Increased mortality of white Americans and a decline in the health of cohorts born after World War II

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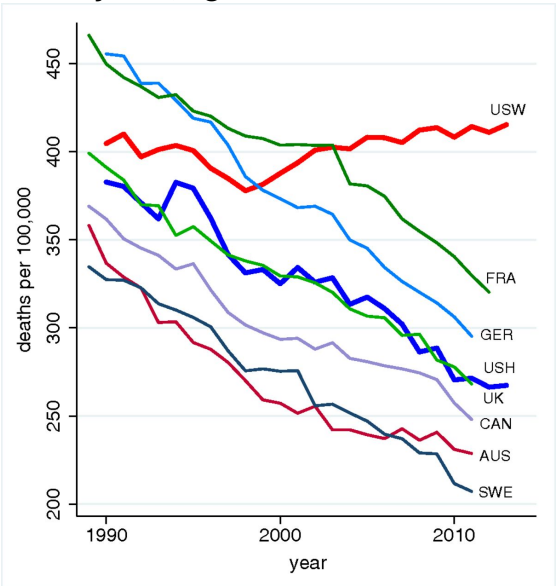
Mortality rate, age 45-54



Case and Deaton (2015)

- sharp increase in non-Hispanic white American mortality after 1999
- possibly caused by:
  - opioid epidemic
  - economic factors?

Origin of this paper

Was this all-cause mortality increase driven by cohort health differences?

- white Americans born between 1958 and 1968 — 45 to 54 in 2012

  less healthy than

- white Americans born between 1945 and 1955 — 45 to 54 in 1999

which predated 1990s

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NOTE: distinct from question of cause of increased “deaths of despair”

Origin of this paper

Was this all-cause mortality increase driven by cohort health differences?

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More recently: Case and Deaton (2017), Lleras-Muney (2017), Masters et al., (2017); Zang et al., (2018) — consider potential role of cohort factors

This paper

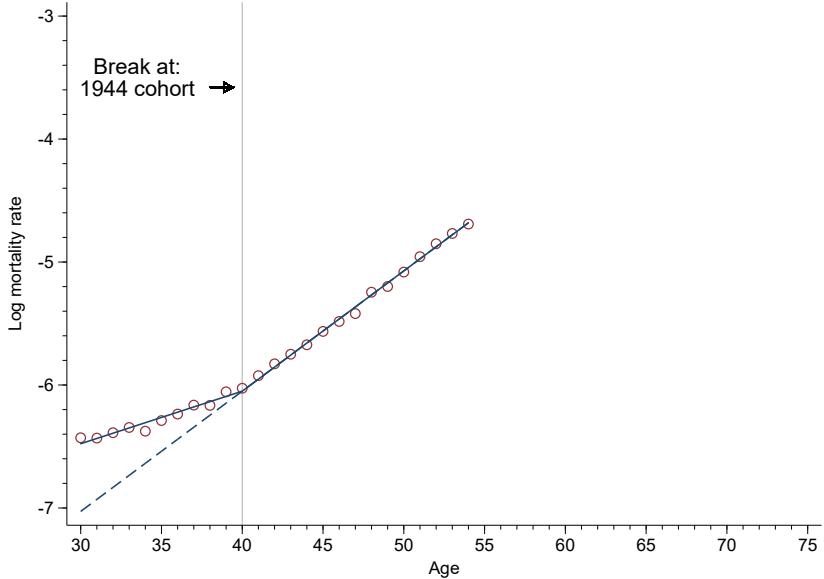
- striking graphical and statistical evidence of decline in cohort health for post-1946 cohorts of white American men, post-1949 cohorts of white American women — relative to trend for prior born
  - sharp break in cross-cohort health trend
  - evident by 1980s
  - contributed to mortality increases since 1999
- systematic deviations from “Gompertz law” which are hard to reconcile with any non-cohort explanation
- (setting-specific) methodological contribution to “age-period-cohort problem”

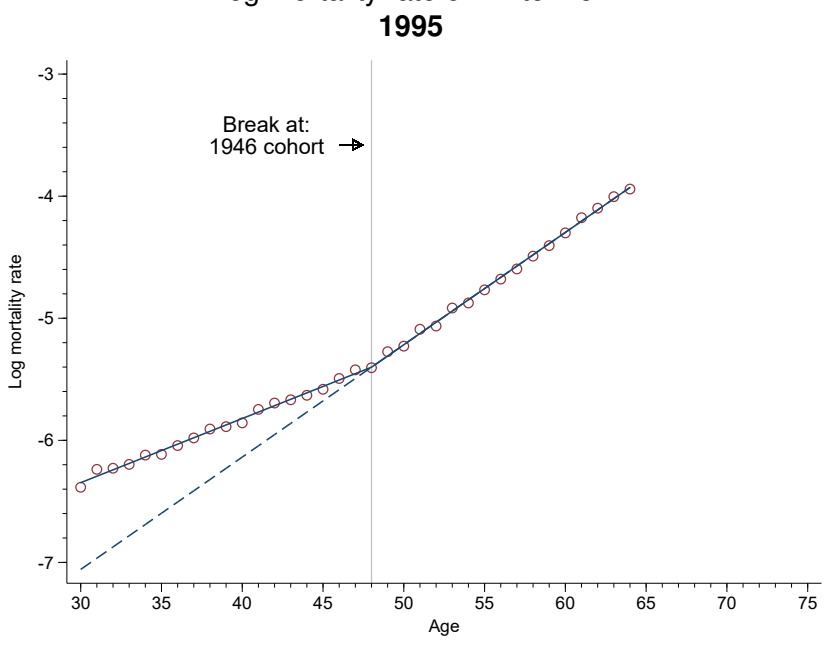
Broader interpretation

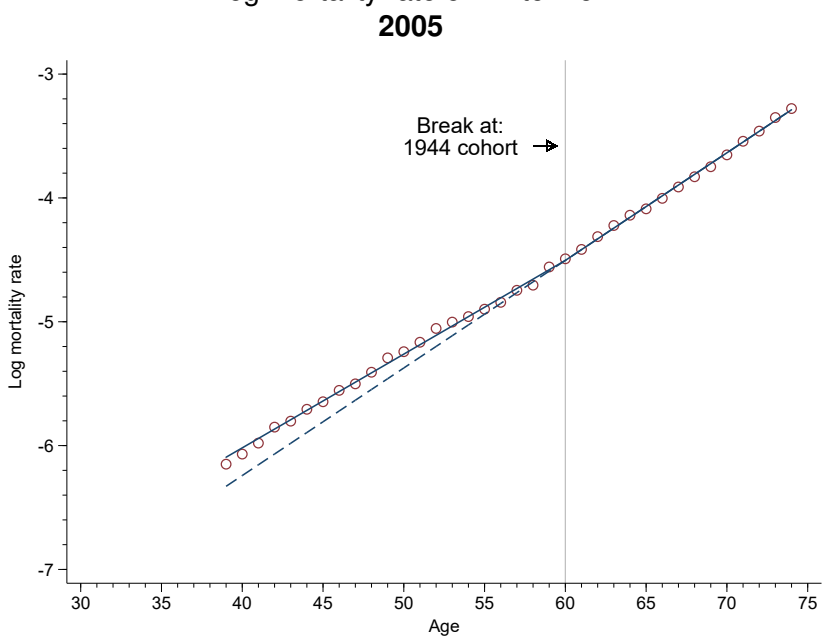
- I argue this cohort health decline likely predated labor market entry
- and was part of much broader decline in health and human capital for these cohorts (documented in my companion/follow-up paper)
- preliminary investigation into underlying cause

Log mortality rate of white men

1985




Log mortality rate of white men
1995
Break at:
1946 cohort
Log mortality rate
-3
-4
-5
-6
-7
30
35
40
45
50
55
60
65
70
75
Age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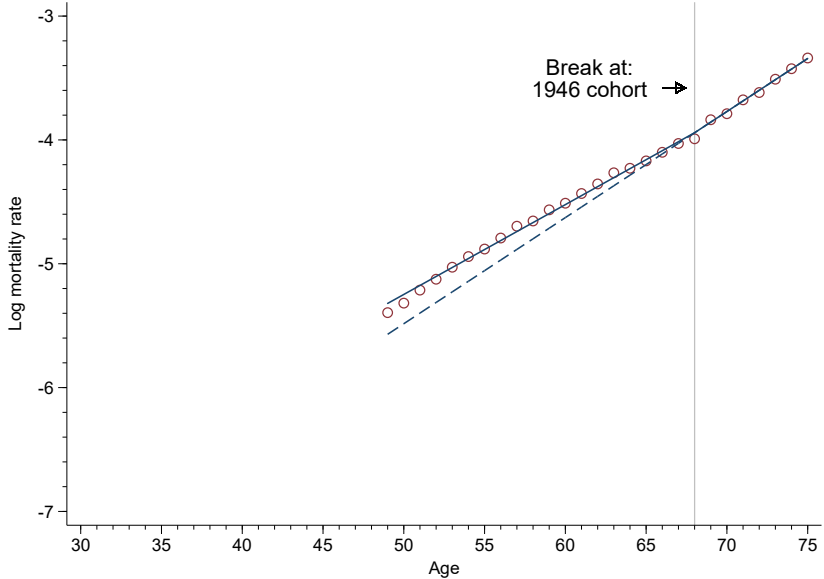

Deviations of log mortality of white men from Gompertz curve for older cohorts

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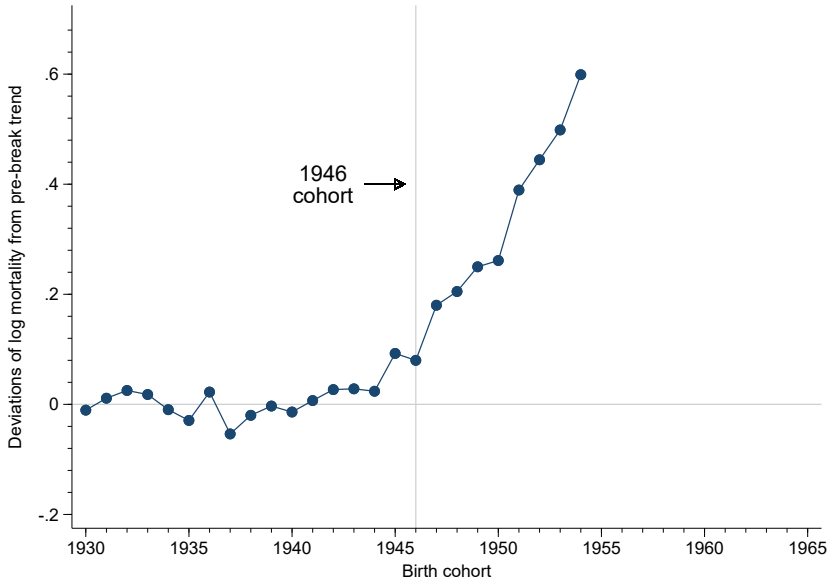

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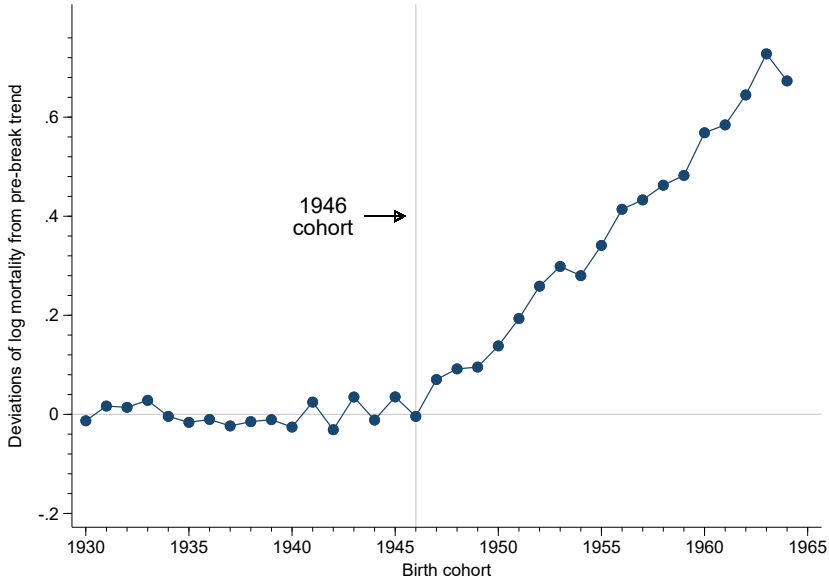

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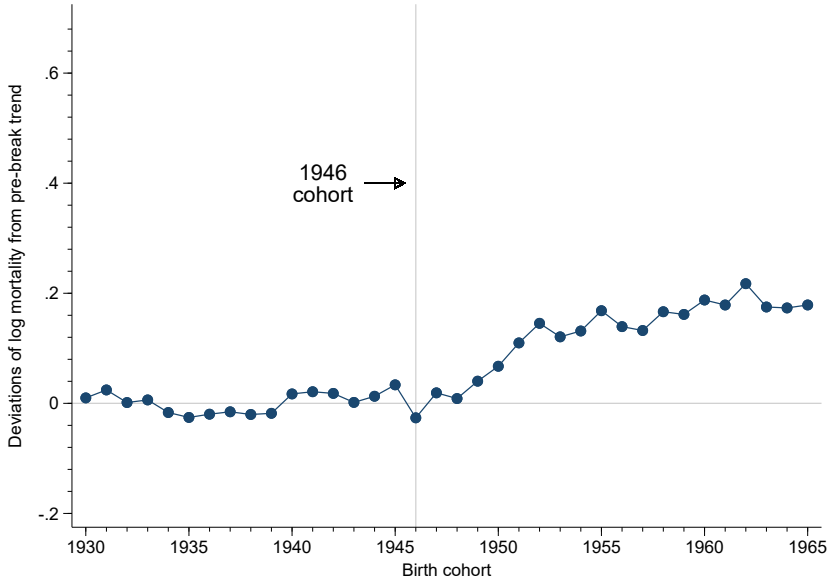

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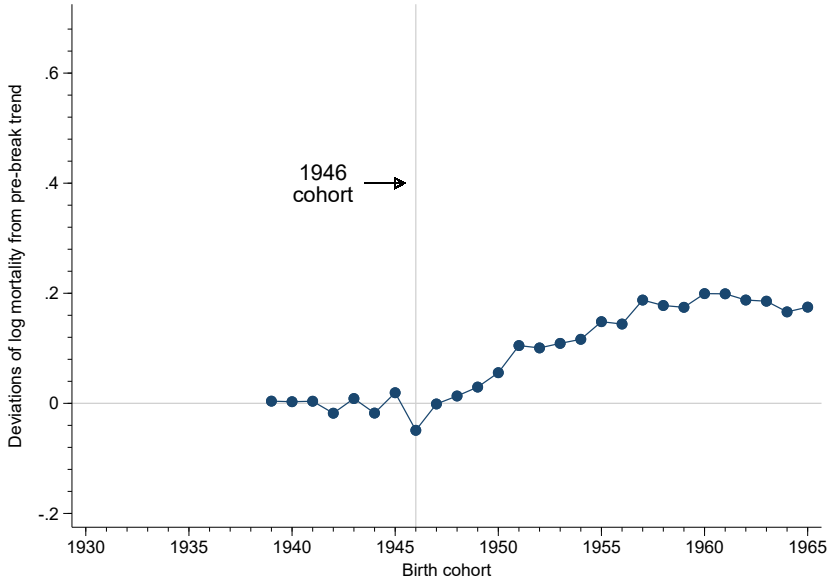


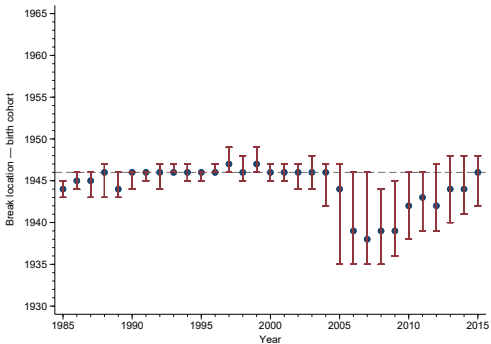
Estimate models with “trend break”/ kink at unknown cohort:

$$ln(mort_{apc}) = \beta^p a + \delta^p \cdot (\gamma^p - c) \cdot 1_{c \geq \gamma^p} + \mu^p + \epsilon_{apc} \quad (1)$$

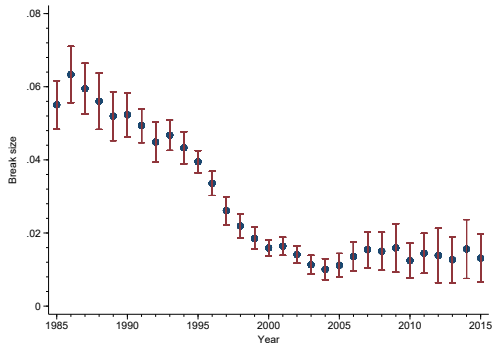
- separately for each year 1985-2015
- choose $\hat{\gamma}_p$ which minimizes SSR
- inference following Hansen (1999)

White men

Break location, $\hat{\gamma}_p$

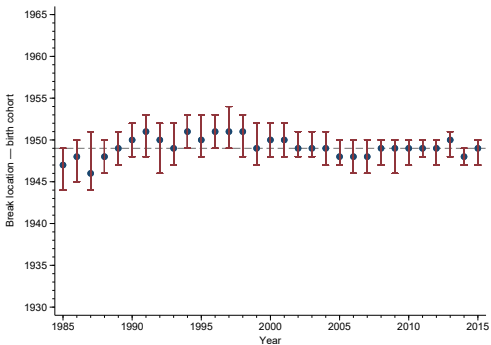


Break size $\hat{\delta}_p$



White women

Break location, $\hat{\gamma}_p$



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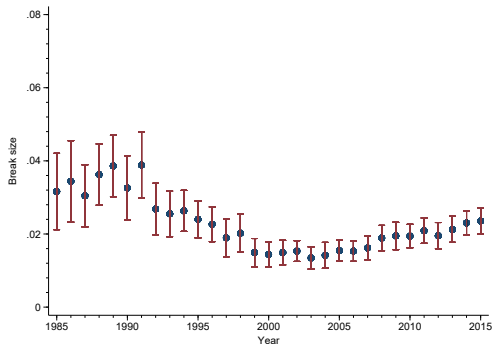


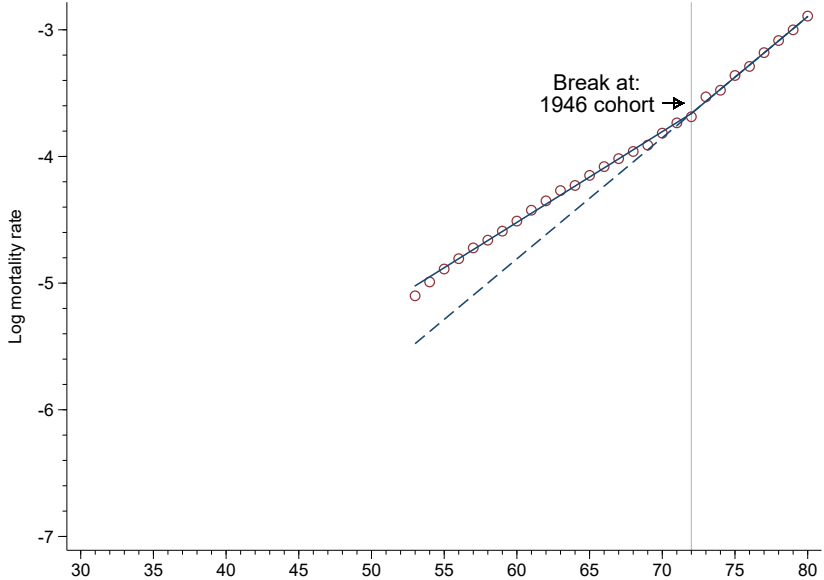
- consistently estimate trend break at or near $\sim$1946 cohort for men and 1949 cohort for women in each year, 1985-2015
- elevated mortality for cohorts born after relative to “Gompertz curve” for prior-born cohorts
- hard to think of reason for this highly non-linear and non-smooth pattern — other than cohort health decline

“Out of sample” validation

- paper uses data through 2015
  - on website since Nov 2020, earlier conference version submitted in Sep 2018 — when 2017-2019 data had not even been released
- does the pattern still hold in 2016-2019??
  - extend sample to ages 30-80
    (otherwise would have very few pre-break cohorts, eg. 1946 cohort was 72 in 2019)

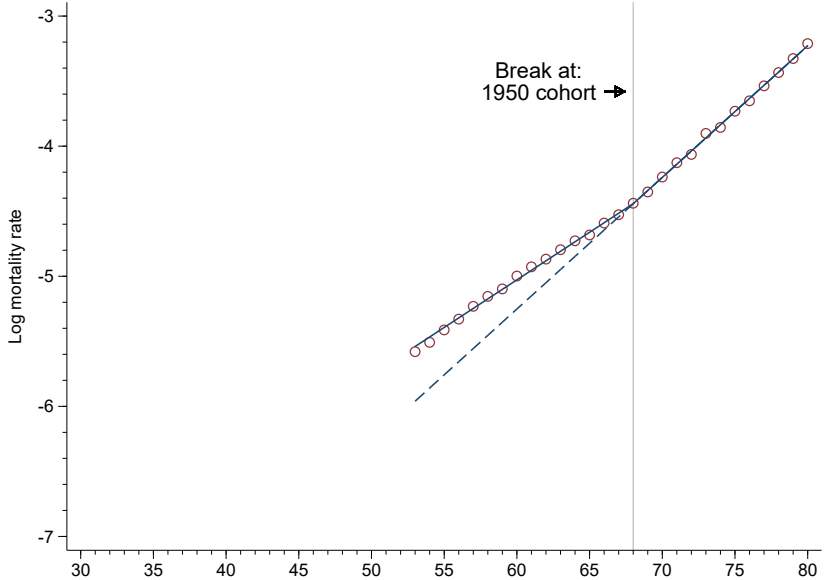
Log mortality rate of white men

2019



Log mortality rate of white women

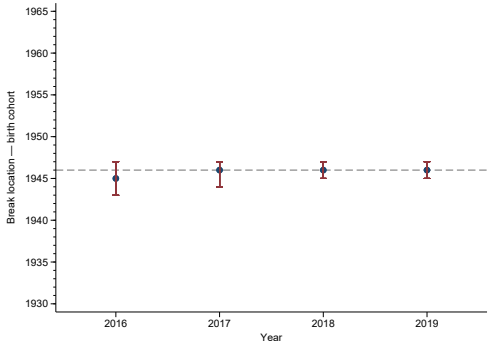
2019



“Out of sample” validation

White men breaks by year 2016-2019

Break location, $\hat{\gamma}_p$



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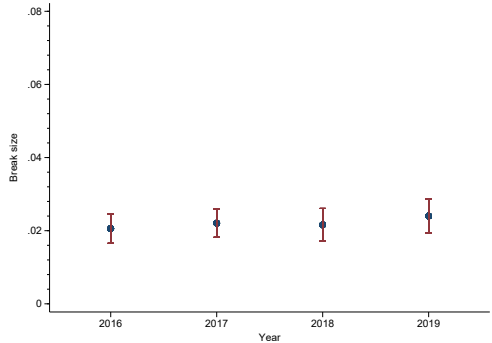

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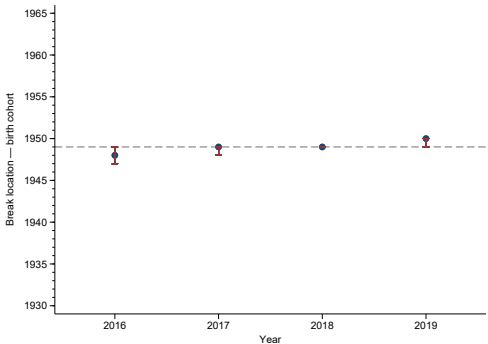

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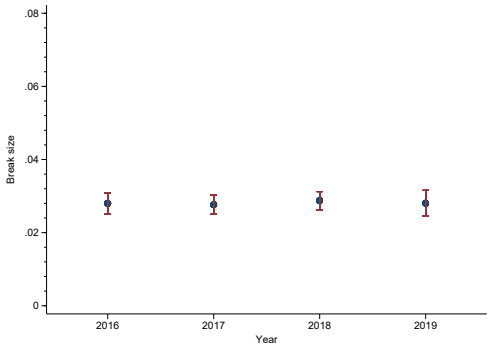

was there a similar (bigger?) break in 2020 during Covid epidemic?

- consistently estimate trend break at or near $\sim$1946 cohort for men and 1949 cohort for women in each year, ~~1985-2015~~ 1985-2019
- elevated mortality for cohorts born after relative to "Gompertz curve" for prior-born cohorts
- hard to think of reason for this highly non-linear and non-smooth pattern — other than cohort health decline
- **motivates estimating a model with linear age effects in each year and trend break in "cohort effects"**

Model

$$ln(mort_{apc}) = \delta^p_{1,c} \cdot c + \underbrace{\delta^p_{2,c} \cdot 1_{c \geq \gamma} \cdot (c - \gamma)}_{\text{trend break at cohort } \gamma} + \underbrace{f^p(a)}_{\text{time varying age effect}} + \epsilon_{apc}$$

- location of trend break γ is parameter to be estimated
  (follow Hansen, 1999)
- $f^p(a)$ linear in baseline model
- experiment with separate higher order polynomials in each year
  - allows age to have smooth effect on mortality which *v*aries by year
- report average size of break, $\delta^p_{2,c}$, across years

White men, cohort trend break in log mortality

	(1)	(2)	(3)
Break size	0.026	0.029	0.025
	(0.001)	(0.001)	(0.002)
Break location	1946	1946	1946
	[1946, 1946]	[1946, 1946]	[1946, 1946]
P-value, break exists	$< .001$	$< .001$	$< .001$
Linear-age-by-year	Yes	Yes	Yes
Quadratic-age-by-year	No	Yes	Yes
Cubic-age-by-year	No	No	Yes

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$\rightarrow$ 1960 cohort mortality elevated by 32 percent

White women, cohort trend break in log mortality

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Break location	1948	1949	1950
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Linear-age-by-year	Yes	Yes	Yes
Quadratic-age-by-year	No	Yes	Yes
Cubic-age-by-year	No	No	Yes

$\rightarrow$ 1960 cohort mortality elevated by 27 percent

Interpretation

- strong evidence of decline in health of White American men born after 1946, women born after 1949 — relative to prior trend
  - sharp break in trend

- can ‘explain’ staggered timing of increases in mortality — eg. increases for white women age 35-44 around 1990; increases for white men and women 45-54 after 1999, white men and women 55-64 since 2010

- BUT hard to justify simple decomposition between cohort health vs. period-specific factors
  - break in trend of cross-cohort health evident by at least 1980s
  - but very plausible that could’ve interacted + been exacerbated by opioid supply + economic distress

Two big followup questions:

- WHEN did these cohorts “fall behind”?
- WHY???? What was the underlying cause?

When did these cohorts fall behind?

I argue likely predated labor-market entry

- declines in educational attainment and test scores for same cohorts
  (eg. Bishop, 1989; Card and Lemiuex 2001; Heckman and Lafontaine, 2010; Acemoglu and Autor, 2012)
  - cohorts already "behind" by at least age 17
  - but mortality increase "too large" to be explained by years of schooling decline
- timing of labor market entry
  - 1946 cohorts turned 19 in $\sim$ 1965
  - wages still increased rapidly until 1973

Part of much broader decline

Follow-up paper:

- Evidence of broader decline in health and human capital for cohorts born after $\sim$ 1947 — relative to prior trend
  - educational attainment and test scores
  - men's earnings
  - maternal health (proxied by birth weight of infants born to these cohorts)
  - mortality

All outcomes except men's mortality exhibit declines for African Americans born after 1947 as well

Why????

Evidence against a few ex ante plausible causes:

- observable changes in family background improve/flat across these cohorts
- maternal smoking
  - growth in smoking of women of childbearing age slowed after mid-1940s
- cohort size
  - increased sharply in 1946 and 1947 — these are most healthy cohorts
  - declined rapidly after 1961 cohort — no evidence of rebound in health

Why????

Two plausible causes worth considering in particular:

- worsening of respiratory health environment after 1946
  - respiratory mortality of both infants and elderly adults began to suddenly increase after late 1940s
  - plausible that exposure in infancy to factors that caused this had negative effect on growth and development broadly

- birth order
  - stacking up of first births in 1946 $\rightarrow$ break + increase in average birth order after eg. Ryder, 1980)
    - evidence that earlier born do 'better' across many dimensions eg.Black et. al, 2005, 2011; Barclay and Kolk, 2015
    - timing is perfect
    - magnitude about 1/2 to 1/3 the necessary to explain, based on w/in family estimates from Sweden (Barclay and Kolk, 2015)

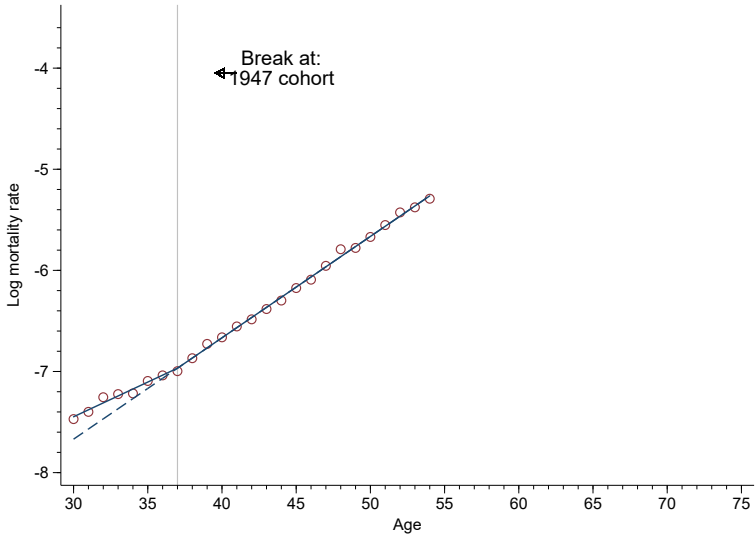
Conclusion

- much more to be done in search for cause:
  - cross-country comparisons
  - examine variation by county/place-of-birth using admin data
- other outcomes could be affected:
  - labor force participation of women at older ages
  - disability and chronic conditions (Martin and Schoeni, 2014)
- sudden stop to long-run process of 'technophysio evolution', Robert Fogel, Dora Costa and coauthors
  - secular growth in height suddenly slowed after circa 1950-55 cohorts (Komlos and Lauderdale, 2007; Komlos 2010)
  - preliminary: trunk in particular declines; later adolescent growth spurt

Appendix slides

Log mortality rate of white women by age

1985



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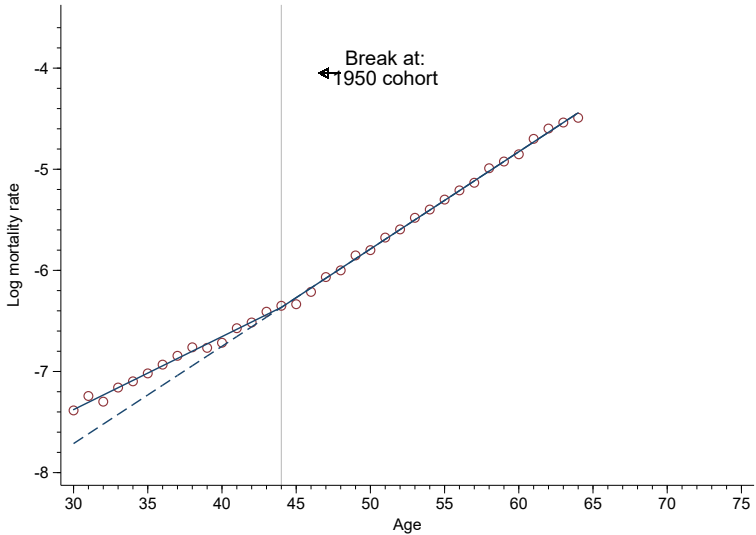

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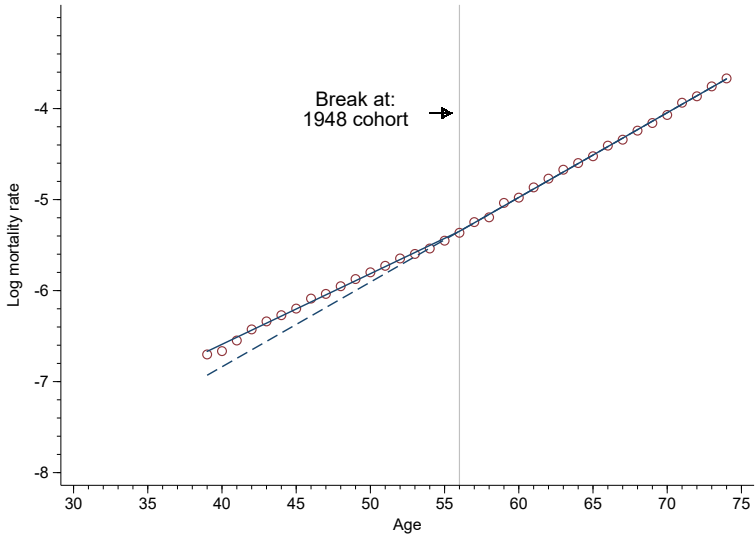

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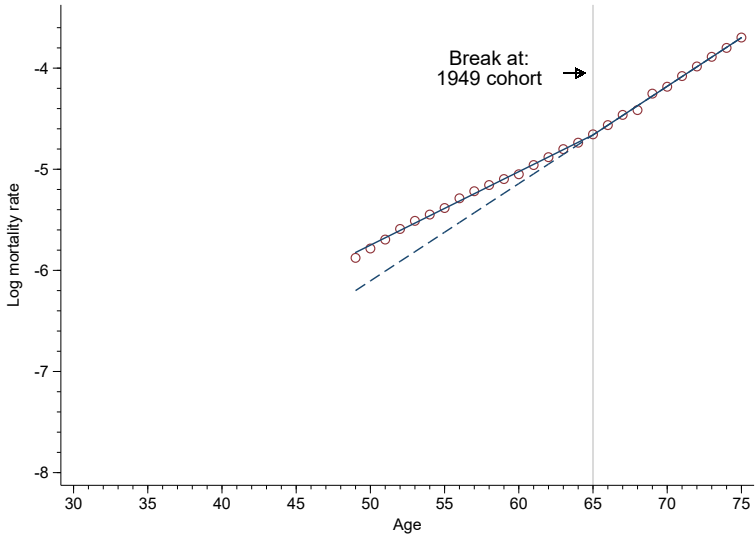

Deviations of log mortality of white women from trend for older cohorts

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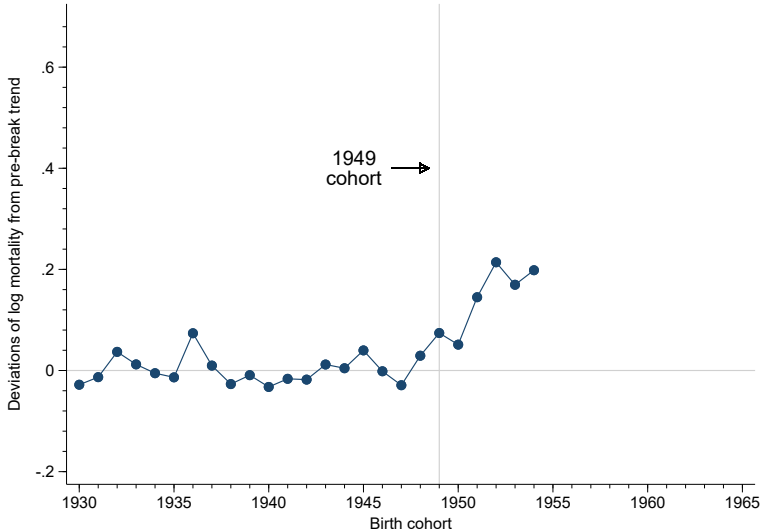

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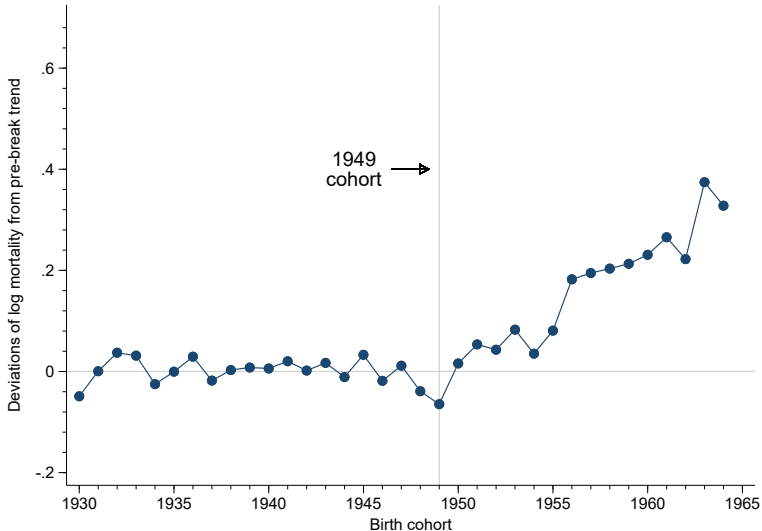

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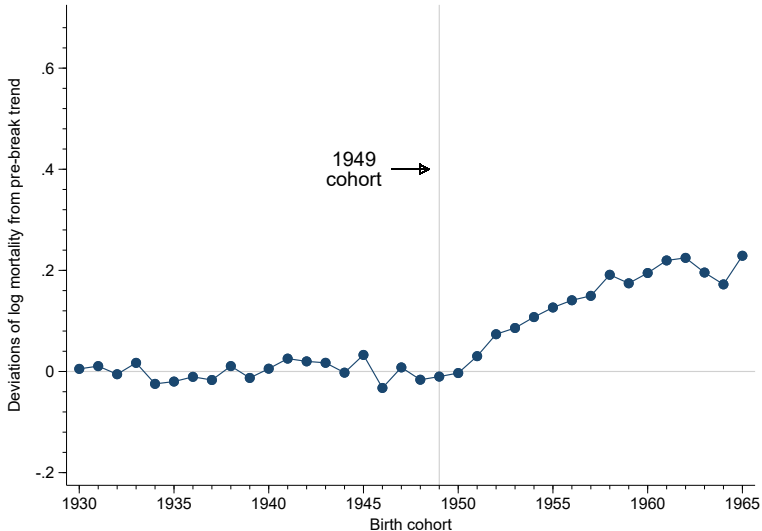

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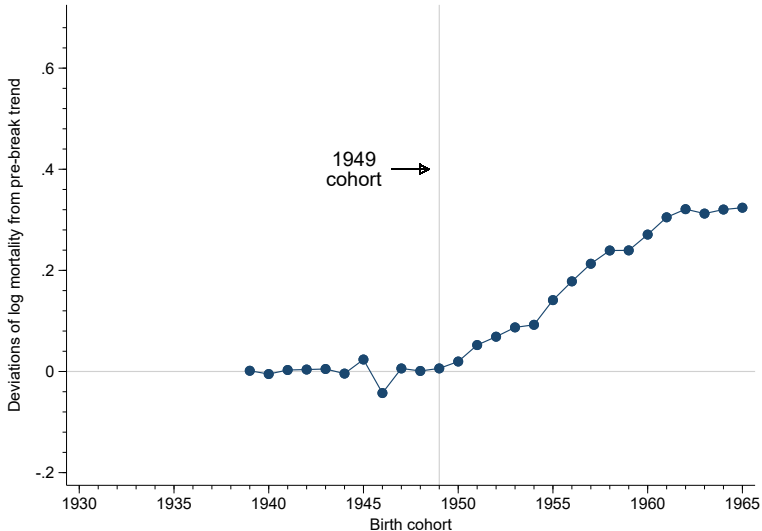
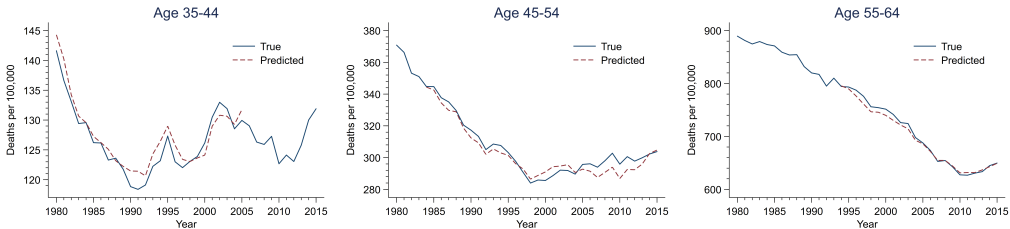


True mortality rate and those predicted by model with cohort-specific trend break
White women



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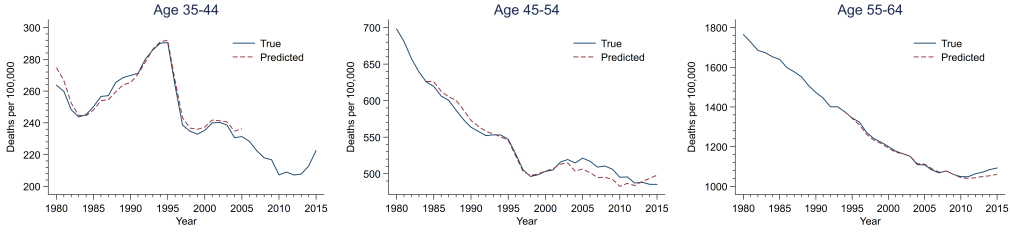
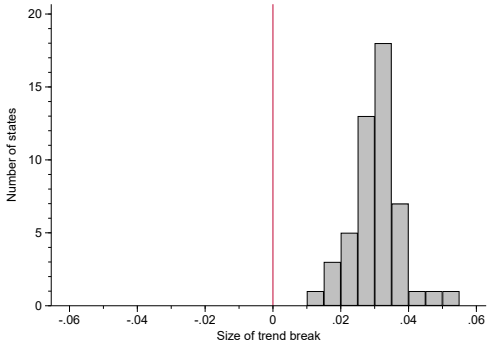


State-level analysis

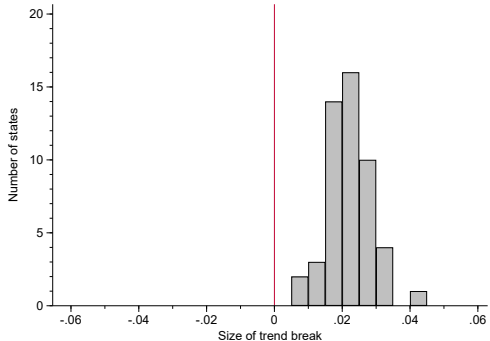
- estimate baseline model with linear age-effects separately for each of the 50 states
- fixing location of cohort break to that estimated at the national level
- yields separate estimate of average break size, $\delta^{p}_{2,c}$, *for each state*

Distribution of break sizes across 50 states

White men

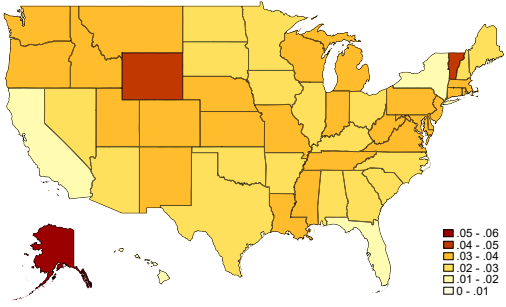


White women

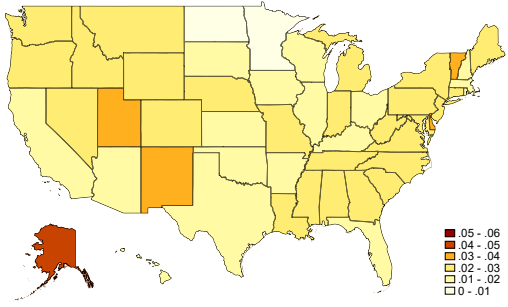


Map of break sizes across 50 states

White men

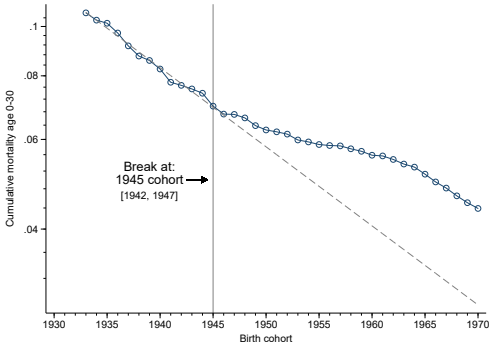


White women

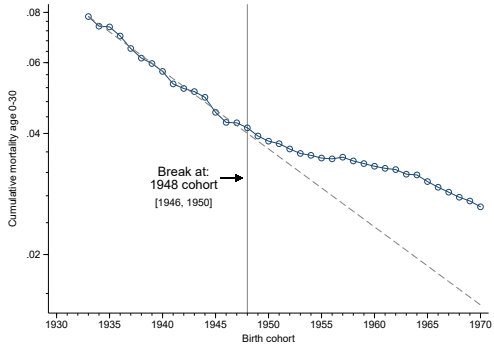


Cumulative mortality age 0-30 by birth year

White males

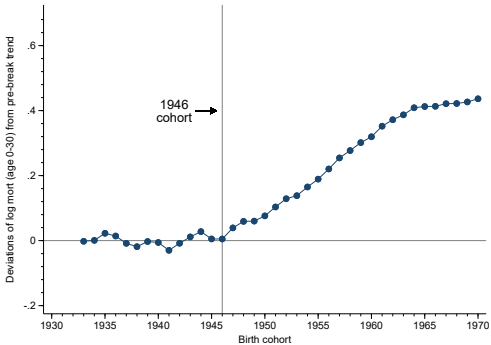


White females



Cumulative mortality age 0-30 by birth year
Deviations of log mortality from trend for pre-break cohorts

White males



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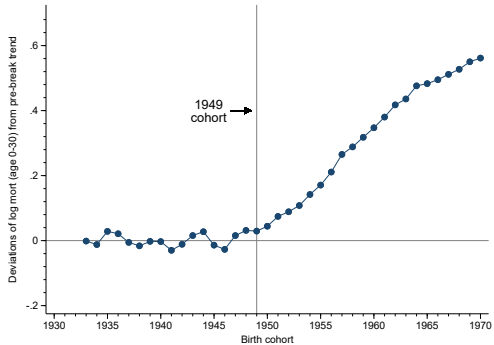
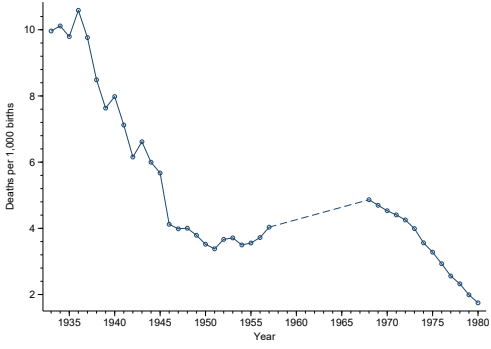
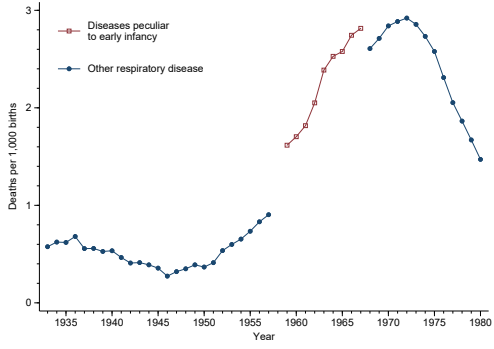


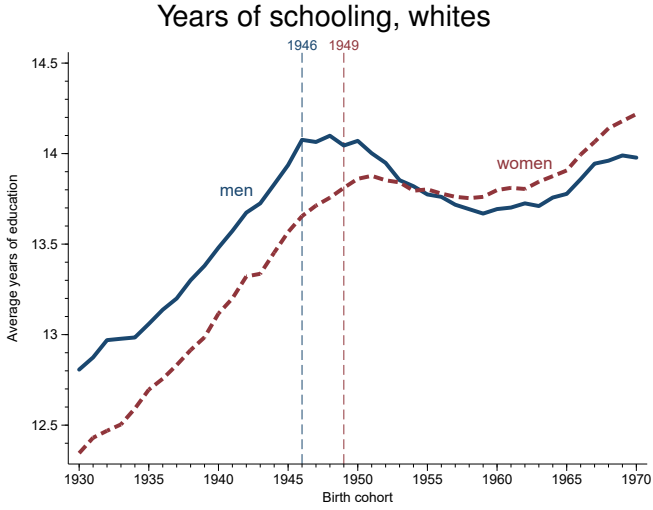
Infant mortality rate

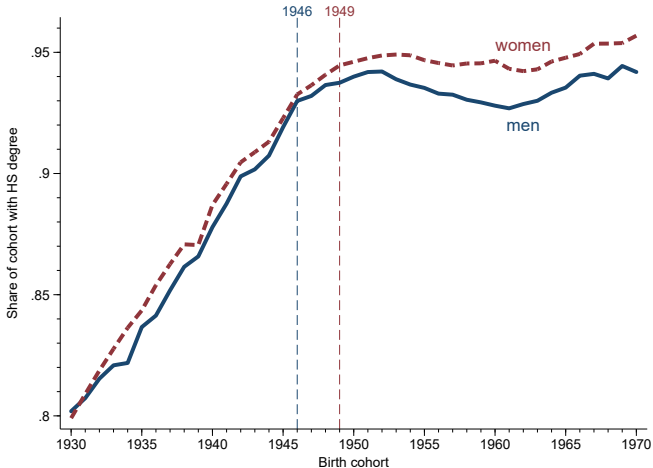
All respiratory diseases

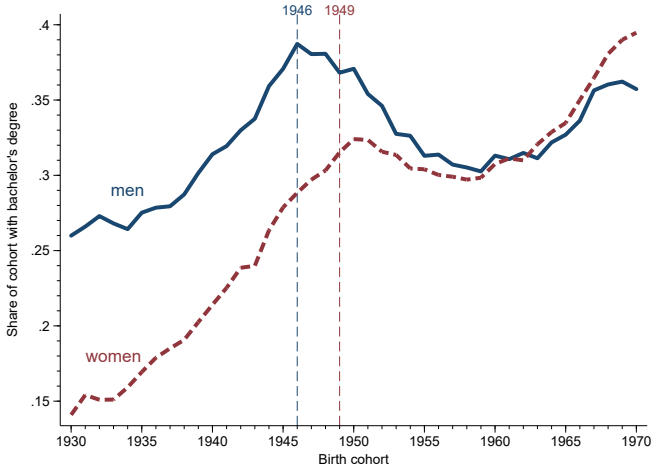


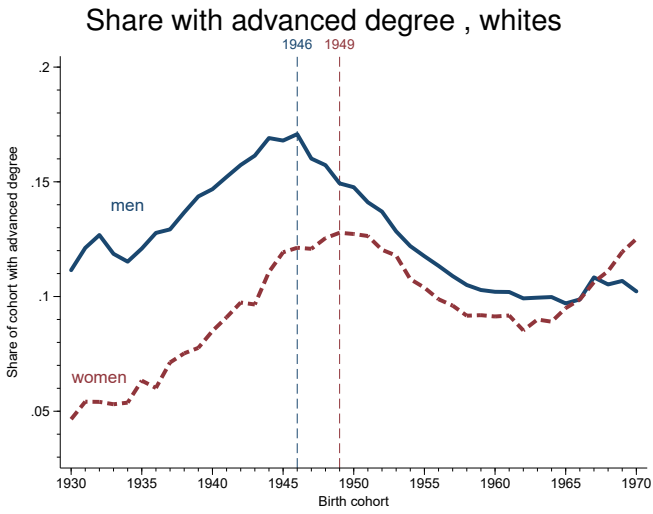
Cause categories including Surfactant Def Synd




Years of schooling, whites
1946
1949
14.5
14
13.5
13
12.5
Average years of education
men
women
1930
1935
1940
1945
1950
1955
1960
1965
1970
Birth cohort

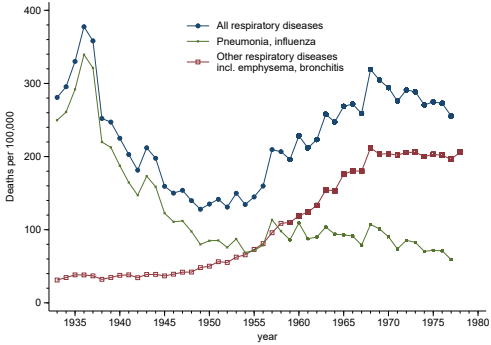

Share with HS degree (or GED), whites
1946
1949
women
men
Share of cohort with HS degree
.95
.9
.85
.8
1930
1935
1940
1945
1950
1955
1960
1965
1970
Birth cohort


Share with BA , whites
1946
1949
.4
.35
.3
.25
.2
.15
men
women
Share of cohort with bachelor's degree
1930
1935
1940
1945
1950
1955
1960
1965
1970
Birth cohort

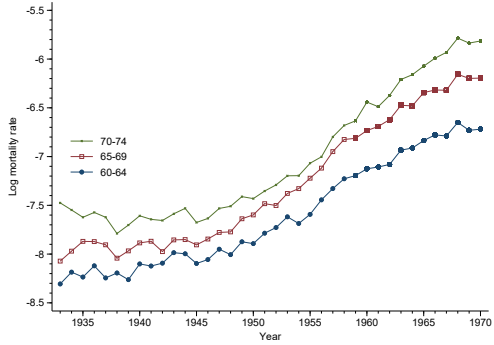

Share with advanced degree , whites
1946
1949
.2
.15
.1
.05
men
women
Share of cohort with advanced degree
1930
1935
1940
1945
1950
1955
1960
1965
1970
Birth cohort

Mortality rate of adult white men

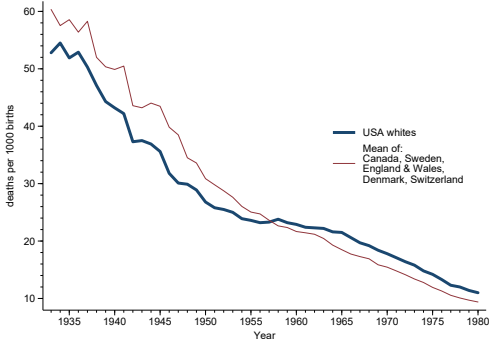
Respiratory mortality, age 65-69



Log mortality, resp. excluding pneu. + infl.

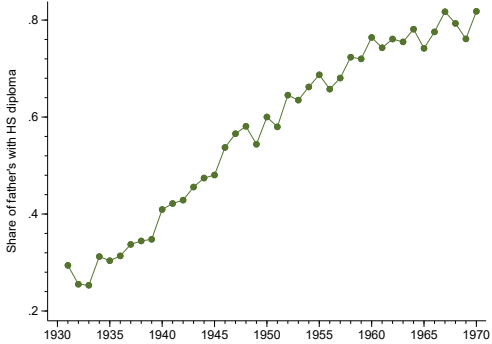


Infant mortality rate comparisons

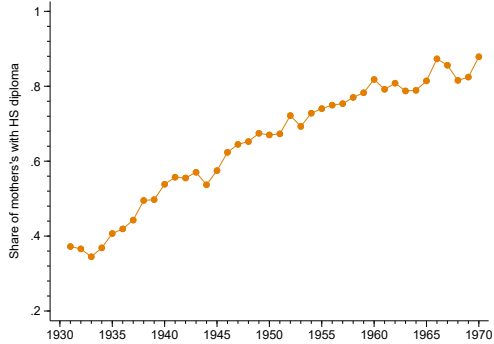


Parental background, whites

Share dad w/ hs

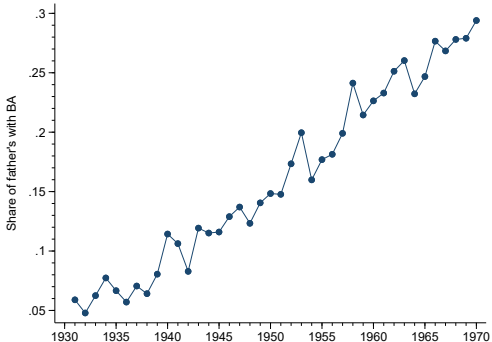


Share mom w/ hs

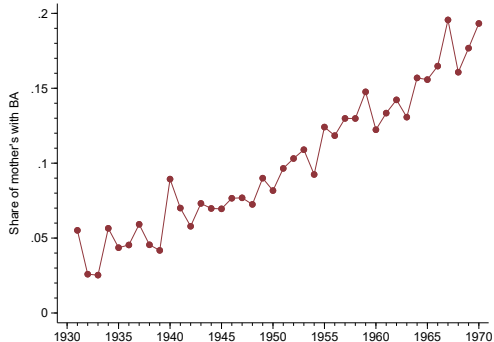


Parental background, whites

Share dad w/ BA

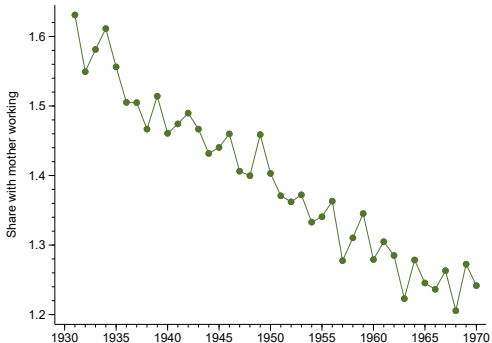


Share mom w/ BA

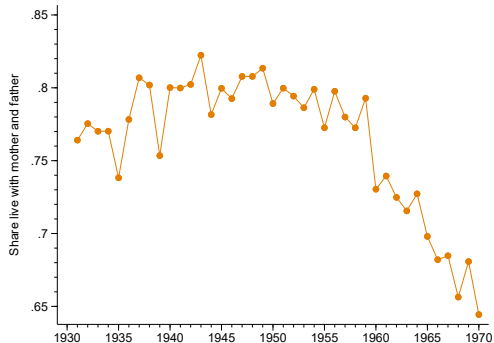


Parental background, whites

Share w/ mom working when 16



Share living w/ mom + dad at 16



Smoking prevalence of American women of childbearing age