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Chapter Author(s): Paul Bingley, Nabanita Datta Gupta, Malene Kallestrup-Lamb, Peder J. Pedersen

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# Labor Force Exit in Denmark, 1980–2016

## Impact from Changes in Incentives

Paul Bingley, Nabanita Datta Gupta,  
Malene Kallestrup-Lamb, and Peder J. Pedersen

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### 3.1 Introduction

Until 1980, the labor force participation rate in Denmark for men 60–64 years old was 80–90 percent, with a very modest decrease reflecting the structural shift out of agriculture. In 1979, five years after the first big oil price shock, a dramatic change occurred. With the purpose of reducing youth unemployment, an early retirement program (*efterløn*, the Post-Employment Wage, hereafter PEW) was introduced without any health or social criteria but with eligibility depending only on being 60 to 66 years old and having a required labor market tenure. The impact was a decline over the subsequent 20 years to half the initial level for labor force participation among men 60–64 years old, as illustrated in figure 3.1.

Next, from around the turn of the century, a trend reversal occurred resulting in a 20 percentage point increase in labor force participation for men and a 25 percentage point increase for women 60–64 years old (cf. figure 3.2). As is well known, this is a phenomenon observed in most Organisation for Economic Co-operation and Development (OECD) countries. Presum-

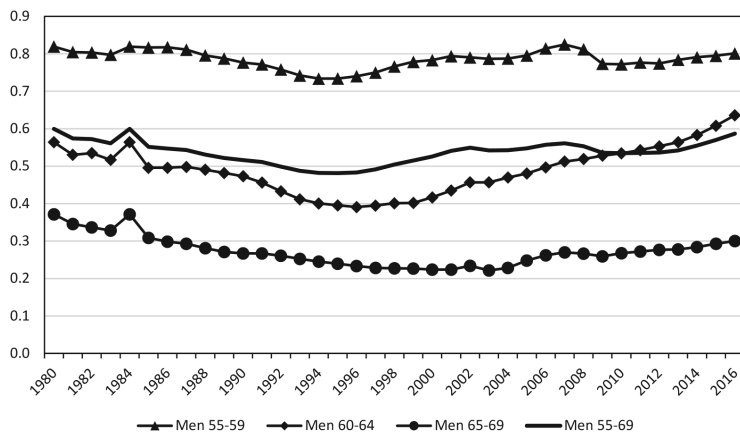
Paul Bingley is a professor at VIVE—The Danish Center for Social Science Research.

Nabanita Datta Gupta is a professor in the Department of Economics and Business Economics at Aarhus University and a research fellow of IZA.

Malene Kallestrup-Lamb is an associate professor in the Department of Economics and Business Economics at Aarhus University and a research fellow at the Center for Research in Econometric Analysis of Time Series (CREATES) at Aarhus University.

Peder J. Pedersen is an emeritus professor of the Department of Economics and Business Economics at Aarhus University, a research professor at VIVE—The Danish Centre Center for Social Science Research, and a research fellow of IZA.

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**Fig. 3.1** Employment rates, men aged 55–69, 1980–2016

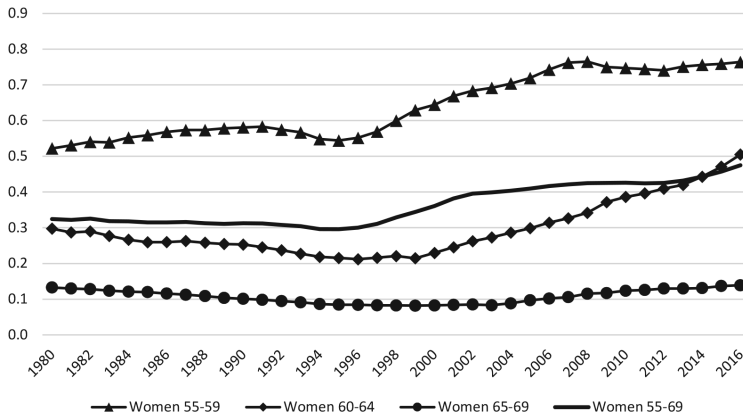
Source: Statistics Denmark

ably, this is the outcome of an interaction between several factors. In many countries sharing the initial decline in the average age for exit from the labor force, reforms were enacted to end or reverse this decline. At the same time, cohort-specific improvements occurred in education and health among new groups of older workers, both factors expected to lead to higher exit ages.<sup>1</sup> It is evident from figure 3.1 that the strongest trend reversal is found for the 60- to 64-year-old group. For the other age groups shown in figure 3.1, the initial decline in labor force participation during the first 15–20 years since 1980 is not regained fully. However, even among those 65 to 69 years old, we see an increase of about 10 percentage points since around 2000.

Figure 3.2 shows the trend reversals for different age groups among women over the same period since 1980. The most dramatic change is seen for the 55- to 59-year-old group, with an increase of about 25 percentage points from the mid-1990s to around 2008. This reflects, however, the closing of a temporary early retirement program described below. In contrast to the case for men, among women there is an ongoing cohort effect explaining part of the impressive trend reversal in the 60- to 64-year-old group from an employment rate of 20 percent to 50 percent occurring over 20 years.

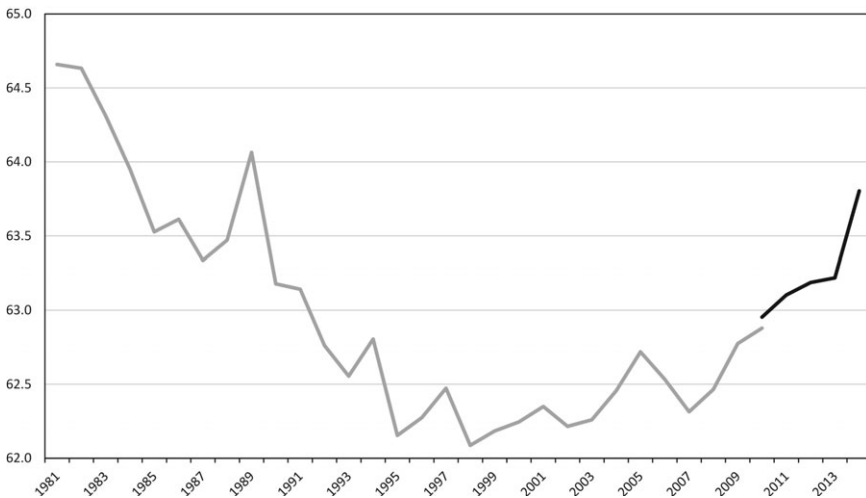
The highly relevant policy question is then to sort out the separate impact from each of these interacting factors. For Denmark, Larsen and Pedersen (2013 and 2017) analyze the impact of changes in education and health on labor force participation in the 60 years and older group, also including individuals older than the normal social security labor force exit age. Bingley,

1. For instance, Datta Gupta and Bengtsson (2015) find that compulsory schooling reforms enacted in Denmark in the 1950s lowered exit via disability pension and diagnoses of chronic diseases later in life. The individuals affected by the reform were in their mid-50s in the late 1990s, around the time the reversal occurs.



**Fig. 3.2 Employment rates, women aged 55–69, 1980–2016**

Source: Statistics Denmark

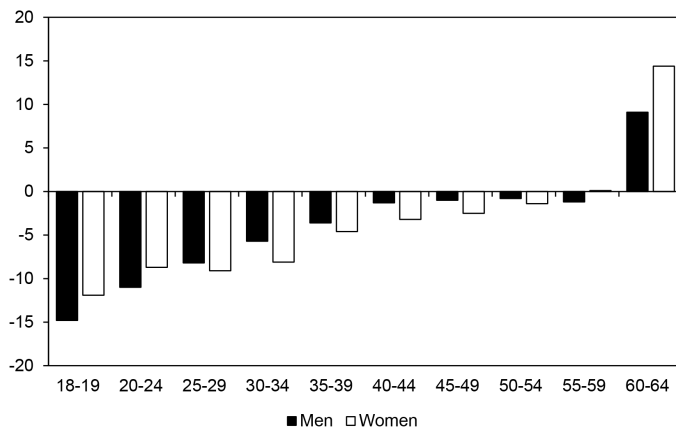


**Fig. 3.3 Average age at exit from the labor force to early retirement in the PEW program or to old-age pension at the normal social security age, 1981–2014**

Source: Own calculations based on data from Insurance and Pension Denmark (IPD), 2017

Datta Gupta, and Pedersen (2019) analyze the trend reversal with a cohort approach, including education, mortality, other health indicators, and job characteristics among the relevant explanatory factors. The focus of the present study is to determine how much of the observed trend reversal in Denmark can be explained by changes in the incentives of social security policy over the years since 1980.

The trend reversal is illustrated in an alternative way in figure 3.3, showing the average age at exit from the labor force to either PEW or old-age pension



**Fig. 3.4** Changes in percentage points in labor force participation by age between 2008 and 2016.

*Source:* Calculations based on data from Statistics Denmark

(*folkepension*, hereafter OAP) at the normal social security age of eligibility. The trend reversal we set out to explain seems even more pronounced here than in figures 3.1 and 3.2, as the average exit age ends up very close to the initial level. In fact, from a trough of 62.1 years in 1998, the rise is almost 2 full years to 63.8 years in 2014. Notice, however, that while the exit pathways included in figure 3.3 dominate, other pathways are available—that is, disability insurance (*fortidspension*, hereafter DI) and a number of smaller programs.

To provide a numerical summary, we find that for men, the percent exiting the labor market via PEW increases from 22 percent in 1980 to 50 percent in 2009. Following that, it decreases to 38 percent in 2016. For women, the percent exiting the labor market via PEW or OAP increases from 8 percent in 1980 to 58 percent in 2007 and then decreases to 46 percent. The U shape in exit ages occurs at 64.6 in 1980, at 62.1 in 1998, and at 64 in 2016.

While figures 3.1 and 3.2 collect the evidence for a 36-year period, figure 3.4 shows the surprisingly steep increase in labor force participation in the 60- to 64-year-old group after the Great Recession from 2008 to 2016. While all younger age groups experience declines in labor force participation during the financial crisis, the 60- to 64-year-old group has a quite different profile, which is about the same if we look at employment rates instead of participation.

Next, in section 3.2, we present a detailed overview of institutional changes in the retirement area since 1980, including both social security programs, occupational pensions, and the interaction between these two program groups. Section 3.2 includes information on how the reforms and policy changes in the period have resulted in specific changes in ages

and other conditions for eligibility for the different pathways to exit from the labor force. Section 3.3 sets up a benefit stream for each pathway to exit from the labor force as determined by earnings history and socioeconomic background factors. In section 3.4 the benefit calculator is used to compute social security wealth accrual for specific types of individuals as a function of claiming benefits from a specific age. Section 3.5 presents the results from calculating the tax force—that is, the implicit tax on working longer—for several specific groups in the labor force. Finally, section 3.6 concludes the chapter.

### 3.2 Institutional Changes, 1980–2016

All major elements in the Danish pension and retirement system have undergone major changes since 1980. Based on policy reforms enacted in 2006 and 2011, further major changes will be phased in during the coming decades to reflect expected increases in life expectancy. The biggest social security program is OAP, for which everybody in 1980 was eligible, dependent on years of residence in the country. Like OAP, DI is financed from general tax revenues, with eligibility for individuals younger than the OAP age dependent on medical and/or social criteria. PEW is a program for early retirement based on specific conditions regarding labor market attachment. PEW was introduced in 1979 and is financed from general tax revenues supplemented by minor contributions from those eligible for the program. Finally, some specific groups of public-sector employees are eligible for a defined benefit (DB) program, *Tjenestemandspension*, financed from general tax revenues.

Next, mandatory defined contributions (DCs), labor market pensions introduced over the period from 1960, currently cover about 85 percent of all employees. Among funded programs, *Arbejdsmarkedets Tillægspension* (supplementary labor market pension, hereafter ATP), introduced in 1964, is a small but nearly universal program covering all employees with more than a marginal attachment to the labor force. Finally, funded programs also contain private voluntary savings for retirement purposes, mostly with a favorable tax treatment. Apart from these major programs, a few smaller, rather specific programs have been in operation for part of the time since 1980. In quantitative terms, the most important one was the transitional benefits program (*overgangsydelse*, hereafter TBP), introduced in 1992 as an early exit route for long-term unemployed in their 50s, closed to further entry in 1996, and finally phased out in 2006. The impact on the exit age is clearly visible in figures 3.1 and 3.2, especially for women.

In the following, we describe the most relevant changes in these pension programs with a focus on the incentives to leave the labor force or to continue working. For most of the period since 1980, the PEW program has been the dominant route to early retirement. The program was introduced

in 1979 as a voluntary route to early retirement open for individuals 60–66 years old with membership in an unemployment insurance (UI) fund for 5 out of the most recent 10 years.<sup>2</sup> Initially, benefits were set at maximum UI benefits for the first 2.5 years in the program. After that, benefits were set at 82 percent of maximum UI benefits for the next two years in the program. Finally, after 4.5 years in the program, benefits were reduced further to 70 percent of maximum UI benefits. The idea behind this stepwise reduction in benefits was to make the transition to OAP at age 67 smoother. Entry to the program turned out to be much higher than expected when the law was proposed. Consequently, eligibility was gradually made dependent on still longer periods of UI fund membership. However, in all cases, the changes in rules in this area were accompanied by “grandfathering” modifications. Already in 1980, eligibility was made dependent on UI fund membership for 10 out of the most recent 15 years. A change in the opposite direction, making entry to PEW more attractive, was decided in 1987, where benefits were set at 82, and not 70 percent, of maximum UI benefits for the last 4.5 years in the program. In 1992, UI fund tenure was increased to 20 out of the most recent 25 years, again with “grandfathering.” Further, a new rule was introduced stating that benefits for the whole period in the program were set at maximum UI benefits if entry was delayed to age 63 or later.

In 1992, TBP was introduced. Eligibility to this new early retirement program was conditional on being 55–59 years old, a member of a UI fund, and unemployed for at least 12 out of the last 15 months. From the beginning of 1994, the program was extended to cover 50- to 54-year-olds with the same labor market criteria as for the 55- to 59-year-olds. Benefits in the program were 82 percent of maximum UI benefits, and the duration was until the person entered PEW at the age of 60 years. Participation in the program greatly exceeded government expectations, and entry was terminated at the beginning of 1996, with the last participant leaving the program in 2006.

In 1999, a comprehensive PEW reform was undertaken. Among the main changes was a further tightening of the required UI fund membership tenure to 25 out of the most recent 30 years. Originally, a main motive behind PEW was to create an instrument to redistribute a given number of jobs from old to young workers. One rule that had originated in this way of thinking was abolished in the 1999 reform—that is, that participants in the program were not allowed to work more than 200 hours during a year. This was replaced by a more “flexible” PEW, making it financially more attractive to work while in the program—for example, working 20 percent of a year implied a reduction of annual benefits by 20 percent. The benefit profile was changed once again to 91 percent of maximum UI benefits for the duration of time in the program. Delaying entry by at least two years implied benefits at 100 percent of maximum UI benefits.

2. UI in Denmark is organized as the so-called Ghent system, implying that membership is voluntary.

Means testing relative to private pensions was made more restrictive—that is, before 1999, there was only means testing in relation to pensions directly related to earlier employment being paid out monthly. From 1999, means testing occurred during the first two years in the program, no matter whether private pensions were being paid out or still being accumulated in the pension fund. However, delaying entry by at least two years (and having worked two years after having obtained eligibility) implied means testing only against pensions paid out monthly based on an earlier employment relationship.

Further, the 1999 reform introduced a tax-exempt premium to those eligible for PEW for continuing to work from age 63 to age 65 (to the OAP age from 2004; see below). Summing up, a main element in the 1999 reform was a change from a system where benefits were reduced as a function of time spent in the program to a system where benefits depended on age at entry, with a premium for delaying entry.

As part of the 1999 reform, the age of eligibility for OAP was reduced from 67 to 65, effective from mid-2004. Superficially, this seems surprising considering the nature of the problems regarding the pension burden. However, it must be interpreted in light of, first, the widening gap at the time between the high OAP eligibility age and the declining average retirement age. Next, a major share of people 65 and 66 years old received PEW benefits, which were higher than OAP, so public expenditures were expected to decline.<sup>3</sup> Finally, means testing of the base amount in OAP against earnings was changed in a way to make gradual retirement more attractive. Reduction of the base amount would begin at a higher level of earnings than before, and the rate of reduction of the base amount was reduced from 60 to 30 percent, implying that the base amount would only be fully phased out at an earnings level well above the average earnings of skilled workers. Once again, this represents a change of mind among policy makers from the redistribution of a—perceived—given number of jobs to a new focus on labor supply. Finally, a new instrument was introduced, making it possible to defer take-up of OAP until 75 with an actuarial adjustment.

As part of the 1999 reform, contributions to PEW—replacing the UI fund membership condition—have to be paid for 30 years, increasing from 25 years. Contributions are required to begin no later than age 30. The changes were “grandfathered.” Further, means testing against income from work was reduced for PEW participants with low hourly wages.

A final reform of PEW was enacted in 2011. The main impact of this is a reduction in the maximum number of years in the program to three—from originally seven—for individuals born after July 1, 1959. In the 2011 retirement reform, PEW benefits are means tested both against all other pensions regardless of whether or not payments have begun and against income from

3. A countering effect might come from people who have not received any income transfers but who now become eligible for OA two years earlier.



work. The impact of the 2011 reform is a decrease in the tax force for continuing to work.

Unemployment insurance (UI) has also undergone several policy changes. We summarize those of special relevance for UI as a pathway to retirement. The labor market reform in 1994 resulted in a shift from a de facto indefinite duration of benefits to a maximum duration of seven years. Shortly after, it was decided to make a stepwise reduction of the maximum duration of benefits from seven to four years over the period 1996 to 2002. Finally, the maximum duration was set at two years from 2010. For those 50 years and older, UI rules were gradually tightened. With the 1994 reform, benefit duration was extended until age 60 with entry to PEW. For those 50–54 years old, benefit duration was gradually reduced to the common level from 1999. Unemployed 58- and 59-year-olds were, however, exempt for activation programs until 2007. In 2007, the benefit duration extension for those 55–59 years old was repealed.

The main changes regarding DI were a major reform in 1984. DI could be granted on three levels depending on a loss of work capacity. Widows' pension was ended as a special program. In 2003, disability pension was reformed again with the three benefit levels consolidated to one—maximum UI benefits.

Labor market pensions were growing in importance from about 1960, with pension funds beginning for certain groups of mostly white-collar workers. From 1991, pension funds also began growing for blue-collar workers. Currently, about 85 percent of employees are covered by labor market pensions. A specific DB program, *Tjenestemandspension*, is relevant for some groups of public-sector employees. It is a very old program where currently about 15 percent of those 60 years and older receive part of their income in the form of this specific DB pension. Finally, there are tax-subsidized private pension savings. Currently about one-third of those 30–55 years old participate to some extent in funded private pension saving. From 2013, tax incentives changed along with a shift to another form of savings program, so far less popular than the earlier programs.

Those labor market and private programs interact with social security, especially OAP, and as mentioned above, also with PEW. OAP consists of a base amount and a supplementary amount that is means tested against income from the labor market pension. This is less relevant for white-collar groups where the typical income from labor market pensions and private pensions is so high that only the base amount of OAP is relevant. For many blue-collar groups, the means testing is, however, a potential challenge when the labor market pension for these groups reaches maturity. The means testing will, with current rules, imply a reduction of supplementary OAP with the same amount as the income from the labor market pension, reducing their incentive to save via labor market pension or private pension programs.

The detailed descriptions of the multitude of institutional changes since 1980 are illustrated in a compact way in figure 3.5, collecting the develop-

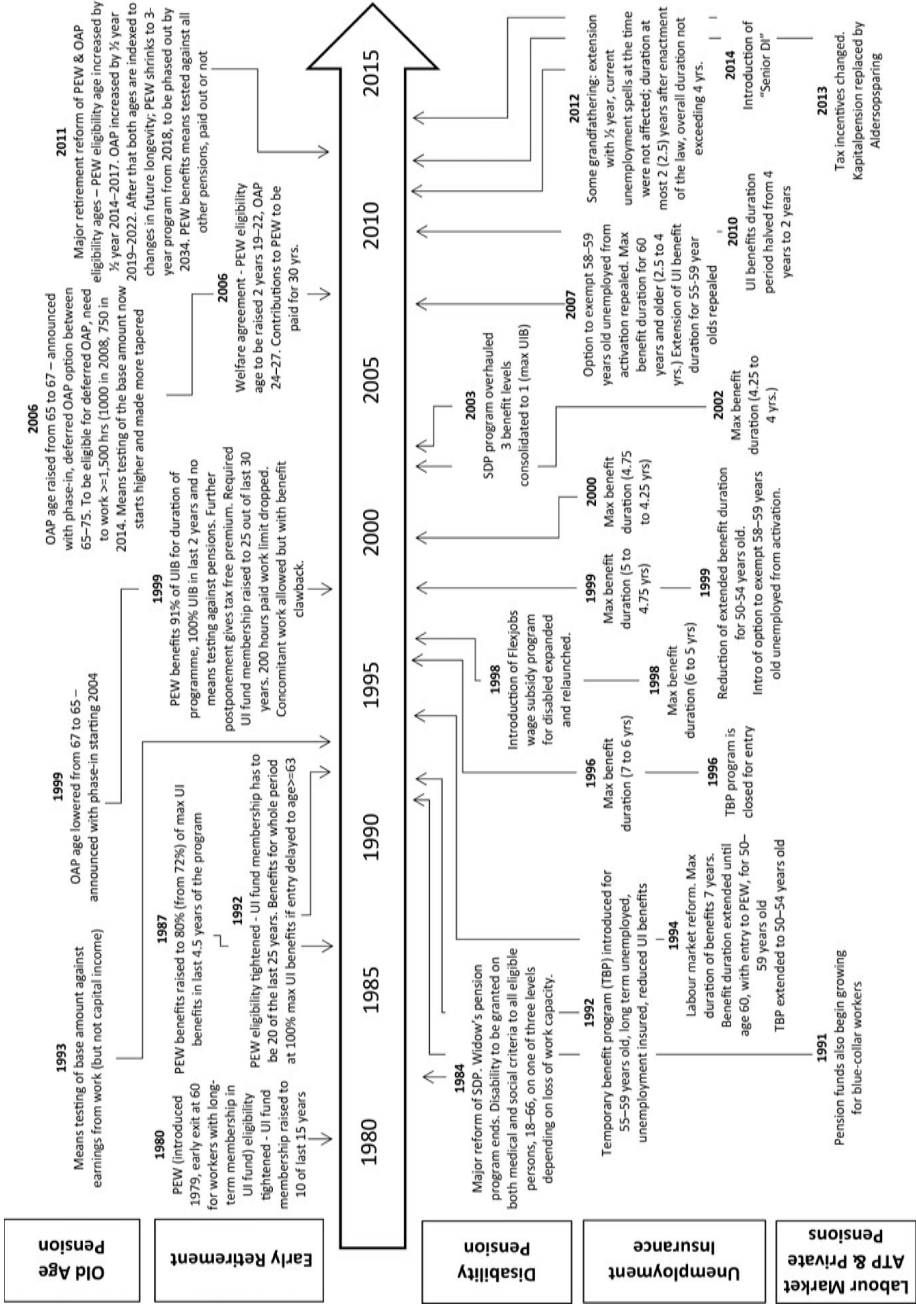


Fig. 3.5 Summary of reforms and policy changes around retirement, 1980–2015

ment in a timeline covering areas of central relevance relative to exit from the labor force—that is, old-age pension, early retirement, disability pension, interactions between unemployment insurance and exit from the labor force, and finally labor market pensions and private savings for retirement.

### 3.3 Benefit Calculator

We calculate pension benefits from the four largest programs supporting consumption in retirement: DI, OAP, PEW, and TBP. Pathways to DI, TBP, and OAP are weighted according to the proportion of each gender aged 50–66 joining each program. Pension benefits can only be claimed on exit from the labor market. Private and occupational pension payouts are not included in social security wealth. From 1999, a PEW clawback was introduced for those retiring at age 60 or 61 as a function of private pension wealth. We ignore this clawback.

Earnings histories are relevant for benefit calculation for the current year's earnings for PEW and for the previous two years' earnings for TBP. We use median earnings by gender at age 50 in each calendar year and assume that earnings profiles are flat. We calculate benefits separately for men and women at median earnings, 50 percent and 200 percent of median earnings, respectively. Individuals' single earnings are treated as the most important source because of the importance of separate taxation in Denmark. We assume a flat 40 percent income tax. This rate represents approximately the case for most individuals being “treated” in the benefit calculator. We take mortality from Statistics Denmark life tables by gender, age, and calendar year.

### 3.4 Social Security Wealth Accrual

To fix concepts, we begin with definitions of key measures. First, we define the social security wealth,  $SSW$ , of an individual of gender  $g$  and (earnings) type  $i$  at each calendar year  $t$  and labor force exit age  $R$ . This is defined as the sum from age  $R$  to the end of life  $T$  of weighted future benefits streams discounted back to current age  $a$ , where the weights denote probabilities of being observed on certain pathways (see, e.g., Gruber and Wise 2004):

$$SSW_{gt}(R, i) = \sum_{a=R}^T \sum_k \pi_{gk} \cdot B_{at}(R, i) \cdot \sigma_{gar} \cdot \beta^{a-R}, \quad 55 \leq a \leq 69.$$

The parameter  $\pi$  denotes the probability of a given pathway,  $\sigma$  is the survival probability, and  $\beta$  is the discount factor, with a discount rate of 3 percent.

We denote the change in  $SSW$  by postponing going on retirement for a year as its accrual,  $ACC$ , where

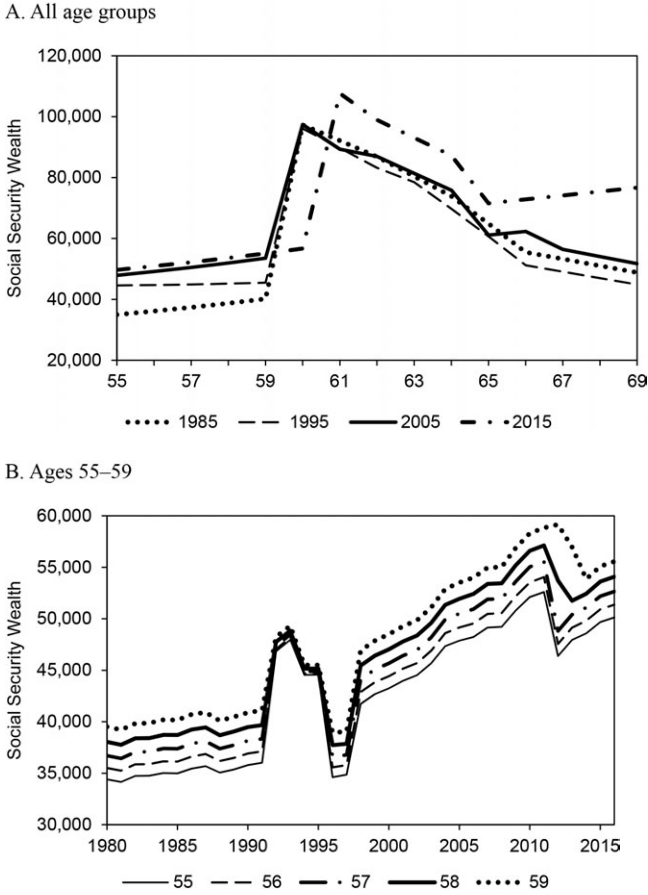


Fig. 3.6 Social security wealth, men with median earnings

$$ACC_{gt}(R,i) = SSW_{gt+1}(R + 1,i) - SSW_{gt}(R,i).$$

The key summary measure of interest in this analysis is the implicit tax on working an additional year, *ITAX*, defined as

$$ITAX_{gt}(R,i) = -ACC_{gt}(R,i)/Y_{gt}(i),$$

where *Y* represents earnings from work. Thus *ITAX* > 0 (<0) when accrual is negative (positive), meaning that work is discouraged (encouraged).

To help understand the implicit tax rate figures shown below, SSW figures are shown first in figure 3.6a–d. SSW, summed across all pathways, is presented below by age and calendar year. Gender differences are due to different program weights and only have modest effects. The following SSW illustrations are for men with median earnings.

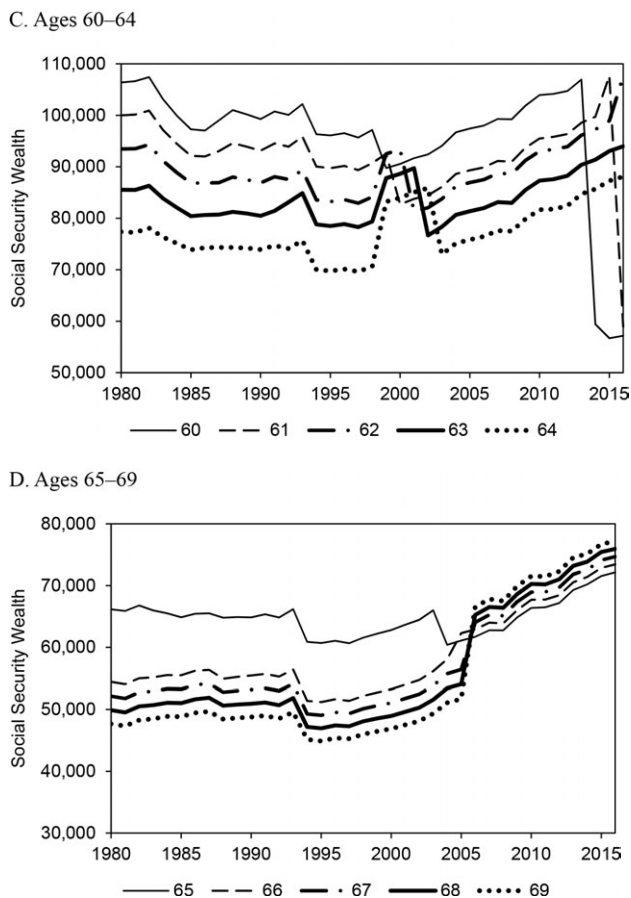


Fig. 3.6 (cont.)

First, from figure 3.6a, it can be seen from the age distribution of SSW that there is a single peak in the early 60s due to the availability of early pension benefits. However, the incentives to retire later for men have been strengthened over time as the peak in SSW has moved from 60 to 62. This change has taken place primarily in the last decade, between 2005 and 2015, suggesting the importance of the 1999 reform (that was phased in between 2004 and 2006) and the subsequent welfare and retirement reforms of 2006 and 2011. Splitting by cohort and looking at the temporal distributions in figure 3.6b, SSW is shifted up by age in the 55–59 age group, indicating retirement incentives are greater as people age. In the years 1992–95, incentives are identical for all age groups and are driven by the rules of the TBP—a program that opened and closed between these years. Again in this figure, we see the fall in retirement incentives for all age groups after 2010.

For the 60–64 age group, however, figure 3.6c shows that SSW falls with age, indicating the strong incentives for retiring early via the PEW program. However, in the late 1990s, the 62- to 64-year-olds have an incentive to retire due to the 1999 reform, whereas the 60- and 61-year-olds have an incentive to delay retirement. This pattern is due to the feature of the 1999 reform pertaining to the PEW program, whereby retirement at 62 was encouraged because of the decreased means testing if early retirement was postponed for two years. However, the effects do not last long, and incentives to retire early again begin increasing in subsequent years. At the end of the period, incentives to retire at 60 or 61 are dramatically reduced due to the 2011 reform, which essentially reduces the early retirement to a three-year program for those born after July 1, 1959.

Finally, figure 3.6d shows that SSW is relatively higher for 65-year-olds (covered by PEW) compared to the older age groups due to the relative generosity of that program compared to the OAP. From 2004 to 2006, there is an increased incentive for 65- to 67-year-olds in particular to exit the labor market due to the 1999 reform that brought the OAP age down from 67 to 65 but introduced an actuarial adjustment for delaying retirement after 65. Notice, however, that even though subsequently the decision to raise the OAP labor force exit age again from 65 to 67 was made in 2006, the actual age will not be 67 before 2022. This is because the first cohorts exposed to the change will be the 1955 birth cohort (born after July 1), who will face an OAP eligibility age of 67 again.

### 3.5 Tax Force, Graphical Presentations

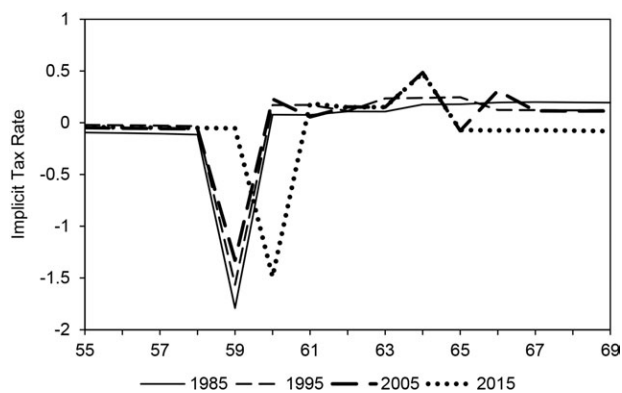
Implicit tax rates on working longer are presented below by age and calendar year and in separate figures by gender and earnings levels (50 percent, 100 percent, and 200 percent of median).

#### 3.5.1 Implicit Tax Rates

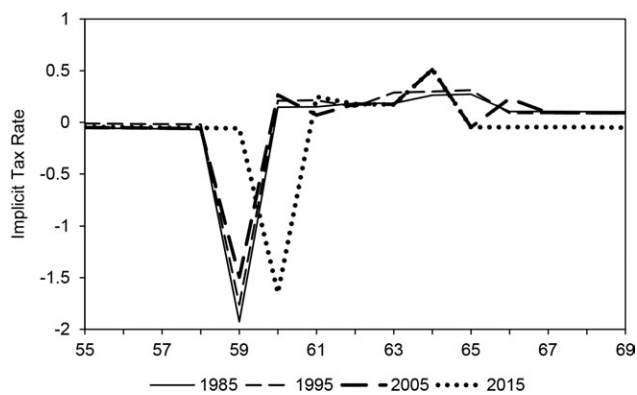
In figure 3.7a–f, implicit tax rates are shown for the full 55–69 age group. Females are depicted in the left panes; men in the right panes. Top panes are for 50 percent of median earnings, middle panes are for median earnings, and bottom panels are for 200 percent median earnings.

Overall, in figure 3.7a–f, when looking at the full age group, we can see that mirroring the change in SSW described above, the implicit tax is strongly negative (i.e., a subsidy encouraging working) for the age group just about to enter early retirement, but it becomes less negative between 2005 and 2015. At the same time, its peak has shifted over time by about a year. The reduction in the subsidy level is higher for median and 200 percent median earnings. Gender differences appear to be minor, except for 200 percent median earnings, where males experience a slightly lower reduction in the subsidy but the same shift. Modest taxes are seen in the age groups 63

A. Females, 50% of median earnings



B. Males, 50% of median earnings



C. Females, median earnings

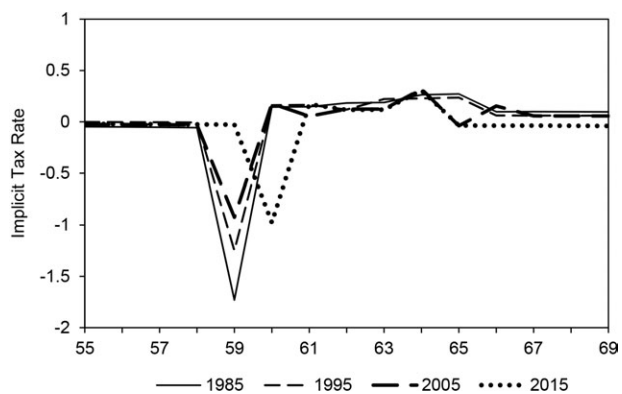
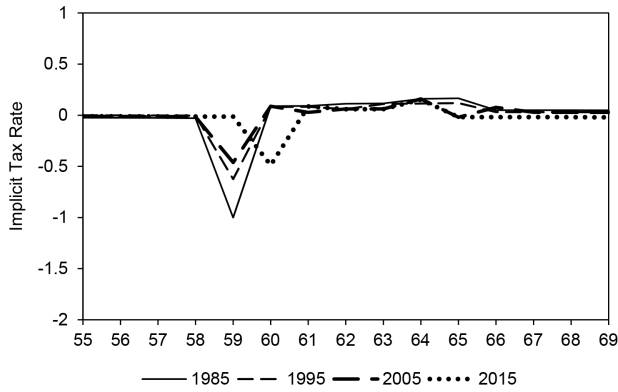


Fig. 3.7 Implicit tax rates, 55–69 age group

D. Males, median earnings



E. Females, 200% of median earnings



F. Males, 200% of median earnings

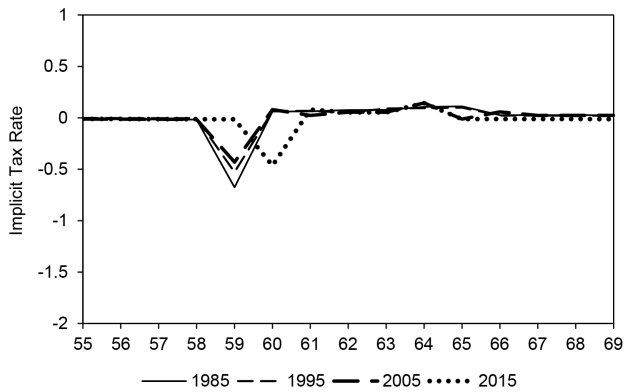
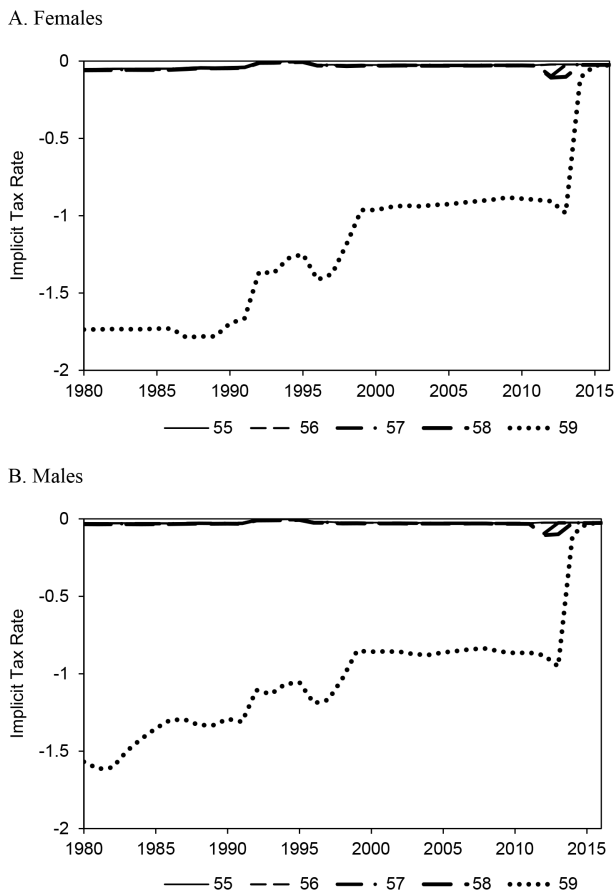


Fig. 3.7 (cont.)



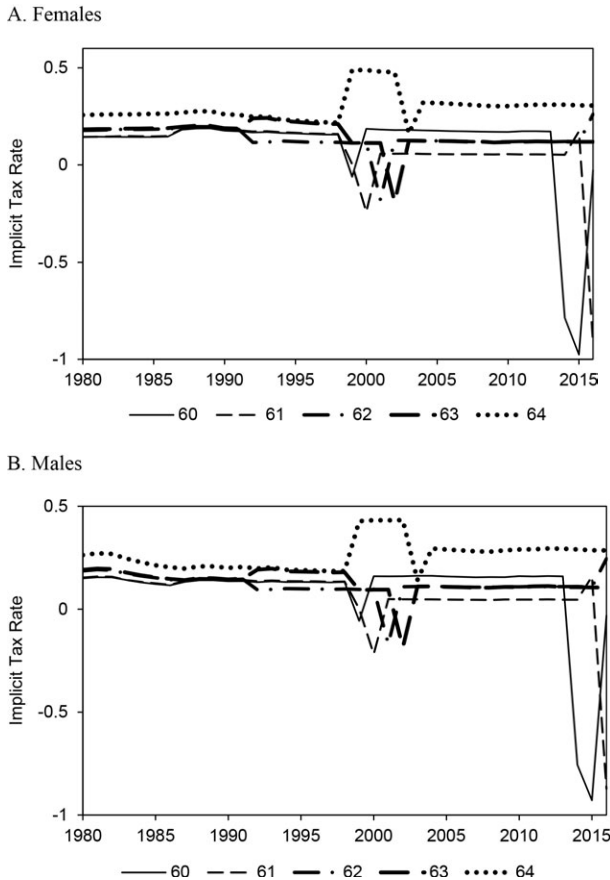


**Fig. 3.8** Median earnings, 55–59 age group

and above, with a peak appearing between ages 63 and 65 in 2015, most evident at 50 percent of the median. This represents the effect of shortening the PEW to a three-year program starting at age 63 according to the 2011 reform.

Since the results shown earlier for figure 3.7 are generally similar across earnings levels, in the next set of figures, we only show the panel for median earnings in each case. In figure 3.8a–b, we show the 55–59 age group; figure 3.9a–b for the 60–64 age group; and figure 3.10a–b for the 65–69 age group. In figure 3.8a–b for the 55–59 age group, the dominating influence of the 59-year-olds is apparent.<sup>4</sup> They face considerably higher subsidy

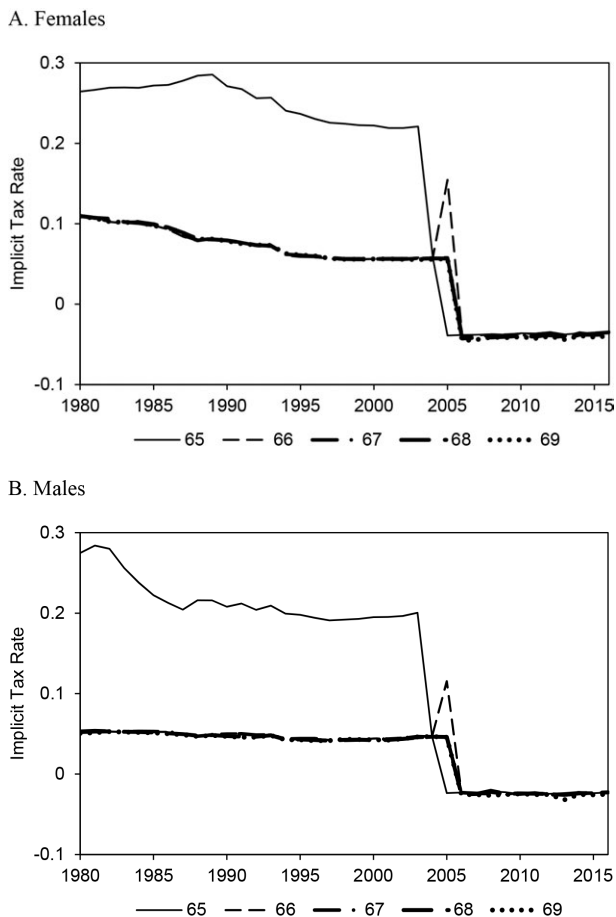
4. Indeed, if the 59-year-olds are dropped from these figures, subsidies to continue working at ages 57 and 58 appear but seem to level off in the latest years. Furthermore, there is a tax to continued work at ages 55–56 in the years 1992–95, when the TBP was active (not shown).



**Fig. 3.9** Median earnings, 60–64 age group

rates (women more than men) than the other groups. Thus these groups face strong incentives to work up to the earliest eligibility ages. This subsidy rate, however, has been declining over time as the eligibility criteria for the PEW program are being tightened; the program is becoming less generous via means testing and gradually being reduced in duration to a three-year program. In particular, the 2011 reform brings the subsidy rate of the 59-year-olds in line with the other groups. The reason that the subsidy appears at age 59 rather than at age 60 is that the implicit tax rate is based on the forward-looking one-year accrual measure, which, relative to current earnings, encourages working at age 59 so as not to lose eligibility for early retirement at age 60.

In figure 3.9a–b, the implicit tax rates for the 60–64 age group are depicted over time. For 60 and 61-year-olds, the welfare and retirement reforms of PEW seem to have induced substantial subsidies to continue working in



**Fig. 3.10** Median earnings, 65–69 age group

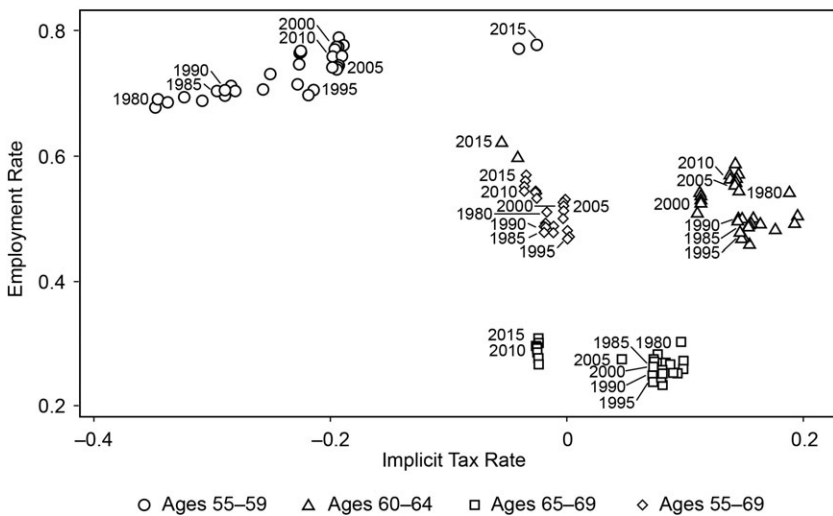
2012–13. There is a tax on continued work at age 64 in the late 1990s due to the TBP, but this tax declines subsequently over time as the program closes. For the 60–63 age group, at the same time, modest subsidies to continue work appear. Both changes seem driven by the 1999 reform, which brings the OAP age forward to 65.

Finally, for the oldest age group, 65–69, it can be seen from figure 3.10a–b that there were previously taxes for continuing work at age 65, and somewhat less for 66, before 2004. For the 66-year-olds, there is a sharp spike in 2005, when the program is first introduced. However, the 1999 reform that brought retirement forward to 65 from 67 in 2004 also results in these taxes turning to subsidies after 2005 for the older age groups, 67–69. These subsidies reflect the provisions of the reform that encouraged the deferral of OAP with an actuarial adjustment.

A. Females, median earnings



B. Males, median earnings



**Fig. 3.11 Relationships between employment rates and implicit tax rates**

### 3.5.2 Employment Rates–Implicit Tax Rates

The relationships between employment rates and implicit tax rates are presented below in figure 3.11a–b by age group and calendar year, again only for the median earner, as earnings differences play a minor role in the Danish context.

There is little difference in the relationships by gender. Women have lower

rates of employment but face essentially the same incentives in terms of implicit tax rates as men, and the evolution over time has been similar for both groups. Implicit tax rates by employment rates show quite a discernible pattern when looking at the 55–69 age group as a whole. The direction of change over time is to move from a high-tax, low-employment regime to a low-tax, high-employment regime—that is, from southeast to northwest. For women, the pattern takes on a reversed *C* rather than a straight line; however, both men and women end with higher employment and lower taxes in 2010–15 compared to 2000–2005, and this is consistent with the changing incentives due to pension reform.

When splitting by age group, however, striking differences are seen. For the youngest age group, 55- to 59-year-olds, the employment–tax force relationship is strong and positive (i.e., high tax rate, high employment). The positive relationship is driven by the first eligibility age for PEW at 60 having a huge influence on the 55- to 59-year-old group to continue working, because retirement before age 60 disqualifies PEW eligibility. However, it seems that after 2010, the relationship has weakened, which corresponds with the retirement reform of 2011 that both shortened the duration of PEW and made it less attractive because of wider means testing. For the oldest age group, 65–69, there appears to be no relationship between the implicit tax rate and employment. This makes sense because most of this group has retired and is immune to changing incentives. Indeed, this group has the lowest employment level. For the PEW-eligible age group, 60–64, we see the highest tax rates. Females show a positive relationship over time, again indicating that even though the tax rate is increasing, this age group keeps working an additional year, say, in order to qualify for early retirement benefits because the earliest eligibility age is being shifted at the same time. Implicit tax rates are based on accrual calculations that are one year forward looking.

### 3.5.3 Regression Analysis

Simple OLS regressions of the effects of *ITAX* on employment rates are estimated, and results are reported in table 3.1 (males) and table 3.2 (females). For both groups, the regressions show the U shape in employment rate as the coefficient to a calendar year is negative and the coefficient to its squared term is positive. However, adding controls diminishes the significance of the basic time effect. The effect of *ITAX* is negative as expected and is highly significant for both males and females. It is also robust to adding controls for the share completing high school in the 55–64 age group, the share completing college in the 55–64 age group, and the age 60 mortality rate.

In the first three columns, the regressions are shown for the full group of, respectively, men and women. In the next three columns, we split each group according to 50 percent, 100 percent, and 200 percent median earn-

**Table 3.1** OLS regressions of employment rate on calendar time, incentives, education and mortality, 1980–2016, males

	All	All	All	50 percent of median earnings	100 percent of median earnings	200 percent of median earnings
Year	-0.4265**	-0.3553**	0.0453	0.0738	0.0415	0.0415
Year-sq.	0.0001**	0.0001***	-0.0000	-0.0000	-0.0000	-0.0000
<i>ITAX</i>	—	-0.1811***	-0.1812***	-0.1438***	-0.2108***	-0.4217***
With controls	No	No	Yes	Yes	Yes	Yes
<i>N</i>	1,665	1,665	1,665	555	555	555
<i>Adj. R</i> <sup>2</sup>	0.0207	0.1207	0.1207	0.1386	0.1262	0.1262

Standard errors in parentheses: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Controls include share completing high school in 55–64 age group, share completing college in 55–64 age group, and age 60 mortality rate.

**Table 3.2** OLS regressions of employment rate on calendar time, incentives, education, and mortality, 1980–2016, females

	All	All	All	50 percent of median earnings	100 percent of median earnings	200 percent of median earnings
Year	-0.4903**	-0.3781**	-0.4784	-0.5198	-0.4613	-0.4545
Year-sq.	0.0001**	0.0001**	0.0001	0.0001	0.0001	0.0001
<i>ITAX</i>	—	-0.2164***	-0.2165***	-0.1938***	-0.2074***	-0.3513***
With controls	No	No	Yes	Yes	Yes	Yes
<i>N</i>	1,665	1,665	1,665	555	555	555
<i>Adj. R</i> <sup>2</sup>	0.0769	0.1914	0.1909	0.2135	0.1856	0.1738

Standard errors in parentheses: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Controls include share completing high school in 55–64 age group, share completing college in 55–64 age group, and age 60 mortality rate.

ings. Incentives exert a similarly strong and significant effect on employment for all three groups; however, the effect is significantly higher in the case of the 200 percent of median earnings subgroup compared to the other subgroups. In each case in columns 4–6, we estimate the specification, including all controls. Finally, to shed light on the question of whether the changed incentives are responsible for the trend reversal in employment among older males and females in the Danish labor market since the mid-1990s, we see from the regressions that the U shape becomes less pronounced in column 2 in tables 3.1 and 3.2 when incentives are added. To summarize, the regression results reveal a strong and robust relationship between simulated incentives and employment in Denmark and show furthermore that incentives explain to some extent the trend reversal that has occurred.

### 3.6 Conclusions

A dramatic trend reversal in employment rates of 60- to 64-year-olds has occurred in many OECD countries, where a declining employment rate in the 1980s and early 1990s has been turned around since the mid-1990s and has been increasing ever since. This U shape in elderly employment is also present in Denmark. Over a 20-year period beginning in 1996, where elderly employment had reached its lowest level, men aged 60–64 have improved their employment by 20 percentage points and women by 25 percentage points. Overall, the average age at exit from the labor force via either early pension benefits or old-age pension has increased by nearly 2 years, from 62.1 years in 1996 to 63.8 years in 2016. Over the same period, pension policy reforms changing the incentives especially for going on early retirement have been enacted, concurrent with the repeated tightening of UI and DI eligibility and increasing work accommodations for the elderly with lowered working capacity via wage subsidy programs. The highly relevant question for policy purposes is, how much of the reversal of labor market trends among the elderly can be attributed to the changing incentives of the social security program?

We investigate this question by identifying key reforms of social security policy in Denmark between 1980 and 2016 and modeling these changes with a benefit calculator, which computes potential income streams in retirement according to different program pathways and retirement ages by gender and earnings level. Using our calculator, we compute social security wealth, its accrual, and the implicit tax on work separately by gender, age, and calendar year. Our computations show that the subsidies to continuing work just before the earliest eligibility age and the subsequent tax discouraging working just after the earliest eligibility age in Denmark have been reduced substantially, mainly as a result of the 1999 reform, the 2006 welfare agreement, and the 2011 retirement reform.

In addition, results of simple aggregate regression models show a significant negative and robust relationship between the implicit tax rate and the employment rate and a role for incentives in explaining the trend reversal that has occurred in the Danish labor market. Thus in the Danish case, a reduction in the tax force to retire early has contributed significantly to employment patterns among the 60–64 age group.

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