue capacity of the Dutch environmental charges and fees represent its success and not its failure. The environmental charges and fees were key to the improvement of important environmental quality conditions in the Netherlands in the first place. Moreover, the stabilization and even decline in revenue shows an important characteristic of effective corrective taxes: its tax base should decline if it is effective and approaches its optimal ('Pigovian') level.

[PM Also discuss to what extent these charges reflect concept of two-part instrument by financing abatement activities]

The *second lesson* relates to the (long run) incentives as triggered by the choice of the tax base. Both the Dutch water and waste charges have often been praised for their effectiveness and even the inducement of technological change (e.g. Opschoor and Vos, 1989; Kemp, 1987; Kinneman, 1996; OECD, 2010). Less attention has been paid, however, to the important design elements that have contributed to this success as explained before. The water charge was a typical emission tax from its conception, i.e. its tax base is directly related to a 'weighted' pollution index. For the waste charge also the introduction of a more direct link with waste disposal behavior induced the observed changes and that led to its praise. As suggested by the seminal work of Baumol and Oates (1971) one indeed observes interesting improvements in environmental quality together with behavorial changes that lead to cost savings. These findings suggest that even in the absence of any monitoring system in the beginning, implementation of a new tax on emissions is likely to be welfare improving even in the long run. Initially the marginal damage of some externalities will be high enough to compensate for the initial investment in a monitoring system that allows for the implementation of an emission tax. Afterwards – with enough abatement possibilities – the emission reduction incentives may induce a much faster reduction of the marginal damage compared to a design with less direct incentives.

This experience also suggests a *third lesson*, in particular for countries with (very) low environmental quality in the beginning or that are on a developing path with large negative impacts on the state of the environment. Investment in monitoring for environmental purposes maybe relatively practical (and less costly) while the tax authorities can exploit these investments to directly tax polluting behavior while financing clean up and abatement.

5.2 Lessons from the Dutch taxes on energy

Another interesting experiment with Green Tax Reform in the Netherlands is the conversion of a set of small taxes on an environmental basis to finance several public expenditures – such as protection shields against noise – into the current Energy Tax.[8] Its tax base is mainly consumption of natural gas, electricity, mineral oils used for other purposes than as motor fuels, and a small tax on coal. Together with the excises on mineral oils used as motor fuels these taxes represent the current *indirect or implicit taxation* of atmospheric emissions such as CO2 and other emissions relevant for air quality, such as SO_2 and NO_x.

Figure 6 is suggestive but should be interpreted with care. Clearly the Netherlands has been quite successful in reducing emissions mainly responsible bad air quality, such as SO_2 and NO_x.[9] Instead, CO_2 emissions still rise despite the enormous increase in overall energy tax revenue since 1985 which is mainly due to the Energy Tax.

[PM careful with causal relationship in this case: taxes are *very indirectly* related to air quality emissions (mainly subject to standards which explain their reduction!);

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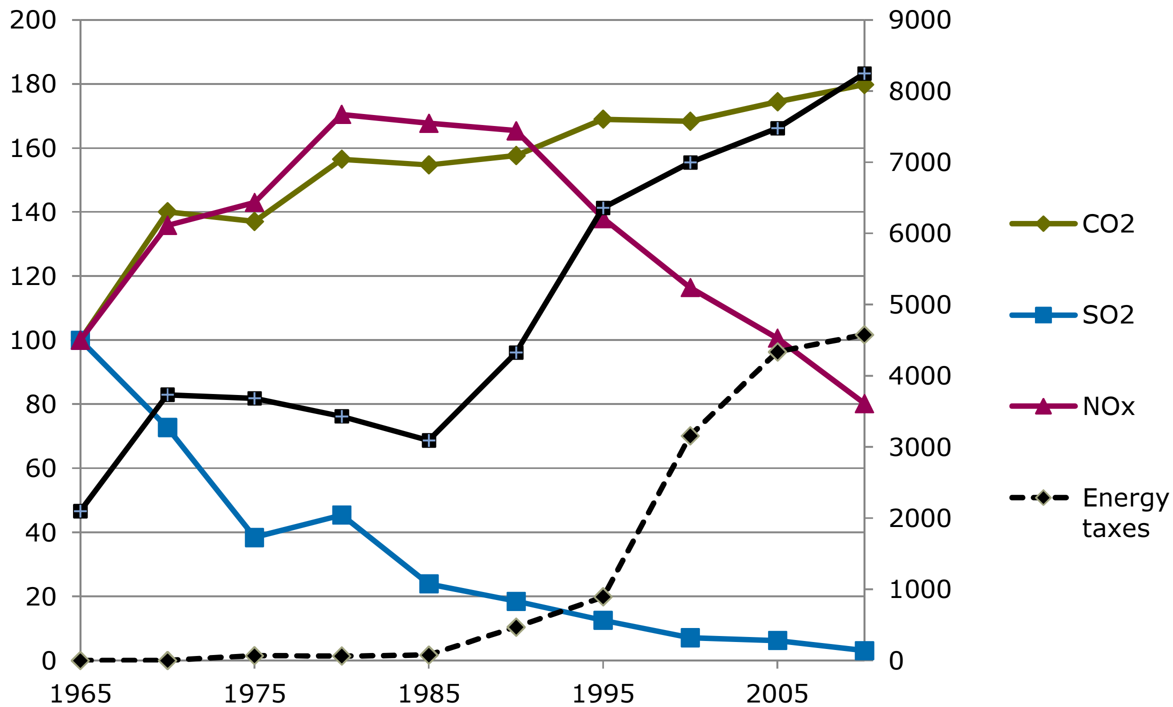
[8] Vollebergh (2007) provides a detailed analysis and evaluation of this tax reform in its different stages, in particular the reform of a broad based energy *input* tax implemented in 1988 and the introduction of an *output* based energy tax on mainly small use of natural gas and electricity in1996 which was shaped along the lines of the EU carbon/energy tax proposal from 1992 (see COM(92)XXX). This whole set of energy excises has been reformed again in 2002. This so called Energy Tax abolished the input taxes in favour of an output based approach to bring the taxes more in line with the European Energy Tax Directive of 2003 (COM(03)YYY).

[9] Also PM10 has been reduced enormously. The index runs from 100 in 1965 to only 17 in 2010.

The relationship with CO2 is much more straightforward for most energy taxes (but not so for electricity tax); we do not know counterfactual, but seems likely that high tax rates have at least reduced consumption of the taxed fuels considerably (eg. Tax on gasoline is over 100% and elasticities are in order of 0.3).

Figure 6 Emissions to the air in the Netherlands (index 1965 = 100)



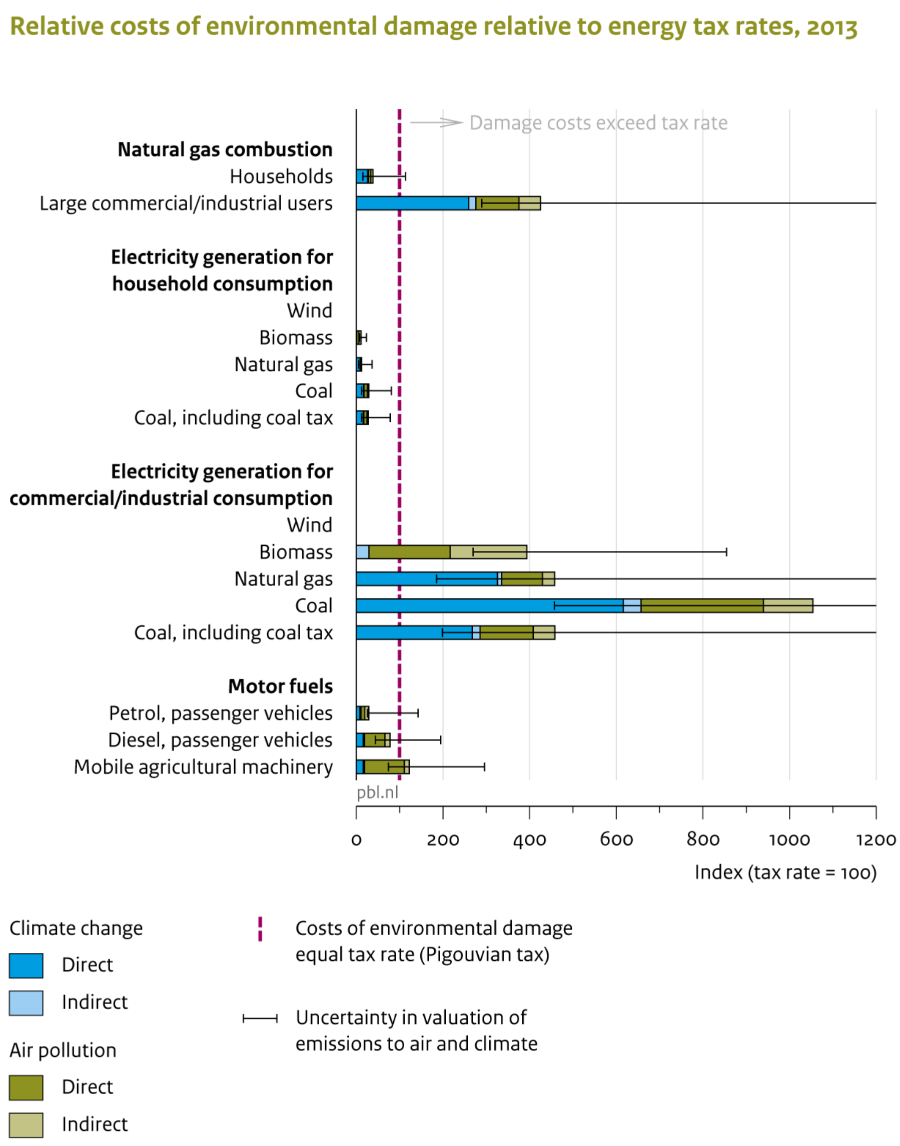
Note: Emission lines are indexed (left axis); tax revenue in mln 2013 euro (right axis); All energy taxes also include revenue from mineral oils (gasoline and other motor vehichle taxes)
Source: http://www.compendiumvoordeleefomgeving.nl/indicatoren

Another source of important information has been recently compiled by PBL (2014) and summarized in Figure 7.[10] The figure clearly shows that households and small firms are currently paying the highest rates for all energy taxes. Particularly for electricity, rate differences between small and large users are considerable. Furthermore, when considering average damage costs (coloured bars), it appears that the high rates for small users cannot really be justified on the grounds of environmental damage alone. However, if the uncertainty

[10] **Note on the damage estimation procedure (see also Vollebergh, 2015)**

of these estimates is taken into account (see uncertainty bars), present rates may not be too high after all – except for electricity generated from natural gas, biomass and wind. Environmental damage costs also differ considerably between electricity production methods (wind, biomass, natural gas and coal), while the tax rate is the same for all electricity, regardless of how it is produced.

Figure 7 Cost of environmental damage relative to energy tax rates, 2013



Source: PBL

In contrast to the relatively high rates for small users, rates for large users are much lower than the estimated environmental damage costs, both for natural gas and electricity. [11] Note that EU ETS does not apply to air polluting emissions, and therefore cannot compensate the low tax rates for large users with regard to air pollution damage. Air pollution has a strong local effect, and any additional emission reduction would first and foremost benefit the Dutch population itself. Coal-fired power plants and natural gas combustion still cause considerable air quality damage, and this is also true for power plants (co-)firing biomass. Again, damage costs are much higher than tax rates for large users. As Figure 7 shows the coal tax compensates at least some of the damage.

As for motor fuels, the relation between excise rates and environmental damage costs shows a number of interesting points. For petrol, it appears that the high excise rates cannot be justified when compared to the average environmental damage costs caused by petrol combustion in an average Dutch car engine. However, when considering the upper limit of the uncertainty range, the gap between petrol excise rates and environmental damage costs becomes considerably smaller. In addition, it should be emphasised that (heavy) taxation of petrol can be justified on numerous other grounds, such as the high damage costs of traffic accidents and congestion. If the latter costs are added to the environmental costs, petrol excises are too low, rather than too high (CE, 2008; Parry et al., 2014). For such a comprehensive assessment, however, a more elaborate analysis is required, including other traffic-related taxes, such as the vehicle purchase tax on new vehicles (see also next section).

[11] In theory, this need not be a problem as far as climate costs are concerned, because CO_2 emissions of large installations are also regulated through the European Emissions Trading System (EU ETS). However, the price of tradable permits is currently so low, that large users of natural gas and coal do not even come close to paying for the current monetary damage of climate change. It should be noted that this is also the case for large users in other countries, particularly in countries that do not regulate CO_2 emissions at all.

[PM explain Pigou rates much higher in the past as implied by Figure 6]

- **weak and variable link exist between tax bases, unit of measurements and emissions (except for several taxes and CO2);**
- **in combi with a tax burden that is highest for consumers (on highly inelastic products like natural gas and electricity) incentives for *emission reduction* are relatively weak [PM NL fossil fuel intensive and still applies relatively high rates even for firms; tax competition as constraint]**
- **switch from input to output taxes in 2002 further reduced abatement incentive**

What does this experiment with energy taxes in the Netherlands suggest? From this case I infer the following lessons.

i) Reconfirms the importance of choice of the tax base (and unit of measurement); for energy taxes this is often too indirect related to emissions [this is likely to be an issue for carbon taxes too]

ii) Relative taxation of fuels weakly reflects environmental damage (despite comprehensive way of taxing energy products in NL); is an issue from a Pigouvian perspective such as lower tax on electricity, higher on gas; constraint is embeddedness in EU (difficulty of reforming ETD)

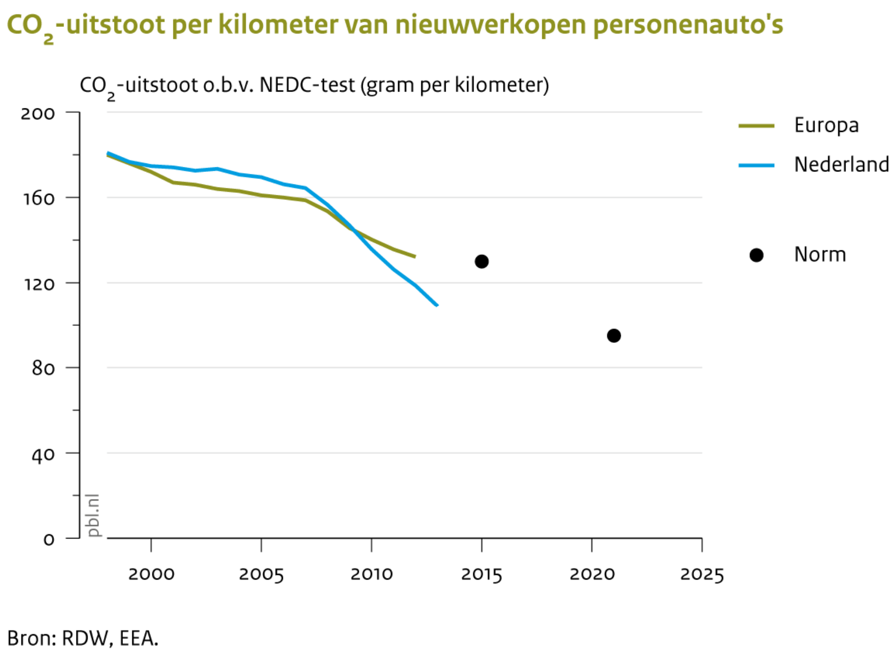
iii) Tax revenue from fossil fuels: useful tax base because most energy products are relatively inelastic; switch to non-fossil fuels poses a challenge for stable environmental tax revenue

iv) You need ability to properly enforce taxation (implementation); transition towards fossil fuel based energy use (usually if countries grow richer they substitute biomass for fossil + consume much more) also facilitates emission regulation ánd tax enforcement because this energy source traded on explicit markets

[PM in a different paper I suggest options for Dutch energy tax reform (see Vollebergh, 2015)]

5.3 Lessons from the Dutch taxes on transport

PM Lesson: even a small country may have an impact



6. Conclusion

General lesson: you need ability to properly enforce taxation (implementation) as another key issue; you need proper institutions to implement taxes. Transition towards fossil fuel based energy use (usually if countries grow richer they use less biomass) usually facilitates emission regulation ánd tax enforcement because this energy source is coupled to market trading (instead of biomass markets in developing countries). For the transaction cost, such as tax collection and tax payment, it is important to realize that public investment in an enforcement system that can also be used as an environmental monitoring system is useful in many circumstances. Indeed, the environmental accounting system creates more transparency in physical flows which is essential for proper regulation. With such monitoring systems in place, tax authorities can piggy bag their own enforcement of levies or taxes by relying on the same measurement of physical flow of goods (Cnossen, 1983).

Finding a proper balance between incentives and transaction costs difficult. A complex tax structure that is difficult to understand for taxpayers and expensive to implement harms allocative efficiency of raising tax revenue as well. Clearly, a host of fiscal measures aimed at an endless array of environmental objectives would not help to simplify the tax structure and may even cause more harm than good.

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