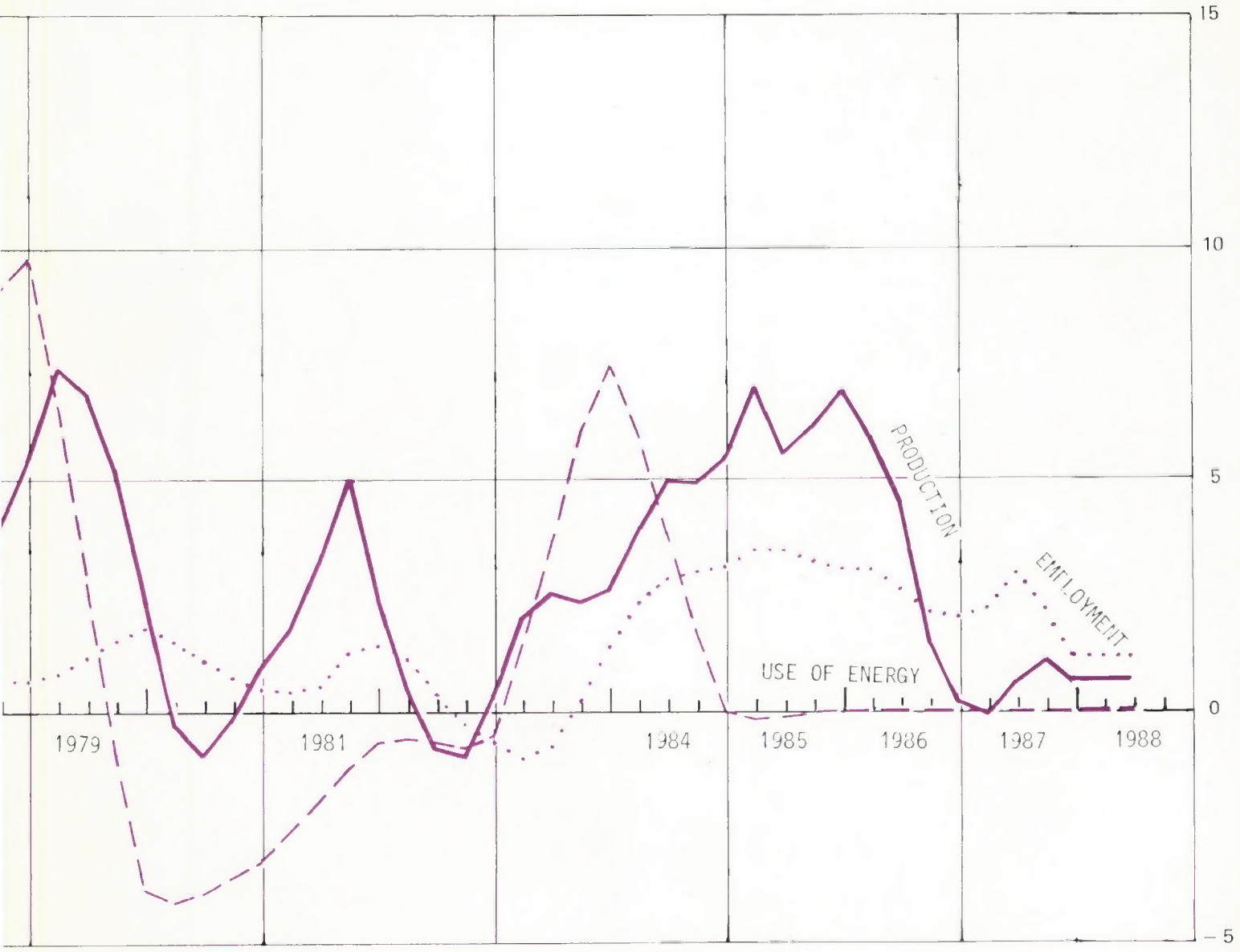
RESEARCH DEPARTMENT

THE CENTRAL BUREAU OF STATISTICS, NORWAY

ANNUAL REPORT 1988



STATISTISK SENTRALBYRÅ

OSLO - NORGE

Front Cover: PRODUCTION, EMPLOYMENT AND USE OF ENERGY IN NORWAY 1968–1988

Estimated growth from preceding quarter, seasonally adjusted. Per cent annual rates.

PRODUCTION: Gross domestic product excluding oil and shipping.

EMPLOYMENT: Number of employees.

USE OF ENERGY: excluding transport oil and solid fuel.

Annual Report 1988

The Research Department, The Central Bureau of Statistics, Norway

Contents

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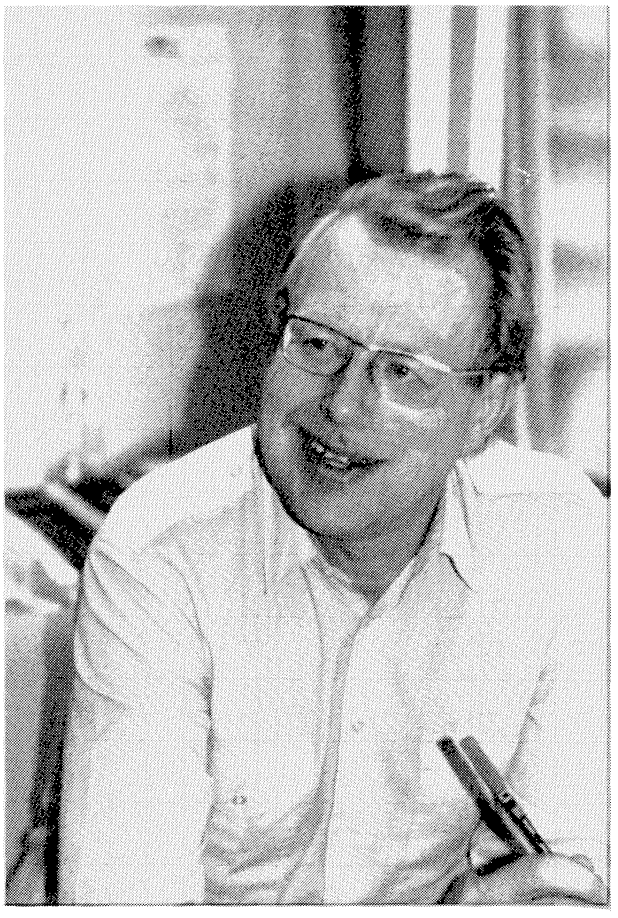
In a Moment of Reflection

by Olav Bjerkholt



Olav Bjerkholt
Head of the Research Department since 1984.

There is a story told of a foreign visitor who some years ago attended the parade in Moscow on the anniversary of the October Revolution. Amidst the parading of the most destructive weapons of the Soviet military machine appeared a small phalanx of not very military looking men with tired eyes and shabby suits. The foreigner looked somewhat puzzled at his Soviet guide who quickly explained: "Those are the GOSPLAN economists; they can *really* do a great deal of damage!".

Such sentiments about government economists and planners are also known to exist in other countries! Economists — often regarded as a bureaucratic caste — have in Norway not been highly venerated in recent years. The economists' advice on how various policy areas should be conducted on the basis of general views on efficient allocation of resources, welfare analysis and macroeconomic management have often been sharply at variance with the views of groups representing traditional sector interests and their political backers. Such conflicts between arguments based on economic theory and unholy alliances of rent-seekers are well-known and have by now a long history in Norway in areas such as energy pricing, off-shore petroleum industry, regional policy, agricultural protectionism, and tax policy.

Conflicts of this kind frequently camouflage conflicts of interest, but are often presented as a clash of values: the economists' narrow monetary measures versus a wide range of important social values said to be ignored in economic reasoning and models. Often these conflicts are explicit in the Government's own White Papers. High-level documents on general policy issues prescribe principles and rules, but lose out in the heat of political struggle that may be no less fierce between ministries than between political parties.

The Research Department, although deeply embedded within the government administration, is not a player in the political arena. Our task is fourfold:

- to provide analytic pictures of the current situation,
- to use appropriate tools and techniques to analyze light on the functioning of the society and underlying features that are not revealed by traditional presentations of statistical data,
- to develop suitable model tools for planning in various policy areas, and
- to use data and tools of analysis to shed light on various policy issues.

These activities are so closely related to the arguments of the political scene that it is unavoidable that our work is used (and sometimes misused) for political ends. That the results of the Research Department's work should be utilized in the design of policy is, of course, a major purpose. In fact, 1988 has been a year in which much of the Department's work has been utilized in important policy documents and reports from government committees.

In moments of reflection on such use of results from our academic research for political purposes one may ponder on observations such as the following:

- The demand for precise information is often over and above what can be provided. A printed number tends to be taken at face value no matter what has been said about the uncertainty of the estimate. We have to admit, however, that even in the Department's oldest area, national accounts, preliminary estimates provided shortly after the completion of the year have sometimes turned out to be further off the mark than we would like to see.

- The macroeconomic and other models that for many years have played a major role in the work of several ministry departments are far from the fine-tuning instruments they are sometimes taken to be. The use of these models to answer "what will happen if"-questions may be far better than other available alternatives, but still remote from the final truth. The presentation of uncertainty in forecasts and estimates is notoriously a very difficult task.

Results from policy analyses whether on efficiency or equity issues often turn out to be difficult to communicate to the general public if they are at variance with the "usual way" of looking at things. Unconventional thoughts are quickly lambasted by interest groups whom they antagonize, perhaps only through a minor point of the analysis. There may also be barriers to communication in the economists' language and presentation of such issues, it is more difficult to gain understanding and appreciation of "deep" results than of more superficial analyses. Most likely the GOSPLAN economists have also experienced this.

The Research Department in The Central Bureau of Statistics

The CBS enjoys a long tradition as a research institution, although the Research Department (as a separate part of the organization) has only existed for one-third of the 110 years that the Bureau has existed. Proximity to primary data sources is of undisputed benefit for a research institution within a statistical bureau. The autonomy traditionally maintained by statistical bureaus and the central position they hold in the production and distribution of information in our societies is also invaluable in research work. The Research Department of the CBS has enjoyed these advantages since its inception.

FROM THE BEGINNING ...

From an early stage there has been a research tradition within the CBS. From the beginning, statistical information was used to enlighten the general public about social conditions. Anders Nicolai Kiær, the Director General for the first 37 years of the Bureau's history, ensured that this became a tradition.

National Accounts, Tax Research, MODIS

The Research Department was not established, however, until 1953. It was formed as a result of the main research effort in the first postwar years, namely the establishment of the national accounts. It was firmly believed, even in that precomputer age, that national accounts data would provide the basis for macroeconomic modelling and analyses of national economic development. The early activities of the Research Department comprised national accounting, input-output analysis, consumer demand analysis, tax research and economic surveys. The first large-scale model (MODIS) was developed in 1960.

The postwar austerity of the 1940s and early 1950s brought economic issues to the forefront of politics. Input-output analysis based on the new national accounts came to be adopted as a multi-task tool for policy analysis and has been a cornerstone in the Department's work since then.

Population

In the 1960s the population wave created by the baby boom of the 1940s swelled the inflow to the labour market. As a result there was an increasing interest in population issues, changes in the labour market, and migration, which led to the establishment of a demographic research unit within the CBS to cover these fields.

Environment

From the early 1970s a growing interest in environment and natural resource issues emerged, which in 1978 led to the establishment of another research unit in the CBS. The latter two units were not formally incorporated into the Research Department until 1983.

Some reflections

During the last 10 to 15 years there has been a great expansion of the Department's activities. The issues of thirty years ago are no less important today. The concepts of the national accounts — at that time known and understood only by a small community of postwar economists — are now a general frame of reference in public debate, taught in school at the intermediary level etc. The development of macroeconomic models and other model tools in this period has been prolific. The challenging task of managing a modern economy has not, however, become any easier. We have to recognize that even the best models we are able to build at present fall far short of ideal requirements.

The tax research activity, which also started in the 1950s, has provided both government and political opposition parties with confidential analyses of the effect of changes in tax rules for more than thirty years. The volume of this service increased immensely after computer-based tax models were developed in the late 1960s.

The 1980s up to now have provided more volatility in economic development than any other part of the postwar period. This has accentuated the need to better understand the international environment and the changes that take place in our own society. There is less unanimity about the future, and perhaps also less belief in traditional forecasting. The practice of extending observed trends without asking what supports such trends, and to take a narrow view with regard to the set of interdependent factors, is still widespread. Furthermore, there is an overwhelming tendency to underestimate the uncertainty of projections.

The future

Norwegian society in the 1990s, the 2000s and the 2010s is being formed by decisions made today. The major challenge for the Research Department is to contribute information to this process and to provide the requisite expertise for providing the best tools and analyses for such decisions in the future.

MAIN ACTIVITIES

The activities of the Research Department comprise:

- National accounts, input-output data, balance of payments
- Economic analysis, macroeconomic models, economic surveys, tax research, input-output analysis, econometric studies
- Population models, family and fertility studies, labour market analysis
- Natural resource analysis, energy analysis, environmental studies
- Petroleum economics
- Regional demographic and geographical analysis

THE RESEARCH DEPARTMENT — CIVIL SERVICE AND ACADEMIC ACTIVITY

The scope of research activity is not matched by many other research institutions in Norway. One important dimension in this range of activities is the emphasis on the use of detailed information to create a picture of the aggregate development in various areas. A second dimension is the emphasis on providing tools and analyses that can be used in general social planning. Models are made available for ministries and others, and forecasts and analyses, e.g. economic growth, population development and indicators of environmental standards are made regularly or on request. A third dimension is the emphasis on academic standards, contact with international research activities etc. to support and complement the applied orientation.

FINANCING

Most of the Research Department's activities are funded via the regular annual budget of CBS, but an increasing share have in recent years come from Norwegian Research Councils and research contracts. The research contracts are mostly with ministries and other central government institutions.

EXTERNAL CONTACTS — AT HOME AND ABROAD

The general orientation of the Department's work makes Norwegian Ministries a particularly important user group. Of particular importance are the ties with the Ministry of Finance and the Ministry of Environment. Also in close contact with the Research Department are the Ministry of Oil and Energy, the Ministry of Family and Consumer Affairs and the Ministry of Labour and Municipalities. With 5–6 other Ministries the contacts are more sporadic. It is of importance for these links that the Research Department is — as part of the CBS — embodied in the central government administration.

During the year 1988 the department received visitors from throughout the world; from several universities in The United States, from universities, research institutes and statistical bureaus in Europe, The People's Republic of China, Israel, holders of UN-scholarships from Mongolia.

The Research Department's staff keeps up an extensive travel activity — both in Norway and abroad — to establish and maintain contact with foreign and domestic authorities and scientists.

PUBLISHING

Research results are reported and published in the following series from the CBS:

- Norwegian Official Statistics (NOS)
- Social and Economic Studies (SØS)
- Reports (RAPP)
- Discussion Papers (DP) (in English)
- Reprint Series
- Internal documentation (IN)

In addition, the Research Department publishes the "Økonomiske analyser" ("Economic Survey") with 10 volumes a year. The first volume of each year presents an economic review of the past year and is also made

available in English. Other issues contain economic surveys both of the Norwegian and the international economic development, quarterly and annual Norwegian national accounts figures with comments and short articles presenting results from ongoing research projects.

ORGANIZATION

The Research Department is divided into 4 divisions:

Division for National Accounts
Division for Economic Research
Division for Socio-Demographic Research
Division for Research on Natural Resources

The divisions are subdivided into smaller units working with one or several related projects within defined research programmes. The Division for National Accounts is administratively a separate division, whereas the responsibility for administration of the current research projects within the other divisions is placed directly with the research units, each under the management of a senior research fellow.

In co-operation with the Head of the Research Department, who is also Assistant Director General of the CBS, the main responsibility of the directors of research is the long-term planning of the research policy within the divisions and the department as a whole.

A central unit for administration is organized across divisions in order to co-ordinate and develop the various administrative functions within the Research Department.

Hanne Rambøl and Bente Torgersen

Elisa Holm and Anne Skoglund

Rita Elin Fjeldbo and Kirsti Angeland

MANAGEMENT AND PERSONNEL

The Research Department employs over 100 persons, of which 70–75 have an academic background. Most of the academic staff of the Division for National Accounts and the Division for Economic Research are economists. Altogether there are about 50 economists in the Department. Other academic staff represent many disciplines. An incomplete list includes sociology, geography, statistics, computer science, agricultural science, physics, biology and engineering. Most of the non-academic staff are highly trained specialists.

Rolv Lea and Jon Ivar Røstadsand

ORGANIZATION CHART OF RESEARCH DEPARTMENT:

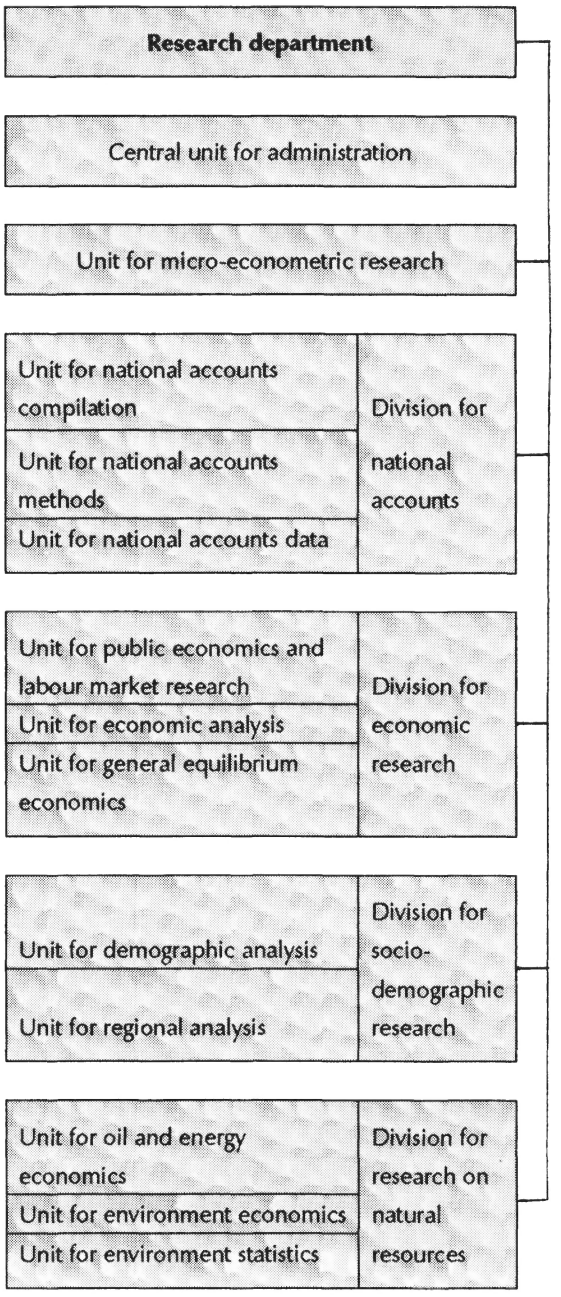
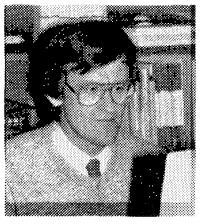


Figure 1: Organization and Management of the Research Department, 1 January, 1988

ASSISTANT DIRECTOR GENERAL
Olav Bjerkholt

CENTRAL UNIT FOR ADMINISTRATION:
Bente Torgersen

UNIT FOR MICRO-*econometric* RESEARCH:
John K. Dagsvik

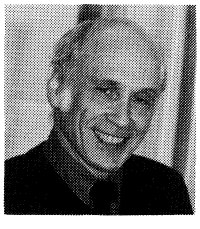


DIVISION FOR
NATIONAL ACCOUNTS
Erling J. Fløttum

Unit for National Accounts Compilation: Tore Halvorsen
Unit for National Accounts Methods: Anders Harildstad
Unit for National Accounts Data: Randi Hallén

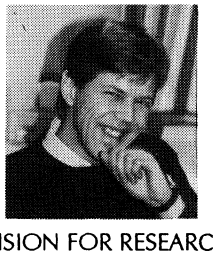
DIVISION FOR
ECONOMIC RESEARCH
Svein Longva

Unit for Public Economics and Labour Market Research: Olav Ljones
Unit for Economic Analysis: Ådne Cappelen
Unit for General Equilibrium Economics: Erling Holmøy



DIVISION FOR SOCIO-
DEMOGRAPHIC RESEARCH
Per Sevaldson

Unit for Demographic Analysis: Helge Brunborg
Unit for Regional Analysis: Tor Skoglund



DIVISION FOR RESEARCH
ON NATURAL RESOURCES
Lorents Lorentsen

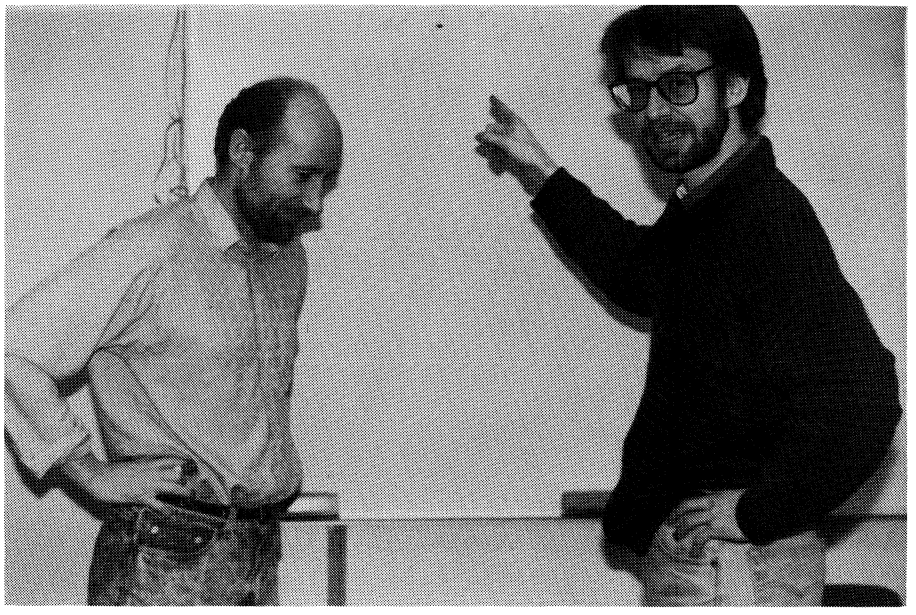
Unit for Oil and Energy Economics: Øystein Olsen
Unit for Environment Economics: Knut H. Alfsen
Unit for Environment Statistics: Frode Brunvoll

Unit for Micro-econometric Research

This unit was established in July 1987. The principal purpose is to conduct econometric analysis on CBS's micro-data with particular emphasis on methodological problems. Currently the unit is engaged in areas such as

- The econometrics of discrete/continuous choice.
- Analysis of consumer demand, educational choice, labour supply, energy demand and duration of unemployment.
- The theory of production and cost functions.
- Methods for analyzing inequality.
- Methods for policy simulations based on micro-econometric models.

A major concern of the unit is to strengthen the relationship between theory and the corresponding empirical specification.



John K. Dagsvik and Rolf Aaberge

Two of the ongoing projects are particularly representative for this concern, namely the modelling of households labour supply and the analysis of consumer demand. In the labour supply project an attempt is made to justify the stochastic properties of the model by explaining unobserved heterogeneity as resulting from households rational choice from a latent set of "positions". By postulating behavioral assumptions about the choice process with respect to the latent positions it is thus possible to obtain a characterization of the labour supply distribution.

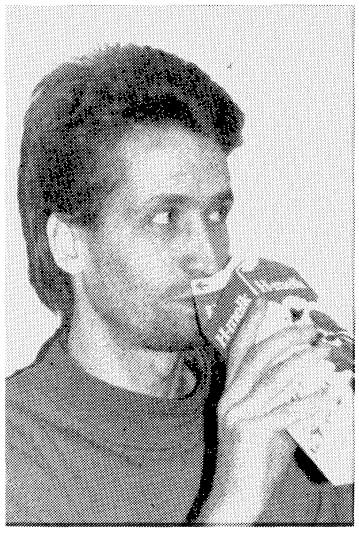
In the consumer demand project measurement error is a serious problem. Both observed consumption goods as well as income variables are measured with errors. The strategy adopted for accommodating these errors is to specify latent variable relations within framework of covariance structure models. So far the empirical results demonstrate that assumptions about the nature of measurement error are of considerable importance.

As already suggested it is recognized the importance of combining the development of theory and methods with their empirical counterparts. This enables us to test behavioral hypotheses and to examine estimation procedures as well as computational costs. It also serves as a bridge between the development of formal structural models to actual implementations in macro-models and policy simulation programs.

As a consequence the activity in empirical investigations provides a mean for maintaining close relationships with other selected units within the research department.

What we may call theoretical econometrics is, as also suggested, closely related to the field of applications mentioned above. One important topic is to develop a framework for analyzing static and intertemporal discrete/continuous choice in the presence of uncertainty (relative to the decision-maker) and unobservable (relative to the econometrician).

The type of models developed so far can be viewed as an extension of the so-called generalized extreme value model and they provide a unified framework where the Luce model as well as the traditional continuous choice model emerge as special cases.



Tom Wennemo

National Accounts

DIVISION FOR NATIONAL ACCOUNTS

Main activities

The national accounts are a comprehensive and balanced system of accounts for the Norwegian economy based on the principles of double book-keeping. The accounts give both a systematic statistical description of the economy as a whole and a quite detailed map of the transactions between the various parts of the economy and between Norway and other countries. This mapping makes use of concepts and classifications that are stipulated according to adopted rules and conventions, often as a result of international collaboration. In all essential aspects the system of accounts follows recommendations given by the United Nations.

A main characteristic of Norwegian national accounts is the complete integration of annual input-output tables including close to 200 production sectors and approximately 2000 commodities. This implies a strong emphasis on commodity flows and commodity balances, as well as on production, consumption expenditure and capital formation accounts rather than income and outlay and capital finance accounts. Thus, the "production approach" has been the main approach used for computing gross domestic product. In recent years, higher priority has been given to completing work on the construction of income and outlay and capital finance accounts, as well as balance sheets. This effort has so far resulted in income and outlay accounts figures being presented on a current basis.

The national accounts figures are of major importance to the development and co-ordination of Norwegian economic statistics and contributing as the main data source for macroeconomic analysis in the CBS.

The annual national accounts are being presented in two preliminary versions until the final figures are constructed. All versions are published (annually) in Norwegian Official Statistics (NOS) of National Accounts. Additionally, quarterly national accounts are published on a current quarterly basis in "Economic Survey" and annually in the NOS. Balance of payments data are produced monthly, and income and outlay accounts by institutional sectors and employment data by industry are produced with regular intervals. National accounts by county are being published every 3–4 years.

Activities in 1988 and plans for 1989

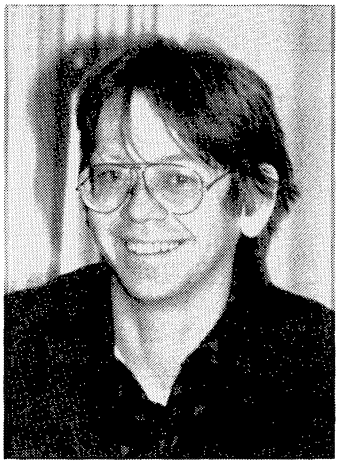
The most extensive project during 1988 has been to alter the national accounts system itself. Improved quarterly accounts now provide a more simplified version to the preliminary annual accounts and an adjustment to a simplified basis model for the work on the national budget. In addition, a limited main revision of the annual national accounts has provided revised series of figures in 1988 — such as introducing a new base year 1984 for the constant-price figures, a change from gross to net treatment of value added tax, some new sector and commodity specifications, and at the same time indicating an increased effort towards a revision of the national accounts in itself in the early 1990s.

Work accomplished in 1988 will result in finalizing some large projects during 1989, such as to publish figures on employment accounts for the period 1962–1987, as well as introducing figures on hours of work in the employment tables in the national accounts on a regular basis. Furthermore, the plan is to publish reconciled figures of the income and outlay and capital finance accounts for the period 1980–1985. This will imply a further extension of the annual accounts sub-

sequent to the integration of the income and outlay accounts with the regular publishing of the national accounts some years ago.

During 1988 efforts have been made towards improvement and extension of the annual national accounts publication by introducing new tables — including commodity and international data. Also, the publication will contain more descriptive and analytical comments than previously.

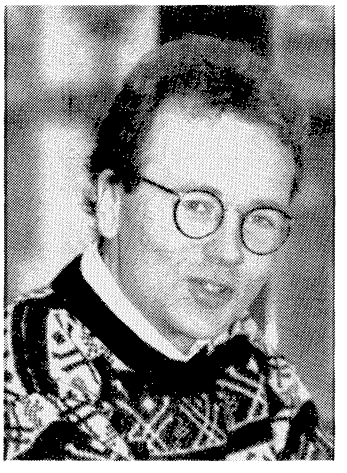
In 1988, work on county specified figures on national accounts for 1986 has been initiated, with plans for publication in 1990.



Tore Halvorsen

Randi Hallén

Rolv Lea



Jon Ivar Røstadsand

Economic Research

UNIT FOR PUBLIC ECONOMICS AND LABOUR MARKET RESEARCH

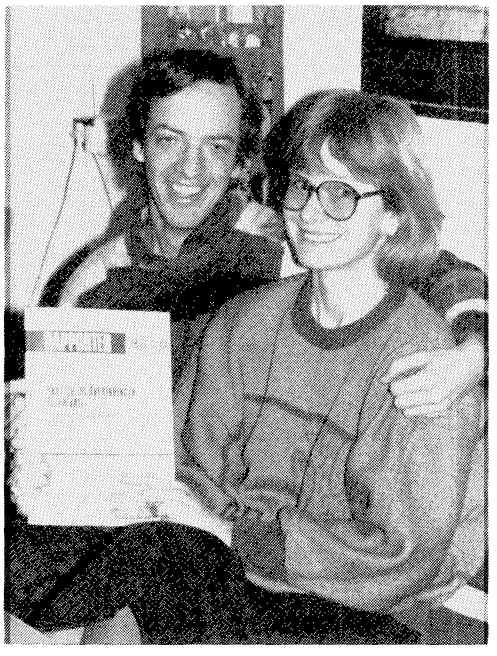
Tax research

Inger Gabrielsen

In 1987 the government introduced a tax reform, which reduced the effect of tax deductions on personal income tax. In the following years minor tax changes further contributed to an increased emphasis on gross income. During the past year several studies have analyzed the effects of these tax reforms on the level of taxation and on income distribution. A new version of the microsimulation model LOTTE was completed, while our work on other household based models was continued. Our annual publications covering taxes in general and taxes and transfers to private consumers were updated in 1988. In 1989 we started a new project, which will analyze corporate taxation.

Government expenditure

In 1988 we again took up development of the macroeconomic model MAKKO. It models the relationship between the central government's targets for local services, the local governments' actual consumption and demographic change. The model will be used in our analysis of the public sector and in the central government's planning process.



Tom Kornstad and Elizabeth Nygaard

Employment and education

Towards the end of 1988 we started developing a new projection model for educational attainment and labour force participation. This microsimulation model, which shall replace the current projection models, simulates demographic events, educational choice, and labour market behaviour for a large model population. Work on the model should be completed by the middle of 1990.

An analysis of spillover effects between different parts of the labour market was begun in 1989. This econometric study will try to estimate a multimarket disequilibrium model where the labour market is split up by education. This project is planned completed by the end of 1990.

THE EFFECTS OF THE INTEREST RATE, TAXES, AND INFLATION ON THE COST OF BORROWING

by Charlotte Koren

The real cost of borrowing depends on three factors: The nominal interest rate, the inflation rate, and

whether the interest may be deducted from income at taxation. Interest is fully deductible when assessing some types of income tax. We have calculated how much taxes are reduced as a result of this deduction, and set it as a percentage of personal debt. This percentage is the share of the cost of borrowing paid by the government through lost tax revenues. The rest is paid by the borrower. When calculated as a percentage of personal debt, this will be the nominal interest rate after taxes. When the price level increases, the real debt decreases. Accordingly, we have adjusted the nominal tax rate with the inflation rate to get the real interest rate after taxes.

Our calculations show that an increasing inflation rate reduced the cost of borrowing from 1985 to 1986. For high income earners the real interest rate after taxes was negative in 1986. In 1987 and 1988 the cost of borrowing has increased for all income groups. This is mainly due to an increase in the real interest rate, but for high income earners it is also due to tax reform. During these years there were minor tax reforms aimed at reducing the effect of tax deductions. Taxes on net income have been reduced and a new gross income tax has been introduced. This last reform has mainly affected wage earners with debts and incomes above approximately NOK 200000.

In 1989 we expect that the real interest rate will continue to rise, and thereby the real cost of borrowing for all income groups. A minor tax change introduced this year will further reduce the value of deducting interest from income, especially for high income earners. In the alternative where the interest rate falls 2 percentage points from 1988 to 1989, low income groups will experience a slight decrease in their cost of borrowing.

Table 1: The effects of the interest rate, taxes, and inflation on the cost of borrowing

	1985	1986	1987	1988	–1989–	
Nominal interest rate	14.0	15.0	16.5	1988	15.5	14.5
Inflation rate through the year	5.4	8.4	7.4	5.6	4.0	4.0
Income NOK 150 000 in 1988						
Tax reduction in % of debt	4.7	4.9	4.6	4.9	4.9	4.7
Nominal interest rate after taxes	9.3	10.1	11.9	11.6	10.6	9.8
Real interest rate after taxes	3.7	1.6	4.2	5.7	6.3	5.6
Income NOK 250 000 in 1988						
Tax reduction in % of debt	7.9	8.3	8.5	7.8	7.1	6.6
Nominal interest rate after taxes	6.1	6.7	8.0	8.7	8.4	7.9
Real interest rate after taxes	0.7	–1.6	0–6	2.9	4.2	3.8
Income NOK 400 000 in 1988						
Tax reduction in % of debt	9.0	9.5	9.2	7.9	7.1	6.6
Nominal interest rate after taxes	5.0	5.5	7.3	8.6	8.4	7.9
Real interest rate after taxes	–0.4	–2.7	–0.1	2.8	4.2	3.8

The cost of borrowing is calculated for a wage earner with a constant real income throughout the period. Her dept is set to NOK 400 000 in 1988, and is held constant in real value. For 1989 we have used two alternative interest rates.

UNIT FOR ECONOMIC ANALYSIS

Macroeconomic models

Kjersti-Gro Lindquist and Nils Martin Stølen

Macroeconomic research is centered around three input — output based macro economic models MODIS, MODAG and KVARTS.

MODIS IV has since 1974 been the main model used by The Ministry of Finance for short-term analysis and national budgeting. A new aggregated version called MODIS V was established and replaced MODIS IV in 1988. Except for the level of aggregation (appr. 50 commodities compared to appr. 200) the new version is very similar to the old.

Different versions of the MODAG-model, designed for medium-term economic analysis, have been used both by The Ministry of Finance and The Research Department in 1988. The main research activities in 1988 centered around financial modelling and modelling of the labour market. In 1989 more emphasis will be given to modelling of consumer and producer behaviour and international economics in addition to financial modelling.

The quarterly model KVARTS is only used by The Research Department as a tool in business cycle analysis and forecasting (see below). Research has been concentrated on behaviour of wages and wage-drift. The research activities taking place in relation to MODAG and KVARTS are often closely related and projects of high priority in developing the MODAG-model are also relevant for KVARTS and vice versa.

Economic Surveys

Analysis of international and domestic economic development is published quarterly in the journal "Economic Analyses" (from 1989 on a summary will be available in English). The short-run development of the Norwegian economy is study using the quarterly national accounts and the quarterly model KVARTS. Preliminary quarterly account figures are published two months after the end of each quarter together with forecasts one or two years ahead based on the model.

The journal "Economic Analyses" contains also shorter non-technical articles presenting results from research taking place in the whole research department.

OUTLOOK FOR 1989 — A MODEL BASED PROJECTION

The CBS' quarterly macroeconomic model KVARTS has for some years been used in forecasting on a regular basis. The figures on the next pages show the forecast, published in the latest annual Economic Survey on Norwegian economy. The primary objective of the calculations was to illustrate a possible course for the Norwegian economy in order to obtain a clearer picture of the challenges the country will face in the coming year.

The calculations show the following:

- Even though domestic demand will fall from 1988 to 1989 there will be growth throughout the year.
- Employment may decline further in 1989. This means that greater use of labour market policies will be required if a continued rise in unemployment is to be avoided.
- The balance of payments will improve in 1989 but show new weakness towards the end of the year.
- The rise in wages and prices will decline from 1988 to 1989.

The forecast for 1989 is based on the OECD's projections for imports by Norway's most important trading partners, published in the OECD's Economic Outlook in December 1988. These estimates show a weak decline in export market growth for Norwegian industrial products in 1989 and a stronger decline in 1990, especially for industrial raw materials that are sensitive to cyclical changes.

Growth in the volume of exports of traditional goods will slow down during the year in step with the assumed slower rate of growth in the world economy. The growth in export prices is also clearly lower than the previous year. A strong rise in volume for oil production and a rise in oil prices will increase the export value of oil and gas considerably.

Assumptions on economic policy in the forecast were mainly based on the approved National Budget for 1989. The Government has, however, later on prepared plans for labour market measures and other kinds of measures which will lead to increased expenditure compared to the budget. The extent and shape of these measures were not known in detail when our forecast was made.

The decline in private consumption is expected to continue into 1989, but it will gradually rise in the course of the year. The reason for this is a gradual increase in real wage income, increase in transfers and a lower nominal rate of interest. The saving ratio is assumed to increase by 1.3 per cent, becoming slightly positive in 1989.

Investments in oil activities will increase considerably in 1989 while investments in ships, which mainly means registration under the Norwegian flag in NIS, are expected to fall markedly. The drop in investments in mainland Norway will continue in 1989. The decline will, however, flatten out and change to a weak growth by the end of the year, amongst other things due to the growth in investments in housing.

The volume of imports of traditional goods should pick up again during 1989, after having dropped in the last 2 1/2 years. An assumed drop in the number of ships registering under the Norwegian flag in NIS will nevertheless lead to a fall in the total volume of imports from 1988 to 1989.

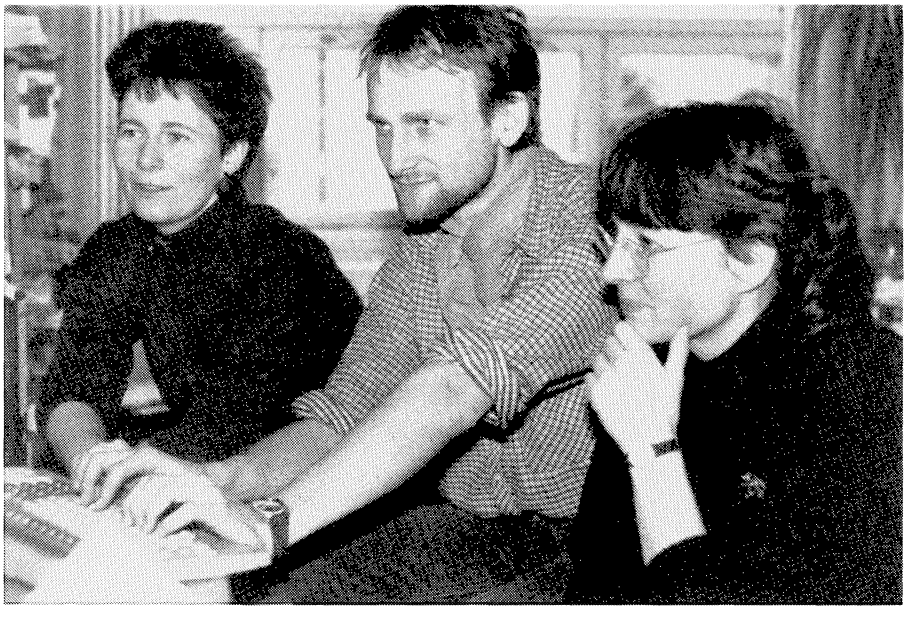
The balance of payments will show a clear improvement. Because of the decline in the growth of exports, the increasing growth of imports and a gradual deterioration of terms of trade, the balance of payments will, however, become weaker in the course of the year, unless oil prices should remain relatively high.

While it was the export industry that contributed to maintaining growth in production in 1988, import-competing industry and sheltered sectors are expected to take over to a greater extent in 1989, as domestic demand increases and foreign demand decreases. The strong growth in oil production is a contributory factor to the total rise in GDP.

The figures show that in 1989 Norway will still be faced with a big unemployment problem. At the beginning of the year unemployment is at a record level and the drop in the number of jobs measured in man-hours worked may continue in 1989, though at a slower pace than in 1988.

Measures to stimulate employment have been included in the calculations. Allowance has not been made for the fact that educational and training schemes that may be included in these measures may reduce the labour force and thereby reduce unemployment figures because of the method of measuring these indicators in the Central Bureau of Statistic AKU survey.

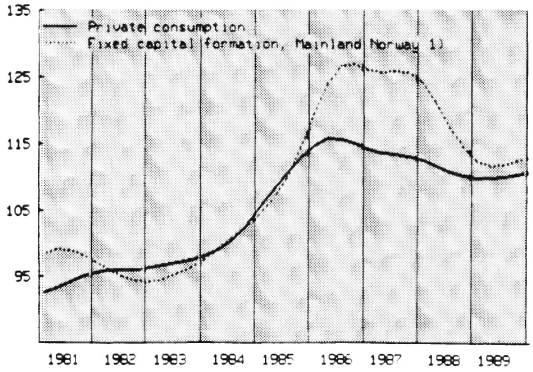
A lower interest rate, a lower growth in wages and import prices, a low growth in indirect taxation and a continued low growth in demand will lead to continued decline in the price growth in 1989.



Laila Haakonsen, Torbjørn Eika and Kari Holst

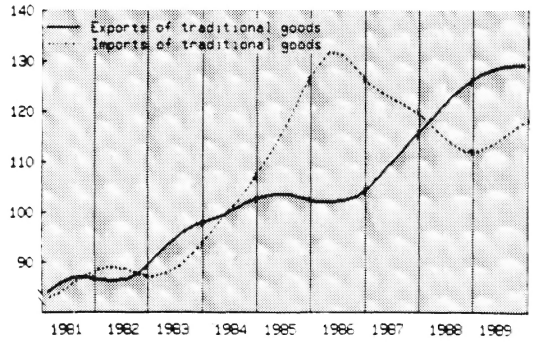
Figure 2: Main Economic Developments

CONSUMPTION AND FIXED CAPITAL FORMATION
1984 = 100. Seasonally adjusted and smoothed.

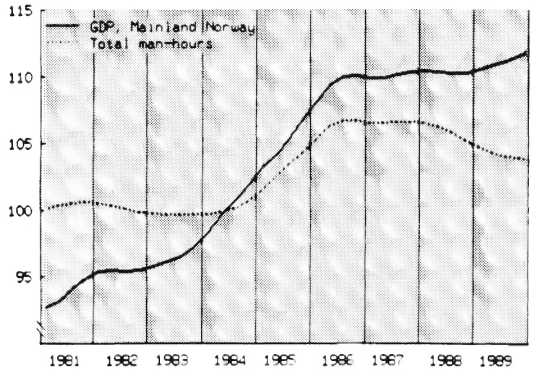


1) Excluding oil and transport.

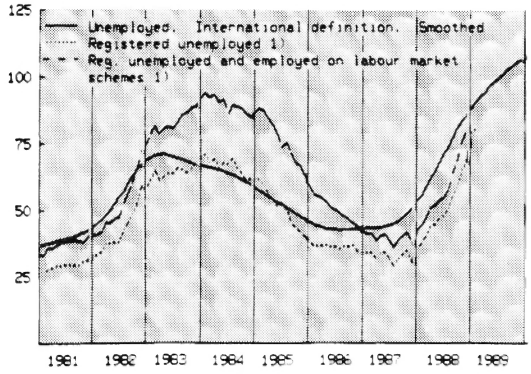
EXPORTS AND IMPORTS OF TRADITIONAL GOODS
1984 = 100. Seasonally adjusted and smoothed.



PRODUCTION AND EMPLOYMENT
1984 = 100. Seasonally adjusted and smoothed.

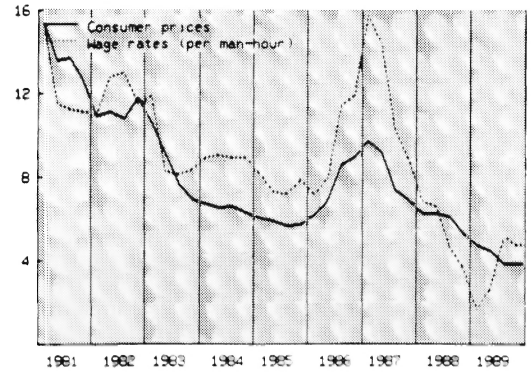


UNEMPLOYMENT
Seasonally adjusted, in thousands.

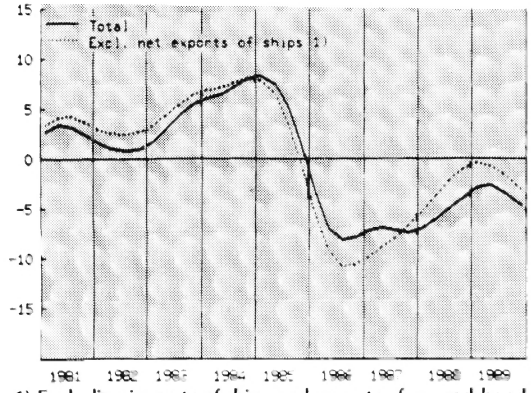


1) According to Labour market authorities.

PRICES AND WAGES
Growth from same quarter one year ahead.



CURRENT ACCOUNT SURPLUS
In 1000 millions Nkr. Seasonally adjusted and smoothed.



1) Excluding imports of ships and exports of second-hand ships.

UNIT FOR GENERAL EQUILIBRIUM ECONOMICS

Erling Holmøy and Berit Hobber

The unit is responsible for keeping the two models MSG-4 and MINK operative. MSG-4 is a 31-sector general equilibrium model developed to analyse sectorial reallocations of outputs and inputs during a growth process. MINK is a "postmodel" for financial flows and stocks. In addition the unit develops other general equilibrium models to analyse issues of trade, taxation and resource allocation.

In 1988 MSG-4 was updated to a new base-year, 1986. The unit conducted two studies of interest for future reformulations of the MSG model. One analysis extended the present exogenous treatment of foreign trade, to incorporate Armington-type functions to endogenously determine export- and import-shares. Special focus was put on the way in which such a model modifies the solution for the factorprices generated by the traditional MSG model. The same problem was studied in another study which documents the experiences of changing the specification of technical change from being Hicks-neutral to labour augmenting.

Normative tax analysis is a major field for application of general equilibrium models. The unit is involved in a research programme concentrating on welfare effects of the taxation of capital income. A new version of the MSG model with complete income accounts and modelling of savings behaviour is now being developed. This model will be extensively applied for measuring welfare effects of changing the tax system. A second line of research focuses on calculating time series of effective tax rates for different capital assets, and the development of an aggregate, dynamic general equilibrium model for analyzing reforms in the system of capital income taxation. Both these efforts will continue in 1989.

A more partial normative study of the welfare gains from increasing the prices on hydroelectric power delivered to electricity intensive industries was carried out. The model, incorporating features of monopolistic competition and scale economics, was estimated on micro data.

The growth in total factor productivity is of major importance to long term economic growth and both theoretical and empirical work on the measurement of this parameter was undertaken by the unit in 1988.

The unit arranged an international workshop on building and applications of general equilibrium models where most of the projects mentioned above were presented.

CAPITAL ALLOCATION AND EFFECTIVE TAX RATES

by Erik Offerdal

The most efficient allocation of a country's capital stock is achieved when the social rate of return is equal for all assets. If this was not the case, society could increase the total return on the capital stock by disinfesting in low-return assets and invest these funds in high-return assets. Private investors will, however, maximize the return on private wealth by allocating their investment funds so that the private rate of return is equal on all assets. If there is a wedge between the social and private rates of return on an asset, and if this wedge is different for different assets, a private portfolio equilibrium will therefore imply a socially inefficient allocation of capital.

In the following we shall assume that the tax system is the only element that introduces such wedges. Hence, we may define the social rate of return as the pre-tax rate of return, net of depreciation, on an asset, and the private rate of return as the return after all taxes — corporate and personal. To measure the neutrality of the tax system, i.e. to what extent the tax system creates incentives to invest in certain assets, we define the effective tax rate as the percentage difference between the social and private rates of return, measured in terms of the social rate of return. This is a shorthand representation of the combined effects of all the provisions of the tax code, and gives a simple way of measuring whether

any asset is given a systematically favorable treatment by the tax system.

Such differential treatment between assets may arise for a variety of reasons; we shall here focus on the effects of the capital consumption allowances. In the Norwegian tax code these are based on the aquisition cost of the asset, meaning that inflation will erode the basis for these allowances, and obviously more so the longer the service life of the asset. During the period 1963–1982 capital consumption could be deducted by applying a linear schedule to each asset, combined with different forms of additional accelerated allowances. In 1983 this was changed to a system of declining balance rates, which is a more accelerated form of capital consumption allowance, and the majority of the additional allowances were removed.

The effects of this may be illustrated as in figure 3, which gives the effective tax rates for the two main classes of assets; Structures and Producer Durable Equipment, and the average aquisition price index for capital goods. The effective tax rate for Structures has been 8–10 times that of Equipment over the whole period. Both increased strongly with the rapid inflation in the period 1963–80, then fell with the introduction of a declining balance rate system and have since increased slightly.

Figure 3: Effective tax rates 1963–1985, by asset

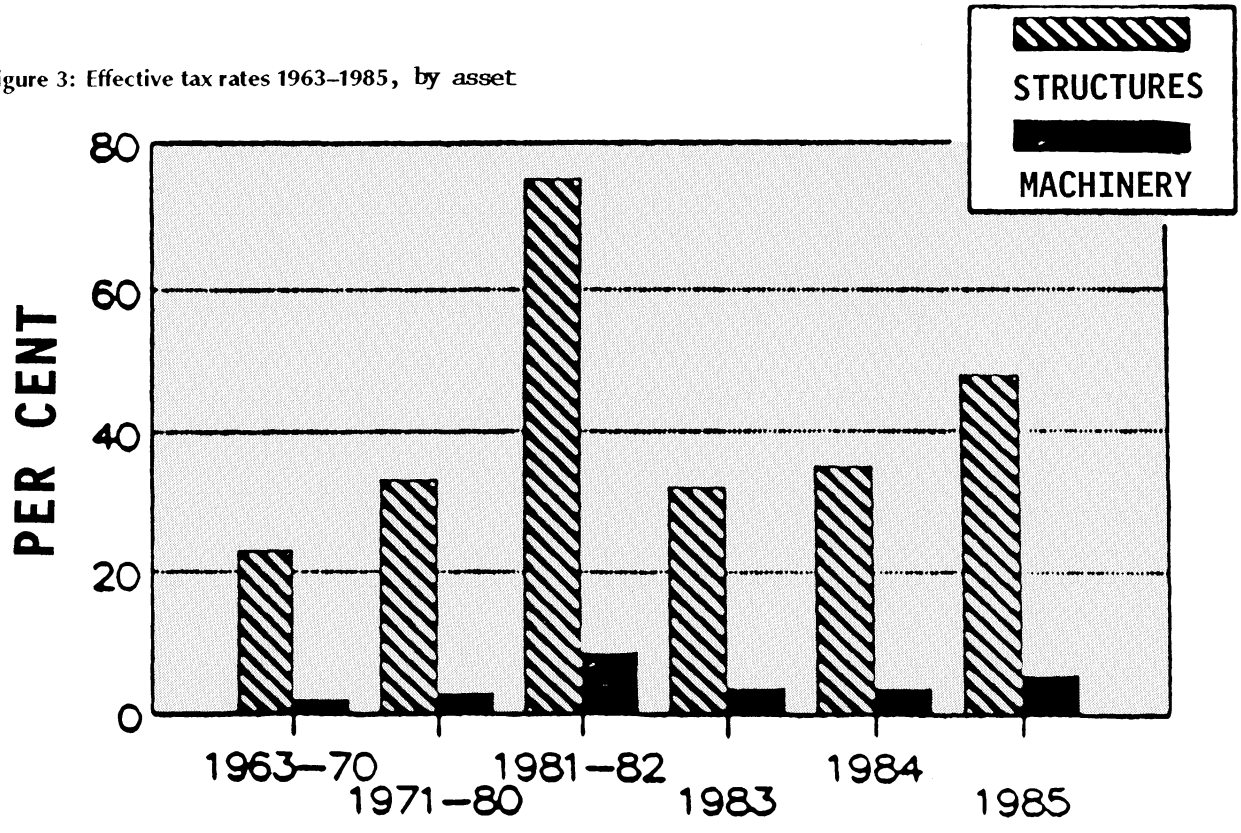


Figure 4: The main macroeconomic models

The macroeconomic models of the CBS are all both conceptually and empirically based on the national accounts. The core of the models are input-output relations of demand and use of goods and services supplemented by behavioral relations etc. for the sectors of economy. The extent and type of these relations and the level of disagregation vary between the models. The models are updated on an annual basis.

MODIS:	The most detailed of the models and was originally developed in the early 1960s. Today's version — MODIS V — has an input-output core comprising 54 goods and 50 sectors of production, covering both quantities and prices. The model offers a detailed and thorough representation of public income and expenses, especially taxes and subsidies. The model is mainly used by The Ministry of Finance in annual economic planning and budgetary work.
MODAG:	Less detailed and much more behaviorally based than MODIS. The input-output core specifies 41 goods and 33 sectors of production and is specifically intended for analysis on a medium-term basis. The behavioral relations cover production, consumption, investment, imports-exports, prices, and wages and the labour market. The model is in the Klein-Tinbergen-tradition also including elements from the Scandinavian model of inflation. The model is used by The Research Department and The Ministry of Finance for impact and economic policy analyses.
KVARTS:	A quarterly model with mainly the same behavioral content as MODAG. Somewhat more aggregated than MODAG, KVARTS has an input-output core specifying 25 goods and 16 sectors of production. The model emphasizes dynamical short-term relations implying that the development during past quarters are decisive for the present course. The model is mainly used in the CBS's work on economic surveys, but is also part of the international LINK-project.
MSG:	An applied general equilibrium model that presupposes full utilization of labour and capital. The model is especially suited for studying the shifts in the structure of trade and industry along a growth path for the economy. The present version — the MSG 4 — is mainly used for long-term calculations in connection with The Government's long-term programme and in structural and growth analysis of the economy.

Figure 5: Tax and allowance models

KFS:	A model calculating income taxes and disposable income for different types of private households by alternative sets of tax rules.
SKATT:	A model for forecasting income and tax revenues based on different tax rates and net income and wealth distribution.
LOTTE:	Estimates the distribution effects of changes in taxable income, the basis of the model being data from a sample of individual income and outlay reports to the tax authorities.
INSIDENS:	Estimates the distributive effects of changing excise taxes and subsidies on consumer goods.
MIFO:	Analyses the consequenses on disposable pensions from changes in pension and tax rules.
MAFO:	A budget model for the public pension system.
MONS:	Model for projections of the school population by sex, age and educational activity and of the non-school population by sex, age, and educational status.
MATAUK:	Model for projections of labour supply and hours of work offered, by sex, age and educational status.

Socio-Demographic Research

UNIT FOR DEMOGRAPHIC ANALYSIS

The Unit for Demographic analysis is the largest research environment for demography in Norway. The goal of the unit is to cover the most important areas of demography, but due to limited resources we have to concentrate our efforts. In recent years we have focused on life course analyses of fertility and marital change, and studies of families and households, in addition to the permanent responsibility of making population projections. Hopefully, one of the outcomes of this concentration will be projections of families and households, a field that has received little attention compared to projections of individuals.

Longitudinal analyses of demographic behaviour using individual data from registers and censuses continued in 1988, including social and demographic determinants of divorce (see below) and completed fertility. The life-cycle perspective has been important in these projects, as well as in the interview survey Family and Occupation 1988. In this survey data on complete histories of births, cohabitation, occupation and education have been collected for 5000 women and 2000 men. The analysis will start in late 1989.

Helge Brunborg and Lars Østby

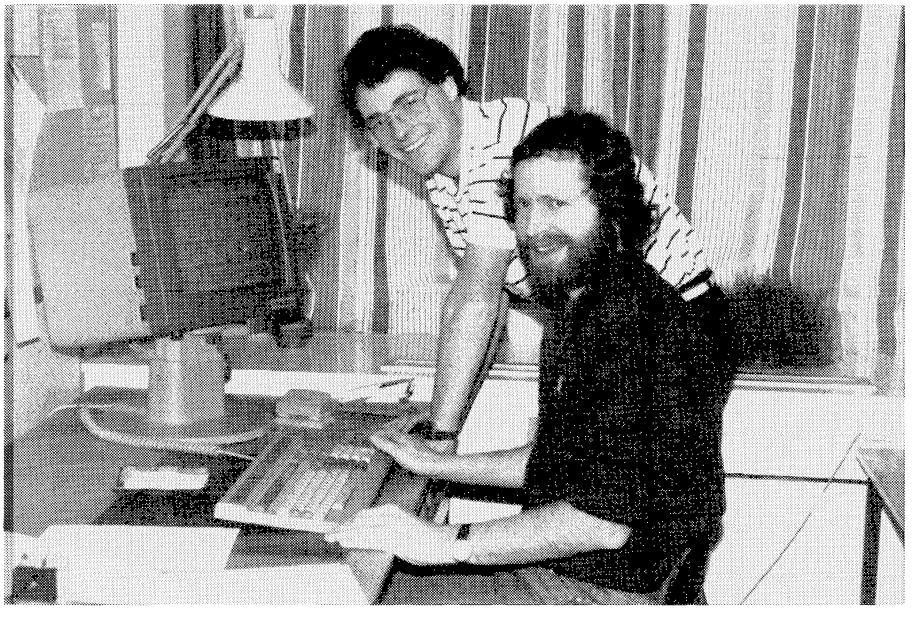
Studies of the interrelation between family structure and social change have been completed, and a survey to obtain data on the family situation of children when growing up has been carried out.

The population projection model has been used to study the effects of immigration on population develop-

ment. With the intention of improving mortality forecasting in the projection model, exploratory data analysis techniques have been used to fit age and period models to observed Norwegian mortality rates.

A preliminary version of a model for projecting the female population by the number of children has been completed, using stochastic micro simulation. This is the first step towards development of a model projecting families and households by type and size.

The Unit for Demographic Analysis monitors and analyzes current population trends and spreads information about this through articles, interviews and lectures, both in professional and general fora. The Unit also devotes considerable energy to organizing data files with longitudinal data on individuals and to informing users about these.



Øystein Kravdal and Svein Blom

DIVORCE TRENDS IN NORWAY

by Øystein Kravdal and Turid Noack

(Based on the publication "Divorces in Norway 1965–1985. A demographic analysis" Rapporter 88/6 (in Norwegian.)

The number of marriages terminated by a judicial divorce has escalated in Norway during the last two decades. Current age-specific divorce rates indicate that every third couple will experience a marital break-up. This proportion is not very high by European standards. For instance, our neighboring countries Denmark and Sweden have witness a much more dramatic change in the stability of formal family ties.

The objective of the analysis is to examine the current dissolution pattern from a demographic point of view. Attention is given to historical trends as well as sociodemographic divorce differentials. A longitudinal perspective is taken, as the divorce propensity for real marriage cohorts has not yet been explored in Norway.

This analysis is based on individual birth and marriage histories extracted from the Central Population Register of Norway and linked with socioeconomic characteristics collected in the Population Censuses 1960, 1970 and 1980. All Norwegian women born after 1935 are included in the data set, which makes it a fairly unique source of information. Unfortunately, informal cohabitation, which has become a progressively more common life-style for young Norwegians, is not registered.

The individual biographies are inspected in a life-table framework with multivariate hazard models. Assuming a piecewise constant baseline hazard, we have estimated the effects of several sociodemographic covariates on the divorce intensities.

17 per cent of the couples who entered a marital union in 1965 dissolved their marriage within 20 years. For this marriage cohort there was a sharp rise in the

divorce intensity during the initial 5 years of marriage, succeeded by a virtually constant level. Consequently, there is no evidence of a particularly critical stage of marriage. For younger cohorts, however, there appears to be a declining dissolution risk after about 5 years duration.

These intensity profiles seem to be very sensitive to the omission of unobserved variables. Using a so-called Heckman-Singer approach, the importance of including a control for unobserved heterogeneity in the models is assessed. The results suggest that the divorce propensity on the individual level increases steadily with duration, and that the observed levelling out or decline according to standard models, may primarily be caused by a selection mechanism.

In Norway, as in several other countries, there is a close correlation between age at marriage and marital stability. Women who marry when they are 20 years old experience a divorce propensity twice that of women marrying at age 25. A further postponement of marriage, however, seems to have a very small effect. It should also be emphasized that young brides have a higher divorce rate than other women not only during the first few years of marriage, but throughout their entire marital life course. Family size also seems to be a crucial determinant of divorce according to the estimated models. Women with two or more children have substantially lower divorce intensities than women who are childless. Furthermore, the presence of young children tends to depress the intensities. With respect to the direction of causality, we are left with a basic problem, however. We cannot find out whether the couple have few children because they have an unhappy marriage that is expected to break, or whether a small family simply makes divorce a less problematic alternative.

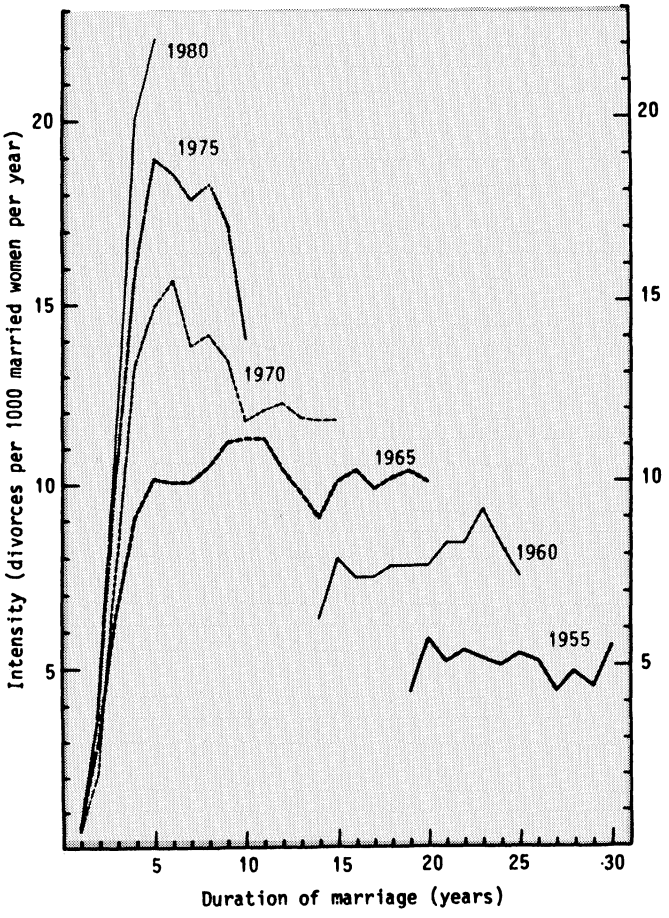
Timing of first birth relative to marriage is another factor that is closely associated with marital instability. The high propensity to divorce among women who have had a premarital birth is not confined to those who marry someone other than the father of their child. Also women who have had a premarital child with their husband, run a much higher risk of divorce marital breakup than those who had their first baby in wedlock. The relative difference between these two groups, which appears to be particularly large in the beginning of the marriage, has decreased during the last two decades.

UNIT FOR REGIONAL ANALYSIS

Regional analysis

The implementation of a new version of the REGION model was completed in 1988. This project has been carried out in collaboration with the Norwegian Institute for Urban and Regional Research. The revised REGION model contains an improved specification of income generation and household consumption compared to previous versions. The model has also been transferred to a new computer program (TROLL). A comprehensive description of the system of equations will be published in 1989.

Figure 6: Divorce intensities by marriage cohort[1]



[1] First and second marriage pooled together.

The unit has in 1988 paid some attention to the problem of obtaining suitable linkages between the REGION model and input-output models used on the county level. A Discussion Paper on this topic was written i collaboration with SINTEF at the Norwegian Institute of Technology. This work will continue in 1989.

A simplified version of the REGION model, called REGAN, was constructed in 1988 and used as a tool for labour demand projections by industry and county. These projections were published in a research report together with updated labour supply projections by county from the labour supply submodel in DRØM.

The results from this analysis, which covered the years 1986–2000, were highly demanded by the regional planning agencies. The macroeconomic framework was based on calculations carried out by an expert group appointed by the Ministry of Finance (the "Perspective-group").

A submodel in the DRØM system links migration between counties to regional labour market conditions. The migration submodel was reestimated in 1988 by using time-series data for the years 1972–1986. The labour market data have been constructed by processing figures from different sources of information. The migration study will be completed and the results published in 1989.

Eva Ivås, Knut Ø. Sørensen

Figure 7: Demographic models

BEFPROG:	Model for population projections by sex and age for the whole country.
BEFREG:	Model for population projections by sex, age and region (down to municipalities).
MAKE:	Model for population projections by sex, age and marital status for the whole country.
DRØM:	Model system consisting of interrelated models for analysis and prediction of labour market conditions in Norway's 19 counties and migration between these counties.
REGION:	Model for breaking down to the county level national projections of production and labour demand by industry. A central component in DRØM.

Research on Natural Resources

Lorents Lorentsen

UNIT FOR OIL and ENERGY ECONOMICS

Activities in 1988 and plans for 1989

The projects run by the Unit for oil and energy economics aim at analyzing the interactions between the energy markets and the Norwegian economy. A large part of the energy demand in Norway (for other than transportation purposes) is covered by electricity, based on hydro power. When planning the further expansion of the power system it is essential that these projections are consistent with the overall development of the economy. For several years, simulation studies on the macroeconomic model MSG-4 has comprised an important element in the planning process of the electricity sector in Norway. To maintain this model framework and to improve its functioning as a tool for the energy sector is an ongoing project in which the Unit of oil and energy takes an active part.

The report from The World Commission on Environment and Development, "Our Common Future", puts focus on the interchange between economic growth, energy use and environmental effects. In 1988, a macroeconomic study of energy use and environmental effects was carried out using the medium term macroeconomic model MODAG. A specific program for analyzing more long term interactions between the economy, energy and the environment will be initiated in 1989. A central part of this project will be to include a more comprehensive description of energy relations and environmental impacts in the MSG model.

A change in the electricity supply system, from being totally dominated by hydro power to a combined hydro power/gas power system, is close at hand in Norway. In addition to studies of macroeconomic effects of such a transition (see below) several aspects of uncertainty have been analyzed, in particular the implications of uncertainty in the gas price. The studies of the supply side in the electricity market will be carried further in 1989.

Energy accounts, covering the period back to 1976 are updated and published annually. The accounts display the energy flows in physical terms from extraction, via conversion to end uses in industries and households.

An econometric study on energy demand in households shows that fuel wood consumption is of considerable importance when estimating substitution responses in Norwegian households. To be able to analyze the energy demand in households in more detail, there is a need for data showing energy use for different end uses. Such data are not available today. A survey of energy demand in households is planned in 1989/1990, and further econometric studies will then be carried out.

The *petroleum economic research* studies in the unit consist partly of constructing separate simulation models for the international petroleum markets and partly by modifying and utilizing existing macroeconomic models in the Research Department in energy economic analysis. In 1988, the project of constructing a demand model for natural gas for Western Europe was completed. The model was utilized in a rather comprehensive study of the Western European gas market, analyzing specifically the effects of a deregulation of the transportation and distribution system the European market ("common carrier"). Model simulations have revealed that with the present organization of the market, transmission companies exploit significant monopoly power, and that there is scope for lower prices and increased consumption of gas in Western Europe.

The model for the international oil market, WOM, was in 1988 used to analyze the implications for the market development of different forms of cooperation between OPEC and other producers of crude oil. The

conclusion of this study was that Norway's self-imposed production cut-back of 7.5% may be a reasonable insurance premium to pay to avoid a further collapse in oil prices. The game theoretical studies of the oil market will be continued in 1989 in cooperation with Center for Applied Research. An interesting question which we will try to analyze is what will be the effects on the oil market if there are international agreements on restrictions on emissions from solid fuels.

The events in the oil market in recent years, with highly fluctuating prices, have clearly demonstrated the great *uncertainty* that prevails. Given the huge amounts of Norwegian exports, this uncertainty is passed over to the overall planning of the economy. The problem of how to adapt and adjust planning procedures to uncertainties in the petroleum markets has been faced and analyzed in separate projects. One application has been methods for evaluating petroleum projects under uncertainty. With the oil field Snorre as an example, it is stressed that under given assumptions one should wait for a higher price before undertaking an investment than in the case of certainty.

In 1989, one will seek to utilize the basic principles and methods for planning under uncertainty within a macroeconomic planning framework. This includes the wealth evaluation of the petroleum resources and how these should be exploited and allocated over time. Some attempts in this directions was made in 1988 related to the extensive work with long term perspectives for the Norwegian economy.

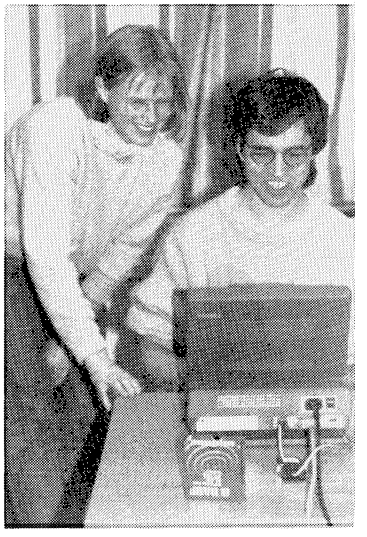
Another project for 1989 that will be given priority is a retrospective analysis of the Norwegian economy over the last 15 years. By model simulations, the actual effects of the oil and gas activities on the Norwegian economy will be analyzed, and alternative hypothetical paths for the economy will be traced out.

ELECTRICITY PRICES AND INVESTMENT DECISIONS IN A COMBINED HYDRO- AND GAS POWER SYSTEM

by Brita Bye and Asbjørn Aaheim

Non-developed resources available for hydro power production in Norway amount to about 1/5 of the present annual production potential of 105 TWh. An expected increase in the demand for electricity calls for alternatives to hydro power, which is the only supply source for electricity in Norway today.

Till 1986, the price of gas from Norwegian gas fields was too high to be competitive with hydro power as energy source for production of electricity. Declining gas prices has turned gas power to a favorable alternative to hydro power. Recently, petroleum reserves far away from the European market, but close to the Norwegian shore have been discovered. These fields contain mainly oil, but they will produce gas as a by-product. The gas, however, has no alternative value due to high costs of transportation to foreign markets. Neither can it be flared, due to Norwegian laws. This has created expectations of extremely low domestic gas prices.



Brita Bye and Asbjørn Aaheim

In Bye and Aaheim (1988), pricing and investment criteria in combined hydro- and gas power systems are discussed. Macroeconomic consequences of three alternatives for the supply of gas to Norway are analysed by CBS's macroeconomic model MODAG A. Environmental effects of gas power production are also surveyed.

Even though some gas may be delivered to the Norwegian market at very low costs, it does not necessarily imply low prices in an optimally dimensioned hydro power/gas power system. If gas is a competitive source of electricity production, the price of electricity will be determined by the marginal cost of gas extraction, not the average cost. Several of the planned hydro power projects are unprofitable if future electricity prices develop as assumed by the Norwegian energy planning authorities. In Bye and Aaheim (1988) it is assumed that at least these unprofitable projects will be replaced by gas power. This indicates a need for 11 TWh of gas power in year 2000, corresponding to approximately 2 billion cubic meters (bcm) of gas. Thus, an eventual reduction in electricity prices requires supply of more than 2 bcm gas per year. These additional quantities must be taken from fields with higher costs. The rising marginal cost of gas therefore puts a limit to a price reduction on electricity. With optimistic estimates on

the costs of gas production the price of electricity may be maximum 20–25 per cent lower than presently expected electricity prices by year 2000.

Compared with a case where all power development is covered by hydro power, the utilization of gas at low costs, means that less resources are needed to meet the domestic demand for electricity. These savings, mostly investments, may be employed for other purposes.

The amount of cost savings and the potential reduction in the electricity price are decisive for the macroeconomic effects of introducing gas power. Such effects are examined in 3 alternatives for future development for production and investments in the electricity sector, displayed in the table. In the reference alternative, future increase in production is covered with hydro power only. In the constant price alternative, gas power is introduced, but the price of electricity is constant at 24 øre/kWh in 1986-prices. In the low price alternative, gas power contributes to a large part of future development of power production, and the price of electricity is reduced to a minimum of 18 øre/kWh in 1986-prices. In the constant and low price alternatives it is assumed that those hydro power projects which can be developed without loss are developed.

In the constant price alternative the macroeconomic gains from production of low cost gas are limited. On the other hand, in the low price alternative the impacts on the overall economy are quite significant. The lower electricity prices result in higher private consumption and in a higher export surplus. The export surplus arises from lower domestic costs of production which causes substitution from imported goods to domestic products. The effects on exported products are small.

Gas power development cannot be considered without taking environmental effects into account. Emissions from gas power plants consist of nitrogen oxides (NOx) and carbon dioxide (CO_2). Emissions of NOx may be modified considerably by cleaning equipment. For CO_2, however, there are no available cleaning technology. In the low price alternative, emissions of CO_2 from gas power plants by year 2000 amount to 40 per cent of total CO_2-emissions in Norway in 1986. The increase may turn out to be unacceptable if Norway signs international agreements on reductions in these emissions.

Table 2: Macroeconomic effects by year 2000 with alternative developments of gas power. Constant 1986 prices.

Variable	Ref. alt.	Constant el. price	Low el. price
Assumptions:			
Annual investments			
power prod. bill. NOK	4.5	2.7	2.6
Hydro power	4.5	1.9	0.2
Gas power	—	0.8	2.3
Annual investments transmission,			
bill. NOK	3.1	3.1	4.1
Electricity price øre/KWh	24	24	18
Results:			
GNP, bill. NOK	641.9	641.9	650.6
Private consumption, bill. NOK	328.2	328.3	332.1
Export surplus, bill. NOK	21.1	21.3	25.6
Increase in electricity consumption			
1986–2000, TWh	25	25	42
Hydro power	25	14	8
Gas power	—	11	34

UNIT FOR ENVIRONMENT ECONOMICS

Data on — and analysis of — past and present emissions to air

In 1988 the national and regional (municipalities) emission accounts were enlarged and updated to include emission of carbon dioxide (CO_2) in addition to sulphur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic components (VOC), particulates and lead (Pb) for the year 1986. In addition to presenting emission accounts by economic sectors, the accounts are now also broken down by type of source of emissions. Work on national emission accounts for the greenhouse gases methane (CH_4), chlor fluor carbons (CFC) and dinitrogen monoxide (N_2O) has also been initiated. On a less detailed level historic emissions numbers for years back to 1960 were calculated for SO_2, NOx and CO_2.

Some transport related studies have been carried out. Among these are analysis of the effects on emission of changes in speed limits on highways, the effects of closure of several local rail roads, and a more general analysis of the pollution load from different modes of transportation.

Several types of damages from air pollution have been analyzed. The cost of SO_2-induced corrosion damages in the short and long term has been estimated, and additional GDP loss due to allocation effects of increased capital costs has been calculated. The relative importance of several different air pollution components on human health has been assessed.

The effects of a transition from the use of oil and coal to the use of natural gas in Europe on SO_2 emissions and deposition as well as emission of CO_2 has been estimated.

Future emissions to air

Forecasts based on revised emission coefficients for NOx emissions from transport activities has been published for the period through year 2000, together with a longer term perspective to the year 2025. The forecasts have been compared with aims for future emission levels derived from different sources and control policies to achieve these goals has been proposed. Effects of further control policies of emissions from automobiles have been assessed.

Possible effects of future SO_2-emissions on mortality in Norway has been estimated, and the long-term economic impact of sulphur induced corrosion damages studied.

Global emissions

The unit has been actively involved in the preparations of an international UN-project on modelling global economic development and its impact on natural resource extraction and the environment. The project is an effort in providing a consistent framework for discussions of issues raised by the World Commission on Environment and Development. This work will continue in 1989, and, providing the project work is started, the unit will actively participate in the construction of the model.

Future work

Further plans includes the construction of a model of the Norwegian economy integrating key resource and environmental factors. This work is to be carried out in collaboration with other units in the research department of the Central Bureau of Statistics, e.g. Unit for general equilibrium economics and Unit for petroleum and energy economics. The plans call for a pilot version of the model before the end of 1989.

Indirect use of energy and associated emissions to air in the Norwegian economy will be analyzed in 1989.

UNIT FOR ENVIRONMENT STATISTICS

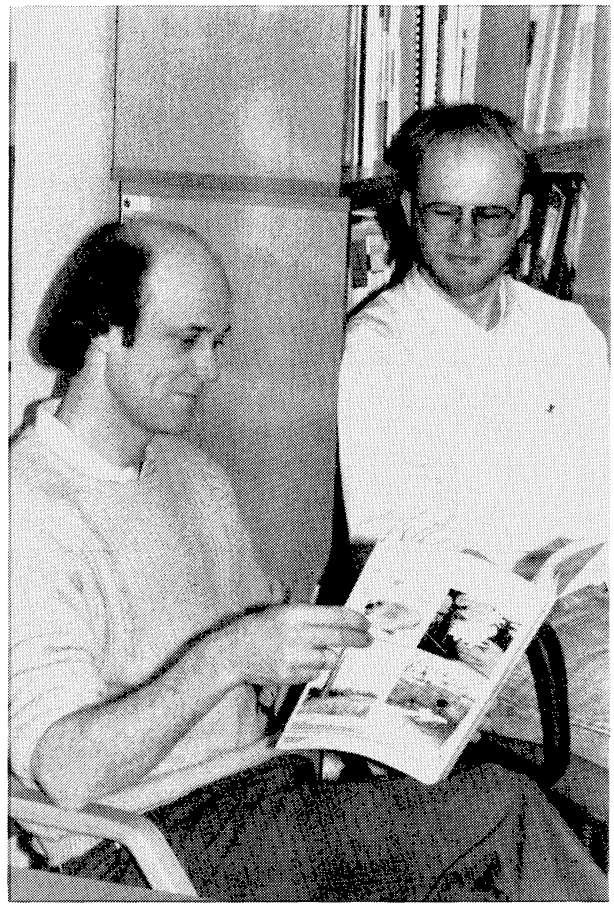
Environment statistics

Work in 1988 has been concentrated on the completion of the compendium "Environmental Statistics 1988". The compendium was published early January 1989. This publication presents a general view of natural resources and pollution in Norway and includes in addition studies on acidification, radioactivity, noise, global ozon depletion and the greenhouse effect. The compendium also contains information on local issues like municipal treatment plants for waste and waste water.

The unit has editorial responsibility for the annual publication "Natural Resources and the Environment", which presents updated natural resource accounts and research projects.

Participation in methodological work and data compilation for the OECD and ECE international environmental statistics, are also important parts of the unit's work.

In 1988 a new project on estimation of water pollution from agricultural activities was started. A model has been constructed to assess area-runoff of nitrogen and phosphorus and soil-erosion. The model is tested on two smaller areas. In 1989 attempts will be made to modify this model for larger regions.



Frode Brunvoll and Jon Åge Vestøl

Figure 8: Models on Natural resources

WOM	is a rather simple partial equilibrium model for the international crude oil market. Based on assumptions for economic growth, prices on other energy carriers, exchange rates and supply side factors the model projects the development of the crude oil price and the equilibrium demand.
GEMOD	is a model used for calculating the demand for natural gas in Western Europe. The model includes all the major gas consuming countries in the region and distinguishes in each country between four sectors (households, industries, the service sector and power generation). The gas demand in each market segment is calculated from assessments on gas — and competitive prices and income/production.

Appendix

List of Persons Employed in the Research Department in the CBS, 29 February, 1989

ASSISTANT DIRECTOR GENERAL

Bjerkholt, Olav

CENTRAL UNIT FOR ADMINISTRATION:

Angeland, Kirsti, Senior Clerk
Fjeldbo, Rita Elin, Senior Clerk
Holm, Elisa, Senior Clerk
Rambøl, Hanne, Executive Officer
Skoglund, Anne, Senior Clerk
Torgersen, Bente, Head of Administration

UNIT FOR MICRO-econometric RESEARCH:

Dagsvik, John, Senior Research Fellow
Klette, Tor J., Research Economist
Skjerpen, Terje, Research Economist
Wennemo, Tom, Senior Executive Officer
Aaberge, Rolf, Research Fellow
Aasness, Jørgen, Research Fellow

DIVISION FOR NATIONAL ACCOUNTS:

Fløttum, Erling Joar, Advising Officer

UNIT FOR NATIONAL ACCOUNTS COMPILATION:

Bakke, Nils, Research Economist
Brathaug, Ann Lisbeth, Research Economist
Fossum, Kari, Senior Executive Officer
Halvorsen, Tore, Planning Officer
Hansen, Stein, Executive Officer
Mæhle, Nils Øyvind, Research Economist
Røstadsand, Jon Ivar, Research Economist
Schancke, Per, Executive Officer
Skagseth, Per, Research Economist
Vørrang, Ingeborg, Clerk

UNIT FOR NATIONAL ACCOUNTS DATA:

Borgen, Ellen, Junior Executive Officer
Hallén, Randi, Senior Executive Officer
Hauger, Linn, Senior Clerk
Snesrud, Karin, Executive Officer
Strøm, Birger, Executive Officer
Tokle, Herbjørg, Junior Executive Officer
Tønjum, Pia, Junior Executive Officer

UNIT FOR NATIONAL ACCOUNTS METHODS:

Baarli, John, Research Economist
Hansen, Halvard, Research Economist
Harildstad, Anders, Planning Officer
Lea, Rolv, Research Economist
Røste, Ole Bjørn, Research Economist
Strøm, Birger, Executive Officer

DIVISJON FOR ECONOMIC RESEARCH:

Longva, Svein, Director of Research

UNIT FOR PUBLIC ECONOMICS AND LABOUR MARKET RESEARCH:

Andreassen, Leif, Research Economist
Fjærli, Erik, Research Economist
Fredriksen, Dennis Finn, Research Economist
Gabrielsen, Inger, Adviser
Hansen, André H., Senior Clerk
Hansen, Kirsten, Executive Officer
Koren, Charlotte, Research Fellow
Kornstad, Tom, Research Economist
Ljones, Olav, Senior Research Fellow
Moe, Ann Synnøve, Senior Clerk
Nygaard, Elizabeth, Research Economist
Aamdal, Kyrre, Research Economist

UNIT FOR ECONOMIC ANALYSIS:

Cappelen, Ådne, Director of Research
Drzwi, Wenche, Executive Officer
Eika, Torbjørn, Research Economist
Hansen, Lisbeth L., Executive Officer
Holm, Inger, Senior Executive Officer
Holst, Kari, Research Economist
Haakonsen, Laila, Junior Executive Officer
Johansen, Per Richard, Senior Planning Officer
Jore, Anne Sofie, Research Economist
Kristoffersen, Herbert, Research Economist
Lindquist, Kjersti-Gro, Research Economist
Magnussen, Knut, Research Economist
Melsom, Christine, Clerk
Moum, Knut, Research Fellow
Nordseth, Sverre, Planning Officer
Storm, Erik, Research Economist
Stølen, Nils M., Research Fellow
Svendsen, Ingvild, Research Economist

UNIT FOR GENERAL EQUILIBRIUM ECONOMICS:

Hobber, Berit, Executive Officer
Holmøy, Erling, Research Economist
Offerdal, Erik, Research Economist
Thonstad, Knut, Research Economist
Vennemo, Haakon, Research Economist

DIVISION FOR SOCIO-DEMOGRAPHIC RESEARCH:

Sevaldson, Per, Director of Research

UNIT FOR DEMOGRAPHIC ANALYSIS:

Blom, Svein, Research Demographer
Brunborg, Helge, Senior Research Fellow
Hansen, Liv, Executive Officer
Kravdal, Øystein, Research Demographer
Leon de, José Goméz, Senior Research Fellow
Moen, Bjørg, Research Fellow
Noack, Turid, Research Fellow
Texmon, Inger, Research Demographer
Østby, Lars, Senior Research Fellow

UNIT FOR REGIONAL ANALYSIS:

Ivås, Eva, Executive Officer
Skoglund, Tor, Research Fellow
Stambøl, Lasse S., Research Demographer
Sørensen, Knut Ø., Research Fellow

DIVISION FOR RESEARCH ON NATURAL RESOURCES:

Lorentsen, Lorents, Director of Research

UNIT FOR OIL AND ENERGY ECONOMICS:

Aslaksen, Iulie, Research Economist
Berger, Kjell Steinar, Research Economist
Brekke, Kjell Arne, Research Economist
Bye, Brita, Research Economist
Bye, Torstein, Research Fellow
Gjelsvik, Eystein, Research Economist
Høgset, Lisbet, Junior Executive Officer
Johnsen, Tor Arnt, Research Economist
Lysell, Kari Anne, Clerk
Mysen, Hans Terje, research Economist
Olsen, Øystein, Senior Research Fellow
Sandmo, Trond, Executive Officer
Aaheim, Asbjørn, Research Fellow

UNIT FOR ENVIRONMENT ECONOMICS:

Alfsen, Knut H., Senior Research Fellow
Andersen, Kirsten, Senior Clerk
Brendemoen, Anne, Research Economist
Fuglestvedt, Jan, research Economist
Glomsrød, Solveig, Research Economist
Johnsen, Torgeir, Research Economist
Strandli, Anne, Junior Executive Officer
Stoltenberg, Jens, Research Economist

UNIT FOR ENVIRONMENT STATISTICS:

Brunvoll, Frode, Senior Executive Officer
Vestøl, Jon Åge, Senior Executive Officer

Publications Issued in 1988

SOS = Norway's Official Statistics
SØS = Sosiale og Økonomiske Studier (SOCIAL AND ECONOMIC STUDIES)
RAPP = Rapporter (REPORTS)
REPRINT = Reprint series
IN = Interne notater (INTERNAL DOCUMENTATION)
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UNIT FOR DEMOGRAPHIC ANALYSIS

Published in 1988

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1. Aaberge, R., Ø. Kravdal and T. Wennemo: *Unobserved heterogeneity in models of marriage dissolution.* Discussion Paper 42, SSB.
2. Bendvold E., I. Skjæråsen, N. Moe, D. Sjøberg and Ø. Kravdal: *Marital break-up amongst couples raising families by artificial insemination by donor.* To appear in Fertility and Sterility.
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9. Noack, Turid: *Den norske familien i endring — en demografisk oversikt.* "The Norwegian family. A short demographic description of postwar trends". In Norwegian. Paper presented at a seminar of the Norwegian Sociological Association, Beito, January 1989.
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12. Østby, Lars: *Stadig færre unge til å forsørge stadig flere gamle. Befolkningsutviklingen fram mot år 2050.* Decreasing number of young people to support an increasing number of old people? In Norwegian. Bakgrunnsmateriale for innlegg på møte mellom Stortingets sosialkomite og trygdeforskere 25. januar 1989.
13. Østby, Lars: *Migration in a Life Cycle Perspective. Project proposal based on individual data from the Norwegian Population Register.* Paper presented at the International Migration Seminar, GHavle 30–31 January 1989.

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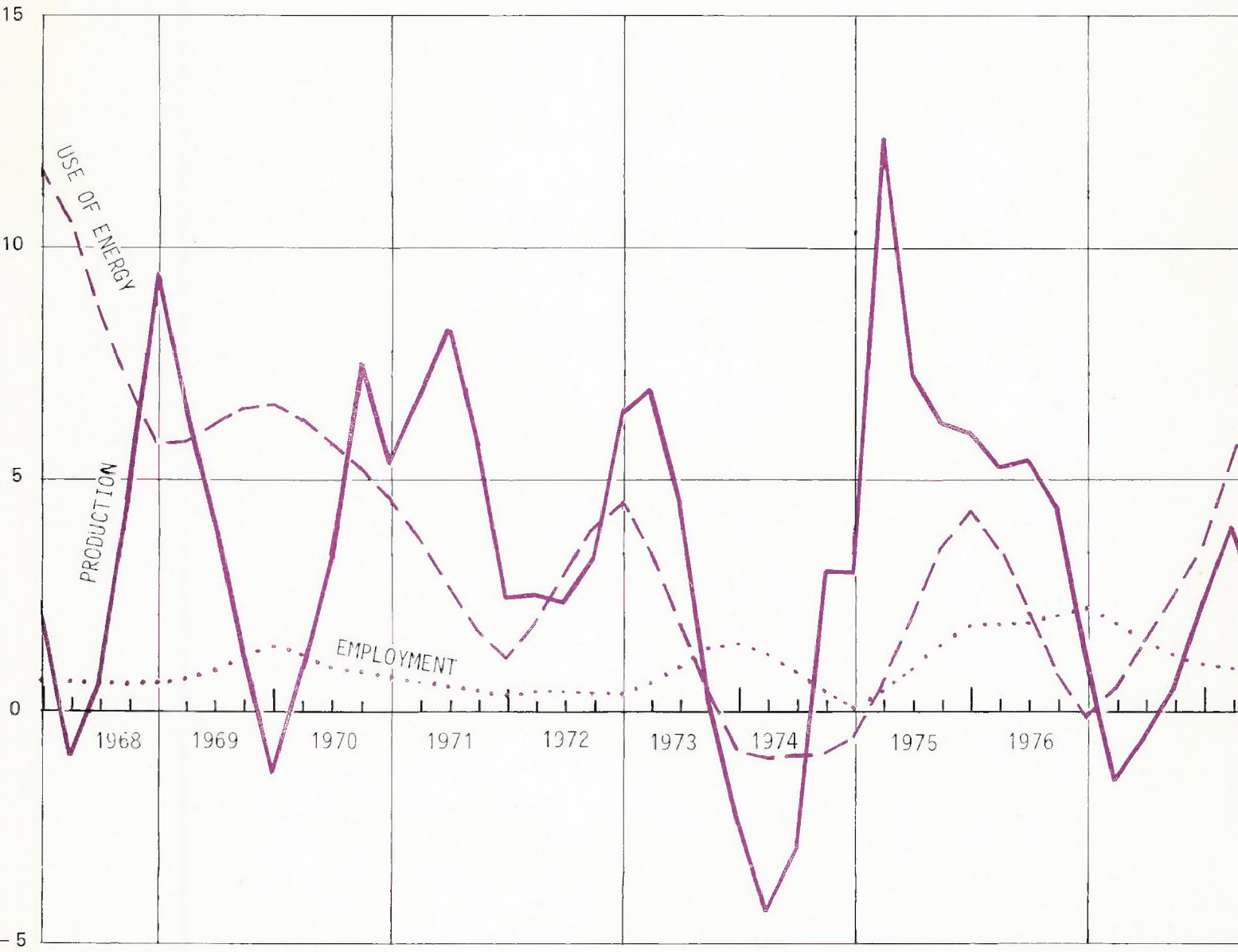

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