Evaluating Economic Policy Instruments for Sustainable Water Management in Europe

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Authors	Marianne Schuerhoff, Hans-Peter Weikard, David Zetland, (WUR)
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Executive Summary

Definition of the analysed EPI and purpose

The Economic Policy Instrument (EPI) we analyse in this case study – a volumetric tax on groundwater extractions levied on a subset of groundwater users in the Netherlands – is simultaneously an instrument for raising revenues and modifying behaviour. The EPI's impact depends on the choices facing users of groundwater. Some will have an incentive to increase water efficiency; others will shift to other sources like surface water; some will not respond at all. All things equal, we know that any water user subject to the groundwater tax will face higher costs, either through the payment of the tax or through the cost of changing behaviour to avoid the tax.

Introduction

The Dutch national groundwater tax (GWT – as opposed to the extant provincial groundwater extraction fee, which is dedicated to groundwater management) was presented as a "green tax" that would simultaneously provide revenue to the central government that would make it possible to lower taxes on "productive behaviour" (income tax) and increase the cost of behaviour with an environmental impact (resource tax).

Our case study examines the tension between a tax that generates revenue (its publicized goal) and a tax that modifies behaviour (its indirect, but predictable effect) while noting that complete success in one implies complete failure of the other. Given its age (passed into law in 1994, and in force since 1995), we can look back on its economic, environmental and social impacts.

The GWT is levied on almost all water extractions made by particular entities – generally large net water extractors. Like other green taxes (e.g., taxes on fuel and rubbish disposal), it was levied on a "resource consuming" behaviour that the Dutch government wanted to reduce.

Legislative setting and economic background

The GWT's fiscal design as a tax (instead of a regulation) reflects a desire to generate revenue at the same time as it modified behavior. It also reflects the existence of provincial fees that funded groundwater regulation; it made more sense to levy a tax as a complement to regulation than add another level of regulation.

The GWT was implemented in 1995 under the Environmental Taxes Act of 1994, which was enacted as part of a general trend to "green" taxes in the 1990s. The GWT was designed to minimize adverse impacts on "sensitive" groundwater users. These were, first, farmers who were mostly exempt from the taxes and, second, industry which was originally taxed at 50 % of the rate levied on drinking water companies. The impact on other payers (drinking water companies, for example) was minimized

by the tax's relatively simple reporting requirements: annual self-reporting of extractions. Although it is possible to assume that agricultural exemptions provided a form of subsidy to their operations, it is not clear that farmers were getting very much of a subsidy or lax regulatory environment. That is because farmers got their water from many sources, were already subject to regulation regarding "bad" practices affecting groundwater (via provincial fees, but often exempt there too), and suffered production losses when groundwater levels were too high for their crops.

Brief description of results and impacts of the proposed EPI

The GWT has been successful as a fiscal instrument designed to raise revenues without affecting behaviour too much. Although the cost of administering the tax was relatively low (EUR 220 000 for a revenue of EUR 170 million) – compared to other taxes – it was also a tax that its few payers (most obviously drinking water companies) disliked immensely, since they saw it as an "optional" cost that they would prefer to do without.

The GWT was immediately successful in raising revenues. Its impact on groundwater levels and environmental quality is hard to determine. First, the government *presented* the tax as a fiscal measure, not as a measure to impact behaviour. Second, there was no systematic collection of groundwater levels before and after implementation of the tax – making it difficult to know if the tax had any impact on groundwater levels. Third, there was no agreement on whether groundwater levels should be higher or lower. The Netherlands has a long history of trying to remove water to reclaim areas for human use (particularly in the western part of the country). At the same time, the Dutch recognize the need to raise groundwater levels in some places where excessive consumption has reduced groundwater levels and environmental health.

The economic impacts of the GWT are, likewise, difficult to either trace or explain. From an economic perspective, the tax raised the price of raw water supplies to drinking water companies and industrial firms. Although these costs amounted to around EUR 170 million per year, they amounted to only 10 % of the cost of tap water to residential users, a number that few would notice. Industrial firms paying the tax probably paid more attention to its financial impact, but few would make significant changes in their operations (beyond perhaps using more surface water) due to the tax being quite small relative to the value of water as an input. We might imagine that farmers would have the strongest response to the tax, but they were mostly excluded from paying the GWT because they individually did not pump enough groundwater to meet the threshold for payment. Many farmers take water from ubiquitous surface water supplies that are connected to groundwater sources, rely on precipitation or are exempt from paying taxes because they use the water for sprinkling and irrigation.

The social impacts and distributional effects are difficult to trace, due to the tax's light burden on water choices that most make while paying more attention to other, larger costs and constraints..

It is important to note that the GWT was implemented at the same time as provincial groundwater fees were already in effect. These fees – although quite small relative to tax revenue – had a much larger impact on groundwater levels in the Netherlands. That is because fee revenues were used to pay the salaries of staff charged with monitoring and managing local groundwater supplies These regulators already influenced practices with (in)formal guidance before the introduction of the GWT.

Conclusions and lessons learnt

There are several lessons for outsiders to take from the Dutch GWT experience. First, pay attention to the difference between the fiscal and behavioural dimensions of a tax. Second, remember that a tax – no matter how efficient or how easily passed through to consumers – is still a tax that payers wish to avoid. Third, not all "green taxes" are green in either design or operation; they may only be a way of raising revenue. That said, it is also important to track the behavioural impact of a tax – if only to understand its economic, social, and environmental impacts.

We therefore recommend that anyone considering a GWT monitor and assess behaviour before and after the GWT is implemented – in terms of groundwater and total water consumption – as well as groundwater levels and groundwater "health." Such data collection, although increasing the administrative costs of the GWT, will facilitate discussion of the environmental and economic impacts of the GWT.

Table of Contents

1 EPI Background

The Dutch national groundwater tax (GWT) came into force in 1995 under the 1994 Environmental Taxes Act. It was simultaneously supposed to reduce groundwater extractions to benefit the environment, raise revenue, and broaden and shift the tax base (Trouw, 1993; Vermeend, 2011).[1]

These goals must be considered within pre-existing contexts

Desiccation of specific areas of the Netherlands became a concern in the 1970s, and remained a concern in later years (Ministry of VROM, 2001). Desiccation was mainly due to sizable extractions by water companies and certain industries (agriculture played a smaller role), but many large extractions were discouraged and even prohibited in the 1970s and 1980s via command and control systems (Graveland, 2011).

Extractors have paid *provincial* fees under the Groundwater Act since 1981. These fees per cubic meter of extracted groundwater (both fresh and brackish) vary among provinces. Revenue is dedicated to groundwater management, research, administration and compensation to farmers facing land use constraints due to groundwater protections (Jantzen, 2008; Spaermon et al., 2009).

Revenue from the *national* GWT flows to the general budget without being directed to any specific purpose. GWT revenue is approximately ten times the revenue from provincial fees (Vermeend and van der Vaart, 1998).

The GWT was intended to reduce the use of groundwater relative to surface water, generate tax income, and green the tax system by shifting taxes from income to consumption (Ecotec et al., 2001; Vermeend and van der Vaart, 1998; and Pfeil, 2009). At the outset it was also acknowledged that its behavioural effect might be limited by a low price elasticity for groundwater (Vermeend and van der Vaart, 1998).

The GWT is charged per extracted cubic meter of fresh groundwater. Extractors are obliged to keep registers and declare their extractions. The normal tariff is EUR 0.1915 per cubic meter. Initially industry received a 50 % reduction – this was dropped later. Users who return extracted water to the same groundwater body pay EUR 0.0619 per cubic meter. Users who have a combined installation for infiltration and extractions pay 0.1604 per cubic meter. These installations usually infiltrate surface water through geological layers such as dunes before abstracting it (Spaermon et al., 2009; UCD, 2008).

The tax has several exemptions (Vermeend and van der Vaart, 1998):

[1] "With respect to the groundwater tax we remark the following on the points raised by our members. This tax [GWT] is based on the idea that clean, fresh groundwater is a scarce good and that striving for sustainable development –as government and parliament endorsed- obliges the current generation to be economical of it [groundwater] in order to achieve that future generations can provide for their needs to the same extent." (Eerste Kamer der Staten Generaal, 1994, 2). The document is signed by the then minister and state secretary of Finance and the minister of VROM, hence the "we" in the first sentence.

- Pumps with a capacity of less than 10m^3 per hour
- Construction-related drainage and testing extractions less than 50 000 m^3 per month, for a maximum of four successive months. Only granted once per construction
- Emergency facilities; fire departments etc.
- Sprinkling and irrigation, when a maximum of 10 % of extracted water is used for other purposes. This exempts most agricultural users.
- Soil and groundwater rehabilitation projects
- Closed energy systems
- Ice rinks in meadows (Spaermon et al., 2009)

The GWT was set to generate income (based on the idea of low elasticity of response and stated goals of policy makers) instead of internalizing externalities related to environmental pressures from groundwater abstractions (Ecotec et al., 2001). Extractors need to keep records of their extractions using a meter. This self-monitoring process is checked with audits (UCD, 2008). The National Environmental Taxes Team Arnhem ([2]) is responsible for administration of the Dutch green taxes, but information on enforcement is not available.

Several steps were taken to avoid negative side effects. First, exporting industries were charged half of the original rate to safeguard their competitive positions. Second, extractions dedicated to irrigation and sprinkling were exempted because it is assumed that this would cause little environmental damage. Third, low capacity pumps were initially exempt, but users installed multiple low capacity pumps to dodge the tax (Vermeend and van der Vaart, 1998). This behaviour led to a new rule that an owner would be taxed according to total pump capacity (Spaermon et al., 2009).

Designing and implementing the tax

The GWT was proposed when a failure to increase the general fuel tax left a revenue gap in the national budget of NLG 425 million (EUR 193 million ([3])). In 1992 the search for other revenues led to an agreement to spread the additional tax burden across different groups of taxpayers and emphasize taxes on consumption. The debate over tax burdens went on so long that the budgetary gap grew. The final targeted GWT revenue was NLG 245 million (EUR 111 million). After further debate and changes, the GWT entered into force on 1 January 1995 (Vermeend and van der Vaart, 1998).

Drinking water companies opposed the proposal because it would tax consumers rather than farmers responsible for more groundwater pollution: they filed a lawsuit opposing the GWT and lost. Lobbying by industries and agriculture influenced the

[2]The National Environmental Taxes Team in Arnhem, The Netherlands (established in 2001) cannot be reached by telephone or email, only by mail. Its precursor, the Central Environment Team in Rotterdam was established in 1995, before that time the Ministry of VROM was responsible for environmental taxes.

[3] We use the 1 Jan 1999 conversion rate of 2.2 NLG for 1.0 EUR.

final form of the tax: industry received a lower rate and agriculture received many exemptions (Vermeend, 2011). Two years after implementation, a first evaluation noted that industry was saving water, but small-scale self-extractions by agriculture had increased. The evaluation proposed to raise the tax and recommended some refinements to the tax (IWACO, 1997a). Later reports recommended ending the lower rate for industry to promote efficient use of groundwater (Vermeend and van der Vaart, 1998; Ecotec et al., 2001). The industrial discount of 50 % on the tax rate was removed in two steps in 2000 and 2001 (UCD, 2008). In 2010 the tax office investigated ways to improve fiscal efficiency and recommended dropping the GWT from 1 January 2012 (Werkgroep 16, 2010). The First Chamber [Dutch upper chamber] will vote on this in December 2011

2 Characterisation of the case study area

I. Environmental characterisation

Table 2.1 shows that the total area of the Netherlands increased since 1985, mostly due to a municipal redistribution of water areas (StatLine, 2011b).

Table 2.1 History of land use in the Netherlands, 1985-2008

	1985	1985	2008	2008
Area	Sq. km	%	Sq. km	%
(Semi) built-up area	5 447	15	6 111	15
Agricultural area	23 974	64	22 758	55
Forest and open natural area	4 500	12	4 850	12
Water area	3 414	9	7 824	19
Total area	**37 334**		**41 543**	

Source: StatLine, 2011b

The northern and western areas of the are below sea level. A third of the Netherlands is below sea level, mostly in the north and west (Graveland and Baas, 2011b). Groundwater tables in the western and northern part of the country are close to the surface and almost completely artificially managed. In the sandy eastern and southern regions, groundwater tables can be several decametres below the surface and the area is vulnerable to desiccation.

The Netherlands receives over 90 % of its freshwater sources from external inflow; annual average water abstraction is 5,500 m3 per capita (Eurostat, 2011a). Since 1994 rainfall has fluctuated around 900 mm per year (StatLine 2011a). Under the WFD-article 5 classifications, Dutch surface water is 90% at risk from an ecological (quantitative) perspective; 70% has good chemical (quality) status. For groundwater, these numbers are 0% and 60%, respectively (EEA, 2010a; 2010b). This quantitative result for groundwater is not without controversy; see 3.1 below.

Some data on groundwater levels are collected, the the lack of systematic collection makes it hard to claim that the GWT (or Dutch national policy) is concerned with groundwater levels.

Increases in surface water abstractions caused total gross freshwater abstraction to increase between 1996 and 2006, while groundwater abstractions decreased slightly, from 1 153 MCM to 1 059 MCM (Eurostat, 2011d).

Drinking water companies are responsible for 75 % of groundwater extractions. They also use surface water and dune water as raw water sources for drinking water. Figure 2.1 shows the relative weights of their raw water sources. We can see that the share of groundwater in total water extractions of drinking water companies drops at the expense of surface water after the 1995 implementation of the GWT.

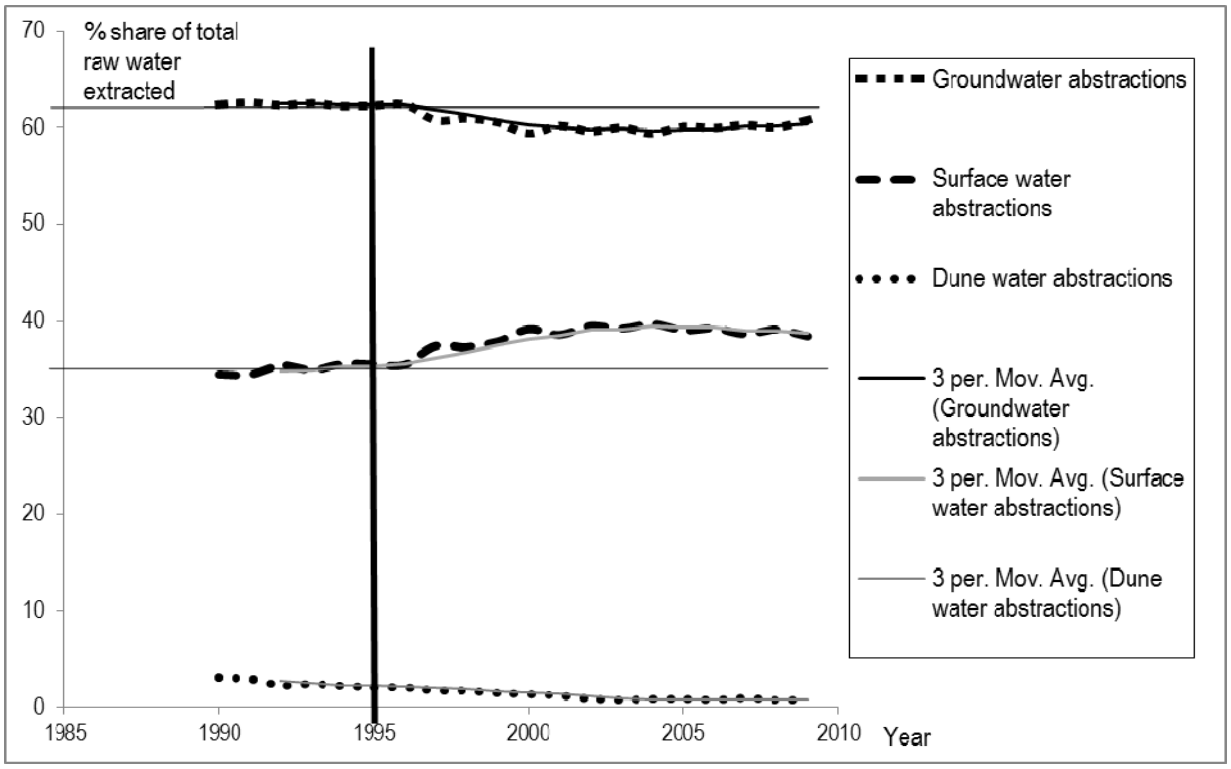

Figure 2.1 Share of raw water sources used by drinking water companies since 1990

Source: VEWIN, 2011

Historically Dutch water management is directed at flood protection, but water quality and groundwater scarcity have recently become more important. The water exploitation index (percentage of freshwater available as a share of total available renewable resources) of the Netherlands increased between 1990 and 2007. Desiccation in the past (before 1995) was a problem in some "stressed areas" due to sizable extractions by water companies and certain industry, and to a lesser extent by inefficient use in agriculture (Graveland, 2011).

Six years after the implementation of the GWT, the Ministry of Housing, Spatial planning and the Environment (VROM) still indicates desiccation in certain areas

and overexploitation of natural resources to be among the main environmental problems (Ministry of VROM, 2001). This can be partly attributed to drainage by agriculture in the west, and the effects of climate change – more and prolonged weather extremes – in the east (Graveland, 2011). For the whole of Europe climate change will increase water shortages, while increasing efficiency is expected to decrease water demand (EEA, 2010a).

II. Economic characterisation

Dutch GDP (in 2010 EUR) per capita increased from EUR 12 200 in 1985 to EUR 35 400 in 2010 (Eurostat, 2011b). Table 2.2. **Errore. L'origine riferimento non è stata trovata.Errore. L'origine riferimento non è stata trovata.Errore. L'origine riferimento non è stata trovata.**provides data for water use per source and the share of GDP of each sector.

Table 2.2 Environmental accounts: monitored water use in MCM by category in 2008

	Use of treated (Tap) water (1)	Use of raw groundwater*	Use of raw surface water*	% of GDP**
Households	718	(2)	(2)	15
Agriculture, forestry and fishery	48	52	23	2
Mining industry	4	0	1	4
Industry	200	156	3296	17
Energy companies	3	2	9045	2
Drinking water companies	0	762	490	1
Other	120	1	431	
Total Water use	**1 093**	**972**	**13286**	

Source: * Statistics Netherlands, 2010, ** Statistics Netherlands 2011a)

Notes: (1) Treated water comes from both raw surface and groundwater. (2) no data. (3) Note that use of raw groundwater by households is probably – slightly – understated because not all groundwater extraction is monitored (Statistics Netherlands, 2006)

The population of the Netherlands - the most densely populated country in Europe - increased from 14 454 000 in 1985 to 16 656 000 in 2010 (Eurostat, 2011c). Population density increased from 429 people per sq. km to 492 people per sq. km (World dataBank, 2011).

The GWT is not subject to macroeconomic fluctuations because of its small size relative to other instruments. It *would* be affected by information lags if it was designed to affect physical groundwater levels, but it is not.

Groundwater extraction is influenced by the national tax but also by provincial levies and international treaties. Resource use in the Netherlands has gone up since the World War II due to population growth on the extensive margin and affluence on the intensive margin (Pfeil, 2009). Dutch water policy is directed at securing water supplies, flood control, water quality and mitigating negative environmental effects of groundwater extractions (Vermeend and van der Vaart, 1998; Graveland and Baas, 2011b).

3 Assessment Criteria

3.1 Environmental outcomes

Responses to the EPI

The tax's effect differed among groups. In the first years after implementation industry and drinking water companies decreased their use of groundwater; they shifted from ground- to surface water sources and probably increased their water use efficiency. Small-scale tax-exempted extractors on the other hand increased their groundwater extractions (IWACO, 1997a). The tax also increased the *tap* water tariff, which may have caused the decrease in *tap* water use per capita and by industry between 1990 and 2009 (VEWIN, 2011). Between 2003 and 2008 total groundwater abstractions still decreased: for a large part due to a sizable reduction in groundwater abstraction by industry (Graveland and Baas, 2011a).

Pressure on water-related ecosystems

Farmers prefer lower groundwater levels to cultivate certain crops, while higher levels are better for nature (Hellegers, 2001). Desiccation negatively affects nature conservation and biodiversity (Statistics Netherlands, 2011b). No economic valuation exercises of environmental benefits were carried out (Vermeend, 2011).

Decreased groundwater extractions may have lowered pressure on ecosystems, but no direct link can be made between these decreased extractions and lower pressures. First, data on changes in groundwater levels are not available to third parties. Second, the ecological status of water-related ecosystems is also influenced by rainfall, temperature, surface flows, and so on. Third, groundwater overdraft issues were already taken care of before the introduction of the GWT (Graveland, 2011). That said, reports dated six and sixteen years after the tax's implementation state that groundwater depletion and desiccation were still major concerns (Ministry of VROM, 2001; Statistics Netherlands, 2011b).

3.2 Economic Assessment Criteria

Alternatives to the EPI

Once it became clear that the fuel tax would not be extended, the government had to look for other revenue-generating options. An extension of the provincial fees was considered and dismissed because it was not a national tax (van der Vaart, 1992; Vermeend, 2011). An increase in provincial fees would have probably contributed more specifically and directly to local groundwater management, while the national

GWT simply contribute to the general budget; see section 1. It is unknown whether the GWT was the least-cost alternative, it is however, known that it was the tax with the most favourable costs/benefit proportions (Vermeend, 2011).

Despite its low administrative costs compared to other taxes, the GWT is called labour intensive in a recent report (Werkgroep 16, 2010).

Contribution to economic efficiency

The shift from labour taxes to environmental taxes was supposed to generate a "double dividend" of more jobs and a better environment, but measured employment gains were low (Vermeend and van der Vaart, 1998).

The national tax increased the price of groundwater, with a goal of promoting high value uses of groundwater (such as drinking water). The GWT lessened the price difference between the use of groundwater and surface water as a raw source for tap water. Tap water made of groundwater is still cheaper than tap water made of surface water – due to differences in treatment costs. Also the price of self-extracted groundwater is still well below the price of tap water.

It appears that companies paying the tax have increased their water efficiency (IWACO, 1997a), but this good result has been partially offset by exempt users increasing their groundwater extractions and confusion over the marginal impact of the GWT. Pre-existing provincial groundwater fees and regulations already influenced abstractions before the GWT was implemented in 1995 (Spaermon et al., 2009; Graveland, 2011). The groundwater tax's introduction was also preceded by the Water Savings Action Plan in 1992 (Vermeend and van der Vaart, 1998), which makes it harder to distinguish the tax's exact contribution to economic or operational efficiency.

The tax's effect on welfare is not obvious. As the national tax tariff is approximately 10 times the tariff charged by provincial taxes, but groundwater demand was expected to be largely inelastic, and groundwater extraction did not respond heavily to price changes (Dutch Green Tax Commission, 1998).

Risk reduction

The GWT might have reduced groundwater extractions, and thereby reduce the *need* for groundwater management. But its revenue is not dedicated to groundwater management. An extension of provincial groundwater fees probably would have reduced risk more than the GWT.

Incentives provided by the EPI

The fiscal purpose of the tax is to raise revenue for the government by taxing an inelastic demand. (Ecotec et al., 2001). Even so, the tax provided an incentive to

decrease extractions. Its initial design included exemptions and reduced rates to minimize tax evasion; see section 1 (Hellegers, 2001; Vermeend and van der Vaart, 1998). The tax increased the cost of drinking water but it is not evident that that caused demand for *drinking* water to fall (Ecotec et al., 2001; Bots, 2008), as the groundwater tax interacted with the tap water tax, increased awareness about water consumption, and other changes in demand (Graveland, 2011).

3.3 Distributional Effects and Social Equity

Information below is derived from (grey) literature and from a 1997 survey commissioned by the central government. This survey looked into the economic effects of the groundwater tax and the waste tax.

The winner of the implementation of the national GWT was the government, which gained tax revenue. The costs (which were not further specified) for the implementation process were born by the government, which entailed following standard procedures. Groundwater extractors paid the tax. Industry and drinking water companies invested in water saving equipment and switched to other sources, but these actions were not due only to the GWT (IWACO, 1997a). It is not clear whether the implementation of the GWT provided a different distribution of income, costs or benefits compared to alternative instruments as no assessments were conducted (Vermeend, 2011).
While GWT revenue is relatively modest (one per cent of the government's total tax receipts), over 1 000 holders (drinking water companies, industry and farmers) pay the tax (Werkgroep 16, 2010). In 2005, drinking water companies contributed over 80 % to the total tax revenue of EUR 168 million. Industry contributes 18 %, and farmers contribute around 2 % (Interdepartementale Werkgroep Grondwaterbelasting, 2007). Farmers are heavily exempt in the design of the tax, due to the strong agricultural lobby (Vermeend 2011). In 2003 only 2 % of farmers paid this tax (Hellegers and van Ierland 2003). Since 2006 groundwater extractions dedicated mainly to irrigating and sprinkling are exempt.

Productive activities

Increasing production costs led drinking water companies to investigate options to increase water efficiency and to shift to surface water (IWACO, 1997b). Residents saw their water bill increase by an average of 10 % (ranging from 2 to 19 %, depending on raw water sources) because drinking water companies can pass the entire tax on to customers (Accenture, 2010). Businesses were affected by the GWT if they were groundwater extractors or bought tap water of drinking water companies. Exporting business (especially paper industry) claimed that the tax lowered their profit margins (IWACO, 1997b).

Cost of production

The GWT increased the cost of raw water to water companies. They passed the tax through to customers, which increased the price of tap water. Between 1990 and 2009 demand for tap water per capita fell, partly due to the GWT (VEWIN, 2011). Companies using more groundwater paid more tax (IWACO, 1997b). That said, the drinking water companies using more groundwater and paying more taxes still have the lowest tariffs for tap water (Accenture, 2010).

Awareness

Drinking water companies indicated that they started using groundwater more sparsely because their awareness increased. Also some business and farmers claimed that they had become more aware of groundwater as a source of production after the implementation of the tax (IWACO, 1997b).

Effect on staff

Four businesses (including at least one farmer) claimed they reduced their staff in response to the tax Drinking water companies indicated that administration of the GWT costs on average 87 man-hours per year per company but there is no indication that they increased staff (IWACO, 1997b).

Greater or weaker say

In the first years after implementation it was unclear whether the tariffs would be increased later, but tariffs were increased when abstractions fell. This adjustment annoyed businesses who felt punished for their "good behaviour" (IWACO, 1997b).

3.4 Institutions

Description of institutions

The Netherlands has a long tradition in combating water threats. Dutch culture emphasises rule obeying and consensus seeking (known as "polderen'). Farmers historically have a large say in Dutch politics (Vermeend, 2011).

Water Boards - the oldest existing governmental bodies in the Netherlands – are historically responsible for water management. The decentralized political system handed different responsibilities to the state, provinces and municipalities. However, in recent years the central government has attempted to centralize responsibility.

The tax office, likewise, has shifted its policy from taxing on "ability to pay" to taxing "harmful" consumption. A simultaneous broadening of the tax base aimed to reduce the income tax burden (Vermeend and van der Vaart, 1998).

Institutional influence on design, implementation and operation

In the first place institutions influenced the choice of a tax. Dutch citizens are dedicated tax payers, which makes increasing or forming a new tax an attractive way to raise revenue. The choice of a "green" tax on consumption was influenced by the rising environmental awareness of the time. For the GWT specifically institutions influenced the creation of reduced rates and exemptions. The Dutch "polder" culture allowed for changes – higher rates and different exemptions - after a delay in implementation.

Impact of EPI on institutions

Currently the National Environmental Taxes Team in Arnhem is responsible for managing GWT. The GWT was one of the first taxes contributing to a greening of the Dutch tax system (Vermeend and van der Vaart, 1998). The introduction of the GWT prevented the evolution of the provincial groundwater fees.

Institutional effect on failure

The tax can be considered a success if tax revenue is all that matters. Its environmental effects on the other hand are limited (Ecotec et al., 2001).

3.5 Policy Implementability

Flexibility of the EPI

The GWT raised the price of groundwater extractions by the same amount across the country, while provincial groundwater fees vary according to local conditions. The initial exemptions and reduced rates increased the implementability of the EPI: stakeholders were given less reason to oppose the tax. Some exemptions and reduced rates have been dropped over the years, as the GWT evolved. After the first planned evaluation in 1997 exemptions on small pump capacities were altered, to prevent small-users from dodging the tax. In 2000 and 2001, reduced rates for industry were terminated. Adjustments were based on budgetary considerations, but no specific costs of adjustments can be retrieved (Vermeend, 2011).

Most farmers" abstractions are exempt from the GWT because they are dedicated to sprinkling and irrigation, but as registration is not required, their total abstractions are unknown (Statistics Netherlands, 2006). Implementation of the GWT took approximately 2.5 years (see section 1), but its fiscal effects were immediate. Environmental effects were not tracked, but desiccation was already managed by command and control systems before the introduction of the GWT (Graveland, 2011).

Public participation

The government took the initiative for the GWT. The proposal of the GWT caused some rumour expressed in newspaper articles and letters to government. But this rumour was not considered to be exceptional for a new tax (Vermeend and van der

Vaart, 1998). The strong agricultural lobby played an important role in the design of the GWT and received many exemptions. Drinking water companies – represented by their association (VEWIN) – tried to influence the design of the GWT by communicating through the media and filing law suits (after implementation), but they were not successful. Exporting industry lobbied against the GWT and received lower rates based on the need to compete (Vermeend, 2011). There were no accounts of other stakeholder protests. Even industry that purchases water from drinking water companies – which faced increasing prices – was not fully aware of the GWT until after its implementation. The 1997 evaluation of the tax revealed that their water costs averaged only 0.3% of total costs. The companies stated that the effect of increasing water prices was close to zero (IWACO, 1997b). Safeguarding mechanisms increased the implementability by granting exemptions and reduced rates to a number of parties; see section 1.

Cooperation between Ministries

The Ministry of Finance and the Ministry of Housing, Spatial Planning and the Environment cooperated to implement the GWT using normal procedures. The implementation of the GWT increased the regulatory burden both for the tax office and affected business. The National Environmental Taxes Team in Arnhem is now responsible for the GWT, and has been installed to manage all taxes under the Environmental Taxes Act. To decrease the tax office's expenses it is now proposed to drop the GWT completely.

Synergies between EPI and Sectorial policies

Table 3.5.1 indicates synergies between the environmental objective of the GWT and the objectives of related policies.

Table 3.5.1 Barriers and synergies between EPI objective and other policy objectives

EPI Objective Other policy objectives	**Environmental:** **Reduce groundwater abstractions**
Waste tax (jointly implemented, taxing land filling)	- Caused some extra exemptions in the GWT design directed at industry that would have otherwise been taxed by both taxes – this was thought to be unfair
Tap water tax (tax on tap water, increasing water prices to increase water efficiency)	+ Increases the price of drinking water, reducing consumption
Provincial groundwater fees (aim to manage and protect groundwater levels, charges groundwater extractions and sets rules and regulation)	+++ Both charge for groundwater extractions, reducing the incentive to use groundwater
Water Savings Action Plan (national act to increase water efficiency)	+ Led to investments in water saving equipment, but simultaneously led to reduced rates for industry that weakens incentives.
CAP (stimulate agriculture by subsidies and projects)	+ The second pillar promotes improvement of the environment and can result in a reduction of groundwater abstraction by its effect on water management projects.
WFD (focus on quality, directive)	+ Article 9 requires that environmental and resource costs are internalized, which facilitates the introduction of the GWT
ECE Charter on groundwater management (Aims at quantity and quality and raising awareness: non-binding agreement)	+ Lower groundwater abstractions through higher awareness and streamlined (sectorial) policies
EU flood risk management directive (aims to reduce flood risks, directive)	+ Lowering surface water levels can indirectly lower groundwater levels, because these interact. This can reduce the need for groundwater abstractions because levels would be relatively lower
Natura 2000 (aims to protect biological species and natural habitats)	+ Natural habitats often require relatively high groundwater levels; this can reduce groundwater abstractions in those areas by regulation.

3.6 Transaction Costs

Description of transaction costs

Table 3.6.1 describes administrative burdens of the GWT for business.

Table 3.6.1 Administrative costs for business

Entry	Cost (EUR) (1)
Keeping up to data with laws and regulations	16 827
Exemption from GWT (2)	61 065
Keeping registers of administration for GWT	9 495
Reporting and payment of GWT	49 538
Control by tax office	82 962
Total	**220 000**

Source: (Interdepartementale Werkgroep Grondwaterbelasting, 2007), 13
Notes: (1) Based on a 2002 measurement and adjusted for realised administrative cost reductions, (2) effort to comply to conditions to receive exemptions

Note that most burdens concerning administration related to GWT would also be necessary without the law (for own administrative purposes and for provincial registers). This means that marginal costs related to the GWT are probably lower. Before a 2006 change of the law, the administration obligation included a large number of holders (mainly farmers) who needed to keep registers but were not paying the tax. After 2006, they were no longer required to keep register for the national GWT, but provinces still require registration of abstractions. (Interdepartementale Werkgroep Grondwaterbelasting, 2007). The GWT administration was considered to be simple compared to other taxes (Vermeend and van der Vaart, 1998), which can be partly explained by the self-reporting requirement for holders. In 2010 the administrative system was described as relatively costly; see section 3.2.

Actors involved

Several organised groups tried to influence the design and implementation of the EPI. The agricultural lobby had a strong influence, especially on the exemptions formed in the final law (Vermeend, 2011). The drinking water companies (33 at the time) represented by their association, VEWIN, lobbied strongly and sued the government after implementation at the European Commission (Algemeen Dagblad, 1995). They did not win (Vermeend, 2011). Industry, represented by VEWM, lobbied for exemptions and reduced tax rates. The latter was allowed because companies were already making water saving investments. Naturally, the government was a key-actor in all phases. The Ministry of Finance and the Ministry of Housing, Spatial Planning and the Environment submitted the bill together. There is no account of overlapping roles. The National Environmental Taxes Team in Arnhem (under the Ministry of Finance) is responsible for monitoring and enforcement.

Selection mechanism

The budgetary revenue of the GWT was the leading motivation to choose the tax (Vermeend, 2011). In 1992 the increase of fuel tax was refused by Parliament. This left a budgetary gap; therefore the bill concerning groundwater was introduced in September 1992. and went into force on 1 January 1995. Two and a half years for the implementation of a new tax in the Netherlands is considered fairly quick by Vermeend and van der Vaart (1998: 23). There was no formal record of meetings, discussions and negotiations, but all debates in the Second Chamber are documented [in Dutch] (Vermeend, 2011). The administrative procedure was similar to the steps followed at the implementation of the first green tax, the fuel tax.

Decision-support tools

The main driver for the GWT was a need to find revenue to fill a budgetary gap. The GWT was based on the idea of paying for groundwater abstraction. The relation between the expected revenue and the costs were important, but no specific studies were undertaken (Vermeend, 2011). Transaction costs were not explicitly examined on forehand, but in more recent studies the GWT is defined as laborious: many tax payers for a "small" revenue (Werkgroep 16, 2010).

Integration of asymmetric information problems

Taxes have a long history in the Netherlands (Pfeil, 2009), and Dutch are dedicated tax payers. Information asymmetry was assumed to be low, because water meters were used; they are unambiguous and tampering is rare.

Combination with other EPIs

The GWT was applied in combination with a tax on waste. These were among the first in a series of "environmental taxes." Existing provincial fees probably lowered TCs as holders already kept registers and paid the groundwater extraction fee.

Monitoring and enforcement costs

Exemptions were mostly practical and aimed at minimizing the number of tax payers (Vermeend and van der Vaart, 1998). This design reduces monitoring costs too. An exact figure of monitoring and enforcement costs is not available, but the self-reported aspect of the GWT (and honesty of those making reports) keeps monitoring costs low (Werkgroep 16, 2010).

3.7 Uncertainty

Specification of objective

The main objective of the GWT was to raise revenue. This was specified in a quantitatively measurable way: it was stated how much the GWT was supposed to

generate per year. The reference was stated in millions for the first year only. The secondary objective of the GWT was the supposed environmental effect through behavioural change affecting groundwater levels, but no policy target was specified and outcomes were not measured (Vermeend, 2011). The social objective of the GWT - to shift the burden away from income tax - was not specified in either time or money (Vermeend and van der Vaart, 1998). This makes it difficult to determine the specific effect of the tax on the environment.

Baseline scenario vs. empirically ascertained outcomes of the EPI

The fulfilment of the tax raising objective can be attributed to the GWT. The (unknown) fulfilment of the environmental effects cannot be determined, because objectives were not quantified. Even if objectives were quantified, any detected results could not be solely contributed to the GWT, as many exogenous factors influence groundwater levels and water related ecosystems. It is likely that positive environmental effects could have been reached, by extending the provincial fee. The money generated by the provincial fees is used exclusively and explicitly for groundwater management and protection.

Environmental outcomes are considered in the scenario. The baseline scenario – no action – would have probably led to increasing groundwater extractions. The "extending provincial fee scenario" could have decreased groundwater extraction by provided more stringent regulation and because its revenues are dedicated to groundwater management and regulation. This scenario would have given a very small price incentive though: provincial fees are supposed to recover costs only, not to make a profit. So the additional price increase that resulted from the "GWT scenario" could not have been reached by extension of the provincial fees. The last scenario probably resulted in an intermediate result; higher prices decreased groundwater extraction, but the design of the GWT gave mixed signals to small users, and GWT revenue was not used for groundwater management. At the time the GWT felt appropriate as it was labelled environmental and because it shifted the tax burden away from income.

4 Conclusions

4.1 Lessons learned

A tax set to generate revenue should not affect behaviour too much, but the GWT altered relative prices of ground- and surface water.

The first lesson learned is the need to pay attention to both the fiscal and the behavioural dimensions of a tax. The GWT was successful in raising money but it is

difficult to determine its environmental impact when environmental impacts are not specified or tracked. The tax's ambiguousness undermines both its fiscal *and* behavioural effect.

Second, affected groups - especially exporting industry and drinking water companies - opposed the tax because it increased their costs. Drinking water companies probably worried that increased prices would reduce demand for tap water and thereby reduce their margins.

Third, while its name may suggest otherwise, the GWT was a revenue-generating tax. This is illustrated by the fact that reduced groundwater abstractions resulted in increased tariffs to maintain revenue. Users who felt that their "good behaviour" was punished probably did not work hard to further reduce groundwater abstractions. "Green" taxes may be more about marketing than the environment.

In the first years of the tax especially small-scale tax-exempted users dodged the tax by installing exempt pumps and thereby evading higher tap water prices. This unexpected effect was corrected with some refinements fairly quickly. This evaluation was planned in advance, and showed to be a good strategy to refine the tax.

Several recommendations follow from these lessons. First, it is important to monitor the behavioural impact of a tax. This needs to be done by tracking behaviour before and after implementation. For a GWT this includes groundwater and total water abstraction, groundwater and surface levels, and groundwater "health." But it needs to be noted that effect of the tax alone is difficult to determine because many other factors influence such "health." Understanding the impact on economic, social or environmental activities might be costly but will facilitate discussion.

The taxes" current design faces high executing costs as it is. Ideally small-users would be monitored and taxed too, but high transaction costs make this not worthwhile. For the GWT cost probably could have been reduced by integrating it with the existing provincial fees. Obviously, that would have reduced the revenue for the government. As the tax was set up for fiscal purposes, the most feasible and realistic improvement would be to improve monitoring of both behaviour and environmental impacts. It is important to be clear about the objective of a tool – not only in its design but also in its name.

4.2 Enabling / Disabling Factors

The groundwater tax was enabled by the institutional characteristics of the Dutch (a rule obeying culture and well-organized political system), but the Dutch "polder" model allowed lobbies to gain exemptions that weakened its effects at the same time as those exemptions made implementation more likely. The tax was disabled to the extent that a "green" tax failed to specify or monitor its environmental effects.

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7 Annexes

Annex I: Pedigree matrix for uncertainty

Table 0.1 *Pedigree matrix for assessment of target, deadline and reference.*

Groundwater Extraction Tax	Policy target (how much)	Policy deadline (when)	Reference
	Generate revenue: For the first year specified as: 245 million NLG/year	Annual tax revenue	In millions (for first year only)
Pedigree	1	1	2
	Positive environmental effect: Shift from ground- to surface water, more efficient use	Not stated	Not stated
Pedigree	3	3	2
	Shift tax burden away from income to consumption	Not stated	Not stated
Pedigree	3	3	2

Note: Policy target (1) quantifiable and clearly stated, (2) measurable in principle, qualitative levels of achievements [weak/substantial], (3) vague and hardly quantifiable. Policy deadline: (1) clearly stated, (2) stated in qualitative terms (short, medium, long term), (3) no statement. Reference: (1) clearly stated in quantitative terms and with specific reference (2) not stated.

Table 0.2 Pedigree matrix for performance of GWT with respect to targets

Groundwater Extraction Tax	Environmental outcomes	Economic Cost	Distributional effect
Target	**Improve**	**Generate revenue**	**Shift tax burden away from income**
Proxy	2	4	0
Empirical	0	4	0
Method	0	3	0

Note: Performance of EPI with respect to the defined targets, time horizon and reference. Proxy (variable used to describe the output/outcomes, and their relationship to the policy target), indicate empirical (basis on which the performance assessment draws), indicate method (analytical tool used to assess the effects of tax especially if not estimated directly using empirical data). Range from 0 to 4, 4 is best.

Annex II: Acknowledgments

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