Discussion Paper

Central Bureau of Statistics, P.B. 8131 Dep, 0033 Oslo 1, Norway

No 66 October, 1991

WILL RESTRICTIVE DEMAND POLICY IMPROVE PUBLIC SECTOR BALANCES ?

Einar Bowitz and Erik Storm
Central Bureau of Statistics,
P.O. Box 8131 DEP
N-0033 Oslo
NORWAY
(tel: 47-2-86 48 11 and 47-2-86 48 16)

ABSTRACT

A policy simulation on the Norwegian macroeceometric model MODAG indicates that there are large automatic stabilizers in the system of government revenues and expenditure in Norway, especially in the short and medium term. A relatively large part of transfers (in addition to unemployment benefits) is found to be influenced by changes in unemployment. The consequence of this is that the potential for improving public sector balances by means of a restrictive demand policy, may be more modest than usually believed.

The paper also contains a long term projection of government expenditure, with special emphasis on effects of ageing of the population and the maturing of the pension system, implying increases in pension payment per beneficiary in the future. The governement expenditure projections indicate that transfers (mainly old-age and disability pensions) will increase by 5 percentage-points of GDP from 1990 to 2030, given that unemployment returns to the estimated NAIRU in the future. In addition increased demand for medical care due to ageing, may be said to warrant additional increases in (public) health consumption of a somewhat smaller size.

This work is a part of the project "macroeconomics and the welfare state", financed by NORAS (Norwegian coucil for applied social research).

1. INTRODUCTION

In many European countries there are widespread concern over the development of public sector finances, several countries having large deficits in public sector balance sheets. As this has lasted for several years, public sectors in many countries have acquired large debts. The average debt/GDP ratio in the G7 countries rose from about 20 per cent in 1979 to 30 per cent in 1989. At the same time GDP growth in the 1980's was clearly lower than in the 1970's, and real interest rates have been much higher. In many countries public sector deficits are also accompanied by large current account deficits, although this is not a universal pattern. Economic policies in most countries in Western Europe have emphasised measures to reduce these deficits, at the same time as persistent unemployment puts large burdens upon public sector finances. Contractionary demand policy will affect unemployment negatively, and may therefore worsen public finances.

In Norway, the situation wrt. public finances up to now has been very different from this pattern. The public sector in Norway, particularly the state sector, has run surpluses almost every year since world war II, and has accumulated a net asset position of more than 35 per cent of GDP (1990). The last decade or so, taxes and other revenues from the emerging petroleum sector have contributed significantly to the favourable financial position of the public sector in Norway.

Since 1988 unemployment has risen sharply in Norway, partly due to the contractionary policy following the oil price drop in 1985/86. At the same time public revenues from the oil sector declined sharply as a direct effect of the falling oil prices. Together with the domestic recession, public sector balances deteriorated sharply, from a surplus of 7,3 per cent of GDP in 1985, to a government projected deficit of 2,8 per cent of GDP in 1991. Growing concern over the development of government finances has followed, leading e.g. to more restrictive rules for obtaining certain transfers and pensions etc. In addition to declining oil revenues it seems clear that reduced taxes excl. oil taxes, and increased transfers, mainly to unemployment benefits, have contributed to the worsening of the public sector balance in Norway.

This paper describes how the government sector surplus (GSS) is determined in the Norwegian macroeconomic model MODAG, and how it is affected by demand policies. The main emphasis is put on describing the cyclical responses of a policy shift, but the model is also well suited to cope with more long term trends in public expenditure as well, eg. increases in old-age pensions and needs for medical care due to ageing of the population. This is described in some detail in chapter 6, containing a long run projection of government expenditure inter alia linked to the effects of ageing of the population.

The main conclusion of this paper is that we find large automatic stabilizers in the system of public revenues and transfers. A relatively large fraction of transfers is found to be influenced by changes in unemployment, apart from unemployment benefits, of course. The consequence of this is that the potential for improving public sector balances by means of a restrictive demand policy, may be more modest than usually believed at least in the short and medium term. The long term government expenditure projections indicate that expenditure to old-age and disability pensions will increase by 3 percentage-points of GDP until 2030, given low unemployment in the future. In addition, demand for medical

care may be said to warrant additional increases in health consumption of a somewhat smaller magnitude in the 2020's. Also the sharply declining demand from the petroleum sector the first years in the next century is likely to require weakening of government balances to prevent high unemployment.

The paper is organized as follows. First we present a general description of the whole MODAG model. Then a more detailed description of the transfer block, accompanied by a description of the structure of public sector revenues and expenditure in Norway is given. A multiplier analysis of a reduction in public sector employment is then used to illustrate the working of the model, both with respect to the real economy and in particular to the financial position of the government sector. Chapter 6 gives an outline of the baseline simulation, containing projections for public sector expenditures and revenues until 2030. In chapter 7 we show some of the effects from a simulation where we have changed the indexation of the basic pension unit (BPU) in the Norwegian system of social insurance.

2. DESCRIPTION OF MODAG[1]

2.1 Main Features

The main structure of the model MODAG is an input-output based model used in short- and medium-term macroeconomic planning and policy analysis in Norway. MODAG is influenced by the Scandinavian model of inflation, with its distinction between exposed and sheltered commodity markets, Keynesian macro theory and input-output modelling. The Norwegian national accounting system forms the conceptual framework and the empirical basis of the model. Nearly all parameters of the various submodels are estimated econometrically from national accounts time series, whereas the coefficients of the input-output structure are estimated from national accounts for the base year of the model. The description of the commodity flows is one of the main elements of MODAG. Just as in the national accounts, commodity transactions are represented by means of two commodity by sector-matrices, one for the flow of commodities to each sector and one for the flow of commodities from each sector. The principal concept for evaluating commodity flows is (approximate) basic values. The commodity flows are flows between (functional) sectors. MODAG has 40 commodities, 28 production sectors and 14 categories of private consumption. Real capital and investments are grouped into 4 categories for each of the production sectors. For crude oil and natural gas exploration investment goods are disaggregated further. Households demand goods (private consumption and housing capital) and supply labour. As opposed to earlier versions of MODAG, the present model has no macro consumption function. Instead there are separate equations determining investment in durable consumer goods and investment in housing. Consumption and saving is determined on the basis of current and lagged values of the variables. Consumption of housing services is proportional to the stock of housing capital following the accounting rules in the Norwegian national accounts. Consumption of non-durables except housing services is determined by a semi-macro consumption function depending on real disposable income and the rate of interest. Different categories of non-durables are then disaggregated using a two-stage dynamic version of the linear expenditure system. Labour supply is described in ch. 2.2.

It is useful to distinguish between two main groups of firms in the private sector; those belonging to resource-based sectors, and other firms. By resource-based industries we mean agriculture, forestry, fishing, crude oil and natural gas exploration and hydro-electric power generation. For these sectors both production and prices are generally exogenous in MODAG. Most other industries are modelled as if the market for each good is characterized by monopolistic competition. In modelling the commodity markets we assume that commodities are imperfect substitutes. More precisely, the model has been constructed on the assumption that it is possible to identify separate demand curves for competing Norwegian products both on foreign and domestic markets. Thus for each commodity there are three market prices, an export price, an import price and a price on goods delivered to the domestic market by Norwegian producers. Export prices and domestic prices are given as mark-up equations where we use variable unit costs in addition to a capacity utilization index as instruments for marginal costs while the ratio

[1]This is largely based on Cappelen (1991).

between the import price and the relevant Norwegian price may change the price elasticities of demand and thereby the mark-up. The export-volume of each commodity is determined by a demand equation depending on the relative commodity price (as an indicator of competitiveness) and an index of imports by the main trading partners (as an indicator of market size). Import-volumes are either determined directly by the commodity balance equation (for non-competitive goods and most resource-based goods) or by import shares where the import shares varies not only between goods but also between different users of each good. Most import shares are endogenous depending on the relative price of imports and the domestic price. Thus, with no changes in relative prices, exports are determined by foreign demand while imports and production are determined by domestic demand. In the production sectors, material inputs are determined by the input-output structure. However, energy inputs (electricity and fuels) are given special treatment. They are substitutes and the input share depends on relative prices. Total energy input by sector is determined by a CES aggregate which is proportional to gross output. Labour demand (hours) is modelled as a function of gross output, relative factor prices, lagged capital stock and a time trend. In those sectors where labour demand depends on relative factor prices, material inputs also depend on relative factor prices and the capital stock so that when the wage rate increase material input is substituted for labour in a consistent way. For other sectors material inputs except energy are proportional to gross output. Gross investment by sector and type of capital good is determined by gross output and profitability.

Although the model has 27 functional sectors, it has only 6 institutional sectors. This means that saving, financial investment and assets and liabilities are determined for these sectors only. Among the institutional sectors, the model distinguishes between central and local government, households, corporate firms ex. oil and shipping, the oil sector and the shipping sector. In long run simulations the development in sectoral financial investment will accumulate and may create potentially large changes in later interest payments.

In the present model version, financial variables and interest rates in particular, mainly affect households due to the income effects and through substitution effects such as in the housing investment equation. These interest rates are modelled as mark-up or mark-down equations of the money market interest rate. The money market rate is largely determined by (a weighted average of) the foreign (Norway's trading partners') interest rates, the interest rates of the different sectors' gross assets and liabilities are different. Historical values for these (average) interest rates are determined by dividing observed flows of interest payments by observed stocks of assets and liabilities. In average, interest rates on assets are lower than the ones for liabilities in the different sectors, and they are all lower than the money market rate. But there are also sectoral differences, eg. the rate of interest of central government assets is especially low, reflecting the historical fact that the government has been a major lender of subsidized loans to housing and agriculture, often loans with very long maturity. For government sector assets and liabilities we thus have introduced a distinction between marginal and average interest rates. Average rates are determined by marginal interest rates and lagged average interest rates, with weights depending on the actual development of gross assets and liabilities in the two government sectors. For private sectors' interest rates we assume that marginal and average interest rates are equal.

2.2 How demographic variables appear in the model analysis

MODAG has a relatively detailed demographic specification, where inputs are the number of persons, by sex, marital status (for women) and age. Forecasts for these variables are obtained from the Central Bureau of statistics' (CBS) official demographic projections. In MODAG the number of persons, together with endogenously determined labour force participation rates, determine labour supply. The equations are on logit-form, securing that simulated participation rates are below one. Given productivity, this limits the level of aggregate production in the model. Of particular interest in a long run simulation are the equations determining the participation rates for the groups married and not married women, respectively. Participation rates for these groups have increased sharply the last 20 years. Important factors determining labour force participation are the level of education and the number of jobs in "women intensive " sectors, inter alia medical care, which is mainly provided by the local government sector. Also the number of small children and the average age of women 25-66 is of importance to labour participation. Increased age having a positive impact on female labour participation captures the effect that the needs of caring for small children in the family are reduced when the number of women in their 20's and the early 30's is reduced. Also an increase in the number of children has a negative impact on female labour participation in the model. Real wages exert a positive, but quantitatively small impact on labour participation rates, income and substitution effects almost cancelling out.

The demographic effects on transfers are potentially large, and to some extent handled outside MODAG. This is the case with the largest programme - old-age pensions - where the number of beneficiaries (all of age 67 and over) is not influenced by economic conditions. But a model block for disability pensions consisting of about 100 equations (only a few econometric) are contained inside MODAG, due to the effects of the labour market situation on entry to disability pension. The disability rates are also varying greatly with age. See ch. 4.

Demographic changes, eg. changes in the number of elderly (especially the number of old elderly), may also have potential effects on the demand for medical and social care services, as such needs increase sharply with age. On the other hand, changes in fertility will in time result in changing needs for e.g. education. Both medical and social services as well as primary and secondary education in Norway are provided by the local government sector. In the CBS there is developed a special model for local government consumption to account for these factors - MAKKO ("a macro-model for the local government sector", cf. Ljones and Aamdal, 1990). To model the production in these sectors, the MAKKO model projects production based on a demographic projection, and parameters reflecting the coverage of different services and the (inverse of) productivity measured as man-hours per client (standards). In our analysis we have utilized the simulated path for local government consumption from this model, based on the same demographic projection as the MODAG-simulation.

Forecasts for standards and coverage rates are crucial to the results for local government consumption from MAKKO. The 1980's evidence indicates that the bulk of the increase in local government consumption was due to increased standards and coverage rates, and not by demography. This may indicate that the authorities' possibilities to adapt local

government consumption to the aggregate macroeconomic development is considerable. However, we will in our analysis explore the possible demographic effects from the future swings in the age distribution of the population, given forecasted values for standards and coverage rates. At the same time we recognise that the simulated government expenditure effects on local government consumption may be less difficult to contain than the one originating from the development of the old-age and disability pensions. For further descriptions on assumptions on local government consumption, see ch. 6.

3. A CLOSER LOOK AT PUBLIC SECTOR EXPENDITURE AND REVENUES IN NORWAY

The size of the public sector in Norway is by OECD standard of average size in terms of public consumption, employment and investment. However, total tax revenue is much larger than the OECD-average and roughly half of total tax revenue is transferred back to firms, households and as development aid (the latter constituting more than one percent of GDP). These transfers are to a large extent public pensions, and subsidies to certain production sectors such as agriculture, domestic transport and to consumers. Given the size of tax revenues and transfers, the modelling of these flows are important for the model properties as a whole. Due to the fairly detailed input-output structure indirect taxes and subsidies are modelled in great detail. The model distinguishes between tax rates ad valorem and on quantities as well as commodity-related and sector related taxes. The latter are lump-sum transfers to production sectors and their real value by sector is exogenous. Direct taxes paid by the households are also treated in detail and a separate microdata-based model is used in order to estimate average and marginal macro tax-rates for three socio-economic groups. These macro tax rates are exogenous variables in MODAG. Taxes from the corporate sector are also endogenized by relating them to net operating surplus and net interest income in the corporate sector (ex. oil and shipping).

The government sector is disaggregated into central and local government, and these sectors again are further disaggregated into three sectors, education, health and others. In addition, in the central government sector, defense is specified as a separate sector. Public sector employment and purchases of goods and services in the various subsectors are exogenous, together with endogenous depreciation determining the path for public consumption. Public sector investment is exogenous as well.

Table 1. Government revenues and outlays 1990[1)]. Bill NOK and per cent of GDP.

Revenues:	**331,2**	**(49,6)**
Personal taxes	114,8	(17,2)
Other direct taxes ex. oil	10,8	(1,6)
Oil taxes etc.	36,8	(5,5)
Payroll taxes	50,5	(7,6)
VAT	57,8	(8,7)
Other indirect taxes ex. oil	46,8	(6,9)
Net interest revenue	14,2	(2,1)
Expenditure:	**323,8**	**(48,4)**
Subsidies	41,1	(6,2)
Transfers	129,2	(19,3)
Public consumption	139,2	(20,8)
Public net investment	14,3	(2,1)
Government sector surplus	**7,2**	**(1,1)**

1) The definitions are somewhat different from official ones, as all net interest revenues are put on the revenue side.

4. MODELLING TRANSFERS

Transfers from the public sector amount to a large fraction of the household sector's revenues. The larger share are transfers from the National Insurance (NI). Revenues and outlays from the National Insurance are however fully integrated into the rest of the public sector balance sheets, and we will not distinguish between transfers from National Insurance and other central government transfers. It may seem somewhat arbitrary which kind of transfers that are paid from National Insurance, and which are paid directly from the state budget. For example, unemployment benefits and family allowances are paid from the central government budget, while illness allowances are paid by National Insurance.

Transfers from the government was about 129 bill kroner in 1990, which is about 1/4 of households' income before taxes, or about 1/5 of GDP.

All transfers to households are endogenous in MODAG. This is done to take account of the more or less automatic payments from social security to old-age pensions, unemployment benefits and disability pensions. But other transfers given by the central or local government also have a great deal of endogeneity, eg. family allowances, illness allowances, childbirth allowances and social care allowances. These transfers are modelled as functions of the demographic development, unemployment and wage growth.

Some other components, accounting for a smaller part of aggregate transfers, are endogenized simply by linking them to population growth and the aggregate wage rate.

Below follows a short description of the equations determining transfers not only linked to population and wages.

Table 2. Transfers to households in MODAG. Bill. kroner 1990

Old-age pensions	37,9
Disability pensions	17,6
Illness and childbirth allowances	14,0
Family allowances	8,8
Unemployment benefits	7,9
Rehabilitation allowances	5,6
Miscellaneous local govt. allowances	7,8
Other transfers[1]	29,6
TOTAL	129,2

1) 6 smaller transfer groups

4.1 Old-age pension

The central parameter for old-age and disability pensions and rehabilitation allowances accounting for about one half of aggregate transfers, is the Basic Pension Unit (BPU). Pensions are paid in different proportions to BPU. BPU also serves as a parameter in

calculating pension rights (pension points) for the working population, see ch. 7 for a more accurate description.

Old-age pensions measured by the number of BPUs (OABPU) is exogenous in MODAG. Given population forecasts, forecasts for OABPU is obtained from a simulation of an other CBS model designed to model old-age pensions in some detail (MAFO- "macro- model for the social security old-age pension"), and from model simulations from the National Social Security Administration. Changes in old-age pensions measured in BPU (OAPBPU) are determined by

- the number of persons 67 and above
- the maturing of social security, as a larger fraction of the pensioners have obtained the maximum pension years possible
- increased labour participation rates for women, leading to increased pension rights
- changes in the rules for obtaining pension rights, and for supplementary pensions

The BPU is determined in MODAG by the indexing formula

(4-1) BPU/BPU(-1)= W/W(-1) + correction variable

implying that the BPU is linked to the (nominal) wage level. This is in accordance with the official policy "rule" when social security was established in 1967, when legislators declared that pensions should increase in line with incomes of the working population. But the actual indexing since the mid 1970's has been somewhat different, as the increases in BPU has been more similar to the increases in consumer prices than to wages. The authorities have however increased the minimum old-age pension by a specific compensation formula (særtillegg) such that in most years the minimum old-age pension has followed or increased faster than average income for the employed.

Old-age pensions i current prices is simply the product of OABPU and BPU (equation (4-2)).

(4-2) OAP=BPU·OAPBPU

As both pension rights and current pensions are linked to BPU, and if BPU follows real income growth (= productivity growth) for the working population, changes in productivity growth does not change the tax burden of the working population to finance the pensions to the elderly, cet. par.

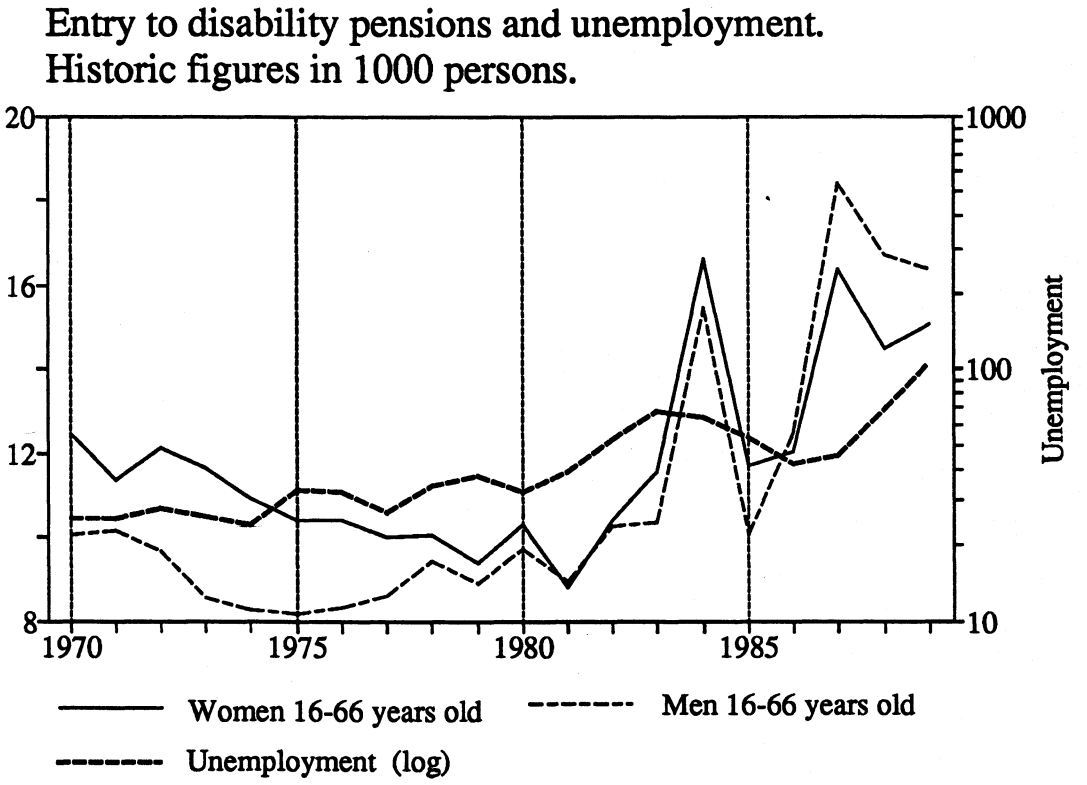
4.2 Disability pension

For disability pensions we have constructed a relatively disaggregated model, accounting for inflow and outflow of persons. Population is divided by sex and the age groups 16-39, 40-49, 50-59, 60-64 and 65-66 years. Entry of pensioners, ageing of the disabled persons and exit from disability pensions are modelled in some detail. As a person has entered the disability pension, the only way out of this programme has been old-age pensions or by death; practically nobody move from being a disability pension receiver back to the

workforce.

Historically there has been a considerable increase in the number of disability pension receivers in the 1970's and 80's. This has largely been due to increased entry rates to disability pension. Many micro-studies in Norway have found strong influences of layoffs and the local labour market situation on the tendency to be classified as disabled, see eg. Westin (1990). Disney and Webb (1991) reports close relationships between unemployment and entry to disability pension in the UK. Also, disability in Norway is much higher in regions with high unemployment than in regions where unemployment traditionally has been low. Figure 1 shows the number of entries into disability pension for men and women respectively, together with the (log of the) unemployment rate. An important feature of the functioning of the disability pension programme in Norway is that practically nobody who once has been classified as disabled ever returns to the labour force. This is why we have chosen a relatively detailed modelling of entries and exits, as temporary increases in unemployment may have long lasting effects on the number of disabled persons and the level of disability pensions.

Fig 1. Entry rates and unemployment



In MODAG entry rates are modelled as functions of (the level of) the unemployment rate and a variable indicating the number of layoffs (see below). For women, there has been a stronger increase in disability pension receivers than for men. This is partly due to larger increases in entry rates, especially for middle-aged women. Death rates for female disability pension beneficiaries are also lower than the ones for men. In our model, we have attributed the tendency of sharper increases in female entry rates to the increased

labour participation rates for women in the 1970's and the 1980's.

The typical equation for entry rates is:

$$(4\text{-}3) \quad \log(ER/ER_{-1})=a_0+a_1\cdot\log(UR_{-2})+a_2\cdot\log(ER_{-1})+a_4\cdot LO_{-1}+a_5\cdot\log(PR_{-1})$$

ER Entry rate
UR Unemployment rate
LO "Layoffs"; sum of changes in employment in sectors with reduction in employment, divided by aggregate labour supply
PR Participation rate (for women only)

The model is estimated on annual data from 1970 to 1989. The long run elasticities wrt. unemployment are about 0,5 for most age groups, both for men and women. For women, the average elasticity wrt. the partition rate is about 1,2. The replacement ratio was not found to influence entry rates into disability pensions, as is in accordance with the findings of Disney and Webb for the UK on aggregate time series, though not on pooled cross-section/time series data.

The aggregate effects of the number of disability pensioners of eg. a permanent increase in unemployment from 4 per cent to 5 per cent is zero the first year, increasing to 12 000 after 5 years and 20 000 after 10 years. This amounts to 0,5 per cent and 0,8 per cent, respectively, of the labour force. The transfers develop in a similar way. In calculating the payments to disability pension account is taken for that women to a smaller degree have income related supplementary pensions. This is due to both lower earnings and lower participation rates before entering disability pension. Also disabled women tend to have lower degrees of disability (less than 100 per cent) than disabled men.

4.3. Other labour market-related transfers

Some other transfers influenced by the labour market situation are modelled in a more simple way. These transfers are

- unemployment benefits
- illness allowances
- rehabilitation allowances
- miscellaneous local government allowances

The typical equation is:

$$(4\text{-}4) \quad \log(RU/RU_{-1})=a_0+a_1\cdot\log(W/W_{-1})+a_2\cdot\log(U/U_{-1})+a_3\cdot\log(RU/(U\cdot W))_{-1}$$

Symbols as above, and

RU Transfers, of the afore mentioned categories
W Average wage rate
U Number of unemployed persons

These equations imply that these transfers in the long run are indexed to wages, the long run relationship between transfers and unemployment and wages being

(4-5) $\log(RU)=-a_0/a_3+\log(U\cdot W)$

In the short run the equations take account for different lags from U and W in determining the different transfers. (See figure 5 in ch. 5).

The transfer block has a parallel in the working of the Norwegian welfare system. Since there is a maximum length a person continuously can earn unemployment benefit (80 weeks), a lot of persons are transferred to other social security programs after a period of unemployment. A great number of unemployed receive rehabilitation benefits and some also attend special rehabilitation training in order to facilitate re-entry to the labour force. Also social care transfers, which are a part of the "miscellaneous local government services", tend to increase as unemployment increases. This is partly due to the fact that many of those receiving unemployment benefits also receive social care transfers as their incomes even with unemployment benefits often fall short of what is regarded as necessary expenditures. Also unemployed persons not eligible for unemployment benefits must rely on social care transfers, especially young unemployed and persons having been unemployed more than the maximum period for continuous unemployment benefit. Also micro-studies indicate that firms actively use the welfare system by encouraging that workers apply for illness allowances and disability pension in periods of economic slump (Dahl and Colbjørnsen 1991).

5. THE WORKING OF THE MODEL; MULTIPLIER ANALYSIS

In MODAG most industrial sectors and domestic transport have production functions that exhibit increasing returns to scale. Combined with mark-up pricing rules and a non-competitive labour market where wage rates are determined by Phillips-curve equations, the flavour of the model is definitely Keynesian both in the short and medium term. In the long run, the NAIRU-feature inherent in the wage equations is the main equilibrating mechanism of MODAG. As the model contains sectorial wage-equations there is no single NAIRU in the model. Still the labour market and wage determination are the main supply side mechanisms. The non-linearity of the wage-equations wrt. unemployment makes the impact multipliers heavily dependent upon the baseline simulation and the level of unemployment in particular. With low levels of unemployment wage growth is quite sensitive to changes in demand while this is not the case when unemployment is high. Some of these features of MODAG are illustrated by figure 2 and 3 below, which show the effects of a demand shock. Government employment is decreased by one percent of baseyear (1988) GDP.

When unemployment is low (below 2,5-3 per cent), increases in unemployment has relatively large wage-moderating effects thus stimulating production and employment in the private sector of the economy. When unemployment is high, however, the effects on wages of further increases in unemployment are small. Today unemployment in Norway is very high by historical standards, 5,5 per cent in the first half of 1991, at international comparable definitions. At the same time special labour market measures are at a high level, preventing the open unemployment reaching perhaps 7-8 per cent. In the baseline simulation, which is the basis for the multiplier analysis above, unemployment is declining gradually from 5,5 per cent to 3 per cent after 2005. (The baseline is described in ch. 6). As unemployment in the baseline simulation is around 3 per cent after 2005, the crowding out effects increase.

Fig 2. GDP, GDP-private sector, employment and unemployment.

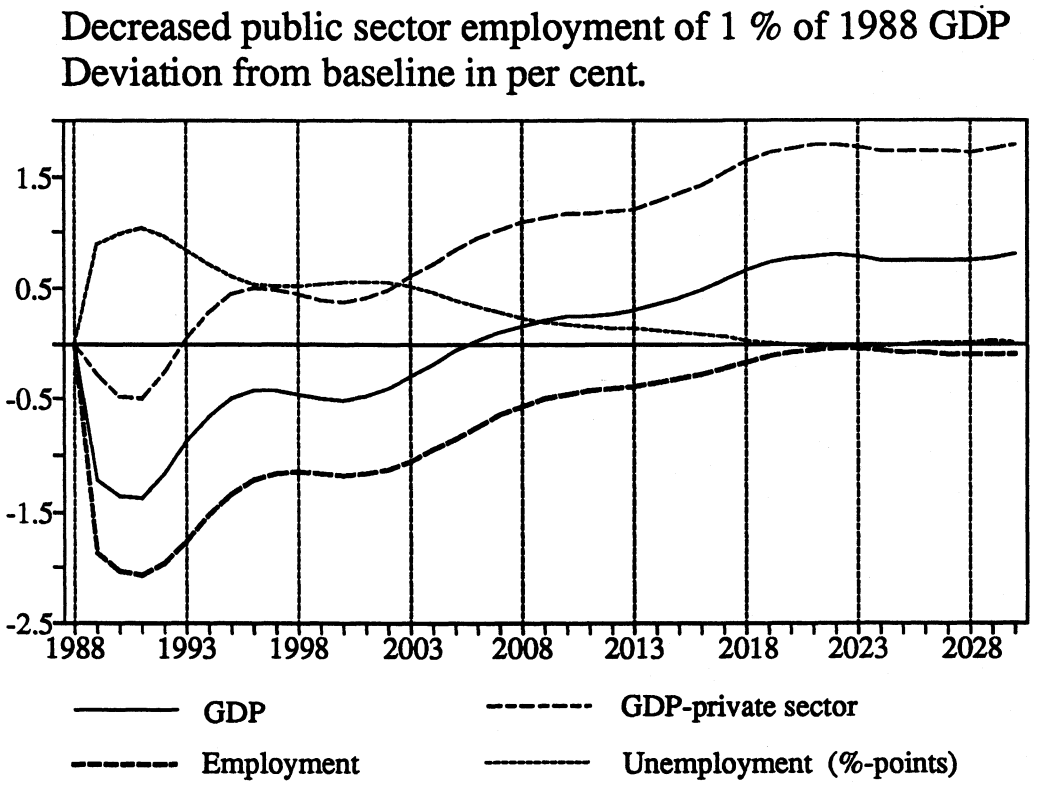


Fig 3. Prices and wages

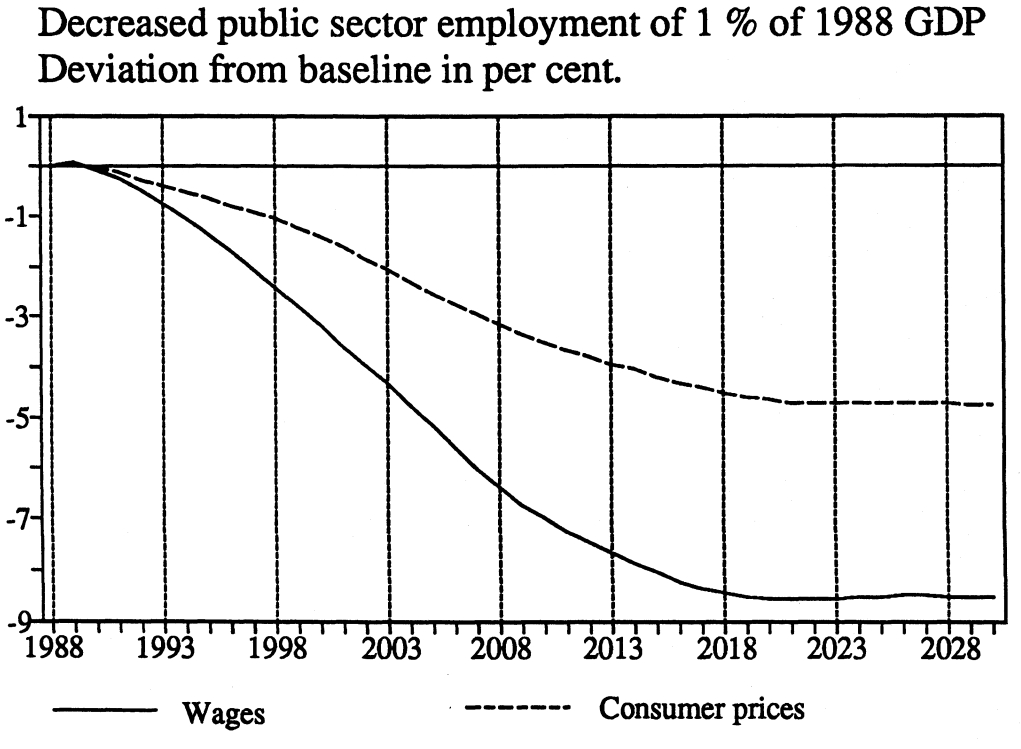


Figure 2 shows the effects on GDP, value added in the private sector, employment and unemployment in the policy shift. There are large effects on employment and unemployment in the short and medium term while the effects after 15-20 years are moderate. GDP is decreased in the short run by slightly more than the direct effect due to traditional multiplier effects. After 5 years the effect on private sector GDP becomes positive and in the long run this effect is quite large even though employment has hardly changed. One important reason why productivity increases (measured as GDP per man-hour) is the relatively low wage paid to public employees in Norway. But also in the private sector value added per man-hour declines. This is due to the increasing returns to scale in many implicit production functions in the private sectors.

Fig 4. GDP, GDP-private sector, employment and unemployment.

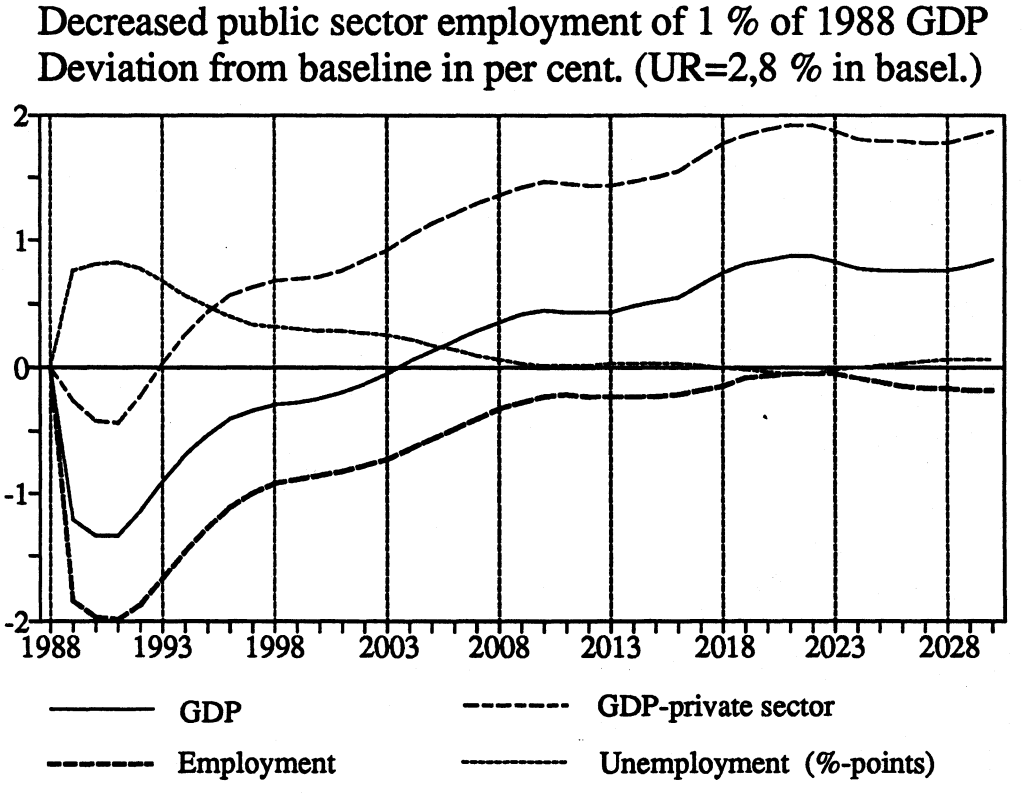


Figure 4 shows the effects of this policy shift assuming that unemployment in baseline is 2,8 per cent in the whole simulation period. This implies that crowding in of the private sector occurs earlier, with larger gains in international competitiveness.

Fig 5. Transfers and pensions.

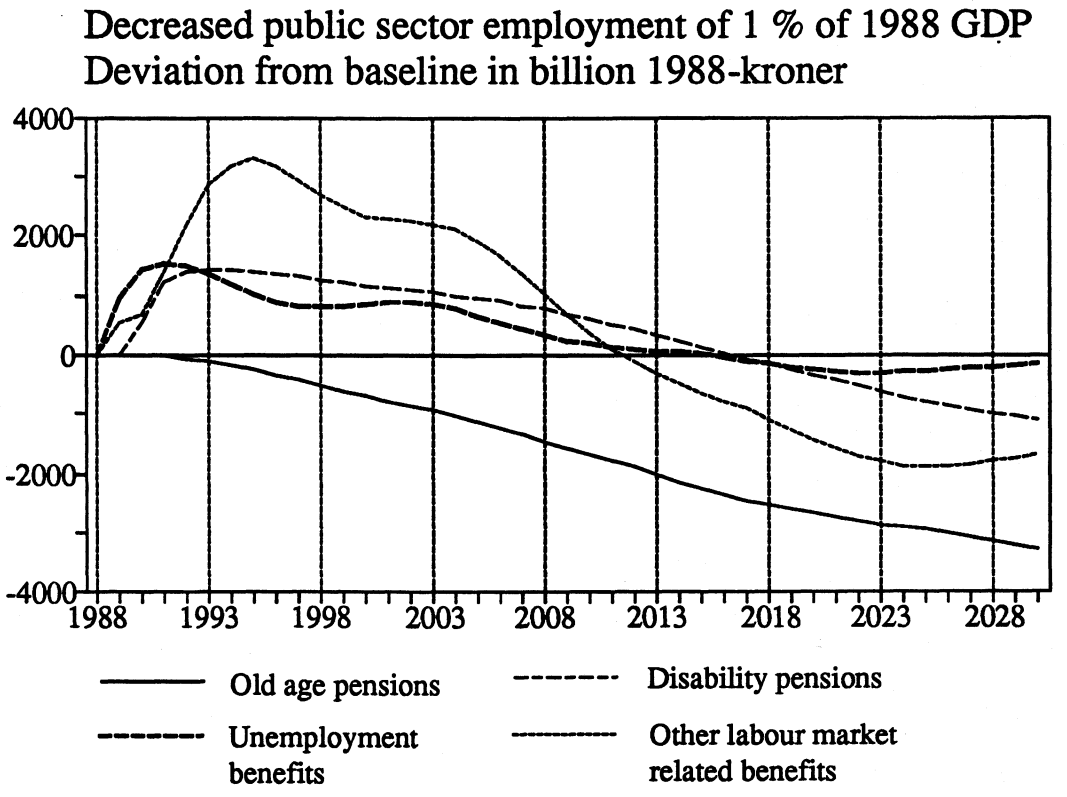


Figure 5 shows the changes in the real value of different transfers in an impact simulation of decreased public employment amounting to 1 per cent of 1988 GDP, on the whole MODAG model.

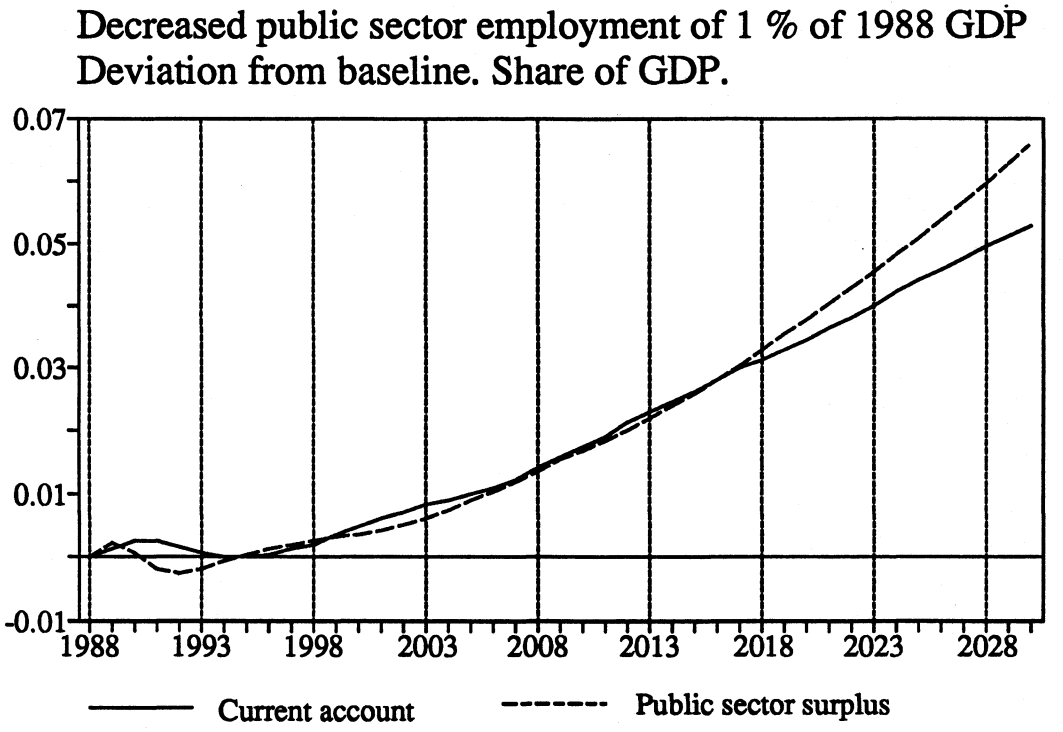
The figure indicates automatic stabilizers in the transfer block. The decreased public employment increases unemployment and depresses real wage growth. Several benefits increase in volume, the most immediate effects appearing in unemployment benefits. For all the labour market related benefits there are two opposing effects:

1) Increased unemployment increases the number of beneficiaries.
2) Lower real wages contributes to lower real value of transfer per beneficiary.

For old-age pensions the latter effects is the only one, while the first effect is the stronger for the other categories for nearly 20 years. The properties of the transfer block implies that unemployment benefit is the first one to increase, followed by e.g. rehabilitation benefits. The most persistent effects of this temporary unemployment increase takes place in disability benefits.

Aggregate transfers are increased by 5,5 bill. 1988-kroner after 5 years. The public sector surplus is furthermore weakened by decreased tax revenues as private production and demand decrease. Consequently the aggregate effects on public sector finances of an contractionary demand policy are quite modest in the short to medium term, see figure 6. Even though the direct impulse of reduced government employment is of magnitude 1 per cent of GDP, government sector surplus hardly changes the first 8-10 years. Only after 10 years the favourable effects come to appearance in the government sector balances. If unemployment is 2,8 per cent throughout the whole baseline, the improvement in government sector surplus comes faster; it is increased by 1 per cent of GDP after 8 years.

Fig 6. Current account and government balance.



The net financial position of government is sharply improved in the long run by this policy shift. Net assets for the country increases by nearly 70 per cent - points of GDP in 2030. Practically all of this increase accrues to the government sector, as net financial investment in the corporate and households sectors are only slightly changed. In the situation where unemployment was 2,8 per cent in baseline every year, the increase in net government assets was 100 per cent of GDP in 2030.

6. THE BASELINE SIMULATION

6.1 Introduction

The future financing of the Norwegian social security system has been given considerable public attention in Norway in recent years. The most important factors of concern have been the medium term development of disability pensions and the more longer term problems of old-age pensions, as the baby boom generation after World War II reaches the retirement age after 2010. Different measures have been and are been proposed to contain expenditure growth under the social security programmes, eg. reducing the amount of earnings-related supplementary pensions. Using published demographic projections from CBS, and projections from the National Insurance Administration (Rikstrygdeverket) for the development in the average pension measured in BPU's for old-age pensions we get the most updated information about the longer term movements in social security into the model. Thus MODAG can be used to incorporate the long term developments in the pension system, in addition to incorporate medium term developments. This chapter thus aims to explore the long term prospects of public expenditure.

6.2 A medium term model simulation to 2030 ?

Although MODAG is a medium term model, we are running simulations on this model until 2030. This is unusual and might seem somewhat hazardous, as the general approach to such longer term problems is the use of more aggregate models, often of a general equilibrium type. Explicit modelling of optimal consumption and saving eg. as results of demographic changes is frequent as well, cf. eg. Cutler et. al (1991). Recognizing that within our model we cannot say much about optimal response of national saving due to demographic changes, use of MODAG is not so much different from many general equilibrium models, as one might believe. The main difference from eg. the Norwegian MSG-model (see e.g. Offerdal et. al (1987) or Vennemo (1991)), which is an AGE-model at the same level of disaggregation as MODAG, is the closure procedure of the model. It is common in AGE modelling to assume that the wage rate adapts such that labour supply equals labour demand at every instant of time, and that the trade balance is exogenously given. MODAG, however, utilizes the historical information in the estimated wage equations, resulting in a wage rate that does not necessarily clear the labour market in the short run, or gives a desired level of net exports. In the long run the NAIRU-properties of MODAG assures clearing of the labour market. Furthermore estimated import share and export volume equations are used in the model, determining the trade balance as an endogenous variable. In the longer term there are strong tendencies in MODAG to produce an unemployment rate near NAIRU, cf. ch. 5.

Another difference between MODAG and many general equilibrium models is the modelling of factor demand. As investment in MODAG is modelled as a flexible accelerator, the impact from changes in user costs of capital has no direct influence of investment demand, apart from via other parts of the model. But the model contains a considerable amount of substitution between labour and material inputs, and also a degree of substitution between capital and labour. Although this might be seen as a weakness in using MODAG in such long run simulations, we do believe them far from prohibitive from using the model in long run simulations. In the baseline simulation the average

capital/labour - ratio in the private mainland economy follows the trend it has followed the last 20 years.

Though we see weaknesses in using MODAG in simulations as far as to 2030, using the model in this way also has its advantages: It is easy to integrate medium term and more longer term analyses, as one only has to simulate one model. It is furthermore perhaps more convenient to use the model in simulations that more easily can be interpreted as possible, or even likely, projections of what might happen. AGE-models, with their strong assumptions on labour market clearing, probably have their stronger sides in more normative analyses regarding eg. demands on public policy or private behaviour to obtain a given development.

6.3 Assumptions in the baseline simulation

We now describe the baseline simulation, which is used as a benchmark for the impact simulation of reduced public employment in chapter 5, and of reduced indexing in ch. 7. We concentrate on the aspects of the simulation that we believe to be of the largest importance for the multiplier. The baseline simulation obviously has a great interest itself, as it may give an indication of the development in eg. public sector finances if no specific policy measures are taken.

The central government has been in surplus almost every year since world war II. This has led to a very strong financial position of the Norwegian government sector, now having large net assets. Net interest revenues for the government amounts to about 2 per cent of GDP. Before the oil age in Norway from the mid 70's the current account most years was in a small deficit, reflecting a long term inflow of capital to finance inter alia the shipping sector, not causing large problems in macroeconomic policy. Since the mid 70's revenues from the petroleum sector has accounted for an increasing share of government revenues. Of course these incomes are closely related to petroleum prices, and to the level of production in this sector. Norway's current account the last couple of years has been in surplus, and without a large drop in oil prices will continue to be so the coming years. The government sector surplus has had a less favourable development the last years, and this has been a source of concern with policy-makers.

The policy of high government saving in Norway has been accompanied by low private, especially household, saving. The net financial surpluses in the government sector was in turn being lent back to firms and households, often at a very low rate of interest, inter alia to agriculture and to housing. In Norway households are net debtors, while government as a whole (in fact only the state; the local government is in a net debt position) is a creditor. Norway as a whole now has a net foreign debt of about 12 per cent of GDP, largely reflecting borrowing in the 70's and after the oil price drop in 1986. Today Norway is running comfortable surpluses on the current account.

As financial revenues are playing a large role in determining revenues for the different institutional sectors, the level of interest rates is of potentially great importance for the effects of different policy shifts. For instance, a government sector deficit will result in higher interest payments in the future if the real interest rate is high, than in a situation of low interest rates. In the baseline simulation perfect capital mobility is assumed, relating

the Norwegian money market rate to the interest rate abroad. (Interest rates of assets and liabilities for norwegian institutional sectors are determined as ratios to the money market rate.) The yield on Norwegian saving is then in principle the international real interest rate, and in a consistent baseline simulation the simulated rate of return of real investment in Norway should be equal to (after correcting for uncertainty) the real interest rate abroad. Differences may of course occur due to imperfections (you name them).

Important assumptions:

GDP growth in Norway's trading partners of 2,5 to 3 per cent per year until 2000, 2 per cent 2000-2020 and 1-1,5 per cent 2020-2030. The decreasing growth is due to ageing of the population also for Norway's trading partners.

Inflation abroad: 3 1/2 - 3 3/4 per cent per year. In the baseline we assume unchanged real oil prices from the mid 90's.

Norwegian petroleum production: A sharp increase in the 1990's due to a high level of investment. Gradual depletion of known oil reserves in the next century. Stable level of gas production.

After a largely domestically driven recession the Norwegian economy is forecasted to regain growth in the first half of the 1990's. The strong growth in oil investments is an important factor behind this development. As oil investments fall from 1997, GDP growth weakens even though we have allowed a permanent tax reduction to counteract this development.

As unemployment remains high in the 1990's, wage growth and inflation in Norway are lower than abroad. This is in accordance with observations since 1989. After 2000, inflation is running parallel with our trading partners.

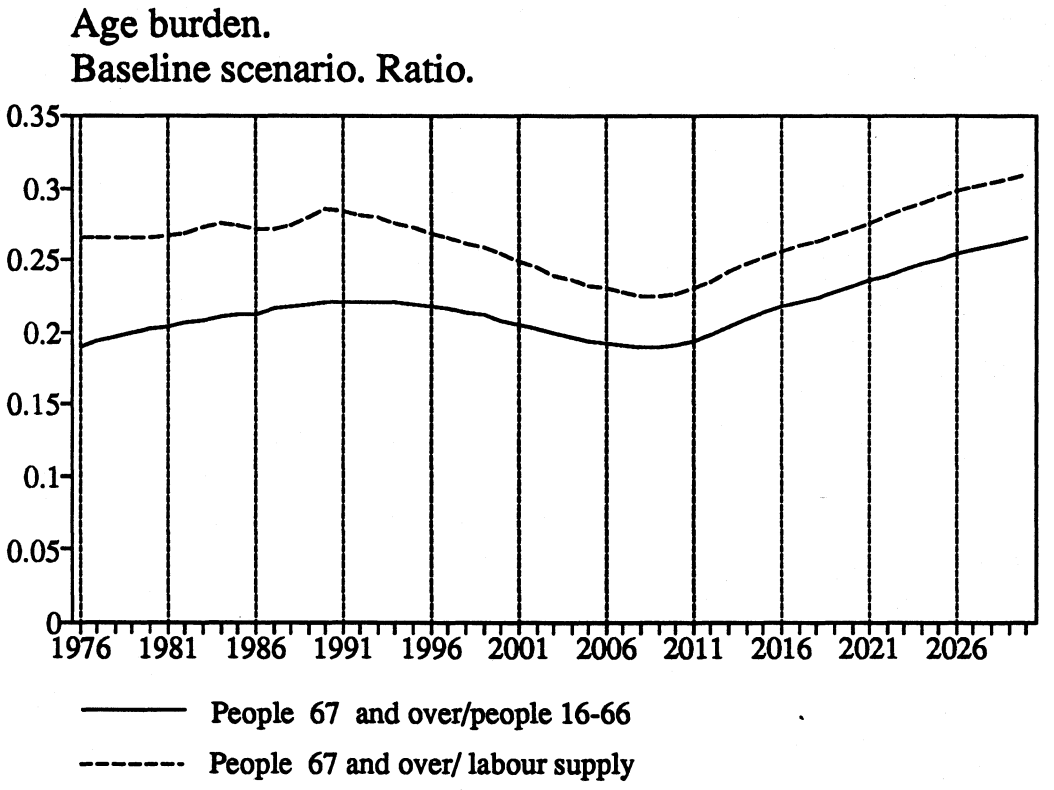
Labour productivity in the mainland economy increases by 1-1,5 per cent per year on average until 2020, which is in line with the latest development, but clearly less than the average over the last 20 to 30 years. After 2020 average growth in labour productivity is about 1 per cent. The aggregate capital-labour ratio in the private mainland sector is increasing in line with the development the last 20 years, although real interest rates in Norway and abroad decline after 2000.

During the 1980's real interest rates had increased to a very high level. We assume a gradual reduction of the real interest rate. From 2005 until 2030, the real interest rate abroad is assumed to be 4 per cent, down from nearly 6 per cent in 1990. Return on real capital in Norway as a whole also decreases in the long run. Until a little after 2000 rates of return are high, partly due to increases in petroleum production. After 2000 there is a steady decline in rates of return both in manufacturing and in the total economy.

Demography: In the baseline we assume constant cohort fertility rates at 1989 level. This implies that the periodic fertility rate rises from 1,7 in 1990 until 2,05 in 2005, and is unchanged thereafter. The projection implies that the annual population growth decreases from 0,5 per cent in the 1990's to 0,3 per cent after 2020. Larger changes appear in the

potential working population. The number of persons 20-66 years stagnate from around 2010, cf. fig 7.

Fig 7. Age burden



In our baseline simulation labour supply continues to increase one more decade, due to an assumed continued increase in female labour participation rates. Increased participation rates after 2000 is partly related to a decline in the number of small children per married woman, and the increase in the average age of the workforce. This mirrors a decline in the relative ratio of women in the age between the mid 20's and 40, for which care for small children and education tend to keep labour participation down. In 2020 the potential for further growth in female labour participation is exhausted, being only slightly lower than the ones for males. With no growth in the workforce GDP growth follows labour productivity, increasing by about 1 per cent per year.

Taking account of the increasing labour supply for women, the prospects for the age burden, measured in per capita terms, seems less threatening. In 2030 the ratio is only slightly higher than in 1990. The coming 20 years implies a reduction of the age burden due to the entry into old-age pension of the small cohorts of the 1920's and 1930's, and due to continued increase in labour supply. Counteracting factors here are the maturing of the pension system, and the rapid growth in disability pensions.

The future development of labour participation is an important factor regarding the burden the ageing of the population may impose upon the working population (at least if one assumes that non-participating women (and men) do not contribute to social and medical

care eg. of the elderly). Table 3 shows the participation rates of an alternative projection, based on a microsimulation approach. The figures are from the CBS microsimulation model MOSART (see Andreassen and Fredriksen, 1991), assuming base year participation rates constant for very disaggregate categories of persons classified by sex, age, marital status and education. The model predicts the number of persons in each cell, with base year transition rates.

As is expected, MODAG projects somewhat higher participation rates than MOSART. This is probably due to MOSART assuming unchanged participation for each sub-group, consequently all changes in participation stemming from changes in the composition of the population wrt. the factors mentioned above.

Table 3. Aggregate participation rates. Per cent.

	1990	2000	2010	2020	2030
MODAG	69,9	75,3	77,6	76,1	76,4
MOSART 1)	70,2	73,6	73,1	71,8	71,2

1) Constant fertility at 1990-level, "low" level of immigration

The tendency of strong growth in the real values of the per capita pensions to receivers of old-age pension and disability pensions will continue in the future. In our baseline simulation we assume that the BPU increases in line with average wages. Due to the maturing of the old-age pension system, pensions for the average wage earner will increase as a new old-age pension beneficiary, if work-active, has earned the minimum years necessary to obtain full supplementary pension (40 years since the introduction of general old-age pension in 1967). Average pension will however increase further due to still increasing pension rights for women as a consequence of the rise in female participation rates.

Growth in the average disability pension will be weaker than the growth in the average old-age pension. The main factor behind this is that there is practically no maturing effect, as receivers of disability pensions are paid today as if he or she already has acquired full pension rights. In addition, in our forecast the number of female disability pension beneficiaries is increasing sharply compared to the one for men. As women have lower benefits due to lower wages, to lower participation rates and lower degree of disability, an increased proportion of female disability pensioners results in lower growth in payments than in the number of receivers of disability pension. See figure 15 in ch. 7 showing average old age - and disability pension per beneficiary. The other transfers are largely linked to wages, and some also to the unemployment rate. Unemployment gradually declines to about 3 per cent, contributing to weaker growth in transfers in the 1990's. On aggregate, transfers increase by more than 5 per cent-points of GDP from today's level until 2030, cf. figure 9. The gradual reduction in unemployment in the 1990's brings entry rates to disability pension down. But the higher female participation rates contributes to high entry rates for women, ch. fig. 8. Also a rise in the average age of the labour force contributes to increased entry to disability pension.

Fig 8. Entry rates to disability pension.

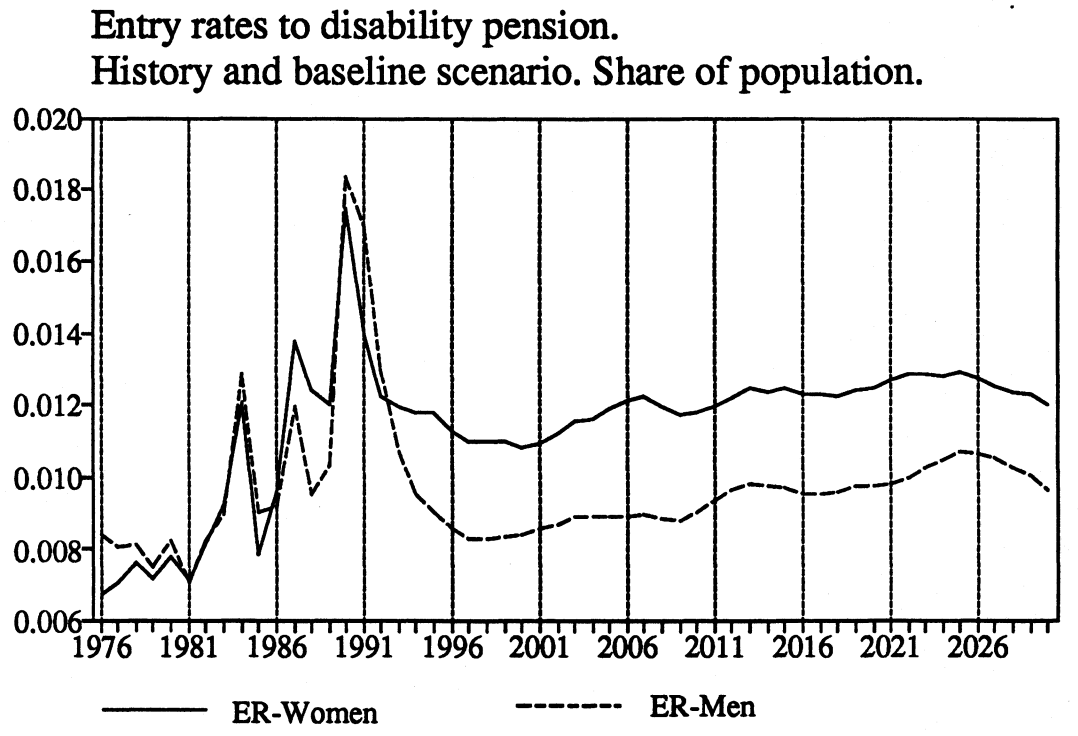
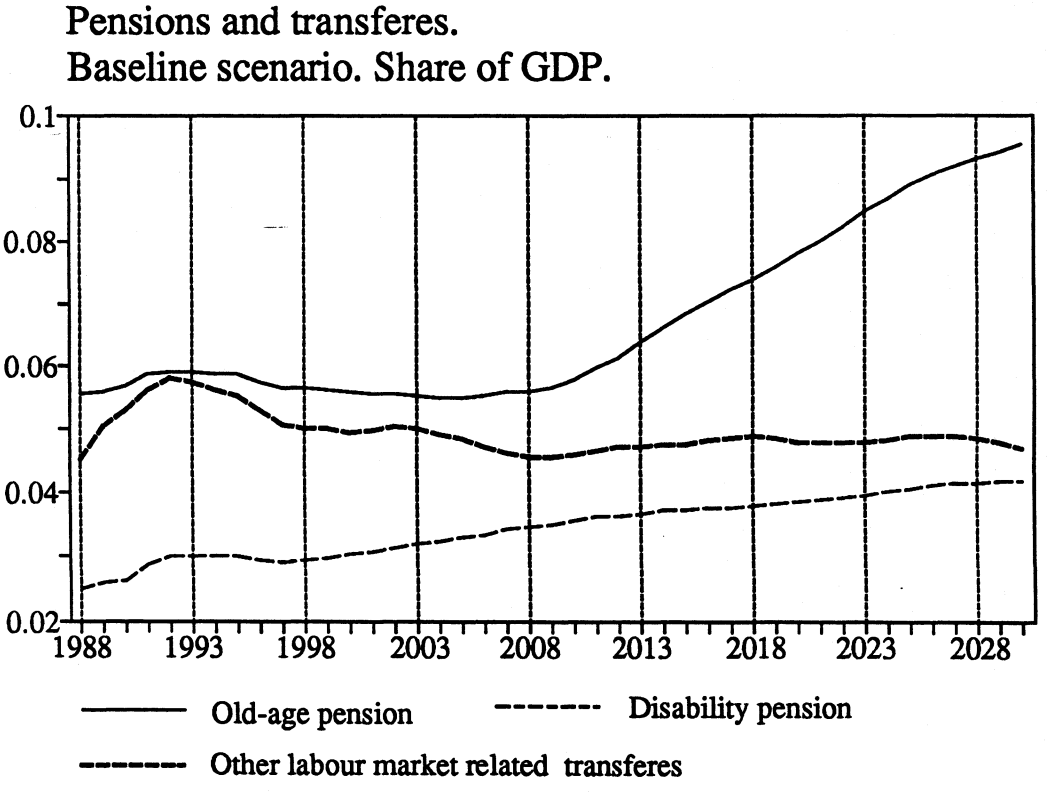
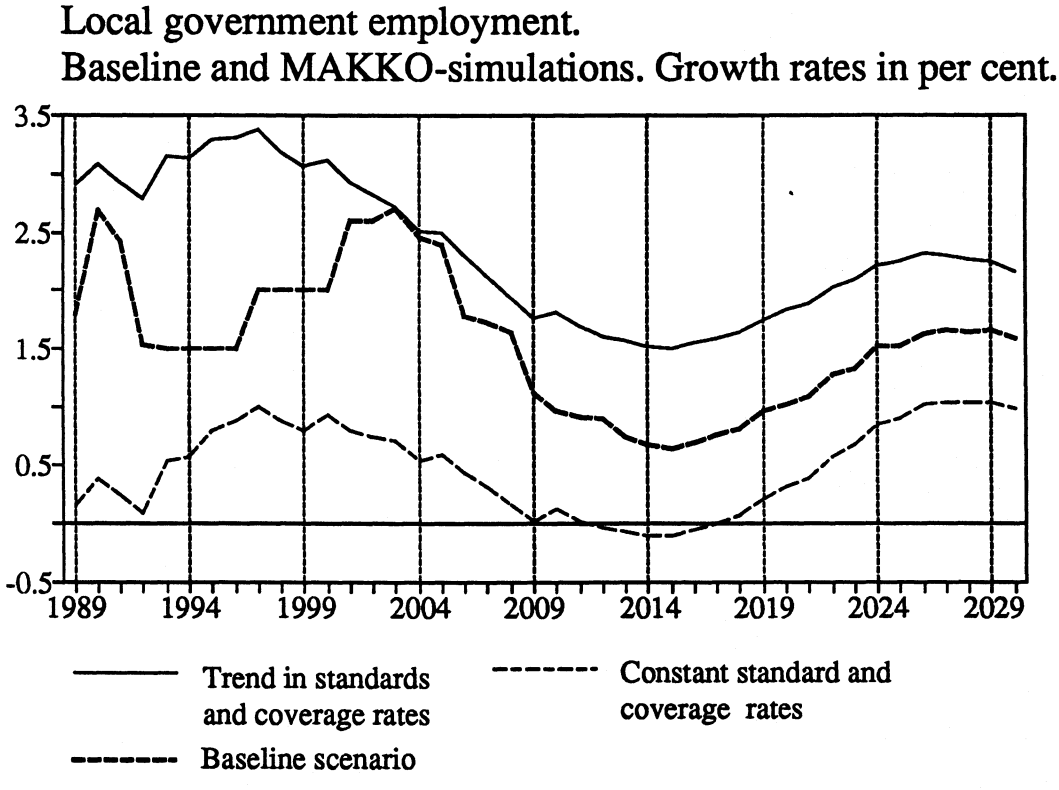


Fig 9. Old-age and disability pensions. Share of GDP.



In our projection, local government consumption to education and health care is largely assumed to develop according to the different "needs" of the population, as the age structure changes. The assumptions regarding local government consumption are taken from simulations on the CBS model for local government consumption, MAKKO (macro model for the economy of the local government sector), cf. ch 2.2. From this simulation we obtain two paths for local government consumption, see fig. 10. The one with the higher growth assumes that the trend in standards and coverage rates of the 1980's continues in the simulation period. The low growth rates are obtained by assuming constant standards and coverage rates at 1989-level. As we see both these alternatives are extreme, our forecast is that the long run growth in local government consumption is the average of the two growth rates each year. The administrative part of the local government sector and the central government sector, are assumed to have a constant growth in the simulation. In the short to medium term our forecast is influenced by aggregate demand considerations, especially wrt. the high unemployment in the 1990's, and the assumed fall in demand from the oil sector the last part of the 1990's. We thus allow for somewhat stronger growth in the beginning of the 1990's and after 2000.

Fig 10. Growth rates in government consumption.



In figure 10, the ratio to GDP of local government consumption, is showed. From 1990 to 2030 local government in per cent of GDP increases by 3 per cent-points. This is the sum of 3 effects - the policy of increasing local government consumption to maintain domestic demand in the medium term, the effects of changes in the age distribution given standards and coverage rates and finally the assumed increases in standards and coverage rates.

The increase in projected growth in the 2020's, largely due to increased needs of health care, reflects that the "baby boomers" after world war 2 reach the age of 80 and above. The need for health care is much larger for eg. an 85-year old than for a 75-year old. The ageing thus implies a sharp increase in old-age pensions from 2010-2015 on, and an increase in health care, which we assume is provided by the local government, as these persons become "old elderly" in the 2020's. The outlays in value terms may develop somewhat differently than in volume. Traditionally wage increases in the public sector have been slower than aggregate wage growth. In the baseline wage growth is 0,3 per cent per year slower in the public sector than in the economy as a whole. The cumulated wage difference from 1990 to 2030 is about 13 per cent, partly counteracting the demographic drag towards increased government consumption in per cent of GDP (in value terms).

Also the assumed reduction in military consumption in the 1990's followed by unchanged consumption from 2000, is a factor in this picture. This, and an assumed constant growth rate of central government consumption, is an important reason why total public consumption increases less as share of GDP, than local government consumption.

As is shown in figure 11, government subsidies in per cent of GDP is assumed to decline steadily. This is partly due to an assumed continue of the declared policy of reducing subsidies inter alia to agriculture. Also the market driven reduction of the size of the primary sectors is a contribution to reduced subsidies, for a given amount of subsidy per head. Also public sector investment is assumed to decline somewhat as population growth decelerates. Government consumption capital increases largely in line with government consumption.

As mentioned earlier, MODAG, is specified in great detail wrt. personal tax rates. This is particularly important wrt. excise taxes, implying that the composition of domestic demand on different commodities is important in determining government revenues.

On the income side of the government balances, there are important changes. Due to the assumed reductions in the personal taxes in the 1990's, the average direct tax rate for households declines towards 2005. In order to contain aggregate demand after 2010, we have implemented a continuous increase in personal taxes, increasing personal taxes of about 2 1/2 per cent points of GDP from 1990 to 2030. The larger tax increases over the simulation period, however, occur in indirect taxes, cf. figure 11. As the VAT is nearly constant in per cent of GDP, the increase in other indirect taxes accounts for the increase in the proportion of indirect taxes to GDP. Excise taxes excl. taxes on petrol and heating oils account for an increase of 0,5 to 0,7 per cent-points of the ratio, due to compositional effects. But the bulk of the increase in the proportion of indirect taxes to GDP is due to our assumed (real) increases in excise taxes on petrol and heating oils. After an already implemented sharp rise of these taxes in 1991, we assume 2 per cent annual increases until 2005, and 1 per cent per year thereafter.

Fig 11. Selected public sector expenditure. Share of GDP.

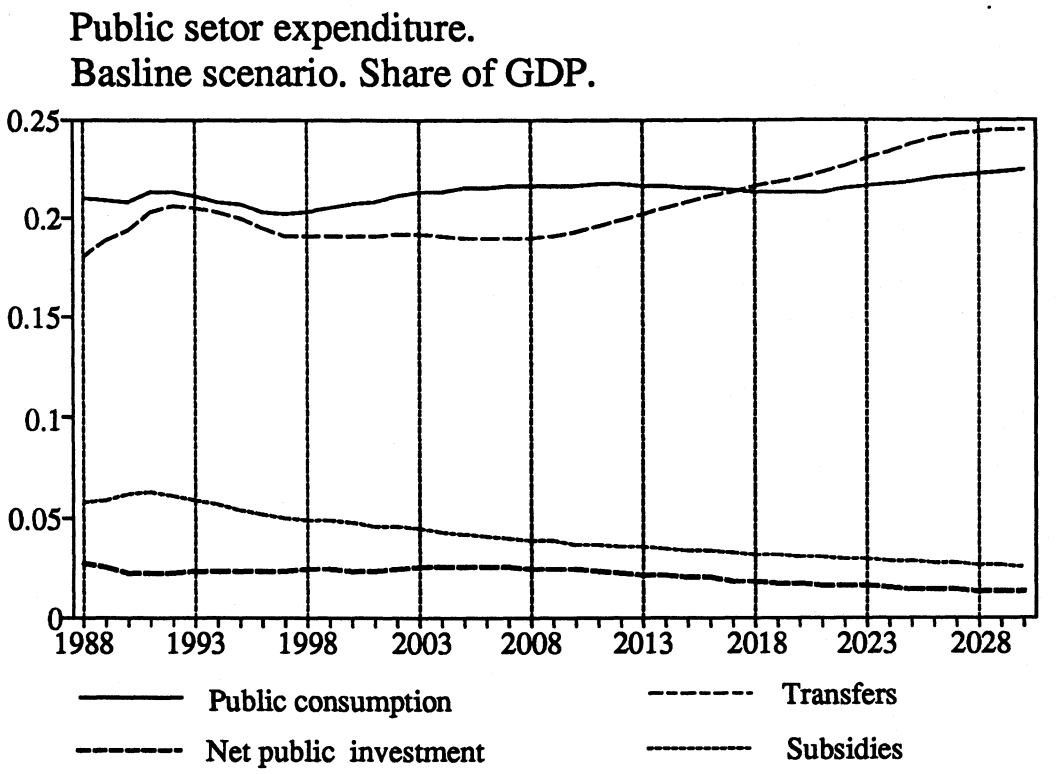
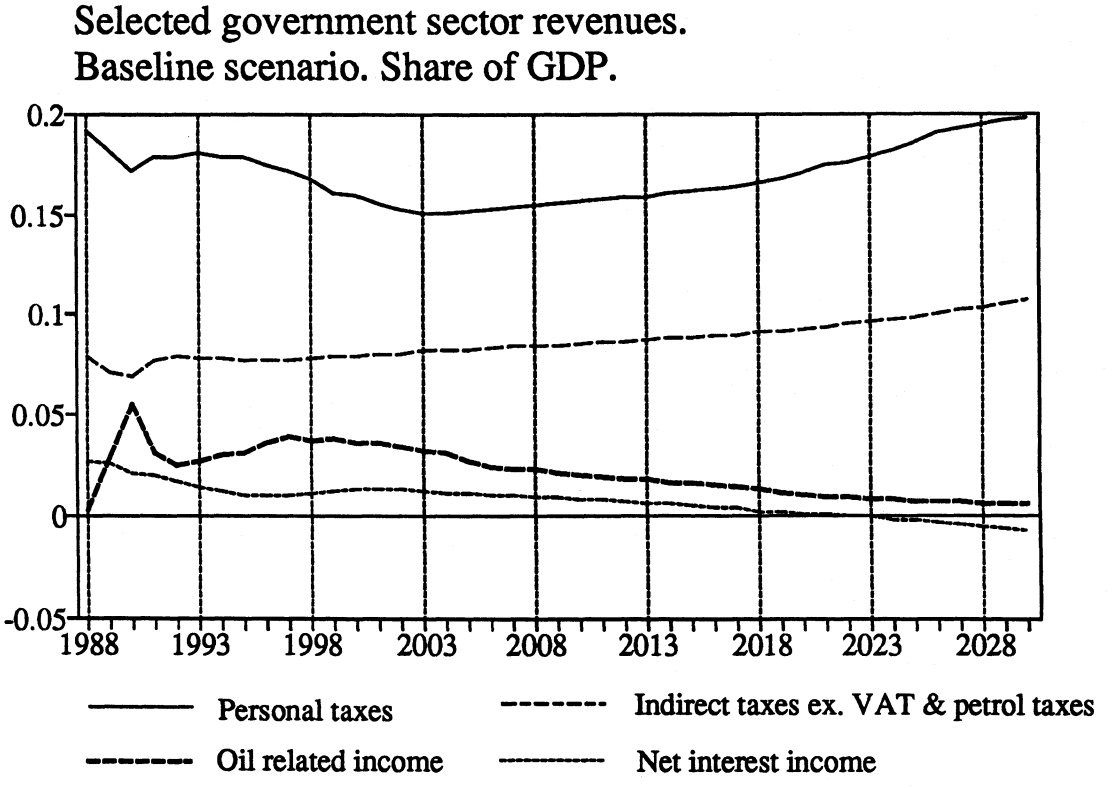


Fig 12. Selected government sector revenues



Government revenues from the oil sector originates from three sources: direct taxes of the oil companies' surpluses, production fees (indirect taxes) and direct surpluses from the government's direct (net) investment in the oil sector. The development of these revenues are probably more uncertain than most of the other government revenues. They are heavily dependent on the real price of petroleum, the operating costs in extraction and of course whether new oil and gas fields are discovered. After a rise in the real price of oil until 120 1990-kroner in 2000, we assume a constant real price of oil. In this simulation we assume that no new oil fields are discovered after 2000. Accordingly, oil production declines steadily thereafter, and is approximately zero in 2030. The level of gas production is however held at a stable level from 2000 to 2030, as known gas resources will last for most of the 21. century. Total government revenues from petroleum falls from 1990 to 1991/1992 due to falling petroleum prices. It increases later in the 1990's due to increased production and prices, and declines steadily from 4 per cent of GDP in 2000 down to below 1 per cent of GDP in 2030. Although these figures are highly uncertain, they underline the point that revenues from oil in 20-30 years may be considerably lower than today.

Net interest revenues in our baseline is of course dependent on cumulated government sector surpluses (GSS), and thus upon how we have chosen taxes and thereby the path for government sector surplus. Here GSS is negative, as shown in figure 13 and 18, implying that net interest revenues to government will be declining.

Fig 13. Aggregate government revenues and outlays

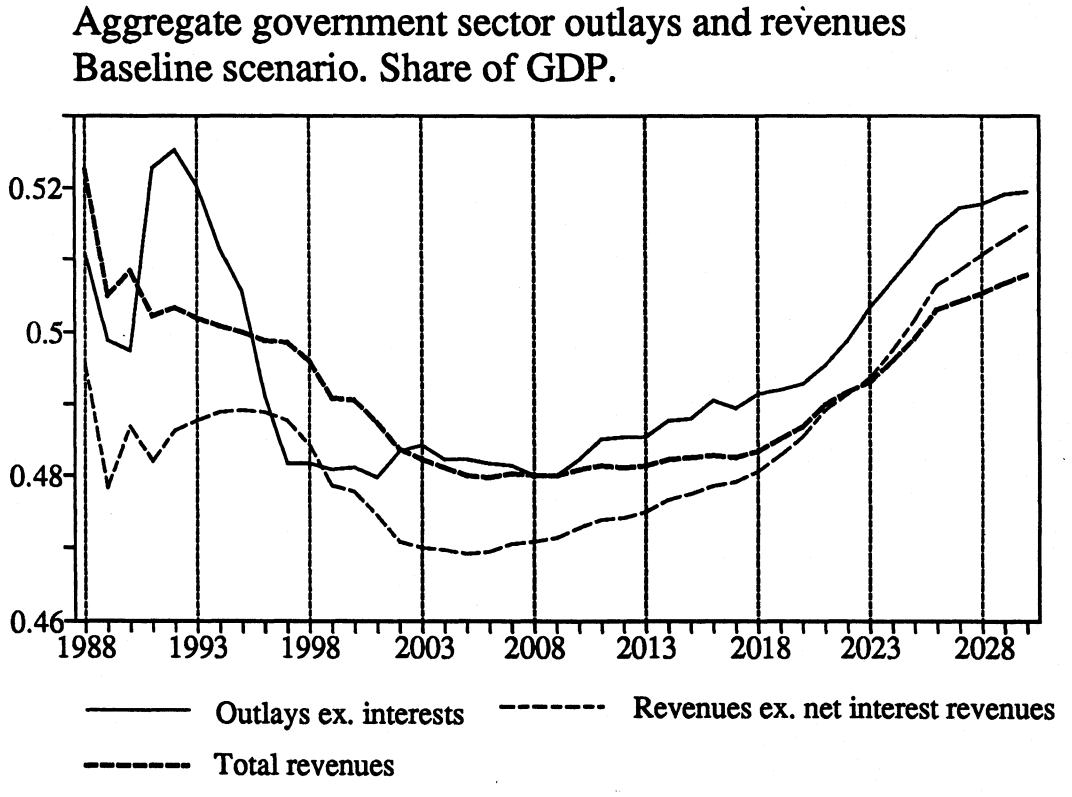


Figure 13 summarizes the previous figures for different income and expenditure categories. Of course we recognize that any desired level of government revenues might theoretically be achieved by determining tax and subsidy rates properly. This in turn implies that government budget deficits may be as much a political problem (government not being able to increase taxes) as an economic problem. As we in our baseline might have obtained many different levels of government surpluses simply by increasing taxes, much weight should perhaps not be put on the actual values of the surpluses and/or deficits, but upon the level of expenditure in per cent of GDP. Among expenditure components one must be aware which are determined by the model(s) or by specific analyses, and which ones that to a larger extent are more simple assumptions.

But of course net interest revenues, which are very important for the government sector in 1990, will develop according to the (to some extent chosen) path for government balances.

The 1990 government surplus is projected to turn into deficit both due to reduced revenues (tax reduction in 1991 and 1992) and increased expenditure, see figures 13 and 18. The large swing in expenditure is to a large extent due to transfers; both the increase in the first half of the 90's, and the reduction in the second half of the decade. Also the assumed reduction in subsidies is important. As taxes change less, government sector surplus is positive in the late 1990's. But the tax reduction and the relatively high local government consumption around 2000 again turns the surplus into deficit, although expenditure in per cent of GDP is unchanged. After 2020 aggregate expenditure increases by about 1 per cent of GDP, which may seem little in light of the increased age burden. The main reasons are assumed reductions in public investment and in subsidies.

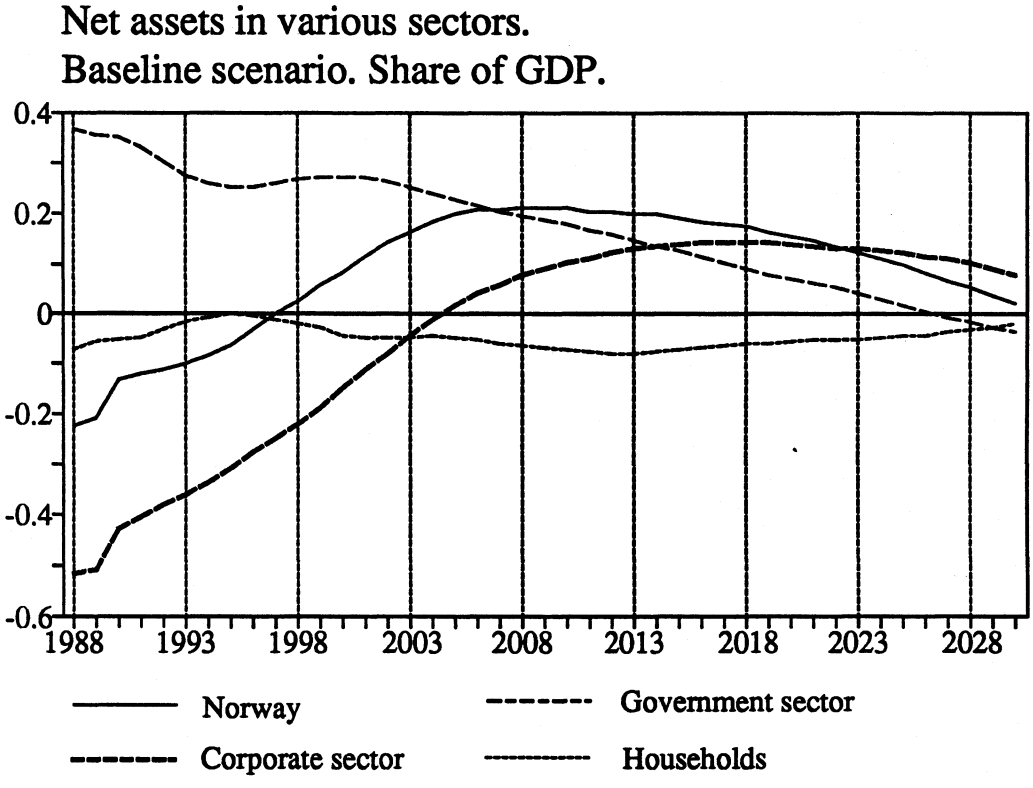
Government sector surplus (before borrowing or lending transactions) (GSS) is the difference between revenues and outlays. A surplus adds to net wealth, giving increased net interest revenues in later periods, and vice versa. We have constructed the baseline such that GSS is stationary, inter alia by adjusting tax rates, but we have allowed shocks in the private sector which produce large changes in government revenues and expenditure, to some extent to result in changes in GSS. In the end of the 1990's we have allowed for reduced personal taxes, and some after 2000 we have allowed for a some stronger growth in local government employment than is warranted by the MAKKO simulations. This brings into our expenditure projections some element of arbitrariness, as a part of the projection for local government consumption is due to counteracting the demand effect of the declining demand from the oil sector. But at the same time this is a part of the likely development in the Norwegian economy the coming decades, and thus should be accounted for.

Figure 14 describes the net asset position of the different institutional sectors in the economy. As the current account is in surplus in most years, Norways net foreign debt turns into net assets in the mid 1990's reaching about 20 per cent of GDP in 2005. The rest of the simulation period net foreign assets declines slightly. This development is consistent with an often proposed policy of building foreign reserves to meet the challenge of an ageing population and declining petroleum production after 2010.

These financial investments occur mostly in the private sector. As households' net debt in per cent of GDP is stable and net government assets decline, the increase in net assets

takes place in the corporate sector. This reflects the fact that the current account surpluses accrue to the private sector. Crucial in this respect is to what extent these revenues are taxable. In our model we only have a rudimentary description of the tax system of the corporate sector. These large revenues are not likely to be invested in Norway, as capital-labour ratios already develop steadily, and further real capital investment will probably give a lower return than (financial) investment abroad. And if this is the case, these revenues will only to a limited extent be taxable. However, we have allowed a considerable increase in share yield payments from the corporate sector to households, resulting in increased consumption and taxation of households.

Fig 14. Net asset position of institutional sectors



From our baseline simulation we now draw the following conclusions:

1. Aggregate transfers may increase by about 5 per cent-points of GDP from 1990 to 2030. Larger increases are likely for old age and disability pensions, but declining labour market related transfers counteracts this development. Old-age pensions start increasing between 2010 and 2015.

2. The declining demand from the oil sector will in the medium term demand weakening of the government budget to maintain a high level of aggregate demand. In our baseline this warrants increased local government consumption to prevent a rise in unemployment.

3. To the (uncertain) extent that demographic trends will determine growth in local government consumption, an increase in local government consumption of 3 per cent-

points of GDP might be envisaged. This will be particularly pronounced in the 2020's, as the baby boom cohorts after world war II become "old elderly".

The composite effects of 1,2 and 3 above amounts to an increase in expenditure of 8 per cent-points of GDP from 1990 to 2030. This is considerable, and lower growth in other expenditure is necessary to prevent tax increases of similar magnitudes in the long run. In the baseline we have to some extent indicated where this might be done.

7. EFFECTS OF A CHANGE IN THE INDEXATION OF THE BASIC PENSION UNIT.

The old-age pension in Norway consists of a basic pension (BP) and a supplementary pension (SP). The size of the supplementary pension depends on previous income, and on the number of years after 1967 with income exceeding the Basic pension unit (BPU) (App. 35.000 Nkr. in 1991 (3500£)). For each pension-earning year a pension point (PP) is calculated as:

$$PP=(Income-BPU)/BPU \tag{7-1}$$

The system is income levelling since incomes between 8 and 12 times BPU only count by 1/3, and incomes exceeding 12 times BPU do not count at all when calculating the PP. We can write this as:

$$\text{if: } 8 < (Income/BPU) < 12$$

$$\text{then: } PP=7+0,33\cdot[(Income/BPU)-8] \tag{7-2}$$

and

$$\text{if: } (Income/BPU) > 12$$

$$\text{then: } PP=7+0,33\cdot(12-8)=8,33 \text{ (maximum PP)}$$

The final pension point (FP) is calculated as the average pension point over the 20 best pension-earning years. Full supplementary pension is given when a person has 40 pension-earning years.

$$Pension=BPU+BPU\cdot SPR\cdot(PEY/40)\cdot FP \tag{7-3}$$

SPR: supplementary pension rate (0,45 in 1991).
PEY: number of pension-earning years.

The system of registering pension-earning years started 1967. This means that the first set of pensioners entitled to full supplementary pension will retire 2007. There are however transition schemes until 2007, giving pensioners a somewhat higher pension than in equation (7-2).

The pension for an average old-age pensioner increases with 74 per cent in real terms from 1991 to 2030 in our baseline scenario. The causes of this real growth may be divided in:

a) Real wage growth.
b) Growth in pension rights (more earning years).
c) Growth in labour participation.

The real wage growth effect account for 36 per cent of the growth in average old-age pensions (average of 0,8 per cent per year) in the baseline scenario.

The sum of the effects in b) and c) is calculated to increase average pensions by about 28 per cent in real terms. In 1990 approximately 75 per cent of the pensioners receive supplementary pensions. Our estimates suggest that this figure will be more than 95 percent in 2030. (See NOU 1988). The most important factor behind the growth in pension rights is the increasing average number of pension-earning years. Growth in women's labour participation is an important element behind this development. In the baseline scenario approximately 85 per cent of the women between 25 and 66 years old will be in the working force by 2030. (Compared to 72-73 per cent in 1990).

The increased average old-age pensions, combined with a growth in the numbers of pensioners by approximately 35 per cent, is estimated to result in more than a doubling of the public sector expenditure on these transfers in real terms in 2030. (see ch. 6) To find a way to finance these transfers will be an important challenge for the government in the years to come, not only in Norway, but also in many other Western countries.

One suggestion which has been discussed in Norway is to change the pension system from a pay-as-you-go system to a fund-based system. (Originally the Norwegian pension system was meant to be fund-based, but a sufficient fund was never built up to cover all the expenses of the system). The obvious problem of such a change is that since we do not have these funds today, and we have a big population of pensioners entitled to pension-rights after the rules in the old system, such a change will result in one generation (or more) paying for both their own and the previous generation's pensions.

Another possibility is to change the formula for calculating pension points. This has also also been done. From 1992 the supplementary pension rate will decrease from 0,45 to 0,42 and the maximum pension point will be reduced from 8,33 to 7. To avoid too big changes in the incomes of the present pensioners, the government has decided that the new system only shall affect pension rights earned after 1991.

A third way to reduce government outlays on pensions could be to change the indexation of the BPU. The way BPU is indexed is of course of major importance for the growth in average pensions. In the reference scenario described earlier in the paper, the BPU was indexed by the wage growth. This is in accordance with the political agreed upon intentions of the pension system, but not entirely in accordance with the way the BPU has been indexed up until now. Using MODAG we have simulated the effect on average pensions and on government outlays of a shift in the pension system from wage- to price indexation. Both old-age pensions and disability pensions will be affected since the BPU is the crucial factor in calculating both these pensions.

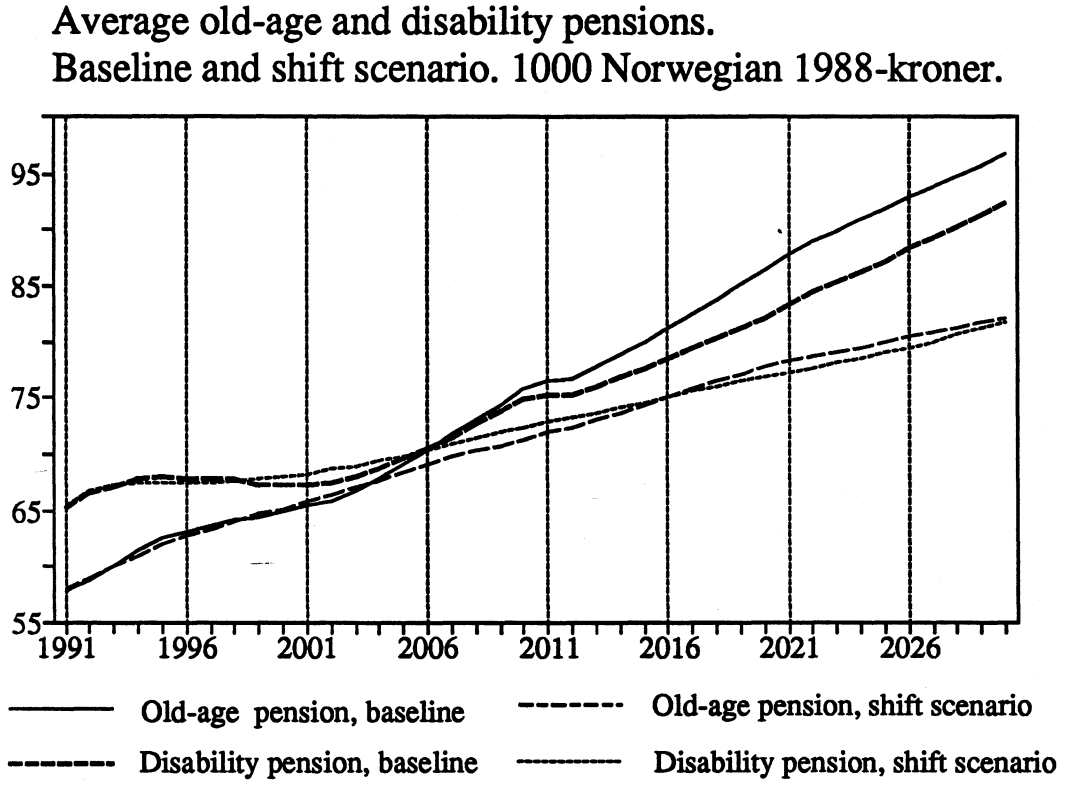
In the baseline scenario described in section 6 real wage growth increased average old-age pensions by 36 per cent. Looking at equation (7-1) & (7-2) we see that the first order effect on the average pension from changing the indexation will be less than this, since the average final pension point will be higher in this scenario. The change in indexation will affect the growth in pensions from year one due to lower growth in the BPU in eq (7-3), but only gradually influence the average number of pension points. Only pensioners

having all their pension-earning years after 1991 will get the full effect of the increased pension points following the change in indexation. For disability pensions this effect will work much faster since these pensions are calculated with a lead.

The effect of rising average pension points is also reduced through the restrictions in the pension point calculations in equation (7-2). More people will have incomes exceeding the range of 8 and 12 times BPU in the shift scenario than in the baseline. We have adjusted for this in the simulation using the real wage from the baseline scenario and assuming constant relative income distribution. (Using wage growth from the shift scenario would be more correct, but this would require simulating the model several times and would not have given significantly different results). In our calculations the real growth in average old-age pensions were reduced by 15 per cent compared to the pension in the baseline scenario. The average disability pension decreased by 12 per cent.

Real average pensions in the two model runs are given in the following figure:

Fig 15. Average pensions



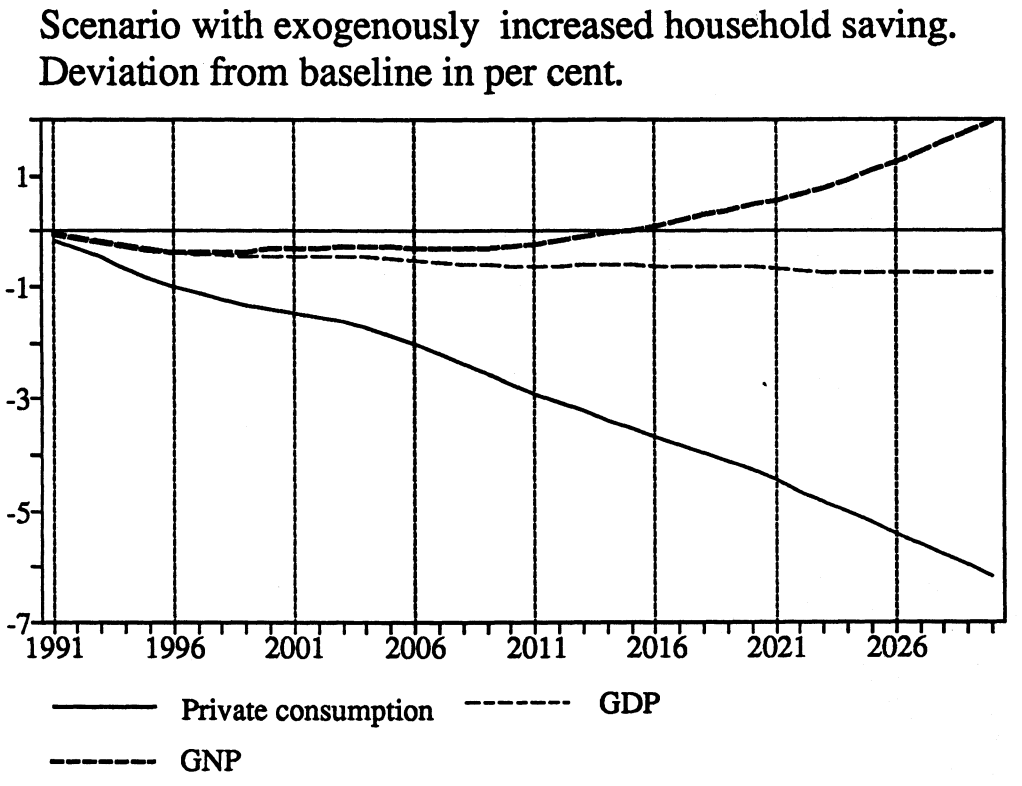
It may be reasonable to assume that this change in the pension system would have some effect on household saving. In some AGE-models this is made endogenous by including future (expected) income in the consumption function (e.g. due to some kind of a life cycle hypothesis). No such mechanism is included in the present version of MODAG. How much saving will be affected is difficult to say. We have chosen to make an extra shift simulation with exogenously increased savings. Here household saving is increased so that the average household save in year t enough to cover half the difference in average

pensions in year t+20. We have set the interest rate on these savings to 8 per cent. We can write this as:

$$\Delta SAVING_t = \frac{\frac{\Delta PENSION_{t+20}}{2}}{(1.08)^{20}} \qquad (7-4)$$

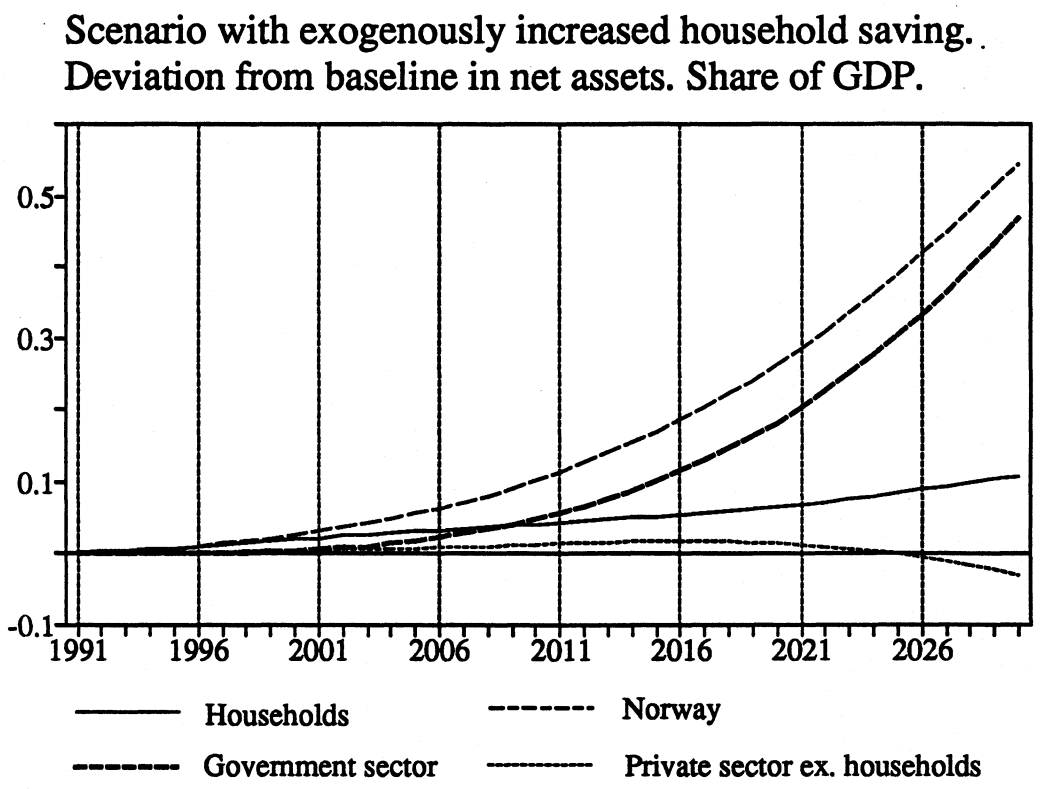
Since the old-age pensions and disability pensions account for a significant part of the households' disposable income (16 per cent in 1990), a change in indexation of the pensions will have substantial effects on many macroeconomic variables. We will concentrate here on the effect on GDP, GNP, private consumption, government outlays and net assets for various sectors.

Fig 16. Effect on GDP GNP and C of a change in indexation



Private consumption decreases, and the deviation from the baseline scenario is increasing as the difference in pensions increases. After 40 years private consumption is reduced by 5 per cent compared to the reference scenario. The extra effect of the exogenously increased saving on consumption is approximately 1.0 per cent all years. Increased unemployment induce lower wage growth and thereby increased marked shares for Norwegian products and this moderates the effects on GDP of the reduced consumption. GNP follows GDP for the first 10 years, but increased household and government savings increase net interest revenue from abroad substantially after some years. The following figure shows the effect on net assets for various sectors as share of GDP.

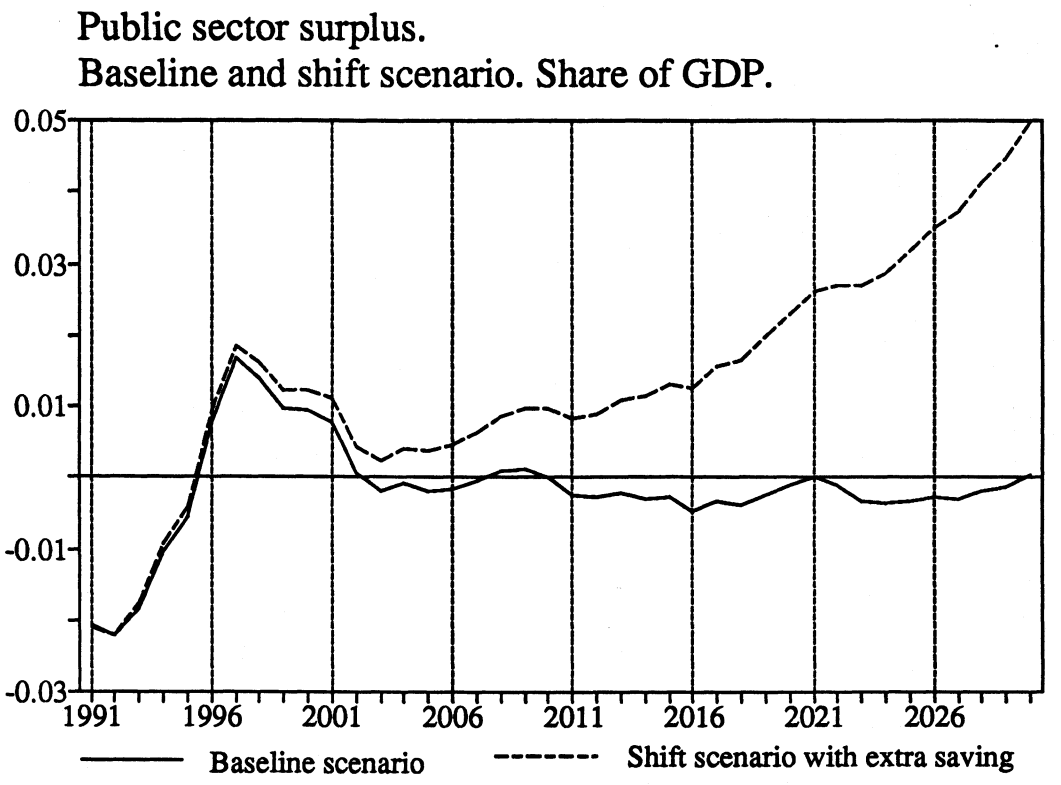
Fig 17. Deviation in net assets for various sectors



For households the growth in net assets is a direct consequence of the exogenously increased saving. In MODAG the increased saving does not directly influence the interest rates. Most of the increased saving will therefore be invested abroad and increase Norway's net assets.

The increase in net assets for the government sector reflects the improved government balances in the shift scenario. The following figure shows government sector surplus as share of GDP in the baseline scenario and in the shift scenario.

Fig 18. Public sector surplus



We see that the choice of indexation may be of substantial importance for whether the growing number of pensioners, and growing pension rights, will represent a financing problem for the government. Still this shift may seem extreme due to the big income distributive effects. But even less extreme changes in the pension system may induce big cuts in future pensions. The changes mentioned earlier in the maximum pension point and in the supplementary pension rate represent a cut in pensions of 15-20 per cent for the pensioners with the highest supplementary pensions. It is important for the government to inform of the implications of a such changes in policy so that tomorrow's pensioners can adjust their savings. This has macroeconomic effects which should be taken into consideration when planning the pension system for the next 30-40 years.

APPENDIX:

Table A1:

Revenues and outlays of government. Per cent of GDP[1)].

	1990	2000	2010	2020	2030
Revenues:	**49,6**	**47,4**	**46,6**	**47,4**	**50,0**
Personal taxes	17,2	16,0	15,6	17,1	19,8
Other dir taxes excl. oil	1,6	2,5	2,9	2,5	1,7
Oil taxes etc.	5,5	3,6	2,1	1,0	0,7
Payroll taxes	7,6	7,5	7,9	7,9	8,0
VAT	8,7	9,2	9,6	9,7	9,7
Other indirect. taxes excl. oil	6,9	7,9	8,5	9,3	10,7
Net interest revenues	2,1	0,7	0,0	-0,1	-0,4
Expenditure:	**48,4**	**46,8**	**47,1**	**48,0**	**50,3**
Subsidies	6,2	4,7	3,7	3,0	2,5
Transfers	19,3	19,1	19,3	21,2	24,2
Public consumption	20,8	20,6	21,7	21,3	22,3
Public net. investment	2,1	2,4	2,4	1,7	1,3

1) See footnote to table 1.

Table A2

Transfers. Per cent of GDP.

	1990	2000	2010	2020	2030	2030-1990
Old-age pensions	5,7	5,6	5,8	7,8	9,5	3,8
Disability pensions	2,6	3,0	3,5	3,8	4,1	1,5
Unemployment benefits	1,1	0,7	0,6	0,6	0,5	-0,6
Rehab., illness and local gov't transfers	4,0	4,3	4,0	4,2	4,2	0,2
Rest of transfers	5,9	5,4	5,3	5,5	5,9	-0,1
TOTAL TRANSFERS	19,3	19,1	19,2	21,9	24,2	4,9
LOCAL GOV'T CONS.	12,5	13,0	14,1	14,1	15,5	3,0
Sum of above 2	31,8	32,1	33,3	36,0	39,7	7,9

REFERENCES:

Andreassen L. and D. Fredriksen: MOSART - en mikrosimuleringsmodell for utdanning og arbeidsstyrke. Økonomiske Analyser (Statsistisk sentralbyrå) 2-1991. (MOSART - a micro simulation model for education and labour force)

Cappelen Å.: MODAG, a medium term macroeconometric model of the Norwegian economy. In Bergmann L. and Ø. Olsen (eds): Nordic Macroeconomic Models, North-Holland, Amsterdam, forthcoming 1991.

Cutler D.M. , J.M. Poterba, L.M. Sheiner and L.H. Summers: An aging society: Opportunity or challenge ? Brookings papers on economic activity 1: 1990.

Dahl S. Å. and T. Colbjørnsen: Trygdens virkning på bedriftens nedbemanning (Effects of soscial security on firms' layoffs). In Hatland A. (ed): Trygd som fortjent. Ad Notam, Oslo 1991.

Disney R. and S. Webb: Why are there so many long term sick in Britain ? Economic Journal 101, 1991.

Ljones O. and K. Aamdal: Modelling the macroeconomic impacts of local governments in Norway. Paper at the 46. congress of International Institue of Public Finance. Brussels 27.-30. August 1990.

NOU-1988 Nr.21: Norsk Økonomi i forandring, Oslo 1988

Offerdal E., K.Thonstad and H. Vennemo: MSG-4. A complete description of the system of equations. Reports from the Central Bureau Of Statistics, Norway 1987-14.

Stortingsmelding nr.2 1991: Revidert nasjonalbudsjett

Vennemo H.: Five studies of tax policy using equilibrium models. Doctoral dissertation, University of Oslo. Fortcoming 1991.

Westin S.: Unemployment and health: Medical and social consequences of a factory closure in a ten-year controlled follow-up study. Trondheim 1990.

ISSUED IN THE SERIES DISCUSSION PAPER

No. 1 I. Aslaksen and O. Bjerkholt: Certainty Equivalence Procedures in the Macroeconomic Planning of an Oil Economy.

No. 3 E. Biørn: On the Prediction of Population Totals from Sample surveys Based on Rotating Panels.

No. 4 P. Frenger: A Short Run Dynamic Equilibrium Model of the Norwegian Production Sectors.

No. 5 I. Aslaksen and O. Bjerkholt: Certainty Equivalence Procedures in Decision-Making under Uncertainty: An Empirical Application.

No. 6 E. Biørn: Depreciation Profiles and the User Cost of Capital.

No. 7 P. Frenger: A Directional Shadow Elasticity of Substitution.

No. 8 S. Longva, L. Lorentsen and Ø. Olsen: The Multi-Sectoral Model MSG-4, Formal Structure and Empirical Characteristics.

No. 9 J. Fagerberg and G. Sollie: The Method of Constant Market Shares Revisited.

No. 10 E. Biørn: Specification of Consumer Demand Models with Stochastic Elements in the Utility Function and the first Order Conditions.

No. 11 E. Biørn, E. Holmøy and Ø. Olsen: Gross and Net Capital, Productivity and the form of the Survival Function. Some Norwegian Evidence.

No. 12 J.K. Dagsvik: Markov Chains Generated by Maximizing Components of Multidimensional Extremal Processes.

No. 13 E. Biørn, M. Jensen and M. Reymert: KVARTS - A Quarterly Model of the Norwegian Economy.

No. 14 R. Aaberge: On the Problem of Measuring Inequality.

No. 15 A.-M. Jensen and T. Schweder: The Engine of Fertility - Influenced by Interbirth Employment.

No. 16 E. Biørn: Energy Price Changes, and Induced Scrapping and Revaluation of Capital - A Putty-Clay Model.

No. 17 E. Biørn and P. Frenger: Expectations, Substitution, and Scrapping in a Putty-Clay Model.

No. 18 R. Bergan, Å. Cappelen, S. Longva and N.M. Stølen: MODAG A - A Medium Term Annual Macroeconomic Model of the Norwegian Economy.

No. 19 E. Biørn and H. Olsen: A Generalized Single Equation Error Correction Model and its Application to Quarterly Data.

No. 20 K.H. Alfsen, D.A. Hanson and S. Glomsrød: Direct and Indirect Effects of reducing SO_2 Emissions: Experimental Calculations of the MSG-4E Model.

No. 21 J.K. Dagsvik: Econometric Analysis of Labor Supply in a Life Cycle Context with Uncertainty.

No. 22 K.A. Brekke, E. Gjelsvik and B.H. Vatne: A Dynamic Supply Side Game Applied to the European Gas Market.

No. 23 S. Bartlett, J.K. Dagsvik, Ø. Olsen and S. Strøm: Fuel Choice and the Demand for Natural Gas in Western European Households.

No. 24 J.K. Dagsvik and R. Aaberge: Stochastic Properties and Functional Forms of Life Cycle Models for Transitions into and out of Employment.

No. 25 T.J. Klette: Taxing or Subsidising an Exporting Industry.

No. 26 K.J. Berger, O. Bjerkholt and Ø. Olsen: What are the Options for non-OPEC Countries.

No. 27 A. Aaheim: Depletion of Large Gas Fields with Thin Oil Layers and Uncertain Stocks.

No. 28 J.K. Dagsvik: A Modification of Heckman's Two Stage Estimation Procedure that is Applicable when the Budget Set is Convex.

No. 29 K. Berger, Å. Cappelen and I. Svendsen: Investment Booms in an Oil Economy -The Norwegian Case.

No. 30 A. Rygh Swensen: Estimating Change in a Proportion by Combining Measurements from a True and a Fallible Classifier.

No. 31 J.K. Dagsvik: The Continuous Generalized Extreme Value Model with Special Reference to Static Models of Labor Supply.

No. 32 K. Berger, M. Hoel, S. Holden and Ø. Olsen: The Oil Market as an Oligopoly.

No. 33 I.A.K. Anderson, J.K. Dagsvik, S. Strøm and T. Wennemo: Non-Convex Budget Set, Hours Restrictions and Labor Supply in Sweden.

No. 34 E. Holmøy and Ø. Olsen: A Note on Myopic Decision Rules in the Neoclassical Theory of Producer Behaviour, 1988.

No. 35 E. Biørn and H. Olsen: Production - Demand Adjustment in Norwegian Manufacturing: A Quarterly Error Correction Model, 1988.

No. 36 J.K. Dagsvik and S. Strøm: A Labor Supply Model for Married Couples with Non-Convex Budget Sets and Latent Rationing, 1988.

No. 37 T. Skoglund and A. Stokka: Problems of Linking Single-Region and Multiregional Economic Models, 1988.

No. 38 T.J. Klette: The Norwegian Aluminium Industry, Electricity prices and Welfare, 1988.

No. 39 I. Aslaksen, O. Bjerkholt and K.A. Brekke: Optimal Sequencing of Hydroelectric and Thermal Power Generation under Energy Price Uncertainty and Demand Fluctuations, 1988.

No. 40 O. Bjerkholt and K.A. Brekke: Optimal Starting and Stopping Rules for Resource Depletion when Price is Exogenous and Stochastic, 1988.

No. 41 J. Aasness, E. Biørn and T. Skjerpen: Engel Functions, Panel Data and Latent Variables, 1988.

No. 42 R. Aaberge, Ø. Kravdal and T. Wennemo: Unobserved Heterogeneity in Models of Marriage Dissolution, 1989.

No. 43 K.A. Mork, H.T. Mysen and Ø. Olsen: Business Cycles and Oil Price Fluctuations: Some evidence for six OECD countries. 1989.

No. 44 B. Bye, T. Bye and L. Lorentsen: SIMEN. Studies of Industry, Environment and Energy towards 2000, 1989.

No. 45 O. Bjerkholt, E. Gjelsvik and Ø. Olsen: Gas Trade and Demand in Northwest Europe: Regulation, Bargaining and Competition.

No. 46 L.S. Stambøl and K.Ø. Sørensen: Migration Analysis and Regional Population Projections, 1989.

No. 47 V. Christiansen: A Note on the Short Run Versus Long Run Welfare Gain from a Tax Reform, 1990.

No. 48 S. Glomsrød, H. Vennemo and T. Johnsen: Stabilization of emissions of CO_2: A computable general equilibrium assessment, 1990.

No. 49 J. Aasness: Properties of demand functions for linear consumption aggregates, 1990.

No. 50 J.G. de Leon: Empirical EDA Models to Fit and Project Time Series of Age-Specific Mortality Rates, 1990.

No. 51 J.G. de Leon: Recent Developments in Parity Progression Intensities in Norway. An Analysis Based on Population Register Data.

No. 52 R. Aaberge and T. Wennemo: Non-Stationary Inflow and Duration of Unemployment.

No. 53 R. Aaberge, J.K. Dagsvik and S. Strøm: Labor Supply, Income Distribution and Excess Burden of Personal Income Taxation in Sweden.

No. 54 R. Aaberge, J.K. Dagsvik and S. Strøm: Labor Supply, Income Distribution and Excess Burden of Personal Income Taxation in Norway.

No. 55 H. Vennemo: Optimal Taxation in Applied General Equilibrium Models Adopting the Armington Assumption.

No. 56 N.M. Stølen: Is there a NAIRU in Norway?

No. 57 Å. Cappelen: Macroeconomic Modelling: The Norwegian Experience.

No. 58 J. Dagsvik and R. Aaberge: Household Production, Consumption and Time Allocation in Peru.

No. 59 R. Aaberge and J. Dagsvik: Inequality in Distribution of Hours of Work and Consumption in Peru.

No. 60 T.J. Klette: On the Importance of R&D and Ownership for Productivity Growth. Evidence from Norwegian Micro-Data 1976-85.

No. 61 K.H. Alfsen: Use of macroeconomic models in analysis of environmental problems in Norway and consequences for environmental statistics.

No. 62 H. Vennemo: An Applied General Equilibrium Assessment of the Marginal Cost of Public Funds in Norway.

No. 63 H. Vennemo: The marginal cost of public funds: A comment on the literature.

No. 64 A. Brendemoen and H. Vennemo: A climate convention and the Norwegian economy: A CGE assessment.

No. 65 K. A. Brekke: Net National Product as a Welfare Indicator.

No. 66 E. Bowitz and E. Storm: Will restrictive demand policy improve public sector balance?