THE ESRI ENVIRONMENTAL ACCOUNTS

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The national accounting framework, including such key concepts as Gross National Product, is a vital input to economic decision making. However, the standard national accounting framework does not take account of the pressure or damage to the environment caused by the economic activity. Thus, similar levels of GNP might involve quite different environmental damage, with implications for both current and future welfare and economic activity. Environmental accounts are now constructed in many countries to take account of these concerns, building on initial research by Nordhaus *et al.* (1972) and agreed international standards (United Nations *et al.*, 2003). Environmental accounts build on the well-established and coherent national accounting framework, but add to this what are termed "satellite accounts" dealing with environmental issues, in a way which allows for them to be integrated and measured in a more comprehensive framework. This provides an increasingly sound basis for decision making on the environment.

A recent paper** presents the ESRI Environmental Accounts for the Republic of Ireland 1990-2006. The paper describes the principles of environmental accounts, and illustrates their use by discussing trends in emissions and resource use in Ireland, by comparing the trend in carbon dioxide emissions in Ireland to other countries, and by attributing emissions to consumption.

There are four parts to the environmental accounts: (1) emissions and waste, (2) resource use, (3) expenditures on environmental protection, and (4) economic value. Data are given by economic sector. The ESRI Environmental Accounts are the most extensive accounts for Ireland, and the only ones that adhere to the international standards. There are 63 substances (26 emissions, 12 types of waste and 25 resources) for 20 sectors (19 production sectors plus households) for the period 1990-2006. The data come primarily from the Central Statistics Office (CSO), the Environmental Protection Agency (EPA) and Sustainable Energy Ireland (SEI). Data on expenditures on environmental protection will be available in the near future. Data on the economic value of the environment is scattered and inconsistent. While the amount of data on emissions and resource use is impressive at first sight, the ESRI Environmental Accounts are heavily skewed towards climate and energy, with a reasonable coverage of waste and acidification. The use of land, water, and materials is largely omitted. Large

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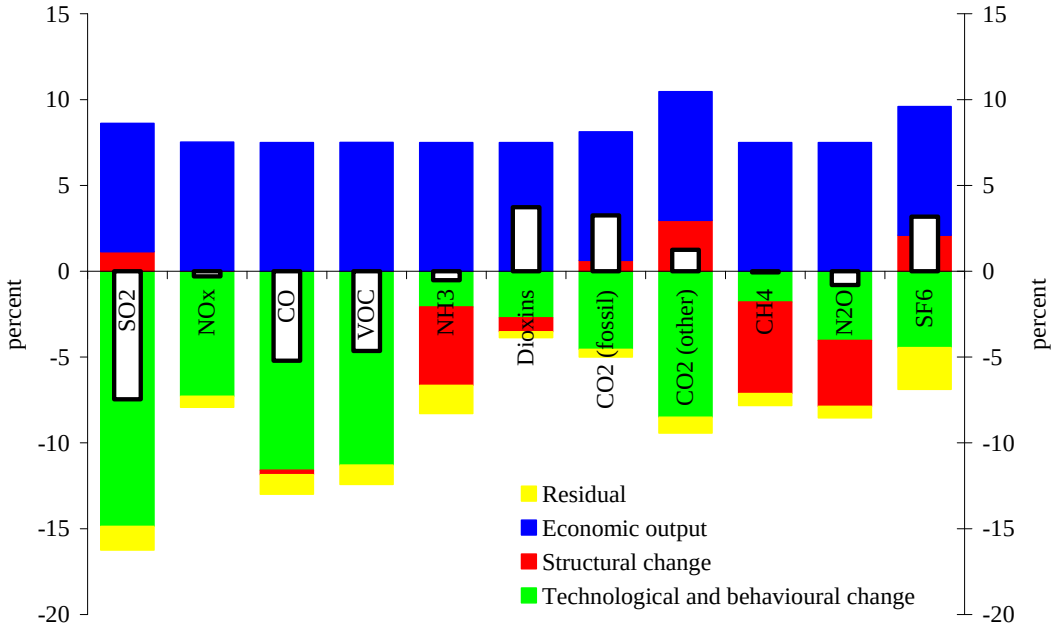
groups of chemicals, including many potentially harmful ones, have to be ignored because of the lack of suitable data.

The ESRI Environmental Accounts are proper satellite accounts of the National Accounts. We can, therefore, readily integrate economic and environmental data. This allows us to interpret trends and, for example, allocate responsibility for particular emissions to the relevant sectors of activity.

Figure 1: A Decomposition of the Growth Rate of Emissions[a]

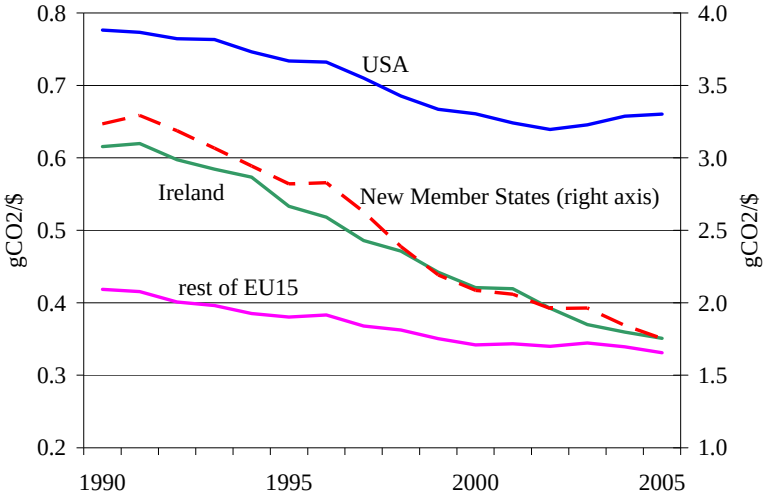


[a] The average annual growth rate for the period 1990-2006 is presented as the white insert. The growth rate is decomposed into the economic growth rate, the rate of structural change in the economy, technological and behavioural change, and a residual. The figure for dioxins is a projected value; the rest were measured.

Source: ESRI/EPA ISus model.

Figure 1 shows the average growth rates for the period 1990-2006 for emissions to air and energy use; this data is taken from the environmental accounts. Some emissions have fallen, notably sulphur dioxide, carbon monoxide, and volatile organic compounds. Other emissions have increased, notably carbon dioxide from fossil fuel combustion. Figure 1 also shows a decomposition of the growth rate (Ang, 2005); this data is taken from the integrated environmental and economic accounts. Economic growth has increased all emissions. Changes in the structural composition of the economy has increased some emissions (process carbon dioxide, sulphur hexafluoride) but decreased others (ammonia, methane, laughing gas). Technological and behavioural change has reduced all emissions, and particularly sulphur dioxide, carbon monoxide, and volatile organic compounds.

Figure 2: The Carbon Intensity of Ireland, Other EU Countries[a] and the USA

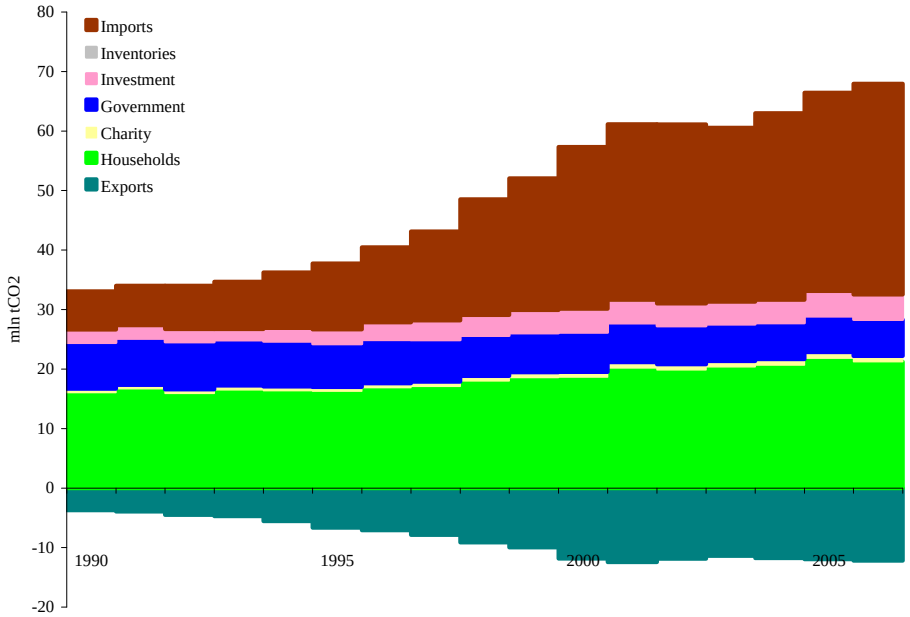


[a] EU countries are split into the 15 countries that were Member States between 1995-2004 and the 12 countries that have joined since 2004.

Source: ESRI Environmental Accounts; http://earthtrends.wri.org

For carbon dioxide, economic growth outpaced technological change. Emissions thus increased. Technological and behavioural change reduced emissions at a rate of 4.5 per cent per year, however. Figure 2 shows that this is unusually fast in an international context. While in 1990 Ireland emitted 50 per cent more carbon dioxide per euro value added than the rest of Western Europe, this difference had disappeared by 2005 (despite a low use of public transport in Ireland). Ireland's rate of improvement in carbon intensity was comparable to that of Eastern Europe.

Figure 3: Fossil Carbon Dioxide Emissions in Ireland by Demand

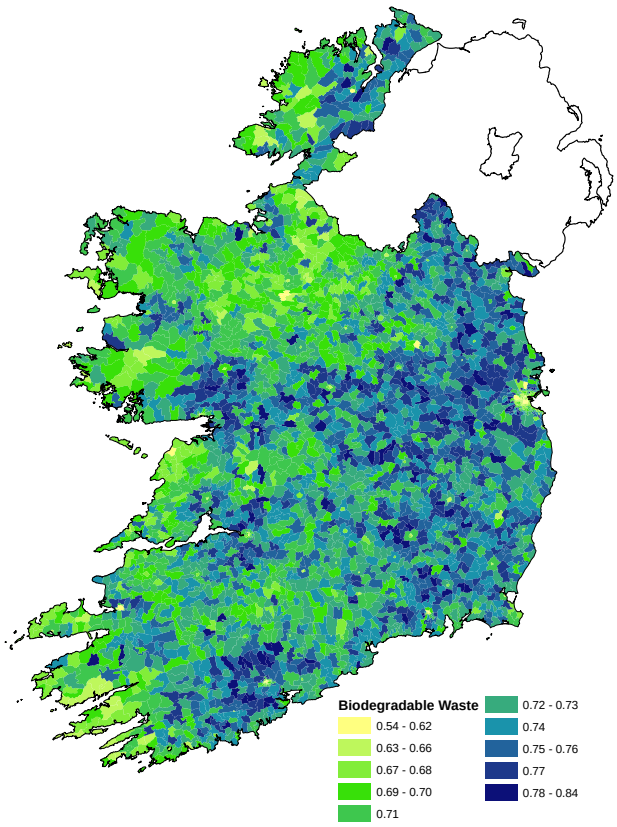


Source: ESRI/EPA ISus model.

The ESRI Environmental Accounts are *production* accounts: Emissions are allocated to the economic activity that generates the emissions. But because the environmental accounts are integrated with the economic accounts, we can use an input-output table to construct *consumption* accounts†, in which emissions are attributed to final consumption. Figure 3 shows whose consumption is ultimately responsible for carbon dioxide emissions from fossil fuel combustion. Households are the largest indirect emitters, followed by exports, the public sector, and capital accumulation. Figure 3 shows three distinct trends. Carbon dioxide emissions from domestic production for domestic consumption increased by about one-fifth between 1990 and 2006. Carbon dioxide emissions from domestic production for export out of Ireland doubled between 1990 and 2000, and then levelled off. Carbon dioxide emissions from foreign production for import into Ireland tripled in size between 1990 and 2006.

Fossil carbon dioxide emissions from domestic production for domestic consumption are further decomposed using household consumption data (CSO, 2008). This shows that the 10 per cent of people with the lowest incomes are responsible for only 5 per cent of emissions. The emissions share gradually increases for higher income deciles. The 10 per cent of people with the highest incomes are responsible for 15 per cent of emissions. While the average income of the richest 10 per cent is 14 times as high as the average income of the poorest 10 per cent; the average CO_2 emissions are only 3 times as high.

Figure 4: Biodegradable Waste Generation Per Household Per Year By Electoral District (Imputed)



Source: ESRI Regional Environmental Accounts.

Emissions can also be analysed by location and activity using the Tourism Satellite Accounts (Fáilte Ireland, 2005). Three-quarters of fossil carbon dioxide emissions from domestic production for domestic consumption is by people at home. Nine per cent is by Irish residents on leisure or business trips in Ireland, and 2 per cent by Irish residents on their way abroad. Foreigners travelling to Ireland for leisure or business account for 14 per cent of emissions.

The ESRI Environmental Accounts are nationwide. Some environmental issues are local rather than national in nature, while environmental policy may have varying effects on different areas. Selected parts of the environmental accounts have therefore been downscaled, imputing emissions, energy use and waste on the basis of census data§. Figure 4 shows a map of biodegradable waste from households, averaged for each of the 3,401 electoral districts. The pattern is largely determined by the average household size with income playing a smaller role. There are distinct differences between the cities (small families), the commuter belt (large families), and the deep countryside (small families).

Environmental accounts are a powerful tool to understand pressures on the environment, particularly when integrated with economic accounts. The ESRI Environmental Accounts are the most extensive accounts for Ireland. In this paper, we illustrate their use by decomposing trends in emissions, by comparing Irish trends to international trends, by attributing emissions to consumption, by splitting emissions by type of consumption and by imputing waste per local area.

Future research will extend the ESRI Environmental Accounts and develop further tools for interpretation, for example, distinguishing between imports for export and imports for consumption. Extensions will include material flows, expenditures on environmental protection, and the value of the environment.

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