

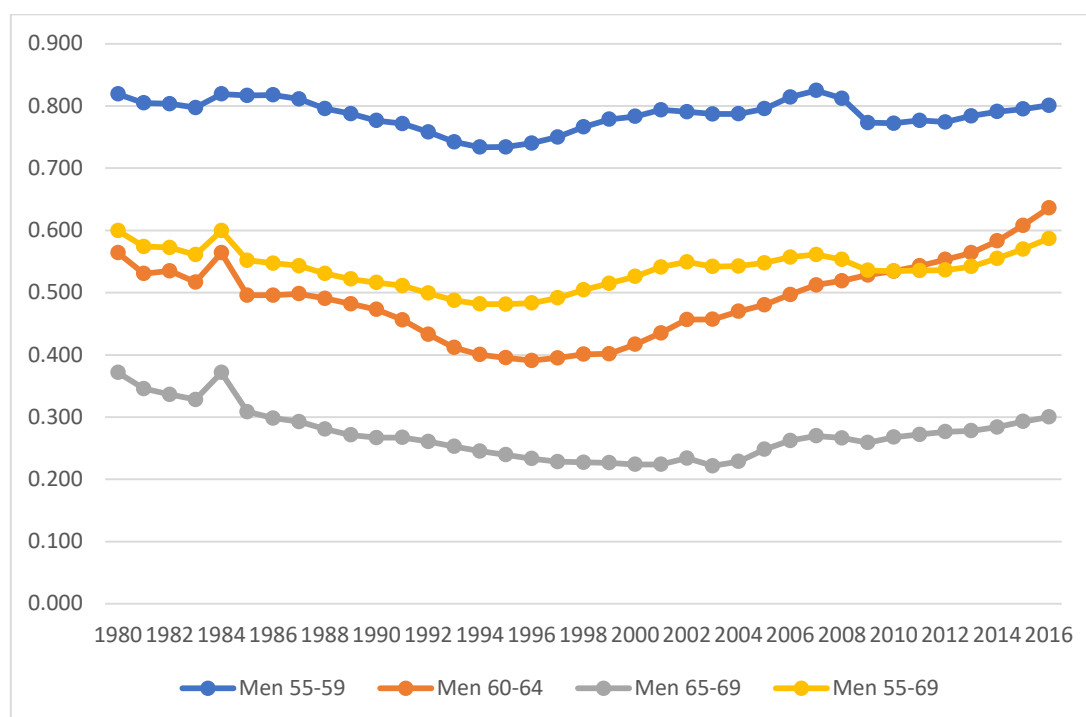
# Labor Force Exit in Denmark 1980-2016: Impact from Changes in Incentives

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## 1. Introduction

Until 1980 the labor force participation rate in Denmark for men 60-64 years old was at a level around 80-90 percent, with a very modest decrease reflecting the structural shift out of agriculture. In 1979, 5 years after the first big oil price shock a dramatic change occurred. With the purpose of reducing youth unemployment, an early retirement program (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 1 below.

Figure 1. Employment rates, men, 55-69 years old, 1980 - 2016. (Source: Statistics Denmark)



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Next, from around the turn of the century a trend reversal occurred resulting in a 20 percentage points increase in labor force participation for men and a 25 percentage points increase for women 60-64 years old, cf. Figure 2. As is well known, this is a phenomenon observed in most OECD countries. Presumably, this is the outcome of 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 in health among new groups of older workers, both factors expected to lead to higher exit ages<sup>1</sup>. It is evident from Figure 1 that the strongest trend reversal is found for the 60 - 64 years old group. For the other age groups shown in Figure 1 the initial decline in labor force participation during the first 15 – 20 years since 1980 is not regained fully. Even among the 65 – 69 years old we see, however, an increase of about 10 percentage points since around 2000.

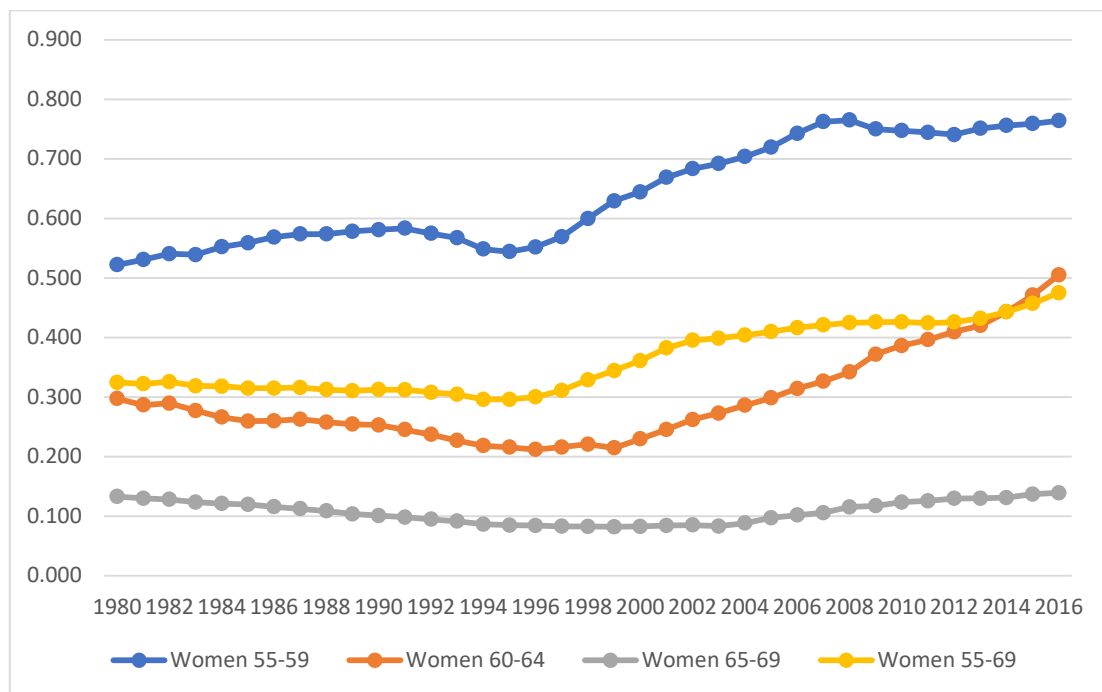
Figure 2 shows the trend reversals for different age groups among women over the same period since 1980. The most dramatic change is seen for the 55 – 59 years old group with an increase of about 25 percentage points from the mid-1990s to around 2008. This reflects however the closing of a temporary early retirement program described below. In contrast to the case for men there is among women an ongoing cohort effect explaining part of the impressive trend reversal in the 60 – 64 years 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 from changes in education and health on labor force participation in the 60 years and older group, including also individuals older than the normal social security labor force exit age. Bingley et al (2016) analyze the trend reversal with a cohort approach, including education, mortality, other health indicators and job characteristics among the relevant explanatory factors. The focus in the present study is to determine how much of the observed trend reversal in Denmark that can be explained by changes in the incentives of social security policy over the years since 1980.

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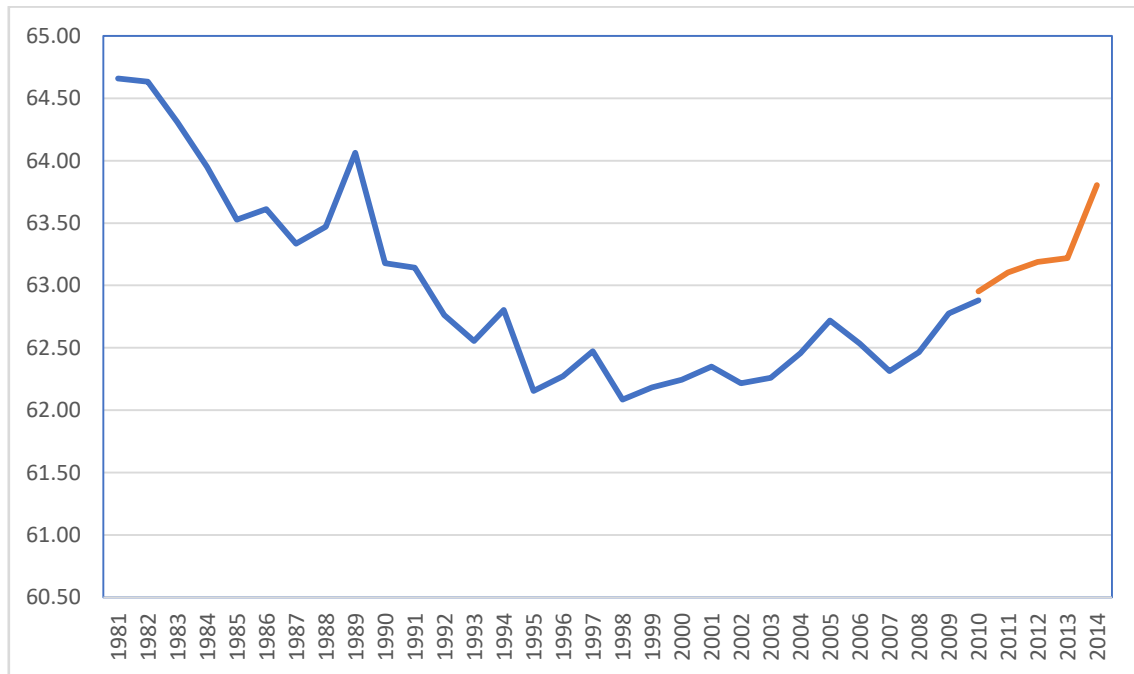
<sup>1</sup> For instance, Datta Gupta and Bengtsson (2015) find that compulsory schooling reforms enacted in Denmark in the 1950s lower exit via disability pension and diagnoses of chronic diseases later in life. The individuals affected by the reform are in their mid 50s in the late 90s, around the time the reversal occurs.

Figure 2. Employment rates, women, 55-69 years old, 1980 - 2016. (Source: Statistics Denmark)



The trend reversal is illustrated in an alternative way in Figure 3 showing the average age at exit from the labor force to either the early PEW retirement program or to old age pension at the normal social security age of eligibility. The trend reversal we set out to explain seems even more pronounced here than in Figures 1 and 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 ways included in Figure 3 are dominating, other pathways are available, i.e. disability insurance (DI) and a number of smaller programs as possible pathways for exit.

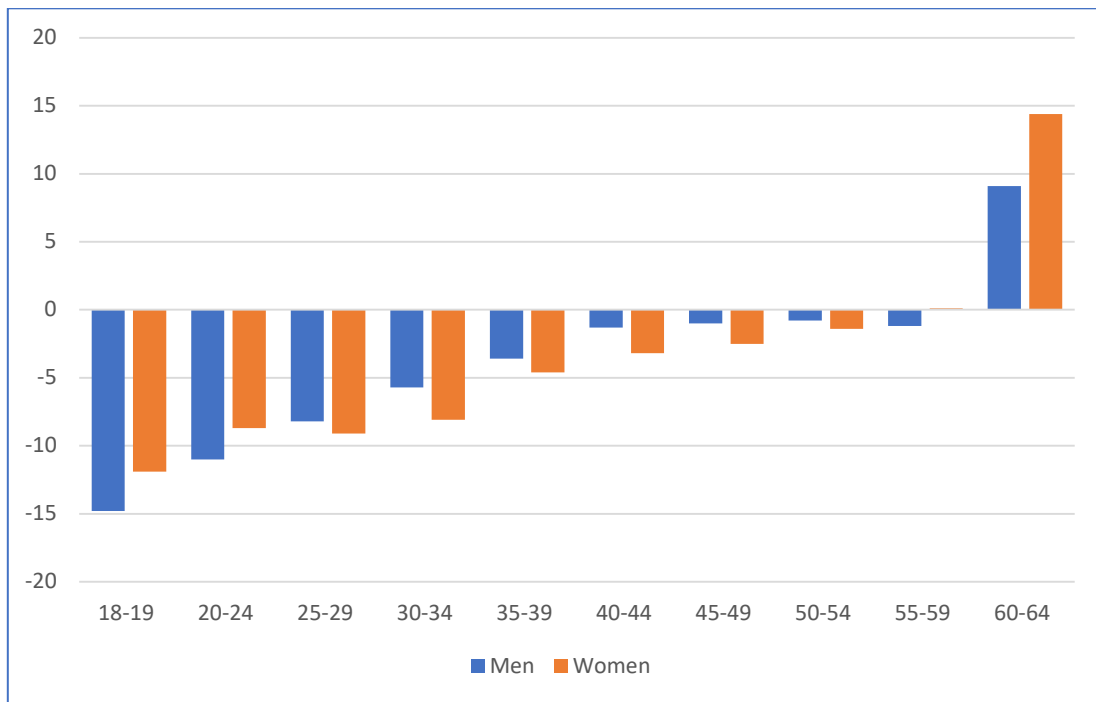
Figure 3. Average age at exit from the labor force to early retirement in the PEW program or to Old age pension at the normal social security age, 1981 – 2014. (Own calculations based on data from Insurance and Pension Denmark (IPD), 2017).



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

While Figures 1 and 2 collect the evidence for a 36-year period, Figure 4 shows the surprisingly steep increase in labor force participation in the 60-64 years old group during the Great Recession from 2008 to 2016. While all younger age groups experience declines in labor force participation during the financial crisis the 60-64 years old group has a quite different profile, which is about the same if we look at employment rates instead of participation.

Figure 4. Changes in percentage points in labor force participation by age between 2008 and 2016.  
 (source: calculations on data from Statistics Denmark)



Next, in Section 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 2 includes information on how the reforms and policy changes in the period has resulted in specific changes in ages and other conditions for eligibility for the different pathways to exit from the labor force. The main content of Section 3 is to set up a benefit calculator to compute the after-tax benefit stream in each pathway to exit from the labor force, as determined by earnings history and socio-economic background factors. In Section 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 5 presents the results from calculating the tax force, i.e. the implicit tax on working longer, for several specific groups in the labor force. Finally, Section 6 concludes the chapter.

## 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 coming decades to reflect expected increases in life expectancy. The biggest social security program is Old Age Pension (OA, folkepension) for which everybody in 1980 was eligible, dependent on years of residence in the country. Like OA, Disability Pension (DI) is financed from general tax revenues with eligibility for individuals younger than the OA age dependent on medical and/or social criteria. The so-called Post Employment Wage (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 (DC) labor market pensions introduced over the period from 1960 currently cover about 80 per cent of all employees. Among funded programs, ATP, is a small, but nearly universal program covering all employees with more than a marginal attachment to the labor force introduced in 1964. Finally, funded programs also contain private voluntary savings for retirement purposes mostly with a favorable treatment relative to taxation. 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 so-called TBP (Temporary Benefits Program, *overgangsydelse*) 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 1 and 2, especially so for women.

In the following, we describe the most relevant changes in these pension and retirement programs with 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 of an Unemployment Insurance (UI) fund for 5 out of the most recent 10 years<sup>2</sup>. Initially, benefits in the program was 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 OA at age 67 more smooth. Entry to the program turned out to be much higher than

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<sup>2</sup> UI in Denmark is organized as the so-called Ghent system implying that membership is voluntary.

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 of 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 was set at maximum UI benefits if entry was delayed to age 63 or later.

In 1992 a so-called Transitional Benefits Program (TBP) was introduced. Eligibility to this new early retirement program was conditional on being 55-59 years old, a member of an UI fund and to have been unemployed for at least 12 out of the last 15 months. From the beginning of 1994 the program was extended to cover 50 – 54-year-olds with the same labor market criteria as for the 55-59-year-olds. Benefits in the program were 82 per cent 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 in 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, i.e. that participants in the program were not allowed to work more than 200 hours during a year. This was replaced by introducing a more “flexible” PEW making it financially more attractive to work while in the program, e.g. working 20 percent of a year implied a reduction of annual benefits with 20 percent. The benefit profile was changed once again to be at 91 percent of maximum UI benefits for the duration of time in the program. Delaying entry with at least 2 years implied benefits at 100 percent of maximum UI benefits.

Means testing relative to savings-based pensions was made more restrictive, i.e. 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 savings-based pensions were being paid out, or still being accumulated in the pension fund. However, delaying entry with 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 be the OA 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 OA was reduced from 67 to 65, effective from mid-2004. Superficially, this seems surprising considering the nature of the problems regarding the pension burden. It must however be interpreted in the light of, first, the widening gap at the time between the high official labor force exit age and the declining actual average age. Next, a major share of people 65 and 66 years old received PEW benefits, which were higher than OA, so public expenditures were expected to decline<sup>3</sup>. Finally, means testing of the base amount in OA 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 per cent, 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 redistribution of a – conceived – 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 OA until 75 with an actuarial adjustment

In another policy reform in 2006 (Welfare agreement) contributions to PEW – replacing the UI fund membership condition – has to be paid for 30 years, going up from 25 years. Payments are required to begin from 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

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



of PEW was enacted in 2011. The main impact from this is a reduction in the maximum number of years in the program to 3 – from originally 7 – 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 payments have begun or not, and against income from work, however not in relation to other individuals in the household. The impact from 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 - de facto indefinite duration of benefits – to a maximum duration of 7 years. Shortly after it was decided to make a step-wise reduction of the maximum duration of benefits from 7 to 4 years over the period 1996 to 2002. Finally, maximum duration was set at 2 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 58-59 years old 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 disability pension (DI) were a major reform in 1984. DI could be granted on three levels depending on 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.

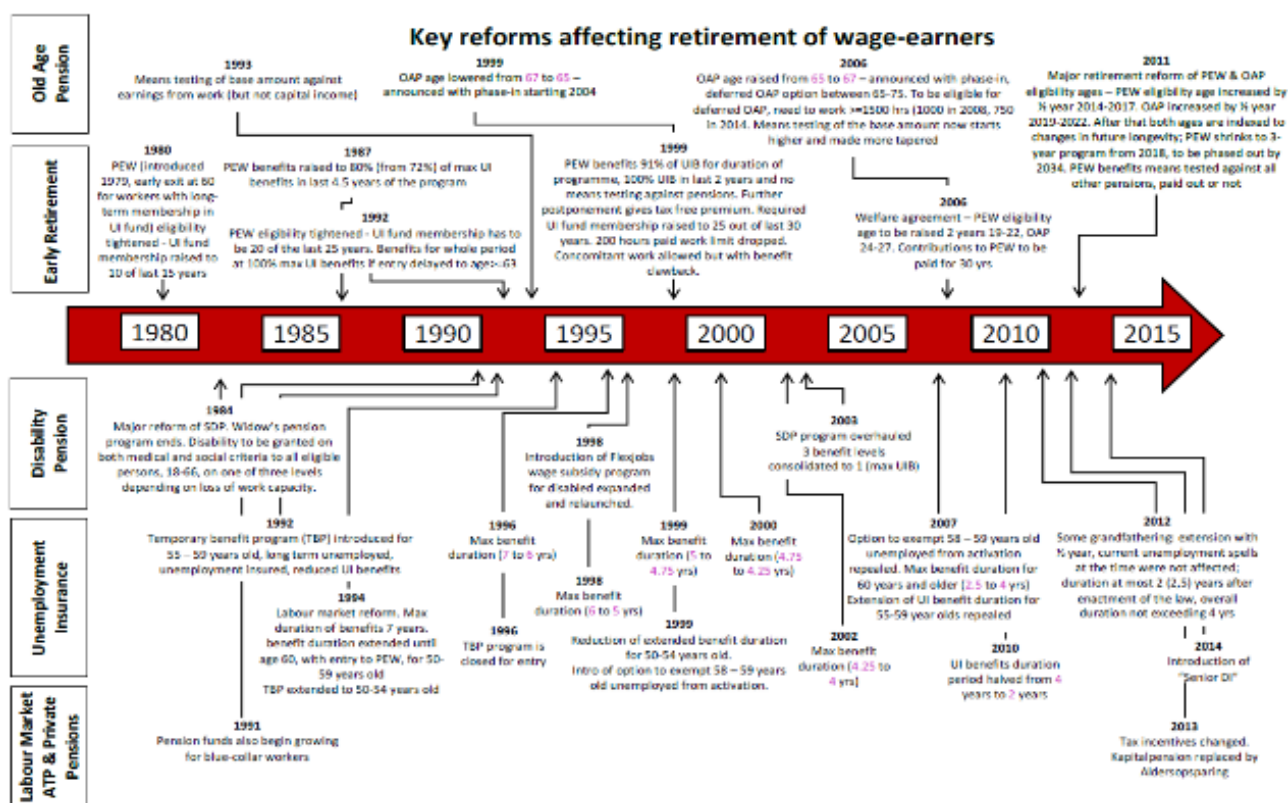
Labor market pensions were growing in importance from about 1960, with pension funds beginning for certain groups of mostly white-collar workers. From 1991 pension funds began growing also for blue-collar workers. Currently about 80 per cent of all employees are covered by labor market pensions. A specific DB program, *Tjenestemandspension*, is relevant for some groups of public sector employees. It is a very old program where currently about 15 per cent 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, i.e. in the form of annuities. 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 saving program, so far less popular than the earlier programs.

Those labor market and private programs interact with social security, especially OA, and as mentioned above, also with PEW. OA consists of a base amount and a supplementary amount which is means tested against income from 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 OA is relevant. For many blue-collar groups the means testing is however a potential challenge when the labor market pension for these groups reach maturity. The means testing will with current rules imply a reduction of supplementary OA with the same amount as the income from the labor market pension.

The detailed descriptions of the multitude of institutional changes since 1980 is illustrated in a compact way in Figure 5 collecting the development in a time line covering five areas of central relevance relative to exit from the labor force, i.e. 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.

Figure 5. Summary of reforms and policy changes around retirement, 1980-2015.



### 3. Benefit calculator

We calculate pension benefits from the four largest free programs supporting consumption in retirement: Disability Insurance (*førtidspension*, hereafter DI), Post Employment Wage (*efterløn*, hereafter PEW), Transitional Benefit Program (*overgangsydelse*, hereafter TBP) and Old Age Pension (*folkepension*, hereafter OA). Pathways DI, TBP and OA 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 claw-back was introduced for those retiring ages 60 or 61 as a function of private pension wealth. We ignore this claw-back.

Earnings histories are relevant for benefit calculation for 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 earnings profiles are flat. We calculate benefits separately for men and women at median earnings, 50% and 200% of median earnings. Individuals' singles earnings are treated as the most important source because of the importance of separate taxation in Denmark. We assume a flat 40% 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.

#### 4. Social Security Wealth accrual

To fix concepts, we begin with a few 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 end-of-life  $T$  of a 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).

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

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%.

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

$$ACC_{gt}(R, i) = SSW_{gt+1}(R + 1, i) - SSW_{gt}(R, i), \quad ACC \geq 0 \text{ or } ACC < 0$$

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, social security wealth figures are shown first in figure 6a-d. Social security wealth, summed across all pathways is presented below by age and calendar year for men with median earnings. Gender differences are due to different program weights, and only have modest effects. The following SSW illustrations are for men with median earnings.

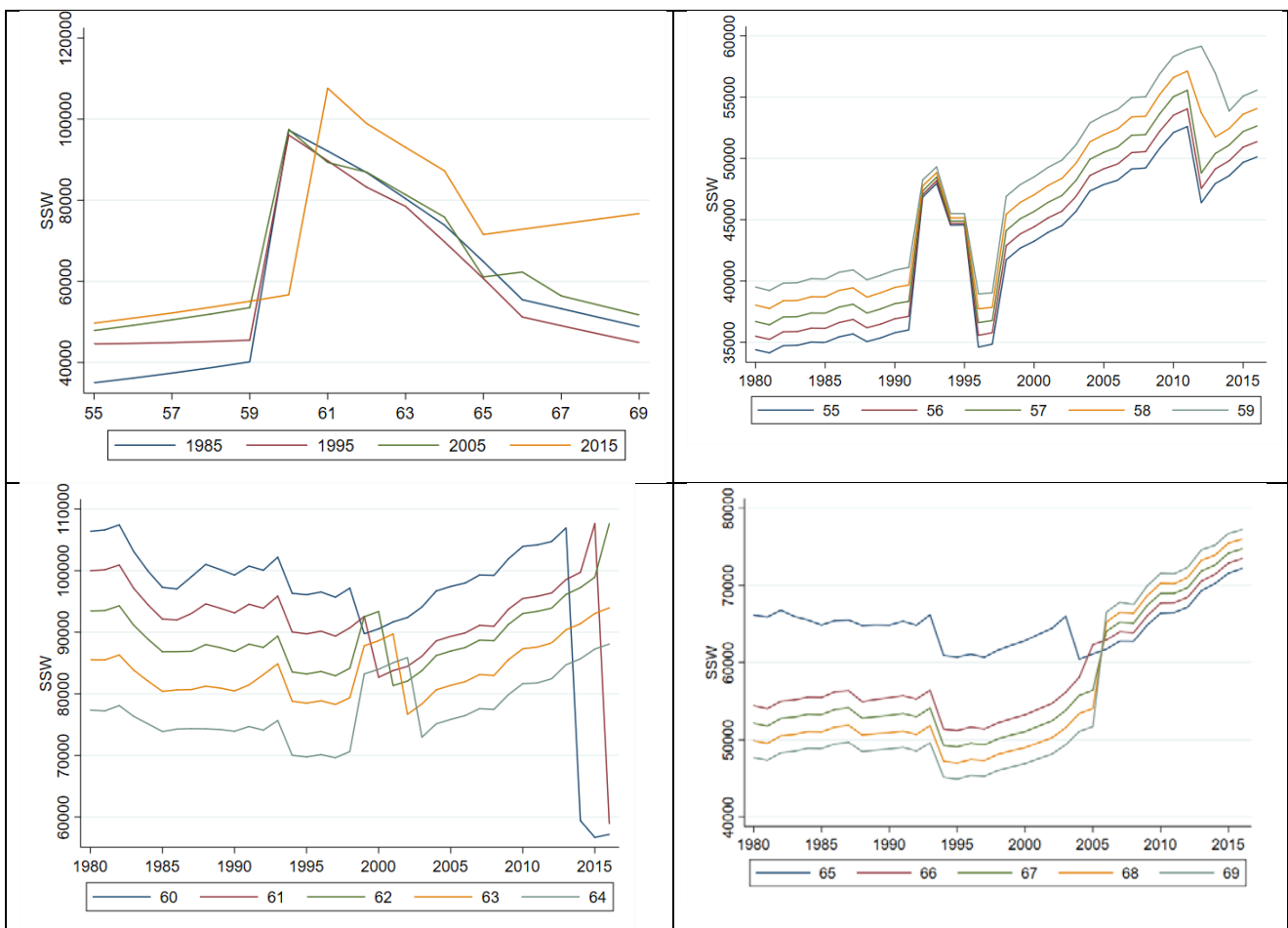
First, from figure 6a, it can be clearly seen from the age distribution of SSW that there is clear single peak in the early 60s due to the availability of early retirement. However, the incentives to retire later for men have been strengthened over time as the peak in SSW is moved from 60 to 62. This change seems to have taken place primarily in the last decade, between 2005 and 2015, suggesting the importance of the 1999 (that was phased in 2004-2006) and the subsequent Welfare and Retirement reforms of 2006 and 2011. Splitting by cohort and looking at the temporal distributions in figure 6b, SSW is shifted up by age in the 55-59 age group indicating retirement incentives are higher as people age. In the years 1992-1995 incentives are identical for all age groups and are driven by the rules of the TBP program that opened and closed between these years. Again in this figure, we see the fall in incentives for all age groups after 2010.

For the 60-64 age group, however, figure 6c shows that SSW falls with age, indicating the strong incentives for retiring early via the PEW program described earlier. However, in the late 90s, the 62-64 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 2 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, that essentially reduces the early retirement to a 3-year program for those born after July 1<sup>st</sup>, 1959.

Finally, figure 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 OA. From 2004-2006, there is an increased incentive for the 65-67 year olds in particular to exit the labor

market due to the 1999 reform that brought the NEA forward from 67 to 65 but introduced an actuarial adjustment for delaying retirement after 65. Notice however, even though subsequently the decision to raise the OA labor force exit age again from 65 to 67 was taken 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<sup>st</sup>) who will face a NEA of 67 again.

Figures 6 a-d. Social security wealth, men with median earnings.



## 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%, 100% and 200% of median).

### Implicit tax rates

In figure 7a-f, implicit tax rates are shown for the full age group 55-69. Females are depicted in the left panes; men in the right panes. Top panes are for 50% of median earnings; middle panes are for median earnings; bottom panes are for 200% median earnings.

Overall, in figure 7a-f, when looking at the full elderly 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 that it has become less negative between 2005 and 2015. At the same time, its peak has shifted right over time, by about a year. The reduction in the subsidy level is higher for median and 200% median earnings. Gender differences appear to be minor, except for 200% median earnings where males experience a slightly lower reduction in the subsidy but the same shift to the right. Modest taxes are seen in the age groups 63 and above, with a peak appearing between ages 63 and 65 in 2015, most evident at 50% of median. This represents the effect of shortening the PEW to a 3 year program starting at age 63 according to the 2011 reform.

Since the results shown earlier for figure 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 figures 8a-b we show the age group 55-59, figures 9a-b for the age group 60-64 and figures 10a-b for the age group 65-69. In figures 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 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 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 par 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 the chance of early retirement at age 60.

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<sup>4</sup> Indeed, if the 59 year olds are dropped from these figures, subsidies to continue working at ages 57 and 59 appear but seem to level off in the latest years. Furthermore, there is a tax to continued working at ages 55-56 in the years 92-95 when the TBP was active (figures available on request).

In figures 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 2012-2013. There is tax on continued work at age 64 in the late 90's due to the TBP program, 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 bring forward the OA age to 65.

Finally for the oldest age group, 65-69, it can be seen from figures 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 for women. However, the 1999 reform that brought retirement forward to 65 from 67 in 2004 also results in these taxes turning to subsidies after 2005, also for the older age groups, 67-69. These subsidies possibly reflect the provisions of the reform that encouraged deferral of OA with an actuarial adjustment.

### **Employment rates – implicit tax rates**

The relationships between employment rates and implicit tax rates are presented below in figures 12a-b by age group and calendar year, again, only for the median earner as earnings differences play a minor role in the Danish context.

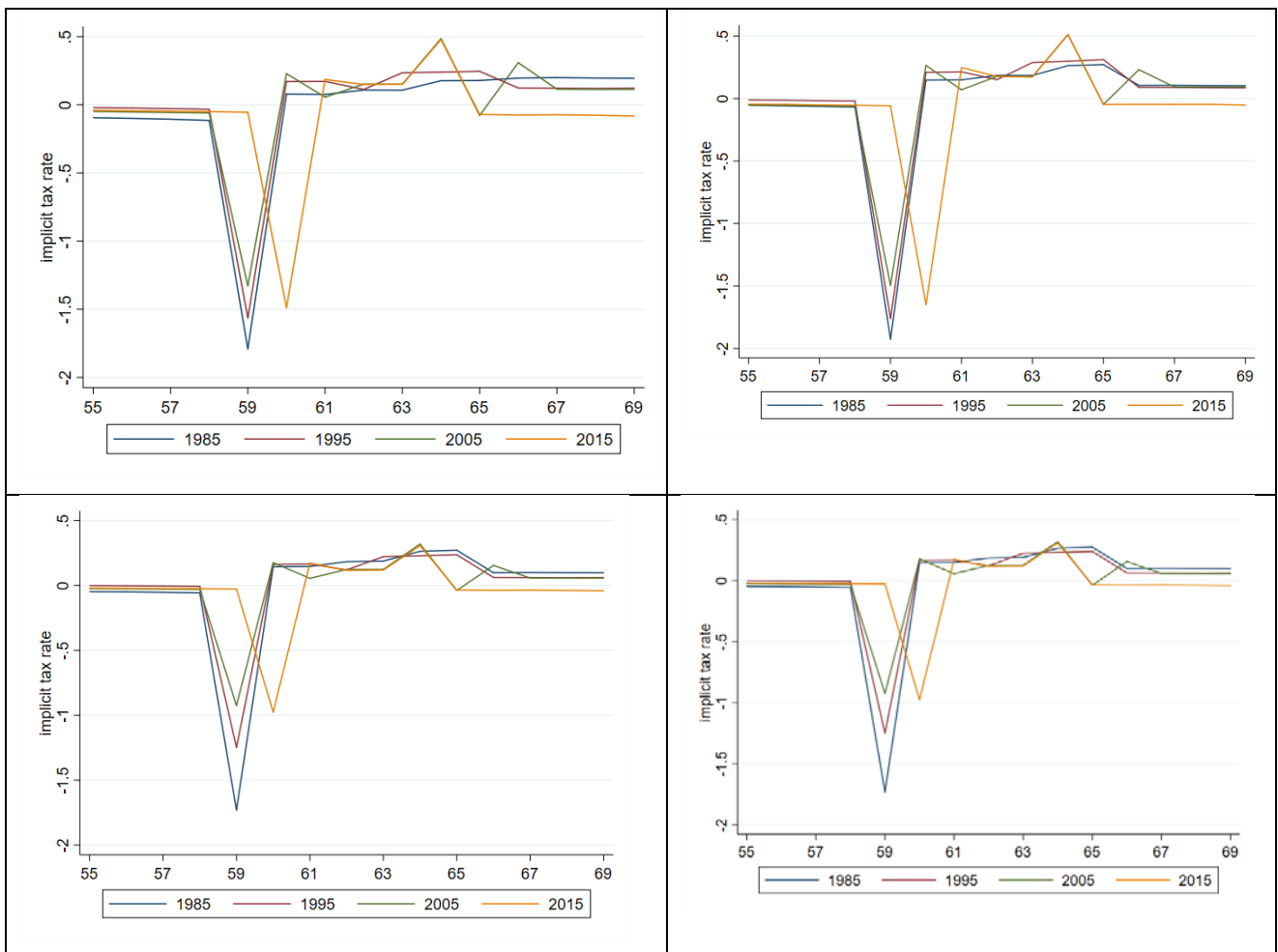
There is little difference in the relationships by gender. Women have lower rates of employment but face essentially the same incentives in terms of implicit tax rates as men, and the evolution over time has been similar for both groups. Implicit tax rates by employment rates show quite a discernable pattern when looking at the age group 55-69 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, i.e. 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 2010-2015 compared to 2000-2005, and this is consistent with the changing incentives due to pension reform.

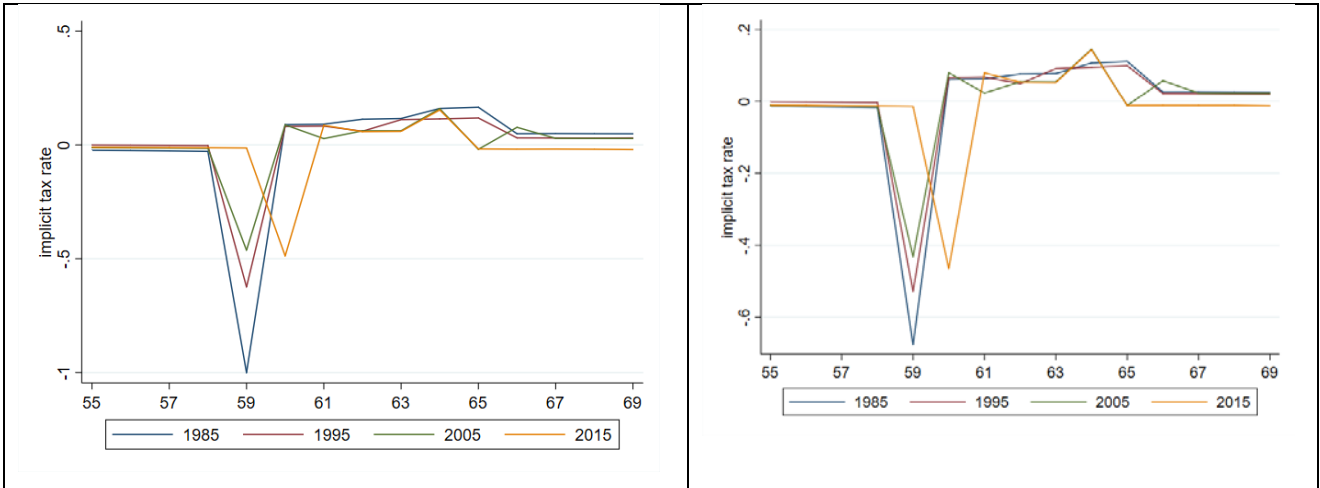
When splitting by age group, however, striking differences are seen. For the youngest age group, 55-59-year olds, the employment-tax force relationship is strong and positive (i.e. high tax rate, high employment). The positive relationship is driven by the first eligibility age for PEW at 60 having a huge influence on the 55-59 years old group to continue working because retirement



before age 60 permanently 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 the early retirement program 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 early retirement 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 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.

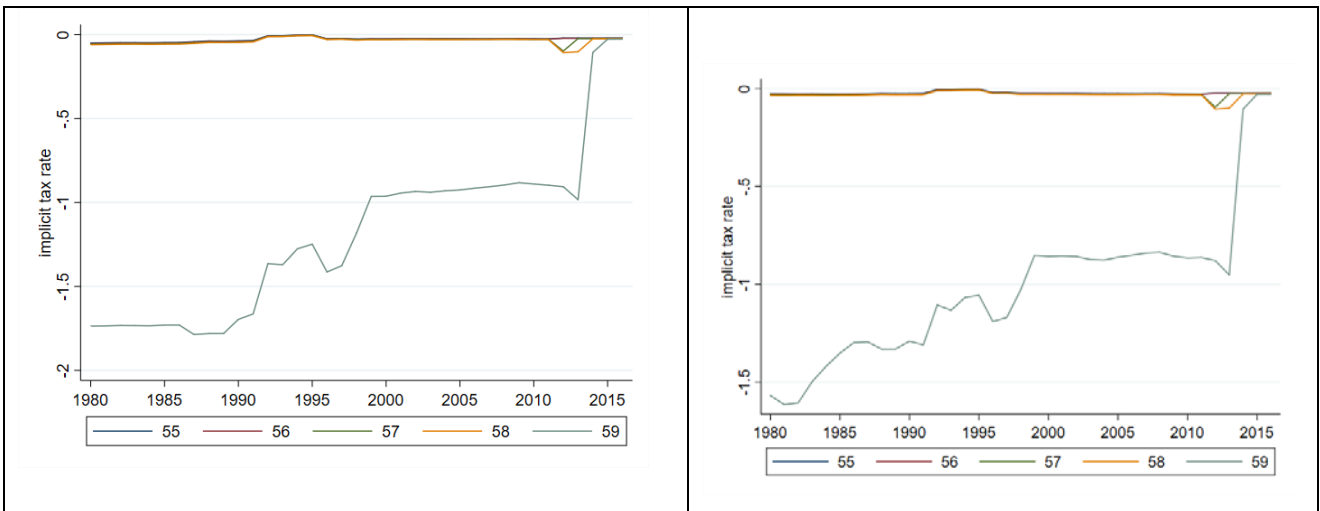
Figure 7a-f





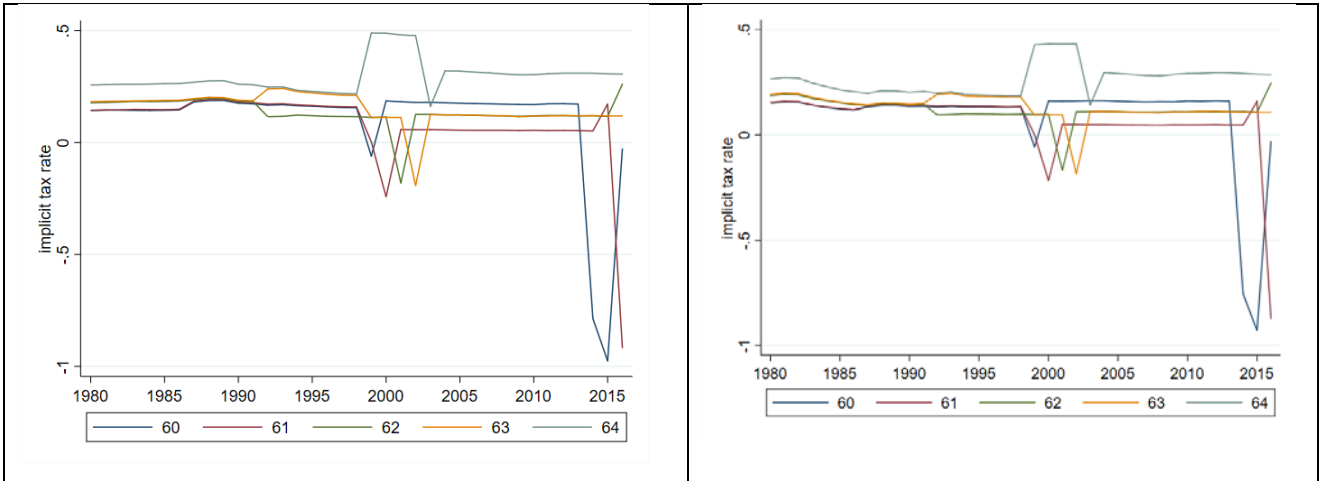
Note: Females are depicted in the left panes; men in the right panes. Top panes are for 50% of median earnings; middle panes are for median earnings; bottom panes are for 200% median earnings.

Figure 8a-b



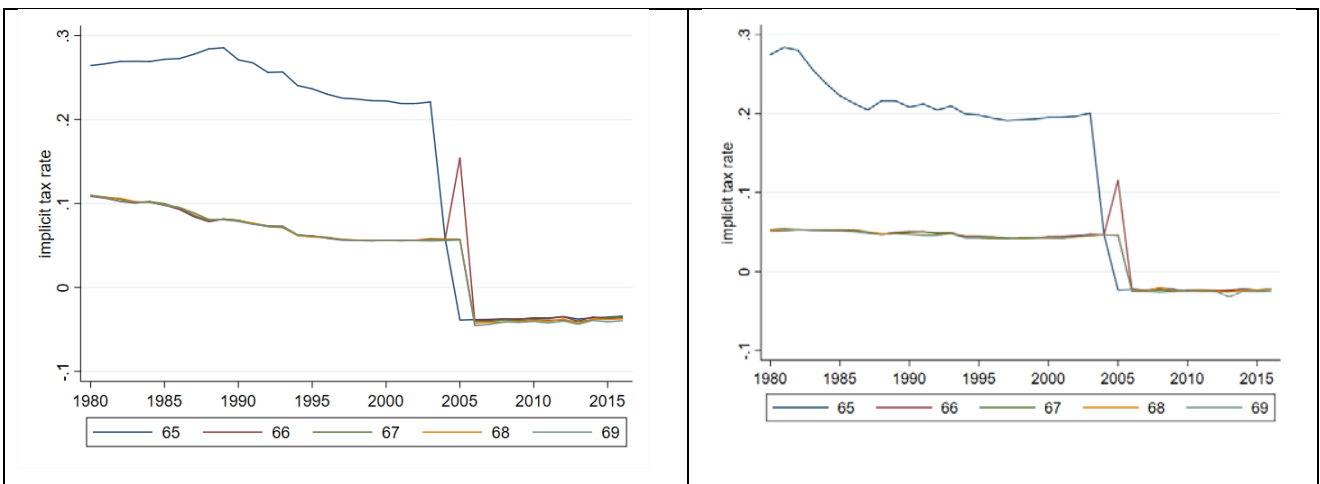
Note: Females are depicted in the left pane; men in the right pane. Figure shown for median earnings only.

Figure 9a-b



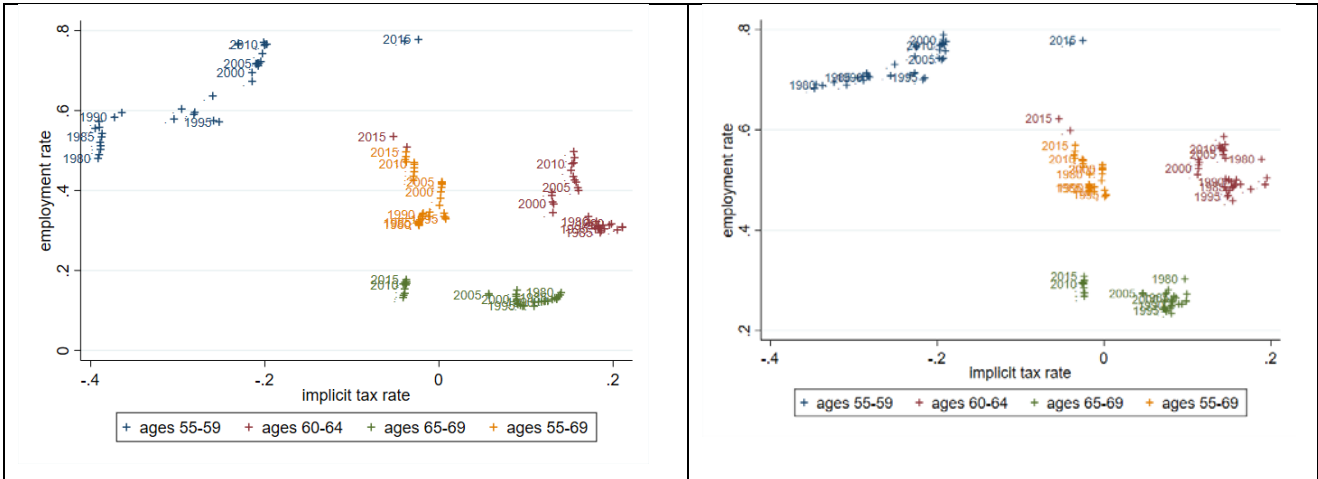
Note: Females are depicted in the left pane; men in the right pane. Figure shown for median earnings only.

Figure 10a-b



Note: Females are depicted in the left pane; men in the right pane. Figure shown for median earnings only.

Figure 11a-b



Note: Females are depicted in the left pane; men in the right pane. Figure shown for median earnings only.

### Regression analysis

Simple OLS regressions of the effects of *ITAX* on employment rates are estimated and results are reported in Table 1 (males) and Table 2 (females). For both groups, the regressions show the U-shape in employment rate as the coefficient to 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 strongly 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 fact, these control variables are jointly insignificant in explaining the employment 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%, 100% and 200% median earnings. Incentives exert a similar strong and significant effect on employment for all three groups, however, the effect is significantly higher in the case of the 200% of median earnings subgroup compared to the other subgroups. In each case in columns 4-6, we estimate the specification including all controls; however, in no case do the control variables carry additional explanatory power as they are always jointly insignificant. Finally, to shed some 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 labour market since the mid-1990s, we see from the regressions that the U-shape becomes less pronounced in column 2 in both Table 1 and Table 2 when incentives are added. To summarize, the regression results reveal a strong and robust relationship between

incentives and employment in the Danish case and show furthermore that incentives explain to some extent the trend reversal that has occurred.

Table 1. OLS regressions of employment rate on calendar time, incentives, education and mortality, 1980-2016, Males

	All	All	All	50% of median earnings	100% of median earnings	200% 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 2. OLS regressions of employment rate on calendar time, incentives, education and mortality, 1980-2016, Females

	All	All	All	50% of median earnings	100% of median earnings	200% 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

## 6. Conclusions

A dramatic trend reversal in employment rates of the 60-64 year old has occurred in many OECD countries, where a declining employment rate in the 80s and early 90s has been turned around since the mid-90s and has been increasing ever since. This “U-shape” in elderly employment is also present in Denmark. Over a 20-year period beginning from 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 retirement 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, retirement policy reforms changing the incentives for going on, especially, early retirement have been enacted, concurrent with repeated tightening of UI and DI eligibility and increasing work accommodation of 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 modelling these changes into a benefit calculator, which computes all possible retirement (net) earnings streams according to the program pathway selected, age at retirement, 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 labour market. Thus, in the Danish case a reduction in the tax force to retire early has contributed significantly to the reversal in employment among the 60-64 age group.

## References

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