

# RETIREMENT SAVINGS ADEQUACY IN U.S. DEFINED CONTRIBUTION PLANS

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# MOTIVATION & RESEARCH QUESTION

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**We evaluate retirement savings adequacy in a large panel of U.S. workers with a 401(k) account.**

- Defined contribution (DC) schemes are gradually replacing traditional defined benefit pensions in several countries.
- DC plans are fully-funded and allow individuals to choose their savings path and asset allocation.
- However,
  - no risk-sharing features
  - Low financial literacy (Lusardi and Mitchell, 2014; Clark Lusardi and Mitchell, 2015)
  - Time inconsistent preferences (Harris and Laibson, 2001)
  - Or other behavioral biases (Madrian and Shea, 2011)might lead some workers to be financially vulnerable at retirement

# MOTIVATION & RESEARCH QUESTION

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- The National Retirement Risk Index (CRR, Munnell, Webb and Delorme (2006)): large fraction of the U.S. population is not saving enough for retirement.
- Most previous studies (Engen, Gale, and Uccello (2005), Scholz, Seshadri, and Khitatrakun (2006) and Hurd and Rohwedder (2012)) find that the vast majority of U.S. workers is saving adequately for retirement.
- We revisit this question using data on a panel 350,859 U.S. workers enrolled in 401(k) plans:
  - We simulate each worker's income and wealth accumulation over time
  - To estimate the evolution of workers' savings and investment decisions, we use *their actual past choices and characteristics, instead of a structural life-cycle model.*

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Advantages:

- To address the question of whether workers are saving for retirement optimally, we need a framework in which they can (potentially) be making mistakes.
  - Capturing features such as time-inconsistency or inertia, which can vary from worker to worker, would make a model challenging, particularly if we added features for which there is no modeling consensus, like financial literacy.
  - We want to match as accurately as possible the behavior of each worker, as opposed to the average behavior. This would require estimating/calibrating a separate version of the model for each worker in our sample.
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# MAIN FINDINGS

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- Based on their current account balances, income, saving, and investment behavior, close to three-quarters of the workers in our sample are not saving enough for retirement.
- The dispersion is related to the generosity of employer contributions,
- account balances, but also worker saving behavior, which can potentially be changed going forward.
- The shortfall worsens if we introduce a bequest motive, decrease the
- fraction of housing equity available, or consider lower expected returns going forward.
- Only if we assume that individuals have both low risk aversion and very high discount rates do we conclude that the median agent is saving optimally.
- Given the magnitude of the problem, only major policy changes

# MAIN FINDINGS

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- Given the magnitude of the problem, only major policy changes would fully address it, but a reasonable age-dependent minimum contribution rate could have a sizable impact, particularly for younger generations which have many years ahead of them to benefit from such a policy.
- An alternative we evaluate is to make age 59 ½ withdrawals significantly more difficult

# MAIN FEATURES OF OUR METHODOLOGY

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## 3 Steps:

1. Using simulations, and assuming a retirement age of 65, for each worker we compute the joint expected distribution of:
  - Total wealth accumulation at retirement ( $W_{iT}^{65}$ )
  - Social security income ( $Y_{iR}$ )
2. For every combination of  $W_{iT}^{65}$  and  $Y_{iR}$ , we compute the optimal level consumption at retirement,  $\{C_{iR}\}_{R=66}^{100}$ .
3. For each individual, we compare  $C_{i66}$  computed in step 2 with imputed current consumption after adjusting for the fact that after retirement some expenditures drop and individuals might reallocate more of their time toward home production.

# OUR DATA

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- Our primary dataset comes from Edelman Financial Engines and includes information on age, current account balance, contribution rate, salary, portfolio allocation, tenure at the company, and zip code for approximately 3.8 million individuals.
  - We combine this with other information on company and pension plan characteristics from Compustat, CRSP, Capital IQ
  - We restrict the sample to workers aged between 20 and 65 who are enrolled in defined contribution pension plans at a company that does not offer DB plans, have valid tenure information and at least 1 year of tenure at the firm and work full time. This leaves us with 350,859 workers.
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# STEP 1: SIMULATIONS

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We simulate:

- Total resources available at retirement: DC wealth, social security income, non-DC financial wealth, net housing equity.

using the following inputs

- Worker-specific portfolio shares and contribution rates, asset allocations, employer contributions, fees.
  - Leakages: job switch or unemployment spell, Hardship, Reaching age 59 1/2.
  - ...
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# STEP 1: SIMULATIONS

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## Total retirement wealth at retirement:

$$W_{i65}^T = W_{i65} + W_{i65}^{other} + W_{i65}^{FW} + W_{i65}^{HW}$$

$W_{i65}$ : wealth in the current and future retirement accounts

Obtained by *simulating forward* individual behavior, returns and income.

$W_{i65}^{other}$ : wealth in retirement accounts from previous jobs

Obtained by *simulating backward* individual behavior, returns and income.

$W_{i65}^{FW}$ : wealth in non-retirement accounts

Imputed from regressions estimated on HRS data.

$W_{i65}^{HW}$ : Net housing wealth (might be available or not)

Imputed from matched local house prices (Zillow) and ownership probability and LTV regressions (HRS).

# STEP 1: SIMULATIONS

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Wealth in the current and future retirement accounts

- Starting from the last observation for each individual we simulate her income and wealth accumulation over time until age 65:

$$W_{it} = R_t W_{i,t-1} + (k_{it} + k_{it}^e) Y_{it} - \text{withdrawals}$$

- where:
  - $k_{it}$  and  $k_{it}^e$  : employee and employer (matching) contribution rates.
  - $Y_{it}$  : labor income/salary.
- The portfolio return is given by

$$R_t \equiv \left[ \alpha_{i,t-1}^S R_t^S (1 - \tau_i^S) + \alpha_{i,t-1}^B R_t^B (1 - \tau_i^B) + (1 - \alpha_{i,t-1}^S - \alpha_{i,t-1}^B) R^f \right]$$

- where:
  - $\alpha_{i,t-1}^S$  and  $\alpha_{i,t-1}^B$  : wealth shares invested in stocks and risky bonds.
  - $R_t^S$ ,  $R_t^B$  and  $R^f$  : returns on stocks, risky bonds and riskless bonds.
  - $\tau_i^S$  and  $\tau_i^B$  : fund fees for stocks and risky bonds.

# STEP 1: INPUTS

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- **Portfolio shares and employee contribution rates:**

Starting from the last observation for each agent we let them evolve over time according to the patterns as a flexible function of age and income estimated from our sample

- **Returns and Income**

Simulated from their respective (exogenous) distributions

- **Investment fees**

Computed from our data

- **Employer contribution rates:**

Computed based on the exact plan rules and the worker contribution

# STEP 1: LEAKAGES

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Withdrawals due to:

- Job switch
- Unemployment spell
- Hardship
- Reaching age 59 1/2

For each of these events we estimate, if applicable,

- The probability of the event
- The probability of withdrawing from the DC account, conditional on the event.
- The percentage withdrawn from the DC account, conditional on a withdrawal taking place.

as a function of worker age and income, and aggregate data.

We then check that by aggregating our data we match the results from Vanguard and Munnell and Webb (2006).



# STEP 1: SOCIAL SECURITY AND TAXES

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- For each simulation, we project social security income using:
  - The actual realizations of the income process in each simulation.
  - The current social security formula from the SSA.
- We do not explicitly estimate/model transfers from Medicaid or Medicare, but rather we take them into account in our model of the retirement phase total health expenditures.
- We also account for both state and federal taxes.

## STEP 2: RETIREMENT OPTIMAL CONSUMPTION

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- We compute optimal consumption during retirement from an intertemporal consumption and savings model with

- Power utility preferences

$$U = E \sum_{t=R}^{100} \beta^{t-R} \left( \prod_{j=0}^{t-1} p_j \right) \frac{(C_{it})^{1-\gamma}}{1-\gamma}$$

- Longevity risk: the  $p_j$  are stochastic
  - Uncertain out-of-pocket medical expenditures,  $M_{it}$  (thus taking into account for medicaid and medicare)
  - Social security income,  $\bar{Y}$ .
  - Investment risk,  $R_{t+1}$  (fixed portfolio allocation)
- The budget constraint is given by

$$W_{i,t+1}^T = R_{t+1} W_{it}^T - C_{it} - M_{it} + \bar{Y}$$

- The levels of social security income and initial wealth are both determined by the previous simulations.
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## STEP 2: LONGEVITY RISK

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- We capture longevity risk following Lee and Carter (1992) who model death rates for age  $t$  and calendar time  $x$  ( $d_{t,x} = 1 - p_{t,x}$ ) as:

$$\ln(d_{t,x}) = a_t + b_t \times \phi_x$$

- The  $a_t$  coefficients capture the average shape of  $\ln(d_{t,x})$  over the life-cycle,
  - The  $b_t$  coefficients reflect how mortality rates at different ages respond to mortality shocks over time,  $\phi_x$ .
- Finally, the random variable  $\phi_x$  is given by:

$$\phi_x = \mu^\phi + \phi_{x-1} + \varepsilon_x^\phi$$

where  $\varepsilon_x^\phi$  is normally distributed.

- We take the values for  $a_t$ ,  $b_t$ ,  $\mu^\phi$  and  $\sigma^\phi$  from Cocco and Gomes (2012).

## STEP 2: MEDICAL EXPENDITURES

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- The process for out-of-pocket medical expenditures is given by:

$$\frac{M_{it}}{Y_R} = f^M(t) + V_{it}$$

where  $f^M(t)$  is a third order polynomial in age, and  $V_{it}$  follows:

$$V_{it} = \rho V_{it} + \varepsilon_{it}, V_{it} \sim N(0, \sigma_V^2)$$

- We estimate this process using HRS data.
  - By measuring out-of-pocket medical expenditures we are also incorporating into our analysis the social insurance provided by Medicare and Medicaid.
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# EVALUATING RETIREMENT SAVINGS ADEQUACY

Consumption changes smoothly between pre and post retirement:

$$U'(C_{i,current\_age}) = E[U'(C_{i,retirement\_age})]$$

hence, a worker is optimally saving for retirement if she expects to be able to keep her current standard-of-living as she retires.

Consumption  $\sim$  Expenditures

- Several expenditures tend to be concentrated in the earlier part of the life-cycle, such as those on housing, education and children-related expenses.
- As they retire, households partially substitute marketplace goods for home production, which have lower financial costs (Aguiar and Hurst (2013)).

*Thus, even under optimality, expenditures after retirement should be lower than those before retirement. We apply a 80% ratio.*

# EVALUATING RETIREMENT SAVINGS ADEQUACY

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Certainty equivalent ratio (CEQR), assuming power utility:

$$CEQR \equiv \frac{\bar{C}_{iR}}{\varphi Expenditures_{ia0}} = \frac{\bar{C}_{iR}}{C_{ia0}},$$

where

$$E[U'(C_{iR})] = U'(\bar{C}_{iR})$$

Alternatively, Consumption retirement replacement ratio (CRRR):

$$\lambda(\omega) \equiv \frac{C_{iR}(\omega)}{\varphi Expenditures_{ia0}} = \frac{C_{iR}(\omega)}{C_{ia0}}, \omega = 1, \dots, \Omega$$

- A risk-neutral individual will aim for a mean/median  $\lambda$  of 1. The distance from 1 measures the exact percentage shortfall expressed in consumption units.
  - A risk averse worker would aim for a CRRR greater than 1 and a CEQR of 1.
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# MAIN FINDINGS

	CRRR ( $\lambda$ )					CEQR	$W^T_{65}$				
	10%	20%	30%	40%	50%		10%	20%	30%	40%	50%
10th Percentile	0.54	0.61	0.68	0.73	0.78	0.68	117	132	148	164	182
25th Percentile	0.6	0.69	0.76	0.84	0.91	0.76	152	180	208	238	270
50th Percentile	0.69	0.8	0.9	1	1.11	0.86	234	287	339	394	456
75th Percentile	0.8	0.94	1.06	1.2	1.35	0.99	419	526	625	730	850
90th Percentile	0.92	1.08	1.24	1.4	1.59	1.14	668	848	1017	1199	1412

Different realizations of the CRRR for an individual at the median of the distribution (“median worker”).

# MAIN FINDINGS

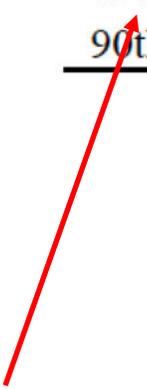
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Different realizations of the CRRR for an individual at the 10<sup>th</sup> pctile of the distribution.

# MAIN FINDINGS

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# COMPARATIVE STATICS/ROBUSTNESS

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- Desired bequest of 10% of age 65 wealth: CEQRs drop btw 3 and 12 ppts, more so for the rich.
  - Ability to use all housing equity to finance retirement: CEQRs drop more for the rich, but even for those at the 10<sup>th</sup> and 25<sup>th</sup> pctiles they drop by 10 and 13 ppts, resp.
  - Increasing allocation to equity: CRRRs go up, but still shortfalls.
  - Lower risk aversion: CRRRs increases, as investors with lower risk aversion need to save less before and during retirement because worry about longevity and medical expenditures less
  - Adequacy is better for lower risk aversion + lower discount factors, although the bottom 10<sup>th</sup> still falls short.
  - Lower average returns: affect mostly the wealthier workers.
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# THE ROLE OF DEMOGRAPHICS, PLAN, AND FIRM FEATURES

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- Retirement wealth is a convex function of cohort, and a concave function of salary at the starting point of the simulations.
- One percentage point increase in worker contribution rate increases retirement wealth at age 65 by \$30,580, while a 10 percentage point
- Higher equity allocation increases it by \$7,120 on average.
- A \$1,000 higher balance on the last observation date in the sample corresponds on average to \$1,294 higher median wealth at retirement. Higher employer contribution are associate with higher wealth at age 65
- Workers employed at companies that are older, more likely to be privately held, and that have higher investment and net income, tend to have accumulated more wealth by the time they reach retirement age.

# COUNTERFACTUAL POLICY EXPERIMENTS

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- Prohibiting age 59 1/2 withdrawals:

increases retirement consumption by at least 5%, and age-65 wealth accumulation by 15% to 20% for those at the bottom of the distribution. By contrast, setting a minimal contribution rate of either 2% to 5% has negligible effects, increasing the consumption retirement replacement ratios by 1% or less.

- Age-dependent increase in contribution rates:

generates sizeable increases in retirement consumption for all age groups, and particularly for the workers at lower end of the distribution.