



# **Lecture 8:**

## **Financial Planning for Retirement**

# Lecture Outline

- The retirement challenge
  - Increasing life expectancy
- The basic life-cycle model
- Taxes and pensions
  - Social Security
  - DB vs DC pensions
- How much should you save for retirement?
  - And do people save enough?
- The role of home equity
  - Reverse mortgages
- Do people understand their retirement savings needs?

# The Retirement Challenge



## The Retirement Challenge

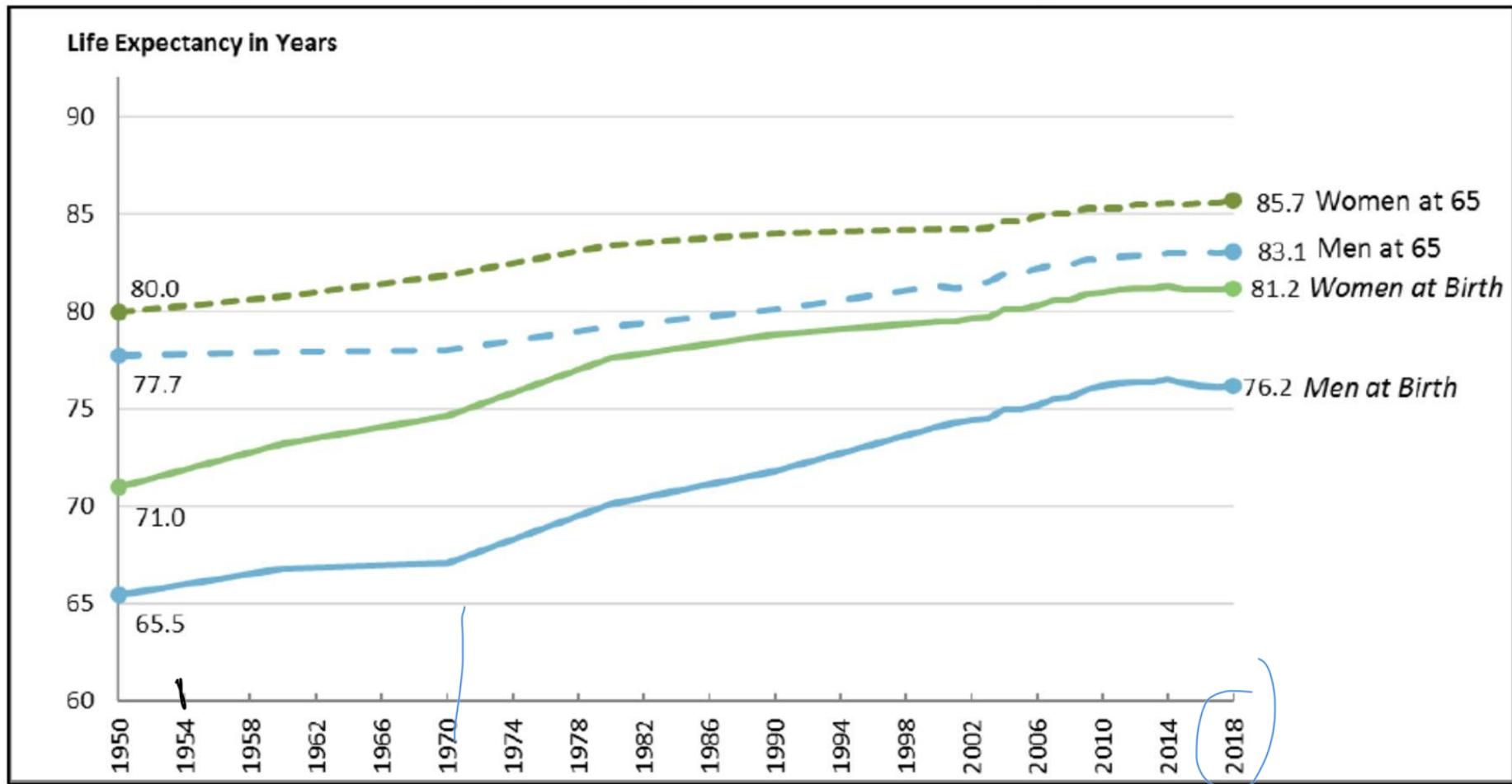
- Retirement is a period at the end of life where you no longer can (or wish to) work.
- To support yourself in this period, you will need to save during your working life.
- Funding retirement is increasingly challenging because of increasing life expectancy.



# How Long Will You Live?

- This is an age-old question.
  - “*LORD, make me to know mine end, and the measure of my days, what it is.*” – Psalm 39:4, King James Version.
- While the problem is unsolved, the modern approach is to report **life expectancy**.
  - The average age of death if mortality rates at each age remain unchanged in the future from their levels today.
  - This calculation can be done for the whole population, for people who have already reached a certain age, for men and women separately, for people at different income levels, and so forth.

**Figure 1. Life Expectancy by Sex at Birth and Age 65, 1950-2018**



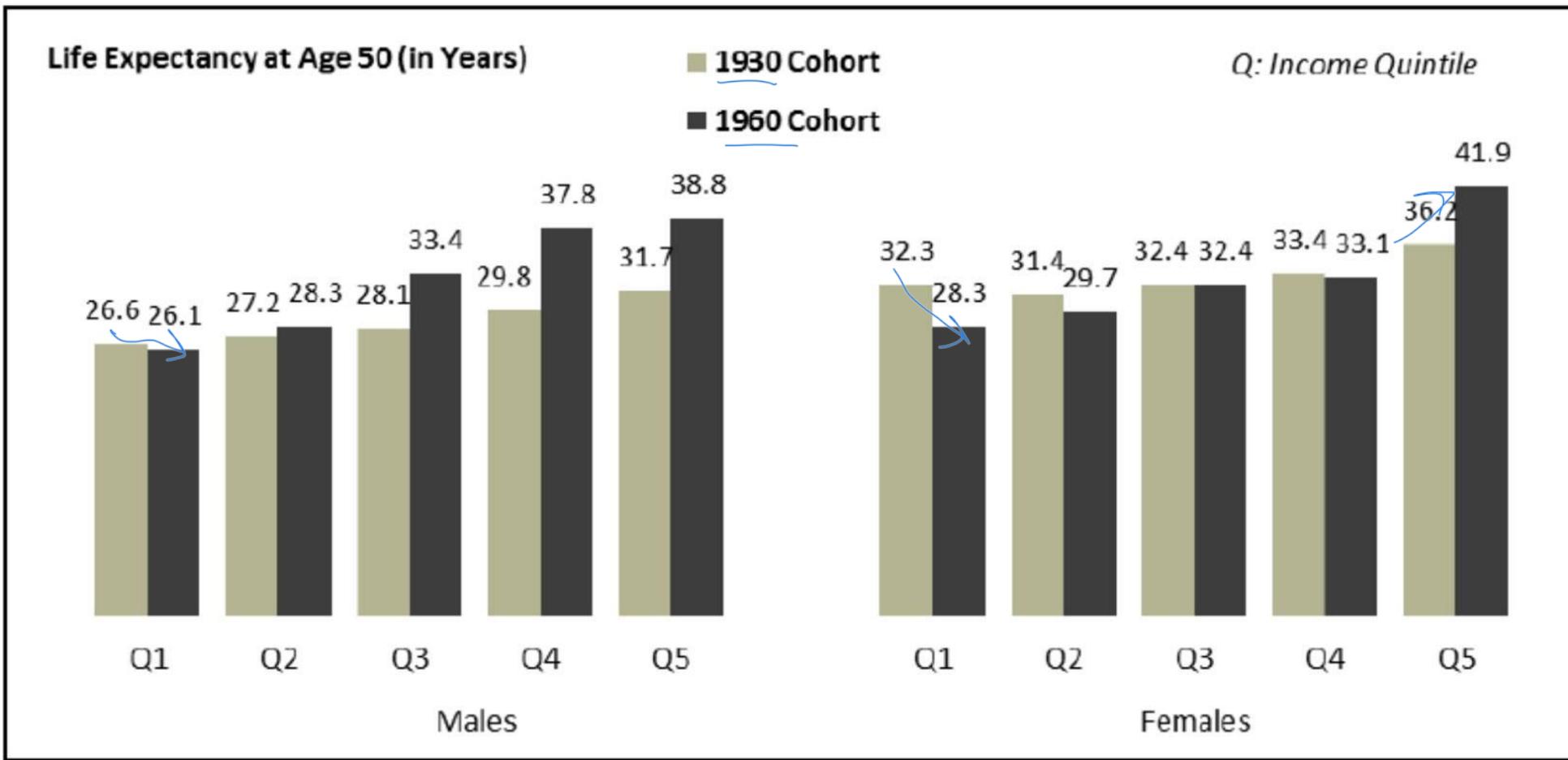
**Source:** Centers for Disease Control and Prevention (CDC), National Vital Statistics.

**Notes:** Period life expectancy estimates based on period mortality rates. Life expectancy at age 65 refers to expected age of death.

Source: Congressional Research Report R44846, July 2021,

<https://crsreports.congress.gov/>

**Figure 4. Life Expectancy at Age 50 for Males and Females Born in 1930 and 1960, by Income Quintile**



**Source:** National Academy of Sciences, *The Growing Gap in Life Expectancy by Income: Implications for Federal Programs and Policy Responses* (Washington, DC: The National Academies Press, 2015), Figure 3-2.

**Notes:** Cohort life expectancy estimates calculated using observed sample mortality where possible and projected mortality for younger sample individuals (i.e., older than age 78 for the 1930 birth cohort and for the entire 1960 birth cohort).

Source: Congressional Research Report R44846, July 2021,  
<https://crsreports.congress.gov/>



## Increasing Life Expectancy

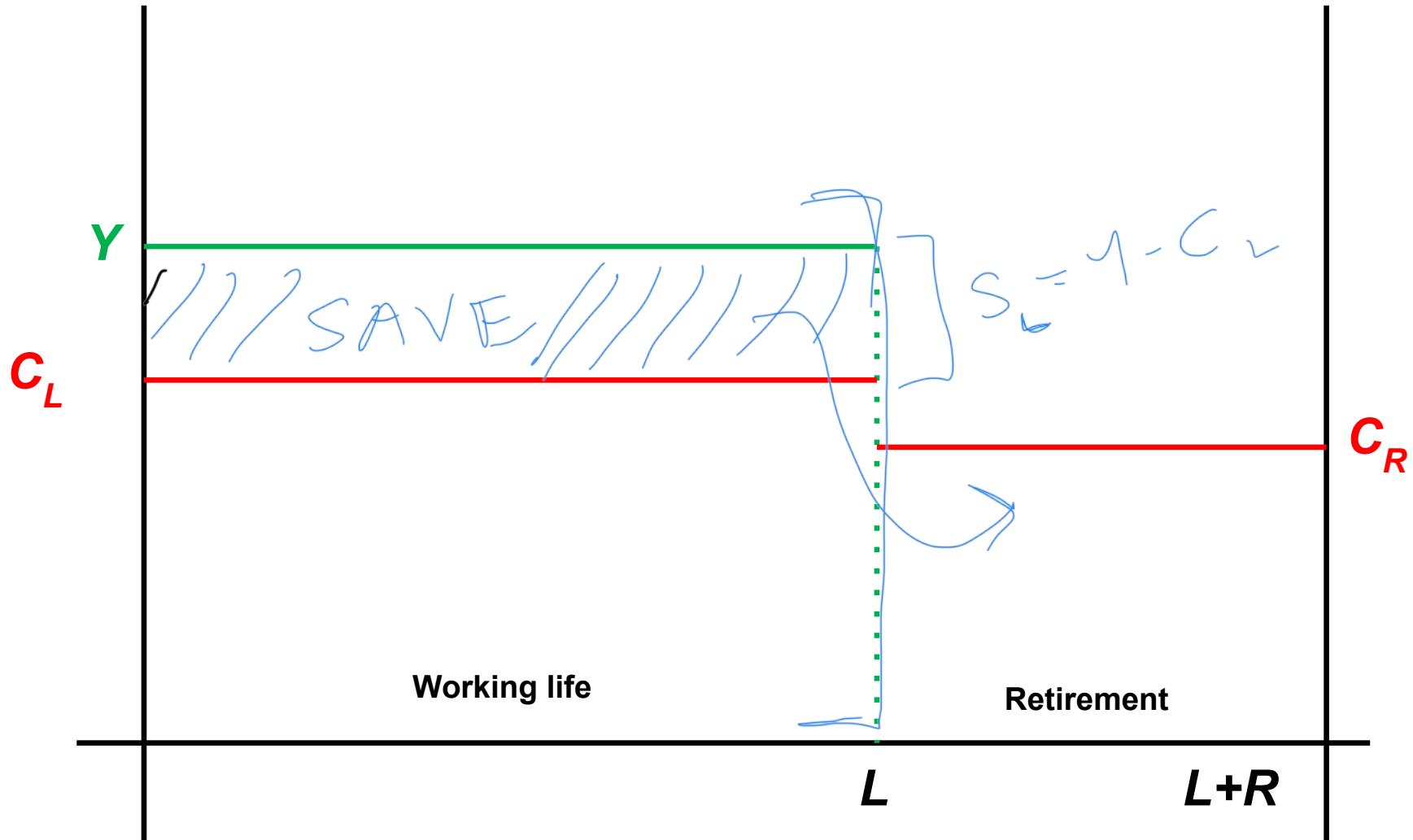
- Life expectancy at birth has risen by about 10 years since 1950.
- Men reaching age 65 can expect to live another 18 years, women another 20 years.
- Life expectancy is considerably higher at the top of the income distribution.
- And all of these numbers are based on current mortality rates, which are likely to continue to decline
  - Despite temporary setbacks such as the COVID-19 pandemic.

# The Basic Life-Cycle Model



# A Simple Model of the Life Cycle

- Assume you work for  $L$  years ( $L$  stands for labor).
- Then you retire for  $R$  years.
- You earn real income  $Y$  per year during your working life.
- Your real consumption expenditure is  $C_L$  while you are working, and  $C_R$  when you are retired.
- You invest your savings at a zero real interest rate.
- You leave no bequest.



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# Lifetime Resources

- Over your lifetime, your consumption expenditure must add up to your resources:

$$\overbrace{(C_L \times L)} + \overbrace{(C_R \times R)} = \overbrace{(Y \times L)}.$$

- Earning more (higher  $Y$ ) raises  $C_L$  and  $C_R$ .
  - Working longer (higher  $L$ , lower  $R$ ) raises  $C_L$  and  $C_R$ .
  - Lowering  $C_L$  raises  $C_R$ .
- So there are three ways to get a well-funded retirement:
    - Earn more money.
    - Work longer and have a shorter retirement.
    - Spend less while working, i.e. save more.

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# Saving and Wealth Accumulation

- Each year, you save  $S_L = Y - C_L$ .
- The fraction of income you save is

$$\left| \frac{S_L}{Y} \right| = 1 - \frac{C_L}{Y}.$$

- At retirement, you have accumulated wealth of  $\underline{S_L \times L}$ .
- Your wealth-income ratio at retirement is

$$\left( \frac{S_L}{Y} \right) \times L = \left( 1 - \frac{C_L}{Y} \right) \times L.$$

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## Two Examples

- Suppose you start work at 25, retire at 70, and live till you are 90.
  - ▶ So  $L = 45$  and  $R = 20$ . 
- You earn either \$50,000 per year or \$100,000 per year.
  - ▶ For comparison, the median US household income is about \$80,000 in 2021.
- Assume you want  $C_R = 0.9 \times C_L$ .
  - ▶ This factors in a modest decline in spending at retirement.
  - ▶ We see such a decline for many households.
  - ▶ It may be associated with reduced costs for work-related expenses (work clothing, commuting, etc.) and increased time allowing for cheaper forms of consumption (home-cooked meals).

# Consumption in the Two Examples

Budget constraint:

- Recall that

$$(C_L \times L) + (C_R \times R) = (Y \times L).$$

- In our examples,

$$(C_L \times 45) + (0.9 \times C_L \times 20) = (Y \times 45),$$

50k  
100k

so

$$C_L = \frac{Y \times 45}{63} = \frac{Y}{1.4}.$$

- If  $Y = \$100,000$ ,  $C_L = \$71,429$ .  $\rightarrow C_R = (71,429) \cdot .9$
- If  $Y = \$50,000$ ,  $C_L = \$35,714$ .



# High Savings in the Two

- We get a high savings rate in these examples.
  - ▶ If  $Y = \$100,000$ ,  $C_L = \$71,429$  so your saving  $S_L = Y - C_L = \$28,571$  or 28.6% of your income.
  - ▶ If  $Y = \$50,000$ ,  $C_L = \$35,714$  so your saving  $S_L = Y - C_L = \$14,826$  which again is 28.6% of your income.
- We also get a lot of wealth accumulation. At retirement, you have 45 years' worth of saving.
  - ▶ If  $Y = \$100,000$ , you have saved  $\$28,571 \times 45 = \$1,285,695$  or 12.9 years of income.
  - ▶ If  $Y = \$50,000$ , you have saved  $\$14,826 \times 45 = \$667,170$  which again is 12.9 years of income.
- These are unrealistically large numbers. What is wrong with our simple examples?

# Taxes and Social Security



# Taxes and Social Security

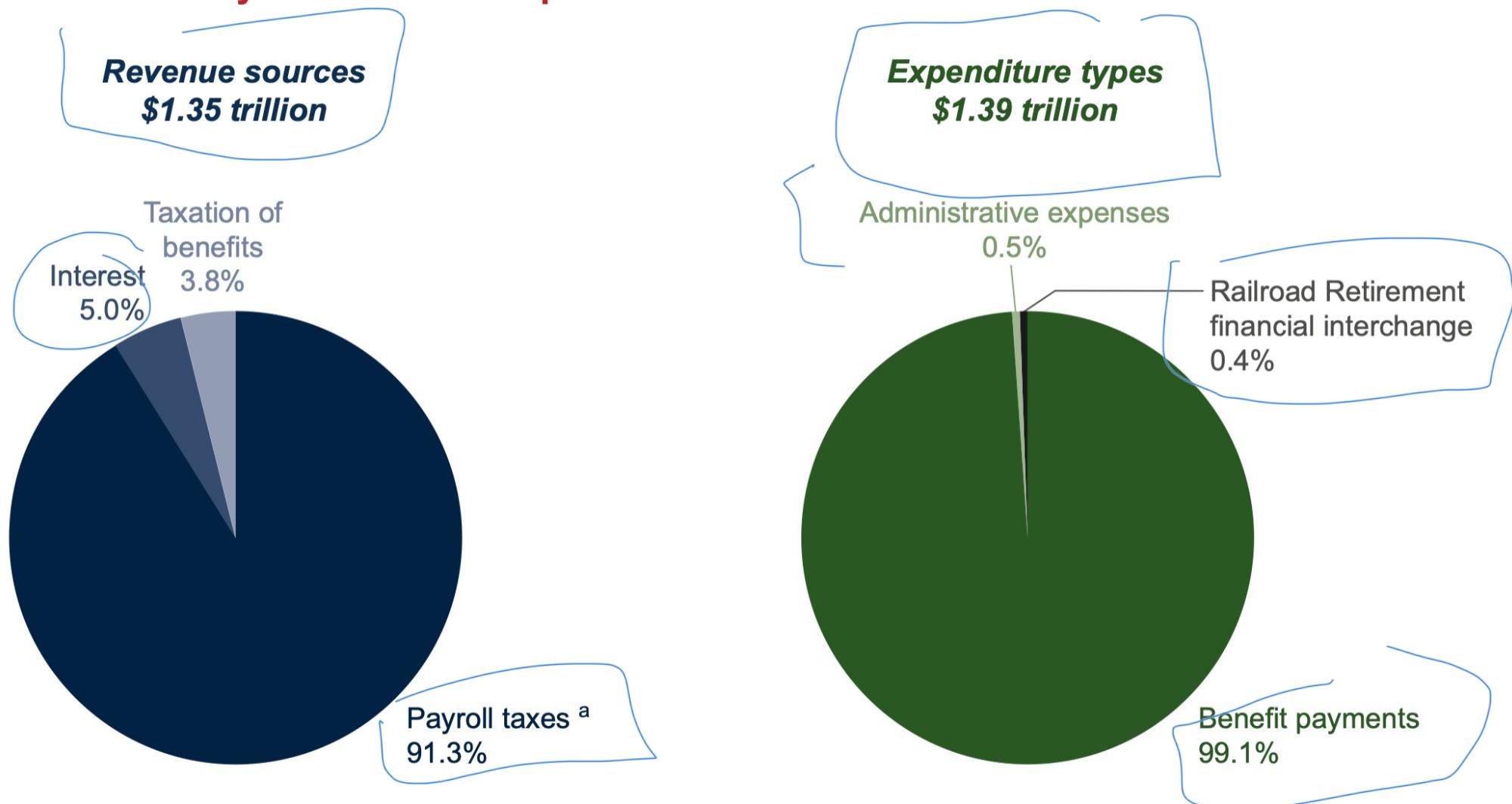
- We need to take account of the role of government.
- During working life, the government taxes your income.
  - The current tax rate for Social Security is 6.2% for the employer and 6.2% for the employee, or 12.4% total.
- Part of this money goes to fund Social Security benefits that are paid to you in retirement.
- This system influences the amount you should save.

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# Social Security

- The US Social Security system was created as part of Franklin Roosevelt's New Deal in 1935.
- Benefits are paid from a trust fund which is replenished by contributions – called “Pay As You Go”
  - The finances of the system are increasingly stressed by the declining number of workers relative to retirees.
  - To handle this, the age at which full benefits are paid is gradually increasing.
  - Further gradual declines in benefits and increases in taxes are likely, but the system is politically popular and likely to remain essentially intact.
- The SS system is progressive: benefits relative to contributions are more generous for poorer people.

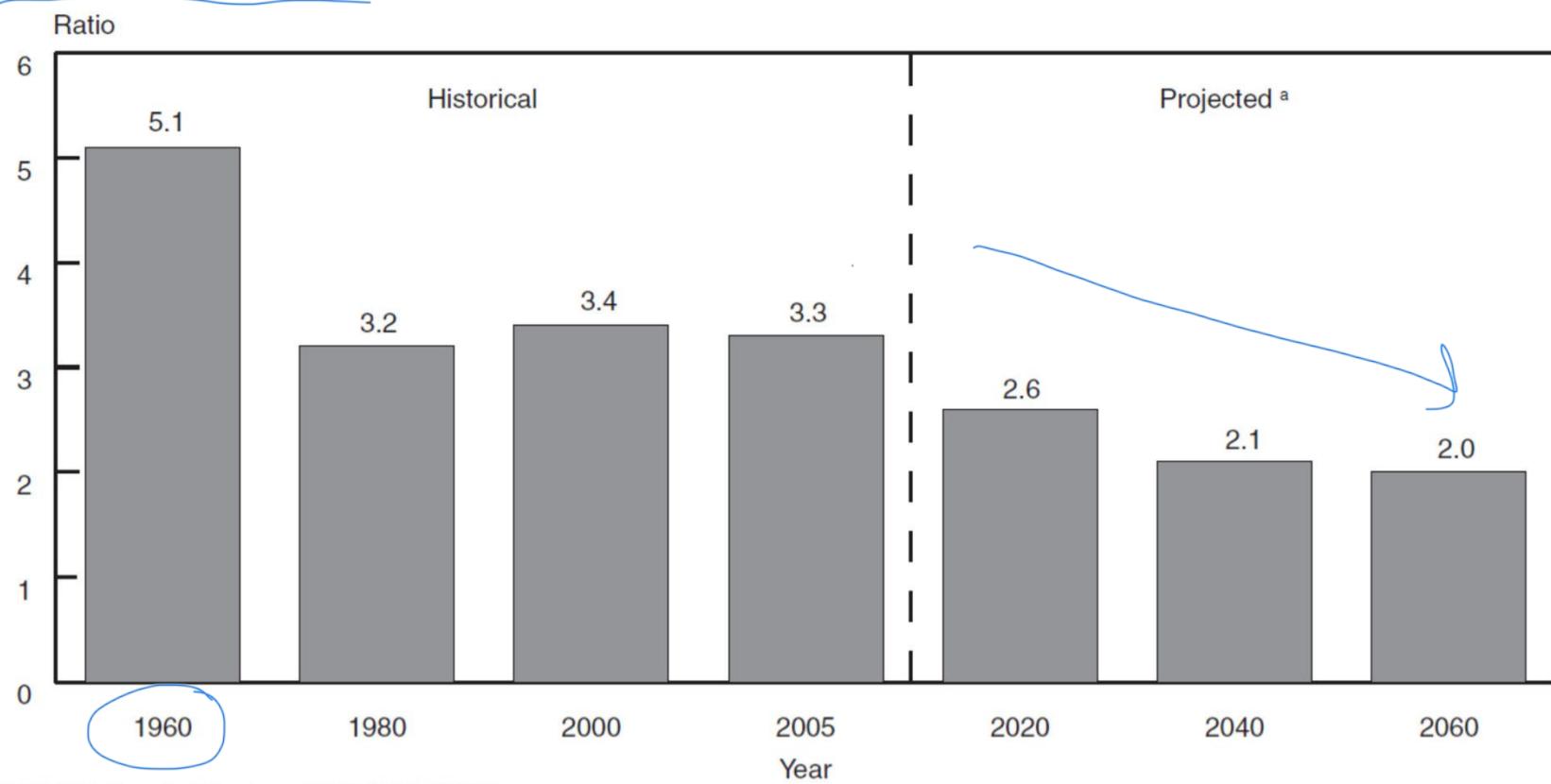
## Social Security revenues and expenditures in 2023



SOURCE: 2024 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, Table II.B1.

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**Chart 3.**  
**Worker-to-beneficiary ratio, selected years 1960–2060**

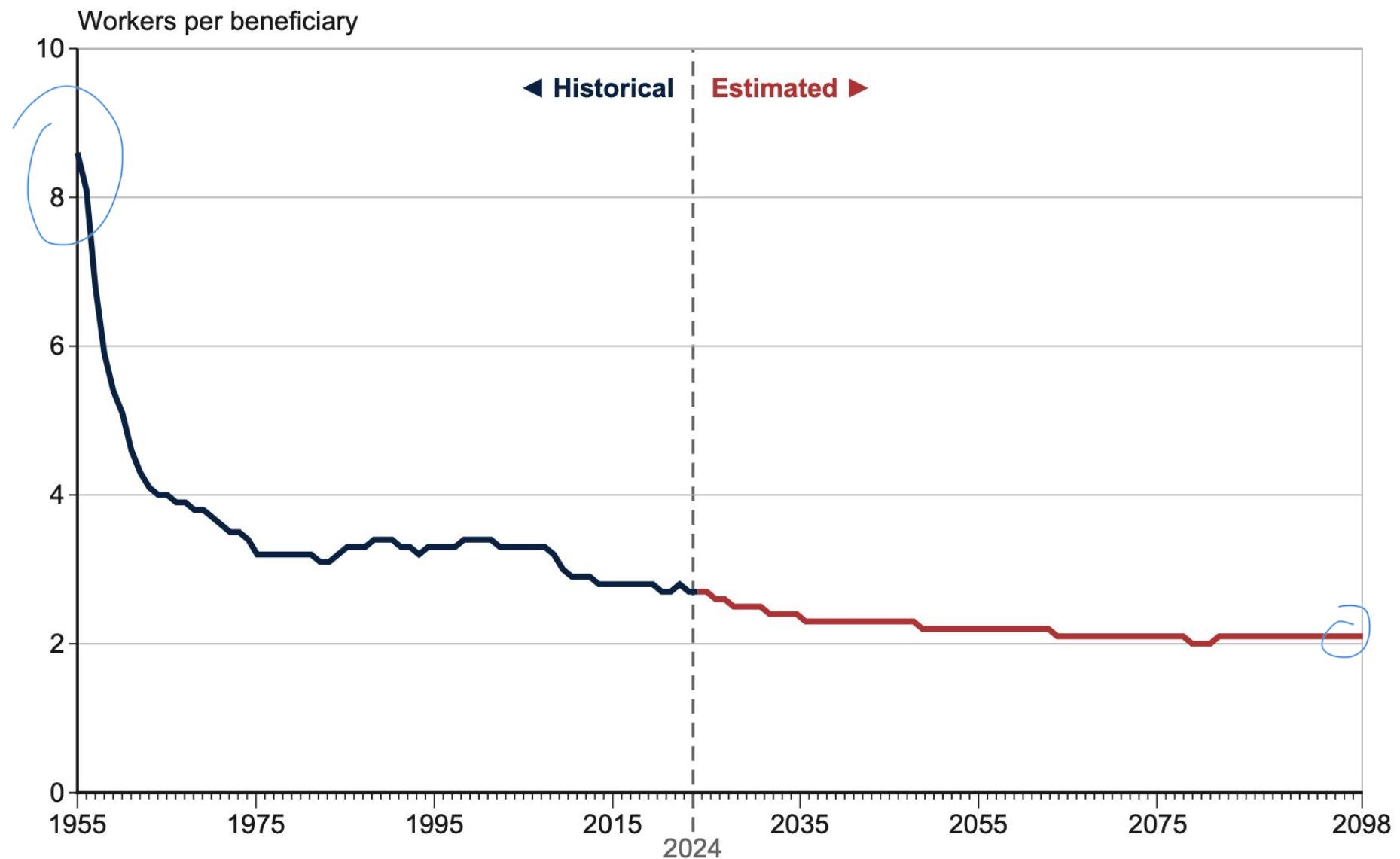


SOURCE: Board of Trustees (2006, Table IV.B2).

Source:

<https://www.ssa.gov/policy/docs/ssb/v66n4/v66n4p37.html>

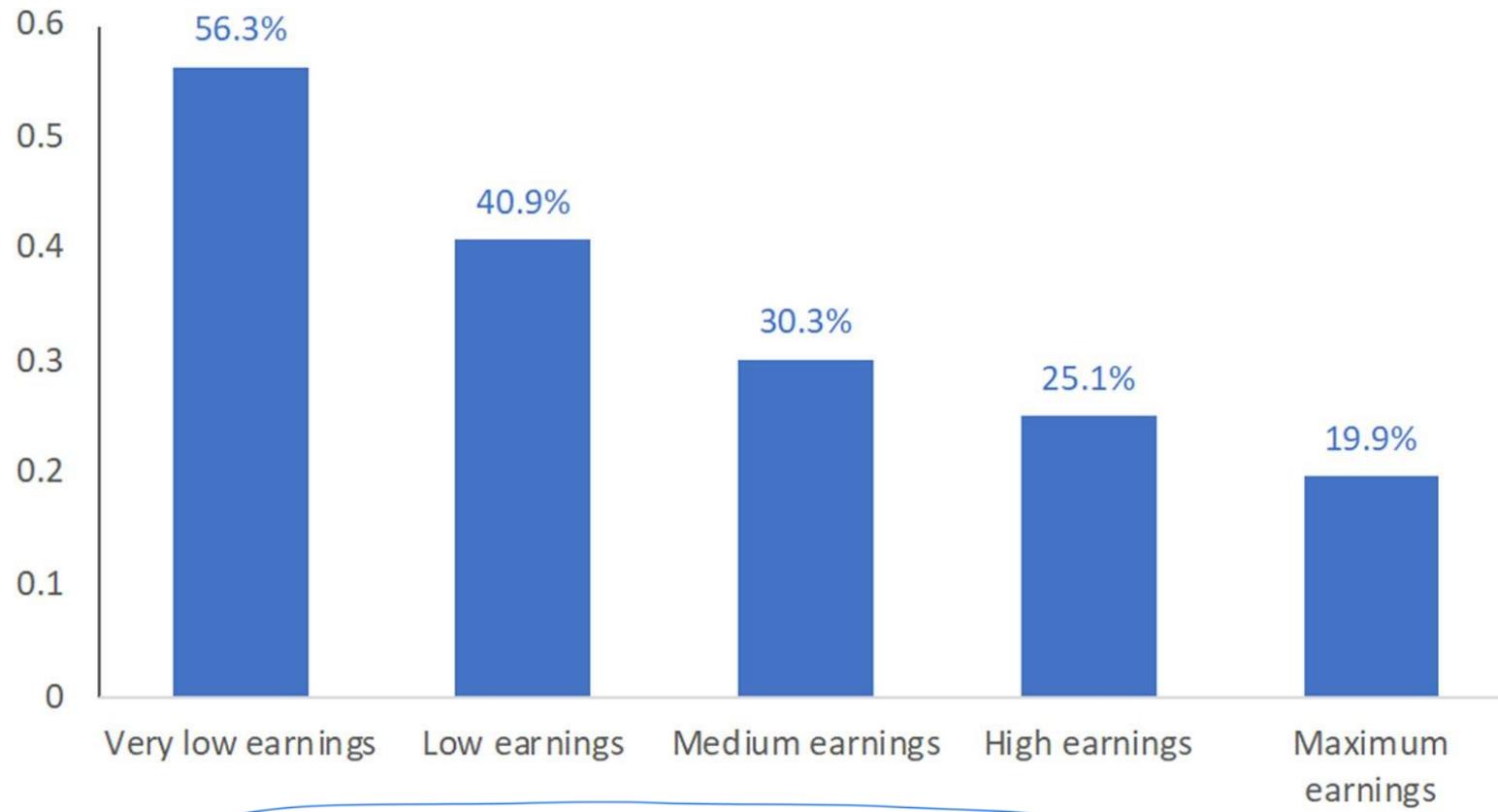
## Ratio of covered workers to Social Security beneficiaries



SOURCE: 2024 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, Table IV.B3 (intermediate assumptions).

## *Scheduled Replacement Rates for Recipients Born in 2000 for Different Earnings Groups*

Percent of career-average earnings



Data from the [Social Security Administration](#)

Note: In 2017, "Very low" corresponded to an average of ~\$12K; "Low" an average of ~\$22K; "Medium" an average of \$50K; "High" an average of ~\$80K; and "Maximum" an average of ~\$122K".

Replacement rates express retirement income as a percentage of preretirement earnings



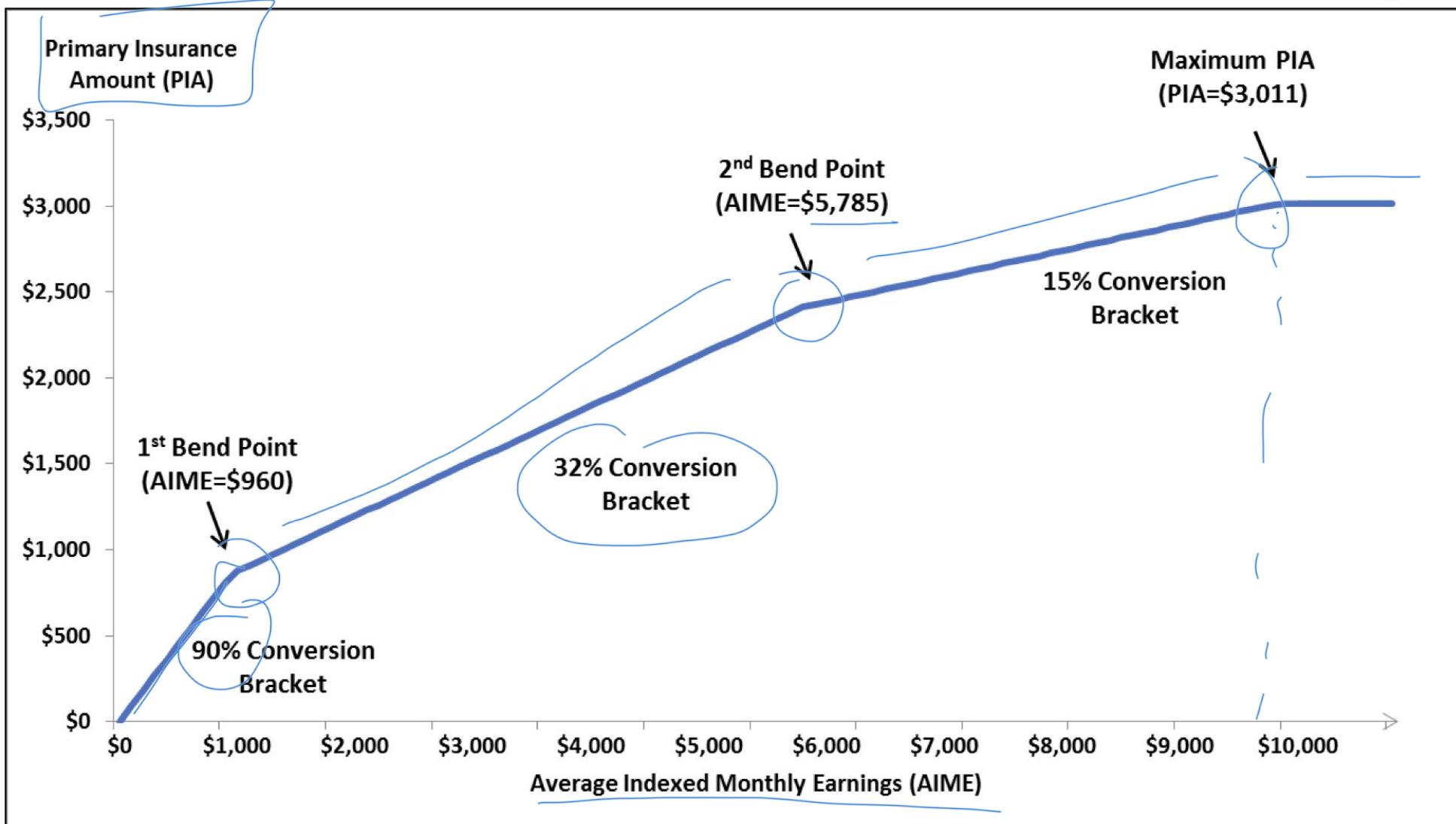
# How is your benefit calculated?

- The exact formula is complicated and changes over time... but the general components are
  - 1. Calculate AIME (Average Indexed Monthly Earnings) – look at worker's lifetime earnings, choose highest (up to 35 years) monthly earnings, and calculate average monthly earnings during that time.
    - If you worked less than 35 years, the remaining years in the calculation will be filled with zero earnings.
  - 2. Calculate the Primary Insurance Amount (PIA) using current formula and AIME
    - The PIA is the sum of three separate percentages of portions of average indexed monthly earnings.
    - The portions depend on the year in which a worker attains age 62, becomes disabled before age 62, or dies before attaining age 62.

See details here:

<https://www.ssa.gov/oact/cola/Benefits.html>

**Figure I. Computation of a Worker's Primary Insurance Amount (PIA) in 2020**





## Current PIA Formula

For an individual who first becomes eligible for old-age insurance benefits or disability insurance benefits in 2025, or who dies in 2025 before becoming eligible for benefits, his/her PIA will be the sum of:

- (a) 90 percent of the first \$1,226 of his/her average indexed monthly earnings, plus
- (b) 32 percent of his/her average indexed monthly earnings over \$1,226 and through \$7,391, plus
- (c) 15 percent of his/her average indexed monthly earnings over \$7,391.



## How is your benefit calculated?

- The exact formula is complicated and changes over time... but the general components are
  - 1. Calculate AIME (Average Indexed Monthly Earnings)
  - 2. Calculate the Primary Insurance Amount (PIA) using current formula and AIME
  - 3. Calculate actual monthly benefits depending on age of retirement.
    - You receive less than the AIME if you retire early, and more if you retire later
    - The normal retirement age (NRA) is the age at which retirement benefits (before rounding) are equal to the "primary insurance amount."

See details here:

<https://www.ssa.gov/oact/cola/Benefits.html>

## Normal Retirement Age

### Year of birth

### Age

1937 and prior	65
1938	65 and 2 months
1939	65 and 4 months
1940	65 and 6 months
1941	65 and 8 months
1942	65 and 10 months
1943-54	66
1955	66 and 2 months
1956	66 and 4 months
1957	66 and 6 months
1958	66 and 8 months
1959	66 and 10 months
1960 and later	67

### Notes:

1. Persons born on January 1 of any year should refer to the normal retirement age for the previous year.
2. For the purpose of determining benefit reductions for early retirement, widows and widowers whose entitlement is based on having attained age 60 should add 2 years to the year of birth shown in the table.



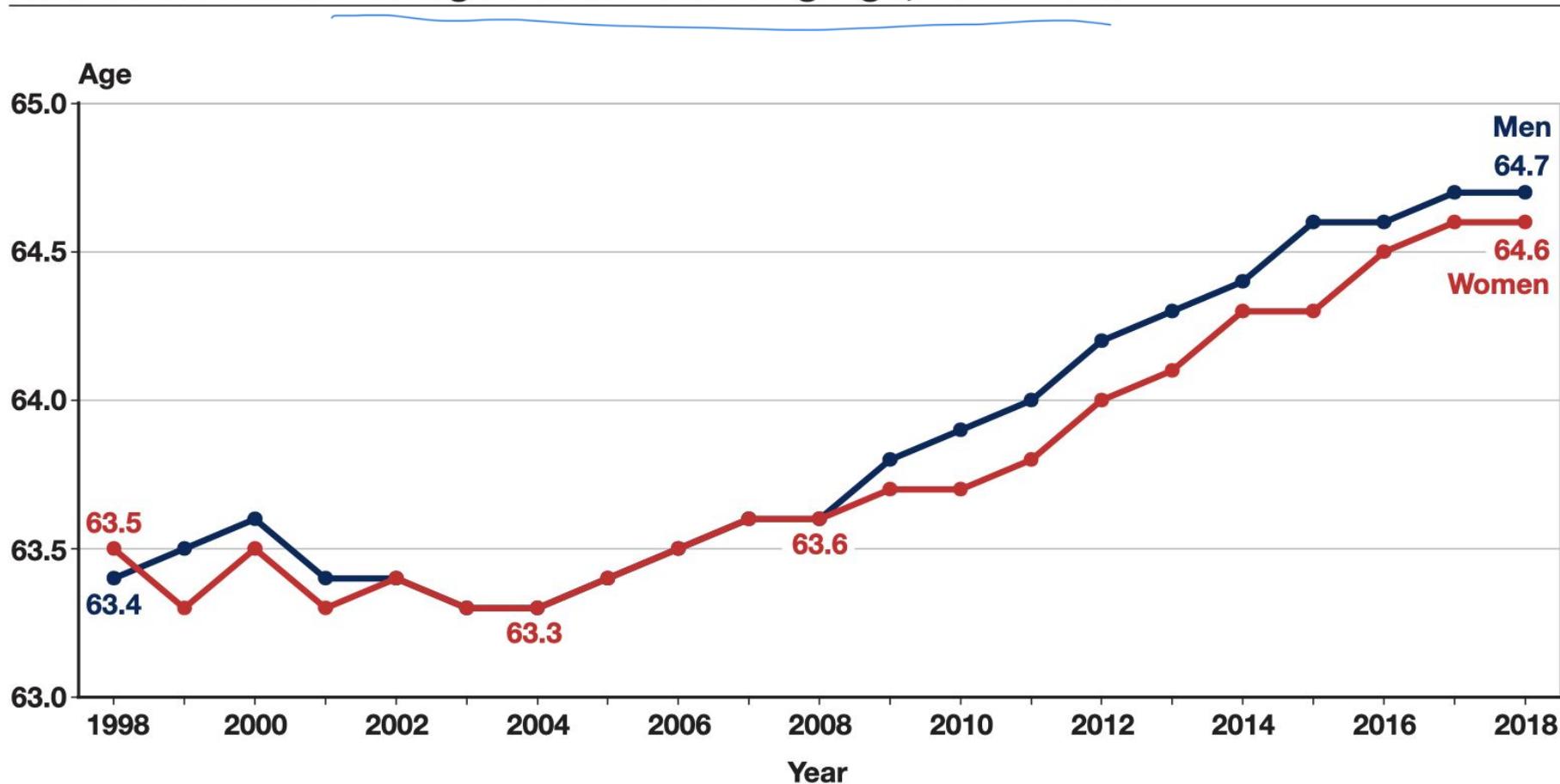
## Early or Delayed Retirement

- In the case of early retirement, a benefit is reduced 5/9 of one percent for each month before normal retirement age, up to 36 months. If the number of months exceeds 36, then the benefit is further reduced 5/12 of one percent per month.
- Annual delayed retirement credit percentage varies from 3% to 8% by year of birth. No credit is given after age 69.

Benefit, as a percentage of Primary Insurance Amount (PIA), payable at ages 62-67 and age 70

Year of birth	Normal Retirement Age (NRA)	Credit for each year of delayed retirement after NRA (percent)	Benefit, as a percentage of PIA, beginning at age--						
			62	63	64	65	66	67	70
1924	65	3	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	103	106	115
1925-26	65	3 $\frac{1}{2}$	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	103 $\frac{1}{2}$	107	117 $\frac{1}{2}$
1927-28	65	4	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	104	108	120
1929-30	65	4 $\frac{1}{2}$	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	104 $\frac{1}{2}$	109	122 $\frac{1}{2}$
1931-32	65	5	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	105	110	125
1933-34	65	5 $\frac{1}{2}$	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	105 $\frac{1}{2}$	111	127 $\frac{1}{2}$
1935-36	65	6	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	106	112	130
1937	65	6 $\frac{1}{2}$	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	106 $\frac{1}{2}$	113	132 $\frac{1}{2}$
1938	65, 2 mo.	6 $\frac{1}{2}$	79 $\frac{1}{6}$	85 $\frac{5}{9}$	92 $\frac{2}{9}$	98 $\frac{8}{9}$	105 $\frac{5}{12}$	111 $\frac{11}{12}$	131 $\frac{5}{12}$
1939	65, 4 mo.	7	78 $\frac{1}{3}$	84 $\frac{4}{9}$	91 $\frac{1}{9}$	97 $\frac{7}{9}$	104 $\frac{2}{3}$	111 $\frac{2}{3}$	132 $\frac{2}{3}$
1940	65, 6 mo.	7	77 $\frac{1}{2}$	83 $\frac{1}{3}$	90	96 $\frac{2}{3}$	103 $\frac{1}{2}$	110 $\frac{1}{2}$	131 $\frac{1}{2}$
1941	65, 8 mo.	7 $\frac{1}{2}$	76 $\frac{2}{3}$	82 $\frac{2}{9}$	88 $\frac{8}{9}$	95 $\frac{5}{9}$	102 $\frac{1}{2}$	110	132 $\frac{1}{2}$
1942	65, 10 mo.	7 $\frac{1}{2}$	75 $\frac{5}{6}$	81 $\frac{1}{9}$	87 $\frac{7}{9}$	94 $\frac{4}{9}$	101 $\frac{1}{4}$	108 $\frac{3}{4}$	131 $\frac{1}{4}$
1943-54	66	8	75	80	86 $\frac{2}{3}$	93 $\frac{1}{3}$	100	108	132
1955	66, 2 mo.	8	74 $\frac{1}{6}$	79 $\frac{1}{6}$	85 $\frac{5}{9}$	92 $\frac{2}{9}$	98 $\frac{8}{9}$	106 $\frac{2}{3}$	130 $\frac{2}{3}$
1956	66, 4 mo.	8	73 $\frac{1}{3}$	78 $\frac{1}{3}$	84 $\frac{4}{9}$	91 $\frac{1}{9}$	97 $\frac{7}{9}$	105 $\frac{1}{3}$	129 $\frac{1}{3}$
1957	66, 6 mo.	8	72 $\frac{1}{2}$	77 $\frac{1}{2}$	83 $\frac{1}{3}$	90	96 $\frac{2}{3}$	104	128
1958	66, 8 mo.	8	71 $\frac{2}{3}$	76 $\frac{2}{3}$	82 $\frac{2}{9}$	88 $\frac{8}{9}$	95 $\frac{5}{9}$	102 $\frac{2}{3}$	126 $\frac{2}{3}$

## Retired Workers: Average Benefit Claiming Age, 1998–2018



SOURCE: Social Security Administration, *Annual Statistical Supplement to the Social Security Bulletin*, 2019, Table 6.B5.1.

NOTE: Data include conversions from disability benefits to retired worker benefits upon attainment of FRA.

[Show as table](#)

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# Changes in SSI Generosity Over Time

- As we can see, there are various ways that the government can make SSI benefits “less generous” over time
  - Change PIA formula or brackets
  - Change NRA
  - Change early retirement penalties or late retirement bonuses
- It’s risky to “count” on a certain level of SSI in the future, since these parameters change constantly

# Private Pensions

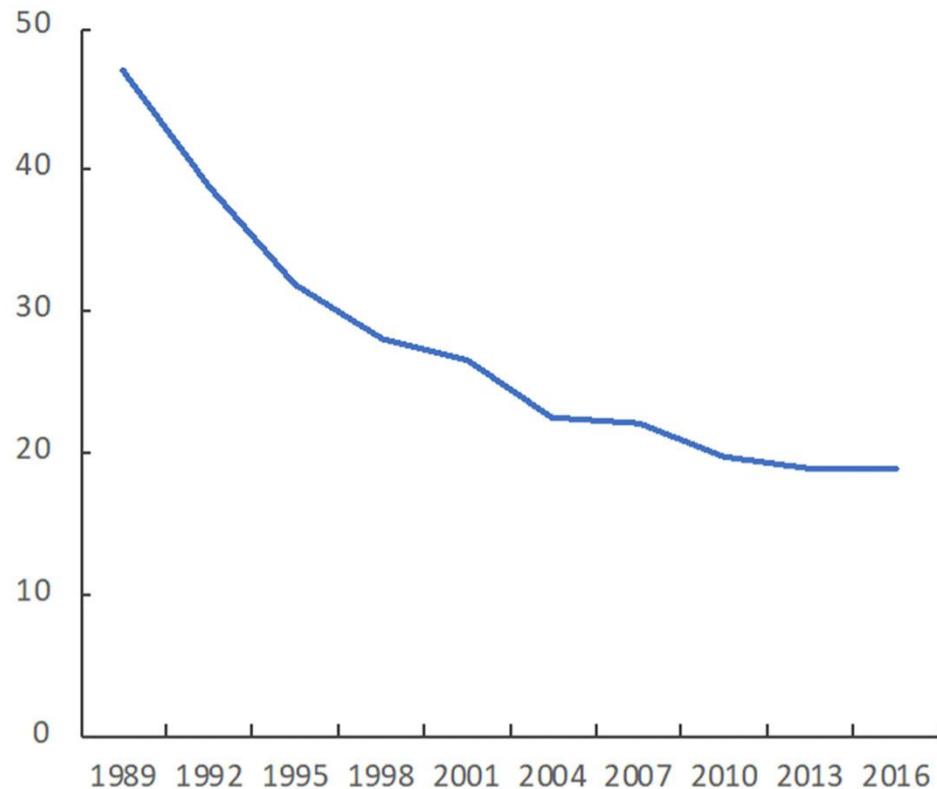


# What About Private Pensions?

- Private pensions come in two varieties
  - **Defined benefit (DB)** pensions, like Social Security, pay benefits in the form of income to retirees.
  - **Defined contribution (DC)** pensions involve the accumulation of assets and are a vehicle for the savings we are discussing. They have tax advantages and may involve employer contributions. We will discuss them in the next lecture.
- If you have a DB pension, you need to do less saving yourself.
  - But there has been a steep decline in the share of employers offering these pensions.
  - They remain common only for workers employed by state and local governments (including teachers).

## Young Households with Defined-Benefit Pensions

Percent

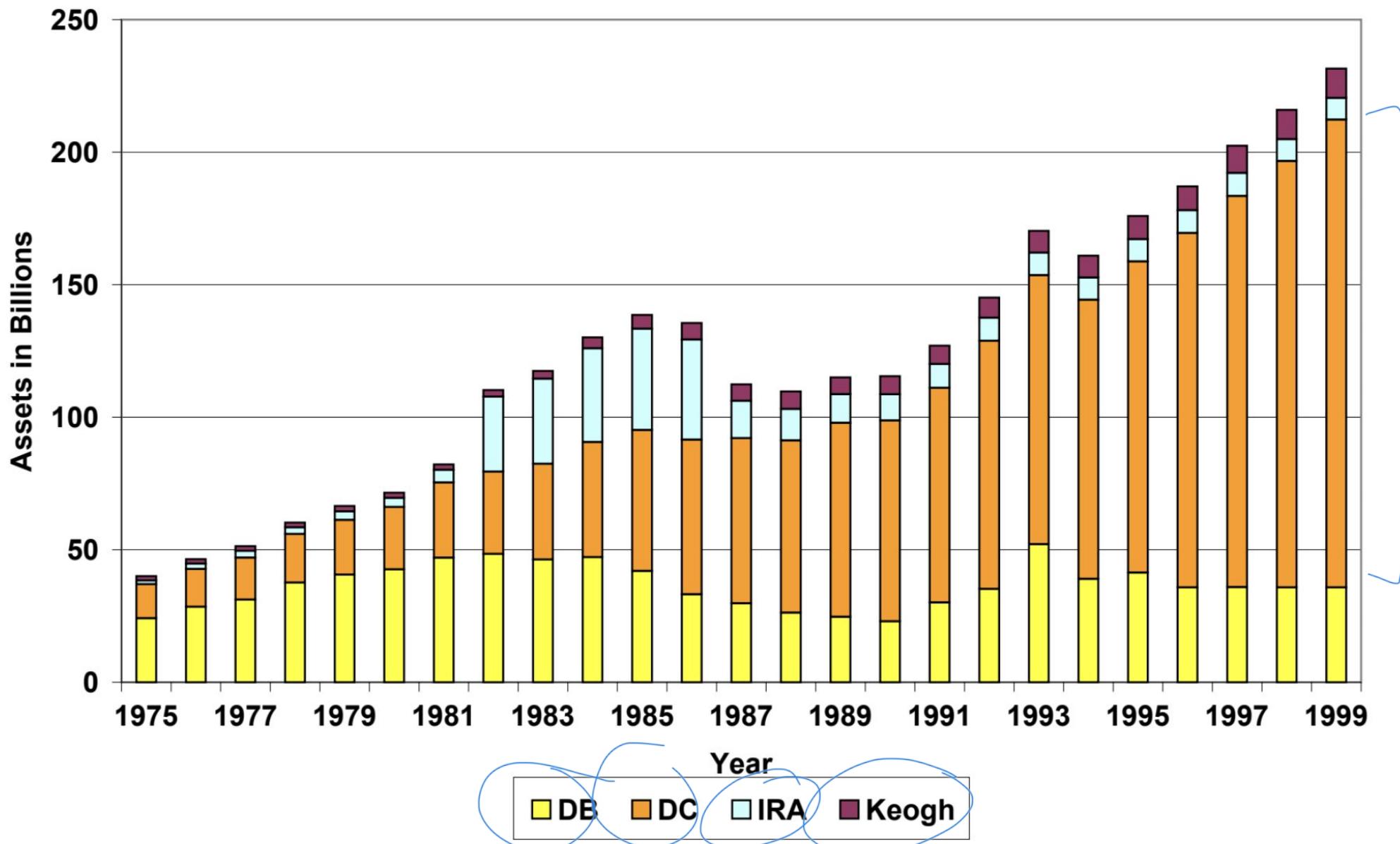


Only 19% of households headed by 35-44 year olds have a DB pension and the numbers for your cohort are likely to be even lower.

Data from the [Survey of Consumer Finances](#)

Source. Young households are those with heads 35-44.

## Figure 5a. Private Pension Contributions



# The Life-Cycle Model with Taxes and Social Security

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## Back to the Life-Cycle Model

- Let's take account of what the government does:
  - ▶ Tax working people, leaving them with disposable income  
$$Y_D = Y - T.$$
  - ▶ Pay Social Security benefits  $B$  to retired people.
- We'll continue to ignore many other issues (positive interest rate, uncertainty about length of life, etc.)
- The basic equation becomes

$$(C_L \times L) + (C_R \times R) = (Y_D \times L) + (B \times R).$$



## Taxes in Our Two Examples

- Realistic tax numbers for a \$100,000 earner in Massachusetts are:
  - ▶ Federal income tax \$15,416
  - ▶ State income tax \$4,876
  - ▶ Social Security and Medicare (federal payroll or FICA tax) \$7,650
  - ▶ Total \$27,942 or average tax rate of 28%.
  - ▶  $Y_D = \$100,000 - \$27,942 = \$72,058$ .
- Realistic tax numbers for a \$50,000 earner in Massachusetts are:
  - ▶ Federal income tax \$4,373
  - ▶ State income tax \$2,326
  - ▶ Social Security and Medicare (federal payroll or FICA tax) \$3,825
  - ▶ Total \$10,524 or average tax rate of 21%.
  - ▶  $Y_D = \$50,000 - \$10,524 = \$39,476$ .



# Social Security in Our Two

- The Social Security (SS) system levies taxes on the working population, and pays benefits to the retired population.
- To be eligible for benefits, you
  - ▶ Pay SS taxes for at least 40 quarters
  - ▶ Reach retirement age
- Once you reach eligibility, you receive  $\$B$  per year in real terms for the rest of your life.
  - ▶  $B$  depends on your earning history.
  - ▶ For a \$100,000 earner, we can assume  $B = 22.5\% \times Y = \$22,500$ .
  - ▶ For a \$50,000 earner, we can assume  $B = 30\% \times Y = \$15,000$ .
  - ▶ Note how  $B/Y$ , the SS **replacement rate**, falls with  $Y$ .



## The Two Examples with Taxes and SS

$$(C_L \times L) + (0.9 \times C_L \times R) = (Y_D \times L) + (B \times R).$$

- We are assuming  $L = 45$  and  $R = 20$ .
- For a \$100,000 earner,  $Y_D = \$72,058$  and  $B = \$22,500$ .
- For a \$50,000 earner,  $Y_D = \$39,476$  and  $B = \$15,000$ .
- Questions, for each of these two people:
  - ▶ How much is consumed each year during working life?
  - ▶ How much is saved each year during working life?
  - ▶ What is the savings rate out of pre-tax income?
  - ▶ At retirement, how many years of pre-tax income have been saved?

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## Saving with Taxes and Social Security

- These numbers are more realistic.
- You need a savings rate out of total income between 10% and 15%.
- You need to accumulate wealth equal to between 5 and 7 years of your income by the time you retire.
- You need a higher savings rate if
  - you are a higher earner, because of your longer life expectancy and the progressive nature of Social Security
  - you start to save later in working life because of low income in the first few years you are working.



## Things Missing from This Analysis

- This analysis leaves out many features of reality
  - Uncertain lifetime and medical expenses (can be handled with insurance).
  - Tax-favored retirement savings accounts (next lecture).
  - Positive return on saving (next lecture).
  - Saving in the form of home equity.
- Nonetheless, a careful analysis by Skinner (*Journal of Economic Perspectives* 2007) delivers comparable results.

Do People Save  
Enough?

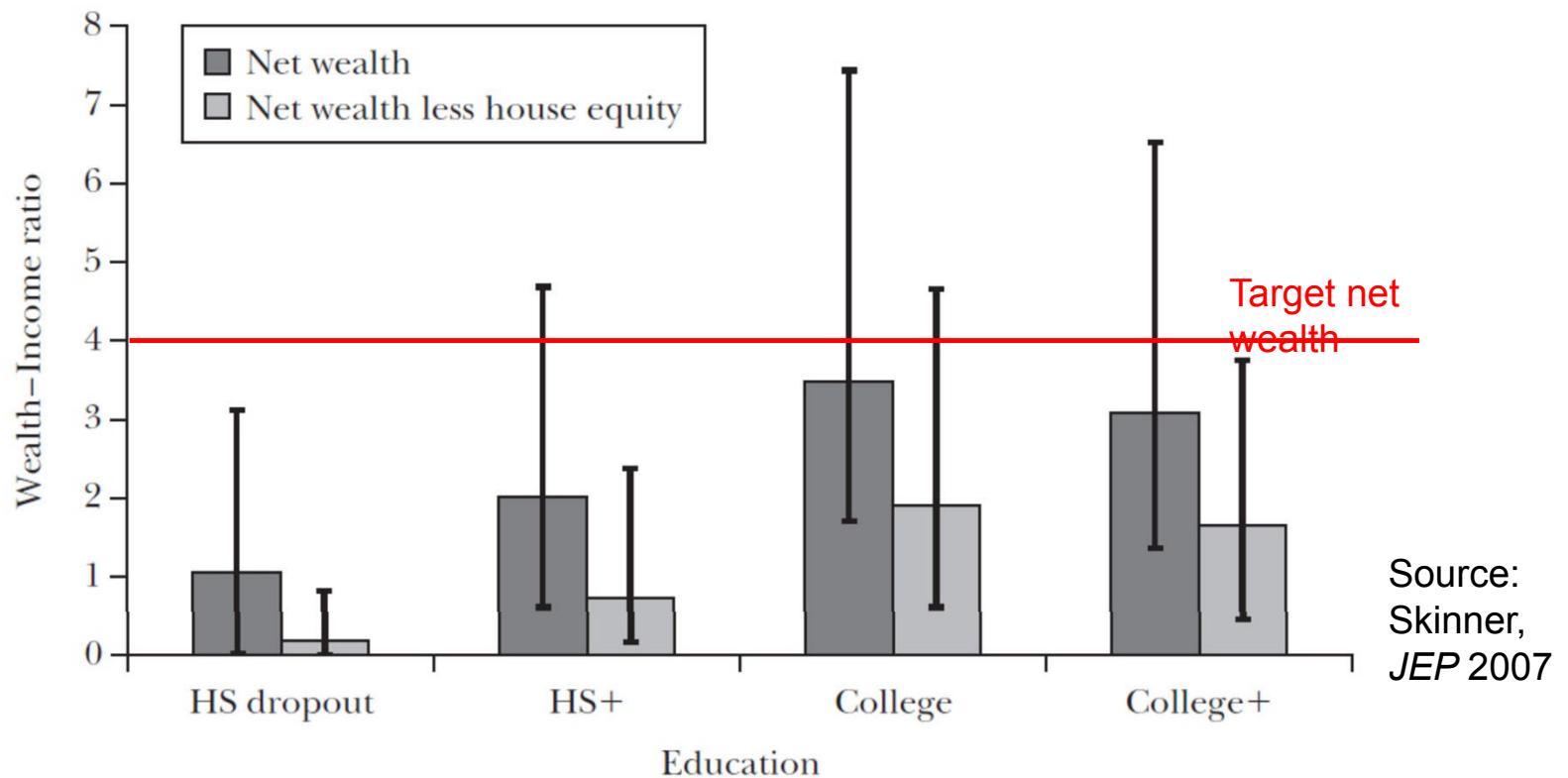


## Do People Save Enough?

- Some do, most do not.
- Our simple model implies that 15 years before retirement, you need wealth of about 4 years of income.
  - $6 \text{ at retirement} - (15 \times 13\% \text{ saving rate}) = \text{about 4}$ .
  - Skinner (2007) gets numbers in the same ballpark.
- US data from 2004 show that 4 years is well above the median level of wealth for people in their early 50's.
  - All education levels have a savings shortfall, but it is worst among people without a college degree.

*Figure 2*

## Wealth–Income Ratios by Education Group: Early Baby Boomers (51–55) in 2004



Source: Calculations by Annamaria Lusardi based on the 2004 Health and Retirement Study (HRS) sample as defined in Lusardi and Mitchell (2006).

Notes: The bars show median wealth-to-income ratio by income category, and the brackets denote the interquartile range (25<sup>th</sup> to 75<sup>th</sup> percentile distribution). N = 2631. HS is “high school.”

# Spending from Home Equity



## The Role of Home Equity

- The previous slide shows that home equity is a very important component of wealth for most middle-aged people.
- This results from accumulating home equity as you pay off your mortgage, and not borrowing against it with home equity loans.
- Home equity contributes to living costs directly by removing the need to pay rent.
- However, during retirement you need to run down this component of wealth in order to spend from it.
  - Recall that the life-cycle plan we have developed involves no bequest, that is, you plan to die with no wealth.
  - Leaving a bequest, e.g. a house, would require more saving and wealth.



## How to Spend from Home Equity

- The obvious way to spend from home equity is to sell your home and ultimately move to rental accommodation such as an assisted living facility.
  - Possibly with downsizing to a smaller owned home along the way.
- However, some older people are determined to continue living in their family home.
- In this case, an alternative strategy is a **reverse mortgage**.
  - A reverse mortgage gives you spending money either in a lump sum or a stream of payments, in exchange for home equity.
  - You pay nothing until you sell the home or die while still living there.



## Pros and Cons of Reverse Mortgages

- Pro: A reverse mortgage delivers cash to pay for consumption while keeping you in your house.
- Pro: It is a non-recourse mortgage so if the house is not worth enough to cover the mortgage when you sell it, the lender takes the loss.
- Con: The interest rate can be high.
  - Lenders have high marketing costs because they have to explain a complicated financial instrument to suspicious seniors.
  - Lenders also fear house price declines while homeowners are often more optimistic about their future home value.

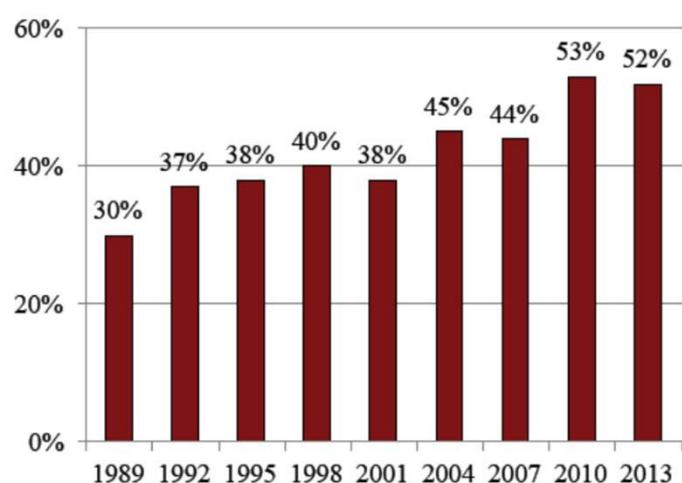
# Do People Understand Their Retirement Financial Needs?



# What Do People Understand?

- Given the inadequate retirement saving that many people have, it's natural to ask whether people understand the problem.
- Alicia Munnell and coauthors from the Boston College Center for Retirement Research (CRR) look at
  - The National Retirement Risk Index (a measure of inadequate savings)
  - Self-assessed household retirement risk.
- Both are calculated in the Federal Reserve's Survey of Consumer Finances.
  - These two measures do not line up particularly closely!

FIGURE 1. THE NATIONAL RETIREMENT RISK INDEX, 1989-2013



Source: Munnell, Hou, and Webb (2014).

TABLE 4. HOUSEHOLDS “AT RISK” AND “NOT AT RISK,” NRRI AND INDIVIDUAL PERCEPTIONS, 2013

Household response	NRRI	
	At risk	Not at risk
At risk	33% (Quadrant I)	24% (Quadrant II)
Not at risk	19% (Quadrant III)	24% (Quadrant IV)

Source: Authors' calculations and SCF 2013.

Source: Alicia Munnell, Wenliang Hou, and Geoffrey T. Sanzenbacher, 2017, “Do Households Have a Good Sense of their Retirement Preparedness?”, Center for Retirement Research brief, [http://crr.bc.edu/wp-content/uploads/2017/02/IB\\_17-4.pdf](http://crr.bc.edu/wp-content/uploads/2017/02/IB_17-4.pdf)



## What Are People Missing?

- People don't realize they can use downsizing or a reverse mortgage to tap home equity if they need to ("too worried").
- People with DB pensions may not realize how valuable they are ("too worried").
- People may not understand all the progressive features of the Social Security system ("too worried").
  - For example, they may not know that after the death of a higher-earning spouse, the survivor gets the higher-earning spouse's SS benefits rather their own benefits.
- People may exaggerate the ability of financial assets to support many years of retirement spending ("not worried enough").