Public Economics II: Public Expenditures
Lecture 5: Social Security

David Macdonald

Aalto University
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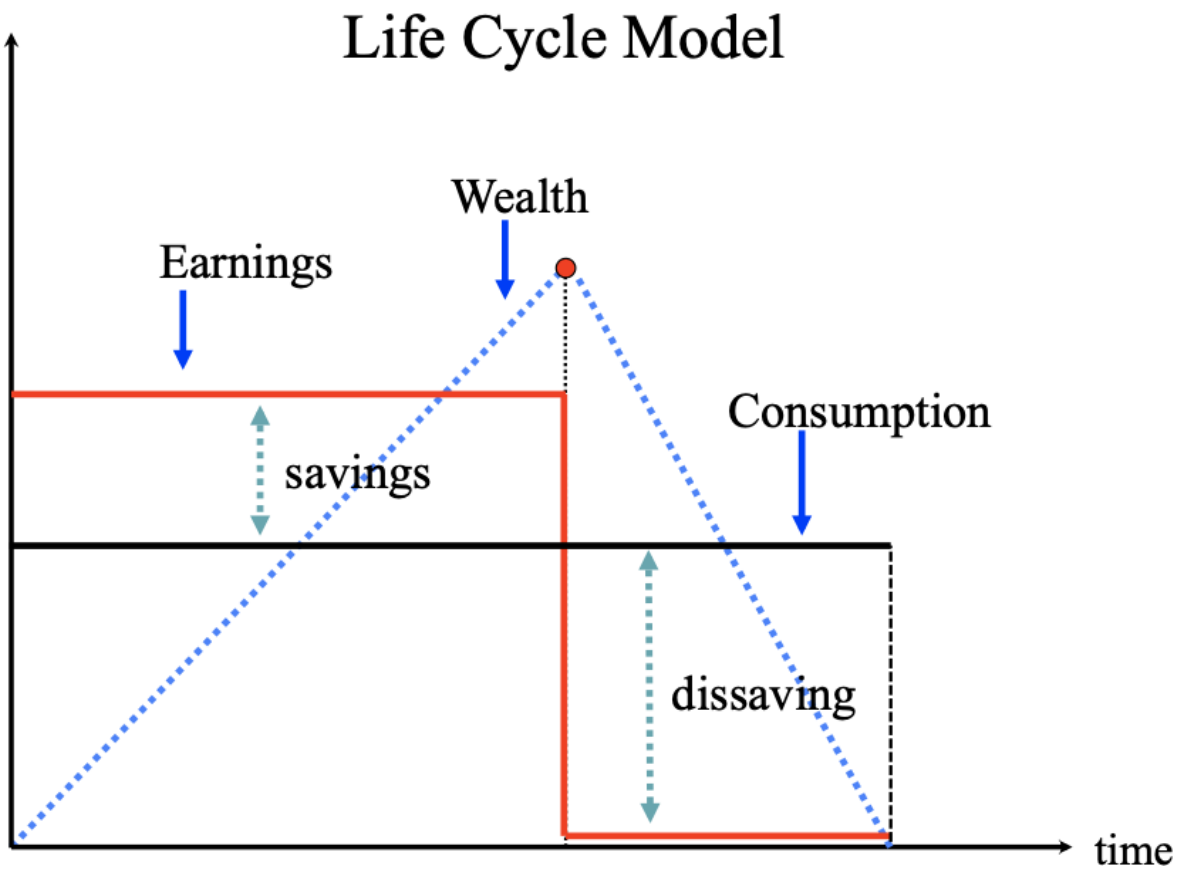
Retirement Problem

- **Life-Cycle**: Individuals ability to work declines with age, but they continue to live after they are unwilling/unable to work.
- **Standard Life-Cycle Model:** Absent government intervention, rational individual would save while working and consuming savings when retired to keep consumption relatively constant throughout lifespan.

  $\longrightarrow$ "consumption smoothing"


Life Cycle Model
Wealth
Earnings
Consumption
savings
dissaving
time

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- **Standard Life-Cycle Model:** Absent government intervention, rational individual would save while working and consuming savings when retired to keep consumption relatively constant throughout lifespan.

  $\longrightarrow$ "consumption smoothing"
- In reality: optimal saving problem is very complex: uncertainty in returns to savings, in life-span, and in future ability, tastes and health.
- **In practice**: Before SS many people worked until they were unable to (often until death) and then were taken care of by family members.

Figure 2.6: Employment rate of men aged 65+ in the UK and the US

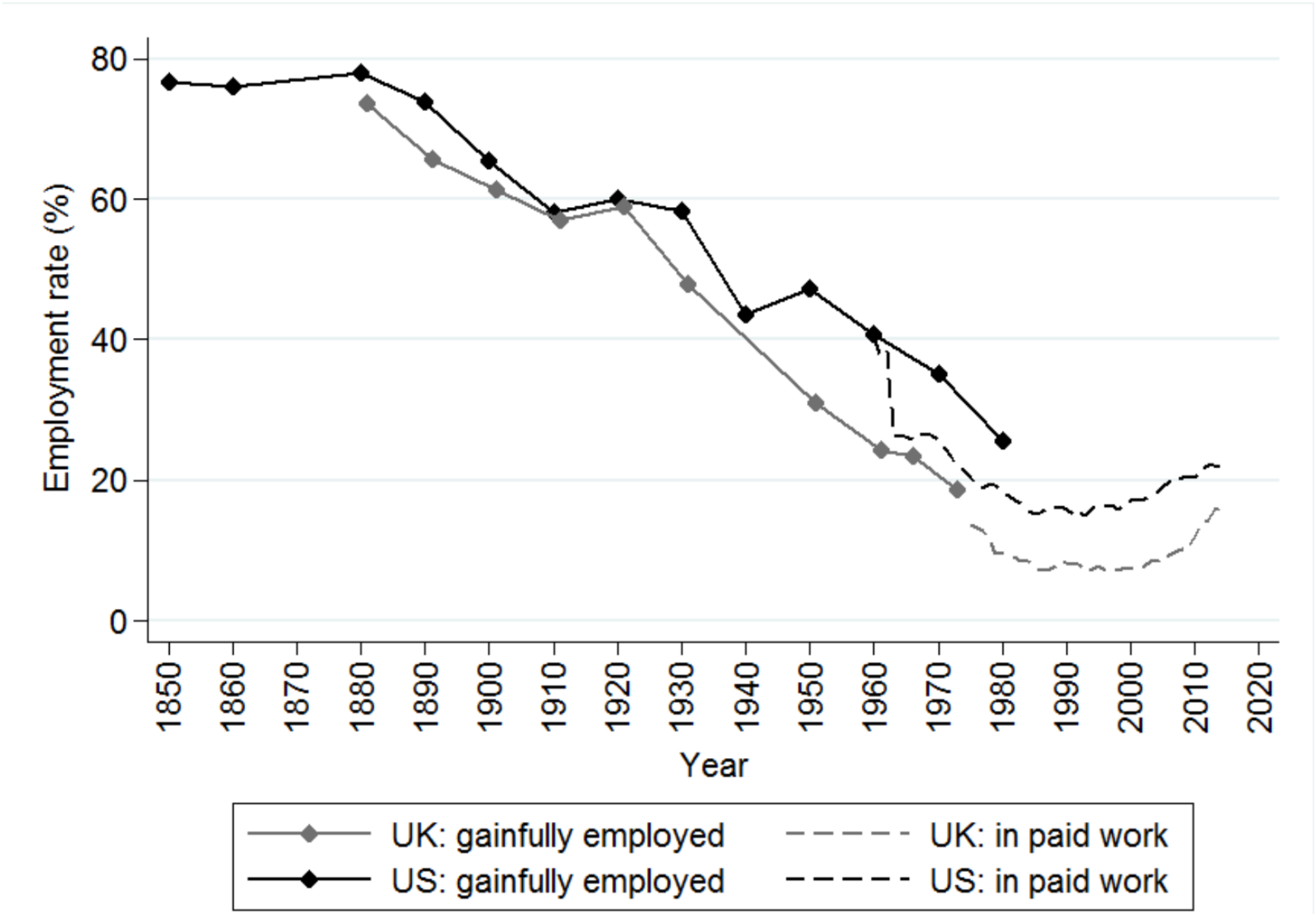
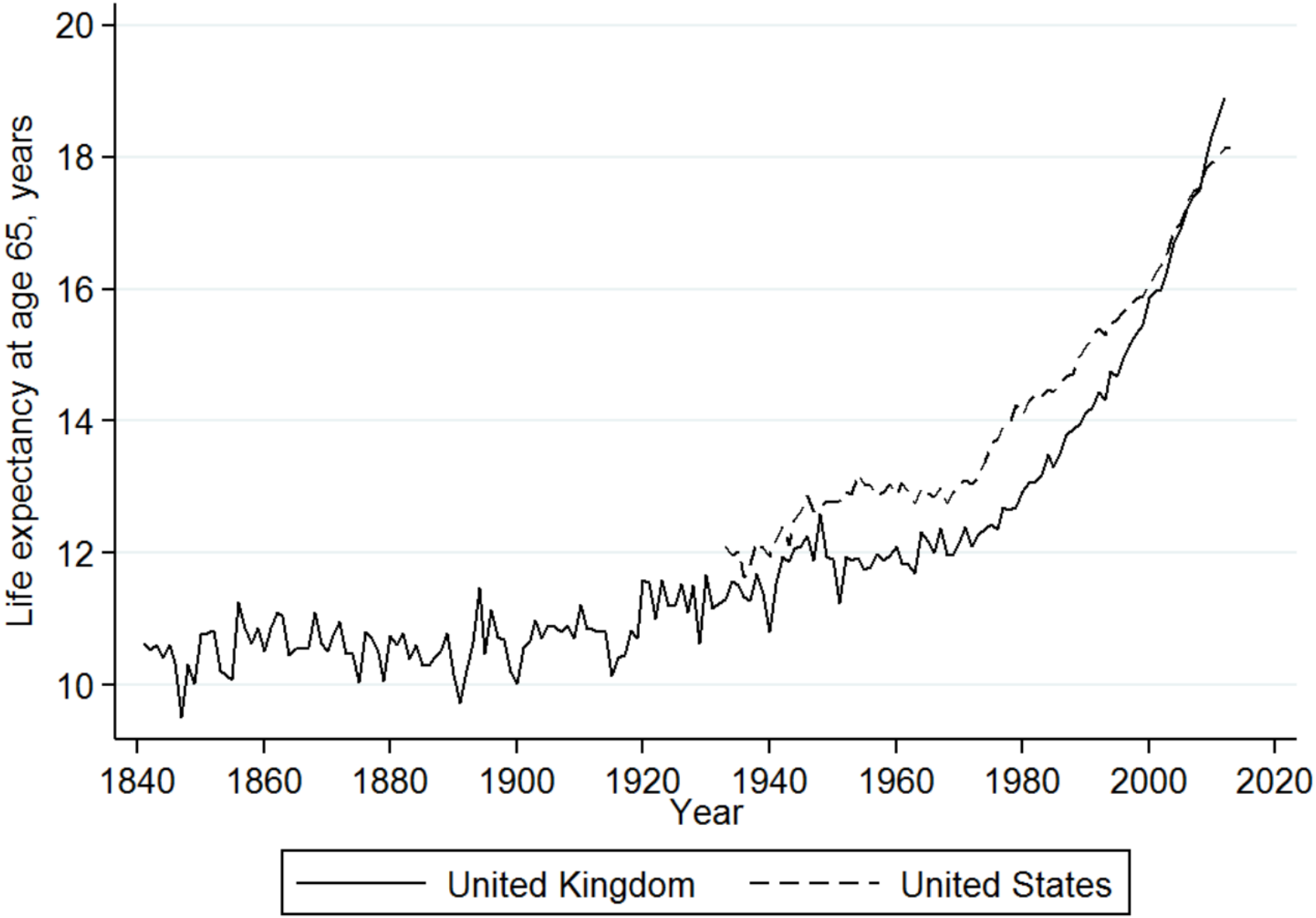
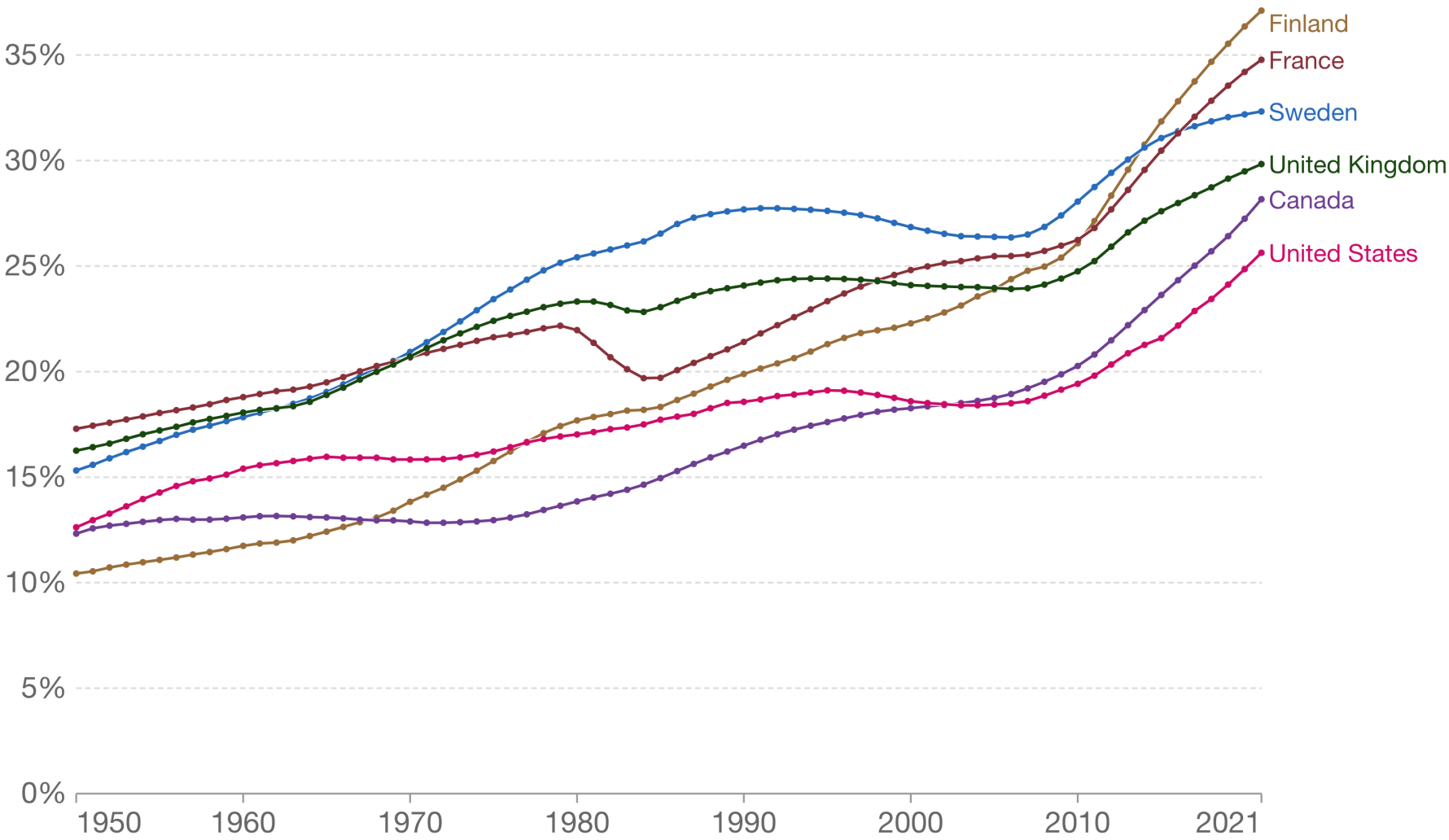


Figure 2.7: Life expectancy of men at age 65 in the UK and the US



Old-age dependency ratio, 1950 to 2021

The ratio of the number of people older than 64 relative to the number of people in the working age population (15-64 years). Data are shown as the number of dependents per 100 working-age population.



Source: United Nations - Population Division (2022)

OurWorldInData.org/age-structure • CC BY

Figure 4. Public social expenditure by function as a percentage of GDP in 1960–2004 (Ministry of Social Affairs and Health 2005).

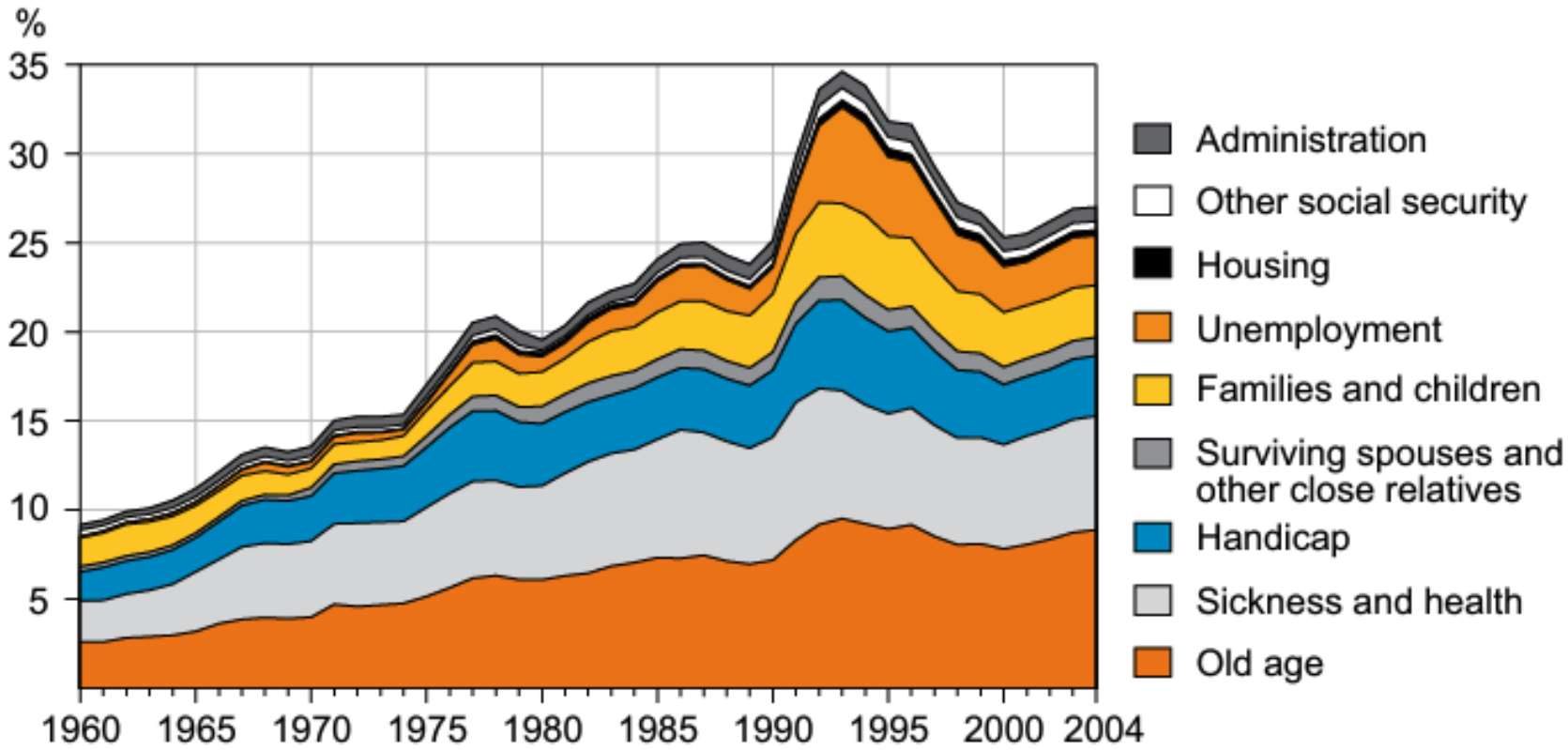
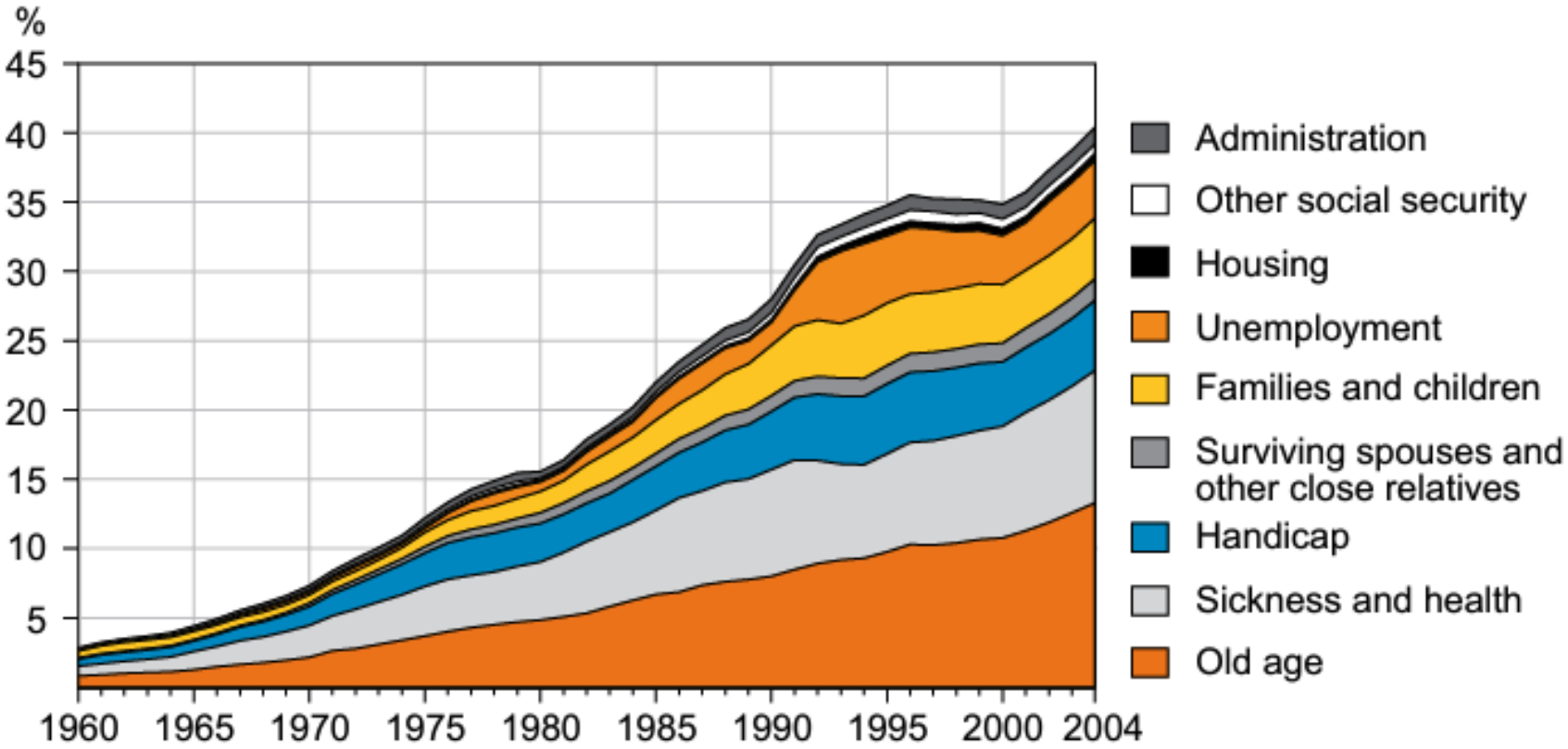


Figure 5. Public social expenditure by function at 2004 prices in 1960–2004 (Ministry of Social Affairs and Health 2005).



Two Different Pension Funding Schemes

1) **Unfunded (pay-as-you-go):** benefits of current retirees are paid out of contributions from current workers (inter-generational link).

2) **Funded:** workers contributions are invested in financial assets and will pay for their own benefits when they retire.

Funded vs. Unfunded Systems

Standard OLG model with 2 periods for each generation (work and retirement).
Generation t lives in periods t and $t+1$ with cohort size N_t and wage w_t.

1) **Unfunded system:** Free benefits to 1st generation of retirees. Generation t pays tax:

$$tax_t = \tau w_t$$

and receives benefit:

$$b_t = \frac{N_{t+1}}{N_t}\tau w_{t+1} = \tau w_t \frac{w_{t+1}}{w_t}\frac{N_{t+1}}{N_t} = tax_t(1+g)(1+n) = tax_t(1+\gamma)$$

where $\gamma \approx n+g$, where n is population growth and g is real wage growth per capita.

2) **Funded system**: each generation gets the market return r on *their own* contributions:

$$b_t = tax_t(1+r).$$

Funded vs. Unfunded Systems: Classic Theoretical Results

1) Samuelson (1958): In OLG model with no capital and no savings (chocolate economy), unfunded system is optimat because it allows trade across generations.

2) Diamond (1965): In OLG model with capital and savings, unfunded pension is optimal iff $n + g > r$. If $n + g < r$, unfunded pensions redistribute to the 1st generation at the expense of all other generations.

Funded vs. Unfunded Systems: Classic Theoretical Results

- In practice $r > n + g$ almost everywhere: funded system delivers higher returns because it does not deliver a free lunch to 1st generation
- In Finland: $n \approx 0.2\%$, $g \approx 2\%$ and $r \approx 5 - 6\%$. (This is pre-covid/covid recovery).
- Note that r is much more risky than $n + g$: risk adjusted market rate of return should be lower than average market rate r but still higher than $n + g$

Historical development of pension systems

1. Before 20th century: private pension arrangements are family based (kids take care of aging parents) which is an unfunded system.

2. 20th century: Governments introduce unfunded pension systems to replace the family based system (workers start paying taxes but no longer have to care for elderly parents)

3. Today: some debate on whether government systems should be funded instead of unfunded (social security privatization debate). Politically difficult because switching to a funded system will require a transitional generation to pay twice (for the unfunded old and then funding themselves).

The Pension System in Finland

1. **Funded component** Työnantajan eläkevakuutus (TyEL) (introduced in 1962) requires employers to put 3.6% of employees earnings into a pension account, half from a payroll tax on employees and half from the employer.

2. **Unfunded component** Kansaneläke: ensures a basic level of pension if the earnings-related pension falls below a certain level.

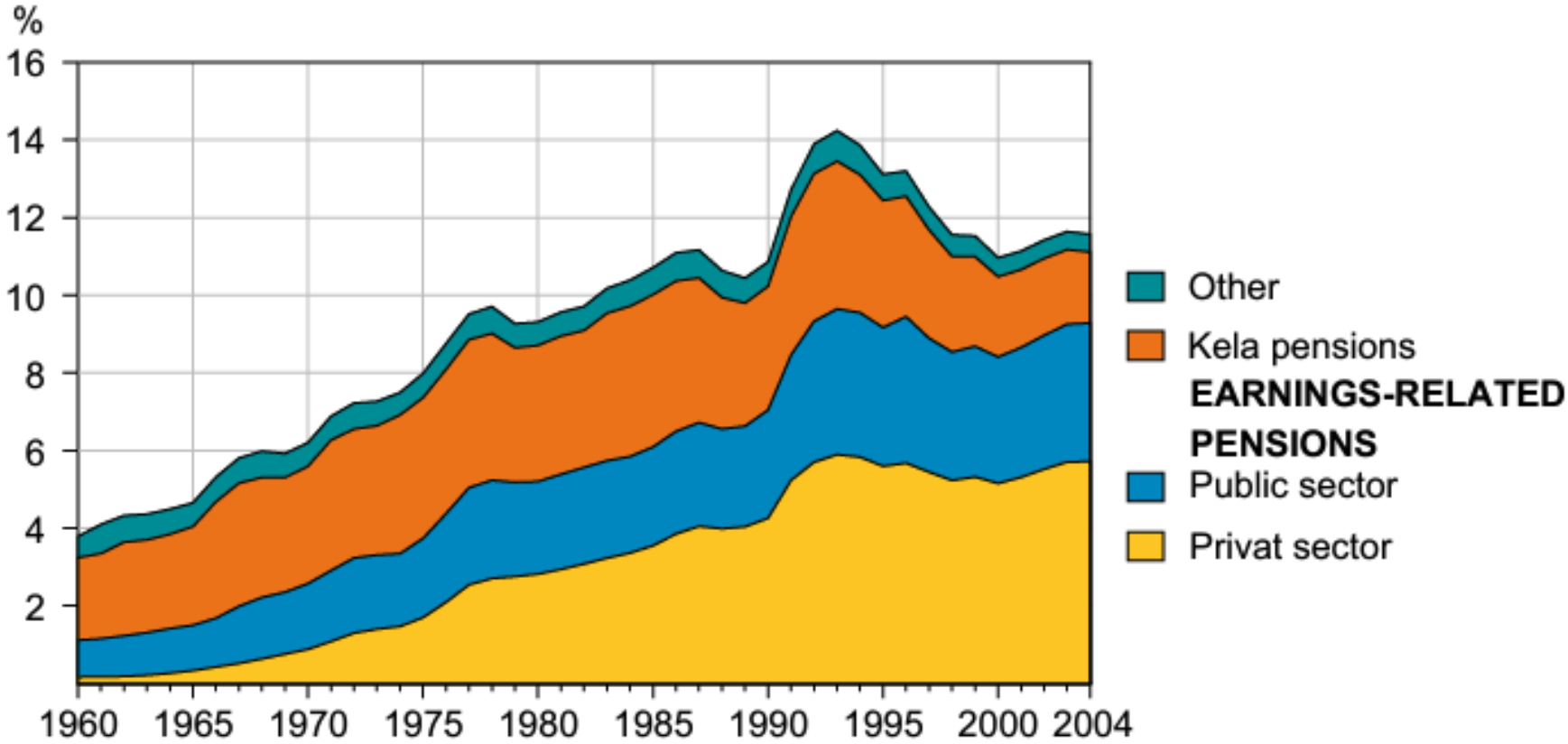
Full national pension (€/month), as of January 2023

	Full national pension	Earnigs-related pension which no longer entitles to a national pension
Single retiree	732.67	1,512.38
Married or cohabiting retiree	654.13	1,355.30

Retirement Age Finland

- **Retirement age** in Finland for receiving your full pension is 65 with plans for increases inline with increases in lifespan.
- **Early retirement age:** Can retire and take out part of your pension as early as 61 years of age but that portion of your pension will be permanently reduced by 0.4% for every month you retire early.
- **Late retirement**: pension will increase by 0.4% for each month you prolong retirement after the regular retirement age.
- Theoretically the pension system should not distort retirement age on average (as adjustments are fair) if people understand it.
- In Reality: The availability of pension benefit early seems to have huge effects (inconsistent with standard model with no credit constraints) → **Liquidity Effects**

The Pension System in Finland



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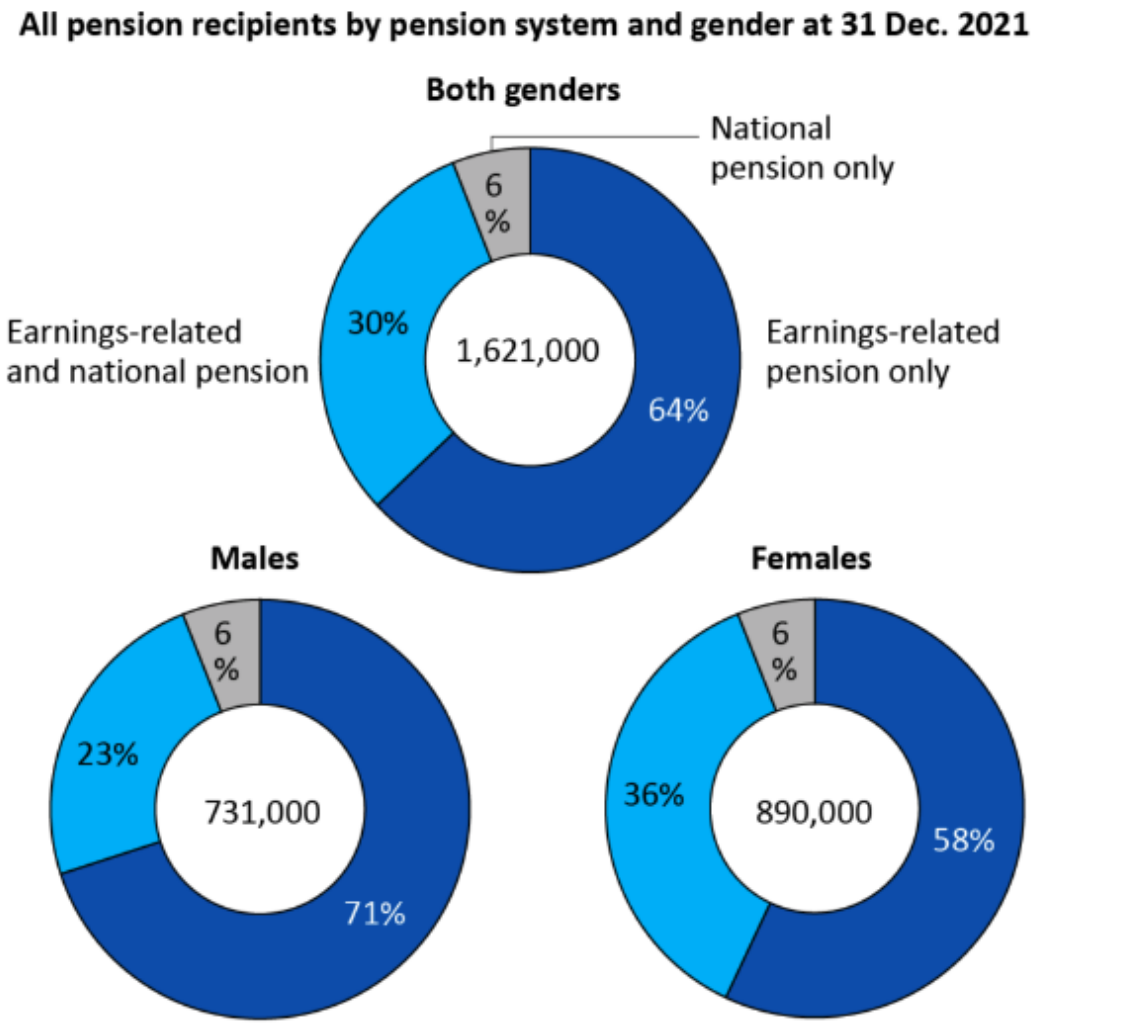
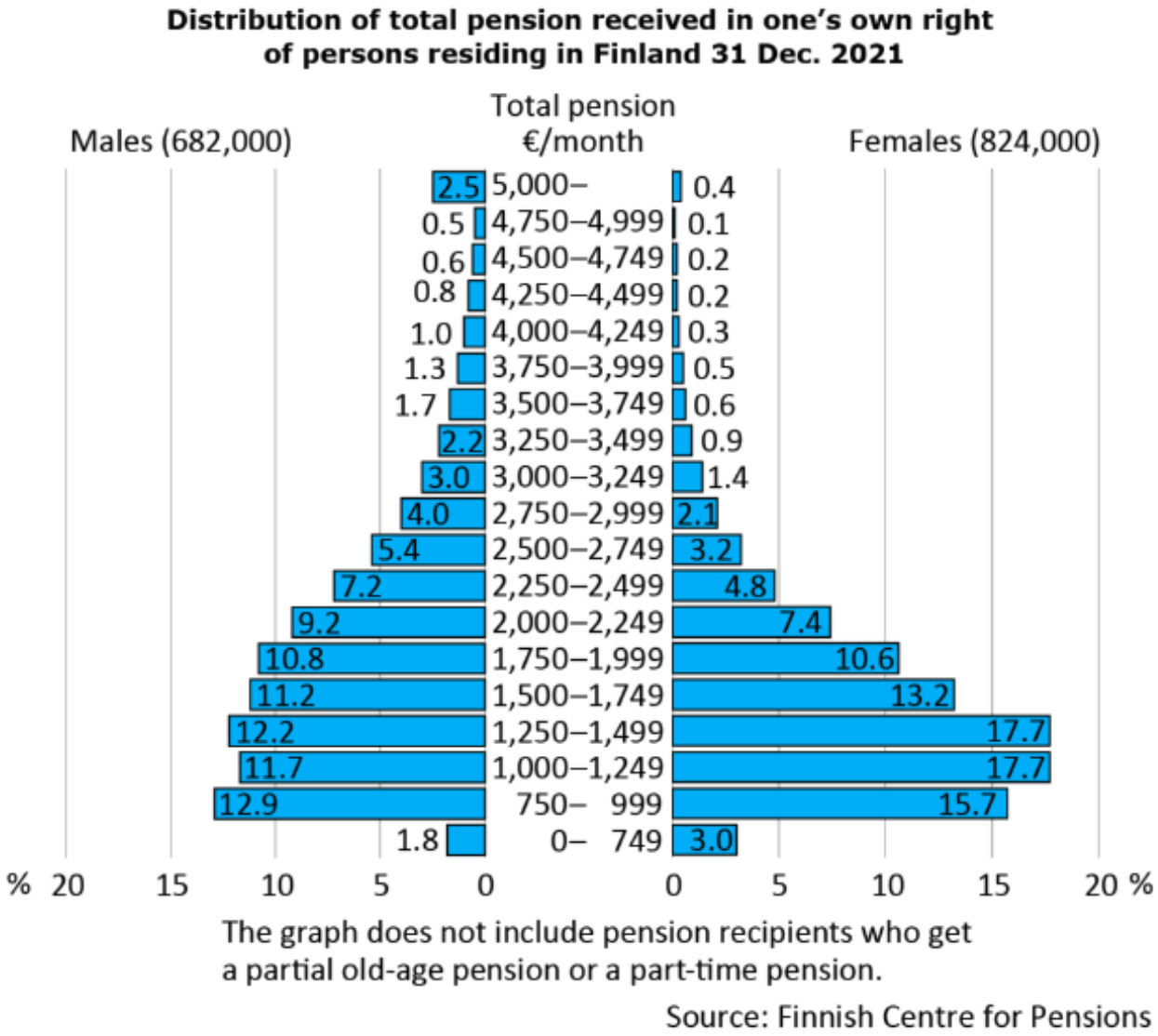


In addition to earnings-related and national pensions, 114,000 persons received a guarantee pension. Around 2,700 persons received only a guarantee pension.

Source: Finnish Centre for Pensions

The Pension System in Finland



A note on research

- When reading about government programs/rules/institutions watch out for statements like this:

  Individuals who have been unemployed for a long time and who are entitled to additional days of the unemployment allowance can get a full national old-age pension as of age 64. Those born in 1962 or later are not entitled to a full old-age pension before they reach their retirement age.

- You can almost certainly use a **regression discontinuity design** to measure the causal impact of SS benefits without penalty on unemployment duration for those closing in on retirement (I honestly would be surprised if no one has at least tried this yet).

- The idea for my own job market paper came from a very similar sort of statement when reading Arizona laws:

  Prisoners with offense dates prior to January 1, 1994 will be eligible for release after serving 1/3rd to 2/3rds or their sentence. Those with offences after January 1st, 1994 prisoners will be required to spend a minimum of 85% of their imposed sentence incarcerated

Reasons for Government Intervention in Retirement Savings

1. Paternalism
   - Individuals will not save enough if left to their own devices
2. Market Failures/Efficiance
   - Absence of safe investment opportunities.
   - Adverse selection in annuities markets.
   - Information failures.
3. Redistribution
   - Income tax is imperfect for redistribution because of transitory shocks to income. SS can redistribute based on lifetime earnings.
   - SS could redistributed from rich to poor generations.

Motivation 1: Paternalism

Model: Rational vs. Myopic Savers

- Individuals live two periods and choose consumption and saving today to maximize their lifetime utility.
- Some are rational:

$$\max u(c_1) + \delta u(c_2)$$

$$\text{s.t.} \quad c_1 + s = w \quad \text{and} \quad c_2 = s(1+r)$$

F.O.C.:

$$u'(c_1) = \delta(1+r)u'(c_2)$$

$\Rightarrow$ if $u(c) = log(c)$ then $c_1 = \frac{w}{1+\delta}$ and $c_2 = \frac{w\delta}{1+\delta}$

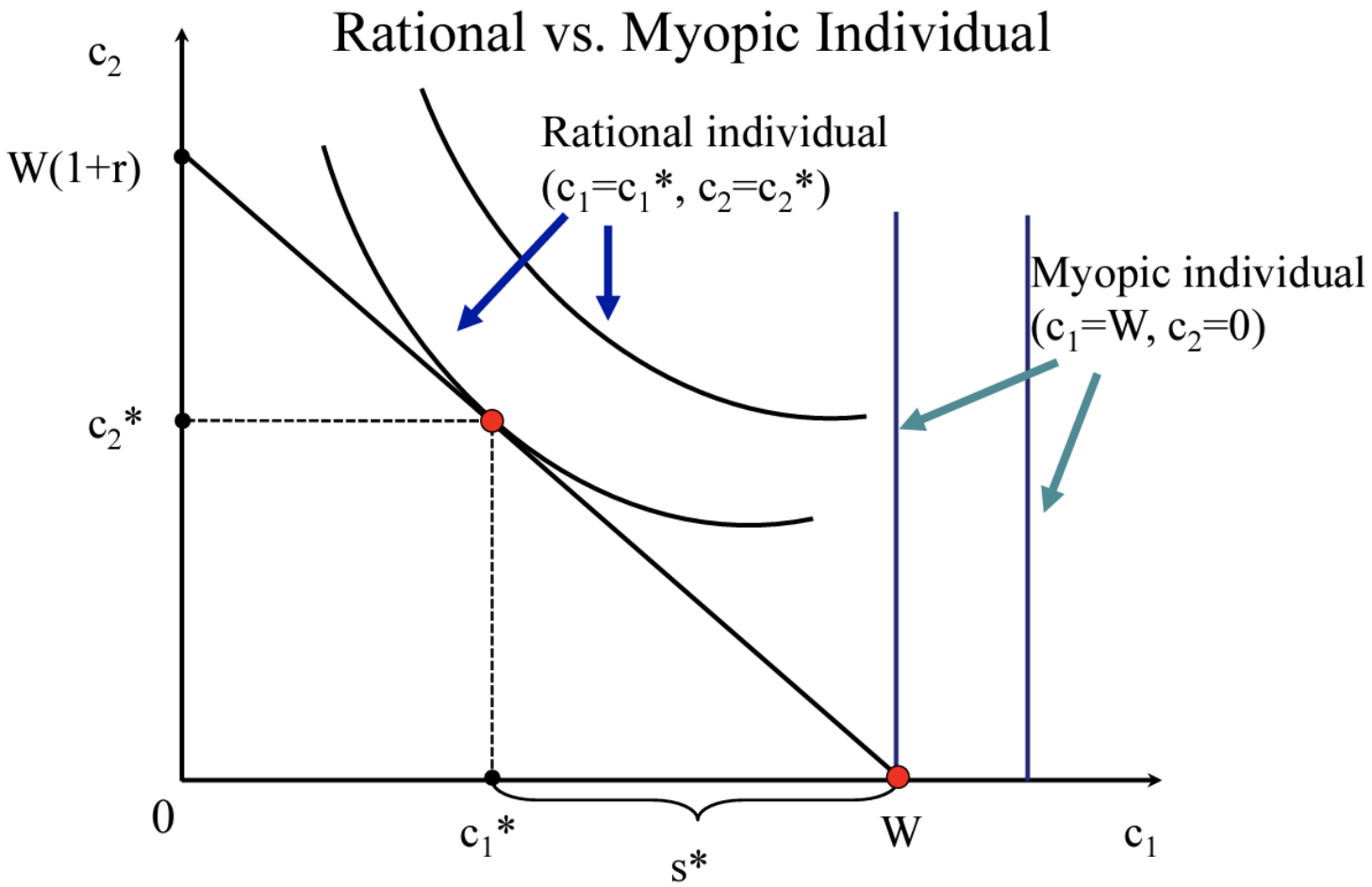
- and others are myopic:

$$\max u(c_1)$$

$$\text{s.t.} \quad c_1 + s = w \quad \text{and} \quad c_2 = s(1+r)$$

$\Rightarrow c_1 = w$ and $s = c_2 = 0$

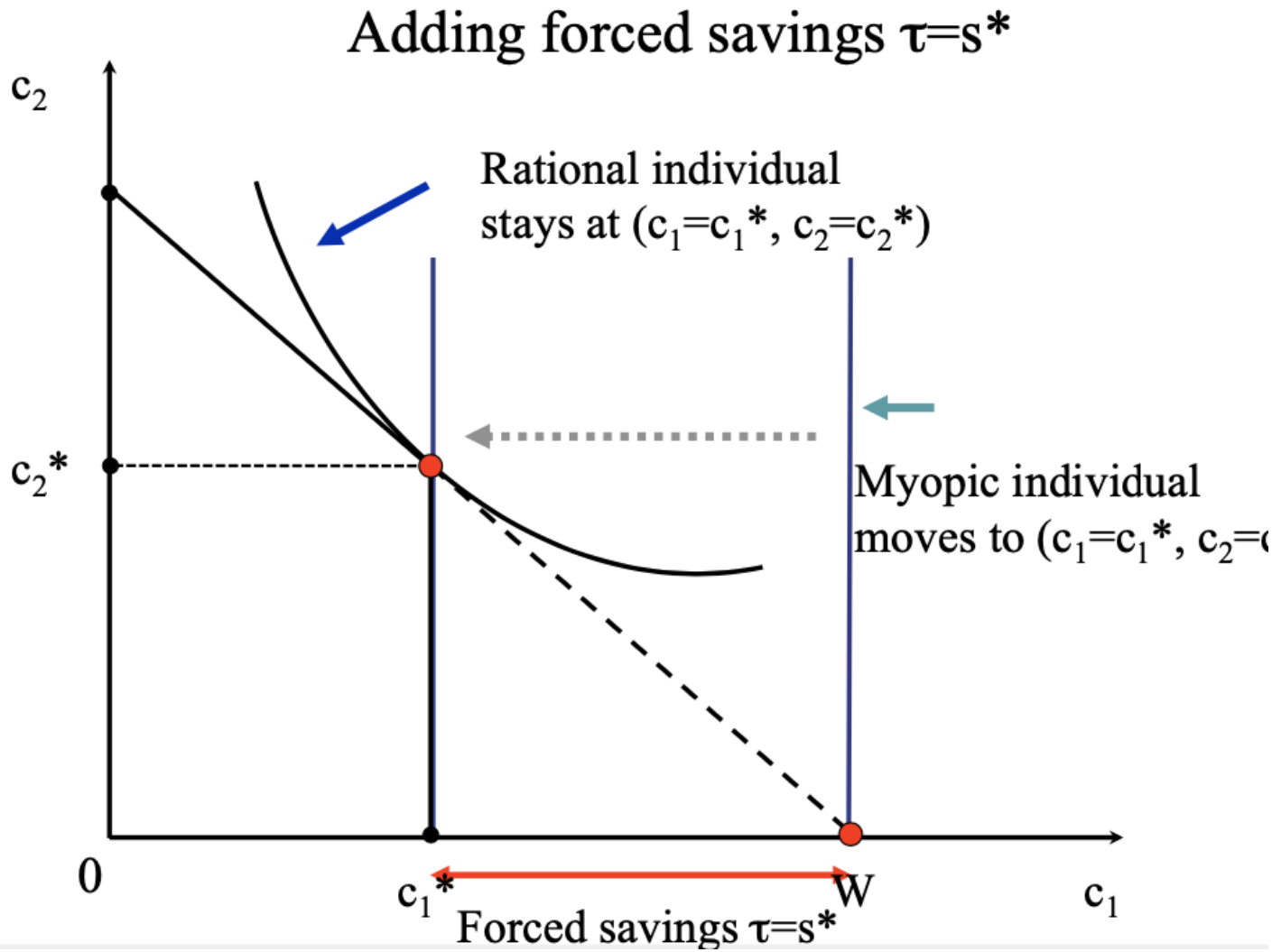
Model: Rational vs. Myopic Savers



Model: Rational vs. Myopic Savers

- Government wants to maximize $u(c_1) + \delta u(c_2)$ for both types.
- Impose a forced saving tax rate τ s.t. $\tau w = s^*$ in period 1.
- Provide benefit $b = \tau w(1 + r)$ in period 2.
- Rational individuals unaffected (if $\tau w \leq s^*$) $\rightarrow$ 100% crowding out of private savings.
- Myopic individual affected (0% crowd out): shifts forced savings to period 2 to reach optimum for rational individuals.

Model: Rational vs. Myopic Savers



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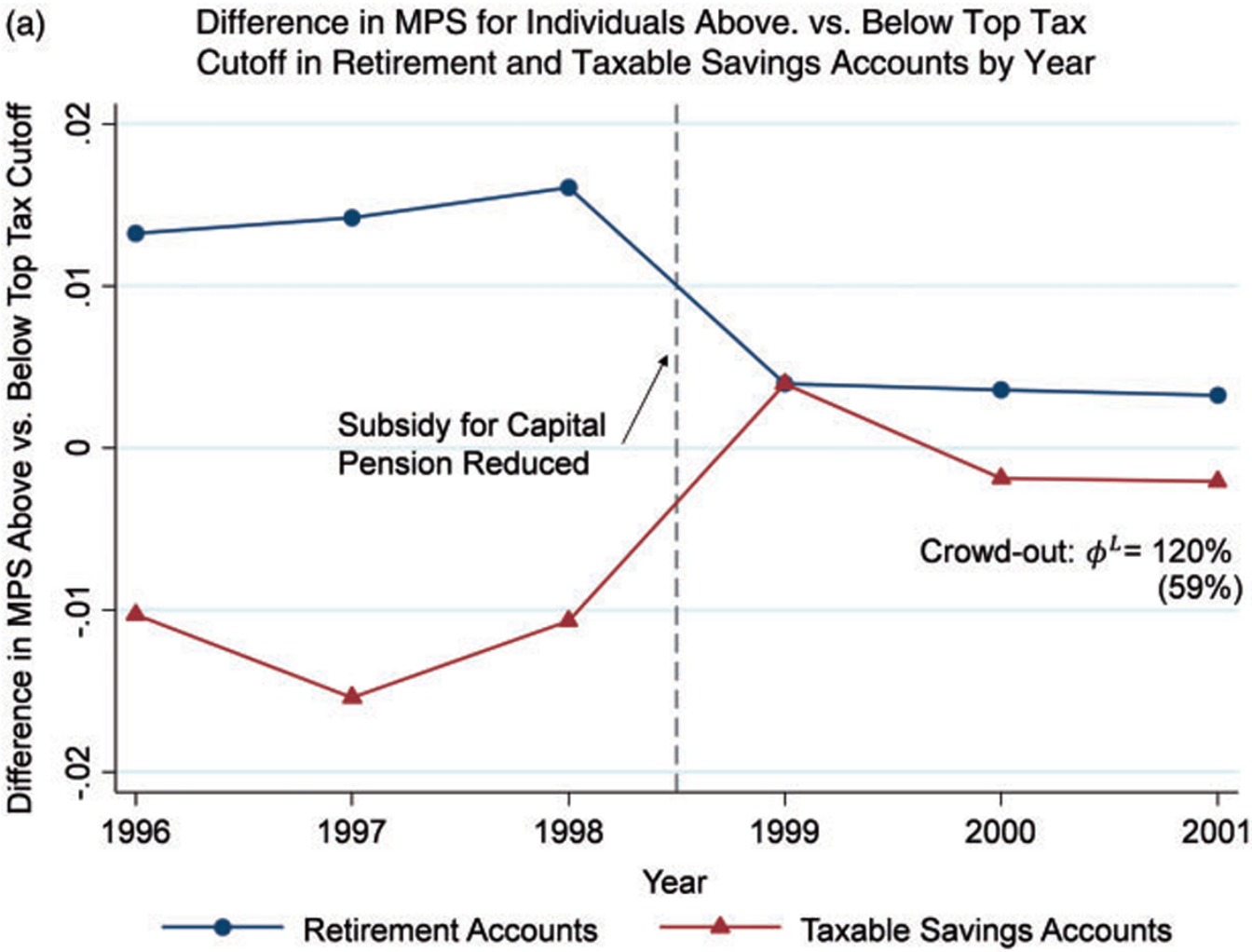
- Change in saving incentives: active savers move savings from one place to another.

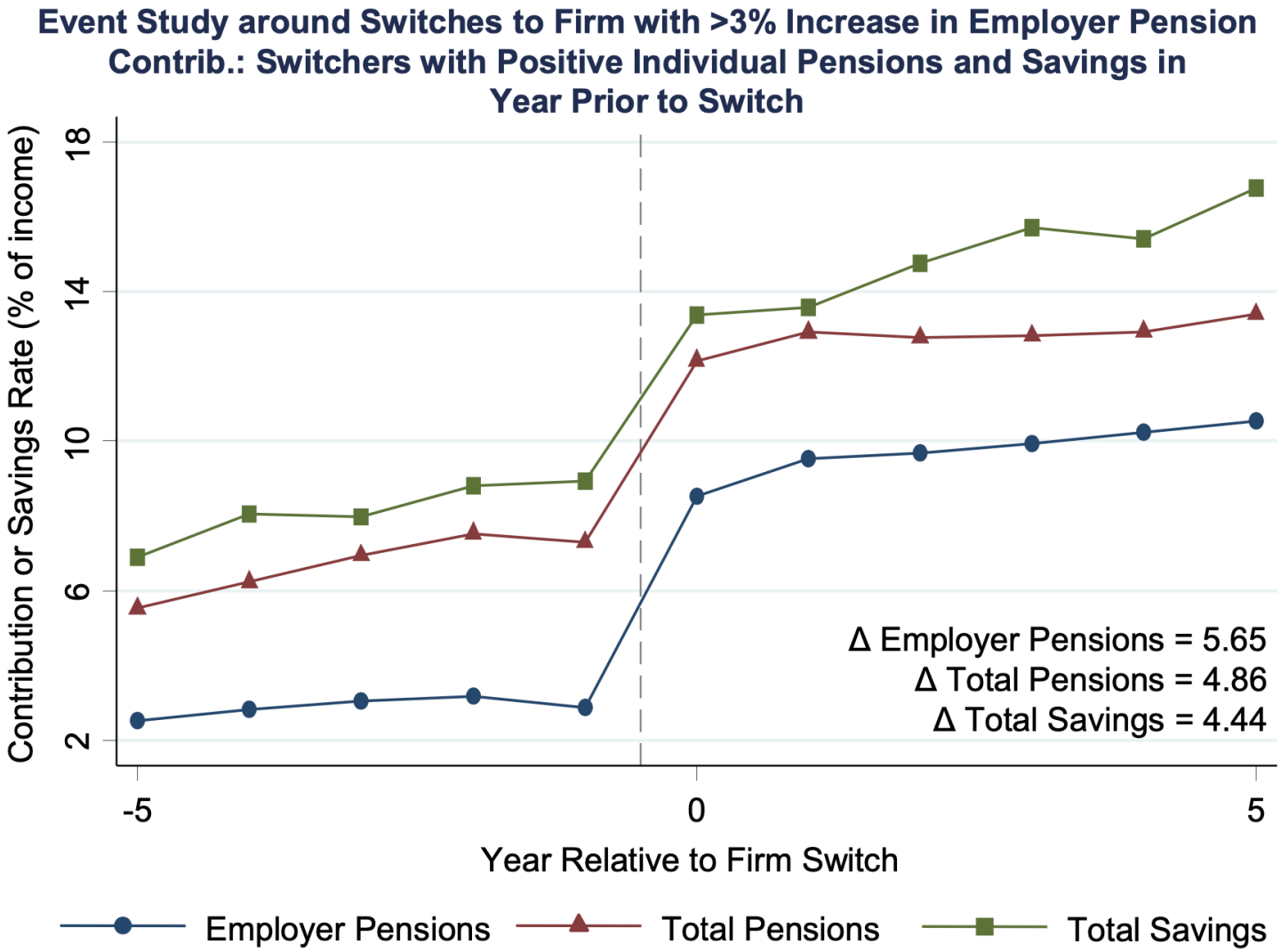
Chetty et. al. (2014): Active Savers



Model: Rational vs. Myopic Savers

- Does this look familiar?
- Chetty et. al. (2014): Active vs Passive Savers.
- Change in saving incentives: active savers move savings from one place to another.
- Forced savings: only 20% crowd out.

Chetty et. al. (2014): Passive Savers



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- Estimate roughly 15% of individuals are active savers, which tracks pretty closely to the observed crowd-out due to forced savings.

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- Interesting that people act as the myopic model predicts: those who are saving enough reduce saving due to forced savings, those who aren't saving enough do not.

Model: Comments

1) Universal vs. Means-Tested Program: Universal forced savings is better than means-tested program financed by tax on everyone.

- No transfer from rational to myopic individuals.
- No incentives to under-save to get means-tested pension
- Caveat: what about those close to poverty line?

2) Adding Labour Supply Response: Things are less simple.

$$\max u(c_1) - h(l_1) + \delta u(c_2)$$

$$\text{s.t.} \quad c_1 + s = (1-\tau)w \quad \text{and} \quad c_2 = (s + \tau w l_1)(1+r)$$

- l_1 of rational individuals not affected if benefits are actuarially fair.
- l_1 of myopic individuals is distorted downward as they only perceive the tax but not the future benefits:

$$\max u(c_1) - h(l_1)$$

  - Labour supply crowded out by forced savings.

Commonly Given as Evidence for Myopia

1. Before SS there was very limited retirement.
   - Other explanations?

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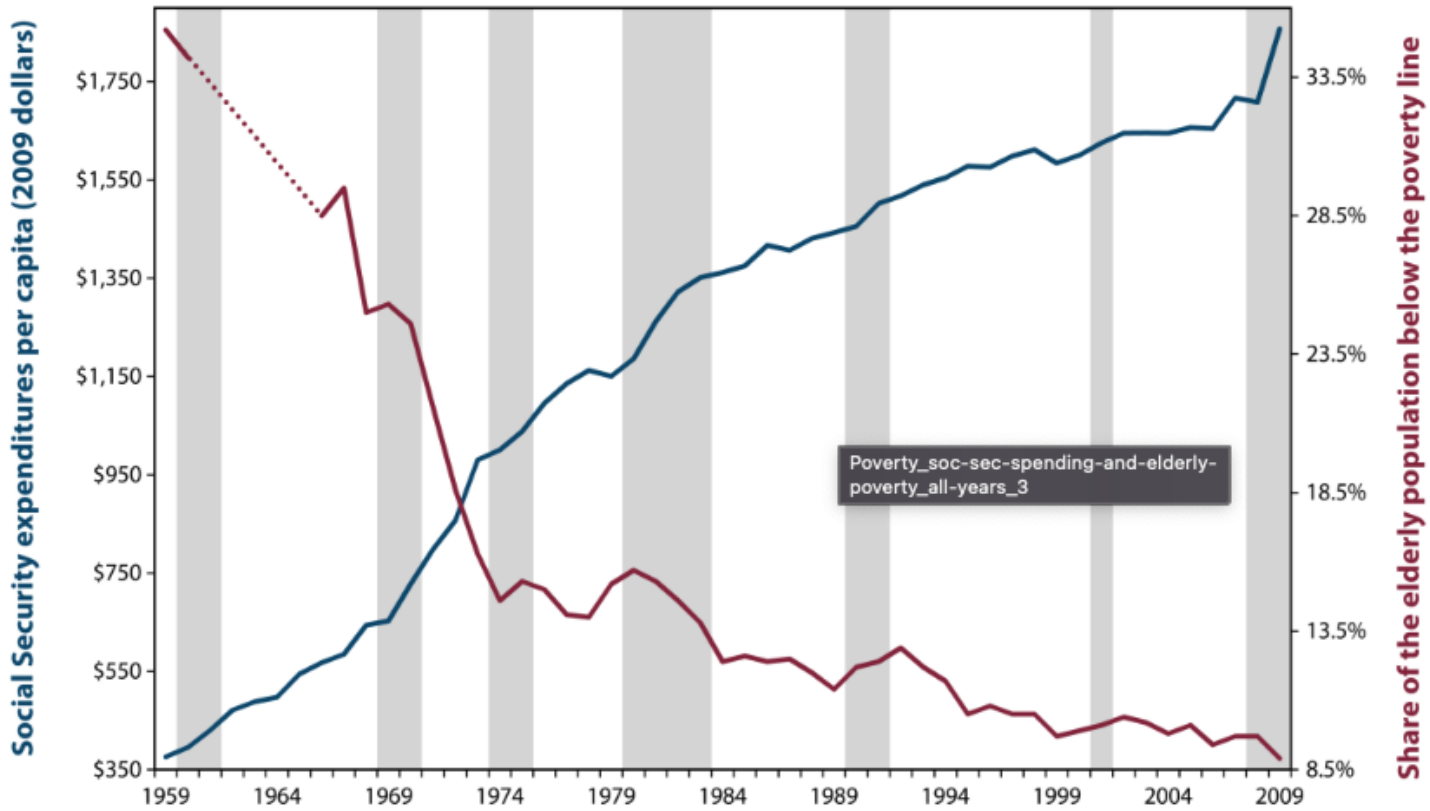
2. Elderly poverty rate has fallen as SS spending has increased.

Social Security decreases poverty among the elderly

Per capita Social Security expenditures and poverty rate for 65+, 1959-2009



Note: Shaded areas denote recession.

Source: U.S. Census Bureau, Historical Poverty Tables, Persons, Tables 2 and 3, and U.S. Treasury, Social Security Administration, Trustees Report 2009, Annual Statistical Supplement.

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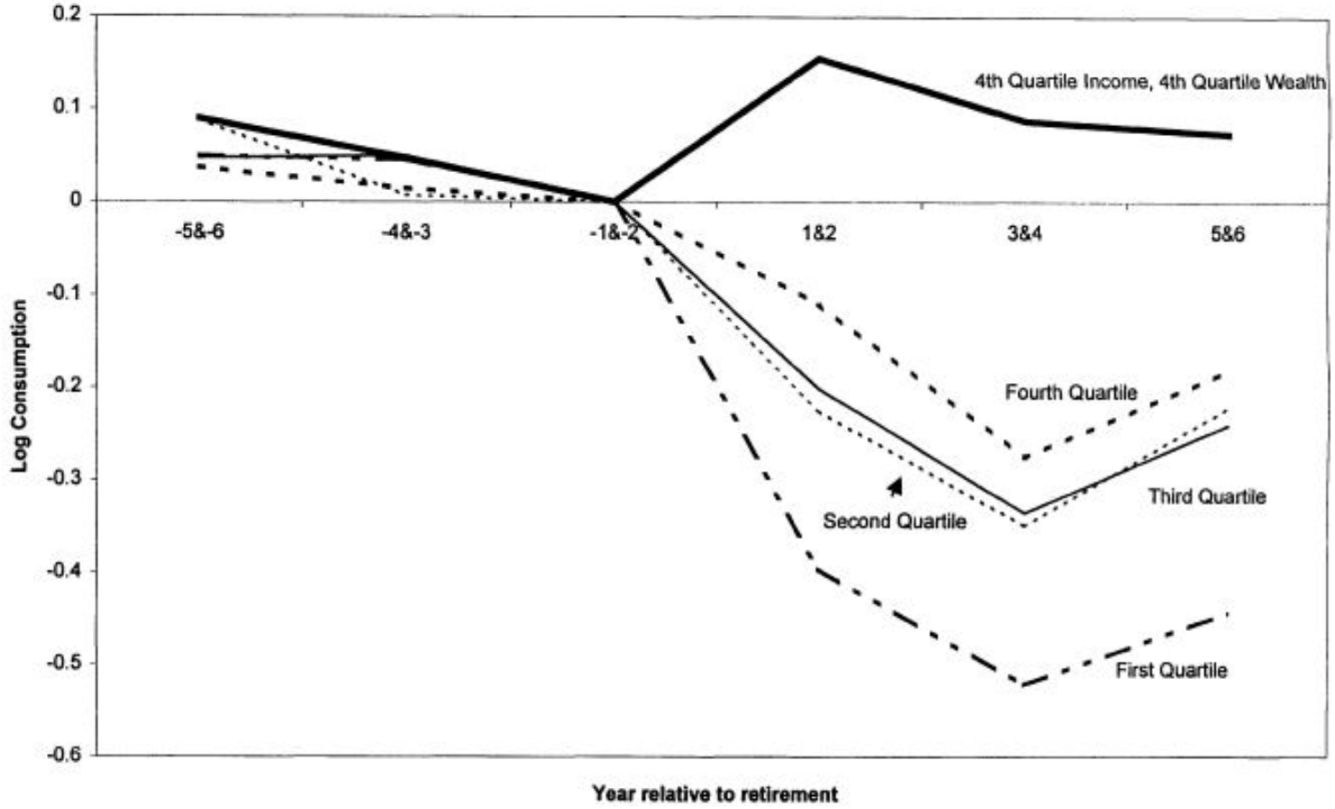

FIGURE 4. CHANGE IN CONSUMPTION AT RETIREMENT, BY WEALTH QUARTILE

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Consumption Changes After Retirement

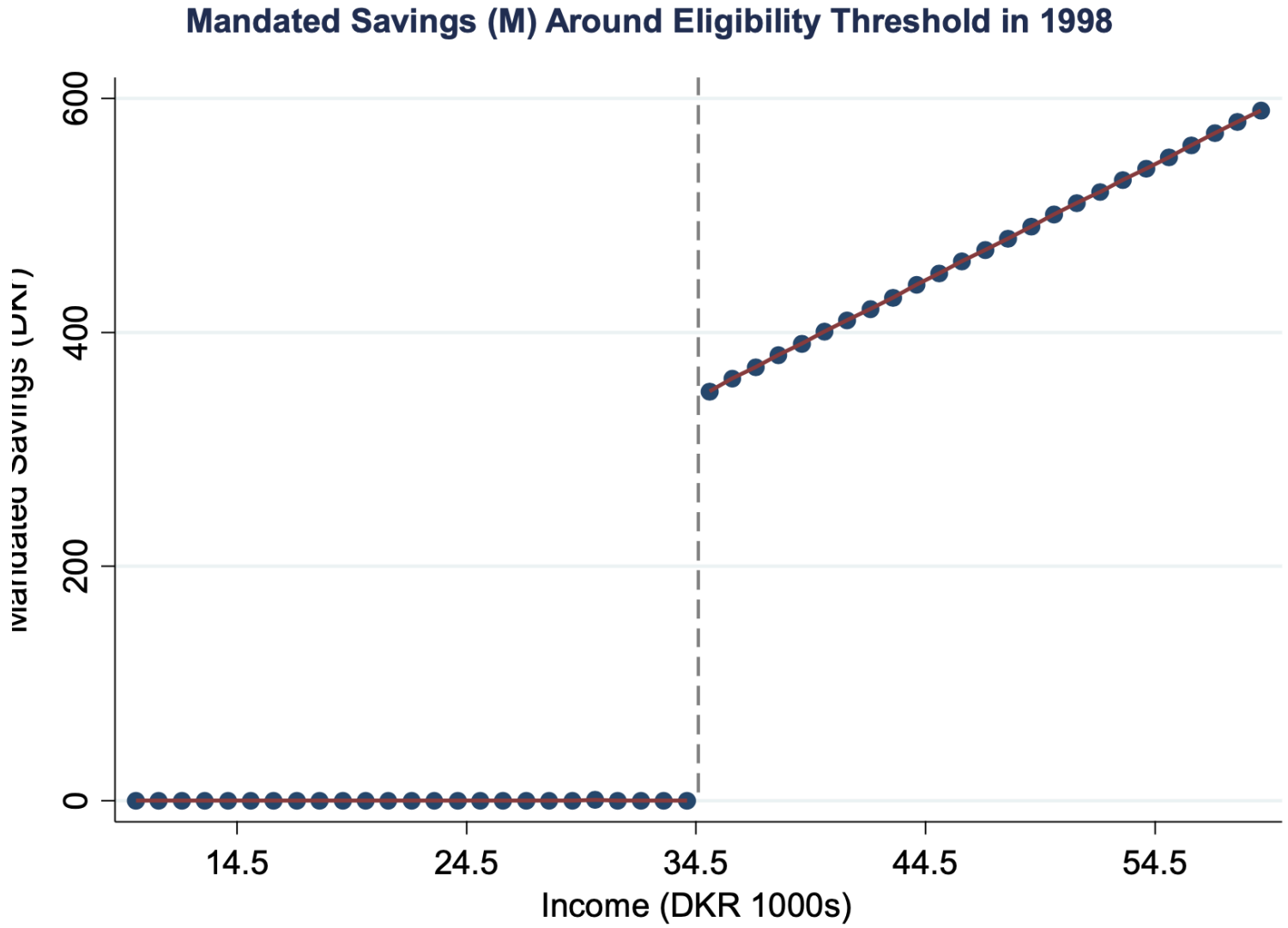
Other Explanations:

- Aguiar and Hurst (2005) show that declines in spending are concentrated on food. But this is matched by a rise in time spent shopping for and preparing meals at home.
  - Does *consumption* actually decline?
- Work-related expenditure falls.
- Non-separabilities between consumption and leisure?

So spending declines don't necessarily imply myopia

Chetty et al. (2014) Government Mandated Saving

- In Denmark, starting in 1998, firms are mandated (by govt) to make automatic retirement contributions to workers' retirement savings accounts of 1% of earnings when earnings crosses some threshold (34.5K DKr)
- Generates a discontinuity by earnings levels: can use a **Regression Discontinuity Design**


Mandated Savings (M) Around Eligibility Threshold in 1998
Mandated Savings (DKR)
0
200
400
600
14.5
24.5
34.5
44.5
54.5
Income (DKR 1000s)


Effect on Mandate on Total Pension Contributions
Percent with Total Pension Contribution > DKr 1265
10
15
20
25
30
14.5
24.5
34.5
44.5
54.5
Income (DKR 1000s)

Chetty et al. (2014) Government Mandated Saving Results

- Main finding: \$1 contribution to mandatory savings plan $\rightarrow$ \$1 increase in total savings
- No crowd out! Exactly what the model above predicts for myopic individuals.
- So is everyone who earn close to the median income in Denmark myopic?
- Hopefully not: Passive savers who are saving otherwise, and don't notice the deduction from their paychecks.

Motivation 2: Market Failures

Sources of market failure in annuities market

1. Information Failures:
   - e.g. do people know their life expectancy?
2. Adverse Selection:
   - e.g. Finelstain and Poterba (2004)
3. Transaction Costs

Annuities Puzzle: Observed demand for annuities around the world is extremely low. Why?

Do people know their life expectancy?

- There is a large literature that documents divergence between objective survival probabilities and individually stated subjective survival probabilities.
  - People under-estimate chances of surviving to younger old ages (65-80) and over-estimate chances of surviving to ages > 80 (conditional to surving into 70s).
  - i.e. The survival curve is too flat.
- O'Dea and Sturrock (2023): to what extent could these biased survival expectations explain low observed annuity demand.

O'Dea and Sturrock (2023)

1. They estimate subjective survival curves.
   - Taking stated survival expectations at face value. Hurd and McGarry (1995) show that these subjective probabilities act like probabilities, even if they are biased.
2. Use a lifetime consumption/savings model where...
   - Insurers price annuities based on **objective** survival probabilities.
   - Individuals make decisions based on **subjective** survival probabilities.

   ... to assess the extent to which mis-informed survival probabilities can explain the annuities puzzle.

O'Dea and Sturrock (2023): Data

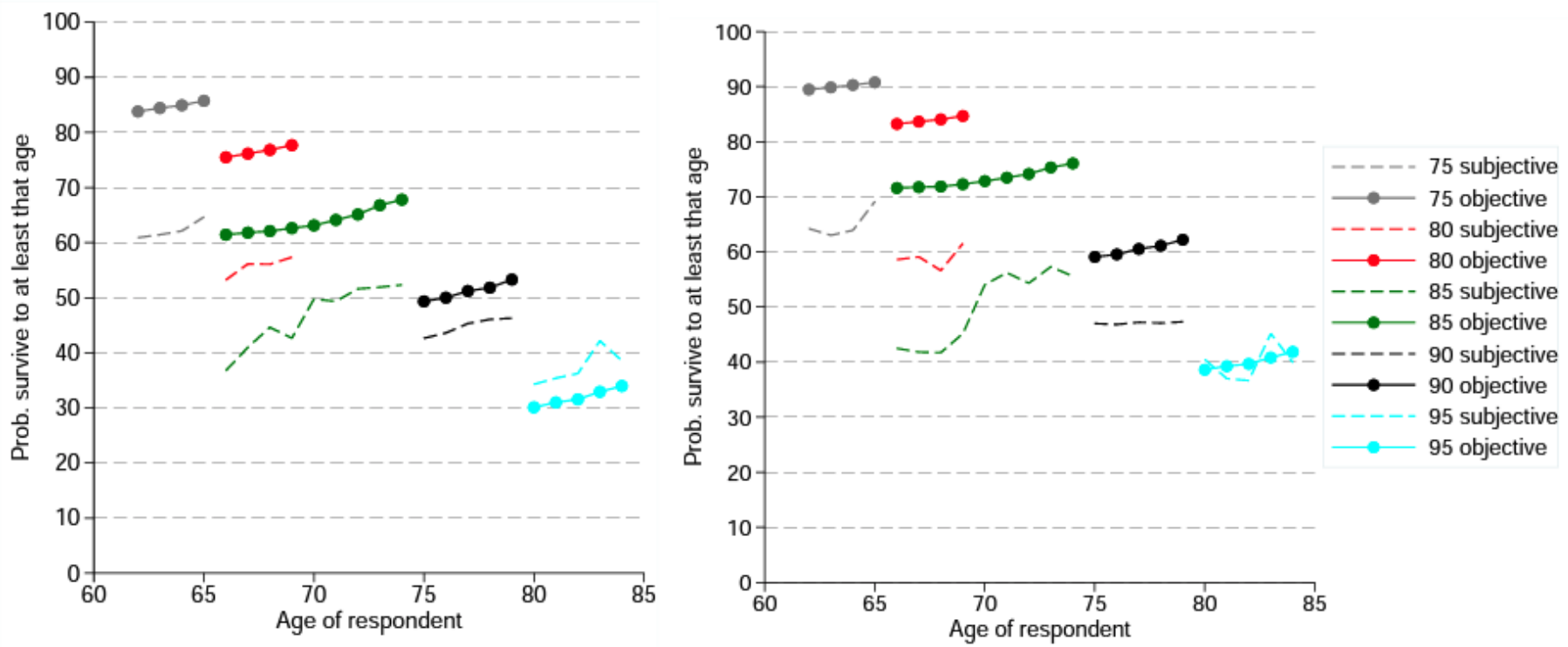
1. Data from the English Longitudinal Study of Aging.
2. Asks respondents questions of the form:

   'What are the chances that you will live to be age X or more'?

Age of respondee	First question	Second question
65 and under	75	85
66 - 69	80	85
...	...	-

Comparing objective and subjective survival probabilities

Comparison of mean 'subjective' reports and scaled ONS cohort survival rates/projections for men (LHS) and women (RHS) born 1930-39



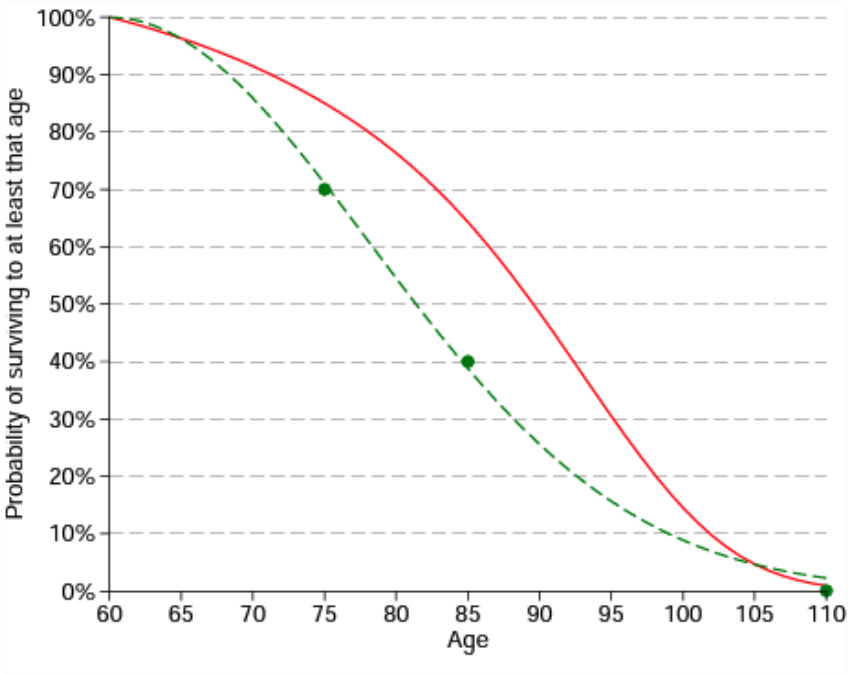
Estimating Subjective Survival Curves

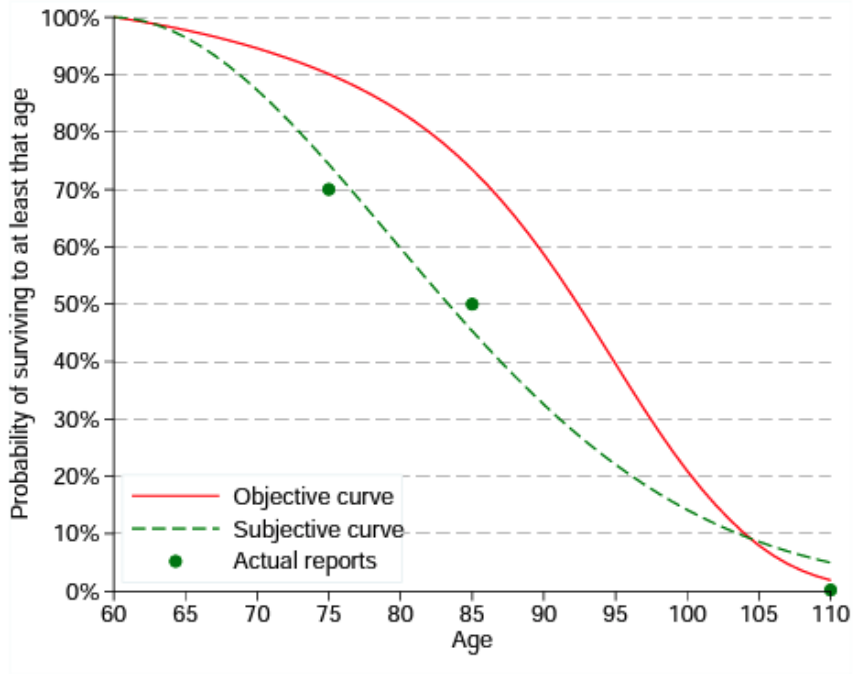
- Assume every individual i has a subjective survival curve that can be expressed using the Weibull distribution:
  - Person i, age z, survives to age α with probability:

$$S_i^s(\alpha; \lambda_i, k_i) = exp\left[-\left(\frac{\alpha - z}{\lambda}\right)^{k_i} \right] \quad : \quad \lambda_i, k_i > 0$$

- Let $R_i(\alpha)$ be individual i who is age z's subjective stated probability of living to age α. Then estimate the parameters of the subjective Weibull distribution by non-linear least squares:

$$(\hat{\lambda}_i, \hat{k}_i) = argmin \sum_{\alpha \in A_i} \left(R_i(\alpha) - exp\left[-\left(\frac{\alpha - z}{\lambda}\right)^{k_i} \right] \right)^2$$


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability of surviving to at least that age
60
65
70
75
80
85
90
95
100
105
110
Age


100%
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10%
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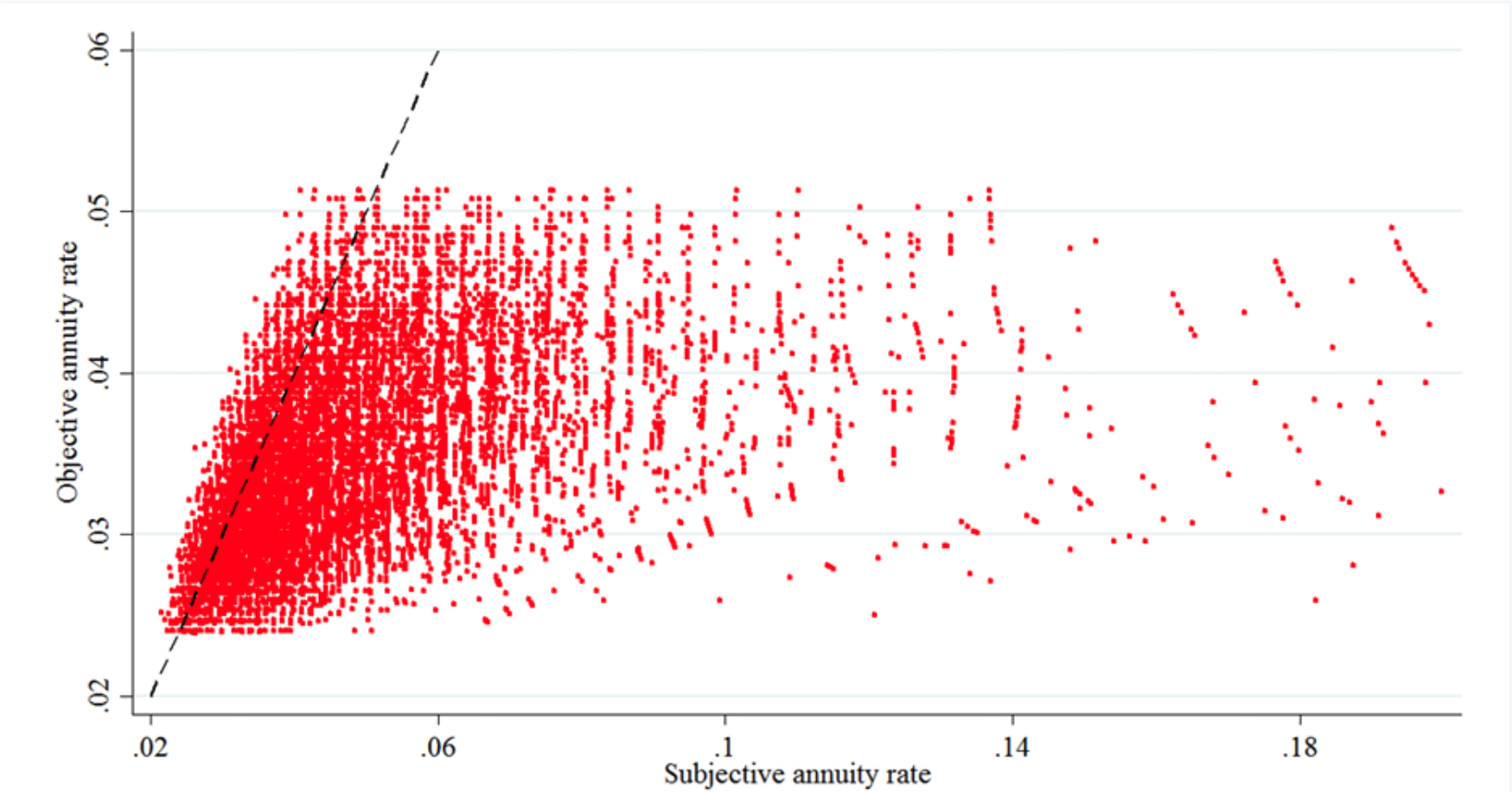
Probability of surviving to at least that age
Objective curve
Subjective curve
Actual reports
60
65
70
75
80
85
90
95
100
105
110
Age

Subjective vs Objective Annuity Rates

- So far: subjective survival probabilities diverge from objective probabilities.
- How does this divergence affect individual's perception of fair annuity prices.
- Next: compare the objectively fair annuity rate for individuals based on their observable characteristics to their perceived actuarily fair rate under their subjective probabilities.
- Subjective actuarily fair rate is estimated as:

$$\theta = \left[\sum_{\alpha=z}^{110} \frac{S_i(\alpha)}{(1+r)^{\alpha-z}} \right]^{-1}$$

Subjective vs Objective Annuity Rates



Subjective vs Objective Annuity Rates

- Finding: 88% of individuals perceive an annuity rate that is priced fairly for a person with their characteristics as offering less than a fair annuity rate.
- Some risk averse individuals might annuitize at a perceived unfair rate if the insurance value is large enough.
- Ultimately these estimates suggest that there are many people who won't buy annuities because they perceive them to be priced too high.
    - Does this remind us of anything?

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- Ultimately these estimates suggest that there are many people who won't buy annuities because they perceive them to be priced too high.
    - Does this remind us of anything?
- This outcome looks a lot like the outcome if adverse selection was present in the market...

Estimate The Impact of Survival Pessimism on Annuity Demand

- Solve a lifecycle consumption and savings model focused on wealth use in retirement

$$\max_{\{c_{it}\},b_i} \sum_{t=0}^{110-z} \beta^t S_i(z+t) \frac{c_{it}^{1-\gamma}}{1-\gamma}$$

s.t.

$$a_{it+1} = (a_{it} + p_i + \theta_i b_i a_{i0} - c_{it})(1+r)$$

- where: b_i is the fraction of initial wealth (at retirement) a_{i0} i chooses to annuitize with objective return θ_i and p_i are government pension payments.
- Individual makes 2 choices:
  1. First Period: whether to annuitize their initial wealth.
  2. Every Period: consumption/savings
- Annuities priced at actuarially fair rate using **objective** survival probabilities.
- Compare the proportion of individuals who would purchase annuities if they had objective vs. subjective survival probabilities for different combinations of discount rate and risk aversion.

Survival Pessimism and Annuity Demand: Model Results

(a) Objectively-measured expectations

Discount factor	Coefficient of relative risk aversion								
	1	1.5	2	2.5	3	3.5	4	4.5	5
0.960	19%	31%	40%	46%	51%	54%	57%	59%	62%
0.965	24%	37%	45%	51%	55%	58%	61%	63%	65%
0.970	31%	43%	50%	56%	59%	62%	64%	67%	68%
0.975	38%	49%	56%	61%	64%	67%	69%	71%	72%
0.980	47%	57%	63%	66%	69%	72%	74%	75%	77%
0.985	57%	65%	70%	73%	76%	78%	79%	81%	82%
0.990	68%	74%	78%	81%	83%	84%	86%	86%	87%
0.995	83%	86%	88%	90%	90%	91%	92%	92%	92%
1.000	100%	100%	100%	100%	100%	100%	100%	100%	100%

(b) Subjectively-elicted expectations

Discount factor	Coefficient of relative risk aversion								
	1	1.5	2	2.5	3	3.5	4	4.5	5
0.960	8%	15%	21%	26%	31%	34%	37%	40%	42%
0.965	10%	18%	24%	29%	33%	37%	40%	42%	44%
0.970	13%	21%	27%	32%	36%	40%	42%	45%	47%
0.975	16%	24%	30%	35%	39%	42%	45%	47%	49%
0.980	20%	28%	34%	39%	43%	45%	48%	50%	52%
0.985	25%	32%	38%	43%	46%	49%	51%	53%	55%
0.990	30%	37%	43%	47%	50%	52%	54%	56%	58%
0.995	36%	42%	47%	51%	53%	56%	58%	59%	61%
1.000	42%	48%	52%	55%	58%	60%	62%	63%	64%

Survival Pessimism and Annuity Demand: Model Results

- Survival pessimism can explain some of the absence in annuitization
  - Assuming modest a modest discount factor and risk aversion ($\beta = 0.98, \gamma = 3$) 43% would annuitize vs 69% when survival probabilities are objective ($\approx$ 37% decline)
- How does this compare the the impact of Adverse selection?
  - Mitchell et al. (1999) estimate that annuity payouts are between 80 to 85 cents on the dollar, due to adverse selection and transaction costs.
  - Therefore this paper looks at the proportion who would annuitize if they had objective probabilities and annuities were offered 17.5% below the actuarially fair rate.

(b) Subjectively-elicted expectations

Discount factor	Coefficient of relative risk aversion								
	1	1.5	2	2.5	3	3.5	4	4.5	5
0.960	8%	15%	21%	26%	31%	34%	37%	40%	42%
0.965	10%	18%	24%	29%	33%	37%	40%	42%	44%
0.970	13%	21%	27%	32%	36%	40%	42%	45%	47%
0.975	16%	24%	30%	35%	39%	42%	45%	47%	49%
0.980	20%	28%	34%	39%	43%	45%	48%	50%	52%
0.985	25%	32%	38%	43%	46%	49%	51%	53%	55%
0.990	30%	37%	43%	47%	50%	52%	54%	56%	58%
0.995	36%	42%	47%	51%	53%	56%	58%	59%	61%
1.000	42%	48%	52%	55%	58%	60%	62%	63%	64%

(b) Objectively-measured expectations with 17.5% rate reduction

Discount factor	Coefficient of relative risk aversion								
	1	1.5	2	2.5	3	3.5	4	4.5	5
0.960	3%	8%	14%	19%	24%	28%	32%	35%	38%
0.965	4%	10%	16%	22%	27%	31%	35%	38%	41%
0.970	5%	12%	19%	25%	30%	34%	38%	42%	44%
0.975	7%	15%	22%	29%	34%	38%	42%	45%	47%
0.980	10%	19%	27%	33%	38%	42%	46%	49%	51%
0.985	13%	23%	31%	38%	43%	47%	50%	53%	55%
0.990	18%	29%	37%	43%	48%	51%	54%	57%	59%
0.995	25%	36%	44%	49%	54%	57%	59%	62%	63%
1.000	34%	45%	51%	56%	60%	63%	65%	67%	69%

Survival Pessimism and Annuity Demand: Summary

- **Survival pessimism is potentially important for annuity demand**
  - Can rationalize low rates of annuitization, but does not account for the whole 'annuity puzzle'
  - *"Overall, we take these results as indicating that the effect of individuals misperceiving their survival probabilities is as large as the effect of adverse selection."*

Social Security and Retirement

Three elements of a social security system may affect retirement behaviour:

1. Availability of Benefits at an Early Retirement Age (ERA)

   • These affects arise due to (a) Myopia, (b) liquidity constraints, and (c) focal point norm.

2. Non-Actuarially fair benefit adjustments for those retiring after the ERA

   • Creates an implicit tax on earnings.

3. Earnings-test after claiming benefits

Early Retirement Age: Implicit Tax

- A simple lifetime consumption model:
  - T: total years
  - R: years worked
  - T - R: years retired
  - w: income per year worked
  - τ: pension tax
  - b(R): retirement benefits
  - R_0: early retirement age
- Lifetime consumption:

$$C = (w - \tau)R + b(R)(T - R) \quad : \quad R \geq R_0$$

- If benefits are actuarially fair: $b(R) = \frac{\tau R}{T-R}$:

$$C = (w - \tau) + \tau RT - R(T - R) = wR$$

→ No affect on lifetime budget constraint

→ Actuarially fair system does not affect retirement age.

Early Retirement Age: Implicit Tax

- Retirement systems are generally not actuarily fair:
- In this case the slope of a individuals lifetime budget constraint is:

$$\begin{aligned} &(w-\tau) && \text{if } R < R_0 \\ &(w-\tau-b) && \text{if } R \geq R_0 \text{ and working.} \end{aligned}$$

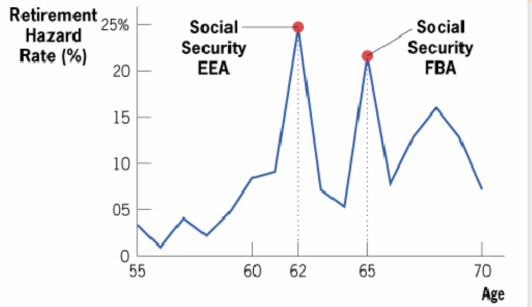
- Tax on working after R_0 is $t = \frac{\tau+b}{w}$ which includes extra implicit tax of size $t = \frac{b}{w}$
- This creates a kink in the lifetime budget constraint, which encourages early retirement.

  → Does this explain bunching or "retirement hazard spikes" observed at ERAs?

  - Retirement hazard at age t is the fraction of people who retire at age t among those still working at age t - 1

Retirement Hazard Spikes in the US Social Security System

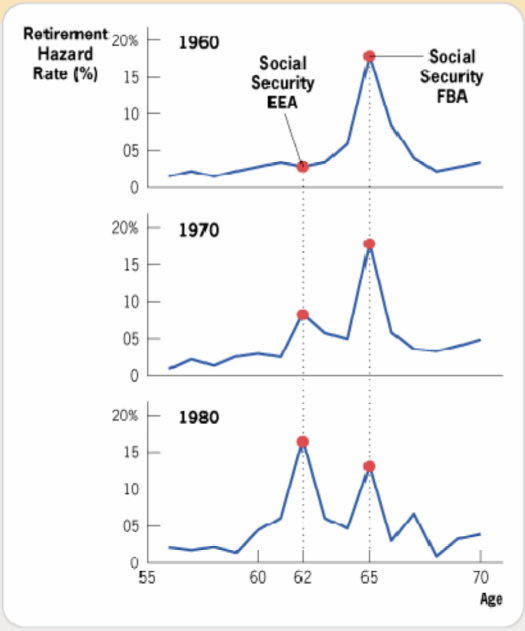
■ FIGURE 13-4



Hazard Rate of Retirement for Males in the United States • The male hazard rate, or exit rate at each age given that a man has worked to that age, has a distinct spike at age 62 (the Early Entitlement Age, EEA) and 65 (the Full Benefit Age, FBA), key ages for the Social Security system.

Source: Diamond and Gruber (1999), Figure 11.12.

■ FIGURE 13-5



The Evolution of the U.S. Male Retirement Hazard • In 1960, before the EEA of 62 was introduced for men, the hazard rate for men was highest at age 65 (the FRA), with no spike at age 62. By 1970, the spike at 62 had begun to emerge, and by 1980 it was larger than the spike at age 65.

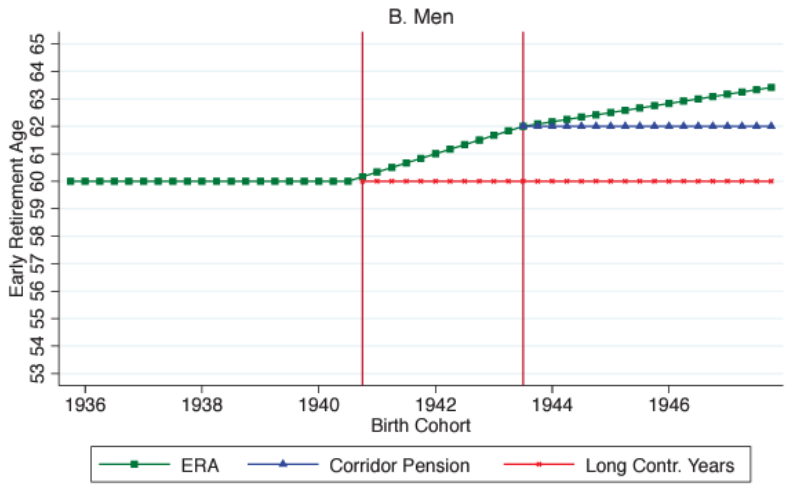
Source: Gruber and Wise (1999), Figure 12

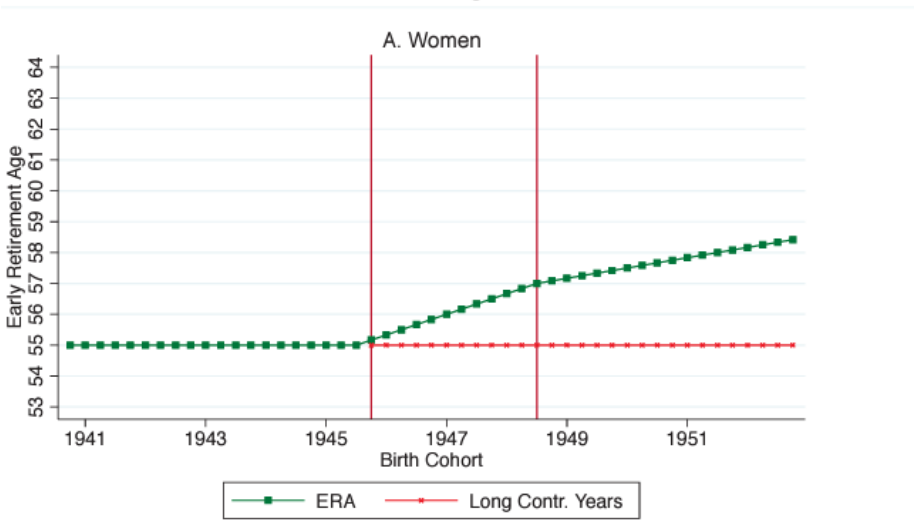
Source: 2007 Worth Publishers *Public Finance and Public Policy*, 2/e, Jonathan Gruber

Manoli-Weber (2016)

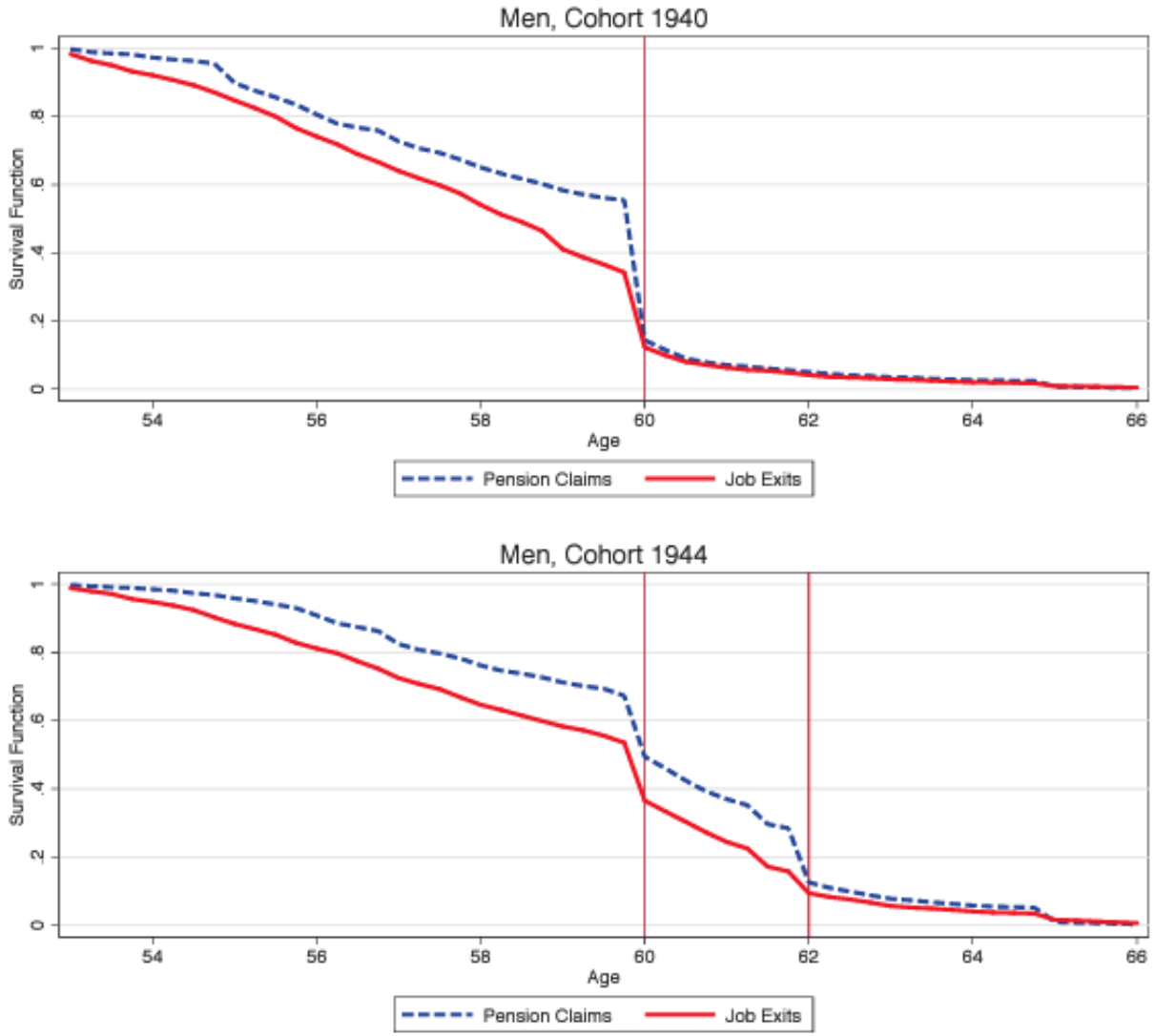
- Studies the effects of increasing the Early Retirement Age (ERA) on older workers' retirement decisions.
- Reform in Austria:
  - Increase in ERA for men from 60 to 62, for women from 55 to 57.
  - Gradual increase: 2 months per-quarter of birth for men (women) born in the 4th quarter of 1940 (1955)
  - Normal retirement age (NRA): 65 (60)
  - After 2004: ERA increased beyond 62 (57) by 1 month per cohort (ERA=NRA by 2017).
  - Two different types of exemptions from ERA increase based on job tenure (not important)

Early Retirement Ages by Cohort

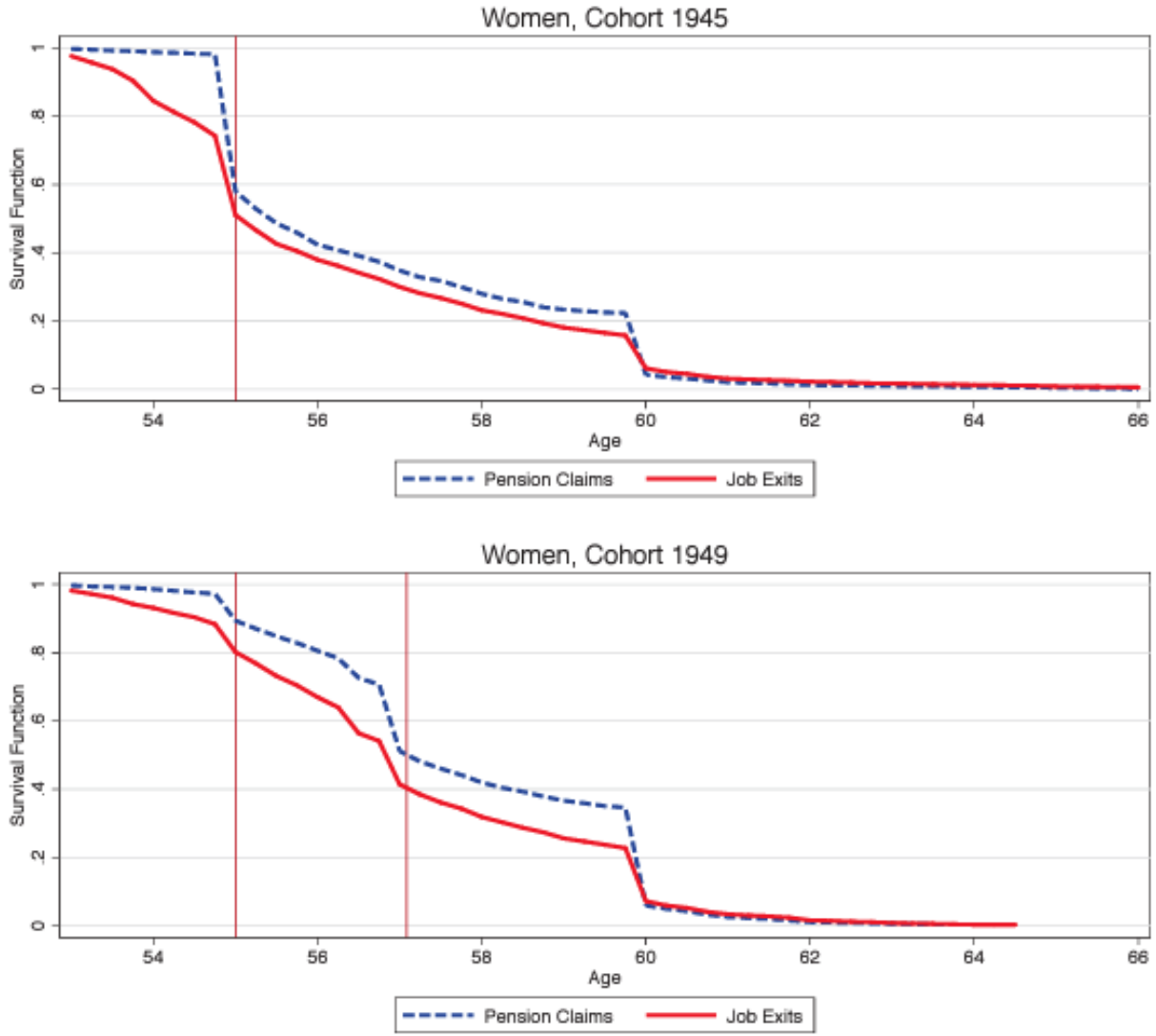




Pension Claims and Job Exits Before/After Reform (Men)



Pension Claims and Job Exits Before/After Reform (Women)



Manoli-Weber (2016): Regression Kink Design (RKD)

- They exploit the kink in the ERA schedule by birth date to explore its impact on labour force exists and claiming age.

$$y_i = \tau b(V_i) + g(V_i) + \epsilon_i$$

where:

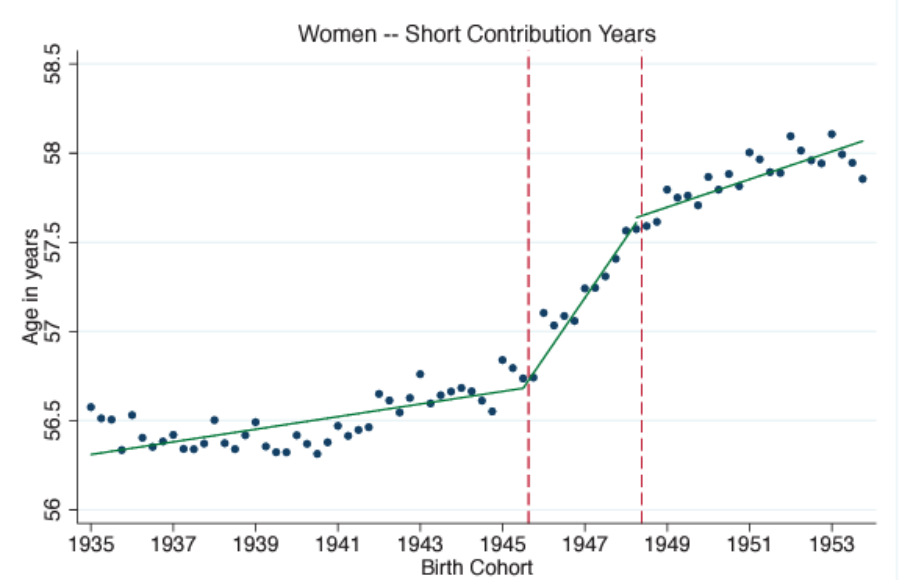
  - V is the running variable - birthdate centered at 0 where the schedule changes
  - $b(V)$ is a deterministic function of v with a kink at $v = 0$ (e.g. at the first kink $b(v)$ changes from 0*v to 2*v at the v=0)
  - $g(V)$ is a polynomial function of the running variable.

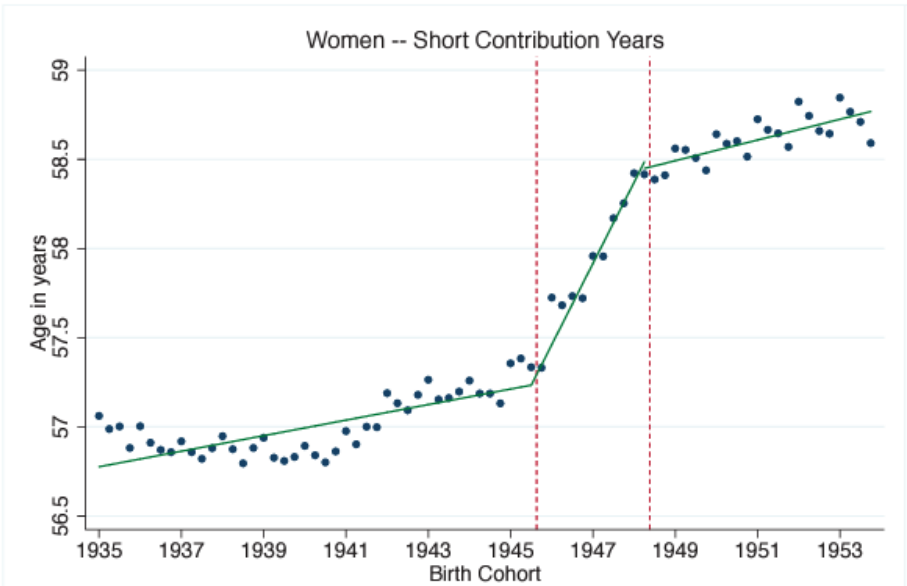
- This identifies:

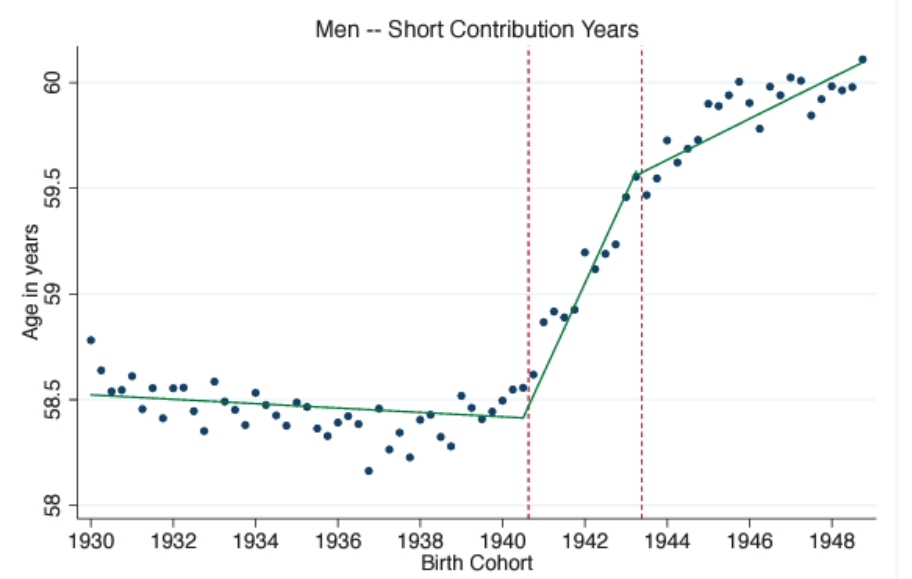
$$\tau = \frac{\lim_{v \to 0^+} \frac{\partial E[y|V=v]}{\partial v} - \lim_{v \to 0^-} \frac{\partial E[y|V=v]}{\partial v}}{\lim_{v \to 0^+} \frac{\partial b(V)}{\partial v} - \lim_{v \to 0^-} \frac{\partial b(V)}{\partial v}}$$

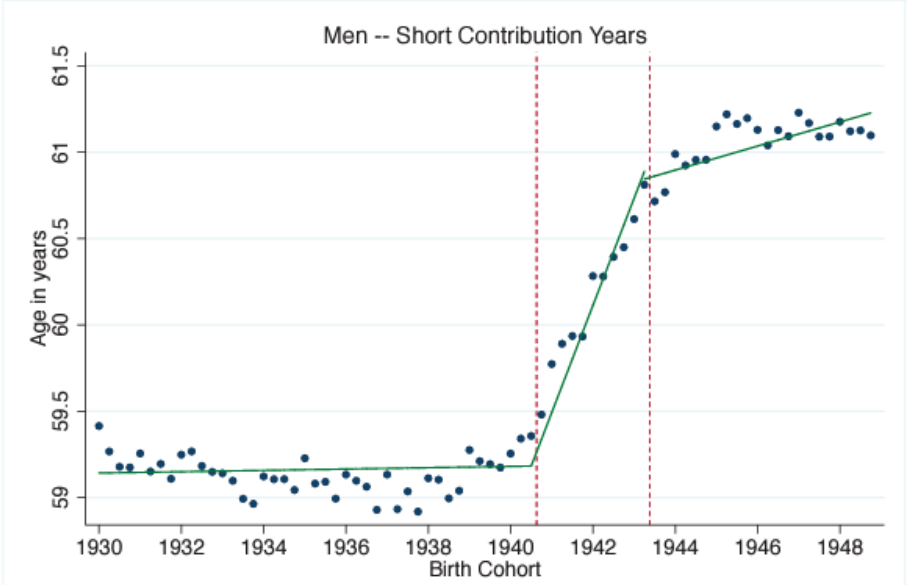
where τ is the change in y at v=0 due to the change in the slope of v.

Change in Schedule for Pension Claim (left) and Labour Force Exit (right)









RKD Estimates

Table 3: Fuzzy Regression Kink Estimates, Maximum Symmetric Bandwith

	Short Contribution Years		Full Sample	
	Women	Men	Women	Men
A. Kink Pension Reform 2000				
Exit Age	0.390	0.358	0.391	0.320
	(0.062)	(0.047)	(0.050)	(0.030)
Claim Age	0.540	0.539	0.496	0.464
	(0.059)	(0.049)	(0.048)	(0.031)
Observations	83,575	71,880	110,897	133,334

Manoli-Weber (2016b): The Impact of Financial Incentives on Retirement Decisions

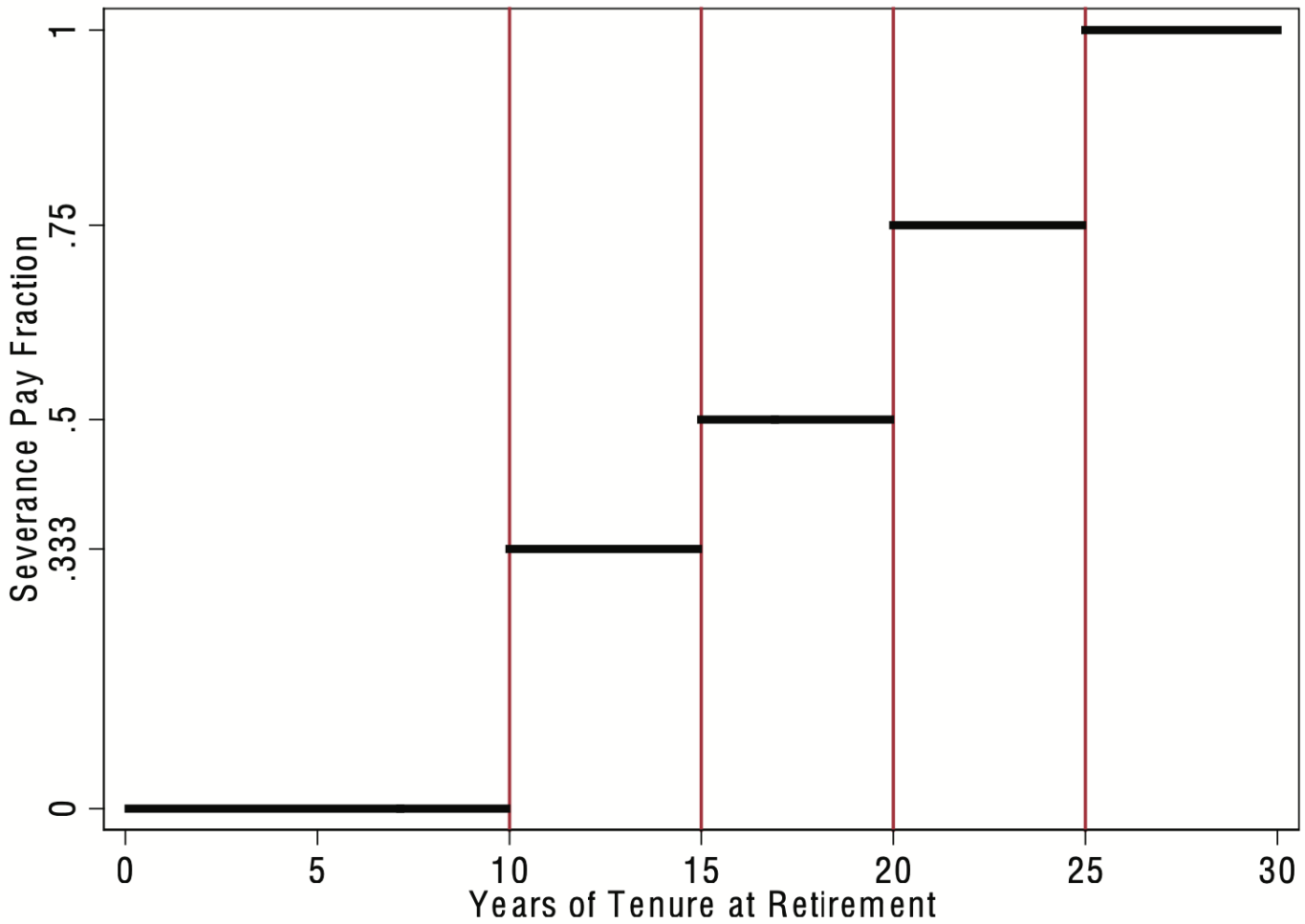
- In Austria (again) employers must provide retiring employees a severance package that is determined by the employees tenure at time of retirement.

TABLE 1—SEVERANCE PAY BENEFIT SCHEDULE

Years of tenure at retirement	Severance pay amounts fraction of annual salary
10–14	0.333
15–19	0.5
20–24	0.75
25+	1

- This creates notches in the lifetime budget constraint that can be exploited to explore the impact of financial incentives on retirement decisions.

Severance Payments at Retirement based on Tenure



Distribution of Tenure at Retirement

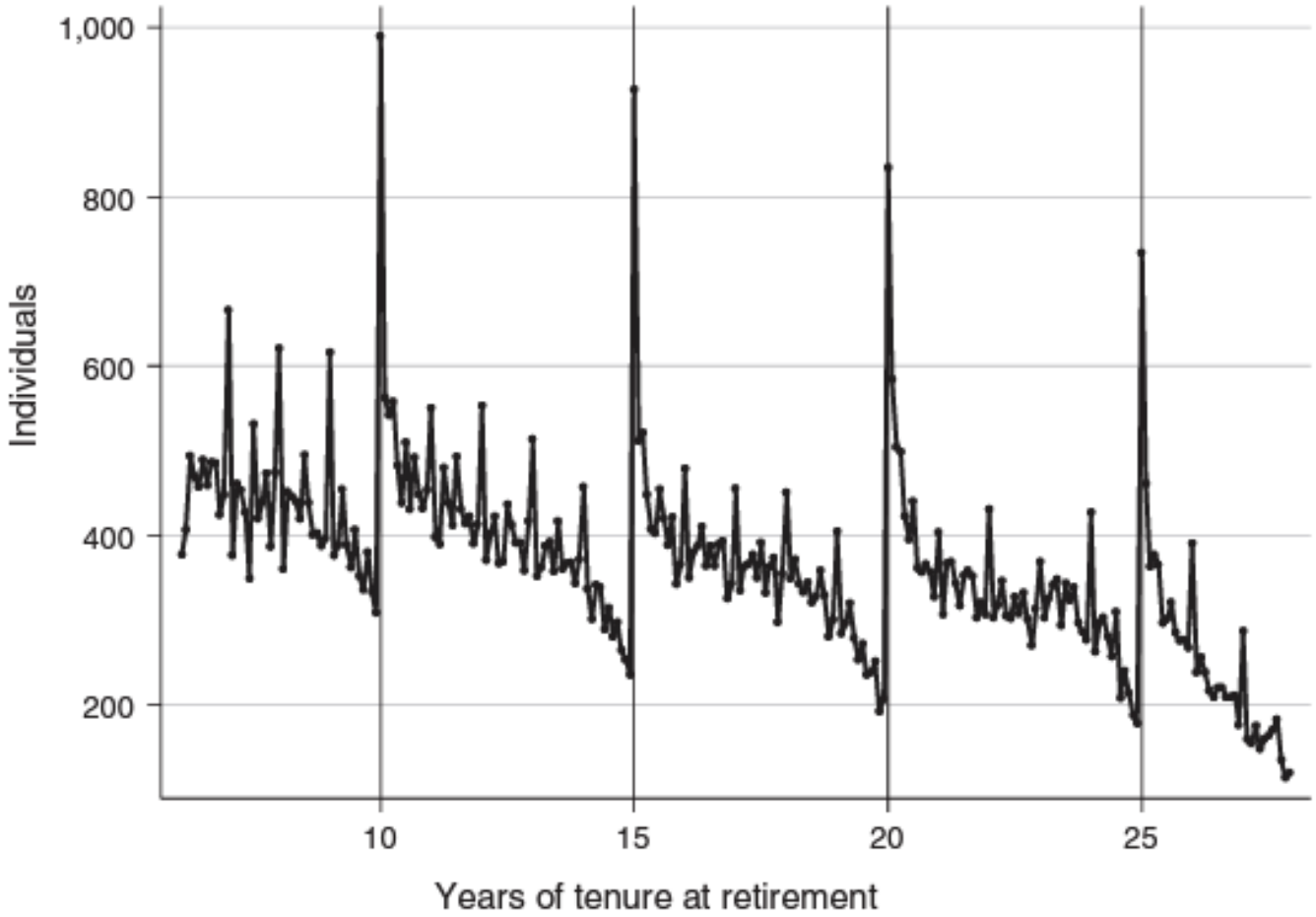
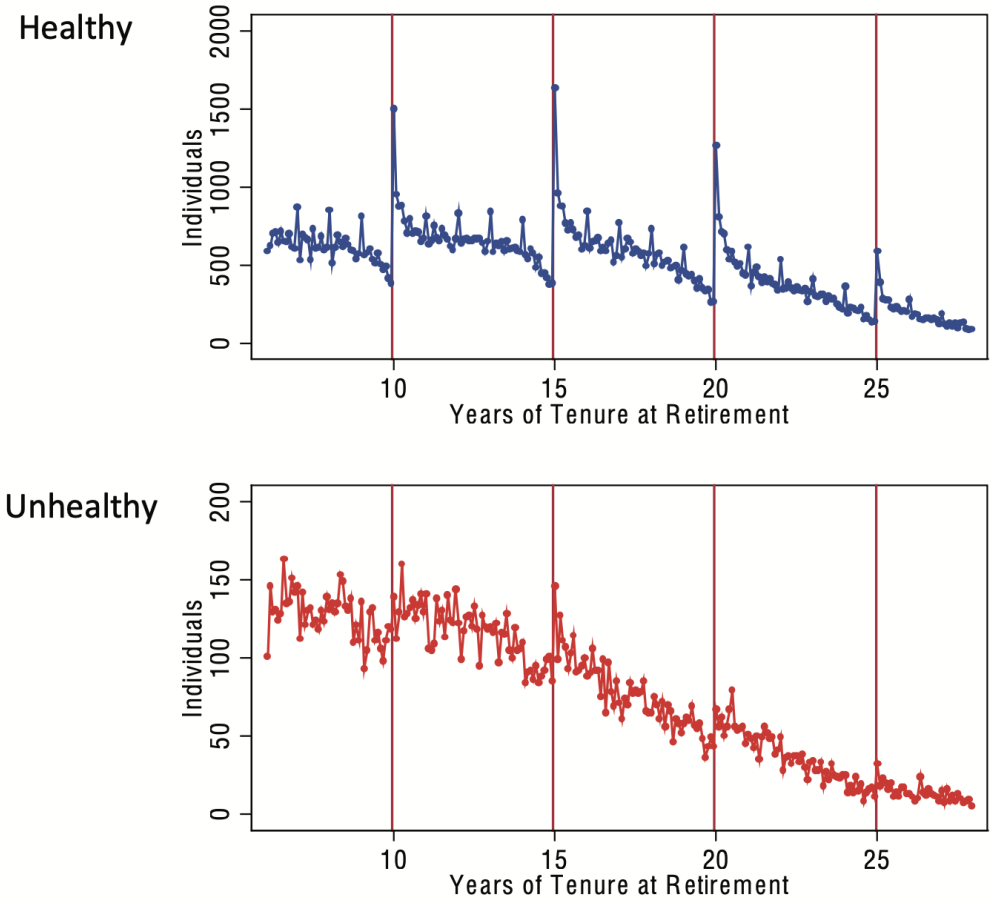


FIGURE 2. DISTRIBUTION OF TENURE AT RETIREMENT

Tenure at Retirement by Health Status



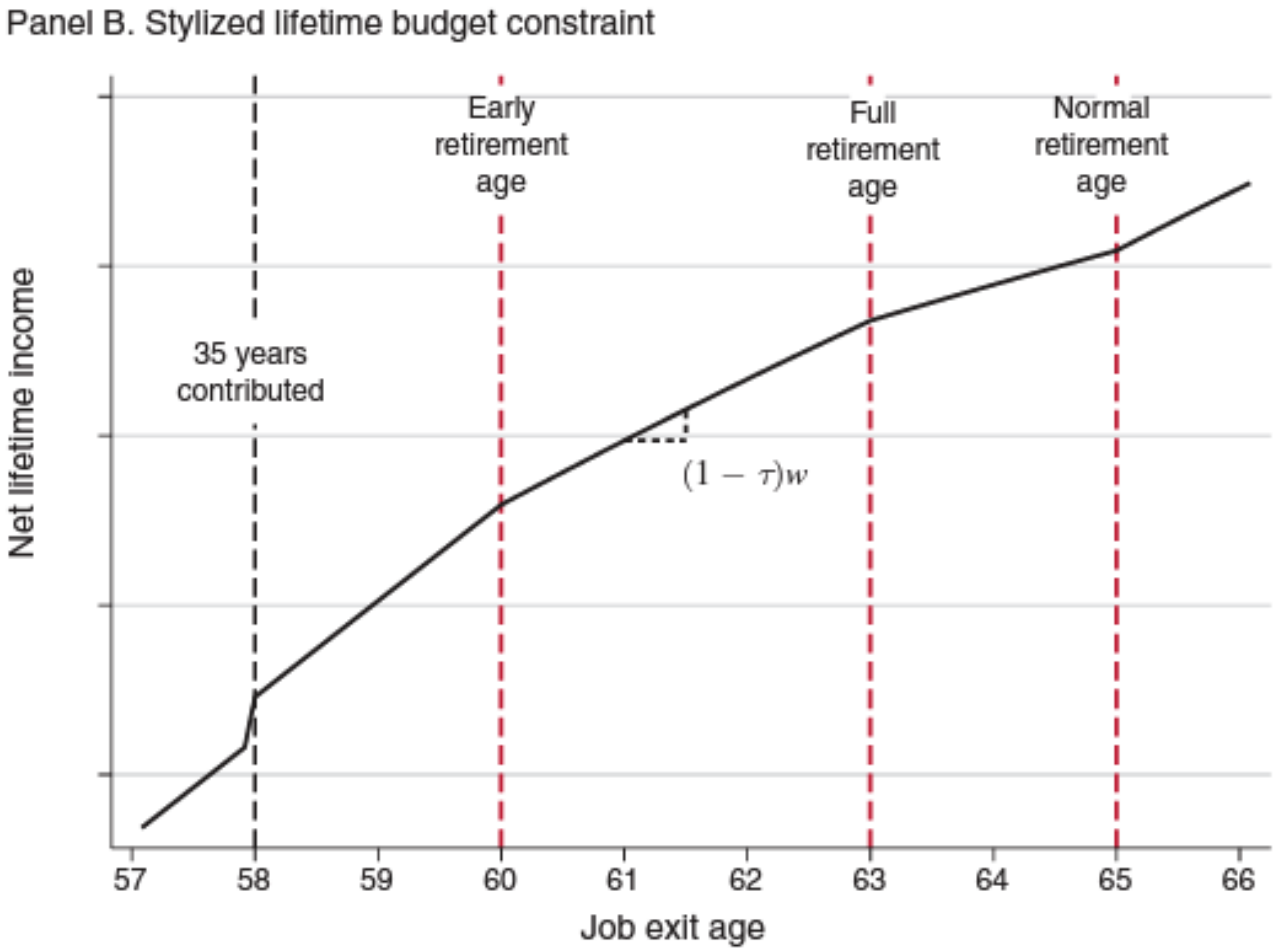
Manoli-Weber (2016b): The Impact of Financial Incentives on Retirement Decisions

- Spikes in retirement at the tenure cutoffs along with dips in retirement just before indicate that these incentives work as expected.
- Evidence of liquidity constrains as a substantial fraction of individuals unable to delay retirement, even right before the tenure cutoff where there is a large and immediate financial incentive.
- When look at distribution of tenure at retirement by health levels we see little evidnece of bunching just after the tenure cutoff. Suggesting yes, those who are constrained and need access to funds now may be the ones not responding to incentives.

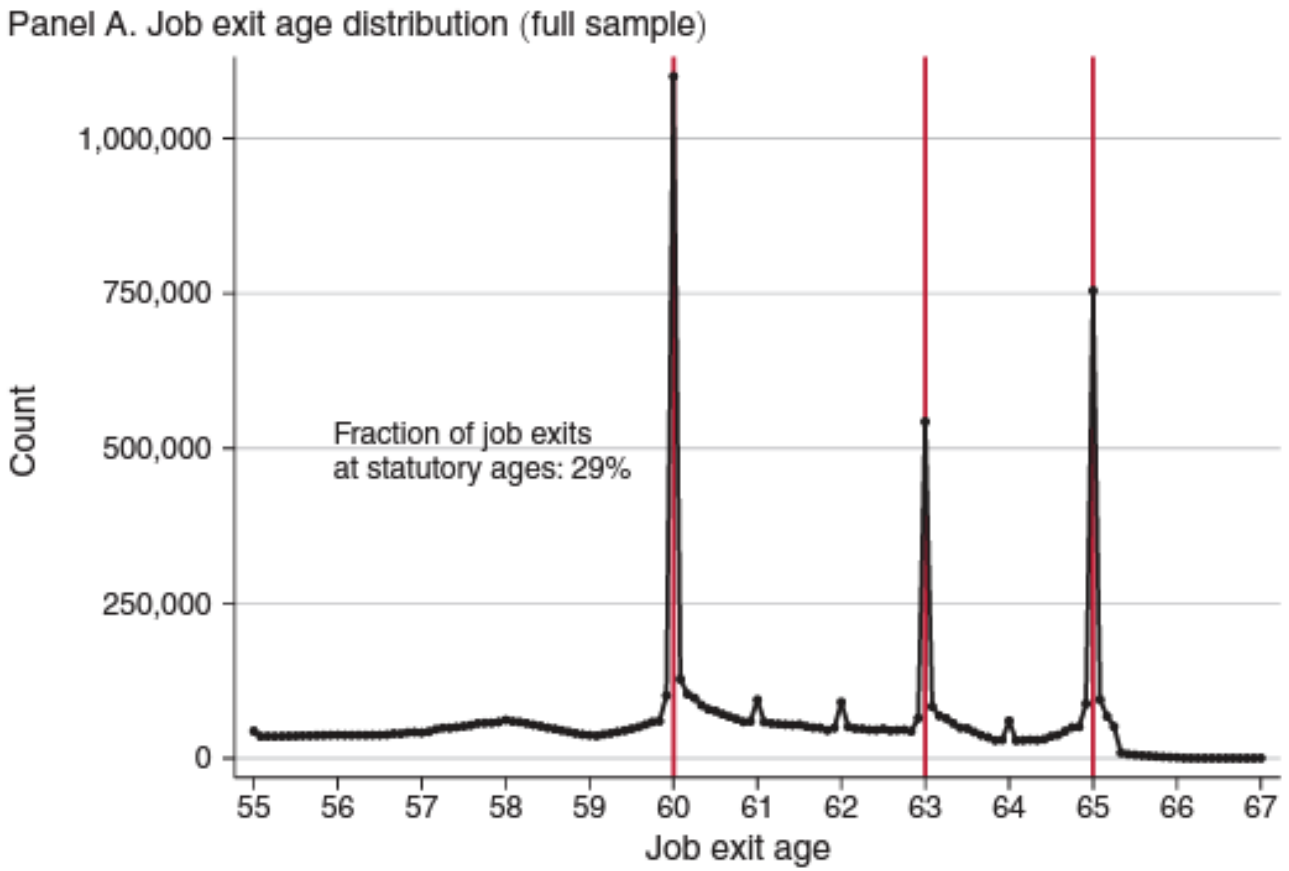
Seibold (2021): Focal Points and Social Norms

- Social Security programs often have what is called a normal retirement age (NRA) which may set a focal point/social norm
- In Germany there are three statutory retirement ages:
  - ERA: after which retirees can receive partial benefits
  - FRA: Full retirement age after which full benefits
  - NRA: benchmark age, no financial incentives change reaching this date.

Stylized Lifetime Budget Constraint



Job Exit Age Distribution



Seibold (2021): Focal Points and Social Norms

- Significant bunching at statutory retirement ages (29% of all labour market exits)
- At the NRA, where there are no changes financial incentives, there is still substantial bunching, more than at the FRA where there are financial incentives.
- Seibold finds that the bulk of the bunching is due to reference effects rather than incentive effects.