Environmental taxes and environmentally harmful subsidies

Report prepared for DG Environment and EUROSTAT

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Preface

Statistics Sweden has developed physical environmental accounts since 1993. To begin with, the focus has been on developing the environmental accounts for energy and certain emissions. This is the first report of results of developmental work on incorporating descriptions of environmental taxes and environmentally harmful subsidies into the Swedish environmental accounts.

Environmental taxes and environmentally harmful subsidies have been on the agenda in many countries in Europe the last couple of years. Environmental taxes aim to decrease the harm to the environment while there are subsidies that support the activities that might be harmful to the environment.

This report presents environmental taxes and environmentally harmful subsidies in Sweden on an aggregate level as well as broken down by industries and sectors. Tax subsidies have been calculated and distributed across different industries and in this connection the difficulty of determining tax norms will also be discussed. The breakdown of environmental taxes by industry are compared to relevant environmental data within the system of environmental accounts, like pollution and energy consumption.

The report is prepared on commission from EUROSTAT, who supports and coordinates development of environmental statistics in the EU member states. The European Commission (DG Environment) has contributed financially to the project. The report is prepared by Mårten Sjölin with contribution from Anders Wadeskog and Viveka Palm.

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Summary

The use of taxes and subsidies as policy instruments has increased in recent years. In Sweden there are environmental taxes that aim to moderate the extent to which the goods and services taxed are used, yet at the same time there are subsidies that contribute to increased use or preserve structures in our society that are unfavourable to the environment. This report presents and describes environmental taxes and certain potentially environmentally harmful subsidies at both total and industry levels. It provides estimates of the tax subsidies received by different industries, and in this connection the difficulty of determining tax norms will also be discussed. The environmental taxes that are described at industry level will be compared with other environmental accounts data available with an industry-level breakdown, such as emissions to air and energy consumption.

Environmental taxes

Environmental taxes are instruments that make the cost of environmental impact visible to actors in society and thus serve as an incentive to consumers to take environmental aspects of their behaviour into account. In practice, however, environmental concerns are weighed against other interests, such as competitiveness, regional policy and employment. One of the ways in which this process finds expression is in various types of special provisions.

Environmental taxes in Sweden have been classified into four categories, based on a method for dividing up environmental taxes that has been developed by Eurostat, OECD (Organisation of Economic Co-operation an development) and IEA (International Energy Association). These categories are taxes on energy[1], pollution taxes, transport taxes and resource taxes (see *Table A*). The tax on carbon dioxide is classified by Eurostat as a tax on energy, the reason is that carbon dioxide tax is an integral part of the energy tax laws in many EU countries and therefore difficult to measure separately.[2]

Table A. Environmental taxes in Sweden, 1993-1998, SEK million in current prices

Environmental taxes (SEK Million)	1993	1994	1995	1996	1997	1998
Taxes on energy	**39 017**	**42 043**	**44 161**	**49 715**	**49 352**	**52 652**
Energy tax (total)	26 230	28 448	29 908	31 957	34 586	37 286
Of which: Fuel	*20 520*	*22 686*	*23 742*	*24 546*	*25 776*	*26 914*
Electricity	*5 710*	*5 762*	*6 166*	*7 411*	*8 810*	*10 372*
Production taxes on electricity	2 243	2 375	2 442	4 093	2 276	2 422
Of which: Tax on hydropower	*1 029*	*800*	*933*	*1 520*	*0*	*0*
Tax on nuclear power	*100*	*139*	*133*	*1 115*	*1 472*	*1 549*
Charrge/tax on dismantling & storing	*1 114*	*1 436*	*1 370*	*1 458*	*804*	*873*
Carbon dioxide tax	10 544	11 220	11 811	13 665	12 490	12 944
Pollution taxes (air, land and water)	**582**	**566**	**682**	**753**	**551**	**508**
Sulphur tax	188	192	165	213	127	113
Environmental tax on air traffic	196	188	186	117	-	-
Tax on fertiliser	185	164	299	388	372	340
Tax on pesticides	13	22	32	35	52	55
Transport taxes	**8 119**	**5 852**	**5 798**	**6 721**	**6 451**	**6 336**
Tax on motor vehicles	4 095	4 064	4 049	5 471	6 242	6 103
Sales tax on vehicles	1 287	1 778	1 749	1 250	209	233
Kilometre tax on diesel fuel	2 737	10	-	-	-	-
Resource taxes				**70**	**131**	**142**
Natural gravel tax	-	-	-	70	131	142
Total environmental taxes	47 718	48 461	50 640	57 259	56 485	59 638
Environmental taxes as per cent of GDP in Sweden	*3,19%*	*3,04%*	*2,96%*	*3,26%*	*3,12%*	*3,16%*
Env. taxes in EU as per cent of total GDP in EU	*2,76%*	*2,85%*	*2,84%*	*2,85%*	*2,85%*	-

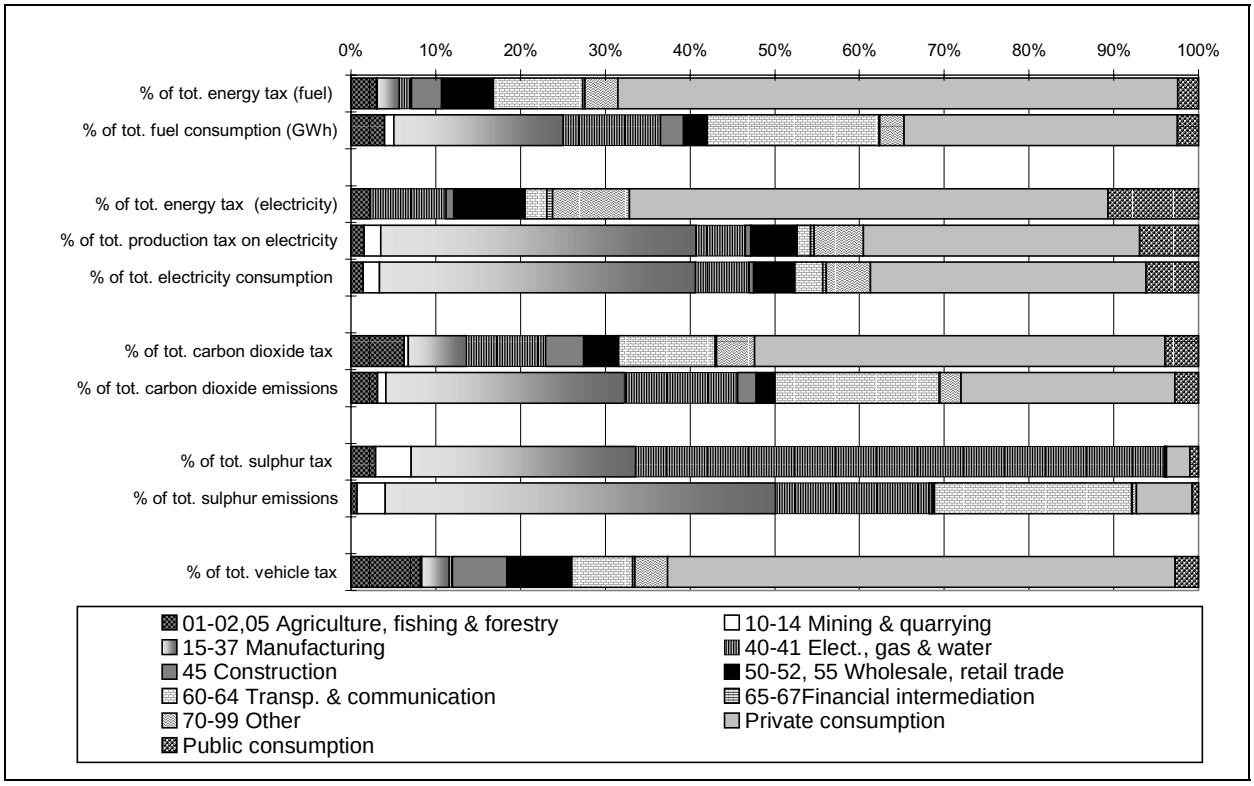
Source: Statistics Sweden, National accounts. Calculations of taxes on energy and the tax on sulphur in 1994 and 1996-98 are based on revenues received by the national government, while in 1993 and 1995 these estimates are based on fuel consumption. Information on environmental taxes as a percentage of GNP can be found in: Eurostat [1999], *Environmental taxes in the EU, Preliminary data.*

The 1993 and 1995 breakdowns by industry of energy, carbon dioxide and sulphur taxes are based on fuel consumption and the tax rates on the different fuels. The breakdown of motor vehicle taxes is based on the stock of motor vehicles in different industries and tax rates for different types of vehicles. *Figure A* illustrates environmental taxes linked with their respective tax bases, as distributed across different industries in the economy in 1995.

[1] Notice that "Taxes on energy" means all taxes on energy while "energy tax" is the specific Swedish tax on electricity and fuel.

[2] In many countries the carbon dioxide tax is introduced by changing the tax rates on the energy tax for different energy products according to carbon content.

Figure A. Overview of breakdown of environmental taxes and emissions/consumption by different industries and final demand, 1995



Taxes on energy

Taken as a whole, in current prices tax revenues from taxes on energy increased between 1993 and 1998. Tax revenues from the tax on carbon dioxide also went up between 1993 and 1996, but have since declined (see *table A*). Looking at the industry breakdown for 1993 and 1995 we can observe that:

- The manufacturing industries (NACE 15-37) and the mining and quarrying industries (NACE 10-14) had a high consumption of electricity and fuel but were exempt from energy tax for reasons of competition and paid only half the normal rate of carbon dioxide tax. The exemptions allowed by the tax legislation become obvious when an industry's payments of energy tax and carbon dioxide tax are compared with its consumption of fuel and electricity and emissions of carbon dioxide (see *Figure A*).

- Water transport (NACE 61) was entirely exempt from energy tax and carbon dioxide tax but nevertheless had a high consumption of heavy fuel oil. This meant that the share of total emissions and fuel consumption for which water transport was responsible was much higher than the industry's share of energy and carbon dioxide taxes. In 1995, water transport accounted for approximately 10 per cent of all emissions of carbon dioxide. As we see in *Figure A*, Transport and Communication (NACE 60-64) account for a higher percentage of emissions / fuel consumption than of energy and carbon dioxide taxes, largely because water transport was exempt from energy and carbon dioxide taxes.

- Activities outside manufacturing, mining and quarrying (NACE 10-37), and water transport (NACE 61), bear a percentage of taxes on energy that is

higher than their percentage of electricity / fuel consumption or carbon dioxide emissions. Private consumption paid a large part of both energy tax and carbon dioxide tax, about 60 per cent of the energy tax and 47 per cent of the carbon dioxide tax. It was responsible for around 25 per cent of total carbon dioxide emissions and about 30 per cent of total fuel and electricity consumption (see *Figure A*).

Pollution taxes

The tax on sulphur was introduced so as to reduce the emissions of sulphur associated with the burning of oil, coal and peat. Tax revenues from the tax on sulphur have declined, from SEK 187 million in 1993 to SEK 113 million in 1998, in current prices. This is due to reduced emissions, which in turn are a result of the decreased use of fossil fuels, a lower sulphur content in oil and improved sulphur removal. Exemptions from the tax on sulphur apply to fuel used by water transport (NACE 61), recovery boiler operation, fuel production and cases where the fuel is used for some purpose other than energy production. As is evident from *Figure A*, transport and communication (NACE 60-64) were responsible for about 25 per cent of total emissions of sulphur dioxide yet paid no taxes. This is due almost exclusively to water transport (NACE 61), which accounted for 96 per cent of all sulphur dioxide emissions from the transport and communication industries and 22 per cent of all emissions of sulphur dioxide in Sweden. Manufacturing (NACE 15-37) was responsible for 46 per cent of total emissions and 26 per cent of the sulphur tax paid (see *Figure A*). This reflects the fact that fuel used for fuel production (e.g. in refineries, NACE 23) and in industrial processes (e.g. recovery boilers and metallurgic processes) was exempt from sulphur tax in 1995.

Other taxes on pollution in 1995 included the environmental tax on domestic air traffic, which affected air transport companies (NACE 62) only, and taxes on pesticides and fertilisers, for which agriculture (NACE 01) was liable.

Transport taxes

The taxes on transport consist of motor vehicle tax, sales tax on motor vehicles and kilometre tax. Total transport taxes diminished from SEK 8.1 billion in 1993 to SEK 5.8 billion in 1995 and then increased slightly to SEK 6.3 billion in 1998, in current prices. The decline was due to the elimination of the kilometre tax in 1994.

The motor vehicle tax primarily affected private consumption and amounted to SEK 2.4 billion in 1995. In all industry (NACE 01-99), the industries that bore the heaviest shares of transport taxes in 1995 were agriculture (NACE 01), wholesale and retail trade, plus restaurants (NACE 50-52, 55), and the transport industry (NACE 60-64).

Subsidies that may run counter to sustainable development

The Swedish Environmental Protection Agency has identified a number of subsidies that may be inconsistent with a sustainable society.[3] The definition of subsidies used is broad and also includes tax subsidies. The report proceeds on the basis of three criteria for sustainable development, which were formulated in the Government's Budget Bill 1996/97:150, appendix 5:

- Protection of the environment,
- Efficient use (of energy and other natural resources), and
- Sustainable supply (closed cycles).

Subsidies that conflict with any of these points are regarded as being inconsistent with sustainable development.

Tax subsidies

Tax subsidies can be identified as exemptions allowed by the tax legislation from a generally accepted or normal rate of taxation. The tax subsidy quite simply consists of the difference between the actual rate of tax paid and this norm. Those who pay a lower rate of taxation than the norm enjoy a tax subsidy and those who pay a higher rate of tax than the norm are hit by a tax sanction. The size of the tax subsidy thus depends on how the normal rate of taxation (tax norm) is defined. Different definitions will result in tax subsidies and tax sanctions of different sizes. In order to shed light on this issue, three different norms for the tax on carbon dioxide will be used in this report. These are: (1) an average norm, (2) a norm based on existing tax rates excluding exemptions, and (3) an environmental norm that reflects the external cost of the carbon dioxide emissions.

According to the Ministry of Finance, tax subsidies have grown in scope from 1995 to the present day. Between 1996 and 2000, total tax anomalies in the field of excise duties increased from about SEK 24.1 billion in 1996 to an estimated SEK 31.9 billion in 2000.[4] The analysis in this report focuses on tax subsidies included in the various taxes on energy and income tax (allowances for journeys to and from work). The industries that suffer energy tax sanctions according to the average norm would be found to enjoy a subsidy if, e.g., the environmental norm were used (see private consumption in *Table B*). The breakdown and relative positions of different industries is evident irrespective of the norm used (see *Table B*).

3 Naturvårdsverket [1997], Ett urval av statliga subventioner som kan motverka en ekologiskt hållbar utveckling (Swedish Environmental Protection Agency, Selected state subsidies that may be inconsistent with ecologically sustainable development).

4 Proposition (Government Bill) 1998/99:100, appendix 4, referring to anomalies in the area of carbon dioxide, energy and sulphur taxes, estimated using a norm which takes into account the use the fuel is put to (i.e. different norms apply depending on whether fuel is intended for transport or heating).

Table B. Tax subsidies in carbon dioxide taxation on domestic fuel oil, estimated using three different norms, 1993 (SEK million)

Industries	Average *TotCO2-tax/Tot consump.*	Tax rate without exemption *Highest tax rate (982 SEK/m3)*	External cost *Fankhauser*
01-05 Agriculture, fishing & forestry	32	49	118
10-14 Mining & quarrying	12	15	29
15-37 Manufacturing	239	308	581
40-41 Elect., gas & water	63	88	189
45 Construction	-2	19	100
50-52, 55 Wholesale, retail trade	0	3	15
60-64 Transp. & communication	-3	-1	5
65-67Financial intermediation	-1	1	6
70-99 Other	-6	22	134
Private consumption	-323	1	1 268
Public consumption	-9	37	214
Total	0	542	2 659

In this report, tax subsidies included in carbon dioxide and energy tax in 1995 have been calculated on the basis of an average norm. The tax subsidies were shared mainly by transport and communication (NACE 60-64) and mining, quarrying and manufacturing (NACE 10-37). Using an average norm as the basis of calculations, the latter enjoyed a tax subsidy of approximately SEK 4 billion. Electricity and gas works and heating plants (NACE 40-41) enjoyed extensive tax subsidies in terms of energy tax, but suffered a substantial sanction in the form of carbon dioxide tax, again according to an average norm.

Direct subsidies

Direct subsidies are grants paid directly to the recipient. The potentially environmentally harmful direct subsidies identified by the Swedish Environmental Protection Agency have gradually diminished during the 1990s, due to the substantial reductions in interest subsidies to housing construction.

Table C. Potentially environmentally harmful direct subsidies in Sweden, 1993-1998, SEK million (current prices)

Subsidies (SEK million)	1993	1994	1995	1996	1997	1998
Support for forest motor roads	4	3	1	0	0	0
Support to agriculture (acreage and livestock support)	0	0	3 743	4 622	4 320	4 373
Transport support	293	341	383	388	323	328
Interest subsidies for housing construction	35 458	32 601	32 075	27 832	20 804	10 798
Support to reindeer husbandry	30	28	28	35	27	32
Support to fisheries	1	2	20	25	16	15
Total	35 786	32 975	36 250	32 902	25 490	15 546

Interest subsidies to housing construction accrued to real estate activities (NACE 70). In practice, most of this support benefits private consumption, even if it is attributed to real estate activities in the national accounts. EU acreage and livestock support accrued exclusively to agriculture (NACE 01), while fisheries support went to fishing (NACE 05). Virtually all the transport support of SEK 383 million in 1995 went to mining, quarrying and manufacturing (NACE 10-37).

Conclusions

Real estate activities (NACE 70) received the largest *direct subsidy*. This is entirely due to the substantial interest subsidies given to housing construction, which in 1995 amounted to SEK 32 billion. The primary industries, i.e. agriculture, forestry, fishing and hunting (NACE 01-02, 05), also enjoyed subsidies, above all for reasons of redistribution policy. It is worth noting that the potentially environmentally harmful direct subsidies to the primary industries (agriculture, forestry, fishing and hunting) exceed the total environmental taxes they pay.

Private consumption, the transport industry (NACE 60-64) – principally land transport (NACE 60) – and wholesale and retail trade and restaurants (NACE 50-52, 55) accounted for a large proportion of total *environmental taxes*. This is because road transport was taxed fairly severely through environment-related taxes, e.g. taxes on motor vehicles and motor vehicle fuels, reflecting the significant environmental impact of road transport, both locally and globally.

Manufacturing (NACE 15-37), transport and communication (NACE 60-64), electricity and gas works and heating plants (NACE 40-41), and mining and quarrying (NACE 10-14) were the industries that enjoyed the most extensive *tax subsidies* in the areas of energy and carbon dioxide taxes in 1995.

As a result of these exemptions, some of the actual emissions or actual consumption were untaxed in 1995, and the industries that consumed most energy and fuel and were responsible for the greatest emissions did not pay most in taxes. Swedish fiscal environmental policy therefore fails to fully satisfy the "polluter pays principle". In *Table D* we estimate how large a part of the actual emissions were freed from taxes, on the basis of general exemptions for water transport (NACE 61), mining and manufacturing (NACE 10-37), and the fuel used in electricity production, and exemptions from sulphur tax for fuel used in recovery boilers. Other exemptions, e.g. the 1.2 per cent rule, metallurgic processes and greenhouse heating, are not taken into account.

Table D. Estimate of the proportions of sulphur dioxide and carbon dioxide emissions that are untaxed, partially taxed and fully taxed, 1995

	Untaxed	Partially taxed	Fully taxed
Carbon dioxide emissions	16 %	29 %	55 %
Sulphur dioxide emissions	33 %	-	67 %

The manufacturing and mining industries are partly taxed (NACE 10-37) with a 75 per cent reduction.

According to estimates by the Swedish Commission on Climate Change, the level of carbon dioxide emissions in Sweden needs to fall by about 80 per cent if the present concentrations of carbon dioxide in the atmosphere are not to increase by more than 25 per cent by 2050. To comply with the resolutions of the 1997 Kyoto Conference, Sweden's carbon dioxide emissions must not increase by more than 4 per cent between 1990 and 2008-2012. With these targets in view, it is a problem that the environmental taxes do not place a greater burden on the actors who are responsible for the most substantial emissions and consumption of fuel.

Because of conflicts between different social goals, however, it is not an entirely unproblematic matter to eliminate these types of tax relief and direct subsidies. Nevertheless, trials have been made with systems of taxes and subsidies that aim to ensure that both environmental and other goals are achieved. Voluntary agreements are becoming more and more common in the countries of Europe. The principle here builds on agreements between industry and the government authorities that certain environmental targets must be met in order to qualify for various types of subsidies.

1 Introduction

1.1 Background

In 1993, Statistics Sweden, the National Institute of Economic Research and the Swedish Environmental Protection Agency were instructed by the Government to prepare a study covering the physical links between the economy, the environment and natural resources, the monetary reflection of these relations, and the state of the environment. The aim of work on environmental accounts at Statistics Sweden is to develop a system of physical accounts that are linked to the economic activities described in the national accounts. In practice this means developing a system of environmental and natural resource statistics that can be linked to the industry, product and sector categories used in the national accounts, thus forming a satellite system of accounts around the national accounts.

According to the UN, a system of environmental accounts should in principle cover:

- **Natural resources**. Environmental accounts should make it possible to describe stocks and changes in **stocks** of selected finite or renewable resources. They should deal both with questions related to the **monetary** valuation of this natural capital and **qualitative** aspects that do not have any market or other defined monetary value, e.g. the value of outdoor life and biodiversity.

- **Flows of materials** through the economy, e.g. energy and chemicals, together with the **emissions** and **waste** to which these flows give rise. Data on emissions, above all to the air, have been published for many countries, but there are often differences between traditional emissions statistics and emissions in environmental accounts, e.g. where bunkering is concerned. Within the EU, many countries have opted to use the Dutch NAMEA system[5] to describe these flows.

- **Economic variables** that are already included in the national accounts but are of obvious **environmental interest**, such as investments and expenditure in the area of environmental protection, environment-related taxes and subsidies, and environmental classification of activities and the employment associated with them, etc. In principle, environmental taxes and environmental protection costs can be regarded as two sides of the same coin. Both entail costs involved in production processes that are related to the exploitation of the environment in different ways. On the one hand, environmental protection costs record investments in measures aimed at improving the environment, while on the other, taxes record the costs set by the central government for exploitation of the environment. Within the framework of economic theory, this dichotomy could be interpreted as clean-up costs versus emissions charges. Thus, in the total cost of production, the environmental taxes paid

[5] NAMEA stands for National Accounting Matrix including Environmental Accounts. In principle this is a Social Accounting Matrix (SAM) supplemented by environmental accounts data on, e.g., emissions to air and waste, linked to the Use and Supply Matrices that a SAM is constructed around. Just as a SAM is a way of presenting national accounts data, NAMEA is a way of presenting environmental accounts data.

can be added to expenditure on environmental protection to give the total cost of using the production factor nature.

The tools the central government has at its disposal for influencing the actors in the economy are information, and administrative and economic instruments. The administrative instruments include laws, standards and ordinances. The economic instruments consist primarily of charges, taxes and subsidies. The use of taxes and subsidies as instruments of environmental policy has grown in significance in recent years. It is important to remember that taxes have two effects. On the one hand, they influence the extent to which the good / service that is taxed is used (the allocation effect) and on the other hand, they generate revenue. Where environmental taxes and other excise duties are concerned, the emphasis is generally on the desired allocation effects. Subsidies, in turn, also have allocation effects, but are perhaps used principally for reasons of redistribution policy. The non-explicit allocation effects of subsidies are probably important not least in the environmental sphere.

In the international arena, the use of environmental policy instruments has increased and organisations such as Eurostat (the Statistical Office of the European Communities), the OECD (the Organisation of Economic Co-operation and Development) and the IEA (the International Energy Association) are attempting to ascertain how environmental taxes are used in different countries. The increased interest on the part of these organisations is due primarily to a strong political interest in fiscal policy instruments in the environmental sphere together with the potential for transferring taxes from areas where they are thought to impede efficiency to the natural resources / environmental sphere.

In Sweden the issue of environmental taxes has been much debated in the 1990s, above all in connection with green “tax shifts”. In themselves, environmental taxes are considered to be an important means of influencing resource management so as to promote a sustainable society, and the link to a “tax shift” is thought to have a potential double dividend. This double dividend essentially consists in the idea that the efficiency of the economy can be enhanced by correcting the price of activities that impose a burden on the environment (i.e. by reducing an implicit subsidy), while at the same time reducing taxes (e.g. on labour) where the tax entails an inefficient use of resources. One further element in the discussions about shifting taxes from labour to the environment has been the hope of achieving a positive impact on both the demand for and supply of labour.

1.2 Definitions

1.2.1 Environmental taxes

Taxation in the environmental sphere consists almost exclusively of indirect, selective taxes[6] (or excise duties) levied on specific goods or environmentally damaging substances. The idea of producing separate accounts for environmental taxes arose out of cooperation between Eurostat, the EU Commission (DG XI and DG XII), the IEA and the OECD. Eurostat and the OECD have elaborated a definition of environmental taxes that has been accepted by the member states, making comparative studies possible between different countries in terms of tax structure, tax base, revenues, etc.

"…it has been chosen to single out the tax bases that seem to have a particular environmental relevance, and to consider all taxes levied on these tax bases as environmentally related regardless of the motives behind their introduction, their names etc."[7]

According to this definition, then, it is the tax base that determines whether or not the tax is an environmental tax. The explicit motivation is of minor importance, as a tax on a natural resource, for example, has the same impact on the economy regardless of whether it is motivated by the interests of public finance or by environmental concerns. This approach makes it possible to avoid the risk of subjectivity and include every tax that is relevant to the environment in the accounts. The tax base is the product, activity or substance that the tax rate is based on. An environmental tax base is defined as follows:

"a physical unit (or a proxy for it) that has proven specific effect on the environment."[8]

Proceeding from this definition, a number of environmentally related tax bases have been identified. These are: emissions to air and discharges to water, substances that affect the ozone layer, waste, natural resources, noise, energy products (fuels and electricity), and taxes levied on the transport sector.

In order to facilitate an overview of environmental taxes, Eurostat, OECD and IEA has classed these tax bases into four major categories, namely, taxes on energy[9] (including carbon dioxide tax), transport taxes, pollution taxes and resource taxes.[10] According to the OECD and Eurostat, the carbon dioxide tax belongs among the the category "taxes on energy" The main reason is that carbon dioxide tax is an integral part of the energy tax laws in many EU countries and therefore difficult to measure separately.[11] In this report we use the same tax bases and classification to identify the environmental taxes that existed in Sweden between 1993 and 1998.

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[6] Indirect tax = Tax that is shifted to someone other than the party that actually remits the tax to the state. Selective tax = Tax levied on a specific good or service.
[7] OECD [1997], *Statistical framework on environmental taxes in OECD countries.*
[8] Ibid.
[9] Notice that "Taxes on energy" means all taxes on energy while "energy tax" is the specific Swedish tax on electricity and fuel.
[10] Eurostat [1998], Steuer, A., *Environmental taxes in the EU*.
[11] In many countries the carbon dioxide tax is introduced by changing the tax rates on the energy tax for different energy products according to carbon content.

1.2.2 Subsidies that can be assumed to run counter to sustainable development

A subsidy can be defined in two different ways:

Narrow definition[12]
A contribution approved by a political decision and paid for producing or consuming a certain good or service. The subsidy raises the producer's receipts or reduces the price to the consumer. For the contribution to be regarded as a subsidy, the amount paid must vary in proportion to the quantity of the subsidised good or service. This definition excludes direct grants, tax subsidies, etc.

Broad definition[13]

- Any transfer of funds from the state / public sector in the form of grants, loans or risk capital.
- Any potential transfer of such resources as a result of guarantees or similar arrangements.
- Tax anomalies (tax subsidies) or non-collected public revenues, e.g. in the form of interest-free tax credits.
- Provision of public services or purchases of goods or services.

In this report, in principle, the broad definition will be used.

Whether and to what extent a subsidy contributes to negative impacts on the environment is far from self-evident. In 1997, the Swedish Environmental Protection Agency published a report commissioned by the Ministry of the Environment, showing the subsidies that have the greatest impact on the environment.[14] The subsidies selected for this report are based on the list of environmentally harmful subsidies compiled by the Swedish Environmental Protection Agency. In assessing whether a subsidy is harmful to the environment or not, the Government's three criteria for ecologically sustainable development[15] were used:

- Protection of the environment
- Efficient use (of energy and other natural resources)
- Sustainable supply (closed cycles).

The subsidies that have been identified come into conflict with one or more of these criteria. These selection criteria mean that the subsidies identified include not only subsidies that can be assumed to have a direct impact on the environment (e.g. in the form of increased emissions), but also subsidies that work against the efficient use of resources or undermine the principle of a sustainable long-term supply.

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[12] Ds 1988: 28, *Subventioner i kritisk belysning* (Subsidies: a critical view).
[13] SOU 1995: 36, *Förmåner och sanktioner – En samlad redovisning* (Benefits and sanctions: an overall account).
[14] Naturvårdsverket [1997], *Ett urval av statliga subventioner som kan motverka en ekologiskt hållbar utveckling* (Swedish Environmental Protection Agency, Selected state subsidies that may be inconsistent with ecologically sustainable development).
[15] Proposition (Government Bill) 1996/97: 150, appendix 5.

1.3 Purpose

This project has five principal purposes:

- To identify and report on the taxes in Sweden that come under the OECD and Eurostat definitions of environmental taxes.
- To estimate tax subsidies and discuss ways of producing such estimates, including how to determine tax norms.
- To investigate the possibilities of producing industry-level running statistics on environmental taxes and environmentally harmful subsidies.
- To study the data sources and methods that are needed in order to produce running statistics on environmental taxes and subsidies.
- To test out various different ways of presenting these data, either in isolation or in conjunction with other parts of the environmental accounts, e.g. data on emissions or consumption.

1.4 Limitations

As stated previously, the selection of subsidies is based on the report on environmentally harmful subsidies delivered by the Swedish Environmental Protection Agency to the Ministry of the Environment. Only national subsidies and certain EU subsidies are taken into account. Subsidies provided by the local authorities are not included. Similarly, only marginal attention is paid to the systems of subsidies (e.g. to agriculture and the regions) that came in when Sweden joined the EU.

Charges will not be reported, with the exception of taxes on commercial fertilisers and pesticides, which were formally charges until 1995. The nitrogen oxide charge (NOx charge) has a powerful effect as an environment control and is important from the environmental perspective, but since the sums remitted are reimbursed to those liable to pay the charge it is classified as a charge and is not dealt with here. Whether the charge/tax on the treatment of nuclear waste and the dismantling of nuclear power plants should be defined as a tax rather than a charge is a matter for debate. In this report it is defined as an environmental tax, since the revenues do not lead to a direct counter-service on the part of the state.[16] The data on taxes and subsidies that is given with an industry-level breakdown applies to 1993 and 1995, and the choice of taxes and subsidies is based on the system of taxes and subsidies existing at that time. For other years, only combined total revenues and expenditures are shown.

[16] The taxes are put into a fund and are later paid out in the form of a subsidy when costs arise for final storage or dismantling. Berglund, H., ES/NR, Statistics Sweden, telephone interview, 8 December 1999.

1.5 Sources and method

The sources given in the report have been chosen bearing in mind that this report is intended to be issued on a running basis in future. For this reason, most of the data we have used in the report has been taken from the programme for National Accounts (NR) at Statistics Sweden and not from other potential sources, such as the Special Tax Office in Ludvika. An exception applies in the case of transport support, where data has been taken from the Swedish National Board for Industrial and Technical Development. The breakdown of energy, carbon dioxide and sulphur taxes is based on quantities of fuel and electricity and the tax rates that apply to different industries and fuels. The breakdown of motor vehicle and kilometre taxes is based on the stock of vehicles in different economic activities and the tax rates for different vehicles. Other taxes burden a single economic activity exclusively. The estimation of tax subsidies builds on a method in which an average tax rate is calculated for energy and carbon dioxide taxes. See *Appendix 4* for a more detailed description of the methods and sources used.

1.6 Organisation of the report

In *chapter 2* there follows, first, a brief description of environmental taxes in the international perspective. Then comes an account of environmental taxes in Sweden between 1993 and 1998. The total tax revenues for these years are reported, together with an industry-level breakdown for 1995 and in some cases also for 1993. The payment of different environmental taxes by the different industries is compared, wherever possible, with emissions and consumption data for the same industries.

In *chapter 3* we describe the tax subsidies included in carbon dioxide and energy taxation, and discuss the problems involved and different methods used in determining tax norms. We then present an example of a possible breakdown of these tax subsidies by industry.

In *chapter 4* we briefly discuss some of the direct subsidies that the Swedish Environmental Protection Agency has identified as environmentally harmful.

In *chapter 5* the various taxes, tax subsidies and direct subsidies presented in the report are shown together, so as to give an overall picture of their total combined impact on the economy. We comment on the result in a brief analysis.

Chapter 6 takes up the different areas of use for these statistics as well as the possibility of linking these statistics with other data in the environmental accounts.

In a number of appendices we present a more detailed breakdown of environmental taxes in 1995 and 1993, background information on the direct subsidies, and some of the methods of estimation that have been used.

2 Environmental taxes

2.1 Environmental taxes: the international context

For a considerable time now, a number of different international organisations have pointed to environmental taxes as an effective instrument for promoting sustainable development. As we have already noted, international work on environmental taxes is being spearheaded by the OECD, the European Commission, Eurostat and the IEA. At the end of 1995, Eurostat and DG XI initiated a project that was meant to serve as a first draft of a manual on the organisation and presentation of statistics on environmental taxes. This project led to a major meeting in 1997 between representatives of the OECD, Eurostat and the IEA, at which the final definition and the statistical framework were set. It was decided that the definition of an environmental tax was to depend on the tax base.

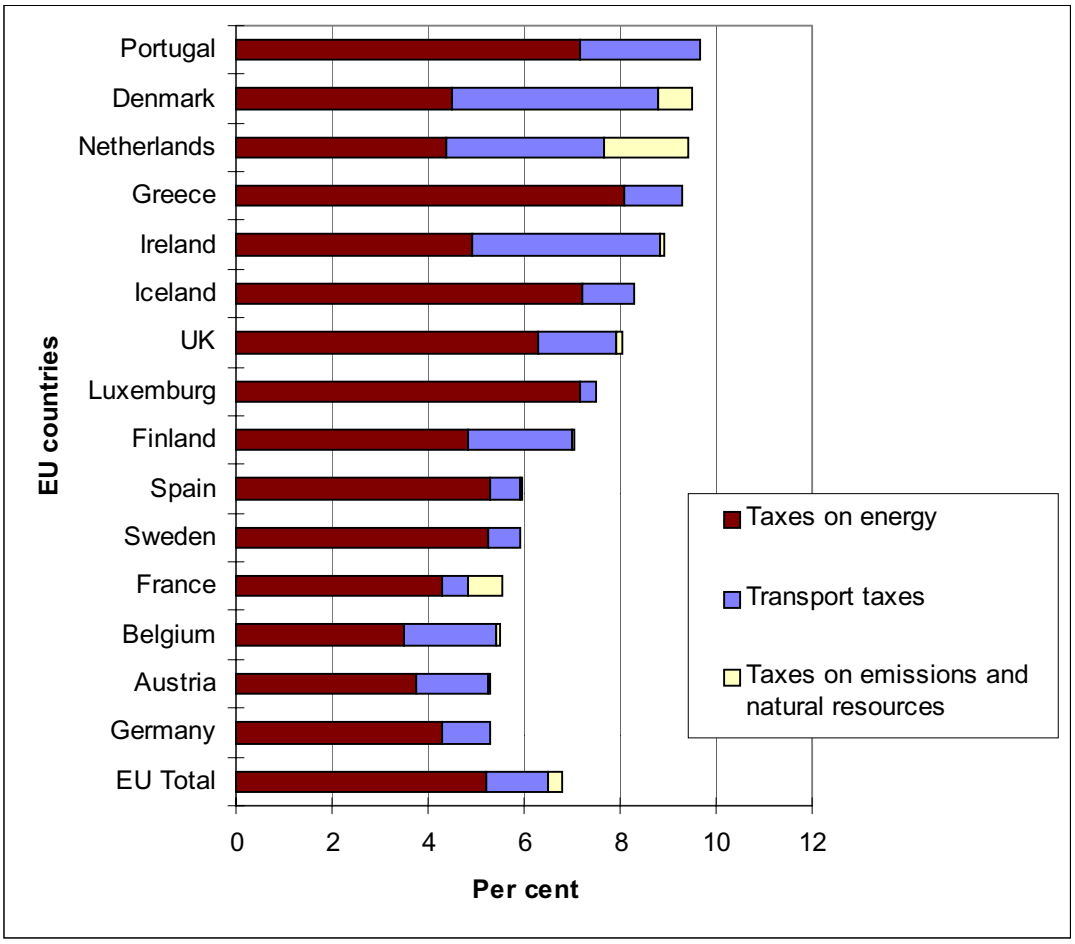
Germany, Finland, the UK, France, Portugal, the Czech Republic, Belgium, Greece, Spain, Denmark, Norway and Austria have written reports on their national environmental taxes. In these reports, the taxes that meet the OECD's definition of an environmental tax have been identified and the total tax revenues have been reported in time series. Norway has also presented an account of the environmental taxes identified at the industry level.

Comparative studies of different countries have been carried out within both the OECD and Eurostat. In May 1998, the OECD published a report comparing the environmental taxes in 1995 in different OECD countries and for different tax bases[17]. The tax revenues from environmental taxes in the different countries were compared with total tax revenues and GNP, so as to give the reader an idea of how large a proportion of total taxes or GNP the environmental taxes constitute in each individual country. The results of this comparison show that Portugal had the largest proportion of environmental taxes relative to total taxes, and the second largest proportion relative to GNP. However, Germany had the largest revenues, USD 59 billion out of a total of USD 121 billion in 1995. Sweden's total revenues from environmental taxes in 1995 were about SEK 50.6 billion (about USD 7.6 billion).

[17] OECD [1998], *Statistics on Eco-taxes: Progress report*, DAFFE / CFA / CT (98) 19.

Eurostat also published a report in December 1999, showing the environmental taxes in each Member State[18]. The different environmental taxes are classified there in four main groups, based on the tax bases previously specified. These four groups are: taxes on energy, transport taxes, pollution taxes and taxes on natural resources. The report shows that in 1997, approximately 74 per cent of all environmental taxes in the EU consisted of taxes on energy (in Sweden, carbon dioxide tax and energy tax). When the different countries' environmental taxes are compared with their total tax revenues and social security costs, it is Portugal that has the largest proportion of environmental taxes (see *Figure 1*).

Figure 1. Environmentally related taxes in per cent of total taxes and social security charges in the different EU Member States, 1997



Source: Eurostat [1999], report no. ACCt-exp / 99 / 5.1 *Environmental taxes in the EU*

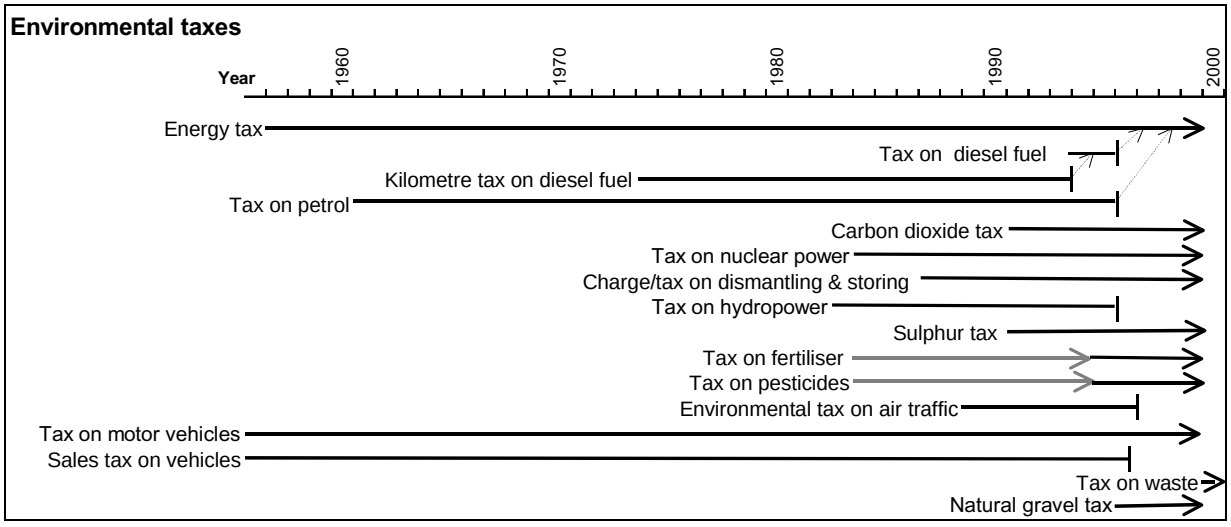
An environmental taxes database is being developed jointly by the OECD, Eurostat and the IEA. The purpose of this database is to facilitate comparative international studies. It will include data on the various exemptions in the tax legislation, the identity of the parties responsible for introducing and administering taxes, and other information.

[18] Eurostat [1999], report no. ACCt-exp / 99 / 5.1 *Environmental taxes in the EU*.

2.2 Development of environmental taxes in Sweden

Excise duties have long been used as a policy instrument in Swedish politics. A tax on motor vehicles was brought in as early as in the 1920s and the excise duty on petrol and alcohol motor fuels was introduced in 1929. The energy tax was introduced in the 1950s. This tax was brought in for reasons of public finance, but in the 1970s and 1980s excise duties on energy and motor fuels also began to be justified by reference to environmental and energy policy. The 1990-91 tax reform brought a greater emphasis on the environmental profile in indirect taxation and led to an increase in the taxes on energy. In 1991 taxes were also brought in on carbon dioxide and sulphur.[19] Between 1993 and 1995 major changes occurred in the Swedish tax system as a result of the harmonisation of the Swedish tax system with the EU; these changes affected the various taxes on transport and energy, and also the pollution taxes (see *Figure 2*). The kilometre tax on diesel motor vehicles was replaced by a duty on diesel oil in 1994. The duties on diesel oil and petrol were replaced by the energy tax in 1995. In this report, the diesel and petrol duties in 1993 and 1994 are included in the energy tax on fuels.

Figure 2. Development of environmental taxes in Sweden



Taxes on fertilisers and pesticides were brought in 1995 but had in reality existed since 1984 in the form of environmental charges. The switch to taxes was motivated partly by the substantial rises in the charges in 1994[20] and partly by the fact that the revenues from the two taxes were no longer earmarked for measures to improve the environment in the agricultural sector, but instead went straight into the public treasury.[21] The harmonisation of the Swedish tax system with EU regulations and taxes meant that the taxes that came into conflict with EU directives were abolished, e.g. the sales tax on motor vehicles and the environmental tax on domestic air traffic. Since entry into the EU, a tax on natural gravel has been introduced (1996) and a tax on waste came into force in 2000.

[19] SOU 1997:11, *Skatter miljö och sysselsättning, Slutbetänkande från Skatteväxlingskommittén* (Taxes, environment and employment. Final report of the Green Tax Commission).

[20] The *tax on pesticides* was raised from SEK 8 to 20 per kg of active substance and the *tax on fertiliser* from SEK 0.60 to SEK 1.80 per kg of nitrogen.

[21] Naturvårdsverket [1997], *Miljöskatter i Sverige* (Swedish Environmental Protection Agency, Environmental taxes in Sweden).

Table 1 shows the total tax revenues from the environmental taxes that currently exist and those that formerly existed in the Swedish tax system between 1993 and 1998.

Table 1. Environmental taxes in Sweden, 1993-1998 (SEK million in current prices)

Environmental taxes (SEK Million)	1993	1994	1995	1996	1997	1998
Taxes on energy	**39 017**	**42 043**	**44 161**	**49 715**	**49 352**	**52 652**
Energy tax (total)	26 230	28 448	29 908	31 957	34 586	37 286
Of which: Fuel	*20 520*	*22 686*	*23 742*	*24 546*	*25 776*	*26 914*
Electricity	*5 710*	*5 762*	*6 166*	*7 411*	*8 810*	*10 372*
Production taxes on electricity	2 243	2 375	2 442	4 093	2 276	2 422
Of which: Tax on hydropower	*1 029*	*800*	*933*	*1 520*	*0*	*0*
Tax on nuclear power	*100*	*139*	*133*	*1 115*	*1 472*	*1 549*
Charrge/tax on dismantling & storing	*1 114*	*1 436*	*1 370*	*1 458*	*804*	*873*
Carbon dioxide tax	10 544	11 220	11 811	13 665	12 490	12 944
Pollution taxes (air, land and water)	**582**	**566**	**682**	**753**	**551**	**508**
Sulphur tax	188	192	165	213	127	113
Environmental tax on air traffic	196	188	186	117	-	-
Tax on fertiliser	185	164	299	388	372	340
Tax on pesticides	13	22	32	35	52	55
Transport taxes	**8 119**	**5 852**	**5 798**	**6 721**	**6 451**	**6 336**
Tax on motor vehicles	4 095	4 064	4 049	5 471	6 242	6 103
Sales tax on vehicles	1 287	1 778	1 749	1 250	209	233
Kilometre tax on diesel fuel	2 737	10	-	-	-	-
Resource taxes				**70**	**131**	**142**
Natural gravel tax	-	-	-	70	131	142
Total environmental taxes	47 718	48 461	50 640	57 259	56 485	59 638
Environmental taxes as per cent of GDP in Sweden	*3,19%*	*3,04%*	*2,96%*	*3,26%*	*3,12%*	*3,16%*
Env. taxes in EU as per cent of total GDP in EU	*2,76%*	*2,85%*	*2,84%*	*2,85%*	*2,85%*	-

Source: Statistics Sweden, National accounts. Estimates of taxes are based on revenues received by the State in 1994 and 1996-98 and on consumption of different fuels in 1993 and 1995. Information on environmental taxes as a percentage of all taxes in EU countries may be found in Eurostat, report no. ACCt-exp / 99 / 5.1, *Environmental taxes in the EU. Preliminary data.*

In 1998, the total taxes came to 3.2 per cent of GNP, which is a slight increase over 1997. The percentage share of environmental taxes is slightly higher in Sweden than the EU average. As *Table 1* shows, taxes on energy brought in approximately 88 per cent and transport taxes about 11 per cent of all environmental taxes in Sweden in 1998.

Below we present a breakdown of the revenues from environmental taxes by different industries of the economy in 1993 and 1995. The breakdown is based on the consumption of various fuels and the tax rates applying to the different sectors and fuels, and on the pools of vehicles and the tax rates specific to types of vehicles. See *Appendix 4* for a more detailed account of the method used in producing the breakdown. The taxes that will be discussed are: energy tax[22], electricity production taxes, carbon dioxide tax, sulphur tax, taxes on fertilisers and pesticides, the environmental tax on domestic air traffic, the motor vehicle tax, the kilometre tax and sales taxes on motor vehicles. A detailed breakdown of environmental taxes by industries in 1993 and 1995 may be found in *Appendix 2 and 3.*

[22] In 1993, there was also diesel duty from October onwards, and the duty on petrol. These are both included in energy taxes.

2.3 Taxes on Energy

2.3.1 Energy tax

The general energy tax was brought in as early as 1957, primarily for reasons of public finance. The tax legislation has been revised several times and is now motivated in part by reference to environmental and energy policy. The energy tax was harmonised with the EU regulations on the taxation of mineral oils in 1995, which means that the energy tax is charged on fuels that are used for heating or operating motors.[23] In addition to fuels, energy tax is also charged on *electricity consumption*.

The *fuels* that are currently subject to the energy tax are petrol, fuel oil, diesel oil, kerosene, liquefied petroleum gas, coal, natural gas and petroleum coke. The tax rates for the different fuels are not proportional to their energy content, which allows greater flexibility in adapting the tax rate so as to meet various political objectives. For example, diesel intended for transport is subject to a heavier energy tax than the same fuel intended for heating. Pilot projects aimed at developing environmentally friendly fuels are exempt from energy tax. Fuel used in commercial water transport, in certain industries and by rail traffic is also exempt from energy tax, as is the consumption of aviation kerosene.

As mentioned previously, energy tax is also charged on *electricity*, the taxation occurring upon delivery to the end user. Double taxation is avoided by exempting fuels used for electricity production from energy tax.

The energy tax is an important source of revenue for the State. In 1998 it brought in approximately SEK 37 billion to the public treasury.

There are also a number of production taxes that burden *electricity production*. These are the nuclear energy tax, the hydropower tax and the charge/tax on storing nuclear waste and dismantling nuclear power stations (charge/tax for dismantling and storing in *Table 1*). The nuclear energy tax was introduced in 1984 and applies to all electricity produced at nuclear power plants. In 1997 the tax rate was SEK 0.022 / KWh. Formerly there was also a production tax on electricity produced at hydropower stations, but this was replaced in 1997 by a higher real estate tax on the value of land occupied by hydropower stations.

The charge/tax for dismantling and storing therefore only affects electricity produced at nuclear power plants. This tax was introduced concurrently with the expansion of nuclear power capacity in Sweden. In 1995 the charge/tax for dismantling and storing and the hydropower tax came to just over SEK 1 billion each, and the nuclear energy tax to SEK 133 million. The breakdown was much the same in 1993.[24] In this report, all these taxes come under the designation “production taxes”.

[23] SFS (1994/1776), *Lag om skatt på energi* (Energy taxes act).
[24] Berglund, H., ES/NR, Statistics Sweden, telephone interview, 23 November 1999.

Energy tax[25] on fuels, by different sectors and industries

As shown by *Table 2*, the share of energy tax on fuel paid by industry (NACE 01-99) increased by more than SEK 2 billion in current prices between 1993 and 1995 (for a listing of NACE categories, see *Appendix 1*). This increase is due in the first instance to the rise in the tax rates in 1995, when the new energy tax was introduced.[26] A further change in the energy tax on fuels that may have contributed to the increased revenues is the taxation of diesel. In 1993, diesel fuel used by working equipment such as tractors and forestry machinery was subject to a lower rate of energy tax than fuel used by motor vehicles such as buses, cars, etc. As from 1995, this situation changed and all diesel used by any type of motor vehicle is now classified as high-tax diesel, i.e. even tractor fuel. Energy tax revenues on diesel alone rose from SEK 1.2 billion in 1993 to SEK 3.4 billion in 1995, at current prices.

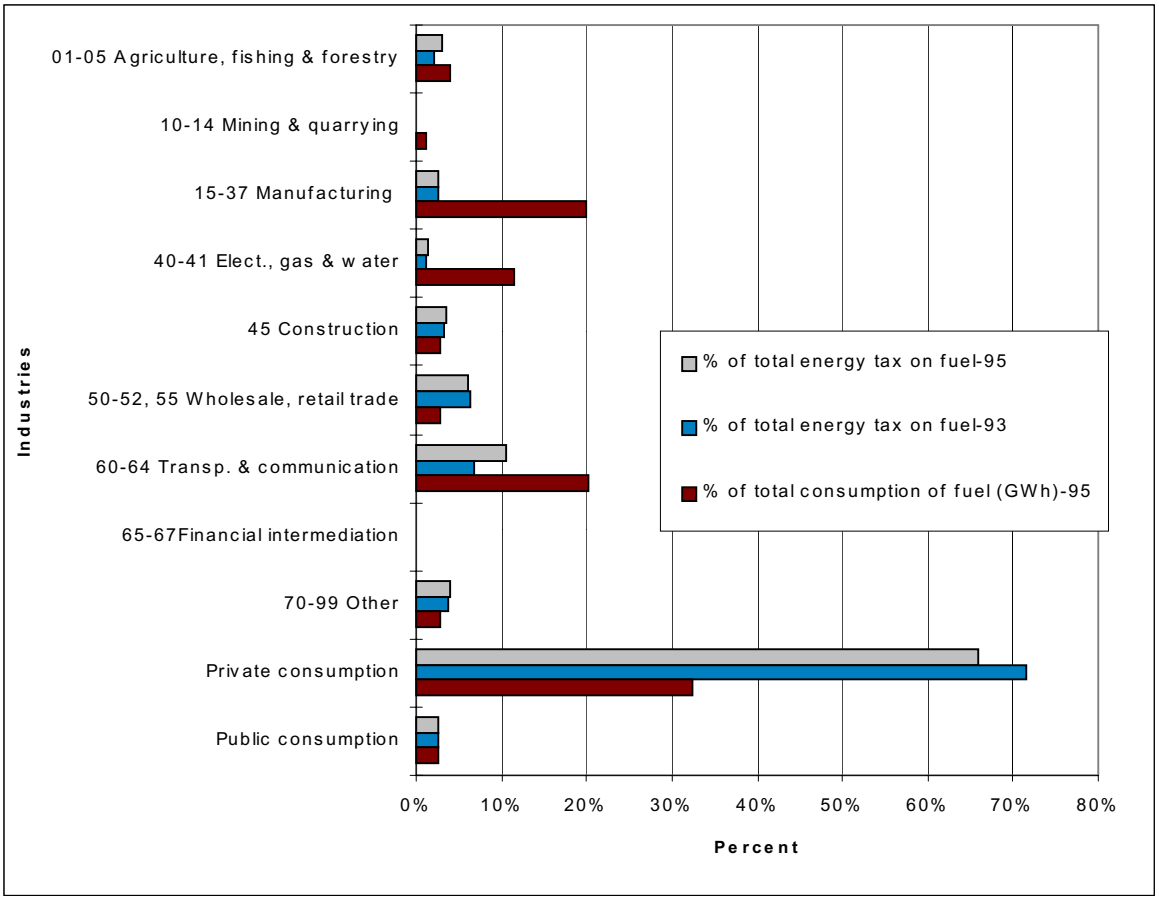
Table 2. Energy tax on fuel, by different sectors in the economy, 1993-1995 (SEK million, current prices)

	Energy tax on fuel (SEK milllion)	
Sectors	*1993*	*1995*
Industry (NACE 01-99)	5 333	7 487
Private consumption	14 662	15 670
Public consumption	525	586
Total	20 520	23 742

[25] Diesel oil duty and petrol duty are included in the energy tax in 1993.
[26] SFS (1994/1776), *Lag om skatt på energi* (Energy taxes act).

Figure 3 illustrates how energy tax on fuel were distributed between different industries of the economy and final demand in 1993 and 1995, and the percentage shares of the different industries in the total energy consumption in GWh generated from all different fuels. The share of energy tax paid by private consumers fell from 71 per cent in 1993 to 65 per cent in 1995. This still exceeded the share of fuel consumption for which private consumers were responsible, which in 1995 was 32 per cent. Manufacturing (NACE 15-37) and mining and quarrying (NACE 10-14) were responsible for 3 per cent and 0 per cent respectively of the total energy tax on fuel in both 1993 and 1995, even though their share of the fuels was considerably higher, totalling over 20 per cent in 1995. The same disproportion applies in the case of transport companies (NACE 60-64). This is because these industries enjoy various types of tax subsidies (see *Chapter 3.2.1*).

Figure 3. Total fuel consumption in 1995, and energy tax on fuel in 1993 and 1995, by different industries and final demand (per cent)



Energy and production taxes on electricity in different sectors of society and industry

Table 3 shows that although industry (NACE 01-99) consumed considerably more electricity than private consumers, it paid less in energy tax in both 1993 and 1995. This is because certain sectors of the economy, e.g. manufacturing, enjoy exemptions from the energy tax. The table also shows that electricity consumption by both industry and private consumers increased between 1993 and 1995.

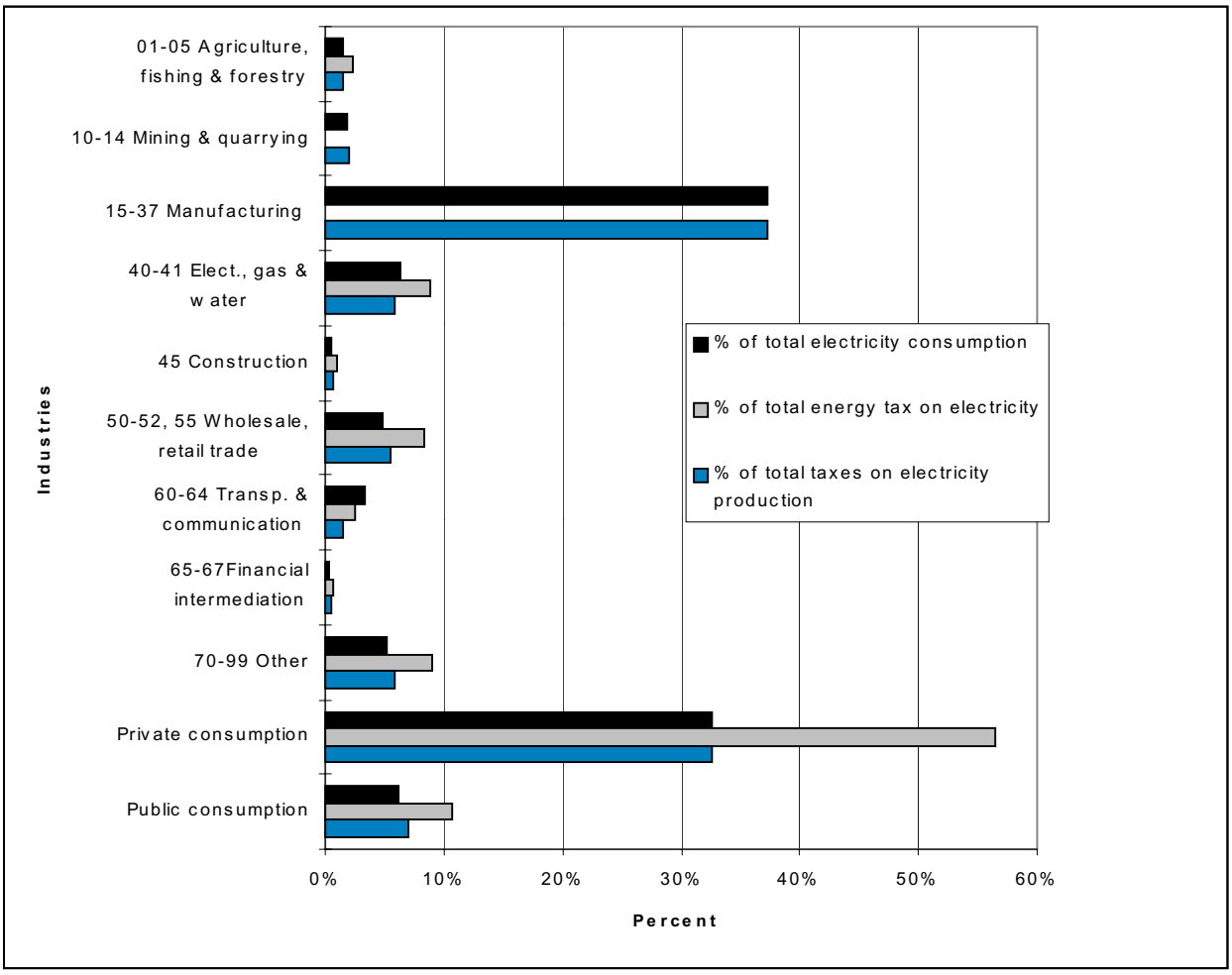
Table 3. Energy and production taxes on electricity, and electricity consumption, different sectors of the economy, 1993-1995 (SEK million, current prices, GWh)

	Tax on electricity production (SEK million)		Energy tax on electricity (SEK million)		Electricity consumption (GWh)	
Sectors	*1993*	*1995*	*1993*	*1995*	*1993*	*1995*
Industry (NACE 01-99)	1 279	1 379	2 006	2 026	78 906	81 137
Private consumption	674	742	3 100	3 482	42 757	43 084
Public consumption	150	159	604	658	8 858	8 165
Total	2 103	2 280	5 710	6 166	130 521	132 386

p
roduction tax on electricity excludes taxes on exports.

Figure 4 provides a breakdown of production taxes on electricity and energy tax on electricity consumption at a more detailed industry level. In 1995, manufacturing (NACE 15-37) accounted for 37 per cent of total electricity use, yet enjoyed a complete exemption from the energy tax. We see also that the percentage of taxes paid by private consumers, i.e. households, exceeded their percentage share of consumption. Private households were responsible for 33 per cent of all electricity consumed, while paying 56 per cent of the total energy tax on electricity. The public sector also pays a higher percentage of energy tax than its corresponding share of consumption. The percentage of energy tax paid by other industries of the economy was slightly higher than their corresponding share of total energy consumption.

Figure 4. Breakdown in per cent of electricity consumption and energy and production taxes on electricity by different industries and final demand, 1995



The breakdown of the different production taxes on electricity (nuclear power tax, hydropower tax and the charge / tax for dismantling and storing) reflected electricity consumption by the different industries.

2.3.2 Carbon dioxide tax

The carbon dioxide tax was introduced on 1 January 1991, at the proposal of MIA[27] (the Commission on Environmental Charges) and is levied on all fossil fuels in proportion to their carbon content.[28] When the tax was brought in in 1991, the tax rate was set at SEK 0.25 per kg of carbon dioxide, but by now it has risen to SEK 0.37 per kg of carbon dioxide. Fuel used for electricity production is exempt from carbon dioxide tax, as are diesel and fuel oils used in commercial water transport and rail traffic, as well as aviation petrol and aviation kerosene. Manufacturing, mining and quarrying (NACE 10-37) pay carbon dioxide tax at a reduced rate, amounting to just 25 per cent of the normal tax rate from 1993 onwards. In 1996 the abatement was lessened, and these industries now pay 50 per cent of the normal tax rate. Companies that use large amounts of energy can obtain further reductions when the tax exceeds 0.8 per cent of their sales value (in 1995, the threshold was 1.2 per cent). The companies that receive this type of reduction mostly operate in the cement, lime and glass industries.[29]

Public revenue from the carbon dioxide tax has increased steadily and came to SEK 12.9 billion in 1998. This makes the tax the secondlargest source of revenue among environmental taxes.

Carbon dioxide tax and carbon dioxide emissions, by different sectors of society and industries

As shown in *Table 4*, the carbon dioxide tax brought in approximately SEK 10.5 billion in 1993, and total carbon dioxide emissions came to 62.9 million tonnes. Both tax revenues and emissions increased until 1995, being then SEK 11.8 billion and 64.8 million tonnes. Industry (NACE 01-99) accounted for the greater part of this increase, both where taxes and emissions were concerned. The tax increase was due mainly to increased revenues from petrol and diesel. If we look at the distribution between different sectors in 1995, industry (NACE 01-99) was responsible for about 3 times as large emissions of carbon dioxide as private consumers, while paying about the same amount in carbon dioxide tax.

Table 4. Carbon dioxide tax and emissions of carbon dioxide, by different sectors of society (SEK million, current prices)

	Carbon dioxide tax (SEK million)		Carbon dioxide emissions (1000 metric ton)	
Sectors	*1993*	*1995*	*1993*	*1995*
Industry (NACE 01-99)	4 988	5 624	44 761	46 618
Private consumption	5 087	5 719	15 790	16 338
Public consumption	469	468	2 357	1 826
Total	10 544	11 811	62 908	64 782

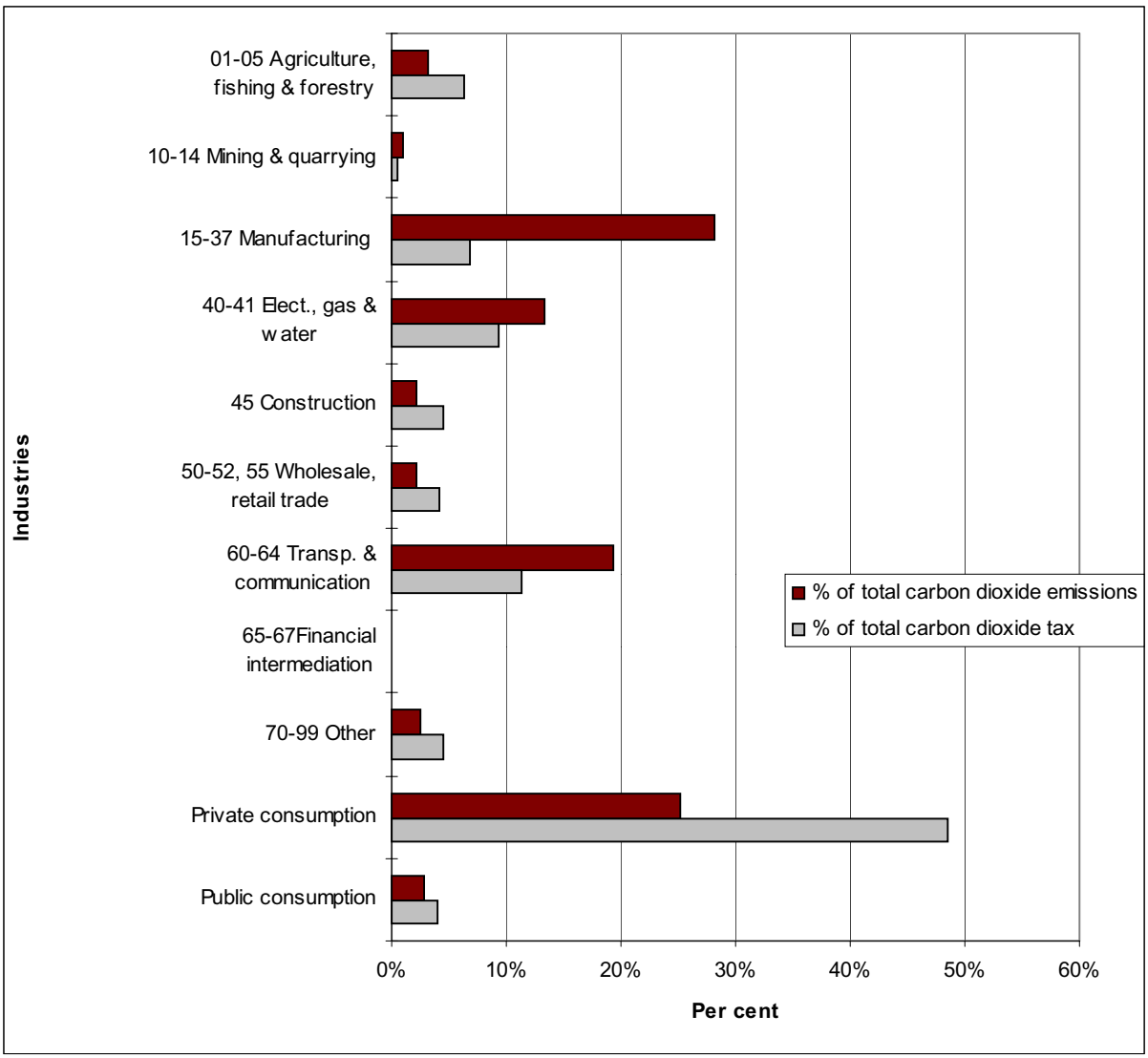
[27] SOU 1989:83, *Ekonomiska styrmedel i miljöpolitikenn* (Economic environmental policy instruments).

[28] Naturvårdsverket [1997], *Miljöskatter i Sverige* (Swedish Environmental Protection Agency, Environmental taxes in Sweden).

[29] Skatteförvaltningen 1994:5, *Ny lag om skatt på energi m.m.* (Swedish Tax Administration, New law on energy taxes, etc.).

Figure 5 illustrates at a more detailed level how the carbon dioxide tax and emissions in 1995 were spread between different industries and final demand. Manufacturing (NACE 15-37) was responsible for 28 per cent of all emissions but paid only 7 per cent of all carbon dioxide tax, reflecting the 75 per cent tax abatement. The transport and communication industries (NACE 60-64) also escaped bearing a share of the carbon dioxide tax corresponding to their share of emissions. The explanation for this is that water transport (NACE 61) was exempt from carbon dioxide tax but caused about 10 per cent of all emissions in 1995. Private consumers paid the largest share of the tax (about 47 per cent) but caused only 25 per cent of all emissions. This is because this sector is a major consumer of fuels intended for motor vehicles, e.g. diesel and petrol, and carbon dioxide tax is always charged at the full rate on these fuels (see tax rates, *Appendix 5*).

Figure 5. Percentage shares of carbon dioxide emissions and tax, by industry and final demand, 1995



2.4 Pollution taxes

2.4.1 Sulphur tax

The sulphur tax was introduced in January 1991 with the intention of reducing sulphur emissions associated with the burning of oil, coal and peat. The tax is based on the sulphur content of all fuels that are liable for energy and carbon dioxide taxes. Fuels that are used for ship propulsion, fuel production, recovery boilers and metallurgic processes, or for purposes other than generating energy, are exempt from sulphur tax.[30] Sulphur tax is not payable on fuels that have a sulphur content of 0.1 per cent by weight or less. The tax rate of SEK 30 / kg of sulphur has not been altered since the tax was introduced. If the sulphur emissions are treated or fixed in ash, deductions may be claimed on tax returns for the sulphur dioxide thus cleaned up.

Breakdown of sulphur taxes by different sectors of society and industry

Sulphur emissions and revenues from the sulphur tax have declined since 1993 and in 1998 the tax revenues came to SEK 113 million. The lower emissions are due to a decrease in the use of certain fossil fuels, a lower sulphur content in oil and improvements in sulphur treatment.[31] The sharp drop in sulphur dioxide emissions from public sector consumption is due to the fact that commercial activities in the public sector have been transferred to the industry sector in the system of national accounts. An additional reason is that the use of heavy fuel oil in heat production has fallen by approximately 74 per cent, being replaced, partly, by district heating.

Table 5. Total revenues from the sulphur tax and total emissions of sulphur dioxide in different sectors, 1993 and 1995 (current prices)

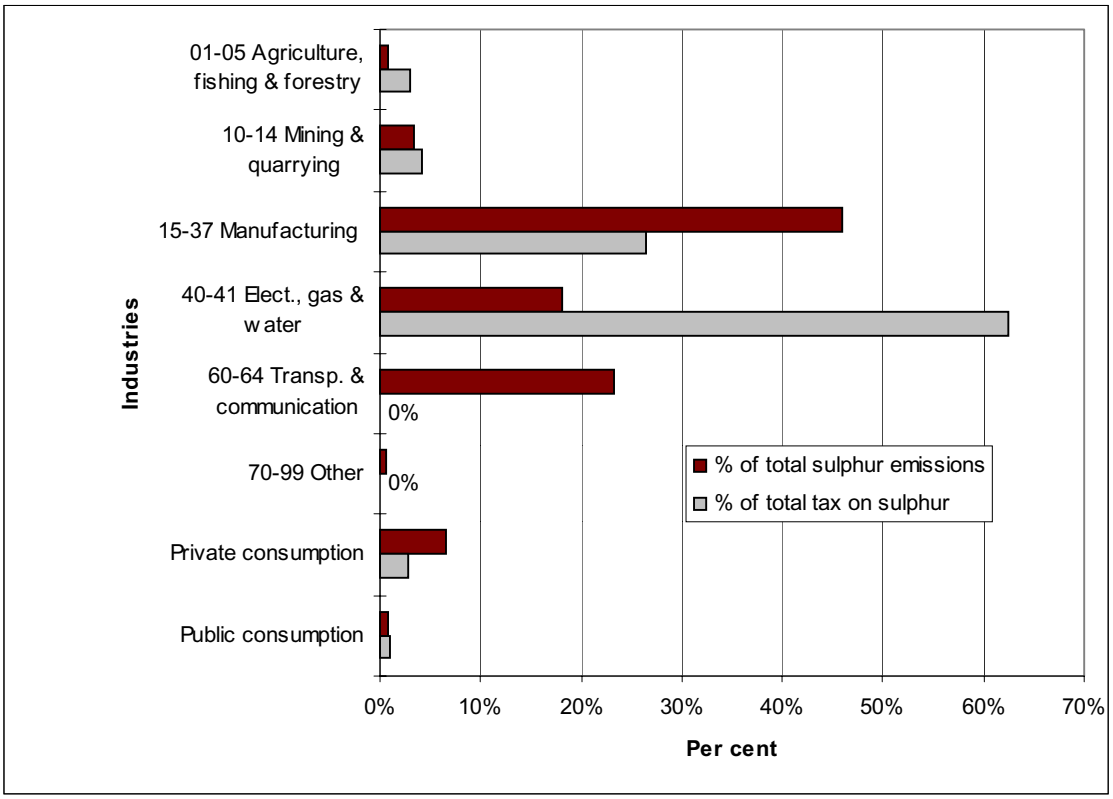
	Tax on sulphur (SEK Million)		Sulphur emission (metric tons)	
Sectors	*1993*	*1995*	*1993*	*1995*
Industry (NACE 01-99)	177	158	92 406	91 308
Private consumption	6	5	6 470	6 477
Public consumption	5	2	1 556	751
Total	188	165	100 432	98 537

[30] Ds 1994:33, Miljö- och naturresursdepartementet, *Så fungerar miljöskatter* (Ministry of the Environment and Natural Resources, How environmental taxes work).

[31] Naturvårdsverket [1997], *Miljöskatter i Sverige* (Swedish Environmental Protection Agency, Environmental taxes in Sweden).

Figure 6 shows the breakdown of the sulphur tax and sulphur emissions by different

Figure 6. Per cent of total sulphur tax and per cent of total sulphur emissions for different industries and final demand, 1995



Trade (NACE 50-52), financial intermediation (NACE 65-67), real estate and construction (NACE 45) are not included in this figure, since they are responsible for virtually no sulphur dioxide emissions or sulphur tax.

Transport and communication (NACE 60-64) accounted for 23 per cent of all sulphur dioxide emissions in 1995, but paid no sulphur tax. This is because water transport caused emissions of 17 857 tonnes of sulphur dioxide in 1995, equal to approximately 22 per cent of all emissions of sulphur dioxide, but was exempt from sulphur tax. The large emissions of sulphur dioxide by water transport are due in part to the use of heavy fuel oil with a high sulphur content.

Manufacturing (NACE 15-37) was responsible for 46 per cent of the sulphur dioxide emissions but paid only 26 per cent of sulphur tax. This was mainly because fuels used for fuel production (e.g. in refineries, NACE 23) and industrial processes (e.g. in recovery boilers and metallurgic processes) enjoyed relief from sulphur tax.

Electricity, gas and heating plants (NACE 40-41) were the industry that paid the largest percentage share of sulphur tax in 1995 (about 62 per cent),while causing approximately 18 per cent of all emissions of sulphur dioxide. This is a result of the regulations allowing abatement of sulphur tax, according to which about a third of all emissions of sulphur are tax exempt (see *Chapter 5*). This means that electricity, gas and heating plants (NACE 40-41) bear a high percentage of total sulphur tax, in proportional terms. Private consumers were responsible for a higher share of total emissions than of tax payments. The sulphur tax paid by private consumers is levied

on sulphur-rich fuel oil intended for heating. In other industries of the economy, sulphur emissions were generally speaking in proportion to the sulphur tax paid.

2.4.2 Environmental tax on domestic air traffic

The environmental tax on domestic air transport was introduced on 1 March 1989.[32] The purpose of the tax was to reduce emissions of hydrocarbons (CH) and nitrogen oxides (NOx) from air traffic.[33] Aeroplanes weighing more than 5700 kg were liable to pay the tax and the tax rate was calculated primarily on the basis of data available to the Civil Aviation Administration on fuel consumption by different types of aircraft, their emissions of hydrocarbons and nitrogen oxides, and the average distances flown. The environmental tax on domestic air traffic was charged for each flight, at a rate of SEK 1 / kg of aviation fuel used and SEK 12 / kg of hydrocarbon and nitrogen oxide emissions. The taxable party was the owner of the aeroplane or the person using the aeroplane if not the owner. This tax was discontinued after 31 December 1996, since it was considered to be incompatible with the EU regulations on taxation of mineral oil products.[34] In 1993 the tax revenues from the environmental tax on domestic air traffic came to SEK 196 million, falling to SEK 185 million in 1995. The environmental tax on domestic aviation affected air transport (NACE 62) only.[35]

2.4.3 Tax on fertilisers

Nitrogen and phosphorus leaking from agriculture can cause eutrophication of inland and coastal waters. The largest source of nitrogen and phosphorus leakage is the use of fertilisers. In order to reduce the use of commercial fertilisers in the agricultural sector, a charge was brought in on 1 July 1984. The revenues from the charge were earmarked for use in various programmes designed to diminish the negative impact of agriculture on the environment. The charge on fertilisers has been modified many times and from 1995 onwards it has been designated a tax, since only a minor portion of the revenues are returned to agriculture in the form of support for measures to improve the environment. The tax rate is based on the cadmium and nitrogen contained in fertilisers. At present the tax is SEK 1.8 / kg of nitrogen and SEK 30 / gram of cadmium, charged on all commercial fertiliser, whether imported or produced in Sweden. The tax on fertiliser came to SEK 185 million in 1993, with a substantial increase to SEK 299 million in 1995. This was due to a hefty rise in the tax rate when the tax was modified in 1995. The tax affects the agricultural industry (NACE 01) solely.

[32] SFS 1988:1567, *Lag om miljöskatt på inrikes flygtrafik* (Law on environmental tax on domestic air traffic).
[33] Ds 1994:33, *Så fungerar miljöskatter* (How environmental taxes work).
[34] SOU 1997:11, *Skatter, miljö och sysselsättning* (Taxes, the environment and employment).
[35] Petersson, Y., National Accounts, telephone interview, 25 August 1999.

2.4.4 Tax on pesticides

A tax on pesticides was introduced on 1 July 1984 in an attempt to reduce the effects that the use of pesticides can have on the environment and health. Like the tax on fertilisers, it was initially framed as a charge but became a tax in 1995. The tax rate is based on the proportion of active substance in the pesticide and now stands at SEK 20 / kg of active substance. In 1993, the taxes levied on pesticides amounted to SEK 13 million, rising sharply to SEK 32 million in 1995 because of a large increase in the rate charged in connection with the switch from a charge to a tax. The only industry affected by this tax is agriculture (NACE 01).

2.5 Transport taxes

2.5.1 Sales tax on motor vehicles

The sales tax on motor vehicles was brought in 1951 by an ordinance (1951:660) on taxes applying to the manufacture and import of passenger cars, etc. The original purpose was to create balance in the economy and to curb the rapid growth of car driving.[36] The tax has undergone repeated modifications; at times it has been calculated as an ad valorem tax – i.e. the tax has been based on a percentage of the sales price – while at other times it has been based on the weight of the vehicle in working order and its age. In 1986 the sales tax on motor vehicles began to be used more as a direct instrument of environmental policy. The tax was graduated and those vehicles that were voluntarily fitted with equipment for cleaning up exhaust fumes received tax relief compared with other vehicles.

In 1991 this tax graduation underwent further development and three different environmental classes paying different tax rates were established. The tax graduation between the different environmental classes was not supposed to alter the total pressure of taxes, which meant that the tax levels was modified so that the tax cuts for environmental class 1 balanced the tax hikes for environmental class three.[37] Sweden's accession to the EU in 1995 curtailed Sweden's ability to retain the sales tax relief provided to vehicles with better environmental qualities. EU directives do not permit the use of economic policy instruments such as sales tax and in consequence, the graduation of sales tax was almost entirely abolished. Sales tax is now charged only on light buses and goods vehicles in environmental class three. Sales tax revenues amounted to SEK 1.3 billion in 1993, but declined in the second half of the 1990s, bringing in SEK 233 million to the treasury in 1998.

2.5.2 Kilometre tax

In 1974 the system of kilometre taxes was introduced for diesel vehicles because the fuel oil tax that had applied until that year could not be efficiently restricted to the road traffic sector. The kilometre tax levied was a certain sum for each ten kilometres driven, graduated according to the type and taxable weight of the vehicle. Since the tax was a direct charge on the vehicle's fuel consumption (variable cost), it was a good instrument from an environmental point of view. This is evident if, for example, we compare it with the motor vehicle tax, which is a tax on vehicle ownership and is not affected by vehicle use, nor, therefore, by the impact on the environment. As from 1 October 1993, the system of kilometre tax was abolished and replaced by the diesel oil tax, one reason being to adjust Swedish transport taxes in preparation for possible Swedish membership of the EU[38] (see *Figure 2*). In 1993 the kilometre tax brought in approximately SEK 2.7 billion and in 1994 just SEK 10 million (owing to late payments).

[36] SOU 1997:126, *Bilen, miljön och säkerheten* (The car, the environment and safety).
[37] Ibid.
[38] Ibid.

2.5.3 Motor vehicle tax

A tax on vehicle ownership was introduced as early as the 1920s so as to make vehicle owners answerable for the cost of road maintenance caused by their vehicles. For many years, the revenues from the tax on motor vehicles were earmarked for the maintenance and building of roads, but the motor vehicle tax can now be regarded as a payment for the right to drive on public roads. In form, it is a fixed tax, charged as a set sum for a given period of time, irrespective of the extent to which the vehicle is used. The size of the tax depends on various factors, including the type of vehicle, type of fuel and number of axles.[39] In 1993 the motor vehicle tax on passenger cars was graduated according to type of fuel, which resulted in a higher rate of motor vehicle tax being charged for cars running on diesel than cars running on petrol. This measure was implemented to compensate for the elimination of the kilometre tax on diesel vehicles and for the fact that diesel is a cheaper fuel than petrol. Diesel passenger cars built in 1994 or later pay a higher rate of motor vehicle tax than diesel cars manufactured in earlier years. This difference in the tax rates was introduced so as not to place those who already owned diesel passenger cars at too great a disadvantage. In 1995 the sales tax rebate for motor vehicles in environmental class one was discontinued and instead they were relieved of annual motor vehicle tax payments for the first five years. This amendment in the tax helped to give the motor vehicle tax a more direct impact as an environmental instrument.[40] The revenues from the motor vehicle tax rose from about SEK 4.1 billion in 1993 to about SEK 6.1 billion in 1998, in current prices.

[39] Riksskatteverket [1998], *Skattestatistisk årsbok* (National Tax Board, Yearbook of tax statistics).
[40] Naturvårdsverket [1997], *Miljöskatter i Sverige* (Swedish Environmental Protection Agency, Environmental taxes in Sweden).

2.5.4 Breakdown of transport taxes

The national accounts provide a breakdown of the motor vehicle tax and the kilometre tax by different industries of the economy. The sales tax, in contrast, is linked to vehicle purchases and is treated as an investment; we therefore present only the total tax revenues from the tax without a breakdown by industries (see *Appendix 4*).

Table 6. Motor vehicle tax and kilometre tax, by different industries, 1993-1995, SEK million (current prices).

	Motor vehicle tax		Kilometre tax		Sales tax on vehicles		Total transport taxes	
Industries	*1993*	*1995*	*1993*	*1995*	*1993*	*1995*	*1993*	*1995*
01-05 Agriculture, fishing & forestry	336	333	291	0	-	-	627	333
10-14 Mining & quarrying	5	5	15	0	-	-	20	5
15-37 Manufacturing	134	131	300	0	-	-	434	131
40-41 Elect., gas & water	16	16	44	0	-	-	60	16
45 Construction	263	260	552	0	-	-	815	260
50-52, 55 Wholesale, retail trade	313	309	559	0	-	-	872	309
60-64 Transp. & communication	296	293	652	0	-	-	948	293
65-67Financial intermediation	10	10	9	0	-	-	19	10
70-99 Other	156	155	315	0	-	-	471	155
Private consumption	2 453	2 426	0	0	-	-	2 453	2 426
Public consumption	113	111	0	0	-	-	113	111
Total	4 095	4 049	2 737	0	1 287	1 749	8 119	5 798

The column "Total transport taxes" does not include sales tax for individual industries, but sales tax is included in the total for the column given in the row "Total". (-)= no information available.

Total taxes on transport (i.e. motor vehicle tax, sales tax and kilometre tax) declined from SEK 8.1 billion in 1993 to SEK 5.8 billion in 1995. This was mainly due to the abolition of kilometre tax in 1994. The transport industry (NACE 60-64) was the sector that benefited most between 1993 and 1995 when the kilometre tax was abolished, mainly because of the large fleets of goods vehicles owned by road haulage companies (NACE 6024).

Private consumers paid approximately 60 per cent of the motor vehicle tax, equivalent to SEK 2.4 billion in both 1993 and 1995. Agriculture (NACE 01) paid motor vehicle tax of SEK 336 million in 1993 and SEK 333 million in 1995. Out of all industrial activities (NACE 01-99), agriculture was the one that paid most in motor vehicle tax, which has to do with the large fleet of tractors. Wholesale and retail trade and restaurants (NACE 50-52, 55) also accounted for a significant part of total motor vehicle tax, due to the extensive fleets of goods vehicles in these industries.

3 Potentially environmentally harmful tax subsidies

Many of the differences between shares of emissions and shares of tax payments presented in *Chapter 3* are due to various forms of tax relief enjoyed by different industries of the economy. These can be regarded as a form of tax subsidisation. As a policy instrument, tax subsidies can function as an alternative to direct transfers. Some of the subsidies that have been identified by the Swedish Environmental Protection Agency[41] are tax subsidies. In this chapter we shall study a selection of these anomalies in the tax system in greater detail.

Following a brief introduction to tax subsides, we will discuss and illustrate the importance of the tax norm in estimating subsidies. Next we will present a method for showing how tax subsidies in the areas of energy and carbon dioxide taxation can be broken down by different industries and final demand for 1995. Since the size of tax subsidies depends on the choice of norm, we present examples of how the results differ if different norms are employed.

3.1 Background

Tax subsidies (tax rebates, anomalies and benefits) have long been discussed in the literature on fiscal law and economics and can be identified, in brief, as exceptions allowed by the tax legislation relative to a generally accepted or normal rate of taxation. A tax subsidy is comparable with direct subsidies and can consequently in many cases be a method to achieve objectives that could equally well be gained by means of direct subsidies and grants. One example is the tax relief and press support granted to Swedish daily newspapers, which in practice have the same effect and are directly interchangeable.[42] In this case, the State could equally well have imposed a tax on the daily newspapers and then returned the money in the form of higher press support. In recent years, many countries have attempted to systematise and describe the tax subsidies that exist in their tax systems. This has been done in Sweden, too, and as from the 1995 budget bill, tax subsidies are shown in an appendix to the budget proposals. Between 1996 and 2000, total tax anomalies in the area of excise duties have risen from approximately SEK 24.1 billion to an estimated SEK 31.9 billion.[43]

[41] Naturvårdsverket [1997], *Ett urval av statliga subventioner som kan antas motverka en ekologiskt hållbar utveckling* (Swedish Environmental Protection Agency, Selected state subsidies that may be inconsistent with ecologically sustainable development).
[42] SOU 1995:36, *Förmåner och sanktioner – En samlad redovisning* (Benefits and sanctions: an overall account).
[43] Proposition (Government Bill) 1998/99:100, appendix 4 (estimates are based on a norm that varies according to the purpose for which the fuel is used).

3.2 Determining a norm

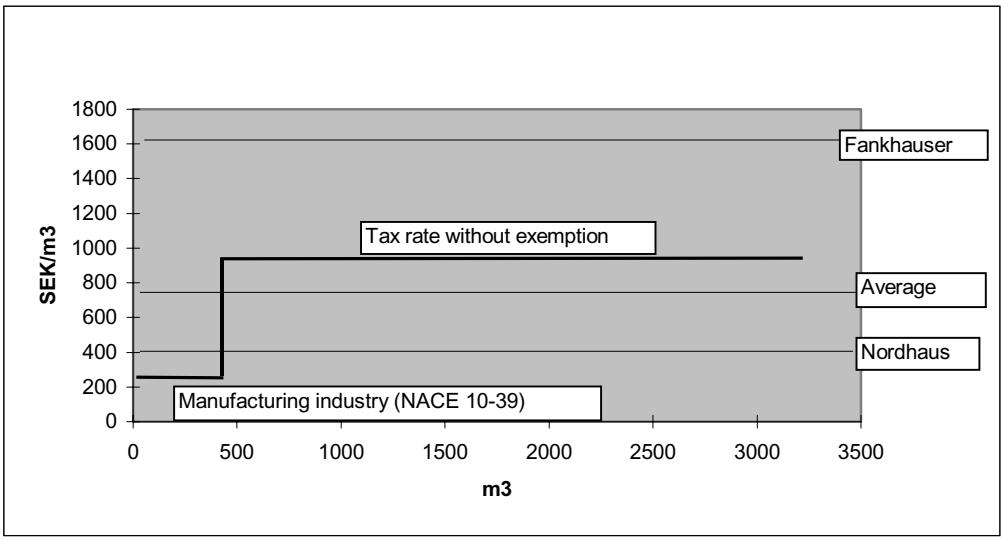
In order to calculate the size of a tax subsidy, the tax anomaly has to be compared with a normative tax system (tax norm). The difference between the tax norm and the taxes paid gives the tax anomaly. If the difference is negative, the anomaly is a tax sanction and if it is positive the anomaly represents a tax subsidy. Where value-added tax (VAT) is concerned, for example, the norm has been set at 25 per cent (= the highest tax rate), which means that we have a tax subsidy in cases where a lower rate is charged. This results in total tax subsidies of SEK 21 billion in 1995 in the area of value-added tax. If the tax norm had instead been set at 21 per cent, this would mean tax sanctions of SEK 3 billion in 1995.[44] The size of the tax subsidy thus depends on a subjective evaluation of what a normal rate of taxation is.

For excise duties it is difficult to determine a uniform norm. In the estimates of tax subsidies applying within *carbon dioxide taxation* produced by the Ministry of Finance, the tax norm has varied from year to year. The reason for this is that according to the Ministry of Finance, it is far from obvious that the abatement of carbon dioxide tax enjoyed by the manufacturing, mining and quarrying industries (NACE 10-37) should be regarded as a tax subsidy. This argument is based on the fact that Sweden is a small, open economy which is dependent on exports and a tax that seriously impinges on the competitiveness of Swedish industry vis-à-vis industry in other countries may be counter-productive. The effect may be that Swedish manufacturing industries move their production to a country where the pressure of taxation is lower. Since the greenhouse effect is a global environmental problem, the environmental impact does not depend on where the emissions occur. From this point of view, it is permissible to lower the norm that applies to the sectors exposed to competition. A graduated carbon dioxide tax has accordingly been regarded as an essential component of the norm and the manufacturing, mining and quarrying industries (NACE 10-37) have not been considered to enjoy any tax benefit.[45]

If the norm were instead to be set according to the cost to society of carbon dioxide emissions, as estimated by Fankhauser, all sectors of the Swedish economy would be seen to enjoy a tax subsidy. *Figure 7* illustrates the problems involved in selecting a tax norm for the carbon dioxide tax.

[44] SOU 1995:36, *Förmåner och sanktioner – En samlad redovisning* (Benefits and sanctions: an overall account).
[45] Johannesson, Å., Ministry of Finance, telephone interview, 17 November 1999.

Figure 7. Model of different tax norms for carbon dioxide tax on domestic fuel oil, 1993



We may take domestic fuel oil as an example. So far, in estimating tax subsidies, the tax rate for sectors other than manufacturing has been used as the tax norm; in 1993, this was SEK 920 / m^3, a figure based on the carbon content of the fuel. All industries of the economy that paid a lower rate of tax were considered to receive a tax subsidy. Manufacturing, mining and quarrying (NACE 10-37) had a tax subsidy, since they paid only a quarter of 920 (SEK 230 / m^3). *Figure 7* shows how large a proportion of the total consumption of domestic fuel oil is highly taxed and how much is taxed at a low rate. It is not obvious that precisely this norm should be chosen in estimating the tax anomaly.

Since the carbon dioxide tax is an environmental tax, it ought to reflect the external costs that emissions give rise to, so as to satisfy the "polluter pays principle". Estimates of external costs of CO_2 emissions have been made by W. D. Nordhaus and S. Fankhauser, among others.[46] If Fankhauser's estimate of the costs were to serve as the norm, all industries of the economy, including private consumers, would be in a receipt of a large tax subsidy. If Nordhaus's estimate applied, this would mean a substantial tax sanction for all sectors except manufacturing, mining and quarrying (NACE 10-37). There is also a Swedish estimate, produced by C. Azar and T. Sterner, the result of which differs significantly from the other estimates.[47] In fact, it differs from the 1993 tax rate of SEK 920 / m^3 by a factor of about ten (see *Table 7*), which means that in order to cover the external costs that can arise as a result of carbon dioxide emissions, the tax on domestic fuel oil should have been SEK 10 635 / m^3. The difference between the estimates is due primarily to the choice of discounting factors, the valuation of the welfare loss that can arise in poor regions and the fact that Azar and Sterner's calculations are based on a more highly developed model of the carbon cycle.[48] In this context it is also worth adding that both Nordhaus's and

[46] SOU 1996:117, *Expertrapporter från skatteväxlingskommittén* (Expert opinions from the Green Tax Commission).
[47] Axar, C. and Sterner, T. [1996], "Discounting and distributional considerations in the context of global warming", *Ecological Economics.*
[48] Ibid.

Fankhauser's estimates have been heavily criticised, above all for their choice of discounting factors and for the individual assumptions underlying their models.[49]

See *Table 7* for a comparison between different estimates of the external costs.

Table 7. Different estimates of the external environmental costs that arise as a result of carbon dioxide emissions.

	SEK/kg CO2	SEK/m3 gas oil
Azar C., Sterner, T.	3,70	10635
Fankhauser	0,57	1638
Skattesats i Sverige (1993)	0,32	920
Nordhaus	0,14	403

Azar and Sterner estimated the external environmental costs at between SEK 2.26 and SEK 5.13 / kg of carbon dioxide. The value given in *Table 7* is an estimated average.

The reason why the different estimates of environmental costs vary so widely is the high degree of uncertainty that exists in this area. On the basis of the knowledge available now, it is difficult to assess the marginal cost to the national economy of carbon dioxide emissions.

Another norm that has been discussed for the carbon dioxide tax is the average tax per unit of fuel, i.e. total tax revenues divided by total consumption. The average tax rate (the average in *Figure 7*) is therefore the uniform tax rate that all are required to pay in order to bring in unchanged tax revenues, i.e. the sum of tax subsidies and sanctions is zero. If this norm had been selected instead of the "tax rate with no exceptions allowed", the tax subsidies enjoyed by manufacturing and mining would appear to be lower, while other sectors would suffer a tax sanction. The conclusion is thus that estimates of tax subsidies in the area of carbon dioxide taxation are uncertain and it is important to investigate which norm has been used as the basis for estimates. In order to illustrate the problems involved in selecting a norm, we have produced three different estimates using different norms (see *Table 8*).

[49] SOU 1996:117, *Expertrapporter från skatteväxlingskommittén* (Expert opinions from the Green Tax Commission).

Table 8. Estimation of tax subsidies in the carbon dioxide tax on domestic fuel oil in 1993, using different norms

Industries	Average *TotCO2-tax/Tot consump.*	Tax rate without exemption *Highest tax rate (982 SEK/m3)*	External cost *Fankhauser*
01-05 Agriculture, fishing & forestry	32	49	118
10-14 Mining & quarrying	12	15	29
15-37 Manufacturing	239	308	581
40-41 Elect., gas & water	63	88	189
45 Construction	-2	19	100
50-52, 55 Wholesale, retail trade	0	3	15
60-64 Transp. & communication	-3	-1	5
65-67Financial intermediation	-1	1	6
70-99 Other	-6	22	134
Private consumption	-323	1	1 268
Public consumption	-9	37	214
Total	0	542	2 659

"Average" means average carbon dioxide tax on domestic fuel oil, "Tax rate without exception" means the highest tax rate applied to sectors other than mining and manufacturing (NACE 10-37) and water transport. "External cost" means the cost to society entailed by one kg of carbon dioxide emissions, as estimated by Fankhauser. The results of the different estimates vary substantially. If the carbon dioxide tax were intended to cover the estimated external costs to which carbon dioxide emissions give rise, all industries of the economy would appear to enjoy tax subsidies. These would amount to more than SEK 2 billion for domestic fuel oil alone. If the average tax norm is used, this means a uniform tax for all sectors and does not change the total pressure of taxes; however, it does make it possible to see the burden placed by the tax on different sectors. The negative figures in *Table 8* correspond to tax sanctions and the positive figures to tax subsidies, relative to the average tax rate. The estimates of tax subsidies in the area of carbon dioxide tax given in this report are based on an average tax norm, where an average tax has been calculated for each fuel, i.e. total taxes / total consumption of each fuel (average in *Table 8*). For a more detailed description of the method of estimation, see *Appendix 4*.

It is easier to establish a norm for the *energy tax* than for the carbon dioxide tax. The reason for this is that the original reason for the energy tax was to generate revenues for the public treasury and not to create allocation effects. This being so, an efficient tax should be in proportion to the energy content of different fuels.[50] The abatement certain sections of industry receive can therefore be regarded as a tax subsidy. The norms that the Ministry of Finance uses in its estimates of tax subsidies are based on a breakdown of the tax base by three different areas of use: transport, heating and production input goods. The norm is therefore determined on the basis of the use to which the fuel or electricity is put, which can be justified with reference to the argument that the different purposes produce differing external effects.

[50] Proposition (Government Bill) 1998/99:100, appendix 4, Presentation of tax anomalies.

An alternative norm for the energy tax also exists, which, like the carbon dioxide tax, is weighted by the energy value of different fuels. A uniform, average tax per MWh for all fuels, irrespective of their area of use, is then calculated and here too the sum of tax sanctions and tax subsidies turns out zero.[51] This average norm has been used in this report. It has been estimated at SEK 0.12 / kWh for fuels, and the norm estimated for electricity is SEK 0.0435 / kWh. See *Appendix 4* for a more detailed description of the method.

As is evident from the discussion above, the estimated amounts of tax anomalies vary greatly depending on which norm is used. For this reason, the main focus in the analysis in *Chapter 3.3* and *3.4* will be the distribution of tax anomalies between different sectors, since this is apparent no matter which norm is used.

3.3 Tax subsidies in the area of energy taxation in different sectors and industries

Since 1995, the energy tax has been regulated by law (1994:1776, *Energy tax act*). The exemptions from the energy tax on fuels (excluding petrol and diesel) and electricity contained in the 1995 tax legislation were:

- Fuels and electricity used by or sold for use in aircraft or in ships not in private use.
- Fuel used for purposes other than generating energy or operating motors, e.g. in metallurgic processes.
- Fuels used in producing mineral oil products, coal-based fuels and petroleum coke, or in producing taxable electricity.
- Relief from energy tax on fuels and electricity for the mining and manufacturing industries (NACE 10-37) and for commercial greenhouse cultivation.
- Fuel sold to communications companies for rail traffic operation.

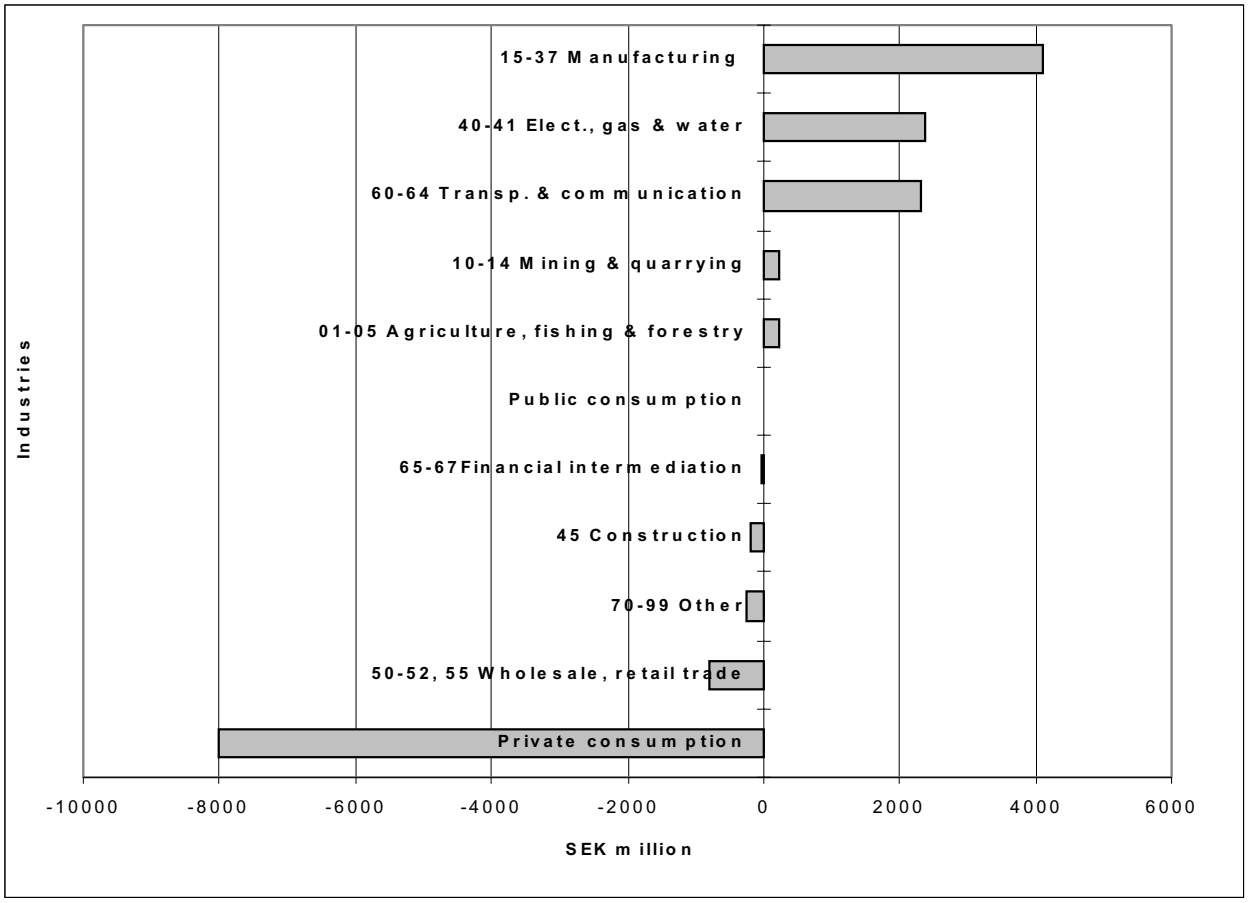
In this report, tax subsidies in the energy tax system are divided up into those applying to fuel and those applying to electricity. The breakdown of these tax anomalies by industry is shown in *Chapter 3.3.1* and *3.3.2*. It is important to bear in mind that these figures are based on **one** method for estimating the tax subsidies and that other possible methods exist. The results depend on the norms employed. Nevertheless, this account may serve to indicate the general effect these various tax subsidies have within the economy.

[51] SOU 1995:36, *Förmåner och sanktioner – En samlad redovisning* (Benefits and sanctions: an overall account).

3.2.1 Tax subsidies for energy tax on fuels

Figure 8 illustrates the exceptions contained in the 1995 tax legislation, broken down by different industries. The fuels used in manufacturing processes in the mining and manufacturing industries (NACE 10-37) were exempt from energy tax in 1995 and accounted for subsidies worth approximately SEK 4.1 billion. Electricity, gas and heating plants (NACE 40-41) also received substantial tax subsidies in 1995 where the energy tax on fuels was concerned. This is because fuels used in producing taxable electricity were exempt from energy tax. Water transport (NACE 61) was also completely exempt from the energy tax on fuel. In 1995 water transport (NACE 61) consumed approximately 1.8 million m^3 of heavy fuel oil, which means this industry received a tax subsidy of about SEK 2.9 billion. This explains the fact that transport and communication (NACE 60-64) received a relatively large part of all tax subsidies where energy tax on fuel were concerned (see *Figure 8*). Other industries in the transport sector (NACE 60, 62-64) suffered tax sanctions of SEK 617 million, since they consumed large quantities of motor vehicle fuels, which are relatively highly taxed. This is also the reason why private consumers paid tax sanctions of approximately SEK 8 billion in 1995, again estimated on the basis of an average norm.

Figure 8. Tax subsidies in the system of energy tax on fuels, by different industries and final demand, 1995



An average norm has been used in estimating tax subsidies.

3.2.2 Tax subsidies for energy tax on electricity

The exemptions from energy tax enjoyed by the mining and manufacturing industries (NACE 10-37) in 1995 made up the entire sum of tax subsidies in the area of energy tax on electricity. The breakdown between the different industries in mining and manufacturing is illustrated in *Table 9*.

Table 9. Tax subsidies in the system of energy tax on electricity enjoyed by mining and manufacturing (NACE 10-37), by different industries, 1995

NACE	Industries	EK million	Per cent
10-14	Mining, quarrying	111	5%
15-16	Man. of food prods. & beverages. Man. of tobacco prods.	119	5%
17-19	Man. of textiles, of wearing apparel; tanning & dressing of leather; man. of luggage, handbags, & footwear.	18	1%
20	Man. of wood & of prods. of wood & cork, except furniture; man. of articles of straw & plaiting materials.	96	4%
21-22	Man. of pulp, paper & paper prods. Publishing, printing & reproduction of recorded media.	865	38%
23-24	Man. of coke, refined petroleum prods. & nuclear fuel, man. of chemicals & chemical prods.	233	10%
25	Man. of plastic & rubber prods.	46	2%
26	Manufacturing of other non- metallic mineral prods.	61	3%
27	Man. of basic metals	350	15%
28	Man. of fabricated metal prod., except machinery prod..	86	4%
29	Man. of machinery and equipment	92	4%
30-33	Man. of office machinery & computers, electric machinery, radio, television, comm. equipment & apparatus, medical, precision & optical instr., watches & clocks.	51	2%
34-35	Man. of motor vehicles, trailers & semitrailers. Man. of other transport equipment.	97	4%
36-39	Man. of furniture	34	2%
10-39	Total mining and manufacturing	2257	100%

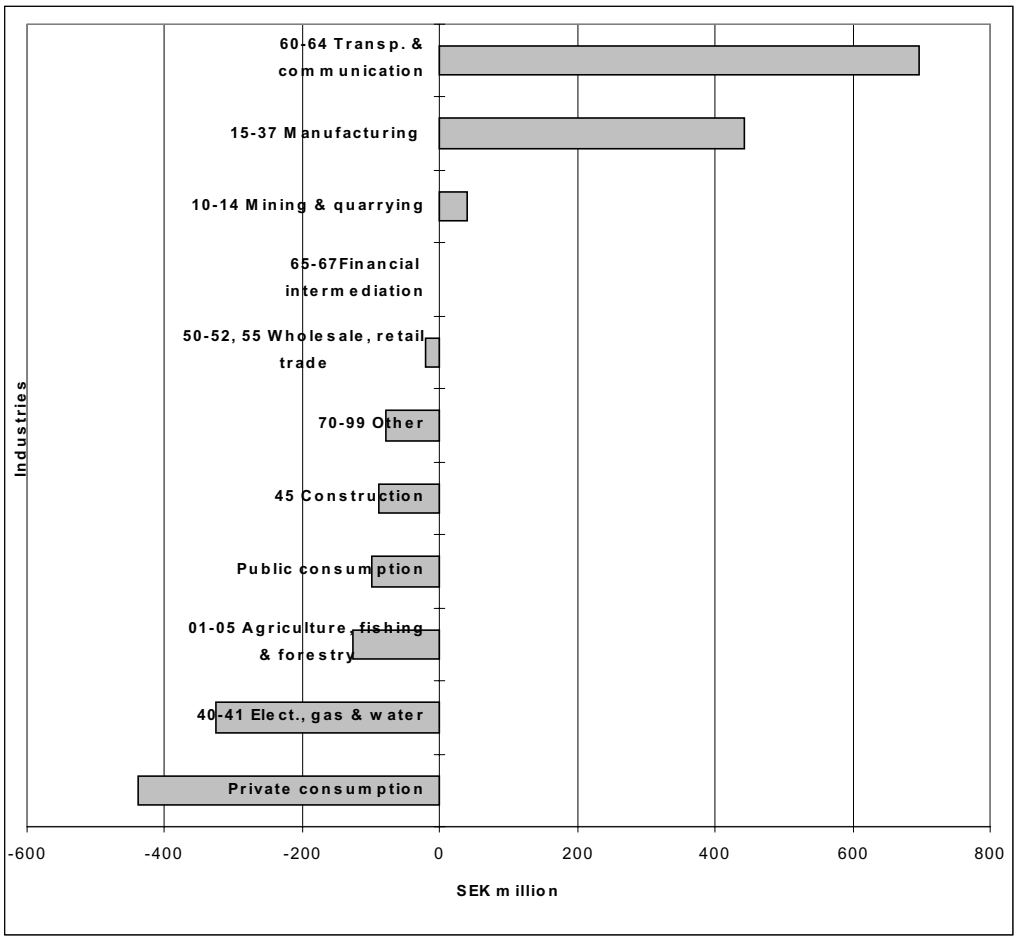
The anomaly is estimated on the basis of a uniform tax (average norm) per kWh.

Table 9 shows that energy-intensive activities such as the manufacture of pulp, paper and paper products (NACE 21-22) enjoyed 38 per cent of the tax subsidies or SEK 865 million in 1995. Manufacture of basic metals (NACE 27) received a tax subsidy equal to SEK 350 million. In all, tax subsidies in the area of energy tax on electricity amounted to SEK 2.3 billion in 1995.

3.3 Tax subsidies in carbon dioxide taxation, by different industries

Like the energy tax, the carbon dioxide tax is regulated by the *Energy tax act* (SFS 1994:1776) and the exemptions that apply within the energy tax system also exist in carbon dioxide taxation. Estimates of the tax subsidies are based on an average tax norm for each fuel. The largest anomaly in the system of carbon dioxide taxation in 1995 was the exemption allowed to water transport (NACE 61). Water transport consumes a great deal of heavy fuel oil. In 1995, this activity consumed approximately 1.8 million m^3 of untaxed fuel oil, which means that water transport enjoyed tax subsidies of about SEK 730 million. The abatement to a quarter of the normal tax rate enjoyed by the mining and manufacturing industries (NACE 10-37) gave them total tax subsidies of SEK 483 million in 1995.[52]

Figure 9. Breakdown of tax subsidies and sanctions in carbon dioxide taxation, 1995



The fuels included in the estimates are natural gas, coal[53], lignite, domestic heating oil, heavy fuel oil, petrol, diesel, propane, kerosene and jet benzene.

[52] In the area of carbon dioxide taxation there are additional tax anomalies over and above the general rules for abatements applying to industry. Manufacturing companies in energy-intensive sectors were entitled to apply for tax abatements if they had carbon dioxide tax arrears of more than 1.2 per cent of the sales value of their products. Most of the companies that receive abatements operate in the cement, lime and glass industries.

[53] Coal used in metallurgic processes is not included in the calculations.

In the manufacturing sector (NACE 15-37) it was the manufacture of coke, refined petroleum products and chemical products (NACE 23-24) that enjoyed the highest tax subsidies in carbon dioxide taxation (approximately SEK 159 million).
Electricity, gas and heating plants (NACE 40-41) suffer sanctions since carbon dioxide tax is charged at the full rate on fuels used in producing heat. In 1995 this sanction amounted to SEK 325 million.

However, caution should be observed in interpreting these figures, partly because it is not obvious which tax norm should be used and partly because problems arise in linking consumption statistics with tax statistics.[54] For the time being, these calculations should be regarded mainly as providing a rough indication of the breakdown of tax anomalies by different industries.

3.4 Allowances for journeys to and from work

Allowances for journeys to and from work are the tax anomaly that has the largest impact on private consumers' bank balances, conferring gross benefits that are expected to amount to around SEK 7 billion in 2000. Expenses in excess of SEK 7000 (in income years 1996-1997, SEK 6000) qualify for allowances when income is assessed for purposes of taxation.

This tax subsidy can help to reduce the cost of transport, particularly car transport, since costs incurred in using public transport rarely exceed SEK 7000. This may function as an incentive to choose road transport, with its accompanying environmental problems. Since this tax subsidy relates to income tax the entire tax anomaly is credited to private consumption. In 1995 the tax anomaly for journeys to and from work amounted to SEK 3.74 billion.[55]

[54] For example, ratio adjustment of figures from the National Accounts.
[55] Proposition (Government Bill) 1995/19996, Appendix 3.

4 Potentially environmentally harmful direct subsidies

Since tax subsidies and direct transfers have the same economic effects, it is important also to identify the direct subsidies that can be considered to have a negative impact on the environment. Here we will discuss these subsidies, proceeding from a selection of the direct subsidies that in the opinion of the Swedish Environmental Protection Agency may run counter to sustainable development.[56]

4.1 The growth of subsidies

Up until the 1930s, public expenditure was seen primarily as a means to meet collective needs such as defence, the judiciary, administration, agriculture, etc. From 1930 to 1950, public spending and subsidies began increasingly to be used as instruments of economic policy.[57] This development was fuelled by considerations of redistribution and stabilisation policy. In the 1960s and 1970s public spending rose still further, partly because of the increasing international competition. The export industries, e.g. the shipbuilding and steel industries, encountered a tougher market and their profitability declined. In order to avoid closures that would bring severe social and regional problems, the government gave these industries various forms of economic support. It was also during this period that regional policy was given systematic form, the aim being to generate as high employment as possible and to even out the differences in competitiveness between industries in different regions. One of the measures involved was the transport support introduced in 1971.

4.2 Direct subsidies to different industries

The potentially environmentally harmful subsidies that will be discussed here are: transport support, agricultural support, subsidies to fisheries, interest subsidies to housing construction, support to reindeer husbandry and support for forest motor roads (see *Table 10*).

[56] Naturvårdsverket [1997], *Ett urval av statliga subventioner som kan antas motverka en ekologiskt hållbar utveckling* (Swedish Environmental Protection Agency, Selected state subsidies that may be inconsistent with ecologically sustainable development).

[57] Södersten, B. [1987], *Marknad och politik: Strukturer och problem i svensk ekonomi* (The market and politics: structures and problems in the Swedish economy).

Table 10. Potentially environmentally harmful direct subsidies, 1993-1998 (SEK million, current prices)

Subsidies (SEK million)	1993	1994	1995	1996	1997	1998
Support for forest motor roads	4	3	1	0	0	0
Support to agriculture (acreage and livestock support)	0	0	3 743	4 622	4 320	4 373
Transport support	293	341	383	388	323	328
Interest subsidies for housing construction	35 458	32 601	32 075	27 832	20 804	10 798
Support to reindeer husbandry	30	28	28	35	27	32
Support to fisheries	1	2	20	25	16	15
Total	35 786	32 975	36 250	32 902	25 490	15 546

Source: Statistics Sweden, National Accounts, except transport support, which is from the Swedish National Board for Industrial and Technical Development.

Subsidies to support housing construction are by far the largest of the potentially environmentally harmful direct subsidies. In 1993, these subsidies totalled approximately SEK 35 billion, which went exclusively to real estate activities (NACE 70). Of this total sum, approximately SEK 6.7 billion went to the construction of one- and two-dwelling houses and holiday homes, and around SEK 28.8 billion to multi-dwelling buildings. Expenditure on interest subsidies has gone down sharply and in 1998 came to barely a third of the 1993 level. The potential environmental harm that may be caused by interest subsidies is mainly connected with the idea that the subsidy has led to larger dwellings being built, which require more materials and energy than would otherwise have been the case. At the present time, there are no environmental requirements that a construction project has to satisfy in order to qualify for support.

Support for forest motor roads is a subsidy that can lead to interference in forest land that is not economically justifiable. The support to forest motor roads disappeared in 1992 but is still paid out, partly because some of the roads are still not finished and partly to cover credit guarantees approved at an earlier date.[58] This support goes exclusively to forestry (NACE 02).

Support to reindeer husbandry consist mainly of *price support*[59] and general promotion of reindeer husbandry. In 1993, price support amounted to SEK 30 million and was paid to reindeer husbandry, which is classified under agriculture (NACE 01). Intensive reindeer husbandry can cause various negative environmental effects, such as increased damage to the soil and vegetation. In addition, the use of off-road vehicles in connection with this activity can be a disturbance to outdoor leisure activities and tourism because of the noise and exhaust fumes. The southern part of the mountain range is particularly sensitive to the effects of reindeer husbandry.

State *support to fisheries* has existed since the 1960s. The support grew in scope between 1993 and 1995. The negative environmental impact this can lead to is overfishing. The direct subsidies paid out annually by the Swedish state and the EU are classified as structural and regional support. The support is specific to a single economic activity, going exclusively to fishing (NACE 05).

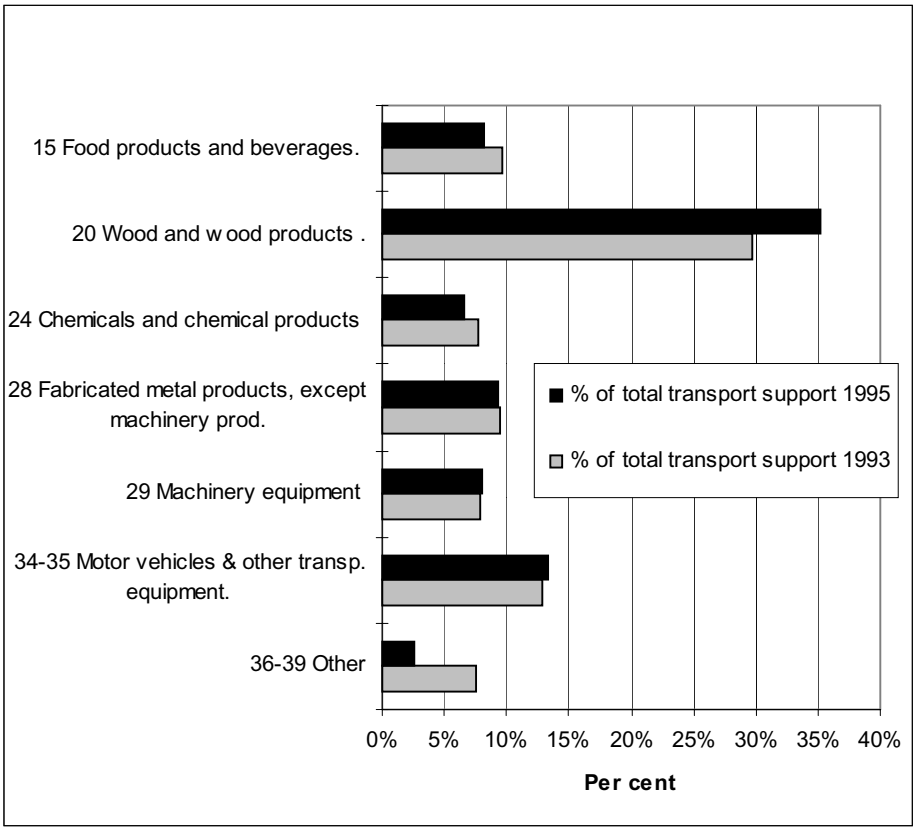
[58] Kullberg, P., National Board of Forestry, telephone interview, 1 September 1999.
[59] Price support designed to compensate reindeer keepers for falls in the price of reindeer meat.

Support to agriculture in the form of acreage support[60] and livestock support[61] is capable of leading to an increased burden on the environment. According to the Swedish Environmental Protection Agency, acreage support can lead to increased leakage of nitrogen and greater use of pesticides. These effects arise because grants are given to support the cultivation of cereals, oil plants, leguminous plants and linseed flax,[62] i.e. crops that leak a lot of nitrogen and that usually require large quantities of pesticides. The livestock support can lead to increased ammonia emissions and nitrogen leakage. This support accrues in its entirety to agriculture (NACE 01). Both forms of support are financed wholly by the EU.

In both 1993 and 1995, 99 per cent of all *transport support* went to mining and quarrying and manufacturing (NACE 10-37). *Figure 10* shows the manufacturing activities that enjoyed the greatest share of this support. Total expenditure on transport support came to SEK 293 million in 1993 and SEK 383 million in 1995. The support then declined to SEK 328 million in 1998, in current prices.[63] The breakdown of transport support between different industries and final demand has not undergone any appreciable change between 1993 and 1995. The industry for wood and products of wood, saw-mills and wood impregnation plants (NACE 20) received the largest share of the support, almost a third of all transport support. This is due primarily to the industrial structure of development areas (see *Appendix 3*).

[60] Price support designed to compensate farmers for falls in the prices of crops.
[61] Price support designed to compensate meat producers for falls in the prices of meat.
[62] *EU stöd till jordbruket* (EU agricultural support) [1999], Swedish Board of Agriculture, EU Information Office.
[63] Ederlöv, H. [1999], Enheten för transportbidrag, NUTEK (Transport subsidies department, Swedish National Board for Industrial and Technical Development).

Figure 10. Percentage breakdown of transport support between different industries, 1993-1995



Source: Swedish National Board for Industrial and Technical Development.

The industry for transport equipment (NACE 34), which received 13 per cent of all transport support in both 1993 and 1995, includes the manufacture of motor vehicles, trailers, and parts and accessories for motor vehicles. The food product and beverage industry received 10 per cent of all transport support in 1993, but its share declined to 8 per cent in 1995.

Table 11 gives a summary overview of the potentially environmentally harmful direct subsidies discussed in this report.

Table 11. Summary overview of direct subsidies that may run counter to sustainable development.

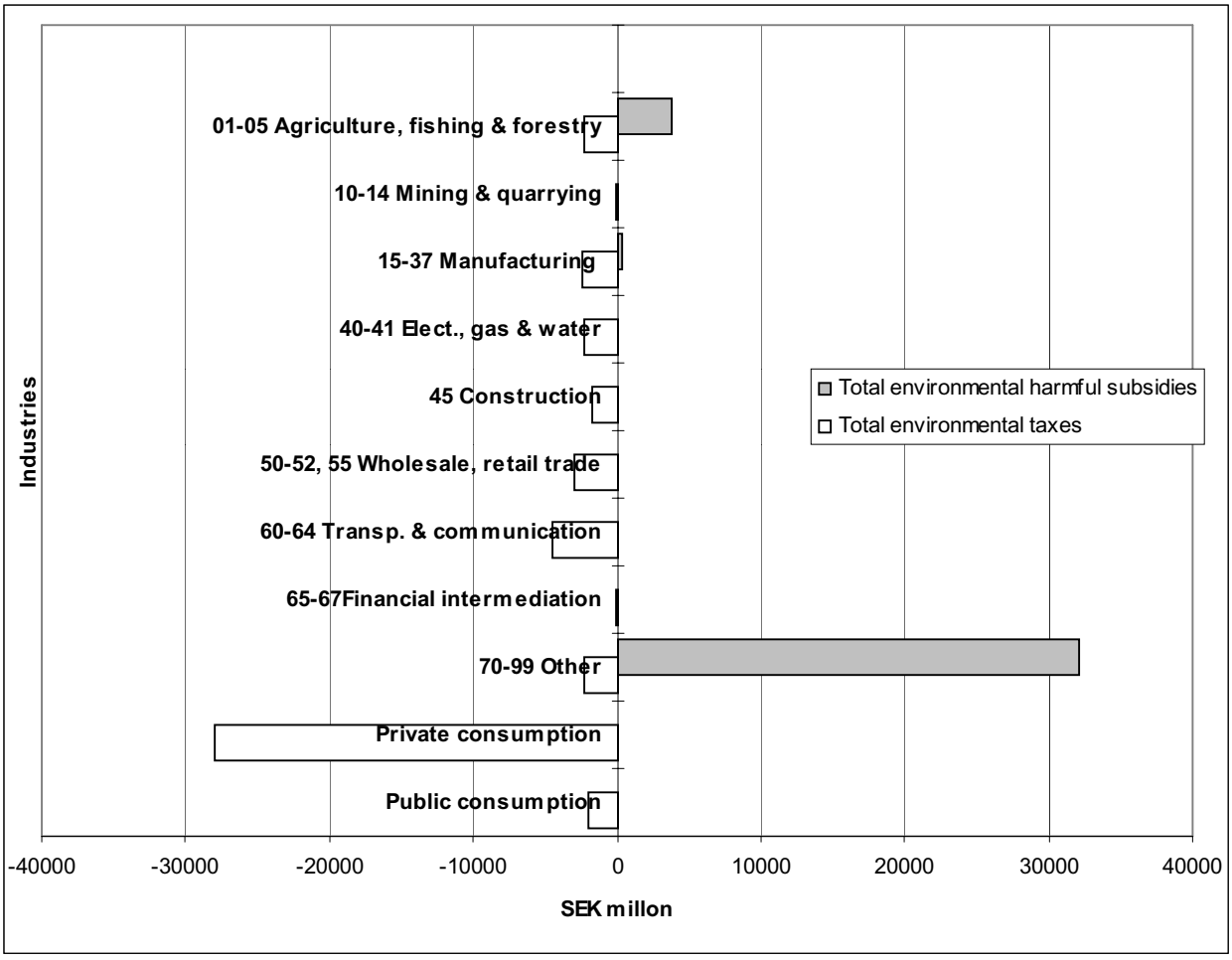
Subsidies	**Purpose**	**Possible environmental impact**	**Industry receiving support**
Support for forest motor roads	Infrastructure improvement	Fragmentation of forest landscape without real economic justification	Forestry (NACE 02)
Support to agriculture			
Of which: Acreage support	Compensation for falls in crop prices	Nitrogen leakage (eutrophication) and increased pesticide use	Agriculture (NACE 01)
Livestock support	Compensation for falls in meat prices	Increased ammonia emissions and nitrogen leakage	Agriculture (NACE 01)
Transport support	To promote good regional distribution of industry	Stimulates increased road transport and therefore increased emissions and noise	Mining and manufacturing (NACE 10-37)
Interest subsidies for housing construction	To stimulate new housing construction and conversion	Has led to construction of more large dwellings requiring more materials and energy	Real estate activities (NACE 70)
Support to reindeer husbandry	To promote reindeer husbandry and Sami culture	Large herds of reindeer and use of off-road vehicles has led to increased damage to soil and vegetation, erosion, disturbance to outdoor activities and tourism	Reindeer husbandry (NACE 01251)
Support to fisheries			
Of which: Structural support	To promote fishing industry	Overfishing	Fishing (NACE 05)

Source: Swedish Environmental Protection Agency, memorandum on environmentally harmful subsidies, and National Accounts, breakdown of subsidies by industry.

5 The impact of environmental taxes and environmentally harmful subsidies on the economy

In chapters 3 to 5 we have presented the different taxes and subsidies individually. We shall now sum them up for each industry of the economy so as to obtain a more readily graspable picture of how all the subsidies and environmental taxes are spread throughout the economy. *Figure 11* shows the impact of all the environmental taxes and direct subsidies discussed in the report on different industries and final demand.

Figure 11. Total environmental taxes and total direct subsidies, by industries and final demand, 1995, SEK million.



Total environmental taxes are given here excluding sales tax.

As is evident from *Figure 11*, the largest direct subsidy went to real estate activities and public administration (NACE 70-99). This is due wholly to the substantial interest subsidies to housing construction, which in 1995 came to SEK 32 billion. In practice most of this money goes to private consumers, even if it is entered under real estate in the national accounts. The primary industries, i.e. agriculture, forestry and fishing (NACE 01-02, 05) also enjoyed subsidies, above all for reasons of redistribution policy. The largest part of these consists of direct EU subsidies to agriculture, which amounted to SEK 3.7 billion in 1995. It is worth noting that the environmentally harmful direct subsidies to these primary industries outweigh the total environmental taxes they pay.

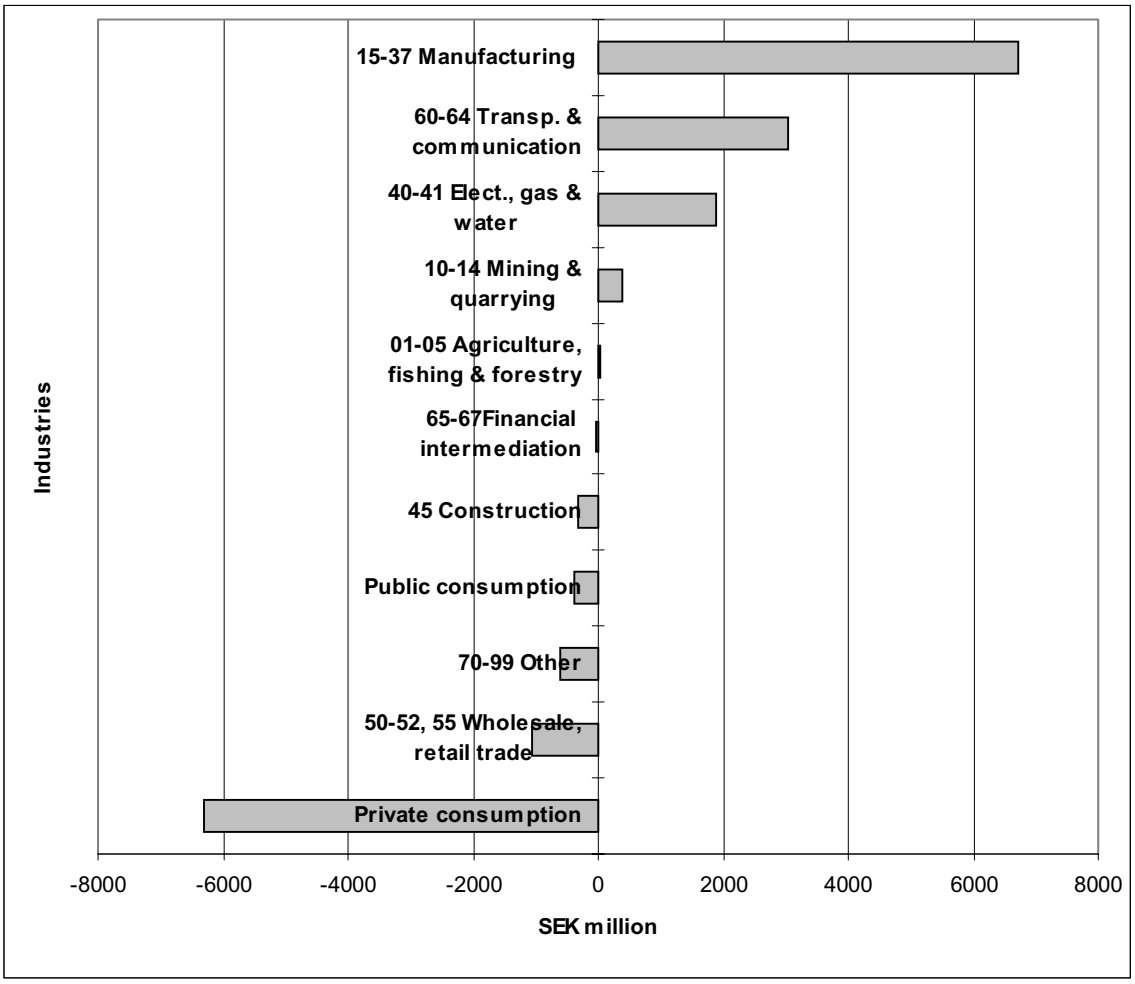
Private consumers, transport companies (NACE 60-64), above all land transport companies (NACE 60), and wholesale and retail trade and hotels and restaurants (NACE 50-52, 55) paid a large share of the environmentally related taxes. This is because transport by road is hit quite hard by environmental taxes, e.g. motor vehicle tax and taxes on motor vehicle fuels (energy tax and carbon dioxide tax), which reflects the significant impact of road transport on the environment, both locally and globally.

Agriculture, forestry and fishing (NACE 01-05) and manufacturing (NACE 15-37) paid about the same amount of taxes. See *Appendix 2* for a complete breakdown by industries and final demand of environmental taxes in 1993 and 1995.

Between 1993 and 1998, the total expenditure on the direct subsidies identified gradually decreased, while the income lost because of tax subsidies has grown. It is therefore important to see these two types of subsidies in combination, since both have the same economic effect and in consequence, both may conceivably run counter to sustainable development. This report presents tax subsidies and direct subsidies separately. The reason for this is above all that estimates of tax subsidies are necessarily based on more or less arbitrarily chosen norms.

As is evident from *Figure 12*, the manufacturing industries (NACE 15-37), transport and communication (NACE 60-64) and electricity, gas and heating works (NACE 40-41) were the industries of the economy that enjoyed the most extensive tax subsidies in 1995, where energy and carbon dioxide taxes were concerned. Comparisons between these subsidies and these industries' share of emissions or consumption reveal large differences in the percentage shares (see *Chapter 2*).

Figure 12. Total tax subsidies and sanctions in all taxes on energy and allowances for journeys to and from work, breakdown by industries and final demand, 1995



Total tax subsidies and sanctions are based on an average tax norm for the energy tax and carbon dioxide tax. Allowances for journeys to and from work are based on estimates of tax subsidies produced by the Ministry of Finance (Proposition [Government Bill] 1994/95, appendix: 150).

When the breakdown of tax subsidies is taken into account, the manufacturing industries (NACE 15-37) enjoy an environmentally harmful subsidy that exceeds by far the environmentally related taxes paid by this sector. Total subsidies are estimated at SEK 6.7 billion and taxes at SEK 2.4 billion. The same observation applies to water transport (NACE 61) and to electricity, gas and water supply (NACE 40-41), which are exempt from energy tax and carbon dioxide tax on fuels used in producing taxable electricity.

This means that some of the actual emissions or actual consumption is untaxed and that the sectors that use most energy and fuel and are responsible for the largest emissions do not pay most in tax. Consequently, Swedish fiscal environmental policy fails to fully satisfy the "polluter pays principle".

In *Table 12* we estimate on the basis of industry emissions data and various general exceptions how large a proportion of emissions are untaxed, partly taxed and taxed in full. The estimates are thus based on the general exemptions that existed in 1995 for water transport (NACE 61), mining and manufacturing (NACE 10-37) and fuels used in producing electricity, and the exemption from sulphur tax granted to fuels used in recovery boilers. Other exceptions, such as the 1.2 per cent rule, metallurgic processes and greenhouse heating are not included in the calculations, since they are difficult to estimate. However, in future we hope to incorporate these exceptions into our calculations too (for a more detailed description of the method, see *Appendix 4*).

Table 12. Estimate of the proportions of sulphur dioxide emissions and carbon dioxide emissions that are untaxed, partly taxed and taxed in full, 1995

	Untaxed	Partially taxed	Fully taxed
Carbon dioxide emissions	16 %	29 %	55 %
Sulphur dioxide emissions	33 %	-	67 %

Mining and manufacturing (NACE 15-37) are partly taxed, since they enjoyed a 75 per cent abatement of carbon dioxide tax in 1995.

Using material received from the IPCC (Intergovernmental Panel on Climate Change), the Swedish Commission on Climate Change has calculated the emissions levels that would lead to an increase of only 25 per cent in concentrations of carbon dioxide in the atmosphere by 2050, compared with the level today. Expressed as annual emissions per capita what is involved is 0.4 tonnes per person per year. This would mean reducing present Swedish emissions by 80 per cent.[64] According to the 1997 Kyoto Conference, Sweden's carbon dioxide emissions must not increase by more than 4 per cent between 1990 and 2008-2012. In view of these targets it is a problem that environmental taxes do not weigh more heavily on the actors that are responsible for the largest emissions.

However, owing to conflicts between the objectives of different sectors of society, it is not entirely straightforward to eliminate these forms of tax relief and direct subsidies. Potentially environmentally harmful direct subsidies, such as interest subsidies to housing construction and EU subsidies, e.g. the livestock support and acreage support given to agriculture, imply a conflict between environmental objectives and other objectives, particularly redistribution policy. However, trials have been made with systems of taxes and subsidies that aim to ensure that both environmental and other objectives are met. Voluntary agreements are becoming more and more common in European countries. The principle behind these builds on agreement between industry and public authorities that certain environmental goals shall be achieved. The Netherlands has a system of agreements under which industries receive tax relief on condition that certain environmental targets are met.

[64] Hunhammar, S. [1999], *Exploring sustainable development with backcasting.*

The advantages are that the industry itself is put in a position to decide what measures are required in order to achieve these goals, which in theory makes it possible for them to achieve the goals by cost-effective means. In terms of production costs, this would mean industry assuming responsibility for investments to protect the environment or other expenditures so as to avoid paying environmental taxes or receiving reduced subsidies.

Where Swedish industry is concerned, possible incentives for entering into such agreements could be, for example, to keep tax subsidies or direct subsidies. This would mean that the political goal intended by the subsidy could still be met while certain environmental requirements would be set that the recipient would have to satisfy in order to benefit from the subsidy or tax anomaly.

6 Future developments

Breakdowns of environmental taxes by industry can be used in many different areas and our ambition is to set up a system for producing this data on an annual basis. One interesting application is to link environmental taxes at an industry level with the tax base affecting the environment, thereby forming an idea of the impact the taxes have on the economic actors responsible for the actual effect on the environment. A reasonable future aim is to attempt to generate time series that make it possible to study the trends for different industries in terms of tax burden and emissions/consumption. This will enable us to obtain more information about the effectiveness of these economic instruments.

Time series would also facilitate a clearer linkage between environmental taxes at the industry level and the costs of protecting the environment. It would then be possible to study the connection between environmental taxes, the costs of clean-up or environmental protection, and emissions. The idea behind this is that it would make it possible to analyse the effects of the instruments of environmental policy. Unfortunately it is impossible to do this at present with the data currently available. Nevertheless, it is an idea and a possible ambition that can be carried forward into the debate about the direction future developments of the environmental accounts might take. In future, this type of data could facilitate analyses of, e.g., green tax shifting, which is likely to remain on the agenda for a long time yet.

Where subsidies are concerned, the method for estimating tax subsidies is capable of further development. The subsidies chosen for study can also be supplemented by further subsidies and perhaps compared with government appropriations for environmental protection. It would also be interesting to shed light on other types of economic instrument, such as environmental charges, interest-free loans and government guarantees.

One aspect of environmental taxes and subsidies that has not been discussed in this report is their effects on prices and price levels and the question of incidence, i.e. how these taxes and subsidies are shifted at different economic stages. It has not been possible to generate consistent input-output models for the years we have studied. As a result, it has not been possible either to set up different price models in order to analyse their effects. Hopefully this will be possible by the time the next report on environmental taxes comes out.

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7.3 Laws

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7.4 Other

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Appendix 1: The industry classification used in the tables with comparable data.

NACE (code)	*Industries*
01-02, 05	**Forestry, Hunting, Fishing and Agriculture**
10-14	**Mining, quarrying**
11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying.
15-37	**Manufacturing**
15-16	Manufacture of food products and beverages. Manufacture of tobacco products
17-19	Manufacture of textiles, of wearing apparel; tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear.
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials.
21-22	Manufacture of pulp, paper and paper products. Publishing, printing and reproduction of recorded media.
23-24	Manufacture of coke, refined petroleum products and nuclear fuel, manufacture of chemicals and chemical products.
25	Manufacture of plastic and rubber products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery products.
29	Manufacture of machinery and equipment
30-33	Manufacture of office machinery and computers. Manufacture of electric machinery and apparatus. Manufacture of radio, television, and communication equipment and apparatus. Manufacture of medical, precision and optical instruments, watches and clocks.
34-35	Manufacture of motor vehicles, trailers and semitrailers. Manufacture of other transport equipment.
36	Manufacture of furniture
37	Recycling
40-41	**Electricity, gas and water supply**
40	Electricity, gas. steam and hot water supply
41	Collection, purification and distribution of water
45	**Construction**
50-52, 55	**Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods. Hotels and restaurants**
60-64	**Transport, storage and communication**
60	Land transport
61	Water transport
62	Air transport
63	Supporting and auxiliary transport activities; activities for travel agencies
64	Post and telecommunications
65-67	**Financial intermediation**
70-99	**Real estate, renting, and business activities. Public administration, and defence; compulsory social security. Education. Health and social work. Other community, social and personal service activities. Private households with employed persons.**

Appendix 2 Breakdown of environmental taxes by different industries and final demand, 1995 (SEK million)

Tax bases	**Taxes on energy**				**Pollution Taxes**				**Transport taxes**			
Different taxes.	***Energy tax on fuel***	***Energy tax on electricity consumption***	***Production taxes on electricity***	***Carbon dioxide tax***	***Sulphur tax***	***Environmental tax on domestic air traffic***	***Tax on pesticides***	***Tax on fertiliser***	***Tax on motor vehicles***	***Kilometre tax on diesel vehicles***	***Sales tax on motor vehicles***	**Total environmental taxes**
NACE (SNI)												
01-02, 05	717	142	35	740	5	0	32	299	333	0	0	2303
10-14	20	0	45	57	7	0	0	0	5	0	0	134
15-37	616	0	848	813	44	0	0	0	131	0	0	2452
Of which: 15-16	*73*	*0*	*46*	*108*	*13*	*0*	*0*	*0*	*21*	*0*	*0*	*261*
17-19	*13*	*0*	*7*	*14*	*2*	*0*	*0*	*0*	*2*	*0*	*0*	*38*
20	*46*	*0*	*38*	*51*	*3*	*0*	*0*	*0*	*14*	*0*	*0*	*152*
21-22	*70*	*0*	*342*	*221*	*15*	*0*	*0*	*0*	*10*	*0*	*0*	*658*
23-24	*28*	*0*	*92*	*50*	*3*	*0*	*0*	*0*	*2*	*0*	*0*	*175*
25	*17*	*0*	*19*	*12*	*1*	*0*	*0*	*0*	*5*	*0*	*0*	*55*
26	*25*	*0*	*23*	*80*	*1*	*0*	*0*	*0*	*5*	*0*	*0*	*135*
27	*16*	*0*	*137*	*104*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*259*
28	*66*	*0*	*35*	*36*	*1*	*0*	*0*	*0*	*32*	*0*	*0*	*170*
29	*86*	*0*	*36*	*41*	*0*	*0*	*0*	*0*	*21*	*0*	*0*	*184*
30-33	*46*	*0*	*21*	*17*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*86*
34-35	*103*	*0*	*38*	*60*	*5*	*0*	*0*	*0*	*9*	*0*	*0*	*216*
36+37	*26*	*0*	*14*	*18*	*0*	*0*	*0*	*0*	*6*	*0*	*0*	*64*
37												
40-41	345	549	133	1100	103	0	0	0	16	0	0	2245
45	841	57	14	531	0	0	0	0	260	0	0	1703
50-52, 55	1459	520	125	489	0	0	0	0	309	0	0	2902
60-64	2498	156	36	1344	0	186	0	0	293	0	0	4513
Of which: 60	*2218*	*52*	*12*	*1201*	*0*	*0*	*0*	*0*	*254*	*0*	*0*	*3737*
61	*4*	*2*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*7*
62	*5*	*6*	*1*	*1*	*0*	*186*	*0*	*0*	*2*	*0*	*0*	*201*
63	*92*	*42*	*10*	*62*	*0*	*0*	*0*	*0*	*8*	*0*	*0*	*215*
64	*178*	*54*	*13*	*78*	*0*	*0*	*0*	*0*	*29*	*0*	*0*	*353*
65-67	53	42	10	20	0	0	0	0	10	0	0	136
70-99	937	560	133	530	0	0	0	0	155	0	0	2315
Total industry	7487	2026	1379	5624	158	186	32	299	1512	0	0	18703
Private consumption	15670	3482	742	5719	5	0	0	0	2426	0	0	28043
Public consumption	586	658	159	468	2	0	0	0	111	0	0	1983
Export	0	0	162	0	0	0	0	0	0	0	0	162
Total	23742	6166	2442	11811	165	186	32	299	4049	0	1749	50641

Appendix 3 Breakdown of environmental taxes by different industries and final demand, 1993 (SEK million)

Tax bases	Taxes on energy				Pollution Taxes				Transport taxes			
Different taxes.	*Energy tax on fuel*	*Energy tax on electricity consumption*	*Production taxes on electricity*	*Carbon dioxide tax*	*Sulphur tax*	*Environmental tax on domestic air traffic*	*Tax on pesticides*	*Tax on fertiliser*	*Tax on motor vehicles*	*Kilometre tax on diesel vehicles*	*Sales tax on motor vehicles*	Total environmental taxes
NACE												
01-02, 05	431	129	32	507	6	0	13	185	336	291	-	1930
10-14	22	0	38	50	5	0	0	0	5	15	-	135
15-37	543	0	755	664	47	0	0	0	134	300	-	2443
Of which: 15-16	*55*	*0*	*44*	*91*	*14*	*0*	*0*	*0*	*22*	*55*	-	*281*
17-19	*14*	*0*	*8*	*9*	*1*	*0*	*0*	*0*	*2*	*7*	-	*41*
20	*29*	*0*	*35*	*44*	*3*	*0*	*0*	*0*	*14*	*31*	-	*156*
21-22	*71*	*0*	*313*	*169*	*18*	*0*	*0*	*0*	*11*	*17*	-	*599*
23-24	*21*	*0*	*85*	*39*	*5*	*0*	*0*	*0*	*2*	*7*	-	*159*
25	*16*	*0*	*16*	*13*	*2*	*0*	*0*	*0*	*5*	*9*	-	*61*
26	*16*	*0*	*20*	*62*	*0*	*0*	*0*	*0*	*5*	*14*	-	*117*
27	*13*	*0*	*113*	*87*	*0*	*0*	*0*	*0*	*2*	*6*	-	*221*
28	*62*	*0*	*28*	*33*	*1*	*0*	*0*	*0*	*32*	*72*	-	*228*
29	*83*	*0*	*29*	*40*	*0*	*0*	*0*	*0*	*21*	*42*	-	*214*
30-33	*54*	*0*	*19*	*13*	*0*	*0*	*0*	*0*	*2*	*11*	-	*100*
34-35	*82*	*0*	*33*	*49*	*4*	*0*	*0*	*0*	*10*	*16*	-	*194*
36+37	*27*	*0*	*12*	*14*	*0*	*0*	*0*	*0*	*6*	*13*	-	*72*
37												
40-41	235	589	146	1074	116	0	0	0	16	44	-	2219
45	650	70	16	445	1	0	0	0	263	552	-	1997
50-52, 55	1279	491	114	464	0	0	0	0	313	559	-	3221
60-64	1377	141	33	1232	0	196	0	0	296	652	-	3927
Of which: 60	*1193*	*50*	*12*	*1120*	*0*	*0*	*0*	*0*	*257*	*547*	-	*3178*
61	*4*	*2*	*0*	*2*	*0*	*0*	*0*	*0*	*0*	*2*	-	*10*
62	*5*	*7*	*1*	*1*	*0*	*196*	*0*	*0*	*2*	*2*	-	*215*
63	*49*	*40*	*10*	*53*	*0*	*0*	*0*	*0*	*8*	*26*	-	*186*
64	*126*	*42*	*10*	*56*	*0*	*0*	*0*	*0*	*29*	*75*	-	*338*
65-67	38	39	10	13	0	0	0	0	10	9	-	120
70-99	757	547	135	538	2	0	0	0	156	315	-	2450
Total industry	5333	2006	1279	4988	177	196	13	185	1529	2737	-	18443
Private consumption	14662	3100	674	5087	6	0	0	0	2453	0	-	25982
Public consumption	525	604	150	469	5	0	0	0	113	0	-	1866
Export	0	0	139	0	0	0	0	0	0	0	-	139
Total	20520	5710	2242	10544	188	196	13	185	4095	2737	1287	47717

Appendix 4: Sources and method

Sources

In choosing sources of information, we have borne in mind the intention to issue these accounts on a running basis, and this means that the sources should be as few in number and as readily accessible as possible. The greater part of the data used consists of internal sources at Statistics Sweden, i.e. the National Accounts and the Environmental Statistics. External sources of information have been used to a limited extent.

Internal sources

The programme for National Accounts (ES/NR) at Statistics Sweden produces accounts of all public revenue and expenditure. To estimate the total tax revenues, we have added up the tax payments from different industries, which we have grouped in accordance with the Swedish Standard Industrial Classification (SE-SIC, based on NACE rev. 1). These statistics are the basis for presenting environmental taxes and potentially environmentally harmful subsidies with an industry-level breakdown.

One requirement to enable accounts of taxes and subsidies to be presented on a running basis is that NR makes this industry-level data available. The extra work it means for NR to supply us with this data on an ongoing basis is not extensive, so this cannot be regarded as a problem. Emissions and consumption statistics exist in the Environmental Accounts and are produced by the Programme for Environmental Statistics at Statistics Sweden (MR/MI).

External sources

In order to get a clear picture of the regulations that apply to environmental taxes in different years, it is best to turn to the Tax Administration and the Special Tax Office in Ludvika. Every year the Tax Administration publishes a brochure (*Excise duties*) that provides concise information on excise duties and the rules in force. This publication can provide a useful overview of the tax legislation and is therefore suitable for acquisition before each annual report on environmental taxes and subsidies.

Every other year, the Swedish Environmental Protection Agency also publishes a list of charges, taxes and grants connected with environmental protection (Report 4702). This report can also serve as an overview of the relevant regulations and ordinances.

Tax subsidies are calculated by the Ministry of Finance and are published annually as an appendix to the Budget Bill. This can be used for checking the estimates we make for each industry.

Transport support is administered by the Swedish National Board for Industrial and Technical Development, who also provide an account of the subsidy with an industry breakdown. The industry-level data on transport support in this report is taken from the Swedish National Board for Industrial and Technical Development.

For international comparisons reports are available from many EU and OECD countries that identify and analyse national environmental taxes.

Eurostat and OECD have carried out comparative studies involving different member countries.

Method

Estimating tax subsidies

The tax subsidies that have been estimated with industry-level breakdowns are tax anomalies in the system of carbon dioxide and energy taxation.

In order to estimate the tax subsidies within *energy taxation*, we use the average tax per energy unit as norm. To calculate this, we first convert all fuel consumption from quantitative units such as tonnes, cubic metres, etc., to energy units (GWh). Next, we calculate the average energy tax per GWh, i.e. the total tax revenue divided by the total consumption in GWh.
We can represent this calculation in algebraic form as follows:

Average energy tax = (total energy tax paid / total fuel consumption in GWh)

This average tax has been chosen as the tax norm, i.e. we assume a uniform tax per unit of energy, irrespective of whether the fuel is used for heating, transport or as a production input. Fuel used for some purpose other than energy generation is excluded, e.g. the use of metallurgical coal in the iron and steel industry.

In estimating anomalies within *carbon dioxide taxation* no distinction is made in the tax subsidies received by manufacturing industries (NACE 10-37) between the general abatements for 1993 and the so-called 1.2 per cent rule. The tax subsidies in *carbon dioxide taxation* that we report are thus the total tax subsidies received by each industry. The norm chosen in estimating the tax subsidies is the average (weighted) carbon dioxide tax per fuel. Thus, for fuel X

Average carbon dioxide tax (X) = Total carbon dioxide tax paid (X) / total consumption (X)

By identifying the tax norm for each fuel and multiplying it by the consumption by each industry of the fuel in question we are able to calculate a hypothetical tax payment, i.e. the tax payment that "ought" to be paid for each fuel in the absence of any anomalies. This figure can then be compared with the actual tax payment and the difference between the two is then the tax subsidy / sanction per fuel and industry. These results are then added up for each industry, enabling us to estimate the total tax subsidy or sanction. This method of estimation has certain inherent weaknesses, since the statistics on taxes and consumption are ratio adjusted and may yield inaccurate values. However, the method does provide an indication of the breakdown of tax subsidies among different industries.

Method for breakdown of taxes by different industries

Many of the excise duties discussed in this report come under the definition of "indirect taxes associated with goods" in the National Accounts.[65] This applies to all taxes on energy payable on different types of fuels, such as the carbon dioxide tax, the sulphur tax, the energy tax and the production tax on electricity. In the National Accounts, these taxes are reported with industry breakdowns, giving the relevant rates of taxation and the quantity of different fuels consumed.

For transport taxes, the taxes are broken down by using the pool of motor vehicles in different industries and final demand the key, i.e. tax rates for different types of motor vehicles and the pool of motor vehicles in different industries. However, in the system of national accounts, sales tax is a tax on investments and is not broken down by industry.

Breakdown of subsidies

Most of the direct subsidies studied in this report are specific to particular industries and benefit a single industry only. Transport support is shared by different manufacturing industries and the Swedish National Board for Industrial and Technical Development has a record of these payments at the most allocated NACE level.

Estimation of proportions of untaxed CO_2 and SO_2 emissions

The general exemptions that the estimates of *carbon dioxide tax* are based on are the abatement for mining, quarrying and manufacturing (NACE 10-37), the exemption for fuel consumption by water transport (NACE 61) and the exemption for fuels used in electricity production.

The Statistical Report SM E 11 SM 9701, *El-, gas och fjärrvärmeförsörjning* (The supply of electricity, gas and district heating in 1995) has been used to obtain data on how much fuel is used solely for electricity production at electricity, gas and heating works (NACE 40-41). Emissions factors for different fuels given in the Environmental Accounts have then been used to estimate the quantities of carbon dioxide emissions that this consumption gives rise to. These estimated emissions plus the total carbon dioxide emissions from water transport (NACE 61) make up the share of carbon dioxide emissions that are untaxed. Partially taxed emissions consist of total carbon dioxide emissions from mining, quarrying and manufacturing (NACE 10-37). Emissions from other industries private consumption and public consumption are fully taxed.

In this report, untaxed sulphur dioxide emissions are estimated as:
Total sulphur dioxide emissions from water transport plus 70 per cent of sulphur dioxide emissions from the manufacture of pulp, paper and paperboard (NACE 2111-2112), which is an estimate of the untaxed emissions from recovery boilers in these industries.[66]

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[65] Indirect taxes = taxes that vary with production, sales, purchases, use or possession of goods, services, labour and real capital. Taxes associated with goods = taxes that are payable as a fixed or flexible charge per unit by quantity or value of a certain product produced, sold or consumed ([1979:11] MIS *Svenska nationalräkenskapssystemet, källor och beräkningsmetoder*) (The Swedish system of national accounts, sources and methods of estimation).

[66] Berglund, H., ES / NR, Statistics Sweden, telephone interview, 13 March 2000.