ENV4-CT 96-0228

ENVIRONMENTAL FISCAL REFORM (EFR)

SUMMARY FINAL REPORT

Key words: Greenhouse gas abatement, Environmental tax reform, Distribution

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I. OBJECTIVES

The main objective of the project was to assess the economic and social effects of key policy instruments (e.g. taxes on pollutants, materials and energy) likely to form important components in the transition towards environmental sustainability, with an emphasis on greenhouse gas abatement.

The assessment included estimates of the effects for different income or expenditure groups as well as for vulnerable groups such as those on state pensions or the unemployed. In most previous studies, these equity questions have been incidental, rather than fundamental, components of the analysis. In this project, equity issues were the main focus, taking into account *all* the main aspects of EFR, i.e. not just the effects on expenditures as in earlier research, but also the effects on equity of the use of tax revenues and of the consequent increase in employment and reduction of pollution. The project also aimed to examine the equity aspects associated with the spatial effects of EFR.

In order to achieve the objectives, it was necessary to identify and collect data for the quantitative analyses and to analyse environmental policies that have been implemented or proposed.

II. METHODOLOGY

The project had three work areas: data collection and analysis, policy identification and the quantitative policy analyses.

Data collection and analysis

The main data source used for the pan-European analysis was the 'Family Budgets' from Eurostat. This reported the results of household expenditure surveys for EU members around 1988. Data for Germany were not available, so the national statistics for Germany were converted into the Eurostat categories to complete the dataset. Data for expenditure on environmentally sensitive goods and services (ESGS) were obtained, with figures for expenditure on domestic energy, transport, package tours, food and white goods (refrigerators, washing machines etc.). Data on ESGS for the Scandinavian countries and Switzerland were also obtained. Further data analysis comprised a comparison of expenditure based vs. income based household data.

Spanish statistics were used to construct a dataset for expenditures on fuels for domestic heating, gross rent and water charges and travel costs. Data on regional variations in expenditure on ESGS, as well as output and value added were obtained for Spain, Germany, Sweden, UK and Switzerland. Data was found which made it possible to correlate air pollution and noise micro data to income data for Berlin. Swedish household survey data on expenditures and national accounts data on total consumption were obtained. The data requirements for an analysis of household time use and expenditure were identified.

Policy identification

A survey of environmental policies, both implemented and proposed, was undertaken. A database of environmental taxes and charges and policies for their implementation, developed at Keele University, UK was extended for the project and supplemented.

Quantitative policy analysis

The core of the project was a quantitative analysis of the EU using an economy-energy-environment model, E3ME. Increased duties on energy products in proportion to their carbon content were simulated to reduce EU CO_2 emissions by 10% by 2010. The E3ME model was also used in an illustrative study of taxation of road freight, providing an analysis of a fiscal reform other than carbon/energy taxation. These studies were complemented by studies by each contractor, depending on the data available and the particular expertise of each contractor. A national analysis for Spain of taxes on energy and transportation was performed, calculating the short-term price effects for different groups of the population. An analysis for Switzerland considered an increase in energy taxes with the revenues recycled in various ways; a comparative analysis of the geographic distributional effects of increases in energy prices on expenditures was also undertaken for Switzerland. The distribution of benefits from reducing pollutants from road transport were analysed, including a case study for Berlin. Finally, an analysis of the effects of an increase of carbon taxes on Swedish households was undertaken and the data requirements for an analysis of household expenditure and time use considered.

EFR and distributional effects for EU-11

The EU-wide analysis was performed using the E3ME model. The version of the model used in the analysis covers 11 EU member states and the interactions between them and the rest of the world. Each country has 30 industrial sectors, 27 consumer categories and trade into and out of a European 'pool'. The main relationships (for variables such as prices, consumption and employment) in the model are statistically estimated from

annual data 1970-93. The project extended the model by introducing 10 ESGS and 14 socio-economic groups, allowing estimates to be made of the real income and expenditures of these groups. These relationships together determine future economic performance, given policy assumptions. Energy use and emissions of pollutants and the labour markets in the member states are modelled in detail.

Distributional effects of EFR for Spain
The analysis for Spain was based on a 'Social Accounting Matrix' for Spain in 1990. This covers the whole economy, with several income groups of consumers, a breakdown of commercial sectors and the government. Prices were modelled based on costs of goods production. The effects of tax increases on energy and transport were calculated and the impact on the different groups of consumers identified.

EFR for Switzerland and spatial effects for selected European areas
The national analysis for Switzerland used comparative data analysis and a model of the Swiss economy (a 'Computable General Equilibrium' model). A comparative data analysis of the geographical distribution of ESGS and industries sensitive to energy taxes was also undertaken for the EU member states and for the areas for which data was available: Spain, Sweden, Switzerland, the UK and W. Germany.

The benefits of pollution reduction and a case study for Berlin
In order to discuss distributional effects of the benefits from an environmental fiscal reform, the analysis of the benefits of pollution reduction applied the following steps:
consideration of local pollution sources: exposure to road traffic emissions
quantification of physical impacts: adverse health effects
review of distributional implications: damages, including a case study for Berlin
potential reductions in damages due to environmental fiscal reform measures
analysis of distributional effects: benefits

Epidemiological studies quantify the adverse effects. The literature on distributional effects was reviewed. Case studies have been undertaken in which the exposure to pollutants on the smallest scale possible was correlated to some socio-economic indicators of people being exposed. Benefits occur when the exposure of people to some pollutant is reduced. Environmental fiscal reform, in addition to measures such as the Auto-Oil programme and quantified reductions in exposure were discussed. Allowing for the possible regional differences in the effects of the measures, the distributional implications of the measures were analysed based on the distribution of damages. The study focused on benefits and damages in real, rather than money terms.

Distributional effects of a Swedish carbon tax
The study for Sweden was an expenditure analysis of the distributional effects of a substantial increase in the carbon tax. The basis for the analysis was a model of demand estimated with the Linear Almost Ideal Demand System, assuming that expenditure shares of non durable consumption goods and services are determined by relative prices and of the goods on the one hand – the price effects - and the total real expenditures on non durable goods on the other – the budget effect. The price effects of the model have been estimated on national accounts data on total private consumption for the period 1970 – 1996 and the total expenditure part of the model was estimated on micro data from the household expenditure survey. Expenditure on durable goods was assumed constant. The consequences of a doubling of the carbon tax were analysed – on its own and with some form of compensation through a decrease in the VAT.

III. MAIN RESULTS

The overall findings from the various studies are that uncompensated, simultaneous increases in energy and transport taxation have weak regressive effects: more vulnerable socio-economic groups experience a slightly greater increase in costs relative to their initial levels. However, the net effects of environmental fiscal reform depend critically upon the compensating measures taken by governments to recycle the extra tax revenues. If taxes on employment are reduced, most vulnerable groups (e.g. low-expenditure households, state pensioners) experience small increases in real incomes because they are mostly isolated from the labour market. Given the size of the extra tax revenues, it would be possible to make EFR strongly progressive, but this would require the active re-direction of revenues by governments towards the vulnerable groups.

The differences between countries are greater than differences within countries across the expenditure/income distributions. This result is confirmed by the 'Environmental policy, social exclusion and climate change' (EPSECC) project.

Data
The analysis of expenditure on ESGS showed patterns of total domestic energy consumption being comparable

across the EU-12. The low-expenditure groups spend a higher percentage of their budgets on energy than the wealthy, but a lower percentage of their budgets on transport, especially vehicle purchases**.** However, all groups spend a much higher percentage of expenditure on transport than energy. An analysis of the Swedish data showed that the categorisation of households by expenditures (the Eurostat treatment) rather than income may be misleading, as it is not possible to distinguish between households that are poor and households that are well off, but frugal.

Findings from the identification of policies
The policy analysis of the countries studied shows that there are important differences between the announced tax rates and the effective tax rates, in particular for the industry sector, due to special provisions and exemptions in the tax legislation.

Policy analysis
The main findings of the overall European analysis (using the E3ME model) were that
revenue-neutral increase in domestic energy and vehicle fuel taxes, recycled into the economy via reductions in employers' taxes, would have a number of beneficial effects. In addition to the reduction in CO_2 emissions (10% by design in the pan-European analysis), there would be an increase in real personal disposable incomes and employment. By 2010, real personal disposable incomes were 2% above baseline and employment is 1.3% above, assuming that the change is tax-revenue-neutral, with employers' contributions to social security schemes being reduced to compensate for the additional revenues from excise duties. However, without deliberate further policy changes to redirect the extra incomes towards the more vulnerable socio-economic groups, the change will be weakly regressive for nearly all the Member States in the study. Although low-expenditure households might be expected to experience an increase in real income following this limited ecotax reform, high-expenditure households experience an even greater increase.

The analysis for Spain assumed a flat 5% tax levied on energy goods (coal, coke, oil & gas, electricity & manufactured gas) and land transportation. The good whose price was most affected is *oil & gas* where a 10.5% increase over the original, pre-ecotax price was found. With a policy that combines the 5% tax with a reduction in social security taxes such as to keep aggregate prices from rising, real income falls by approximately 0.2%. The distributional impact of the ecotax reform is estimated to be systematically regressive, and more so if compensation by the government is smaller. Across consumer types, there was not much of a difference in income loss. The self-employed agrarian type was always the largest loser in all the scenarios.

The case study for Switzerland found that the macroeconomic impact of the EFR-scenarios was modest compared to the benchmark scenario. The variation of all important economic indicators was less than 0.5%. The small impacts of the EFR-scenarios on economy can be explained by the moderate tax levels and by the fact that at least 50% of the revenues are recycled back to the producing sector directly. The most important social distributional effects results were as follows.

Lump-sum payments to households had a progressive impact. Low-income households benefited more than households with a high income. A reduction of social security contributions had a regressive impact. The income reduction (in terms of changes in the equivalent variation) for households with low income was about 0.8% in a scenario with price increases of 3.5% per year for fossil energy and 2% per year for electricity, and about 0.4% in a scenario with a 0.006 SF/kWh tax on fossil and nuclear energy.

The study of damages from pollution found evidence that applying tax measures to improve environmental quality may result in progressive distribution of the health benefits. In a case study of Berlin, the distribution of the damages from exposure to some traffic induced air pollutants (interpreted both as exposure as well as health impacts) is clearly regressive. Differences in additional cancer cases e.g. due to road traffic induced air pollution were obtained between social groups in the order of magnitude of 2-4 in 10,000 inhabitants of Berlin per lifetime. This regressive distribution of damages can be "improved" by an EFR measure because this would ceteris paribus lead to an overall reduction of traffic and thus a reduction of exposure to air pollution. In principle, the same conclusion holds true for traffic-induced noise. However, the characteristic non-linear relationship between transport volume and noise clearly implies that the reductions in health risk (especially of noise-induced cardiovascular disease) are of minor importance compared to the effects of reductions in air pollution.

In the analysis carried out for Sweden, the effects of doubling the carbon tax were offset by a decrease in VAT set so as to produce a revenue-neutral overall effect. The decrease in VAT was just above 6%, or roughly 1.5 percentage points of the full VAT.
The general picture is that the decrease in the VAT benefited those that spend most. The households that actually benefited, in terms of having to pay lower taxes overall, were those in the highest two expenditure

categories in relation to the mean. This effect does not show up in the income quintiles. There is an increase in the implicit tax rate for most groups, regardless of whether they are considered from an income, expenditure, demographic or a regional perspective. Both singles and married/cohabiting with children were less hurt by the increase than those without children. The implicit tax rates for singles were generally higher than for married. The loss in real income in relation to the expenditure per adult equivalent was also higher for singles, with or without children than for married with or without children. The regional perspective indicated that households in the rural north of Sweden would lose more from the increased tax than households in the south. Households in the big cities were best off with a real income loss in relation to expenditure that was well below 1 percent.

Working papers describing the analyses:

No.1 Expenditure on environmentally sensitive goods and services: Household spending in Europe
No.2 Distributional effects of an increase in the Carbon Tax within a partial equilibrium framework- the case of Sweden
No.3 Charging For Road Freight In The EU: Macroeconomic Implications of a Weigh-In-Motion Tax
No.4 Social and regional Distributive Impacts of Ecotax Proposals
No.5 Bibliography for the Environmental Fiscal Reform Project
No.6 Unevenly distributed benefits from reducing pollutants, especially road traffic emissions, via reducing road transport
No.7 European Fiscal Policies for Sustainable Development
No.8 Modelling Equity Effects of Ecotax Reform in Europe
No.9 Ecotaxes and Income Distribution in Spain: a linear framework approach
No.10 Equity and Ecotax Reform in the EU: Achieving a 10% reduction in CO_2 emissions using excise duties
No.11 Imputed Data for Expenditure and Income in the E3ME Model
No.12 Households activities and sustainability - possible uses of potential data

IV. SCIENTIFIC INTEREST AND NOVELTY

The project breaks new ground in the analysis of distributional effects. For the first time, a quantitative analysis of the distributional implications of environmental policies across the EU been undertaken. This analysis has employed a disaggregated econometric model of the European economy, E3ME. This has several advantages: equations are estimated separately for each member state, but all states interact in a fully dynamic manner. The common data definitions and calculation permit meaningful comparisons between countries and household and industrial groups across Europe, as well as within countries.

In undertaking this work, the data available on the distribution of expenditure across expenditure groups on a consistent basis across EU member states has been improved and extended. In particular, German data on household expenditure has been converted into the Eurostat expenditure categories, making it possible to compare German household expenditures to the other 11 EU member states on a consistent basis. The data requirements for an analysis of the sustainability of households' activities in general, as well as consumption, have been identified. The policy identification has provided an up-to-date and comprehensive survey of environmental policies, both implemented and proposed, in Europe today.

The possibility of regressive outcomes of environmental fiscal reform and the necessary policies to compensate for these effects have been identified and reported. The importance of considering the use of revenues raised by environmental fiscal reform has been confirmed: reductions in labour taxes can lead to a net increase in economic activity and employment, an example of the 'double dividend'. The results of the pan-European analysis have been supported and confirmed by national studies for Spain, Sweden and Switzerland.

The analysis of distributional implications has been broadened to include variables other than income and expenditure. The distribution of damages from pollutants across social groups (in the case study for Berlin) and the geographical distribution of sensitivity to environmental fiscal reform have been studied.

V. POLICY RELEVANCE AND ANALYSIS

The contributions of Professor W.G.Grant, independent academic rapporteur and the Commission participants in the policy seminar 'Fair taxes for greenhouse gas reduction: the distributional implications of fiscal policies to reduce CO_2 emissions', Brussels, 19.6.98, to this discussion are acknowledged.

The results of this project are of considerable interest to European policy makers, both within individual member states and at the European level. It has shown that social exclusion must be considered simultaneously with environmental policy and not as a separate policy area. Fiscal measures to promote environmental

sustainability do not require countries to forego their economic development or social welfare. An increase in taxes on fuels will be slightly regressive, but the scale of the revenues is such that poorer households can easily be compensated.

The scale of the revenues generated by these reforms leads immediately to a consideration of the use of these revenues. The effectiveness of environmental fiscal reform in meeting the goals of the EU - sustainable economic growth together with social equity and a reduction in unemployment - can be most effectively achieved by considering packages of measures, instead of individual taxes in isolation. It is possible to induce a moderate increase in employment and possibly a slight increase in economic activity if the revenues are used to attain these objectives.

Given the weakly regressive findings, offsetting measures must be designed. The conditions affecting socially-excluded groups tend to be country specific, so it is necessary to consider effects of policies on each country individually. The regressive results are dominated by taxes on domestic energy, rather than road fuels. This implies that for countries with high domestic energy expenditures, the regressive effects of domestic fuel tax increases will be greater than for countries with low expenditures, which might be a result of good housing insulation in poor homes. It should also be noted that poorer households tend to place a lower priority on environmental improvements, so that an equal distribution of benefits would tend to be regressive. However, poorer households also tend to live in more heavily polluted areas, so if pollutants that have localised effects are reduced, the overall impact of pollution reduction may be progressive.

A significant problem for policy makers is that if tax reductions go to employers, households may perceive an increase in prices or taxation without any immediate benefit. This may make the introduction of EFR politically difficult. One possibility for overcoming this difficulty is to earmark some of the revenues from environmental taxes for purposes that have an immediate and obvious public benefit, for example environmental clean-up or public transport improvements to offset increased road fuel costs. In the UK, the original 3% per year fuel duty escalator (now 6%) was introduced at the same time as reductions in National Insurance contributions and income taxes. This was done without presenting the two changes as associated but the link was made in practice. A further problem for EU policy makers is that the EU only has powers to raise taxes; it cannot decide on the allocation of tax revenues. This complicates the introduction of policy packages such as those analysed and proposed in this report, although the EU does disburse revenues in the context of structural funds etc.

In the Nordic countries objections to EFR are based on considerations of competitiveness. These can be addressed by harmonising taxes across the EU. Pollutants with localised effects may be difficult to harmonise, as they may impose varying external costs, but the EU could then introduce a minimum tax and member states could then have locally determined increases above the minimum.

The policy analysis has shown that each member state has generated its own ideas and programme of environmental fiscal reform. It is therefore possible for the member states to learn from each others' experiences and to consider the advantages of coordinated actions across the EU.

VI. LIST OF PUBLICATIONS

"Charging For Road Freight In The EU: Macroeconomic Implications of a Weigh-In-Motion Tax" is to be submitted to the *Journal of Transport Economics and Policy*.

Social and Regional Distributive Impacts of Ecotax Proposals is to be translated in to German and expanded for a report for the Swiss government.

Unevenly distributed benefits from reducing pollutants, especially road traffic emissions, via reducing road transport will be adapted to become a shorter article, suitable for publication and will be presented at conferences on policies for cities.

"European Fiscal Policies for Sustainable Development" has been used as the basis of presentations at the Goteborg and Munich meeting of the European Network on Market-based instruments. It will be published in a book on the Munich meeting.

"Ecotaxes and Income Distribution in Spain: a linear framework approach" will be submitted to the *Journal of Policy Modelling*. It will also be translated into Spanish for publication in Spain.

"Equity and Ecotax Reform in the EU: Achieving a 10% reduction in CO_2 emissions using excise duties" has been submitted to *Fiscal Studies*. Presentations on the results have been given at the Copenhagen and Goteborg Munich meeting of the European Network on Market-based instruments.