Working Paper 409

Environmental Fiscal Instruments: A Few International Experiences

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ISBN 978-81-7791-265-4

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Working Paper Series Editor: **Marchang Reimeingam**

ENVIRONMENTAL FISCAL INSTRUMENTS: A FEW INTERNATIONAL EXPERIENCES

Rajat Verma[*] and K Gayithri[†]

Abstract

This paper attempts to document the status of Environmental Fiscal Instruments *(EFIs) to explore the relative international experiences of eco taxes in the context of India and examine India's specificities in these taxes in a wider perspective of other fiscal measures. Environmental levies across 15countries were reviewed and categorised into Annex-II and Non-Annex-I groups. Further, revenues from these levies in the 15 countries were also analysed. The most common form of taxes in the Annex II countries is energy tax which is followed by transport taxes. For India, energy and transport taxes could prove to be vital types of eco tax for addressing issues of climate change. Pollution taxes would be difficult to levy due to administrative difficulties but resource taxes would be imperative because of severe environmental problems associated with mining and related activities. Revenue generated from the levy of environmental taxes/charges for all the Annex II countries hovered between 2 to 4% of their respective GDP except for Canada and US. On the other hand, for Non-Annex I nations this lay only between 0 to 1%.*

JEL: H23, Q50, Q58
Keywords: Environmental Fiscal Instruments, Environmental Taxes, Externalities

Introduction

Provisioning of environmental goods suffers from market failure[1] for which externalities are one of the prime causes. This is because environmental goods are considered to be public goods whose property rights are not clearly defined leading to their over exploitation, for example lakes, forest resources, atmosphere etc. (Coase, 1960). This not only affects these environmental resources but also the living and non-living bodies in and around these resources which are intricately linked to each other, either directly or indirectly. Thus, generating negative externality i.e. deterioration of the entire ecosystem either in quality or in quantity or both. On the other hand, market failure in the context of environment also exists where a positive externality is generated due to innovations in environment-friendly technologies such as production of electricity through solar, wind or tidal energy. In such cases there is a situation of underinvestment because the costs involved in generating such technologies are huge and private benefits accrued to the investors are normally less than their social benefits, therefore leading to a sub-optimal level of output. Given this backdrop, an attempt will be made in this study to understand the role of Environmental Fiscal Instruments (EFIs) in addressing the issues of market failure, specific to India, by reviewing the levy of these instruments across a few environmentally-active countries and other emerging countries in this area. Reviewing these instruments also become imperative because

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We are grateful to Prof R S Deshpande, Prof S Madheswaran and Dr Barun Deb Pal; Panel Experts Prof Abdul Aziz and Dr Elumalai Kannan for their valuable comments and support. The authors are also thankful to the anonymous referees for their suggestions and comments. Based on the comments and suggestions the paper has been revised. The usual disclaimer, however, remains.

they have already shown its positive impact on environment in several European countries (refer to Table 1).

EFIs could be defined simply as those fiscal instruments that are pro-environment, such as giving subsidies to solar projects, taxing polluting activities, etc. These instruments achieve environmental improvement by targeting both positive as well as negative externalities. Hence, these instruments can be broadly divided into two groups: instruments that address positive externalities and those targeting negative externalities (Figure 1). The first group consists of environmental subsidies and environmental tax expenditure whereas the second group consists of environmental taxes/charges. Classification of first group is different from the existing literature on environmental policy (Kosonen and Nicodeme, 2009), because generally this group is classified only under the category of environmental subsidies. Further, the categorisation of the EFIs is normally not explicitly linked with the issue of market failure in the literature. Thus, in this study not only different and a more meaningful categorisation of EFIs has been provided but also these instruments have been linked explicitly with market failure.

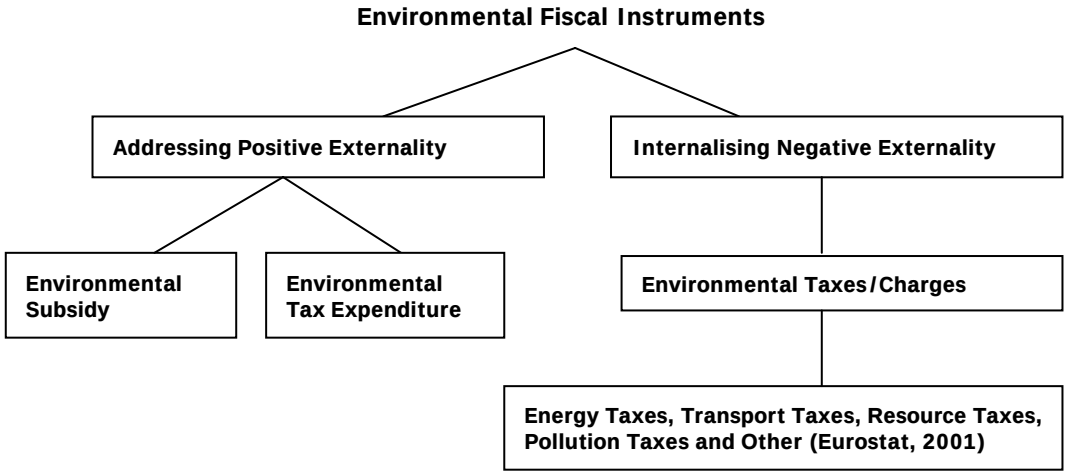
A probable reason as to why EFIs in the literature are generally classified under the first two categories, i.e. taxes/charges and subsidies, is because fiscal instruments emerge from the area of public finance which has been traditionally defined by Dalton (1922) as a subject which, *"is concerned with the income and expenditure of public authorities..."*. Defined this way, taxes/charges are concerned as income for the government, and therefore, would address negative externality by levying a fee, whereas subsidies would account for some share of the government's expenditure and would address positive externality by providing incentives. Hence, this justifies the general categorisation of EFIs into taxes and subsidies. But, this study considers tax expenditure to be different from the subsidies given by the government for addressing positive externality (Figure 1). This is because tax expenditures for any government could be simply defined as the revenue forgone by the government on account of tax concessions. The revenue forgone could either be in the form of reduced tax rates or there could be a complete tax exemption which is normally used for promoting R&D in environmentally viable projects. Therefore, such concessions would relate to the revenue forgone by the government whereas, subsidies are the direct payments by governments to either encourage consumption/production of a commodity. This study, thus, differs from the categorisation of tax concessions as a part of subsidies by Kosonen and Nicodeme (2009) and is similar to that of Goulder (2005) who considers tax credits as an additional fiscal instrument for environment protection. This framework will be utilised in the study to attain the objective of documenting eco taxes in the wider perspective of EFIs and also analysing the revenue of eco taxes.

Table 1: Impact of a Green Shift in Taxation: Selected International Evidence

Country and Tax	Period Evaluated	Impact
Finland: Energy and Carbon Tax	1990-2005	CO2 emissions 7 percent lower than would have otherwise been; A shift from carbon tax to output tax on electricity in 1997 may have lessened impact
Norway: Carbon and Sulphur Dioxide Taxes	1991-2007	21 percent reduction in CO2 from power plants by 1995; 14 percent national reduction in CO2 in the 1990s; 2 percent attributed to carbon tax; 12 per cent reduction in CO2 emissions per unit of GDP
Denmark: Energy and Carbon Tax	1992	CO2 emissions in affected sectors down by 6 percent and economic growth up by 20 percent between 1988 and 1887 and a 5 percent reduction in emission in one year in response to tax increase; In 1990s a 23 per cent reduction in CO2 from as usual trend and energy efficiency increased by 26 per cent; Subsidy to renewables may have accounted for greater proportion of emissions reductions than tax
Sweden: Energy and Carbon Taxes	1990-2007	Emissions reductions of 0.5 million tonnes per annum; Emissions would have been 20 per cent higher than 1990 levels without tax
The Netherlands: Energy Tax	1999-2007	Emissions 3.5 per cent lower than would have otherwise been; Low tax rates may have limited impact
Germany: Environmental Tax Reform, Taxes on Transport, fuels and electricity	1999-2005	CO2 reduced by 15 per cent between 1990 and 1999 and 1 per cent between 1999 and 2005; CO2 emissions 2-3 per cent lower by 2005 than they would have been without tax; German re-unification an important factor in reductions
UK: Industrial Energy Tax	2001-2010	UK CO2 emissions reduced by 2 per cent in 2002 and 2.25 per cent in 2003 and cumulative savings of 16.5 million tonnes of carbon up to 2005; Reduction in UK energy demand of 2.9 per cent estimated by 2010

Source: Green Fiscal Commission (2009) as cited in Srivastava and Kumar (2014)

Figure 1: Categorisation of Environmental Fiscal Instruments



Source: Authors' Construction

Data and Methodology

The documentation of the EFIs has been done by using the only comprehensive database available, i.e., OECD/EEA database[2]. This database not only gives extensive information about various kinds of EFIs used across several countries but also gives the revenue details for these instruments. For a meaningful analysis of these policy options across the countries, a set of 15 countries were chosen. These countries were chosen from the classification of UNFCCC[3] which categorises the signatories' of this convention into three broad groups: Annex I, Annex II and Non-Annex I. Since the fiscal policy options examined here relates to preservation of environment, the choice of the countries from UNFCCC is obvious. The 15countries have been chosen from the group of Annex II and Non-Annex I countries because the former group, which consists of developed countries, would not only give financial and technical assistance to the latter, which consists of developing countries, but would also assist in developing and transferring environment-friendly technologies (UNFCCC, 2014). The development of these technologies would also require adoption of certain EFIs such as tax exemption, reduced taxes, tax credit etc., by both Annex II and Non-Annex I countries, thus justifying the usage. Such a choice would also ensure a rich mix of developed and developing countries.

From the group of Annex-II countries,11OECD countries have been selected of which five are Nordic countries –Denmark, Finland, Iceland, Norway and Sweden – and the rest are Australia, Canada, Netherlands, Germany, United Kingdom (UK) and United States of America (USA). The Nordic countries were chosen because they are considered to be the most environment conscious countries around the globe and they are also the pioneers in levying environmental taxes (OECD, 2002 and 2006 as cited in Barde and Godard, 2012). The other European countries – Germany, The Netherlands and United Kingdom – were included in the list because they are also environmentally active (Szigeti, 2005). On the other hand, Australia, Canada and USA are chosen because, among the non-European OECD members, these countries recently have been pro-active towards environmental improvement. Amongst the Non-Annex I group, BRICS nations have been selected so as to analyse the development of ecotaxes among the developing countries which are comparable in terms of their macroeconomic structure to a certain extent. Though, Russia had to be excluded due to non-availability of data for EFIs and also because it is a part of Annex I countries. Thus, we were able to make a comparison only across the other four BRICS countries i.e. Brazil, India, China and South Africa.

The second objective of this study is to examine the revenue of ecotaxes. This will be done by comparing the revenue generated from the levy of ecotaxes in the 15 countries selected above from the OECD/EEA database. On the contrary, analysing the financial cost of subsidies and tax expenditures would have been the optimum measure to examine the cost associated with these measures to the exchequer but this could not have been fulfilled due to unavailability of data. Analysing revenue generated from these taxes is imperative because it is a by-product of such a levy which could be used for various environmental and developmental purposes including financing of environmental subsidies. Further, provided the petty condition of provisioning of environmental goods in India it becomes an important policy question to analyse how best the revenue from these instruments could be utilised.

For making appropriate comparisons among the different countries, the absolute revenue details were converted into relative ratios of GDP and total tax revenue for the Annex II countries and GDP, and total net indirect taxes for the four Non-Annex I nations. Since the data on total tax revenue for the Non-Annex I nations was not available from a common database, data on their net indirect taxes were, therefore, obtained from the World Bank database. Also, GDP figures for these countries are not available from OECD/EEA data base, hence, these were also taken from the World Bank database. The GDP figures for Annex-II countries are at current prices and current exchange rates whereas, for Non-Annex I nations, the GDP is at current prices. The data on total tax/net indirect tax revenue is also in nominal values. This would not affect the analysis because the concern here is ratios and not absolute values. Therefore, if both the numerator and denominator are in nominal or real values, the ratios will not be affected. All the analysis has been done from the year 1994 to 2010. Even though the revenue for certain taxes is available for the year 2011 and 2012, this is for a very few taxes and hence, it distorts the analysis by showing an abrupt decline in the ratios. Therefore, to keep the analysis uniform the period of assessment was restricted only till 2010.

Status of EFIs in Annex II and Non-Annex I Countries

In this section, a detailed review of EFIs that have been levied in 11 Annex II and four Non-Annex I countries will be done. This section has been divided into two sub-sections wherein the first sub-section gives details of environmentally related taxes and charges, and the second, details about the various environmental subsidies and tax expenditures used across these countries.

Status of Environmentally Related Taxes/Charges

The levies in this section have been classified into six categories i.e. Energy taxes, Transport taxes, Pollution taxes, Resource taxes, Others and Fee/Charges. The first four categories are adopted from Eurostat (2001)[4]as cited in Steinbach et al. (2009)whereas, the 'Others' category was added so as to group the rest of the environmentally related taxes which could not be classified under the first four categories. The fee/charges have been kept separately so that they could be differentiated from taxes. These taxes/charges have been categorised for both Annex II and Non-Annex I in two separate sub-sections.

Annex II Countries

Energy Taxes: Among the 11 selected Annex II countries, energy taxes are levied the most amongst the six environmental levies[5] as described above. It comprises 27% of the total environmental levies in these countries. UK and USA are the two countries which rely the most on energy taxes whereas, Australia the least. As much as 38% of the total environmental levies in both the countries comprises of energy taxes. On the other hand, only 9% of the total levies in Australia comprises of energy taxes. The tax bases of energy taxes majorly comprises of petroleum products and electricity across the countries. Further, all the countries levied some or the other form of energy taxes. Therefore, energy taxes are the most common form of environmentally related taxes. But, the range in the proportion of the usage of energy tax among these countries is 29 percentage points which is quite large.

Transport Taxes: Transport taxes are yet another important form of environmental levy in the Annex II countries as it comprises 14% of the total. Iceland uses it the most (30%) and Germany the least (9%). The variation for this tax is lesser than that of energy taxes but still it is 21 percentage points. The tax base is mostly on vehicles and the tax is levied both in the form of ad-valorem and per unit tax. The tax rate is progressive by differentiating on various basis, such as, seating capacity, weight of the vehicle, fuel used, etc.

Pollution Taxes: Four out of 11 countries do not levy any tax that could be categorised under pollution taxes. The total proportion of this tax is only 5% which shows that this is not a preferred tax in these countries. As per the definition of this category, the taxes which are levied upon the emissions are termed as pollution taxes. The unfamiliarity of these taxes shows the difficulties in administering this form of tax. It's difficult to monitor the emissions from the polluting sources and probably this is the reason why countries like Canada, Germany, UK and Iceland do not have any tax in this category. In this category, the proportion of these taxes is the highest for Australia (17%) and is followed by Netherlands (16%) and Norway (15%). Australia and Netherlands are the only countries that levy a pollution tax on noise generated from airplanes. Also, Australia's pollution taxes covers all the types of pollution as mentioned in the classification above i.e. air, water, solid waste and noise.

Resource Tax: This is yet another kind of tax that is not very familiar amongst the selected Annex II countries. Only 7% of the total levies consist of resource taxes. Finland, Germany, Iceland, Norway and UK don't have any examples of resource taxes. USA being the frontrunner in this category has 12% of its total levies as resource taxes. Rest of the countries' share ranges between 2 to 5%. USA has 30 such levies and these could be categorised under: severance tax, mining tax/license and timber tax. The other levies being some variation of these taxes. The tax bases for other countries are also similar to that of the USA.

Others: Since this category is not originally a part of the Eurostat's classification, it shows the limitations of this classification. All those taxes that couldn't be classified under the above four classes were placed under this category. As much as 23% of the total environmental levies could be treated as 'Others'. This category forms the third largest category amongst the six defined classes and it shows that the classification by Eurostat (2001) is not holistic. Maximum share of the environmental levies under this category is levied in US, Iceland and Norway. As much as 30% of the levies in these countries couldn't be classified under any of the four classes listed by Eurostat. Germany being the only country wherein all the levies were classified under the Eurostat's definition. The taxes that are majorly included under this category are taxes on hazardous chemicals and lead batteries, taxes on waste/sewerage and fees/charges on fishing, hunting, etc.

Fee/Charges: The environmental levies under this category are the second-most used in the Annex II countries and its total share is around 25%. Germany's 73% of the environmental levies are in the form of either a fee/charge and is the highest amongst the Annex-II countries' respective share of their

total environmental levies. On the other hand, for US this share is only 5%. Of the 16 charges levied in Germany, 11 are on water extraction. Similarly, other countries also levy charges on water extraction, hunting, sewage and waste management, etc.

Please refer to Table 2 for details of a few taxes in these countries.

Table 2: Details of a Few Environmentally Related Taxes in Annex-II Countries

Countries	Name of Tax	Specific tax base	Rate in Euros
Australia	Oil recycling levy	Petroleum based oils and greases and their synthetic equivalents	0.0384 per litre (liquids) or per kg (greases)
	Product stewardship oil levy	Lubricant oil	0.0396 per litre.
Canada	Motive Fuel Taxes	Diesel fuel	0.0658 per litre.
	Hydrocarbon duty	Coke used in steel production	0.0095 per kg.
Denmark	Duty on CO2	Coal	59.5243 per tonne.
	Duty on nitrogen	Nitrogen used by households	0.6702 per kg.
Finland	Excise on fuels and electricity	A Energy tax - 40 Coal	54.5400 per tonne.
	Strategic stockpile fee (Security of supply fee)	40 Coal	1.1800 per tonne.
Germany	Duty on electricity	Electricity consumption exceeding 4000 kWh per year in all-year dwellings that are heated by electricity	0.0552 per kWh.
	Nuclear fuel tax	Use of nuclear fuels	145.0000 per gram plutonium 239, plutonium 241, uranium 233 or uranium 235 used in nuclear fuel rods.
Iceland	Carbon tax	Diesel	0.0354 per litre.
	General excise on petrol	Unleaded petrol	0.1508 per litre.
Netherlands	Duty on petrol	Leaded petrol	0.6529 per litre.
	Fuel tax (tax on coal)	Coal	12.5600 per 1000 kg.
Norway	Basic tax on mineral oil	Heavy fuel oil	0.1995 per litre.
	CO2-tax on mineral products	Diesel	0.0794 per litre.
Sweden	Energy tax on electricity	Electricity consumption -- In certain remote parts of the country	0.0216 per kWh.
	Tax on nuclear power	Thermal installation in nuclear power stations	1462.2980 per MW and month.
United Kingdom	Non-fossil fuel obligation levy	Electricity production	0.7% of the price.
	Climate Change Levy	Coal consumption -- Ordinary rate	#N/A
United States	Compressed natural gas tax	Compressed natural gas	0.0364€ per litre.
	Aviation fuel tax	Kerosene for use in aviation, Leaking Underground Storage Tank LUST tax	0.0002 per litre.

Source: OECD/EEA Database

Non-Annex I Countries

While analysing the data for Non-Annex I countries problems were faced in categorising several taxes because of insufficient information. Thus, for those levies an additional category 'Data unavailable' was created.

Energy Taxes: In all, 30% of the total environmental levies in the selected Non-Annex I countries could be classified under energy taxes. Unlike Annex II countries, a major proportion of the taxes in Non-Annex I countries is not in the form of energy taxes. As much as 40% of the total levies in Brazil are in the form of energy taxes which is also the largest share in Non-Annex I nations. After Brazil, India has the largest share which amounts to 35%. On the other hand, China doesn't have any levy which could be strictly termed as energy taxes. It levies domestic consumption tax on fuels and cars which would come under both energy and transport taxes. The energy taxes in Brazil comprises of tax on electricity and fuel whereas, for India, almost all the states impose a tax on electricity which comprises a major proportion of energy taxes. On the other hand South Africa (SA) levies three different kinds of taxes on electricity, fuel and road accident. The tax to generate a fund for road accidents is levied on diesel and petrol and is termed as energy taxes.

Transportation Taxes: This is the largest category in terms of its share in the total levies. As much as 35% of the total levies in the selected Non-Annex I countries are in the form of transportation taxes. This is the only category in which all the four countries have some form of taxes. India and Brazil have the largest share amounting to 40%. For India, most of these are in the form of motor vehicles tax but it also has a few examples of taxes on old vehicles so as to discourage their use. There are a total of six states that have this form of tax but not all the states are listed in the database (Verma, 2016). It is also evident from this study that there are other taxes as well which are missing from the OECD/EEA database. South Africa has the least share in this category amounting to only 12% of its total levies. These are in two forms: ad-valorem customs and excise duty, besides airport passenger departure tax.

Pollution Tax: China has the maximum share that amounts to 10% in this category. The situation is similar to that of Annex II countries because these taxes are also not prevalent in Non-Annex I countries. India and Brazil do not have any example of such taxes. Here also, a possible explanation is the difficulty in monitoring the emissions, especially from a non-point source, such as motor vehicles. China's pollutant charge system is one of the oldest emissions charge system across the globe. It was established in 1982 and was reformed in 2003 (Xu, 2012). On the other hand, SA levies a CO_2 vehicle emissions tax which was introduced only in 2010. It just has two differential tax rates which would be levied after crossing a threshold limit.

Resource Tax: The situation in this category is similar to that of pollution taxes and therefore both the categories have least share in terms of the levies in Non-Annex I countries which amount to only 2%.The only major difference is that in the category of pollution taxes, China and SA had a certain share, but here, only China has a share of 20%. None of the other three countries have any levy which

could be classified under this category. China's resource tax was introduced in 1993 and it has over 63 different categories under which various rates are charged. These categories consist of various minerals and the tax is levied on extraction of their ores.

Others: Only 3% of the environmental levies in Non-Annex I group were not classified under the Eurostat's categorisation. This share is minimal and is way less than in Annex II countries. China and SA are the only countries which have two environmental levies each that couldn't be classified under any of the above categories. While China levies tax on Farmland for non-agricultural use and also on Urban land-use, in SA there is a levy on Incandescent light bulb and Plastic shopping bag.

Fee/Charge: There are only 9% of the total levies that are termed as fee/charges in the Non-Annex I nations. Amongst the four countries, it's only SA and China which have these charges. In case of SA, almost half of its levies are fees/charges. On the other hand, China has only 20% of its levies as fee/charges. This is again a major difference between Annex II countries and Non-Annex I nations. They have 25% of their total levies as fee/charges. China and SA both have levied charges on water usage, as was also the case in Annex II countries. SA, apart from levying charges on water, also levies charges on electricity and airport activities.

Data Unavailable: The share of those levies for which data is unavailable amounts to 20%. Of this 25%is for India, 20% is for Brazil and 6% for SA. In case of India, data is insufficient for only one tax i.e, tax on goods and passengers which is levied in 21 States in India. This is why 25% of the environmental levies in India could not be classified in any of the categories due to insufficient data. There is no mention of the tax base or tax rate for this tax and only revenue is given over the period. Hence, it becomes impossible to classify it in any category. In the case of Brazil, the situation is similar to that of India because there is no information on tax rate and tax base for the tax named Contribution for Intervention in Economic Domain. Same is also the situation for the road licensing fee in the case of SA.

Refer to table 3 below:

Table 3: Details of a Few Environmentally Related Taxes in Non-Annex-I Countries

Country	Name of the Instrument	Specific Tax Base	Tax Rate (in Euro)
Brazil	Tax on the circulation of goods and services -- Electricity	Electricity	#N/A[6]
	Tax on the circulation of goods and services -- Fuels	Diesel	#N/A
India	Green tax on motor vehicles	Old Vehicles	Various rates depending upon the State in which it is levied and type of vehicle: Rates levied are: 3.056, 3.82, 7.64 15.28, 76.41
	Additional tax on electrical energy (Green cess)	All plants/generating companies in the state of Gujarat producing electrical energy	0.0003 per kW unit of energy
China	Pollutant charge	Discharge of Class I water pollutants	0.07
	Urban land-use tax	Land use in county, town and mining areas	0.07 - 1.37 per m²
South Africa	Electricity Levy	Electricity generated from non-renewable sources	0.0027
	Carbon dioxide vehicle emissions tax	Double cabs-CO2 emissions above a threshold of 175 gCO2/km	7.7991

Source: OECD/EEA Database

Status of Environmentally Related Subsidies and Tax Expenditures

In this section we will give details of the other two types of EFIs which were mentioned in the introduction, i.e. environmentally related subsidies and tax expenditures in the selected Annex II and Non-Annex I countries (table 4 and 5).Even though the database classifies these fiscal instruments under the broad class of subsidies, which is further classified as grants, soft loans, tax reduction and other, these have been placed under the two categories of subsidies and tax expenditure in this study on the basis of the fundamentals of public finance, as argued in the introduction section. The data for Non-Annex I countries is available only for India and China, hence, we were not able to analyse these EFIs for Brazil and South Africa. EFIs for which the classification was not clear are classified under the category of 'Others'. This category has been further divided into three sub categories for better identification: Others (Combination), Others (Insufficient Information) and Others (None).

Annex II Countries

Environmentally Related Subsidies: Under this category, in total 864 different parts of 569 EFI schemes have been analysed across 11countries. Of this, 395 schemes can be classified under environmentally related subsidies, as per the classification adopted in this paper. Thus, it forms 46% of the EFIs levied by the Annex II countries, which is also the largest proportion amongst this category. Further, all the EFIs levied in Denmark and Iceland are in the form of environmental subsidies. In case of Sweden, except for one EFI, all the others are in the form of subsidy. On the other hand, Norway is the only country which does not have any environmental subsidy.

There are various kinds of subsidies that are provided across these countries. Most of these countries give subsidies for conserving bio-diversity, forest, water; soft loans for green initiatives, energy efficiency programmes, renewable energy etc. Apart from these, many countries also have their specific subsidies, such as, subsidy for tyre recycling in Canada, subsidy for ecological buildings in Denmark, soft loans for pollution control activities in Finland and USA, market incentive programmes in Germany, carbon credits in Netherlands, etc.

Environmental Tax Expenditure: It is also widely used EFI in the Annex II countries as its total share in these countries is 41%, i.e. 352 in all. Norway has only three EFIs and all promote the use of electric vehicles by means of favourable income tax treatment and VAT exemption. On the other hand, Denmark, Germany and Iceland do not provide any kind of tax expenditure. After Norway, the share of EFIs in the form of tax expenditure is largest for Finland i.e.78% which amounts to 25 such EFIs. These instruments are diverse and ranges from subsidising vehicles using alternative fuels, such as biofuel, methane etc., to renewable electricity, pollution abatement methods, biogas etc. USA also relies heavily on tax expenditures as its share is 68% of the total EFIs used. Some of the examples are, tax concession/credit to agriculture water conservation system, renewable electricity generation techniques, energy-efficient commercial buildings, pollution control activities, alternative fuel vehicles, biodiesel, ethanol etc.

Others: This is the category which consists of those EFIs which were not classified under any of the two categories mentioned above. This category is further divided into three sub-categories: Others (Combination), Others (Insufficient Information) and Others (None). The first sub-category consists of those EFIs which use both subsidies and tax expenditure as a policy tool in a particular scheme, the second consists of those EFIs which were not classified because of insufficient information. The last includes those EFIs which neither follow the definition of subsidy nor that of tax expenditure. Canada is the only country that uses both subsidies and tax expenditure for five schemes which comprises of 4% of its total EFIs. Out of five such schemes four schemes are for disposing off old vehicles. One of these schemes is at the federal level whereas, other three are implemented by three provinces: British Columbia, Manitoba and Nova Scotia. The fifth scheme is for upgrading homes with efficient-energy products.

As much as 3% of the overall EFIs used across these countries could be classified under Others (Insufficient Information). Most of the EFIs which are under this category consist of soft loans

for which there is not much clarity as to whether the respective government bears the cost of these loans or the banks bear the costs. Seven per cent of the UK's EFIs were classified under this sub-head. The last category of Others (None) majorly consists of the grants that are offered by the public or private companies. For example, in the case of Canada all the 37%, or 52 EFIs, in this category are implemented either by the public or the private sector companies that are providing environment-friendly products/services. Thus, in a strict sense they cannot be considered as an environmental subsidy because here only those fiscal instruments are concerned which are levied by the governments. In total, there are 14% of the overall EFIs implemented by Annex II countries that are classified under the category 'Others'. Thus, this shows the lacuna in the database.

Table 4: Details of a Few Environmentally Related Subsidies in Annex-II Countries

Country	Name of the Instrument	Details
Australia	Biodiversity and natural icons	Aims to increase the area of native habitat and vegetation that is managed to reduce critical threats to biodiversity and to enhance the condition, connectivity and resilience of habitats and landscapes. Also aims to reduce the impact of invasive species.
	Low emissions energy development fund	LEED funding support of around AUD 30 million has been invested in a range of projects, including: wave, geothermal and solar thermal power generation; biomass projects including a mallee harvester, bio-fuel from algae and biomass pyrolysis and power generation from commercial and agricultural waste streams; LNG methane and carbon-dioxide recovery.
Canada	Subsidy for conservation of soil and water courses	#N/A
	Residential energy efficiency programme	Households with an income of $30,000 or less that use either home heating fuel or electricity as the primary heating source will be eligible for a grant of up to $200 for furnace testing and tune-ups, a $1000 grant to top up the financial assistance for energy-saving renovations available through the federal Ener Guide for Low-Income Households programme (limited to houses built before 1980), real-time power meters, and energy efficiency training courses for homeowners.
Denmark	Grants for environment-friendly agriculture	To improve the use of environment-friendly practises in the agricultural sector. Half of the financing is given by the European Union.
	# -- General subsidy for integrated product policy	Cleaner products - refund from CO2 tax: This is an extension of the other sub-scheme, where some of the revenues from the CO2 tax is used especially for subsidising the manufacturing industry.
Finland	Subsidy for sanitation/wastewater sector	Grant, max. 50% of costs.
	Electricity Conservation Check	Electricity Conservation Assistants visit low-income households to check where they can save on electricity expenses.
Germany	Support programme for hybrid buses in public transport	Investment into hybrid motors: The maximum grant amount for solo buses is EUR 150,000; articulated buses receive up to EUR 250,000.

	Municipal directive for the support of climate protection projects	Development of climate protection concepts
Iceland	# -- Subsidy for maintenance of forests	Income and corporate tax exemption for income of forestry owners.
	Energy investment allowance	This is a tax relief for investing in sustainable energy and certain types of energy-saving assets, providing an extra deduction in profit-before-tax of 44% of the total amount of qualifying energy investments in a calendar year.
The Netherlands	General support for environmental projects and activities	Companies, households, municipalities and civil organisations can apply.
	Subsidies for sustainable electricity generation	Electricity generation based on landfill gas: A grant per unit of electricity produced, with the following rates: 1.1.2004: 0.0; 1.7.2004: 0.006€; 1.1.2005: 0.021€ per kWh
Norway	VAT exemption for electrical vehicles	Electric vehicles are not subject to value added taxation.
	Return of taxes on fertilizer and pesticides	#N/A
Sweden	Eco car subsidy	2.5 year programme where 10,000 SEK were paid out to the buyer of an "eco car".
	Environmental support in agriculture	The main purpose is to reduce the pressure on the environment caused by agriculture, for example, by preservation of certain types of valuable land in the agricultural landscape, keep the landscape open, restore and preserve the environment of sensitive areas, and organic production.
United Kingdom	Boiler Scrappage Scheme	Rebate for new boilers: Households could apply for a grant of GBP 400 to replace a working G-rated boiler with an A-rated boiler.
	Green Bus Fund	Funding for low-carbon emissions buses: Large subsidies paid to organisations to invest in fleets of electric or hybrid buses.
United States	Energy-efficient home credit	Builders could receive USD 2,000 for houses built that used at least 50% less energy on heating and cooling than a comparable dwelling, and could receive USD 1,000 for a house that used at least 30% less (but less than 50%) energy on heating and cooling than a comparable dwelling.
	Grants for low-emission school buses	The grant enables the districts to obtain less-polluting school buses and new pollution control equipment for their current fleets.

Source: OECD/EEA Database

Non-Annex I Countries

Environmentally Related Subsidies: Only China has some cases of EFIs that can be classified under this category. Five out of 6 (83%) of the total EFIs implemented by China are in the form of subsidies. All these five EFIs are promoting the disposal of e-waste appropriately i.e. they are subsidising the recycling of air conditioners, computers, refrigerators, TVs and washing machines.

Tax Expenditure: There are only three schemes which could be classified under this category. Two of these schemes are provided by the State of Rajasthan in India which gives exemption of VAT on plant and machinery that is used for generation of electricity through renewable resources and on waste

paper. On the other hand, China provides favourable price to those thermal power stations which have installed desulphurisation and denitrogenation facilities for emissions from these power stations.

Table 5: Details of a Few Environmentally Related Subsidies/Tax Expenditures in Non-Annex-I Countries

Country	Name of the Instrument	Details
India	VAT exemption for plant and machinery used in the generation of electricity from renewables	Promote generation of electricity from renewables: Exempted from VAT are plant and machinery, including parts thereof, used in generation of electricity, from: (a) Solar (b) Wind power; and energy; (c) Biomass as defined under Policy for promoting generation of electricity from Biomass
	VAT exemption for waste paper	Promote paper recycling: Waste paper (raddi) is exempted from VAT.
China	Subsidies for energy-saving products to benefit the people programme	To accelerate the spread of high-efficient and energy-saving products and stimulate economic development: A certified recycler of e-waste will receive CNY 35, 85 & 80 as a subsidy from the government for each set of air-conditioner, personal computer & refrigerator respectively, they dispose off
	National scheme for subsidising recyclers of electronic and electrical waste	To promote the appropriate disposal of electronic and electrical waste: A certified recycler of e-waste will receive CNY 85, 35 as a subsidy from the government for each set of TV & washing machine respectively they dispose off.
	National scheme of favourable prices for electricity generated by coal-burning power plants with desulphurisation and denitrogenation facilities	To encourage coal-burning power plants to establish desulpurisation and denitrogenation facilities and reduce the emission of SO2 and NOx: Electricity generated by a coal-burning power plant with denitrogenation facilities will be offered a favourable price when it is sent to the national grid. The cost will be transferred to the consumers through price adjustment finally.

Source: OECD/EEA Database

Analysing the Revenue from EFIs

After reviewing the environmental levies across Annex II and Non-Annex I countries the revenue details for these taxes/charges will be analysed in this section. Under a strict Pigouvian framework the aim of an environmental tax would be never to maximise the revenue but to design the taxes in such a manner so that the revenue from these taxes would instead decline over the years. Therefore, the revenue raised from these taxes shall be viewed as by-product and shall be utilised to support any other cause, be it for financing certain environmental projects through provision of subsidies/tax expenditure etc. or for reducing the other distortionary taxes. This section is broadly divided into two sub-sections. The first analyses the revenue details from environmentally related taxes/charges. The second provides details of the paucity of data on financial costs incurred by the governments for providing subsidies and tax concessions.

Revenue Details of Environmentally Related Taxes/Charges

A. Annex II Countries

The 11countries have been categorised into three groups based on the pattern of their relative revenues: Relatively Stable, Relative Gradual Decline and Relative Steep Decline. The first group consist of Denmark, Finland, The Netherlands and Sweden; second group includes Australia, Canada and USA whereas the third group comprise of Germany, Iceland, Norway and UK.

Figure 2 to 4 gives the ratio of the revenue from environmental levies to GDP for the Annex II countries in the above mentioned order. As is evident from Figure 2, the environmental taxes/charges[7] revenue, as a proportion of its GDP, is clearly the largest for Denmark throughout the period under analysis. It begins from 4% of its GDP and reaches the maximum of 5% in 1999.The ratio remained almost stable during 2000 to 2006 at a level of 4.6% before falling back to around 4% in the subsequent periods. This downturn in the ratio after 2006 occurred because the rate of growth of GDP was more than that of ETR[8] (Table 6). Further, the relative steep decline in 2008 could be attributed to the global recession which not only affected the GDP but also the ETR for Denmark. This is also the case for all the other Annex II countries except that the decline for USA and Germany is not as steep as that of Denmark. This analysis is not possible for Australia and Canada because post 2007 and 2006, respectively, the data is discontinuous.

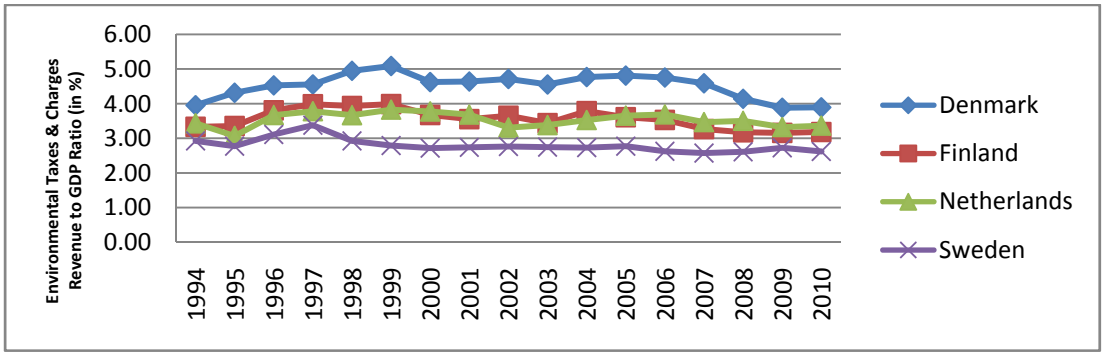
The second category depicts almost a continuous decline for Australia, Canada and USA except for certain periods where there is an abrupt increase in the revenue, such as 1997 and 2006 for Australia. This decline is relatively gradual when compared to the third category (Fig. 3 and 4). Iceland and UK show the steepest decline in the third group followed by Norway, but Germany is relatively the most stable of all. These countries move between a range of 2 and 3% on a whole, except for Iceland which dropped below 2% after 2007. This sudden drop is majorly because of a drastic decline in the revenue from two taxes: Excise on motor vehicles and petrol and diesel. The contribution of the former tax in the decline is the largest, amounting to around $97mn.

In the case of the proportion of the revenue from environmental levies to the total tax revenue for these countries the trend is almost similar except that the ratios are on a higher end[9]. The Netherlands moves closer to Denmark. In fact, it crosses Denmark in the year 2008 and stabilises at 9.39% whereas Denmark declines to 8.37%.Finland moves to around 8% and Sweden stabilises at around 6%. In the case of the second category, the pattern of decline is similar to that of Fig. 3 but the movement in the graph of USA is a little more evident. It begins at around 4% and ends around 2% of its total tax revenue. On the other hand, there is a much steeper decline for almost all the countries in the third category. But still, the pattern of decline is similar to that of Fig. 3. These countries move along a bandwidth of 6 to 9%of their respective total tax revenue.

Since for most of the countries the proportion lies between 5 to 10% of their total tax revenue and between 2-4% of their GDP, it shows that environmental levies form a substantial part of their taxes and also their economies. Among the European countries the dominance of the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) is clearly depicted in Fig. 2 and 4. These figures show clearly that ETR for all the Nordic countries lay between 2 to 5% of their GDP. The only non-Nordic European country whose ETR proportion lies close to Nordic countries is The Netherlands. Findings of

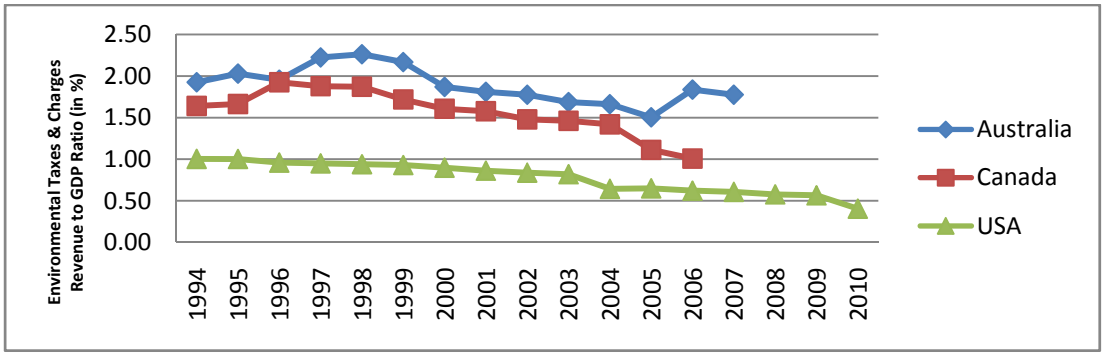
this study are similar to the existing literature (OECD, 2002 and 2006 as cited in Barde & Godard, 2012; Szigeti, 2005 and Srivastava and Kumar, 2014). Explanations for the patterns of ETR proportions for all the countries have been provided in Table 6.

Figure 2: Environmentally Related Taxes & Charges Revenue/GDP Ratio for Annex II Countries (i)



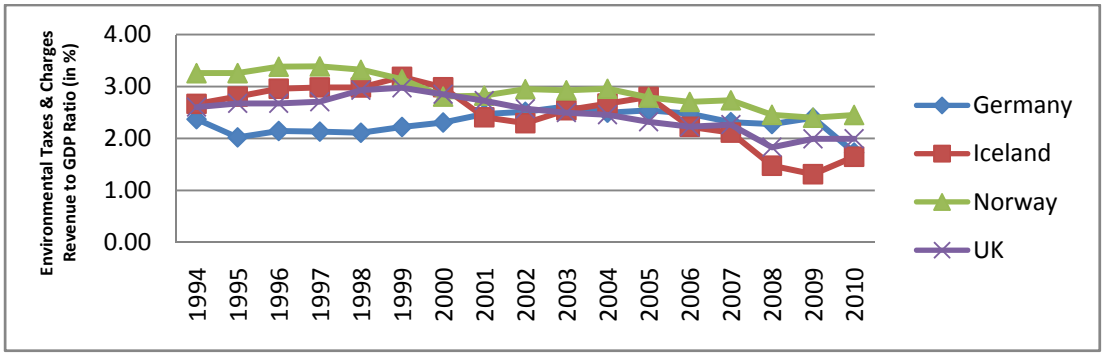
Source: Authors' Construction, basic data obtained from OECD/EEA Database

Figure 3: Environmentally Related Taxes & Charges Revenue/GDP Ratio for Annex II Countries (ii)



Source: Authors' Construction, basic data obtained from OECD/EEA Database

Figure 4: Environmentally Related Taxes & Charges Revenue/GDP Ratio for Annex II Countries (iii)



Source: Authors' Construction, basic data obtained from OECD/EEA Database

Table 6: Analysing the Pattern of the Environmental Levies' Revenues in the Annex II Countries

Sl. No.	Countries	Pattern	Reasons	
			Explanation Through Data	Mathematical Explanation
1	Australia	1. 1998 onwards continuous decline in share of environmental levies' revenues in GDP & total tax revenue till 2005. 2. Rate of growth of ETR and GDP are highly fluctuating	High fluctuation in the growth rate of ETR is because of discontinuity in data.	The rate of growth/decline in GDP is more/less than in ETR between 1998 & 2005 leading to its decline
2	Canada	1. 1996 onwards continuous decline in the share of environmental levies' revenues in GDP & total tax revenue till 2006 2. Abrupt decline in both the ratios in 2005	Abrupt decline in the ratios is because the revenue for Motor Vehicle Licenses in British Columbia is not reported in 2005	The decline is primarily because the rate of growth in GDP is more than ETR
3	Denmark	Share of environmental levies in GDP declined since 2006 till 2009 but its share in total tax revenue declined since 2007 & the decline being most in 2008 in both. Denmark has the highest environmental levies' revenues share in GDP	Data is properly reported	Decline between 2006-2009 could be attributed to higher rate of growth in GDP than in ETR
4	Finland	Share of environmental levies' revenues in GDP & total tax revenue increased till 1997 & then declined in 2000 with subsequent increase thereafter till 2004. There was an abrupt increase in 2004 after which a continuous decline till 2010.	1. Decline in 2000 can be attributed to decline in ETR for few taxes related to vehicle & water charges. 2. Increase in 2004 could again be attributed to above mentioned taxes & discontinuity in data	Decline after 2004 is because of higher rate of growth in GDP than in ETR.
5	Germany	Movement in the share of environmental levies' revenues in GDP & total tax revenue is similar. Both showing steep decline in 1995 & increase during 1999 to 2003.	Abrupt decline after 2009 is because of discontinuity in the data	Abrupt decline in 1995 because the rate of growth of GDP is 17% & that of ETR is only 13% & vice-versa between 1999 to 2003
6	Iceland	Share of environmental levies' revenues in GDP declined since 2000 till 2009 except for a rise during 2003-05, though share in total tax revenue started to decline since 1998.	Increase in ratio in 2010 is because of discontinuity in the data	The rate of growth in GDP & TTR was more than ETR during 2000-2009.
7	The Netherlands	Share of environmental levies' revenue in GDP & total tax revenue are moving in similar patterns except between 1999 to 2001. Both showing decline in 1995 but its share 2007 onwards in total tax revenue is highest amongst all 11 countries that were analysed.	Data is properly reported	Decline in 1995 is because the rate of growth of GDP is more than ETR

8	Norway	Both the shares are depicting similar pattern showing continuous decline since 1998 till 2009 except between 2001-04.	This increase in 2001 is primarily due to two taxes: Electricity consumption tax & Motor vehicle registration tax. But, it is majorly due to the latter which monotonically increased till 2007.	The decline is because the rate of growth of GDP & TTR is more than ETR
9	Sweden	Both the shares depict stability since 1998 and alternate decrease & increase between 1994 & 1998	Increase in 1996 is highest in terms of ETR and is primarily because of increase in the share of 3 taxes: Energy tax on fuel & electricity and tax on CO_2	The stability is because the rate of growth/decline in GDP & TTR behaved in a similar way as in ETR
10	UK	An increase in 1998 and a steep decline since 2000 are observed in both the ratios.	Duty on Hydrocarbon oils and Air Passenger Duty are responsible for an increase in the ratios in 1998. Decline in the former environmental duty since 2000 lead to the decline in total ETR for 2000 and2001.	Rate of decline in ETR is more than GDP in 2000 which lead to a decline in both the ratios. This mismatch continues for the subsequent periods.
11	USA	Both the shares decline in a similar manner all throughout. There is a steep decline in both during 2004 and 2010.	The major reason is discontinuity in the dataset. In 2004 the ETR for Motor Vehicle Registration Licenses is unavailable causing a decline of $16,000 mn as compared to 2003. In 2010, ETR for 47 taxes/charges are missing	The rate of growth in GDP & TTR was more than ETR for most of the years analysed

Source: Authors' Construction

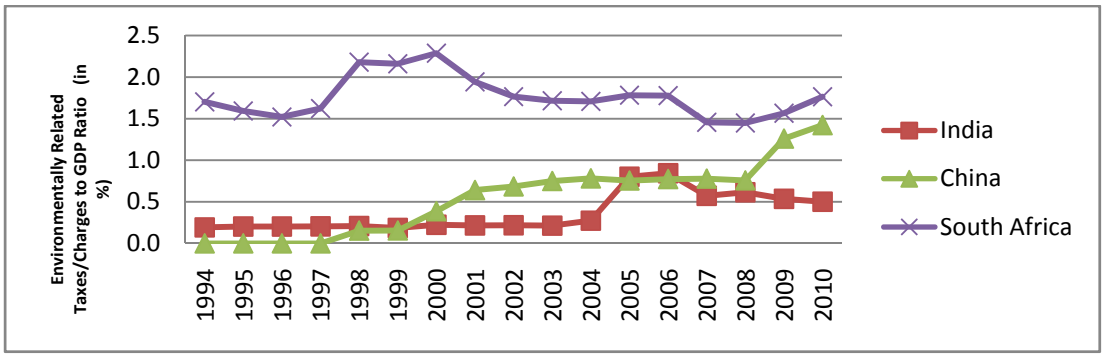
B. Non-Annex I Countries

Figure 5 depicts revenues from environmental levies as a proportion to their GDP for Non-Annex I countries. This figure does not include Brazil because its pattern is hugely irregular which distorts the analysis for other three countries. Therefore, we have considered Brazil separately in Figure 6. The analysis shows that India and Brazil remained stable in their initial years at around 0.2% and 3.4% of their respective GDPs, whereas China stabilised only during 2004 to 2008 at 0.8% of its GDP after which there was an abrupt increase. On the other hand, South Africa stabilised only during 2003 to 2006 at around 1.7% of its GDP, otherwise it fluctuated considerably. On the other hand, Figure6 depicts an abrupt increase for Brazil in 2002 and more so in the year 2006. This increase in 2006 is attributed to the discontinuity of data regarding taxes on electricity and cars. The revenue of these taxes was reported only since 2006, therefore, it leads to an increase of around $17,000mn, thereby distorting the analysis. Similarly, the increase in the year 2002 is because the ETR for a tax named 'Contribution for intervention in economic domain' is reported only since 2002 which lead to an increase of around $2500mn in the total ETR in 2002. Similar is the situation for India in 2005, where the drastic increase

in the ETR is majorly because 16 out of 85 environmental levies' revenues have been reported only since 2005. In case of China as well, both the shares i.e. share of ETR in GDP and in total net indirect tax revenue, increased during 2000 to 2003 and in 2009. In 2000, the ETR for Domestic Consumption Tax on fuels and cars and Vehicle purchase tax were reported only since 2000 and2001 respectively. Whereas, in 2009 the increase could again be attributed to Domestic Consumption Tax on Fuels and Cars but this increase is not due to discontinuity in data but due to an increase in the rates of this tax in the year 2008 (Xu, 2012).

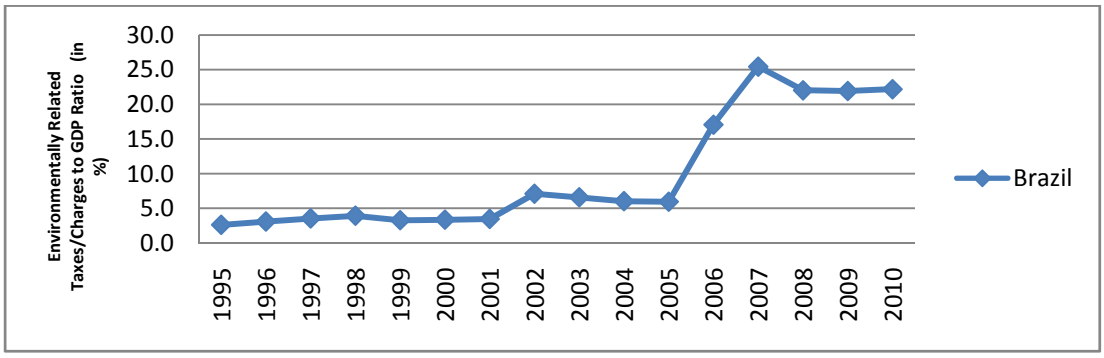
South Africa is the only exception where the discontinuity in the data has not affected the analysis. As discussed above, South Africa shows a lot of variations in both the ratios and the pattern of these ratios is similar for the entire study period. For example, 2001 onwards both the ratios declined till 2007, except the share in GDP ratio which increased slightly after 2004 for two years. The ratios also increased during 1996 to 2000. The decline in both the ratios could be attributed to the ETR in 2001, which declined majorly because of the reduction in the revenue from the General Fuel Levy. From 2003 onwards the decline in rate of growth of environmental levies revenues is more than the total Net Indirect Taxes (NIT) revenues because of which the share of ETR in NIT declined. A synopsis of this analysis can be found in Table 7.

Figure 5: Environmentally Related Taxes & Charges Revenue/GDP Ratio for Non-Annex I Countries (Excluding Brazil)



Source: Authors' Construction, basic data obtained from OECD/EEA Database

Figure 6: Environmentally Related Taxes & Charges Revenue/GDP Ratio for Brazil



Source: Authors' Construction, basic data obtained from OECD/EEA Database

Table 7: Analysing the Pattern of the Environmental Levies' Revenues in the Non-Annex I Countries' Revenues

Sl. No.	Countries	Pattern	Reasons	
			Explanation Through Data	Mathematical Explanation
1	Brazil	Both ratios depict a similar pattern i.e. an abrupt increase in 2002 & 2006 whereas an abrupt decline in 2008	Abrupt increase in 2006 is due to the discontinuity of data in the taxes on electricity and cars. Whereas, in 2002 it is because ETR for "Contribution for intervention in economic domain" is reported only from 2002	The decline is because the rate of growth is more in GDP and NIT revenue than in ETR
2	India	1. Both ratios depict stability till 2004 2. They further show an abrupt increase in 2005	Abrupt increase in 2005 is because 16 out of 85 environmental levies' revenues have been reported only since 2005.	The stability is because the rate of growth/decline in GDP & TTR behaved in a similar way as in ETR
3	China	1. Both the shares increased between 2000 and2003 and stabilised thereafter till 2008. 2. They also depict an abrupt increase in 2009.	Abrupt increase in 2000 is because ETR for Domestic Consumption Tax and Vehicle purchase tax were reported only since 2000 and2001 respectively.	1. The increase in both the shares is also because of the higher rate of growth in ETR than GDP & NIT. 2. Abrupt increase in 2009 is because of the increase in ETR of Domestic Consumption Tax on Fuels and Cars. This is because Government of China revised the rates of this tax in 2008 (Xu, 2012)
4	South Africa	From 2000 onwards both ratios declined till 2007 except the share in GDP ratio which increased slightly after 2004 for two years. The ratios also increased between 1996 and 2000	The Decline in the ETR in General Fuel Levy is the prime reason for the decline in both the ratios in 2001.	From 2003 onwards the decline in rate of growth of environmental levies revenues is more than NIT revenues

Source: Authors' Construction

Analysing Financial Cost from Environmental Subsidies and Tax Expenditure

The data on financial cost associated with environmentally related subsidies and environmental tax expenditure is available only for a very few parts of the various subsidy schemes adopted by the Annex II countries. Therefore, this restricts in carrying out any analysis for these fiscal instruments. Except for Iceland and Denmark, data is unavailable for more than 80% of such instruments. Iceland is an exception because there are only two such levies therefore, there is no difficulty in obtaining the data. On the other hand, Denmark is the only country which has a continuous time series data for 90% of its total fiscal instruments levied. This highlights the lacuna with the OECD/EEA database in providing

details on financial cost of such fiscal instruments. The condition for non-OECD countries is even worse. This is because the financial cost of environmentally related subsidies and tax expenditure was available only for two countries i.e. India and China which is also incomplete.

Conclusion

In this study an attempt was made to document the status of EFIs so as to explore relative international experiences of ecotaxes in the context of India and examining India's specificities in these taxes in a wider perspective of other fiscal measures. This was done by reviewing the environmental levies and their revenues across 15 countries that were categorised into Annex-II and Non-Annex-I groups based on the UNFCCC classification. EFIs were categorised into three groups: environmental taxes/charges, environmental subsidies and tax expenditure. Although, it is clear that ecotaxes have a dominant advantage over other the two in terms of generation of revenue as a by-product but subsidies and tax expenditure shall also be used along with ecotaxes so as to enhance the environmental gains reaped from ecotaxes. Because both EFIs work in tandem with each other, as one disincentivises the polluting behaviour and other incentivises the positive environmental behaviour. Hence, ecotaxes could be understood as an indispensible initial and economically viable step for environmental preservation through the use of EFIs. Further, issues pertaining to categorisation were prevalent and it was found that there were certain levies which couldn't be classified under any of the four categories mentioned by Eurostat (2001). There are certain levies which are prevalent in India but were not classified by the database such as, Forest Development Tax, Sikkim Ecological Fund etc. (Verma, 2016).

The analysis further showed that the most common form of taxes in the Annex II countries is energy tax which is followed by transport taxes. For India, energy and transport taxes could prove to be vital types of ecotax as India has committed itself to reduce its emissions intensity by 33-35% by 2030 (Government of India, 2015). Pollution taxes would be difficult to levy in the Indian context which is also the case for other Annex-II countries given the technological and administrative requirements for such taxes. Resource taxes, on the other hand, would be an important class of ecotaxes that would be required because of severe environmental problems associated with mining and related activities in India (MoEF, 2009). In this regard, India could learn from US for levying ecotaxes on mining. Subsidies and tax expenditure are both prevalent across the Annex-II countries which are provided in various forms such as grants, soft loans, tax reduction and others. Some examples of these are: Subsidies for conserving bio-diversity, forest, water; soft loans for green initiatives etc. No analysis could have been possible for the financial cost of these EFIs because of the paucity of data. However, analysis of revenue generated from the levy of environmental taxes/charges showed that the revenue forms a substantial part of the total tax revenue for all the Annex II countries. It hovered between 5 and 10% of their respective total tax revenue and between 2 and 4% to the proportion of their GDP except for Canada and US. On the other hand, Non-Annex I nation's environmental tax revenue to GDP ratio lay only between 0 and 1% of their GDP and between 1 and 10% of their total net indirect tax revenue. This share, when compared with Annex-II countries, is small for Non-Annex I countries and this could possibly be because of relatively recent origin of these taxes in non-Annex-II countries (Verma, 2016).

Notes

[1] Market Failure could be defined simply as a condition where sub-optimal (inefficient) level of output is produced. Hence, defined this way it does not necessarily implies that a market for a good does not exist.

[2] http://www2.oecd.org/ecoinst/queries/

[3] UNFCCC: United Nations Framework Convention on Climate Change

[4] Eurostat (2001), as cited in Steinbach et al. (2009), defines these categories as follows:

Energy Taxes include taxation on energy products like petrol, diesel, electricity, coal etc. which are used for transportation and stationary purposes. But a tax on CO_2 is also included in this group.

Transport Taxes are the taxes which are confined only to the ownership and the usage of the vehicles. This also includes taxes on aviation industry.

Pollution Taxes are the ones which are levied on activities which not only pollute water and air but also on those which create noise pollution and solid waste. These are targeted by measuring the emission levels from these activities. A tax on SO_2 also comes under this category.

Resource Taxes are the taxes on activities which deplete natural resources such as water, forests etc. In Netherlands, there is a tax on groundwater extraction which fits in this category and in India certain states levy 'forest development tax' which would also come under this category.

[5] Environmental levies imply five categories of environmentally related taxes and fee/charge.

[6] #N/A implies information is not available in the database

[7] Environmental taxes/charges are referred to be environmental levies from here on.

[8] ETR implies Environmental Tax Revenue which also includes the revenue from the environmental fees/charges

[9] Since, the pattern are almost similar the graphs have not been included in the text

References

Barde, J P and O Godard (2012). Economic Principles of Environmental Fiscal Reform. In J E Milne and M S Andersen (eds), *Handbook of Research on Environmental Taxation*. Cheltenham: Edward Elgar Publishing Limited.

Coase, R (1960). The Problem of Social Cost. *Journal of Law and Economics*, 3: 1-44.

Dalton, H (1922). *Principles of Public Finance*. Allied Publishers Pvt. Ltd.

Eurostat (2001). *Environmental Taxes - A Statistical Guide*. Luxembourg: European Union.

Goulder, L H (2005). Fiscal Instruments for Pollution Control: Attractions, Limitations and Strategies. Stanford University. Presented at the International Forum on Tax and Fiscal Policies to Promote Clean Energy Development. November 16, Beijing.

Government of India (2015). *India's Intended Nationally Determined Contribution: Working Towards Climate Justice*. New Delhi: Government of India.

Green Fiscal Commission (2009). *The Case for Green Fiscal Reform: Final Report of the UK Green Fiscal Commission*. London: Green Fiscal Commission.

Kosonen, K and G Nicodeme (2009). *The Role of Fiscal Instruments in Environmental Policy*. Luxembourg: European Union.

MoEF (2009). *State of Environment Report India*. New Delhi: Government of India.

OECD (2002). *Environmentally Related Taxes in OECD Countries: Issues and Strategies*. Paris: OECD.

———— (2006). *The Political Economy of Environmentally Related Taxes*. France: OECD.

OECD/EEA Database (n.d.). Accessed on April 25, 2017 from, *http://www.oecd.org/env/tools-evaluation/oecdeealaunchnewdatabaseoneconomicinstrumentsusedinenvironmentalpolicy.htm*.

Srivastava, D K and K K Kumar (2014). *Environment and Fiscal Reforms in India*. New Delhi: SAGE.

Steinbach, N, V Palm, M Cederlund, A Georgescu and J Hass (2009). Revision of SEEA 2003: Outcome Paper: Environmental Taxes. Retrieved March 25, 2015, from UNStats: *http://unstats.un.org/unsd/envaccounting/londongroup/meeting14/LG14_18a.pdf*

Szigeti, C (2005). Environmental Tax Revenue and Environmental Consciousness in the European Union. Retrieved March 25, 2015, from *http://ageconsearch.umn.edu/bitstream/54343/2/Szigeti_2005_12(k)_37_40.pdf*

UNFCCC (2014). Retrieved December 2014, from UNFCCC: *http://unfccc.int/parties_and_observers/items/2704.php*

Verma, R (2016). Ecotaxes: A Comparative Study of India and China. I*SEC Working Paper Series, No. 353*. Bangalore: ISEC.

Xu, Y (2012). Environmental Taxation in China: The Greening of an Emerging Economy. In J E Milne and M S Andersen (eds), *Handbook of Research on Environmental Taxation*. Cheltenham: Edward Elgar Publishing Limited.

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Price: ₹ 30.00 ISBN 978-81-7791-265-4

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