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A welfare state funded by nature and OPEC
A guided tour on Norway's path from an exceptionally impressive to an exceptionally strained fiscal position

Abstract:
Large petroleum revenues make Norway an enviable fiscal loner. The fiscal policy rule adopted from 2001 transforms petroleum wealth into foreign assets, and only the real return on the financial fund should be spent annually. Despite this ambitious saving of the petroleum wealth, we find it unlikely that present tax rates and welfare schemes are sustainable in a long run perspective. Rather, the results from combining detailed models of demography and government expenditures with a detailed CGE model, suggest that Norway is exceptional also with respect to strong growth in government expenditures. In our baseline scenario the payroll tax rate must be increased continuously when ageing sets in after 2020, passing twice the present level about 2045. This is required even if the pension fund reaches 1.4 times GDP, commanding an unprecedented degree of fiscal discipline.

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1. Introduction

Most industrial countries face fiscal sustainability challenges due to substantial increases in their demographic old-age dependency ratios after 2010. Contingent on present tax rates and welfare schemes, government expenditures are projected to grow faster than the tax base, which necessitates increases in the tax rates or cost saving reforms of the welfare schemes.[1] The fiscal sustainability problem is likely to be particularly severe in the Scandinavian welfare states where the government provides relatively generous and highly non-actuarial pensions and most of the health and care services.[2] The wave of pension reforms indicates that policy adjusts to the prospects communicated through long run economic projections.

Contingent on the expenditure path, governments may follow a continium of mixes of two polar strategies in order to meet their intertemporal budget constraint: 1) pay-as-you-go (PAYG) adjustments of one or several tax rates (or other fiscal policy instruments), or 2) pre-funding combined with tax-smoothing. Taking the tax-smoothing strategy to its extreme implies an initial once-and-for-all change in welfare benefits or tax rates to bring the fiscal policy on a sustainable track, defined as a set of tax and subsidy rates, rules defining social security benefits, and levels of government real consumption that can be maintained forever. The main weakness of the PAYG system is the well known Barro-argument: Since the social cost of public funds is convex in the tax rates, the social cost of financing a given time path of government expenditures is higher the stronger are the variations in the tax rate. Specifically, the PAYG system is vulnerable to population ageing. In open economies PAYG financing does not exploit international capital markets to redistribute consumption possibilities over time. Moreover, by linking current expenditures to current revenues, the PAYG system does not exploit all beneficial possibilities for risk diversification across generations. Third, PAYG-financing of generous welfare schemes may eventually imply tax burdens that are not accepted by the public. The political turbulence in the wake of an uncontrolled breakdown of the welfare state

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[1] See Chauveau and Loufir (1995), OECD (1998, 2000, 2001), the European Commission (2001), McMorrow and Roeger (2002) and Visco (2002) for international comparisons of quantitative assessments of the fiscal and macroeconomic consequences of ageing. Kotlikoff, Smetters and Walliser (2001), Kotlikoff (2001) and Feldstein (2005) estimate the fiscal gap in the US. Beetsma, Bettendorf and Broer (2003) and The Danish Welfare Commission (2004) estimate the need for raising the tax burden in the Netherlands and Denmark, respectively. Andersen, Jensen and Pedersen (2004) provide a review in English of The Danish Welfare Commission (2004).

[2] The generosity of the Scandinavian welfare states is reflected in relatively higher tax rates. According to Eurostat (2006) total tax revenue in 2004 averaged 40.7 percent of GDP in EU25 and 51.2 and 49.9 percent, respectively, in Sweden and Denmark. The corresponding ratio in Norway was 44.5 percent, see Statistics Norway (2006a). These average tax rates measure gross taxes, which include the tax revenue that is reimbursed to the taxpayers as cash transfers. Net taxes amounted to 27.0 percent of GDP in Norway in 2002.

may stimulate rent seeking and cause unpredictable and ill-advised changes in business conditions and welfare arrangements.

The main obstacle against a higher degree of pre-funding is the effect on intergenerational distribution when the PAYG system implies an increasing trend in the tax rates. *Cet. par* front-loading of the fiscal adjustment redistributes income from current generation to the future ones, which are likely to be better off even without such redistribution, due to normal economic growth. There are also other weaknesses of the pre-funding strategy. By being forward looking, its informational requirements are higher. Specifically, if the relevant growth adjusted interest rates are small the estimated permanent tax rate will be highly non-robust to new information about future revenues and expenditures. Thus, the strategy has to be complemented by a procedure for how frequent the government should undertake once-and-for-all revisions of tax rates. As pointed out by Andersen, Jensen and Pedersen (2004), frequent revisions of the chosen fiscal policy instrument run counter to the basic fundamental idea of tax smoothing. One may also question the credibility of the pre-funding strategy; will the fiscal discipline be sufficiently strong to maintain a tight fiscal policy when the government fund grows large?

Very few countries have the opportunity of experimenting with a high degree of pre-funding. The fiscal situation in most OECD countries is strained already today, not only in the remote part of long run projections. Norway stands out as a peculiar exception from this generally gloomy picture. The assets accumulated in the Central Government Pension Fund - Global[3] (CPF) increases rapidly, passing 70 percent of GDP by the end of 2005. The impressive fiscal stance reflects large government petroleum revenues, as well as fiscal discipline. The petroleum wealth provides the government with a unique opportunity to pre-fund a great share of the future increase in government expenditures without the political cost associated with heavy taxation of current generations. More generally, Norway may serve as another natural experiment of how a well-developed country manages the large petroleum wealth in order to avoid the resource curse discussed in the Dutch Disease literature.

The intertemporal consumption of the petroleum wealth has been discussed in Norway ever since the early 1970s. A new fiscal policy rule was adopted in 2001, recognizing that the petroleum revenues reflects a temporary transformation of wealth from natural resources to more liquid assets, rather than ordinary contributions to GDP. The government petroleum revenues are invested in the CPF, and only the expected real return of the fund should be used to finance non-petroleum government budget

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[3] This fund was named "The Central government petroleum fund" until 2006.

deficits. The rule is supposed to be an operational compromise balancing concerns for intergenerational distribution of the petroleum wealth, high uncertainty about the value of the petroleum resources, and a gradual phasing in of the "oil-money" in order to avoid Dutch Disease problems associated with excessive de-industrialisation.

The purpose of this paper is to examine the fiscal sustainability implied by the fiscal policy rule. The combination of current large but temporary petroleum revenues and a generous welfare state vulnerable to ageing, make the potential contrast between the fiscal stance today and some decades ahead particularly sharp in Norway. This makes it particularly important to undertake careful long run projections of government revenues and expenditures, as we do in this paper.[4] More precisely, we address the following questions:

1. To what extent does the fiscal policy represent a compromise between PAYG financing and pre-funding? More precisely, what tax rate adjustments and degree of pre-funding follows from the rule?

2. How robust are the fiscal sustainability assessments to alternative assumptions about important determinants of the tax bases, government consumption and government transfers? We examine the robustness of the tax bases by changing productivity growth, the international interest rate, the world prices of petroleum products and other tradables. The robustness of government consumption is studied by changing the determinants of the strongly age dependent spending on public health and social care, including productivity growth in this sector, service standards, the health of the elderly, and household production of care. Changes in government transfers are studied by simulating the effects of a proposed reform of the public pension system.

Methodologically our study is foremost characterised by the ambition of taking account of all available information about relevant determinants of the main government expenditures and revenues. To this end we combine a dynamic CGE model with special models of government expenditures that capture more relevant details compared to most studies of fiscal sustainability. Specifically, we use a detailed dynamic micro simulation model to calculate accurate estimates of individual pension benefits and government pension expenditures for given individual work histories. This model captures the relevant heterogeneity of the population over time and an exact description of the Norwegian social

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[4] Careful projections of the Norwegian economy in general and on the fiscal prospects in particular, have been carried out regularly by the Norwegian Ministry of Finance, see for example Ministry of Finance (2004). Our study deviates from these projections by including the budget effects of the tax rate adjustments required to meet the government budget constraint

security system. The projected use of labour within the government service sectors results from estimates of service standards (man-hours per client), age specific demand intensities and demographic development. These expenditure projections are input in a large dynamic CGE model determining tax bases at a rather disaggregated level, as well as the prices of government consumption.[5]

Another methodological contribution is related to the empirical importance of some of the general equilibrium effects. We find that the most important equilibrium effect can be attributed to wage rate adjustments necessary to meet an intertemporal constraint on foreign trade. An increase in the wage rate turns out to raise government expenditures significantly more than the tax bases. Fundamentally, wage rate adjustments reflect that we account for the econometric evidence of decreasing returns to scale in private industries. Compared to constant returns, decreasing returns complicates the CGE model since prices and quantities are simultaneously determined. This may be the reason why most CGE studies have neglected the wage effect by *a priori* assumption.

The paper is organised as follows: In Section 2 we describe briefly our model framework, key exogenous assumptions and the growth paths of the main macroeconomic aggregates along our baseline scenario. Section 3 assesses the fiscal sustainability problem in the baseline scenario, focusing on the necessary tax rate adjustments and the accumulation of government funds. Section 4 examines the robustness of these results with respect to important determinants of the tax bases, government spending on health and social care, and the government pension expenditures. Section 5 concludes.

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implied by the fiscal policy rule. Moreover, we explore in greater detail the importance of general equilibrium effects on the required tax rate adjustments.

[5] The use of models to project government expenditures and revenues makes our study qualitatively different from the study of the Norwegian fiscal prospects by Antolin and Suyker (2001).

2. Model framework and basic assumptions

2.1. Models

Transfers to households (including pensions) and consumption accounted for 84.6 percent of total government expenditures in 2005. We base our projections of both components, as well as the growth in the tax bases, on detailed projections of the Norwegian population, see Statistics Norway (2002).[6] The demographic development here enter a dynamic micro simulation model, MOSART, which simulates the life courses of a cross-section of the Norwegian population, including labour market participation and earnings. An accurate description of the pension rules and a rich description of relevant population heterogeneity make the model especially suitable for computing individual pension entitlements and government pension expenditures.[7]

We distinguish between 4 sectors of government consumption. The greatest expenditures are allocated to the provision of individual services within *Education* and *Health and Social Care*, each one of which is broken down into three service categories. We decompose costs in each service category into i) man-hours and other resources per user, ii) the price of the resources, iii) the number of users, or the demand intensity, within different age groups, and iv) the number of individuals in different age groups. Thus, we are able to distinguish expenditure changes driven by population ageing from changes in the standard of the services, which is linked to the resources per user and productivity changes.

The detailed calculations of government consumption and different government pension expenditures are used as inputs in a dynamic CGE model, MSG6, of the Norwegian economy.[8] Exogenous projections of real government consumption follow from the decomposition above. *Ex ante* indexation, the MSG6 projections of average pension benefits and the number of pensioners are consistent with the MOSART projections. All tax bases are endogenous in MSG6. As the model specifies 60 commodities, the calculation of the revenue from indirect taxation captures important details of the tax system. One might say that the main job of MSG6 in the present study is to capture

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[6] In general, the projections from 2005, see Statistics Norway (2005), do not deviate much from the projections made in 2002.

[7] Fredriksen (1998) provides a detailed documentation of MOSART and examples of applications. MOSART is regularly used by the government to compute government pension expenditures.

[8] Heide, Holmøy, Lerskau and Solli (2004) provide a detailed description of the model structure and its empirical characteristics.

the complex endogenous mechanisms that determine the tax bases as well as the wage rate and the prices of resources used for government consumption.

MSG6 assumes the Norwegian economy to be too small to affect world prices and the international interest rate. The exchange rate is fixed. All agents have access to international capital markets. The economy as a whole obeys an intertemporal budget constraint formalised as a non-Ponzi game condition for the accumulation of foreign debt.[9] Goods and factors are perfectly mobile between industries. Supply equals demand in all markets in all periods. In each period consumers decide on labour supply and the composition of private consumption according to standard consumer theory. The parameters are calibrated so that the uncompensated wage elasticity equals 0.1.[10] Most imported products are close but imperfect substitutes for the corresponding domestic products. Firms are run by managers with model consistent expectations, who maximise present after tax value of the net-of-tax cash flow to owners. They allocate output between the domestic and the foreign market. Norwegian firms face exogenous export prices, but engage in monopolistic competition in most domestic markets. It is costly to redirect output between these two markets. The production functions exhibit decreasing returns to scale.[11]

Although the wage rate determination is part of the simultaneous model structure, one may still say that the wage rate adjustment is the basic mechanism that ensures that the economy meets the intertemporal external balance constraint. In a long-term scenario nominal wage growth will be relatively close to the sum of the exogenous growth in world prices and the endogenous growth in labour productivity, as predicted by the Scandinavian Model of Inflation.[12] The deviation is due to decreasing returns to scale in the industries. Section 4 explains the fiscal implications of the wage rate determination.

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[9] This national budget constraint reflects that households and the government obey their intertemporal budget constraints. The corporate sector is assumed to distribute all after tax profits to the owners of the companies, which include the households, the government and foreigners.

[10] This choice is consistent with the results in Aaberge, Dagsvik and Strøm (1995).

[11] The scale elasticities range from 0.85 - 1.00. Evidence of decreasing returns to scale at the firm level is presented in Klette (1999).

[12] Holmøy and Heide (2005) analyse how the equilibrium wage growth determined by MSG6 deviates from the wage growth predicted by the Scandinavian Model of Inflation.

2.2. Macroeconomic development

The key exogenous assumptions underlying our baseline scenario are:

1. The ratio of those of working age 20-66 to those 67 and older decreases from 4.7 in 2005 to 2.5 in 2050.[13] Over this period the labour force grows by 10 percent.

2. Total Factor Productivity (TFP) grows by 1.3 percent per year in private industries, which is in line with historical trends. Labour productivity in government sectors grows by 0.5 percent per year.

3. The nominal interest rate stays constant at 5.5 percent. *World prices*, except prices of crude oil and natural gas, grow by 1.5 percent annually.

4. Petroleum revenues contributed to 41 percent of government revenues in 2005. We rely on the price and production forecasts in Ministry of Finance (2004). If, hypothetically, the present production were kept constant the profitable resources would be depleted after 34 years (from 2004). The real oil price is assumed to stay at 25 dollars per barrel, in line with the IEA forecast from 2004, but quite low compared to the prices observed in 2005-06 and recent forecasts. The price of natural gas follows the oil price.

The baseline scenario prolongs the present fiscal and welfare policy, including the present public pension system and other welfare schemes regulating government transfers to households, wage indexation of most of these transfers, present (2004) standards (man-hours per user) and age specific use of government services in the sectors *Health and Social Care* and *Education*, the 2004-levels of employment in the government sectors *Defence* and *Administration*, the 2004-proportions of capital and intermediaries to labour remain constant in government sectors, and all tax rates in real terms, except the payroll tax rate. Being a broad tax on labour income, we let the payroll tax rate adjust annually in order to meet the time path of the government budget constraint implied by the fiscal policy rule adopted in 2001.

The government budget constraint implied by the fiscal policy rule can be seen by decomposing the accumulation of government financial assets, *B*, from year *t-1* to *t*: $B_t - B_{t-1} = iB_{t-1} + P_t - D_t$, where *i* is the international nominal interest rate, *P* is the cash flow from the petroleum sector to the government, and *D* is the non-petroleum fiscal deficit. A strict interpretation of the fiscal policy rule is that the non-petroleum deficit should be equal to the real return on the financial assets, i.e. $(i - \pi)B_{t-1} = D_t$, where π is international inflation. *i-π* is the expected real rate of return, denominated

in international prices. So far $i-\pi$ has been set to 4 percent. If the fiscal policy rule is followed, the stock of financial assets grows according to $B_t - B_{t-1} = \pi B_{t-1} + P_t$. In a long run perspective P is basically a policy decision, given the profitable petroleum reserves. Contingent on P, the annual growth in B is determined purely by exogenous variables, which represents a constraint on the *annual* non-petroleum primary budget deficit. As P declines, the annual consumption of the petroleum wealth converges to the permanent income associated with this wealth after conversion to financial assets.

Table 2.1 summarizes the growth picture in our baseline scenario. Growth in GDP averages 1.7 percent over the period 2004-2050, mainly as a result of TFP growth and capital deepening. A more rapid growth in private consumption is feasible mainly because of slow growth in government consumption.

Table 2.1. **Macroeconomic development in the baseline scenario. Average annual growth rates. Percent**

|	2004-2025	2026-2050
GDP	2.0	1.6
Employment	0.3	0.1
Wage cost per hour relative to world prices	4.1	4.1
Consumer real wage rate	2.5	1.7
Net foreign wealth relative to GDP	6.0	0.2
Private consumption	3.0	2.1
Government consumption	0.7	1.1

3. Is the current fiscal policy sustainable?

Our baseline projection shows that rapid depletion of petroleum resources and significant positive interest income probably makes Norway one of the countries in which the long run fiscal prospects deviate most from the current stance and medium run prospects. Figure 3.1 shows that the fiscal policy rule allows the payroll tax rate to be lower than the present rate of 13 percent until 2030 in the baseline. (The non-baseline curves in Figure 3.1 refer to shifts explained in section 4.) This reflects more rapid growth in tax bases than expenditures until 2020, and that the spending "oil money"

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[13] An important driving force behind the expected ageing is the increased longevity: 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.

finances a larger share of government expenditures in these years than in subsequent decades. However, the most important and striking message revealed by Figure 3.1 is that an evaluation of the sustainability of the current policy would be highly misleading if the time perspective were confined to the first couple of decades. Given the baseline assumptions, the fiscal policy rule is highly inconsistent with fiscal sustainability; the payroll tax rate must be raised in every year after 2020, passing 31 percent in 2050. And that is not the end. Population forecasts conclude that the demographic dependency ratio will continue to increase throughout the century at roughly the same pace as in the period 2020-2050. Also note that the present effective tax on marginal labour income in Norway is already among the highest in the OECD area.[14]

Figure 3.1. Projected payroll tax rate, given the fiscal policy rule. Percent
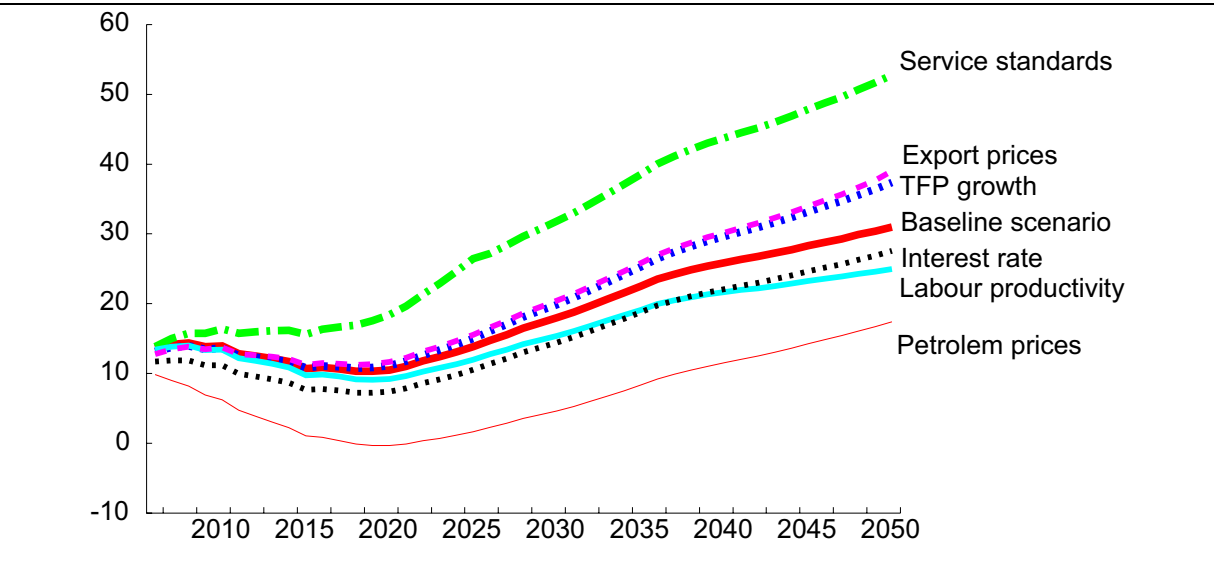
TFP growth: TFP in private industries grow by 1.6 instead of 1.3 percent per year.
Petroleum prices: World prices of oil and gas are increased by 100 percent in all years compared to the baseline.
Export prices: World prices of all exports but oil and gas grow by 2.0 rather than 1.5 percent per year.
Interest rate: World interest rate increased permanently from 5.5 to 6.5 percent.
Service standards: Prolongation until 2025 of the average growth in man-hours per user observed in the 1990s in the government sector Health and social care.
Labour productivity: Annual labour productivity growth in the government sector Health and social care raised from 0.5 to 1.0 percent in all years.
Health: Age specific demand for health and social care services reduced from the constant baseline levels in line with increased longevity.
Household production: Household production of social care services reduced from the baseline to the 2005-level in all years.

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[14] In addition to the payroll tax, its most important elements include 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 about 20 percent, see also Footnote 2. In addition, the pension system, especially the early retirement scheme, magnifies the labour supply distortions at the extensive margin.

Figure 3.2. Government financial wealth relative to GDP
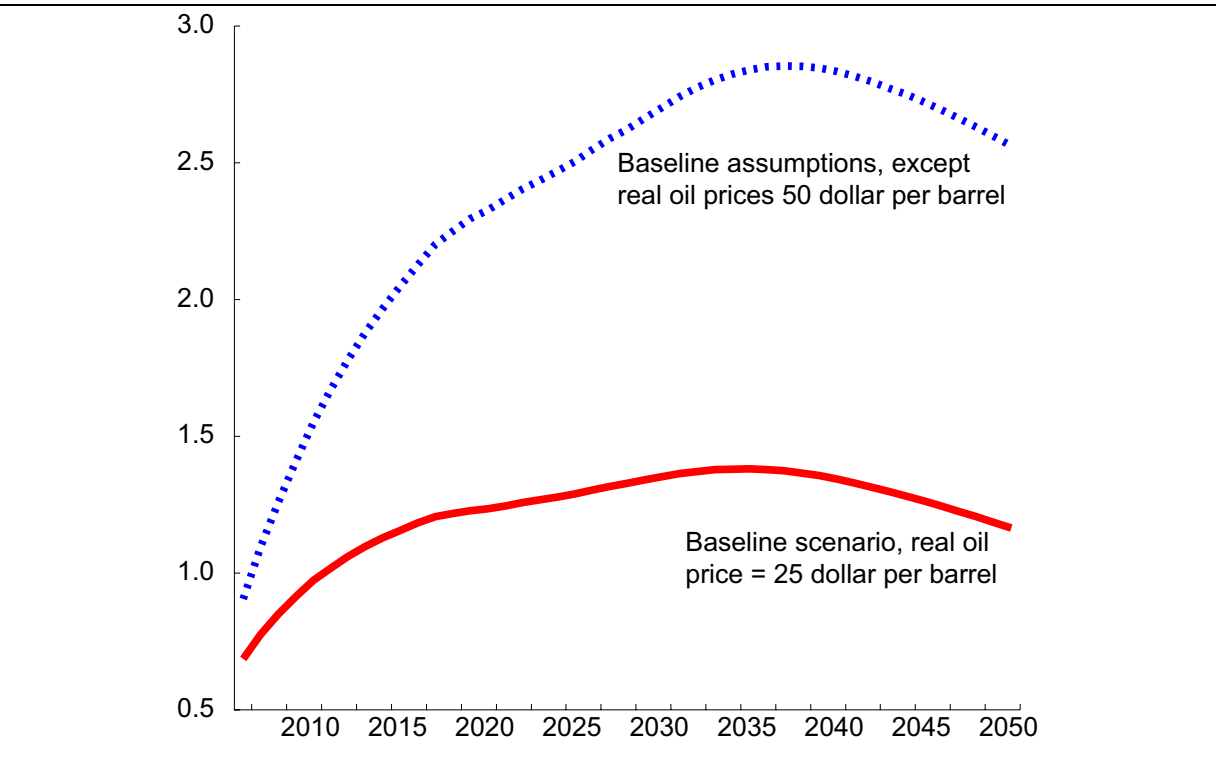
Although the pre-funding implied by the fiscal policy rule is far from sufficient to pay for the increasing costs of maintaining the present welfare state when ageing sets in, it is far from small. In terms of current GDP the CPF rises from 0.7 at the end of 2005 to a peak of 1.4 around 2035, see Figure 3.2. It can be questioned whether the rule is robust to such a degree of funding. It commands an unprecedented fiscal discipline against the pressure from various interest groups, including the rapidly increasing group of elderly.

In light of the impressive present fiscal stance and the prospects of large petroleum revenues, it is striking that our estimated necessary increase in the Norwegian payroll tax rate is much stronger than similar estimates for other countries being in strained fiscal position. Projections presented in OECD (2001) show that budgetary pressures from ageing populations on average require a 7 percent increase in the GDP-share of taxes. This exceeds the corresponding estimates in Chauveau and Loufir (1995) for the seven major economies. According to Feldstein (2005) the actuaries of the U.S. Social Security Administration estimate that the payroll tax rate must increase by about 6 percentage points from today to 2075 to finance the benefits specified in current law. 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 is about 9 percentage points. The model-based estimate in Kotlikoff *et al.* (2001) is somewhat higher; they find that the

payroll tax rate must increase by 10 percentage points over the next three decades. The Danish Welfare Commission (2004) concludes that fiscal sustainability will be obtained by increasing the base income tax rate permanently from 2011 by 8.7 percentage points.[15]

Table 3.1. GDP-shares of government revenues and expenditures in the baseline scenario. Percent

	2004	2025	2050
Total government revenues, of which	**69.5**	**57.5**	**60.5**
Net interest and other capital income	4.7	8.0	6.8
Total tax revenue, excl. petroleum revenues	47.8	44.1	52.0
Indirect taxes	17.8	13.9	12.7
Direct taxes, excl. petroleum revenues	30.0	30.2	39.3
Petroleum revenues	16.3	4.6	1.1
Total government expenditures, of which	**53.7**	**51.6**	**57.9**
Cash transfers to households, of which	19.5	24.3	27.3
Old-age pension expenditures	5.0	11.3	14.9
Government consumption, of which	27.3	22.0	26.0
Health and social care	10.5	12.4	16.6
Net financial investment	**15.8**	**5.9**	**2.6**
Capital in the Central Government Pension Fund - Global	47.7	128.9	116.5
Average payroll tax rate, percent	13.1	13.8	31.0

Growing pension expenditure is the driving force behind the growth in the expenditures-GDP ratio, see Table 3.1. Specifically, the GDP-share of government old-age pension expenditures grows from 5.0 in 2004 to 14.9 percent in 2050. The GDP-share of government consumption follows a U-shaped development, approaching the 2004-level in 2050. On the revenue side, the bases of indirect taxes grow more slowly than GDP when measured in current prices, whereas the direct tax revenue increases relative to GDP, especially after 2020 when the payroll tax rate starts to increase. In addition the wage share in nominal GDP grows over the whole scenario. Government petroleum revenues decline from 16.3 percent of GDP in 2004 to 1.1 percent in 2050, as the most profitable reserves are depleted. The fiscal policy rule implies that interest income compensates for the decline in petroleum revenues.

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[15] 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.

The most important factor behind the growth in government pension expenditures is that the total number of pensioners increases by more than 100 percent from today until 2050, see Table 3.2. The strong fiscal effect of increased longevity depends, however, crucially on the non-actuarial properties of the current public pension system. Whereas the present value of individual pension benefits would be invariant to changes in life expectancy in a completely actuarial system, annual individual benefits are independent on the number of years as a pensioner in the Norwegian system. Second, the government pension system is still maturing in the sense that the number of pensioners entitled to supplementary pensions is still increasing, and females will on average be entitled to higher pension benefits due to growth in labour market earnings. *Ex ante* wage indexation the average public old-age pension benefit is projected to increase by about 25.8 percent from 2004 to 2050. Third, the growth in the GDP-share of government pension expenditures also reflects wage indexation of entitlements and benefits, as wage growth exceeds the growth in GDP deflator by more than 2 percentage points in most years. A fourth but less important reason, is the expected continuation of the growth in the use of early retirement schemes observed over the last 15 years.[16]

Table 3.2. Projected development in the number of pensioners, average annual benefits *ex ante* indexation and the labour force in the baseline scenario. Thousand persons and thousand NOK, current prices

	2004	2020	2050
Old age pensioners	639	873	1317
Average annual benefit	116	140	146
Disability pensioners	308	388	407
Average annual benefit	120	124	122
All pensioners (including widow pensioners)	971	1278	1734
Pensioners in percent of labour force	40	50	65

The 32 percent increase in the already high number of disability pensioners from 2004 to 2050 follows from ageing combined with constant age specific transition rates from work into disability. Adding the growth in the average disability benefit, public disability pension expenditures will increase by nearly 50 percent *ex ante* wage indexation.

The U-shaped development of the GDP-share of government consumption results from aggregating quite different trends for the government sectors. Ageing alone makes it necessary to increase employment in the government sector *Health and social care* at annual rates between 1 and 2 percent

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[16] This has adverse fiscal effects because the government finances about 40 percent of the early retirement benefits. The present early retirement scheme allows about 60 percent of the employees of age 62 to retire at that age instead of the formal

after 2015, whereas total government employment grows at annual rates between 0.5 and 1.0 percent. The GDP-share of government spending on health and social care grows from 10.5 to 16.6 percent from 2004-2050. On the other hand, the GDP-share of other government consumption declines from 16.8 to 9.3 percent over the same period. A higher wage share in government consumption than in GDP contributes to raise the GDP-share of government consumption. Measured in fixed prices government consumption grows more slowly than real GDP, reflecting that labour productivity grows annually by 0.5 in the government sector and 2.5 percent on average in the private industries. Thus, a Baumol effect is implicit in our projection, since there is an increase in the relative prices of services provided by the government.

4. Gloomy fiscal prospects - a robust assessment?

How robust is the striking conclusion that the apparently affluent Norwegian state faces more severe problems of fiscal sustainability after 2020 than other already fiscally strained countries? And what alternative trends would significantly change the gloomy fiscal prospects? In this section we answer these questions by comparing the baseline with scenarios based on alternative assumptions on the main determinants of 1) government revenues, 2) government spending on health and social care, 3) government pension expenditures. Before commenting the simulation results reported in tables 4.1 and 4.2, it is convenient to point out three general equilibrium effects that turn out to be of special importance for the shifts discussed below.

4.1. General equilibrium effects

i. **Consumption effect:** Higher private consumption increases the indirect tax bases. The aggregate consumption tax rate is about 20 percent in Norway

ii. **Employment effect:** Labour supply responds to changes in the consumer real wage rate and in non-labour income, and most tax bases are directly or indirectly positively related to employment.

iii. **Wage effect:** A rise in the wage rate turns out to raise government expenditures more than the tax bases. The large budget shares of labour costs and wage indexed transfers to households make government expenditures nearly proportional to the wage rate. Directly or indirectly most tax bases are also nearly proportional to the wage rate. Thus, *if* the primary budget were initially balanced, the balance would be nearly independent of the wage rate. In the Norwegian

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retirement age of 67.

case, however, wage dependent expenditures exceed wage dependent income, foremost because the fiscal policy rule allows parts of the wage dependent expenditures to be financed by (wage independent) petroleum revenues.

Since the empirical significance of the wage effect depends on the wage share in government expenditures and revenues, as well as the wage formation, it will obviously be country specific. High petroleum revenues make the Norwegian state a fiscal outlier compared to other OECD countries serving substantial government debt. The quite strong egalitarian traditions in Norway imply that wage growth is spread relatively quickly to all sectors, including government sectors, and to pensions and other cash transfers through wage indexation.

Also the magnitude of the wage rate adjustment will be country specific. In the MSG6 model exogenous world prices and diminishing returns to scale at the industry level are crucial for the wage determination in the Norwegian economy. With constant returns unit labour cost is determined by world prices and labour productivity in the traded goods sector, independent of the activity level. Changes in the payroll tax rate are completely absorbed by the wage rate leaving unit labour cost unchanged. With diminishing returns to scale the wage rate must adjust in order to make the production of traded goods consistent with the intertemporal external balance constraint. Relatively rich endowments of certain natural resources are often used to explain the specialization of the traded goods sector in Norway. Resource based production typically exhibits diminishing returns. Empirical studies have found diminishing returns in most manufacturing industries, see Klette (1999). The closer scale elasticities are to unity, the more wage elastic is exports, and the less is the increase in the wage rate necessary to bring about a given increase in net exports. In MSG6 most scale elasticities lie in the vicinity of 0.85, which implies a price elasticity of export equal to nearly 6.

4.2. Determinants of tax bases

Table 4.1: Robustness of the macroeconomic projection for 2050 with respect to tax base determinants. Percentage deviation from baseline scenario

	TFP growth	Petroleum prices	Export prices	Interest rate
Private consumption	14.4	10.2	6.8	2.5
Employment	-3.9	-1.3	-3.9	-1.3
Pay roll tax, percentage points	5.7	-14.0	7.6	2.8
Wage cost per hour	26.9	16.0	34.2	6.0
Consumer wage rate	21.2	28.9	26.6	8.8
Consumer real wage rate	17.8	13.6	7.0	2.3
CPF/GDP	-19.6	120.0	-15.3	-6.7
Total government revenues, of which	20.1	28.6	28.1	6.1
Indirect taxes	11.2	24.9	17.7	4.8
Direct taxes, excl. petroleum revenues	27.2	4.1	34.8	5.8
Total government expenditures, of which	21.7	21.0	29.0	6.6
Cash transfers to households	20.0	27.9	25.5	8.4
Government consumption	23.2	15.4	33.3	5.7

TFP growth: TFP in private industries grow by 1.6 instead of 1.3 percent per year.
Petroleum prices: World prices of oil and gas are increased by 100 percent in all years compared to the baseline.
Export prices: World prices of all exports but oil and gas grow by 2.0 rather than 1.5 percent per year.
Interest rate: World interest rate increased permanently from 5.5 to 6.5 percent.

4.2.1. Accelerated TFP growth in private industries

In the long run productivity growth in private industries is the dominating determinant of the tax bases. However, foremost due to the wage effect explained above, accelerated TFP growth reduces the government budget surplus. This general insight is illustrated by accelerating TFP growth in *private industries* from 1.3 to 1.6 percent in every year. The payroll tax rate must then increase faster than in the baseline scenario, and by 2050 it would be 5.7 percentage points above the corresponding baseline rate, see Table 4.1. Faster growth cumulates to a wage rate being 26.9 percent higher than the baseline level in 2050. The employment effect reinforces the wage effect, because the increase in non-labour income is strong enough to reduce labour supply, whereas the consumption effect mitigates it. An important policy lesson is that policy makers - at least in Norway - cannot rely on economic growth in

the private sector as a source to finance the increase in government expenditure.[17] This qualitative result is relevant also for Denmark, see Andersen and Pedersen (2005).

4.2.2. Higher petroleum prices

In 2005 petroleum cash flow accounted for 27 percent of total government revenues. The baseline assumption of a 25 $/barrel real price of oil must be considered to be quite low as the oil price exceeded 70 $ in spring 2006. We have simulated alternative scenarios where the real prices of both oil and gas are increased permanently up to 100 percent from the baseline from 2006. We disregard any changes in other world prices as well as effects on oil and gas production. It turns out that most of the interesting effects are close to proportional to the shift in petroleum prices.

The fiscal policy rule implies that the additional petroleum revenues are saved, allowing the non-petroleum primary budget deficit to increase by 4 percent of the additional cash flow. A 100 percent price increase allows a 13-14 percentage points reduction in the payroll tax rate. The ratio of CPF to current GDP becomes more than doubled, peaking at 2.7 around 2035. It is highly questionable if a democracy will realize such a vast pre-funding. Even if it did, it would not suffice to make present tax rates sustainable; the tax rate must still grow after 2020, passing 17 percent in 2050.

The importance of general equilibrium effects on the room for tax cuts can be elucidated by comparing our estimate with a naïve estimate obtained by dividing 4 percent of the increase in the CPF by the baseline payroll in the private sector. The naïve estimate is a reduction of the payroll tax rate by 5 percentage points. Thus, general equilibrium mechanisms have halved the scope for tax reductions. Most of the correction can be attributed to the wage effect. Higher petroleum prices improve terms of trade, and the external balance constraint is restored by an increase in the wage rate from the baseline (1.9 percent in 2050). As higher non-labour income brings about a drop in labour supply, the employment effect pulls in the same direction, but the effect is empirically small. On the other hand the terms-of-trade gain increases private consumption from the baseline path (about 2 percent in 2050), and the consumption-effect magnifies the payroll tax rate reduction.

4.2.3. Successive terms of trade improvement

Assuming world prices of non-petroleum exports to grow annually by 2.0 instead of 1.5 percent highlights the equilibrium budget effects, notably the wage effect, since such a shift has no direct budget effects. The successive terms-of-trade improvements allow a faster growth in labour costs, and

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[17] We are not the first to make this point for Norway, see e.g. Ministry of Finance (2001).

in 2050 the wage rate would be 34.2 percent higher than in the baseline scenario. The wage effect is the main reason why the payroll tax rate must increase faster than in the baseline; in 2050 the difference passes 7.6 percentage points. Income effects are strong enough to reduce employment, reinforcing the necessary increase in the tax rate, whereas accelerated private consumption dampens it.

4.2.4. Improved access to profitable foreign investments

With government net financial assets reaching 1.4 percent of current GDP around 2035, even when the real oil price is as low as 25 $/barrel, we would expect significant fiscal effects of permanent changes in the world interest rate. Moreover, as the net financial wealth of the government is quite equal to the net national financial claims on the foreign sector, a higher interest rate is equivalent to a terms-of-trade gain for the Norwegian economy. One effect of globalization is improved access to profitable international investment projects, raising the opportunity cost of domestic investments. We illustrate the effects of such a development by increasing the world interest rate permanently from 5.5 to 6.5 percent. The fiscal policy rule complies with the higher interest rate, i.e. the expected real return to finance government expenditures is increased by 1 percentage point each year.

This shift allows the payroll tax rate to be 2.8 percentage points lower than the baseline level in 2050. A naïve estimate, disregarding general equilibrium effects, would be a 4 points cut. The improved interest income activates the consumption effect, reinforcing the tax rate reduction. In 2050 private consumption would be 2.5 percent above the baseline scenario. The employment effect pulls in the opposite direction since income effects dominate the labour supply response. Again, the wage effect represents the most important modification of the tax cut. Although higher capital costs reduce the scope for increasing the wage rate, there is room for raising labour cost by 6 percent in 2050. Adding the effect from a lower pay roll tax, allows an 8.8 percent increase in the consumer wage rate.

4.3. Determinants of government expenditures

4.3.1. Spending on Health and Social care

The government sector *Health and social care* is already large in Norway; the shares of total employment and GDP were, respectively 16.2 and 7.8 percent in 2005, increasing further to 25.2 and 16.7 percent in 2050 in the baseline scenario. The consequences for government spending depend crucially on 1) labour productivity growth in the sector, 2) service standards, 3) age specific demand propensities, reflecting basically the health of the elderly, and 4) household production. Table 4.2

reports the long-run changes from the baseline scenario of the shifts in these variables specified more precisely below.

Table 4.2. **Robustness of the macroeconomic projection for 2050 with respect to main determinants of government expenditures allocated to Health and social care and public old-age pensions. Percentage deviation from baseline scenario unless otherwise stated**

	Service standards	Labour productivity	Health	Household production	Pension reform
Private consumption	-8.4	2.7	4.6	-3.9	9.9
Government consumption	20.8	-0.3	-10.0	8.3	-2.1
Employment	-2.2	-0.3	0.6	-0.5	10.6
Government employment	21.8	-8.4	-10.6	8.8	0.0
Pay roll tax, percentage points	14.8	-4.5	-8.1	7.7	-14.0
Wage cost per hour	7.9	-2.0	-1.6	1.4	-8.4
Consumer wage rate	-6.9	2.6	4.7	-4.1	2.8
Consumer real wage rate	-8.1	3.1	4.2	-3.6	5.7
CPF/GDP	-3.1	1.4	0.4	-0.3	-9.4
Total revenues, of which	10.0	-3.0	-2.7	2.4	-6.5
Indirect taxes	-3.3	1.9	2.7	-2.3	6.8
Direct taxes, excl. petroleum revenues	16.2	-5.2	-5.0	4.4	-11.8
Total expenditures, of which	10.6	-3.2	-2.9	2.5	-6.8
Cash transfers to households	-9.1	3.4	5.9	-4.9	-5.3
Government consumption	32.3	-10.4	-12.5	10.6	-9.7

Service standards: Prolongation until 2025 of the average growth in man-hours per user observed in the 1990s in the government sector Health and social care.
Labour productivity: Annual labour productivity growth in the government sector Health and social care raised from 0.5 to 1.0 percent in all years.
Health: Age specific demand for health and social care services reduced from the constant baseline levels in line with increased longevity.
Household production: Household production of social care services reduced from the baseline to the 2005-level in all years.

Improved service standards

The baseline assumption of constant service standards would break the trend observed over the last decades. As an alternative we have examined the fiscal impact of prolonging the growth in service standards observed in the 1990s. However, such a prolongation cannot be sustained as a feasible equilibrium after more than 2-3 decades, as most of the labour supply by then would be employed in the government *Health and social care* sector. The assumed improvements in service standards are therefore halted in 2025. Real government consumption would then be 20.8 percent higher than the baseline scenario in 2050, whereas the payroll tax rate would have to increase by 10.1 percentage points in 2025 and by 14.8 points in 2050. The reason why the necessary payroll tax rate grows faster than in the baseline scenario even if there is no further standard improvements after 2025 is a positive interaction effect between resources per user and the increase in users due to ageing. Government

employment increases by nearly 3 percentage points from 2025 to 2050 compared to the baseline scenario, solely due to the standard improvements prior to 2025.

If all general equilibrium effects were disregarded, except the reallocation of labour from the private to the government sector, the payroll tax rate increase in 2050 would have to be nearly 22 percentage points. Thus, general equilibrium effects modify significantly the direct negative budget effect. This is surprising since tax bases shrink; the expansion of government employment crowds out private consumption, and total labour supply is about 2 percent lower than the baseline in every year. However, the wage effect of a 6.9 percent lower consumer wage rate dominates the negative tax base effects of lower employment and private consumption.

The modest effect on labour supply requires a qualification in the case of expanded government consumption. In our model government consumption does not enter individuals' utility functions. Thus, crowding out of private consumption in favour of government consumption induces an income effect on labour supply. If government consumption of individual goods entered the individuals' utility functions, the reduction in labour supply would have been reinforced.

Accelerated labour productivity growth
The scope for productivity gains in the labour intensive social care sector is typically considered to be limited compared to other industries, cf. "Baumol's Disease". In our baseline projection labour productivity grows annually by 0.5 percent in government sectors, as compared to 2.5 percent in private industries. We have as an alternative simulated the effects of increasing labour productivity growth in the government *Health and social care* sector to 1.0 percent each year. Standards on public services maintain as in the baseline scenario, so the productivity gain reduces government employment. In 2050 the reduction has accumulated to 8.4 percent compared to the baseline, and the corresponding reduction of the payroll tax rate has passed 4.5 percent. The increase in both private consumption and leisure has opposite fiscal effects. If, alternatively, the productivity gain were reaped by increasing service standards, our model would generate higher labour supply, since government services do not enter individuals' utility functions.

Improved health among the elderly
The baseline scenario assumes no changes in the age specific demand for health and social care services, which can be interpreted as no improvement in the health of the elderly. This is a pessimistic assumption when the same scenario assumes life expectancy of the elderly to rise by more than 7 years from 2005 to 2050. We have simulated the effects of health improvements among the elderly in line with the increased longevity. More precisely, the age specific demand for health and social care services is reduced so that the individual use of these services on average remains constant over the

individual lifetime. The effects cumulate to large magnitudes. In 2050 total government employment and the payroll tax rate can be reduced by as much as 10.6 percent and 8.1 percentage points, respectively, from the baseline. The tax cut is reinforced by the 4.6 percent increase in private consumption, and to a less extent by the slight increase in total employment, reflecting a weak dominance of the substitution effect over income effects on labour supply.

Increased household production

Based on time use surveys[18] household production of care services is roughly estimated to about 1/3 of the employment in the government *Health and social care* sector in 2005. The baseline scenario assumes that household production of care services grows at the same rate as government production of these services. Such a growth in household production can be suspected to be positively biased, because the scope for further outsourcing of these services from the households is limited due to increased female market labour participation historically and in the baseline scenario. We have simulated the effects of alternatively assuming the present level of household production to remain constant. The fiscal effects are significant, and nearly symmetric to the effects of improved health among the elderly described above. The government employment would be 8.8 percent higher in 2050 than the baseline in order to provide the same service standards. The corresponding increase in the payroll tax rate would have to be 7.7 percentage points.

4.3.2. A Pension reform

In order to improve fiscal sustainability, labour market efficiency and transparency the government proposed a pension reform in 2004. Below we summarize the estimated macroeconomic and fiscal effects of the proposed reform in Fredriksen, Heide, Holmøy and Solli (2005). The most important reform elements include:

- The pension benefit continues to include two elements, a granted minimum benefit and an income based benefit. The level of the minimum benefit follows the same development as the minimum benefit in the present system. Contrary to the present system, it is means-tested against the income based pension benefit.
- Stronger dependency between earnings and pension benefits. In the present system the pension entitlement depends on the earnings in the 20 best years. In the proposed system the income based benefit is basically 1.25 percent of *lifetime* earnings with a few restrictions.
- The reform makes the system much more actuarial; the future annual pension benefit is adjusted such that the total value of the future pension benefits remains roughly invariant to

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[18] See Statistics Norway (2006b)

life expectancy and age of retirement. The current non-actuarial early retirement arrangements, covering about 60 percent of the persons occupationally active at 62 years, is gradually replaced by a general access to early retirement from the age of 62.

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

- The new system is supposed to be phased in from 2010 over a 15 years period.

The reform allows an increasing cut in the payroll tax rate over time as the present public pension system becomes increasingly expensive as more retirees live longer, whereas the actuarial properties of the proposed system prevent to a large extent increasing life expectancy to raise government pension expenditures. In 2050 the payroll tax rate is as much as 14 percentage points below the baseline scenario. The tax cut is possible due to both reduced government pension expenditures and expansion of tax bases. In 2050 the old-age pension expenditures *ex ante* indexation are 16 percent lower than projected under the present system due to less generous indexation and a more actuarial cut in annual benefits to increased life expectancy. By 2050 employment is 10.6 percent higher than in the baseline scenario. Delayed retirement accounts for 4.1 percentage points of this increase, and 4.2 points can be attributed to an 8 percent increase in the effective wage rate caused by increased income dependency in the proposed system. The average retirement age increases over time due to increased life expectancy, from 0.6 years in 2015 when the present early retirement scheme has been phased out, to 2.6 years in 2050.[19] These strong and positive fiscal effects are modified by the increased wage rate.

5. Conclusions

By combining different models we have exploited most of the available detailed information required to project long run growth in government expenditures and revenues in Norway. Our main substantive conclusion is that despite an impressive fiscal stance today and ambitious saving of the large government petroleum revenues, fiscal prospects for Norway are gloomy. Given our baseline assumptions, a broad tax such as the payroll tax rate, must be continuously raised after 2020, passing twice the present rate of 13 percent around 2045 in order not to violate the fiscal policy rule adopted in

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[19] Norwegian studies on retirement behaviour are surveyed in Hernæs, Røed and Strøm (2002). The study ignores any effects on disability retirement of making early retirement more costly for the individual.

2001. This is not a realistic projection of what is most likely to happen. On the contrary, the purpose of the baseline scenario is to stimulate the debate on policy reforms, just by showing quantitatively that prolongation of current policy is indeed unrealistic; it is unlikely to be optimal and hardly feasible. Surprisingly, our estimate of the necessary growth in the tax rate after 2020 in Norway is also higher than corresponding estimates for other OECD countries, despite Norway being in an apparently exceptionally favourable fiscal position. Consequently, the long run perspective in fiscal sustainability assessments is even more important for policy decisions in Norway than in other countries, where strained budgets have already triggered unpopular cost saving reforms of their welfare schemes.

Given our baseline assumptions, a corollary is that the petroleum wealth is far from sufficient to permanently meet the *increase* in the public funds required to finance the Norwegian welfare state when one looks beyond 2030. This holds even if the ambitious saving plan implied by the current fiscal policy rule is realized. The rule implies that consumption of the petroleum wealth converges from below to the real return on the wealth. The realism of the pre-funding implied by the fiscal policy rule may be questioned. Even in the low oil price scenario (25 $/barrel) the fund peaks around 2035 at about 1.4 times current GDP, compared to 0.7 at the end of 2005. With 50 $/barrel increases the ratio peaks at 2.7. Thus, the rule commands an unprecedented fiscal discipline against the pressure from various interest groups, including the rapidly increasing group of elderly. Already today there is a strong pressure for breaking the fiscal policy rule. Moreover, the baseline scenario suggests that it is unrealistic - probably unfeasible - to replace tax rate increases in the future by a once-and-for-all increase today, as long as the government expenditures on average grow at a faster rate than government income.

The gloomy fiscal prospects are quite, but far from completely, robust to alternative assumptions on the key determinants of government revenues and expenditures. An important insight is that productivity growth in the private sector contributes to reduce the primary budget surplus through wage growth. Fundamentally, this is due to the automatic redistribution embedded in the Norwegian welfare state, reflecting the strong position of egalitarian preferences in Norway. Specifically, centralized wage formation and wage indexation of the pension benefits and most other cash transfers ensure that productivity gains in private firms benefits all, including civil servants and pensioners.

Equilibrium wage rate adjustment turns out to be the most important of several general equilibrium effects on government revenues and expenditures. In light of its empirical significance, we consider the identification and the quantitative assessment of this effect to be an important methodological

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contribution to the literature on fiscal sustainability. The potential of this effect is perhaps most strikingly demonstrated in the analysis of increasing the oil price. The feasible tax reductions were halved when taking general equilibrium effects into account, and the wage effect is by far the most important source of this modification.

One may criticize the baseline scenario for relying on a negatively biased oil and gas price projections. 50 rather than 25 $/barrel reduces drastically the need for raising tax rates in the future. The same is true if increased longevity reflects a postponement rather than an increase in the number of years when elderly have strong demands for health and social care services. On the other hand the baseline scenario assumes no increase in service standards for individual services provided by the government, despite 2.5 percent annual growth in private consumption. Keeping up the historical trend in standard improvements is very costly and cannot be sustained for more than a couple of decades. The adverse budget effect of increasing government spending per elderly is exacerbated by the increase in the number of elderly. This dynamic interaction effect is important to keep in mind during the years before the ageing process really takes off around 2020. In this period there will be substantial fiscal room for costly welfare reforms, as well as further postponement of a cost saving pension reform, if tax rates are maintained.

A policy reform that would take great step towards a solution to the fiscal sustainability problem in Norway is a pension reform along the lines proposed by the government in 2004. The reform has incorporated mechanisms that neutralize much of the trend-driven expenditure growth: annual benefits should be actuarially (on average for a cohort as a whole) adjusted to increased life expectancy, and they should be indexed by the average of wage and price growth. One may speculate if analogous ways of increasing the individual responsibility for financing consumption after retirement can be implemented also for parts of the health and social care services that are tax financed today. Such a curtailment of the present welfare state would imply a reversal of the outsourcing of care services from households to the government sector and the related increase in female labour market participation observed over the last decades. Quantitative assessments of such policies belong to future research.

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