The impact of EU Cohesion policy on environmental sector sustainability in the Baltic states

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Abstract

This article analyses investment from European Union cohesion policy funds into the Estonian, Latvian, and Lithuanian environmental sectors during the budget period 2007-2013. Total investment from these funds in Estonia, Latvia, and Lithuania during that period will be about 14.7 billion euros, of which about 18 percent covers the environmental sector.

The purpose is to analyse whether allocation of expenditure to the environment is sustainable. In their analysis the authors apply sustainability criteria based on the cost-benefit rule and the Environmental Performance Index (EPI). The main finding is that the Baltic States allocate least environmental funds to those fields found to be most relevant to sustainability.

Keywords: environmental investment, EU funding, sustainability
JEL classification: H59; Q20; Q28; Q58

1. Introduction

Vincent and his co-authors (2002) note that despite strong reasons for analysing public expenditure and the environment, only limited literature is available within this field. So far, most analyses concerning public expenditure on the environment have been undertaken by the World Bank and the OECD. This paper aims to fill the gap and offers a novel perspective into the study of allocation of public expenditure to the environment by comparing EU cohesion policy fund allocation to the environment in three countries of similar size and corresponding economic prerequisites.

The analysis concerns the structure of EU cohesion policy funding for the environment in Estonia, Latvia, and Lithuania during the period 2007-2013. Since all countries eligible for funding are subject to the same regulations, it is expected that funding choices will be similar. However, country specific time schedules for fulfilling EU directives agreed on during membership negotiations can be a source of differences. The overall purpose of the analysis is to assess whether budgetary allocation to the environment according to funding plans supports sustainability of the environmental sector. Funding plans, the outcome of negotiations

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between each beneficiary country government and the EU Commission, are documented in National Strategic Reference Frameworks 2007-2013 and Operational Programmes.[2] The Operational Programmes for Estonia, Latvia, and Lithuania represent the primary source of data of this paper.

We begin by describing the theoretical framework for defining an efficient and environmentally sustainable resource allocation. Based on the theoretical framework, we then present an outline for step-wise assessment of sustainability of budgetary allocation to the environmental sector. In the following section we present the outcome of cohesion policy fund allocation in the three Baltic States. After that we carry out step-wise assessment and, based on the results, we classify spending priorities according to their relevance to sustainability. The conclusions are presented in the last section.

2. Theoretical framework

Environmental regulations and public expenditure directed to the environment are generally justified by efficiency reasons. This is because unregulated markets pay too little attention to environmental protection, i.e. environmental quality. Supply of environmental goods may be insufficient since they are public goods, while oversupply of activities that give rise to negative externalities can also occur. The role of government expense on the environment is thus to redirect tax income to provision of public goods and to tax activities that give rise to negative externalities. To some extent, environmental protection can be self financing if taxes and charges paid by polluters are directed to rehabilitation and pollution control.

In this paper we deal with supra-national funding where Member State payments are reallocated among EU countries. For this reason, the concept of fiscal federalism can be applied to allocation of public expenditure. Fiscal federalism addresses the problem of vertical allocation of economic responsibilities by level of government. Efficient allocation assigns the responsibility to the territorial authority where beneficiaries correspond to that of taxpayers (see Pitlik, 2007). If the benefits of public goods spill over to a neighbouring territory or country, this gives reason to centralize responsibility. Fiscal federalism would thus predict that EU funding to the environmental sector is devoted to environmental issues with cross border characteristics. In addition, efficiency reasons would motivate higher levels of funding when neighbouring countries benefit from improvements. Pitlik (2007) finds that almost half the financial resources of the EU budget are allocated to spending categories in which EU responsibilities are questionable from the viewpoint of fiscal federalism. Since one of the intentions of cohesion funding is to reduce disparities among Member States, regions, and individuals[3], it is likely that the concept of fiscal federalism is not applicable for our purpose.

Our main focus of environmental spending involves sustainability. Analogous to sustainable development, sustainability represents resource use that meets human needs while preserving the environment so that needs can be met for both present and future generations. The literature suggests a close relationship between efficiency and sustainability (see e.g.

[2] See list of references.
[3] See COM 2008/301 (2008).

Pädam, 2003). Efficiency implies resource allocation that considers peoples' preferences and accounts for resource constraints. By allowing for reallocation of resources in case human needs are not met and by adopting a dynamic perspective, efficiency will overlap with sustainability. According to the interpretation by Stavins *et al.* (2003), sustainability can be understood as dynamic efficiency along a feasible consumption path. Sustainability entails non-wastefulness, implying that the choice of a consumption path is such that the economy is on the Pareto frontier. Following Stavins *et al.*'s application of a Ramsey type of presentation, welfare, *W,* of such a path can be evaluated over time as:

$$W(t) \equiv \int_{t}^{\infty} U(C(\tau)) e^{-r(\tau - t)} d\tau \tag{1}$$

where *U* denotes the utility function which depends on consumption, *C,* including both direct consumption and enjoyment of non-market goods and services. Time is denoted by τ and t ($\tau, t \geq 0$) and the time horizon is taken to be infinite. The utility discount rate is denoted by *r*. Since *C* contains two types of goods, the argument of the utility function can be rewritten as:

$$C = f(x(\tau), z(\tau)) \tag{2}$$

where x(τ) denotes market goods and z(τ) denotes non-market goods, including environmental goods and services. In order to be sustainable, current decision making must consider the perspective of inter-temporal public goods and inter-temporal externalities. Securing future supply of environmental goods and services implies production of inter-temporal public goods, which need to be provided so as to include the preferences of future generations. Stavins *et al.* formulate a condition of intergenerational equity requiring non-decreasing welfare:

$$\frac{dW(t)}{dt} \geq 0 \tag{3}$$

The requirement that the stream of welfare does not decline over time implies that future generations will not be worse off. Although constant consumption at no more than subsistence level could in principle meet the definition of sustainability, Stavins *et al.* (2003) argue that this definition would not be accepted as meeting reasonable social goals. For evaluating sustainability they propose a decision rule similar to the Kaldor-Hicks criterion, i.e. that those who are made better off by a policy in theory can fully compensate those who are made worse off. A policy that fails the Kaldor-Hicks test cannot pass the stricter Pareto test. In a dynamic context, intergenerational transfers could be applied to achieve non-declining welfare. This is the justification for their proposal to use dynamic efficiency as a criterion to find policies that are potentially sustainable.

Although intuitively appealing, the approach of Stavins *et al.* (2003) disregards two central issues: one is the implicit assumption they make about **natural capital** and the other is the **preferences of future generations**.

The implicit assumption that they make about **natural capital** is that natural environments and ecosystems can be represented by equations that are convex sets and that are at least twice differentiable. However, this need not be the case. The reason is that regeneration paths

of natural environments and ecosystems tend to exhibit nonlinear dose-response relations, implying that marginal changes in anthropogenic pressure may result in irreversible effects (see Dasgupta and Mäler 2004). Therefore no guarantee exists that equation (3) is non-negative or that the inequality can be defined in a meaningful way. In an analysis of policy reforms in imperfect economies, Arrow *et al.* (2004) show that social welfare might or might not be sustained between two periods. Reasons why an imperfect economy is incapable of sustaining welfare over time include e.g. scarcity of resources and limited substitution possibilities among capital assets. At the same time, Arrow *et al.* (2004) show that the general cost-benefit rule holds for guiding sustainable investment decisions in an imperfect economy. But, in order to certify that the cost-benefit rule produces correct estimates, it will become necessary to derive proper accounting prices, which can to a large degree differ from market prices (*ibid*). In the absence of proper accounting prices, the need arises to find other ways to consider scarcity and the need for preservation of key natural resources.

Finding information about proper accounting prices is not only hindered by lack of know ledge about non-linear dose response relations of natural environments. Another difficulty in determining sustainable development over a long period or even more so over an infinite time span is lack of information about the **preferences of future generations**. Current decisions that affect sustainable development would need to take into account estimates of willingness to pay by unborn persons in the distant future. Taking a closer look at decision making, we can see that people do not tend to give up decision making in those cases where their decisions tend to have an impact on future generations. In several cases people even include the welfare of their children or grandchildren in their decisions. Monchareva and Gudas 2009 report that a large portion of respondents declare that improving the water quality in the Nevezis river basin is important "for children and for future generations' wealth". This implies that current generations have the capacity to represent future generations. Assuming that the preferences of current generations contain the requests of future generations on the natural environment implies that willingness to pay estimates based on generations now alive can be approximated as representative of the preferences of future generations.

However, we cannot expect to find the whole answer from willingness to pay estimates based on generations now alive. The failure of humans to put an accurate value on critical natural assets is due to the inherent complexity of the natural environment. Taking into account that human preferences cannot correctly sense when ecosystems are at risk implies a need to use knowledge of ecological science in order to identify critical environmental assets.

3. Combined approach

Since it may prove impossible to collect proper accounting prices by estimating willingness to pay (WTP) for natural environments and ecosystems, i.e. the accounting prices of $z(\tau)$ in equation (2), from generations now alive, the implication is that a need exists for a combined approach to assess the sustainability of environmental spending. In our analysis we will consider the cost-benefit rule in the first step for assessing sustainability and in the second step we will use ecological knowledge in order to certify that investments will be undertaken in critical fields of $z(\tau)$. For the purpose of the second step we use the Environmental Performance Index (EPI), (see Esty *et al.* 2008). This index is based on empirical data about the

environment in 149 countries and allows cross country comparisons. The index has been developed by first identifying specific environmental targets and then measuring the distance between the target and current national achievement (*ibid*). Although the authors identify several data gaps, EPI is a comprehensive measure based on ecological knowledge.

In terms of our purposes, EPI is no substitute for WTP estimates. Instead we need EPI in order to complement the information of the cost-benefit rule. Since EPI is available for a broader range of environmental issues than WTP estimates, we will use EPI as an indicator for suggesting additional policy implications when WTP estimates are missing. However, EPI cannot assess the range of required investment and cannot measure whether a certain level of investment passes the cost-benefit rule.

4. Budget allocation to the environmental sector

Cohesion policy funding included by the Convergence Objective during the programming period 2007-2013 amounts to about 346 billion euros. Among the Baltic States, funding per country is between 3.4 and 6.8 billion euros. Estonia obtains less than Latvia, and Lithuania receives more than the two other Baltic states. The ranking of the contribution to the environmental sector shows similar positions between countries. Lithuania devotes most, then Latvia, while Estonia assigns least funds to the environment, see Table 1.

Table 1. Allocation of cohesion policy funding to the environment, in total and per country 2007-2013, euros current prices**

Priority theme	Estonia	Latvia	Lithuania	Community Wide*
Euro, million				
Environment	781.3	792.7	1,053.4	46,735.9
Total	3,403.5	4,530.4	6,775.5	346,150.8
Euro, per capita				
Environment	582	347	311	270
Total	2,535	1,986	2,002	1,997
Percent				
Environment	23.0	17.5	15.5	13.5
Total	100.0	100.0	100.0	100.0

Sources: Operational Programmes, COM 2008/301(2008) annex 1 and Eurostat (2008). Population data for January 2007: Estonia 1,342,409, Latvia 2,281,305, and Lithuania 3,384,879.

*Community wide covers Member States and regions falling under the convergence objective covering 35 percent of the Union's population.

** All amounts expressed in current prices. To accommodate inflationary expectations during 2007–2013, EU countries agreed to adjust financial framework ceilings (expressed in 2004 prices) by using a yearly 2 percent price deflator between 2004 and 2013.

The primary reason why funding differs between countries is due to country size. Dividing funding by population puts these figures into another perspective. The per capita allocation of cohesion policy funding to the environment is highest in Estonia and lowest in Lithuania. In comparison to the community wide allocation of cohesion funding that falls under the convergence objective, all three Baltic states devote more to the environment than is directed by cohesion funding on average.

The definition of community funding devoted to the environmental sector includes 12 out of a total of 86 priority themes. The chosen priority themes include all but one theme of the category "Environmental protection and risk prevention" and two priority themes of "Tourism": see EU (2006) for a complete list of priority themes. Our definition of the environmental sector is closely connected to fields commonly included in environmental protection expenditure of the general government budget. The fields used in general government expenditure include waste management, waste water management, pollution abatement, protection of biodiversity and landscape, and R&D in environment protection.

Expenditure to reduce contribution to climate change is not explicitly included in our definition other than forming part of pollution abatement. One reason is the choice to follow the fields in general government expenditure. Another reason for not including climate change is that the Baltic states have different starting points depending on major differences in energy supply between countries. Leaving out investment in energy efficiency, renewable energy, and environmentally friendly transportation thus allows for a more equivalent base when making cross country comparisons between the Baltic states. In addition, a comparison of impacts of EU cohesion funding on climate change has been made elsewhere (see CEE Bankwatch Network 2007). Table 2 shows allocation of funding by priority theme of the three Baltic states and a comparison with community wide allocation for Member States and regions falling under the Convergence Objective.

Table 2. Cohesion policy funding for the environment, per priority theme 2007-2013, euros per capita current prices** and percent

Priority theme	Estonia		Latvia		Lithuania		Community wide*	
Management of household and industrial waste	52	8.9%	57	16.4%	82	26.5%	36	13.4%
Management and distribution of water (drinking water)	152	26.1%	123	35.5%	61	13.0%	47	17.3%
Water treatment (waste water)	152	26.1%	123	35.5%	41	19.6%	81	29.9%
Air quality	10	1.7%	0	0.0%	51	16.3%	6	2.2%
Integrated prevention and pollution control	0	0.0%	0	0.0%	0	0.0%	4	1.6%
Mitigation and adaptation to climate change	0	0.0%	0	0.0%	0	0.0%	2	0.7%
Rehabilitation of industrial sites and contaminated land	103	17.7%	21	6.2%	4	1.4%	20	7.4%
Promotion of biodiversity and nature protection (including Natura 2000)	16	2.7%	11	3.2%	26	8.3%	16	5.8%
Risk prevention (including drafting and implementing plans and measures to prevent and manage natural and technological risks)	29	5.0%	11	3.2%	0	0.0%	34	12.6%
Other measures to preserve the environment and prevent risks	50	8.6%	0		23	7.5%	10	3.6%
Promotion of natural assets	9	1.6%	0	0.0%	23	7.5%	7	2.5%
Protection and development of natural heritage	9	1.6%	0	0.0%	0	0.0%	8	3.0%
Environmental sector, total	582	100.0%	347	100.0%	311	100.0%	270	100.0%

Source: Authors' calculations based on Operational Programmes, COM 2008/301(2008) annex 1 and Eurostat (2008).
*Community wide covers Member States and regions falling under the convergence objective covering 35 percent of the Union's population.
** All amounts expressed in current prices. To accommodate inflationary expectations during 2007–2013, EU countries agreed to adjust financial framework ceilings (expressed in 2004 prices) by using a yearly 2 percent price deflator between 2004 and 2013.

Not all priority themes have been covered by the Baltic states. It is interesting to note that no Baltic state will invest in the priority themes of "Integrated Prevention and Pollution Control" or "Mitigation and Adaptation to Climate Change". Moreover, community wide investment in these two priority themes is low. Estonia is the only Baltic state to allocate funds to "Protection and Development of Natural Heritage". The other priority themes are covered by at least two Baltic states. In total, Estonia's funding covers 10 priority themes, Latvia's 6, and Lithuania's 8.

All Baltic states prioritise drinking water distribution and waste water treatment. These two priority themes are top priorities in Estonia and Latvia. Lithuania puts top priority on waste management, while drinking water and waste water treatment come at numbers two and four, respectively. Air quality is the third priority for Lithuania, while Latvia's third is waste management. Estonia's third priority is rehabilitation of contaminated land. Ranking of priority themes by expenditure is relatively similar in Estonia and Latvia for common fields, while Lithuania shows another ranking of priorities in that it includes a relatively large share of promotion of biodiversity and natural assets. Community wide priorities rank waste water treatment as top priority, followed by drinking water supply, and waste management.

Notwithstanding comparable economic prerequisites and similar country size, funding plans for Estonia, Latvia, and Lithuania reveal larger differences than were expected. One reason for greater focus on drinking water in Estonia and Latvia may be that that Estonia and Latvia were granted transitional periods for fulfilling the directive on drinking water quality, while Lithuania was expected to fulfil the requirements on accession. In addition, Estonia's funding plans cover a larger number of priority themes than Latvia's and Lithuania's and shows larger per capita spending on the environment. These differences may be due to the fact that Estonia's production of electricity gives rise to significant pollution and that environmental protection was a major issue during the struggle to regain independence. Latvia has chosen fewer priority themes than its Baltic neighbours, but will spend more per capita than Lithuania. In Lithuania, biodiversity and natural assets receive a larger share of funding than in the other Baltic States.

5. Assessment of sustainability

The observations above raise questions about whether more investment into the environmental sector is better from the viewpoint of sustainability and how the various priority themes add to sustainable development. Based on our initial discussion, sustainability can be assessed by the cost-benefit rule. However, since human preferences cannot correctly sense when ecosystems are at risk, WTP estimates might not produce proper accounting prices. Therefore, we will need to assess sustainability in two steps.

5.1. Cost-benefit rule

Applying efficiency motivations to spending priorities, market failure can motivate all priority themes that were included in the environmental sector. Several priority themes deal with alleviating negative externalities including waste management, waste water treatment, and

pollution control. Other priority themes can be motivated by reasons of provision of public goods, including air quality, rehabilitation of contaminated land, and promotion of natural assets. Drinking water infrastructure is not a public good, but its provision can be classified as market failure since the supply of drinking water infrastructure is characterised by increasing returns to scale.

Existence of market failure is not sufficient to conclude that a certain priority theme needs funding for reasons of efficiency. In addition, the cost-benefit rule requires that total benefits exceed total costs, i.e. that willingness to pay (WTP) for the services or goods in question covers costs. Unfortunately, we know very little about whether willingness to pay covers the costs associated with the priority themes. However, some evidence exists for four priority themes.

5.1.1. Waste management and sewerage services

Bluffstone and De Shazo (2003) report estimates of willingness to pay for two priority themes in Lithuania. They estimated the cost of implementing EU directives on waste management and urban waste water treatment and conducted contingent valuation studies among Lithuanian households in Ukmerge municipality 40 kilometres north of Vilnius. The population is approximately 34,000 and the average monthly household income is close to the national median (see Bluffstone and De Shazo, 2003).

In interviews with households, the benefits of improved landfill construction and closure of old landfills were described in terms of avoiding pollution to surface and ground water and that after closure old landfills would be sealed and replanted to avoid future contamination. Respondents who indicated they had no access to the sewerage network were surveyed for their WTP to be connected to the municipal sewerage system. The benefits of municipal sewerage services were described in terms of there being no need to service their private septic system or pit toilet and no smell once connected to the municipal system. The authors found that at least 50 percent of respondents would be willing to pay 0.62 euros (2.73 litas) more per person and year for landfill upgrade and that half of respondents were willing to pay an additional 0.51 euros (2.24 litas) per person and per year for sewerage services. The average household size in Ukmerge is 2.67, thus producing household WTP of 1.7 and 1.4 euros respectively.

Assuming that the households studied are representative of Lithuania, the authors estimated that national WTP covers between 80-90 percent of the costs of improving waste management practices, but that WTP for sewerage services covers only 10 percent of the costs (*ibid*). This implies that neither of the directives produces benefits large enough to cover costs. However, one limitation of the benefit estimation of sewerage services is that benefits from improved environmental conditions are missing. These include, for example, benefits that arise from improved water quality in local surface water bodies, enhanced fisheries, and improved recreation opportunities. Since 1.4 euros per household covers only 10 percent of costs, the improved environmental conditions of water bodies resulting from the urban waste water treatment directive must cover at least the remaining 90 percent of the 14 euros (i.e. 12.6), in order to pass the cost-benefit rule.

5.1.2. Water quality

In a recent article, Monarcheva and Gudas (2009) review three contingent valuation studies that have presented monetary WTP estimates for improving the water status in the river basins of the Nevezis (Lithuania), the Ludza (Latvia), and the Valgejogi (Estonia). The Lithuanian and Latvian studies measured the WTP for improving water quality from poor to good, while the purpose of the Estonian study was to estimate the value of restoration of salmon and other rare fish species in the Valgejogi River. These studies differ in certain respects. Firstly, the Lithuanian and Latvian studies focus on water quality and the Estonian on restoration of fish populations. Secondly, the authors mention a significant socio-economic difference between the Latvian study and the other two, as the Latvian study area has low population density and low income levels. Since WTP estimates are generally strongly correlated to income, it is reasonable to expect that the Latvian WTP is lower than the Lithuanian. The results, expressed in annual WTP in euros per household, are reported in the table below. The values in brackets represent estimates when zero bidders are included.

Table 3. Willingness to pay (WTP) for improving water quality of river basins in the Baltic states, euro per year

Environmental good	WTP per year per household, euros
Restoration of salmon and other rare fish species in Valgejogi river (Estonia)	22.8 (22.8)
Improving the water quality of Lake Ludzes and the upper part of the river Ludza river basin (Latvia)	13.7 (6.2)
Water quality improvement of the Nevezis River basin (Lithuania)	20.5 (13.3)

Source: Monarcheva and Gudas (2009)

In order to use the WTP for water quality estimates we would like to know whether implementation of EU directives on urban waste water management will result in improvements that have been valued by the Estonian, Latvian, and Lithuanian studies. The Estonian estimate concerning restoration of fish stocks seems less suitable for our purpose. The Latvian and Lithuanian studies seem to be more in line with expected impacts from improved sewage treatment. Including zero bidders, the Latvian and Lithuanian estimates produce a span of WTP for water quality improvements ranging from 6.2 to 13.3 euros annually per household. Assuming that the Latvian and Lithuanian WTP estimates approximately relate to the water quality benefits of the EU directive, this suggests that benefits might not be sufficient to cover the remaining 90 percent of the costs of about 12.6 euros.

5.1.3. Drinking water

Experience from Poland implies that public willingness to pay for municipal services is higher for drinking water than for waste water services: see Stanek (2002). This seems logical based on the fact that people pay relatively more for safe drinking water, such as bottled water. However, a high WTP for drinking water does not seem to be the case for the Ukmerge municipality. One explanation may be that the WTP for safe drinking water only concerns a limited quantity of the water consumption of an average household. In the background documentation of the Ukmerge study, DEPA and DANCEE (2001) report the WTP for water

supply. According to DEPA and DANCEE (2001), the quality of tap water distributed to households in Ukmerge municipality is checked regularly, but due to insufficient water pipe maintenance, households from time to time receive tap water with an orange/red colour or an odour. Respondents in Ukmerge were asked to value the benefit of upgrading the water supply pipes to ensure that the water supply system would be safe and so that no colour or odour would be present. The WTP was estimated to be 1.44 litas per person, per year, which corresponds to approximately 74,880 litas per year for the whole municipality. The estimated annual cost of upgrading the water supply pipe in Ukmerge municipality was estimated at approximately 10 million litas, suggesting that benefits cover less than 1 percent of investment.

5.1.4. Promotion of biodiversity

Ehrlich *et al.* (2008) compared the costs and benefits of biodiversity enhancement by expanding the area covered by semi-natural plant communities in Estonia. Semi-natural plant communities, such as meadows, were developed by scythe, axe, fire, and grazing. These landscapes can persist only with support from human activity, such as mowing, grazing, and brush cutting. In 2007, semi-natural plant communities covered approximately 10,000 hectares in Estonia and the area is declining. Since these semi-natural plant communities are a prerequisite for richness in biodiversity and for migrating birds, the decline of traditional farming activities has put biodiversity under threat.

Ehrlich *et al.* (2008) estimated that annual WTP was 265 euros per hectare of semi-natural plant communities. This amount was derived from the annual WTP estimate of 11.8 euros per person of the working age population. Based on an inventory covering all 31 protected areas in Estonia, the costs were collected for extending preservation of semi-natural plant communities to all Natura 2000 areas. This inventory was a base for Estonia's funding plan for the priority theme promotion of biodiversity and nature protection. The present value of costs for extending the preservation areas to 19,334 hectares was estimated at 56.3 million euros. The cost estimate includes both running costs and investment costs during a 30 year period using a discount rate of 5 percent. The present value of benefits was found to be 89.0 million euros. The results indicated that willingness to pay for biodiversity enhancement exceeded costs by 58 percent.

5.1.5. Benefit transfer

The cost-benefit rule can only be applied to four priority themes, and this scattered evidence gives point estimates for Lithuania in three out of four cases and in one case for Estonia. Benefit transfer from one country to another is a relatively common practice in literature and for policy purposes. However, differences in socio-economic characteristics and in the physical characteristics of study sites influence WTP. Generally, income is the most important variable affecting WTP estimates.

The authors of the Lithuanian studies (see DEPA and DANCEE, 2001 and Bluffsone and De Shazo, 2003) assume that their results can be transferred to Lithuania as a whole. This

is based on the fact that the socio-economic characteristics of Ukmerge are assessed as representative of the whole country. The Estonian study is based on a representative sample of the working age population (see Ehrlich *et al.* 2008). There are some differences in GDP per capita between the Baltic States, but from an EU perspective the income levels are similar. In addition, EU directives have imposed comparable requirements on the Baltic States.

Assuming that it is possible to transfer the above results between the Baltic states implies that too many funds will be devoted to improving drinking water supply. Waste management funding probably also receives more funds than desirable. Connection to the municipal sewerage system and upgraded waste water treatment can only be motivated if the benefits of improved water quality are added to the benefit estimate. The scattered evidence further suggests that promotion of biodiversity receives too little funding. The results thus imply that from an efficiency point of view the funding plans will oblige the Baltic states to invest more than is socially desirable in drinking water and waste management. The implication is thus that support to drinking water and waste management should be reduced, while financing of biodiversity should be increased.

5.1.6. Cross border benefits

Prior to arriving at conclusions concerning the first step of the assessment, it will be important to assess potential cross border benefits. We expect that more expenditure is allocated to priority themes that give rise to cross border benefits than can be motivated by national benefits.

The priority themes of the environmental sector that can motivate costs exceeding national benefits are those that have significant cross border impacts. Potential priority themes include pollution control in those cases when air and water pollutants spread on a regional scale. Reduction of environmental risk could have cross border benefits if environmental damage spreads across national borders. Promotion of biodiversity, natural assets, and natural heritage might also have cross border benefits if citizens in other countries express use value or non-use value for preservation.

Probably the most important cross border benefits are those that concern the water quality of the Baltic Sea. In the mid 1990s an extensive inter-disciplinary study on the state of the Baltic Sea was carried out by Turner *et al.* (1999). The authors simulated a 50 percent nitrogen and phosphorus reduction scenario. According to Turner *et al.* this corresponds approximately to nutrient levels of the Baltic Sea in the 1960s before its drastic deterioration. Cost effective policies for reducing nitrogen levels were found to include increased waste water treatment capacity at sewage treatment plants, reduction of use of nitrogen fertilisers, and construction of wetlands. Sewage treatment was proposed as a relatively low cost reduction option for reduction of phosphorous. On the other hand, benefits of waste management and of improvement of drinking water are geographically limited and high funding levels cannot be motivated by cross border benefits.

The costs of nutrient reductions were compared to the benefits. Two WTP surveys were carried out: one in Poland and the other in Sweden, asking the adult population in each country

for their willingness to pay for a 20 year action plan to reduce eutrophication in the Baltic Sea. The action plan would be financed by introduction of an extra environmental tax. The willingness to pay estimates were transferred to the other countries around the Baltic Sea by adjusting WTP estimates to the levels of GDP per capita. The Polish values were transferred to the formerly planned economies and the Swedish values were transferred to the other countries: see Turner *et al.* (1999).

In order to achieve a better fit to current circumstances, WTP estimates for improving the status of the Baltic Sea have been updated and new estimates have been derived by using meta-regression analysis based on a large number of willingness to pay studies for improved water quality: see Huhtala *et al.* (2009). The authors found an average WTP of 60 euros per person and per year. This was then converted to country specific estimates by using country specific data on GDP per capita. The results are shown in Table 4. The population figures represent an estimate of the adult population in the Baltic Sea drainage basin of each country.

Table 4. Distribution of benefits between Baltic Sea countries based on meta-regression results, benefits in euros 2007

Country	Average annual WTP per person	Population (in millions)	Benefits per year (million euros)	Percentage of total benefits
Estonia	45.2	1.05	47	1.8%
Latvia	38.8	1.78	69	2.7%
Lithuania	40	2.42	97	3.8%
Denmark	71	3.58	254	9.9%
Finland	68	3.86	262	10.2%
Germany	66.2	2.45	162	6.3%
Poland	36.6	25.85	946	36.9%
Russia	33.5	7.00	235	9.2%
Sweden	72.6	6.78	492	19.2%
Total		54.77	2 564	100.0%

Source: Huhtala *et al.* (2009)

Clearly, the WTP estimates for sea water quality in the Baltic States are higher than the WTP estimates for water quality in river basin areas reported in Table 3. This is in line with the findings of Huhtala *et al.* (2009) who report that the type of water body is influential in determining willingness to pay values. If the affected water body is a sea area, willingness to pay is on average 31–42 euros higher than for other water bodies. Although improved waste water treatment represents only one of the measures for achieving better Baltic Sea water quality, the WTP estimates in the table suggest that the benefits are substantial for all countries that border the Baltic Sea.

5.2. Environmental Performance Index

The efficiency criterion in terms of the cost-benefit rule carries information about the desirability of investment in a sustainability perspective. However, the problem of finding proper accounting prices necessitates collection of inputs from other sources about the state of the environment. For this reason and since available evidence of the cost-benefit rule is rather

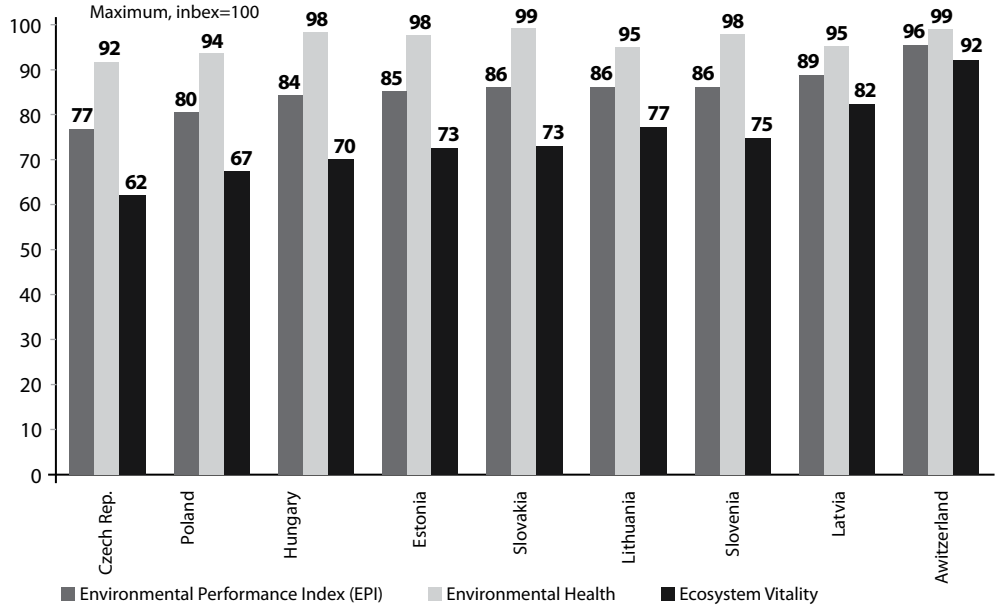
narrow, we have chosen an empirical source that allows cross country comparison about environmental status.

The Environmental Performance Index (EPI) gives input by assessing current national achievement towards environmental targets (see Esty, *et al.* 2008). The two overarching environmental objectives of EPI include: reducing environmental stress to human health (i.e. environmental health) and promoting ecosystem vitality and sound natural resource management. These objectives and the overall ranking of the eight Eastern European countries that joined the EU at the same time as Estonia, Latvia, and Lithuania plus Switzerland is shown in the figure below. The reason for including Switzerland is that this was the country with the highest EPI in 2008.

Latvia, with an index of 89, scores the highest value of the index among the East European countries that joined the EU together with the Baltic states. Lithuania and Estonia have 86 and 85 as index values, placing them top after Latvia and Slovenia. Based on Figure 1, it is also possible to conclude that the problems of environmental performance in Eastern Europe involve ecosystem vitality and sound natural resource management rather than environmental stress to human health (i.e. environmental health). This might be taken as an additional indication of over-investment in such priority themes as drinking water supply.

The ecosystem vitality index is further decomposed into four indicators. Figure 2 takes a closer look at this index of the Baltic States. Three of the indicators show the status of threats to ecosystems, such as water and air pollution and climate change, and the fourth indicator

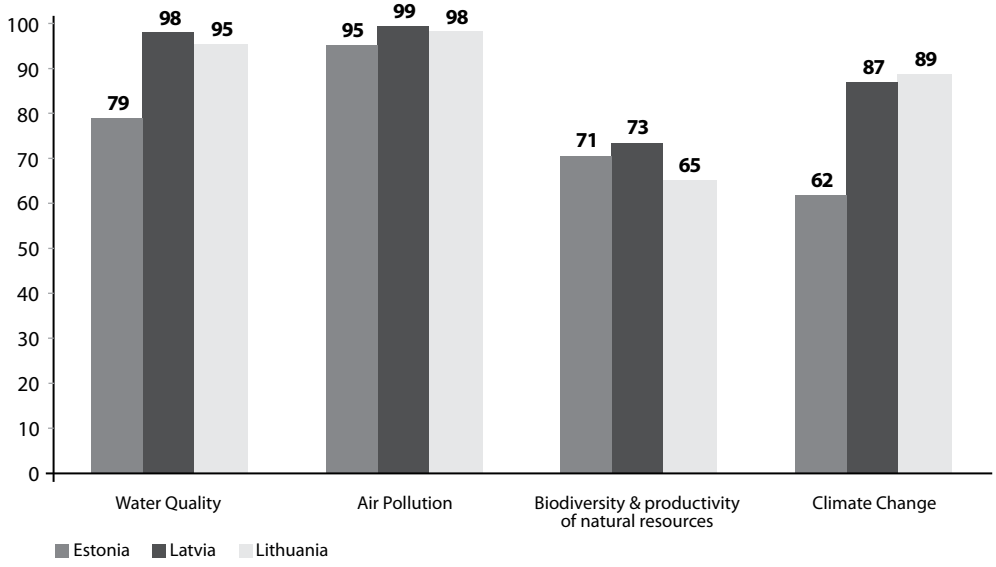
Figure 1. Environmental performance index of countries that became EU members in 2004 plus Switzerland, EPI 2008



Source: Esty *et al.* (2008)

measures the state of ecosystems including aspects such as species protection, forest, agricultural, and fishery re-productivity. The Baltic states score ranks lowest in biodiversity and productivity of natural resources. Estonia has a low position in climate change depending on large-scale use of oil shale in its energy sector.

Figure 2. Ecosystem vitality index decomposed into four fields (maximum index=100), Baltic States 2008.



Source: Esty *et al.* (2008)

The policy implications of EPI are that the Baltic states should pay more attention to biodiversity (e.g. conservation of habitats) and productivity of natural resources (e.g. fishery and cropland intensity). Both efficiency motivations and EPI thus suggest that more funds should be allocated for biodiversity and less for drinking water provision. In addition, EPI proposes that more attention is paid to enhancement of natural resource productivity, i.e. fisheries and cropland. In terms of priority themes, rehabilitation of industrial lands, promotion of biodiversity, and promotion of natural assets are put forward by EPI. Although water quality does not stand out as being at risk, productivity of fisheries needs attention, thus indicating the importance of upgrading waste water treatment.

6. Relevance to sustainability

The analysis in the previous section suggests some implications for sustainability of cohesion fund allocation to the environmental sector in the Baltic states in 2007-2013. However, it was not possible to include all priority themes in the analysis because of gaps in knowledge about the benefits and costs of several priority themes. Waste water treatment and promotion of biodiversity passed the cost-benefit rule. Management of household and industrial waste did not pass the criterion, although benefits were not far from covering costs. Drinking water supply was rejected.

EPI was used as a complementary input, and supported the scattered evidence of the cost-benefit rule. In addition, EPI suggested that rehabilitation of industrial lands, promotion of biodiversity, and promotion of natural assets would be important from an ecological point of view. In order to arrive at an overall assessment we will take the analysis one step further by classifying all priority themes under study into four fields (see matrix in Table 5).

Table 5. Classification of priority themes 2007-2013

Biodiversity and resource productivity	**Pollution control**
Rehabilitation of contaminated land	Waste management
Biodiversity and nature protection	Waste water treatment
Promotion of natural assets	Air quality
Protection of natural heritage	Integrated prevention and pollution control
Preventive measures	**Incidental environmental expenditure**
Mitigation and adaptation to climate change	Management and distribution of drinking water
Risk prevention (plans and measures to prevent and manage natural and technological risks)	
Other measures to preserve the environment and reduce risks	

Biodiversity enhancement in Estonia was supported by the cost-benefit rule. In addition, EPI further highlighted the need to promote biodiversity and resource productivity in the Baltic States. Four priority themes are classified as enhancing biodiversity and resource productivity and these will be classified as highly relevant for sustainability of the environmental sector.

The theoretical framework emphasized the long run perspective and proposed that sustainability concerns future generations into an infinite future. This long term perspective has so far not been highlighted by the analysis. Since preventive measures allocate funding to future environmental problems, this category will be classified as highly relevant to sustainability. Three priority themes are included among preventive measures: mitigation and adaptation to climate change, risk prevention, and other measures to reduce risks.

Four priority themes aim at reducing pollution. These include waste management, waste water treatment, air quality, and integrated pollution control. According to EPI, the status of water and air pollution is at satisfactory levels in Latvia and Lithuania. At the same time, WTP estimates for improving the water quality of the Baltic Sea show significant benefits. The level of funding of waste management did not pass the cost-benefit rule. These considerations imply that investment in pollution control can be considered as having medium to high relevance for sustainability.

The remaining expenditure is classified as incidental environmental expenditure. This classification follows Vincent *et al.* (2002) who classify incidental environmental expenditure as expenditure undertaken for non-environmental reasons. Drinking water infrastructure falls under this category. Neither the cost-benefit rule nor EPI suggests that drinking water is important from the perspective of sustainability. Incidental environmental expenditure is thus classified as having low relevance from a sustainability perspective. Table 6 below shows funding support from EU cohesion funds according to the four fields defined above.

The table shows that the Baltic States have allocated 10-24 percent of cohesion funds to biodiversity and resource productivity. Preventive measures receive 3-14 percent of funds. This

implies that the two fields found to have high relevance for sustainability have been allocated less than half of the cohesion policy funding directed to the environmental sector. Latvia devotes least funds for investment in fields that will add most to sustainability (12.6 percent). Estonia allocates 37.1 percent and Lithuania 24.6 percent of environmental cohesion funding to these two fields.

Funds for reducing pollution were found to have medium to high relevance for sustainability. Pollution control receives more than half of the funds devoted to the environmental sector in Latvia and Lithuania and a little more than one third in Estonia. In per capita terms, funding is on a similar level in the three countries and will receive about 200 euros per capita in each country during the period 2007-2013. Incidental environmental expenditure, the field classified as having least relevance to sustainability, will receive between one quarter and one third of funding to the environmental sector.

It is evident that priority themes classified as having highest relevance to the sustainability perspective receive less funding than priority themes found to be of low and medium/high relevance to sustainability. Estonia, with its larger per capita contribution to the environment, also shows higher investment both in absolute terms and in percentages to fields highly relevant to sustainability. Lithuania, which ranks lowest according to its per capita funding, shows a better position than Latvia concerning allocation to fields highly relevant to sustainability.

Table 6. Cohesion funding for the environmental sector classified by relevance to sustainability, euros million current prices, euros per capita and percentages 2007-2013

Euro, million	**Estonia**	**Latvia**	**Lithuania**	**Total**
Biodiversity and resource productivity	184.2	75.0	180.7	439.9
Preventive measures	105.5	25.2	78.6	209.2
Pollution control	287.8	411.0	656.6	1,355.4
Incidental environmental expenditure	203.9	281.5	137.4	622.8
Total	781.3	792.7	1,053.4	2627.4
Euro, per capita				
Biodiversity and resource productivity	137	33	53	63
Preventive measures	79	11	23	30
Pollution control	214	180	194	193
Incidental environmental expenditure	152	123	41	89
Total	582	347	311	375
Percent				
Biodiversity and resource productivity	23.6%	9.5%	17.2%	16.7%
Preventive measures	13.5%	3.2%	7.5%	8.0%
Pollution control	36.8%	51.8%	62.3%	51.6%
Incidental environmental expenditure	26.1%	35.5%	13.0%	23.7%
Total	100.0%	100.0%	100.0%	100.0%

7. Conclusion

The purpose of this paper is to evaluate sustainability of investment plans of EU cohesion policy funds for the environment in Estonia, Latvia, and Lithuania during the budget period 2007-2013. Theoretical literature shows that the efficiency criterion, i.e. the cost-benefit rule, is applicable to identify sustainable investment. But since natural environments are complex, proper accounting prices may be hard to find when relying on human preferences. With these difficulties in mind, we applied a step-wise assessment to identify sustainability. Economic efficiency was considered by using the cost-benefit rule. In the second step we used the Environmental Performance Index (EPI) as a complementary indicator and to identify whether critical fields of investment in the environmental sector had been left out.

Use of the cost-benefit rule requires information on benefits and costs of planned investment. This information was only available for four out of twelve priority themes. Assuming that benefit transfer is possible between the Baltic states, available evidence suggests that too much funding is devoted to investment in drinking water infrastructure. Neither did management of household and industrial waste pass the cost-benefit rule, though benefits were not far from covering costs. Investment in sewerage services and waste water treatment were not possible to motivate unless benefits from environmental impacts on water bodies were included. Another implication is that investment in biodiversity protection could be extended since benefits significantly exceed costs.

The complementary input of EPI supported the scattered evidence of the cost-benefit rule. EPI showed that the Baltic States have no serious concerns related to environmental stress to human health, which might be taken as an additional indication that allocation of cohesion funds represents over-investment in drinking water infrastructure. The implication of the environmental performance index is that more attention should be paid to biodiversity (e.g. conservation of habitats) and productivity of natural resources (e.g. fishery and cropland intensity). Although water quality did not stand out as being at risk, productivity of fisheries was suggested by EPI to be at a low level, thus indicating the importance of upgrading waste water treatment.

Both steps of our analysis had similar implications, but neither was detailed enough to enable an assessment of all priority themes. In order to obtain an evaluation of all priority themes, we classified them into four fields. These fields were categorized according to their relevance to sustainability. The main finding is that the Baltic States allocate least investment to those fields of the environmental sector found to be most relevant to sustainability, i.e. preventive measures, and biodiversity and resource productivity.

Investment in drinking water was assessed as too large from the sustainability perspective. Having as an objective to reduce disparities between Member States, distributional considerations may have guided funding plans. It is not clear, though, how extensive investment in drinking water infrastructure promotes this purpose.

Another finding is that the three Baltic states, having large similarities concerning recent history, level of economic development, and natural environment, show significant differences concerning their priorities. Estonia has the highest per capita contribution to the environ-

mental sector and also larger investment in fields with the highest relevance to sustainability. Lithuania ranks lowest according to its per capita funding, but shows a better position than Latvia concerning highly relevant fields. It is possible that Estonia's significant environmental problems stemming from oil shale based energy production have made the country more inclined than its Baltic neighbours to invest in the environmental sector and also more ready to direct investment into fields with high relevance to sustainability.

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