



Environmental Taxation and Expenditure in New Zealand

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Environmental Taxation and Expenditure in New Zealand

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Abstract¹

Environmental accounting aims to understand the interactions between the environment and the economy. Environmental protection expenditure and taxes are two key environmental accounts that shed light on society's economic response to environmental change. This paper discusses the role of environmental protection expenditure and taxes in the economy and presents the findings from Statistics New Zealand's environmental-economic accounts on the extent to which these are used in New Zealand. Preliminary analysis of the relationship between environmental taxes and expenditure, using OECD data, shows a positive and significant empirical association between these two fiscal instruments.

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1 Introduction

Environmental accounting has emerged as a global response to the shortcomings of the System of National Accounts (SNA) to reflect environmental considerations. The System of Environmental-Economic Accounts (SEEA) was endorsed by the United Nations in 2012 as a statistical standard for measuring the interactions between the environment and the economy in a manner consistent with the principles and concepts used in the SNA (a statistical standard since 1958). In addition to accounting for the stocks and flows of natural resources, SEEA also includes a set of accounts called environmental activity accounts. The accounts record the range of transactions, in monetary terms, between economic units (e.g. firms, households, or government) that may be considered environmental. Environmental taxes and environmental protection expenditure are two key components of the SEEA that have bearing for an understanding of the role of fiscal instruments in preserving, protecting, mitigating, and adapting to environmental change.

Generally, environmental activity accounts record the transactions of an economic activity (i.e. expenditure) undertaken to preserve and protect the environment. Further, a range of transactions, such as taxes and subsidies, reflects efforts by governments on behalf of society to influence the behaviour of producers and consumers with respect to the environment. There is considerable interest in the use and effectiveness of these accounts as they show a direct response of countries to manage environmental change through economic instruments. The accounts enable an understanding of the economy's response to environmental change. They can identify not just the extent of the transactions being undertaken, but also which economic units (e.g. government, households, and producers) are involved in the transactions.

Data on environmental taxes and expenditure are readily available from many countries and international databases. The abundance of data in the European Union (EU) on environmental taxes and expenditure is due to these accounts being two of six SEEA accounts that EU countries are required to produce under legislation (Eurostat, 2018). Until recently, Statistics New Zealand (SNZ) had only produced environmental protection expenditure (EPE) accounts covering the years 2001-03 for the public sector. In February 2018, SNZ released updated EPE accounts for central and local government and a set of environmental tax accounts for the first time (SNZ, 2018a).

According to the results of a 2017 Global Assessment, SEEA programmes can be found in 69 countries with a further 22 having indicated that they intend to start producing accounts. It is important to note that the accounts can be produced and examined in isolation and there is no necessity to produce a full set before they become useful. According to the survey, overall, the most commonly compiled accounts included energy, environmental protection expenditures, material, air emission, environmental taxes and subsidies, environmental goods and service sector and water accounts. The most commonly compiled accounts varied between developed and developing countries, with developed countries

focusing more on accounts such as material flow (of natural inputs, products and residuals), environmental taxes and subsidies, and air emission accounts compared to developing countries which focussed more on energy and water accounts. (United Nations, nd).

Such data enable environmental components to be identified within the key aggregates of SNA. Most of these environmental transactions are recorded within the core national accounts framework, but many cannot be easily identified owing to the structure of the accounts or the types of classifications used. SEEA provides appropriate definitions and accounts for organising information in a manner consistent with the national accounts. Information on these transactions can be examined alongside other pressure-state-impact (PSI) indicators derived from scientific or monitoring/management data to help assess whether economic resources are being used effectively to reduce pressures on the environment and maintain the capacity of the environment to deliver benefits.

As well as environmental outcomes, environmental taxes and expenditure may also have implications for economic growth, capital formation, and employment. Analysis of such impacts is required to assess whether the benefits for environmental purposes are having adverse economic consequences, or whether a double dividend may materialise (Dokmen, 2012). Taxes on polluting activities can lead to, firstly, an improvement in environment outcomes, and, secondly, produces revenues that can reduce the need for other distortionary taxes that affect labour supply and saving decisions. The extent and longevity of the double dividend is subject to debate. Effective environmental taxation (i.e. which leads to behavioural change and therefore environmental improvement), could lessen the need in the long-term for ongoing environmental taxation, ultimately leading to less revenue from this source (and potentially therefore increases in other types of taxation).

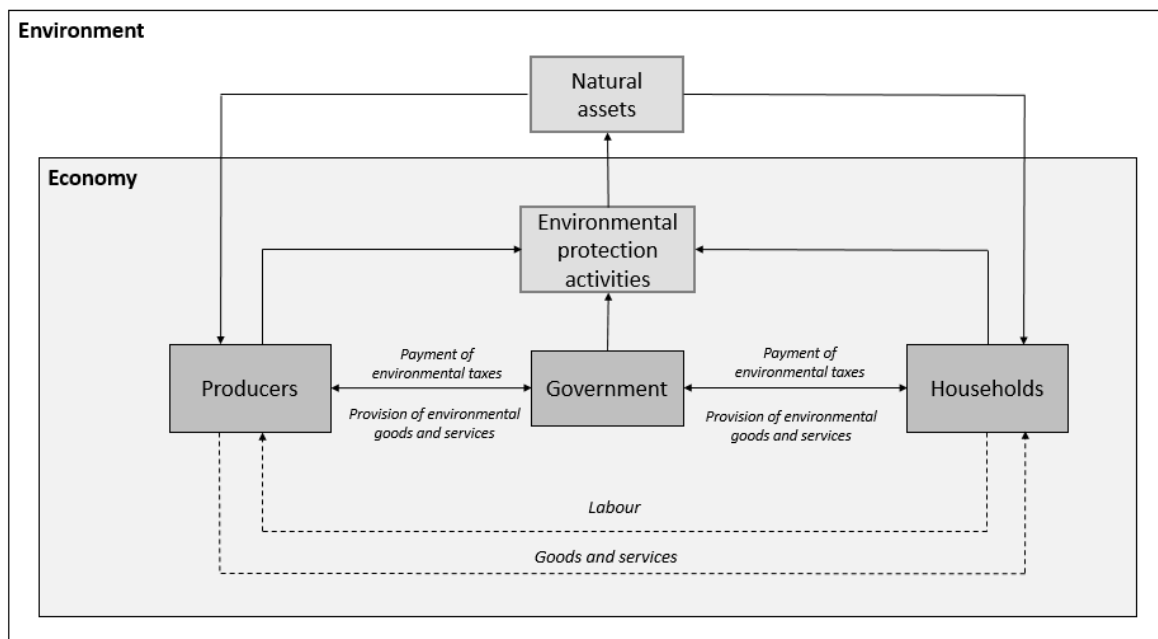
This paper presents an overview of the role of environmental taxes and expenditure in determining environmental and economic outcomes. We provide an overview of the methods used by SNZ to measure environmental expenditure and taxation and highlight the extent to which these are used in New Zealand. We present an analysis of EPE and taxation data from OECD countries to shed light as to what extent these instruments may be related. This is a novelty provided by this paper as most academic studies assess the effectiveness or implications of EPE or taxes in isolation from each other. From a public finance perspective, understanding the degree of environmental expenditure protection is a function of financing arrangements, which includes (but is not limited to) the extent to which environmental taxation is used.

2 Fiscal instruments, environmental outcomes, and economic growth

As well as showing the economy's response to environmental change, and whether environmental outcomes have improved because of the use of fiscal instruments, environmental taxes and expenditure have implications for economic performance.

The role of environmental protection and taxation in the relationship between the environment and the economy is presented in figure 1. The dark arrows reflect the flows between the environment and economy in respect to economic transactions and resource use. The dashed lined reflects the typical depiction of flows between producers and households (i.e. the provision of goods and services for labour). Market enterprises and households pay environmental taxes to government but also receive benefits from the provision of environmental protection expenditures. In this framework, services from natural assets (known as ecosystem services) may be received by both households and producers, although the types of services received may differ. Households are more likely to receive cultural (e.g. recreational) services directly, but provisioning (e.g. production of food and water) and regulating services (e.g. control of climate and disease) to a lesser extent. Producers, on the other hand, primarily receive provisioning and to a lesser extent regulating services. These economic responses are a response to changes in the extent and condition of natural assets, which provide services for production and the benefit of society more broadly.

Figure 1 Flows between the environment and economy from environmental taxes and expenditure



Much of the theoretical basis for the link between environmental taxes, expenditures and economic growth stems from the ‘Environmental Kuznets Curve’ (EKC) which posits an inverse U shape relationship between economic growth and environmental degradation. As economies grow and become more resource intensive, environmental degradation increases through use of fossil fuels and other uses of the environment as a ‘sink’. However, the economy reaches a point in its development where it is able to be more efficient and may have sufficient national income to undertake expenditures to restore or protect the environment from further damage. As noted by Stern (2004), however, the EKC is not without its critics, both on theoretical grounds and statistical robustness. Arrow et al. (1995), for

example, emphasised that the inverted U shaped curve between economic growth and environmental degradation has been shown to apply to a limited set of pollutants (particularly those involving short term costs, not stocks or long lived pollutants such as carbon dioxide). In addition, the relation does not apply to resource stocks particularly where ‘the feedback effects of resource stocks are significant, such as those involving soil and its cover, forests, and other ecosystems’ (Arrow et al., 1995). This suggests that the use of environmental taxes or expenditure may only be effective in certain cases.

Arnold’s (1999) summary of the debate regarding the impacts of environmental protection highlights that although it is argued to have several negative economic effects (such as lowering the rate of economic growth, affecting international competitiveness, and job losses), little (robust) empirical evidence supports these assertions. Arnold emphasises that environmental protection expenditures are significant in the US, but less than health care and defence, but consideration of these expenditures should be made in relation to the significant benefits to people such as in terms of pollution control.

The environmental accounting approach aims to bring together environmental and economic data on a comparable basis so that debates, such as those discussed in Arnold (1999), consider the range of effects and interactions. Combined with information on the changing pressures on the environment, information on environmentally related economic transactions helps us assess whether fiscal policy and economic resources are being used effectively to reduce pressures on the environment. The information may also be used to assess whether investments in natural capital are maintaining or increasing the flow of ecosystem services.

Analytical extensions of environmental protection expenditure include evaluating the influence of environmental protection costs on (domestic or international) competitiveness, implementing the ‘polluter pays’ principle, and determining the cost-effectiveness of environmental control mechanisms. EPE accounts may also be analysed alongside the environmental taxes account to examine the extent to which different economic agents internalise the actual costs of environmental protection in their decision-making, and the extent to which different economic instruments prevent environmental degradation. The analytical value of EPE accounts can be enhanced by comparing it to biophysical data, such as the amount of waste treated or the quality or quantity of air emissions.

Huang, for example, discusses the influence of the government's EPE on sulphur dioxide (SO₂) emissions in China. Huang finds that SO₂ emissions can be effectively reduced by government spending on environmental protection and that the relationship between SO₂ emissions and gross regional product per capita in China is non-linear. Morley (2012) assesses the effectiveness of environmental taxation on air pollution (carbon dioxide emissions). Regardless of the measure of environmental taxation (either in levels or as a proportion of total tax) and specification of the relationship between GDP and pollution (e.g. linear or non-linear), environmental taxation was found to lead to a significant reduction in air pollution. When using environmental taxation relative to other taxes, the effect was more significant

suggesting that the effects of environmental taxation depend on the extent of other taxes (e.g. capital and labour taxes). Miller and Vela (2013), in using a cross-section regression and a panel dynamic regression, find that countries with higher revenues from environmental taxes also exhibit higher reductions in CO₂ emission, PM₁₀ emissions, and energy consumption and production from fossil sources.

The standardisation of environmental tax and expenditure accounts internationally means that panel data sets can be constructed to empirically assess whether the use of environmental taxes and expenditures by governments are more (or less) likely to be used in higher income countries or whether environmental taxes are a constraint (or boon) to economic growth. EPE, for example, was found to have a positive effect on economic growth in Central Europe from 2001-12 (Krajewski, 2016). Dokmen (2013) also finds that economic growth responds positively to environmental tax shocks.

3 Role of institutions

The previous section discussed how general relationships may exist between the use of fiscal instruments, the economy and environment. However, the roles of government, producers, and households are distinct. Within government, different functions exist in environmental protection between central and local government. Central government spending on environmental protection generally consists of departmental output classes, non-departmental output classes, and other expenses to be incurred by the Crown. Departmental output classes are costs incurred by government departments and offices of parliament for the provision of environmental goods and services. Included are: Department of Conservation, Ministry for the Environment, Ministry for Primary Industries, and the Office of the Parliamentary Commissioner for the Environment. Central government, of course, is also responsible for setting and collection of environmental taxes which are paid by both industries and households.

In New Zealand, regional councils and territorial authorities (unitary authorities, city councils, and district councils) are all engaged to some degree in activities aimed at protecting the environment and promoting the sustainable use of resources. Rates are the main way councils fund their activities with other funding sources being investments, fees and charges. Central government also provides some funding mainly for roading (Department of Internal Affairs, 2011). Rates are a tax and are recorded in the National accounts as such but are not recorded as environmental taxes. In many countries taxes on land (rates) are considered property taxes and are recorded as taxes on income. These taxes are often levied on the value of the land and associated real estate. The Eurostat guidance on compiling tax accounts states that these should not be considered environmental taxes, primarily to ensure international comparability but also because specific information on the breakdown of land rates to the environmental tax bases is not usually available. (Eurostat, 2013).

City councils provide the essential utilities and infrastructure that enable cities to function. Utilities that fall under the EPE are waste management, sewage, and stormwater. District councils provide the same key EPE functions as city councils: waste management, sewage, stormwater, resource consents, district plans, and parks and reserves. They also have district-specific areas of EPE similar to city councils, for example restoring landfill sites and protecting the coastal environment. Regional councils have a strategic planning and monitoring role, with a focus on protecting the natural environment and regional transportation, including harbours. They are also more involved with promoting sustainable land use than city or district councils. Regional councils do not provide essential utilities, such as refuse collection and sewage disposal. Unitary councils fulfil the functions of both a district and regional councils, spending on both the provision of essential utilities as well as activities normally looked after by regional councils, such as pest control and inland-water management.

A number of factors may contribute to different levels and growth of EPE and taxation over time, thus affecting the functioning of institutions. Blauvert (2014), for example, examined seven factors which may have driven non-capital environmental expenditures in the US between 2000 and 2009. Factors considered which could account for a state's environmental spending choices included: population, total state expenditures, Gross State Product (GSP), the manufacturing and mining sectors of Gross State Product (M&M GSP), unemployment rates, amount of chemicals regulated discharged to air and surface water, and health ranking score by state. Blauvert found that the factors relating to the overall financial capacity of a state were significant in a number of states. Population (in 15 states), GSP (in 21 states), M&M GSP (in 12 states) and total state expenditures (in 17 states) were found to have the most connection with environmental expenditures.

Although not explored in this paper, households and business are important agents in the fiscal expenditure, economy and environment nexus, in ways other than the payment of taxes. Expenditure by government may 'crowd out' private investments (if the provided goods and services are non-rivalrous; Barro, 1991), and households may also be a source of environmental protection activity. Further statistical developments are required to assess the extent of households and business environmental protection expenditure and thus whether government expenditures may be substitutes or complements to private expenditures. Some information is available from the Non-Profit Institutions Satellite Account (Statistics New Zealand, 2016) that gives an idea of the significance of environmental non-profit institutions in New Zealand. In 2013, the 2080 employees in environmental non-profit institutions contributed \$18.8 million to GDP (as measured by value added). Expenditure of these institutions amounted to \$231.6 million.

4 Scope of environmentally related fiscal instruments

A range of types of environmental expenditures or taxes can be levied by governments depending on the environmental consideration at hand seeking to be managed, or the specific economic activity which

government wishes to modify. It is important to note that the instruments are independent and in some cases are non-substitutable (e.g. an environmental tax cannot be used instead of physically building flood or storm water protection infrastructure). It is not necessarily the case that all revenue raised from environmental taxes should be invested back into environmental protection. This is because environmental taxes are defined not by purpose but by the intending incentive effect they are considered to have.

Environmental taxes reflect efforts by governments, on behalf of society, to influence the behaviour of producers and consumers with respect to the environment. There is considerable interest in the use and effectiveness of these taxes as they show a direct response of countries to manage environmental change through economic instruments, meeting dual targets of environmental and economic management.

Environmental taxes are taxes with a base that is a physical unit (or a proxy of a physical unit) of something that has a proven, specific negative impact on the environment. These include:

- **energy** taxes on energy production and on energy products used for both transport and stationary purposes (e.g. taxes on petrol or diesel, electricity consumption and production, and emissions of greenhouse gases – including proceeds from emission permits recorded as taxes in the national accounts)
- **transport** taxes related to the ownership and use of motor vehicles, although taxes on other transport and related transport services are also included (e.g. motor vehicle import or sales, registration of motor vehicles, flights and flight tickets)
- **pollution** taxes on the management of waste (including measured or estimated emissions to air excluding carbon dioxide, measured or estimated effluents to water, and waste collection treatment and disposal)
- **resource** taxes on raw materials, such as water abstraction, harvesting of biological resources, or extraction of minerals, oil, and gas.

The SEEA central framework (United Nations, 2014) states that, in practice, the definition above is applied by looking at all the various taxes levied in a country and determining whether the tax base in each circumstance is something that has a negative environmental impact.

The Eurostat guidance emphasises that:

1. taxes may be collected with more than one purpose but will generally be included if they apply to products or activities that have an adverse effect on the environment
2. tax account be consistent with the definition of taxes within the SNA.

A full definition of environmental taxes is given in the SEEA, the Eurostat manual and the SNZ (2018b). Appendix 1 shows the tax bases as specified in the international guidance, the sub tax types below these and shows where the applicable New Zealand taxes have been assigned to the various categories.

The scope of environmental activities for EPE encompasses economic activities whose primary purpose is to reduce or eliminate pressures on the environment or to make more efficient use of natural resources. Examples of these activities are restoring polluted environments, conservation and resource management, and investing in technologies designed to prevent or reduce pollution. Environmental expenditures undertaken (and measured) in New Zealand fall under the five broad categories:

- **Wastewater** includes sewerage network (including mains), reticulation of sewage, sewerage treatment: oxidation ponds and on land disposal, stormwater (the water that runs off surfaces such as roads, driveways, footpaths, and rooftops). Also includes culverts and open drains. Excludes land drainage in non-urban areas as this should be included in land and soil management.
- **Solid waste/refuse** includes collection and disposal (aftercare, landfill operations, street and roadside rubbish bins), and recycling collection and recovery (recycling centres, reusable materials depots, and roadside recycling).
- **Air and water quality** includes any measurement and analysis of air and/or water quality and education. Also includes dairy effluent.
- **Flood, river, land and soil management** includes shelter belts, management of contaminated sites, and soil conservation to reduce erosion. For non-urban areas, includes any drainage of the land (e.g. run off), flood protection schemes and river control functions, maintenance, works, and monitoring.
- **Pest management** includes both animal and plant. Pests are defined as organisms that are capable of causing, at some time, a serious adverse and unintended effect on people and/or the environment and can include rabbits, stoats, birds, possums, feral goats, wasps, and invasive weeds and pest plants.

The SEEA classification of environmental activities includes additional items such as noise and vibration abatement and research and development, and management of mineral, energy, timber, and aquatic resources. Some of these will be (partly) captured in estimates of central government expenditure.

5 Data sources

Data for the environmental tax account is sourced from the national accounts. The New Zealand System of National Accounts measures taxes on production in a standard way across all industries. National totals are derived through the Treasury's Crown Financial Information System (CFIS), a secure website that collects actual and forecast information from government departments, Crown entities, and state-owned enterprises. Taxes are allocated on a proportional basis to industries. The proportions used are

derived mainly from data collected through the annual enterprise survey (AES). Environmental taxes are available at the [New Zealand Standard Industrial Output Categories NZSIOC\) level 1 classification](#), which is a 19-class aggregation of all ANZSIC06 industrial codes, from 1999-2016.

Central government EPE is sourced from the government finance statistics produced by Stats NZ. Data are based on departmental expenditure (obtained via the Crown Financial Information System (CFIS)) for those departments whose primary purpose is to provide environmental protection. Government expenditure in the government finance statistics is classified according to the Classification of Function of Government. Central government EPE cannot be disaggregated by type of environmental protection as the data is fit for purpose only at the total EPE level. Data are available from 2009. Local government data by type of EPE are available from this year. Local government financial information is collected by 'activity' through the local authority census (LAC). Central government data are only currently available from 2009 due to a significant change to the structure of CFIS data for 2007–08.

6 Methods

6.1 Environmental taxes

The SEEA Central Framework (United Nations, 2014), Eurostat environmental taxes guide and the Office for National Statistics (2015) provided guidance on compiling environmental taxes. An assessment is first made on whether the tax base in each circumstance is something that has a negative environmental impact. The individual taxes are then allocated to industry. Where specific information is available, generally supplied by the administrative agency responsible for each tax, then we could do this with some confidence. Where taxes are allocated using proportions derived from AES, they are generally allocated at the total aggregated level within the national accounts systems. For this reason, we are less confident in the industry allocation for some taxes and therefore, the figures for breakdown of environmental taxes by industry should be interpreted with caution.

The SEEA central framework defines environmental tax as a tax whose tax base is a physical unit (or a proxy of a physical unit) of something that has a proven specific negative impact on the environment. The SEEA central framework (United Nations, 2014, para 4.150) states that, in practice, this definition is applied by looking at all the various taxes levied in a country and determining whether the tax base in each circumstance is something that has a negative environmental impact. The Eurostat guidance emphasises that:

1. taxes may be collected with more than one purpose but will generally be included if they apply to products or activities that have an adverse effect on the environment;
2. tax accounts be consistent with the definition of taxes within SNA.

These transactions are recorded in SNA but are not specifically identified as being related to the environment. The environment taxes presented are a subset of the total taxes on production and imports released in national accounts (industry production and investment); see SNZ (2017).

For the purpose of compiling environmental tax statistics, payments for emission permits that are recorded as taxes on production in the national accounts are included (Eurostat, 2013). The SNA 2008 did not fully address how to record transactions in emission permits (see sections A4.2, A4.47, 17.363 of the SNA, 2008). For more recent information on the treatment of these within the national accounts, and subsequently environmental taxes accounts see the Eurostat environmental taxes statistical guide.

Value added or goods and sales tax (GST) is not considered an environmental tax even though in some instances GST may be levied against the consumption of goods which have a negative effect on the environment (e.g. GST on electricity or equipment which combusts fuels). Such taxes do not influence relative prices and therefore are not considered to have any marginal effect on behaviour which may be contributing to environmental change.

In interpreting environmental taxes, a distinction needs to be made with Pigouvian taxes. Pigouvian taxes are defined as those directed toward negative externalities. The SEEA accounting approach to environmental taxes differs from that of Pigouvian taxes as, under the SEEA, a tax may be collected with the motive of increasing revenue and still fall under the definition of an environmental tax whereas Pigouvian taxes do not include taxes collected for fiscal motivation. The precise motivation for tax collection may be difficult to ascertain so for this reason the SEEA focuses on the underlying tax base (United Nations, 2014). In New Zealand the tax system is not generally used to modify behaviour, except for alcohol and tobacco excise taxes which have the stated aim of discouraging drinking and smoking (Tax Working Group, 2018).

6.2 Environmental protection

The environmental protection expenditure account presents information on the amount of expenditure by central and local government on activities whose primary purpose is the prevention, reduction, and elimination of pollution and other forms of degradation of the environment (United Nations, 2014, para 4.12). This can include resource management activities, which are activities whose primary purpose is preserving and maintaining the stock of natural resources and hence, safeguarding against depletion (United Nations, 2014, para 4.13). The EPE account provides information that assists in understanding society's response to the challenge of environmental degradation and depletion of natural resources, and the potential for economic activity to be based on environmentally friendly and more resource-efficient activities.

The EPE accounting framework includes output, intermediate consumption, imports & exports, investment (gross fixed capital formation) and transfers with a breakdown by four sectors and by functional classifications of environmental protection (CEPA). While a full EPE account has yet to be developed for New Zealand, data on general (central and local) government final consumption expenditure and investment expenditure are available.

Final consumption expenditure includes expenditures on consultants, experts, and legal advice, insurance premiums, employee costs (salaries and wages, ACC levies, and superannuation contributions), depreciation and amortisation, purchases and other operating expenditure, and indirect taxes. As output is performed on a non-market basis, it is valued as the sum of costs in the absence of a market price. Measuring non-market output, or output for own use, requires excluding non-production expenditure items such as interest, grants, and subsidies that are in the government finance statistics.

LAC's definition of environmental protection includes non-production expenditure items, such as interest payments, subsidies, and grants. For environmental accounting purposes, these are excluded from the output of local government but may reflect activity by market providers. The environmental accounting estimates differ from those used in local authority statistics due to the concepts being applied. Depreciation and amortisation from LAC is also included. However, as this is financial accounting depreciation rather than economic depreciation, further work is required to align the concepts to those in SEEA.

Gross fixed capital formation is the additions less disposals of fixed assets. It includes, among other items, furniture, computer software and hardware, land improvements, transport equipment, non-residential buildings, other construction, and plant, machinery, and equipment.

7 Results

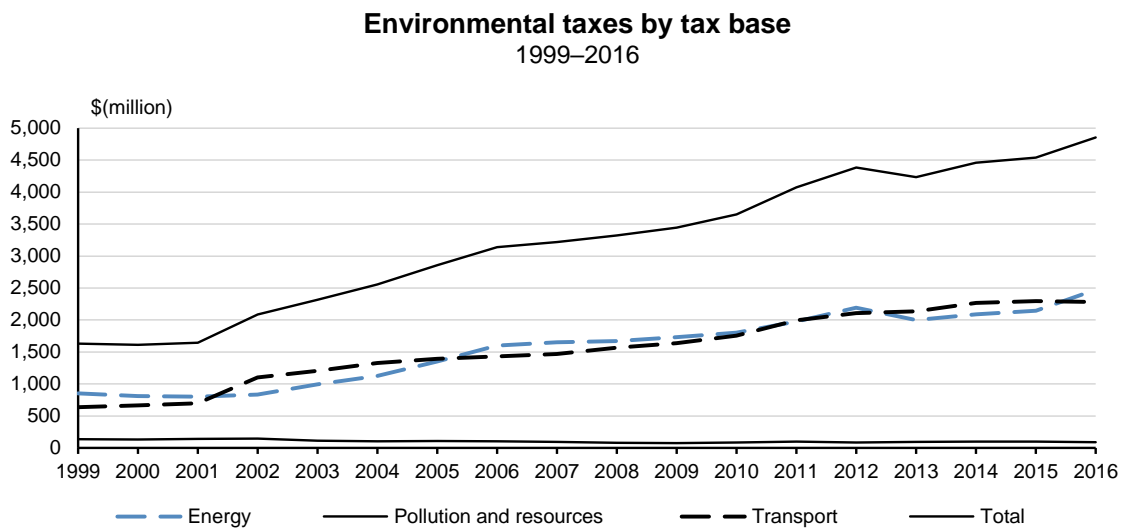
7.1 Environmental taxes

In 2016 the total amount of environmental taxes was \$4.9 billion, an increase of \$3.2 billion from \$1.6 billion in 1999. This was 6.2 percent of all taxation received by general government (central and local) up from 4.8 percent in 1999. This was also up from a share of 5.5 percent in 2009. By comparison, total environmental protection expenditure and investment by general government (in relation to total expenditure and investment) was 6.5 percent in 2009 but declined to 5.4 percent by 2016.

The share of environment taxes paid by households increased relative to industry. In 2016, households paid 13 percent of environment taxes, up from 7 percent in 1999. Over the same period industry contribution dropped from 93 percent to 87 percent. Almost all environment taxes paid by households are transport environment taxes. In 2016, most environment taxes were energy (51 percent) and transport (47 percent) taxes. Combined pollution and resources taxes made up only 2 percent of the

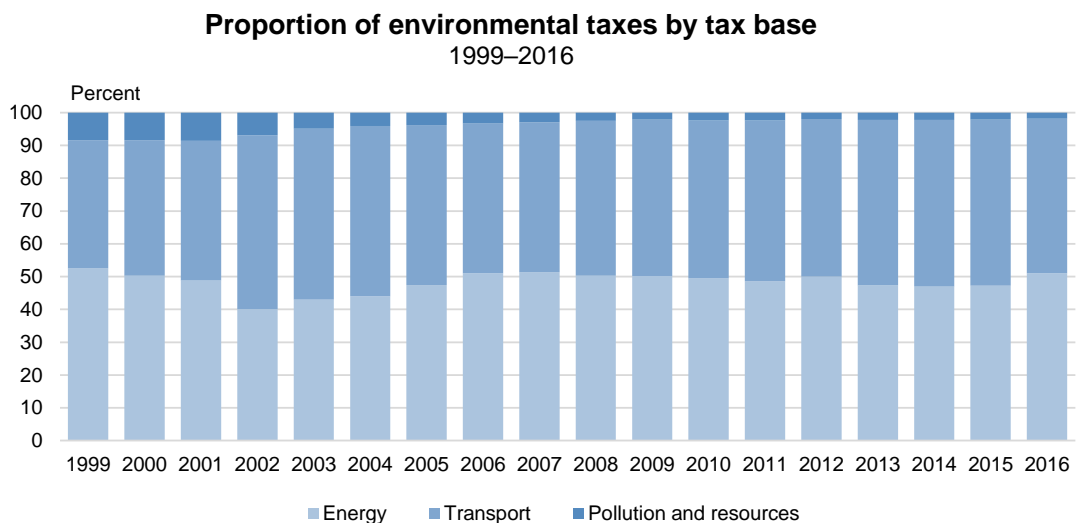
total. New Zealand’s environmental taxes are made up mainly of energy and transport taxes. Over the period 1999–2016, energy taxes increased from \$856 million to \$2.5 billion, while transport taxes increased from \$637 million to \$2.3 billion (figure 2). Movements were volatile over the period 2002–05, but generally each of these two tax types made up on average 48 percent of the total over the whole time period.

Figure 2 Environmental taxes by tax base



The share of pollution and resource taxes declined over the period 1999–2016 (figure 3). In 1999 these taxes made up 8 percent of total environmental taxes, but dropped to 2 percent in 2016. Unlike energy and transport taxes, the total amount of pollution and resource taxes also declined, from \$138 million in 1999 to \$93 million in 2016.

Figure 3 Proportion of environmental taxes by tax base



This is reflected in the breakdown of taxes by industry with most taxes paid by the petroleum, chemical, polymer, and rubber product manufacturing industries (27 percent) and the transport and storage industries (20 percent).

7.2 Expenditure on environmental protection

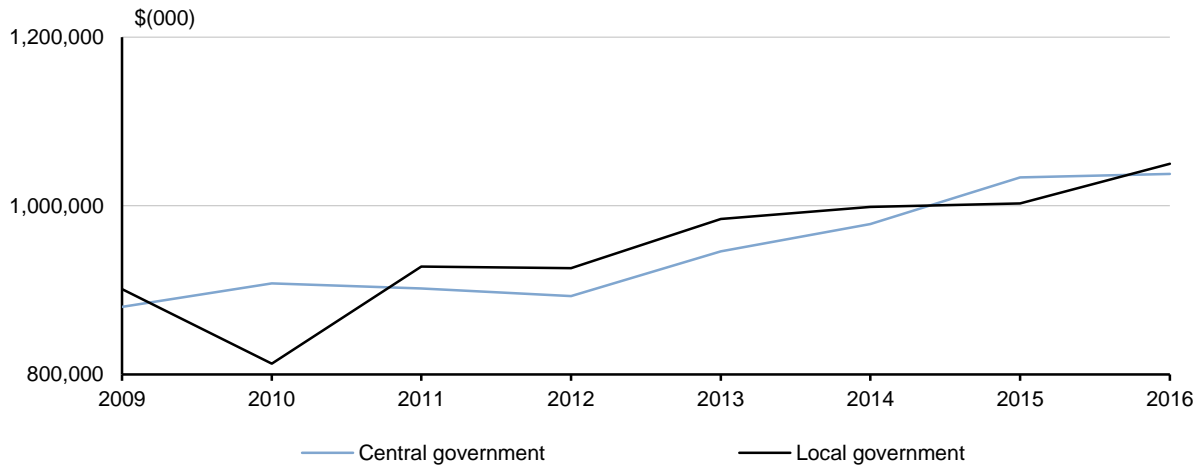
Final consumption expenditure on environmental protection by general government reached \$2.1 billion in 2016, amounting to 4.5 percent of total general government final consumption expenditure. This share was down from 4.8 percent in 2009. General government final consumption environmental protection expenditure increased at a rate of 2.3 percent a year from 2009 to 2016, while total final consumption expenditure increased by 3.3 percent a year over the same period. Government final consumption expenditure represents government expenditure on goods and services that are used for the direct satisfaction of individuals and communities. However, in order to understand the benefits derived, it should be noted that estimates are in current prices and therefore reflect increases in unit costs as well as real output.

Central government final consumption expenditure on environmental protection increased 18 percent (or 2.4 percent a year) from 2009 to 2016 reaching \$1.0 billion in 2016 (figure 4). Local government environmental protection final consumption expenditure on air and water quality, wastewater, pest management, solid waste and refuse, and flood, river, land, and soil management reached \$1.1 billion in 2016 (figure 5), up 17 percent from \$901 million in 2009 (a rate of 2.2 percent a year). Wastewater management accounted for 56 percent (\$586 million) of local government environmental protection final consumption expenditure, while pest management accounted for 3 percent (\$33 million) in 2016.

The share of final consumption expenditure for both central and local government remained relatively constant from 2009 to 2016, with EPE accounting for around 19–21 percent of total final consumption expenditure for local government and 2–3 percent for central government.

Figure 4 Environment protection expenditure

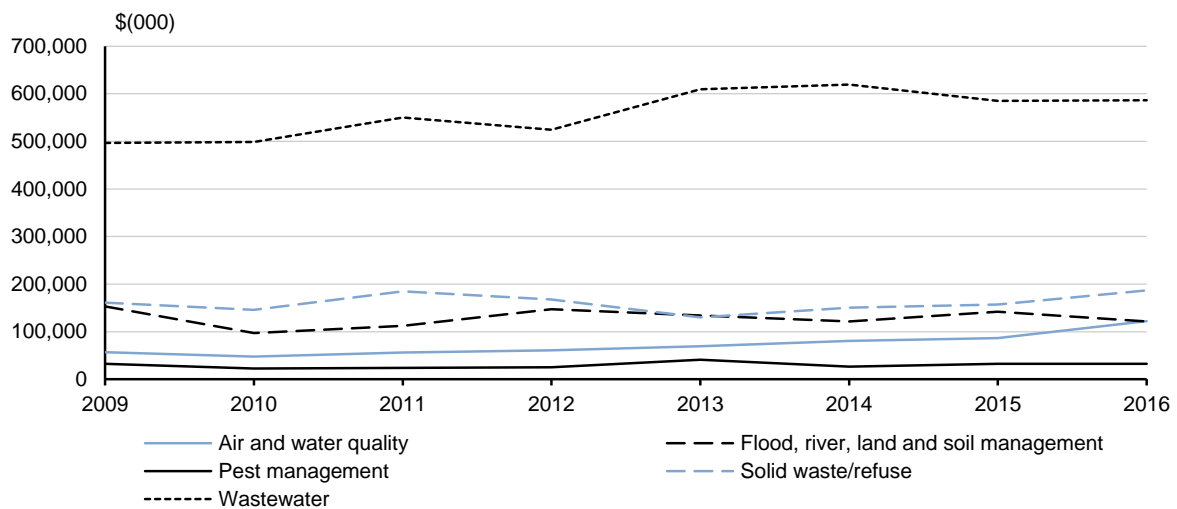
Environment protection expenditure
Final consumption expenditure by government
2009–16



Source: Stats NZ

Figure 5 Local government final consumption expenditure

Local government final consumption expenditure,
by type of environmental protection expenditure
2009–16



Source: Stats NZ

7.3 Investment in environmental protection

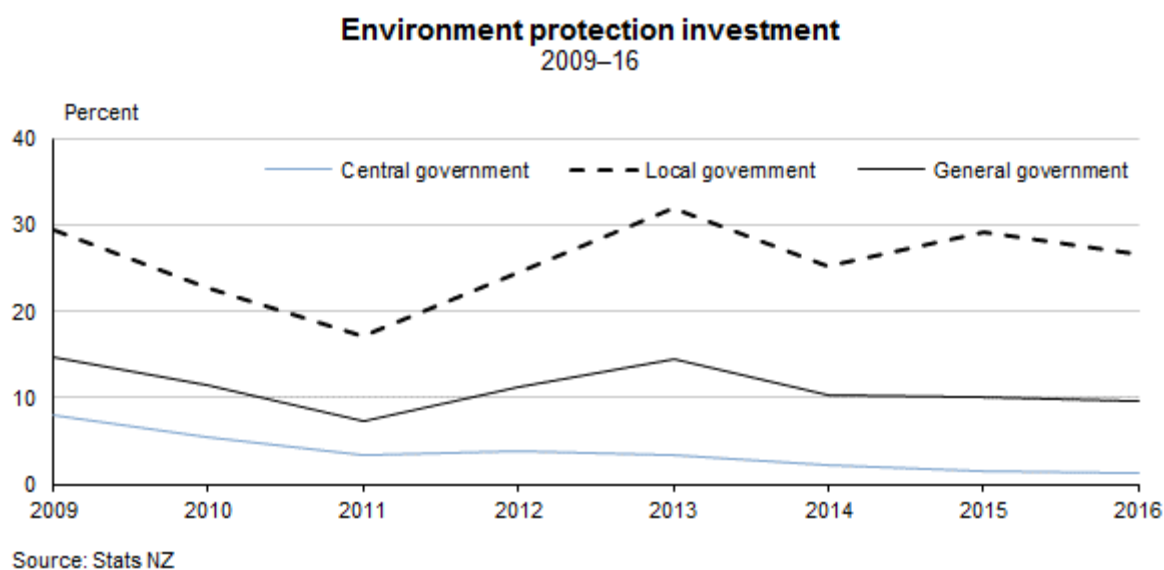
Environmental protection investment is the additions less disposals of fixed assets (gross fixed capital formation) for those departments whose primary purpose is to provide environmental protection. It includes, among other items, furniture, computer software and hardware, land improvements, transport equipment, non-residential buildings, other construction, and plant, machinery and equipment.

General government investment in environmental protection amounted to \$970 million in 2016, with \$880 million from local government and \$91 million by central government. Wastewater accounted for

81 percent of local government environmental protection investment, while flood, river, land, and soil management accounted for a further 15 percent.

Combined, environmental protection investment to total investment declined from 14.8 percent in 2009 to 9.7 percent in 2016. From 2009 to 2016, the share of central government’s environmental protection investment to total investment fell from 7.9 percent to 1.4 percent (figure 6). For local government, this share was 26.7 percent in 2016, varying between 17.2 percent and 32.1 percent from 2009 to 2016. Waste water accounted for the majority of local government environmental protection investment from 2009-16. In 2016, waste water investment amounted to \$713 million (81.1 percent of total local government environmental protection investment). Flood, river, land and soil management accounted for a further \$134 million (15.2 percent). Investment in solid waste/refuse showed a general decline from 2009-16 while investments for other types of activity showed more variability over time.

Figure 6 Environmental protection investment



Interpreting levels and changes in environmental protection expenditures and investments can be challenging. Declines in investment may be due to the capital stock being sufficiently high that no more investment is required. Longer time series are required in this case to assess the levels of previous investments and thus assess the level of the stock. As Blauvert (2014) showed in the US financial constraints may be a factor. Population levels and change are also likely to be significant particularly for infrastructure investments that directly serve households (e.g. waste water). Political and social preferences also cannot be ruled out as having an influence. Institutional arrangements, lagged effects, regulatory compliance, and the extent of market sector activity (and potential substitutability) are also factors to consider in interpreting environmental protection in New Zealand.

7.4 International comparisons

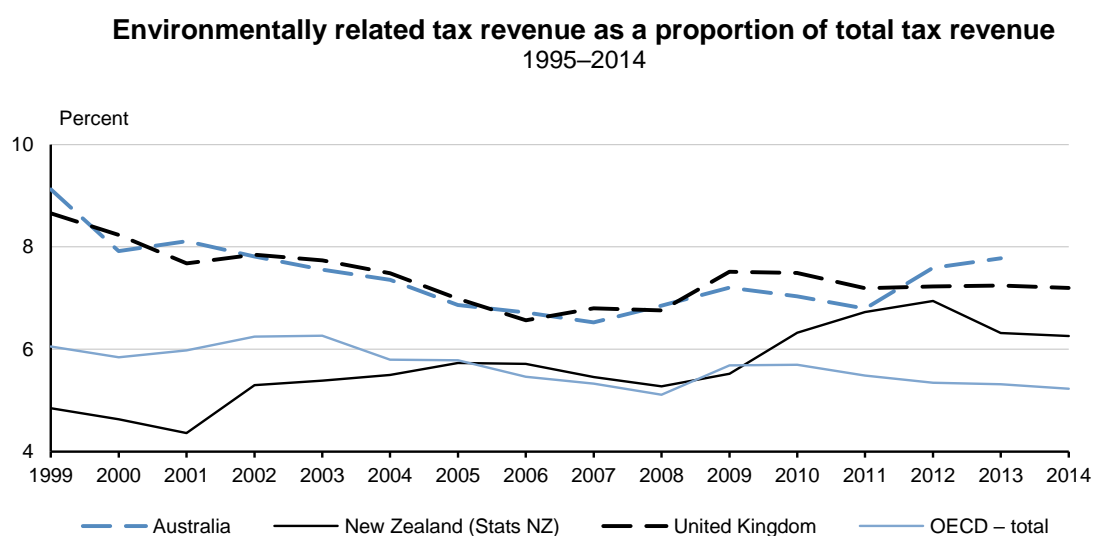
7.4.1 Environmental taxes

The OECD has produced estimates of environmental taxes for member economies. In 2014 across the OECD, environmental taxes made up 5.2 percent of total tax revenue (OECD, nd1). The OECD's estimates of 4.2 percent in 2014 for New Zealand are lower than SNZ's estimates. The SNZ estimates are based on more recent and complete data. In all OECD countries, the share of environmental taxes to total taxes declined slightly over the 1999-2014 period (figure 7). This is attributed in part to rising fuel costs triggering substitution away from motor vehicle fuels (OECD, 2016).

In OECD countries in 2014, the make-up of environmentally related taxes was similar to that for New Zealand with the majority being energy and transport taxes. Other environmental taxes, such as those on resources and pollution, made up 3 percent; unlike New Zealand, the share of these taxes across the OECD is growing.

In New Zealand and in the OECD energy and transport taxes make up most of the total (98 percent and 97 percent respectively in 2014). However, in New Zealand in 2014, energy taxes contributed 47 percent to the total and transport taxes 51 percent. This contrasts with the OECD average where revenue was dominated by taxes on energy products, which included motor vehicle fuels (69 percent), and motor vehicles and transport (28 percent).

Figure 7 Environmentally related tax revenue as a proportion of total



Note: Australia data for 2014 is not available. Estimates for New Zealand are provided by Stats NZ, other estimates are from the Organisation for Economic Co-operation and Development (OECD).

Source: OECD; Stats NZ

In the UK, environmental taxes raised £44.6 billion in 2014 (around \$85 billion), providing 7.5 percent of all revenue from taxes and social contributions (ONS, 2015a). In the UK the percentage of taxes paid by households is much higher than in New Zealand. In 2012, just under half (49 percent) of all

environmental taxes in the UK were paid by households compared with 16 percent in New Zealand. The main reason for this difference is due to a differing treatment of energy taxes. Two-thirds (66 percent) of all environmental taxes paid by UK households were 'hydrocarbon oils', classified as energy taxes energy taxes (energy products for transport purposes) with the rest being 'vehicle duty paid by households', classified as a transport tax.

Almost all environment taxes allocated to households in NZ are transport taxes these are primarily related to flights and vehicle registration. In New Zealand fuel excise taxes are paid directly to the government by the petroleum and coal product manufacturing industry, a subgroup of Petroleum, chemical, polymer, and rubber product manufacturing. This industry then passes on these taxes to households and other industries through fuel pump levies so they are not directly allocated to households.

Excise taxes are defined as indirect taxes, which are taxes imposed on certain transactions, goods or events as opposed to direct taxes which are imposed on income, capital gains, net worth or property. Indirect taxes, which also include sales tax, services tax, stamp duties and transaction taxes, are normally intended to fall upon consumption and be borne by consumers. The entrepreneur who pays the tax on their supplies of affected goods and services is said to shift the incidence of the taxation when it is passed forward to the consumer (OECD, nd2). Recent work by the Tax Working Group (2018) has also addressed tax incidence and noted that while certain firms may be statutorily and administratively liable for excise taxes it is normally assumed that the incidence is felt by the consumers of the products produced or imported. It is outside of the scope of the scope of this paper to consider the taxes, environmental or otherwise, that are paid ultimately by households or the distributional effects of these taxes although other papers have addressed these issues (Thomas, 2015). Other papers have also considered the distributional effects of potential carbon taxation in New Zealand and overseas (Creedy and Sleeman, 2006; Allan et al, 2014).

7.4.2 Environmental protection expenditure

Estimates of environmental protection expenditure and investment are produced regularly by Eurostat for EU member states data available for additional countries via the OECD.

In EU member states in 2014 (the latest period available), general government (which also includes non-profit institutions serving households) final consumption expenditure on environmental protection services ranged from 5.3 percent to 0.3 percent of total final consumption expenditure by general government. By comparison, general government (which does not include non-profit institutions serving households) final consumption expenditure in New Zealand was 4.6 percent of total final consumption expenditure by general government in 2014, well above the EU average. Countries with high proportions of final consumption expenditure by general government include Bulgaria (5.3 percent), the Czech Republic (3.2 percent) and the Netherlands (3.0 percent). The lowest shares were

for Sweden (0.3 percent) and Portugal (0.6 percent) with Germany, France, and Belgium also among those countries with the lowest shares (each spending 1.1 percent of their countries total government expenditure on environmental protection).

Declines in the importance of environmental protection investment have been observed in Europe where this proportion declined from 6.3 percent in 2006 to 5.9 percent in 2015 for European Union (EU)-28 countries (Eurostat, 2017). By comparison, New Zealand's general government investment was 9.7 percent of total general government investment in 2016. While it had declined from 14.8 percent in 2009, its share in 2016 was still comparatively high when compared internationally.

7.5 Environmental taxes and protection expenditure: A (preliminary) cross country analysis

The availability of internationally comparable datasets allows for an assessment of whether relationships between EPE and taxation may be present as higher revenues could facilitate EPE to be undertaken. In general, the link between taxation and revenue is obvious given the needs for governments to balance budgets. It could also be expected that consideration of the types of expenditure is made on the basis of the source of revenue due to the notion of a 'fiscal contract' (Welham et al., 2015). The fiscal contract connects the efficiency and effectiveness of public expenditure to the willingness of citizens to provide revenue through domestic taxation, thus enabling governments to collect revenue in return for providing benefits to taxpaying citizens through public expenditure. Welham et al. (2015) argue that due to the accountability relationship between taxpayers and the state, governments are more likely to spend public funds financed via taxation on priorities favoured by taxpayers.

As discussed earlier, it is not necessarily the case that all revenue raised from environmental taxes should be invested back into environmental protection, as the primary objective of tax policy is to provide revenue for the government to fund the provision of public goods and services, and redistribution (Tax Working Group, 2018) However, some correlation may be expected on the basis that: (1) environmental taxes provide revenue for expenditures to be made; (2) the use of an instrument indicates a need (and capacity) for using further instruments in this way; and (3) the instruments are independent and in some cases are non-substitutable so multiple instruments will need to be used to address multiple problems. The last two points echo the Tinbergen rule which states that there should be at least the same number of instruments as there are targets. A further argument for expecting environmental taxes and protection expenditure to be correlated is due the interplay between "the source of revenue and the fiscal contract which implies that composition of revenues is a strong determinant of the character of the state and the way it spends its money" (Welham et al., 2015, p.4).

However, as noted earlier, as households and private enterprises also undertake environmental protection expenditures, the extent of substitutability or complementarity with government efforts. In

addition, as the extent of privatisation of environmental services (e.g. waste, water and wastewater services) varies across countries, some countries will have quite different patterns of environmental expenditure than those that have not privatised such services, thus affecting any association between environmental taxes and revenues.

In addition, tying revenue to specific uses may not be economically efficient if fundamental needs are to be addressed and other services could not be provided if it was tied to revenue. Only where a tax can be aligned to an identifiable set of beneficiaries can it be considered for hypothecation (e.g. road user charges).

Figures 8 and 9 illustrate the correlation between EPE and environmental tax revenues for the public sector in OECD countries across the 1997-2003. Data are expressed in per capita terms to remove the influence of population levels and change. A strong positive (linear) relationship is observable for current EPE with revenues but not investments which exhibits a greater degree of dispersion.

Figure 8 Environmental protection expenditures and revenues, OECD countries, 1997-2013

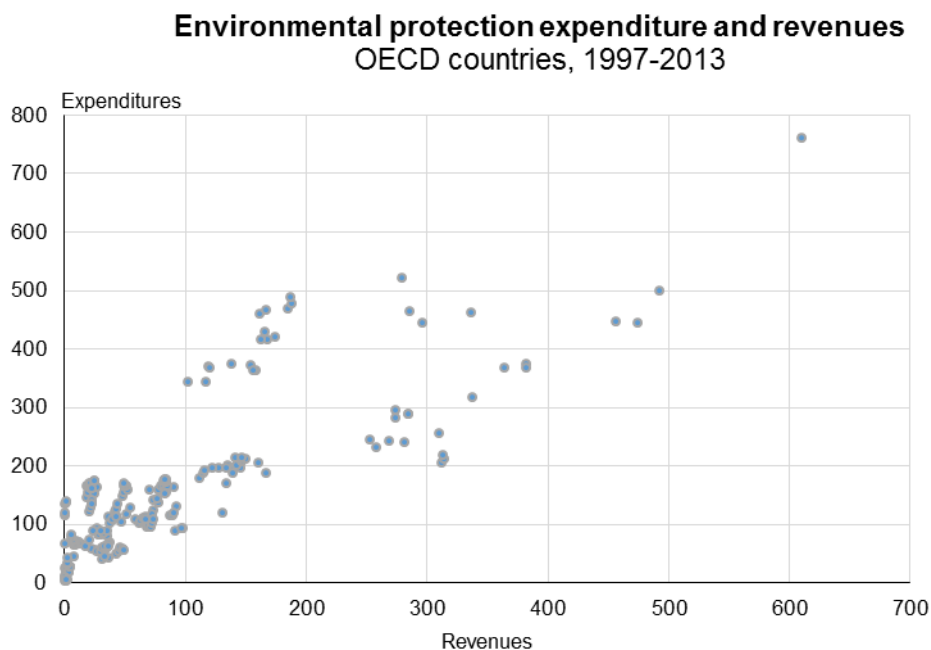
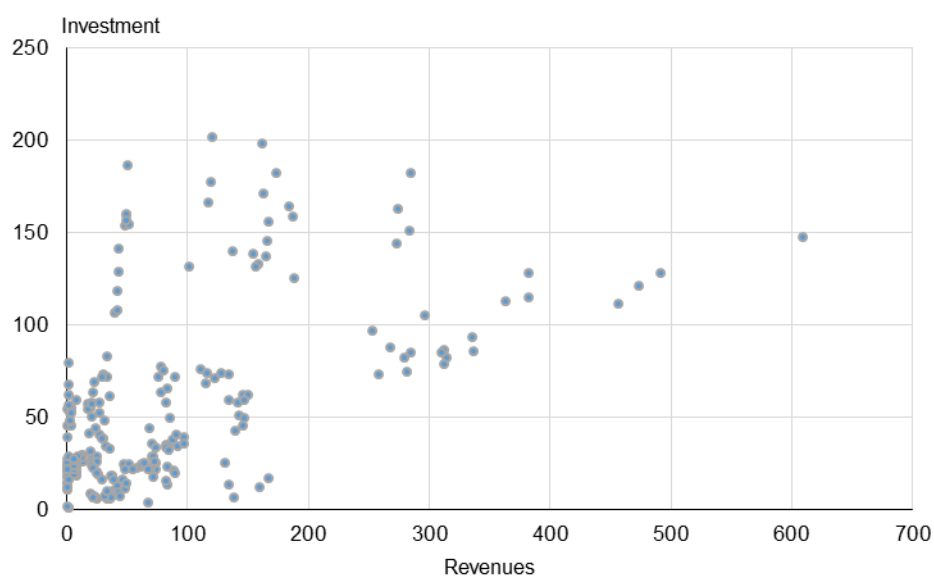


Figure 9 Environmental protection investments and revenues, OECD countries, 1997-2013

Environmental protection investment and revenues OECD countries, 1997-2013



Source: OECD

A panel data regression ($n = 226$) using two-way fixed effects (to account for time and country specific effects) yields a coefficient of 0.76 ($t = 12.89$) for environmental protection expenditures and revenues indicating a significant and linear association is present in the available data. The panel data regression coefficient for investments of 0.06 was insignificant with $t = 1.53$. This suggests other factors, potentially including the pre-existing level of the capital stock (both in terms of natural assets and environmental protection assets), may be important. These correlations may mask the role of other influential factors that affect the ability for countries to undertake environmental protection and raise additional revenues, such as the level of GDP per capita (i.e. omitted variable bias may be present). Controlling for GDP per capita, however, had no influence on the coefficient for revenue. In addition the GDP per capita coefficient was insignificant.

8 Summary and future developments

This paper has presented an overview of the role of fiscal instruments (environmental protection expenditure and environmental taxation) in the environment and economy nexus and presented findings from Stats NZ's environmental-economic accounts. Public sector EPE has been increasing in absolute terms since 2016, but has remained a relatively constant proportion of total public sector expenditure. Central government investment in environmental protection declined in absolute terms from 2009 to 2016 but general government investment increased due to growth in investments by local government. Over the same time period, environment taxes increased in absolute terms and as a share of total taxes (from 5.5 percent in 2009 to 6.2 percent in 2016). New Zealand's public sector investment in environmental protection (in relation to total public sector investment) and environmental taxes (in relation to total taxes) were above the OECD average in the latest available period.

Further developments to the estimates of EPE and environmental taxes are expected to be made over time. The EPE account is currently experimental as further work to extend the coverage and alignment to national accounts is required. Our current estimates of EPE and investment do not include those by households or market enterprises. In EU-28 countries, household EPE exceeded general government expenditure in 2015: 41 percent was undertaken by central government compared with 59 percent by households (Eurostat, 2017). It is unclear, at present, whether household EPE will be as significant in New Zealand.

Investment by private companies is likely to be significant and measuring private contributions will show whether there may be a substitution of public-private activity. In 2015, 2.0 percent of total investment by corporations in EU-28 countries related to environmental protection (Eurostat, 2017). Further work is required to fill these data gaps and determine the significance of these sectors to EPE in New Zealand. In addition, the estimates include a breakdown of all EPE for local government only. Further work is required to produce estimates by type of EPE for central government.

The methodology used here is broadly consistent with guidance in SEEA. However, further work is required to align the estimates with the national accounts: adjustments to the national accounts, such as financial intermediate services indirectly measured and research and development, have not been applied to the estimated EPE; we expect the impact of these adjustments to be small. The concept of depreciation used is currently based on accounting depreciation, not consumption of fixed capital, and we will seek to adjust this over time.

For environmental taxes, future improvements may be made to the proportions used to allocate taxes to agriculture. Further disaggregation to the more detailed NZSIOC level 3 classification will be prioritised for the next release so data will be available at a level consistent with the annual national accounts

The availability of data at the industry level for environmental taxes means economic modelling of the impacts of various policy scenarios, using CGE or input-output analysis for example, could be possible. In conjunction with other environmental accounts that have an industry dimension, such as the air emissions account or other environmental accounts yet to be developed, the effect of the potential for the double dividend of achieving both environmental and economic goals could be explored.

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Appendix I: Environmental taxes bases, tax types and specific taxes included

Environmental taxes			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
			\$(millions)																	
Tax base	Tax type	Specific taxes included																		
Energy			856	811	804	836	997	1,125	1,353	1,601	1,651	1,669	1,731	1,803	1,978	2,191	2,002	2,091	2,144	2,475
	Energy products for stationary purposes	Other Revenue - Energy, Control of Natural Gas Service & Levy on Electricity Industry.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Energy products for transport purposes	Petrol excise belonging to ACC, Fuel Excise, Local Authority Petrol Tax and Fuel Duties (Customs import duty).	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Greenhouse Gases	Synthetic Greenhouse Gas Levy, Emissions trading scheme.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pollution			..	..	..	..	..	..	..	..	..	..	..	18	25	25	27	25	30	33
	Waste management	Waste Disposal Levy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Resources			138	135	143	145	113	104	110	105	95	82	74	69	73	60	69	75	69	60
	Extraction of raw materials	Energy Resource Levies - Coal and Gas.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Harvesting of biological resources	Levies and fees recorded as taxes on fishing and quota ownership.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Transport			637	668	700	1,105	1,208	1,329	1,393	1,433	1,471	1,568	1,640	1,758	1,994	2,108	2,135	2,267	2,294	2,283
	Flights and flight tickets	Civil aviation passenger security and fuel levies.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Other means of transport	Maritime Safety Charges: Customs Levy.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Registration or use of motor vehicles, recurrent / Road use	Motor Vehicle Registration and Road user charges.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total environmental taxes			1,631	1,614	1,647	2,086	2,318	2,558	2,856	3,139	3,217	3,320	3,445	3,648	4,070	4,385	4,233	4,458	4,537	4,851
..	not available																			
...	not applicable																			

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