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A REVIEW OF MODELS AND DATA  
IN THE NORWEGIAN SYSTEM  
OF ECONOMIC PLANNING

By  
Terry Barker

EN OVERSIKT OVER MODELLER OG DATA  
I NORSK ØKONOMISK PLANLEGGING

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## PREFACE

This article gives a review of the system of data, models and computer programs used by central authorities in Norway to formulate and present economic policies and plans. It has been prepared by professor Terry Barker, Department of Applied Economics, University of Cambridge, UK for the Government Secretariat for Long Term Planning and Coordination, Norway. Professor Barker was asked to give an independent and critical review of the Norwegian system of economic planning.

The Central Bureau of Statistics greatly acknowledges the permission given by professor Barker to publish his report.

Central Bureau of Statistics, Oslo, 12 November 1981

Arne Øien

*FORORD*

Denne artikkelen gir en oversikt over data, modeller og EDB-systemer som brukes av myndighetene i Norge for å utarbeide og presentere økonomiske beregninger og planer. Oversikten er laget av professor Terry Barker ved Department of Applied Economics ved University of Cambridge i England etter oppdrag fra Planleggingssekretariatet i Norge. Professor Barker ble engasjert for å gi en uavhengig og kritisk gjennomgang av det norske systemet for økonomisk planlegging.

Statistisk Sentralbyrå vil takke professor Barker for tillatelse til å trykke artikkelen.

Statistisk Sentralbyrå, Oslo, 12. november 1981

Arne Øien

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This review could not have been done in the short time available without the help and co-operation of many busy people who took time off their work to talk to me and answer many questions. In particular I thank Svein Longva of the Central Bureau of Statistics and Lorents Lorentsen of the Government Secretariat for Long Term Planning and Coordination. I also thank

Per Schreiner, Amund Utne and Knut Eggum Johansen of the Planning Secretariat,

Olav Bjerkholt, Ådne Cappelen, Nils Terje Furunes, Svein Røgeberg, Vetle Hvidsten and Sigurd Tveitereid of the Central Bureau of Statistics, Asbjørn Fidjestøl and Harald Bøhn of the Bank of Norway,

Jan Qvigstad and Tore Eriksen of the Economic Policy Division, Ministry of Finance and

Leif Johansen of the University of Oslo.

This review has of course been heavily influenced by those who know the Norwegian system inside out. It channels and articulates a common purpose and consensus which is already there and it reflects views which have been put to me with which I agree. Any errors and omissions are my responsibility.

Oslo and Cambridge

April 1981

Terry Barker



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## 1. INTRODUCTION: BACKGROUND AND SCOPE OF THE REVIEW

This is a review of data and models in the system of planning. It emphasizes issues and problems which are interdepartmental and which are of particular importance in the operation and usefulness of the whole system. The reason for this is simply that weaknesses are more likely to arise in the interface between departments where responsibilities may be less clear or may overlap.

No doubt with more time and resources a much more detailed and thorough job could be done. However, I have preferred to make a virtue of the time limits in order to comprehend the essential features of the system and to bring to bear a critical and fresh viewpoint from outside which is different (yet very much in the same tradition) from that of those working within the system.

I have confined the review mainly to the use of models and data. The planning system obviously extends to the interaction between the Ministry of Finance and the Planning Secretariat on the one hand and the other Ministries and Departments, the Cabinet, the Storting, local government and the general public at the other. I have not had time, or indeed the comparative advantage in background or skills, to look into this area in any depth. Furthermore I have severely restricted my investigations into the complex areas of methods and data processing for the National Accounts and the use of computers and computer programs in the system.

## 2. CONCLUSIONS

Norway over the post-war years has developed a remarkable planning system of high quality. This is the background to these conclusions which should also be seen in the context of this review, especially bearing in mind the limited time put into the study. The conclusions are abstracted from the rest of the review which gives some of the reasoning behind them. They are intended to be thought-provoking rather than prescriptions for action.

### The planning policy system

1. More resources should be put into model building, model research, financial data and consistent estimates of accounts in the Central Bureau of Statistics (pages 11, 24).
2. Rules and procedures should be developed to prevent the proliferation of models, to ensure consistency and to rationalize the models in use, ensuring that generally acceptable models are operated by the Central Bureau and others are eventually closed down (page 13).

3. The long-term programme should be revised annually on a regular basis to incorporate revisions to plans and new data (page 14).
4. There is room for a formal training course every two years open to economists and others working with the models and plans in government and covering the practical use of the models, the National Accounts and training in "sector expertise" (pages 14-15).
5. The future of the software system, particularly DATSY, should be looked at with some care. There is a need for a package which can both take over the functions of DATSY and solve models larger than the 2000 equation model which is the upper size limit for TROLL (pages 15-17).
6. Card input to MODIS should be replaced by on-line input with some further preprocessing before the main solution routines are entered (page 17).
7. Some capability for the use of optimal control techniques should be introduced in the model building unit at the Central Bureau of Statistics (pages 17-18).

#### The models in the system

8. MODIS as an accounting system should extend to include the accounts of the institutional sectors of KRØSUS. It should also be more flexible in accepting changes in input-output coefficients, derived, for example from the energy model (pages 18-20).
9. MODAG should be developed as a MODAG/MSG/FINMOD model eventually replacing MSG and FINMOD and incorporating parts of KRØSUS. It would be a more behavioural and a more dynamic model than MODIS or MSG. Special attention should be paid to a method of achieving a consistent MODAG/MODIS solution (pages 20-24).

#### The data

10. The Hovedbok should be extended to include the institutional and financial accounts as in the SNA (pages 24-27).
11. Looking to the future, computer-based methods of balancing accounts with subjective estimates of reliability of different entries should be investigated and perhaps used at first with an aggregated version of the accounts (pages 27-28).
12. Some rationalisation in the preparation of the preliminary national accounts may be worth considering, in particular the replacement of the First Preliminary Accounts with the MODIS solution for the same year. An outside body should be commissioned to evaluate the performance of the Preliminary Accounts and the models in forecasting the Final Accounts (pages 28-30).

### 3. THE PLANNING/POLICY SYSTEM

#### 3.1. Objectives

The primary objective of the system is to provide the base projection and the policy simulations used in preparing that projection for the annual National, Fiscal and Credit Budgets and the 4-year Long-Term Programme. The system also forms and provides the "view of the economic world" held as the consensus amongst civil servants, politicians and others closely concerned with the economy. It serves to co-ordinate and reconcile the assumptions about exogenous variables including desired plans and policies in different departments in as much as they relate directly to economic developments. The Ministry of Finance and the Long-Term Planning Secretariat plays a leading initiating role in these functions.

Finally on a wider basis still, the system serves to inform the Storting, the Press and the general public on official views of economic developments.

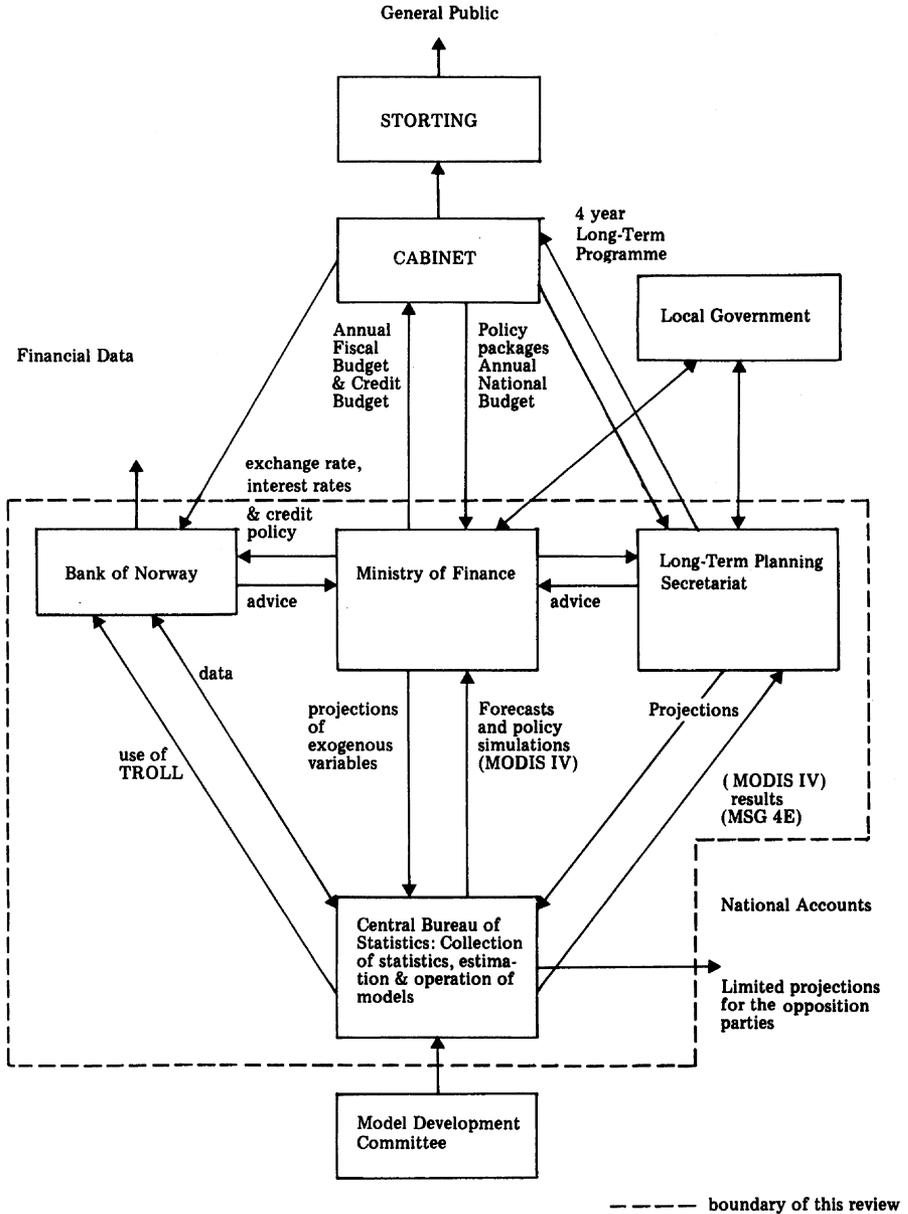
#### 3.2. Institutions and the models

Figure 1 shows a simplified view of some of the more important relationships between institutions in the system. The dotted line shows the boundaries of this review of the system.

The central relationship in the planning process is that between the Central Bureau of Statistics which produces the National Accounts and constructs and estimates the main models and the departments which formulate economic policies and plans - the Ministry of Finance and the Planning Secretariat. This is not a usual arrangement: in the UK for example the main economic model is constructed, estimated and solved in the Treasury whilst the Central Statistical Office is confined to providing statistics. The Norwegian system has considerable advantages, especially when the basic model in use is highly disaggregated: it keeps the main use of the data close to the data sources, methods and estimation and it distances the models from the political policies of the day so helping to preserve continuity and objectivity.

There is a possible problem here, however, in that fewer resources may be put into model building and research than would be put into them by the policy-making departments if they were directly responsible for research and development. Associated with this is a slower response by the model-builders to new policy pressures, for example in the past few years to produce financial implications of policies. There are symptoms of these

Figure 1. Relationships between Institutions in the Planning System



problems and pressures in the development of models in the Ministry of Finance (FINMOD; KONK) and the Bank of Norway (KRØSUS) which are on the border-line between support models and alternative models to those in the Central Bureau of Statistics. There is further evidence of pressure in the direct financing by the Ministry of Finance of research in the Central Bureau.

Such models outside the Bureau are to be seen either as aids to thinking or as pressures on the Bureau to change or amend its own models to meet the needs of the user. If the Bureau is to do its job properly within the system, it cannot tolerate serious competition to its models for very long and must react by developing acceptable alternatives. It is important that as soon as the Bureau has developed a satisfactory alternative, the outside model should be closed down. Otherwise there is a waste of scarce resources and unproductive tension between government departments.

This issue will become much more important as access to computers develops and the building of models becomes easier. Rules and procedures should be developed to maintain consistency between the new models and the existing ones and to review periodically the new developments to see whether they have proved useful and stable enough to be included in the Central Bureau's set of models.

### 3.3. The models, the National Budget and the Long-Term Programme

A slightly surprising feature of the relationship between the models and the plans is as follows. MODIS, which is used to form the basis of the annual National Budget, Fiscal and Credit Budgets in fact projects policies year by year 4 years into the future, for example over the period of the present Long-Term Programme. And MSG, which is used as the basis of the 4-year Programme, projects policies starting 4 years and going on into the future.

The reason for this state of affairs seems to be partly historical (MODIS was developed originally to project one or two years into the future; MSG is by definition a Long-Term equilibrium model and so the model to use for the Long-Term Programme). But partly, and more importantly, it is argued that the longer-term consequences of policies should be taken into account, an argument with which I wholly agree.

There is an awkward gap, however, between the final year of the MODIS projection and the first year of the MSG projection, the two being

in principle inconsistent, although with luck and judgement no doubt they can be drawn together. My suggestion here (see the MODAG and MSG section below) is that MSG should be merged with MODAG as the steady state solution of the estimated econometric equations, so that the projections gradually become long-term ones, depending on the parameter estimates in the equations. MODAG should be able to provide specific long-term projections.

Another issue is the timing of the Long-Term Programme. At present it comes once every 4 years, in the election year. This has the great advantage of putting the economic proposals of the election programmes into a medium-term focus and helping to fit both the Government and Opposition proposals into a consistent and coherent framework. However, circumstances change and the Programme inevitably gets out of date. Furthermore medium-term projections are already being made year by year. So it would be a short and sensible step to introducing a "rolling" Long-Term Programme, especially if it was easy to do and it made sense to run the medium-term model to the 4-year horizon and beyond to give an even longer-term view presently provided by the MSG model.

#### 3.4. Labour resources in the system

There is clearly a pool of highly experienced and skilled economists and others who have worked in different parts of the planning system from data processing to policy making. There is an awareness of the need not to have key knowledge and skills concentrated in a very small number of people and the advantages of computing powers and skills being available to all those who work in the system. Finally, there appear to be reasonable opportunities for people to visit universities and planning/research institutions abroad, which offset the dangers of complacency and inward-looking attitudes. However, perhaps more movement in the other direction would be valuable, if only because the mature and advanced Norwegian system has much to teach other countries. I'm not sure of the best way of doing this.

However, in one area the system could be improved. Clearly, most of the skills in providing forecasts and plans, in running the models and in developing them must be "learned by doing". But there is room for more formal courses, seminars and research work. I understand that periodically lectures have been given on the use of MODIS and its associated models. I suggest that this be widened into a structured course given in a quiet period once every two years starting for example in late October or early

February. The administration should be done by the civil service Ministry, but the course content would need to be worked out and taught by experienced practitioners and academics in the policy ministries, the Central Bureau of Statistics, the Bank of Norway and the Institute of Economics at the university. The following topics might be considered for such a course.

1. Overview of the planning and the model system.
2. Teaching in the practical use of the models, particularly MODIS IV.
3. National Accounts methods and presentation.
4. Training for "sector expertise" in different areas.
  - Areas - data sources and developments
    - empirical models available for use
    - theoretical models and background
    - econometrics and statistical methods
  - Sectors - consumption, income and taxes
    - foreign trade and balance of payments
    - investment and stockbuilding
    - prices, wages and indirect taxes
    - employment and labour market
    - public sector
    - oil sector
    - money and credit

It may make sense to be much more ambitious and to consider proposing a university post-graduate course lasting a year, and organised on these lines. However, it would be essential to have very close links with the planning ministries and Central Bureau of Statistics.

### 3.5. Computing in the system

Figure 2 shows the main three packages used to hold data, estimate and solve models and prepare tables of exogenous data and results.

The weakest part of the system seems to be the package DATSY. This is about 12 years old and a replacement is under consideration. It was obviously well in advance of its time, because only now are general packages with similar features coming on to the commercial market. The main problem is not with its facilities or efficiency, but that if it collapses, then there may be insufficient expertise to get it working again quickly. This lack of expertise also means that there is considerable reluctance to extend the facilities and concern at probable difficulties in transferring the package from the Honeywell machine to another

Figure 2. The Main Computer Programs and Packages in Use

Program/Package	Uses	Limitations
<p><b>TROLL</b>            Package developed at MIT. Presents and solves models up to 2000 equations.            Databank of up to 3000 time-series variables</p>	<p>Estimates &amp; solves            MSG, MODAG,            KVARTS, MODEX</p>	<p>Size limitations;            Solution problems with large models</p>
<p><b>DATSY</b>            Package developed for the Central Bureau of Statistics. Matrix manipulation, Solution of Input-Output models</p>	<p>Generates base data for MODIS, MSG etc. Solves MODIS. Some use in producing National Accounts</p>	<p>Only implemented on Honeywell machine            'A black box'</p>
<p><b>NATBLES</b>            Special program</p>	<p>Prepares National Accounts tables from 'Hovedbok' type data file. Used with Hovedbok &amp; output of MODIS etc.</p>	<p>Being replaced with an 'intermediate databank' holding up to 10,000 time series</p>

machine which will be necessary in due course unless DATSY is replaced.

The limitation with TROLL is rather different. It is written to solve the traditional time-series econometric model consisting of a limited number of single equations and identities. It is not written for large-scale multisectoral models and its solution algorithm does not seem suitable for such models. The options appear to be

- (i) to limit the development of MODAG/MSG to the maximum size acceptable to TROLL,
  - (ii) to develop a new version of TROLL capable of handling larger problems
- or
- (iii) to investigate the possibilities of using another package.

The advantage with (ii) and (iii) is that a large-system package should also be able to solve MODIS and therefore replace some of the functions of DATSY when the computing is done on another machine. The disadvantage of (ii) is that it will use an unknown quantity of resources and will become a specialised system without outside back-up leading to the same difficulties at present being experienced with DATSY.

The future of the software system should be looked at with some care. There was a session on program packages for use in large-scale models at the Third Economics and Control Conference held in Copenhagen June 1981. The papers give a good review of the state of the art in this field. The new databank being developed by David Walker to replace NATBLES will need to be accessible by TROLL and by any package replacing DATSY.

On the day to day use of computers, one outstanding feature is the continued use of card input to run MODIS. This should be replaced with on-line input. Another improvement would be to include some further pre-processing of the MODIS job before the main solution is performed. For example, inputs into MODIS could be checked in an interactive on-line job to make sure that they conform to those expected by the program, looking for and printing out all those values which lie outside a pre-selected set of reasonable bounds.

### 3.6. The use of optimal control techniques

A significant development in the theory of economic policy formulation has been the use of optimal control techniques originally developed by engineers for controlling physical systems. The main uses of such techniques, and associated ones modelling the bargaining process between competing interest groups such as the government, the trade unions and business entrepreneurs, in the Norwegian system would be first to explore the

solution properties of the models and second to map out combinations of instrument and target values. This is done at present by the estimation and use of impact tables. Optimal control techniques, which can now be applied to models of any size, can be used to structure and organise such tables.

However, there is no capability in the system for either developing or using these techniques, despite the fact that a lot of resources go into the formulation of policy using the models. Some capability should be established, perhaps at a minimal level of obtaining a suitable control package and applying some simple control exercises to MODIS, for example tracing out various projections keeping full employment and a satisfactory balance of payments, yet varying the mix of direct and indirect taxes. This will prepare the ground for more sophisticated exercises using MODAG/MSG.

#### 4. THE MODELS IN THE SYSTEM

The administrative procedures of the Ministry of Finance and the Planning Secretariat have adapted to the needs of the model (even to the extent of changing the fiscal year to a calendar year basis!) and the model has been adapted to meet the needs of the planners, by becoming very "user-friendly", conforming to National Accounts and having its input requirements simplified. Figure 3 shows how the models relate to one another at present.

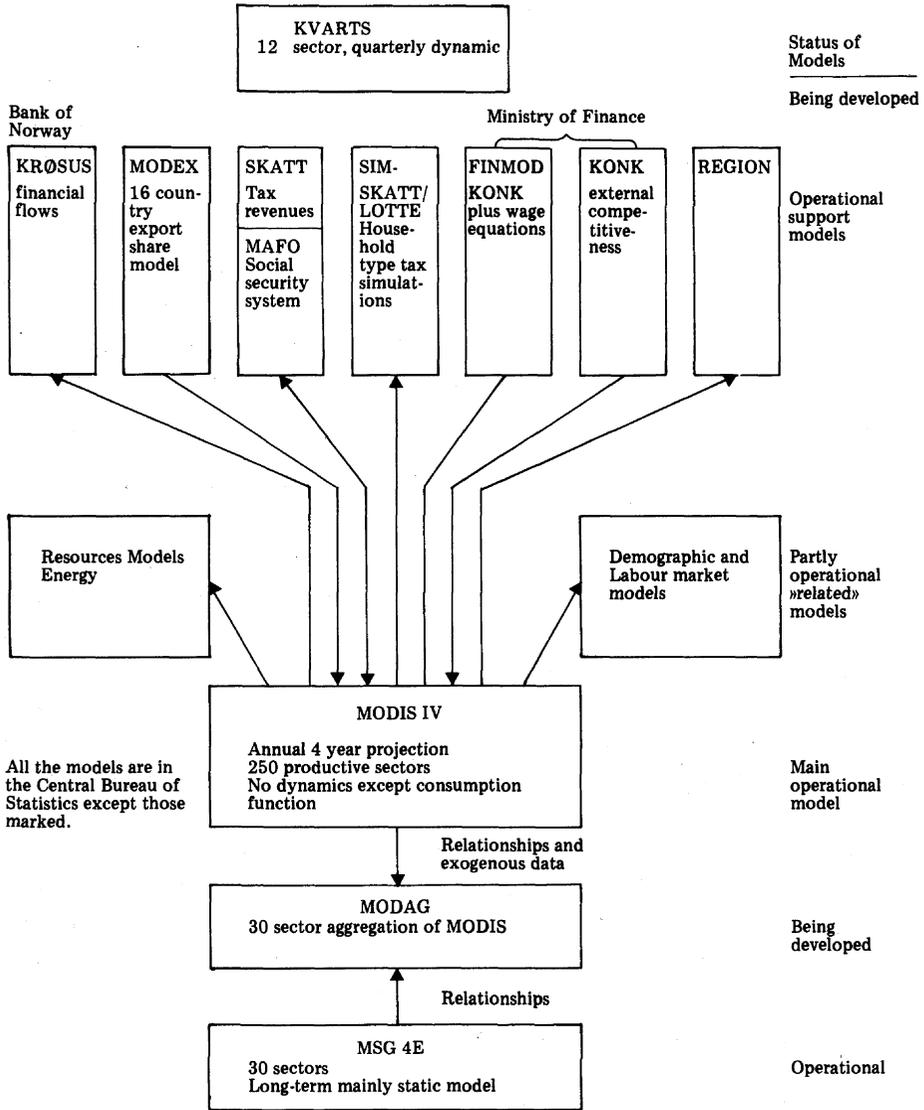
##### 4.1. MODIS and its support models

MODIS is a highly disaggregated open model in the sense that it simulates very little of economic behaviour. Its functions within the system are as follows.

- (i) as "a glorified typewriter" putting together the economic assumptions behind a forecast and presenting them along with their implications.
- (ii) maintaining consistency, accounting identities and uncontroversial straightforward economic relationships such as input-output relations.
- (iii) organising by means of form-filling, committee meetings, papers and notes, the planning ministries' views on economic development and economic policy.

A number of support models have been developed over the years which provide inputs into MODIS or which use the results of MODIS. Some

Figure 3. The Main Models in the System



do both - for example the energy model in principle should change some input-output coefficients in MODIS. The problems here are two.

- (i) The support models may be built by just one person and fully understood only by that person so it becomes very difficult to use the support model if that person leaves.
- (ii) The solutions of MODIS and the support models will not be consistent. The repeated solution of the models during the period leading up to the final accepted solution will of course ensure consistency, but unless the models are all solved simultaneously it will be difficult to make major last minute changes.

The solution to the second problem is to integrate the support models which are tried and tested into the MODIS solution. Or if this is too extreme, it should be ensured that there are operational procedures to repeatedly solve all the models so that output from one solution becomes input in the next. This will be computationally inefficient, but it should ensure consistency if all the relevant interactions are included.

With regard to the first problem, integration with MODIS helps, but is not enough. It must be emphasised to anyone building a support model that full documentation on data sources, methods and techniques used must be made. If there is not one already, there should be a series of papers, one for each model, which should be written and approved before the models are extensively used.

More generally, the strength of MODIS is its accounting framework. Although it seems to be agreed that MODIS should not be extended, it does seem appropriate that important sets of accounting identities, most notably the money and credit accounts, should be included. Furthermore, because typically the input-output coefficients are not changed, the repeated solution of MODIS will never achieve consistency with support models whose outputs imply (for example the energy model) changes in the input coefficients of industries. So there is a case for making the model even more flexible than it is, by opening up the input-output sector to changes which are well-founded and agreed.

#### 4.2. MODIS and MODAG

A new development is the aggregation of the sectors in MODIS to the 30 branch aggregation level of MSG. The aggregated version, MODAG, at present follows exactly the economics of MODIS, but there are plans to extend it to include more behavioural equations. This seems a sensible direction in which to go and fits in with the idea that MODIS should be

used to provide the central path of the forecast and MODAG to provide the deviations from that path as a result of changes in exogeneous assumptions and economic policies. MODAG would then replace the KONK and FINMOD models, and indeed KRØSUS, if it is extended (as it should be) to include financial behaviour.

There are, however, problems in the relationship between the MODIS solution and this "behavioural" MODAG solution. Even if both models receive the same exogenous variables (where these coincide; many exogenous variables in MODIS would be endogenous in MODAG) they will normally yield different forecasts. Following the spirit of the present procedures to their logical conclusion would mean that the equations for endogenous variables in MODAG which are exogenous in MODIS would have special extra terms (add-factors) calculated so that the solution of the two models was identical. The development of MODAG should reflect this need for consistency with MODIS.

This procedure would ensure that the central or standard projection of the economy was the same for both MODIS and MODAG. However, any simulation of alternative policy would differ between the models, with MODAG giving the fully interrelated dynamics of the behavioural equations and MODIS giving the elementary input-output effects.

#### 4.3. MODAG and MSG

At present MODAG is conceived of as a medium-term annual model projecting 4-5 years into the future and MSG as a long-term model showing the steady state economy 4 years ahead and more. In any projection with such a system there will be an awkward year (1985 at the moment) when the two sets of projections are liable to be different and the question arises of whether 1985 is on the long-term steady state path or not. The issue becomes more complicated if a realistic development of oil prices is allowed i.e. very substantial increases every 4-5 years coinciding with the top of the world trade cycle.

What I suggest is that MODAG be developed as a dynamic year-to-year model with the equilibrium levels of the equations chosen as for the MSG model. The fitting of the equations will provide estimates of the time lags involved in the movement towards steady-state equilibrium during the projection period.

An example of such a treatment can be given using the simple long-term consumption function

$$c_t = a y_t$$

where  $c_t$  is consumption, year  $t$

$y_t$  is income, year  $t$

and  $a$  is a parameter.

Now take the function

$$\log c_t - \log c_{t-1} = \alpha_0 + \alpha_1 \log y_t + \alpha_2 \log y_{t-1} + \alpha_3 \log c_{t-1} + \epsilon_t$$

and estimate it both freely and subject to

$$\alpha_1 + \alpha_2 = 1, \alpha_3 = -1.$$

Then if  $y_{t-1} = \beta y_t$ , i.e. steady-state income growth

$$\log y_{t-1} = \log \beta + \log y_t$$

we have

$$\log c_t = \alpha_0 + \alpha_1 \log y_t + \alpha_2 \log \beta + \alpha_2 \log y_t + \epsilon_t$$

$$\log c_t = (\alpha_0 + \alpha_2 \log \beta) + \log y_t$$

$$c_t = (e^{\alpha_0 + \alpha_2 \log \beta}) y_t$$

which is of the same form as the original long-term consumption function

$$c_t = a y_t$$

Thus, in the long run, consumption will be proportional to income, but in the short run, the adjustment will depend on the values of  $\alpha_1$  and  $\alpha_2$ . A test on the restrictions on the parameters will indicate whether the long-term relationship is justified by the data.

#### 4.4. Relationships in MODAG/MSG

An annual model intended to project well into the future will have to be fairly tightly constrained to prevent it giving unacceptable results. The following features are recommended in such a model.

- (i) It should be price homogenous, except in the case of one or two key aggregate relationships, such as an aggregate wage equation.
- (ii) The price effects should be symmetrical and of the "right" signs; other parameters where there is an expected sign or magnitude should be constrained to achieve the desired results.
- (iii) Great care should be taken in introducing time trends into the basic equations. They should only be inserted as specification tests to see if important variables have been omitted. Where an equation displays an insignificant time trend, this trend should be removed. Where the trend is significant, an investigation should be made into its cause to see whether it should be replaced by a dummy variable, for example. Any time trends left in the model should be scrutinised to determine when they should end in the projection period.
- (iv) Highly complex non-linear equations with many parameters to be fitted to a small sample of data should be avoided. They can cause serious problems. First, special fitting procedures may be necessary and they may be very expensive of computer time. Second, a wide variation in parameter values may fit the data more or less equally well, yet give very different properties to the model. Finally, the economics of the equation may not be easy to interpret or understand.

The main models at present in use appear to have these features already, but they should be kept in mind by those developing the MODAG model.

In contrast with the present MODIS and MSG models, an extended MODAG might contain.

- (i) More dynamics.
- (ii) Factor demand equations for capital, labour and energy. The problem here is to combine the production function with a consistent system of dynamic factor demand equations. If a set of such equations is derived from a static production function then a dynamic structure is added to each equation independently, they will be inconsistent and any cross-equation constraints imposed from production theory may cause serious mis-specifications.
- (iii) Different unit-values for imports, domestic output and exports for each commodity. These might be estimated subject to the removal of the differential in the long-term if the law of one price was believed to be true for Norway.

- (iv) Price equations, wage differential equations and a wage equation.
- (v) Income and outlay accounts for institutional sectors leading to net acquisition of financial assets by each sector. In a medium-term and long-term model this is very useful for checking whether each sector's borrowing and lending implied by the real and nominal flows is not going completely out of control. For example at high rates of interest, a public sector deficit can easily expand to the point that all extra borrowing is required to pay interest charges. The long-term financial constraint represented in the balance of payments accounts is also part of this exercise.

#### 4.5. A proposed model arrangement

Figure 4 shows a tentative re-arrangement of models, with MODAG and MSG merged with KONK and FINMOD whilst several other models would be solved simultaneously with MODIS or MODAG/MSG but also be capable of being solved independently.

With the development of MODAG into a behavioural dynamic model, this would entail a major effort by the Central Bureau of Statistics requiring re-organisation and extra resources in the model-building unit. At present the unit is responsible for maintaining the existing models, improving them and investigating new models, with 2 people working on MODAG and 1-2 people in MSG. Clearly, the maintenance of existing models including KVARTS must go on, leaving between 2 and 4 people working on a new combined MODAG/MSG/FINMOD/KRØSUS model.

Such a team is too small to tackle such a major development. In my experience the best size for a team working on developing such a model is about 7 or 8 people. Each member of the team should be allocated an economic sector (consumption, production etc.) as his or her primary responsibility and should be insulated from the other work of the model-building unit.

## 5. THE DATA

### 5.1. The national accounting procedures and MODIS

The procedures starting from the different original data sources (for example the Census of Production data) and going to the disaggregated National Accounts are complicated and specialised. The arrangements are shown in figure 5.

Figure 4. A Propose Arrangement of Models

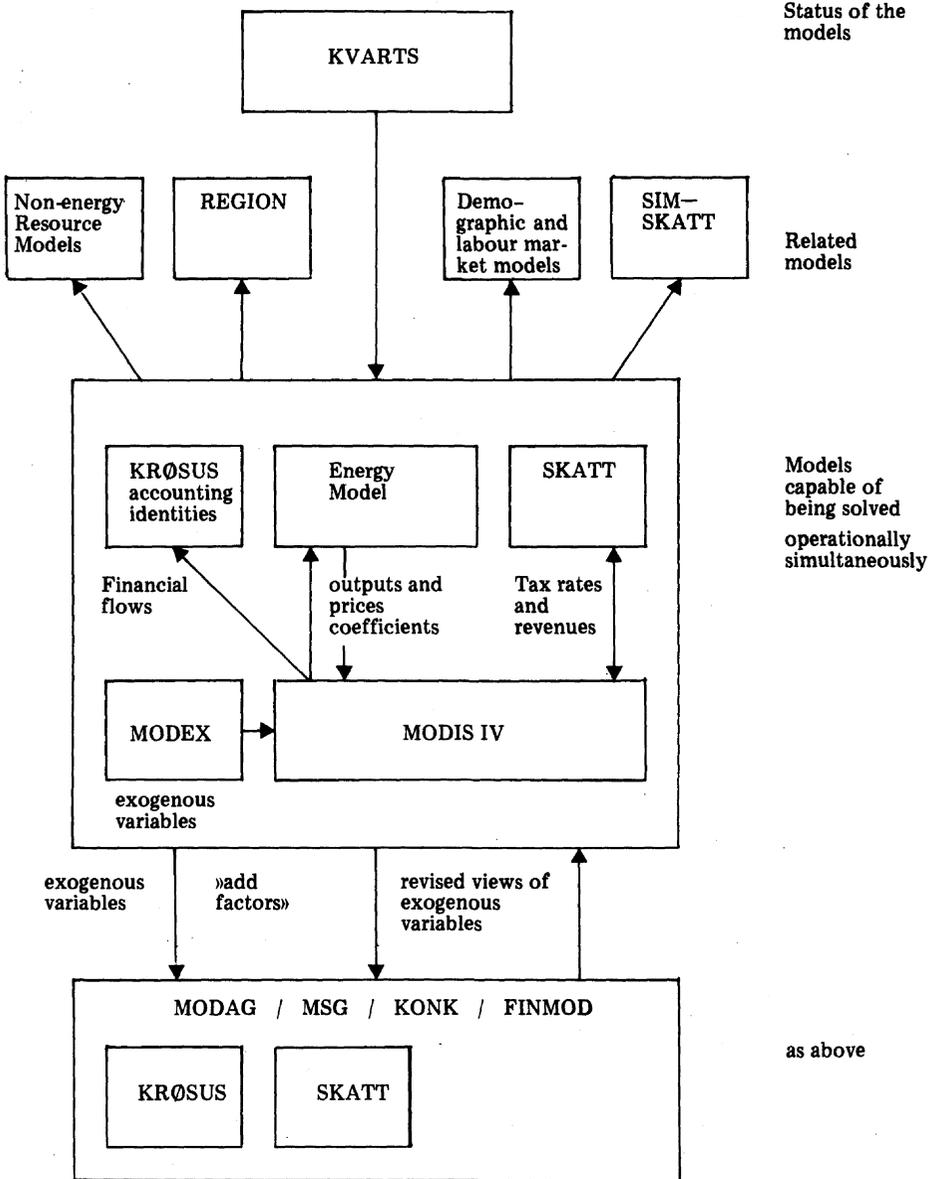
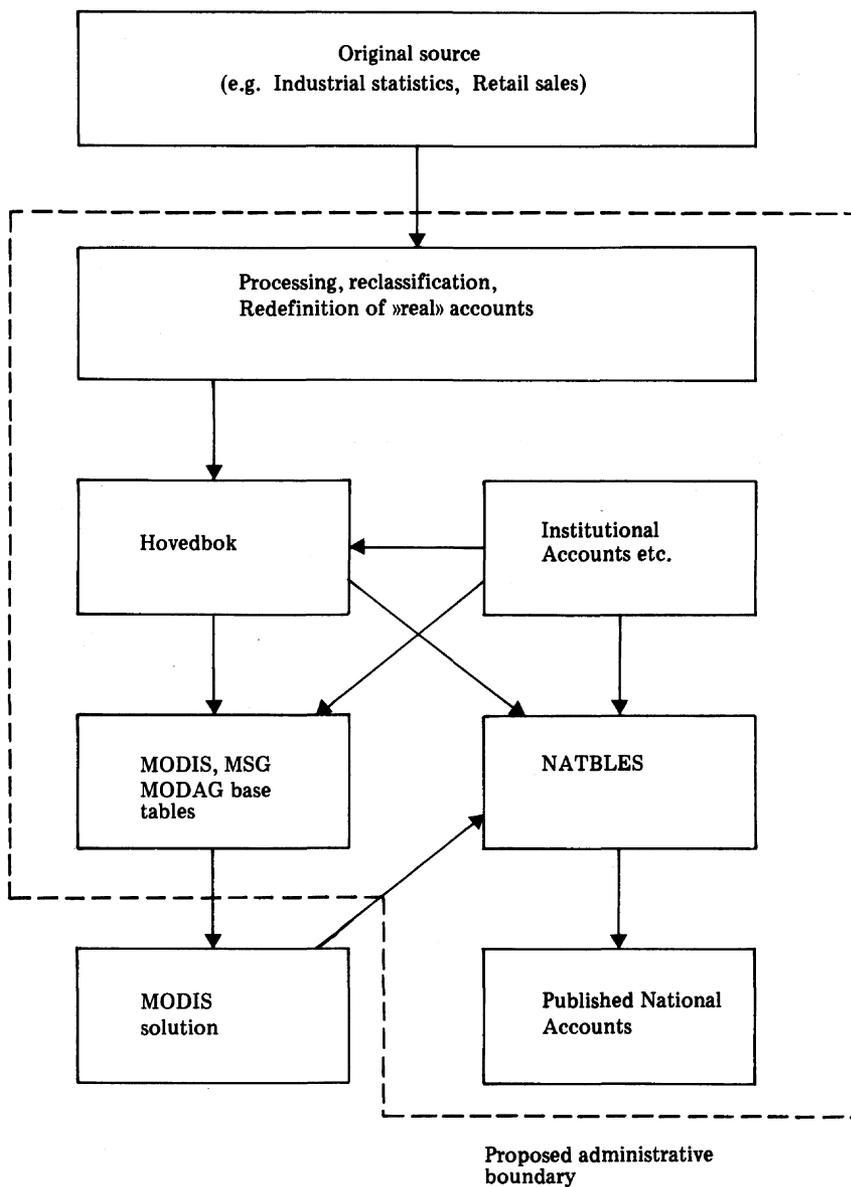


Figure 5. National Accounts Procedures and the Main Models



In these arrangements, it is not clear where the responsibility lies for constructing the base tables for MODIS. The dotted line includes this with the work for the national accounts. I think this is where it should be, for three reasons.

- (i) It is done once a year, unlike the solution of MODIS which is done many times during the year.
- (ii) It involves the same kind of definitional problems, aggregation and special procedures as the work for the National Accounts.
- (iii) It is already being done by the National Accounts team.

If the accounting structure of MODIS is extended to include the institutional income and expenditure accounts, as suggested above, then the base tables for MODIS would have to be extended similarly. The Hovedbok should also be extended to include institutional and financial flows as treated in the SNA. Many of the entries in the institutional flow accounts over the projection period will be already available in the MODIS solution, for example many tax receipts and payments. Others would be exogenous to be calculated by the Ministry of Finance or the Bank of Norway.

## 5.2. Data reliability, the National Accounts and residual errors

Apparently in the early days an indication was given of the subjective reliability of different items in the accounts. The present procedures go to extremes in treating some data as more or less wholly unreliable (profits, stockbuilding, changes in holdings of financial instruments) and other data as more or less correct when reconciling supplies and demands for commodities and gross domestic product measured from the income side and from the expenditure side. The reliability of many individual items is, however, taken into account during each balancing exercise.

No residual error between income and expenditure GDP is shown and indeed the practice has been to publish only consistent data with full allocation of any discrepancies. However, this principle is being relaxed, with the publication, for example, of a balancing item for error in the balance of payments (the institutional accounts of "the rest of the world"). A further balancing item will arise when the present exercise reconciling consumer savings from the income and outlay accounts with those of the financial accounts comes to fruition.

Perhaps the best treatment of errors is to publish estimates of all the main discrepancies, including those between the different measures of GDP and also to provide a balanced picture of the whole of the accounts with full allocation of the errors, on the grounds that the Central Bureau of Statistics knows the data best and so is in the best position to produce a consistent set of accounts.

There is some danger of the present system being rather ad hoc and depending very much on one or two individuals' judgement. There is movement in the right direction with the present balancing procedures being formalised as a "menu" of alternatives for each item. I was told that this could be done by the computer and would take care of about 90 per cent of the adjustment.

On a longer term basis and perhaps initially with an aggregated version of the accounts, new computer-based procedures should be investigated. These allow the balancing exercise to meet all the accounting identities and at the same time allow for subjective reliability of the different items in the accounts. Rick van der Ploeg (see the reference list) reports work done in this area by the Cambridge Growth Project in a recent paper for the UK Royal Statistical Society.

### 5.3. Preliminary National Accounts and the models

Table 1 shows the various preliminary and final accounts prepared for a particular year, say year  $t$ . MODIS uses the Second Preliminary Accounts (the March account) as data for the base tables for the year  $t$  when doing a projection in the year  $t+1$  for the years  $t+1$  to  $t+5$ . The time series data used for estimating behavioural relationships comes from the Final Accounts and the Revised Final Accounts which take account of occasional censuses and surveys as well as new price bases.

Some rationalisation may be worth considering in this arrangement. In particular the value of the First Preliminary Accounts seems to be very limited.

- (i) They are obsolete after about 8 weeks when the Second Preliminary Accounts are produced.
- (ii) They involve guesses as to the outcome for the final months of the year.
- (iii) They could be replaced by the current MODIS solution for the year without much loss in accuracy. (I was told that the MODIS solution for year  $t$  has turned out to be more accurate in general as a guide to the final accounts for year  $t$  than the First Preliminary Accounts prepared at the same time as the MODIS solution.)

Table 1. National Accounts for Year t

Name of the Accounts	Uses	Date of Preparation	Publication	Year of Input-Output Base	Method
First Preliminary Accounts Economic Survey Accounts	May be used in revised National Budget	December year t	<u>Economic Survey</u> end January year t + 1 aggregated tables	t - 2	The November accounts in current prices for year t - 1 are "inflated" by use of quantity indicators for the first 10/11 months of year t then reconciled. These are then "inflated" by price indicators to obtain current values.
Second Preliminary Accounts "March accounts"	Base year for MODIS, MSG, etc.	March year t + 1	<u>Weekly Bulletin of Statistics</u> (aggregated) April, year t + 1 & <u>National Accounts &amp; Statistical Yearbook</u> August/September year t + 1	t - 2	Same as above, except that indicators are now used for the whole year t.
Third Preliminary Accounts "November accounts"	Basis for first and second Prelim. Acc. year t + 1	November year t + 1	<u>Economic Survey</u> end January, year t + 2	t - 1	Final accounts for year t - 1 are used as the basis and many of the values previously calculated from indicators are replaced by final values for year t.
Final Accounts	Statistics for estimating models	Year t + 1	<u>Economic Survey</u> end January, year t + 3	t	
Revised Final Accounts	Put N/As on a new price basis (eg. 1980)	Every 5 years			

If these accounts were no longer estimated, and the MODIS solution updated for obvious changes and used instead, it may help to make sure that the Second Preliminary Accounts were produced in good time.

A related issue, which also concerns the predictions of the models, is the "track record" of the Preliminary Accounts and the model solutions in forecasting the final outcome. This is a complicated exercise, but one which may yield big rewards in pinpointing the weaknesses in the models and the Preliminary Accounts. It is also an exercise which is probably better done outside the Government service. One suggestion is that an economist and statistician/programmer in an outside institution should be commissioned by the Central Bureau of Statistics to do an evaluation of past forecasts of the models and the preliminary accounts, highlighting weaknesses and comparing performance with similar models and accounts in other countries.

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