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Macroeconomic effects of proposed pension reforms in Norway

Abstract:

Ageing combined with generous welfare state schemes makes the present fiscal policy in Norway unsustainable, despite large government petroleum revenues. We estimate to what extent two suggested reforms of the public pension system improve fiscal sustainability and stimulate employment, two main objectives of the reforms. To this end we apply two large models iteratively: 1) a detailed dynamic micro simulation model to estimate government pension expenditures; 2) a large CGE-model to estimate general equilibrium effects on all tax bases and employment, i.e. macroeconomic effects. We find that the reform proposals have much larger effects than typically found for reforms of the tax and trade policy. Whereas maintaining the present system implies that the payroll tax rate must be increased from about 13 percent today to 25 percent in 2050, both proposals imply that taxes can be reduced from the present level in all years up to 2050. Most of this reduction can be attributed to higher employment.

Keywords: Population ageing, Fiscal sustainability, Pension reforms, Computable general equilibrium model, Dynamic micro simulation

JEL classification: H30, H55, H62

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1. Introduction

Due to increased longevity and low fertility rates after 1970 Norway will experience a significant ageing of its population throughout this century. According to population forecasts¹ the ratio of those of working age 20-66 to those 67 and older decreases from 4.5 in 2002 to 2.5 in 2050. Although ageing in Norway is expected to be less pronounced than in most other OECD countries, Antolin and Suyker (2001) concludes that the existing welfare state schemes imply that Norway will experience one of the sharpest increases in public expenditures as a share of GDP after 2010. Three forces stand out as most important in driving this development. First, the public pension system is still maturing in the sense that the number of pensioners entitled to supplementary pensions is still increasing. Second, since there are no actuarial mechanisms in the public pension system, retirees receive their defined annual benefits over more years as they live longer. Third, the nominal value of public pension benefits is indexed to wage growth rather than to some average of wage and price growth.²

The strength of the determinants of government expenditures is a result of policy, especially of the design of the public pension system and other welfare state schemes. Accordingly, another fundamental reason to the expected rapid growth in government expenditures is that successive governments have not yet undertaken cost saving reforms of the relatively generous welfare state schemes. One reason for lack of policy action may be that the apparently impressive current fiscal situation has not yet forced governments to do so. In an international comparison large petroleum revenues make the Norwegian Government an outlier with respect to financial wealth: According to the National Budget for 2005 (Ministry of Finance, 2004) the value of the Central Government Petroleum Fund (CGPF) was expected to reach 62.5 percent of GDP by the end of 2004. Measured as a share of Mainland GDP, it is expected to grow until about 2020.³ On the other hand, most other OECD countries have for several years struggled to limit public budget deficits. Even a decade before the baby-boom cohorts become pensioners, several EU-countries have problems with meeting the budget constraints defined by the EU Growth and Stability Pact.

¹ See Statistics Norway (2002).

² Wage indexation is the political intention, and this assumption underlies all Norwegian projections of government pension expenditures. Effectively, however, the historical indexation has been somewhat less generous.

³ The ratio between the return of the fund and trend-GDP for the Mainland economy was 4.5 percent of in 2005. This ratio is expected to peak at about 6.5 percent around 2030.

The current strong financial position of the Norwegian government gives a very misleading picture of the long run situation. Long run projections undertaken by the Pension Commission (NOU 2004:1), the Ministry of Finance (2001, 2004a, 2004b, 2004c), Aaberge, Colombino, Holmøy, Strøm and Wennemo (2004) and Fredriksen, Heide, Holmøy and Solli (2005) show that Norway faces a serious problem of fiscal sustainability as ageing boosts government expenditures after 2020. Since a substantial part of the problem can be attributed to the growth in the government pension expenditures, pension reforms have been high on the policy agenda, as in other countries. A Pension Commission appointed in 2001, delivered reform proposals in January 2004. The main proposal from the Commission, which implies a more actuarial public pension system, constituted the basis for the government reform proposal (Ministry of Finance, 2004c), which is scheduled for discussions in the Parliament during May 2005. Available to the Commission was a huge international literature on the economics of social security and pension reforms, as well as several earlier expert reports discussing pension reform issues in a specific Norwegian context⁴.

However, comprehensive quantitative assessments of the effects of the proposed pension reforms have so far been missing. The purpose of this paper is to provide estimates of:

1. The need for a pension reform. We do this by projecting how a continuation of the present pension system (and other welfare state schemes) will affect labour income taxation, represented by the payroll tax rate, given that the government budget deficit follows the current fiscal policy rule over the next 50 years.
2. The long run macroeconomic effects of two pension reforms proposed by the Pension Commission, NOU 2004:1. We focus on the scope for tax cuts made possible by the reforms. In particular, we examine to what extent tax rates can be reduced as a result of expansion of tax bases generated by increased labour supply, rather than reduced average benefits. Stimulating labour supply has been one of the primary purposes of the pension reforms.

To this end we combine a detailed dynamic micro simulation model, MOSART, with a large scale dynamic CGE-model, MSG6. The MOSART model provides a detailed description of the demographic dynamics, including the development of the labour force and the number of various kinds of pensioners. Being a micro simulation model it also provides a complete representation of the relevant heterogeneity of the population and an exact description of the Norwegian social security system. MOSART provides an accurate calculation of individual pension benefits and government pension expenditures for given individual work histories. Consequently, it provides precise estimates

⁴ Most notably, NOU 1998:10 and NOU 1998:19.

of what Coile and Gruber (2003) refers to as “mechanical” effects on these variables of pension reforms, i.e. effects for given behaviour and given wage rates and prices. We will in the following include these effects in what we refer to as “direct” effects, i.e. effects calculated outside the CGE model. The MSG6 model accounts for the equilibrium adjustments to the changes in government expenditures, labour supply incentives and private savings induced by the pension reforms. As the model is rather disaggregated, it captures the equilibrium adjustments of all tax bases and the prices of government consumption. It also provides a relatively rich description of the production structure, including decreasing returns to scale of industry production functions. This property implies a complex determination of the wage rate, and the wage adjustments have important feedback effects on the government budget, especially when government pensions are indexed to the wage rate.

Quantitative assessments of the macroeconomic consequences of ageing abound in the literature. Chauveau and Loufir (1995), OECD (1998, 2000, 2001), the European Commission (2001) and Visco (2002) provide relevant international comparisons. The literature on numerical simulations of pension reforms has also become large, see Kotlikoff, Smetters and Walliser (2001) and Lindbeck and Persson (2003) for an overview. Some recent examples of studies within this field are Kotlikoff *et al.* (2001), Beetsma, Bettendorf and Broer (2003), Bovenberg and Knaap (2005), Miles (1999), McMorrow and Roeger (2002). Thøgersen (2001) and Fehr, Sterkeby and Thøgersen (2003) estimate the effects on macroeconomic aggregates and welfare of a reform of the Norwegian public pension system. All the referred studies utilise CGE models with a rather small number of agents representing overlapping generations. Even a specification of 12 lifetime earning classes in each cohort, as in the model used in Kotlikoff *et al.* (2001), loses many potentially important aspects of heterogeneity among agents and details of the pension system that are incorporated in a dynamic micro simulation model such as MOSART. Moreover, the MSG6 model provides a rather detailed description of commodity markets, thereby providing a more detailed determination of relative prices and the items in the government budget than what is the case in most OLG equilibrium models. However, accounting for details implies some costs in terms of loss of complete consistency. In our analysis most, but not all, of the general equilibrium effects computed by the MSG6 model are captured by the MOSART simulations. Our credo is that the shortcomings caused by lack of complete consistency are empirically less important than the details we have been able to account for.

By including endogenous retirement behaviour in a dynamic micro simulation model, Coile and Gruber (2003) share some of our ambitions with respect to estimating the fiscal effects of Social Security reforms in the US. They find that the retirement responses have minor effects on the balance

of the Social Security system, because this system is close to actuarial. However, when other taxes are factored in, delaying retirement raises net government revenue. There are two reasons why we would expect that a pension reform stimulating labour supply at both the intensive and the extensive margin is likely to have a much stronger positive fiscal effect in Norway than in the US. First, since the present public pension system in Norway does not include any actuarial mechanisms linked to life expectancy, delayed retirement has first order budget effects. Second, the effective taxation of labour income is higher in Norway than in the US.

The paper is organised as follows: Section 2 describes briefly the micro simulation model and the CGE model. In Section 3 we present a reference scenario in which the existing pension system is maintained, and we quantify the non-sustainability of the present fiscal policy. Section 4 presents the macroeconomic effects of what we refer to as a More Actuarial Public Pension System (MAS), which is the main proposal from the Pension Commission. Section 5 presents the similar effects of another reform proposal, which we refer to as the Flat Benefit System (FBS), since supplementary public pension benefits are phased out in this reform. Section 6 concludes.

2. Modelling framework

In order to be relevant for estimating the effects of fully specified pension reforms the model framework should meet some fundamental requirements. First, to be operational the model must include a detailed description of the rules constituting the pension systems. Second, a detailed description of the population heterogeneity with respect to age and income is necessary for accurate calculations of individual and aggregate pension entitlements and benefits. Third, a detailed description of all tax bases, as well as of their determinants, is required for a full assessment of the development in public finances. The labour supply responses are particularly important in this respect. Fourth, the model should take into account that changes in relative prices affect the prices of government consumption and transfers indexed to wages. Fifth, analyses of fiscal sustainability require a long run perspective, which captures both the long run reform effects as well as the capacity effects of investments and productivity growth.

2.1. The dynamic micro simulation model

The dynamic micro simulation model, MOSART, simulates the life courses of a representative cross-section of the Norwegian population. Fredriksen (1998) provides a detailed documentation of MOSART and examples of applications. The model captures the following events: migration, deaths,

births, marriages, divorces, educational activities, retirement and labour force participation. Transitions between states over the life course depend on individual characteristics, and the transition probabilities have been estimated from observations in a recent period. MOSART is especially designed to analyse the *direct* effects on individual pension entitlements and government pension expenditures of changes in the pension system. By direct effects we mean effects ignoring behavioural responses and general equilibrium effects. The model includes an accurate description of the pension rules, it captures all relevant details of the population dynamics, as well as the heterogeneity of the pension entitlements accruing to individuals. Labour market earnings and participation rates depend on individual characteristics, as well as earnings in earlier years.

2.2. The CGE Model

The CGE model, MSG6, provides a rather detailed description of the Norwegian economy based on National Accounts data. Heide, Holmøy, Lerskau and Solli (2004) provide a detailed description of the model structure and its empirical characteristics. The Norwegian economy is assumed to be too small to affect world prices. The exchange rate is normalised to unity. All agents have access to international capital markets where they face an exogenous interest rate. The economy as a whole obeys an intertemporal budget constraint. Goods and factors are perfectly mobile between industries. Supply equals demand in all markets in all periods.

In each period consumers allocate an exogenous time endowment to leisure and labour according to standard consumer theory. The parameters are calibrated so that the uncompensated wage elasticity equals 0.1, consistent with the econometric results in Aaberge, Dagsvik and Strøm (1995). The composition of private consumption is determined in a demand system derived from a separable structure of nested origo adjusted CES subutility functions. Most imported products are close but imperfect substitutes for the corresponding domestic products. Firms are run by managers with perfect foresight, who maximise present net-of-tax cash flow to owners. Most producers of tradables allocate their output between the domestic and the foreign market. It is costly to redirect output between these two markets. Whereas world prices of exports are exogenous, firms engage in monopolistic competition in most domestic markets. Industry production functions exhibit decreasing returns to scale.⁵

⁵ The scale elasticities range from 0.85 - 1.00. Klette (1999) and Klette and Raknerud (2005) provide econometric evidence of decreasing returns to scale at the firm level in Norwegian industries.

The model includes comprehensive and detailed accounts of government revenues and expenditures. In real terms all expenditures are exogenous in MSG6, but the projections of these exogenous variables have utilised some specialised models developed at Statistics Norway.⁶ The projection of government pension expenditures results from a combined use of MOSART and MSG6. All tax bases are endogenous. In particular, the detailed classification of industries, commodities and various types of indirect taxes improves the accuracy of the computations of revenues from indirect taxation. The public budget constraint is satisfied by endogenous adjustments of the payroll tax rate, which serves the role as a representative of a broad tax on labour income.

3. What happens in case of no pension reform?

3.1. The existing public pension system

The National Insurance Scheme (NIS) in Norway was established in 1967, and replaced a general public pension system consisting of a flat pension benefit. The NIS benefit includes three elements, a basic benefit, a special supplement and a supplementary benefit. The basic benefit and the special supplement constitute the granted minimum benefit. The special supplement is means-tested against the supplementary pension:

Pension benefit = basic benefit + Max(special supplement, supplementary benefit)

The supplementary pension is based on labour market earnings after 1967, and only persons born 1950 and later will receive supplementary benefits based on their entire working career. Since each new cohort of pensioners will have a larger percentage of their working career included in the computation of their supplementary pension, the average benefit has grown and will continue to grow relative to the wage level until 2030. The growth in the minimum benefit and in female labour force participation also contributes to the growth in average benefit.

The income basis for the supplementary benefit is the average labour market earnings over the 20 years with highest earnings. Full pension is reached after 40 years of labour force participation. Using MOSART to account for all elements in the public pension system for a representative sample of the

⁶ The projections of government consumption within the sectors *health care* and *education* has utilised a model which decomposes changes in the input of labour and intermediate inputs into a) changes in the number of persons in different age groups; b) changes in the service standards; c) changes in coverage ratios. Thus, the projections capture the fact that ageing, *cet. par.*, increases the public health care expenses.

Norwegian population, we find that increasing labour market earnings by 1 NOK raises the average present value of future pension benefits by 0.11 NOK. There is large variation in the individual increments in benefits. Moreover, the complexity of the rules makes it hard for individuals to compute the impact on pension benefits of increasing their earnings.

Assuming that the political intention of wage indexation of both pension entitlements and individual benefits, the NIS benefits imply a pre-tax replacement ratio equal to about 50 percent for a person with 40 years of labour market earnings and a steady and normal income level. Special tax rules for pensioners raises the average after-tax replacement ratio of NIS benefits to about 65 percent. Private pensions schemes and special pension schemes for public employees may increase the compensation level further.

The formal retirement age in the NIS is 67 years. Both disability pensioners and early retirees obtain entitlements as if they were working until the age of 67. Roughly 40-50 percent of the population is receiving disability pension when reaching retirement age, and about 60 percent of the (still) employed are entitled to early retirement from the age of 62. Disability pension and early retirement imply that the present effective retirement age averages 59-60 years in Norway. Note that early retirement through these arrangements does not reduce future pension benefits at any point in time, neither because of a shorter period of labour market earnings nor through a longer period as pensioner.

3.2. Key exogenous assumptions in all projections⁷

- *Population ageing:* We rely on the middle alternative in the population projections presented in Statistics Norway (2002). The ratio of those of working age 20-66 to those 67 and older decreases from 4.5 in 2002 to 2.5 in 2050.⁸
- *The labour force:* The population aged 20-66, increases by 13.6 percent, from 2.8 millions in 2002 to 3.2 millions in 2050.
- *Public pension expenditures:* Population ageing more than doubles the number of old-age pensioners from 2002 to 2050. This projection presumes that the age and gender specific transition rates from work to disability and early retirement observed in 2001 stay constant.

⁷ Appendix 1 and Fredriksen, Heide, Holmøy and Solli (2005) provide some more details on the exogenous assumptions. Further information is available from the authors.

⁸ An important driving force behind the expected ageing is the increase in life expectancy. In the middle alternative in the projections presented in Statistics Norway (2002) the life expectancy for males increases from 77.0 years in 2003 to 84.2 years in 2050. The corresponding increase for females is from 81.9 to 88.1 years.

The government finances about 40 percent of the early retirement benefits. We assume that pension entitlements are indexed to wage growth, which is the political intention.

- *Government consumption:* We have made the rather cautious assumption that no changes take place in standards and coverage ratios of public services beyond already approved reforms. A plausible interpretation of our scenario is that the growth in private consumption per capita involves privatisation of services traditionally provided by the government sector in Norway, including care for the elderly.
- *Productivity growth:* Based on historical trends Total Factor Productivity (TFP) grows by 1.3 percent annually.⁹
- *World prices,* except prices of crude oil and natural gas, measured in NOK, grow by 1.5 percent annually.
- *The nominal interest rate* is assumed to stay constant over the simulation period at 5.5 percent, which implies a 4.0 percent real interest rate in terms of foreign goods. This is in line with the assumption in the current fiscal guidelines, and with American interest rates in the second half of the 1990s. In their projections for the EU McMorrow and Roeger (2002) assume the nominal interest rate to fall from 5.5 percent to 5.25 percent from 2000 to 2050.
- *Petroleum revenues:* In 2004 the export share of petroleum products was 45.8 percent, and taxes and other revenues from the petroleum sector amounted to 27.1 percent of total Central Government income. We have adopted the projections reported in Ministry of Finance (2001). Export of crude oil declines at an annual rate of 4.4 percent to 2010 in value terms. Thereafter the percentage annual decline will be approximately 5.4 percent. Export of natural gas is projected to increase by an annual rate of 6.8 percent to 2010 and thereafter to stabilise.

3.3. Implications of maintaining the existing pension system

Table 3.1 reports the development of some key variables in the reference scenario. Below we highlight the patterns of particular relevance in the perspective of fiscal sustainability and pension reforms.

On average private consumption per capita can grow at about 2.8 percent, implying a doubling after 25 years, without violating the long run constraint on foreign debt. The annual GDP growth averages 1.7 till 2050. The difference between the growth in private consumption and GDP reflects our assumption of zero-growth in the quality of government services. It is likely that private consumption

⁹ Private business industries are characterised by decreasing returns to scale in MSG6. Taking this into account, TFP grows by approximately 1 percent when computed by the standard procedure assuming constant returns. Labour productivity in

in such a scenario will include an increasing share of services that traditionally have been produced by government sectors. The estimated growth prospects demonstrate that in the long run productivity growth is by far the most important source of economic well-being, and that ageing has a much more moderate role in this respect.

Table 3.1. Macroeconomic development in the reference scenario. Average annual growth rates in percent

	2002-2025	2026-2050
Private consumption	3.4	2.2
Government consumption	0.8	1.3
GDP	1.9	1.6
Mainland industries	2.5	1.7
Wage cost per hour relative to world prices	2.8	2.8
Payroll tax rate	-2.5	5.4
Consumer real wage rate	2.8	1.6
Employment	0.3	0.1
Government sector	0.5	0.9
Private business sector	0.3	-0.3
Government financial wealth relative to GDP	3.2	-1.0
Net national financial wealth relative to GDP	5.0	-0.4

However, one may question if the no-pension-reform scenario is politically feasible. The reason is that *despite the substantial petroleum wealth and the assumption of constant quality of government services, the present tax rates are by far not high enough to ensure fiscal sustainability*. On the contrary, such a broad tax on labour income as the payroll tax rate must be raised on a pay-as-you-go basis from the present level of 13 percent to about 25 percent in 2050, and it follows an increasing trend if the horizon is extended beyond 2050. Growth in public pension expenditures is the main source to the necessary rise in the payroll tax rate. Measured in percent of GDP, these expenditures grow from 5.3 in 2002 to 15.9 in 2050. Maturing of the existing pension system, as well as increased female labour market earnings, imply a 30 percent increase in the average public old-age benefit from 2002 to 2050.¹⁰

government sectors is assumed to grow by 0.5 percent per year, which is the standard assumption in the Norwegian National Accounts.

¹⁰ The scheme for occupational pensions in the government sector guarantees that the sum of all old-age benefits to government sector employees equals two thirds of previous earnings. This implies that a reduction in the public pension benefit is exactly compensated by an increase in the occupational benefit. We have assumed that the pension reform does not

In addition, ageing after 2020 brings about a stronger growth in nominal government consumption than in the tax bases. Ageing alone implies an annual growth in government employment of 0.6 percent from 2002 to 2020, about 1.0 percent in 2021-2040 and 0.3 percent thereafter. Prior to 2020 there is, however, room for substantial reductions in the payroll tax rate without breaking the fiscal policy rule. The necessary increase in the payroll tax rate after 2020 adds to an effective tax on marginal labour income that is already rather high.¹¹ If the continuous increase in the payroll tax rate is politically accepted, the resulting distortion of labour supply incentives is likely to cause a significant loss in social efficiency of the allocation of time. Moreover, an increase in rent seeking activities is likely. Higher international mobility of tax bases exacerbates both these problems.

Our estimated continuous increase in the payroll tax rate after 2020 is much stronger than corresponding estimates for other countries. Projections presented in OECD (2001) show that budgetary pressures from ageing populations on average requires a 7 percent increase in the ratio between taxes and GDP. This exceeds the corresponding estimates in Chauveau and Loufir (1995) for the seven major economies. On the other hand, McMorrow and Roeger (2002) find that the ratio between social security contributions and wages in EU must increase from 16.1 percent in 2000 to 26.9 percent in 2050, and this is due uniquely to the rise in the old-age dependency ratio. McMorrow and Roeger explain why their estimate of increase in public pension expenditures as a share of GDP from 2000 to 2050 is about 4 percentage points higher than the corresponding estimate made in the European Commission (2001).¹² According to Feldstein (2005) the actuaries of the U.S. Social Security Administration estimates that the payroll tax rate must increase by 48 percent from today to 2075 to finance the benefits specified in current law, i.e. about half of the percentage increase in the payroll tax rate in our reference scenario. However, the projection neglects the development in other government expenditures as well as general equilibrium effects. Taking these effects into account, Feldstein assesses that the necessary increase in the tax rate must become about 70 percent. The

affect this scheme, but any increase in the occupational benefits is financed by higher premiums. Thus, continuation of this scheme does not imply any additional need for raising taxes.

¹¹ In addition to the payroll tax rate, its most important elements includes an average marginal tax on personal labour income approximately equal to 40 percent, compulsory social security premiums averaging 7 percent of wages, and net indirect taxation of consumption (including VAT) averaging 19 percent. In addition, the pension system, especially the early retirement scheme, magnifies the labour supply distortions at the extensive margin.

¹² It is somewhat unclear how the projections of McMorrow and Roeger (2002) should be interpreted. The referred estimates are taken from their Table 3 showing deviations between a scenario based on realistic population ageing and a "technical" scenario assuming no ageing. This suggests that the referred figures represent effects of a partial shift in demographic development, not projections as such. For example, the reported 19.0 percent *decrease* in GDP per capita by 2050 means that ageing, *cet. par*, contributes to reduce GDP per capita by 19.0 percent in 2050 compared to the technical scenario. If the changes in the ratio between pension expenditures and GDP are measured in the same way, i.e. as shift effects, it means that the role of growth over time, due to e.g. productivity growth and capital accumulation, on both pension expenditures (through indexation) and GDP is ruled out.

model based estimate in Kotlikoff *et al.* (2001) is somewhat higher; they find that the payroll tax rate must increase by 77 percent over the next three decades. With respect to welfare state schemes Denmark is more similar to Norway than the U.S. The Danish Welfare Commission (2004)¹³ projects that government expenditures in percent of GDP will increase from 52 percent in 2001 to 59 percent in 2050 if the present welfare state schemes are maintained. Over the same period government revenues in percent of GDP will increase from 54 to 55 percent. One way of obtaining fiscal sustainability is to increase the base income tax rate permanently from 2011 by 8.7 percentage points, corresponding to an increase in the tax revenue-GDP ratio of 5.1 percent compared to a scenario based on constant tax rates.¹⁴

The reference scenario also demonstrates that *productivity growth in the private sector will not contribute to reduce the fiscal sustainability problems*. This is an important lesson to learn: Policy makers cannot rely on the misconception that economic growth will finance the increase in government expenditure. On the contrary, in our reference scenario economic growth makes it somewhat harder to finance the Norwegian welfare state. It is true that productivity growth raises most tax bases. However, the government expenditure will increase even more. This result reflects that the government pension benefits are indexed to wages, that the real wage growth is basically driven by productivity growth, that productivity growth is stronger in the private sector than in the government production sector, that productivity growth does not have significant effects on labour supply¹⁵, and that the wage dependent government expenditures exceed the wage dependent government revenues. The latter condition is basically a result of the fiscal policy rule. This rule allows the government to run a deficit, excluding the net cash flow from the petroleum sector, equal to the expected real return on the government petroleum fund. Since this return is independent of the growth in productivity and wages, productivity growth, *cet. par.*, slightly increases the difference between government expenditures and non-petroleum tax revenues. Alternatively, we might say that the relevant real rate of return on the government financial assets, i.e. the nominal return deflated by the price index of government expenditures, falls when the wage rate increases as a result of productivity growth in the private sector.

¹³ See Andersen, Jensen and Pedersen (2004) for a review in English.

¹⁴ The estimate presented by The Danish Welfare Commission (2004) of the permanent increase in the base income tax that is necessary in order to obtain fiscal sustainability, is radically higher than the estimate in Jensen, Nødgaard and Pedersen (2001). The latter study concludes that "the fiscal policy in Denmark is almost sustainable, in the sense that a smooth tax rate, which fulfils the intertemporal budget constraint of the public sector is only 1.1 percentage point higher than the announced base tax rate for 2003.

¹⁵ Aaberge, Colombino, Holmøy, Strøm and Wennemo (2004) find that income and substitution effects on labour supply caused by economic growth roughly cancel out.

4. Effects of a More Actuarial Public Pension System (MAS)

4.1. Main reform characteristics

The More Actuarial System (MAS) is supposed to be gradually phased in over a 15 years period from 2010. It continues to be a pay-as-you-go financed system. We assume that the reform does not affect the fiscal policy rule, which implies that the pension reform does not change government savings.¹⁶

The payroll tax rate adjusts annually to meet the same time path of the fiscal surplus as in the reference scenario. Although the reform strengthens the incentives to retire as a disability pensioner, the disability pension scheme is not altered. Moreover, we assume that the reform does not change the rates of transition from work to disability.

The most important reform characteristics include:

- The pension benefit continues to include two elements, a granted minimum benefit and an income based benefit. The minimum benefit is maintained at the same level as the current minimum benefit. Contrary to the basic benefit in the present system, it is means-tested against the income based pension benefit.
- The system implies a stronger dependency between earnings and pension benefits. The income based benefit is basically 1.25 percent of lifetime labour market earnings with a few restrictions.
- The current early retirement arrangements are phased out. They are replaced with a flexible retirement age from the age of 62 years available to everyone. However, the system becomes more actuarial as the pension benefit is adjusted in accordance with retirement age and current remaining life expectancy, such that the total value of future pension benefits remains roughly constant. However, special rules imply deviations from an exact actuarial adjustment.¹⁷
- The income dependent entitlements are indexed by wage growth until retirement. The new system is calibrated such that those from the 1943-cohort who retire at the present statutory retirement age of 67 in 2010, will receive the same pension benefit in 2010 as in the existing system. However, over time the retirees receive lower annual benefits than in the present

¹⁶ The motivation of the fiscal policy rule is to ensure a fair intergenerational distribution of the petroleum wealth and to ensure that the use of the petroleum wealth is gradually increased. On the other hand, the main intention of the pension system is to help individuals to achieve a rational allocation of consumption possibilities over their life span. In this perspective, there is no reason why a pension reform should change the general long and short run considerations underlying the fiscal policy design.

¹⁷ An important non-actuarial element is the exemption of 30 000 2005-NOK, corresponding to 28.5 percent of the present public minimum pension benefit, from the base of entitlements subject to adjustments to early retirement or increased life expectancy. Moreover, the annual benefits and pension premium are independent of gender and other observable characteristics correlated with life expectancy.

system since the received benefits will be indexed to the average of the growth rates of wages and consumer prices, rather than the wage growth.

4.2. Direct effects

Within our framework the reform to the MAS may affect the economy through four channels: 1) labour supply at the intensive margin; 2) labour supply at the extensive margin; 3) government pension expenditures; 4) private savings.

We assume that *the reform does not change the aggregate private financial savings*. Any specific assumption on the private savings response is hard to justify due to lacking relevant empirical evidence. For example, Carman, Gokhale and Kotlikoff (2003, p.4) write: "Notwithstanding lots of careful estimation, the empirical literature provides little means of knowing precisely how a particular households' spending will respond to any given policy change." Under our assumptions on retirement behaviour (see below) the average annual public pension benefit will be nearly unaffected by the reform for individuals who works until old-age retirement.¹⁸ This is the main rationale for our assumption of no adjustment in private financial savings. Since neither government nor private financial savings changes, the time path of net national financial investments and the foreign financial assets will be the same under the MAS as in the reference scenario. However, aggregate savings will change as firms adjust their fixed capital stocks to changes in relative prices. The subsequent sections briefly give the reasons for our estimates concerning the effects working through channels 1 – 3. Appendix 4 provides some sensitivity analyses of the assumptions on the two labour supply stimuli, and we check the robustness of the effects of the MAS reform with respect to population ageing.

4.2.1. Labour supply at the intensive margin

Simulations on MOSART reveal that the average increment in the present value of future pension benefits of raising labour market earnings by 1 NOK, increases from 0.11 NOK to 0.20 NOK when the present system is replaced by the MAS. In addition, the reform makes the individual income dependency more transparent and more similar between individuals. All effects contribute to raise the effective marginal wage rate facing workers at the intensive labour supply margin. The aggregate incentive effect will be uncertain due to uncertainty about the effective tax element in the existing system. Moreover, the relevant weights used to compute the increase in the average marginal effective wage rate should take into account that low income workers are found to have a more wage elastic

¹⁸ Individuals who are disabled before they become old-age pensioners will experience a substantial reduction in their annual old-age benefits. However, the majority of this group has low income, which makes an increase in savings implausible.

labour supply than high income workers, see e.g. Aaberge, Colombino and Strøm (2000). Our preferred estimate, which we regard to be cautious, is that the increased income dependency of the benefits translates to an 8 percent increase in the average effective marginal wage rate.¹⁹ Appendix 3 discusses in more detail to what extent rational individuals will consider the contributions necessary to finance the MAS-benefits as taxation or mandatory savings.

4.2.2. Labour supply at the extensive margin

Several studies find that labour supply is more elastic on the extensive than on the intensive margin, see e.g. Heckman (1993). However, the recent international empirical literature does not provide clear guidelines for assessing the magnitude of the effects of pension reforms on retirement. From 12 comparable country studies Gruber and Wise (2004) concludes that the pension system has “enormous effect on retirement”. Chan and Stevens (2003) confirm that forward-looking measures of pension wealth only, and broader measures of wealth, are significantly related to individuals' expectations of continuing work into their 60s. However, they conclude that existing research, which largely ignores (unobservable) heterogeneity in tastes for retirement, may substantially overstate the responsiveness of individuals to pension-related incentives. Samwick (1998) finds that levels of pension and other wealth are not major determinants of retirement. Norwegian studies on retirement behaviour are surveyed in Hernæs, Røed and Strøm (2002).

The MAS reform has both positive and negative effects on the average age of retirement. First, whereas about 60 percent of the labour force may retire at the age of 62 in the present system, all individuals get this option at the age of 62 in the MAS. This contributes to reduce the average retirement age. On the other hand, the reform increases the individual cost of early retirement. Whereas early retirement in the present system does not reduce benefits in subsequent years, the MAS implies that the annual pension benefits is cut in a close to actuarial way the earlier one retires. We will refer to this positive effect on the retirement age as the *cost effect*.

As a starting point to assess the cost effect on the retirement age, we use the observed labour market participation rates for persons aged 60-69 in Norway in the early 1980s, when no early retirement scheme existed. These participation rates may serve as an upper boundary for what the labour participation rates in these age groups will be under a perfectly actuarial system. As a more realistic and cautious estimate we assume that a perfectly actuarial pension system would raise the present

¹⁹ If the difference between the interest rate and the wage growth is set to 2.5 instead of 1.1, this estimate falls to 5 percent. Assuming this growth-adjusted interest rate to be 0 implies an increase in the effective wage rate by 11 percent.

relatively low participation rates of these age groups to the average of the present rates and the rates observed in the early 1980s. Keeping the present life expectancy fixed, this response implies an increase in the average retirement age equal to 2.4 years. Taking into account that only 60 percent of the labour force has access to the present early retirement scheme, the postponed retirement corresponds to an increase in total labour supply of about 2 percent. This response is in line with the estimate in Brinch, Hernæs and Strøm (2001) of abolishing the present early retirement scheme.

However, the cost effect of the MAS reform should be modified since it includes several non-actuarial elements. Most significantly, an amount equal to 30 000 NOK is exempted from an actuarial division of pension entitlements by the expected number of years as pensioner. We also believe that the gravity of 62 years as the norm for the retirement decision will be stronger in the MAS. The reason is that 62 years will be the only statutory retirement age in the MAS, whereas the present system includes several formal age limits, most notably 67 years in the NIS, and 62 years in the present early retirement scheme. As pointed out by e.g. Gruber and Wise (2004) and Hernæs, Røed and Strøm (2002), statutory retirement ages are likely to have an important effect on the norm for what is considered to be the normal retirement behaviour. The empirical importance of these modifications is highly uncertain. We assume that they reduce the cost effect on the retirement age from 2.4 to 1.2 years.

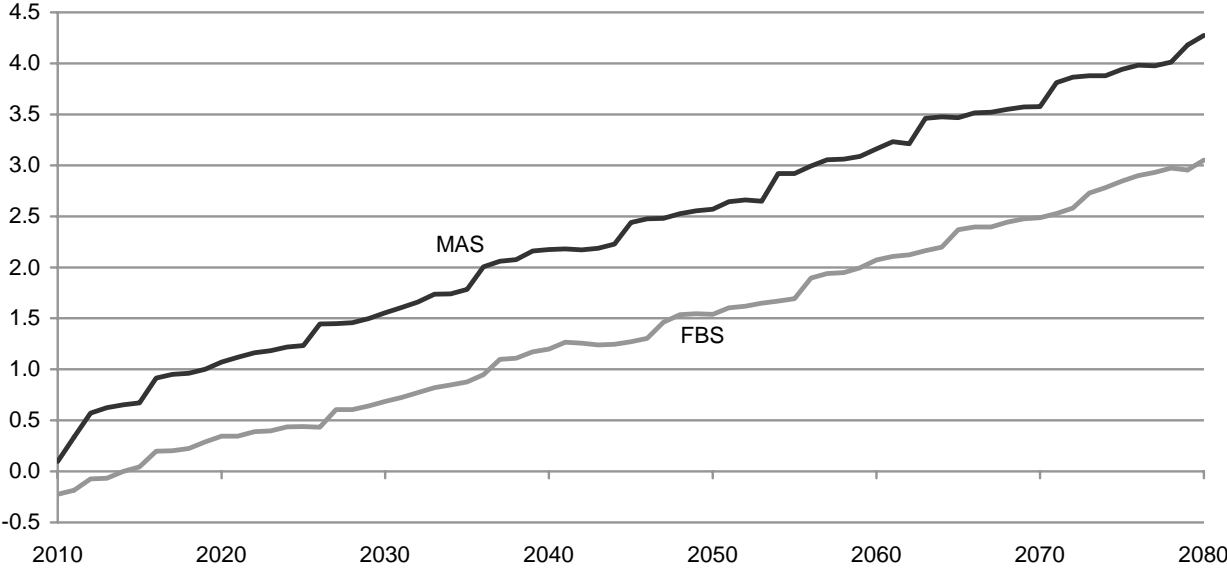
The cost effect is only relevant for the 60 percent of the labour force that have access to the present early retirement scheme. From this cost effect we must subtract the effect of making early retirement optional for the whole labour force. Provided that the retirement behaviour is not systematically different between the two groups, the *ex post* reform retirement age will be the same as the one assumed above. This implies that the 40 percent without access to the present early retirement scheme will reduce their retirement age by 0.3 years. As long as we ignore the effect of increased life expectancy, our estimate on the increase in the average retirement age of a more actuarial system becomes $0.6 \cdot 1.2 \text{ years} + 0.4 \cdot (-0.3 \text{ years}) = 0.6 \text{ years}$.

However, so far the estimates have been contingent on constant mortality rates. Increased life expectancy is likely to increase the retirement age in an actuarial system, see e.g. Bloom, Canning and Moore (2004) for a theoretical discussion. One reason is the preference for consumption smoothing; an additional year of consumption can be financed, at least partly, by postponing retirement. In addition, if increased longevity results from improved health, it can be interpreted as an increase in income, taking the form of more leisure time. At a given consumer real wage rate, the optimal response would be to exchange some of the leisure increment for consumption in the labour market.

Postponing retirement is one way of doing this. We are not aware of information about the empirical magnitude of the effect of life expectancy on the retirement age. Our best guess is that increasing life expectancy by 1 year increases the average retirement age by 0.4 years. This guesstimate takes into account that 40-45 percent of the population at age 62 either will be disability pensioners or prefer to retire as early as possible. The remaining share postpones their retirement by 2/3 years when life expectancy increases by 1 year. Such a postponement implies that the annual benefit can be kept approximately constant in the MAS.

On the other hand, we believe that increased life expectancy will have a negligible effect on the average retirement age if the present system is maintained. The basic reason is that the annual benefit is independent of the number of years as pensioner under the present system. Thus, if all consumption initially is financed by the benefit, this consumption-leisure combination can be maintained when life expectancy increases. If the initial consumption level is financed out of private funds in addition to the public benefit, the consumption level cannot be maintained when life expectancy increases without increasing labour supply. However, at the statutory early retirement age the individual faces a kinked budget constraint when he decides to work or retire. At this age the effective marginal tax rate of labour income jumps to a very high level, because he simply loses the pension benefit that alternatively could be received.²⁰

Figure 4.1. Postponed retirement in the MAS and FBS. Deviations from the reference scenario. Years



²⁰ Holmøy (2002) and Holtmark (2002) estimate the effective marginal tax rate on labour income when the early retirement scheme is taken into account.

To sum up, we assume that replacing the present system by the MAS increases the average retirement age by 0.6 years when the present early retirement scheme has been phased out in 2015.²¹ Increased life expectancy strengthens the effect over time. Average retirement is delayed by 1.6 years in 2030, and by 2.6 years in 2050, see Figure 4.1.

4.2.3. Government pension expenditures

MOSART simulations show that the MAS reform implies a 16 percent direct cut in government old-age pension expenditures in 2050. This reduction can be decomposed into the following sources: First, keeping life expectancy and indexation rules fixed, the average benefits *increase* by 3-4 percent when the MAS replaces the present system. Second, in the MAS annual benefits are indexed to the average of the growth rates of wages and the consumer price index. In the present system the annual benefits are indexed to the wage growth. Less generous indexation contributes to reduce government pension expenditures by 7-8 percent in 2050 compared to the reference scenario.

The third source is the impact of a more actuarial cut in annual benefits to increased life expectancy. MOSART simulations show that this effect alone contributes to about 13 percent of the reduction of government pension expenditures in 2050. This reduction works through two channels. The first channel is a reduction in the number of pensioners. As explained above, those working until they become old-age pensioners will on average postpone retirement, so that their annual benefit will be approximately the same as it would have been under the present system. But the increase in the retirement age reduces the number of old-age pensioners in a given year. In 2050 the number of old-age pensioners will be reduced by 11 percent (145 000) compared to the reference scenario, corresponding to the 2.6 years increase in the average retirement age. The other channel is a close to actuarial reduction of the annual old-age pension benefit to individuals who do not work prior to old-age retirement. Disability pensioners are the most important example in this category. In 2050 this effect contributes to a 8 percent reduction of the average annual benefit received by all old-age pensioners.

4.3. General equilibrium effects

Table 4.1 shows the macroeconomic effects in 2050 of replacing the present pension system by the MAS when we account for both direct and general equilibrium effects through the iterative use of MOSART and MSG6. By 2050 employment is 10.6 percent higher than in the reference scenario, see

²¹ When the reform is implemented in 2010 the immediate increase in the average retirement age is only 0.1 years because it is assumed to take 5 years to phase out the existing early retirement scheme.

Figure 4.2. As firms also adjust their stocks of fixed capital, private consumption and GDP can be expanded in almost the same proportion. The slight difference between the growth in inputs and output, respectively, reflects decreasing returns to scale in the production functions. A 10 percent increase in private consumption per capita is a large effect compared to what can be expected from most other policy reforms. CGE estimates of the consumption effect of tax- and trade policy reforms are typically close to 1 percent. However, the effects of a pension reform need a long time to unfold. Figure 4.4 clearly brings out the point that even a 10 percent shift becomes rather modest compared to the consumption growth that normal productivity growth is able to generate over 50 years, independent of the pension system.

The MAS reform makes it possible to reduce the payroll tax rate substantially in all years compared to the reference scenario, see Figure 4.3. Whereas maintaining the present system requires an increase in the payroll tax rate from the present level of 13.1 percent to 25 percent in 2050, only 11 percent is sufficient in 2050 in the MAS. The tax cut is possible due to reduced government pension expenditures and expansion of tax bases. Note that the increase in employment expands most tax bases, not only the bases for the personal income tax and the payroll tax. The ratio of government pension expenditures to GDP is 14.1 percent lower compared to the reference scenario in 2050.

The fall in the wage cost deserves an explanation since it demonstrates that MSG6 accounts for mechanisms, which make the determination of factor prices significantly different from the textbook model of a Small Open Economy (SOE). In the SOE model factor prices would, under certain conditions, be unchanged according to the Stolper-Samuelson theorem. Contrary to the SOE model, MSG6 captures the econometric findings of decreasing returns to scale, not only in extraction of natural resources such as crude oil, natural gas and hydro power, but also in Norwegian manufacturing industries. Decreasing returns to scale makes a decrease in factor prices necessary in order to meet the long run external balance constraint when the MAS reform expands the economy and thereby the demand for tradables. If the price of input factor did not fall, firms would not find it profitable to produce the additional exports needed to pay for the import growth. In the domestic markets, lower costs are transmitted into lower prices of Norwegian products, which induce Norwegian firms and households to reduce the import share in their demand. Appendix 2 provides a more thorough explanation of the equilibrium mechanisms determining the wage cost in MSG6.

Figure 4.2. Employment. Million man-hours

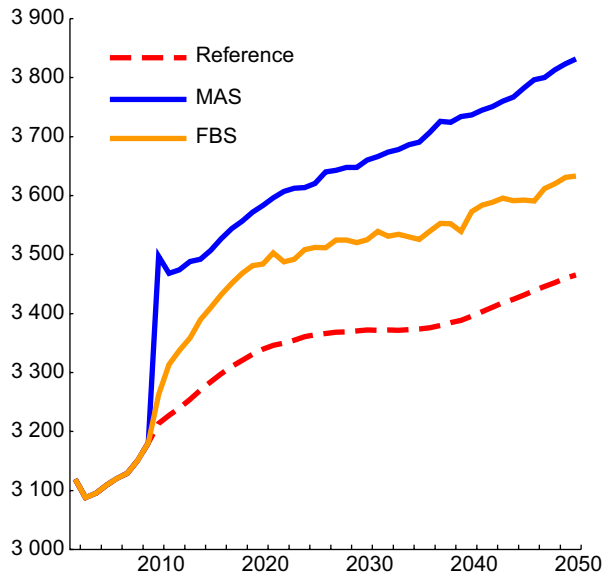


Figure 4.3. The payroll tax rate. Percent

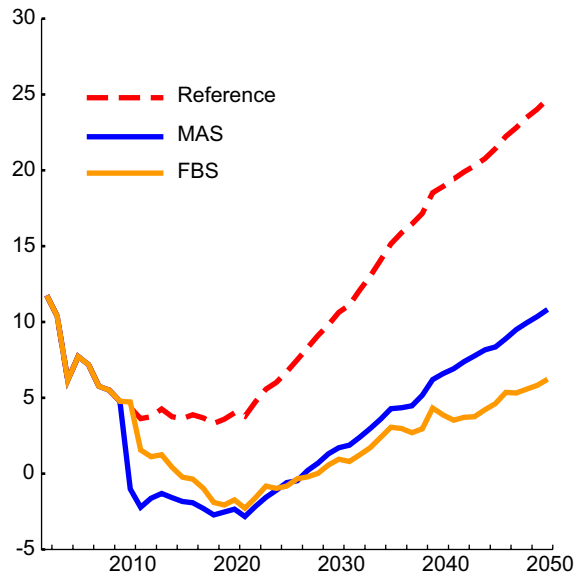


Figure 4.4. Private consumption per capita. Thousand 2001 NOK

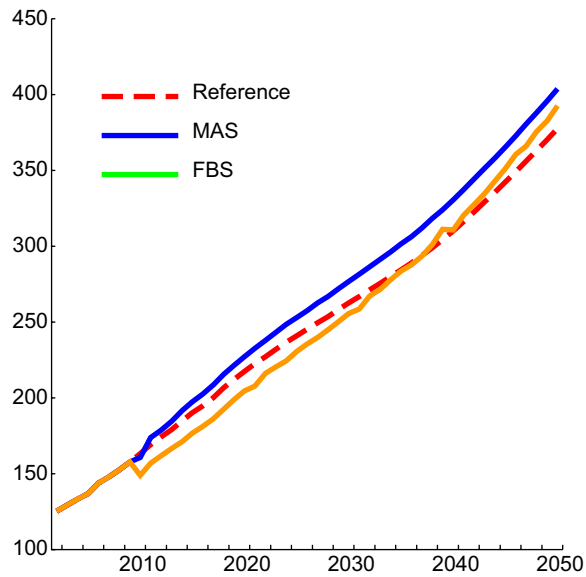


Table 4.1. Macroeconomic effects of a More Actuarial System. Deviations from the reference scenario in 2050. Percent

Total employment	10.6
GDP	9.7
Private consumption	9.9
Wage cost per man hour	-8.4
Payroll tax rate	-56.1
Real consumer wage rate, excl. the pension effect	5.7
Effective real consumer wage rate, incl. the pension effect	13.7
Net national financial wealth/GDP	-3.2
Gross real investment	11.2

However, the magnitude of the fall in the wage cost, which equals 8.4 percent in 2050, may appear surprisingly large compared to scale elasticities close to 0.85 and the roughly 10 percent expansion of the economy. If labour were the only input, and if the expansion reflected a proportional increase in exports of all tradables, a 1.5 percent drop in the wage cost would be roughly sufficient. Among all the forces affecting the wage cost in MSG6, most of the relatively large fall in the wage rate can be attributed to two effects. First, exports of crude oil and natural gas, constituting close to half of total exports, does not adjust to changes in the wage rate. Consequently, the relative increase in the *adjustable part* of total exports must be as large as 21 percent in 2050. Decreasing returns to scale makes the percentage increase in factors allocated to exports even higher, and the necessary reduction of the aggregate factor price index becomes more than 3 percent in 2050. Second, the cost share of wages is less than fifty percent in the dominating traded goods industries, even when the indirect labour content in domestically produced intermediates and capital goods is accounted for via the input-output structure of the Norwegian economy. Since no other prices of primary inputs change, the necessary reduction of the wage cost must be more than twice as strong as the necessary reduction of the price index of all inputs.

Consumers experience an increase in their real wage rate despite the reduction of wage costs because the reduction of the payroll tax rate is shifted over to the consumer wage rate, and because lower wage cost is transmitted into lower consumer prices.

Figures 4.2, 4.3 and 4.4 show that the effects in 2050 are not stationary. The reason is that the average life expectancy is projected to increase steadily over the whole century. The effects of replacing the existing system with the MAS will grow over time as the present public pension system becomes increasingly expensive as more retirees live longer, whereas the actuarial properties of the MAS prevent to a large extent increasing life expectancy to raise government pension expenditures. Nevertheless, the payroll tax rate follows an increasing trend also in the MAS scenario after 2020, but this basically reflects that ageing increases the government expenditures related to services used by the elderly. Note that prior to 2020 the demographic development makes it possible to reduce the payroll tax rate in every year. With the MAS it is even possible to cut more than the whole payroll tax. It should be stressed, however, that our models do not give a realistic picture of the short run adjustments to the pension reform.

Table 4.2 decomposes the reform effects into contributions from the direct effects. The improved labour supply incentives at both the extensive and the intensive margin dominate the total effect on

employment. Postponed retirement enters MSG6 as two exogenous impulses: i) the number of pensioners falls, reducing the government pension expenditures; ii) the workers who postpone retirement represent an increase in the tax bases. Both effects make it possible to lower the payroll tax rate, which stimulates labour supply at the intensive margin.

Table 4.2. Decomposition of the effects of a More Actuarial System. Deviations from the reference scenario in 2050

	Employment, percent	Payroll tax rate, percentage points	Consumer real wage, percent
1. Increased retirement age	5.6	-8.0	3.3
1.1. Direct effect	4.1		
2. 8 percent increase in the effective wage rate	4.2	-4.5	1.2
3. Reduced average benefits	0.6	-3.1	2.1
4. Interaction effects (= 5 - 1 - 2 - 3)	0.2	1.7	-0.9
5. Total effect	10.6	-13.9	5.7

5. Effects of a Flat Benefit public pension System (FBS)

5.1. Main reform characteristics

In this reform alternative the public pension benefit is limited to a flat uniform pension benefit for all pensioners equal to the minimum pension benefit in the present system. The reform implies privatising the supplementary benefits in the NIS; individual benefits beyond the flat public benefit are left to the market, either through private savings or through occupational pension schemes. The flat benefit is assumed to be pay-as-you-go financed by adjusting the payroll tax rate. Feldstein and Samwick (2002) and Feldstein (2005) discuss how such a system could work. In our simulation we assume that the formal retirement age is reduced from 67 to 62. The flat benefit is indexed to wage growth and is not means-tested against any other sources of wealth or income. The reform is phased in from 2010. NIS pension entitlements accrued prior to 2010 are honoured.

5.2. Direct effects

5.2.1. Labour supply at the intensive margin

Given our assumptions, MOSART simulations show that removing the income dependent supplementary pension in the existing system implies, *cet. par.*, a 3 percent decrease in the average effective wage rate. Appendix 3 discusses in more detail why the tax element in the contributions

necessary to finance the public pension benefits will be much higher in the FBS than in the MAS. However, increasing tax cuts are possible as retirees receiving only the flat benefit gradually replace retirees entitled to pre-reform supplementary benefits. The resulting labour supply effect is examined in Section 5.3.

5.2.2. Labour supply at the extensive margin

The general access to early retirement from 62 years without any cut in the flat pension benefit, contributes to reduce the retirement age. On the other hand, the annual supplement from private savings will be actuarially adjusted to an increase in the expected number of years as a pensioner. However, under our assumptions (see Section 5.2.4) the annual benefit that can be financed by private savings on average accounts for less than one third of total pension benefit. Since the flat benefit is not actuarially adjusted, the effective subsidy of early retirement is greater in the FBS than in the MAS. Our preferred estimate on the average postponement of retirement is therefore reduced compared to the MAS case. Specifically, we assume that employees on average retire 2 months earlier than in the reference scenario in 2010. However, the impact on retirement of increased life expectancy will be about the same as in the MAS case. Compared to the reference scenario, retirement will on average be postponed by 8 months in 2030 and by 1.5 years in 2050, equivalent to 2.5 percent increase in labour supply.

5.2.3. Government pension expenditures

As the retirees receiving pre-reform supplementary benefits die, the decrease in government pension expenditures becomes more significant in the FBS than in the MAS. *Ex ante* indexation, the average public pension benefit will increase slightly from 2010 to 2020, before it declines to about two thirds of the average pension benefit under the present pension system in 2050.²² Government pension expenditures *ex ante* indexation will be reduced by nearly the same proportion, given our assumptions of postponed retirement. Note that while government expenditures are almost invariant to the retirement age and the life expectancy in the MAS, this is not the case in the FBS since the retirees receive the granted flat benefit in all years.

5.2.4. Private savings

The removal of the public supplementary pension benefit will stimulate private savings. However, as noted in Section 4.2, any specific assumption on the private savings response is hard to justify due to

²² Measured in 2001-NOK, *ex ante* wage indexation of benefits, the average public pension benefit increases from 126 000 in 2010 to 136 000 in 2020. Then it declines to about 100 000 in 2050.

lacking relevant empirical evidence. An extreme alternative is that the cut in public benefits is fully compensated through private savings. From the literature on savings behaviour, see e.g. Mankiw (2000), such a response is unlikely as an average response for several reasons. Our preferred guess is that private savings compensate for 75 percent of the loss in public benefits.

5.3. General equilibrium effects

Table 5.1 shows the macroeconomic effects in 2050 of replacing the present pension system by the FBS when we account for both the direct effects and the general equilibrium effects. Compared to maintaining the present pension system, the FBS stimulates labour supply, see also Figure 4.2. However, this stimulus, and thereby the general expansion of the economy, is considerably smaller compared to the MAS reform. Due to significantly lower government pension expenditures in the long run, the payroll tax cuts are stronger with the FBS than with the MAS after 2025. While the MAS makes a payroll tax rate of 11 percent sufficient in 2050, the corresponding tax rate can be reduced to 6.3 percent with the FBS, see Figure 4.3.

Table 5.1. Macroeconomic effects of a Flat Benefit System (FBS) and a More Actuarial System (MAS). Deviations from the reference scenario in 2050. Percent

	MAS	FBS
Total employment	10.6	4.8
GDP	9.7	4.6
Private consumption	9.9	5.7
Wage cost per man hour	-8.4	-2.3
Payroll tax rate	-56.1	-75.6
Real consumer wage rate, excl. the pension effect	5.7	14.2
Effective real consumer wage rate, incl. the pension effect	13.7	11.2
Net national financial wealth/GDP	-3.2	73.7
Gross real investment	11.2	7.1

There are two main reasons why employment is lower with the FBS than with the MAS. These, as well as other effects, are quantified in Table 5.2. First, as explained above, the average retirement age is lower in the FBS than in the MAS. Compared to the reference scenario in 2050, the direct labour supply effects are, respectively, 2.5 and 4.1 percent. Second, taking the labour supply incentive effects of the pension system into account, the effective marginal taxation of labour income is lower in the MAS than in the FBS. This is reflected in change rates reported in Table 5.1 for the effective real consumer wage rate, including the pension effect. The *formal gross* tax revenue is greater in the MAS than in the FBS. However, in the MAS the reimbursement of a significant share of the tax revenue to

retirees makes individuals perceive a significant share of the formal gross tax payments as mandatory savings. In result, the stronger income dependency in the MAS makes the *effective net* taxes smaller than in the FBS. Replacing the present pension system with the MAS lowers the effective tax rate by 8 percent. On the other hand, all of the (remaining) government pension expenditures in the FBS must be financed by distortionary taxation. Appendix 1 explains the difference in effective taxation between the MAS and the FBS in greater detail.

Privatising supplementary pension benefits also affects employment through other mechanisms. An important one is the income effect due to the double burden carried by the working generations under the transition from a (pure) pay-as-you-go pension system to a (more) funded system. *Cet. par* the transition from the present system to the FBS implies an income loss for the cohorts who must finance pre-reform supplementary benefits through taxes, because they cannot look forward to receiving such benefits themselves. This income loss stimulates labour supply and reduces consumption. The effects are particularly strong the first couple of decades after the reform is implemented, when the number of retirees with entitlements from the present pensions system is still high.

Table 5.2. Decomposition of the effects of a More Actuarial System (MAS) and a Flat Benefit System (FBS). Deviations from the reference scenario in 2050

	Employment, percent		Payroll tax rate, percentage points		Consumer real wage, percent	
	MAS	FBS	MAS	FBS	MAS	FBS
1. Increased retirement age	5.6	3.4	-8.0	-5.0	3.3	2.0
1.1. Direct effect	4.1	2.5				
2. Reduced tax rate due to lower benefits, and changed income dependency	4.8	0.2	-7.6	-6.9	3.3	5.7
2.1. Changed income dependency	4.2	-1.7	-4.5	2.1	1.2	-0.6
2.2. Lower benefits	0.6	1.9	-3.1	-9.0	2.1	6.3
3. Accumulation of financial assets	0	1.3	0	-7.7	0	6.2
4. Interaction effects (= 5 - 1 - 2 - 3)	0.2	-0.1	1.7	-1.1	-0.9	0.6
5. Total effect	10.6	4.8	-13.9	-18.5	5.7	14.5

MSG6 captures an important interaction between changes in savings, the real wage rate and employment. Since the government financial investment is unchanged compared to the reference scenario, the increase in private savings is basically matched by accumulation of foreign financial assets. Thus, the net *accumulation* of private pension funds requires increased net exports. Thus, the intertemporal reallocation of aggregate consumption must be associated with a temporary reallocation of resources from industries producing non-traded consumer goods to the traded goods industries. As pointed out in Section 4.3, such a reallocation requires a reduction of the wage costs from the

reference path due to decreasing returns to scale. As the aggregate pension fund converges to its desired level, net exports decrease compared to the reference scenario since a greater share of imports is financed by interest income. Thus, the wage rate can increase, and by in 2050 the percentage increase in consumption exceeds the percentage increase in employment and GDP. The dynamic wage rate adjustments transform the increase in individual supplies of savings into actual saving. Line 3 in Table 5.2 captures both the income effect experienced by the transition generation and the effect of accumulation of foreign assets, where the former dominates the latter over the entire simulation period: The temporary fall in the wage rate has only modifying effects on labour supply. It reduces the initial increase in labour supply and dampens the succeeding fall.

The model also captures another important interaction effect: Pension reforms alone affect the wage growth, which in turn affects the balance of the public budget and thereby the room for tax cuts. Considering the FBS reform, this effect can be explained as follows: When public pensions are indexed to the wage rate, and because wage costs dominate government consumption, an increase in the wage rate yields a close to proportional increase in government expenditures. Whereas most tax bases in the Norwegian Mainland economy are also close to proportional to the wage rate, the share of the petroleum wealth, which the fiscal policy rule allows to be used each year, is independent of the wage rate. Hence, an increase in the wage rate generates *cet. par* a fiscal deficit, which must be neutralised by raising the payroll tax rate. This interaction effect contributes to modify the cut in the payroll tax rate made possible in the long run by the FBS reform. In addition to the weaker labour supply stimulus, it explains why privatising the supplementary pension benefits does not generate an even greater long run cut in the formal taxes compared to what is possible in the MAS.

5.4. Comparison with related simulation studies

The simplicity of the FBS system makes it a common reference system in the discussion of pension systems. However, differences between the initial public pension systems entail country specific effects of a reform to a common FBS even in the hypothetical case of identical models. Thøgersen (2001) uses an OLG model to simulate the dynamic effects of a FBS reform of the Norwegian system.²³ Comparing long run effects, the reform makes it possible to reduce the labour income tax rate by 13 percentage points from the scenario in which the present system is maintained. Our simulation allows a reduction by 18.5 percentage points in the payroll tax rate in 2050. In addition to model differences, the difference is also likely to reflect more rapid increase in life expectancy in our

²³ The FBS reform is called an individualized funding strategy in Thøgersen (2001).

scenarios than in Thøgersen's. This reinforces the tax cuts made possible by privatising the supplementary benefit. The steady state effect on employment is only 1 percent in Thøgersen's study. However, his study does not include changes in retirement. Moreover, intertemporal substitution makes the employment effects stronger in the years 2025 to 2070 than the steady state effects. After 40-50 years employment is 4-5 percent higher than in his reference scenario, which is not so far from the 5.7 percent increase we find in 2050.

Fehr, Sterkeby and Thøgersen (2003) has calibrated the OLG model used by Fehr (1999) to Norwegian data and simulates the effects of a FBS reform of the Norwegian pension system. Compared to Thøgersen (2001), this study captures endogenous retirement and income heterogeneity within each cohort. Compared to our results, Fehr *et al.* obtains much smaller macroeconomic effects. They estimate the long run increase in consumption to 2.0 percent, while private consumption increases by 5.7 percent in our simulation. (Even if one corrects for no growth in government consumption, a significant difference remains). The cut in the consumption tax is 4.0 percentage points in Fehr *et al.*, while the cut in the payroll tax rate is 19 percentage points. Some of this large difference can be explained by differences in the population projections and the increase in government expenditures. Moreover, the initial equilibrium consumption tax of only 15.2 percent in Fehr *et al.*, is very low compared to the VAT rate and other indirect tax rates. It indicates that the base of the consumption tax has been very broadly defined.

Kotlikoff, Smetters and Walliser (1999) simulates the dynamic effects of a FBS reform of the US social security.²⁴ The steady state effects on labour supply and the capital stock are, respectively, 1.2 and 12.4 percent. These effects are less than one third of the effects obtained in the case of complete privatisation of social security. The reason is the same as pointed out in the interpretation of our results: Tax financing of the flat benefit implies that a substantial labour supply disincentive remains. Moreover, in Kotlikoff *et al.* (1999) the FBS reform reduces employment, the capital stock and output from the initial levels during the transition. It takes about 50 years before these variables pass their initial levels.

²⁴ Kotlikoff, Smetters and Walliser (1999) refer to the FBS reform as "Privatisation with a Flat Benefit". In the simulation of this reform the income tax is used to finance accrued benefits.

6. Conclusions

We have used a detailed dynamic micro simulation model together with a large scale dynamic CGE model to project the macroeconomic development of the Norwegian economy until 2050 under different public pension systems. The detailed description of population heterogeneity and the pension system in the micro simulation model allows accurate calculations of the direct effects on government pension expenditures of population ageing and pension reforms. The CGE model captures a rich menu of general equilibrium effects caused by changes in these variables. In particular, the CGE model accounts for endogenous adjustments of most tax bases and prices of government consumption. The two models are run iteratively to obtain consistency. Specifically, the equilibrium effects on the wage rate and labour supply has been accounted for in the results produced by the micro simulation model, and the necessary tax rate adjustments rely on the government pension expenditure projections produced by the micro simulation model, as well as the general equilibrium effects captured by the CGE model.

The reference path shows that *continuation of the present pension system contributes severely to make the present fiscal policy far from sustainable after 2020*. In 2050 even such a broad based tax as the payroll tax rate must be raised to 25 percent, nearly a doubling from the present average of 13 percent. Moreover, a further steady increase is necessary when the time horizon is extended beyond 2050. The necessary increase in the tax burden after 2020 is much stronger than what is estimated for most of the seven major economies in Chauveau and Loufir (1995). Thus, the petroleum wealth is far from sufficient to finance the Norwegian welfare state when one looks beyond 2020. The reference scenario is a good motivation for a pension reform that stimulates labour supply and establishes some kind of actuarial mechanism that motivates individuals to postpone retirement as they live longer. It is questionable if the projected increase in the future tax burden will be politically approved. If it is, the efficiency loss may be severe since the present effective tax rates are already relatively high in Norway.

Any projection is uncertain. *On balance, however, in our opinion the estimate of the necessary increase in future tax rates is likely to be negatively biased*, because it rests on the assumption that the standard of government services per user is kept constant over the whole simulation period. Such a development would imply a radical break with historical trends, including a much stronger growth in private than government consumption. It should also be noted that the scope for tax cuts before 2020 rests on these assumptions, as well as on the presumption of a high degree of fiscal discipline. If the room for temporary tax cuts is instead used to improve the standards in the services directed towards the elderly, the need for raising tax rates after 2020 will be exacerbated.

Do the proposed pension reforms have significant macroeconomic effects? Our estimates suggest an ambiguous answer. On one hand, *our estimated effects of the proposed pension reforms are very large compared to the effects of most other policy reforms*. In sharp contrast to the 10 percent expansion of the Norwegian economy generated by the MAS reform, CGE studies of tax- and trade policy reforms typically estimate welfare gains less than the gains obtained over one year with normal productivity growth.

On the other hand, *pension reforms are not likely to matter very much for the average individual consumption level three decades or more ahead*, cf. Figure 4.4. Our projections confirm Paul Krugman's statement: "Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker." (Krugman, 1990, p. 9). Compared to several decades of exponential growth, most partial policy reforms will turn out to be rather insignificant, as long as they do not affect the growth rate. This is particularly true for a pension reform, which needs long time to unfold its long run effects

Both reforms have a great positive effect on fiscal sustainability, which makes it possible to avoid a dramatic increase in the future tax burden. The effect is strongest in the FBS reform, which privatises the responsibility for supplementary benefits. In 2050 the payroll tax rate can be reduced from 25 percent in the reference scenario assuming continuation of the present pension system, to 6.3 percent in the FBS alternative and 10.9 percent in the MAS alternative. These effects are not stationary; the payroll tax rate follows an increasing trend in both reform scenarios after 2020. However, the necessary growth in the payroll tax rate after 2020 is foremost driven by growth in government consumption of services directed to the elderly. One may question if a pension reform should pay for the growth in these services.

Basically, the scope for tax cuts created by the reforms is not driven by reductions of the average public pension benefits. Instead most of the tax cuts can be attributed to the growth in tax bases generated by the positive effects on labour supply incentives. The MAS reform implies the strongest labour supply stimulus; in 2050 employment is 10.6 percent higher than in the reference scenario. The corresponding increase generated by the FBS reform is 4.8 percent. When calculating the fiscal effects of the reforms it is important that our model framework takes into account that most tax bases are endogenous and highly correlated with employment.

The effective marginal tax rate on labour income is lower in the MAS than in the FBS, despite higher formal tax rates in the MAS than in the FBS. This reflects that a greater share of the total average benefit is actuarially adjusted to early retirement and increased life expectancy in the MAS compared to the FBS. Moreover, due to a higher perceived correlation between labour market earnings and public pension benefits in the MAS than in the FBS and the present system, a substantial share of the formal tax on labour income is regarded as mandatory savings rather than a distortionary tax in the MAS. The difference between the effective marginal tax rates on labour income is the main reason why the increase in employment is stronger in the MAS than in the FBS.

Large effective tax rate on the consumers' return to work implies that the reallocation of time from leisure to market work improves the social efficiency. The most important elements of the effective marginal tax rate on labour income include an average marginal tax on personal labour income of approximately 40 percent, a payroll tax rate averaging 13 percent, and net indirect taxation of consumption, including VAT, averaging 19 percent. The tax wedge made up by these tax rates makes the ratio between the social and the private marginal rate of transformation of leisure into consumption as large as 2.3.²⁵ The increase in the payroll from the present 13 percent to 25 percent in 2050 in the reference scenario exacerbates the distortion of time allocation. To the extent that employment increases as a result of delayed retirement the efficiency gain will be even larger because leisure through early retirement is heavily subsidised under the present pension system.

Transformation of increased labour supply and individual savings into higher employment and more assets involve equilibrium adjustments of the real wage rate and industry structure that may be hard to realise. In particular, as explained in Section 5.3, a higher degree of pre-funding of future pension expenditures must mainly take place through net financial investments in foreign assets. Accumulation of foreign assets cannot take place unless real resources are reallocated from consumption to net exports. However, the traded goods sector, e.g. manufacturing industries, will not be willing to employ more labour unless the real wage cost is sufficiently reduced. Thus, *cet. par* pre-funding warrants slower real wage growth. One aspect of the diagnosis "Dutch Disease" is that re-industrialisation may be much harder to carry through than the process involving real exchange rate appreciation and de-industrialisation. Like many other open economies, Norway has experiences which makes it questionable to what extent the actual wage formation follows the norm defined by the textbook equilibrium model of a small open economy. The temporary large revenues from the petroleum sector have probably increased the problems of bringing the wage growth in accordance with what is

²⁵ See Fæhn and Holmøy (2000) for a derivation of this estimate.

sustainable in a long run perspective.²⁶ More pre-funding exacerbates problems caused by rigidities in the wage setting.

The welfare state is already under pressure, and ageing will further erode its financial basis. In Norway the large cash flows from rapid transformation of petroleum wealth to financial assets makes the problems of fiscal sustainability less transparent than in other OECD economies. This makes long run macroeconomic projections even more relevant in Norway than in other countries. In particular these projections should quantify the consequences of different changes in the government provision of subsidised welfare services and income replacement schemes. Analyses similar to those undertaken by the Danish Welfare Commission (Velfærdskommissionen, 2004) seem highly relevant also in the Norwegian context and are high on our agenda for future research.

Such projections should be based on models that cannot be blamed for ignoring available relevant information. This apparently obvious ambition has a more controversial and perhaps non-fashionable implication: accuracy, gained by including a disaggregated classification of e.g. tax bases, exact descriptions of the tax- and pension systems, detailed modelling of population heterogeneity and market structures affecting the real time dynamics of policy reforms, should be given priority over analytical tractability and transparency. Although the model work underlying this paper has gone quite a long way in order to account for details of potential relevance, there is obvious scope for improvements. Specifically, consistency can be improved by merging the most important aspects of individual life courses and the general equilibrium mechanisms into a CGE-model with overlapping generations and income heterogeneity within each cohort. Moreover, since labour supply at both the intensive and the extensive margins, as well as savings behaviour are crucial for the results, future modelling work should probably give priority to capture the heterogeneity of this behaviour found in micro econometric studies.

²⁶ Holmøy and Heide (2005) analyses the scope for sustainable real wage growth in the Norwegian economy.

References

- Aaberge, R., J. Dagsvik and S. Strøm (1995): Labour supply effects of tax reforms, *Scandinavian Journal of Economics* **97**, 635-659.
- Aaberge, R., U. Colombino and S. Strøm (2000): Labour Supply Responses and Welfare Effects from Replacing Current Tax Rules by a Flat Tax: Empirical Evidence from Italy, Norway and Sweden, *Journal of Population Economics* **13**, 595-621.
- Aaberge, R., U. Colombino, E. Holmøy, B. Strøm and T. Wennemo (2004): Population ageing and fiscal sustainability: An integrated micro-macro analysis of required tax changes, Discussion paper 367, Statistics Norway.
- Andersen, T.M., S.E.H. Jensen and L.H. Pedersen (2004): The welfare state and strategies towards fiscal sustainability in Denmark, Mimeo.
- Antolin, P. and W. Suyker (2001): How should Norway respond to ageing?, Working Paper 296 in *OECD Economics Department Series*, OECD.
- Beetsma, R., L. Bettendorf and P. Broer (2003): The Budgeting and Economic Consequences of Ageing in the Netherlands, *Economic Modelling* **20**, 987-1013.
- Bloom, D., D. Canning and M. Moore (2004): Health, Longevity and Optimal Retirement, mimeo, August 2004, Harvard School of Public Health, Boston, MA.
- Bovenberg, L. and T. Knaap (2005): Ageing, funded pensions and the Dutch economy, CESIFO Working Paper 1403.
- Brinch, C., E. Hernæs and S. Strøm (2001): Labour supply effects of an early retirement program, Memorandum 33/2001, Department of Economics, University of Oslo.
- Carman, K.G., J. Gokhale and L.J. Kotlikoff (2003): The impact on consumption and saving of current and future fiscal policies, Mimeo, September 2003.

Chan, S. and A.H. Stevens (2003): Do changes in pension incentives affect retirement? A longitudinal study of subjective retirement expectations, *Journal of Public Economics* **88**, 1307-1333.

Chauveau, T. and R. Loufir (1995): The future of public pensions in the seven major economies, OFCE Working paper, Research Department-OFCE, Paris.

Coile, C. and J. Gruber (2003): Fiscal effects of social security reforms in the United States, Working Paper 2003-05, Center for Retirement Research at the Boston College, downloadable at <http://www.bc.edu/crr>.

The Danish Welfare Commission (2004): *Analyserapport - Fremtidens velfærd kommer ikke af sig selv*, downloadable at www.velfaerd.dk. (In Danish).

European Commission (2001): Budgetary challenges posed by ageing populations: The impact on public spending on pensions, health care for the elderly and possible indicators of the long-term sustainability of public finances. Report of the working group on ageing populations to the Economic Policy Committee.

Fehr, H. (1999): *Welfare effects of dynamic tax reforms*, Mohr Siebeck.

Fehr, H., W.I. Sterkeby and Ø. Thøgersen (2003): Social security reforms and early retirement, *Journal of Population Economics* **16**, 345-361.

Feldstein, M. (2005): Structural reform of social security, NBER Working Paper 11098.

Feldstein, M. and A. Samwick (2002): "Potential paths of social security reform", in J. Poterba (ed.): *Tax Policy and Economy 2001*, Volume 16, Cambridge, MA: MIT Press, 181-224.

Fredriksen, D. (1998): *Projections of Population, Education, Labour Supply and Public pension benefits. Analyses with the Dynamic Simulation Model MOSART*, Social and Economic Studies 101, Statistics Norway.

Fredriksen, D., K.M. Heide, E. Holmøy and I.F. Solli (2005): Makroøkonomiske virkninger av pensjonsreformer, *Reports 2005/2*, Statistics Norway. (In Norwegian).

Fæhn, T. and E. Holmøy (2000): Welfare Effects of Trade Liberalisation in Distorted Economies: A Dynamic General Equilibrium Assessment for Norway. In G.W. Harrison, S.E.H. Jensen and L.H. Pedersen (eds.): "Using Dynamic General Equilibrium Models for Policy Analysis", Amsterdam: North-Holland, 171-202.

Gruber, J. and D. Wise (eds.) (2004): *Social security and retirement around the world. Micro-estimation*, Chicago: University of Chicago Press.

Heckman, J. (1993): What has been learned about labour supply in the past twenty years?, *American Economic Review* **83**, 116-121.

Heide, K.M., E. Holmøy, L. Lerskau and I.F. Solli (2004): Macroeconomic Properties of the Norwegian Applied General Equilibrium Model MSG6, *Reports* 2004/18, Statistics Norway.

Hernæs, E., K. Røed og S. Strøm (2002): *Yrkesdeltakelse, pensjoneringsadferd og økonomiske insentiver*, Reports 4/2002, Ragnar Frisch Center of Economic Research, Oslo. (In Norwegian).

Holmøy, E. (2002): Hva koster tidligpensjonering for samfunnet? *Økonomiske analyser* 2/2002, Statistics Norway. (In Norwegian).

Holmøy, E. and K.M. Heide (2005): Is Norway immune to Dutch Disease? CGE estimates of sustainable wage growth and de-industrialisation, Discussion paper 413, Statistics Norway.

Holtmark, B. (2002): Hva får AFP-pensjonister igjen for å arbeide? *Økonomiske analyser* 2/2002, Statistics Norway.

Jensen, S.E.H., U. Nødgaard and L.H. Pedersen (2001): Fiscal sustainability and generational burden sharing in Denmark, *Nordic Journal of Political Economy* **28** (1), 43-60.

Klette, T. J. (1999): Market power, scale economies and productivity: Estimates from a panel of establishment data: *The Journal of Industrial Economics* **110**, 451-75.

Klette, T. J. and A. Raknerud (2005): Heterogeneity, productivity and selection: An empirical study of Norwegian manufacturing firms, Discussion paper 401, Statistics Norway.

Kotlikoff, L., K. Smetters and J. Walliser (2001): Finding a way out of America's demographic dilemma, *NBER Working Paper 8258*.

Kotlikoff, L., K. Smetters and J. Walliser (1999): Distributional effects in a general equilibrium analysis of social security, Mimeo.

Krugman, P. (1990): *The age of diminished expectations*, Cambridge, MA: The MIT press.

Lindbeck, A. and M. Persson (2003): The gains from pension reform, *Journal of Economic Literature* **XLI**, 74-112.

Mankiw, G. (2000): The savers-spenders theory of fiscal policy, *American Economic Review* **90**, 120-125.

McMorrow, K. and W. Roeger (2002): EU Pension reform - an overview of the debate and an empirical assessment of the main policy reform options, DG ECFIN Economic papers no. 162, European Commission.

Miles, D. (1999): Modelling the impact of demographic change upon the economy, *The Economic Journal* **109**, 1-36.

Ministry of Finance (2001): *Langtidsprogrammet 2002-2005*, St.meld. no. 30 (2000-2001), Oslo. (In Norwegian).

Ministry of Finance (2004a): *Nasjonalbudsjettet 2005*, St.meld. no. 1, Oslo. (In Norwegian).

Ministry of Finance (2004b): *Perspektivmeldingen 2004 - utfordringer og valgmuligheter for norsk økonomi*, St.meld. no. 8, Oslo. (In Norwegian).

Ministry of Finance (2004c): *Pensjonsreform - trygghet for pensjonene*, St.meld. no. 12, Oslo. (In Norwegian).

NOU 1998:10: *Fondering av folketrygden*. The Ministry of Finance and The Ministry of Social Affairs, Oslo. (In Norwegian).

NOU 1998:19: *Fleksibel pensjonering*. The Ministry of Finance and The Ministry of Social Affairs, Oslo. (In Norwegian).

NOU 2004:1: *Modernisert folketrygd. Bærekraftig pensjon for framtida*. The Ministry of Finance and The Ministry of Social Affairs, Oslo. (In Norwegian).

OECD (1998): *Maintaining Prosperity in an Ageing Society*, Paris.

OECD (2000): *Reforms for an Ageing Society: Social Issues*, Paris.

OECD (2001): Fiscal implications of ageing: Projections of age-related spending, *OECD Economic Outlook* **69**, ch. IV, Paris.

Samwick, A.A. (1998): New evidence on pensions, social security, and the timing of retirement, *Journal of Public Economics* **70** (2), 207-236.

Statistics Norway (2002): *Befolkningsframskrivninger. Nasjonale og regionale tall, 2002 - 2050*, downloadable at www.ssb.no/emner/02/03/folkfram/. (In Norwegian).

Thøgersen, Ø. (2001): Reforming social security: Assessing the effects of alternative funding strategies, *Applied Economics* **33**, 1531-1540.

Visco, I. (2002): "Ageing populations: Economic issues and policy challenges", in H. Siebert (ed.): *Economic Policy for Ageing Societies*, Berlin: Springer-Verlag, 9-47.

Exogenous assumptions in the projections and background facts

Table A1.1. Demographic assumptions in the reference scenario

Net immigration	13 000 persons per year
Life expectancy at birth	Increases gradually. 7-8 years higher in 2050 than in 2005
Fertility rate	1.8
Education	Educational transition rates as in 2001
Disability	Transition from work to disability as in 2001
Early retirement	Transition rates as in 2001
Official retirement age	67 years
Labour participation	As in 2001
Wage distribution	As the average over the years 1967-1993

Table A1.2. Historical and projected development in the number of pensioners and the labour force in the reference scenario. Thousand persons

	1962	1970	1980	1991	2000	2002	2010	2020	2030	2040	2050	2060
Old age pensioners	234	335	520	616	629	623	679	873	1074	1259	1317	1419
Disability pensioners	68	130	160	239	280	295	365	388	396	379	407	419
Widow pensioners		58	57	77	68	51	22	17	14	11	10	8
Total number of pensioners	302	523	737	932	977	969	1066	1278	1484	1649	1734	1846
Labour Force	1570	1653	1940	2126	2350	2378	2477	2564	2587	2612	2669	2686
Pensioners in percent of the												
Labour Force	19	32	38	44	42	41	43	50	57	63	65	69

Source: Own computations and Ministry of Finance (2001).

Table A1.3. Projections of important exogenous variables in the scenarios. Average annual growth rates. Percent

	2002-2010	2011-2020	2031-2060
Total factor productivity (TFP), private sector	1.30	1.30	1.30
Labour productivity in government sectors	0.50	0.50	0.50
Employment, man-hours	0.39	0.20	-0.05
World prices	1.50	1.50	1.50
Crude oil price	-4.30	1.75	1.75
Natural gas price	-1.22	1.45	1.75
International nominal interest rate	5.50	5.50	5.50

Table A1.4. Old-age dependency ratios in the EU and Norway

	2000	2050		2000	2050
Belgium	0.28	0.50	Luxemburg	0.23	0.42
Denmark	0.24	0.42	Netherlands*	0.22	0.40
Germany	0.26	0.53	Austria	0.25	0.55
Greece	0.28	0.59	Portugal	0.25	0.49
Spain	0.27	0.66	Finland	0.24	0.48
France	0.27	0.51	Sweden	0.30	0.46
Ireland	0.19	0.44	UK	0.26	0.46
Italy	0.29	0.67	Norway**	0.22	0.37

Source: Eurostat, (*) Netherlands Central Bureau of Statistics, (**) Statistics Norway.

The determination of the equilibrium wage cost in MSG6

MSG6 captures important interaction effects between government net revenues, the wage rate, the endogenous payroll tax rate and the accumulation of foreign assets. The purpose of this appendix is to explain the main mechanisms of the wage rate determination in MSG6. These mechanisms are more complex than in the textbook model of a Small Open Economy (SOE), since MSG6 has incorporated econometric evidence of decreasing returns to scale at the firm and the industry level. We also explain how the equilibrium wage cost adjusts to exogenous shifts in labour supply and savings caused by the pension reforms.

In principle, the version of MSG6 used in this paper can be reduced to a system of two equilibrium conditions, which determines the wage cost per man-hour and the utility level of the representative consumer. These conditions are depicted by the two curves LL and BB drawn in the wage-utility diagram in Figure A.1. The LL- and BB-loci describe the wage and utility combinations that are consistent with, respectively, labour market equilibrium and the budget constraint for the total economy implied by the external balance requirement. The point where the two loci intersect represents the general equilibrium. The subscripts “0” and “1” denote, respectively, the pre- and post-reform situations.

The *LL-locus* is upward sloping because an increase in the utility level, *cet. par*, causes households to decrease labour supply and increase consumption of goods. Both effects contribute to excess demand for labour. For a fixed payroll tax rate, increasing the wage rate restores labour market equilibrium through the following mechanisms:

- 1) At given output levels a partial increase in the wage rate causes firms to choose a less labour intensive factor composition.
- 2) Changes in the industry structure reinforce the fall in labour demand. The higher wage rate shifts the unit cost functions upwards, especially in the most labour intensive industries. For import competing, as well as exporting Norwegian producers, the international competitiveness deteriorates, causing a negative scale effect on labour demand. In addition, households will face an increase in the relative price of domestic goods produced by the most labour intensive technologies, and substitute less labour intensive ones for these. In the standard SOE model the assumptions of constant returns to scale in each sector and perfect intersectoral mobility of factors make the aggregate factor demands infinitely elastic with

respect to factor prices. Excess labour demand would be eliminated by a reallocation of factors from the most labour intensive sector into the other sectors, without any adjustments in the factor prices. In MSG6 decreasing returns to scale makes it possible for firms and sectors to adjust output to keep the producer value of marginal factor productivities equal to changing factor prices.

- 3) The real consumer wage rate rises, and households substitutes consumption for leisure along the fixed indifference curve. This substitution implies a simultaneous rise in both labour supply and induced labour demand, having opposite effects on excess demand for labour. Due to taxation of labour income and consumption, as well as import leakage, the former will unambiguously dominate.

This relationship is complicated by the endogenous adjustment of the payroll tax rate keeping the government budget surplus fixed. An increase in consumption raises the revenue from indirect taxation. However, the reduction of revenue from taxation of labour is greater, so the payroll tax rate must increase. For a given consumer wage rate, the increase in the payroll tax rate reduces labour demand through the same mechanisms as those operating in the case of a rise in the wage rate. Thus, the government budget constraint implies a negative modification of the increase in the wage rate that restores labour market equilibrium.

The *BB-locus* is downward sloping because a partial increase in the utility level implies that households increase their consumption of imported goods. In addition, the increase in the payroll tax rate raises wage costs, which deteriorates the international competitiveness. A fall in the wage rate restores the equilibrium surplus through export expansion, substitution of domestic deliveries for imports, and substitution of leisure for consumption.

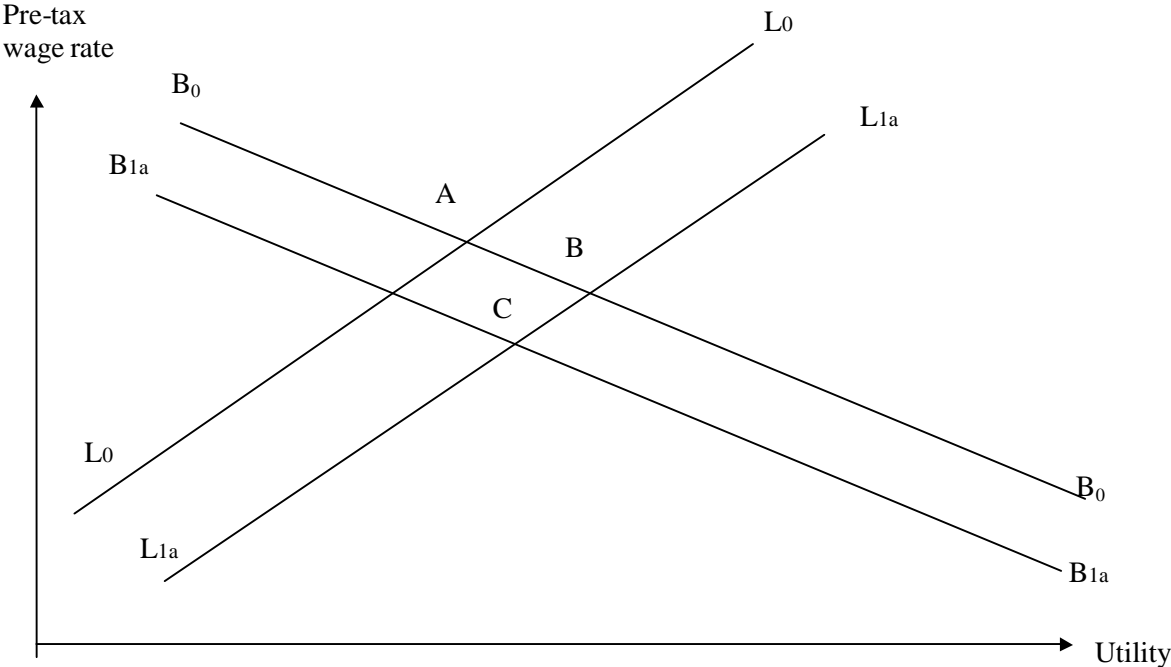
Equilibrium adjustments to exogenous shifts in labour supply

Postponed retirement and a stronger correlation between labour market earnings and public pension benefits represent positive shifts in labour supply schedule. They shift the LL-locus outwards from L_0L_0 to L_1L_1 in Figure A2.1. Restoring labour market equilibrium requires a fall in the wage cost and higher demand for consumption and leisure following from higher utility. The equilibrium moves from A to B.

Equilibrium adjustments to exogenous shifts in savings

An exogenous positive shift in private savings must raise national savings by the same amount when government savings is fixed. Assuming the increase in savings to exceed the endogenous change in fixed capital investments, national financial investments must increase. In equilibrium, the increase in national financial investments must be brought about by increased in current account surplus, which in turn warrants higher net exports. The wage cost must fall to make the necessary increase in net exports profitable for firms characterised by decreasing returns to scale. Thus, in a year characterised by higher savings and higher net exports, the BB-locus shifts downwards from B_0B_0 to B_1B_1 in Figure A2.1. The equilibrium moves from A to C.

Figure A2.1. Determination of utility of the representative consumer and the wage cost in MSG6



Effective taxation implied by the MAS and the FBS

The purpose of this appendix is to use a somewhat stylised numerical example to shed light on how replacing the present public pension system by the More Actuarial System (MAS) or the Flat benefit System (FBS) affect the effective taxation of labour income. For simplicity we consider a stationary population and ignore interest and wage growth. We start by assuming that individuals of the same age are identical. The individual lives as a retiree for 20 years. His lifetime earnings is equal to 220G, where G is the accounting unit used in the Norwegian National Insurance system. By the end of 2004 one G was 58 778 NOK, and the minimum pension received by a single retiree was 1.8G in 2005.

In the FBS the flat benefit is equal to the minimum benefit in the present system, i.e. 1.8G. In order to finance his own flat benefit by a flat tax rate, the person must pay $1.8 \cdot 20 / 220 = 16.3$ percent of his average annual earnings. This is a purely distortionary tax rate. Since all individuals are identical this tax rate finances the government expenditures related to the flat benefit.

In the MAS only a fraction of the public pension benefits will be financed by taxes. Instead, rational individuals will consider most of the contributions as mandatory savings. We shall assume that the benefits that unambiguously must be financed by (distortionary) taxes averages 0.1G per year per retiree. The flat tax rate necessary to finance this amount equals $(0.1G/\text{year}) \cdot (20 \text{ years}) / (220G) = 0.9$ percent. In addition, the individuals must pay contributions. According to the MAS rules the contribution rate becomes $(1.25 \text{ percent/year}) \cdot (20 \text{ years}) = 25$ percent. To what extent this contribution rate is regarded as a tax or mandatory savings depends on the lifetime earnings. We must now distinguish between four categories of individuals:

1. Retirees receiving the minimum benefit. The lifetime earnings of these is less than 80G. About 5 percent of the population belongs to this category. Marginal changes in their labour market earnings will not change their benefit from the minimum level. Thus, they will regard all contributions as taxation. Therefore, their marginal tax rate related to financing the public pension benefits will be 0.9 percent + 25.0 percent = 25.9 percent.
2. Individuals with lifetime earnings in the interval 80G - 187G. About 15 percent of the population belongs to this category. Their marginal tax rate related to financing the public pension benefits will be 0.9 percent + 25.0 percent $\cdot 0.6 = 17.1$ percent.

3. Individuals with lifetime earnings higher than 187G but annual income lower than 8G. About 70 percent of the population belongs to this category. Their marginal tax rate related to financing the public pension benefits will be only 0.9 percent.
4. Individuals with lifetime earnings higher than 187G and annual income higher than 8G. About 10 percent of the population belongs to this category. These individuals will not receive higher benefits by working more in the MAS. It is not decided whether these individuals shall pay 25 percent as a surtax, or if they will pay no contributions out of annual income exceeding 8G. Their marginal tax rate related to financing the public pension benefits will be 25.9 percent in the first case, and 0.9 percent in the latter case.

If individuals in category 4 pay no contributions out of annual income exceeding 8G, the population weighted average of the marginal tax rates associated with financing the MAS benefits equals $0.05 \cdot 25.9 \text{ percent} + 0.15 \cdot 17.1 \text{ percent} + 0.70 \cdot 0.9 \text{ percent} + 0.10 \cdot 0.9 \text{ percent} = 4.6 \text{ percent}$. If the marginal tax rate paid by category 4 is 25 percent, the average marginal tax rate becomes $0.05 \cdot 25.9 \text{ percent} + 0.15 \cdot 17.1 \text{ percent} + 0.70 \cdot 0.9 \text{ percent} + 0.10 \cdot 25.9 \text{ percent} = 7.1 \text{ percent}$.

In both cases the average marginal tax rate associated with financing the public pension benefits is much lower than the 16.3 percent characterising the FBS. In this stylised example individuals in category 3 regard all mandatory contributions as equivalent to voluntary savings. It is unlikely that all individuals in this large category share such a perception. In the model calculations we have therefore increased the effective tax rates for category 2 and 3 somewhat compared to this example.

Sensitivity analysis of the MAS effects

We have checked the sensitivity of the effects of replacing the present public pension system by the More Actuarial System (MAS) with respect to

- the impact on the effective marginal wage rate,
- the impact on the retirement decision,
- the mortality assumptions, i.e. longevity.

The impact on the effective marginal wage rate

In the main MAS scenario the average effective marginal wage rate was assumed to increase by 8 percent due to higher correlation between earnings and benefits. In an alternative scenario we have assumed that the corresponding wage effect is 10 percent. The stronger labour supply stimulus causes employment to increase from 10.6 to 11.6 percent relative to the reference scenario in 2050.

Table A4.1. Sensitivity of the MAS reform effects to the impact on the effective marginal wage rate. Deviations from the reference scenario in 2050. Percent*

	8 percent	10 percent
Employment	10.6	11.6
Private consumption	9.9	10.8
GDP	9.7	10.6
*Payroll tax rate, percentage points	-13.9	-14.7
Consumer real wage rate	5.7	6.0

The retirement decision

We have calculated the effects of the MAS reform assuming no change in the retirement age compared to the reference scenario. On the other hand, in the main MAS alternative the reform caused the retirement age to increase gradually over time from the reference path. In 2050 retirement was delayed by 2.6 years.

The actuarial mechanism in the MAS, represented by the life expectancy adjustment ratio, now causes a cut in the average annual benefit also for those working until retirement. On the other hand the number of retirees does not fall compared to the reference scenario. On balance, the reduction in government pension expenditures is approximately insensitive to variations in the retirement age, illustrating the actuarial characteristics of the MAS. The labour supply effect is, however, much weaker under the alternative assumption, since there is no contribution from delayed retirement.

Employment increases by 5.7 percent compared to the reference scenario in 2050, nearly 5 percentage points less than in the main MAS alternative. Accordingly, the expansion of the tax bases is also smaller than in the main alternative, leaving a smaller room for tax cuts. The deviation between the main MAS alternative and the alternative where there is no effect on retirement, increases over time.

Table A4.2. Sensitivity of the MAS reform effects to delayed retirement. Deviations from the reference scenario in 2050. Percent*

	2.6 years delay	No delay
Employment	10.6	5.7
Private consumption	9.9	5.5
GDP	9.7	5.3
*Payroll tax rate, percentage points	-13.9	-11.4
Consumer real wage rate	5.7	6.1

Longevity

Since the MAS is much more actuarial than the present public pension system, we expect the assumptions on mortality to be crucial for the reform effects. We have re-calculated the MAS reform effects when the “Middle alternative” in the population forecast (Statistics Norway, 2002) is replaced by the so-called “High alternative”. Compared to the Middle alternative, the latter assumes higher fertility rates and net immigration, and reduced mortality. The average life expectancy for females increases from 88.1 to 90.0 years in 2050. The corresponding increase for males is from 84.2 to 86.7 years.

As expected, the effects of the MAS are reinforced when retirees live longer. Based on our assumptions in Section 4, the increase in life expectancy will raise the average retirement age in 2050 by nearly 3.6 years, one additional year compared to the corresponding effect in the main MAS scenario. Including the general equilibrium effects, the corresponding magnification of the employment effect in 2050 is 2.1 percentage points.

Table A4.3. Sensitivity of the MAS reform effects to the assumptions on average longevity. Deviations from the reference scenario in 2050. Percent*

	Middle alternative	High alternative
Employment	10.6	12.7
Private consumption	9.9	11.6
GDP	9.7	11.5
*Payroll tax rate, percentage points	-13.9	-14.9
Consumer real wage rate	5.7	7.2