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Fiscal Implications of Reforms in Retirement Systems in Denmark

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3.1 Introduction

Like most other OECD countries, Denmark faces a demographic change of major dimensions in the coming decades. The expected change in Denmark is, however, among the smallest among the OECD countries—that is, on the same level as expected in the United States and much lower than the expected increase in some of the countries in southern Europe and Japan. Based on the most recent projection of the population by age, the share of people 65 and older relative to the number of people 20 to 64 years old is expected to go up from 24 percent currently to about 40 percent 40 years from now (Statistics Denmark 2002, Economic Council 1998). This is not the first jump in the share, as it went up from 13 percent in the years immediately after World War II to 26 percent in 1990. This development was, however, more easily absorbed by the economy. For one thing, the initial burden of providing for the elderly was lower. Second, this first jump in the share was accompanied by a strong increase in female labor force participation, to a level close to what is found for men. This, obviously, cannot be repeated during the expected future jump in the share of

people 65 years and older, as the current female labor force participation is close to that of men.

The demographic change has been accompanied by a change in retirement behavior, implying a significant decrease in the actual average retirement age. Comparing estimates from the mid-1970s to behavior in the late 1990s, before current reforms of the early retirement programs were enacted, the average retirement age for men has gone down from about 66 years to 61 to 62 years. For women, the average retirement age has gone down by about one year since the late 1980s. Women retire on average earlier than men, but the more moderate decline in the retirement age among women reflects the net effect of cohorts of married women with increasing labor market participation along with a decrease in the average retirement age (Economic Council 1998). Over this period, the official retirement age, defined as the age at which individuals are entitled to National Old Age Pension, has remained unchanged at 67 years. The decline in the actual average retirement age has occurred along with the introduction during the last 23 years of new public-sector subsidized programs for early retirement. At the same time, private pension plans and arrangements that typically contain options for early retirement, beginning at age 60, have become relevant for many people.

The projected changes in the age composition of the population along with changes in retirement behavior have potentially large consequences for public sector finances. In the Danish context, in a number of recent studies the full impact on the tax-to-GNP ratio has been estimated to be between 4 and 9 percent (Socialkommissionen 1993, Finansministeriet 1996, Finansrådet 1998, Economic Council 1998).

In this chapter, we quantify the impact of reforms to the social security system on the government's solvency situation for a particular cohort of workers aged 50 in 1995. The set of reforms considered are selected mainly for their comparability across OECD countries, and are not necessarily the most desirable or politically feasible in the context of Denmark. Nonetheless, the exercise is expected to yield some useful insights into the net effects on the government budget of changing social security provisions. The set of reforms we consider are compared to the system that was in place in 1995, the base year for our simulations, and include a mandatory increase in program eligibility ages, a move to an actuarially fair system, and the implementation of a simple unified system that is common across countries.

In the second section, we provide evidence on the decreased labor supply activity among the elderly in Denmark by surveying the main trends in the labor force participation of men and women over 45 years of age. We also review the basic institutional elements of the Danish retirement system. The Danish retirement system is a complex mix of pay-as-you-go-financed old-age pension, tax-financed social disability pension, with eligibility depending on a mix of health and social criteria, early retirement as part of

labor market policy, funded labor market pensions, and a broad range of private pension arrangements. We emphasize the retirement incentives inherent in this broad range of programs and consider their impacts on retirement behavior. Finally, we review implications for the fiscal position of the growing dependency burden. Section 3.3 presents the basic model used for the simulations of the impact of reforms in retirement systems on the net fiscal contribution of older workers. Section 3.4 describes the simulation methodology and the particular issues that arise in its implementation in the Danish case, section 3.5 presents the findings from the simulation exercise on the main fiscal impacts of proposed policy reforms, in terms of expected changes in the present discounted value of tax receipts and benefit payments, and section 3.6 concludes.

3.2   Labor Supply of Older Workers and Retirement Systems in Denmark

3.2.1   Work Behavior of the Elderly

The very big changes in industrial structure along with changes in retirement programs and pension options for different groups have shaped the long-term development in participation rates. Another factor with a big impact, especially in the Nordic countries, has been the long-run trend toward increasing labor force participation among married women.

Figure 3.1 shows the trend in labor force participation since 1960 among men older than 44 years. The observation for 1975 is the first year with high unemployment in the graph. The first three observations refer to years of full employment in a period of big structural changes. There was a large move out of agriculture, implying a reduction in the share of self-employed men in these age groups. People in independent business have always had a relatively high retirement age, so this structural shift in the economy is part of the explanation for the declining participation rates in the beginning of the period covered in figure 3.1.

After 1975 there follows 20 years of high and mostly increasing unemployment until the mid-1990s. The participation rates among men 45 to 59 years old decline further, reflecting, among other things, an easier entry to Social Disability Pension (SDP) during a high unemployment period. It is evident, however, that the really large changes occur in the age group 60 and older, and especially so among people in the first half of their 60s. This reflects primarily the introduction in 1979 of a labor-market-related program for early retirement at the age of 60. The program, called the Post-Employment Wage (PEW) was intended for unskilled workers with many years of hard physical work behind them, but it turned out to become much more broadly popular than initially expected. We return to the details of the program in the following.

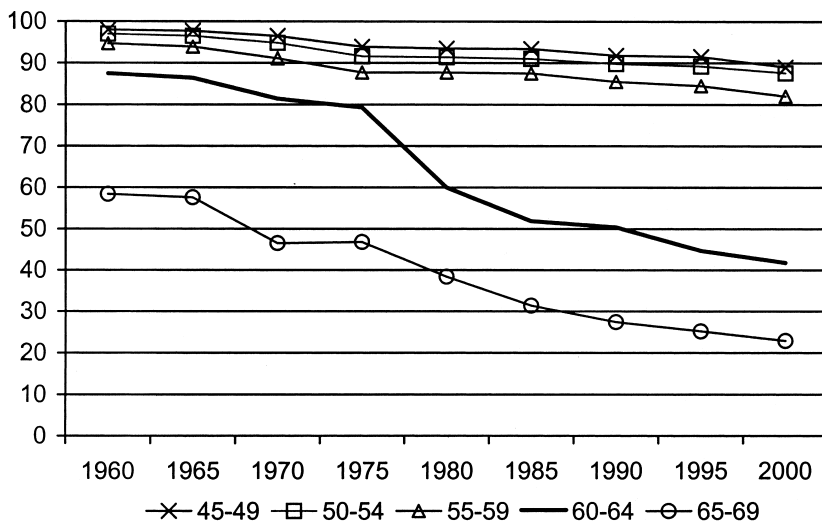For women 45 years and older, figure 3.2 presents a quite different pic-

Fig. 3.1   Participation rates for men 45 years and older, 1960–2000
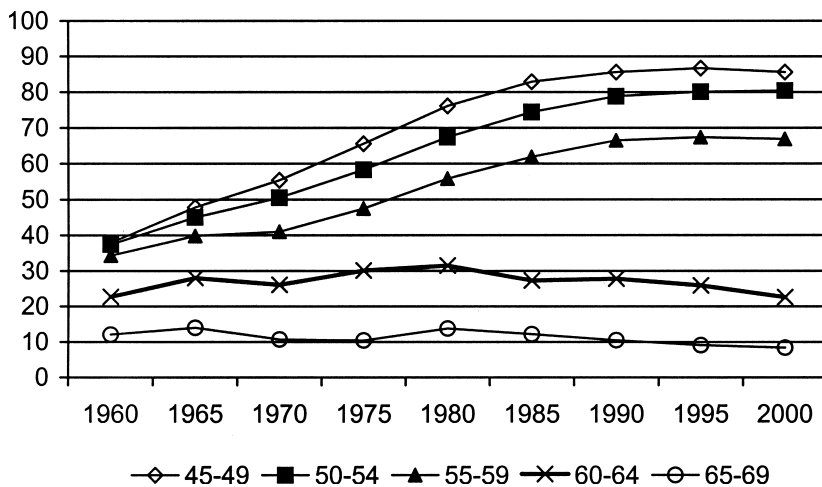
Fig. 3.2   Participation rates for women 45 years and older, 1960–2000

ture. The difference obviously relates to the strong increase in labor market participation among married women, which did not level out until the late 1980s.

The increase in participation in age groups up to 59 years until the mid-1990s reflects cohort effects. For those 60 years and older, the cohort effects are counteracted by the possibility of entry into the PEW program and
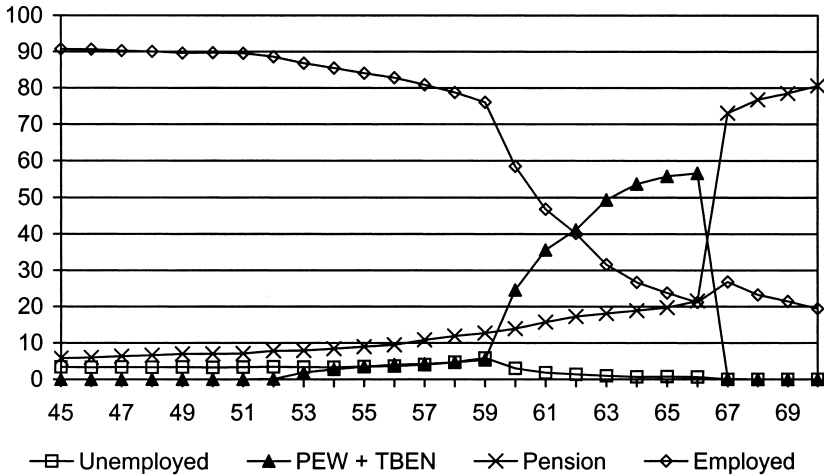
Fig. 3.3   The distribution of men on activities, 45–70 years, 2000

Fig. 3.4   The distribution of women on activities, 45–70 years, 2000

from extended possibilities to enter the SDP. The decline in participation rates is much smaller among men, but note that the participation rate among women 60 and older never reached near the initial level among men in this age group. For people up to the age of about 50, figures 3.1 and 3.2 show, on the other hand, a near complete convergence between the participation rates for women and men from the mid-1980s.

For the year 2000, figures 3.3 and 3.4 further illustrate the distribution of men and women according to a number of activities. For both women and men there is a distinct kink in the share in employment from age 60,

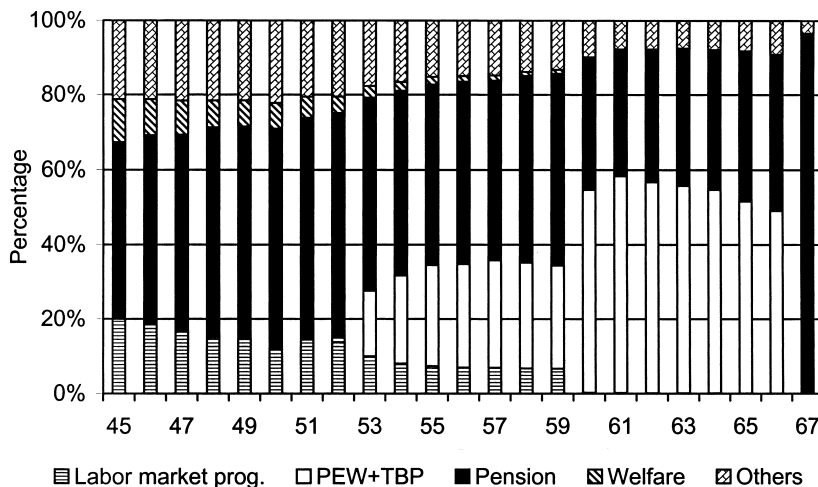**Fig. 3.5   Distribution of women 45–67 years old outside the labor force on different states in 2000**

when a major part of the labor force becomes eligible for PEW. A corresponding decrease occurs in the share in unemployment from age 60. For women, there is a stronger decline in the employment share from age 50 to age 59 than among men. More women (52 and older) are in a temporary benefit program for early retirement, called the TBP program, which is described later. More important is the fact that the share of women with SDP in their late 50s is nearly double the level found among men. Fewer women than men fulfill the eligibility criteria for PEW. As a reflection of this, we note that the share of women with SDP at age 66, after which everyone becomes eligible to old age pension, is double the level found for men. From age 67, old-age pension takes over as the dominant state. Still, however, there is a gender difference here, as about 20 percent of the men still have a market income as the dominant income source at age 70.

While figures 3.3 and 3.4 include individuals in the labor force and in retirement programs, figures 3.5 and 3.6 concentrate on the distribution on different states of individuals outside the labor force between 45 and 67 years old.

Individuals in labor market programs and individuals on welfare benefits may return to the labor force. The other states included in figures 3.5 and 3.6 are approximately absorbing.

Most individuals outside the labor force have an income from a labor market program, from welfare, or from one of the early retirement programs. The ages of eligibility are clearly visible; that is, in 2000 it was 53 for the TBP program and 60 for the PEW program. In principle, people older
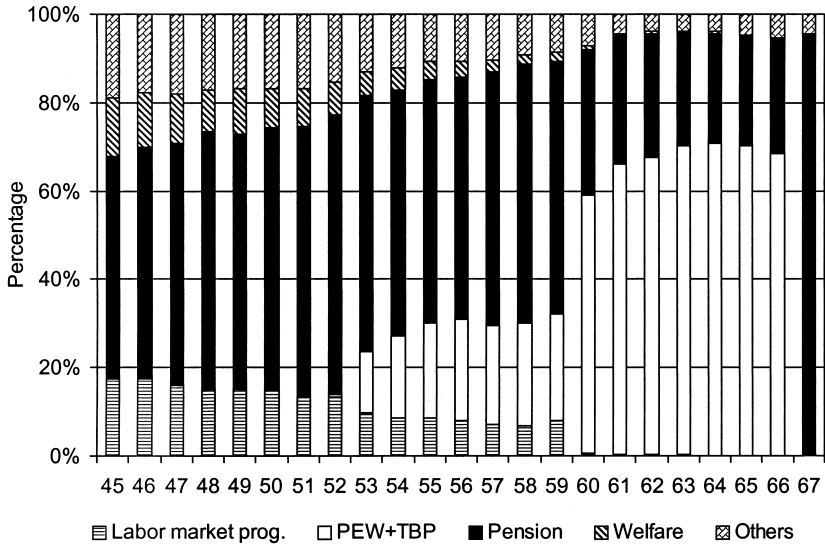
Fig. 3.6   Distribution of men 45–67 years old outside the labor force on different states in 2000

than 60 are not cut off from labor market programs or from being eligible for welfare. In practice, however, figures 3.5 and 3.6 demonstrate that alternative states become completely dominant from that age.

3.2.2   Retirement Programs in Denmark

By international comparison, the official retirement age in Denmark is high. Until 1998 it was, at 67, one of the highest in the OECD countries. Along with a reform in 1999 of a major early retirement program, the PEW, the official pension age was reduced to 65 years, effective from 2004.

The structure in the Danish pension and retirement system consists of a number of public-sector programs and private arrangements. The major public sector-financed programs consist of the National Old Age Pension (OAP, Folkepension), Social and Disability Pension (SDP, Førtidspension [until 1984 Disability pension]), and pensions to certain groups of public employees in permanent positions—the Public Employees Pension scheme (PEP, Tjenestemandspension).

There are two important mixed public/private sector arrangements. The biggest is a labor-market-related program open for people 60 to 66 years old, called the Post Employment Wage (PEW, Efterløn). Another is the ATP program, to which employed persons and their employers, both public and private, contribute.

Private-sector arrangements cover a broad range, from mature pension

funds, other funds in the blue collar part of the labor market still in a build-up phase, and fully individual arrangements, of which most are tax subsidized. We describe the different programs briefly in the following.[1]

3.2.3   National Old Age Pension (OAP, Folkepension)

The OAP is in principle a universal program in the sense that eligibility depends only on age and on the duration of stay in Denmark. Thus, it is not dependent on labor market experience or former earnings. Depending on the level and the type of other income, a person is entitled from the age of 67 to a base amount and to pension supplements. The base amount is, however, means tested against earnings from work. Until the 1999 reform, the pension age was 67 years and the base amount was reduced, with 60 percent of eventual earnings from work in excess of an amount roughly corresponding to earnings in a fulltime job during the whole year at the minimum wage.[2]

The *reduction* of the official pension age in 1999 from 67 to 65, effective from 2004, appears as slightly paradoxical in relation to current policy discussions in most OECD countries of *increasing* the retirement age. The intention in the 1999 reform was, however, exactly to result in an *increase* in the *average* actual retirement age (currently around 61.5 years) at the same time as the official pension age was reduced. It was part of a policy package primarily directed toward the PEW. We return to complete this picture later. The reduction in the official pension age regarding the OAP was accompanied by more liberal rules regarding means testing of the base pension amount against earnings from work. In the future, the reduction percentage will be 30 percent of income from work in excess of annual earnings, corresponding roughly to the average annual income from an unskilled job. The impact from this change on retirement behavior is difficult to estimate in isolation, as by now people who are still in the labor force when they are 65 and older will typically have incomes well above the relevant part of the income scale regarding means testing. The eventual impact should be seen, however, in conjunction with the impact on retirement behavior and attitudes from changes in the PEW proposed in 1998 and enacted in 1999; see the following.

In addition to the base amount in the OAP, which as described is means tested against income from work, there is a pension supplement that is means tested against all other income, that is, also capital income. The rules regarding means testing of the pension supplement were not changed as part of the 1999 reform.

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1. A discussion of the ongoing policy reforms in this area can be found in OECD (2000).
2. Actually, this is a description of the rule until the mid-1990s. During the last few years, until the 1998 reform, the free earnings maximum (the exemption) before reduction of the base amount was gradually increased.

3.2.4   Social Disability Pension (SDP, Førtidspension)

The main principles behind the rules for the SDP were enacted through a major reform in 1984 of the public sector programs regarding early retirement. The SDP was intended to replace a number of earlier programs. The biggest among these was the disability pension, which could be granted on three levels according to health criteria. Other programs, which were included into the SDP, were a public-financed program for widows' pension and a program for early OAP for persons whose (older) spouses were already receiving the OAP.

SDP on medical or social criteria can be granted on three levels. The highest level is applicable to persons younger than 60 whose work capacity has been (or always was) reduced to almost nothing. The intermediate-level SDP is open for those younger than 60 with a work capacity reduced to one-third of the normal level and to people 60 to 66 years old with almost no remaining work capacity. Eligibility for the highest and the intermediate-level SDP is decided on medical criteria. Finally, eligibility for the lowest level, the so-called ordinary-level SDP depends on work capacity having been reduced to below half the normal level. The evaluation of this is based on health criteria or on a combination of health and social criteria. Recipients of the ordinary-level SDP who are younger than 60 are entitled to a supplementary amount. Granting of the ordinary-level pension is dependent on rehabilitation having been considered or tried without success.

In principle, award of SDP depends on an application being decided on relative to a set of medical and social criteria. SDP is thus not an individual option like eligibility—for example, labor-market pension from a specific age. SDP consists of a number of components. Parallel to OAP, it includes a base amount and an additional pension amount. Furthermore, SDP can include supplementary amounts, depending on the level of the SDP that has been granted. A Work Inability Amount is granted to people on the highest SDP level. People in that group, along with people granted the intermediate-level SDP, receive further a Disability Amount, while—as mentioned earlier—persons younger than 60 granted the ordinary-level SDP receive a supplementary, so-called Compensating Amount. The SDP system is quite complex, as the rules differ regarding tax treatment and regarding means testing of the different components and amounts. In 2003 a reform was enacted that made the program simpler.

3.2.5   Post-Employment Wage (PEW, Efterløn)

In contrast to the SDP the PEW scheme, introduced in 1979, provides the possibility of early retirement without having to fulfill any health criteria. It was intended to be a labor-market policy instrument with the purpose of creating jobs for young people by reducing the retirement age for

older workers. The PEW can be entered both from employment and from unemployment. To be eligible, a person must be between sixty and sixty-six years, have been a member of an unemployment insurance (UI) fund for 20 of the previous twenty-five years, and be eligible for UI benefits. If a person enters directly from a job, benefits in the PEW system are equal to the amounts to which she or he would be entitled in case of unemployment. This is for a maximum of 2.5 years, after which period benefits in the program are reduced to 82 percent of the UI benefits until reaching eligibility for the OAP. The only difference in the situation for a person who is entering PEW from unemployment is a reduction of the period with full UI benefits by the length of the spell of unemployment, which became terminated by entry into the program. Participants in the program are only allowed paid work up to a maximum of 200 hours per year. The benefits in the PEW program are not means tested against the income of other family members, but income from pension schemes from previous employers are deducted from the PEW benefits. The SDP cannot be collected at the same time as PEW. Finally, it should be mentioned that the PEW was introduced as a no-regret system, in the sense that a participant returning to the labor force could not reenter PEW at a later date.

In 1999 a fairly complicated reform of the PEW was enacted. In the following we describe the main features of this reform. A number of transitory arrangements are not covered. The age of eligibility is still at 60, but incentives were introduced to postpone entry until the age of 62 or later. At the same time, as part of the reform, the eligibility age for the old-age pension was reduced from 67 to 65. To become eligible for PEW after the reform, an individual is required to have been in an unemployment insurance fund for 25 out of the last 30 years, and to have paid an early retirement benefit contribution during this period.

If PEW is entered before the age of 62, benefits are reduced not only against actual income from other pension schemes but also against an actuarial calculation of the current value of the income stream from private pensions, which are postponed. Before age 62 benefits are 91 percent of the maximum unemployment benefits.

Entry from age 62 results in higher benefits and more favorable rules regarding means testing against other pension incomes. Furthermore, postponing retirement for two years or more from age 62 implies a tax discount maximized at a little above 100,000 Danish Kroner (13,800 €). Finally, the rules have been changed, making it more attractive to continue working at the same time as collecting PEW. The reform has so far resulted in a decline in the takeup of PEW for those 60 to 61 years old (see Economic Council 2002). The initial impact on retirement is analyzed using microdata by Danø, Ejrnaes, and Husted (2000) and Quaade (2001). The impact from a minor reform in 1992 is analyzed in Larsen (2005).

3.2.6   Transitional Benefits Program (TBP, Overgangsydelse)

This program was introduced in 1992. Eligible persons for entry were initially 55- to 59-year-old members of unemployment insurance funds who had been unemployed for at least 12 out of the most recent 15 months. Benefits were set at 82 percent of maximum unemployment insurance benefits and the maximum duration was until transition to PEW at the age of 60. From the beginning of 1994 the program was extended to cover the age group 50 to 54 years, with the same labor market criteria as for the 55- to 59-year-old group. Entry to the program was terminated at the beginning of 1996. Entry to the program surpassed projections, as was also the case when the PEW was introduced, in 1979.

3.2.7   Public Employees Pension Scheme (PEP; Tjenestemandspension)

The PEP is a program covering many employees in the public sector. The pension is considered to be part of a lifetime wage contract, and consequently is unfunded. The pension amount is calculated as a function of the wage, depending on seniority and position.

3.2.8   Labor-Market Pensions (LMP)

There is a wide and expanding coverage of LMP programs. The building up of pension funds began some 40 years ago for fairly small, highly educated groups. Coverage has since broadened; during the last decade a major part of the labor market for blue collar workers has also been covered with pension plans. Typically, the pension funds build on defined contributions of either 15 percent (high-wage groups) or 9 percent (industrial workers) of their annual earnings.

3.2.9   Other Programs

The General Labour Market Pension (ATP) is a small, supplementary program to OAP. It was introduced in 1964 and is being funded by contributions, which depend on hours of work. Finally, there is a broad coverage with private pension plans, mostly into some broad categories of savings arrangement, which until recently have been treated quite favorably by the tax rules.

3.2.10   Fiscal Implications of the Growing Dependency Burden

As reported in section 3.1, in the coming years the dependency ratio in Denmark is expected to go from the current four persons in the active age group per senior citizen (65 or over), to about 2.5 in 2040. Further, the proportion of very old persons (80 years and above) is expected to double in the years to come, from its current 5 percent of the working-age popu-

lation to about 10 percent. The Economic Council (1998) has calculated the economic implications of the growing number of senior citizens, using a general equilibrium model. The findings show that expenditures on public pensions, nursing homes, and so on are expected to increase considerably. The decrease in the labor force will affect production and decrease the tax base. However, at the same time, tax revenue will increase due to greater taxable income being paid out from labor market and private pension schemes. Projections show that overall taxes must increase by 9.4 percent of GDP for the period 2005 to 2035. Other studies (Socialkommissionen [1993], Finansministeriet [1996], Finansrådet [1998]), find significantly lower increases in the tax/GDP ratio; that is, between 4 and 6 percentage points. While the calculations in the Economic Council (1998) take into account the changing demographic profile of future generations, and the growing importance of labor market pension schemes in future pensioners' income, no attempt is made to model retirement behavior, and all persons are assumed to leave the labor market at the age of 62 and to receive PEW income until the age of 67, when they start to receive old-age pension and income from pension funds. The most recent projection is made by the Velfaerdskommissionen (Welfare Commission [2004]), illustrating the importance of the assumptions regarding expected lifetime in the future. The base projection, assuming an expected lifetime increase, in accordance with the experience in recent decades and assuming no behavioral changes, results in a necessary increase in the basic income tax of 8.7 percentage points for fiscal policy to be long-run sustainable. Assuming instead, unrealistically, that no further increase occurs in expected lifetime, the necessary increase in the tax rate is only 1.6 percentage points.

In contrast, the approach taken here is to use the predictions arising out of a behavioral model of the retirement decision in which workers make forward-looking comparisons of the advantages of retirement at alternative ages in the future to the value of present retirement and update that information as they age. These predictions are then used to simulate the effects of strategic reforms of the pension system on the net fiscal contribution of older workers to retirement income finances. Of course, the analysis is limited to the implications of reform for a given (recent) cohort of older persons, and the given structure of the Danish pension and retirement system, in which old-age pensions from the government are the primary source of income for pensioners. In the future, most pensioners are expected to receive the greater part of their income from labor-market pension schemes. This will imply both higher mean income and a greater expected level of income dispersion among future pensioners. The Economic Council's (1998) calculations suggest that the median income of future pensioners will be around 40 percent higher than the income of today's pensioners. At the same time, however, a relatively large group of future

pensioners will be without a private pension scheme and will have the same income level as today's pensioners. Those pensioners who were employed full-time throughout their careers are expected to make up the higher end of the income distribution, while people who were periodically unemployed or held part-time employment during their working life will constitute the middle of the income distribution, and those with only a loose attachment to the labor market will make up the lower end of the retirement income distribution.

With this background of the Danish pension and retirement system in mind, we turn in the next section to the exercise in which we focus on the retirement decisions of a recent cohort of older workers, simulate the effects of changes in plan provisions on the retirement decisions of these workers, and then track how changes in retirement patterns affect the fiscal balance sheet of retirement income for the current generation of older workers.

3.3   The Base Model for the Simulations

The data set used in the analysis is a 2 percent sample drawn from the Integrated Database for Labour Market Research (IDA), which covers the population of residents of Denmark. All information in the IDA data, which is compiled and made available by Statistics Denmark, is based on administrative registers and therefore has no survey component to it. We focus on a single-year birth cohort, that is, the 1945 birth cohort that is observed to be aged 50 in 1995, thereby controlling for both time and age effects in the analysis. Although early retirement eligibility begins first at age 60, we start our analysis at 50, as this is the age at which public or private retirement income for disability or illness can first be expected for those in the labor market. We condition on labor force attachment before 50, as most of the population in Denmark is employed at that age. Our sample sizes for the simulations are 1,533 individual workers. Each of the workers of age 50 in our sample represents 50 workers in the population of public and private sector workers born in 1945.

For each of the workers at age 50, we predict earnings forward for each year until age 70. Age 70 is the age at which all workers still in the labor force are assumed to exit the labor force permanently through retirement. On the basis of predicted earnings, we can then project each worker's social security wealth (SSW) at each possible future retirement age until age 100. As exit from the labor force can also occur through death, we account for mortality by applying the probability of dying taken from the age-gender life tables in 1995 for the total population. Workers in our sample can exit the data either through retirement, death, or attrition. We can identify when the first two types of exits occur, but cannot identify the reason behind the third type of exit (i.e., death or out-migration). Therefore, we use

external population mortality rates in order to adjust the statistical sample for death. In equation form, we have, then:

$$\text{prob(exit)} - \text{prob(death)} = \text{prob(retirement)}$$

As our overall goal is to simulate the impact of reforms to retirement systems on the retirement behavior of older workers, and then to calculate the effects of changed labor supply behavior on the net contribution of older workers to retirement income finances, we start by presenting our estimates from an option value behavioral model of retirement, in which workers make forward-looking comparisons of the advantages of retirement at alternative ages in the future to the value of present retirement and update that information as they age (see Gruber and Wise [2004] for details on that model).

The option value model was operationalized by a simple probability model of retirement (for example, probit):

$$\text{Prob(retire in year } t) = \text{Pr}[\alpha + \beta G_t(r^*) + \delta \mathbf{X}_t + \varepsilon_t > 0],$$

in which the dependent variable is binary and takes the value 1 if retired, 0 if not, and where $G(\cdot)$ is the option value of postponing retirement (in other cases, the peak value or the accrual measure) calculated under the assumed parameter values, and $\mathbf{X}$ is a vector of additional variables, including SSW.

In tables 3.1 and 3.2, we present model estimates of β and the coefficient of SSW (included in $\mathbf{X}$) for samples of male and female older workers drawn from the IDA. Each regression is run in two ways, with age entered either linearly or captured by a full set of dummies, for each of the three incentive measures mentioned earlier, accrual (one-year change in SSW), peak value (the financial option value) and option value.

Model estimates from the sample of males are shown in table 3.1. The

Table 3.1   **Estimates from the retirement probit—males sample**

	Accrual incentive		Peak value incentive		Option value incentive	
	Linear age	Age dummies	Linear age	Age dummies	Linear age	Age dummies
SSW	0.0023437	0.0000568	0.0021998	0.0009605	0.0020257	0.0009254
	(0.000122)	(0.0001361)	(0.0001238)	(0.0001306)	(0.0001252)	(0.0001325)
	0.001838	**4.12E-06**	**0.0001363**	**0.000075**	**0.0001235**	**0.0000716**
Incentive	0.0036759	−0.0355246	−0.0159361	−0.0050171	−0.0112939	−0.0041719
measure	(0.000608)	(0.0008928)	(0.0002211)	(0.000312)	(0.0001574)	(0.0002204)
	0.0002882	**−0.0025742**	**−0.0009874**	**−0.0003915**	**−0.0006887**	**−0.0003228**
Pseudo R^2	0.29	0.3658	0.3104	0.321	0.3117	0.3217
Log likelihood	−44,879.02	−40,085.73	−44,763.012	−44,077.778	−43,327.098	−42,699.919

Note: For each incentive measure, we report the estimated coefficient, its estimated standard error in parentheses, and the marginal effect in bold.

Table 3.2   **Average retirement ages in simulations—males and females**

		Simulated reform			
	Baseline	Three-Year Reform	Difference from baseline	Common Reform	Difference from baseline
Males					
Accrual—S1	60.44432	60.28469	−0.15963	60.38432	−0.06000
Accrual—S2	60.27340	60.64349	+0.37009	60.95542	+0.68202
Accrual—S3	60.27340	62.28802	+2.01462	59.60625	−0.66715
Peak value—S1	60.76490	62.12958	+1.36468	61.18836	+0.42346
Peak value—S2	60.68337	61.23892	+0.55555	61.08496	+0.40159
Peak value—S3	60.68337	62.57302	+1.88965	60.09098	−0.59239
Option value—S1	60.77458	62.16372	+1.38914	61.23221	+0.45763
Option value—S2	60.69852	61.32813	+0.62961	61.13278	+0.43426
Option value—S3	60.69852	62.59626	+1.89774	60.14049	−0.55803
Females					
Accrual—S1	60.44432	60.28469	−0.15963	60.38432	−0.06000
Accrual—S2	60.27340	60.64349	+0.37009	60.95542	+0.68202
Accrual—S3	60.27340	62.28802	+2.01462	59.60625	−0.66715
Peak value—S1	60.76490	62.12958	+1.36468	61.18836	+0.42346
Peak value—S2	60.68337	61.23892	+0.55555	61.08496	+0.40159
Peak value—S3	60.68337	62.57302	+1.88965	60.09098	−0.59239
Option value—S1	60.77458	62.16372	+1.38914	61.23221	+0.45763
Option value—S2	60.69852	61.32813	+0.62961	61.13278	+0.43426
Option value—S3	60.69852	62.59626	+1.89774	60.14049	−0.55803

level of SSW, which captures the wealth effects of retirement income, significantly positively affects the retirement probability, while in all but one case (accrual-linear age), the relevant incentive measure that measures the incentive to continue working significantly negatively affects the odds of retiring. In general, the age dummy specification fits the data a little better than the specification in which age is entered linearly. Specifications that employ forward-looking incentive measures (peak value and option value) fit the data better than using the one-year accrual incentive measure. Thus, observed retirement behavior is better explained by incentive measures that take into account the potential future benefits of continuing work. Similar results are obtained for the sample of females (not shown here).

Based on these model estimates, we map each worker's actual characteristics into a probability of retirement. Then, we simulate the impacts of three strategic reforms of the retirement system on the predicted probabilities of retirement. The first, the Three-Year Reform, involves a three-year delay in the early and normal ages of retirement. Thus, the age of first eligibility of postemployment wage (PEW) and early retirement through the Public Employee's Pension (PEP) is increased by three years (from 60 to 63), and the age of first eligibility of Transitional Benefit Program UI (TBP) is also delayed by three years, from 55 to 58. The normal old-age

pension (OAP) retirement age is increased by three years. The age-gender-specific probability of disability for those aged 60 to 62 is assumed to be that probability observed in the data at age 59, and for those aged 63 to 70 the age-gender-specific probabilities are those observed in the data for individuals three years younger.[3]

The second, the Common Reform, is intended to apply a unified system in each country, in which the early retirement age is set at 60, the normal retirement age at 65, and in which benefits are set equal to 60 percent of (capped) lifetime earnings and are reduced actuarially 6 percent per year if taken before 65, and increased actuarially 6 percent per year if taken after 65. No other retirement program is assumed to be in effect alongside.

The third reform, the Actuarial Reform, implies a move to an actuarially fair system without changing the early or normal retirement ages or the replacement rate and without removing coexisting means-tested programs such as disability or public employers' pension. Thus, this reform is a compromise between the Three-Year Reform and the Common Reform and should thereby be useful in understanding the full impact of the Common Reform. Under this reform, the benefit at NRA is kept at its existing level and adjusted 6 percent per year actuarially away from this level, as in the common case.

In each case, we specify a model with age-specific dummy variables, doing the simulation in each of three ways: S1 is the simulation method in which a linear-age term is included in the estimation only; S2 is the simulation method in which the age dummies are included in the estimation but not in the simulation, and S3 is the simulation method in which age indicators are both used in the estimation, and the estimated coefficients on these indicators are used to simulate retirement under program changes. The resulting baseline and simulated average retirement ages in the Danish case are presented in table 3.2.

Average retirement ages for the male sample in table 3.2 show that the three-year eligibility delay under the Three-Year Reform increases the average age of retirement by nearly two years in Denmark for all incentive measures using S3 assumptions. Comparing across simulation methods S1, S2, and S3, we find that in general (except for the accrual case), the increase in the average retirement age is greatest under S3 and smallest under S2, while S1 falls in the middle. It is to be expected that S3 will predict later retirement than S2 and S1, as S3 includes both age-indicator effects and program incentive effects. For the Common Reform, in the Danish case the average retirement age is lowered under S3 assumptions, most likely due to the relative generosity of the Common Reform compared to the existing system. Again, S3 predicts a bigger decrease in the retirement

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3. At the same time, we adjust the age at which the supplement for delayed retirement to PEW is effective from 63 to 66.

age than S2 and S1 for the reasons stated previously. Findings for females are nearly the same as seen in the bottom rows of table 3.2.

3.4   Simulation Methodology

Based on the predicted retirement rates generated under the current system and under each reform, our goal is to compute the associated tax revenue and benefit payments corresponding to the retirement patterns under the baseline, and then compare that to the projected tax revenue and benefit expenditure for each hypothetical change in plan provision. Thus, the key policy parameter will be the percentage change in the net cost of the retirement program for a representative individual (aged 50 in 1995) drawn from our sample of workers.

Note that in the implementation of this exercise, we do not use actual data for the workers in our sample, because this is the only way we can obtain a clean comparison of the expected outcome under the current system and the expected outcome under a change in pension plan provision. We merely take our sample of workers and apply to them the estimated retirement probabilities generated from our option value analysis, and use these as the starting point for producing a time series that tracks the evolution of this cohort of workers between age 50 and 100, the assumed date of death of the last remaining individual in the sample. Note that we do not keep track of survivors or dependents in the analysis. This is because the Danish retirement income and taxation calculation is purely individual based, so that accounting for dependents' and survivors' income is not a relevant issue.[4]

The presence of multiple retirement programs in the Danish context, however, introduces some complexity, which is solved by assuming that individuals take the most financially lucrative path by constructing a weighted incentive measure, in which the weights are the probabilities that the person is eligible for each program.[5] When simulating the reforms, the issue of eligibility to programs such as unemployment and disability needs to be addressed. While we increase all other eligibility ages (PEW, OAP, PEP, and TBP) by three years under the first reform, as disability benefits are available at every age in Denmark, we adjust the age-gender-specific probabilities of disability receipt so that they are the same as the observed probabilities of individuals three years younger. In the case of the Actuarial Reform, we retain the probabilities of disability receipt at each age but

---

4. The only element of joint taxation present in the Danish tax system is in the treatment of capital income, for which data is not available. Other than that, we account for allowances that vary by marital status, but do not need to use actual spousal income for computing individual tax or benefit amounts.

5. A more detailed description of the algorithm used to construct this weighted-average SSW can be found in the appendix to the introduction in Gruber and Wise (2004).

adjust the disability benefit 6 percent per year actuarially away from the NRA (67). In the Common Reform, we eliminate access to any other (including disability) programs.

The focus of the analysis will be to distinguish the effects on fiscal balances of the labor-supply response to the reform, which we label *fiscal implications of behavioral effect,* from the effects on fiscal balances that arise purely out of a change of benefit entitlements, holding constant any labor-supply response, which we term the *mechanical* effect. The total fiscal impact is then the sum of both effects. That is, if i denotes individual and s denotes state (exit to death or retirement at each age) and B is base and R is reform,

$$\text{base SSW} = \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{B} SSW_{is}^{B},$$

$$\text{reform SSW} = \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{R} SSW_{is}^{R},$$

$$\text{total effect of reform} = \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{R} SSW_{is}^{R} - \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{B} SSW_{is}^{B},$$

$$\text{mechanical effect} = \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{B} SSW_{is}^{R} - \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{B} SSW_{is}^{B},$$

$$\text{behavioral effect} = \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{R} SSW_{is}^{R} - \sum_{i=1}^{N} \sum_{s=1}^{40} P_{is}^{B} SSW_{is}^{R}.$$

Note that in our case, potential retirement ages go from 50 to 69, giving $2 \times 20 = 40$ possible states.

3.5   Results

The expected present discounted value (PDV) of tax payments and benefit payments for our sample of workers is computed from age 50 to age 100.[6] Results are based on the forward-looking incentive measures only (peak and option value) in this study, although in Gruber and Wise (2004), a set of results for one-year accrual in SSW were also generated. For most countries, it was found that accrual and peak value produced similar results. Also, in this study, we mainly discuss the findings arising out of the two simulation methodologies S1 (linear age) and S3 (age dummies included in the model and shifted in the simulation), although results for S2 are presented in the tables. These results appear in appendix figures 3A.1 to 3A.8, figure 3.7, and tables 3.3 and 3.4.

Consider first the set of figures labeled figure 3A.1, panels A–C (S1OV), which describe the option value, linear age specification results under the

6. All pension flows and tax payments are discounted back to age 50 by a 3 percent real rate of interest.
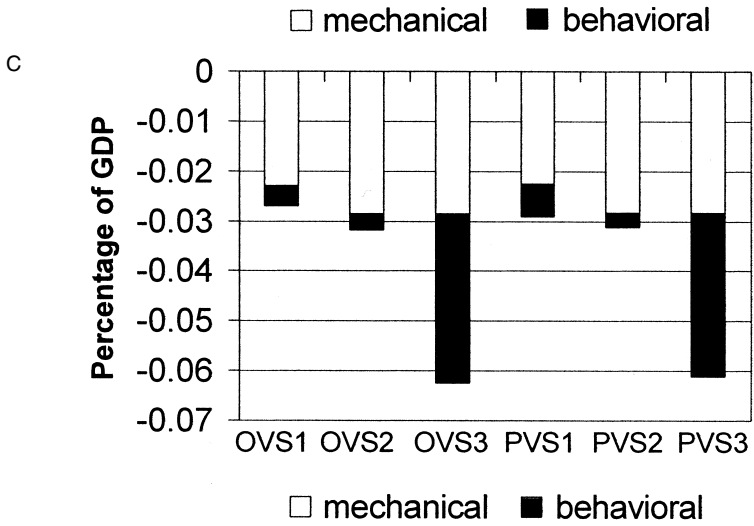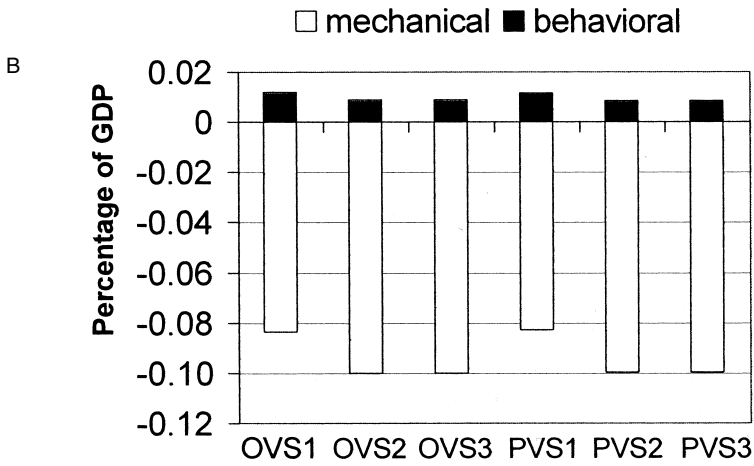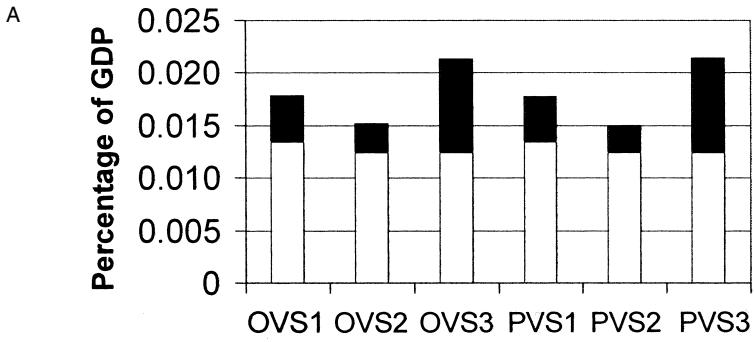
Fig. 3.7 *A,* Fiscal impact of Three-Year Reform; *B,* Fiscal impact of Actuarial Reform; *C,* Fiscal impact of Common Reform

three reforms. From figure 3A.1, panel A (S1OV), it appears that the gross SSW profile changes little under the Three-Year Reform, as entitlements do not change, only the age at which they can be first received. In figure 3A.1, panel B (S1OV), for the Actuarial Reform, note that gross SSW peaks at age 60 (age of first eligibility of early retirement) under the baseline and declines thereafter, though flattening out from age 66 and over. The decline in gross SSW under the baseline clearly reflects the actuarial unfairness of the benefits system, as gains in earnings from postponing retirement are largely offset by losses in future social security benefits. Gross SSW is considerably lowered for all ages up to 64 under the Actuarial Reform, and is higher thereafter compared to the baseline. Thus, the reform is more actuarially fair than the existing system at older ages. Gross SSW is particularly lowered at early retirement ages, both by the low level of benefits away from the NRA of 67, which are in turn weighted by the (low) probability of disability receipt at these ages. A similar profile to gross SSW is generated under the Common Reform, although benefits are not penalized nearly as much if retirement is taken early, because the NRA is now brought forward to 65 and access to disability is removed. Figure 3A.2, panels A–C (S1OV) present the PDV of tax collections under the baseline and for each of the three reforms. As evidenced in these figures, the PDV of tax is close to the baseline in the case of the Three-Year Reform, and slightly lowered in the 56 to 63 age group compared to baseline and higher than baseline in the 67-and-up age group in the case of the other two reforms. This would indicate that as the two latter reforms essentially make early retirement much less generous at early ages, less is collected by way of taxes on benefits. By the same argument, more would be collected at higher ages relative to baseline because the benefit profile becomes more actuarially fair. Of course, if retirement is delayed, people work longer and thereby pay taxes on income (although wages are not high on average for elderly workers), but as we shall see later, behavioral responses are relatively smaller in the Danish case, so changes to the tax profile are also dominated by changes in entitlements. From figure 3A.3, panel A (S1OV), there is no appreciable change in the postreform retirement hazard in the Three-Year Reform case, largely because the linear age specification fails to adequately capture the full behavioral effects of the change in the age of eligibility induced by the reform and because of the adjustment made to the age-gender-specific probabilities of disability, in which workers have the option of going on disability-based retirement even when all other programs' eligibility ages are shifted three years. In the case of the two other reforms, figures 3A.3, panels B–C, there appear to be significant delaying effects of retirement until the age of 60 as compared to the baseline, with the retirement hazard now peaking between 62 and 64 instead of between 60 and 62. This occurs also in the case of the Common Reform where the NRA is brought forward to 65, indicating the importance of early retirement in Denmark.

The next figure, figure 3A.4, panels A–C (S1OV), shows the total fiscal effect (gross and net) by age of labor force exit under the three reforms. The total effect is the sum of the mechanical and the behavioral effect and measures the reform SSW minus the base SSW. The gross total fiscal effect is positive and increasing up to 65 (the maximum about 9,000 euros per person) and declining thereafter (but still positive), under the Three-Year Reform. This reflects, (compare figure 3.2) that net SSW is higher at ages 60 and up compared to the baseline, because of the fact that by delaying eligibility to retirement programs by 3 years, the government is forced to pay out more to the (costly) disability program instead as disability continues to be available up to 63 now (previously only up to 60). The net effect is somewhat mitigated by increased collection of taxes on disability benefits and work for those who delay retirement. The gross total effect of the Actuarial Reform, figure 3A.4, panel B is considerably negative between ages 50 and 65 (nearly 80,000 euros per person in this age range) and moderately positive thereafter (20,000 euros). The considerable savings in the 50 to 65 age range are due to the removal of the costly PEW program, which offers a high replacement rate to those who take it up (skilled, blue collar workers), and therefore removing this program constitutes a considerable fiscal saving for the government. Plus, although disability is available in principle, the low probability of takeup in this age interval combined with the low earnings (age 67 NRA benefits actuarially adjusted at 6 percent per year) if disabled represents a big saving compared to the previous disability benefits paid out. Nearly the same gross total effect is seen in the case of the Common Reform, in figure 3A.4, panel C, except that the gains in the 50 to 65 age group are a bit less than half (30–35,000 Euros per person) of what they were under the Actuarial Reform. This is because access to disability is now removed, and instead people are paid the full actuarially adjusted retirement benefit for early retirement rather than a small fraction of it, depending on probability of disability. On the other hand, by bringing the NRA forward to 65 (from 67), more is paid out by way of normal retirement. However, the first effect still dominates, so that the net effect is still a total saving, despite the replacement rate under the Common Reform being more generous than the existing old-age pension system.

How do these results change when we change the way age is specified in the model? We expect larger fiscal implications of the behavioral effects, particularly in the Three-Year Reform, because the age dummies were highly significant in the Danish case. Figure A.5, panels A–C (S3OV) examines the impact of each reform on baseline SSW under S3 assumptions for the option value incentive measure. Looking first at the Three-Year Reform, figure A.5, panel A in contrast to the linear specification, gross SSW increases over the baseline at all retirement ages, but particularly in the 54 to 62 interval, indicating the move to disability for those no longer entitled to PEW at age 60. Gross SSW in the Actuarial Reform and Common

Reform, figure 3A.5, panels B–C, are not changed much under S3 assumptions. In figure 3A.6, panels A–C (S3OV), the PV of taxes also display non-monotonicities and differ more from the baseline now, with the PV of tax collection peaking at 60 and 67 under the baseline, and now peaking at 68 as workers are induced to stay longer in the labor market under the Three-Year Reform (figure 3A.6, panel A). In both the Actuarial and Common case, figure 3A.6, panels B–C, the tax profile becomes much more nonmonotonic and concentrated around 67 indicating the higher taxes on earnings and consumption of those who are induced to continue working at older ages. In figure 3A.7, panel A (S3OV), Three-Year Reform, retirement hazards are no longer smooth functions of age (which they are by definition under S1) but show spikes at ages 60, 62, and 68 under the baseline, age 60 being the age of first eligibility of PEW, and age 62 possibly indicating the actuarial adjustment effect present in PEW if taken at 62 instead of 60 and the peak at 68 representing the mass of retirement that takes place around the age of first eligibility of the old-age pension, which is 67. The effect of the reform is a clear move to the right of the retirement hazard, so that the spikes now appear between 64 and 68, representing the behavioral response to the reform, which the S1 method failed to capture. The behavioral response is more moderate in the actuarial case, figure 3A.7, panel B, although there is evidence of delayed retirement, with spikes at 62 and 68 being more pronounced and less at earlier ages. In figure 3A.7, panel C (S3OV), the Common Reform redistributes the mass at 68 by inducing retirement to take place between 62 and 65, more clearly evidenced under S3 assumptions.

This indicates that when age dummies are introduced in the analysis, they clearly reflect the effect that people retire earlier (from 67 to 65) under the Common Reform, and this produces much larger fiscal implications of the behavioral effect in this age range.

In figure 3A.8, panels A–C (S3OV), the total effect (gross and net) of the reforms is largely the same under S1 and S3 for the Actuarial and Common Reforms. However, a big change is seen for the Three-Year Reform, in which the total effect is now (in both gross and net terms) considerably larger and nonmonotonic. The profile also peaks at 57 now instead of at 66. However, the total effect is still positive for this reform, even though the labor supply response was to delay retirement. The explanation must therefore lie in the alternative available to workers in the 60 to 62 age group, which is the expensive disability option.

Figure 3.7, panels A–C, summarizes the previous observations, by presenting both the behavioral effect and the mechanical effect together on the same diagram, for each reform, for each type of assumption (S1, S2, S3), and for each incentive measure (peak and option value).

In each case, as peak and option value results are nearly identical, only the option value results are discussed. For the Three-Year Reform, both

mechanical and behavioral effects are positive, although mechanical effects are relatively larger, except under S3 assumptions, where both are roughly of the same magnitude. Both type of effects are, however, relatively small (less than 0.015 percent of GDP). In the actuarial case, in figure 3.7, panel B, mechanical effects are negative and relatively stronger than under the Three-Year Reform case (–0.1 percent of GDP). Behavioral effects are positive but small, so that the total effect is still a savings to the government of about 0.1 percent of GDP, which is not insignificant. That is, under the Actuarial Reform, it is largely changes in program rules that determine the overall fiscal picture, and the overall effect is a reduction in net SSW. In the case of the Common Reform (figure 3.7, panel C), both mechanical and behavioral effects are negative and reinforce each other, representing overall fiscal savings, particularly in the case of S3, to the tune of –0.06 percent of GDP. Thus, the biggest savings come from the Actuarial Reform, while the Three-Year Reform actually decreases the fiscal budget.

Tables 3.3 and 3.4 break out the fiscal impacts on the government budget of these three reforms into the effect on benefits and the effect on income and value added taxes, on average, for our sample.[7] Table 3.3 is in terms of levels of PDV, while table 3.4 in changes in the PDV. The monetary units are 2001 Euros. The numbers in the tables refer to an average per person. The results presented in these tables summarize and reinforce the figures. In table 3.3, option value S3 (the model that produced the best fit in the Danish case), the Three-Year Reform produces an average increase of benefits by 12.9 percent relative to baseline, while the Actuarial and Common Reform generate a benefits savings of 21 percent and 16 percent, respectively. After-tax income goes up 1.1 percent in the first case, and goes down 7.1 percent and 6 percent in the latter two reforms. The total tax collection, however, increases by 7.6 percent in the Three-Year Reform case and decreases between 0.9–2.7 percent in the other two cases. Thus, the Actuarial and Common Reforms produce a real savings for the government, despite the small drop in taxes. Looking at table 3.4, the row of interest is the "Change as a percent of base benefits," which shows that the change in PDV relative to base is greatest in the actuarial case, a drop of almost 20 percent in S2 and S3 assumptions and 17 percent in S1. The drop in the common program is about 7–13 percent. In the Three-Year Reform case, the increase is from 3–5 percent. Mechanical effects are relatively much larger in the Actuarial and Common Reforms, almost all the savings arising from changes in program rules, while in the Three-Year Reform, mechanical and behavioral effects are roughly of the same magnitude.

7. In the Danish case, retirement benefits are financed through overall taxes, not through a system of payroll taxes. The VAT factor = 0.3 and is derived from the national estimates of VAT taxes and specific taxes on goods over private consumption, 2002 data.

Table 3.3 **Total fiscal impact of reform (VAT factor = 0.301803)**

		Present discounted value			Total change relative to base (%)		
	Base	Three-Year Reform	Actuarial Reform	Common Reform	Three-Year Reform	Actuarial Reform	Common Reform
Option value—S1							
Benefits	136	143	114	125	5.3	–16.4	–8.1
After-tax income	233	238	226	233	1.8	–3.3	–0.3
Taxes							
Payroll	0	0	0	0			
Income	85	86	88	84	1.1	3.3	–1.7
VAT	70	72	68	70	1.8	–3.3	–0.3
Total	156	158	156	154	1.4	0.3	–1.1
Option value—S2							
Benefits	138	145	110	125	4.7	–20.7	–9.7
After-tax income	220	224	205	217	1.7	–7.1	–1.3
Taxes							
Payroll	0	0	0	0			
Income	80	81	83	78	1.5	4.3	–2.7
VAT	66	68	62	66	1.7	–7.1	–1.3
Total	146	149	145	143	1.6	–0.9	–2.1
Option value—S3							
Benefits	138	156	110	116	12.9	–20.7	–15.9
After-tax income	220	223	205	207	1.1	–7.1	–6.0
Taxes							
Payroll	0	0	0	0			
Income	80	90	83	80	13.0	4.3	0.0
VAT	66	67	62	62	1.1	–7.1	–6.0
Total	146	158	145	142	7.6	–0.9	–2.7
Peak value—S1							
Benefits	136	143	114	124	5.3	–1.64	–8.9
After-tax income	234	238	225	231	1.8	–3.5	–0.9
Taxes							
Payroll	0	0	0	0			
Income	85	86	88	84	1.1	3.2	–2.2
VAT	70	72	68	70	1.8	–3.5	–0.9
Total	156	158	156	153	1.4	0.2	–1.6
Peak value—S2							
Benefits	138	145	109	125	4.6	–20.8	–9.6
After-tax income	220	224	204	217	1.7	–7.5	–1.4
Taxes							
Payroll	0	0	0	0			
Income	80	81	83	78	1.5	4.0	–2.8
VAT	66	68	61	65	1.7	–7.5	–1.4
Total	146	149	145	143	1.6	–1.2	–2.2
Peak value—S3							
Benefits	138	156	109	117	13.0	–20.8	–15.2
After-tax income	220	223	204	201	1.1	–7.5	–8.7
Taxes							
Payroll	0	0	0	0			
Income	80	90	83	80	13.0	4.0	0.5
VAT	66	67	61	61	1.1	–7.5	–8.7
Total	146	158	145	141	7.6	–1.2	–3.7

Table 3.4   **Decomposition of the total effect of reform**

	Change in present discounted value								
	Three-Year Reform			Actuarial Reform			Common Reform		
	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total
Option value—S1									
Benefits	6	1	7	−29	7	−22	−12	1	−11
After-tax income	5	−1	4	−29	22	−8	−8	7	−1
Taxes									
Payroll	0	0	0	0	0	0	0	0	0
Income	1	0	1	0	3	3	−4	2	−1
VAT	1	0	1	−9	7	−2	−2	2	0
Total	3	0	2	−9	9	0	−6	5	−2
Net change	3	2	5	−20	−2	−23	−6	−4	−9
Change as % of									
base benefits	2.4	1.3	3.7	−15.0	−1.8	−16.8	−4.1	−2.7	−6.9
Option value—S2									
Benefits	6	1	6	−35	6	−29	−15	1	−13
After-tax income	4	−1	4	−35	20	−16	−10	7	−3
Taxes									
Payroll	0	0	0	0	0	0	0	0	0
Income	1	0	1	0	3	3	−5	2	−2
VAT	1	0	1	−11	6	−5	−3	2	−1
Total	3	0	2	−10	9	−1	−8	5	−3
Net change	3	1	4	−25	−3	−27	−7	−3	−10
Change as % of									
base benefits	2.2	0.8	3.0	−17.7	−2.0	−19.8	−5.1	−2.4	−7.5
Option value—S3									
Benefits	6	12	18	−35	6	−29	−15	−7	−22
After-tax income	4	−2	2	−35	20	−16	−10	−3	−13
Taxes									
Payroll	0	0	0	0	0	0	0	0	0
Income	1	9	10	0	3	3	−5	5	0
VAT	1	−1	1	−11	6	−5	−3	−1	−4
Total	3	8	11	−10	9	−1	−8	4	−4
Net change	3	4	7	−25	−3	−27	−7	−11	−18
Change as % of									
base benefits	2.2	2.7	4.9	−17.7	−2.0	−19.8	−5.1	−8.0	−13.0
Peak value—S1									
Benefits	6	1	7	−29	7	−22	−12	0	−12
After-tax income	5	−1	4	−29	21	−8	−8	6	−2
Taxes									
Payroll	0	0	0	0	0	0	0	0	0
Income	1	0	1	0	3	3	−4	2	−2
VAT	1	0	1	−9	6	−2	−2	2	−1
Total	3	0	2	−9	9	0	−6	4	−3
Net change	3	2	5	−20	−2	−23	−6	−4	−10
Change as % of									
base benefits	2.4	1.2	3.6	−14.9	−1.7	−16.6	−4.1	−3.0	−7.1
Peak value—S2									
Benefits	6	1	6	−35	6	−29	−15	1	−13
After-tax income	4	−1	4	−35	18	−17	−10	7	−3
Taxes									
Payroll	0	0	0	0	0	0	0	0	0
Income	1	0	1	0	3	3	−5	2	−2
VAT	1	0	1	−11	6	−5	−3	2	−1
Total	3	0	2	−10	9	−2	−8	4	−3

Table 3.4   continued

	Change in present discounted value								
	Three-Year Reform			Actuarial Reform			Common Reform		
	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total
Net change	3	1	4	–24	–3	–27	–7	–3	–10
Change as % of base benefits	2.2	0.8	3.0	–17.7	–1.9	–19.5	–5.0	–2.3	–7.3
			Peak value—S3						
Benefits	6	12	18	–35	6	–29	–15	–7	–21
After-tax income	4	–2	2	–35	18	–17	–10	–9	–19
Taxes									
Payroll	0	0	0	0	0	0	0	0	0
Income	1	9	10	0	3	3	–5	5	0
VAT	1	–1	1	–11	6	–5	–3	–3	–6
Total	3	8	11	–10	9	–2	–8	2	–5
Net change	3	4	7	–24	–3	–27	–7	–9	–16
Change as % of base benefits	2.2	2.7	4.9	–17.7	–1.9	–19.5	–5.0	–6.3	–11.4

It may appear counterintuitive that the effect of the Three-Year Reform on PDV under the age-dummy specification results in more benefits paid out in spite of delayed eligibility to retirement programs, that is, a 6,000 Euro increase due to the mechanical effect in table 3.4. However, this finding can be explained by (1) retirement taking place through PEW at ages 63 or older after the Three-Year Reform means more years of PEW entitlement (extended to age 69), which is more generous than the previously entitled OAP and (2) that retirement taking place between 60 and 62 now means receipt of disability instead of PEW at these ages, which more than makes up for the loss of OAP between 67 and 69. Thus, (1) and (2) could lead to larger gross SSW under the Three-Year Reform, particularly as the loss of OAP under (2) occurs in the future and is small, due to discounting and mortality probabilities, while on the other hand expected DI payments are generous enough to offset these losses, even given the low probabilities of disability in this age range. However, a mitigating factor is that tax collections also rise because of delayed retirement, and the net effect is that PDV of benefits increases 12.9 percent, the change in PDV being about 5 percent of base level. While in the Common and particularly in the Actuarial Reform case, the generosity of benefits is significantly reduced by the 6 percent actuarial reduction of the NRA benefits, which is particularly taxing in the instance where the NRA is still retained at 67. This is because these reforms essentially eliminate the costly PEW early retirement program. This, in turn, has a strong effect on consumption and earnings, so that taxes also go down, but the net effect is still a large saving.

3.6 Conclusions

We study the fiscal implications for the government's budgetary situation resulting from a set of reforms to the social security system, traced through a particular cohort of workers aged 50 in 1995. Compared to the system that was in place in 1995, the reforms involve either a mandatory increase in program eligibility age, a move to an actuarially fair system, or the implementation of a simple unified system that is common across countries. Although future demographic changes in Denmark are projected to be smaller than in other OECD countries, they are expected nonetheless to have potentially big consequences for public-sector finances, as labor-force participation is already at high levels. Therefore, it becomes imperative to consider alternative ways to delay retirement and to gain an understanding of the implied fiscal consequences thereof. Our results show that the biggest savings are obtained under the Actuarial Reform, which, by replacing the PEW (existing early retirement) program by an actuarially fair benefits system, implies a large fiscal saving for the government. In the Danish case, changes in program rules largely drive the fiscal implications of the reforms, and behavioral effects are in general relatively smaller. However, small behavioral effects are to be expected, because disability continues to be a possible exit route from the labor market, even with reduced access and program generosity.
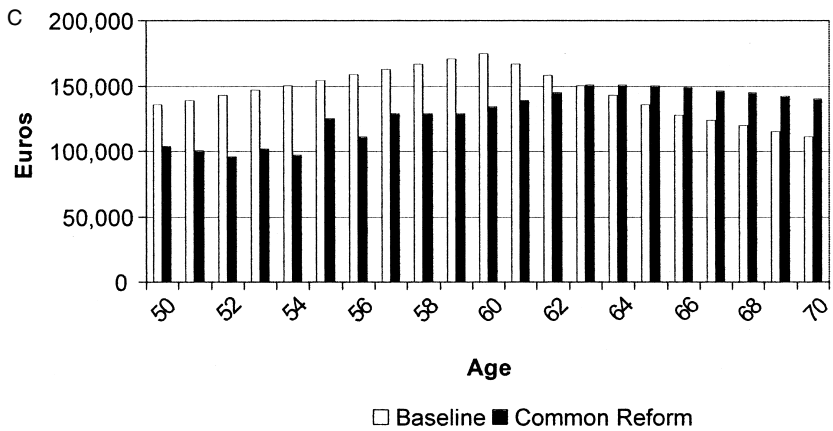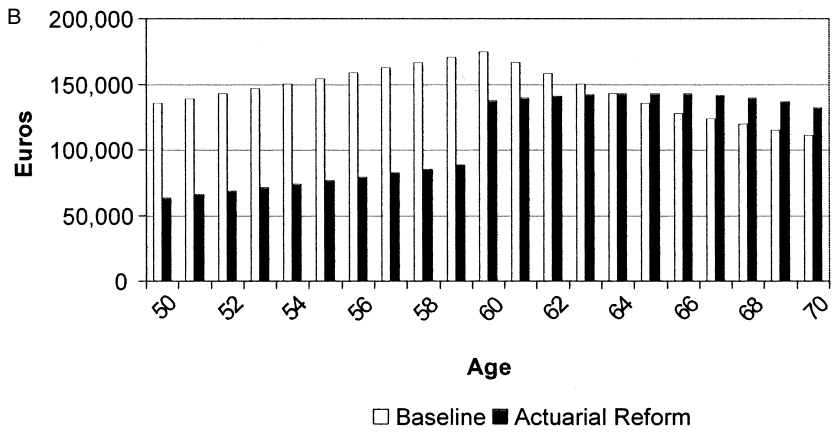
Appendix

Fig. 3A.1   (S1OV) Gross social security wealth (SSW)

A

B

C

Fig. 3A.2 (S1OV) Peak value (PV) of taxes

Fig. 3A.3 (S1OV) Retirement rates by age

Fig. 3A.4 (S1OV): *A,* Total effect of Three-Year Reform; *B,* Total effect of Actuarial Reform; *C,* Total effect of Common Reform

A
300,000
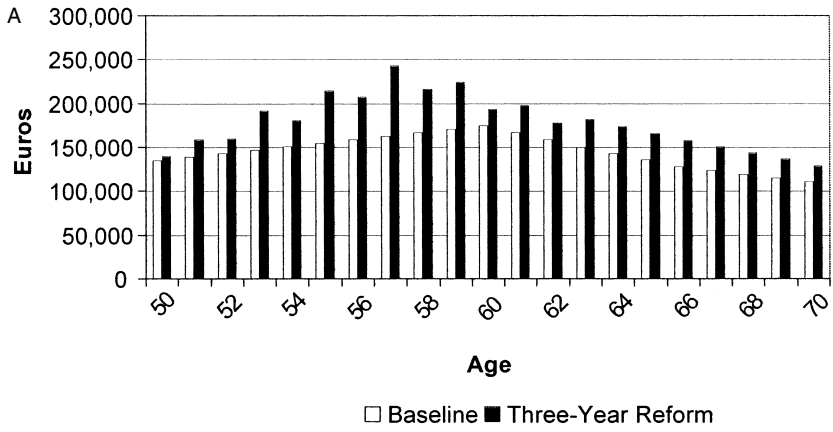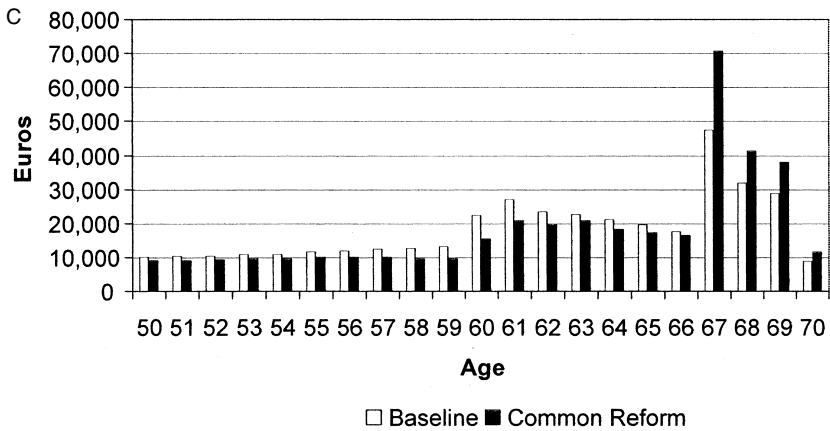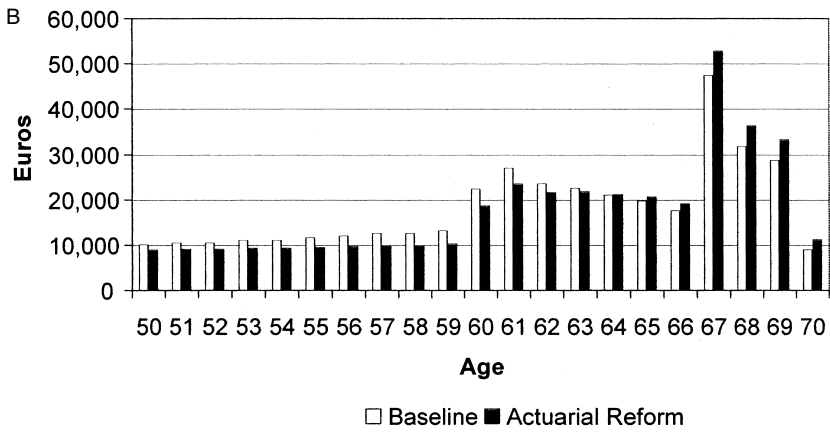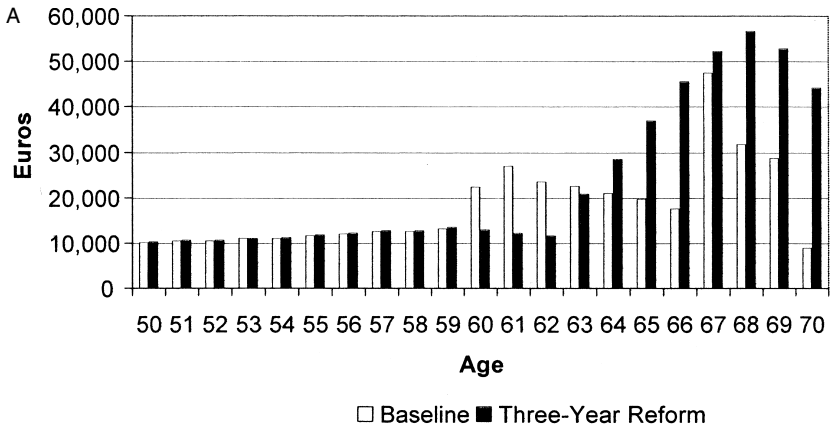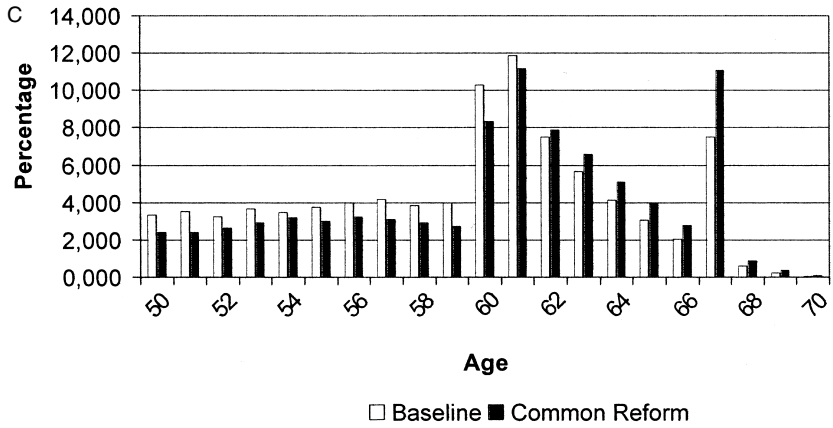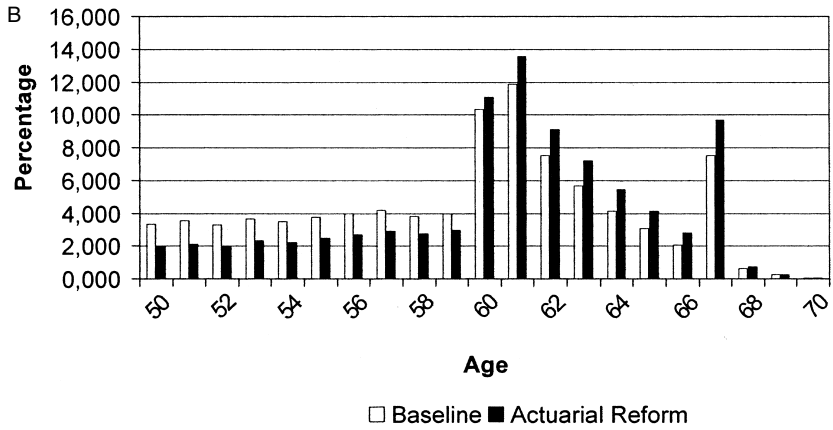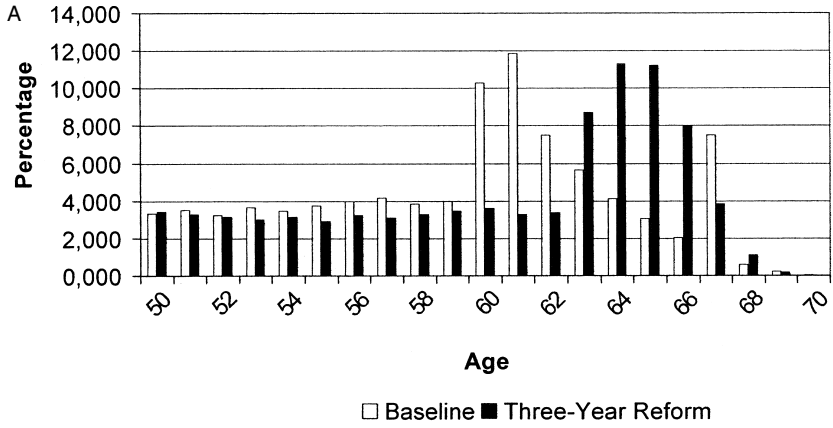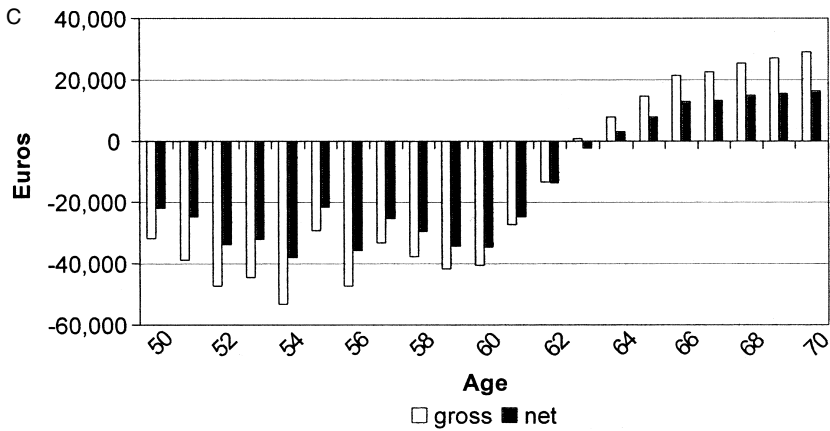
Euros

| Baseline | Three-Year Reform |

Age

B
200,000

Euros

| Baseline | Actuarial Reform |

Age

C
200,000

Euros

| Baseline | Common Reform |

Age

Fig. 3A.5   (S3OV) Gross social security wealth (SSW)

Fig. 3A.6 (S3OV) peak value (PV) of taxes
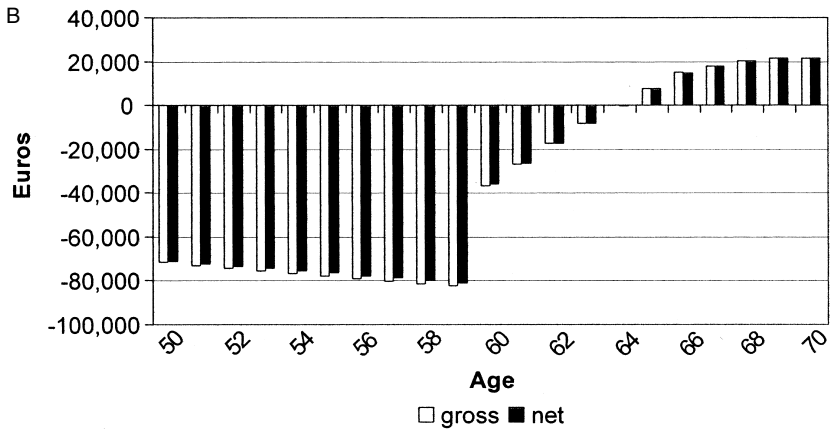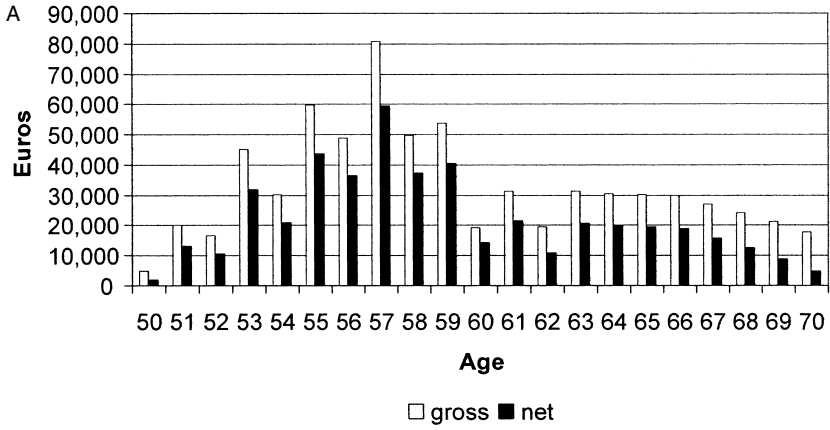
Fig. 3A.7 (S3OV) Retirement rates by age

Fig. 3A.8 (S3OV): *A*, Total effect of Three-Year Reform; *B*, Total effect of Actuarial Reform; *C*, Total effect of Common Reform

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