An Phríomh-Oifig Staidrimh
Central Statistics Office

Standard Report on Methods and Quality for Environment Taxes 2018

Standard Report
on
Methods and Quality

For

Environment Taxes

This documentation applies to the reporting period:

2018

July 2019

CENTRAL STATISTICS OFFICE
Skehard Road, Cork
021 4535000
www.cso.ie

Table of Contents

1 Overview

2 General Information

2.1 Statistical Category
2.2 Area of Activity
2.3 Organisational Unit Responsible, Persons to Contact
2.4 Objectives and Purpose; History
2.5 Periodicity
2.6 Client
2.7 Users
2.8 Legal basis

3 Statistical Concepts, Methods

3.1 Subject of the Statistics
3.2 Units of Observation/Collection Units/Units of Presentation
3.3 Data Sources
3.4 Reporting Unit/Respondents
3.5 Type of Survey/Process
3.6 Characteristics of the Sample/Process
3.7 Survey Technique/Data Transfer
3.8 Questionnaire (including explanations)
3.9 Participation in the Survey
3.10 Characteristics of the Survey/Process and its Results
3.11 Classifications used
3.12 Regional Breakdown of Results

4 Production of the Statistics, Data Processing, Quality Assurance

4.1 Data Capture
4.2 Coding
4.3 Data Editing
4.4 Imputation (for Non-Response or Incomplete Data Sets)
4.5 Grossing and Weighting
4.6 Computation of Outputs, Estimation Methods Used
    4.6.1 General Observations
    4.6.2 Non-fuel tax estimates
    4.6.3 Fuel tax estimates
    4.6.4 Final Environment tax estimates
4.7 Other Quality Assurance Techniques Used

5 Quality

5.1 Relevance
5.2 Non-Sampling Effects
    5.2.1 Quality of the Data Sources used
    5.2.2 Register Coverage
    5.2.3 Non-response
    5.2.4 Measurement errors
    5.2.5 Accuracy and reliability
        5.2.5.1 General Observations
        5.2.5.2 Forecasts
        5.2.5.3 Backcasts of Use Tables and environment tax estimates
5.3 Timeliness and Punctuality
    5.3.1 Results
5.4 Coherence
5.5 Comparability
5.6 Accessibility and Clarity
    5.6.1 Assistance to Users, Special Analyses
    5.6.2 Revisions
    5.6.3 Publications
        5.6.3.1 Releases, Regular Publications
        5.6.3.2 Statistical Reports
        5.6.3.3 Internet
    5.6.4 Confidentiality

6 Additional documentation and publications

1 Overview

Environmental Accounts is a satellite account within the European System of Accounts (ESA), a satellite account provides additional information on selected areas of specific interest. Environment taxes are a subdivision within Environmental Accounts concerned with estimating the amount of environment taxes paid annually by households and industries in the state. Environment taxes are compiled under EU Regulation (EU) 691/2011. The first official estimates of environment taxes for Ireland covering the years 2004 to 2018 are published in 2019 in this release. The principal environment tax statistics made available in this release relate to annual total taxes paid when Energy, Transport, Pollution or (natural) Resources are used in the state.

An environment tax is defined by the regulation 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, and which is identified in European System of Accounts as a tax."

In Ireland the source for environment tax data is the National Tax List (NTL) compiled for National Accounts. Using the definition certain taxes in the NTL are classified as environment taxes. Using a variety of mainly administrative data sources overall environment tax amounts are allocated to households and industries with the industry amount further distributed across NACE Revision (Rev.) 2 sectors at 2-digit level – NACE Rev. 2 is the Statistical Classification of Economic Activity in the European Communities. Importantly, for national economic purposes this shows where the tax burden falls and how that burden changes over time. It also ensures that Ireland's classification of environment taxes are comparable with those of other EU member states. Accordingly, this information is particularly useful for informing policy on sustainable development goals and the green economy both nationally and at the EU level and more generally for monitoring developments in the wider economy.

2 General Information

2.1 Statistical Category

Environment Taxes are based on taxes classified as environment taxes in the NTL, this data is combined with internal CSO administrative data and data from other miscellaneous sources to arrive at the detailed environment taxes estimates.

2.2 Area of Activity

Environment Accounts (EA).

2.3 Organisational Unit Responsible, Persons to Contact

Environment Division

Persons to contact:

Name: Gerard Keogh, Statistician
Division: Environment and Climate
Directorate: Statistical Systems Co-ordination Unit
Telephone: (01) 498 4320
E-mail: environment@cso.ie

Name: Berna Lawlor, Higher Executive Officer
Division: Environment and Climate
Directorate: Statistical Systems Co-ordination Unit
Telephone: (01) 498 4210
E-mail: environment@cso.ie

2.4 Objectives and Purpose; History

Environmental policy aims to reach national and international environmental and sustainable development goals. In this context the European Action Programme to 2020 calls for applying the polluter-pays principle more systematically, through phasing out environmentally harmful subsidies and shifting taxation away from labour and towards production. Here environment taxes can serve to discourage behaviour that is potentially harmful to the environment and can provide incentives to lessen the burden on the environment and preserve it by 'getting the price right'. The economic rationale for

environment taxes comes from their ability to influence markets in a cost effective way, unlike regulatory or administrative approaches aimed at changing how we impact on the environment. Accordingly, detailed environment tax data are needed to enable policy makers assess the environmental impact of a certain tax, such as the reduction in pollution resulting from the introduction of a new tax, and more importantly assess the proportion of overall tax burden that is environmental. This release provides key data within the overall framework of environment statistics that contributes to addressing these needs for Ireland.

2.5 Periodicity

Environment tax estimates are compiled annually.

2.6 Client

Environment tax estimates are compiled under EU Regulation (EU) 691/2011for Eurostat. This release makes the estimates available nationally and internationally.

2.7 Users

National users: CSO, EPA, Department of Finance, economic commentators, the media, third level educational institutions, the public at large.

International users: Eurostat, IEA and OECD.

2.8 Legal basis

The legal basis for the compilation of Environment Taxes Statistics is under EU Regulation (EU) 691/2011. This provides a framework for the development of various types of environmental accounts (also called modules). Other modules cover air emissions, economy wide material flow accounts and environmental goods and services.

3 Statistical Concepts, Methods

3.1 Subject of the Statistics

The basic data is taken from the NTL. It is the overall amount of tax paid under headings defined as environment taxes. The taxes statistics produced cover the following four main base categories:

- **Energy taxes (including fuel for transport):**

  This category includes taxes on energy production and energy products, including taxes on fuels for transport and stationary purposes. By definition Carbon taxes are included as an Energy tax rather than a Pollution tax, largely to aid international comparability. In Ireland's case, taxes on transport fuels make up the bulk of energy taxes.

- **Transport taxes:**

  This category includes taxes related to the ownership and use of motor vehicles. In Ireland this mainly relates to Vehicle Registration Tax (VRT) and Motor tax.

- **Pollution taxes:**
  This category includes taxes levied on emissions to air and water, management of solid waste and noise. Carbon taxes are not included in this category.

- **Resource taxes:**
  Included are taxes linked to the extraction or use of natural resources. Taxes on land are generally not included, nor are taxes designed to capture the resource rent from the extraction of natural resources.

3.2 Units of Observation/Collection Units/Units of Presentation

There is no unit level data. Input data included are annual macro-economic NTL tax aggregates for the economy of Ireland as a whole by main tax base and further broken down by tax type. These aggregates are distributed across NACE Rev. 2 sectors to provide the outputs; these are a detailed estimate of annual environment taxes for households and industries at NACE Rev 2, 2-digit level across the State.

3.3 Data Sources

The main data sources are the NTL, the Use Table from Supply-Use Tables (SUT) compiled by National Accounts and CO_2 Emissions data available internally in Environment division. All these data sources are aggregate data.

3.4 Reporting Unit/Respondents

Not applicable. No unit level data is collected.

3.5 Type of Survey/Process

Environment Taxes are estimates compiled by a process that involves weighting NTL aggregates using weights derived from SUT and CO_2 Emissions aggregates for the relevant year. The weights applied depend on the particular type of tax, for example Energy taxes use both SUT and CO_2 Emissions weights with the latter applied to fuels.

3.6 Characteristics of the Sample/Process

The key characteristic of the estimation process is that it is primarily based on the methodology set out in the Eurostat publication, "Environmental taxes A statistical Guide, 2013 edition". The guide emphasises an administrative data approach to estimate environment taxes based on applying the Use Table (UT) in the SUT, the SUT are published annually by the CSO (see http://www.cso.ie/en/releasesandpublications/ep/p-sauio/supplyanduseandinput-outputtablesforireland2014/).

The UT associates products (on rows) with the industries (on columns) that use those products. It gives the €000 amounts spent is making a product or providing a service by a particular industry. Both the product and industry classification used is NACE Rev. 2 at 2-digit level. Thus, for example, a cell in the UT might specify the amount spent in delivering say rental and leasing services (NACE 77) by say the wholesale trade (NACE 45) industry.

Specifically, only relevant products (rows) are selected from the UT to create weights for distributing NTL aggregate tax amounts. For example, for certain energy taxes, Electricity and Gas (NACE 35) production is the row of the table chosen to compute weights to distribute the aggregate amount of tax across each industry using that product. This approach will be elaborated further below.

3.7 Survey Technique/Data Transfer

Not applicable.

3.8 Questionnaire (including explanations)

Not applicable.

3.9 Participation in the Survey

Not applicable.

3.10 Characteristics of the Survey/Process and its Results

The key characteristic of the estimation process have been outlined above in subsection 3.6.

The results published and disseminated are a distribution of NTL environment tax aggregate amounts paid by type of tax at NACE Rev. 2 at 2-digit sector level of the tax payer. The results are publicly available on the CSO's website (see http://www.cso.ie/en/releasesandpublications/er/eaet/environmenttaxes2016/).

3.11 Classifications used

NACE Rev. 2 classification.

3.12 Regional Breakdown of Results

The statistics compiled and published refer to Ireland as a single regional unit.

4 Production of the Statistics, Data Processing, Quality Assurance

4.1 Data Capture

Not applicable.

4.2 Coding

Not applicable.

4.3 Data Editing

Not applicable.

4.4 Imputation (for Non-Response or Incomplete Data Sets)

Not applicable.

4.5 Grossing and Weighting

Not applicable.

4.6 Computation of Outputs, Estimation Methods Used

4.6.1 General observations

Detailed annual estimates of environment taxes are compiled in two parts as follows:

- Non-Fuel taxes
- Fuel taxes

These are added together to arrive at annual estimates of environment taxes classified by environment tax type and NACE Rev.2 industry sector of the payee. All computations and analysis involved are undertaken using SAS software.

4.6.2 Non-Fuel Taxes

Table 1 shows how individual NTL tax base headings within NTL environment tax types are associated with NACE Rev 2. product headings. The identification of individual tax bases by type of tax was accomplished jointly by National Account Division and Environment Division in CSO.

For each tax listed in the body of Table 1 the associated NACE Rev 2. product manufactured or service delivered that is primarily responsible for the tax burden is identified, specifically the column heading in Table 1. The corresponding row in the UT is extracted and weights for each NACE Rev. 2 industry involved in making this product or delivering this service are computed. Specifically, the weights are the contribution in the relevant row of UT of each industry to the total for that row including the household amount. Denoting the €000 amount in cell (i, j) of the UT by u_{ij}, the industry weight w_{ij} for industry j ($j = 1 \cdots J$) relating to the use of the product in row i is

$$w_{ij} = \frac{u_{ij}}{\sum_{j=1}^{J} u_{ij} + h_i}$$

where h_i is the amount spent in household consumption (Personal Consumption Expenditure PCE) of product in row i. Where tax exemptions exist or the use is clearly not related to final consumption of the product the €000 amount in cell (i, j) of the UT (u_{ij}) is set to zero, the use of motor vehicles within the motor trade being an example. The zeroing of UT components in the computations is accomplished via multiplying the u_{ij} value by a corresponding binary indicator value (0 or 1) separately maintained in an 'inclusion table'. With the appropriate weight computed for a particular tax in each row k and product in column i in Table 1 (e.g. cell $(2,1)$ is Carbon tax), the amount of this tax attributable to industry j, denoted by tax_{kij}, is

$$tax_{kij} = w_{ij} * tax_{ki}$$

This provides a breakdown of environment taxes by tax type, product and industry, aggregating over products i we obtain estimates of tax paid by industry sector of payee for non-fuel taxes. Note the use of the inclusion table permits this procedure to be applied *mutatis mutandis* to pure household taxes such as Motor Tax (households), here in the inclusion table we simply set all industry indicator values to zero and the household value to 1, this automatically assigns the full tax to households within the estimation procedure.

Table 1: NTL Tax headings classified by NTL Environment Tax Type and NACE Rev 2. Product

		NACE Rev 2. Product					
		Coke and refined petroleum products (19)	**Motor vehicles, trailers and semi-trailers (29)**	**Electricity, gas, steam and air conditioning supply (35)**	**Waste collection, treatment and disposal activities; materials recovery (38)**	**Air transport (51)**	**Households**
NTL Environment Tax Type	**Energy**	National Oil Reserves Agency Levy		ElectricityTax			
		Carbon Tax		Public Service Obligation Levy			
	Transport		Vehicle Registration Tax			Air Travel Tax	Motor Tax (Households)
			Motor Tax (Business)				Vehicle Driving Licence Expenses
	Pollution				Land Fill Levy		Plastic Bag Levy
	Resource						Fishery Levy

4.6.3 Fuel Taxes

Fuel taxes are designated as a type of Energy tax. Estimates of fuel taxes follow along similar lines to non-fuel taxes outlined above subject to a few notable differences. Firstly, the business versus household distribution of a Fuel tax is computed from PCE data. For their own purposes PCE within the National Accounts separately allocate fuel taxes to businesses or households. We take the relative proportions of these amounts and apply it to each tax, *e.g* excise duty on Petrol (light hydrocarbon oils) – PCE data is not directly used in our computations as our tax amounts are compiled on an accruals basis while taxes in PCE are based on a receipts, the differences are however small. The business portion of the tax is then estimated using the UT procedure outlined above (with households excluded) for fuels for heating or powering stationary machinery. For motor vehicle uses fuel taxes (Petrol and Diesel) are estimated using weights derived from CO_2 Emissions data available internally in Environment division in CSO. Annual CO_2 Emissions data are also available by NACE Rev. 2 sector. Here the fuel weights, labelled fw, are straightforwardly computed from the value amount of emissions, labelled e_j, as in industry j ($j = 1 \cdots J$) as

$$fw_j = \frac{e_j}{\sum_{j=1}^{J} e_j}$$

The business amount of fuel tax of type m ($m = 1: Petrol,\ 2: Diesel$) attributable to industry j, denoted by tax_{mj}, is then computed as

$$tax_{mj} = fw_j * tax_m$$

4.6.4 Final environment tax estimates

Estimated non-Fuel and Fuel environment taxes are added to arrive at overall estimated environment taxes. Resulting estimates are held as Excel files and are available by environment tax type and NACE Rev.2 industry sector of the payee. The outputs required for the release and for Eurostat are generated from these Excel files.

4.7 Other Quality Assurance Techniques Used

A key aspect of the estimation is that the overall environment tax amounts are taken from the NTL, these control totals are maintained throughout the estimation procedure.

Year-on-year comparisons are made to the estimates produced to ascertain whether or not continuity of the estimate may raise concerns. When this occurs, intervention to adjust the weights in the process is considered. For example changes to the sample size of the Annual Services Inquiry going from 2007 to 2009 raised a concern in relation to Rental & Leasing sector (NACE 77), necessitating adjustments to weights.

Prior to publication, some further manual checking is also carried out to ensure the robustness of the estimates.

5 Quality

5.1 Relevance

As stated in Section 2 the key driver for the compilation of environment tax estimates comes from the need of policy makers to assess the environmental impact of a certain tax, such as the reduction in pollution resulting from the introduction of a new tax, and importantly assess the proportion of overall tax burden that is environmental. This release provides key data within the overall framework of environment statistics that contributes to addressing these needs for Ireland.

In the international context these data are needed to fulfil Ireland's requirements under EU Regulation (EU) 691/2011, specifically the 'module' on environment taxes. This contributes to the development of a satellite account for the environment sector. The principal environment tax statistics are annual total taxes paid for Energy, Transport or Pollution and Resources uses in the state.

5.2 Non-sampling effects

5.2.1 Quality of data sources used

The data used by the procedure comes from administrative source within CSO. Accordingly, these data sources are considered to be highly reliable.

5.2.2 Register coverage

Not applicable.

5.2.3 Non-response

Not applicable.

5.2.4 Measurement errors

Not applicable.

5.2.5 Accuracy and Reliability

5.2.5.1 General Observations

As stated the estimation is based on maintaining overall environment tax amounts from the NTL as control totals throughout the estimation procedure. The procedure itself follows the guidelines set out in the Eurostat publication, "Environmental taxes A statistical Guide, 2013 edition". The Irish specific estimation procedure has been coded in SAS, this approach ensures the data and programming are maintained separately (unlike an Excel based solution). Thus new data that might involve revisions can be readily incorporated without contaminating the procedural aspects of the estimation. Accordingly the estimates are considered reliable.

5.2.5.2 Forecasts

Use Tables are normally compiled 3 years after the period in question in accordance with Eurostat requirements. This means that it is necessary to forecast the most recent UT for recent years. Forecasts ahead for each cell in the UT, that is for each product by industry cell combination (both at NACE Rev.2, 2-digit level) are made; about 8,000 individual series are forecast. A simple univariate forecast procedure has been found most stable and reliable given the very short length of the series (16 annual data points from 2000 to 2015). The method involves computing the last two growth rates and taking their weighted average. If T denotes the last year the UT has been compiled, we compute the forecast of the value in product by industry cell (i, j) of the UT at time $T + k$ as

$$u_{ij,T+k} = u_{ij,T+k-1} * g_{ij,T} \qquad (k = 1,2,3)$$

where the growth rate in the cell is given by the weighted combination of the growth rates at the last two available time periods, specifically

$$g_{ij,T} = 0.75 * \frac{u_{ij,T}}{u_{ij,T-1}} + 0.25 * \frac{u_{ij,T-1}}{u_{ij,T-2}}$$

We note that this procedure was found to be more reliable than SAS Proc Forecast methods and also better than forecasts arising from a full automatic ARIMA modelling procedure. This of course is not surprising given the very short nature of the series. Indeed in many instances these more sophisticated methods failed to converge and no forecast on an unreliable

forecast was produced. Nonetheless, as more UT's become available in future years one of the other procedures may be adopted if they prove to give more robust forecasts.

5.2.5.3 Backcasts of Use Table and environment tax estimates

To comply with the spirit of EU Regulation (EU) 691/2011 we have endeavoured to make available a continuous series of environment tax estimates from 2000 onward. To facilitate this it has been necessary to compile the UTs for 2000 to 2007 under the NACE Rev. 2 classification as UTs for those years are currently only published in Ireland under the older NACE Rev. 1.1 classification of economic activity.

The methodology used to compile UTs under NACE Rev. 2 for 2000 to 2007 is not trivial. Firstly and obviously values for activity codes headings with a one-to-one match are copied directly, about 2/3$^{rd's}$ of all matches were of this type. Where mismatches occur two methods are adopted. Specifically, many-to-one matches from NACE Rev. 1.1 to Rev 2. are simple aggregations. For one-to-many activity code headings matched from Rev. 1.1 to Rev 2 a split of the Rev. 1.1 amount was needed. The weights used to allocate the single NACE Rev. 1.1 amount in the UT to many NACE Rev 2 amounts was derived from the corresponding split of the United Kingdom's UT for the relevant year. Because of the two-way structure of the UT the allocation was applied both row wise and column wise to arrive at a valid two-way allocation. This highly intricate procedure was programmed in SAS to ensure the structure of the two-way transformations applied were identical across all years 2000-2007, in other words only the within year weights changed from year to year. The resulting NACE Rev. 2 UT was then used as described earlier to compile the environment taxes estimates for the years 2000 to 2007.

5.3 Timeliness and Punctuality

5.3.1 Results

The results arising from this procedure are required to be sent to Eurostat within 21 months of the end of the year to which the figures relate. We endeavour to make available the release of the estimates nationally as soon as practicable before the 21 month deadline has elapsed. Indeed, estimates for 2017 have been released in under 6 months from the end of 2018.

5.4 Coherence

As stated earlier a key aspect of the estimation is that the overall environment tax amounts are taken from the NTL, these control totals are maintained throughout the estimation procedure. Year-on-year comparisons made to the estimates to ensure reasonable continuity over time.

5.5 Comparability

The statistics are compiled to meet, to the greatest extent possible, the recognised statistical standards recommended by Eurostat as set out in their publication, "Environmental taxes A statistical Guide, 2013 edition". Accordingly, they are regarded as being methodologically sound and therefore comparable over time between those countries subscribing to the methodology. However, UTs are country specific and so reflect specific shocks that occur in that economy, irrespective of whether those shocks are anticipated or not. Statistical comparisons over time and across countries should therefore be made with care.

5.6 Accessibility and Clarity

5.6.1 Assistance to Users, Special Analyses

The release and background notes are available on the CSO website at 11am on the release day.
The release calendar is published on the CSO website:
https://www.cso.ie/en/csolatestnews/releasecalendar/

The release presents data across 5 Tables. Table 1 presents the total environment taxes from 2000, broken down by category of environment tax and individual tax type. Tables 2 to 5 present the environment tax categories broken down by NACE Rev. 2 economic activity of the payee.

5.6.2 Revisions

Revisions will be made annually as more up-to-date UTs become available. Indeed, the need for annual revisions based on more up-to-date UTs is highlighted in the Eurostat publication, "Environmental taxes A statistical Guide, 2013 edition". Revisions in 2018 also occur on foot of more refined National Accounts data.

5.6.3 Publications

5.6.3.1 Releases, Regular Publications

The Environment Taxes Release is available at:
http://www.cso.ie/en/releasesandpublications/er/eaet/environmenttaxes2017/

5.6.3.2 Statistical Reports

None

5.6.3.3 Internet

http://www.cso.ie/en/statistics/environment/

Estimates may be made available on CSO Statbank in the near future.

5.6.4 Confidentiality

Certain key data used to compile environment taxes, such as SUT, are available on the CSO website. Other data are available internally in CSO, these are confidential and so in accordance with Statistics Act, 1993 cannot be accessed under the terms of the Freedom of Information Act, 1997. Such data are not disclosed by the CSO to any other Government Department or outside body.

6 Additional documentation and publications

The Eurostat publication, “Environmental taxes A statistical Guide, 2013 edition” is available at

http://ec.europa.eu/eurostat/documents/3859598/5936129/KS-GQ-13-005-EN.PDF