THE DILEMMA OF ENVIRONMENTAL TAXATION - CASE STUDY OF ESTONIA

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Abstract

Environmental tax rhetoric in the Estonian policy discussion leads to a dilemma. Policy makers want to increase environmental charges for budgetary reasons and at the same time achieve environmental goals. The article examines the empirics of this issue, i.e. whether pollution charges have been successful as a fiscal or as an environmental instrument. By index analysis the authors find that pollution charges were fiscally successful in the beginning of the 2000's and have since 2004 been successful environmental taxes. The proposition that environmental charges do not cover the damage costs of pollution is also under investigation. It is found that the damage cost estimates have incorrectly been interpreted as average costs. The implication is that the damage costs which have been used as evidence for increasing pollution charges are incorrect and that the over-estimation of damages is in the order of a magnitude of two or more.

Keywords: environmental taxes, revenue raising, damage cost estimates

JEL classification numbers: H59; H23; H72; Q5; Q28; Q58;

1. Introduction

Estonia uses economic instruments for environmental protection since early 1990s. When introduced in 1991, the main purpose of the pollution charges was to provide incentives to enterprises for pollution abatement and to generate revenue for environmental protection activities (World Bank 1993). There are also clear references to the polluter pays principle. Reinvald (1992) mentions for instance the responsibility of polluters to pay for their damage. The system of charges was designed in 1989-1990, but by 1991 the rapid inflation had eroded the level of charges. This implied that incentives were limited. In 1994 charges were raised by 1.4 times and adjusted by the increase in consumer price index in the time period 1995-1996. However, in 1996 it was decided that starting from 1997 and until 2001 charges would increase by 20 per cent annually (Kraav and Lüpsik, 2006). During the time period 2000-2001 there were extended discussions about charge levels and a broad circle of stake holders agreed that from 2002 and until 2015 charges will be raised stepwise: emission charges by 20, water charges by 10 and resource charges by 5 per cent per

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year (ibid). In 2005 Estonia carried through an ecological tax reform. The principle to increase the use of environmental taxes and to use revenues to cut down taxes on labour; in Estonia this meant decreases in income taxation. On the environmental side, the ecological tax reform resulted in doubling most charges in 2006 and the deputy environmental minister announced that the two primary aims of environmental charges are to affect behaviour and earn tax revenue (Tammemäe 2006). This implies a shift in the rhetoric about how the purpose of revenue generation has been interpreted by the Government; from proceeds having been earmarked for environmental protection purposes to the generation of tax revenue in general. The shift in purpose leads to a dilemma - the environmental charges have two aims but there is only one means.

One recent example, suggests that the problem of this dilemma has escalated. Prior to the next round of negotiations, the Estonian Government raised the rates of mining and mine water charges in October 2012 (RT I, 09.10.2012, 5). This change was brought before court. The Supreme Court found the argument of the Government about the need for environmental protection and increases in budgetary revenues to be of less weight than industry expectations on already announced charges until 2015 (Estonian Supreme Court 16.12.2013 case 3-4-1-27-13). The increases in charges undertaken by the Government prior to 2015 seem to be based on several recent studies, which conclude that the current charges are too low to give polluters the right incentives to abate pollution. The general policy recommendation in Estonia is to increase charges so that they correspond to damage costs (Pihor et al. 2013, Lahtvee et al. 2013, National Audit Office 2008 and 2013). A concern held by the National Audit Office (2013) is that polluters do not compensate for their damage through the charges they pay.

The aim of this article is to assess whether pollution charges have been successful as a fiscal or as an environmental policy measure and to investigate the proposition that environmental charges do not cover the damage costs of pollution. The assessment of success is done ex-post by index analysis of tax revenues. Index analysis is a powerful tool of follow-up, but it cannot make claims to assess the effects of pollution charges on environmental quality. The investigation whether polluters compensate for their damages is based on microeconomic analysis.

In the next section, we discuss the nature of the dilemma. Section 3 presents a method for assessment of tax success. In Section 4, we scrutinise the empirical data on external damage costs and discuss the implications. Section 5 concludes the paper.

While there is a wide range of academic research devoted to the hypothesis of the double dividend of environmental taxes, the research is limited concerning the ability of environmental taxes to raise revenue (Zhou and Segerson 2012). This paper contributes in the field of budgetary implications of environmental taxes by presenting an ex-post analysis of the success of revenue generation of the Estonian pollution taxes in the time period 2001-2013. The analysis is carried out by a novel approach using index analysis. This tool of analysis is in use in e.g. business management. To the knowledge of the authors this is the first time such an analysis has been carried out in the field of environmental taxation. The second contribution of the paper is related to the inspection on what grounds damage costs are estimated and whether these estimates provide valid evidence to policy makers.

2. The dilemma of two goals and one means

Prior to the general popularity of the hypothesis of the double dividend, i.e. the argument that in addition to addressing the problem of an externality, a Pigou tax generates additional revenue that can be used to reduce other distortionary taxes, Oates (1993) warned that the role of pollution charges in public revenue generation becomes complicated in an empirical setting. According to Oates the basic problem is that the Government finds itself trying to do two things with a single policy instrument (ibid. p. 136).

The goals of the Estonian environmental charges are to provide incentives to reduce pollution (i.e. the environmental goal) and, to earn tax income (i.e. the fiscal goal). These two goals have different theoretical motivations. Environmental charges (i.e. Pigou taxes) are imposed in order to correct for market failure and this is achieved by affecting resource allocation. Fiscal taxes, on the other hand, should by the Ramsey rule minimize the impact on resource allocation. Since successful Pigou taxes change resource allocation towards less pollution, they will erode the tax base and cannot generate stable tax income. This implies that the dilemma does not only relate to having two goals and one means. There is a more profound dilemma since Pigou taxes and Ramsey taxes have the opposite implication on resource allocation. This means that it is not possible to have both. Either the Government earns tax income from the environmental charges and receives limited environmental benefits because of a low impact on behaviour or the Government accepts limited tax income in order to obtain a cleaner environment.

3. Analysis of tax success

Since the pace of the increase in pollution charges is known and data about the pollution charge revenues are available for the time period 2001-2013, it is possible to test the success of Estonian environmental charges and to find out whether they have been successful fiscal taxes or successful environmental taxes.

The statistical office provides national account data on aggregate revenues from pollution charges for the time period 2001-2013. Data divided into three groups; waste charge revenues, air pollution charge revenues and water pollution revenues, are available for the time period 2005-2013 at the home page of the Ministry of Environment (Keskkonnaministeerium 2014). In order to carry out the analysis, indexes were constructed. Based on the time series of revenues, we calculate an index of aggregate pollution charge revenues for the time period 2001-2013 and another index for air pollution charge revenues for the time period 2005-2013, see equation 1.

$$R_{j,t_0-t_i} = \frac{r_{j,t_i}}{r_{j,t_0}} \times 100 \qquad (1)$$

where R denotes the index of revenues, t_0 is the base year, t_i the current year and r_j denotes the type of environmental charge (j=1 aggregate revenue from pollution charges, j=2 air pollution charge). The index of revenue development will be compared to the index of increases in charge levels. The index of charge levels is found according to equation 2.

$$C_{j,t_0-t_i} = \frac{c_{j,t_i}}{c_{j,t_0}} \times 100 \qquad (2)$$

where C denotes the charge index.

The definition of a successful fiscal tax is that the index of revenues (R) has increased by about the same degree as the index of pollution charges (C). By similar reasoning, the definition of a successful environmental tax is that the index of revenues (R) has increased significantly less than the index of the level of pollution charges (C). Since the growth path of carbon dioxide (CO_2) charges differs from the pre-defined general levels, mainly because CO_2-charges have increased less than other pollution charges, it was necessary to find a weight of revenues from CO_2-charges. However, due to data gaps, weighting was only possible to do for the air pollution charge index (Index C_2). Data from Statistics Estonia on air emissions from stationary sources were used to calculate fictive tax revenues based on actual pollution charges. It was found that during the time period 2005-2012 fictive revenues from CO_2 charges make up about 81.4 per cent of the fictive revenues of air pollution charges in aggregate. The weights for the air emissions were applied to adjust index C_2.

Figure 1 shows the indexes of aggregate pollution charges for the time period 2001-2013. The figure suggests that in the beginning of the period (2001-2003) revenue generation closely followed charge level increases. Starting from 2004 and until 2013, there is an increasing gap between the growth in charge levels and revenue generation. This implies that the pollution charges were successful as fiscal instruments in the beginning of the time period and that the pollution charges became successful environmental taxes at about the time of the ecological tax reform. Further, it is interesting to note that revenues started declining in 2008. One reason is that an excise duty on CO_2 emissions from electricity production was imposed on power plants replacing the CO_2 pollution charge in 2008 (Kralik et al. 2012). The excise duty was set on the same level as the CO_2 charge (ibid.).

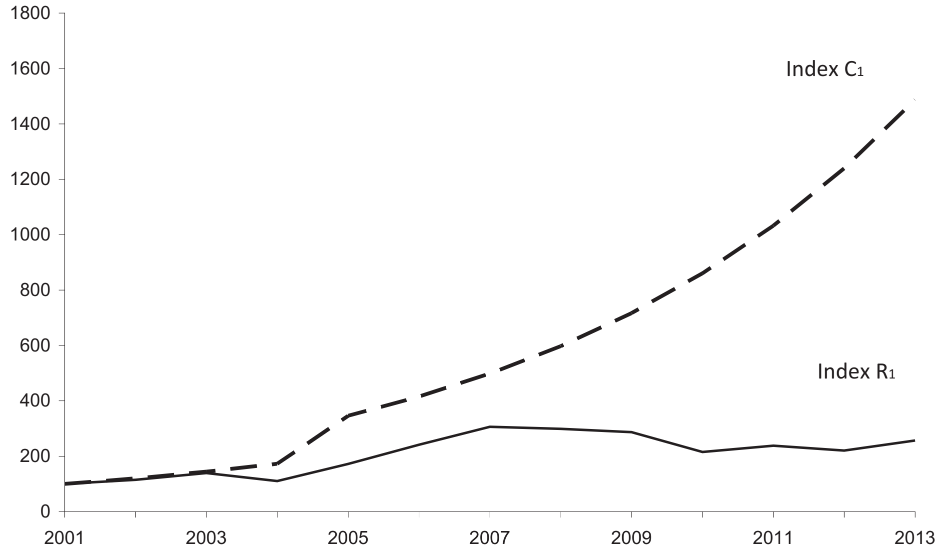

Figure 1. Pollution charge (Index C_1) and pollution charge revenue (Index R_1) 2001-2013.
Source: authors' calculation.

Figure 2 shows the development of the charge levels and the revenues of air pollution charges.

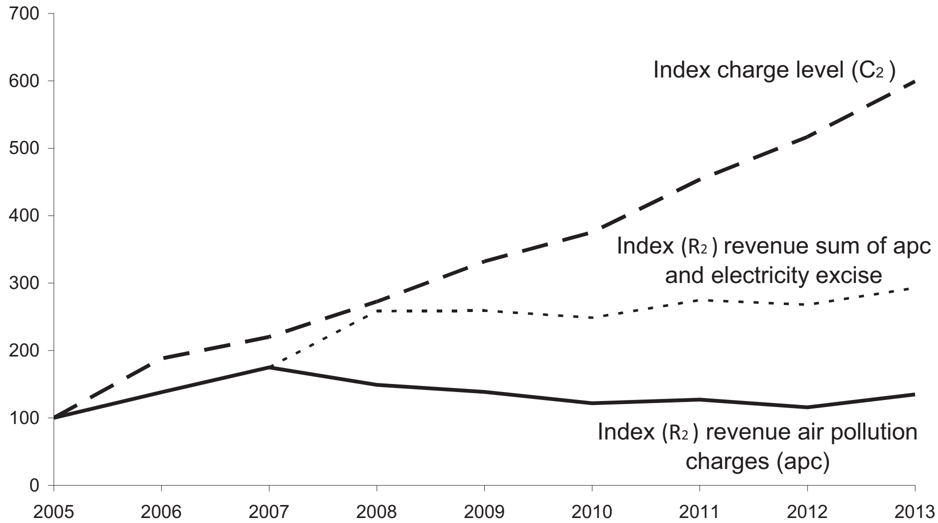

Figure 2. Air pollution charge (Index C_2), sum of revenue change on air pollution charge and electricity excise (Index R_2) and revenue change on air pollution charge revenue (Index R_2) 2005-2013.
Source: authors' calculation.

Figure 2 clearly shows that during the time period 2005-2013, the growth of revenue generation has been significantly slower than the increase in the rates of air pollution charges. Between 2005 and 2006 revenues grew by 38 per cent while the weighted average of the increase in air pollution charges was 88 per cent. The figure further shows that the decrease in air pollution charge revenues was significant in 2008. The decrease compared to the year before was 15 per cent. However, if taking into account that electricity excise replaced the CO_2-charge, the index based on the sum of income from air pollution charges and electricity excise shows there was no reduction in revenues in 2008. However, starting from 2009 the sum of revenues shows no significant growth.

In 2013 the level of air pollution charges was about 500 per cent larger than in 2005. The increase in index (C_2) was from 100 to 599 between 2005 and 2013. During the same time period, the revenues from air pollution charges had grown by 35 per cent. If adding the budgetary income from electricity excise, revenues were 156 per cent larger in 2013 than in 2005. Regardless of how revenues are defined, air pollution charges must be considered having been successful environmental taxes. Considering the long run rather than the year-to-year change, it is even more obvious that air pollution charges have not been successful in revenue generation. The lesson for policy makers is that environmental charges are not successful for reaching fiscal goals. This development is probably related to the erosion of the tax base. According to data for the time period 2001-2012, sulphur dioxide (SO_2), volatile organic compound (VOC) and particulate matter (PM) emissions decreased from stationary sources, while emissions of carbon monoxide (CO) and carbon dioxide increased (CO_2).

In a recent article, Zhou and Segerson (2012) suggest another reason why environmental charges might not be appropriate for revenue generation. Their argument is that due to their small tax base, environmental charges are not good revenue-raising devices. The authors estimate the potential income from two environmental charges in Connecticut and compare the result with personal income tax and sales taxes. They find that environmental taxes would generate between 2.9 and 15.5 per cent of existing taxes.

By similar reasoning, it is possible to do an ex-post evaluation for Estonia. Table 1 below shows annual tax revenues from pollution charges, income taxes and VAT. In 2007 when revenues from pollution charges reached the maximum, they were 5.0 and 3.3 per cent of personal income tax and VAT respectively. In 2013 the shares had dropped to 3.5 and 2.3 per cent. The second lesson for policy makers is that due to their limited tax base, the revenue generation capacity of environmental taxes is negligible.

Table 1. Public sector budget income, Euro millions 2001-2013, current prices. Source: Statistics Estonia.

	Pollution charges	Personal income tax	Value added tax (VAT)
2001	14.4	453.7	554.2
2002	16.5	498.9	650.1
2003	20.0	563.6	715.0
2004	15.8	608.1	722.7
2005	24.7	622.2	938.1
2006	34.7	746.5	1191.6
2007	44.0	935.7	1425.5
2008	42.9	1010.8	1313.3
2009	41.3	788.6	1202.1
2010	30.9	776.4	1248.2
2011	34.2	845.9	1343.3
2012	31.7	931.3	1493.7
2013	36.9	1030.6	1550.6

4. Damage cost estimates

Among policy makers it is under discussion whether polluters compensate for their damage costs through the environmental charges they pay. The general proposition is that environmental charges are too low. In order to investigate the underlying arguments we refer to scientific evidence and study some of the background documents that have estimated damage costs for Estonia.

Extensive work has been carried out in order to find estimates of the damages of various pollutants and the associated external costs. In Europe, the most prominent work has been carried out in a series of projects under the research network ExternE which is the acronym for "External Costs of Energy" which was active during the time period 1991-2005. Based on the Impact-Pathway-Approach (i.e. damage function approach) external costs from energy generation and transport were calculated for the EU15 countries (ExternE 2005). Additionally, external costs were estimated for Poland and the Czech Republic in 2004 (Melichar et al. 2004). As a result of about 15 years of research, a tool with an accompanying database was developed for calculating external costs at different locations in the EU: the EcoSense model.

The first application of the EcoSense model to the Estonian energy sector is found in Kareda (2008). The author reports external cost estimates per tonne of several air emissions; volatile organic compounds (VOC), nitrogen oxides (NO_X), particular matter ($PM_{2.5}$) and sulphur dioxide (SO_2). By multiplying the estimates of external costs with emissions from stationary sources in 2006, Kareda finds that health damage costs were about 4.4 billion Estonian kroon in 2006 (ibid. p. 15). Kareda's damage estimate corresponds to approximately Euro 281 million. The study was commissioned by the Ministry of Environment on the recommendation of the National Audit Office (2008). The motivation was that it would be possible to design effective pollution charges based on the knowledge of the true damage costs. Although Kareda (2008) mentions in his report that one of the aims of the study is to discuss whether the EcoSense model is appropriate for assessing environmental taxes, this is not done (ibid.).

A recent study (Pihor et al. 2013) calculates the external damage costs of air pollution by reference to the European CAFE project (CAFE stands for Clean Air for Europe). Pihor et al. (2013) multiply an average of the Estonian external cost estimates of Holland et al. (2005) by total oil shale industry emissions of VOC, NO_X and SO_2 in 2011. As a comparison, estimates of damage costs based on Kareda (2008) are reported by the authors (Pihor et al. 2013, Table 36). The cost estimates are shown in Table 2 below.

Table 2. Estimates of damage costs of the oil shale industry in Estonia in 2011.

	NO_X	SO_2	$PM_{2.5}$	VOC	Source
Emissions in 2011, tonnes	14289	69657	-	391	Pihor et al 2013
External cost, Euro/tonne	2241	3548	7677	134	Kareda 2008
Damage cost, Euro Million	**32.02**	**247.14**	**-**	**0.05**	Pihor et al 2013
External cost, Euro/tonne	1428	5350	7750	272	Pihor et al 2013
Emissions in 2011, tonnes	14289	69657	-	391	Pihor et al 2013
Damage cost, Euro Million	**24.40**	**372.66**	**-**	**0.11**	Pihor et al 2013

The National Audit Office (2013) refers to previous damage cost estimates and mentions an additional study (Lahtvee et al. 2013), which concludes that the oil shale industry in Estonia does not fully pay for its damage costs via the system of environmental charges. “Since environmental charges do not cover the damages to the environment,..., the state and society in a wider sense have to carry an additional cost” (National Audit Office 2013, p 46). The implication is that polluters should pay a sum that corresponds to the damage cost estimates. This represents a strict application of the polluter pays principle. Based on the estimates of the damage costs, the Government could check whether tax payments are sufficient. In 2006 the revenue from air pollution charges was Euro 13.4 million, while Kareda (2008) estimated the damage costs of four pollutants at Euro 281 million. The damage cost estimates of three air pollutants in the study of Pihor et al. (2013) are in the interval of Euro 254-279 million. The revenue from pollution charges was Euro 12.4 million in 2011.

The question, however, is that whether the reasoning above is valid. In case the damage cost estimates are based on sound methods and if it is possible to claim a strict application of the polluter pays principle, the implications made by the National Audit Office are valid. There are, however, several issues with the reasoning. The two studies we have referred to find the damage costs by multiplying the estimates of the external costs with the quantity of observed emissions. This is not correct since external cost estimates are marginal costs. The problem with the damage cost estimates presented in Table 2 is that the authors have interpreted the external cost estimates as average costs of a tonne of emissions. Kareda (2008) uses the term average external costs (Kareda 2008, Table 6), but applies marginal cost estimates for finding the damage cost. Although, Holland et al. (2005) point out in their report that they have estimated marginal external costs, this has not been observed by Pihor et al. (2013).

This mistake implies a significant over-valuation of the true damage costs. Figure 3 below gives an assessment of the misinterpretation of marginal costs being average costs.

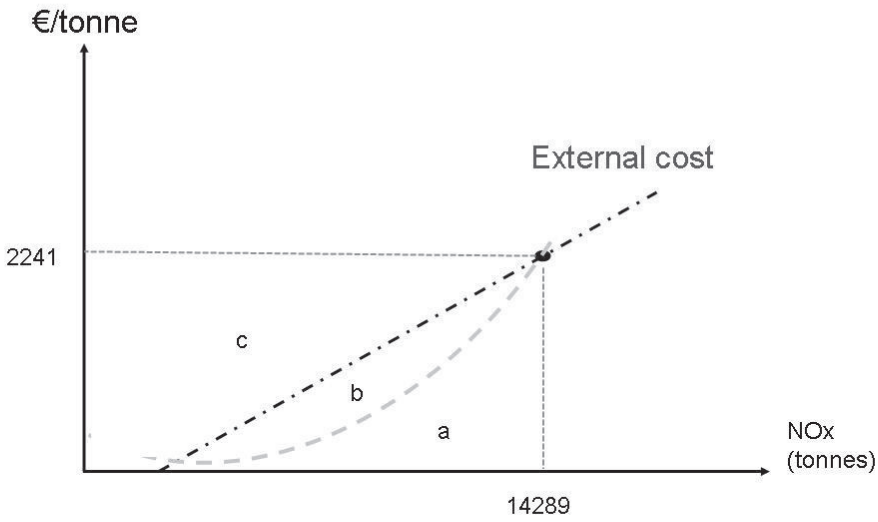

Figure 3. External marginal cost and external damage cost estimates.

Since the external cost estimates are marginal costs, this means that the damage cost depends on the already existing amount of emissions. The emissions of NO_X were 14,289 tonnes in 2011 and the marginal external damage cost was Euro 2,241 according to Kareda (2008). At this point in the figure the damage cost for the last tonne of emissions is Euro 2,241. If emissions decrease the damage cost of the last tonne will be lower. For small levels of emissions the damage costs are negligible or zero. This has to do with the ability of the natural environment to assimilate some pollutants. Since plants take up nitrogen, low levels of total emissions of NO_X are likely to have zero costs of damage. Therefore, it is shown that the external cost of NO_X is zero for small amounts.

The damage cost estimates of Pihor et al. (2013) and Kareda (2008) have found a damage cost, which equals the area *a+b+c*. The correct estimate of damage costs in Figure 3 above depends on the shape of the marginal cost curve. The linear marginal cost curve would result in an estimate of *a+b,* while damages according to the non linear marginal cost curve is equal to the area *a*. This suggests that the presented estimates of damage costs over-estimate the true damages by more than two times. One reason for believing that the over-estimation exceeds two is that small amounts give rise to zero damage costs. Another argument is that the marginal cost might be non-linear. It is generally believed that the marginal cost curve increases with increasing amounts, suggesting a non-linear dose-response function (ExternE 2005, p.42). The implication is that the damage costs which have been used as evidence for increasing pollution charges are incorrect and that the mistake is significant.

5. Conclusions

Since the rhetoric of policy makers in Estonia, more and more often include budgetary motivations for increases in environmental charges, the article pointed at a dilemma which is based on the fact that the environmental Pigou taxes and the fiscal Ramsey taxes have the opposite implications on resource allocation. In order to learn from the past experiences, the article investigated whether Estonia's pollution charges have been environmentally successful or fiscally successful.

It was found that in the beginning of the studied period (2001-2003) revenue generation closely followed increases in pollution charge levels. Starting from 2004 and until 2013, there is an increasing gap between the growth in charge levels and revenue generation. These findings suggest that pollution charges were successful as fiscal instruments in the beginning of the 2000's and that the pollution charges became successful environmental taxes at about the time of the ecological tax reform in 2005-2006. The investigation of air pollution charges further confirmed the observation for the latter time period. The lesson for policy makers is that environmental charges are not successful for fiscal purposes. The reason is most probably related to the erosion of the tax base. Another reason why pollution charges have limited capacity to generate tax revenue is that their share is minor in comparison to other tax sources, such as personal income tax and value added taxes (VAT). Rather than justifying pollution charges for budget reasons, it is more important that policy makers devote resources to design charges which internalise the externalities.

The slow revenue growth from air pollution charges has probably been accidentally interpreted as an indication of non-decreasing pollution. This has motivated background studies about whether environmental charges do cover the damage costs of pollution. Two of the background studies referred to in this article have come up with incorrect estimates of damage costs possibly leading to false policy recommendations.

The reason to the over-estimation of damage costs is that theses background studies have misunderstood the concept of marginal costs. External cost estimates have been interpreted as average costs. The damage costs reported by these studies have been found by multiplying marginal external costs with the quantity of observed emissions. This mistake leads to over-estimations by a magnitude of two or more. The implication is that the damage costs which have been used as evidence for increasing pollution charges are incorrect and that the mistake is large.

If the goal of the Government is to find an optimal level of charges, it will be important to collect additional information. Firstly, policy makers will need to address the scientific uncertainty concerning the shape of the marginal external cost curve. Secondly, and even more importantly, policy makers need to estimate the marginal abatement costs. Only by comparing the marginal external costs and the marginal abatement costs, will make it possible to find an optimal Pigou tax (see e.g. Stavins 2003). Whether this is possible in practice needs to be discussed further. The lesson is that policy makers need to examine the evidence they have and to complement with information for further analysis.

References

1. **ExternE** (2005) Externalities of Energy Methodology 2005 Update Edited by Peter Bickel and Rainer Friedrich, Institut für Energiewirtschaft und Rationelle Energieanwendung — IER, Universität Stuttgart, Germany
2. **Holland, M., Pye, S., Watkiss, P., Droste-Franke, B.** and **Bickel, P**. (2005) Damages per tonne emission of PM2.5, NH3, SO2, NOx and VOCs from each EU25 Member State (excluding Cyprus) and surrounding seas. AEA Technology plc for the clean air for Europe (CAFE) programme.
3. **Kareda, E.** (2008) Eesti õhusaaste väliskulude arvutamise võimalused ExternE metoodika ja EcoSenseWeb abil, SEI aruanne, Töövõtuleping nr. 18-20/399 Availble at http://www.envir.ee/orb.aw/class=file/action=preview/id=1159752/Ohusaaste_Kareda.pdf
4. **Keskkonnaministeerium** (2014) Keskkonnatasude laekumised, available at http://www.envir.ee/et/eesmargid-tegevused/keskkonnakorraldus/keskkonnatasud
5. **Keskkonnaõiguse uudiskiri**. Available at. http://www.k6k.ee/uudiskiri/2013/detsember/keskkonnatasud
6. **Kraav, E.** and **Lüpsik, S**. (2006). 15 aastat keskkonnatasusid Eestis. Kogumikus T.Frey (toim.). *Kaasaegse ökoloogia probleemid. Loodushoiu majandushoovad*. Eesti X ökoloogiakonverentsi (27.-28.04.2006) lühiartiklid. Tartu, 71-85.
7. **Kralik, S**., **Kaarna, R** and **Rell, M.** (2012). Keskkonnakaitse kulutuste analüüs. SA Poliitikauuringute Keskus Praxis. Tallinn 2012.
8. **Lahtvee, V., Nõmmann, T., Runnel, A., Sammul, M., Espenberg, S., Karlõseva, A., Urbel-Piirsalu, E., Jüssi, M., Poltimäe, H.** and **Moora, H.** (2013). Keskkonnatasude mõjuanalüüs. SEI Tallinn ja Tartu Ülikool, RAKE, 2013. Tellija Riigikantselei.

9. **Melichar, J., Havranek, M., Maca, V.** and **Scasny, M**. (2004) Implementation of ExternE Methodology in Eastern Europe. Available at. http://www.externe.info/externe_2006/expolwp7.pdf
10. **National Audit Office** (2013) Ülevaade riigi vara kasutamisest ja säilimisest 2012.–2013. aastal. Riigikontrolöri kokkuvõte Eesti riigi arengu ja majanduse probleemidest. Tallinn 2013.
11. **National Audit Office** (2008) Saastetasude mõju keskkonnasaaste vähendamisele, Riigikontrolli aruanne Riigikogule, Tallinn, 6. oktoober 2008.
12. **Oates, W. E.** (1993) Pollution charges as a source of public revenues, in *Economic Progress and Environmental Concerns*, editor Gierch, H. A publication of the Egon-Sohmen-Foundation, pp. 135-152.
13. **Pihor, K.; Kralik, S.; Aas, A.; Jürgenson, A.; Rell, M.; Paat-Ahi, G.** and **Batueva, V.** (2013) Põlevkivi kaevandamise ja töötlemise sotsiaalmajanduslike mõjude hindamine. Praxis,
14. **Reinvald, A.** (1992) Keskkonnaseisundi reguleerimine majandusmeetoditega. Tartu Ülikool, majandusteaduskond, 1992.
15. **Satvins, R.** (2003) Experience with market based environmental policy instruments, in *Handbook of Environmental Economics*, editors K. G. Mäler & J. R. Vincent (ed.), 2003. Elsevier, volume 1, number 1,
16. **Tammemäe, O.** (2006) Ökoloogiline maksureform, Teemakohaline seisukohavõtt, Linnade ja valdade päevad 2006, Keskkonnaseminar 16.02.2006. Available at, http://portaal.ell.ee/7520
17. **World Ban**k (1993). Estonia: The transition to a market economy. A world bank country study. The World Bank, Washington, D.C. March 1993.
18. **Zhou, R.** and **Segerson, K.** (2012) Are green taxes a good way to help solve state budget deficits? *Sustainability*, vol. 4 pp. 1329-1353.

KESKKONNA MAKSUSTAMISE DILEMMA EESTI NÄITEL

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1. Sissejuhatus

Eesti keskkonnapoliitika kujundajad on viimasel ajal sageli väitnud, et saastetasud ei kata saaste kahjustuste kulu. Artikli eesmärgiks on hinnata saastetasude kui fiskaalse ja keskkonnapoliitilise meetme edukust ning analüüsida saastemaksude suhet saastekahjudesse. Keskkonnamaksude edukuse analüüsil on kasutatud tagasiulatuvat (*ex-post*) maksutulude indeksanalüüsi. Indeksanalüüs on saastemaksude hindamisel uudne meetod, mis paraku ei pretendeeri hindama saastemaksude mõju keskkonnakvaliteedile. Vastuse otsimine küsimusele, kas saastajad kompenseerivad nende poolt tekitatava kahju, põhineb mikroökonoomilisel analüüsil.

2. Kahe eesmärgi ja ühe vahendi dilemma

Käesoleval ajal on keskkonnamaksudesse suhtumisel levinud nn topeltdividendide hüpotees, mis seisneb selles, et lisaks väliskulude (*externalities*) sisestamisele, mis on olnud keskkonnamaksu (ehk Pigou maksu) algne eesmärk, loob see maks täiendavat tulu, mida saab kasutada teiste maksude vähendamiseks. Juba enne topeltdividendide hüpoteesi püstitamist hoiatati (Oates 1993), et saastemaksude roll riigi tuluallikana on tegelikkuses komplitseeritud. Oatesi väitel seisneb põhiprobleem selles, et valitsused püüavad saavutada kahte erinevat eesmärki ühe ja sama poliitilise instrumendiga (ibid. p. 136).

Keskkonnamaksude eesmärk Eestis on olnud suunatud saaste vähendamisele (mis on keskkonnakaitseline eesmärk) ja maksutulu suurendamisele. Viimane eesmärk on olemuselt majanduslik ja seotud eelarve tulude suurendamisega. Nendel kahel eesmärgil on erinev teoreetiline põhjendus. Keskkonnatasud (st Pigou maksud) on kehtestatud korrigeerimaks turutõrget, mis saavutatakse ressursside paigutuse mõjutamisega. Riigimaksud peaksid aga vastavalt Ramsey seadusele mõju ressursipaigutusele minimeerima. Kui õigesti kehtestatud Pigou maks muudab ressursikasutust saaste vähenemise suunas, murendab see samal ajal maksustamisbaasi ja ei taga seetõttu riigile stabiilset sissetulekut. Sellest järeldub, et dilemma ei ole seotud ainult kahe eesmärgi ja ühe vahendiga, vaid on oma olemuselt palju sügavam, kuivõrd Pigou maksul ja Ramsey maksul on vastandlik eesmärk ressursside paigutuse suhtes. Mõlemat eesmärki üheaegselt ei ole võimalik saavutada. Valitsus kas saab keskkonnamaksudest tulu, mis toob endaga kaasa maksude tagasihoidlikuma mõju keskkonnakvaliteedile või lepib suhteliselt väiksema maksulaekumisega puhtama keskkonna nimel.

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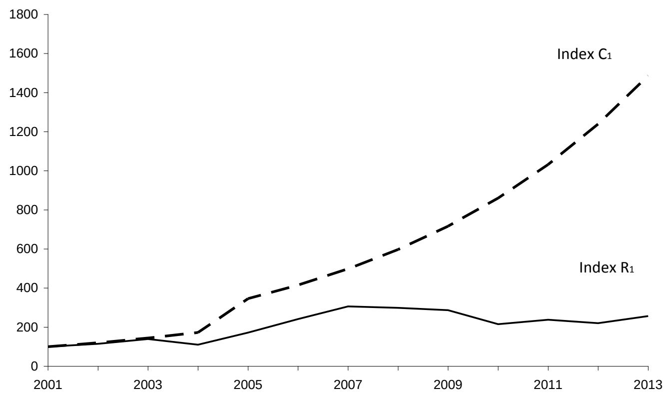
3. Maksude edukuse analüüs

Teades keskkonnamaksude dünaamikat ja maksudest laekunud tulu perioodil 2001-2013, on võimalik kontrollida Eesti keskkonnamaksude edukust ja selgitada välja, kas keskkonnamaksud on olnud edukad keskkonna reguleerimisel või riigieelarve täitmisel.

Joonisel 1 on toodud agregeeritud keskkonnamaksude indeksid perioodil 2001-2013. Jooniselt nähtub, et perioodi alguses (2001-2003) järgis maksudest saadav tulu maksude kasvu. Alates 2004. aastast kuni vaadeldava perioodi lõpuni 2013 on maksude suuruse ja nende poolt genereeritava tulu vahel kasvav lõhe. Sellest võib järeldada, et perioodi alguses olid keskkonnamaksud edukad fiskaalinstrumendina ja muutusid keskkonnamaksudena edukaks pärast ökoloogilist maksureformi. Keskkonnamaksudest saadav tulu hakkas langema 2008. aastal, mille üheks põhjuseks on, et elektrijaamade süsinikdioksiidi emissioonilt võetav saastemaks asendus 2008. a aktsiisiga (Kralik et al. 2012). Kehtestatud aktsiis oli mahult samaväärne enne aktsiisi kehtestamist võetud CO_2 maksuga (ibid.).



Joonis 1. Saastemaksu taseme tõus (indeks C_1) ja tulu saastemaksust (Indeks R_1) 2001-2013, *Allikas: autorite arvutused.*

Õppetund keskkonnapoliitika kujundajatele seisneb selles, et keskkonnamaksud ei ole edukas meede riigieelarve täitmiseks. Selle põhjuseks on tõenäoliselt maksude tagajärjel aset leidev maksubaasi murenemine.

4. Hinnang saastekahjudele

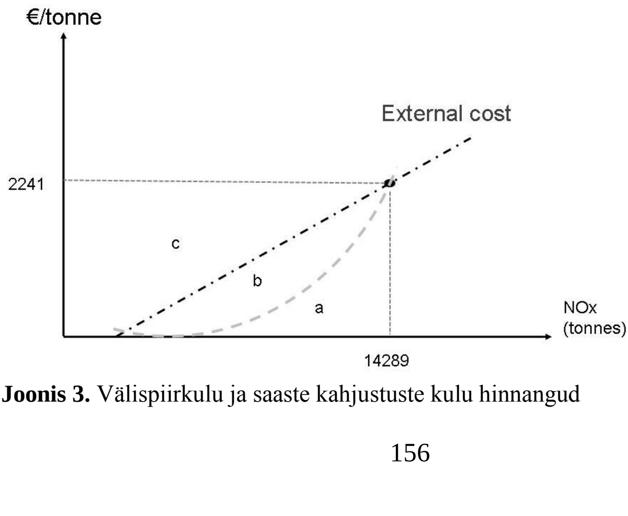
Keskkonnapoliitika kujundajate hulgas toimub laialdane diskussioon teemal, kas saastajad kompenseerivad tekitatava kahju keskkonnamaksude kaudu või mitte. Üldlevinud seisukoht on, et keskkonnamaksud on liiga madalad. Selleks, et teaduslikult uurida väite aluseks olevaid argumente, tuleb analüüsida saastekahjustuste kohta käivaid andmeid Eestis.

Hiljuti tehtud uuringus õhu saaste kohta (Pihor et al. 2013) on arvutatud saastekahju rahaline ekvivalent. Saadud andmeid on võrreldud Kareda uurimusega (Kareda 2008). Saastekahjude hinnangud on toodud tabelis 2.

Tabel 2. Hinnang Eesti põlevkivitööstuse saastekahjudele 2011

	NO_X	SO_2	$PM_{2.5}$	VOC	Source
Emissions in 2011, tonnes	14289	69657	-	391	Pihor et al 2013
External cost, Euro/tonne	2241	3548	7677	134	Kareda 2008
Damage cost, Euro Million	**32.02**	**247.14**	**-**	**0.05**	Pihor et al 2013
External cost, Euro/tonne	1428	5350	7750	272	Pihor et al 2013
Emissions in 2011, tonnes	14289	69657	-	391	Pihor et al 2013
Damage cost, Euro Million	**24.40**	**372.66**	**-**	**0.11**	Pihor et al 2013

Vaadeldud kahes uuringus tuletakse saastekahju mõõdetud saaste hulgaga võrdeliste väliskulude kaudu, mis ei ole õige, sest väliskulud on oma olemuselt piirkulud. Tabelis 2 toodud saastekahjude puhul on metoodiline viga selles, et tööde autorid on interpreteerinud väliskulusid kui ühe tonni emissiooni keskmisi kulusid. Selline lähenemine viib tegelike saastekahjude tuntavale ülehindamisele. Joonis 3 selgitab viga, mis tekib kui piirkulu asemel opereeritakse saastekahjude hindamisel keskmiste kuludega.



Joonis 3. Välispiirkulu ja saaste kahjustuste kulu hinnangud

Kui väliskulude hinnangud on piirkulud, tähendab see, et saasteühiku tekitatav kahju sõltub juba olemasolevast emissioonist. Lämmastikühendite (NOx) emissioon oli 2011. a 14289 tonni ja väliskulu oli Kareda (2008) andmetel 2241. Vastavalt joonisele 3 on viimase tonni saastekahju maksumus 2241. Emissiooni vähenedes väheneb ka viimase saasteühiku poolt tekitatav kahju. Väikeste emissioonide korral on saasteühiku poolt tekitatav kahju nullilähedane, mis on seotud looduse isepuhastusvõimega. Vaadeldud töödes (Pihor et al., 2011; Kareda 2008) toodud saastekahju hinnang on võrdeline pindalaga $a+b+c$ (joonis 3). Saastekahjude metoodiliselt õigel hindamisel sõltub saastekahju suurus piirkahju kõvera kujust. Lineaarse piirkahju hinnang on võrdeline pindalade a ja b summaga ($a+b$), mittelineaarne piirkahju kõver on aga võrdeline pindalaga a. Ülaltoodud arutlusest võib järeldada, et vaadeldavates töödes esitatud saastekahjud on võrreldes tegelike saastekahjudega rohkem kui kahekordselt ülehinnatud. Üheks põhjuseks, miks saastekahjud on rohkem kui kahekordselt ülehinnatud, tuleb pidada asjaolu, et väikeste saastekoguste juures on saastekahju peaaegu olematu. Teiseks põhjuseks on piirkahju mittelineaarsus. Üldiselt arvatakse, et saaste piirkahju kõver tõuseb järsemalt (kasvab) saastekoguse suurenedes, vastates mittelineaarsele doosi-vastuse funktsioonile (ExternE 2005, p.42).

Käesoleva töö autorite järelduseks on, et saastekahjud, mis on aluseks saastetasude suurendamisele, on saadud ebaõigesti ning on märkimisväärselt ülehinnatud.

5. Kokkuvõte

Aeglane maksutulu suurenemine õhusaaste maksudest on viinud sageli ebaõigele järeldusele, et õhusaaste ei vähene. See on omakorda initsieerinud uuringuid probleemi kohta, kas keskkonnatasud katavad saastekahjud. Käesolevas töös analüüsitud kahe uuringu alusel võib järeldada, et ebaõigesti hinnatud saastekahju on aluseks ebakohasele keskkonnapoliitikale.

Kui valitsuse ülesandeks on leida optimaalne maksude tase, on vaja koguda täiendavat informatsiooni ja teha uurimistööd. Esiteks peaksid keskkonnapoliitika kujundajad pöörama tähelepanu väliskulude piirkululisele iseloomule ja saaste piirkahju kõvera kujule. Teiseks, ja see on veelgi tähtsam, tuleb poliitikutel hinnata saaste vähendamise kulusid. Ainult saaste kahjustuste piirkulu ja saaste vähendamise piirkulu võrreldes on võimalik määrata optimaalne keskkonnatasude (e Pigou maksu) määr. Selle praktiline teostatavus jääb tulevase uurimistöö ja arutelu objektiks.