ANNUAL REPORT
1987

Annual Report 1987

The Research Department,
The Central Bureau of Statistics, Norway

Contents

That Was The Year That Was!

by Olav Bjerkholt

"In 1987 Norway once again spent far more than the nation produced. The balance of payments deficit amounted to 28 billion NOK (about 4 billion USD), despite a decline in private consumption and investment and substantial growth in exports. Prices and wages continued to rise faster than in competing countries, and we splurged needlessly by granting ourselves a shorter work week. For better or worse, the Norwegian economy took its own course in 1987." This quote from the Bureau's Economic Survey 1987 published earlier this year sets the tone for the current evaluation of the state of the Norwegian economy. The imbalances developed in the Norwegian economy in the years of high oil and gas revenues will require more than one year to put right. It is argued in the Survey that even if oil and gas revenues had been as large as in 1985, the current account for 1987 would barely have balanced. This indicates that the Norwegian economy was moving off track even before the drop in oil prices.

Norway has grown rich from harvesting natural resources. In succession these have been timber, fishing, whaling, hydro power and, finally, crude oil and natural gas. With proper management this exceptionally rich endowment of natural resources for a small nation will for years to come provide Norwegians with rental income of considerable proportions. But it seems less likely that it will contribute to the growth of GDP as it has done in the most expansive periods of Norwegian economic history. Even population — the ultimate natural resource — is stagnating. Future growth must to a greater extent come from better use of available resources.

For Research Department policy the reassessment of the perspectives of the Norwegian economy underlines the importance of current research priorities. The sluggish reaction of the domestic economy in adjusting to new conditions emphasizes the need for more intensive studies of the behaviour of households, firms and government agencies. This requires improved availability and quality of data for econometric analysis. The main improvements in the quality of macroeconomic modelling will most likely come from better use of microeconometric information. The distrust in conventional macroeconomic models which has been voiced in many countries should be countered in this way, rather than by dropping the models in favour of "scenario techniques" or other panaceas based on less rather than more insights into the workings of a modern economy.

The major policy choices in the long-term management of the economy will more than ever be felt to depend upon uncertain factors many of which the national government have little influence over. Rather than presenting the policy makers and politicians with a menu of possibilities in the form of forecasts under different assumptions of economic policy, the challenge for model builders and forecasters should be to present the strategic choices in a dynamic programming context. This is certainly more easier said than done, but it should be a goal to cast the current tools of analysis in a form which emphasizes that the best that we can do is to use the information available now in the best possible way rather than working out what we should have done had we known more than we possibly could have!

One event in 1987 illustrates this point in a poignant way. In April last year the UN World Commission on Environment and Development published its report. Its analyses of requirements needed to save the world from environmental disaster introduces a time perspective and attention paid to unknown factors of a degree far beyond a normal long-term economic exercise. The essence of the Commission's report may be summarized as arguing that the option value of preserving the environment is far greater than the value imputed to it by the current international economic system. Due to the fact that the Norwegian Prime Minister chaired the Commission the report has received more publicity in Norway than in most other countries and the Norwegian government has set itself the task of promoting its recommendations both at home and in the international community. If words shall become deeds, this will be a challenge of unusual proportions both for research communities and governments towards which we would like to contribute.

The Research Department of 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.

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. 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. 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.

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.

So far the 1980s 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.

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, land use accounts, environmental studies
- Petroleum economics
- Regional demographic and geographical analysis

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.

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.

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

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*) in 10 volumes a year. The first volume of each year presents an economic review of the past year and is also available in English. Other issues contain surveys both of Norwegian and international economic developments, quarterly and annual Norwegian national accounts figures with comments, and short articles presenting results from ongoing research projects.

Organization

A reorganization of the Research Department was completed during 1987. This new model of organization in-

tends to strengthen the professional development and rationalize the administrative functions.

The Research Department is divided into 4 divisions:

Division for National Accounts
Division for Economic Research
Division for Socio-Demographic Research
Division for Research of 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 Department.

Group for Administration.

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.

Figure 1: Organization and Management of the Research Department, 1 January, 1988
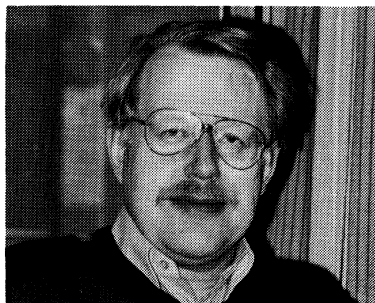
ASSISTANT DIRECTOR GENERAL
Olav Bjerkholt

CENTRAL UNIT FOR ADMINISTRATION:
Bente Torgersen

UNIT FOR MICRO-ECONOMETRIC RESEARCH:
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DIVISION FOR
NATIONAL ACCOUNTS
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Unit for National Accounts Compilation: Tore Halvorsen
Unit for National Accounts Methods: Anders Harildstad
Unit for National Accounts Data: Randi Hallén

DIVISION FOR
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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
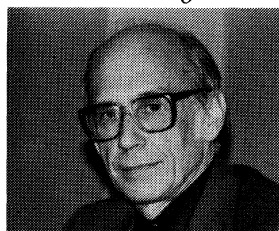
DIVISION FOR SOCIO-
DEMOGRAPHIC RESEARCH
Per Sevaldson

Unit for Demographic Analysis: Lars Østby
Unit for Regional Analysis: Tor Skoglund

DIVISION FOR RESEARCH
OF NATURAL RESOURCES
Lorents Lorentsen

Unit for Energy Economics: Asbjørn Aaheim
Unit for Environment Economics: Knut H. Alfsen
Unit for Land Use Accounts: Øystein Engebretsen
Unit for Environment Statistics: Torbjørn Østdahl
Unit for Petroleum Economics: Øystein Olsen

National Accounts

Tore Halvorsen, Ingeborg Vørrang and Erling Joar Fløttum

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 1987 and plans for 1988

During 1987 efforts have been made towards further development and improvement of the quality of the Norwegian national accounts, — such as improvement of methods applied in the accounting system and the use of technical means or routines of production.

Work accomplished in 1987 will result in finalizing some large projects during 1988, such as to publish

figures on employment accounts for the period 1962–1985, 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 subsequent to the integration of the income and outlay accounts with the regular publishing of the national accounts some years ago.

In 1987, county specified figures on national accounts for 1983 were published in the NOS and in 1988 the Division plans to publish input-output figures for single years.

However, the most extensive project during 1988 will be to alter the national accounts system itself. Improved quarterly accounts will 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 will provide 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 possibly other changes of considerable input — and at the same time indicating an increased effort towards a revision of the national accounts in itself in the early 1990s.

National accounts by county

Since the National Accounts by County were made for the first time for the year 1965, they have been improved and developed, although prepared in much the same way. Such regional accounts have been published for the years 1965, 1973, 1976, 1980 and 1983, for the latter year issued in 1987.

The regional accounts are compiled using National Accounts and regional data. The national figures are broken down using different regional data sources. Detailed estimates are worked out for about 300 commodities and 200 production sectors. In each production sector, the accounts provide information about production, intermediate consumption and value added. Value added has been further sub-divided into compensation of employees, indirect taxes, subsidies, consumption of fixed capital and operating surplus. The accounts also provide estimates for gross capital

formation and for private and government final consumption expenditure.

In the course of these years the accounts have been used increasingly often for economic analysis and planning. Regional input-output models are now used in approximately 10 counties and National Accounts by County provide the main input in the REGION model, this being the multiregional economic model developed and used by the Central Bureau of Statistics.

Regional economic growth 1973–1983

The general impression of the regional growth of the gross domestic product is that the difference in development between counties has been relatively small. In most counties the growth has been close to the average for the country. However, there are two counties, Akershus and Rogaland, in which the growth has been well above the average, and to a less degree also in Troms. The rapid growth in Akershus has its main explanation in an enormous growth in services, and it comes at the same time as the growth in Oslo has been well below average. As Oslo is situated in the center of Akershus, but is a separate county, it seems as if the growth in the capital-area has taken part outside the narrow city limits. The growth in Rogaland is clearly connected with the growth in the oil sector that has mainly been taking place in this part of Norway. Most of the counties with modest growth are situated in the south-eastern part of the country, most marked among these being Vestfold.

The manufacturing sector has grown most rapidly in the counties in the western part of Norway, the main explanation for this being that this part of Norway has had the largest deliveries to the oil sector. Rogaland has together with Akershus increased most in services.

General government expanded most considerably between 1973 and 1983, counting for over 80 per cent of the increased employment in the country. Our figures show that most counties have taken part in this growth, and that the growth has been decentralised. This appears from the fact that lowest growth took place in the counties of the 3 largest cities.

One general impression of this period is that the development in counties was relatively well balanced. This was not the case for the 1960s, a period in which there was a centralised development. We also have clear indications that there has been a centralised development in recent years.

Table 1: Regional economic growth 1973–1983. National average = 100. Total and some selected sectors![1]

County	Gross domestic product			
	Total	Manufacturing	Services[2]	General government
Østfold	94	75	117	107
Akershus	137	112	182	101
Oslo	89	89	84	78
Hedmark	96	92	89	113
Oppland	93	77	90	111
Buskerud	93	113	97	110
Vestfold	80	53	89	107
Telemark	96	112	100	111
Aust-Agder	108	123	84	108
Vest-Agder	104	162	94	99
Rogaland	128	131	144	111
Hordaland	97	104	90	96
Sogn og Fjordane	102	139	102	130
Møre og Romsdal	103	102	115	112
Sør-Trøndelag	97	77	92	89
Nord-Trøndelag	102	114	100	126
Nordland	93	80	80	109
Troms	116	164	113	120
Finnmark	102	116	95	120
Norway	100	100	100	100

[1] Not including undistributed activities
[2] Non-government services defined by ISIC 6–9

Source: National Accounts by County 1973 and 1983

Economic Research

UNIT FOR PUBLIC ECONOMICS AND LABOUR MARKET RESEARCH
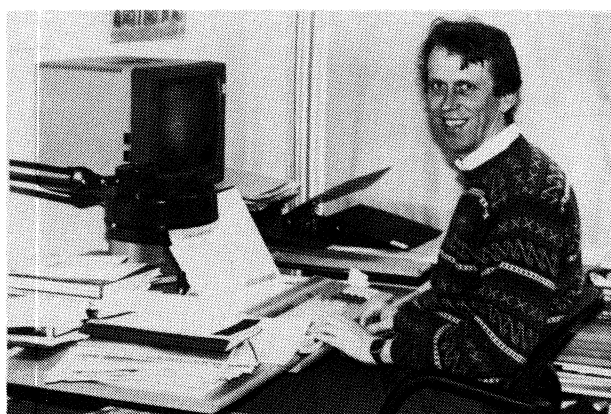
Olav Ljones

Tax research

For 1987 a new "gross-tax" element was introduced in the personal tax system, and accordingly, analysis of the effects of the proposed changes were given priority. The annual publications of tax figures and taxes and transfers to private consumers were updated. Work on distribution analyses both by the further development of the microsimulation model LOTTE and other household based models was continued in 1987. In 1988 the model for pensions will be revised.

Employment and education

The model for projecting labour supply, MATAUK, has been updated to 1986 and new results were published.

A programme analysing the patterns of choice of educational activity and transfer to the labour market was started in 1986 and continued in 1987. Some preliminary results were presented at a conference in Finland.

The work with micro-econometric studies of labour force participation and working hours was continued. Decisive for labour market participation in this model are i.a. tax structure, wage levels and income of spouses. During 1987 the model has been estimated on Swedish data and we have started a project based on data from Finland. We have also started a project about the equality between sexes, where the model will be used in an analysis of the work division between spouses.

Labour force projections

Labour force projections for Norway are made through the use of a simple trend model, MATAUK. It is primarily a demographic model which does not take into consideration the effects of economic variables on labour market participation. Using population projections made by the model BEFREG and extrapolating present participation rates, the model calculates the consequences for the labour force of a changing population. By extrapolating present trends for average hours worked, the model also projects the number of hours offered by the labour force per week. The extrapolations are based on the period 1976–1986.

By the year 2025 the number of persons in the labour force will have increased by 247000, from 2.1 million in 1986 to just under 2.3 million in 2025. The labour force will peak in 2012 at about 2.4 million persons, 15 per cent larger than today. The total number of hours offered per week will have increased by 14 per cent in 2025. Hours offered will also peak in 2012, 18 per cent higher than in 1986. The numbers are calculated for the age interval 16 to 74 years of age.

The model's strength is that it splits the population into fairly small segments (560 groups) according to age, sex, education, and marital status (only for women). By estimating participation rates and average hours worked for each group, this disaggregation makes it possible not only to take into account the consequences of a change in the size of the population, but also of the changes in it's composition. For example in the year 2000 the population between 16 and 74 years of age will have grown by about 4 per cent while the labour force will have grown by 13 per cent. Most of this difference can be ascribed to the changing composition of the population.

Further development of the model, incorporating econometric estimates of the supply functions for the various groups of persons, will be completed in 1989 and new projections will be made.

Table 2: Labour force and man hours. Labour force participation rates. 1986–2025

Year	Labour Force 1,000,000 persons			Weekly Man Hours Offered 1,000,000 man-hours			Labour Force Participation Rates Per cent		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1986	2.11	1.17	0.94	68.5	43.8	24.6	70.1	77.7	62.4
1987	2.14	1.18	0.96	69.3	44.1	25.2	70.6	77.7	63.5
1988	2.17	1.19	0.98	70.2	44.4	25.8	71.1	77.8	64.5
1989	2.19	1.19	1.00	71.0	44.7	26.3	71.7	77.9	65.4
1990	2.22	1.20	1.02	71.8	45.0	26.8	72.1	78.0	66.2
1995	2.31	1.24	1.08	75.0	46.4	28.6	74.5	79.4	69.6
2000	2.38	1.27	1.12	77.2	47.5	29.7	76.3	80.6	72.0
2005	2.44	1.29	1.15	78.7	48.3	30.4	76.9	80.8	73.0
2010	2.47	1.30	1.17	79.1	48.4	30.8	76.2	79.8	72.7
2015	2.46	1.29	1.17	78.6	47.9	30.8	75.0	78.4	71.5
2020	2.42	1.27	1.16	77.5	47.1	30.4	74.4	77.8	71.1
2025	2.37	1.24	1.13	75.7	45.9	29.8	74.3	77.6	71.1

Leif Andreassen

UNIT FOR ECONOMIC ANALYSIS

Ådne Cappelen and Svein Longva

Photographer: Thomas Olsen

Macroeconomic models

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. The model was updated in 1987 and a new set of impact tables were produced. A new aggregated version called MODIS V was established and will replace MODIS IV during 1988. Except for the level of aggregation (appr. 50 commodities compared to appr. 200) the new version will be 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 1987. The main research activities in 1987 centered around financial modelling and modelling of the labour market. In 1988 more emphasis will be given to modelling of 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. In addition we have carried out in-sample, post-sample and stochastic simulations in order to better understand the properties of the model. 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 Survey* (only the annual survey is 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 two years ahead based on the model.

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

Wage and price forecasts using KVARTS

The development of wages and prices in Norway during 1986 and 1987 was influenced heavily by the devaluation in May 1986, the shortening of normal working hours by January 1987 and the general boom in economic activity. As a consequence, consumer prices in Norway have increased more than twice as fast as the OECD average during the last two years. An important question facing policy-makers is then: will consumer prices and wages increase less in 1988 and

Per Richard Johansen, Wenche Drzwi and Lisbeth Lerskau Hansen

1989 and more in line with the OECD average? This has been an important subject for analysis during 1987.

Firstly, when studying short-run changes in wages it is of interest to distinguish between centrally negotiated wages and wage drift. Figure 2 shows a decomposition of wage growth in manufacturing using quarterly data from 1969 to 1986.

An econometric study based on a traditional expectation augmented Phillips-curve gives the following main conclusions regarding wage developments

- Wage drift seems to be largely unaffected both by centrally negotiated wage increases and labour market conditions. Thus labour productivity and import prices are the main factors influencing wage drift.

- Centrally negotiated wage increases on the other hand are heavily affected by labour market conditions (in particular when unemployment is low as was the case both in 1986 and 1987) in addition to growth in productivity and import prices. In 1987 wage growth per hour also increased due to lower normal working hours.

According to this model which is part of the quarterly model KVARTS, we should see a decline in the growth rate of hourly wage rates from 1987 to 1988 if there is no further devaluations. In addition, a less heated labour market should have an impact on wage growth by the end of 1988 and in 1989 in particular. Fairly long lags for the impact of import prices on wage growth implies only a gradual moderation in wage growth during 1988 and 1989. The forecast indicate a decline in wage

growth to 5 pct by 1989 given an increase in import prices of traditional goods of less than 3.5 pct in 1988 and 1989 consistent with an inflation rate in OECD of 5 pct. The rate of inflation in Norway will then decline from 8.7 pct. in 1987 to 5.5–6 pct. in 1988 and 4–4.5 pct in 1989.

Figure 2: Wage growth in manufacturing.

[1] Inclusive separate low-income wage increases in pct. of wage level previous year.

The KVARTS model is a disaggregated non-linear model of the Norwegian economy. It is well known that in such models a consistent predictor can only be calculated using stochastic simulations.

Such simulations were carried out on the model, but limited to the error terms in the wage and price equations only. It turned out that our point forecasts for 1988

and 1989 were little affected by the non-linear character of the model. As an indication of the reliability of

the point forecast, we calculated the standard deviation which turned out to be around half a percentage point for the private consumption deflator. Thus the error terms in the wage and price equations alone indicates that the degree of precision even for short term forecasting is limited given that to compute a complete "confidence" interval we would have had to take into account the stochastic properties of other error terms, parameter estimates and the process generating exogenous variables in the model.

UNIT FOR GENERAL EQUILIBRIUM ECONOMICS

The unit is responsible for keeping the general equilibrium model MSG-4 and the postmodel for financial flows and stocks, MINK, operative. Additionally the unit undertakes further developments of the MSG-model, and applications of general equilibrium models for analysing problems connected to inefficient allocation of the resources of the economy.

In 1987 MSG-4 was updated to a new base-year, 1985, and the model was used rather intensively by the so-called "Perspective-group" appointed by the government. The model is now thoroughly documented both with respect to the system of equations and the procedures for updating the model to a new base-year. The unit has supported the "Perspective-group" with interpretations of the MSG-calculations, and this work has given useful insight in several topics. Particularly it has been clarified that the cost functions have properties which are very unsatisfactory when the simulations result in changes in the relative prices that are "too large". Another problem, which is rather serious in view of the long simulation period chosen by the *Perspective-group*, is that the user of the model has nothing but his own common sense considerations for determining a "reasonable" time-path for the two important stock variables, real capital and foreign liabilities.

The development of a new generation of applied general equilibrium models, as an alternative to MSG, has been undertaken by means of a program in TROLL

which aggregate MSG-4 to a level chosen by the user. The classification of commodities, sectors and activities can then be adapted to the specific problems one wants to analyse. The work in the unit has been concentrated towards finding ways to determine the export and import flows endogenously, and has been done in cooperation with SAF/Bergen. A MSG-model based on the Armington specification has been implemented and a report presenting the empirical characteristics of this model is forthcoming. Further, a model built on the assumptions in the Hecksher-Ohlin-model as to the adjustments carried out in the long run in a small, open economy, has been simulated by use of the software package COMPAC. A model describing the dynamic process through a sequence of temporary equilibria, each one characterised by immobile sectoral capital, finally reaching an equilibrium where the total capital stock is allocated as if it was perfectly mobile, is also under implementation. A documentation of the different specifications of the foreign sector in general equilibrium models will be finished within the first half year of 1988. In addition some work was also dealing with making a small, highly aggregated intertemporal optimisation model of the Norwegian economy. The purpose of this project was that the optimal time-paths for accumulation of capital and foreign liabilities could be used as inputs in more disaggregated equilibrium model of the MSG type. The unit intends to do some further research on this topic in 1988.

The most frequent and important applications of numerical equilibrium models have been the construction of long-term projections and normative studies of the impact of taxes and subsidies on the allocation of the economy's resources. The first mentioned topic has traditionally been studied by use of the MSG-model. It is well known that an important determinant of long-term growth paths is increasing total factor productivity (TFP). The unit is running a project on the sources to TFP-growth, in particular the relationship between TFP and research and development. However the second topic, normative tax studies, is given highest priority in 1988. Two projects were started in 1987, and will continue in 1988: The welfare effects of (a) public transfers to the agricultural sector and (b) subsidies on electricity used in the manufacture of metal products.

Socio-Demographic Research

Inger Texmon, Turid Noack and Per Sevaldson

Population research

The year 1987 has, to a large extent, been devoted to studies of fertility and the family, and to updating the population projections. At present, a data file containing individual life histories for men — derived from the Central Population Register — has just been established, and the first results documenting male reproductive behaviour have been published. Register data have also been utilized in a study of current divorce trends. The first stage of this study is now completed, and a second stage, where socio-economic variables from the population censuses are included, has begun.

Preparations for the 1988 survey on fertility and cohabitation have continued during 1987, including a test of the questionnaire on a small sample of men and women.

Analysis of the trends in cohabitation, family and household patterns has continued. The results so far obtained will be utilized in a study of children's family experience, which will be initiated in 1988.

The internal migration patterns as well as the amount of net immigration has changed considerably since the previous regional population projections were published in 1985. Therefore, the group has made a new set of projections based on the population present at the beginning of 1987.

The new population projections intend also to satisfy the demand of local and national level planners for population information essential to the decision making involved in their planning. In the recent past the demand for such kind of information reached a level that we thought — in conjunction with other considerations — merited producing a new set of population projections. These were produced in December 1987.

New population projections: 1987–2050

The new set of population projections consists of a slightly revised version of previous projections (produced in 1985) improved in accordance with new available evidence documenting the development of population trends in Norway. The basic assumptions used in the computations are the following: (a) fertility was held constant at roughly its present level, a Total Fertility Rate (TFR) of 1.7 children per women; (b) mortality was assumed to decline according to the trend defined by its gradual change during the last ten years; (c) net international migration assumed three alternatives: a null balance, 5000 net immigrants per year, and 10000 net immigrants per year (close to the observed 1986–1987 average). Figure 3 shows the resulting projected population under these alternatives (except for the null net migration alternative). For comparative purposes, also included in Figure 3 are some of the alternatives of the previous 1985-projection. The assumptions retained in the 1987 projections overrun the previous assumptions as they include the demographic evidence available up to the end of 1987, and their corresponding modification of the hypothesized trends.

Several points are noteworthy. Irrespectively of the migration alternative (+5000 or + :0 000), it is evident that, under the retained assumptions, the population will start to decline in absolute numbers at some point in time around 2025. Under the high immigration hypothesis the population will reach a peak of about 4.75 millions in 2029 and then decrease slowly afterwards. Under the medium immigration hypothesis a peak of about 4.47 millions will be reached in 2023, followed by a gradual decrease afterwards. The inertia in the number of births (which explains why the population will continue to increase even with below replacement fertility) is due to the current age composition of the population. Once the relatively large cohorts of women born before 1972 pass through their prime reproductive ages, the subsequent less numerous cohorts will conceive (with a fixed propensity of 1.7 children per women) an increasingly reduced number of children. In the absence of net immigration, the population will start declining by the year 2006. Assuming 5000 net immigrants per year, the total population in 2050 will be of about the same size as in 1987. Finally, assuming 10000 net immigrants per year, the total population in 2050 will be 10 percent higher than in 1987.

The projected age composition of the population is relatively insensitive to the different migration assumptions. The number of persons in economically active ages (20–66) will gradually increase until about 2010, when the swollen cohorts of the mid-forties will reach retirement age. Thereafter, the number of persons over 66 (retired pensioners) will increase at about 2 percent per year, together with a declining number of persons in the working ages. For instance, if today for every person over 66 there are 4.25 persons aged 20 to 66, in 2050 the same ratio is expected to be of only 3 persons. At the extreme old ages, the proportion of persons over 80 will increase from 3.5 percent in 1987 to 6.5 in 2050.

The regional distribution of the population was projected using the tendencies reflected in the 1983–86 internal migration rates. According to this assumption, the percentage of the population living in the counties of Oslo and Akershus will increase from 20.4 in 1986 to 21.5 in 2000, and to 22.2 in 2015. In turn, the proportion of the population living in northern Norway (in the counties of Nordland, Troms, and Finnmark) will decrease from 11.1 percent in 1986 to 10.2 in 2000, and to 9.7 in 2015. In general, the rest of the counties will have only small changes in their relative share of the population. The only minor exception to this pattern is the county of Rogaland that will experience a relative increase from 7.8 percent in 1986 to 8.9 in 2015. The higher immigration from abroad, the higher will the percentage of population living in the most central areas be.

Figure 3: The population of Norway, observed 1960–1986, projected 1987–2050
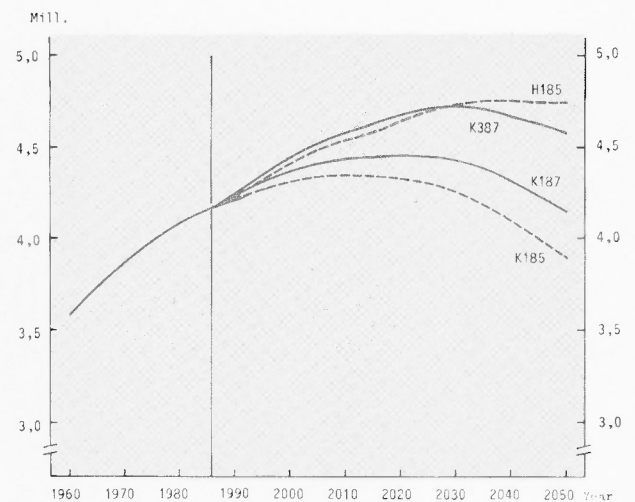
H185 Net immigration 4000, Total fertility rate 1.7–2.0 (increasing 1985–2000), then constant)

K185 Net immigration, 4000, Total fertility rate 1.7 (constant)

K387 Net immigration 10000, Total fertility rate 1.7 (constant)

K187 Net immigration 5000, Total fertility rate 1.7 (constant)

UNIT FOR REGIONAL ANALYSIS

Regional analysis

The models REGION and DRØM are central in our re-
gional research. REGION models the distribution of
economic by county activities and DRØM the popu-
lation distribution and labour supply.

An outline of the models was published in 1987.
The report also contains a review of the research ac-
tivity related to these models in the last decade and
a discussion of the models compared to multiregional
economic-demographic models in other countries.

A major part of the research resources in 1987 was
allocated to the implementation of a new version of
the REGION model. This project has been carried out
in collaboration with the Norwegian Institute for Ur-
ban and Regional Research. The revised model is esti-
mated by processing data from the National Accounts
according to County, 1983, which were published in
1987. The processing includes estimating trade flows
between counties and estimating employment figures
by county. The revised REGION model contains an im-
proved specification of household consumption com-
pared to previous versions. The model has also been

transferred to a new computer program (TROLL).

Work on the labour supply submodel in DRØM con-
tinued in 1987. A report which contains a comprehen-
sive description of the submodel and a set of county
projections was published in 1987.

Another submodel in the DRØM system links migra-
tion between counties to regional labour market con-
ditions. The migration submodel has previously been
estimated by using time-series data for the years 1967–
79. After a period with little activity, efforts have been
made to revitalize this research area in 1987. An im-
portant task is to extend the analysis with data for the
1980s.

A report which gives an outline of the main trends
in the economic and demographic development in the
counties during the last 20–25 years was completed in
1987. The report was published early in 1988.

In 1988 increased emphasis will be given to the use
of the REGION and DRØM models in regional analysis
and planning. Updated economic and labour market
projections according to counties are highly demanded
by the Ministry of Environment and other governmen-
tal agencies. The 1988 plans also comprise the com-
pletion of the migration study. Minor projects aiming
at improving various parts of the models will be started
as soon as the necessary resources are available.

Lasse Stambøl, Tor Skoglund and Knut S. Sørensen

Research of Natural Resources
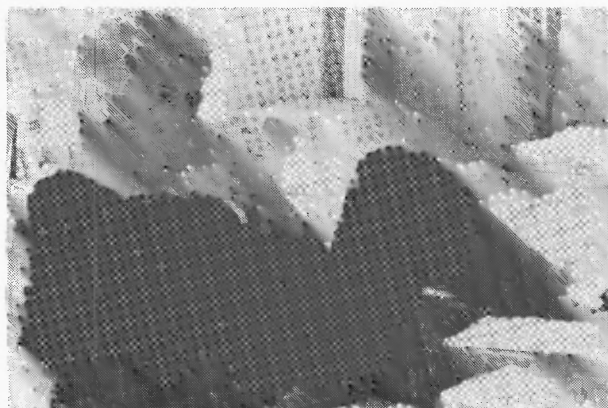
Lorents Lorentsen

UNIT FOR ENERGY ECONOMICS

Energy

Energy accounts are updated and published annually. In 1987 priority has been given to analyses of energy use and energy prices in energy intensive manufacturing industries. Furthermore, studies of possible effects of the introduction of gas power on electricity prices and the balance between water power and gas power development has been carried out.

Analyses of the future electricity production system will continue in 1988. Optimal production systems with uncertain gas prices, energy demand and production of water power will be studied. Priority will also be given to a closer study of energy demand in households, which is poorly analyzed today.

Discrimination of electricity prices

The prices of electricity in Norway differs substantially both regionally and between users. Some of these differences may be explained by different costs attached to deliveries. For example, transmission costs to energy intensive manufacturing industries are far lower than to households. In addition, electricity demand in households fluctuates considerably from day to night and from season to season. The rate between total capacity and mean production in the supply system, therefore, has to be higher with respect to deliveries to households than to manufacturing industry, where the demand is more stable. However, these arguments are not sufficient for explanation of all the price differences. Table 3 displays electricity prices adjusted for different production and transmission costs connected to deliveries to different sectors. All prices are thus referred power production plant.

Price discrimination implies that the willingness to pay for the last kWh consumed must be higher in some sectors than in others. By lowering prices to those who pay high prices, and increasing prices for others, one would obtain a more efficient utilization of electricity. An optimal price system would require equal prices between all sectors. To illustrate the effect of an optimal price system prices and traded quantities in a competitive equilibrium have been estimated. Given the production of electricity in 1984 on 98.4 TWh (excl. exports, incl. imports) the equilibrium price was estimated at about 12.5 øre/kWh. This would lead to a reduction in the price to households by 25 per cent, and an increase in their electricity consumption by 15 per cent. In energy intensive manufacturing sectors the electricity price would increase by 85 per cent, and energy demand would decrease by 35 per cent. The advantage this sector draws from today's low electricity prices amounts to about 2,100 million NOK, corresponding to about 7.5 per cent remuneration on the capital equipment in the sector.
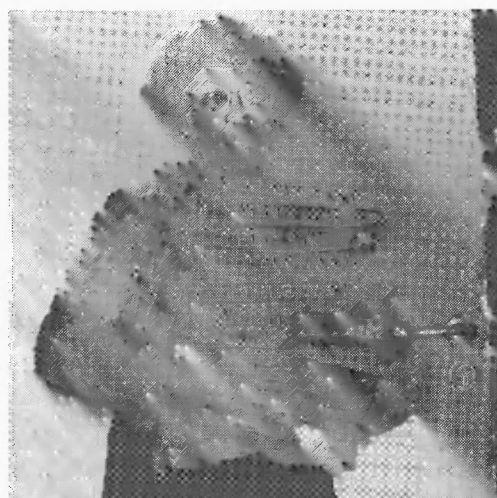
Kirsten Andersen

The figures presented are connected with considerable uncertainty. In particular, the consequences of a 85 per cent increase in electricity prices for energy intensive manufacturing industries are not easily predictable, partly because most of its products are exported to fixed prices. However, this study would rather indicate a recommended direction for future price policy of electricity in Norway.

Table 3: Electricity prices by sector, referred production plant, adjusted for different costs attached to sectors. øre/kWh.[1]

Sector	1978	1979	1980	1981	1982	1983	1984
Households and agriculture	6.98	7.82	8.65	9.87	11.58	14.26	14.90
Private and public services	8.07	8.64	9.61	10.93	12.95	16.06	18.07
Other manufacturing	7.04	7.61	8.25	9.58	11.53	14.94	16.51
Pulp and paper	4.85	5.19	6.10	6.69	8.42	7.24	8.59
Energy intensive manufacturing	3.72	3.89	4.52	4.97	5.33	5.39	6.70

[1] Differences in energy prices between sectors may be somewhat lower than calculated, due to different control costs not taken into consideration.

UNIT FOR LAND USE ACCOUNTS

Land-use and forests

In 1987 work has been concentrated particularly on development of new techniques to collect and process land-use data. Within the land-use accounts attention has been directed towards the use of information from the earth observation satellite SPOT and information from the Norwegian cadastral register GAB. In addition there has been some work in the field of geographical information systems (GIS). Within the forest field there has been work on methods for valuation of forest resources in addition to updating of the forest accounts. Within both fields resources have been used to contribute to Environmental Statistics 1988.

UNIT FOR ENVIRONMENT ECONOMICS

Environment economics

In 1987 the national and regional (municipalities) emission accounts were enlarged and updated to include emissions of volatile organic components (VOC) and soot in addition to sulphur dioxide (SO_2), nitrogen dioxides (NOx), carbon monoxide (CO) and lead (Pb) for the year 1985. Emissions related to oil and gas exploration and production on the Norwegian continental shelf and to ocean transport in Norwegian territorial waters were estimated. Work on an national emission account for carbon dioxide (CO_2) was initiated. Emission forecasts for the last quarter of the century based on the revised Long-Term Programme of the government has been published, and sensitivity analysis been made with respect to changes in oil and electricity prices. The effects on total emissions of introducing catalytic converters on private cars has been assessed and the social cost estimated. The economic cost of excess corrosion due to SO_2 emissions has also been evaluated. A forecast of European SO_2 emissions to the year 1991 has been made based on the international economic modell LINK. Future deposits of sulfur on Norway from these emissions has also been calculated.

A survey of investments in new, environmentally sound processes and cleaning equipment in the period 1974–1985 was completed in 1987. The survey covered nine of the most polluting sectors in Norway.

The World Commission on Environment and Development presented its report *Our Common Future* in 1987. The group has been involved in discussions on how to follow up this report, both on a national and an international level. This activity will continue next year and may be supplemented by international modelling work where economic activity, energy use and emissions in the air are treated in a consistent manner.

The national forecasts of air emissions will be updated and augmented to include CO_2, and possibly, other emissions. Further studies will be made in order to analyse the potential for cost effective control policies, especially with respect to future NOx emissions. The question of whether empirical data on regionalized pollution concentrations can be explained by data on local air emissions will be studied in 1988. If this turns out to be the case, the emission accounts will be used to make a first estimate of total air pollution induced health damages in Norway.

Knut Alfsen, Torstein Bye

UNIT FOR PETROLEUM ECONOMICS

Unit for Petroleum Economics

Activities in 1987 and plans for 1988

The projects run by the Unit for petroleum economic research aim at analysing the impacts from oil and gas markets and the extraction activities in the North Sea on the Norwegian economy. The analysis are done partly by constructing separate simulation models for the international petroleum markets and also by modifying and utilizing existing macroeconomic models in the Research Department. The overall purpose of this work is to equip decision makers in the petroleum sector — both public authorities and within oil companies — with model tools and improved understanding of various mechanisms and events within this area.

The research activities of the group in 1987 covered several topics. Lots of efforts were put into a project of constructing a demand model for natural gas for Western Europe. A first version of the model, covering the most important gas consuming countries in Western Europe, is now implemented in the PC-software system MODLER. Moreover, a more detailed demand model for the household sector has been made operational on a spreadsheet. In addition to these demand studies, analysis of strategic behaviour in the gas market have been undertaken. An empirical model based on dynamic game theory has been developed. Within this framework a central element is that producers of natural gas have incentives of entering early into the market with their investment projects in order to capture or defend market shares.

WOM is a rather simple partial equilibrium model for the international oil market. During 1987 it was implemented in a MODLER version and used on several occasions for projecting future developments in the oil market. These calculations point to the possibility that the crude oil price will remain low, i.e. at or slightly below today's level, the coming 3–4 years. Based on assumptions of reasonable growth in the world economy, strongest in LDCs, a gradually increasing oil price during the 1990s is a likely outcome. In the very long run, the rise in the oil price will be restricted by the presence of back-stop technologies.

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 oil exports, this uncertainty hovers over 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 analysed in separate projects launched by the group. Some analytical results have been derived from stylized models based on stochastic optimization theory, and these attempts will stimulate specification of more realistic and comprehensive models.

A main project that was completed in 1987 focused on macroeconomic impacts of different investment profiles on the Norwegian continental shelf. This analysis is described in some detail below.

The plans for 1988 include the following tasks:

– The project of constructing an operational de-

mand model for natural gas will be completed.

- Work will be started to develop the WOM model, both on the demand side (LDCs) and the supply side (OPEC behaviour).
- Problems of resource allocation related to the planning of the petroleum sector with particular emphasis on uncertainty will be further analysed.

Investment profiles in the North Sea and macroeconomic performance

During the last 6-7 years there has been a strong increase in investments in petroleum activities and in the Norwegian production of oil and gas. Investment costs related to pipeline transportation and extraction rose from a level around 10 billion kroner in the 1970s to today's level of over 30 billion kroner. The fall in the crude oil price in 1986 temporarily tended to halt investments in the North Sea, but after a more favourable tax regime was introduced later in the same year, the present plans of the oil companies may imply a new strong boom in investment activities in the early 1990s.

The opinion held by the public authorities is that such a development could be very unfortunate. Firstly, there is a large income risk involved, since the present plans imply that Norway will produce a large share of its oil reserves in a period of sluggish oil prices. Secondly, the experiences from the last investment boom indicate that investments at this level involve strong and undesirable pressure in the overall economy, in particular in major domestic supply industries. This forms the background for the present discussion of introducing a queue for oil investment projects on the Norwegian continental shelf.

In the Central Bureau of Statistics a project has been carried out which analyses the impacts on the Norwegian economy up to 1995 of three different investment profiles in the North Sea. The first scenario is based on existing investment plans of the oil companies. From figure 4 it is seen that this results in yearly investments of more than 40 billion kroner in 1992. This obviously also implies a considerable increase in oil production, see figure 5. The second investment profile aims at keeping the investments at a rather constant level over the simulation period, restricted of course by the fact that one here deals with large and discrete projects. This is in the following referred to as the reference scenario. As shown by the same figures, investments slightly decrease in the first years, but then return to the present level around 1990. Production increases significantly in this scenario as well, as shown by figure 5. The third investment profile, however, is constructed just with the aim of smoothing out oil production. This is accompanied by a marked fall in investments before they are stabilized at about 20 billion kroner per year.

To study how the Norwegian economy reacts to the various developments of oil investments, calculations are carried out on the macroeconomic model MODAG V. The impacts on GDP and net exports of alternative investment paths, measured as deviations from the reference scenario, are shown in figure 6 and figure 7 respectively. In scenario 1 (companies' plans) the high level of investments causes a boom in the total economy as well. However, the economy nosedives from 1991 on and the only factor to prevent the growth rate in GDP from decreasing is the petroleum production. This shows that the economy in this scenario has become very oil dependent, wages and prices accelerate and it may be difficult for other sectors to maintain their competitiveness.

In scenario 3 (constant petroleum production) the growth in GDP is reduced compared to the reference path. The pressure on prices and production costs are, however, avoided and factors of production may be released to contribute to increased production in other industries than the petroleum sector.

Finally, in figure 8 we show the impacts of different levels of investments on production in the construction sector. In scenario 1 the high level of investment in the North Sea pushes these deliveries up strongly in the period 1988-1991. As opposed to this construction activities in scenario 3 stagnate until 1990, from where they gradually pick up. The same pattern is showed for well drilling activities and production of services, but with a time lag of a couple of years.

UNIT FOR ENVIRONMENT STATISTICS

Environment statistics

Work in 1987 has been concentrated on collection and analysis of environmental data for publication in the next Compendium of environmental statistics. The compendium will be published during spring 1988. Main topics will be environmental effects from human use of natural resources, including studies on acidification, radioactivity, global ozon depletion and the greenhouse effect. The Compendium will also contain a registration of municipal waste treatment plants in Norway.

Participation in and data delivery to the OECD and ECE work on international environmental statistics is also an important part of the unit's work.

In 1988 a new project on estimation of water pollution load from agricultural activities will be started.

Figure 4: Total Investment in the Petroleum Sector.

Total investment in the petroleum sector.
Three profiles. 1987—95.
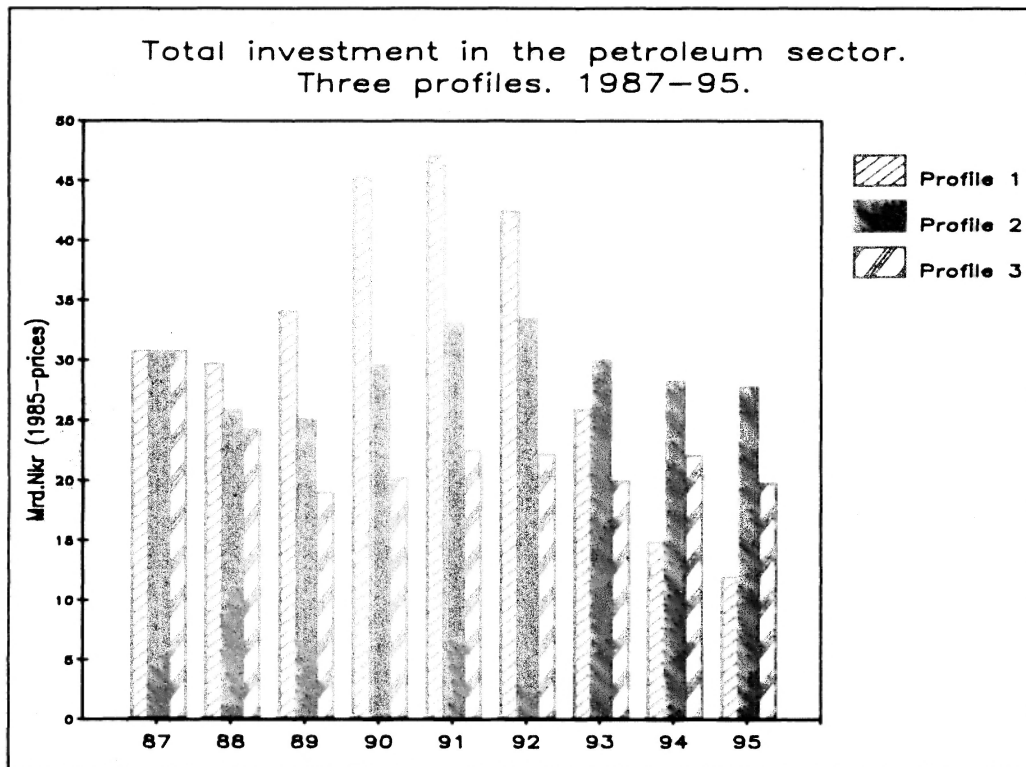
Figure 5: Oil and Gas Production. Million toe. Profiles 1, 2 and 3.

Oil and gas production. Mill.toe.
Profiles 1, 2 and 3.

Figure 6: GDP. Deviation in Per Cent from the Reference Scenario.

GDP. Deviation in per cent
from the reference scenario.

Scenario 1: GDP.

GDP,mainland.

Scenario 3: GDP.

GDP,mainland.

deviation in per cent

87 88 89 90 91 92 93 94 95
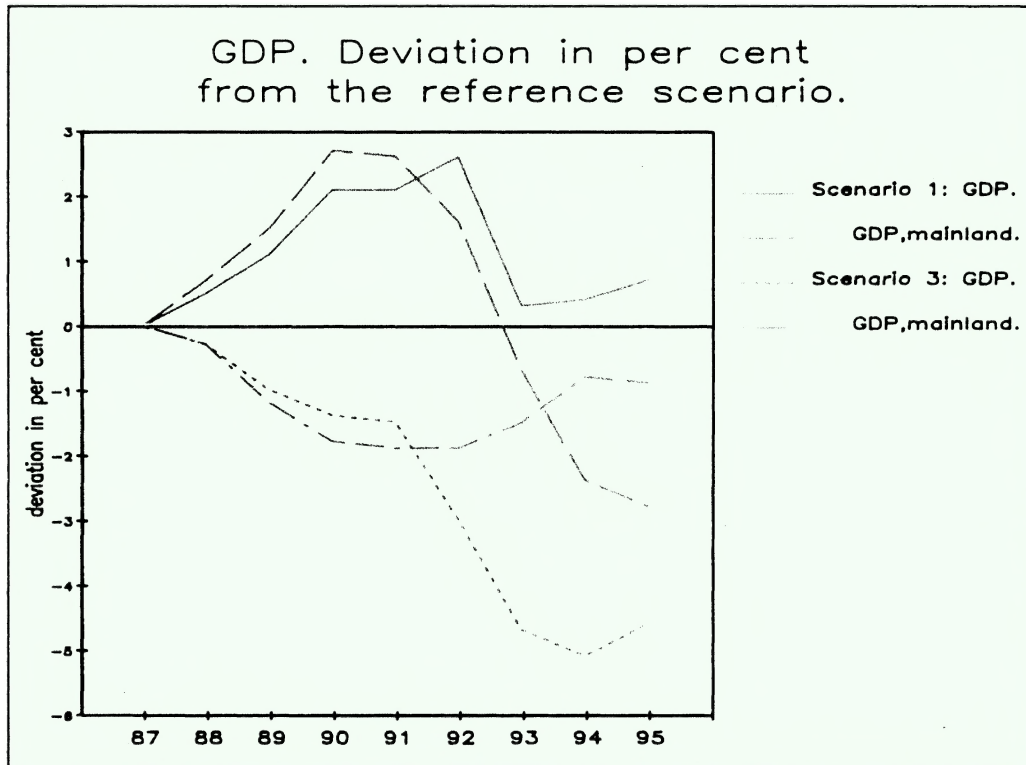
Figure 7: Net Exports of Goods and Services. Deviation from the Reference Scenario.

Net exports of goods and services.
Deviation from the reference scenario.

scenario 1

scenario 3

bill.Nkr.

88 89 90 91 92 93 94 95

Figure 8: Manufacturing of Machinery and Equipments. Scenario 1, 2 and 3.

Unit for Micro-Econometric Research

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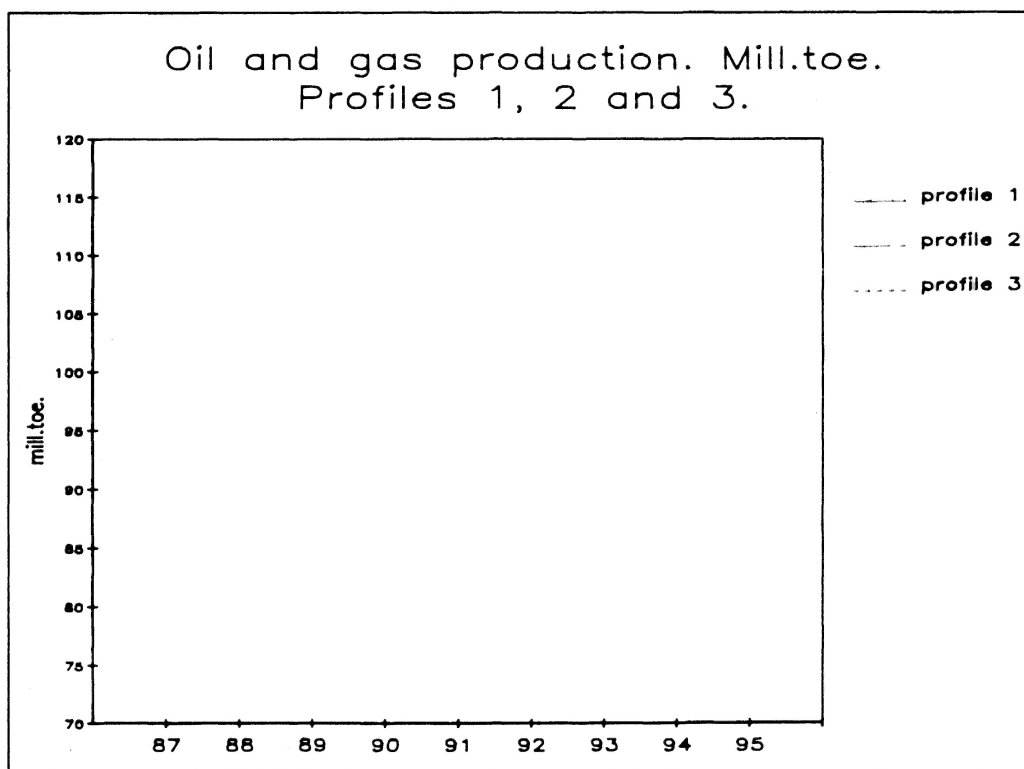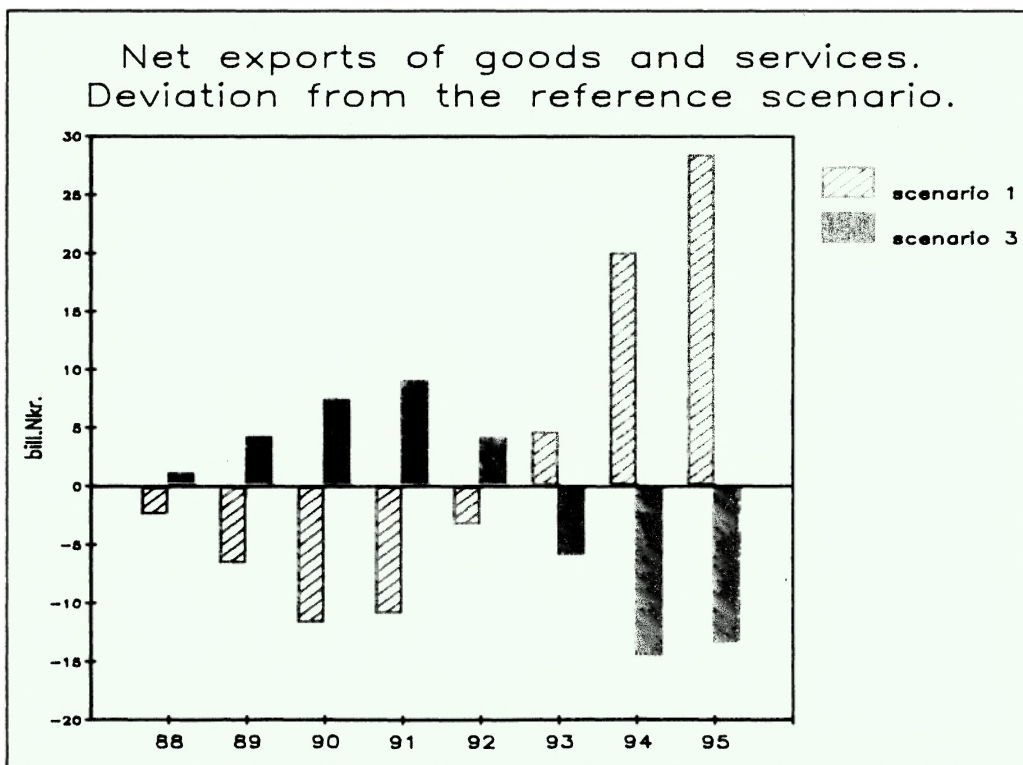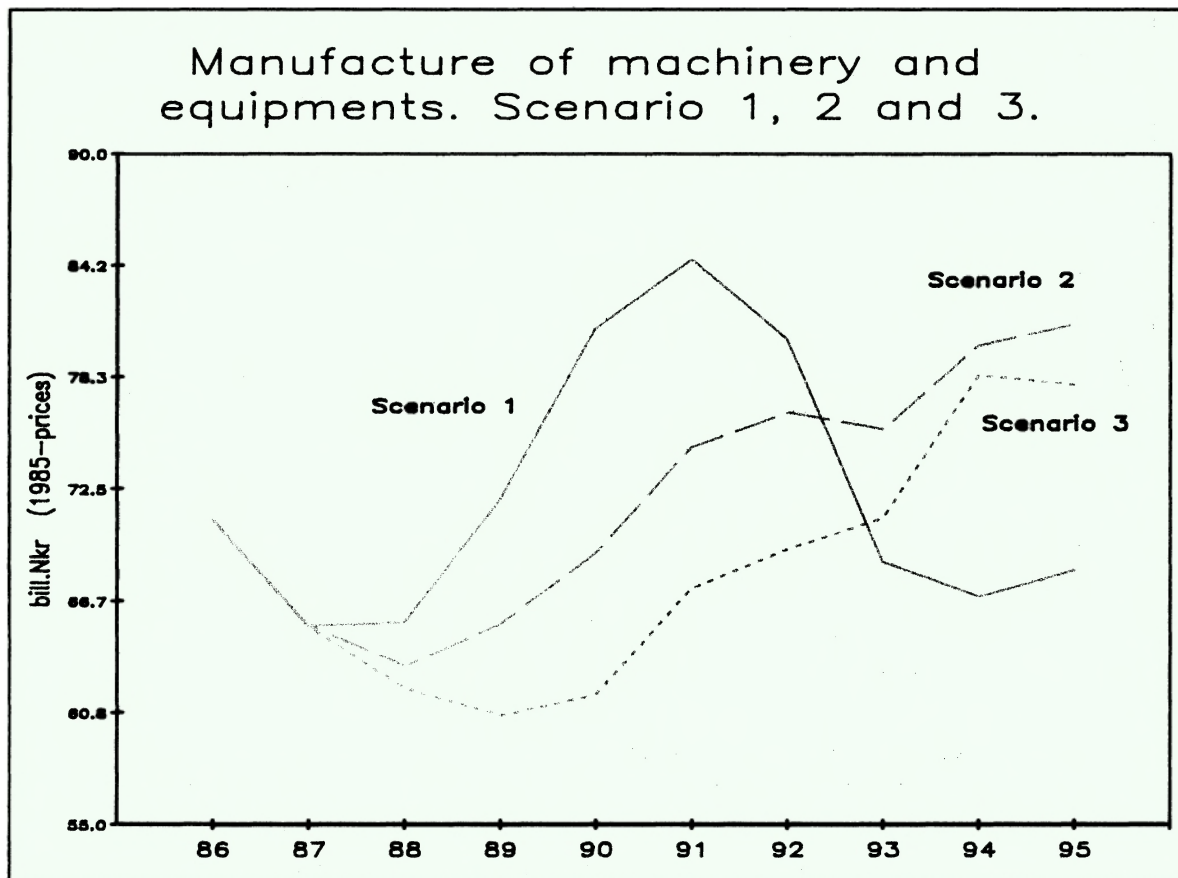
- The econometrics of discrete/continuous choice.
- Analysis of consumer demand, educational choice, labour supply, energy demand and duration of unemployment.
- The theory of production and cost functions.
- Methods for analysing inequality.
- Methods for policy simulations based on micro-econometric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

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

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 behavioural 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 the importance of combining the development of theory and methods with their empirical counterparts is recognized. This enables us to test behavioural 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 analysing static and intertemporal discrete/continuous choice in the presence of uncertainty (relative to the decision-maker) and unobservables (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.

Appendix

List of Persons Employed in the Research
Department in the CBS, 29 February, 1988

ASSISTANT DIRECTOR GENERAL
Bjerkholt, Olav

CENTRAL UNIT FOR ADMINISTRATION:
Angeland, Kirsti, Senior Clerk
Bråthen, Eva, Senior Clerk
Fjeldbo, Rita, Clerk
Rambøl, Hanne, Executive Officer
Skoglund, Anne, Senior Clerk
Torgersen, Bente, Head of Administration

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
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, Clerk
Jensen, Eva, 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:
Hansen, Halvard, Research Economist
Harildstad, Anders, Planning Officer
Lea, Rolv, Research Economist

DIVISION FOR ECONOMIC ANALYSIS:
Longva, Svein, Director of Research

UNIT FOR PUBLIC ECONOMICS
AND LABOUR MARKET RESEARCH:
Andreassen, Leif, Research Economist

Gabrielsen, Inger, Senior Planning Officer
Hansen, André H., Senior Clerk
Hernæs, Erik, Research Fellow
Koren, Charlotte, Research Fellow
Kornstad, Tom, Research Economist
Ljones, Olav, Senior Research Fellow
Moe, Ann Synnøve, Senior Clerk
Nygaard, Elizabeth, Research Economist
Østervold, Jannike, Research Economist
Aamdal, Kyrre, Research Economist

UNIT FOR ECONOMIC ANALYSIS:
Bowitz, Einar, Research Economist
Cappelen, Ådne, Director of Research
Drzwi, Wenche, Executive Officer
Eika, Torbjørn, Research Economist
Haakonsen, Laila, Secretary
Hansen, Lisbeth L., Executive Officer
Hobber, Berit, Executive Officer
Holm, Inger, Senior Executive Officer
Johansen, Per Richard, Senior Planning Officer
Jore, Anne Sofie, Research Economist
Kristoffersen, Herbert, Research Economist
Lindquist, Kjersti-Gro, Research Economist
Moum, Knut, Research Fellow
Nordeng, Wenche, Clerk
Nordseth, Sverre, Planning Officer
Stølen, Nils M., Research Fellow
Wettergreen, Kjell, Research Economist

UNIT FOR GENERAL EQUILIBRIUM ECONOMICS:
Hansen, Kirsten, Executive Officer
Holmøy, Erling, Research Economist
Klette, Tor J., 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
Hansen, Liv, Executive Officer
Kravdal, Øystein, Research Demographer
Leon de, José Goméz, Senior Research Fellow
Moen, Bjørg, Research Fellow
Noack, Turid, Research Fellow
Stordahl, Erik, Senior Executive Officer
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 S., Research Fellow

DIVISION FOR RESEARCH OF NATURAL RESOURCES:

Lorentsen, Lorents, Director of Research

UNIT FOR ENERGY ECONOMICS:

Bye, Brita, Research Economist
Bye, Torstein, Research Fellow
Hansen, Mona Irene, Executive Officer
Høgset, Lisbet, Junior Executive Officer
Johnsen, Tor Arnt, Research Economist
Torvanger, Asbjørn, Research Economist
Vik, Turid, Executive Officer
Aaheim, Asbjørn, Research Fellow

UNIT FOR ENVIRONMENT ECONOMICS:

Alfsen, Knut H., Senior Research Fellow
Andersen, Kirsten, Senior Clerk
Brendemoen, Anne, Research Economist
Glomsrød, Solveig, Research Economist
Rosland, Audun, Senior Executive Officer
Selboe, Odd Kristian, Executive Officer
Strandli, Anne, Junior Executive Officer

UNIT FOR LAND USE ACCOUNTS:

Engebretsen, Øystein, Research Fellow
Nsset, Erik, Senior Executive Officer
Ramtvedt, Anne E., Executive Officer
Sandmo, Trond, Junior Executive Officer
Vestøl, Jon Åge, Senior Executive Officer
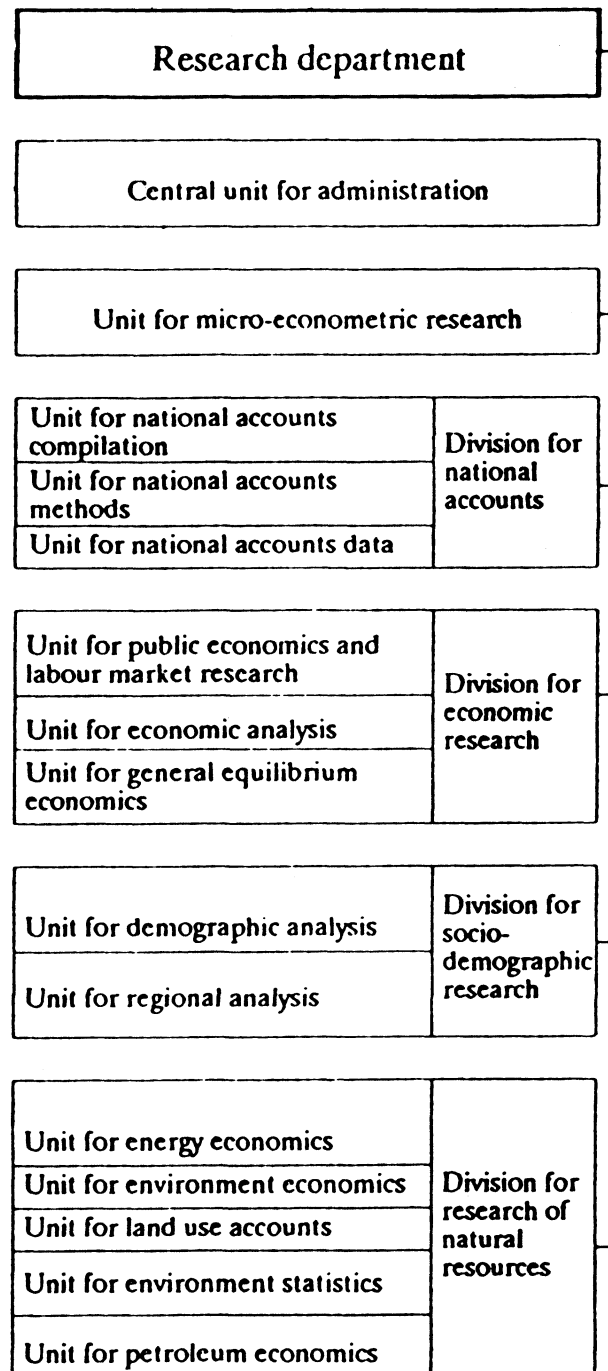
UNIT FOR ENVIRONMENT STATISTICS:

Brunvoll, Frode, Senior Executive Officer
Røsten, Erland, Executive Officer
Østdahl, Torbjørn, Senior Executive Officer

UNIT FOR PETROLEUM ECONOMICS:

Aslaksen, Iulie, Research Economist
Berger, Kjell Steinar, Research Economist
Brekke, Kjell Arne, Research Economist
Gjelsvik, Eystein, Research Economist
Olsen, Øystein, Senior Research Fellow

UNIT FOR MICRO-ECONOMETRIC RESEARCH:
Dagsvik, John, Senior Research Fellow
Frenger, Petter, Senior Research Fellow
Skjerpen, Terje, Research Economist
Wennemo, Tom, Senior Executive Officer
Aaberge, Rolf, Research Fellow
Aasness, Jørgen, Research Fellow

ORGANIZATION CHART OF RESEARCH DEPARTMENT:

Research department

Central unit for administration

Unit for micro-econometric research

Unit for national accounts compilation	Division for national accounts
Unit for national accounts methods	
Unit for national accounts data	

Unit for public economics and labour market research	Division for economic research
Unit for economic analysis	
Unit for general equilibrium economics	

Unit for demographic analysis	Division for socio-demographic research
Unit for regional analysis	

Unit for energy economics	Division for research of natural resources
Unit for environment economics	
Unit for land use accounts	
Unit for environment statistics	
Unit for petroleum economics	

Publications Issued in 1987

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)
DP = DISCUSSION PAPERS (in English only)
ØA = Økonomiske analyser (ECONOMIC SURVEYS)

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		1987	Annual Report 1987
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		1987	Situasjonsoversikt, mai 1987.
		1987	Situasjonsrapport, april 1987, Sosiodemografisk Seksjon og Gruppe for Regional Analyse.
		1987	Statusrapport — 1. halvår 1987.
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