Research Department

Statistics Norway

Annual Report 1994

Contents

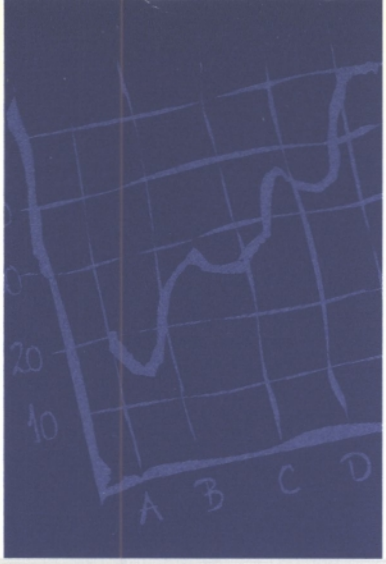
The Annual Report 1994 for the Research Department of Statistics Norway presents in outline major programmes and projects in 1994-95 with complete lists of publications and staff. The Annual Report also gives a brief history of the Department and its role as a social and economic research institution in symbiosis with the statistical responsibilities of Statistics Norway.

The ultimate aim of the research activity of Statistics Norway is to contribute towards a better foundation for social and economic policies. To an increasing degree theories and methods pertinent for this aim are drawn from international research pools

The Research Department welcomes interests in our publications, and we are happy to forward these on request or as institutional exchange subscriptions.

Oslo, 13 February 1995

Olav Bjerkholt
Assistant Director General
Head of Research Department



Introduction

Brief history of the Research Department

The research activities of Statistics Norway have roots far back in the history of the institution. The statistical bureau of Norway was founded in 1876 by separating a small statistical office from the Ministry of Interior. In the historical chronicles of Statistics Norway the background for the separation of the statistical service from the ministerial environment was stated as follows: "The work of the Office would be facilitated by more distance from the government offices; the scientific character of the Office would thus be better understood by the public." Since then Statistics Norway, or as it was known until 1993 - the Central Bureau of Statistics - has been the national statistical institution of Norway, part of the government administration but with an autonomy in statistical matters, like similar institutions in other countries.

The first Director General of Statistics Norway, Anders N. Kiær (1876-1913), took an active part in the international statistical cooperation and was a pioneer in the use of representative samples as a basis for statistics, especially with regard to income statistics. Kiær pioneered also in technical advances: a Hollerith electrical machine was employed in Norway for the first time in the compilation of statistics of incomes and wealth for 1891, shortly after its invention. The research activity of Statistics Norway in the early years was modest and mostly related to analysis of data from the population census and income statistics. Later on after the turn of the century statistical investigations of social issues and poverty conditions became an important area. After World War I Statistics Norway started to publish regular economic surveys.

A separate Research Department was not established, however, until 1950 on the initiative of the new Director General Petter Jakob Bjerve (1949-1980) who had strong academic interests and to whom applied economic and econometric research was a natural extension of the statistical work. In the years just preceding 1950 intensive efforts had taken place in establishing National Accounts, based on production statistics as the primary data source. The pioneering national accounts work of this period was an empirical research frontier which later would provide a basis for macroeconomic modelling and other planning and policy oriented tools. The national accounts system was completed in the early 1950s as one of very few, which at that time integrated detailed annual input-output tables within the national accounting framework.

In the first decade the work of the Research Department comprised in addition to national accounts, tax research, monthly and annual economic surveys, and other research activities often directed towards improving methods of economic planning in the postwar period. Towards the end of the 1950s the first macroeconomic model of Statistics Norway - the MODIS I model - was developed as a simple input-output model, large in relation to the computer capabilities of the time. The model drew on inspiration from W. Leontief's pioneering work as well as the modelling experiments of Ragnar Frisch at the Institute of Economics (University of Oslo). The computer used to solve the MODIS I model from 1960 until its replacement in 1965 was a British built first-generation vacuum-tube computer called DEUCE, the only one of its kind in Scandinavia.

Throughout the 1960s and 1970s models of the MODIS family, ever increasing in size continued to be developed and used intensively by policy makers. Around 1980 a new breed of macroeconomic models were finally taking over, and constituted the family of models used today. The 1960s also initiated an era of computer based tax models run by the Research Department as a service directed primarily towards the Ministry of Finance and the Storting (Parliament).

In the 1970s natural resource accounts and energy economics became new adopted research fields, later on after 1980 petroleum economics followed. During the 1980s and even today, a major emphasis is placed on developing microsimulation models, combining advances in computer technology, econometric methods, and data availability. These models, although far from having reached perfection, have been extremely versatile and useful vehicles for the analysis of societal change as a result of demographic development, economic growth, and government policy.

General research objectives

The general objectives of the Research Department's function within Statistics Norway are fourfold:

Enhanced empirical knowledge
Statistics alone is an insufficient source of information for understanding social and economic development. Analysis of statistical data by means of relevant theory and analytical methods and the use of models when appropriate may give enhanced empirical insight and deeper understanding of the phenomena under consideration. Such analytic knowledge beyond what can be derived from data alone, is inherent in many of the published results of the Department on the state of the economy, the environmental situation etc. Key parameters, such as the interest sensitivity of household saving or of the relation between economic growth and environmental deterioration, are examples of embodiments of empirical knowledge beyond the realm of statistics.

Analytical tools for monitoring economic and environmental development or government planning
An important use of empirical insight gained is embodied in the design of tools for government planning, usually in the form of simulation models. Modelling activities are carried out in close contact with user interests and with emphasis on government planning needs. Signals concerning needs will generally be channelled through Research council programmes and direct contact with ministries. Analytical tools will often involve substantial operational commitments. In order to avoid an accumulation of operational tasks in the Research Department, continual attempts is made to make operation of existing models more efficient, and assessing the society's need and willingness to pay for continued operation.

Feed-back to the statistics
Researchers in the Statistics Norway have a unique position close to the sources of data. The Statistics Act clearly states that this position should not be utilized to monopolize access to data. The proximity with the statistical work provides special opportunities for exploitation of the data expertise in the Statistics Norway, for special organization of data material and links to other sources, and for influencing the methods of collection of primary data. The analytic use gives feed-back effects to statistical work and may serve to improve the quality of the official statistics.

Cumulating competence
Adequate expertise and scientific competence are obvious prerequisites for successful performance of research tasks. The research activity shall give results that can be utilized in the Norwegian society and provide documentation that high scientific standards in the analyses have been maintained. Good contact with research institutes and universities abroad and at home is a necessity. Competence building and the maintenance of a high scientific level demands considerable resources.

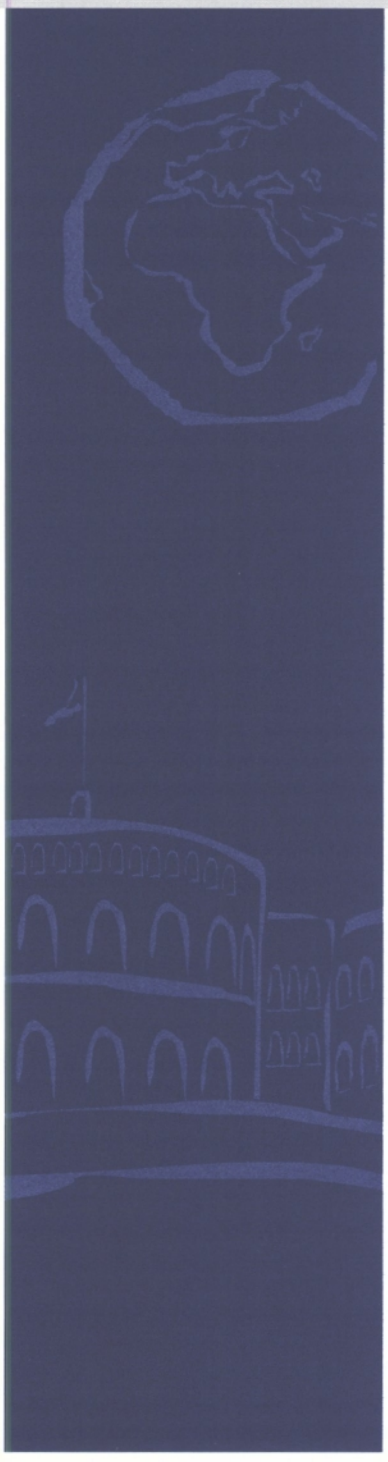
Department	Division	Office
Economic Statistics	National Accounts	Administration
	Environmental Statistics	Systems Development
	External Trade, Energy and Industrial Production Statistics	
	Economic indicators	
	Public Finance and Credit Market Statistics	
	Labour Market Statistics	
Social Statistics	Social and Demographic Research	Administration
	Population and Education Statistics	Systems Development
	Health and Social Welfare Statistics	
	Sample Surveys	
Industry Statistics	Business Register	Administration
	Income and Wage Statistics	Systems Development
	Primary Industry Statistics	
	Transport, Construction and Service Statistics	
	Data Registration	
Research Olav Bjerkholt	**Public Economics** Nils Martin Stølen	**Administration and Computer Services** Otto Gerhard Vaagen
	Resource and Environmental Economics Knut H. Alfsen	
	Macroeconomics Ådne Cappelen	
	Microeconometrics Jørgen Aasness	
Administrative Affairs	Budget and Accounting	Joint Services, Oslo
		Joint Services, Kvgr.
		Personnel Development
Coordination and Development	Computer Systems and Development	
	Statistical Methods and Standards	
Units without department connection	Information and Publishing	International Consulting
	Computer Services	

Chairman of the Board
Åge Danielsen

Director General
Svein Longva

Each division has its own responsibilities and research tasks. On an ad hoc basis the divisions join forces to cooperate on major studies or special investigations. A staff unit deals with personnel, finances, publication, and computer resources.

6 Macroeconomic analysis



The objective of the macroeconomic analysis within Statistics Norway is to analyse the state, functioning and development of the Norwegian economy by exploiting internal and external data sources and by developing and utilizing macroeconometric models and other analytical approaches.

Business cycle analysis

As in earlier years the Research Department in 1994 published - parallel editions - Økonomiske analyser (in Norwegian)/Economic Survey (in English) comprising the annual Economic Survey of the preceding year and three quarterly economic surveys. In addition to presenting the quarterly national accounts and other short term indicators the quarterly business cycle surveys also provide a brief presentation of the main international economic trends and a forecast of the macroeconomic development of the Norwegian economy. The forecast is undertaken by means of the quarterly macroeconometric model KVARTS (see below). The KVARTS model is also used to provide alternative scenarios for the Government appointed Expert Committee for Income Settlements in connection with the annual wage and income negotiations.

The second quarterly survey of 1994 briefly assessed the role of falling domestic interest rates in the present economic upturn. The examination was based on a comparison of the presented forecast and a counterfactual simulation on the KVARTS model with domestic interest rates kept constant at their end-of-1992 level throughout 1993 and 1994. The counterfactual simulation focused on the interest rate sensitivity of the Norwegian economy and deliberately ignored that German monetary policy was a moving force not only behind the decline in Norwegian rates but also behind the European upturn.

The simulation suggested that most of the increase in consumption growth in 1994 can be traced back to the swift decrease in domestic interest rates. Housing construction would probably have fallen also in 1994, if interest rates had not come down. Due to the fall in interest rates housing rents showed only a marginal increase from 1993 to 1994, which explains most of the decrease in the rate of inflation between these years. The simulation suggests that the drop in domestic interest rates contributed approximately one percentage point to GDP-growth.

The plausibility of the counterfactual simulation hinges on KVARTS's ability to capture important mechanisms in the Norwegian economy. A description of the model's structure and tracking record was given in the Norwegian edition of the third quarterly survey. The account illustrated that the interest sensitivity of the model is an important component behind the models reasonable ability to capture the considerable fluctuations in the Norwegian economy during the 1980s.

Project leaders*: Knut Moum and Mette Rolland*

Business cycle history
This project aims at analysing Norwegian business cycles since the early 1970s. Previous studies have analysed earlier periods after World War II. The purpose of the project is partly to isolate different "shocks" to the economy. Such shocks are e.g. demand and supply shocks coming from abroad, shocks of domestic origin such as the build-up of the oil sector which had both supply and demand effects, and finally, policy shocks. Another part of the project is to relate model based simulations with theories of business cycles. In 1994 historical simulation properties of the KVARTS model has been studied and some counterfactual simulation studies have been carried out. Different filtering techniques have been compared and analyzed in order to derive som stylized properties of Norwegian business cycles. In cooperation with NIESR in London, UK, some counterfactual analysis of international macroeconomic issues have been carried out using a version of their global econometric model (GEM).

Project leader: *Per Richard Johansen*

Macroeconometric models
The Research Department possesses two major macroeconometric models, the quarterly KVARTS model and the annual MODAG model. The further development of these two models is regarded as a joint programme. There has been little activity in terms of reestimation and further extentions of the models during 1994. However, a number of reports have been published that present and explain model structure and econometric results. The national accounts are about to be revised and until the new data become available, we have chosen to concentrate on using the existing models in applied work. A study of possible effects of a Norwegian membership in the EU has been carried out (see pp. 11-12). An analysis of employment effects of subsidies to the service sector shows that structural unemployment problems can be reduced in this way. Labour market problems has also been studied with regard to labour market imbalances for different educational groups. A small quarterly macroeconometric model with forward looking behaviour is being constructed and econometric studies related to this model and related issues have been carried out.

Project leader MODAG: *Einar Bowitz*
Project leader KVARTS: *Torbjørn Eika*

General equilibrium models
The Research Department has for 20 years developed and used successive versions of the Multi-Sectoral Growth (MSG) model which originated in the late Professor Leif Johansen's doctoral thesis of 1959.

The current official version of the MSG-model, MSG-5, was thoroughly documented in Reports 94/19. The report includes a non-technical description of the model structure, a complete listing and explanation of the implemented equation structure and an overview of values of key parameters in behavioural equations. A more technical review of the model properties illustrated by multipliers was provided in Notater 94/11.

In 1994, most modelling efforts were allocated to the development of a new general equilibrium model. The new model deviates from MSG-5 in several respects, of which two stand out as more important than the others. First, the new model assumes that producers and households have perfect foresight. This implies that producers have self-fullfilling expectations about the growth of the prices of capital goods. It also implies that the present value of household consumption is restricted by the value of their assets which equals the present value of all income components. A solution of a model with such a dynamic structure must involve all periods simultaneously. Second, the modelling of each industry is founded on the theory of imperfect competition in the product markets and is consistent with decreasing average costs at the firm level due to fixed costs of production. Thus the model is designed to capture features identified as important in the recent literature on industrial organisation and the "new trade theory". The new model specifies 33 industries, and the industry and commodity classification have been chosen in order to make the model relevant for studies of different kinds industrial policy, including trade policy and taxation, and policies directed against air polllution. The model can now be solved on a work station.

Macroeconomic models:
All of Statistics Norway's macroeconomic models are based on the national accounts. The core of the models consists of input-output relations for supply and utilization of specified goods and services. Linked to this core are behavioural relations etc. for different sectors of the economy.

The MODAG model has an input-output core with 41 goods and 33 production sectors. This model is particularly designed for medium term analysis. The behavioural relations cover production, consumption, investment, imports, exports, prices, interest rates, wages and the labour market. The Ministry of Finance is an important user of the MODAG model for forecasting and economic policy analyses.

The KVARTS model is a quarterly model which contains largely the same type of behavioural relations as MODAG, but is more aggregated. The input-output core has 24 goods and 18 production sectors. In the model great emphasis is placed on short-run dynamics. The model is used in business cycle analyses and for work in the Expert committee for Income Settlements.

The MSG model is an applied general equilibrium model which describes an economy characterized by perfect competition, flexible prices and full utilization of labour and capital. The aggregation level and input-output structure in the official version of the model, MSG5, are identical to the MODAG model. The model is particularly suitable for studies of changes in industry structure along a growth path for the economy and for analyses of policies that affect the economy's supply side. The Ministry of Finance is an important user of the MSG model.

The model based studies of industrial policy issues will draw extensively on the work which was carried out in connection with the studies of "Effective Rates of Assistance (ERA)". ERA is a summary measure of the industry assistance effect from a wide range of policy instruments including government transfers, taxation, trade policy and price regulations. A separate review of the project is given below (see pp. 9-10). A presentation prepared for international publication of the methodology and the results were given in Discussion Paper no. 122. That paper was also presented at a seminar at the OECD. In 1994 most of the work under this project concentrated on trade policy. The results from this work provided input to the study of the macroeconomic consequences for Norway of joining the EU (see pp. 11-12). Moreover, the work on trade policy has been part of an OECD project which aims at extending the computations of "Producer Subsidy Equivalents (PSE)" to cover a wider range of industries than Agriculture. During 1994 the ERA calculations were completed for 1989 and 1991. The results were published in a report early in 1995.

Under certain assumptions the ERA measure can serve as an indicator of distortions of the allocation of labour and capital between industries. Among the crucial assumptions are i) perfect competition and ii) constant returns to scale technology in all industries. The work presented in Reports 94/31 examines the possibilities for a consistent incorporation of monopolistic competition on the product markets and increasing returns to scale into an indicator of the assistance effect of industrial policy.

Project leader: *Erling Holmøy*

Persons employed

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Eika Torbjørn, *Research Fellow*
Holmøy, Erling, *Sen. Research Fellow*
Holtsmark, Bjart, *Research Fellow**
Johansen, Per Richard, *Sen. Adviser*
Lindquist, Kjersti-Gro, *Research Fellow**
Naug, Bjørn, *Research Fellow*
Magnussen, Knut, *Research Fellow*
Moum, Knut, *Sen. Research Fellow*
Olsen, Øystein, *Director of Research**
Skjerpen, Terje, *Research Fellow*

Bjørnland, Hilde *(Economist)**
Bye, Brita *(Economist)*
Choudhury, Robin *[Conscientious objector] (Economist)*
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Fæhn, Taran *(Economist)*
Grünfeld, Leo Andreas *(Economist)*
Holm, Inger, *Sen. Executive Officer*
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Hægeland, Torbjørn *(Economist)*
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Rolland, Mette *(Economist)*
Strøm, Birger, *Sen. Executive Officer*
Svendsen, Ingvild *(Economist)*

* on leave

Examples of research projects in 1994

Effective rates of assistance (ERA) for Norwegian industries

During recent years, there has been increasing focus on policies working primarily through the supply side of the economy, affecting either the potential output or the overall flexibility of the economy. A major area of interest has been to define and calculate indicators of government industrial support. Governments have a number of instruments for assisting private firms, including budgetary subsidies, trade policies and indirect and direct taxes. The basic task of the ERA project has been to calculate the total assistance effect from a broadly defined set of government policy instruments.

The concept of Effective Rates of Assistance (ERA) provides a summary measure of how government policies affect the remuneration of labour and capital, measured by a value added price, of a production sector. ERA is a generalization of the concept "Effective Rates of Protection" introduced by Corden (1966) in that it is not restricted to measure the effect of tariff protection only. Underlying this definition of the assistance measure is the idea that it can serve as an indicator of how different kinds of government policies affect the sectorial allocation of labour and capital in the economy. Under specific assumptions there will be a positive correlation between changes in the value added prices and the changes in the allocation of value added between industries exposed to international competition. In this respect the *ERA* is an interesting way of defining assistance to industries exposed to international competition. Based on this theoretical framework, it is clear that it is the effects on relative prices that matters and ERA should be calculated for an exhaustive set of exposed industries in an economy to serve as an indicator of distortions of industry structure attributable to government policies.

The key characteristic of actually exposed industries is that their product prices are given on the world markets, including tariffs, as long as the domestic firms have negligible market power and their products compete with perfect foreign substitutes. This implies that changes in product prices or costs are compensated by changes in the remuneration of labour and capital. On the other hand, industries producing goods in which international trade is quantitatively restricted can shift changes in costs forward to the product prices leaving the value added price unchanged. Such restrictions have natural causes in the case of naturally sheltered industries, but they may also be due to various arrangements working like import quotas. Since naturally sheltered industries will neutralize changes in costs by price adjustments, ERA is inadequate for measuring assistance to these

Table 1. Change in factor income from different categories of policy instruments 1991

Industries	ERA-effects (= percentage change in factor income) from: Indirect taxes and subsidies	Trade policy	Price discrimination of hydro power	Joint (second order) effects	Total ERA	Total effective assistance, mill. Nkr
Potentially exposed industries						
Agriculture	-70.2	-33.0	0.9	0.0	-102.3	-16657
Forestry	-8.3	1.9	0.0	0.0	-6.4	-159
Fishing and Breeding of Fish etc.	-36.2	28.8	1.5	0.0	-5.9	-163
Food Processing	4.5	-87.9	0.8	-1.6	-84.3	-10048
Prod. of Beverages and Tobacco	5.6	-52.1	0.5	0.0	-46.0	-829
Prod. of Textiles and Wearing Apparels	-2.1	-0.5	0.4	0.0	-2.3	-45
Prod.of Wood Products	-0.6	1.9	-0.4	0.0	0.8	46
Prod. of Chemical Products n.e.c.	-0.1	-15.0	-0.5	0.0	-15.6	-1326
Printing and Publishing	-0.7	1.7	-0.2	0.0	0.9	71
Mining and Quarrying	-9.1	1.5	-0.7	0.0	-8.3	-184
Manufacture of Pulp and Paper	6.7	1.7	-18.9	0.0	-10.5	-459
Manufacture of Industrial Chemicals	6.7	-3.9	-8.6	0.0	-5.8	-249
Petroleum Refining	15.3	-3.6	-1.8	0.0	9.9	226
Manufacture of Metals	13.3	2.9	-22.6	0.0	-6.3	-480
Manufacture of Metal Products, Machinery and Equipment	-0.5	-4.3	0.0	0.0	-4.8	-852
Building of Ships	-25.8	1.6	0.3	0.0	-24.0	-1015
Building of Oil-Platforms	-2.8	-6.3	0.3	0.0	-8.8	-387

industries. For potentially exposed industries protected by import quotas, ERA can only be measured when the import quotas are abolished.

The endogenous nature of the prices of sheltered products implies that policies affecting the costs of producing these products may have an indirect assistance effect upon the exposed industries through the deliveries of intermediate goods. Accordingly, the ERA-calculations involve all industries in a simultaneous input-output framework for price determination.In two recent studies, documented in Holmøy, Hægeland, Olsen and Strøm (1993), Holmøy, Hægeland and Olsen (1994) and Fæhn, Grünfeldt, Holmøy, Hægeland and Strøm (1995), ERA calculations were carried out for the Norwegian economy. The results reported in table 1 are taken from the most recent one where the private business sector was separated into 24 industries. Three categories of policy instruments were considered: i) indirect taxes and subsidies including both commodity and sectorial taxes, ii) trade policy including tariffs and non-tariff barriers (NTBs), iii) price discrimination between industries in the hydro power market.

The major conceptual framework for the ERA calculations is the Norwegian national accounts (NA), which provide base year data for input-output coefficients and prices in the formal model. The NA also form the data basis for indirect taxes, subsidies and tariffs included in the model. However, the aim of the ERA study sometimes suggested another distribution of sectorial taxes and subsidies than implied by the practice in the NA. A close examination of this part of the NA system was therefore necessary and resulted in a substantial sectoral redistribution of these taxes compared to the NA.

Average nominal tariff rates for the specified commodities (about 40) were derived from the 7-digit level in the NA. The weights were based on gross production value since it is the domestic price effect which is of interest in an ERA context.

NTBs include a number of measures (other than nominal tariffs) with the aim of protecting domestic producers from foreign competition. Examples of non-tariff restrictions on trade are import quotas, home preferences in government procurement, voluntary export restraints and technical trade barriers (standards, design). These have been converted into equivalent tariff rates. There are severe conceptual and empirical problems related to the assessment of such equivalent tariff rates. They are for most commodities based on international price comparisons. However, price comparisons need to be backed up by evidence which justifies that relative high Norwegian prices can be interpreted as a result of NTBs. At this point our strategy has been to collect relevant information and utilize results from available industry studies aiming at assessing tariff equivalents.

The quantification of rates of price discrimination in the electricity market is based on Johnsen (1991). In short, the method decomposes the purchaser prices of electricity to different sectors into i) a uniform producer price on homogeneous electricity; ii) various sector specific cost components reflecting differences in indirect tax rates and qualitative differences between the deliveries to different sectors; iii) a residual price-cost margin. The differences in these margins are interpreted as a measure of price discrimination.

The results from the ERA computations indicate that most of the potentially industries in Norway were effectively assisted through various forms of policy measures in 1989 and 1991. This suggests that the change in the relative competitiveness of the industries, if intended, could have been brought about at a lower level of government interference. The total assistance and its composition did not change significantly between these two years, except for *Food Processing* and energy intensive industries. The value of assistance through favourable long-term contracts for hydro power deliveries to energy intensive industries increased from 1989 to 1991 due to an increase in the market price. Not surprisingly, price discrimination of hydro power is an important assistance component for energy intensive industries only. For the other exposed industries budgetary subsidies and NTBs stand out as the most important contributors to the total ERA. *Agriculture* and *Food Processing* are clearly the most supported industries, Also *Beverages and Tobacco*, *Prod. of Chemical Products* and *Building of Ships* were relatively more supported than the business sector as a whole.

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Analysing macroeconomic effects of Norwegian EU membership

Before the referendum 28 November 1994 on whether to join the European Union (EU) or not, Statistics Norway published a study of possible macroeconomic effects of Norwegian membership, Bowitz et al. (1994). The analysis utilized the MODAG-model (see separate presentation) to quantify the results. MODAG characterizes the Norwegian economy as largely demand-driven in the short run, but includes important supply side effects that are essential for overall model properties in the longer run. The model based reference scenario describes a possible development of the Norwegian economy within the EEA (European Economic Area), but outside EU. To assess possible effects of an EU membership and take account of some of the uncertainties involved, this scenario was compared to three different simulations, see table 2. The simulations were designed to capture important changes in the Norwegian economy and economic policy in the wake of a membership in the Union.

As an EU member, Norway would have participated fully in the inner market of the Union. Furthermore, Norway would have had to contribute its share of the EU budget, and Norwegian businesses, local governments and individual citizens would have been eligible for EU support programs. Finally, Norway would as a member have been obliged to adopt EU's common policy for agriculture and fisheries and EU's directives on indirect taxation.

Membership would have lowered prices on agricultural products due to the implementation of the common agricultural policy. However, import prices on a number of other goods would have increased, since EU has higher external tariffs and more strict non-tariff trade barriers against third countries than Norway. But the effect of lower food prices dominates, and aggregate import prices would have fallen. Full membership would also have eliminated the EEA requirements of declaration of origin for Norwegian exports to EU. This simplification of rules has been estimated (by others) to reduce unit costs of exports by approximately 1.5 percent, and contributes to higher exports in the EU simulations than in the EEA simulation via traditional relative price effects.

The removal of the protection of Norwegian agriculture and food processing industry from EU competition, were estimated to give lower revenues for the farmers and a more rapid structural change within the agricultural sector. The behaviour of agriculture is not modelled explicitly in MODAG, however, although agricultural production, prices and employment appear as exogenous variables. Hence, the assessment of agricultural consequences was based on studies published by agricultural economists, see Børve et al. (1994). Although the magnitude of the estimated effects is uncertain, the direction was unambiguous: In the medium term, production and especially employment in agriculture would have been significantly lower with EU membership than with EEA membership.

The Norwegian government's contribution to the Union budgets was calculated to around 12 bill. (1995-) Nkr, at the end of a transitional period of 5 years. The net transfer from Norway has been estimated to 7 bill. Nkr, as some subsidy payments from EU to the private sector in Norway were expected.

The transfers from the Norwegian government to the Union budget would in the absence of further fiscal policy restraint have adversely affected the government accounts, as would some other required budgetary changes. In the EU-1 simulation only such changes in fiscal policy param-

Table 2. Estimated effects of EU membership. Difference from EEA simulation in percentage points (unemployment rate) and bill. 1995-Nkr (government surplus)

	2000		2010	
	Unemployment rate	Government surplus	Unemployment rate	Government surplus
EU-1 No fiscal restraint, no export stimulus	0.6	-19	0.1	-26
EU-2 Fiscal restraint, no export stimulus	1.3	-8	0.7	-11
EU-3 No fiscal restraint, with export stimulus	0.4	-15	-0.6	-11

eters that follow from the direct implementation of the requirements of the membership treaty were implemented. In the EU-2 simulation some fiscal restraint was assumed.

In the debate preceding the referendum, it was argued that membership would give a stronger impetus to exports than captured by relationships estimated on historical data. Having no firm basis to assess the probable magnitude of such effects, the EU-3 simulation asks the following question: What extra export growth due to improved market access etc. is needed to produce the same balance on governmental budgets in 2010 as obtained in the EU-2 simulation, but without any fiscal restraint?

Due to the space limitations, the following comments will focus on the EU-1 simulation, i.e. the scenario without further fiscal action and additional exports growth. Some results from the three simulations are given in the table.

In all simulations, the negative GDP contribution from reduced production in agriculture and food processing industry is notable. Lower food prices contribute to an increase in the purchasing power of the household sector, but lower income for the farmers due to lower transfers counteracts this effect. As aggregate production goes down, tax revenues also decline which result in a further weakening of the government budget. Unemployment rises compared to the EEA simulation. This, however, gradually produces a reduction in real wages, thus stimulating labour demand in the rest of the economy. The increase in labour demand outside agriculture is due both to factor substitution effects and increased competitiveness in domestic and foreign commodity markets. In 2010, the increase in employment in the rest of the private sector has nearly compensated for the employment decline in agriculture. But the government's financial position has deteriorated substantially.

The report emphasizes the uncertainty of the macroeconomic effects of EU membership. However, in the short run, transitional problems of going from EEA to full EU membership seem to dominate. The response of fiscal policy is important for the effects in the short and medium term as does the impetus to export: If membership would have resulted in a stronger growth in exports than indicated by the model, production, employment and public sector budgets would hav been less adversely affected than indicated by the EU-1 simulation.

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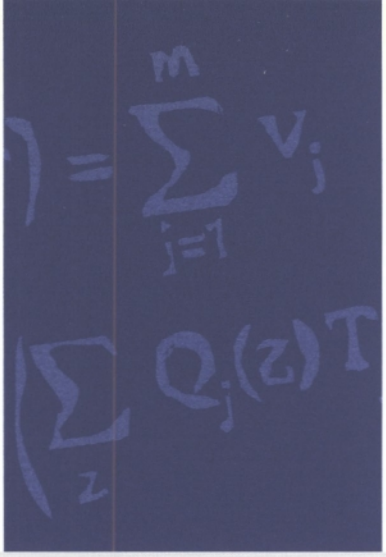

Microeconometric research

13

A long tradition within the Research Department is econometric analyses of micro-data collected by Statistics Norway and application of estimated behavioural relations and welfare measures in policy simulation experiments. The overall aim has been to establish a micro-based system of structural behavioural relations for households and firms. Adequate theory and methods for econometric analysis is developed and adapted for this purpose. The microeconometric research activity within Statistics Norway emphasize empirical studies and the application of findings from these in the Department's inventory of macroeconomic models and microsimulation tools.

Discrete and continuous choice
The activity in this field includes the development of theory and methodology for structural analysis of data generated by individual choice from a continuous or/and finite set of alternatives. In particular, it is focused on topics such as:

(i) Characterization of transition probabilities for indvidual choices that take place over time;

(ii) Modelling two-sided search/ matching behaviour in markets with flexible contracts and limited information;

(iii) Characterization of models for discrete and continuous choice;

(iv) Development of models of consumer demand for commodities with unobservable quality attributes;

(v) Stochastic models for choice among strategies when the outcomes are uncertain.

Work on these topics was published in [5] and [6]. An empirical analysis of the potential demand for alternative-fuel cars has been developed and estimated on the bases of data collected by means of a stated preference survey.

Project leader: *John K. Dagsvik*

Labour supply
The labour supply studies are focused on estimating empirical models that account for nonstandard budget constraint (such as kinked and nonconvex tax systems), and non-pecuniary job-attributes (such as type of work). To this end an econometric framework has been developed that allows for convenient treatment of rather general budget constraint and rationing of jobs. Unfortunately, some of the properties of the random variables and the functional forms in the model has a rather ad hoc justification. Both empirical and theoretical work is now in progress that will provide a more satisfactory justification of the formal model structure.

Project leader: *John K. Dagsvik*

Consumer behaviour
Models of systems of household expenditure are developed, estimated, tested, and implemented into a network of macro- and microeconomic simulation models. A study based on panel data from the household expenditure survey was published in Econometrica (Reprint 68), and is continued with a more detailed and refined model with 28 commodity groups. A specific feature is simultaneous estimation of the distribution of preferences, measurement errors and latent total expenditure across the population of Norwegian households. Multilevel nonhomothetic utility trees are calibrated based on both micro- and macroeconometrics, and implemented in macromodels (MSG, MODAG) and in a microsimulation model with 8000 utility maximizing households (LOTTE-KONSUM). A spin-off using our approach, with latent variables and panel data, to study the behavior of criminals was finished (DP 124 and [21])

Project leader: *Jørgen Aasness*

Producer behaviour and productivity analyses
Studies are conducted on investment, foreign ownership, patents, market power, R&D and productivity. Currently, the relationship between R&D-investment and firm performance, such as profits and productivity, is under investigation. Other topics with work is in progress are: The relationship between physical investment and the financial condition of the firm, the possibility of using patents as an indicator of R&D activity, and the pattern of job creation and entry and exit of firms, see DP 109, 111, 112, 120, 125, 127, 130, 133.

Project leader: *Tor Jakob Klette*

Welfare and inequality
During recent years considerable efforts have been made to establish a theoretical foundation for ordering of Lorenz curves. The results achieved form the basis for a particular type of measures of inequality which have been applied for empirical analyses. Currently, a joint project with the Nordic countries deals with the comparison of income mobility and trends in income inequality.

Project leader: *Rolf Aaberge*

Persons employed

Aasness, Jørgen, *Director of Research*

Aaberge, Rolf, *Sen. Research Fellow*
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Kornstad, Tom, *Research Fellow*

Brubakk, Leif, *(Economist)*
Førre, Svein Erik, *(Economist)*
Johansen, Frode, *(Economist)*
Vatne, Bjørn Helge, *Adviser (EDP)*
Wennemo, Tom, *Sen. Exec. Officer (EDP)*
Wikestad, Renée H.P., *Computer Scientist*
Zhu, Yu *(Economist)**

* on leave

Example of research project in 1994

Job creation, job destruction and plant turnover in Norwegian manufacturing

The labour market in Norway, as in other Scandinavian countries, is often claimed to be overregulated and incapable of adjustment to changes in job opportunities. The results presented in our study suggest to the contrary that in terms of job creation and job reallocation between plants, the manufacturing sector in Norway is surprisingly flexible, and similar to the manufacturing sector in other OECD countries such as the U.S.

Some of the main findings of the project are:

- Job creation and destruction rates are substantial, reflecting a large amount of heterogeneity at the plant level even within narrow industry groups. These large amounts of heterogeneity have been shown to prevail both in the long and in the short run. We have documented that job creation and destruction to a large extent reflect persistent employment changes at the plant level, and not only temporary layoff and recall policies.
- Entry and exit are important for job creation and destruction in the long run, but constitute small parts of annual gross job reallocation.
- Job creation rates, but also job destruction rates, are substantially higher for small plants than for larger plants. Net job destruction is more prevalent among larger plants.
- Small firms, with less than 20 employees, have created additional jobs in the sample period, while the larger firms have, on average, reduced their employment.
- Industry specific shocks account for a small share of gross job reallocation.
- Among the theories of plant heterogeneity considered, we find that the selection hypothesis by Boyan Jovanovic receives strong support, while the vintage hypothesis, as put forward by Leif Johansen and others, seems largely irrelevant as an explanation for plant entry and exit and job reallocation

Project workers: *Tor Jakob Klette and Astrid Mathiassen*
Financial support: *The Norwegian Research Council*
Reference: *DP 136*

Table 1. Components of job creation and destruction in the Manufacturing sector. Percentage of total manufacturing employment

Years	Plant birth (1)	Plant expansion (2)	Plant contraction (3)	Plant closing (4)	Total job creation (1+2)	Total job destruction (3+4)	Net job creation (1+2-3-4)	Total job reallocation (1+2+3+4)
A. Annual movements								
Average	1.1	6.0	6.8	1.6	7.1	8.4	-1.2	15.5
B. Longer run movements								
1976-81	5.8	12.0	13.6	8.5	17.8	22.1	-4.2	39.8
1981-86	5.8	13.4	16.5	11.0	19.2	27.5	-8.4	46.6
1976-86	11.1	17.9	21.2	20.8	29.0	42.0	-13.0	71.0

Table 2. Rates of job creation and destruction by firm size, 1977-86. Percentage of employment in the size group

Size class[1)]	Total job creation	Total job destruction	Net job creation	Total job reallocation	Employment share[2)]
Firm size					
<20	12.9	12.5	0.3	25.4	15.6
20-50	8.2	8.2	0.0	16.4	12.5
50-150	6.1	7.5	-1.4	13.6	19.2
150-500	6.0	8.1	-2.1	14.1	18.8
500-1000	5.5	6.4	-0.9	11.9	12.8
>1000	5.5	7.8	-2.3	13.3	21.1

1) Size is measured as average employment throughout the sample period.
2) Percentage of total manufacturing employment.

16 Natural resources

and environmental management

The primary objective of this research area is to provide models and analytical capacity able to shed light on the interactions between the management of the environment and the natural resources, and economic development. The main user groups are governmental bodies, although informing the general public is also emphasized. The work is organized around three main projects: one on the domestic energy use and the associated environmental impacts, one on international aspects of energy supply and demand, and one on methodological problems related to the integration of economic, environmental and natural resource issues within a national or international management context.

The SAMMEN project

SAMMEN is a Norwegian acronym for Society, Environment and Energy. The project is part of a larger Norwegian research programme aiming at improving the knowledge and modelling tools necessary for the authorities to formulate and carry out a rational energy policy with due regard to the environmental impacts of energy use.

Much of the project is related to the management of the extensive hydro power resources of Norway. The deregulation of the domestic energy market and the liberalization of international trade in electricity have potentially large ramifications both for energy policy, e.g. through proper pricing of the energy resources, and for environmental policy through the impact on emission of greenhouse gases. The question of the impact of delivered effect and the peak load on the optimal pricing structure will be studied in 1995. The focus of our effort is the macroeconomic model MSG-EE (see box).

The SAMMEN project also analyses issues related to fossil fuel use, and the associated air pollution. Particular emphasis is put on the benefits of controlling future emission of local air pollutants, and how these benefits will affect the cost-benefit ratio of policy proposals – in particular climate policies. In recognition of the central role of transport, greater emphasis has been put on studies of the linkages between investment in transport infrastructure, use of cars and environmental impacts. Other external effects of transport, such as traffic accidents and congestion costs are also covered.

The impact of road transport on the economy and the environment will be further studied in 1995. While the effort in previous years has concentrated on clarifying the impact of road transport on air quality, accidents, congestion, etc., the plan in 1995 is to focus on the role of investments in transport infrastructure (roads), in particular whether the considerable investments made in the transport sector over the years have paid a reasonable dividend in terms of economic growth.

Earlier estimates of the economic productivity losses due to air pollution

will be updated. While previous estimates were to a certain extent based on subjective assessments by experts, the work in 1995 will aim at incorporating physical damage functions in economic models, and thereby assess the economic value of the ensuing productivity losses.

The Research Department has a strong tradition in integrating studies of economic growth, energy use and air pollution problems. In 1994 this work was extended to also cover generation of waste. In 1995 the waste projections will be refined and expanded to include modelling of waste handling. The aim is to be able to analyse waste generation and economic growth in a consistent manner within a unified modelling framework.

Project leader: *Torstein Bye*.

International energy and environmental issues

The project on international energy and environmental issues has as its main objective to analyse problems related to Norway's considerable oil and gas resources. As most of the oil and gas resources are exported, the demand for these products requires an understanding of international, in particular Nordic and European, oil and gas markets. Demand side models covering the Western European and Nordic energy markets have been developed, as well as a game theoretic model for the supply of natural gas to the European market.

The use of fossil fuels in Europe have a strong impact on the Norwegian state of the environment through deposition of transboundary pollutants. Thus, the European energy demand model SEEM (see box) is linked to the RAINS model developed by IIASA, making it possible to analyse national emissions, transport and depositions of acid compounds due to changes in for instance the taxation of energy in Western Europe.

The Department takes part in several international projects. A model for studying the supply of gas to the European market is developed in cooperation with the CORE institute in Belgium. Scenarios for the use of natural gas in Europe is analysed in a cooperation with the Dutch ECN institute and Statoil. The SEEM model is used, in conjunction with the RAINS model, to analyse scenarios of an integrated Europe and of a Europe marked by disintegration, respectively. The Department also cooperates with the Battelle Northwest Pacific Laboratory in USA in the development of a global economy-energy-carbon emission model.

Project leader: *Snorre Kverndokk*

Methodological issues

The methodological issues related to natural resources and environmental management cover such diverse topics as the selection of a useful and operational set of *environmental indicators*, including the issue of a 'greening' of the GDP and the integration of the natural resource accounts and the national accounts, and welfare theoretical and ethical questions related to the monetary valuation of natural resources and environmental services. Also of concern are topics related to the modelling of the intertemporal nature of many natural resource and environmental problems.

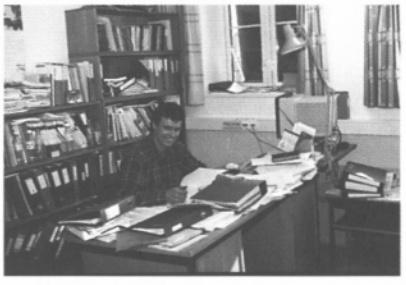
Besides providing a forum for research on methodological and fundamental issues related to natural resources and the environment, a central objective of this project is to provide ideas for the future development of the inventory of models operated on a more or less permanent basis by the Department. For instance, a new project concerns the use of macroeconomic models as a basis for projecting the long term waste generation in Norway.

Multisectoral Growth - Energy and Environment: MSG-EE

MSG-EE is a variant of the official version of the MSG-model MSG5, distinguished by a more detailed modelling of transport activities. Domestic commercial transport is produced in five sectors covering road, rail, air and boat transport as well as post and telecommunication services. Transport is also produced in other producing sectors for own consumption (own transport). In MSG-EE transport is treated as a separate input factor in production, in addition to the usual capital, labour, energy and materials set of input factors. Finally, the households have a choice of consuming own or public road transport.

Many, if not all, environmental and natural resource issues are of an intertemporal nature. In 1994 a macroeconomic model of the Norwegian economy incorporating aspects of intertemporal optimization was made operational. In 1995 the model will be used for analyses of environmental tax reforms among other issues.

Project leader: *Kjell Arne Brekke*



International models

Nordic energy demand model

This model is a regionalized partial equilibrium energy model for the Nordic countries (Norway, Denmark, Sweden and Finland) covering the most important energy carriers in this region. Supply functions and an energy transport network is linked to a demand model comprising three manufacturing sectors, a service sector, four transport sectors and the households. The demand for energy in Iceland is covered in a separate model.

Sectoral European Energy Model (SEEM)

The Sectoral European Energy Model (SEEM) is a model for the calculation of future demand for fossil based energy in thirteen Western European countries given an economic development path, and price paths for oil, gas and coal at the import level (cif). The model calculates end user prices including taxes and demand for solid, liquid and gaseous fossil fuels from manufacturing industry, services, transportation, power production and households. For given supply paths of non fossil electricity, the model computes equilibrium prices and quantities of electricity based on the average incremental cost of conventional power and relative energy prices. The model also comprises a routine for calculating emissions of CO_2 from fossil fuel use.

DYNOPOLY - a DYNamic OligoPOLY model for the European gas market

The game depicted by the model is essentially an investment game between dominant natural gas suppliers (Algeria, former USSR and Norway) facing a deregulated gas market with no intermediate barrier between suppliers and end users. The demand region is continental Western Europe. Each player possesses a bundle of strategic investment options. In the beginning of each five-year period they can make use of one or more of the remaining options, or none. The moves are made simultaneously, only previous investments are known. The investments are operative from the next period. The players maximize discounted cash flows over the remaining horizon. They have full information of demand, options and costs and can predict the other players' best moves. The model is solved by dynamic programming, and the solutions are perfect Nash equilibria. In equilibrium, the players balance the profits from discouraging the opponents' supplies by making an investment, against the profits from restricting supply by postponing the investment.

Persons employed

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Kverndokk, Snorre, *Research Fellow*
Vennemo, Haakon, *Sen. Research Fellow**

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Boug, Pål *(Economist)*
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Katz, Alexandra *(Economist)*
Kolsrud, Dag *(Sen. Executive Officer)*
Larsen, Bodil Merethe *(Economist)*
Lurås, Hilde *(Economist)*
Malo, Solfrid, *Executive Officer*
Mysen, Hans Terje *(Economist)**
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Nyborg, Karine *(Economist)*
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Rosendahl, Knut Einar *(Economist)*
Wiig, Henrik *(Economist)*

*on leave

Examples of research projects in 1994

Natural gas in a Nordic electricity market

The electricity market in Norway was largely deregulated in 1991. Sweden has for the moment postponed her plan for deregulation while Finland will probably carry it through in the summer of 1995. The debate in Denmark on deregulating the electricity market currently seems to gain momentum. Besides affecting the national markets, this can have substantial impacts on the inter-Nordic trade of electricity. For Norway this will better the opportunity for export of electricity directly or for export of natural gas for power generation in one or more of the other Nordic countries. Over time the distribution of CO_2 emissions within the Nordic countries will also be affected.

The price of electric power is very different in the Nordic countries. At the same time the power producing systems in the Nordic countries are very dissimilar, with differences both in the short term and the long term costs of production, leading to opportunities for trade.

Statistics Norway has developed an energy model for the Nordic countries. Five user groups are specified in each of the Nordic countries and technologies for power production are modelled in great detail. Transport costs of electricity as well as natural gas between the countries are specified. The model user is allowed to introduce restrictions on free trade with electricity and natural gas, specify new production technologies and introduce political control policies like for instance carbon taxation.

Here we briefly describe an application of the model where four scenarios were developed to study some of the impacts of free trade in power and natural gas and increased reliance on carbon taxation in the Nordic countries towards year 2010.

A transition from nationally segregated power markets to a regime with free trade in electric power increase the total production of power in the Nordic countries with 2 per cent in year 2010 according to the model, see figure 1.

In Norway the power production increases with 20 per cent (26 TWh), mainly by use of natural gas. In Finland and Sweden power production are reduced since it is cheaper to import power from Norway. Norwegian power goes at the expense of coal dust fired power production in Sweden and bio-power in Finland. Free trade equilibrates the power prices and all users will face the same prices corrected for differences in transport costs. As net exporter Norway will continue to have the lowest prices.

The total benefit of free trade in electricity, measured as consumers' plus producers' surpluses, is estimated to be approximately 1 500 million Nkr. There is also a large redistribution of the surpluses as power producers in importing countries lose income while end users profit from lower prices. In Norway increased power prices lead to a loss for the users, while power producers reap a gain.

Total CO_2 emissions in the Nordic countries are almost unaffected by the change in regime to free trade in electricity. However, Norwegian emissions are almost doubled due to production of gas power, while emissions in Sweden are reduced by 25 per cent.

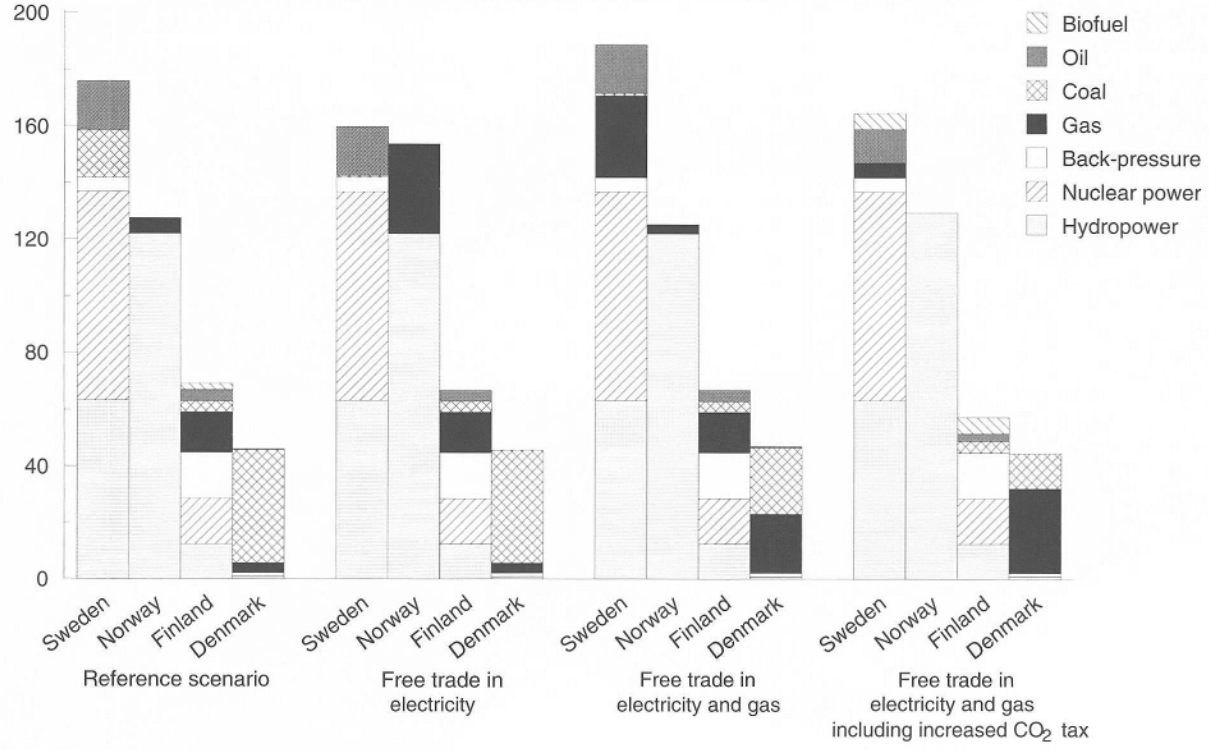
In the model it is also possible to open for free trade in natural gas. However, within existing transmission capacities it is cheaper to transport electricity than natural gas. If, however, transmission capacities will have to be expanded, it is cheaper to build pipelines and produce gas power abroad than to produce gas power for export in Norway. It is also easier to utilize the spill-over heat from power generation in more densely populated countries like Sweden and Denmark than in the sparsely populated Norway. According to the model calculations most of the power production based on natural gas will take place in Sweden and Denmark when we open for free trade in natural gas, see figure 1. The power production in this scenario leads to a demand for natural gas that justify construction of pipelines rather than further expansion of the transmission net. Total power production increases slightly in the Nordic countries, while the price level is slightly reduced as more countries get access to Norwegian natural gas. The Nordic CO_2 emissions are reduced by 7 per cent with most of the reductions taking place in Denmark as coal based power production is replaced by gas power production.

We have also studied the effect of increasing the CO_2 tax level in the Nordic countries to 350 Nkr/tonnes CO_2 (the level of the CO_2 tax on gasoline in Norway today). According to the model simulation the total power production will decrease by 8 per cent (32 TWh). The tax, which is levied on all fossil fuel use, will increase the price of electricity with approximately 30 per cent. Even with this price increase, the tax will render power production based on natural gas unprofitable. Instead, hydro power in Norway will be expanded, as will power based on bio fuels in the other Nordic countries. Both of these technologies have high capital costs. Total welfare, measured by consumer plus producer surpluses, is reduced by 40 billion Nkr. End users face higher prices and consume less, leading to a loss in consumer surplus. Hydro and nuclear power producers gain due to the higher prices, while other power producers get their cost levels increased by the CO_2 tax and surplus reduced. The revenue from the CO_2 tax will be approximately 20 billion Nkr. The benefit of reduced emissions (including emissions on local pollutants like SO_2, NO_x and particulate matter) must therefore be larger than 20 billion Nkr to justify the introduction of a CO_2 tax at the rate considered here.

Project workers: *Torstein Bye, Tor Arnt Johnsen and Hans Terje Mysen*

The work has been supported by The Nordic Council of Ministers.

Figure 1. Power production in the Nordic countries in four scenarios in year 2010. TWh



Public economics

The Research Department, Division for Public Economics, has for many years had the responsibility for tax simulation models used both by the Ministry of Finance and the Storting (Parliament). The models are also used for other analytical purposes. The present model strategy is concentrated on microsimulation models, both static and dynamic.

The division is also responsible for providing models and analytical capacity for projections of the labour market. This includes microsimulation model tools for projection of the labour force by gender, age and education and social security rights and status, as well as appropriate model tools for analyses of labour market imbalances, regional development and growth in the municipal sector.

Tax-benefit models LOTTE and ODIN

The tax-benefit models LOTTE and ODIN are the main tools in analyses of effects of direct taxes and social security benefits. Recent applications of the microsimulation model LOTTE range from analysis of the tax reform for corporate taxation (see below) to studies of taxation of old age pensioners. In order to simultaneously analyse changes in taxes and benefits, LOTTE has been further extended in 1994 with a module for social security benefits using data from the social security registers and social security compensation rules. The new module for social security ensures consistency between tax rules and social security entitlements for each individual in the sample.

The basic LOTTE model includes only direct taxes but has now been extended by a module for econometric simulation of consumption. The new module (LOTTE KONSUM) allows calculation also of indirect taxes and simulation of policy mixes with both direct and indirect taxes.

The data sets in the microsimulation models LOTTE and MOSART (see below) has been made available as anonymized micro datasets - model populations - in 1994.

Staff: *Marie W. Arneberg, Iulie Aslaksen, Hanne A. Gravningsmyhr, Kirsten Hansen, Bård Lian, Ann Synnøve Moe and Thor Olav Thoresen.*

Transfers to children

The aim of this project has been to analyse the distributional consequences of transfers to families with children. Descriptions of the actual effects from transfers to children on the income distribution are given. The project has used data and simulation modules from the tax-benefit model LOTTE with additional simulation procedures established for this project.

The measurement of income distribution and poverty for different household types raises many problems, e.g. the choice of unit (household/individual) and equivalence scale. The project has tried to show how the distributional conclusions depend upon the measurement definition.

A new module, for simulation of the birth benefit is recently established within the LOTTE tax-benefit model. A simulation module for child care subsidies has been completed. The latter module also includes behavioural effects of changes in child care subsidies and, hence explicitly considers labour supply effects of changes in taxes and transfers. The project has been supported by the Norwegian Ministry of Children and Family Affairs.

Staff*: Thor Olav Thoresen.*

Analysis of changes in income distribution

A recent project involves a methodological approach to the issue of comparing measures of inequality before and after substantial changes in policies influencing income distribution, or large structural changes in e.g. labour market conditions. The new methodology is applied to a study of the effect on inequality in personal income distribution of increased labour market participation of married women over the last 20 years.

Staff*: Rolf Aaberge and Iulie Aslaksen.*

The microsimulation model LOTTE

LOTTE is a static tax-benefit microsimulation model that simulates direct taxes and social security benefits. Simulations are based on a sample of income tax returns, with additional information from administrative registers. Household characteristics are recorded by interview. The sample size varies from year to year. The sample from 1992 includes approximately 24 000 individuals (8 000 households). Sophisticated calibration methods are applied to ensure consistency between model estimates and the corresponding totals from the tax register. The individual records can be aggregated to households and married couples, and are weighted in terms of consumption units. The model keeps track of the link between each individual's income, tax, pension entitlement and pension income. For any change in tax or benefit rules, the model simulates taxes, disposable income, and average and marginal tax rates, for individuals and households. Model results comprise total tax revenue, as well as effects on tax revenue and income distribution of specified policy changes. LOTTE is extensively used by the government, especially Ministry og Finance, by the Storting (Parliament), and for special projects, e.g. OECD-studies.

Corporate taxation and behaviour

The first part of a project intending to shed light on corporations' utilization of accelerated depreciation and tax exempt funds was completed in 1993 and is published in ØA 4/94. The plan for 1995 is to extend the work, by developing a better theoretical foundation and using a richer data set. The work will be done in collaboration with Jeffrey K. MacKie-Mason, University of Michigan and Diderik Lund, University of Oslo.

An important element in the recent Norwegian tax reform was to split by imputation the income of unincorporated businesses in labour remuneration and capital income. The tax reform has been evaluated in 1994 using a specially adapted version of LOTTE for self employed persons and the corporate sector. This model connects the personal tax for the self employed persons and the owners of a corporation to the corporate tax liability. This gives us the opportunity to calculate the total tax on the corporate income, whether the corporate income is paid out as wages, dividends or retained.

Staff: *Bård Lian and Karl Ove Aarbu.*

Tax-incentives and corporate financing behaviour

The project investigates the effects of non-linearities in the corporate tax code on financing behaviour, using panel data from Norwegian corporations in the period 1986-1991. The analysis concentrates on the retention policy of the firm, because this is viewed as a more important as well as a more flexible and tax-sensitive source of financing than share issues.

Empirical findings reported in ØA 3/94 indicate that different probabilities of tax-exhaustion accross firms have significant effects on the firm's choice between retention and borrowing, measured by the individual dividend pay-out ratios.

Staff: *Erik Fjærli*

The household type model ODIN

ODIN is a "law model" that calculates direct taxes and social security benefits for stylized household types. The model simulates taxes, disposable income, and average and marginal tax rates for households with given characteristics such as family composition, socio-economic group and pension status. ODIN is used in research projects, by the Ministry of Finance and by some other external users.

Taxation of hydropower plants: A microsimulation model

In 1992, a hydropower tax-reform committee proposed reforms in the taxation of hydropower plants. A model is being constructed to evaluate the concequences of this tax-reform for the local and national tax-revenue and for the tax-burden falling on the rent accruing to the owners of hydroelectric power plants. The model is based on detailed economical, historical and technical micro-data from hydroelectric plants and -firms.

The model will be completed and publication of the project will take place early 1995.

Staff: *Torstein Bye, Erik Fjærli and Bård Lian.*

Projections of labour force, education and social security

The microsimulation model MOSART is used for projections of the labour force, the population by educational level and future pension benefits. The model was in 1994 calibrated so that it now is consistent with the data for 1993, and a revised base line projection was made. In the new baseline projection future net immigration is assumed to be greater and future mortality rates lower than earlier assumed, in accordance with a revised official population projection from Statistics Norway.

The updated version of the model has been used extensively to analyse the long run development in disability and old-age pensions covered by the Norwegian National Insurance System. The number of pensioners will increase relative to the number of workers, leading to a growing tax burden on future generations. The model has been used to analyse how changes in behaviour (such as changes in the number of people claiming disability

benefits) and in the rules for determining pension benefits will affect this future tax burden. A number of technical improvements are implemented in the model, reducing random variation in output as well as reducing the time it takes to run the model. The modelling of transitions through the educational system is being improved by the inclusion of unemployment and the capacity of the system as explanatory variables for choice of education.

In 1995, a new initial population will be constructed for use in the model and the transition probabilities concerning disability and pension entitlements will be reestimated. In addition, two new projects will be started, one which will analyse how labour force participation has changed over the last decade and another which will study the inclusion of private pensions, capital income and taxes in the model.

Staff: *Leif Andreassen, Helge Brunborg, Dennis Fredriksen and André Hansen*

Labour market imbalances

In order to analyse the possibility of disequilibrium in various labour markets a simple submodel to the macroeconometric model MODAG and the microsimulation model MOSART is constructed. In this model supply and demand for different kinds of labour by education is compared by using the number of persons as the unit of measurement. Based on the updated version of MOSART consistent with data from 1993 growth in the number of persons with education at the university level is much stronger than earlier predicted due to the marked increase in the educational propensities the last years (cf. ES 4/94). Expected growth in supply of persons with these kinds of educations is thus much stronger than the expected growth in demand, indicating that a lot of persons within these groups may get troubles in finding a job in accordance with their education.

The projections are rather simple regarding the assumptions about the composition of demand for the different kinds of education. To improve the projections further, work is started to analyse the factors determining the composition of employment by education in different industries. Relative wages, technical progress, and supply of different kinds of education may be important in this respect.

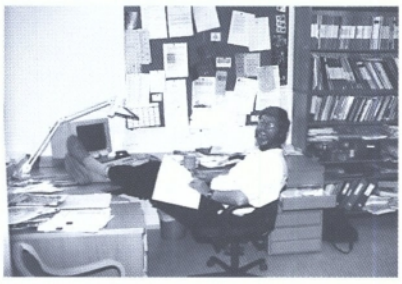
Staff: *Nils Martin Stølen and Turid Åvitsland with assistance from the Macroeconomic Division.*

The microsimulation model MOSART

MOSART is a dynamic cross-sectional stochastic microsimulation model which projects population size and composition, labour force, educational level, and future pension benefits. The simulation sequence for each year in the projection period starts with the demographic events death, birth, marriage, divorce and education, continues with the simulation of disability and retirement and concludes by simulating labour force participation and wage income. The model keeps track of the link between spouses and of each individual's pension entitlements and pension income. The initial population and the transition probabilities in the model are based on data registers covering the whole population. MOSART is extensively used by government ministries, especially the Ministry of Finance, in analysing long-run developments in the labour force and in disability and old-age pensions. The current version of the model simulates life histories for a one per cent sample of the Norwegian population from 1990 to 2060.

Regional analyses

REGARD is a regional model for the Norwegian economy based on regional national accounts and other statistical sources and is documented in SES 88. The core model for production is based on 7 regions and 28 industrial sectors. A demographic model block takes care of internal migration and labour force participation. The model provides projections of the labour market balances, illuminating the implications for regional employment and the labour force of a given macroeconomic scenario. Further, the model may be applied to analyze the effects on regional employment and population from changes in economic policy. REGARD is used as a submodel to the macroeconometric model MODAG.



In 1995 an analysis investigating the migration patterns of persons in the labour force will be completed. In this project we are also planning a cooperation with researchers in other Nordic countries, making a comparison of internal migration patterns.

Staff: *Eva Ivås, Lasse S. Stambøl, Nils M. Stølen and Turid Åvitsland.*

Municipal economics
MAKKO is a macro model for the local public economy. At the aggregate level, MAKKO contains submodels for services provided by local government, like kindergartens, primary and secondary education, health care and care for the elderly. For given standards (man-hours per client) and coverage levels (number of clients in proportion to the population in separate age groups), the model describes how employment and service production is affected by population changes. The model is used to project employment and the number of clients in local public services in Norway. A revised version of the model has been developed, and new simulation results have been reported in 1994.

A project on econometric time series modelling of local public spending behaviour has made progress, and results are documented in DP 117. The model endogenizes local public consumption, the capital stock and net financial wealth in Norway at the aggregate level, assuming that local public disposable income is exogenous. The analysis has been extended to incorporate endogenous user charges and current expenditure.

Staff: *Audun Langørgen*

Persons employed

Stølen, Nils Martin,
Director of Research

Aslaksen, Iulie, *Research Fellow*
Andreassen, Leif, *Research Fellow*
Brunborg, Helge, *Sen. Research Fellow*
Stambøl, Lasse S., *Research Fellow*

Aarbu, Karl Ove *(Economist)*
Arneberg, Marie W. *(Economist)**
Fjærli, Erik *(Economist)*
Fredriksen, Dennis F. *(Economist)*
Gravningsmyhr, Hanne *(Economist)*
Hansen, André H., *Executive Officer*
Hansen, Kirsten, *Sen. Executive Officer*
Ivås, Eva, *Executive Officer*
Langørgen, Audun *(Economist)*
Lian, Bård, Adviser *(EDP)*
Moe, Ann Synnøve, *Clerical staff*
Oftedahl, Knut Olav *(Economist)*
Thoresen, Thor Olav *(Economist)**
Åvitsland, Turid *(Economist)*

* on leave

Examples of research projects in 1994

Taxation of old age pensioners - costs and distributional effects
Pensioners have special tax benefits, and pay lower taxes than wage-earners with the same income. Old age pensioners receive on average 10 000 Nkr per year in tax relief, while other pensioners receive 6 300 Nkr. The tax reduction rule restricts taxes for pensioners and people of less than 70 years of age, with low income. Pension incomes face a lower tax rate than wage earnings. There is also a general income deduction for age and disability.

A recent issue is whether tax reliefs for old age pensioners should be reduced, in view of higher income levels for this group and escalating costs of the social security system. The costs of the different tax reliefs shown in table 1 are calculated in the micro-simulation model LOTTE. The low tax rate on pension incomes is the most costly of the three, while the general income deduction is the least costly. Interaction between tax rules causes the total tax relief to be larger than the sum of tax reliefs from each ot the three rules separately.

The different tax rules affect individuals in different income groups differently, and consequently they affect income distribution and inequality differently. The tax reduction rule works to the benefit of low-income individuals and reduces inequality (measured by the Gini coefficient). Tax relief from the lower tax rate benefits high-income groups and tends to increase inequality. The general income deduction for age and disability does not affect inequality significantly. Total tax reliefs tend to reduce inequality, both between old age pensioners, other pensioners and for the whole population.

Staff: *Marie W. Arneberg, Hanne A. Gravningsmyhr*
Financial support: Ministry of Finance
Reference: *ØA 7/94*

Table 1. Tax relief in million Nkr

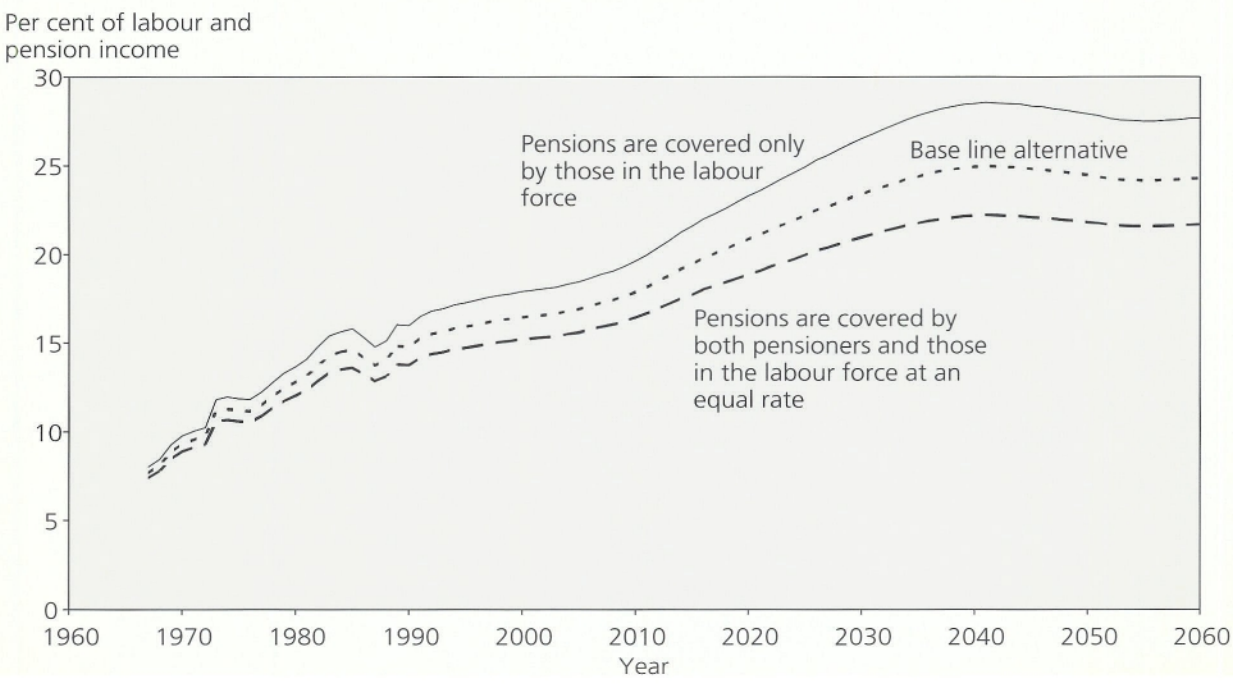
Reduced tax rate on pension income	2 550
Tax reduction	1 850
General income deduction for age and disability	1 450
All three reliefs simultaneously	

The future burden of public pension benefits

An effect of the welfare state is to divide the population into receivers and contributors of government funds. If the number of receivers or the value of the transfers to the receivers grows rapidly, the tax-burden on the contributors can become politically unacceptable. The danger of this happening is especially great in countries, such as Norway, facing low fertility rates and an ageing population. The future burden of public pension benefits in Norway has been analysed using the microsimulation model MOSART, focusing on the public pensions received by the disabled and the retired in relation to the contributions to the social security system from those in the labour force. The pension system in Norway is a pay-as-you-go system, where pensions are determined by legal rules based on each individual's labour income history.

One of the main determinants of the burden of pension benefits is the dependency ratio which can be defined as the number of pensioners per person in the labour force. An economic indicator which is closely connected to the dependency ratio is the ratio between total pensions and total labour income. This ratio can be thought of as the required contribution rate (tax rate) which is necessary for the social security system to be able to honour its obligations when all pensions are covered only by those in the labour force. The ratio has been calculated for the period 1993 to 2060 using MOSART, and is given by the highest curve in figure 1 showing contribution rates under different tax systems. The lowest curve in this figure shows the contribution rate when it is defined as the ratio between total pensions and the sum of total pensions and total wages each year, which can be thought of as the average tax rate which will apply if pensioners contribute to the social security system at the same rate as those in the labour force. The base line alternative shown in figure 1 gives an intermediate alternative where pensioners contribute at half the rate of those in the labour force. In all three alternatives the contribution rate will increase substantially from the present to the middle of the next century. In the base line alternative it will increase from a level of 15-16 per cent in 1993 to a level around 25 per cent in 2040. The growth in the contribution rate during the first 20 years is caused by the maturing of the National Insurance system (which is also one of the main factors behind the large increase experienced during the last 25 years) and a major increase in the number of

Figure 1. Contribution rates under different tax assumptions



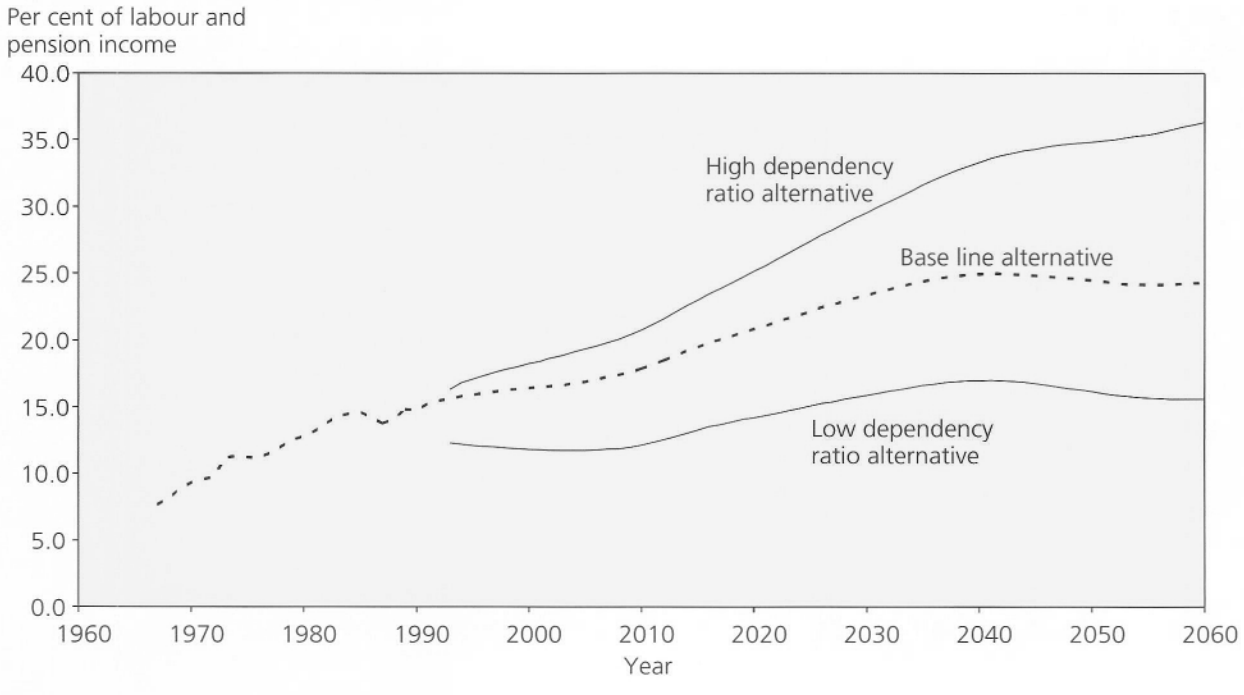
disability pensioners. In this period we expect an increase in the labour force and a (slight) reduction in the number of people older than 67 years. These socio-demographic changes will isolated reduce the contribution rate. Just after 2010 the first cohorts of the post-war baby-boom reach retirement age, and this will lead to a strong growth in the contribution rate.

The projections made using MOSART depend heavily upon the assumptions used concerning demographic behaviour, real wage growth and the development in the rules governing the social security system. The base line alternative assumes a net immigration of 8 000 persons a year, a total fertility rate of 1.89 (as observed in 1989), declining mortality implying a 4-5 year increase in life expectancy towards the year 2050, a disability propensity equal to the average for the period 1989-1993, and labour force participation as in 1993 (a fairly low figure compared to the historical high experienced in 1987).

Two extreme projections are compared with the base line alternative in figure 2, showing contribution rates under different demographic assumptions. The curve showing the greatest increase in the contribution rate assumes that all these assumptions are changed so that they each increase the dependency ratio (called the high dependency ratio alternative in the figure), while the curve showing a levelling off in the contribution rate assumes that all these assumptions are changed so that they each decrease the dependency ratio (the low dependency ratio alternative in the figure). In the high dependency alternative life expectancy is assumed to have increased by 7-8 years in 2050, fertility is assumed to fall to a total fertility rate of 1.7, there is no net immigration and the disability propensity stays equal to its all time high in 1989. These assumptions lead to an increase in the contribution rate (when pensioners contribute at half the rate of those in the labour force) to almost 34 per cent in 2040 and above 35 per cent in 2060. In the low dependency alternative life expectancy increases by only 1-2 years during the period, the total fertility rate is assumed to be 2.08 (close to the replacement level) net immigration is assumed to be 12 000 persons a year, and the disability propensity is set to the fairly low level observed in 1993. In addition the low dependency ratio alternative assumes that women's labour force participation rates will become the same as those observed for men in 1987. These assumptions lead to a very small increase in the contribution to about 17 per cent in 2040. These two extreme alternatives to the base line projection show how important demographic factors are when considering the future burden of public pensions. Even so, it is important to note that most realistic combinations of demographic assumptions lead to a contribution rate close to the base line alternative.

Staff: *Leif Andreassen, Helge Brunborg, Dennis Fredriksen og André Hansen*
Financial support: *Ministry of Finance and Ministry of Local Government and Labour*
Reference: *DP 115*

Figure 2. Contribution rates under different tax assumptions



Forecasting labour market imbalances

Unemployment in Norway has traditionally differed by educational categories and has been highly concentrated among less skilled individuals. Although unemployment now is clearly coming down after the peak of 6 per cent in 1993, the worry is that there may be lack of skilled persons creating wage pressure even if average unemployment remains above normal historical levels. In order to analyse this question further a submodel (called AD-MOD) to the macroeconometric model MODAG and the microsimulation model MOSART has been constructed, and the model used to forecast labour market imbalances during 1994-2000.

Table 2. Excess supply for different kinds of education in 2000 under different assumptions of educational propensities. 1000 persons

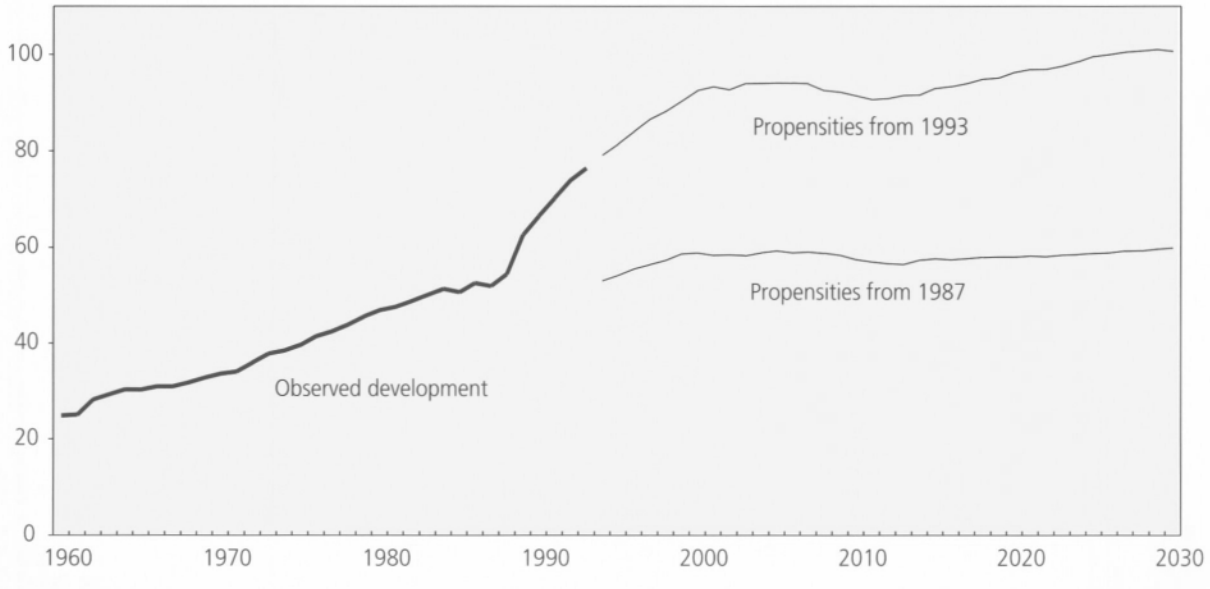
	1991-propensities	1993-propensities
Primary school/secondary I	93	37
Secondary school II	-13	-23
University level I	0	49
University level II	6	25

The model structure is rather simple. The total number of persons employed in each sector in MODAG is aggregated and transferred to the sectors in AD-MOD where demand for labour is further subdivided by education by using a set of exogenous coefficients which may be changed over time. Total supply of labour is also collected from MODAG and is subdivided by education by the shares of different kinds of education collected from MOSART. By comparing supply and demand the model gives an indication of possible imbalances in the labour markets for 24 educational groups. The present version of the model system contains no repercussions from the projected imbalances to wage formation, substitution with other kinds of labour and choice of education.

Based on a updated version of MOSART with data from 1993 growth in the number of persons with education at the university level is stronger than earlier predicted due to the marked increase in the educational propensities. The growth in the number of pupils and students relative to the number of persons in the age group 16-24 years is shown in figure 1, and while the share of pupils and students was estimated to 50 per cent of this group based on the educational propensities from 1987, the proportion is estimated to reach more than 90 per cent before 2000 with the propensities from 1993. As a result there will be a strong growth in supply of persons with higher educations.

The projection of excess supply by education presented in table 1 shows that growth in supply of persons with university education is much stronger than the expected growth in demand, indicating that a lot of persons within these groups may get troubles in finding a job in accordance with their education. This does not necessarily mean that unemployment becomes high for these groups as they may fill up jobs which traditionally have been occupied by persons with lower education. From the table it is also evident that the growth in the educational propensities is the main factor

Figure 3. The number of pupils and students relative to the number of persons in age 16-24 years



behind the predicted excess supply of persons with education at the university level. On the other hand, the higher educational propensities lead to a decrease in supply of labour from persons with education from secondary school, and especially primary school, so the situation in the labour markets may improve for these groups towards 2000.

Staff: *Ådne Cappelen, Wenche Drzwi and Nils Martin Stølen.*
Financial support: *Directorate of Labour.*
Reference: *REP 94/2 and ES 4/94.*

Regional Labour Market Development

Regional labour market development is a result of the interaction between supply and demand mechanisms in spatial labour markets. From the demand side of these markets, employment is affected by regional economic and industrial factors. On the other hand, labour supply is mainly influenced by demographic factors and by the rate of labour market participation. To address the simultaneity in the functioning of the regional labour markets Statistics Norway has developed the model REGARD. In 1994 this model has been applied, giving regional breakdowns of the Long Term Programme of the Norwegian Government.

Macroeconomic trends for Norway suggest a considerable increase in employment in service industries, whereas employment in manufacturing industries and agriculture is expected to fall through the 1990s. This developments tend to give a stronger increase in employment in typical service regions than in regions where the economic base is concentrated in rural activities and manufacturing industries. At the same time, labour supply does not increase at the same rate in all regions, because of varying fertility, demographic composition and migration. Projections with REGARD illustrate how this cause unemployment rates to fall more than average in densely populated areas in the south-eastern part of Norway and in the northern parts of the country. On the other hand, the problems in the labour market are more likely to prevail in south-western areas than indicated by the country-average figures.

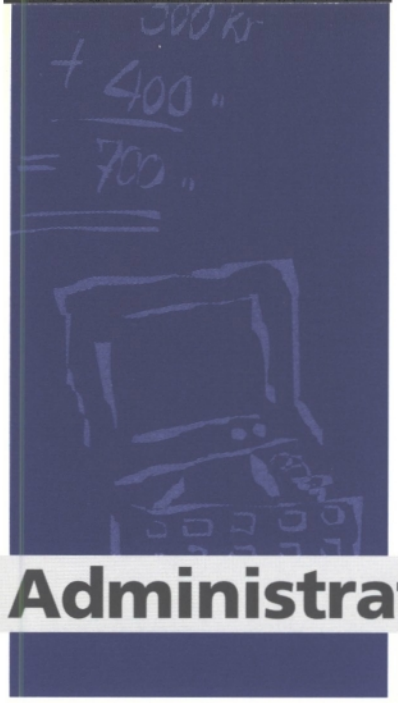
Staff: *Klaus Mohn, Lasse S. Stambøl, Knut Ø. Sørensen*

Financial support: *Ministry of Local Government and Labour, Ministry of Environment.*

Reference: *Notater 93/3, REP 93/22, Notater 94/12, ØA 3/94, ØA 4/94, ØA 5/94, REP 94/17, SES 88*

Table 3. Growth in labour force and employment by region. Annual average 1990-2000. Per cent

Region	Labour force	Employment at the place of residence
Oslo/Akershus	0.9	1.2
South Eastern Norway	0.6	0.8
North Eastern Norway	0.6	0.7
Agder/Rogaland	0.8	0.7
Western Norway	0.5	0.7
Trøndelag	0.7	0.9
Northern Norway	0.4	0.6
Norway	0.7	0.8



28 Administration

Personnel and budget

The total staff in 1994 was roughly 100 in total number of persons. The distribution by division is given by the table below.

The financial resources of the Research Department stem partly from the government budget as allocated within Statistics Norway. About 44 per cent of total total expenditures in 1994, or approximately Nkr 15.8 million are project financed. The bulk of the project revenues comes from research grants from the Norwegian Research Council and from contracts with Ministries, primarily the Ministry of Environment, the Ministry of Finance, the Ministry of Industry and Energy, the Ministry of Local Government and Labour, and the Ministry of Foreign Affairs. See adjoining page for distribution of operating costs.

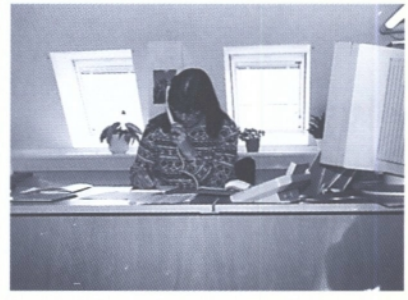
Persons employed

Vaagen, Otto Gerhard,
Head of Administration

Bjørnstad, Knut, *Computer Scientist*
Dihle, Anne Kari, *Sen. Exec. Officer (Personnel)*
Rambøl, Hanne, *Sen. Exec. Officer (Finances)*
Karlsen, Anne Strandli., *Exec. Officer (Publications)*

Fjeld, Ole Henrik *(EDP)*
Gundersen, Marit Berger, *Clerical staff*
Johansen, Rune, *Computer Scientist*
Kronlund, Tone, *Clerical staff**
Lysell, Kari Anne, *Clerical staff*
Salvesson, Sigmund G., *Clerical staff*
Skoglund, Anne, *Clerical staff*
Veiby, Tone, *Clerical staff*
Vogt, Yngve, *Computer Scientist*
Vågdal, Marit, *Executive Officer*
Walseth, Aud, *Clerical staff*

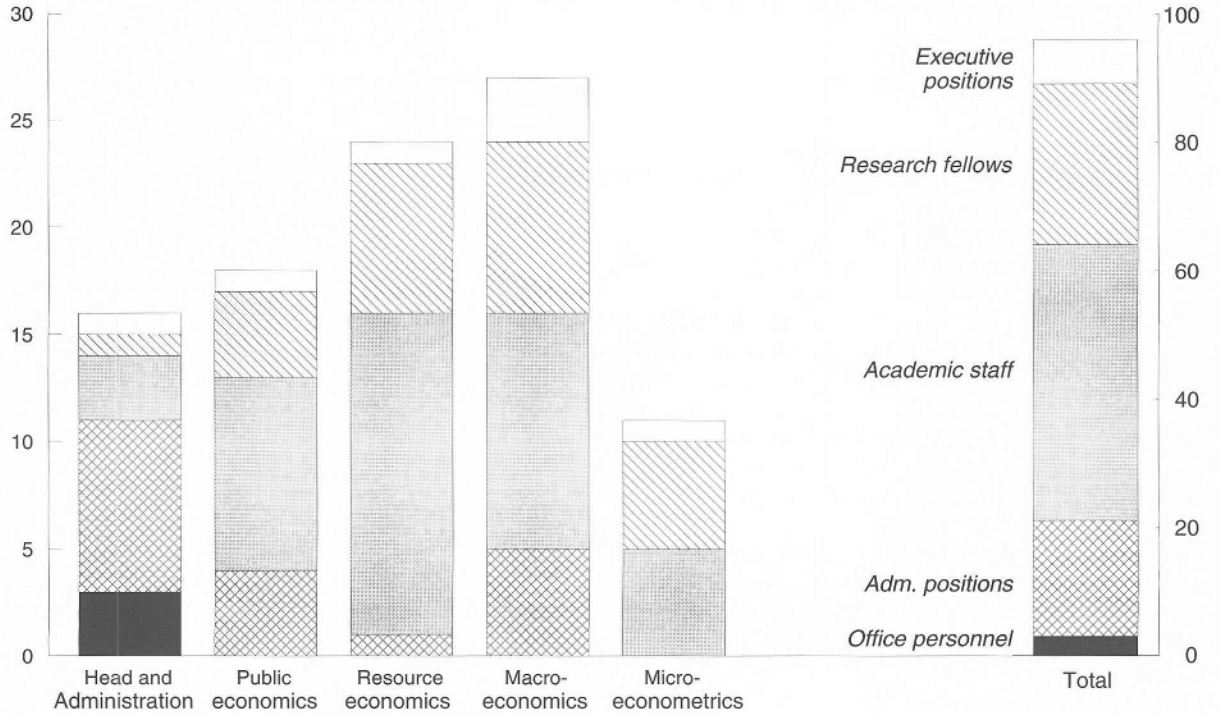
* on leave



Personnel in Research Department (1995)

Division/Unit	Government Budget	Project	Total
Head of Department	1		1
Public Economics	12	8	20
Resource and Environmental Economics	14	13	27
Macroeconomics	15	11	26
Microeconometrics	6	6	12
Administration and Computer Services	8.5	5	13.5
Research Department	56.5	43	99.5

Distribution according to occupational group (including personnel on leave)

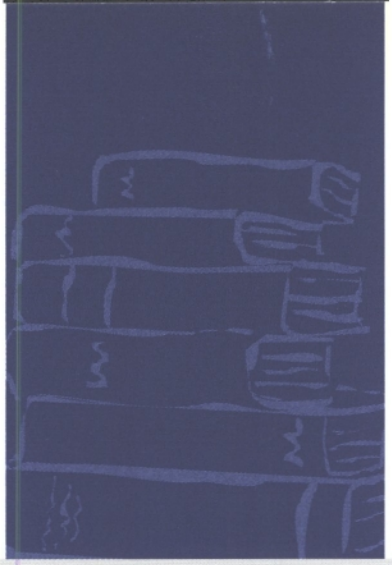


Age structure of the Research Department (including personnel on leave). W(women), M(men)

Division/Unit	20-29		30-39		40-49		50-59		>60	
	W	M	W	M	W	M	W	M	W	M
Head of Department/Administration and Computer Services	3	1	3	2	3	1	-	1	-	1
Public Economics	3	2	2	7	1	1	1	1	-	-
Resource and Environmental Economics	3	2	9	9	1	2	-	1	-	-
Macroeconomics	1	3	4	9	6	8	-	-	-	-
Microeconometrics	2	2	-	5	-	2	-	1	-	-
Research Department	**12**	**10**	**18**	**32**	**11**	**14**	**1**	**4**	**-**	**1**

Distribution of operating costs in 1994

	Government Budget	Project	Total
Personnel	16 545 000	9 998 000	
Office expenses etc.	3 720 000	5 756 000	
Total	20 265 000	15 754 000	36 019 000



Publications

Most of the research results are published in the publication series of Statistics Norway, but also in journals, books, etc. published by others. Monographs are published in the series Social and Economic Studies, other research documentations and reports in the Report series or as Documents. In the Discussion Papers series are issued research papers intended for book or journal publications. There is also a Reprint series of journal articles and book chapters by staff employees. The Research Department publishes two periodicals: Økonomiske analyser, in Norwegian with 9 issues a year, and Economic Survey, in English with 4 issues a year.

Social and Economic Studies (SES)

84 **Bjørn E. Naug:** *En økonometrisk analyse av utviklingen i importandelene for industrivarer 1968-1990* (An econometric analysis of the development of manufacturing import shares 1968-1990). 1994.

85 **Einar Bowitz and Ådne Cappelen:** *Prisdannelse og faktoretterspørsel i norske næringer* (Price formation and factor demand in Norwegian industries). 1994.

86 **Klaus Mohn:** *Modelling Regional Producer Behaviour - A Survey.* 1994.

87 **Knut A. Magnussen:** *Old-Age Pensions, Retirement Behaviour and Personal Saving. A Discussion of the Literature.* 1994.

88 **Klaus Mohn, Lasse S. Stambøl and Knut Ø. Sørensen:** *Regional analyse av arbeidsmarked og demografi - Drivkrefter og utviklingstrekk belyst ved modellen REGARD* (Regional analysis of labour market and demography with the REGARD model). 1994.

89 **Nils Martin Stølen:** *Wage Formation and the Macroeconomic Functioning of the Norwegian Labour Market.* 1995.

90 **Øystein Kravdal:** *Sociodemographic Studies of Fertility and Divorce in Norway with Emphasis on the Importance of Economic Factors.* 1994

91 **Tom Kornstad:** *Empirical Life Cycle Models of Labour Supply and Consumption.* 1995

Reports (REP)

94/1 **Torstein Bye, Ådne Cappelen, Torbjørn Eika, Eystein Gjelsvik and Øystein Olsen:** *Noen konsekvenser av petroleumsvirksomheten for norsk økonomi* (The petroleum activity, some consequences for the Norwegian economy).

94/2 **Wenche Drzwi, Lisbeth Lerskau, Øystein Olsen and Nils Martin Stølen:** *Tilbud og etterspørsel etter ulike typer arbeidskraft* (Supply and demand for different categories of labour).

94/3 **Hilde-Marie Branæs Zakariassen:** *Tilbud av arbeidskraft i Norge. En empirisk analyse på kvartalsdata for perioden 1972-1990* (Supply of labour in Norway. An empirical analysis using quarterly data from 1972 to 1990).

94/5 **Haakon Vennemo:** *A Growth Model of Norway with a Two-way Link to the Environment.*

94/9 **Leif Brubakk:** *Estimering av en makrokonsumfunksjon for ikke-varige goder 1968-1991* (Estimating a macro consumption function for non-durables 1968-1991).

94/10 **Marie W. Arneberg and Thor Olav Thoresen:** *Syke- og fødselspenger i mikrosimuleringsmodellen LOTTE* (Sick-pay

and maternity leave payment in the tax-benefit model LOTTE).

94/11 **Klaus Mohn:** *Monetarism and Structural Adjustment - The Case of Mozambique.*

94/12 **Tom Andersen, Ole Tom Djupskås and Tor Arnt Johnsen:** *Kraftkontrakter til alminnelig forsyning i 1993. Priser, kvantum og leveringsbetingelser* (Electricity sale-contracts 1993. Prices, quantities and specifications).

94/14 **Asbjørn Aaheim:** *Inntekter fra utvinning av norske naturressurser. Noen teoretiske betraktninger* (Income from extraction of Norwegian resources. A theoretical inquiry).

94/16 **Tom-André Johansson:** *En økonometrisk analyse av lagertilpasningen i norske industrisektorer* (An econometric analysis for inventory behaviour in Norwegian manufacturing industries).

94/17 **Lasse S. Stambøl:** *Flytting, utdanning og arbeidsmarked 1986-1990 - En interaktiv analyse av sammenhengen mellom endringer i flyttetilbøyelighet og arbeidsmarked* (Internal migration, education and labour market 1986-1990 - an interactive analysis of internal migration behaviour and labour market).

94/18 **Anne Brendemoen, Mona I. Hansen and Bodil Larsen:** *Framskriving av utslipp til luft i Norge. En modelldokumentasjon* (Projection of emission to air in Norway. A model documentation).

94/19 **Erling Holmøy, Gunnar Nordén and Birger Strøm:** *MSG-5. A Complete Description of the System of Equations.*

94/20 **Ragnhild Balsvik and Anne Brendemoen:** *A Computable General Equilibrium Model for Tanzania. Documentation of the Model, the 1990 - Social Accounting Matrix and Calibration.*

94/21 *Skatter og overføringer til private. Historisk oversikt over satser mv. Årene 1975-1994* (Taxes and public transfers. Historical overview: 1975-1994).

94/24 **Audun Langørgen:** *Framskriving av sysselsettingen i kommuneforvaltningen* (Projections of local public employment in Norway).

94/25 **Einar Bowitz, Taran Fæhn, Leo Andreas Grünfeld and Knut Moum:** *Norsk medlemskap i EU - en makroøkonomisk analyse* (Norwegian membership in the European Union - a macroeconomic analysis).

94/26 **Mette Rolland:** *Militærutgifter i utviklingsland. Metodeproblemer knyttet til måling av militærutgifter i norske programland* (Military expenditure in developing countries. Problems of measurement of military expenditure with reference to the Norwegian program countries).

94/27 **Helge Brunborg and Svenn-Erik Mamelund:** *Kohort- og periodefruktbarhet i Norge 1820-1993* (Cohort and period fertility for Norway 1820-1993).

94/28 **Petter Jakob Bjerve:** *Utviklingsoppdrag i Sri Lanka* (Development advising in Sri Lanka).

94/29 **Marie W. Arneberg:** *Dokumentasjon av prosjektet LOTTE-TRYGD* (Implementing transfers in the tax-model LOTTE, documentation).

94/30 **Elin Berg:** *Estimering av investeringsrelasjoner med installasjonskostnader* (Estimation of investment relations including installation costs).

94/31 **Torbjørn Hægeland:** *En indikator for effekter av næringspolitiske tiltak i en økonomi karakterisert ved monopolistisk konkurranse* (An indicator of the effects of industrial policies in an economy characterized by monopolistic competition).

Discussion Papers (DP)

107 **Snorre Kverndokk:** *Depletion of Fossil Fuels and the Impact of Global Warming.* February 1994.

108 **Knut A. Magnussen:** *Precautionary Saving and Old-Age Pensions.* February 1994.

109 **Frode Johansen:** *Investment and Financial Constraints. An Empirical Analysis of Norwegian Firms.* February 1994.

110 **Kjell Arne Brekke and Pål Børing:** *The Volatility of Oil Wealth under Uncertainty About Parameter Values.* April 1994.

111 **Margaret J. Simpson:** *Foreign Control and Norwegian Manufacturing Performance.* April 1994.

112 **Yngve Willasen and Tor Jakob Klette:** *Correlated Measurement Errors, Bounds on Parameters, and a Model of Producer Behavior.* April 1994.

113 **Dag G. Wetterwald:** *Car Ownership and Private Car Use. A Microeconometric Analysis Based on Norwegian Data.* April 1994.

114 **Knut Einar Rosendahl:** *Does Improved Environmental Policy Enhance Economic Growth? Endogenous Growth Theory*

Applied to Developing Countries. April 1994.

115 **Leif Andreassen, Dennis Fredriksen og Olav Ljones:** *The Future Burden of Public Pension Benefits. A Micro-simulation Study.* April 1994.

116 **Anne Brendemoen:** *Car Ownership Decisions in Norwegian Households.* May 1994.

117 **Audun Langørgen:** *A Macro-model of Local Government Spending Behaviour in Norway.* May 1994.

118 **Kjell Arne Brekke:** *Utilitarism, Equivalence Scales and Logarithmic Utility.* May 1994.

119 **Kjell Arne Brekke, Hilde Lurås and Karine Nyborg:** *Sufficient Welfare Indicators, Allowing Disagreement in Evaluations of Social Welfare.* June 1994.

120 **Tor Jakob Klette:** *R&D, Scope Economies and Company Structure: A "Not-so-Fixed Effect" Model of Plant Performance.* June 1994.

121 **Yngve Willassen:** *A Generalization of Hall's Specification of the Consumption Function.* July 1994.

122 **Erling Holmøy, Torbjørn Hægeland and Øystein Olsen:** *Effective Rates of Assistance for Norwegian Industries.* July 1994.

123 **Klaus Mohn:** *On Equity and Public Pricing in Developing Countries.* August 1994.

124 **Jørgen Aasness, Erling Eide and Terje Skjerpen:** *Criminometrics, Latent Variables, Panel Data, and Different Types of Crime.* August 1994.

125 **Erik Biørn og Tor Jakob Klette:** *Errors in Variables and Panel Data: The Labour Demand Response to Permanent Changes in Output.* August 1994.

126 **Ingvild Svendsen:** *Do Norwegian Firms Form Extrapolative Expectations?* September 1994.

127 **Tor Jakob Klette and Zvi Griliches:** *The Inconsistency of Common Scales Estimators when Output Prices are Unobserved and Endogenous.* October 1994.

128 **Knut Einar Rosendahl:** *Carbon Taxes and the Petroleum Wealth.* November 1994.

129 **Søren Johansen and Anders Rygh Swensen:** *Testing Rational Expectations in Vector Autoregressive Models.* October 1994.

130 **Tor Jakob Klette:** *Estimating Price-Cost Margins and Scale Economies from a Panel of Microdata.* October 1994.

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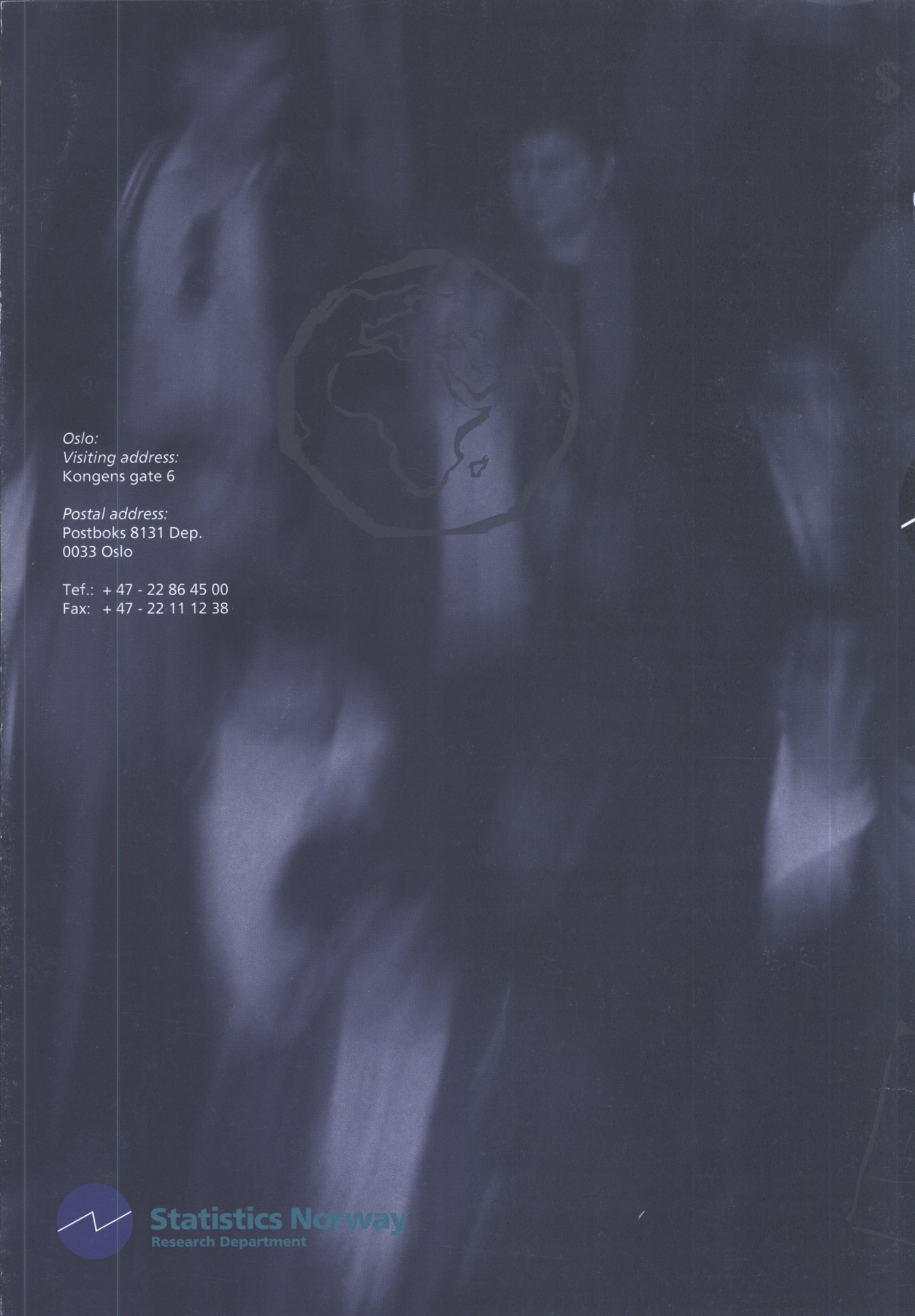

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