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Norwegian pension reform
Defined benefit versus defined contribution

Abstract:
Defined benefit versus defined contribution is discussed related to the new pension system in Norway. The new system fulfils several criteria for a defined contribution scheme. Earnings from all years in work count in the accumulation of entitlements, and an actuarial rule converting the final balance into an annuity is introduced. But the pension system will still be a part of the general public finances and therefore financed pay-as-you-go. And before taking adjustments for increasing life expectancy into account, the level of old age pension benefits is calibrated to the former defined benefit system. The paper shows that given these restrictions it is of minor importance if the new pension system is described as defined benefit versus defined contribution. One modification follows from the treatment of inheritance of entitlements from persons who die before the lower age limit of retirement. The discussion is illustrated empirically by using Statistics Norway's dynamic microsimulation model MOSART.

Keywords: Pension systems, pension reform, life expectancy adjustment, microsimulation.

JEL classification: H53, H55, J26

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Sammendrag

Artikkelen drøfter i hvilken grad det nye systemet for alderspensjon i Norge kan karakteriseres som ytelsesbasert eller sparelignende. Det nye systemet oppfyller flere kriterier for et sparelignende system:

- Arbeidsinntekter fra alle år i yrkesaktivitet teller i opptjeningen av pensjonsrettigheter
- De årlige pensjonsytelsene blir bestemt ved å dividere de opptjente rettighetene med et delingstall som avspeiler forventet antall år som pensjonist

På den andre siden skal systemet for alderspensjon fortsatt være en integrert del av de generelle offentlige finansene. Utbetalingene vil derfor bli løpende dekket av skatteinntektene, og rettighetene opparbeides på en fiktiv konto. Før justering av ytelsene som følge av indeksering og økende levealder, samt valg av alder for uttak av pensjon, er nivået på ytelsene også fastlagt i tråd med det gamle systemet.

Drøftingen viser at utformingen i tråd med kriteriene ovenfor innebærer at det ikke har noen særlig reell betydning om systemet framstilles som ytelsesbasert eller sparelignende. En modifikasjon følger av behandlingen av arvede rettigheter fra personer som dør før pensjoneringsalderen. Dette elementet kan bare ivaretas ved en sparelignende utforming.

Drøftingen er illustrert empirisk ved hjelp av Statistisk sentralbyrås dynamiske mikrosimuleringsmodell MOSART. Systemet med levealdersjustering bidrar til å motvirke effekten som økende levealder ellers ville ha hatt for fremtidige utgifter til alderspensjon. Ettersom langt større fødselskull enn tidligere er i ferd med å nå opp i pensjonistenes rekker, vil det i de nærmeste tiårene likevel finne sted en betydelig økning i utgiftene til alderspensjon sammenlignet med befolkningens arbeidsinntekter, og dermed skatteinngangen for det offentlige. Et svært gunstig forhold mellom tallet på sysselsatte og tallet på alderspensjonister i løpet av de siste tiårene har ført til at den løpende finansieringsbyrden for de yrkesaktive har vært klart lavere enn den pensjonspremien som hadde vært nødvendig med en rendyrket sparelignende utforming.

Introduction

To reduce future challenges for public finances caused by an increasing number of elderly, a reform of the old age pension system in Norway is implemented from 2011. Like in most other Western countries the expected increase in the future pension burden is caused by higher life expectancy and relatively large cohorts born in the years after the Second World War. These cohorts are now reaching the age of retirement. When the former system was established in 1967, the number of retirees was low relative to those in working age. In spite of increasing life expectancy, financing the old age pension scheme in Norway pay-as-you-go has up to now only caused a small tax burden for the working population.

In the design of the reform experiences from former reforms in other Western countries have been taken into consideration. Especially the paper relates the Norwegian reform to the discussion about defined benefit versus defined contribution. According to a survey by Whiteford and Whitehouse (2006) there have been major reforms of the pension systems in about half of the OECD-countries that will have significant effects on pension entitlements and future contribution rates. In many cases reforms were *parametric*, tightening the level of benefits while the main structure of the pension system was unchanged. A common limitation with these parametric reforms is that they are not sufficient to avoid the risk that pension expenditures may continue to increase in the future as a consequence of further growth in life expectancy. Several countries have therefore implemented *systemic* pension reforms that change the way future benefits will be determined if life expectancy improves. A simultaneous objective of these reforms is to create incentives to postpone retirement.

As a result of recent pension reforms a link between changes in life expectancy and future pension benefits is introduced in 13 OECD countries. According to Whitehouse (2007) these pension systems may be classified in different categories depending on how this link is constructed. As pointed out by Lindbeck and Persson (2003) the difference between defined benefit and defined contribution systems ought to be discussed along several dimensions. They point at the following three; determined benefits versus exogenous contribution rates, the degree of funding, and finally actuarial characteristics. They also point out that 'Real-world systems are rarely clear-cut in any of these dimensions'.

In his survey Whitehouse notes that Australia, Mexico, Hungary, Poland, the Slovak Republic and Sweden have introduced *funded defined contribution* (DC) plans as a substitute for parts of their public, earnings-related pension schemes. In

Denmark a DC occupational pension system has covered a majority of the workforce for a long time, and a mandatory second pillar DC occupational pension system was introduced in Norway in 2006. In a DC system contributions accumulate in an individual account. At retirement the pension capital is transformed into an annuity, and adjustments to changes in life expectancy are automatic. Increasing life-expectancy causes the yearly benefits to decrease if retirement age is unaffected. Each person may thus counteract the effects on benefits by postponing retirement.

As a second group of pension systems Whitehouse notes that parts of the public earnings related pension systems in Italy, Poland and Sweden are made up of *notional accounts.* Although these parts of the system are financed pay-as-you-go, they mimic the features of funded DC-schemes. As pointed out by Holzmann and Palmer (2006) systemic pension reforms in this direction also have taken place since the 1990s in Latin America and transition economies of Central and Eastern Europe, and they call these systems *non-financial or notional defined contribution schemes* (NDCs). These systems are attractive because they include the main advantages of a fully funded system without involving transition costs and other requirements necessary for a fundamental shift in this direction. With notional accounts, entitlements are accrued from yearly earnings without being actually paid. The rate of return may often be fixed by the government, and at the age of retirement accumulated capital is also in this case transformed into an annuity. Corresponding to pure DC-schemes and funded systems, increasing life expectancy causes the yearly benefits to decrease for a given retirement age.

In traditional *defined benefit* (DB) schemes, benefits are unaffected by shifts in life expectancy and demographic and economic conditions affecting the rate of return and the tax burden for the economic active cohorts in financing the pension expenditures. However, in the defined benefit schemes of Finland, Portugal and Germany actuarial elements are introduced *adjusting benefit levels* to changes in life expectancy as benefits are normalised against a chosen age of retirement and life expectancy for a specific cohort. Thus, also with this system increasing life expectancy will cause the yearly benefits to decrease.

Adjusting qualifying conditions is a fourth way to counteract the effect from increasing life expectancy on future pension expenditures. In Denmark pension eligibility age will be linked to life expectancy from 2027 after already being increased from age 65 to 67. In the reform of the pension system in France from 2003 the required number of years of contributions necessary to get a full pension was linked to life expectancy.

An actuarial design with adjustments for changes in life expectancy is the main new element in the new system for old age pensions in Norway. The structure of this system may be linked to the three dimensions introduced by Lindbeck and Persson (2003) and the classification by Whitehouse (2007). Except from the element of funding in the second pillar occupational pension system, the entire National Insurance System is still going to be financed pay-as-you-go. Benefits are determined by the individual's previous earnings and are normalised against the levels in the former system. In this respect the new system may be characterised as defined benefits. On the other hand, strong actuarial elements are introduced by notional accounts. The link between labour incomes and entitlements is strengthened compared with the present system, but even more important is the fact that yearly benefits are made dependent on average remaining life expectancy at the point of retirement. Early retirement thus means low yearly benefits and vice versa. Increasing life expectancy in the future also means that retirement has to be postponed to maintain the benefit level. Combining these actuarial elements with an indexing of pension entitlements according to wage growth, the new old age part of the pension system in Norway may be characterised as 'quasi-actuarial'.

According to the definition of a pure NDC pension system by Börsch-Supan (2006), the approved Norwegian pension scheme fulfils criteria 1, 3 and 4, but not criterion 2:

1. An accounting mechanism that credits all life-time earnings.
2. A mechanism linking the final balance with the demographic and macroeconomic environment.
3. An actuarial rule converting the final balance into an annuity.
4. Claims on future benefits are not collaterized with real capital but promises by a government-related entity.

While future old-age pensioners have to face the risk of increasing life expectancy, the government (and thereby the tax-payers) bears the risk of an unfavourably development in other demographic components, macroeconomics and the labour market. It is then up to politicians to decide how taxes and government expenditures should be adjusted to maintain government budgets in the long run.

Because the approved Norwegian pension scheme is somewhere between a pure defined contribution and a defined benefit systems, the paper extends some of the aspects discussed by Lindbeck and Persson (2003). The discussion will also be illustrated empirically by use of Statistics Norway's dynamic microsimulation model MOSART. With a quasi-actuarial pension system, neither pension benefits nor contribution rates are exogenous. For a given retirement age pension benefits

are reduced if life expectancy increases. Although the effects from higher life expectancy are neutralized, average contribution rates in this system may shift as a consequence of a shift in the number of pensioners relative to the population in working age, or by shifts in participation rates or average working hours. Under certain conditions within this framework it does not matter if the pension system is implemented as defined benefits or defined contributions. One modification follows from the treatment of inheritance of entitlements from persons that die before the lower age limit of retirement.

The actuarial elements of the new old age pension system in Norway

The actuarial elements of the new old age pension system in Norway imply that the expected present value of pension benefits is independent of the age of retirement and the cohort's remaining life expectancy. At the age of retirement accumulated pension entitlements are thus turned into an annuity. Somewhat simplified the accumulation of notional pension wealth may be expressed as:

$$W_A = \alpha \cdot \sum_{t=0}^{A-1} I_t \cdot (1+i)^{A-t} \tag{1}$$

Here

W_A = Calculated pension wealth at retirement age A,

α = Accrual coefficient as a share of the income base for pension entitlements,

I_t = Income base for pension entitlements in year t, and

i = Nominal rate of interest relevant for pension entitlements.

Based on the yearly income base for pension entitlements (mainly corresponding to labor incomes), the pension entitlements earned each year are calculated by the accrual coefficient α. Before retirement these entitlements have to be indexed to the retirement age A. In a fully funded, but also in a quasi-actuarial system, the nominal rate of interest from corresponding funding in the financial markets may be most relevant. In the new, Norwegian system it is decided that pension entitlements are going to be indexed according to average growth in wage rates.

At retirement age (A) expected pension benefit at a future age may be calculated as the product of the expected benefit at that age and the probability of surviving to the considered age. Taking the indexing of pension entitlements and the rate of

interest into account, a factor for expected present value per unit of future benefits calculated at retirement age A for a person born in year K, may be presented as:

$$\Phi_{K,A} = \sum_{x=A}^{\infty} p_{K,A,x} \cdot (1+i)^{A-x} \cdot (1+w)^{x-A} \quad (2)$$

Here

K = Birth year of the actual cohort,

$p_{K,A,x}$ = Survival probability for persons born in year K from retirement age A to age x

w = Rate of nominal wage growth.

Net real rate of interest (ρ) is defined as:

$$\rho = (1+i)/(1+w) - 1 = (i-w)/(1+w) \quad (3)$$

By inserting from (3) in (2), Φ may be expressed as:

$$\Phi_{K,A,\rho} = \sum_{x=A}^{\infty} p_{K,A,x} \cdot (1+\rho)^{A-x} \quad (4)$$

In the special case where the nominal rate of interest is assumed to equal wage growth, $\Phi_{K,A}$ expresses remaining life expectancy for cohort K at retirement age A, $e_{K,A}$.

$$\Phi_{K,A,\rho=0} = \sum_{x=A}^{\infty} p_{K,A,x} = e_{K,A} \quad (5)$$

The yearly pension benefit in fixed values ($\overline{B}$) may be determined in such a way that the present value of future pension benefits calculated by actual retirement age (A) corresponds to the present value of entitlements at that age. In a fully funded or a quasi-actuarial pay-as-you-go system with defined contributions, the yearly pension benefit may then be calculated by:

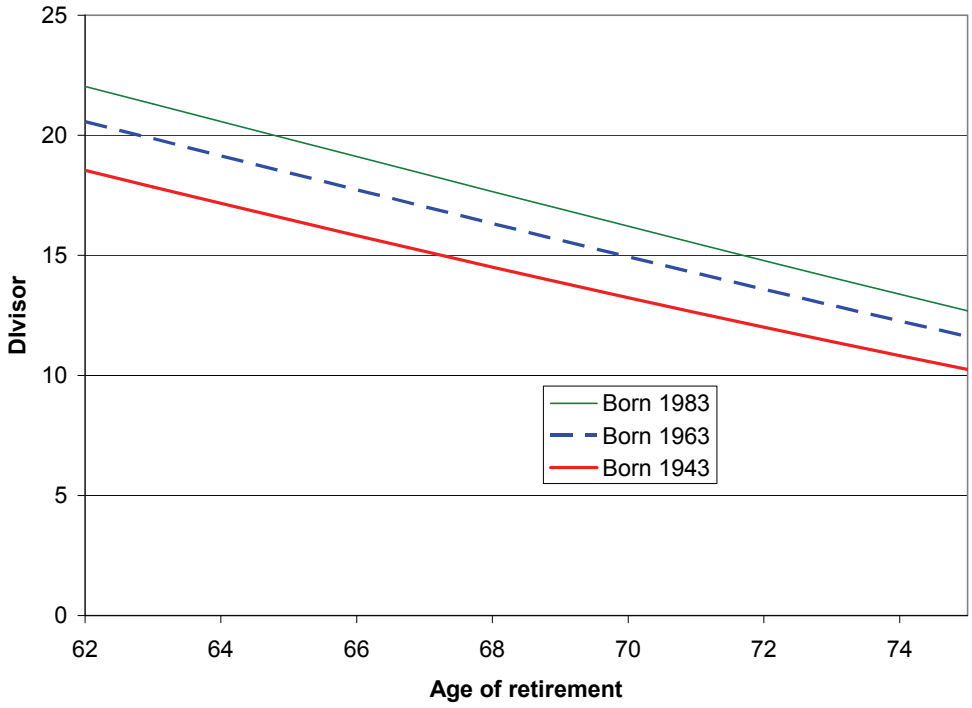
$$\overline{B}_{K,A} = W_A / \Phi_{K,A} \quad (6)$$

If the nominal rate of interest is fixed equal to wage growth, the yearly pension benefit according to equation (6) simply is calculated by dividing the earned entitlements by life expectancy at the age of retirement.

In the new system for old age pensions in Norway the factors for expected present value per unit of future benefits are denoted 'divisors' as the accumulated pension wealth is going to be divided by these factors to calculate the yearly benefits. To avoid distortions from random fluctuations in mortality rates, a 10 year retrospective average is chosen. Too low divisors calculated in this way as a result of a declining trend in mortality rates is counteracted in the calibration of the accrual coefficient α. The divisors are also adjusted for the fact that benefits after retirement are indexed 0.75 percentage points less than wage growth.

The divisors may be calculated for every cohort and every retirement age independent of the model for accrual of entitlements. If a person chooses to retire early, the divisors increase as the pension wealth has to be divided by a larger number of years. This is shown in figure 1. For a given retirement age the divisors also increase as time goes by when remaining life expectancy increases.

Figure 1: Divisors by age of retirement for different cohorts



Defined contributions versus defined benefits

The old pension system in Norway was clearly a defined benefit system. When the work with the Norwegian pension reform started by the Pension Commission (NOU 2004:1), the benefits from the old system was a natural point of departure when calibrating the accrual coefficient in the new system. As a first approach for the new system the Pension Commission based their analyses on assumptions of an adjusted defined benefit system with actuarial characteristics. Instead of accumulating pension wealth as in (1), an alternative then was to define a base

benefit (before taking into consideration increasing life expectancy and indexation) as:

$$B_A = \beta \cdot \sum_{t=0}^{A-1} I_t \cdot (1+i)^{A-t} \tag{7}$$

Here

B_A = Calculated yearly base pension at retirement age A, and

β = Accrual rate used for calculating yearly base pension entitlements as a share of the relevant income base.

By combining equations (1) and (7) we get:

$$W_A = (\alpha / \beta) \cdot B_A \tag{8}$$

If the assumed rate of interest and other elements of earning of entitlements are equal, it does not matter whether earnings of pension entitlements are calculated by pension wealth as in (1) or yearly base pension as in (7).

In a defined benefit system things get somewhat more complicated compared to defined contributions as pension benefits have to be standardized in some way. Two elements of standardization seem to be necessary. Firstly, the base yearly pensions before adjusting for increasing life expectancy have to be standardized through calibration of the parameter β in (2) giving equal average benefits compared to a predefined system (e.g. the old system). This element corresponds to the calibration of α with defined contributions. Secondly, if increasing life expectancy shall be counteracted by decreasing yearly pensions, pension benefits have to be standardized for a given cohort retiring in a given year. In the proposal for a new pension system in Norway outlined by the Pension Commission the pension benefits were standardized according to calculated life expectancy for persons born in 1943 who retired at the age of 67 in 2010, the year before the new system was implemented. The aim was that pension benefits for these persons with the new system should be equal to what they would have obtained by maintenance of the old system. From equations (6) and (8) we then get the following connection between α and β:

$$\alpha / \beta = \Phi_{1943,67} \tag{9}$$

Except from the choice of standardization, this connection is equivalent with the connection between a pension premium in a notional accounts system with defined

contributions and a defined benefit accrual rate described in OECD (2005). When β is standardized from equation (7), α is given from equation (9).

To introduce actuarial elements in a defined benefits for other cohorts and other assumptions regarding retirement age and life expectancy, the yearly benefits have to be adjusted compared to the given base benefit. This may be done by introducing a relative divisor decreasing yearly benefits if life expectancy increases or retirement age decreases. According to the specifications above and the standardization suggested for the reformed pension system in Norway, the relative divisor for a person from cohort K who retires at age A, may be defined as:

$$\delta_{K,A} = \Phi_{K,A} / \Phi_{1943,67} \tag{10}$$

As a consequence of the standardization the relative divisor for persons from the 1943 cohort who retire at age 67 in 2010, is identically 1.

The relative divisors may be calculated for each cohort and each retirement age independent of the system for accumulating pension entitlements. The approach also implies that it is only in the point of standardization where the actual pension benefit corresponds to the given level from the old system. Like in the defined contribution system, if a person chooses to retire before the point of standardization, the given pension entitlements have to be divided by more years. And the point of standardization will increase if life expectancy increases, giving a higher relative divisor for a given retirement age as time passes. Before taking the annual indexation of benefits into account the pension benefit in a defined benefit system is given by:

$$\overline{B}_{K,A} = B_A / \delta_{K,A} \tag{11}$$

Inheritance of entitlements

Inheritance of entitlements arises in pension systems because different persons from a cohort die at different ages. Entitlements built up by those who die are divided among those who survive. A consequent treatment of this aspect should take into account the development of mortality both among persons in working age and among pensioners. In the proposal from the Pension Commission (NOU 2004:1) only inheritance of entitlements after the lower age of retirement, 62, was taken into account. The main reason for this limitation was the fact that the proposed approach for a system with actuarial characteristics was based on an adjusted defined benefit system. The Commission did not consider inheritance of

entitlements before the lower age limit as a natural element of a defined benefit system mainly because this would be strange for entitlements based on the old system because of a maximum number of years for accrual of entitlements fixed to 40 and calculation of entitlements based on observations from the 20 years with the highest earnings. A system with correct inheritance of entitlements before retirement requires that earnings from each year are corrected by survival probabilities in a consistent way. Such a correction is not meaningful when some years do not count.

For a person in cohort K who considers to retire at age A the inclusion of inheritance of entitlements after the lower rate of retirement N in the defined benefit system with actuarial characteristics was suggested implemented by correcting the factors for expected present value per unit of future pension benefits in the following way (assuming a rate of interest equal to wage growth):

$$\Phi_{K,N,A,\rho=0} = \sum_{x=A}^{\omega} p_{K,N,x} = l_{K,N,A} \cdot e_{K,A} \tag{12}$$

Here $l_{K,N,A}$ denotes the survival probability from age N to age A for a person from cohort K. In this case $\Phi_{K,N,A}$ expresses the expected number of years as a pensioner considered from age N when planned retirement age is A. In this suggestion from the Commission, as a simplification mortality before the chosen lower retirement age (62) was disregarded and earnings after the age of 62 were treated as if they took place at that age.

With a defined contribution model it seems most relevant to take inheritance of entitlements before the age of retirement into account by correcting the earning of entitlements by survival probabilities. An adjusted notional pension wealth compared to (1) may then be expressed as:

$$W_A = \alpha_2 \cdot \sum_{t=0}^{A-1} I_t \cdot (1+i)^{A-t} / l_{K,t,A} \tag{13}$$

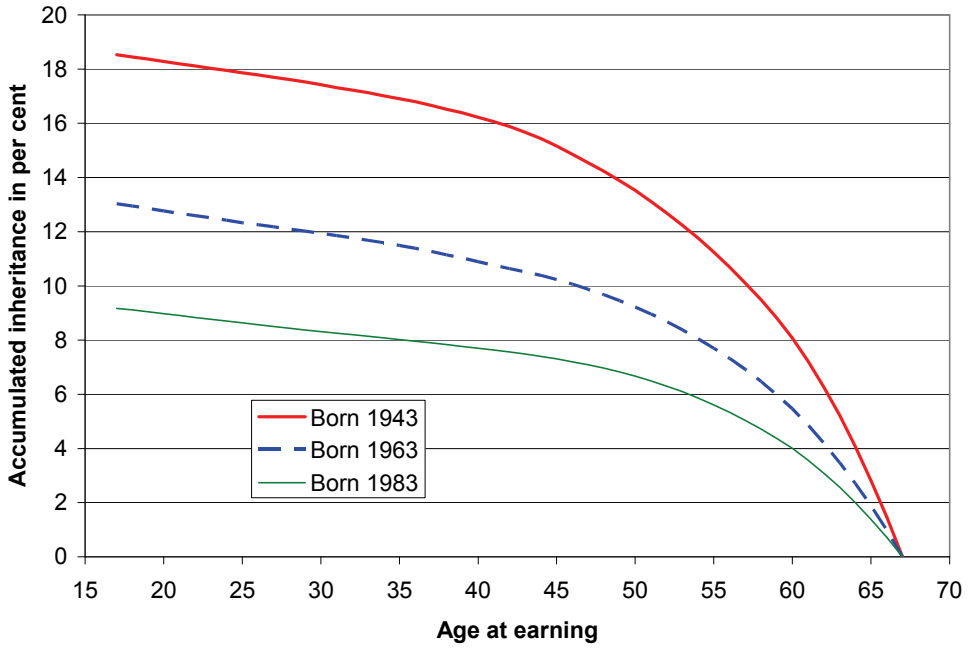
Here labour incomes are adjusted by the survival probability from age t to retirement age A. By this representation inheritance of entitlements is based on mortality rates for the different cohorts, and not on redistribution of actual earnings among those who die. This approximation is, however, only of minor importance. Lower mortality among women than among men is e.g. outweighed by lower earnings.

Inheritance of pension entitlements before the age of retirement means that earnings early in working age are given a larger weight compared to incomes that

are earned late. The accumulated effect of inheritance of entitlements up to the age of 67 is illustrated in figure 2 for three different cohorts based on projected survival probabilities. The accumulated inheritance is obviously highest based on earnings of entitlements early in working life, and is reflected by a lower survival probability up to age A in (13). When a person grows older, the survival probability up to retirement age will increase, and accumulated inheritance based on earnings from these years is reduced. Especially, accumulated inheritance from incomes earned after the age of 50 is decreasing when the present probability for dying before reaching 67 is significantly reduced.

For persons born in 1943, the accumulated inheritance from incomes earned at the age of 20 is more than 18 per cent. From incomes earned at the age of 60 the rate of accumulated inheritance is still about 8 per cent for this cohort. For persons born in 1963 the rate of accumulated inheritance from incomes earned at the age of 20 is estimated to about 13 per cent. As a consequence of a projected decrease in mortality, the accumulated rate of inheritance from incomes earned at the age of 20 is falling to about 9 per cent for persons born in 1983. The decrease in the rate of inheritance compared with persons born in 1943 is especially caused by a projected decrease in mortality for those over 50. For younger age groups mortality has already reached low levels, and further decrease is only of minor importance.

Figure 2: Accumulated inheritance of entitlements at age 67 in per cent of total entitlements by age at earning and year of birth



When the survival probability from lower retirement age of 62 up to the age of retirement is taken into account in the adjustment for earned entitlements by the defined contribution approach, the divisors may simply be represented by the remaining life expectancy from the age of retirement in (5). These divisors may then be used to calculate yearly pension benefits for entitlements based on earnings achieved under the new pension system in Norway. Because of a defined benefit representation of entitlements based on the old system (and also for the guarantee pension in the new system) relative divisors from (10) and (12) are used when calculating yearly benefits based on entitlements from the present system in a period of transition.

Empirical calibration of the accrual coefficient

To introduce actuarial elements in the old age pension system of Norway, it would have been sufficient to introduce the relative divisors from (10) in a defined benefit representation in combination with a stronger connection between earnings and entitlements as introduced in the new system. As evident from the preceding sections, a main motivation for describing the new system as defined contribution has been to introduce an accrual coefficient as a share of the income base for pension entitlements to provide the population with better information about this connection. In addition, a shift to a defined contribution representation has also made it possible to incorporate a consistent treatment of mortality before and after the age of retirement.

The original proposal for a reformed pension system from the Pension Commission was based on a defined benefit representation where benefits were normalised to the benefits for persons in the 1943-cohort who retire at age 67 in 2010. The implementation of a defined contribution representation with inheritance of entitlements before the age of retirement thus has some implications for calibration of the accrual rate α_2. By dividing (13) with (5) and equalizing this expression for the annual benefits with what may be obtained in the situation with defined benefits where (12) is inserted in (10), we get the following expression when entitlements are indexed according to wage growth:

$$\alpha_2 = \frac{\beta \cdot e_{1943,67} \cdot \sum_{t=0}^{66} I_t \cdot (1+w)^{67-t}}{\sum_{t=0}^{66} I_t \cdot (1+w)^{67-t} / l_{1943,t,67}} \tag{14}$$

Equation (14) expresses the relation between the accrual rate β with the defined benefit representation, and the accrual coefficient α_2 with the defined contribution representation also including inheritance of entitlements in working age. As a result

of the calibration, the connection is dependent on life expectancy for persons from the 1943-cohort at age 67 in 2010. In the actual calibration (also taking into consideration lower indexation of benefits than wage growth after the age of retirement and smoothing of survival probabilities, aspects not discussed in this paper), this figure is estimated to 15.17.

The ratio between the two terms for summing up in respectively the nominator and the denominator expresses the correction for inheritance of entitlements before the age of 67. This correction means that the accrual coefficient has to be larger to obtain a given level of benefit the later in the working career the earning of entitlements takes place. In (14) the survival probabilities are approaching 1 when earnings take place close to the age of 67. The denominator in (14) then moves towards the summing up term in the nominator.

It is not obvious which profile for earnings over the working age that should be used in the calibration. As there has been a strong growth in participation rates for females during the past decades it would obviously be wrong to base the calibration on the low participation rates for females from the 1943-cohort during the 1970s. The yearly earnings for persons from this and other cohorts from the period before the implementation of the present social insurance system in Norway in 1967 are also unknown. As earnings of entitlements in the new system mainly affect future pensioners we have chosen a cross-section of current earning profiles assuming a retirement age of 67. Based on these assumptions the factor for correction for inheritance of entitlements is calculated to 0.883.

As the Parliament earlier approved an accrual rate of 1.35 per cent when the pension system was described as defined benefits, the corresponding accrual coefficient in the case of defined contributions may be calculated to 18.1 per cent according to (15).

(15) $$18.1 = 1.35 \cdot 15.17 \cdot 0.883$$

The product $1.35 \cdot 15.17 \approx 20.5$ expresses the corresponding accrual coefficient in a defined contribution system if inheritance of entitlements before the age of 67 had not been taken into account. With the originally proposed defined benefit description where inheritance of entitlements after the lower age of retirement were included in the divisor to make decisions about retirement neutral, the accrual coefficient in the corresponding defined contribution description should have been calculated from (9) and (12) as $1.35 \cdot 15.17 \cdot 0.941 = 19.3$, where 0.941 denotes the survival probability from age 62 to 67 for a person from the 1943 cohort.

Effects on pension expenditures from the adopted Norwegian life expectancy adjustment mechanism

The effects on pension expenditures from the adopted Norwegian pension reform, including the life expectancy adjustment mechanism, are analysed by using Statistics Norway's dynamic microsimulation model MOSART. The model is especially designed to analyse the *direct effects* on individual pension entitlements, benefits, and government pension expenditures from changes in the Norwegian public pension system. By *direct effects* we mean effects ignoring behavioural responses and general equilibrium effects, in line with the terminology employed by Gruber and Wise (2004). These direct effects will always be of interest. They constitute the most important elements that may be used as a point of departure for more comprehensive analyses, and the effects may easily be controlled. By using a microsimulation model, it is also possible to calculate distributional effects connected to shifts in the pension system in a consistent way. In addition to the mechanical effects, we have incorporated plausible labour supply assumptions exogenously in the model. Because no corresponding reform of the Norwegian pension system has taken place, it is quite difficult to estimate the effect on retirement behaviour and participation rates for the economic active population. A discussion of plausible alternative responses handled exogenously in the model may thus be convenient.

From a representative sample of the population in a base year, the MOSART model simulates the further life course for each person in this initial population. The life course is simulated by possible transitions from one state to another, given by transition probabilities depending on each person's characteristics. The transition probabilities are estimated from observed transitions in a recent period. Events included in the simulation are migration, deaths, births, marriages, divorces, educational activities, retirements and labour force participation. Public pension benefits are calculated from labour market earnings and other characteristics included in the simulation. Old age pensions, disability pensions, survival pensions and early retirement pensions are included in the model.

The analysis in this paper is based on a representative sample from 1993 that is mainly calibrated to the situation in 2006. The demographic assumptions are in accordance with Statistics Norway's demographic projections from May 2008. A total fertility rate of 1.85 and net immigration decreasing from about 40 000 persons per year at present to about 20 000 persons per year after 2030 imply that the size of the younger and middle-aged cohorts almost stabilizes towards 2050. As a result of the rather high immigration in the nearest future in combination with a further increase in life expectancy at birth of about 6-7 years in the same period,

aggregate population is expected to increase. The assumptions on probabilities for entering disability are based on the observations from 2006 that are close to the average of the fluctuating probabilities during the past 15 years.

There has been a growing propensity to enter early retirement schemes for those entitled to these schemes during the 1990s, and the projections are based on the observed level from 2006. This is also the case for assumptions about participation in the labour force and working hours. The necessary information about distribution of incomes between individuals over the life cycle is based on observations from a longer period. When pension entitlements are indexed by wage growth in the projections, the choice of base year for wages and prices is of minor importance. For convenience the level from 2006 is chosen for the presentation in this paper.

The Norwegian pension reform is expected to stimulate labour supply on the extensive margin by postponing retirement. The interval for old-age retirement in Norway has been fixed in the interval 67-70 years since 1973, but with no actuarial elements most people participating in the labour market at the age of 67 have chosen to retire within a few months after their 67th birthday. Therefore, it has only been possible to make a simple estimate of how retirement age might be affected by a shift towards a more actuarial pension system. However, analyses made by Hernæs et al. (2000), Røed and Haugen (2003), Hernæs and Iskhakow (2009) and Hernæs and Zhiyang (2009) indicate that the former Norwegian early retirement scheme (AFP) favoured early retirement, because there were not any negative consequences for future pension benefits. An inclusion of these provisions in the actuarial part of the new pension system is then expected to have a positive effect on participation rates for elderly workers. Although there is uncertainty about how much retirement age might be increased as a consequence of the reform, this is only of minor importance for the projected effects on pension expenditures as early retirement is counteracted by low benefits.

As the new old-age pension system in Norway also is going to be financed pay-as-you-go, a contribution rate (CR) calculated as the ratio between old-age pension payments (PP) and labour incomes (LI) according to Disney (2004) is a relevant measure for the future pension burden. By correcting for the more lenient taxation of gross pensions than wage incomes in Norway, the contribution rate may be formally defined as:

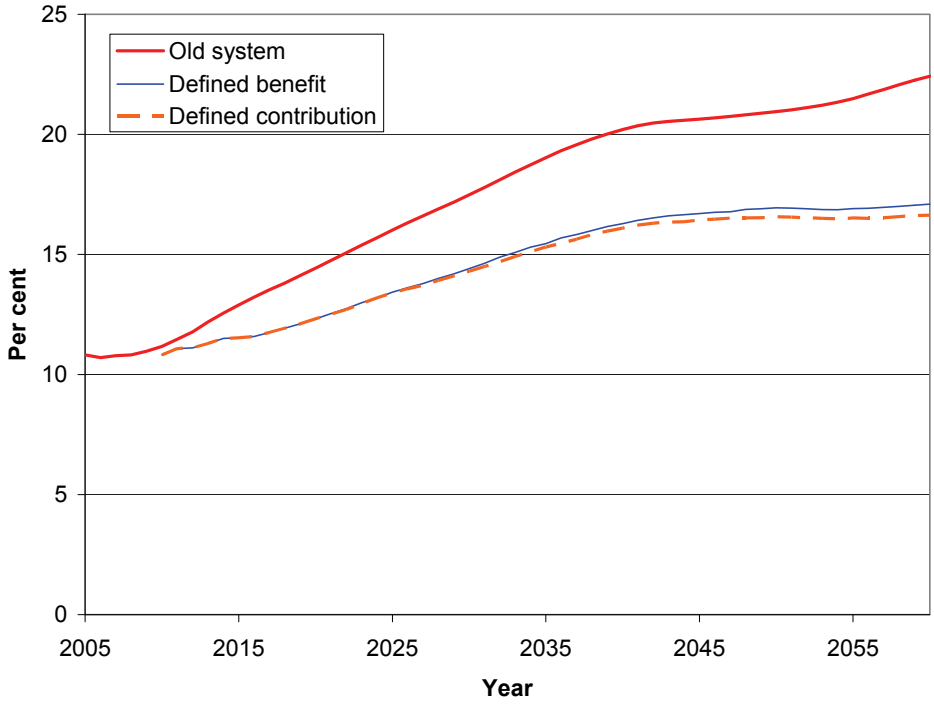
$$CR = \frac{PP}{(LI + \gamma * PP)} \tag{16}$$

The right hand side numerator represents nominal public pension expenditures, whereas the denominator is the relevant tax base. The parameter γ represents the more lenient taxation of pension incomes compared to wage incomes, and is assumed to be 50 percent under the current tax regime. The contribution rate may then be interpreted as the minimum tax rate sufficient to finance the public old age pension expenditures, assuming that the entire tax burden is placed on labour and pension incomes.

The effects on the contribution rate from the pension reform with the chosen DB- and DC-specifications compared with the old system are shown in figure 3. Without any reform the contribution rate for old age pension expenditures was estimated to almost double from the present level of 11 per cent to about 21 per cent in 2050. The increase in the contribution rate is caused by three main factors:

1. Small cohorts of pensioners born in the period between the two World wars are replaced by large cohorts born after the Second World War.
2. A persistent increase in life-expectancy. Remaining life-expectancy at age 62 is presumed to increase by about 4 years from 2010 to 2050.
3. Average pension benefits will increase compared with the wage level because of maturing of the old system regarding the accumulation of pension entitlements and growing labour market participation rates among women during the past decades.

Figure 3: Effects on the contribution rate for old age pension expenditures from respectively a DB and DC design of the new pension system in Norway



As a result of the demographic assumptions and maturing of the pension system, the first and the third factor are estimated to almost stabilize after 2040. The life expectancy adjustment mechanism in the new pension system neutralizes the effects on the contribution rate from factor two. The contribution rate for old age pension expenditures thus seems to stabilize between 16.5 and 17 per cent after 2050 with the new system. Compared to maintenance of the old system, the estimated increase in the contribution rate towards 2050 is reduced by more than 40 per cent. As almost 60 per cent of the increase remains, higher future old-age pension expenditures have to be financed by higher taxes or lower growth in other public expenditures.

Due to the advantageous ratio between the number of employed and the number of old age pensioners the present contribution rate according to this definition is much smaller than the earning of pension entitlements of 18.1 per cent. The contribution rate necessary to finance the payment of old age pensions in the long run is also lower than 18.1 per cent because gross pensions are taxed in Norway and thus included in the denominator in the definition above. Furthermore incomes above the annual ceiling in the accumulation of entitlements are included in the contribution rate, but do not give pension entitlements. Financing of the guarantee pension for people with low incomes, however, works in the opposite direction.

Within the limits chosen for the design of the new pension system in Norway, it is only of minor importance if the system is described as defined benefits versus defined contributions. The main difference is caused by inclusion of inheritance of entitlements before the age of 62 in the latter case. Because of reduced mortality for persons below 62 (corresponding to figure 2) as time goes by, this means somewhat lower expenditures in the defined contributions case in the long run because benefits are standardized against the benefits for the 1943-cohort retiring in 2010. But even in 2050 the partial effect on pension expenditures from this element is only slightly above 2 per cent, and of minor importance for the contribution rate.

Concluding remarks

Strong actuarial elements are introduced in the new national old-age insurance system in Norway. But with financing pay-as-you-go, indexing of entitlements by wage growth and standardization of benefits against the levels in the old system for persons from the 1943-cohort who retire in 2010, important elements from a defined benefit system are maintained. The new system may thus be characterized as ‘quasi-actuarial’. In this system neither pension benefits, nor contribution rates

are exogenous. In combination with demographic assumptions almost stabilizing the size of the different cohorts in younger and middle-aged groups towards 2050, neutralizing further growth in life-expectancy also means an almost stable contribution rate. A shift towards larger cohorts of old age pensioners born after the Second World War and increasing average benefits caused by maturing of the system, have to be financed by higher taxes or met by lower growth in other public expenditures. Under the conditions designed for the new system it is of minor importance if the system is implemented as defined benefits or defined contributions. One modification follows from the treatment of inheritance of entitlements from persons who die before the lower age limit of retirement.

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