Lecture 4: Pensions and labour markets

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Introduction

- **What is retirement ?**
  - Withdrawing from the labour force ? Reducing hours of work ?
  - Claiming a pension ?
- **Labour vs public economics**
  - Labour economics : supply/demand for labour
  - Public economics : impact of public pensions/mandatory savings
- **Impact of pension reforms**
  - Do pension reforms have an impact on labour force participation ?
  - Or are exit from the labour market determined by other factors ?

Outline of the lecture

I. **Facts about retirement**
   1. Measurement issues
   2. Decline in labour force participation of older men (1880–1990)
   3. Increase in labour force participation of older workers since 1990

II. **Modelling retirement**
   1. A simple lifetime retirement model
   2. Option value model
   3. Dynamic programming models

Outline of the lecture

III. **Impact of pensions on retirement**

1. Early empirical evidence
2. Impact of pension benefit level
3. Impact from financial incentives
4. Impact from retirement age references

IV. **Early retirement policies**

1. Early retirement policies
2. Impact on older workers' employment
3. Impact on unemployment

I. Facts about retirement

1. Measurement issues
2. Decline in labour force participation of older men (1880–1990)
3. Increase in labour force participation of older workers since 1990

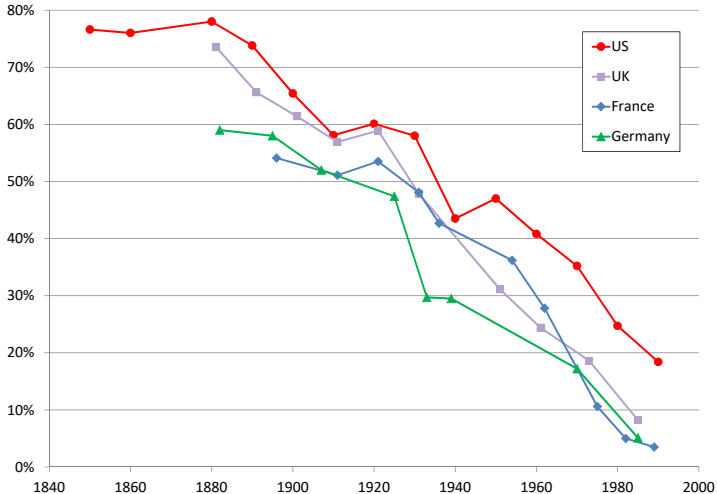
Measurement issues

1. **Ambiguity of retirement**
   - Retirement and unemployment
   - Part time work
2. **Partial retirement**
   - Progressive decrease in hours of work
   - Change of job while claiming a pension
3. **Retirement as absorbing state ?**
   - Used to be thought that retirement was irreversible
   - Now not anymore the case

Data sources on retirement

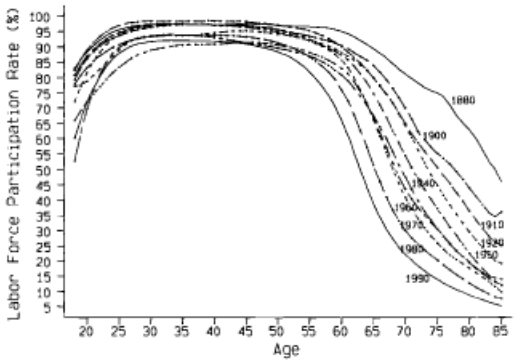
1. **Labour force surveys**
   - Since late 1960s
   - Little information on pensions
2. **Retirement surveys**
   - US Retirement history survey (1969-79)
   - UK Retirement survey (1989-94)
3. **New Ageing surveys**
   - Health and retirement survey (HRS) : 1992-2018
   - English Longitudinal Study of Ageing (ELSA) : 2002-2018
   - Survey of Health, Ageing and Retirement in Europe (SHARE) : 2004-2018
   - Japanese Study of Aging and Retirement (JSTAR) : 2007-2011

Figure 1 – Labour force participation rates of men aged 65 and over (1850–1990)



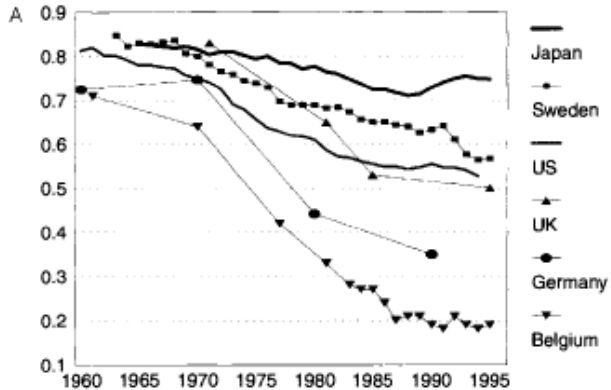
Source : Costa (1998), Tab. 2A.2, p. 29.

Figure 2 – Labour force participation rates of U.S. men aged 18 to 85 (1880–1990)



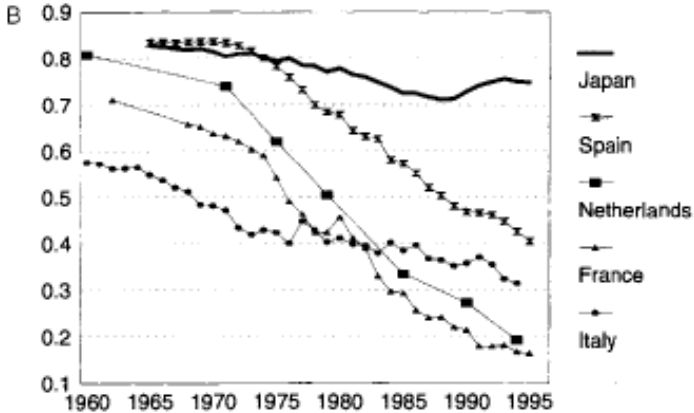
Source : Costa (1998), Fig. 2-5, p. 12.

Figure 3 – Labour force participation rates of men aged 60 to 64 (1960–1994)



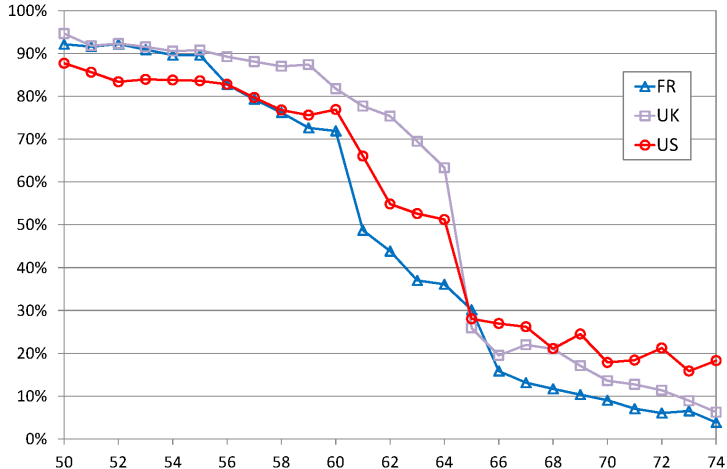
Source : Gruber and Wise (1999), Fig. 1A, p. 3.

Figure 4 – Labour force participation rates of men aged 60 to 64 (1960–1994)



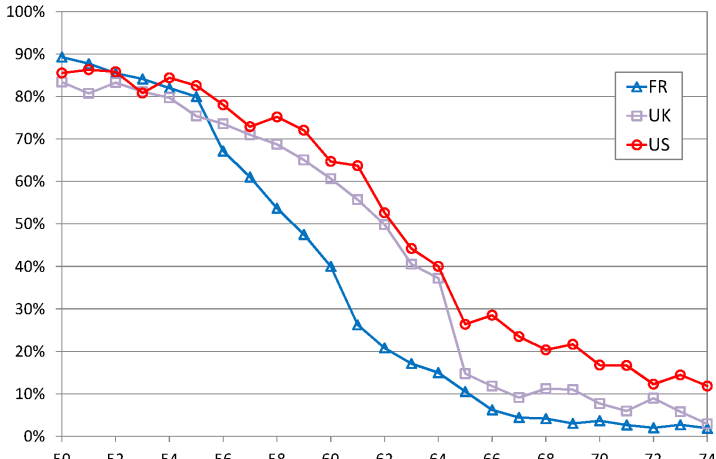
Source : Gruber and Wise (1999), Fig. 1B, p. 3.

Figure 5 – Employment rates of men aged 50 to 74 (1977)



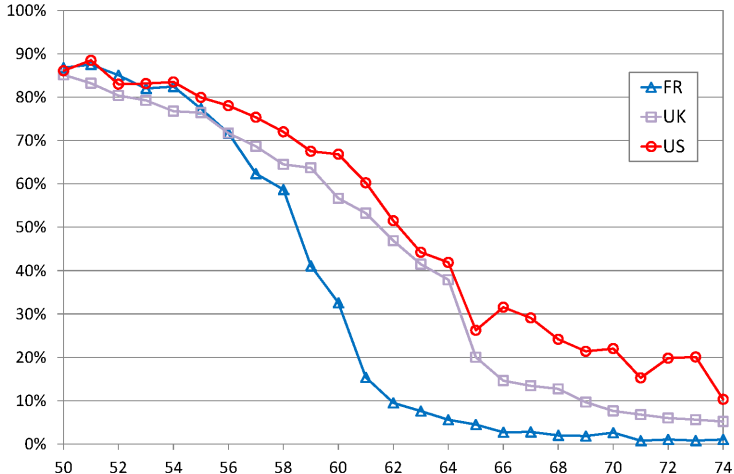
Source : Blundell, Bozio and Laroque (2013).

Figure 6 – Employment rates of men aged 50 to 74 (1987)



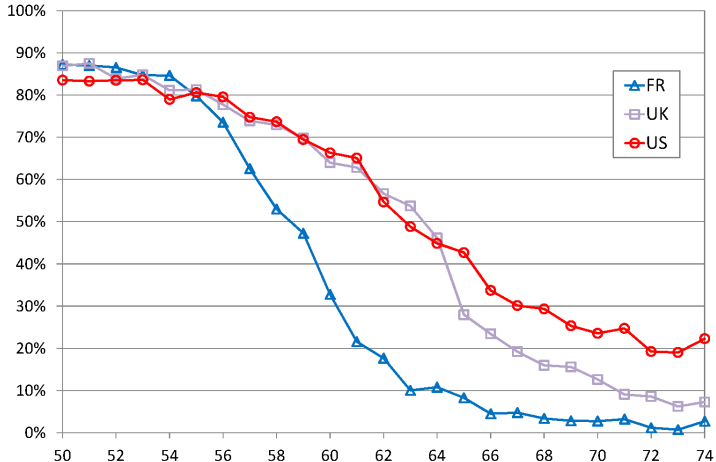
Source : Blundell, Bozio and Laroque (2013).

Figure 7 – Employment rates of men aged 50 to 74 (1997)



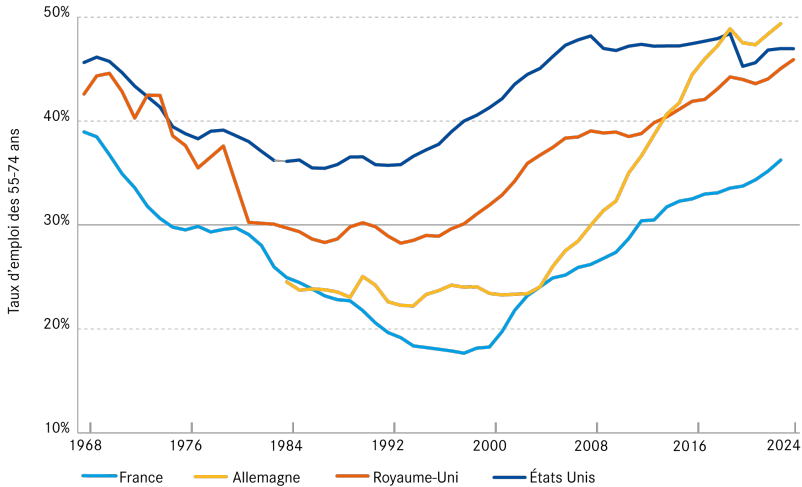
Source : Blundell, Bozio and Laroque (2013).

Figure 8 – Employment rates of men aged 50 to 74 (2007)



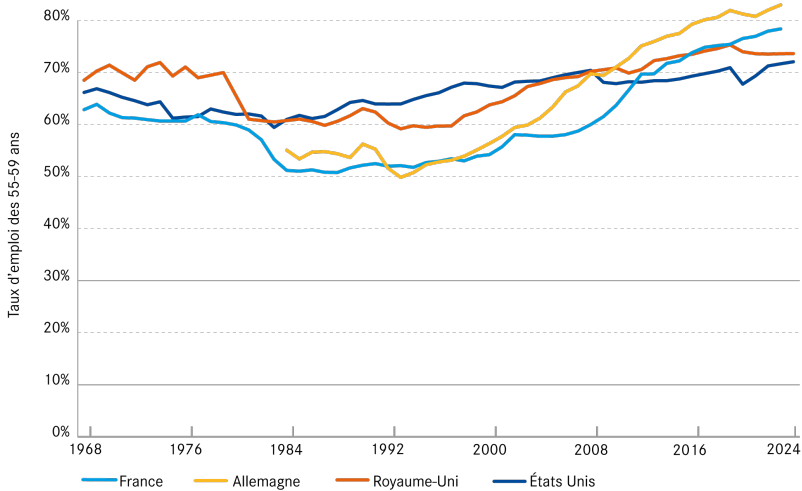
Source : Blundell, Bozio and Laroque (2013).

Figure 9 – Employment rates of men aged 55 to 74



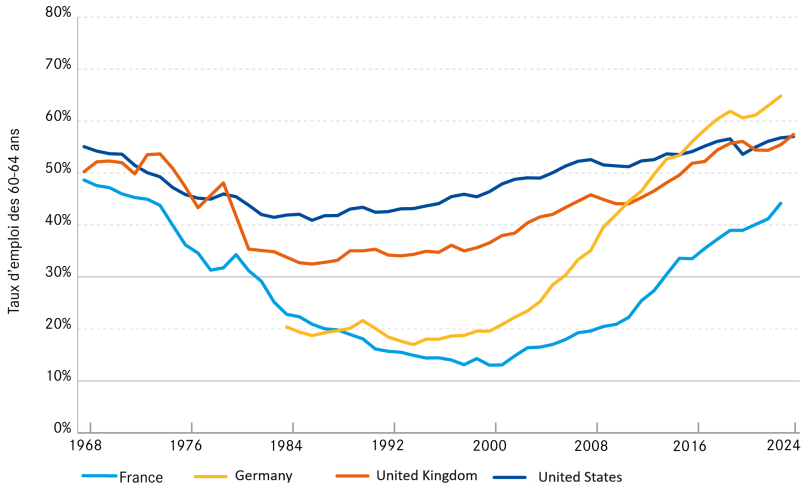
Source : Bozio et al. (2025) updated from Blundell, Bozio and Laroque (2013).

Figure 10 – Employment rates of men aged 55 to 59



Source : Bozio et al. (2025) updated from Blundell, Bozio and Laroque (2013).

Figure 11 – Employment rates of men aged 60 to 64



Source : Bozio et al. (2025) updated from Blundell, Bozio and Laroque (2013).

II. Modelling retirement

1. A simple lifetime retirement model
2. Option value model
3. Dynamic programming models

A simple retirement model

- **Lifetime budget constraint**
  - Live T years, work L years, retired $R = T - L$ years
  - Constant wage w, interest rate $r = 0$
  - Lifetime consumption C, lifetime leisure R

- **Lifetime utility maximisation**

$$\max_{L} U(R, C) \; s.t. \; C \leq (T - R)w$$

- **Standard demand for leisure framework**
  - Leisure is a normal good
  - Increase in income leads to a decrease in retirement age R (more leisure)
  - A wage increase leads to income and substitution effects, hence ambiguous effect on retirement

A simple retirement model

- **Income effects**
  - Long-term trend in decreasing retirement age
  - Could be explained by income effects
  - Being richer, we consume more leisure
- **Limits**
  - Value of market time independent of age
  - Value of leisure independent of age
  - No reason for bunching of leisure at the end of life

Option value model

- **Stock and Wise (Econometrica, 1990)**
  - Individuals assess utility of retiring at each date
  - Individuals retire if value of retiring now is higher than retiring later
  - Irreversibility of retirement decision

- **Model setup**
  - People earns Y_s while working in year s
  - Receive pension $B_s(r)$ when retiring at age r
  - Value at date t of future income, discounted at rate β, when retiring at age r :

$$V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} U(Y_s) + \sum_{s=r}^{T} \beta^{s-t} U(B_s(r))$$

Option value model

- **Optimal retirement age**
  - Gains from postponing retirement : $G_t(r) = E_t V_t(r) - E_t V_t(t)$
  - r^* is the year with highest expected value : r^* solves $\max_r E_t V_t(r)$
  - Retirement decision if $G_t(r^*) = E_t V_t(r^*) - E_t V_t(t) < 0$

- **Parametrization of the model**
  - $U(Y_s) = Y_s^\gamma + \omega_s$
  - $U(B_s) = (\kappa B_s(r))^\gamma + \xi_s$
  - γ is risk aversion relative to income uncertainty
  - κ is the value of income while working relative to its value when retired
  - ω_s and ξ_s are individual random effects

Option value model

- **Estimation technique**
  - Retirement decision is $Pr[G_t(r^*) > 0]$
  - Parameters κ, γ, β estimated by maximum likelihood
- **Applications**
  - Stock and Wise (1990) on a pension plan firm data
  - Lumsdaine, Stock and Wise (1992)
  - Blanchet and Mahieu (2004) and Mahieu and Walraet (2005) on French data

Dynamic programming models

- **Stochastic dynamic programming models**
  - Dynamic : budget constraint, health, earnings
  - Stochastic : uncertainty around earnings, health, asset returns
  - Structural : generability of results based on structure
- **Key papers**
  - Gustman and Steinmeier (Econometrica, 1986)
  - Rust and Phelan (Econometrica, 1997)
  - French (RESTUD, 2005)

III. Impact of pensions on retirement

1. Early empirical evidence
2. Cross-country evidence (NBER ISS project)
3. Impact of pension benefit level
4. Impact from financial incentives
5. Impact from retirement age references

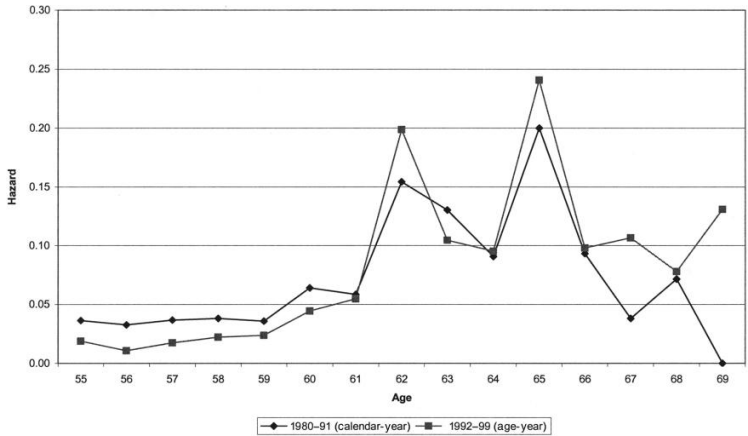
Early empirical evidence

- **Empirical methods**
  1. Time-series evidence
  $$LFP_t = \alpha + \beta B_t / w_t + \varepsilon_t$$
  2. Cross-sectional evidence
  $$LFP_i = \alpha + \beta B_i / w_i + \varepsilon_i$$
- **Not very conclusive literature**
  - Boskin and Hurd (JPuBE, 1978) : strong effects of pensions
  - Hurd and Boskin (QJE, 1984) : large effect
  - Burtless (REStud, 1986) : little impact

Retirement hasard spikes

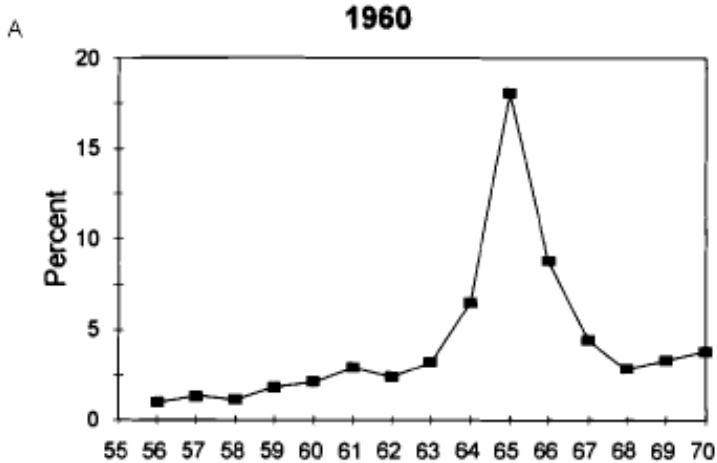
- **Retirement hasard spikes**
  - Retirement hasard at age a is the fraction of people who retire at age a among those still working at age $a-1$
- **Spikes are common**
  - U.S. : early retirement age at 62, full-rate at age 65
  - France : full-rate at age 60 (pre 1993)
  - Spikes move when pension rules are changed
- **Evidence of large pension effects**
  - Either non-rational behaviour or liquidity effects

Figure 12 – Hasard rate out of labour force in the U.S. (1980s and 1990s)



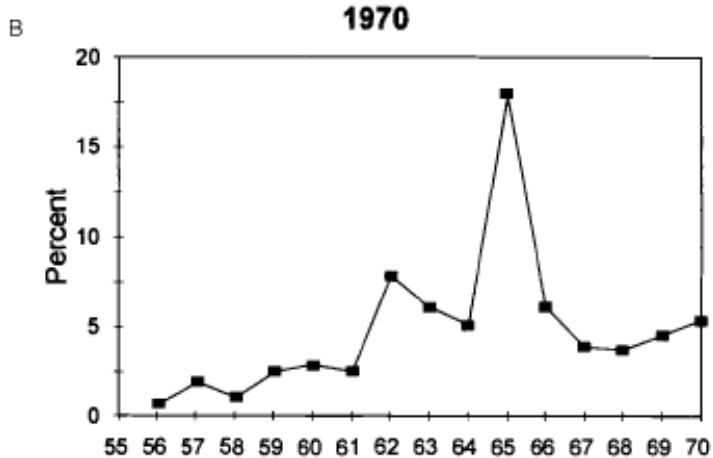
Source : Coile and Gruber (2007), Fig. 1, p. 237.

Figure 13 – Hasard rate out of labour force in the US (1960)



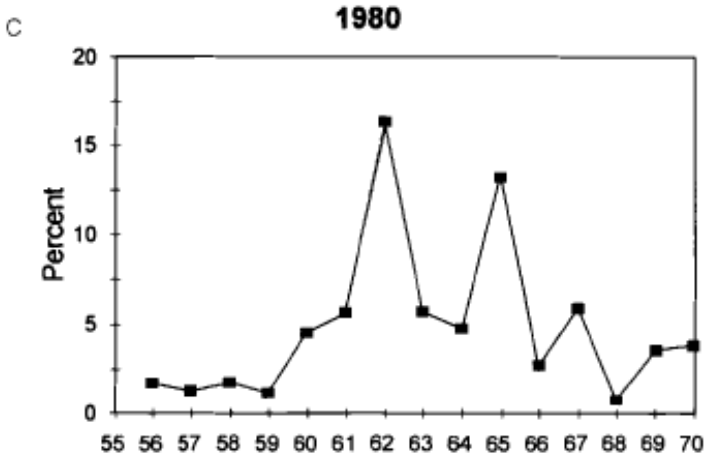
Source : Gruber and Wise (1999), Fig. 12.A, from Burtless and Moffitt (1984).

Figure 14 – Hasard rate out of labour force in the US (1970)



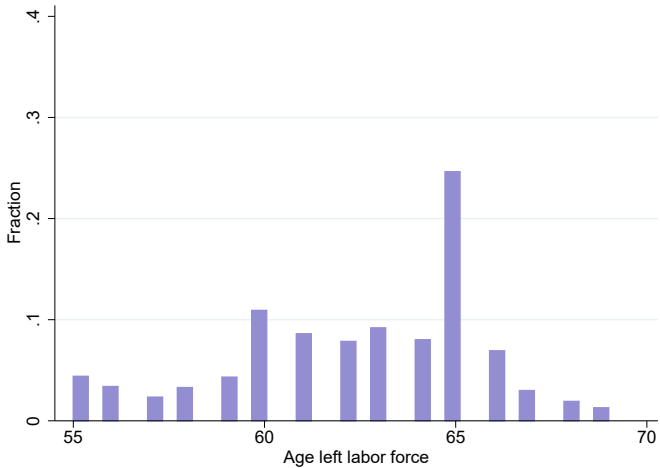
Source : Gruber and Wise (1999), Fig. 12.B, from Burtless and Moffitt (1984).

Figure 15 – Hasard rate out of labour force in the US (1980)



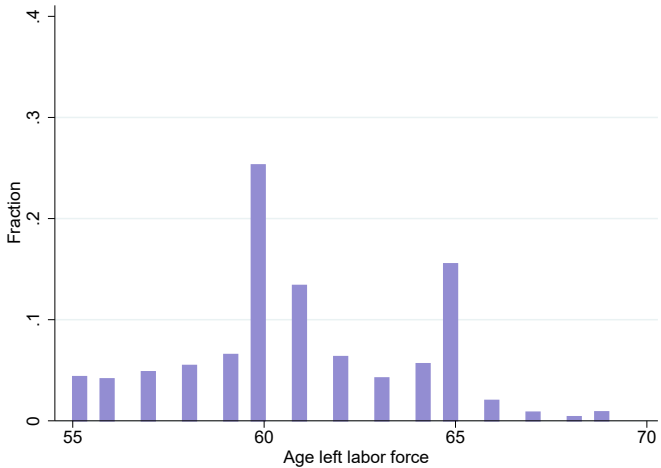
Source : Gruber and Wise (1999), Fig. 12.C, from Burtless and Moffitt (1984).

Figure 16 – Hasard rate out of labour force in France – Cohort 1912 (aged 60 in 1972)



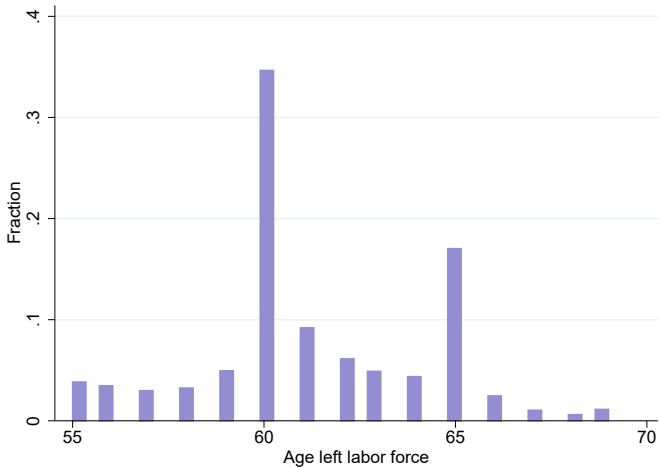
Source : Échantillon interrégime des retraités (EIR) 1988, Drees.
Note : This graph replicates Gruber and Wise (1999), Fig. 9.A, p. 14 taken from Blanchet and Pelé (1999), Fig. 3.15, taken from Dangerfield (1994).

Figure 17 – Hasard rate out of labour force in France – Cohort 1922 (aged 60 in 1982)



Source : Échantillon interrégime des retraités (EIR) 1993, Drees.
Note : This graph replicates Gruber and Wise (1999), Fig. 9.A, p. 14 taken from Blanchet and Pelé (1999), Fig. 3.15, taken from Dangerfield (1994).

Figure 18 – Hasard rate out of labour force in France – Cohort 1926 (aged 60 in 1986)

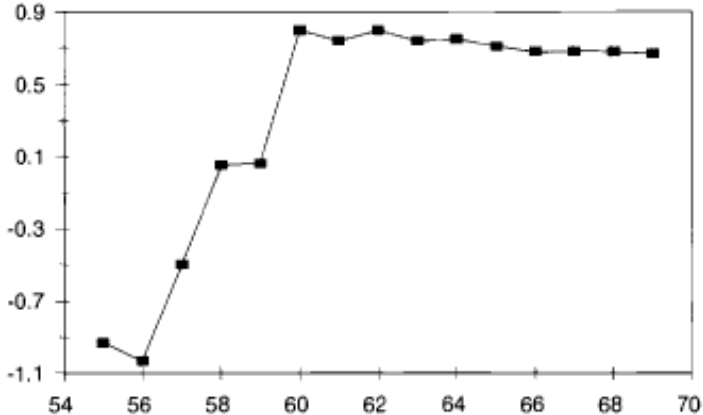


Source : Échantillon interrégime des retraités (EIR) 1997, Drees.
Note : This graph replicates Gruber and Wise (1999), Fig. 9.A, p. 14 taken from Blanchet and Pelé (1999), Fig. 3.15, taken from Dangerfield (1994).

Cross-country evidence

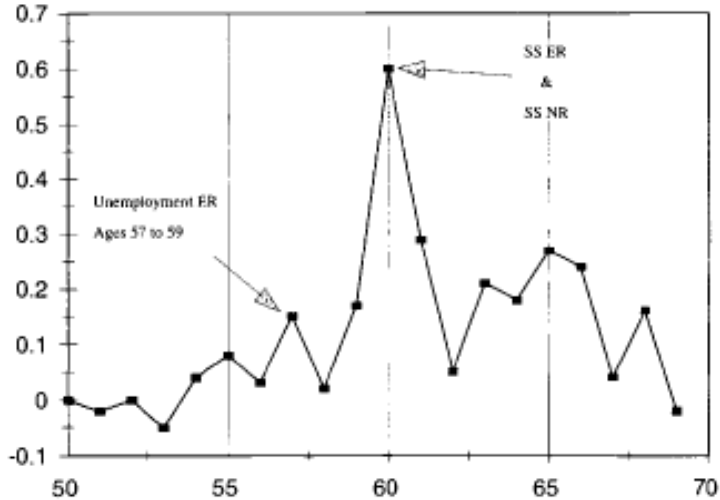
- **NBER International social security (ISS) group**
  - Researchers from different countries
  - Using micro-data in a cross-country framework
  - Led by Jon Gruber and David Wise
- **Gruber and Wise (1998, 1999)**
  - Documenting pension reforms over time
  - Computation of measures of tax incentives through pension
  - Correlate pension tax with labour force participation

Figure 19 – Tax rate on work in France



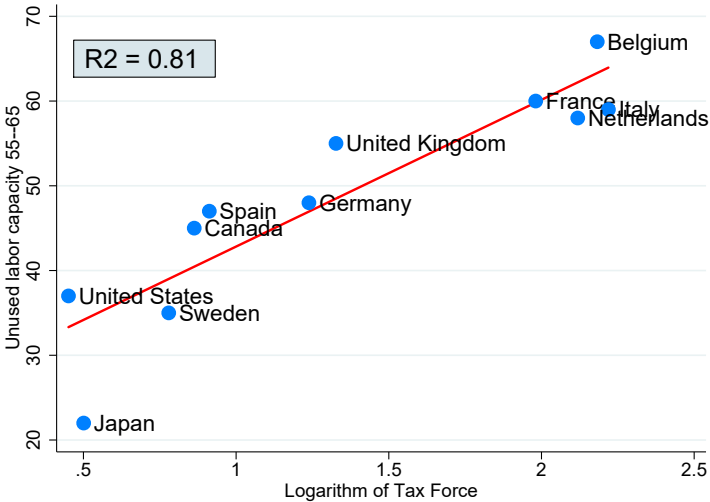
Source : Gruber and Wise (1999), Fig. 10, p. 16 ; Blanchet and Pelé (1999).

Figure 20 – Hasard rate out of labour force in France



Source : Gruber and Wise (1999), Fig. 11, p. 16 ; Blanchet and Pelé (1999).

Figure 21 – Unused capacity vs. tax force



Source : Gruber and Wise (1999), Fig. 17.A, p. 32, data from Tab. 1, p. 29.

Pension incentives

- **Coile and Gruber (RESTAT, 2007)**
  - Use forward-looking pension incentives (Stock and Wise, 1990)
  - Reduced-form regression framework
- **Social security wealth (SSW)**
  - $SSW_t(r)$ is the present discounted value (PDV) of pension wealth at date t, when retiring at r

$$SSW_t(r) = \sum_{s=r}^{T} \beta^{(s-t)} p_{s|t} B_s(r)$$

  - β discount factor ; $p_{s|t}$ probability to survive until s conditioned on having survived until t

Pension incentives

- **Accrual**
  - Gain to postpone retirement from 1 year

$$Accrual_t = SSW_t(r+1) - SSW_t(r)$$

- **Implicit tax**

$$Tax_t = -\frac{Accrual_t}{E_t Y_{t+1}}$$

- **Peak value (PV)**
  - Forward-looking incentive measure

$$PV_t = \max_{x>=t+1}[SSW_t(x)] - SSW_t(t)$$

Pension incentives

- **Option value (OV)**
  - Following Stock and Wise (1990)
  - Derive utility measure of option to remain in work at age a

$$U(a,R) = \sum_{u=a}^{R} \beta^{(u-a)} \frac{w^{1-\gamma}}{1-\gamma} s(u|a) + \sum_{u=R}^{\omega} \beta^{(u-a)} \frac{(\kappa p(R))^{1-\gamma}}{1-\gamma} s(u|a)$$

  - Use previously estimated parameters for γ, κ
  - Derive option value

$$OV_t = \max_r [U(t;r)] - U(t;t) = U(a;r) - U(a;a)$$

Coile and Gruber (RESTAT, 2007)

- **Regression framework**
  - Probit estimation

$$R_{it} = \beta_0 + \beta_1 RW_{it} + \beta_2 IV_{it} + \beta_3 X_{it} + \varepsilon_{it}$$

  - R worker retires, RW PDV of pensions, IV incentive variable, X controls

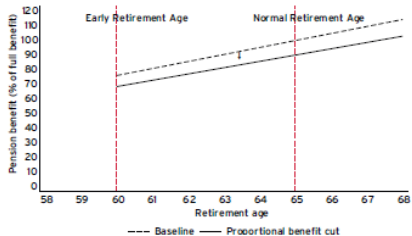
- **Results on U.S. data**
  - $\beta_1 > 0$; $\beta_2 < 0$ i.e., higher gains for postponing retirement reduce retirement probability, while higher pension wealth increases probability of retirement
  - But no account of spikes of hasard rate at 62 and 65

- **Other applications**
  - Cross-country (Gruber and Wise, 2004)

Pension reforms changing the level of benefits

- **Change in the level of benefits**
  - A change in benefit at any given retirement age
  - Expected impact on labour supply through income or wealth effect

Figure 22 – Stylised pension reform : a cut in benefit level



SOURCE : Giupponi and Seibold (2024), Fig. 1.a, p. 12.

Krueger and Pischke (JOLE, 1992)

- **"Credibility revolution"**
  - First paper to defend "credibility revolution" in pension economics
  - Alan B. Krueger (1960–2019), the earlier proponent of natural experiments in labour economics

- **Critique of previous literature : Identification issues**
  1. Income effect correlated with development of public pensions (colinearity)
  2. Pension is a function of past earnings and past career, likely to influence propensity to retire

- **Finding exogenous variations in SS benefits**
  - Use U.S. SS notch as natural experiment
  - Use aggregate cohort data from CPS
  - Find small wealth effect of SS on retirement

U.S. Social Security notch

- **U.S. Social Security before 1972**
  - Average monthly earnings (AME) based on *nominal* earnings
  - Progressive benefit formula applied to AME to obtain Primary Insurance Amount (PIA)
  - U.S. Congress decided on *ad hoc* increases in the benefit formula

- **1972 amendments to the Social Security Act**
  - Aim to adjust benefit formula automatically on inflation
  - Flaw in the adjustment :
    - AME uprated for inflation
    - replacement rate increased with inflation

  $\Rightarrow$ "double indexation"

U.S. Social Security notch

- **1977 amendments to the Social Security Act**
  - End to double indexation for new retirees
  - Average indexed monthly earnings (AIME) takes into account real earnings
  - Lower benefits for those born after Jan. 1917 ("notch babies")
  - Grandfathering of old law for previous cohorts
- **Discontinuity in benefit level**
  - With same lifetime earnings two individuals born in Dec. 1916 vs Jan. 1917 could have markedly different pension benefit level

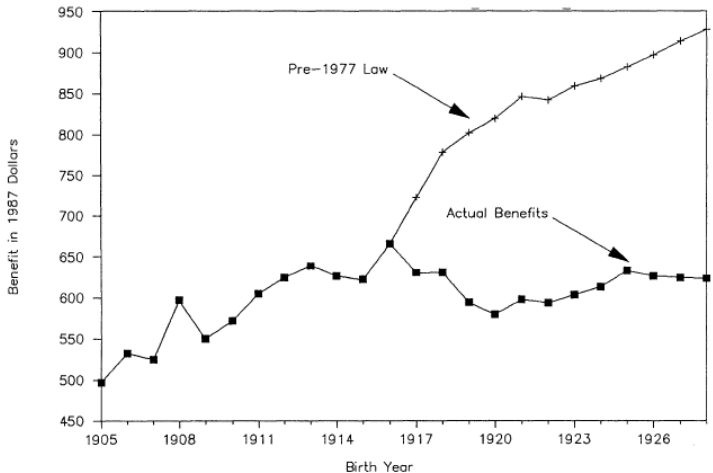
U.S. Social Security notch

"Two sisters, Edith and Audrey, started work at the same book bindery in southern California on the same day in October 1957. Audrey was slightly older, having been born in March 1916, than Edith who was born in June 1917. (...)

To their surprise, when they received notification of their benefit award, the difference was not slight. Edith (born in 1917) received a $512.60 monthly award or $111.80 per month less than Audrey (born in 1916) who received a higher benefit of $624.40 per month."

General Accounting Office (1988), p. 14,
quoted by Krueger and Pischke (1992)

Figure 23 – Average monthly Social Security benefit for workers retiring at age 65



Source : Krueger and Pischke (1992), Fig. 2, p. 419.

Krueger and Pischke (JOLE, 1992)

- **Data**
  - March CPS aggregate cohort data
  - No micro data available at the time !
- **Methods**
  - Regress H weeks worked on SSW Social Security Wealth and G growth in SSW

$$log(H_{a,c}) = \alpha + \beta ln(SSW_{a,c}) + \gamma ln(G_{a,c}) + AGE_a + T + \varepsilon$$

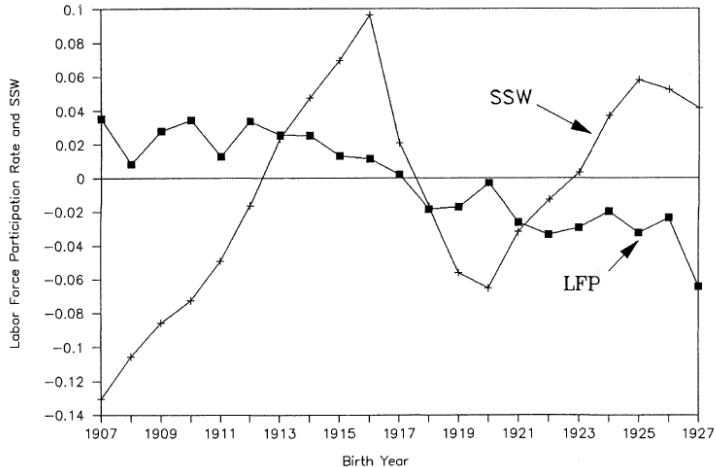
- **Results**
  - Before notch : negative coeff. on SSW
  - Notch : positive coeff. on SSW
  - Take-away : Negative relationship between SSW and LFP spurious ; once control for year FE no remaining relationship

Table 1 – The Effect of Social Security on the Log-Odds Ratio of the Labor Force Participation Rate of Older Men in the Notch Period

	Sample					
	1976–88		Notch period		1976–88	
Independent variable :	(1)	(2)	(3)	(4)	(5)	(6)
Log Social Security Wealth	-0.199	-0.191	0.178	0.105	0.004	0.036
	(0.231)	(0.223)	(0.268)	(0.265)	(0.166)	(0.173)
Growth of Social Security Wealth	–	1.562	–	1.318	–	0.546
		(0.503)		(0.711)		(0.787)
Mandatory retirement dummy	0.124	0.170	–	–	-0.072	-0.084
	(0.055)	(0.055)			(0.047)	(0.050)
Age dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	No	No	No	No	Yes	Yes
Sample size	117	117	51	51	117	117

SOURCE : Krueger and Pischke (1992), Tab. 6, p. 432.

Figure 24 – Log labor force participation and Social Security wealth, average cohort effects after removing age



Source : Krueger and Pischke (1992), Fig. 4, p. 433.

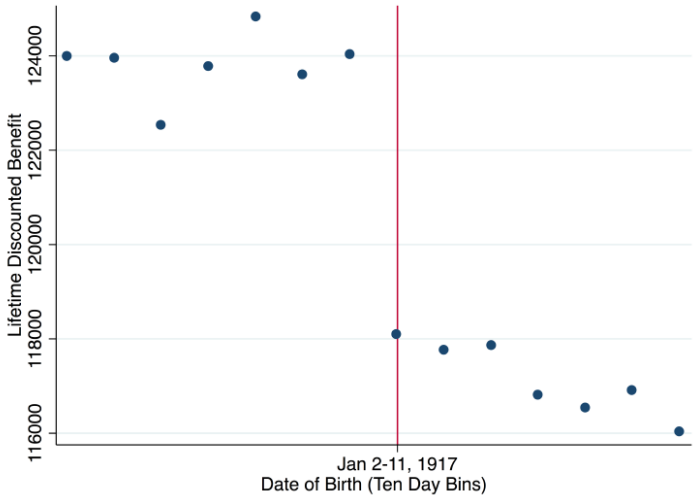
Krueger and Pischke (JOLE, 1992)

- **Interpretation from the authors**
  - "*These findings suggest that the growth in Social Security wealth cannot explain much of the decline in male labor supply*"
- **Still a dated analysis**
  - Aggregate data, 117 observations
  - No reversal in the LFP trend is a very weak test for the impact of SS notch
- **But the first paper to bring causality to the economics of pension !**

Gelber, Isen and Song (2016, R&R QJE)

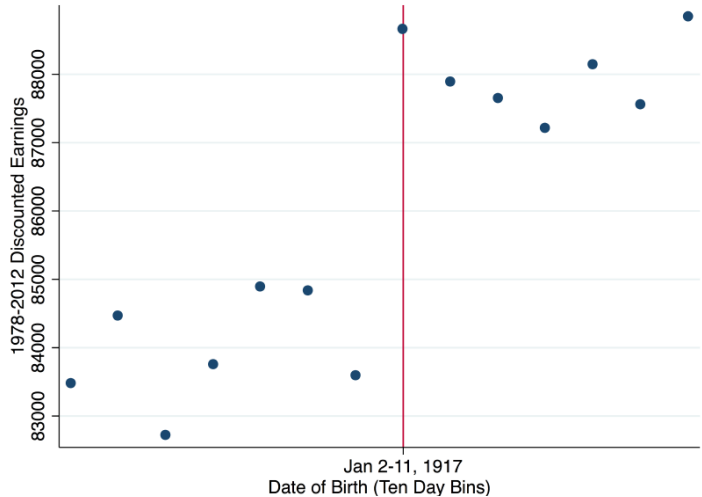
- **Another look at U.S. SS Notch**
  - Using SSA administrative data : individual data with exact date of birth
  - 24 million obs. from 724 000 individuals
  - Using regression discontinuity design around date of birth 2 Jan. 1917
- **Large earnings effects**
  - a $1 increase in OASI benefits causes earnings in the elderly years to decrease by 46 to 61 cents
  - No responses after the policy was announced and before the cut in benefit
  - the evidence is consistent with the hypothesis that only current (not future) benefits affect earnings
  - Consistent with either myopia or liquidity-constraints

Figure 25 – Mean discounted real OASI benefits, 1978 to 2012 (ages 61 to 95)



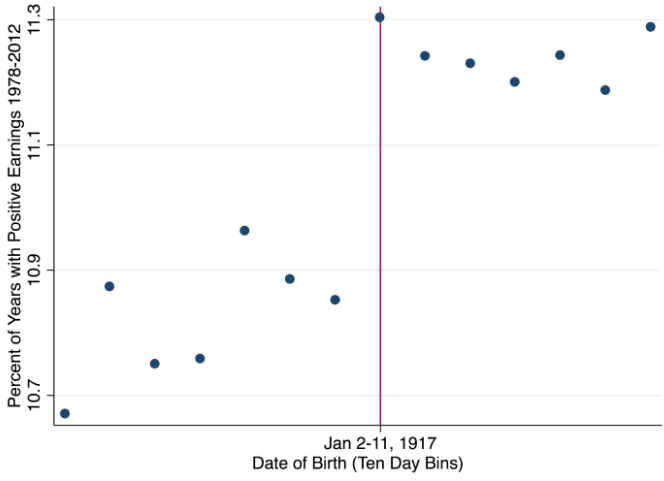
SOURCE : Gelber, Isen and Song (2016), Fig. 3.a.

Figure 26 – Mean discounted value of real earnings, 1978 to 2012 (ages 61 to 95)



SOURCE : Gelber, Isen and Song (2016), Fig. 4.a.

Figure 27 – Extensive margin : percent of years with positive earnings, 1978 to 2012 (ages 61 to 95)



Source : Gelber, Isen and Song (2016), Fig. 5.a.

Figure 28 – Effect of Notch on benefits, earnings, and participation

Outcome	(1) Linear	(2) Linear	(3) Quadratic	(4) Quadratic
A) Discounted benefits, 1978 to 2012	-6,125.64	-6,109.97	-5,958.18	-6,393.76
	(673.10)***	(664.65)***	(1,180.62)***	(1234.24)***
B) Substitution incentive, μ_{j1979}	-0.22	-0.22	-0.22	-0.22
	(0.0030)***	(0.0035)***	(0.0079)***	(0.0069)***
C) Discounted earnings, 1978 to 2012	3,766.02	3,865.18	5,996.94	5,702.02
	(858.30)***	(865.10)***	(1,144.14)***	(1,139.05)***
D) Percent years with positive earnings,	0.40	0.41	0.52	0.51
1978 to 2012	(0.09)***	(0.09)***	(0.12)***	(0.12)***
E) Log odds of fraction of years with	0.040	0.042	0.053	0.051
positive earnings, 1978 to 2012	(0.0088)***	(0.0093)***	(0.012)***	(0.013)***
F) Last year earned positive amount	0.16	0.18	0.24	0.22
	(0.06)***	(0.065)***	(0.094)**	(0.092)**
Controls?	N	Y	N	Y

SOURCE : Gelber, Isen and Song (2017), Tab. 3.

Gelber, Isen and Song (2016)

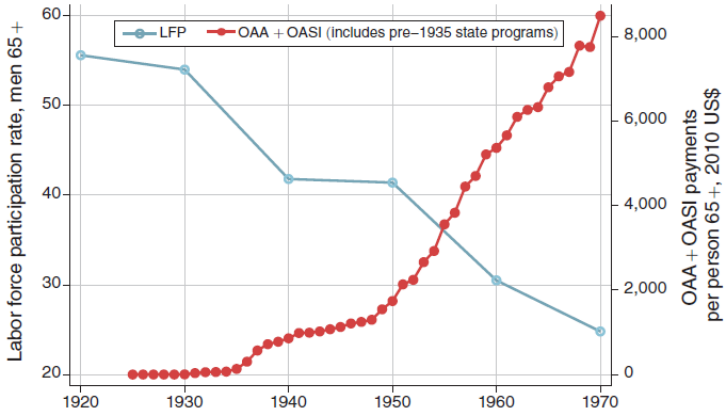
- **Large income effects**
  - Use cohort boundary to estimate income effects
  - Participation rate of individuals just affected by the reform increases by 0.4 ppt (3.6% increase)
  - Implied elasticity of participation with respect to lifetime pension benefits is -0.7 (i.e., a 10% increase in benefits lead to a 7% drop in participation)
  - On the other hand substitution incentives are small (Frisch elasticity < 0.010)

- **Implications**
  - Results suggest that the increase in OASI benefits from 1950 to 1985 can account for at least 50% of the dramatic decrease in the elderly employment rate over this period
  - And the slowdown in growth rate of OASI could explain 28% of the increase in employment rate of those aged over 65

Fetter and Lockwood (AER, 2018)

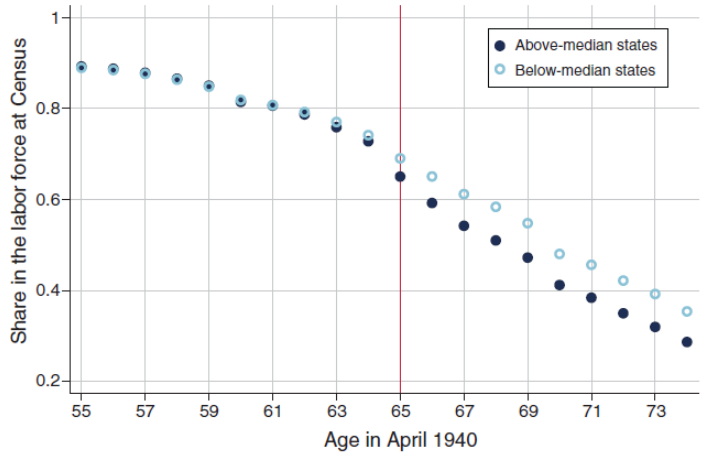
- **Old Age Assistance Program (OAA)**
  - A means-tested program introduced in the 1930s alongside Social Security that later became the Supplemental Security Income (SSI) program
  - OAA was state-administered and exhibited considerable variation across states in eligibility and benefit levels
- **Empirical strategy**
  - Use U.S. Census data
  - Use age eligibility requirements and cross-state variations

Figure 29 – Aggregate trends, 1920–1970



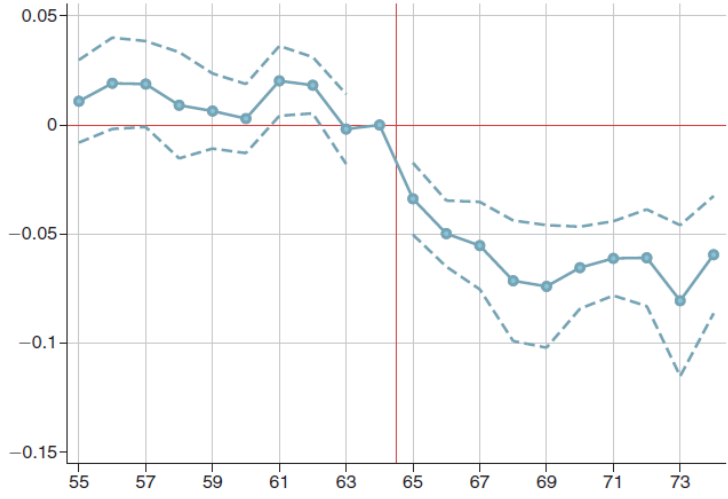
Source : Fetter and Lockwood (2018), Fig. 1.A, p. 2176.

Figure 30 – Labour force participation in 1940 by age and by State OAA payments per person



Source : Fetter and Lockwood (2018), Fig. 2, p. 2177.

Figure 31 – Impact of labour force participation by age



Source : Fetter and Lockwood (2018), Fig. 5.A, p. 2189.

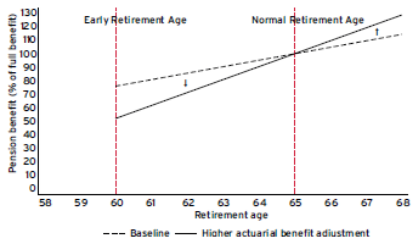
Fetter and Lockwood (AER, 2018)

- **Results**
  - OAA reduced the labor force participation rate among men aged 65-74 by 8.5 ppt, more than one-half of its 1930-1940 decline
  - Effects concentrated for men with low education and low earnings potential
- **Implications**
  - The welfare cost to recipients of OAA's implicit taxation of work has been small

Pension reforms changing marginal financial incentives

- **Change in marginal financial incentives**
  - A change in the slope of benefit to retirement age
  - Or a change in the rules to received earnings while claiming a pension (earnings test)

Figure 32 – Stylised pension reform : marginal financial incentives

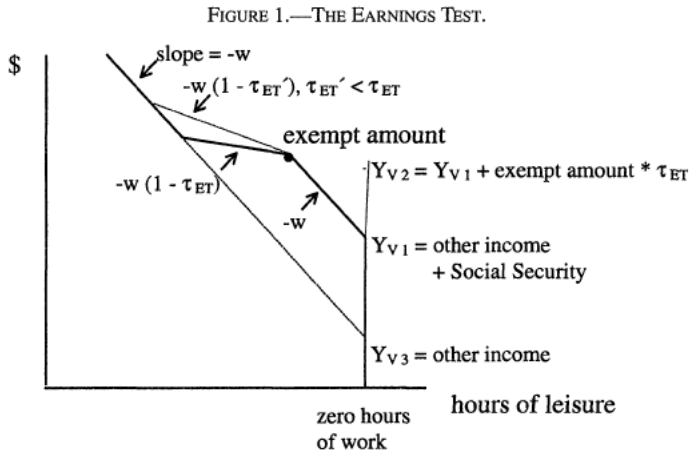


Source : Giupponi and Seibold (2024), Fig. 1.b, p. 12.

Earnings test

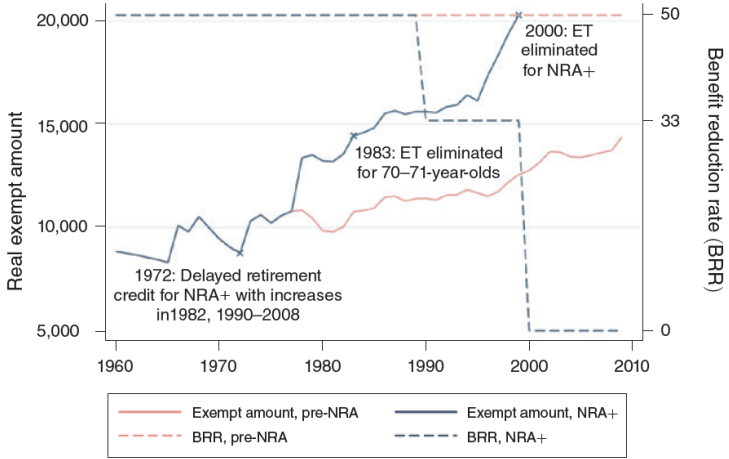
- **Earnings test**
  - Limit on earnings while claiming pensions
  - U.S. earnings test partly removed in 2000
  - U.K. earnings rule repelled in 1989
  - French rules on *cumul emploi retraite*
- **U.S. Social Security earnings test in 2022**
  - $62 < Age < NRA$, 50% tax above \$19,560
  - No earnings test above Normal retirement age (NRA)
  - NRA today 66 (increasing progressively to 67)
  - Delayed Retirement Credit : Benefits taxed away will be credited back at NRA with 8% increase

Figure 33 – Budget constraint of the earnings test



SOURCE : Friedberg (RESTAT, 2000), Fig. 1, p. 49.

Figure 34 – Changes in the U.S. earnings test rules (1961–2009)

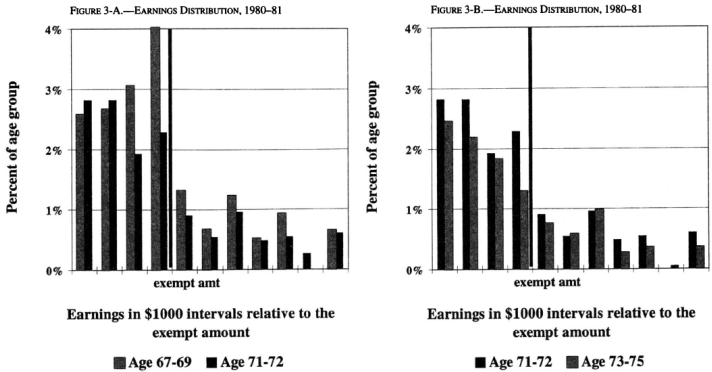


Source : Gelber, Jones and Sachs (2020), Fig. 1, p. 5.

Friedberg (RESTAT, 2000)

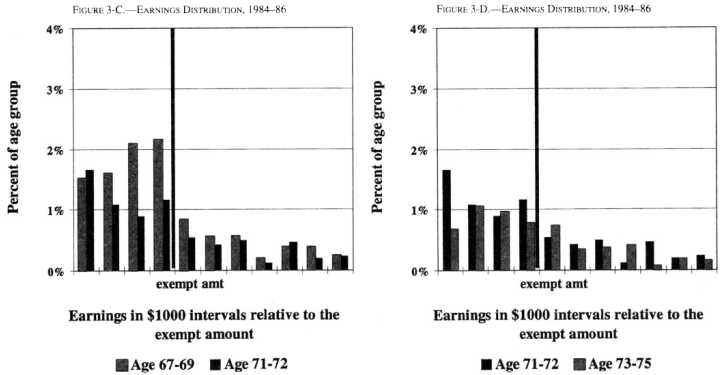
- **Exploit changes in the U.S. earnings test**
  - Use March Current Population Surveys (CPS) data
  - Assess bunching before the threshold
- **Changes exploited**
  1. 1978 increase in the exempt amount for the 65-71
  2. 1983 reform removed the earnings test for 70 and 71 years old
  3. 1990 decline in the tax rate (from 50% to 33%) for the 65-69

Figure 35 – Earnings distribution at the earnings test before 1983 reform



SOURCE : Friedberg (RESTAT, 2000), Fig. 3, p. 55.

Figure 36 – Earnings distribution at the earnings test after 1983 reform



SOURCE : Friedberg (RESTAT, 2000), Fig. 3, p. 55.

$\Rightarrow$ no more bunching below the exempt amount of 70-71 years old

Friedberg (RESTAT, 2000)

- **Labour supply estimation**
  - Piece-wise linear budget constraint

$$log(H) = \beta_0 + \beta_1 w(1-\tau) + \beta_2 Y_v + \beta_3 X$$

  - Exploit the change in earnings test to generate changes in net earnings and virtual income
  - To obtain substitution and income elasticities

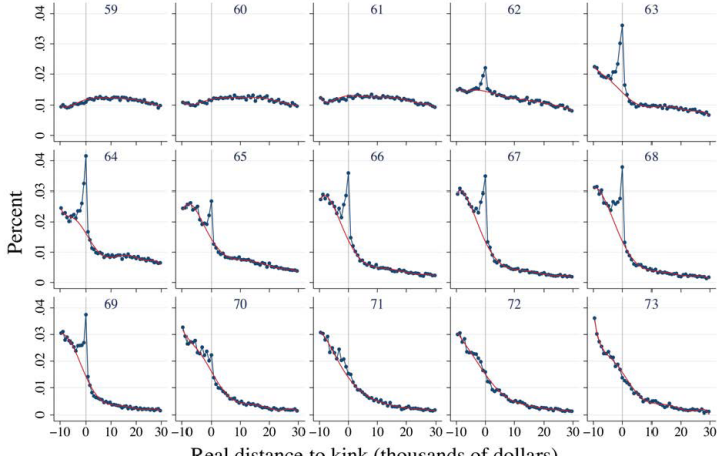
- **Results**
  - Large income and substitution elasticities
  - Large implied deadweight loss of earnings test
  - Removing earnings test would lead to 5.3% increase in hours worked

Gelber, Jones and Sachs (AEJ-AE, 2020)

- **Bunching estimation**
  - Exploit recent changes in the U.S. earnings test (ET)
  - 2000 removal of the test above NRA
  - Use bunching estimation techniques (Saez, 2010) to estimate adjustment frictions
  - Use SSA administrative data

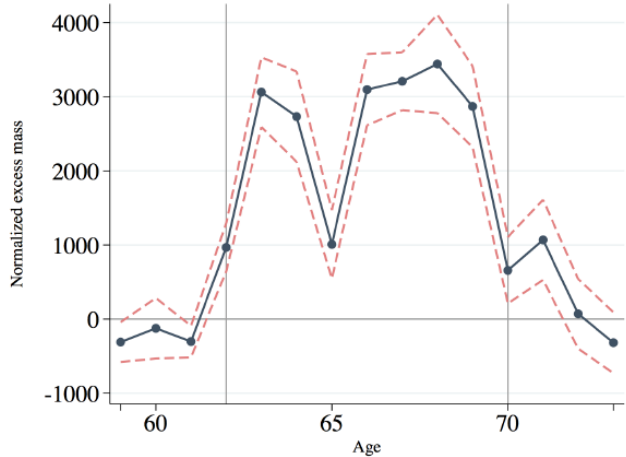
- **Results**
  - Significant bunching at kinks, even after removal of ET
  - Inertia :
    - earnings of bunchers around exempt amount before and after removal of ET
    - bunching slowly removed over time
  - Larger elasticities once adjustment frictions are taken into account

Figure 37 – Earnings histogram by age (1990 to 1999)



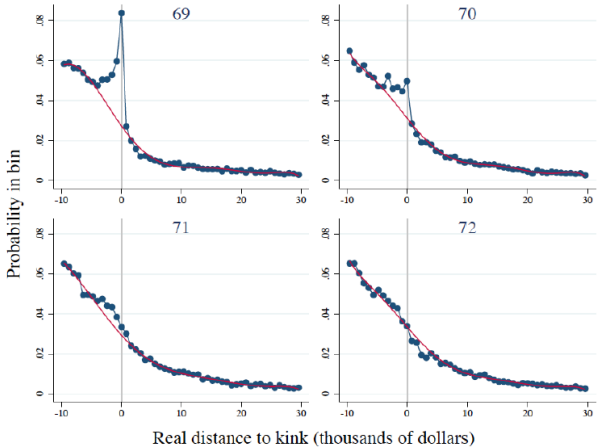
Source : Gelber, Jones and Sachs (2020), Fig. 2.A, p. 9.
Note : From 1990 to 1999, the earnings test applies to ages 62 to 69.

Figure 38 – Normalized Excess Mass by Age (1990 to 1999)



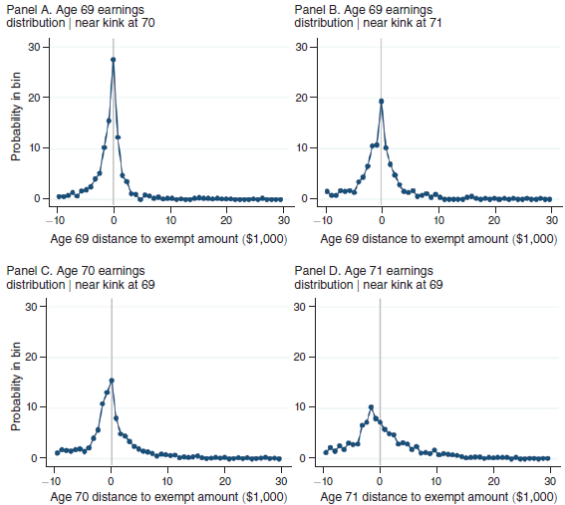
Source : Gelber, Jones and Sachs (2020), Fig. 2.B, p. 9.

Figure 39 – Earnings histogram by age (1983 to 1999)



SOURCE : Gelber, Jones and Sachs (2020), Fig. 3.A, p. 11.

Figure 40 – Inertia in Bunching from 69 to 70 and 71

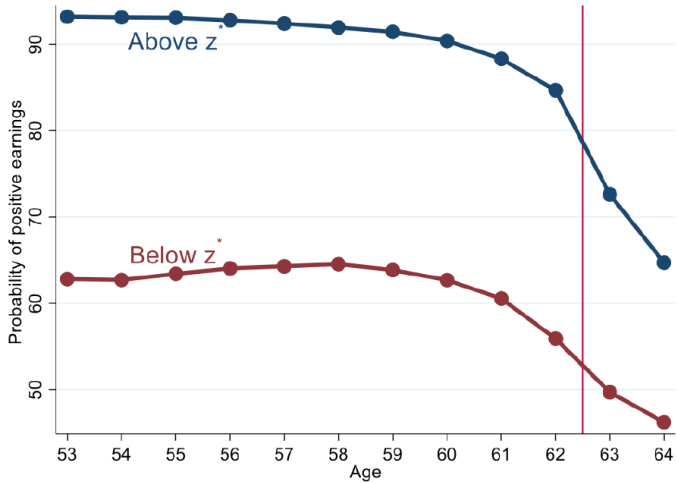


Source : Gelber, Jones and Sachs (2020), Fig. 4, p. 12.

Gelber, Jones, Sachs and Song (JHR, 2022)

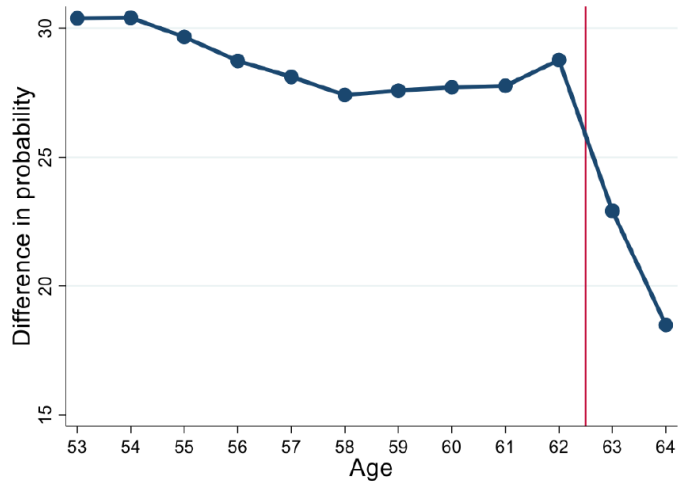
- **DiD estimation**
  - Data from U.S. Social Security Administration
  - 9 million individuals over 1968 to 1987
  - Estimation strategy is difference-in-differences
  - Comparison of the probability to have positive earnings conditional on having earnings pre age 63 above or below the earnings test
- **Results**
  - Large employment effect of the earnings test : -3.3 ppt of employment rate for Americans aged 63-64

Figure 41 – Probability of positive earnings by age and earnings relative to exempt amount



Source : Gelber, Jones, Sachs and Song (JHR 2022), Fig. 6.

Figure 42 – Difference between probability of positive earnings among those earning above and below the exempt amount, by age



Source : Gelber, Jones, Sachs and Song (JHR 2022), Fig. 7.

Pension reforms changing retirement ages

- **Retirement ages**
  - ERA : early retirement age, no claim before that age
  - NRA : normal retirement age or full retirement age (FRA)

Figure 43 – Stylised pension reform : change in ERA or NRA

SOURCE : Giupponi and Seibold (2024), Fig. 1.c, p. 12.

Evidence from full rate age (France)

- **Bozio (2006, 2008)**
  - Exploit the 1993 pension reform
  - Use of administrative data
  - Very significant effects of pension rules
- **The 1993 pension reform**
  - First reform aiming to increase retirement age
  - Only affected private sector workers
- **Régime général (Cnav) formula**
  - P pension, PC proportionality coefficient, W_{ref} reference earnings

$$P = \tau * PC * W_{ref}$$

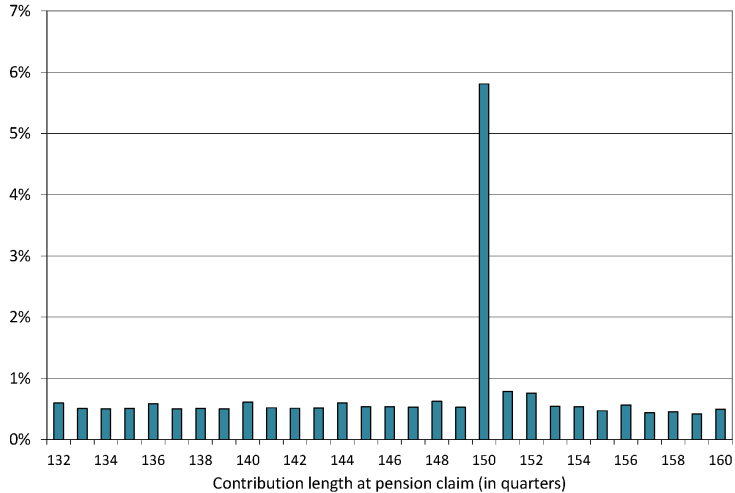
Evidence on France

- **Pension rate formula**
  - δ the penalty, of 10%, N_1 the required contribution length and D_1 the contribution length of the worker

$$\tau = 0.50 * \left[1 - \delta * \max \left\{ 0, \min \left[(65 - AGE), (N_1 - D_1) \right] \right\} \right]$$

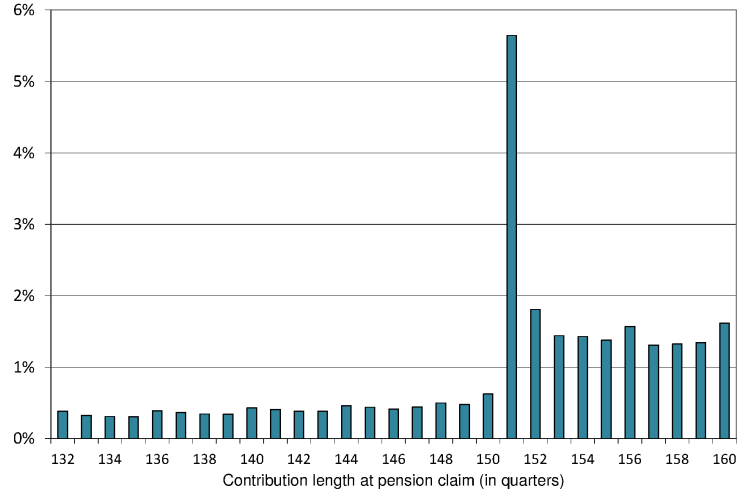
- **The 1993 pension reform**
  1. W_{ref} is computed with the best 25 years and not the best 10 years
  2. N_1 increases from 150 quarters to 160 quarters (37.5 to 40 years) - N_2 remains at 150 quarters
  3. Pension benefits are indexed on inflation and not anymore on wage growth

Figure 44 – Distribution of contribution length at pension claim (cohort 1933)



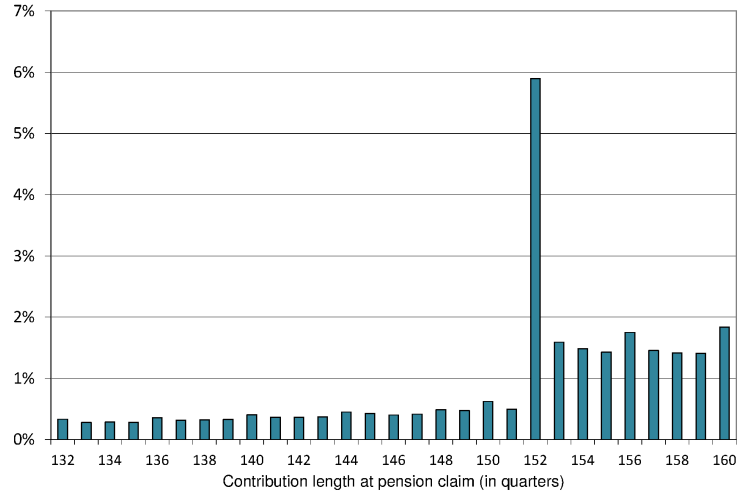
Source : Bozio (2008), Fig. 2.3, p. 48-49.

Figure 45 – Distribution of contribution length at pension claim (cohort 1934)



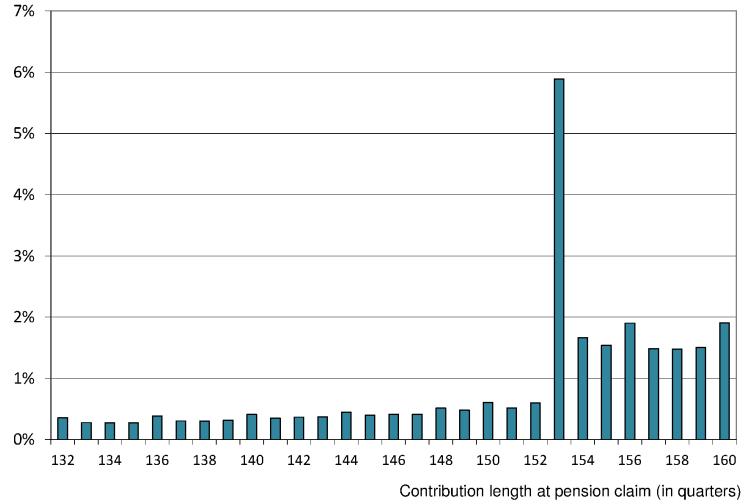
Source : Bozio (2008), Fig. 2.3, p. 48-49.

Figure 46 – Distribution of contribution length at pension claim (cohort 1935)



Source : Bozio (2008), Fig. 2.3, p. 48-49.

Figure 47 – Distribution of contribution length at pension claim (cohort 1936)

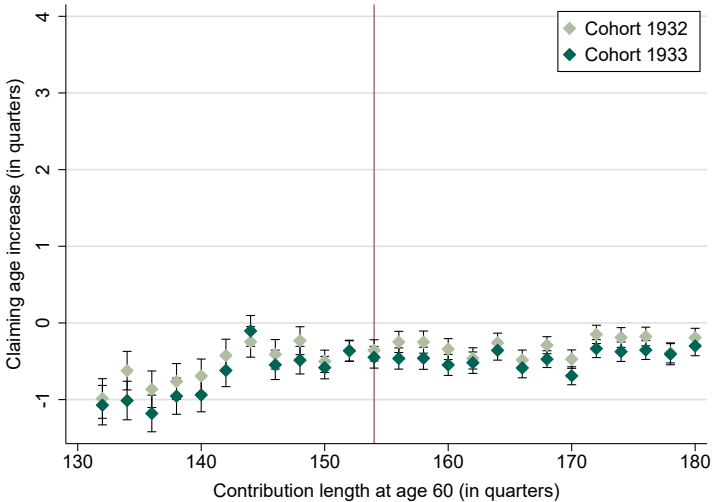


Source : Bozio (2008), Fig. 2.3, p. 48-49.

Evidence on France

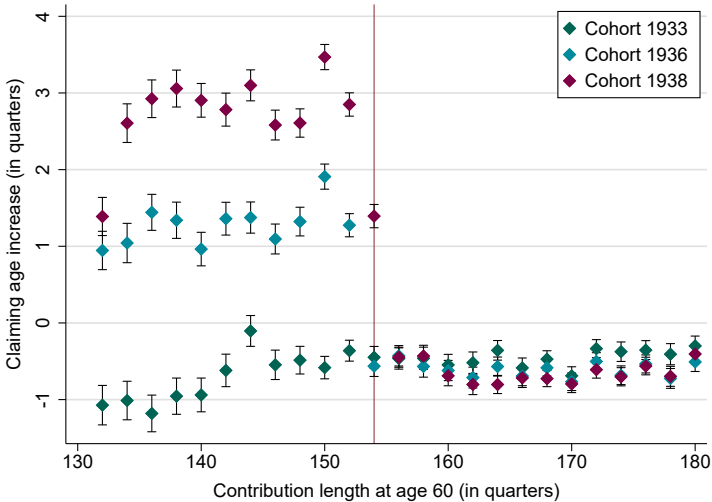
- **Estimation strategy**
  - Use [$birth_year \times contribution\ length\ at\ 60$] as instrument for change in pension benefits
  - Use cohorts born before 1934 as control groups
- **Results**
  1. Very large claiming elasticity
  2. Large work elasticity
  3. Impact on probability of claiming incapacity pensions

Figure 48 – Impact of 1993 reform on retirement age



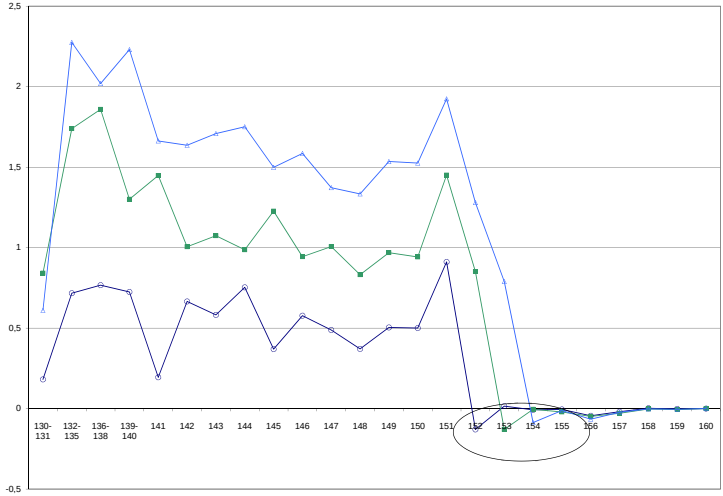
Source : Bozio, Garrouste and Perdrix (2021), Fig. 3a, p. 1186.

Figure 49 – Impact of 1993 reform on retirement age



Source : Bozio, Garrouste and Perdrix (2021), Fig. 3b, p. 1186.

Figure 50 – Impact of 1993 reform on retirement age



Source : Bozio (2008), Fig. 2.6, p. 54.

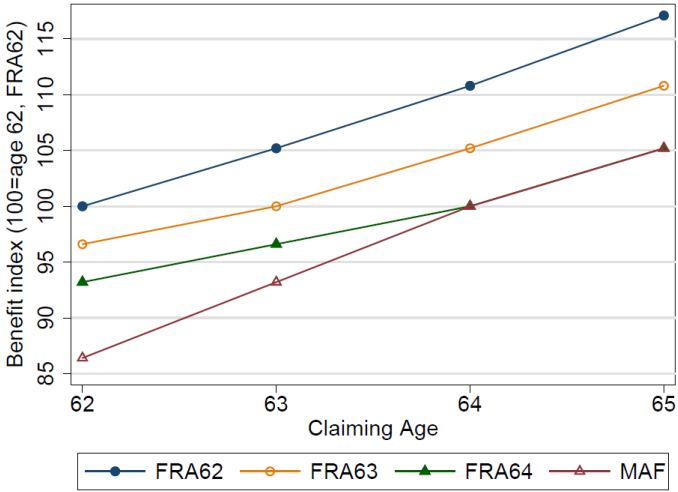
Evidence from Switzerland

- **Swiss old-age insurance (AVS/HAV)**
  - 1925 referendum on the principle of a federal interventions in social insurances
  - 1947 referendum to create Old-age insurance scheme (introduced in 1948)
  - *Alters- und Hinterlassenenversicherung* (AHV) or *Assurance-vieillesse et survivants* (AVS) or *Assicurazione per la vecchiaia e per i superstiti* (AVS)
- **Generic rules (before 1997)**
  - Full benefit at FRA (*ordentliches Pensionsalter*)
  - FRA is 62 for women, 65 for men
  - After FRA, benefits increased by 5.2% (actuarially fair)
  - No earnings test

Evidence from Switzerland

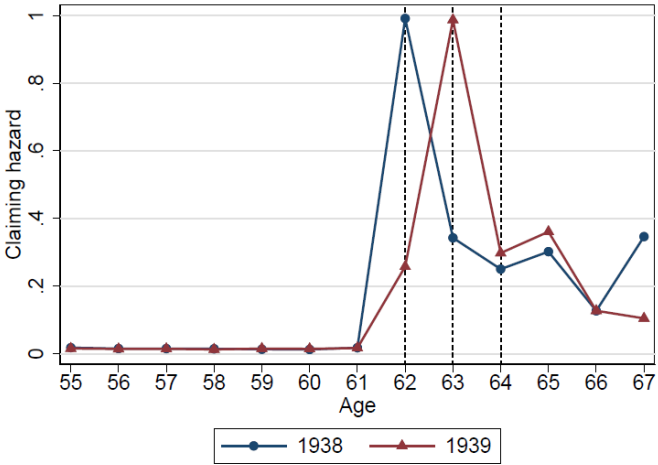
- **1997 Swiss pension reform**
  1. Increased in FRA for women from 62 to 63 (born in 1939) with ERA still at 62 with 3.4% penalty
  2. Increased in FRA for women from 63 to 64 (born in 1942)
  3. Penalty for early claiming increased to 6.8% (born in 1948)
- **Lalive, Magesan and Staubli (AEJ-EP, 2023)**
  - Identify the impact of full retirement age (FRA) and financial incentives separately on claiming and retirement
  - Social security data and tax register

Figure 51 – 1997 Swiss pension reform : change in schedule



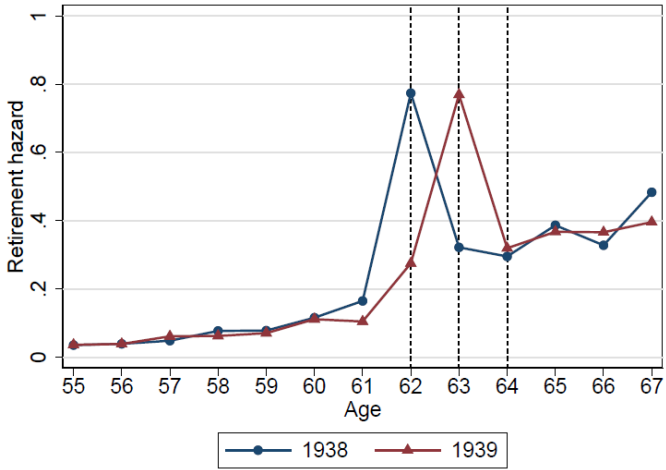
Source : Lalive, Magesan and Staubli (2023), Fig 1.A.
Note : MAF : more than actuarially fair. The penalty for early retirement at 6.8% is higher than what actuarial fairness would imply.

Figure 52 – Effect on pension claiming hazard of FRA to 63



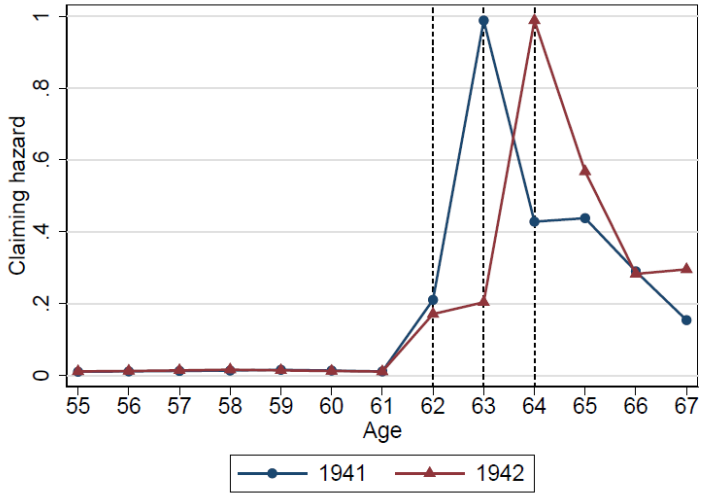
Source : Lalive, Magesan and Staubli (2023), Fig. 7.

Figure 53 – Effect on retirement hazard of FRA to 63



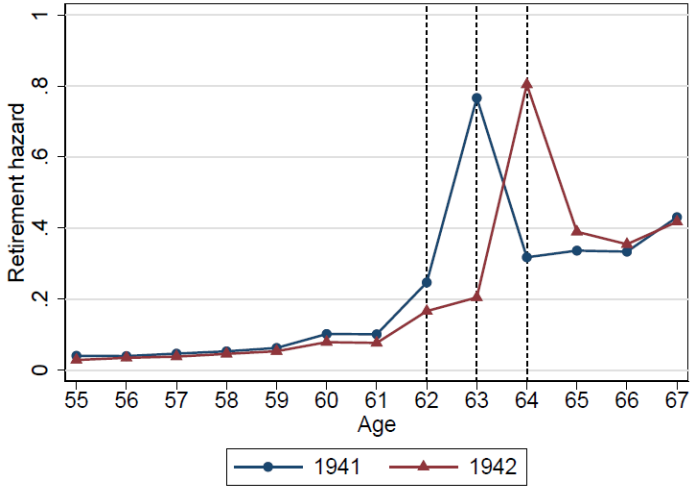
Source : Lalive, Magesan and Staubli (2023), Fig. 7.

Figure 54 – Effect on pension claiming hazard of FRA to 64



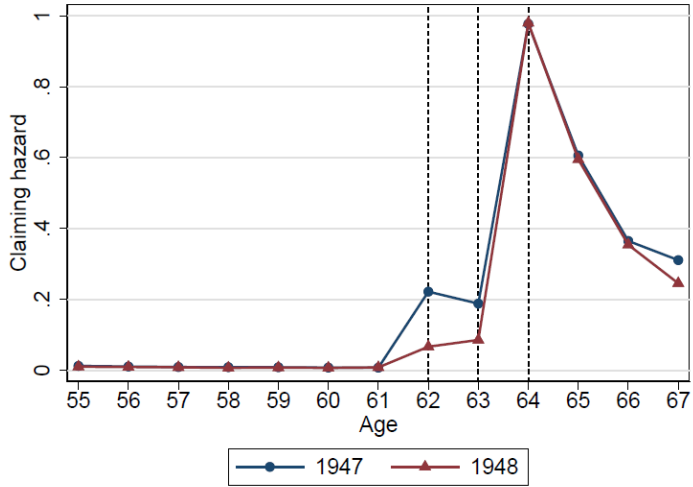
Source : Lalive, Magesan and Staubli (2023), Fig. 7.

Figure 55 – Effect on retirement hazard of FRA to 64



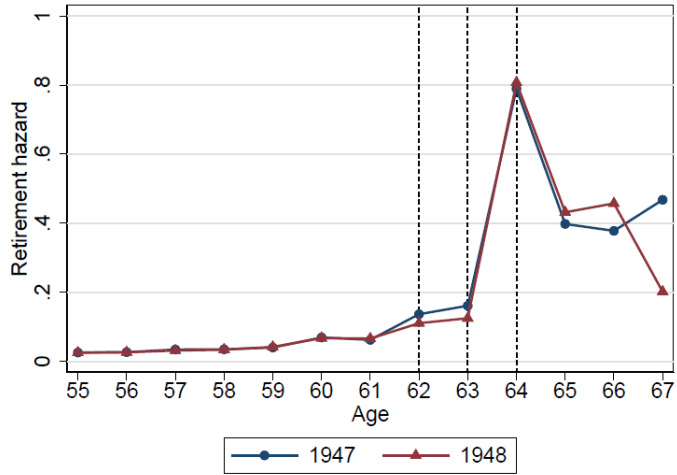
Source : Lalive, Magesan and Staubli (2023), Fig. 7.

Figure 56 – Effect on pension claiming hazard of changed penalty



Source : Lalive, Magesan and Staubli (2023), Fig. 7.

Figure 57 – Effect on retirement hazard of changed penalty



Source : Lalive, Magesan and Staubli (2023), Fig. 7.

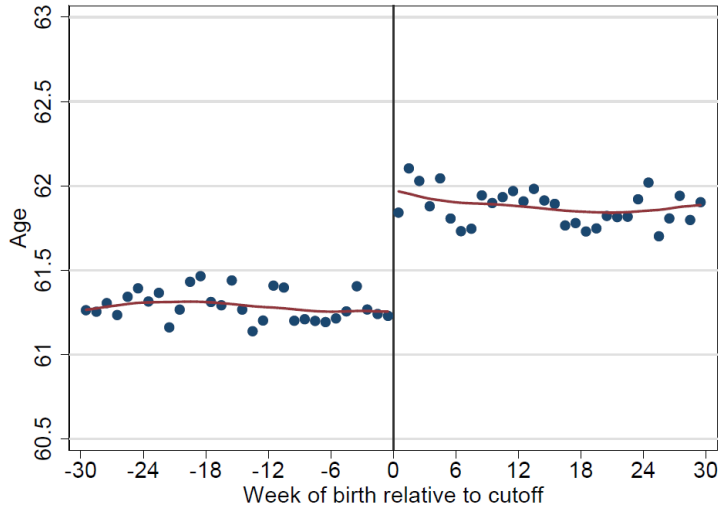
Lalive, Magesan and Staubli (AEJ-EP, 2023)

- **Empirical approach : RDD design**
  - Treatment groups : women born in 1939/1942/1948
  - Control groups : women born in 1938/1941/1947
  - Perform analysis by week of birth Z_i, with cutoff z

$$y_i = \gamma + \delta D_i + f_0(Z_i - z) + D_i f_1(Z_i - z) + \varepsilon_i$$

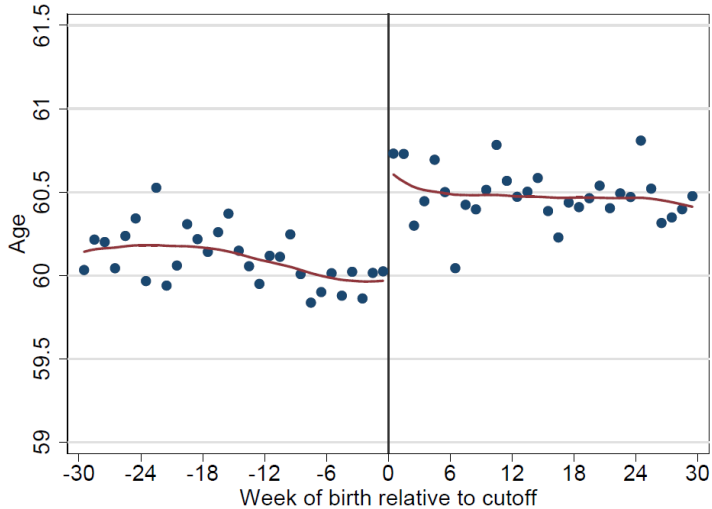
- **Results**
  1. One year increase of FRA : $\nearrow$ claiming age by 7-8 months
  2. One year increase of FRA : $\nearrow$ retirement by 5-7 months
  3. Increasing the financial penalty : $\nearrow$ claiming age by 4 months and has no effect on retirement

Figure 58 – Effect of FRA 63 on claiming age



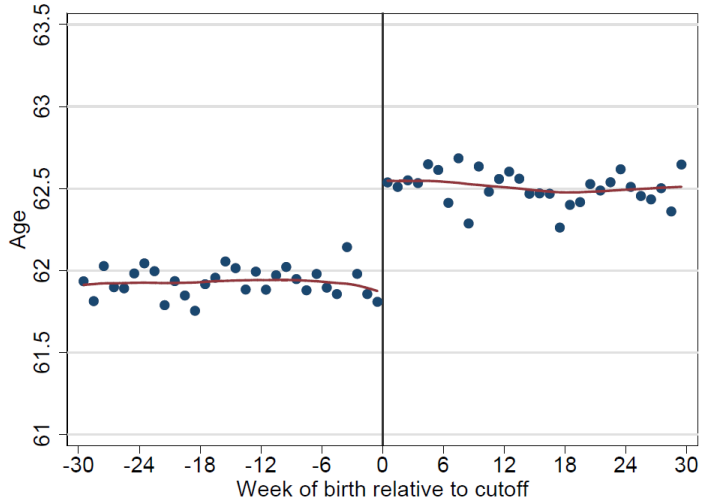
Source : Lalive, Magesan and Staubli (2023), Fig. 3.A.

Figure 59 – Effect of FRA 63 on labour market exit



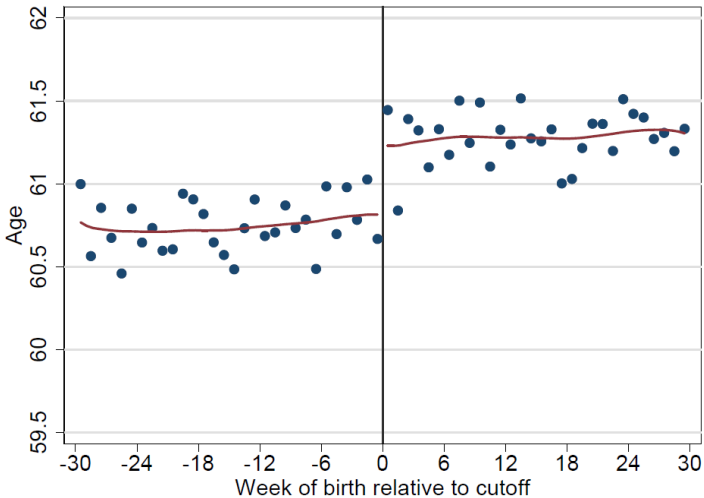
Source : Lalive, Magesan and Staubli (2023), Fig. 3.C.

Figure 60 – Effect of FRA 64 on claiming age



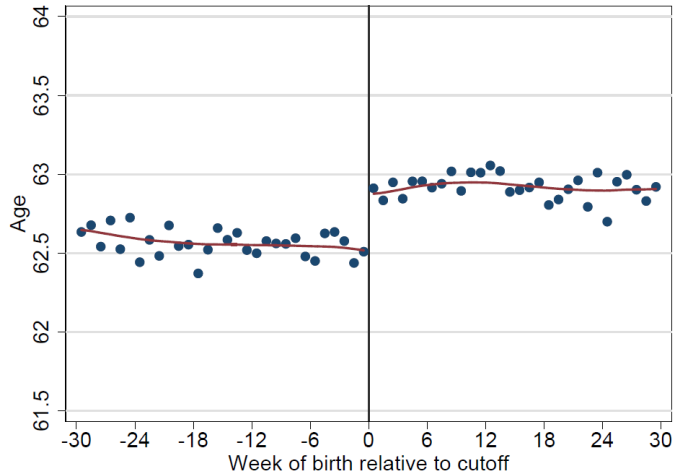
Source : Lalive, Magesan and Staubli (2023), Fig. 3.A.

Figure 61 – Effect of FRA 64 on labour market exit



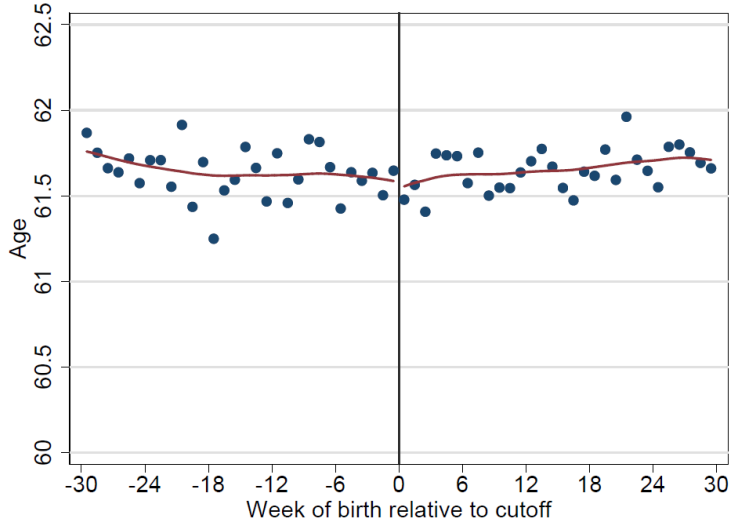
Source : Lalive, Magesan and Staubli (2023), Fig. 3.C.

Figure 62 – Effect of MAF on claiming age



SOURCE : Lalive, Magesan and Staubli (2023), Fig. 3.A.

Figure 63 – Effect of MAF on labour market exit



Source : Lalive, Magesan and Staubli (2023), Fig. 3.C.

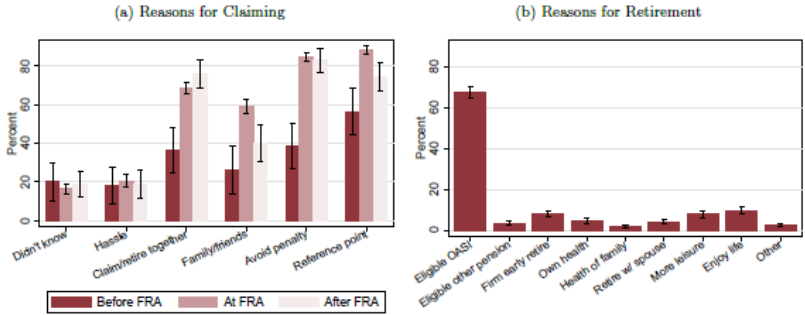
Table 2 – RDD estimates : Effect of Reform Steps on the Claiming Age, Pension Benefits, and the Retirement Age

	FRA at 63		**FRA at 64**		**MAF**	
	local	global	local	global	local	global
Claiming age (years)	0.71***	0.68***	0.68***	0.64***	0.33***	0.37***
	(0.06)	(0.04)	(0.07)	(0.04)	(0.07)	(0.04)
Annual benefits (CHF)	-348	-195	-552**	-494**	181	41
	(254)	(161)	(235)	(148)	(210)	(131)
Retirement age (years)	0.63***	0.53***	0.53***	0.54***	0.01	0.03
	(0.10)	(0.06)	(0.10)	(0.06)	(0.09)	(0.06)

NOTE : The local (global) specification uses a bandwidth of 12 (30) weeks and includes a linear trend of the running variable on either side of the cutoff.
SOURCE : Lalive, Magesan and Staubli (2023), Tab. 3.

Determinants of claiming and retirement

- **Survey data**
  - Survey of 1,223 Swiss women born after 1948



  - More than 80% of women who claim at the FRA say that "avoiding the penalty", averting the "loss" in annual benefits and "claiming at the FRA seems natural" are important determinants of the claiming decision
  - Evidence suggestive of **reference dependence** and **loss aversion**

Determinants of claiming and retirement

- **Policy implications**
  - Increasing the statutory full retirement age is an effective tool for governments who wish to improve the solvency of their social security systems
  - The way that benefit schedules are framed is also an important policy lever
  - The costs of increasing the FRA fall disproportionately on women who fail to maximize pension wealth

Evidence from ERA reform in Austria

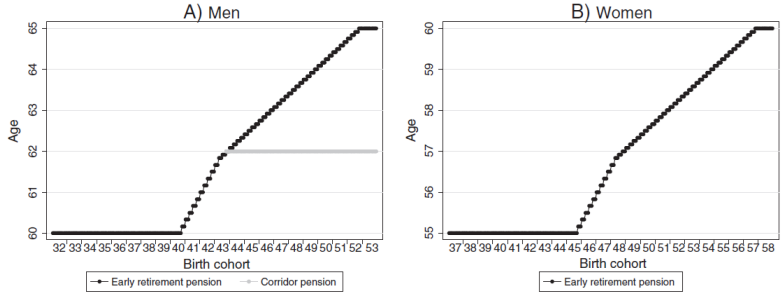
- **Austrian old-age insurance scheme (pre reform)**
  - ERA at 60 for males, 55 for female (conditional on having 35 contribution years or 37.5 insurance years)
  - NRA at 65 for males, and 60 for female (conditional on having 15 insurance years)
  - Pension computed based on average earnings of the best 15 years
- **2000 Austrian pension reform**
  - ERA increased to 61.5 for males, 56.5 for female
  - Long career history exempted (45 years of insurance for men, 40 for women)
- **2003 Austrian pension reform**
  - ERA increased to 65 for males, 60 for female
  - Pension computed on best 40 years of earnings (instead of best 15)

Staubli and Zweimüller (JPuBE, 2013)

- **Estimation of the impact of ERA increase**
  - Identification using month of birth to compare very close cohorts, and exploit the phasing-in of the reform
  - Data from Austrian social security administration database (ASSD) : universe of private sector workers
  - Assess the impact on employment, spillovers to UI, DI, and fiscal impact

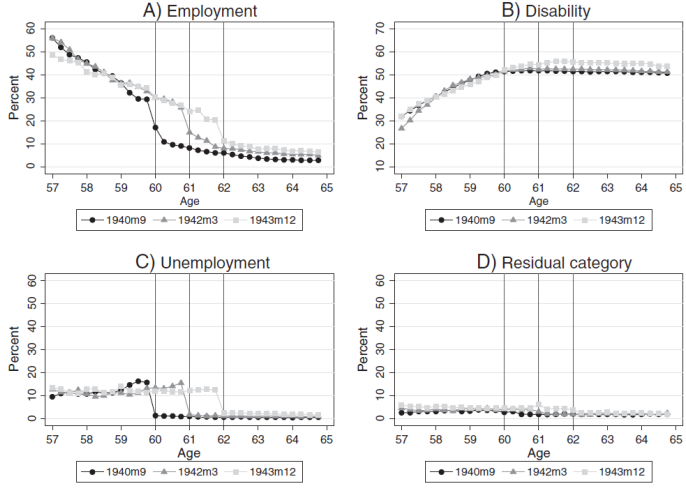
- **Results**
  - A positive but relatively modest employment effect :
    i.e., ERA + 1 year $\Rightarrow \nearrow$ employment by 9.75 ppt (males) and 11 ppt (females)
  - A substantial increase in registered unemployment :
    i.e., + 12.51 ppt (men) +11.77 ppt (women)
  - Employment response is largest among healthy, high-wage workers while low-wage workers in poor health retire through DI or UI
  - Fiscal effects is net positive (even accounting for spillover effects)

Figure 64 – Increase in the ERA for men and women



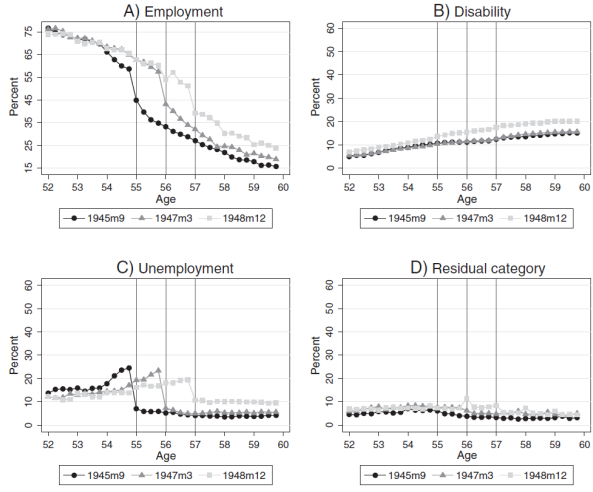
SOURCE : Staubli and Zweimüller (2013), Fig. 1, p. 21.

Figure 65 – Trends in employment, disability, unemployment, and the residual category over age (men)



Source : Staubli and Zweimüller (2013), Fig. 4, p. 23.

Figure 66 – Trends in employment, disability, unemployment, and the residual category over age (women)



Source : Staubli and Zweimüller (2013), Fig. 5, p. 24.

Figure 67 – Estimation of the impact of the increase in ERA (men and women)

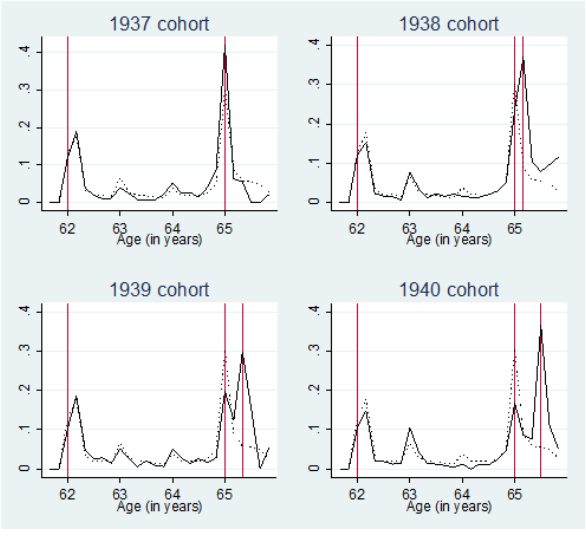
	Men				Women			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Retirement benefits								
I(age < ERA)	−26.34***	−24.85***	−21.12***	1.03***	−34.45***	−24.63***	−22.06***	0.19
	(0.61)	(0.46)	(0.93)	(0.22)	(1.04)	(0.94)	(1.13)	(0.28)
R^2	0.248	0.345	0.275	0.433	0.369	0.492	0.420	0.442
Pre-policy mean	37.93	37.93	37.93	49.82	52.09	52.09	52.09	52.61
B. Employment								
I(age < ERA)	12.09***	9.75***	7.50***	−0.17	18.91***	11.00***	9.26***	−0.03
	(0.45)	(0.30)	(0.47)	(0.17)	(0.50)	(0.34)	(0.38)	(0.12)
R^2	0.196	0.385	0.300	0.355	0.225	0.410	0.331	0.342
Pre-policy mean	8.76	8.76	8.76	9.66	27.56	27.56	27.56	26.02
C. Unemployment								
I(age < ERA)	10.64***	12.51***	11.81***	−0.66***	11.79***	11.77***	11.50***	−0.14
	(0.28)	(0.31)	(0.53)	(0.19)	(0.52)	(0.65)	(0.76)	(0.22)
R^2	0.045	0.108	0.097	0.128	0.025	0.086	0.077	0.119
Pre-policy mean	0.85	0.85	0.85	0.72	4.07	4.07	4.07	4.28
D. Disability								
I(age < ERA)	1.90***	1.01***	0.66***	−0.19**	0.84***	0.14***	0.12***	−0.02
	(0.65)	(0.16)	(0.12)	(0.09)	(0.23)	(0.05)	(0.04)	(0.04)
R^2	0.025	0.293	0.292	0.273	0.012	0.156	0.156	0.161
Pre-policy mean	51.10	51.10	51.10	38.24	12.64	12.64	12.64	13.28
E. Residual category								
I(age < ERA)	1.71***	1.58***	1.14***	−0.01	2.91***	1.71***	1.18***	−0.00
	(0.09)	(0.09)	(0.10)	(0.03)	(0.09)	(0.10)	(0.11)	(0.03)
R^2	0.009	0.019	0.022	0.031	0.009	0.095	0.112	0.075
Pre-policy mean	1.36	1.36	1.36	1.56	3.65	3.65	3.65	3.81
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Age range	57–64	57–64	60–62.5	57–64	52–59	52–59	55–58.5	52–59
Years	1997–2010	1997–2010	1997–2010	1987–2000	1997–2010	1997–2010	1997–2010	1987–2000
#Obs.	8,731,826	8,731,826	2,796,527	8,441,943	9,391,883	9,391,883	4,199,444	8,275,754
#Individuals	440,537	440,537	318,272	422,068	495,714	495,714	378,103	402,520

Note : Columns (2) to (4) and (6) to (8) have controls like experience, insurance years, earnings, sick leaves, etc.
Source : Staubli and Zweimüller (2013), Tab. 3, p. 25.

Norms, reference point

- **Behaghel and Blau (AEJ-EP, 2012)**
  - Exploit increase in FRA in the U.S. from 65 to 66
  - Estimate the effect of the increase in the FRA on the hazard of exiting employment and claiming OASI pension
- **Spikes at FRA**
  - Spike in claiming hazard moved with FRA
  - Less clear evidence on labour market exit
- **Results**
  1. FRA effect can account for 10-40% of the hazard at age 65
  2. Individuals with higher cognitive ability respond more to FRA changes
  3. Suggest reference dependence with loss aversion

Figure 68 – U.S. Social Security Benefit Claiming Hazard



Source : Behaghel and Blau (2012), Fig. 2, p. 50.

Norms, reference point

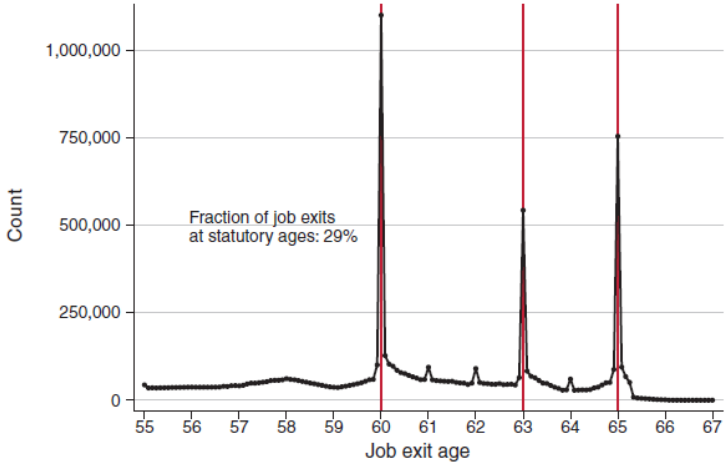
- **Seibold (AER, 2021)**
  - Exploit discontinuities in German pension systems : statutory ages, kinks in incentives
  - Use bunching techniques to infer elasticities
- **Statutory ages**
  - Early retirement age (ERA) : 60 to 65
  - Full retirement age (FRA) : 63 to 65
  - Normal retirement age (NRA) : 65
- **Results**
  1. Large effects of statutory ages
  2. Much larger than financial incentives
  3. Rationalised with reference dependence

Table 3 – Statutory ages according to retirement pathways in Germany (cohort 1941)

Pathways	Required contribution	Statutory retirement ages			Share
		ERA	FRA	NRA	of sample
Regular	5 years	65	65	65	5%
Long-term insured	35 years	63	65	65	19%
Women	15 years	60	61	65	32%
Unemployed	15 years	60	64	65	20%
Invalidity	35 years	60	60	65	11%
Disability	5 years	60	60	65	11%

SOURCE : Seibold (2021), Tab. 1, p. 1133.

Figure 69 – Job Exit Age Distribution in Germany



Source : Seibold (2021), Fig. 1.A, p. 1127.

Seibold (AER, 2021)

- **Bunching method**
  - Measuring the bunching mass B at age $\hat{R}$ compared to counterfactual density $h_0(\hat{R})$ gives the excess mass b

$$b = \frac{B}{h_0(\hat{R})}$$

  - Elasticity of retirement age w.r.t. the net-of-tax rate $\hat{\varepsilon}$

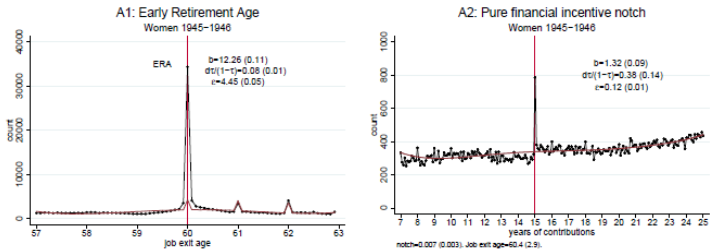
$$\frac{b/\hat{R}}{\Delta\tau/(1-\tau)}$$

- **Bunching with frictions and statutory ages**
  - Note x_i obs. var. and D_i^s dummy for statutory age at i

$$B_i = B(\varepsilon, D_i^s, x_i)$$

  - Idea is to use different statutory ages, to uncover structural elasticities ε from frictions or statutory age effects

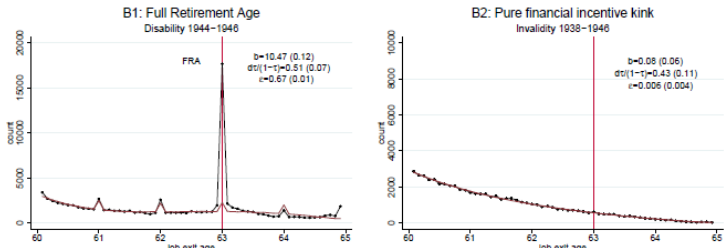
Figure 70 – Statutory age vs. pure financial incentive notch



Source : Seibold (2021), Fig. 3.A1 and 3.A2.

- ERA at age 60 for women born in 1945-46, $\varepsilon = 4.45$
- 15 years contribution notch, $\varepsilon = 0.12$

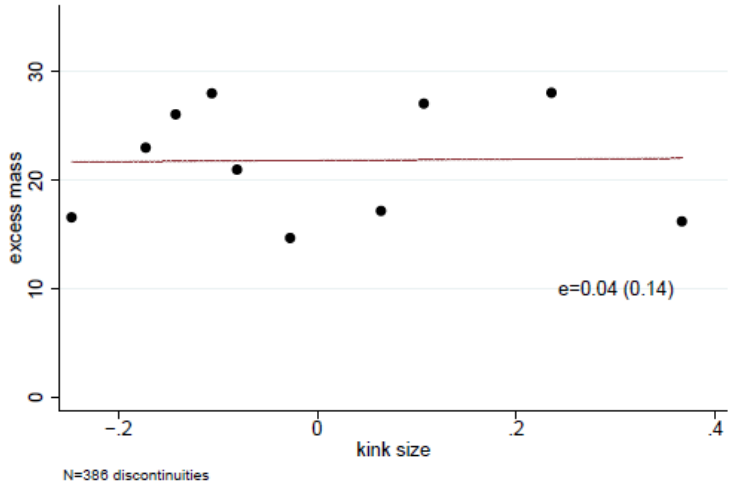
Figure 71 – Kinks in Disability vs. Invalidity Pathways



Source : Seibold (2021), Fig. 4.B.

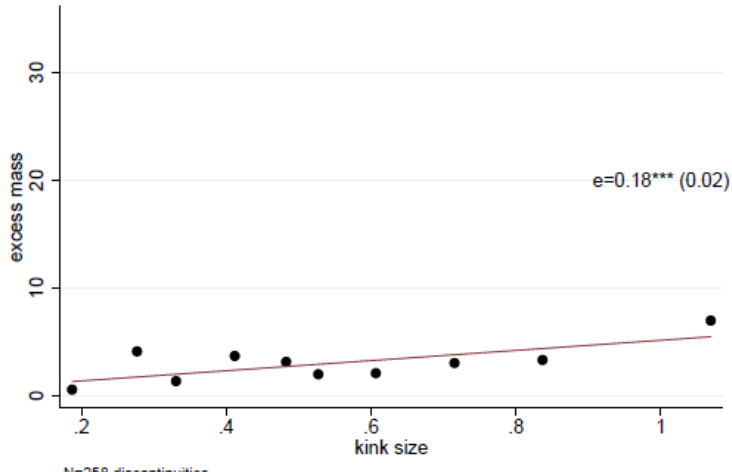
- FRA at age 63 for disabled born in 1945-46, $\varepsilon = 0.67$
- Kinks at age 63 for invalidity due to financial adjustment of pension (not statutory age), $\varepsilon = 0.006$

Figure 72 – Excess Mass from Bunching at Statutory Age



Source : Seibold (2021), Fig. 5.A.

Figure 73 – Excess Mass from Bunching at financial incentives kinks



Source : Seibold (2021), Fig. 5.B.

Seibold (AER, 2021)

- **Reduced-form estimation**
  - Regression of bunching on financial incentives and statutory ages

$$\frac{b_i}{\hat{R}_i} = \varepsilon \frac{\Delta \tau_i}{1 - \tau_i} + \sum_s \beta^s D_i^s + \gamma Z_i + \nu_i$$

  - Observation i corresponds to each discontinuity
  - β^s measures additional bunching for each statutory age

- **Results**
  - *NRA* has largest effect on bunching : $\beta^{NRA} = 0.8$
  - *FRA* has large effect on bunching : $\beta^{FRA} = 0.3$
  - *ERA* has significant (but smaller) effect on bunching : $\beta^{ERA} = 0.2$
  - Elasticity $\varepsilon = 0.1$

Recap

- **Evidence that incentives matter**
  - Pension design should incorporate financial incentives
  - But moderate elasticity to pure financial incentives
  - Arguments for using moderately financial incentives in pension design
- **Evidence that signal/norms/reference matter**
  - Retirement ages matter considerably
  - Signal (Cribb et al. 2013), reference dependence (Lalive et al. 2023)
  - Relabelling could be a policy tool (Gruber et al. 2022)

IV. Unemployment and pensions

1. Early retirement policies
2. Impact on older workers' employment
3. Impact on unemployment

IV. Unemployment and pensions

Early retirement policies

- **Lump of labour idea**
  - Unemployment is caused by excess labour supply
  - If older workers (women, immigrants) leave the labour force, they "release" jobs for the unemployed
  - Very popular idea
- **Early retirement policies in Europe**
  - 1970s oil shock, increase in unemployment
  - Development of early retirement schemes in many countries (France, Netherlands, Belgium, UK)

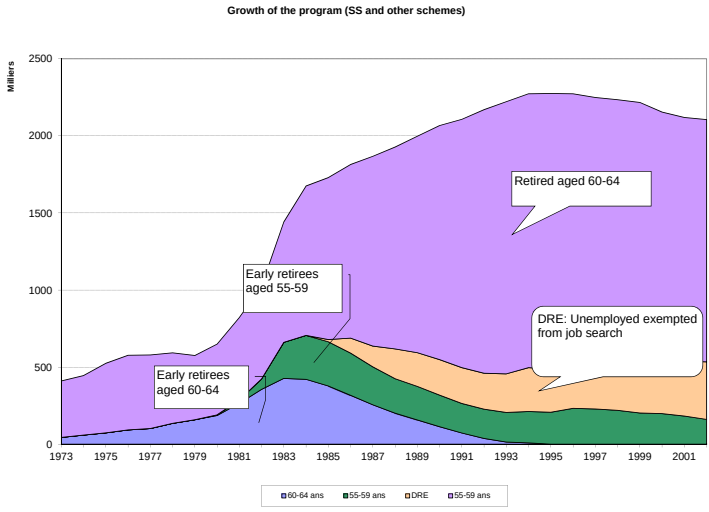
IV. Unemployment and pensions

Early retirement policies

- **Early retirement in France**
  - 1972 *garanties de ressources* : age 60-64
  - 1977 *garanties de ressources démission* : : age 60-64
  - 1981 *contrat de solidarité* : age 55-60
  - 1983 reform to lower effective retirement age at 60
  - 1983 Removal of the incentive to delay retirement

- **Large support**
  - Across party support
    "*Que ceux qui sont les plus âgés, que ceux qui ont travaillé, partent, fassent la place aux jeunes pour que tout le monde ait du travail.*"
    Pierre Mauroy, French Prime Minister, 1981
  - Employer and employee unions

Figure 74 – Development of early retirement schemes in France



Source : Ben Salem, Blanchet, Bozio and Roger (2010), Fig. .

IV. Unemployment and pensions

Early retirement policies

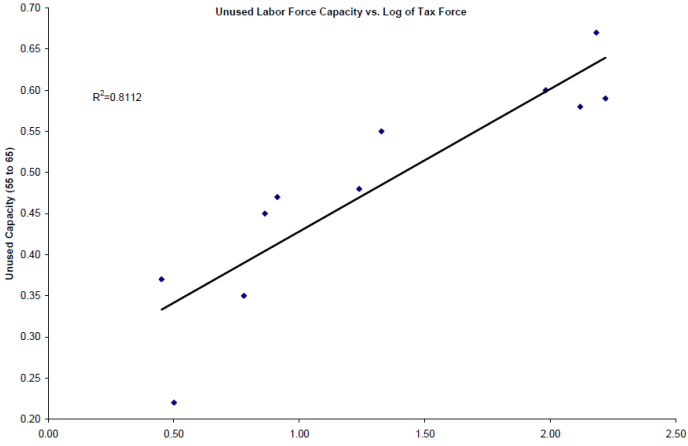
- **Evaluation**
  - Little evaluation at the time (assumption that 1 for 1 reduction in unemployment)
  - Gruber and Wise (2010) : country case studies
  - France : Ben Salem et al. (2010)
  - UK : Job Release Scheme (Banks et al. ,2010)
  - Denmark : very sharp introduction of early retirement scheme in 1979
- **Results**
  - Very significant negative effect on older worker's employment
  - No effect detected on youth unemployment or employment

IV. Unemployment and pensions

Early retirement policies

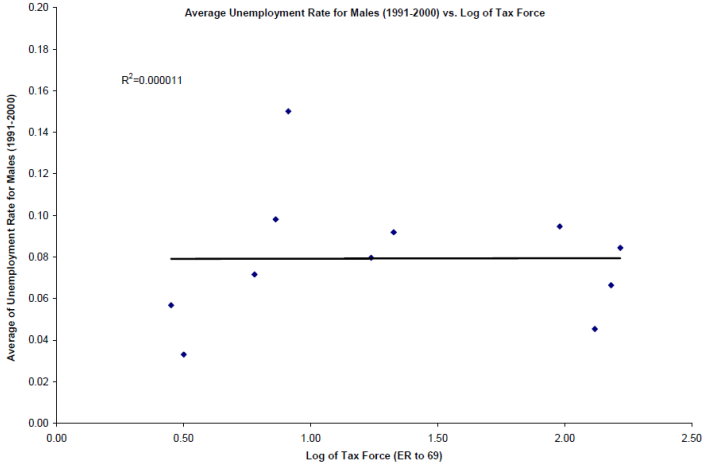
- **Cross-country evidence**
  - Diamond (2006) using Gruber and Wise (1999)
  - Gruber, Milligan and Wise (2010)
- **Results**
  - No correlation between tax incentives and unemployment
- **Mechanisms ?**
  - Not well understood
  - Bozio (2006) suggest labour market modelling with impact of early retirement funding on labour cost of younger workers

Figure 75 – Tax on postponing activity vs labour force participation



SOURCE : Diamond (2006), based on Gruber and Wise (1999).

Figure 76 – Tax on postponing activity vs unemployment



Source : Diamond (2006), based on Gruber and Wise (1999).

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