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# Rising Midlife Mortality in the US

When did it start? Who is it affecting?

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# Interest in rising mortality

Recent studies of mortality trends have examined lots of things

race and ethnicity

gender

age group

education

geography

cause(s) of death

Many studies share key elements

1999 as a starting year

use of age groups and age standardization

# What we have done

Our objective is to get a careful description of overall mortality patterns as a baseline for more detailed work

Our data sources are

US Vital Statistics on Mortality 1980 - 2016

US Census Bureau intercensal population estimates

Our variables of interest are

Year

Year of Age

Gender

# Mortality Rates

The unit of analysis is the age-specific annual mortality rate at age  $a$  and year  $y$ :

$$\lambda_{a,y} = (\text{deaths})_{a,y} / (\text{midyear population})_{a,y}$$

Mortality rates and patterns of mortality rates might be distorted by causes with predictable effects

- Incorrect Census estimates of midyear population

- Incorrect ages on death certificates

- Annual fluctuations in the true mortality rates

- Multi-year cycles in the true mortality rates

- Trends in mortality rates that differ across broad age groups

# How we have done a visualization

Our exploratory visualization maps single-year trends in age-specific mortality rates

$$\Phi_{a,y} = \exp(\ln(\lambda_{a,y}) - \ln(\lambda_{a,y-1}))$$

$$\Phi_{a,y} \text{ (smoothed)} = (\Phi_{a,y-1} + 2*\Phi_{a,y} + \Phi_{a,y+1} + \Phi_{a-1,y} + \Phi_{(a+1,y)})/6$$

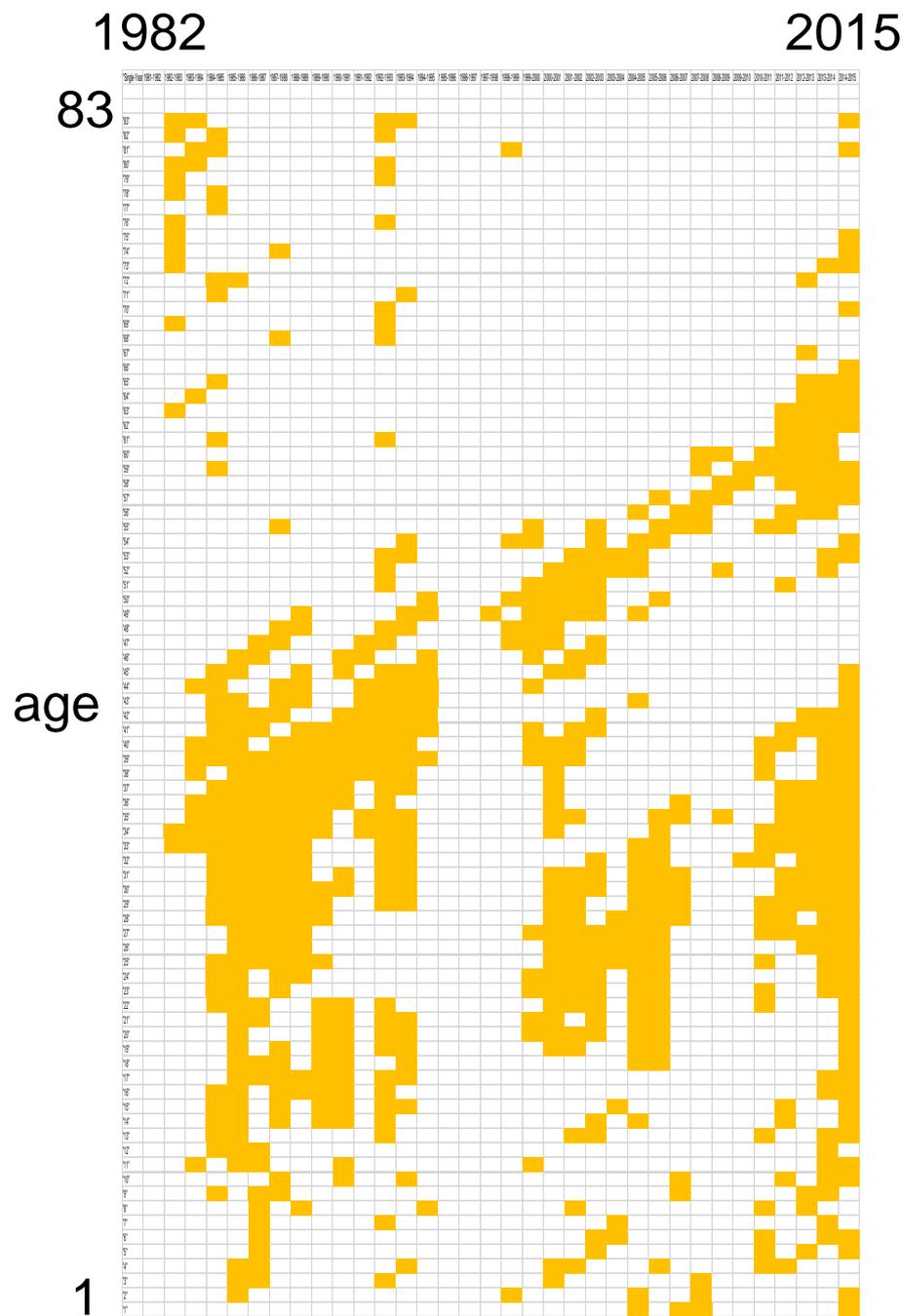
Then we highlight any age & year cell where death rates increased from the previous year at the same age:



for  $\Phi_{a,y} > 1$

# Figure 1: Ages and Years with Rising Death Rates: US Males 1982 – 2015

■ = death rate increased for the given age in the given year



# Figure 2: Ages and Years with Rising Death Rates: US Females 1982 – 2015

■ = death rate increased for the given age in the given year



# How we have done a period/cohort analysis

The unit of analysis (again) is the age-specific annual mortality rate at age  $a$  and year  $y$ :

$$\lambda_{a,y} = (\text{deaths})_{a,y} / (\text{midyear population})_{a,y}$$

with 40 years of age (25 to 64)

and 37 years (1980 to 2016)

covering 76 birth cohorts (1916 to 1991)

$$\lambda_{a,y} = \exp(\beta_0 + \beta_a * a + \beta_y * y + \beta_c * c)$$

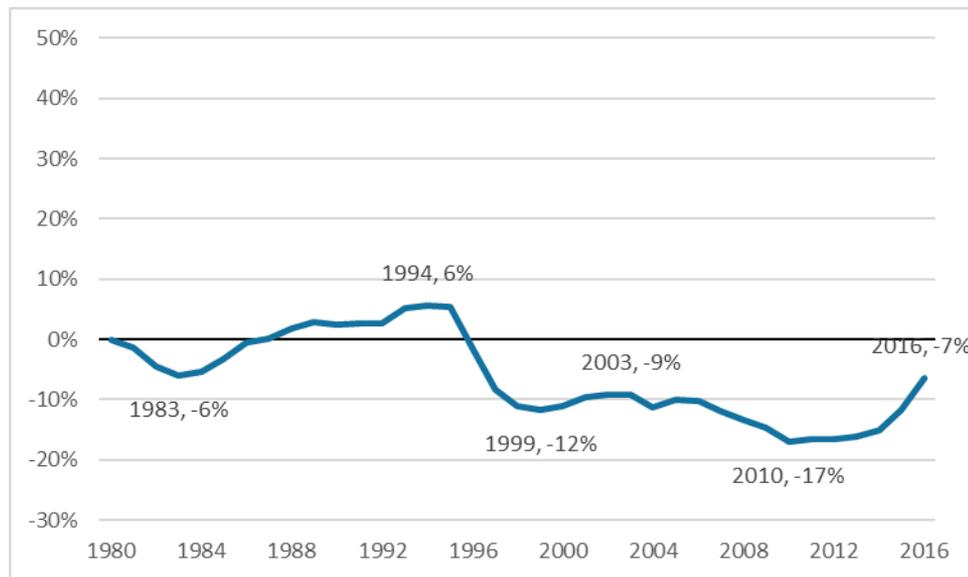
$$n = 1480$$

$$df = 149$$

Figure 3:  
 Regression Model of Mortality  
 Year and Birth Cohort Coefficients,  
 US Males Age 25 – 64, 1980 – 2016

age coefficients estimated but not shown  
 reference year = 1980  
 reference birth cohort = 1945

year coefficients



birth cohort coefficients

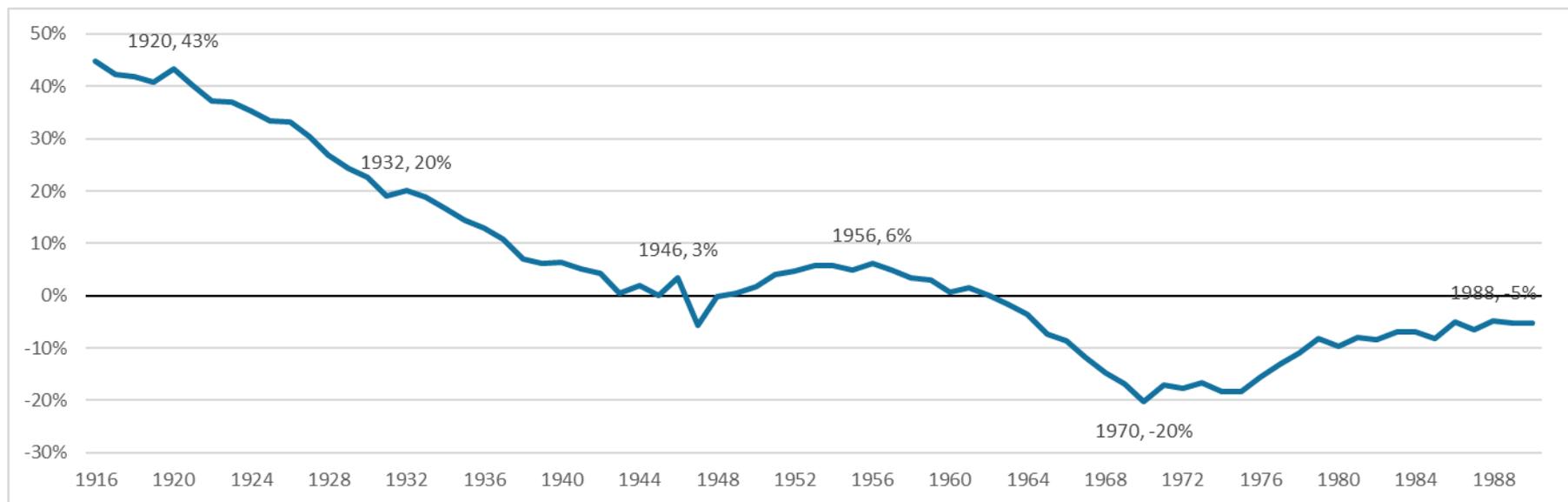
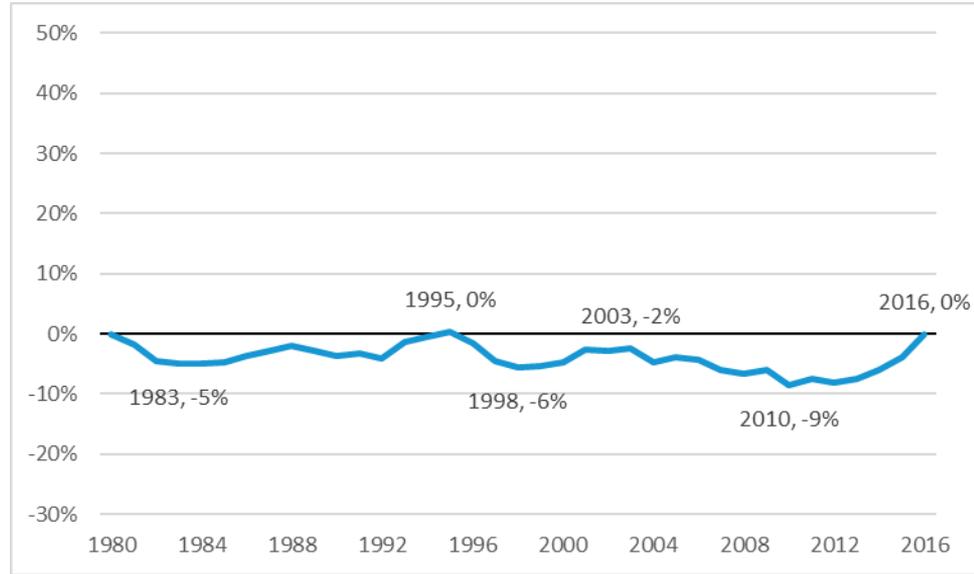


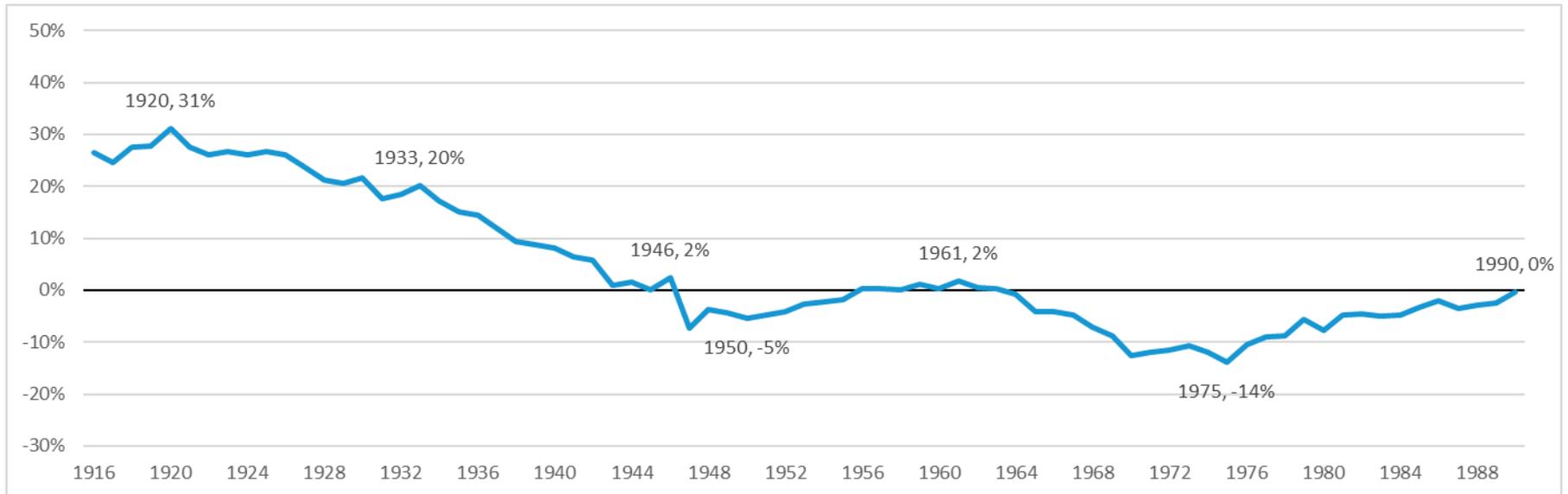
Figure 4:  
 Regression Model of Mortality  
 Year and Birth Cohort Coefficients,  
 US Females Age 25 – 64, 1980 – 2016

age coefficients estimated but not shown  
 reference year = 1980  
 reference birth cohort = 1945

### year coefficients



### birth cohort coefficients



# Tentative conclusions and possible implications

The use of single-year-of-age data has the potential to provide much finer resolution on mortality patterns than age-grouped data.

It is possible to identify distinct cohort and period patterns in US mortality data at mid-adulthood from 1980 to 2016.

Pending confirmation of these findings, cohort patterns in mortality might help us project future mortality trends.

Pending confirmation of these findings, cohort patterns in mortality might assist in the examination of historical patterns of social, economic, public health, and medical processes affecting mortality across the life course.