THE LIFE AND DEATH OF THE DUTCH GROUNDWATER TAX

MARIANNE SCHUERHOFF, HANS-PETER WEIKARD AND DAVID ZETLAND

Abstract. We examine the Dutch national groundwater tax (GWT) — a "win-win-win green tax" that promised to simultaneously provide revenue to government, reduce the relative burden of other taxes on productive behaviour (e.g., income tax), and improve environmental outcomes. We find that the GWT generated revenue without having a noticeable impact on production incentives or environmental health. Although the GWT is often cited as an example of environmental economics in action, it was neither designed, implemented nor operated in accordance with environmental goals. In many ways, the GWT was just another source of revenue — and one that bothered special interests. The Dutch government revoked the "inefficient" GWT on December 31 2011.

A win-win green tax that wasn't

In this paper, we analyze the 1995 Dutch national groundwater tax (GWT) implemented under the Environmental Taxes Act of 1994. Like other "win-win green" taxes implemented in the 1990s, the GWT promised simultaneously to replace taxes on productive activities and reduce resource-consuming behaviour (Fullerton and Metcalf, 1998; EEA, 2011). We discuss the potential for such a double-dividend tax before moving to the actual tradeoffs made when designing, implementing and operating a GWT that affected behavior on two margins. On the intensive margin, the GWT's impacts varied. Non-exempt groundwater users either reduced their demand for groundwater, increased their demand for surface water, or paid the tax. On the extensive margin, the GWT interacted with existing provincial groundwater fees (PGFs) that paid for local groundwater management. This extensive interaction explains two aspects of the GWT's real impact. First, it was implemented as a tax instead of regulation because the PGFs already funded regulations; second, it was more of a fiscal tax than a green tax because PGFs already targeted environmental outcomes.

Taking these characteristics into account, we then consider how the GWT's design and implementation led to environmental and economic impacts — or lack thereof. Although the government presented the GWT as a fiscal measure that would not

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Address: Environmental Economics and Natural Resources, Wageningen University, PO Box 8130, 6700 EW, Wageningen, The Netherlands. Zetland (corresponding author) can be reached at dzetland@gmail.com.

impact behaviour, others hoped that the "green tax" would result in better environmental outcomes. The response that they got was perhaps the opposite: a small change in behavior affecting groundwater levels and a large change in behavior to change or reverse a policy that was costly (in time or money) to farmers, industry and drinking water companies (DWCs).

The GWT was designed to minimize adverse impacts on "sensitive" groundwater users: farmers were mostly exempted from the GWT; industry paid a lower rate for some time (Vermeend and van der Vaart, 1998). Agricultural exemptions may have functioned as a subsidy, but they also reflected the fact that farmers could turn to surface water, were already regulated on groundwater use, and needed lower groundwater levels for production in water-abundant areas. The GWT also reduced compliance costs by allowing users to self-report their annual extractions, but it still raised costs for non-exempt users who either faced higher direct costs from the tax or incurred indirect costs in changing their behavior to avoid the tax. The most important non-exempt users were the handful of DWCs that paid nearly 90 percent of the GWT, a burden that probably led to the GWT's eventual demise.

The GWT's impact on groundwater levels and environmental quality is hard to determine. First, because Dutch data on groundwater levels were never connected with groundwater extractions before or after the GWT was implemented, making it difficult to know the GWT's impact on groundwater levels. Second, the GWT was a crude tool to use in a country where targeted groundwater levels are higher (in the east) or lower (in the west). Finally, because the GWT was just one of many factors affecting environmental conditions.

The economic impacts of the GWT are, likewise, difficult to trace. The tax raised the cost of raw groundwater to DWCs, but the pass through of that cost only raised residential tap water prices by 10 percent — an increase that few noticed (Accenture, 2010). Industrial firms had more reason to pay attention to the GWT, but most of them ignored it due to their low consumption of water. Other firms switched to surface sources or — lacking alternative sources — paid the tax. Farmers might have had the strongest response to the tax, but most of them were exempt from the GWT or could switch to surface water.

These weak impacts did not necessarily mean that environmental and economic groundwater conditions worsened in the Netherlands, since PGFs funded programs for managing local groundwater at only 10 percent of the GWT's 170 million EUR "cost" (Vermeend and van der Vaart, 1998). Ironically, one of the GWT's impacts may have been to distract attention from improving PGF effectiveness.

The Dutch GWT experience offers several lessons: First, pay attention to the difference between a tax's fiscal and behavioral dimensions. Second, remember that a tax — no matter how efficient or easily passed through to consumers — is still a cost that payers wish to avoid. Third, some "green taxes" are more about raising revenue than improving environmental outcomes. These lessons lead us to recommend that anyone considering a green tax should monitor and assess behaviour before and after implementation. Monitoring raises costs, but those costs are worth incurring if the

resulting data facilitate discussion of the economic, social, and environmental impacts of a "green" tax.

Water, taxes and the Dutch

The GWT promised 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.

Water in the Netherlands. Dutch water management is directed at securing water supplies and flood protection, but water quality and groundwater scarcity have recently become more important (Vermeend and van der Vaart, 1998; Graveland and Baas, 2011a). Water management occurs at several levels. The national government is responsible for coastal flood defences and other large-scale projects. Water boards (*Waterschappen*, the oldest existing governmental bodies in the Netherlands) are responsible for managing water within regional catchment areas, but provinces manage groundwater, with cooperation from municipalities. Since 2010, water boards and provinces have jointly collected the PGF and used the funds for projects under their jurisdiction.

Water boards were dominated originally by farmers who needed to protect their land from flooding and regulate water flows. Additional functions have been added over time, but farmers' influence is still strong.

The Netherlands receives over 90 percent of its freshwater from external surface flows; annual precipitation is 900 mm. Annual average water consumption is 5,500 m^3 per capita (Eurostat, nd; StatLine, 2011). Supply is usually greater than demand, but the Dutch water exploitation index (percent of freshwater available as a share of total available renewable resources) increased between 1990 and 2007. According to classifications given in Article 5 of the EU's Water Framework Directive, Dutch surface water is 90 percent "at risk" from an ecological perspective (quantity) while 70 percent has good chemical status (quality). These numbers are 0 and 60 percent, respectively, for groundwater (EEA, 2010, nd). For groundwater quantity this means that abstraction is sufficiently compensated by precipitation and infiltration (Council of Ministers, 2009), however it does not exclude local desiccation problems. Table 1 shows water sources for water-intensive sectors.

A third of the Netherlands is below sea level, mostly in the north and west. Groundwater tables in these areas are close to the surface and artificially managed. In the sandy eastern and southern regions, groundwater tables are further below the surface. Figure 1 illustrates fresh and brackish aquifer layers and location of the water table

[1] "With respect to the groundwater tax we remark on the following points raised by our members. This [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 so future generations can provide for their needs" (Eerste Kamer der Staten Generaal, 1994, p. 2). The document is signed by the minister and state secretary of finance and the minister of VROM (the Ministry of Housing, Spatial Planning and the Environment), hence the "we" in the first sentence.

TABLE 1. Treated, raw groundwater and raw surface water uses (MCM) in 2008. Treated water comes from dune-, surface- and groundwater.

	Treated	Raw ground	Raw surface	% GDP
Households	718	n/a	n/a	n/a
Farming, forestry and fishery	48	52	23	2
Mining	4	0	1	4
Industry	191	183	3,322	11
Energy companies	3	2	9,045	2
Drinking water companies	0	762	490	1
Other	129	1	430	
Totals	1,093	1,000	13,286	n/a

Sources: Statistics Netherlands (2006, 2010, 2011b)

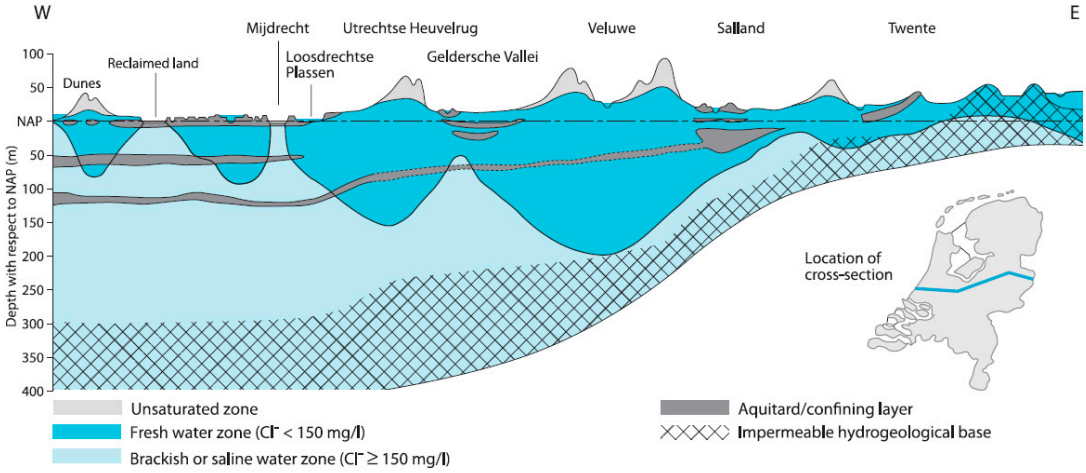

FIGURE 1. Dutch aquifers occur in layers, above and below NAP. *Source:* De Vries (2007).

relative to NAP (*Normaal Amsterdams Peil*, the zero value of which was set to the height of summer floods; land below NAP is vulnerable to flooding or needs to be drained). Desiccation in these areas became a concern in the 1970s and remains a concern (VROM, 2001). Desiccation was mainly due to sizable extractions by DWCs and certain industries (agriculture played a smaller role), but these extractions were discouraged in the 1970s and 1980s via command and control systems (Graveland, 2011). Note that farmers prefer lower groundwater levels to cultivate certain crops, while higher levels are better for nature conservation and biodiversity (Hellegers, 2001; Statistics Netherlands, 2011a).

Extractors have paid PGFs (authorized under the 1983 Groundwater Act) since 1986. The PGF per cubic meter of extracted fresh and brackish groundwater varies among provinces; see the right frame in Figure 2. PGF revenue is dedicated to

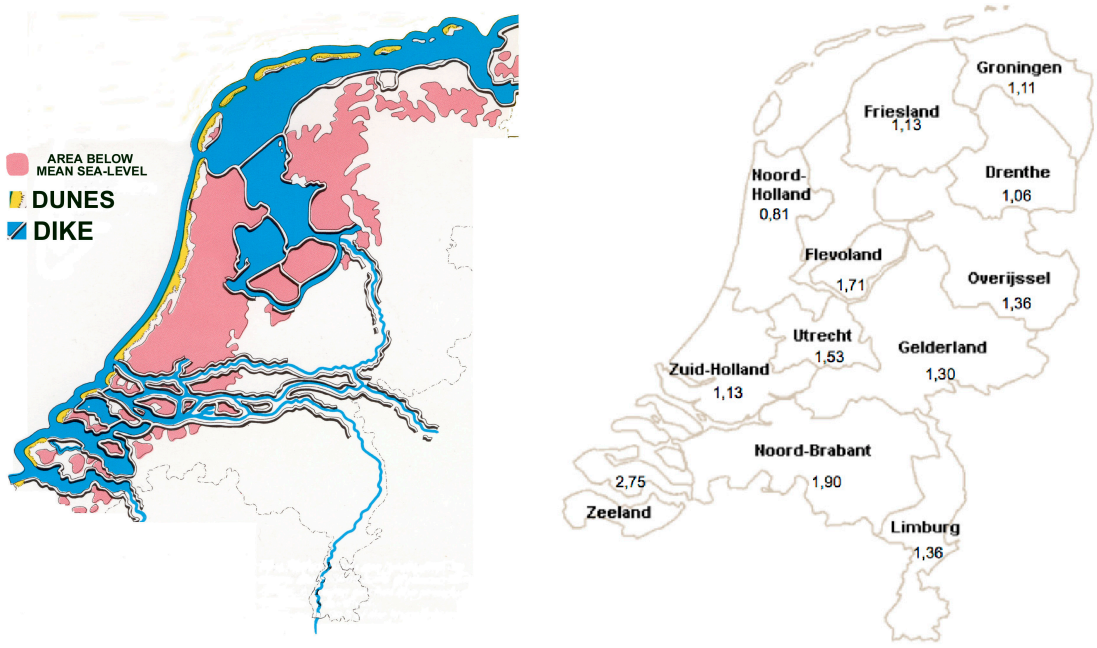

FIGURE 2. Most of the western Netherlands is below mean sea level (left frame), but PGFs (right frame) vary according to local water conditions. *Sources:* TNO-NITG (undated) on left and Geudens (2012) on right.

groundwater management and compensating farmers for the adverse impacts of decisions aimed at groundwater protection (Jantzen, 2008; Spaermon et al., 2009).

Designing the GWT. The GWT was proposed in 1992 when a failure to increase the fuel tax left a revenue gap in the national budget of NLG 425 million (EUR 193 million).[2] The search for other revenues led to an agreement to spread the tax burden across different groups of taxpayers and tax consumption. The GWT was intended to tax "bad consumption" instead of productive activities and reduce groundwater consumption (Vermeend and van der Vaart, 1998; ECOTEC, 2001; Pfeil, 2009), but these "win-win" goals did not get much weight in the GWT's eventual design.

First, as Vermeend and van der Vaart (1998) acknowledge, low price elasticity would limit the GWT's impact on groundwater use. Second, there was no move to track groundwater levels before and after GWT-implementation. Third was the debate between implementing the GWT and increasing PGFs. Greater PGF revenues would have had a larger impact on local groundwater, but that idea was discarded in favor of a GWT that would contribute to the general budget (van der Vaart, 1992; Vermeend, 2011). So it seems that the GWT's "green" label was less about environmental impact than making it easier to implement a new tax.

[2]We use the 1 Jan 1999 conversion rate of 2.20371 NLG = 1 EUR.

These debates went on for some time, until a GWT was designed to raise NLG 245 million (EUR 111 million); a waste tax closed the reminder of the gap (Vermeend and van der Vaart, 1998). Exemptions for farmers resulted from a combination of political influence, the desire to minimize transaction costs, and the uselessness of taxing groundwater extractions when (conjoined) surface waters were nearby. DWCs (33 at the time; 10 today) represented by their association, VEWIN, sued the government at the European Commission, claiming that exemptions for farmers distorted competition, but they lost (Algemeen Dagblad, 1995; Vermeend, 2011).

Who pays what? The 2011 GWT per extracted cubic meter of fresh groundwater was EUR 0.20. Exporting industries were initially charged half this rate to safeguard their competitive positions until IWACO (1997a) found that industry was saving water and recommended higher rates to promote efficiency; the discount was removed by 2001 (ECOTEC, 2001). Users with combined installation for infiltration and extractions (often using sand dunes to filter water) pay EUR 0.16; users who return extracted water to the same source pay EUR 0.06 per cubic meter (Spaermon et al., 2009). According to Vermeend and van der Vaart (1998), GWTs were not collected on exempt uses such as:

- Pumps with a capacity of less than 10 m^3 per hour;
- Temporary construction-related drainage and extractions;
- Emergency facilities (fire departments, etc.);
- Soil and groundwater rehabilitation;
- Closed-loop cooling systems; and
- Ice rinks in meadows.

Over the years, exemptions have changed. Taxes shifted to total pump capacity after administrators noticed users trying to dodge the tax by installing multiple low capacity pumps (Vermeend and van der Vaart, 1998; Spaermon et al., 2009). Farmers using groundwater for irrigation and sprinkling were exempt from the GWT after 2006, under the assumption that these uses did not cause environmental damage.

In 2005, DWCs, industry and farmers, respectively, paid 80, 18 and 2 percent of the GWT (IWG, 2007). By 2008, farmers were exempt, and 10 DWCs paid nearly 90 percent of all GWTs. Table 2 compares groundwater uses and GWT payments.

Low or high administrative costs? The government's cost of implementing the GWT was low due to a Dutch cultural emphasis on obeying rules and seeking consensus (known as "polderen"). The former made it easy to levy a new tax at a low cost, i.e., using self-reporting and basic monitoring.[3] The latter made it possible to tax farmers for their activities in exchange for "reasonable" exemptions (exemptions that increased over time) as well as modify the GWT after its implementation to adjust for realized impacts.

[3]The National Environmental Taxes Team in Arnhem has administered and audited green taxes since 2001. Their precursor, the Central Environment Team in Rotterdam, was established in 1995; VROM was responsible for environmental taxes before 1995.

TABLE 2. Groundwater uses and GWT payments in 2008. Note that Belastingdienst (2012) reported 14 DWCs even though there are 10 in the Netherlands; they will not disclose the names of these 14 DWCs (confidentiality), but they may include bottled water companies.

Sector (units)	Extraction (MCM)	Extraction (percent)	GWT revenue (percent)	GWT payers (number)
DWCs	762	76	87	10
Industry	183	19	13	901
Farmers	52	5	0	n/a
Total	997	100	100	911

Sources: Statistics Netherlands (2011b); Belastingdienst (2012).

Administration costs were also low because responsibility for the GWT was given to the team already collecting the fuel tax and payers already had to maintain extraction records for PGFs — a requirement that predated and outlasted the GWT (IWG, 2007). Although IWG (2007) reported the cost of administering the tax — EUR 220,000 for business and 1.5 million for government — was "low" relative to its revenue of EUR 170 million, Werkgroep 16 (2010) claimed that these costs were relatively high.

NO DOUBLE DIVIDEND

Although proponents promised that the win-win GWT would improve the environment and unburden productive activities, we explore how it did neither in the next few sections. We start by exploring a fundamental tension between affecting behavior and raising revenue.

The tradeoffs between Pigou and Ramsey. Tax impacts depend on elasticity. On one extreme is a tax that changes elastic behavior by altering relative prices; on the other extreme is a tax that raises revenue by targeting inelastic behavior. Most taxes simultaneously invoke a mixed response based on intermediate elasticities. These ideas can be traced back to two Englishmen, Arthur Pigou and Frank Ramsey.

Pigou (1920) is widely acknowledged as the first to discuss setting a tax to reduce activities that create negative spillovers. A basic "Pigouvian tax" on groundwater use that represented the cost of desiccation to others would raise pumping costs and lower extractions. The GWT would be Pigouvian if it reduced demand for groundwater.

Ramsey (1927) approached the pricing problem from a different direction, showing that taxes gather more revenue, the weaker the response to them. The GWT would fit this criterion if either it was levied on inelastic residential demand for water or reduced the tax on elastic labor. Although it seems that the GWT hit both of these targets to some degree, the actual incidence of the tax on DWCs led to a elastic response of a different type: a policy response opposing the GWT from its initiation to its demise.

Taking these two bookends in hand, let us consider three possible groundwater policies — holding other factors (weather, surface flows, infiltration, etc.) constant. A baseline scenario of no GWT would mean that groundwater extractions would proceed at their natural increasing pace. The GWT scenario increased tax revenues, but the lack of an environmental objective or program for monitoring pumping made it hard to measure its environmental impact. A third feasible scenario would have increased PGFs to pay for additional groundwater management, regulation and protection.

A comparison of the differences between the GWT and PGFs in terms of revenue and environmental impact — GWT revenues were ten-times larger; PGF impacts were greater — highlights how objectives may have driven the policy choice. The GWT may have decreased groundwater extraction, but that outcome was peripheral to the main objective of collecting revenue; its exemptions for small users, lack of monitoring for impact on groundwater, and diversion of revenues to the general budget indicates that the GWT was not really directed at groundwater management or environmental health.

Further, the GWT and PGF sometimes agreed and sometimes conflicted. The PGF was closer to a Pigouvian tax because it varied with location (according to the intensity of groundwater management; see Figure 2, right) and funded appropriate responses to either flooding or desiccation. The GWT, in contrast, did not vary with local conditions; sometimes it functioned as a "perverse" Pigouvian tax that increased pumping costs in places where more pumping was better.

The GWT also suffered from a Ramsian defect because it fell on a few DWCs that had the motive and means to oppose it. Their "elastic" response to the GWT was exacerbated by bearing the tax burden without a proportional benefit. The GWT they paid went to the treasury — not to improving groundwater levels or offsetting local groundwater management costs (MVW, 2005).[4]

Environmental impacts. In the first years after implementation industry and drinking water companies shifted from ground- to surface water sources and probably increased their water use efficiency (IWACO, 1997a), but the Dutch Green Tax Commission (1998) concluded that the GWT did not have a big net impact on groundwater extraction. Figure 3 shows that DWCs — responsible for 75 percent of groundwater extractions — used less groundwater after the implementation of the GWT, shifting to raw surface water sources, but IWACO (1997a) reports these gains were offset by small-scale, tax-exempted extractors who increased their groundwater use.

Decreased groundwater extractions may have lowered pressure on ecosystems, but no direct link can be made between these decreased extractions and lower pressures. First, existing 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, many problems with groundwater overdrafting were already being addressed by operations funded by the PGF and techniques promoted by the 1992 Water Savings Action Plan (Vermeend and van der

[4]There is some undocumented discussion of PGFs discounts given to DWCs that managed their groundwater sources.

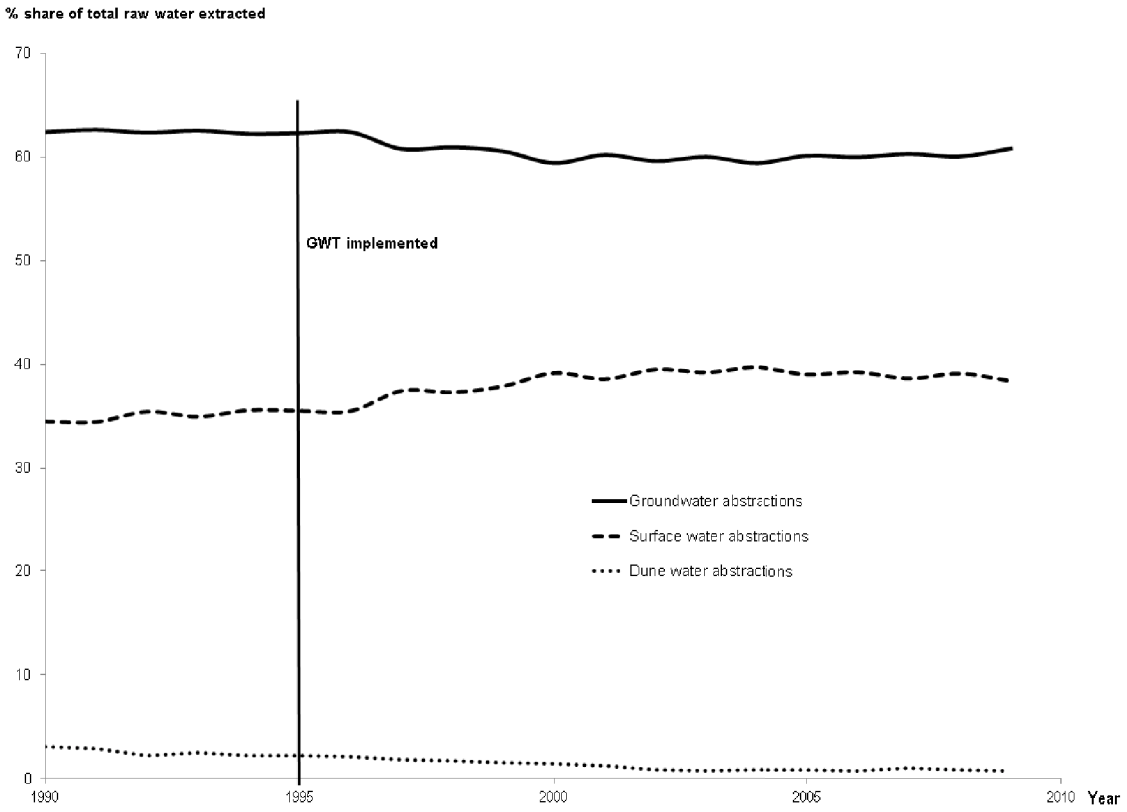

FIGURE 3. Share of raw water sources used by drinking water companies since 1990. Source: VEWIN (2011).

Vaart, 1998; Spaermon et al., 2009; Graveland, 2011). Fourth, technological changes gave industry exogenous reasons for reducing their groundwater use; they fell between 2003 and 2008, for example (Graveland and Baas, 2011b). Finally, there has been little interest in the effect of this "green" tax on the environment: the tax's environmental impact was evaluated only once (IWACO, 1997a). That said, reports dated six and sixteen years after the tax's implementation state that groundwater depletion and desiccation were still major concerns (VROM, 2001; Statistics Netherlands, 2011a). These concerns can perhaps be traced to drainage by agriculture in the west and more weather extremes in the east, but we'll never know how the GWT affected local environments (Graveland, 2011).

Economic impacts. The GWT lessened the price differential between groundwater and surface water as a raw source for tap water, but it costs roughly 20 cents more to treat a cubic meter of surface water (Accenture, 2010). This cost differential meant that some DWCs continued to treat groundwater for drinking, so that a 10 percent average increase in the retail cost of drinking water varied among DWCs, ranging from 2 to 19 percent according to their raw water sources. Industrial customers faced

similar choices, sometimes preferring to use reasonably clean self-extracted groundwater or raw surface water instead of tap water. Even further, the GWT was only one of many costs; DWCs using more groundwater have the lowest tap water tariffs because their other costs are lower (Accenture, 2010).

Even holding price effects equal, it's not easy to identify a link between the GWT and decrease in residential and industrial demand for tap water between 1990 and 2009. Demand was also influenced by a tax on tap water, a Water Savings Action Plan, increased awareness about water consumption, the PGF, and other factors (ECOTEC, 2001; Bots, 2008; Spaermon et al., 2009; VEWIN, 2011; Graveland, 2011). For industrial users, the effect was likely to be weaker, since only 0.3 percent of their total costs were due to water (IWACO, 1997b).

Vermeend and van der Vaart (1998) say that the GWT (and other green taxes) made it possible to pay for additional spending without raising income taxes. In that sense, the GWT would have shifted the tax burden from productive activities to resource consuming activities, but we — like Vermeend and van der Vaart (1998) — could find no evidence linking the GWT to greater wages or employment. This lack of an empirical result does not mean that the GWT had no effect on the margin; it's just difficult to measure the impact of a small tax on a single input for operations affected by many taxes on many inputs.

Special interests kill the tax

The GWT was relatively cheap to administer since the PGF already required extraction reporting (Vermeend, 2011). IWACO (1997a) confirmed the GWT's modest financial and administrative burdens at the GWT's first evaluation, while noting the heavier financial burden on DWCs. Ten years later, IWG (2007) noted the GWT's relatively small costs for implementation and execution (0.9 percent on revenue of 160 million EUR compared to the tax office's overhead of 1.1 percent on revenue of 179 billion EUR). Just a few years later, a 2010 tax office investigation into fiscal efficiency recommended dropping the GWT (and various other taxes) claiming that it was "inefficient" in terms of administrative costs and ineffective (relative to PGFs) at reducing environmental impacts (Werkgroep 16, 2010).[5] The government began removing the GWT, a tax on tap water consumption, and other taxes on December 31, 2011 without a plan to replace those EUR 800 million in revenues.[6]

Although we might assume that the GWT incidence rested on consumers (due to their low elasticity of demand for tap water or ignorance of the cost of water), the ten DWCs that paid nearly 90 percent of GWTs considered it a burden. First, we can consider the psychological factor: water companies disliked paying GWT to the

[5]Weekers (2011), citing IWG (2007), claimed that the GWT burden on 4,000 payers was inefficient. Werkgroep 16 (2010) said there were just over 1,000 payers; Belastingdienst (2012) — the organization responsible for collecting the tax — listed as few as 755 and as many as 947 payers between 2005 and 2011.

[6]As of June 2012, the cancelation of the tap water tax may be reversed due to changing coalitions in the Dutch government.

government, even if 100 percent of that cost was passed to consumers.[7] Second, the GWT increased prices and/or costs; companies used the same amount of groundwater or switched to surface water that needed more treatment. Third, higher costs resulted in either higher prices (and less demand) or lower profits.

A recent article in the industry press (WFO, 2011) reveals their bottom line:

> The abolition of the groundwater tax in 2012 saves Vitens, the largest water company in the Netherlands, approximately 70 million euros. The abolition of the [separate] tax on tap water will save the customer from January 2013 another 40 million euros.

On the one hand, this article may not correctly attribute incidence of the tax between Vitens and its customers. On the other, we can see that Vitens will see costs (from both taxes) fall by EUR 110 million, while customers will see their bills fall by EUR 40 million. These figures appear to show that the GWT (and tap water tax) were not passed through 100 percent — contradicting our assumptions of optimal regulation and inelastic consumer demand. These numbers, in fact, reveal that the regulator allocated costs roughly 60/40 to the water company and its customers.[8] The less-than-total pass through of the two taxes means that the water companies indeed had a lot to gain by their abolition. It also indicates that the GWT was much more a tax on a narrow special interest group (DWCs) than a broad base (all water users), a fact that makes it easier to understand how it might have affected behavior (good for the environment perhaps, but not for fiscal efficiency) as well as fueled opposition to its existence (Olson, 1971).

Green taxes and greenwashed taxes

Taxes can be good at raising revenue or affecting behavior, when one effect grows stronger, the other one weakens. The Dutch national groundwater tax was presented as a "green" tax that would simultaneously generate revenue (lowering tax pressure on labor and production) and improve groundwater conditions, but the green label may have been more about marketing than the environment.

The GWT's environmental impact was hard to determine. It raised the price of groundwater relative to surface water for some users, but it exempted others. It made surface water relatively cheaper, but surface water is more expensive to clean for use. It may have affected demand for groundwater, but environmental targets were neither specified nor tracked. Most important, the GWT interacted with — and perhaps interfered with — PGFs that paid for cheaper effective local programs for monitoring and managing groundwater.

The incidence of the GWT undermined its effectiveness. The dozen or so DWCs that paid nearly 90 percent of the GWT passed a portion of their additional costs

[7]Under prospect theory, people are likely to perceive the receipt and transfer of the same amount of money as a net loss since the positive utility value of funds received will be less than the negative utility value of funds disbursed (Tversky and Kahneman, 1986).

[8]The head of VEWIN claims that customers can use their savings to buy water-efficient appliances, but that's unlikely when average household bills will fall by EUR 30 per year (Schmitz, 2012).

to customers, such that they experienced a simultaneous reduction in demand (due to higher prices) and increase in costs (from non-passed tax payments). These few payers of over EUR 100 million per year had the incentive and ability to oppose the GWT. Ultimately, they succeeded in killing the GWT.

Green tax advocates can learn from the Dutch experience: First, track both fiscal and behavioral targets (economic, social and environmental) before and after implementation of a tax. Second, consider the marginal impact of the tax as it interacts with preexisting institutions (the PGF, for example). Third, pay attention to the actual incidence of the tax burden. It doesn't make sense to tax special interests that will fight the tax instead of a broader population that will pay it without complaint. Finally, make sure that the primary purpose of your "green" tax is to affect green outcomes.

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