The Swedish web-based household budget simulation module

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Introduction

Statistics Sweden wants its data to be used by more than core users. Today this mainly means finding ways of publishing on the internet in a way that creates interest.

The idea that the household or the private consumer can influence environmental pressures through its purchases has been in focus over the last decade. As producers of economic and environmental statistics, Statistics Sweden wants to be able to assist in showing the statistical links between private consumption and environmental pressures in pedagogical ways. In a way that is useful and stimulating.

At Statistics Sweden, we have therefore developed a web site for presenting results from our work with environmental accounts, both the official statistics and results from internal and external modeling efforts and analysis. One of the modules developed, as a result of participating in a governmental commission on sustainable consumption, focuses on how the household budget and composition of expenditures determines the emissions of CO_2. It is a simple simulation model showing the relationship between a household budget and the amount of CO_2 generated to satisfy that budget.

The module is possible to use on different levels – from just looking at the results for different pre-calculated household types, to setting up a budget and calculating emissions for a new household, with or without rebound effects.

It can be accessed through www.mirdata.scb.se (the direct address to the Household Module is ww.mirdata.scb.se/MIRS3/Model.aspx).

Before giving a brief presentation of that module, we will start by giving a view of the framework in which it is developed.

Background

The environmental accounts at Statistics Sweden were initiated in the early 1990's. Today this work has produced time series on different aspects of the environmental pressures from the economic development described in the national accounts.

Being a satellite account to the national accounts, it is important that the results can be shown in a way that clarifies the links, for instance, between economic activity, energy use and emissions to air. Data from all three areas should be presented with the same system boundaries, the same classification system and definitions, at the desired level of aggregation. This facilitates a clear view of the link between the economic actor and the environmental pressures from the actions taken by this actor during a certain year.

Most traditional databases at statistics bureaus are organized the same way that data is collected/compiled, i.e. by subject matter. Economic data is in one box, energy in another, environmental data in a third, etc.

This is not an optimal way of presenting/using the environmental accounts data. We therefore decided to try a parallel web site for users who wanted more than what is published in the official databases under environmental accounts data.

The framework for the website

Environmental accounts data are basically compiled by industry and domestic final consumption, i.e. all domestic economic actors that use fuel and other resources with an environmental impact. This is what we call a production perspective although it is probably more correct to call it a direct use, or input, perspective.

We compile and publish yearly data for the direct use of fuels, emissions to air from these used fuels and the economic indicators that describe the economic aspect of these production/use processes, i.e. Value Added, Production value, employed persons etc., using the same classification and level of aggregation. To this data we add a few analytical tools that simplify the overview and interpretation of the data.

In the yearly, cross section, perspective data can be viewed as:

- Absolute values

- Share of total industry/final demand/total – Profiles

- Values per MSEK Production, Value Added, Employed etc – Intensities

In the time series perspective data can be viewed as:

- Absolute values

- Values per MSEK Production, Value Added, employed etc –monetary denominators in fixed and current prices - Intensities

- Indexed series with user defined base year

The added functionality in the time series perspective facilitates quick decoupling analyses, by industry or total production (i.e. GDP).
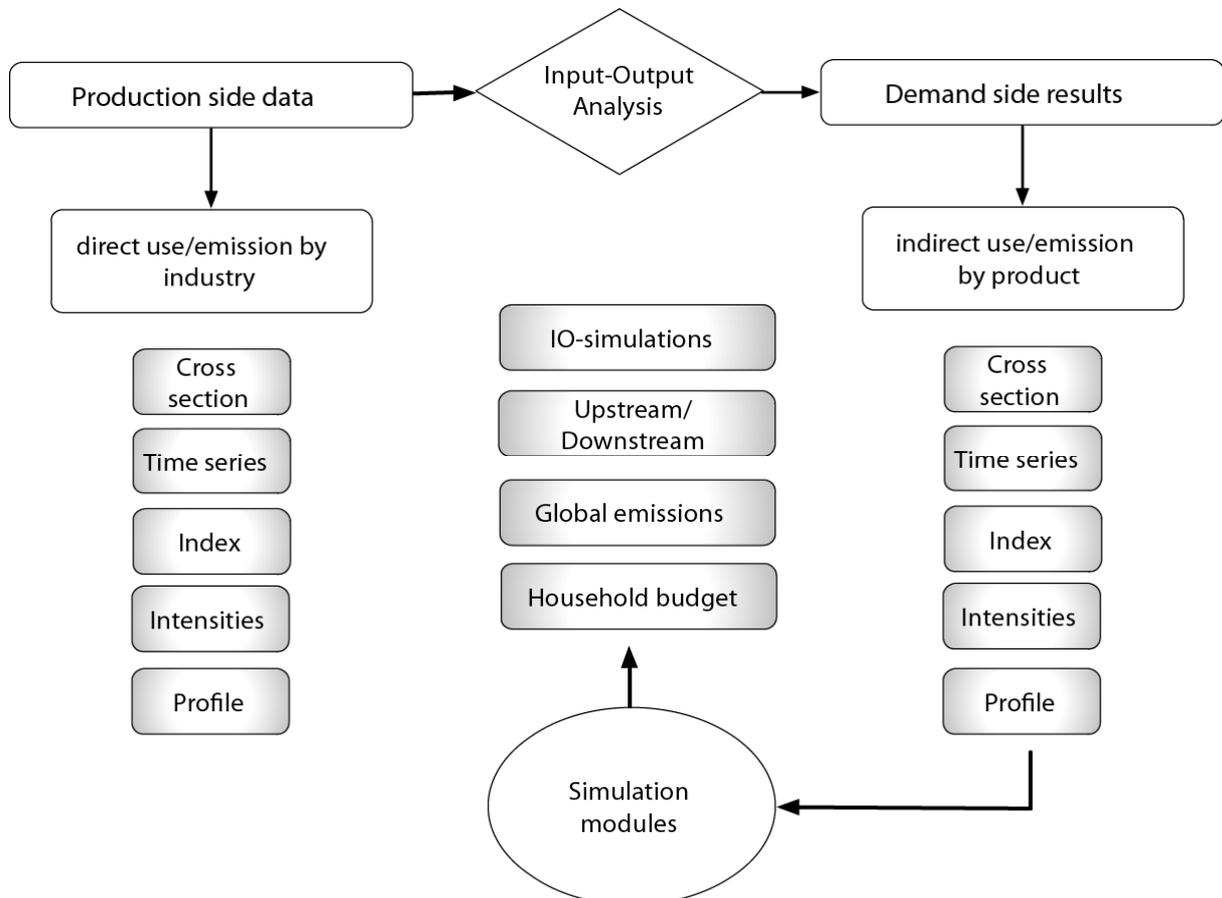
In addition to these built in analytical tools it is also possible to:

- Sort by a certain variable, i.e. to do a ranking of absolute values, intensities or index values.

- Create an own defined industry aggregation and save this for future use.

Using the same direct use data, mirror results are calculated for all indirect uses/emissions using Input-Output tables from the national accounts. The results from these calculations follow the same format as those describing the direct effects, i.e. by cross-section or time series with the same analytical tools. In addition to this results are also calculated as:

- Domestic - i.e. the mirror image of the domestic direct values presented as Production side data. These add up to the same total as that for direct use/emissions for all industries but are now allocated according to the indirect (upstream) uses/emissions by purchased product.

- Total - in which an estimate of the indirect uses/emissions in other countries from our imports are included. Emissions in other countries are usually calculated as if these imports where produced in Sweden.

Demand side results come in two versions.

Total final demand by product is presented in the same 2-digit NACE classification that is use from the production side.

Private consumption by households on the other hand is presented in a mixed level COICOP classification of 105 products. The idea with this finer classification is to facilitate the more detailed consumption based analysis that has become popular in recent years.

One of the aims with the Input-Output based results is to serve researchers, for instance, doing Life Cycle Analysis of products with complementary data that can be used to fill in gaps caused by necessary cut-offs in their analysis.

The environmental accounts, especially the Input-Output based version, has been is used in several research projects and government commissions, dealing with resource use, decoupling, trade and emissions, sustainability, etc. Some interactive examples of these studies are published on the web site.

One of these is a household budget simulation module that was originally developed for a government commission on sustainable consumption, using the results from the demand side analysis of private consumption.

The Household budget module

What and how much we consume will have environmental effects. The last couple of decades have seen a lot of initiatives in both measuring and influencing the choices we do as consumers. One way of measuring the effects of private consumption, and other parts of final demand, is to use environmental accounts data together with Input-Output analysis and show the upstream environmental pressures caused by our purchases of food etc. These emissions divided by the expenditures on food will give a measure of the emissions per MSEK and can be compared with emission intensities of other products. This is OK for policy making.

For everyday life and the decisions we are faced with in physical and virtual stores, it is too abstract.

Several environmental calculators have appeared over the last decade. They are usually based on results from life cycle analysis and built to answer questions like: If I drive my Volvo for 10000 Km per year, how much emission will I then cause? Or, how much emissions will a T-shirt cause? These types of calculators are fine for looking up emissions from the production of specific products. Attempts at using this kind of data to aggregate up to the total consumption of a household or groups of households have not been successful.

We decided to develop an environmental calculator that starts off with the purchases made - in SEK per year, not physical units. Furthermore we wanted to illustrate the fact that our expenditures occur under a budget restriction. This means that we make trade-offs between how much we buy of different products. It is the total level of purchases and the composition of these purchases that determine our own environmental pressure.

The household expenditure module should be used in three ways:

a) To understand the relationship between what, and how much, we buy and our environmental pressure – the pedagogical part.

b) To see what changes I can do in my household to contribute to a decrease of emissions – the action part.

c) To compare the environmental pressures of different household types – the statistical part and also the "us and them" part.

a) and b) was easily implemented using the data already in the core module, i.e. the emission intensities per product. C) needed additional data in the form of household expenditure data. With the results from the household budget surveys we could allocate the expenditures per product group, already calculated, over different household types – by region, income or demographics.

Using these building blocks, we built a web page with the following layout and functionality.

Statistiska centralbyrån
Statistics Sweden

CO2 Emissions from Households - A Simulation Tool

Consumption 2006

Reference Unit: All households
Estimate Unit: Single without ch.
Scope: Domestic
Unit: SEK per household

[Update] [Reset] [Level out] [Mark] [Save to File] [Help]

	Purpose	Reference	Estimate	%	Fix
1	Food	41 529	22 838	55	☐
2	Alcoholic beverages	6 939	5 222	75	☐
3	Tobacco	5 351	4 353	81	☐
4	Clothing materials	855	458	54	☐
5	Garments, repairs	13 727	7 644	56	☐
6	Footwear	2 533	1 454	55	☐
7	Imputed rentals for housing	71 544	82 401	115	☐
8	Maintenance and repair of the dwelling	1 502	537	36	☐
9	Electricity/Gas	12 939	6 755	52	☐
10	District heating	4 351	1 669	38	☐
11	Liquid fuels	1 339	968	72	☐
12	Solid fuels	645	365	57	☐
13	Furniture, repairs	6 932	3 406	49	☐
14	Household textiles	2 097	791	38	☐
15	Household appliances	1 414	587	42	☐
16					

CO2 Emissions(Kg) 2006

[Reference] [Estimate] [Difference] [Diff %]

	Type	Indirect	Direct	Sum
1	Mobile	1 465	2 454	3 919
2	Stationary	1 556	352	1 907
3	Bio	1 835	1 055	2 890
4	Process	165	43	208
5	Sum fossil	3 186	2 849	6 034

The bigger table contains yearly expenditure data in SEK for an average household of a given type, called Reference and the same for another average household called Estimate. Total expenditure is allocated over 45 products, and the % column shows the share of the reference household expenditures. The average single person household spent 55% of the average Swedish household on food. Both the Estimate and the % columns are editable and are to be used when simulating the environmental consequences of changes in expenditures.

In the smaller table, the emissions of CO2 from these household budgets are given in absolutes as well as absolute and % differences between the two household types. Here the expenditures of the average Swedish household generates more than 6 000 Kg of fossil CO2 emissions. All components of these emissions (fossil, as well as biofuel, based) are displayed.

As can be seen from the dropdown-lists on the left, the results can be viewed in different ways:

Scope – you can choose between domestic CO2 emissions or domestic emissions of CO2 plus emissions of CO2 in other countries due to import. This applies to the emission results.

Unit – you can choose between Total for all households, per household, per capita or per adult equivalent. This applies to both expenditures and emissions.

Over the expenditure table there are a few buttons with specific functions:

Update – recalculate emissions for the Estimate household after changes have been made to expenditures.

Reset – resets expenditures to that of the household type chosen in the Estimate Units dropdown list

Level out – equalizes total expenditure between Reference and Estimate household, but retains the structure of expenditures for the Estimate household. This can be seen as a crude decomposition analysis, but was originally developed to handle the so called rebound effect, i.e. that reduced expenditures (e.g. on emission intensive products) leads to increases in expenditures on other (more or less emission intensive) products.

Mark – is used to check/uncheck all the check boxes in the Fix column. The Fix column is used to mark all the expenditures that are not to be part of the equalizing of total expenditures. If we save money by purchasing less fuel, it could be reasonable not to have the Level out function raising fuel expenditures when it compensates for the decrease in total expenditures.

Save to file- saves the expenditure table and all the tabs in the emissions table to a local MS Excel file. This makes it possible to do a range of simulations and compare the outcomes. If you use MS Internet Explorer you can actually also copy and paste between a local MS Excel sheet and the Estimate and % columns in the expenditure table.

The data in the Household Budget module is updated annually with the rest of the web site and the official environmental accounts data.

Concluding remarks

The Household Budget module has pedagogical values and is appreciated, especially by people who are interested in, and used to, environmental data. It can be used in different ways, either just to look at the results and to do regional, income or demographical comparisons between households or as a tool for a more elaborate simulation exercise.

A tool like this will of course always be coarse and non specific. There will always be problems with specific products – e.g. airplane travel to Bangkok as opposed to the same level of expenditure for a trip to Luxembourg– we only have average emissions per monetary unit and at a fairly aggregated level.

The upside of this is that it is easier to overview and handle. Our aim is for it to produce quick results that can produce aha-experiences and fuel discussions and questions on the relationship between household expenditure and environmental pressures.