US Target Date Funds: Effects on Risk-Taking and Stock Market Dynamics

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MIT and NBER

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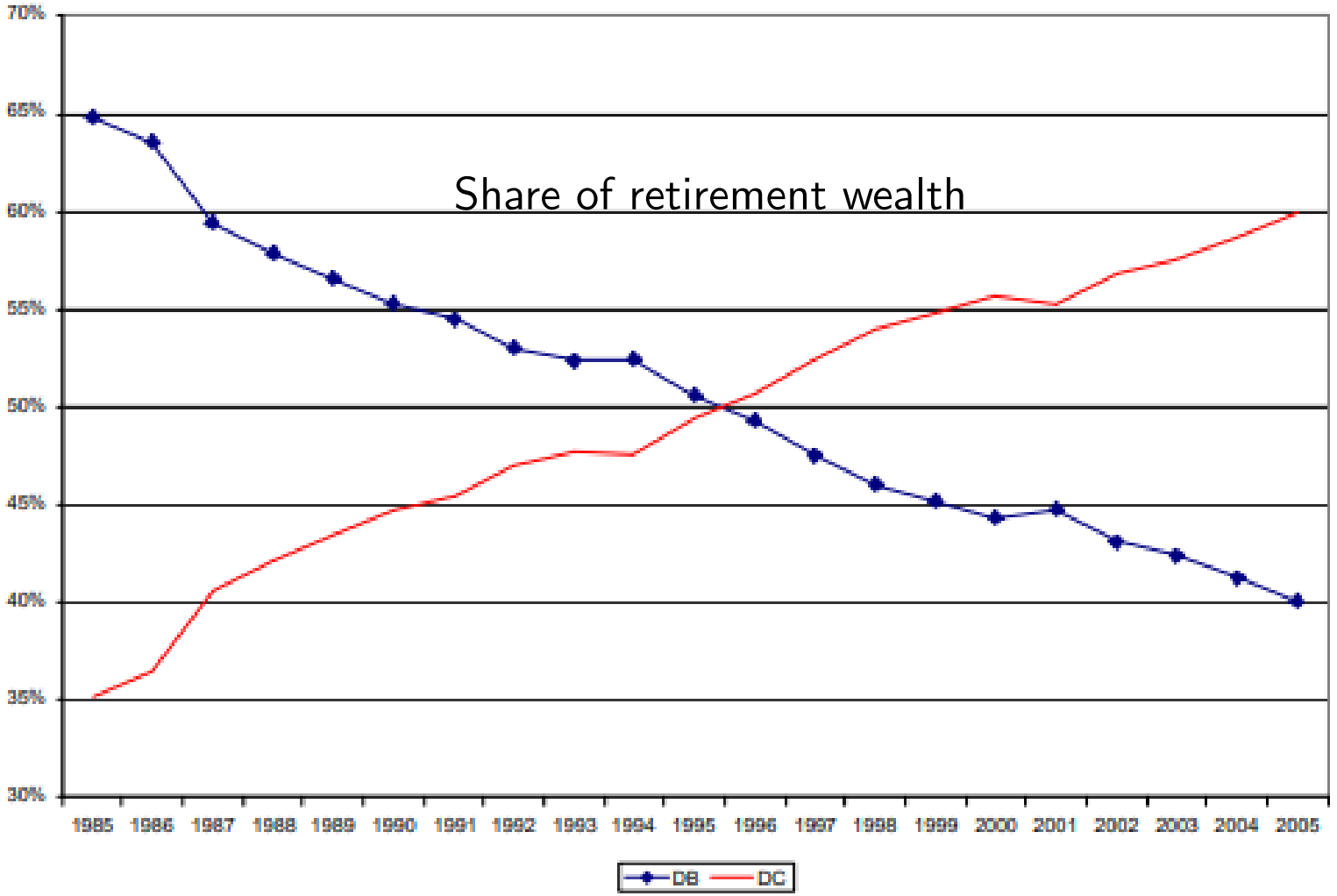
Talk based on:
Parker, J. A., A. Schoar, and Y. Sun, "Retail Financial Innovation and Stock Market Dynamics: The Case of Target Date Funds," MIT manuscript, June 2021
Cole, A., J. A. Parker, A. Schoar, and D Simester, "Household Portfolios and Retirement Saving over the Life Cycle" MIT manuscript, June 2021
Duarte, V. , J. Fonseca, A. Goodman, and J. A. Parker, "Simple Allocation Rules and Optimal PortfolioChoice Over the Lifecycle"

Background

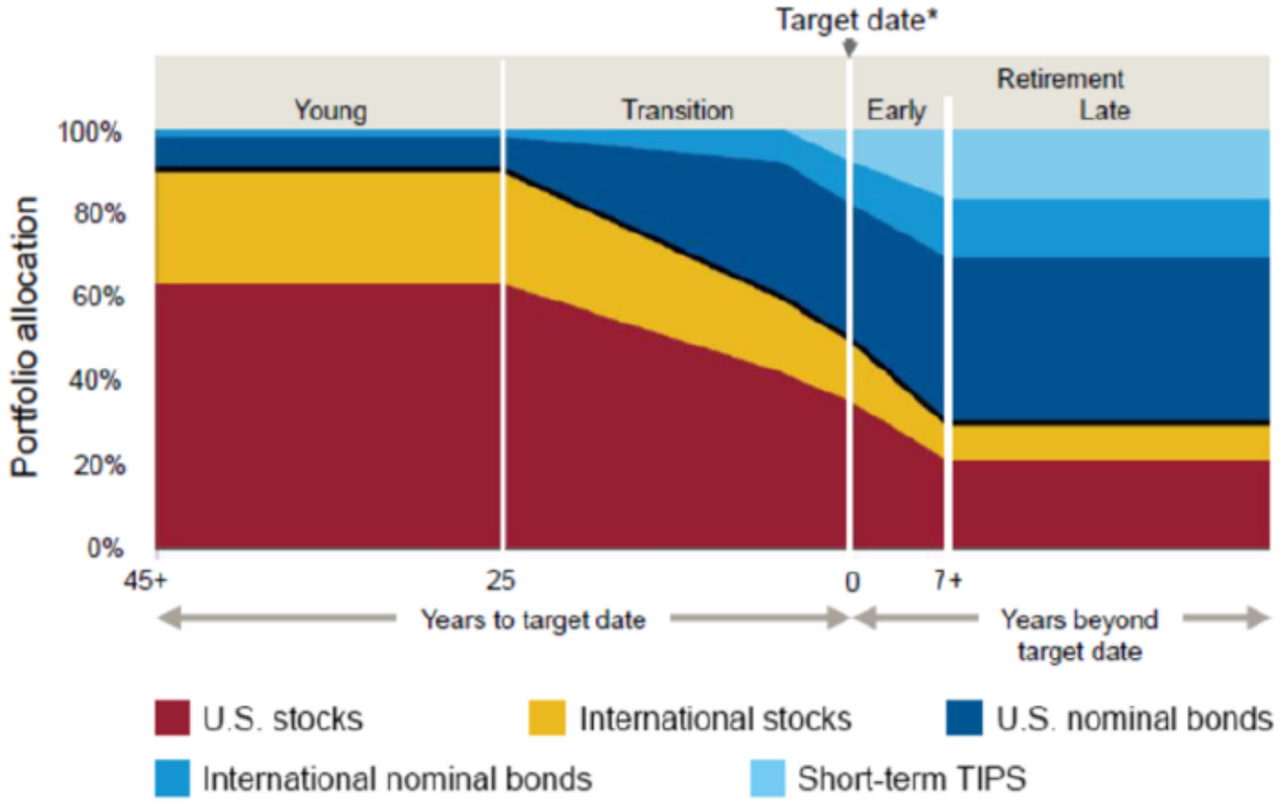
Over past 40 years in the US:

defined contribution (DB) => defined contribution (DC)

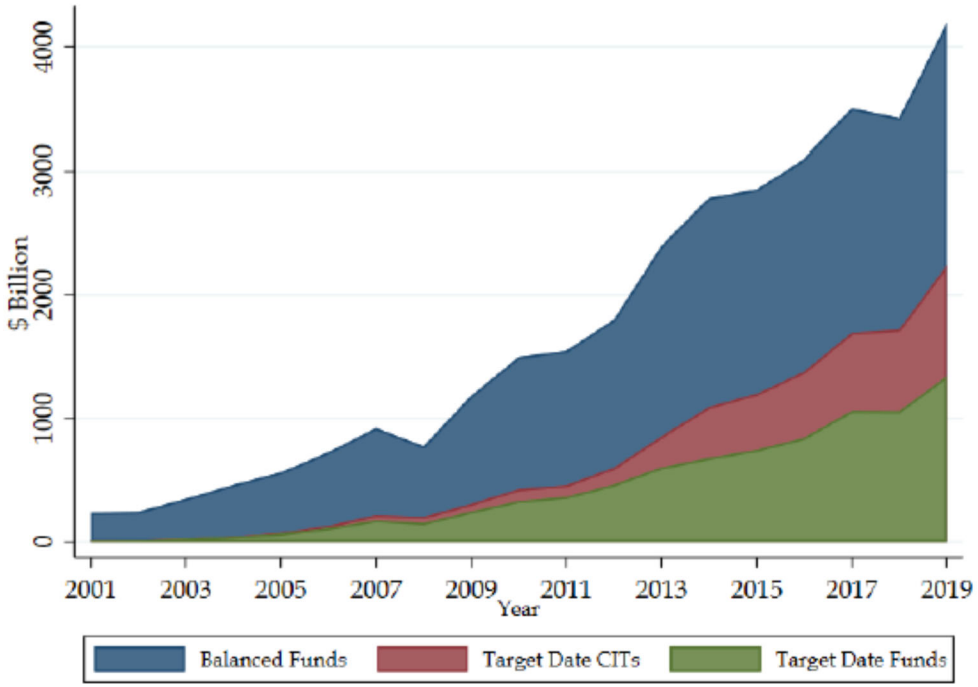


Target date Funds

- TDFs: Funds of funds (FoFs) maintaining age-appropriate equity/bond shares, consistent with life-cycle portfolio choice theory
  - Merton (1969), Campbell Viceira (2002), Cocco Gomes Maenhout (2005)
- Example: Equity share of Vanguard TDF



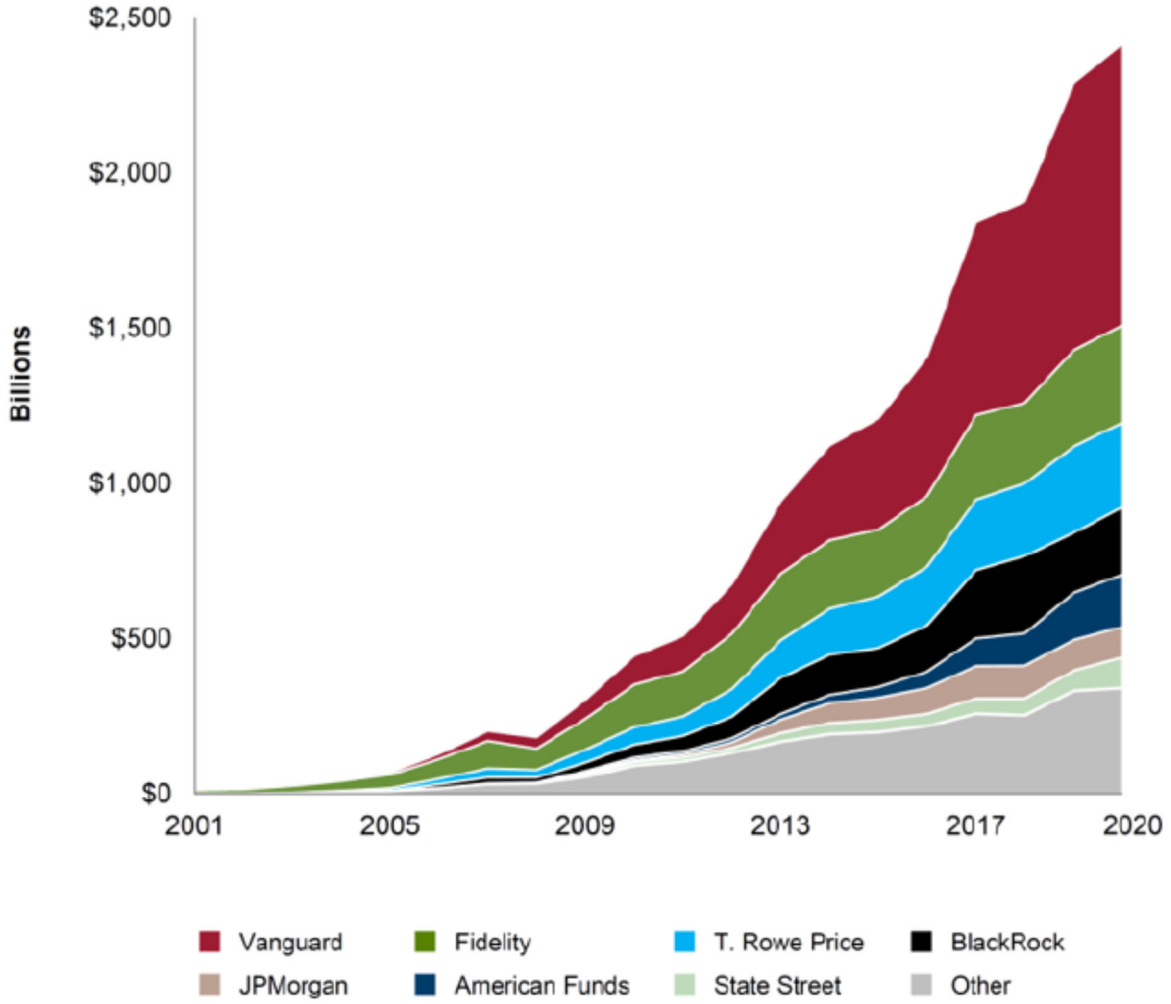
The rise of TDFs in the US



- Collective investment trusts (CITs): target date strategies with lower fees than mutual fund series
- Balanced funds: simply maintain fixed allocations in stocks and bonds
- Total assets: \$4.1 trillion in 2019, almost \$5 trillion in 2020
- TDBFs hold $\sim$ \$2 trillion, or 4%, of the \$49 trillion U.S. stock market

The rise of TDFs in the US

Figure 8.1 Growth of target-date fund industry assets and market share



The rise of TDFs in the US

- Changed regulation on default options in DC plans

Qualified Default Investment Alternatives

Under the proposed regulation, a QDIA must satisfy the following requirements:

- A QDIA may not impose financial penalties or otherwise restrict the ability of a participant or beneficiary to transfer the investment from the qualified default investment alternative to any other investment alternative available under the plan.
- A QDIA must be either managed by an investment manager, or an investment company registered under the Investment Company Act of 1940.
- A QDIA must be diversified so as to minimize the risk of large losses.
- A QDIA may not invest participant contributions directly in employer securities.
- A QDIA may be:
  - Life-cycle or targeted-retirement-date fund;
  - Balanced fund; or
  - Professionally managed account.

Outline of talk

1. TDFs have contributed to households investing a greater share of their wealth in stocks, and changed the lifecycle pattern

2. TDFs have changed stocks market dynamics

3. Are TDFs optimal? How can they can and will become more customized

I. TDFs and household portfolios

Analyze anonymized, account-level data on millions of customers holding trillions in assets at one large US financial services company

Cover the **typical** American household

- Not low income and not high wealth
- Overweight retirement as share of investable wealth
- Not randomly selected
- Missing assets at other institutions
- May be missing spouse

Sample: December 31, 2006 to December 31, 2019

Subsample

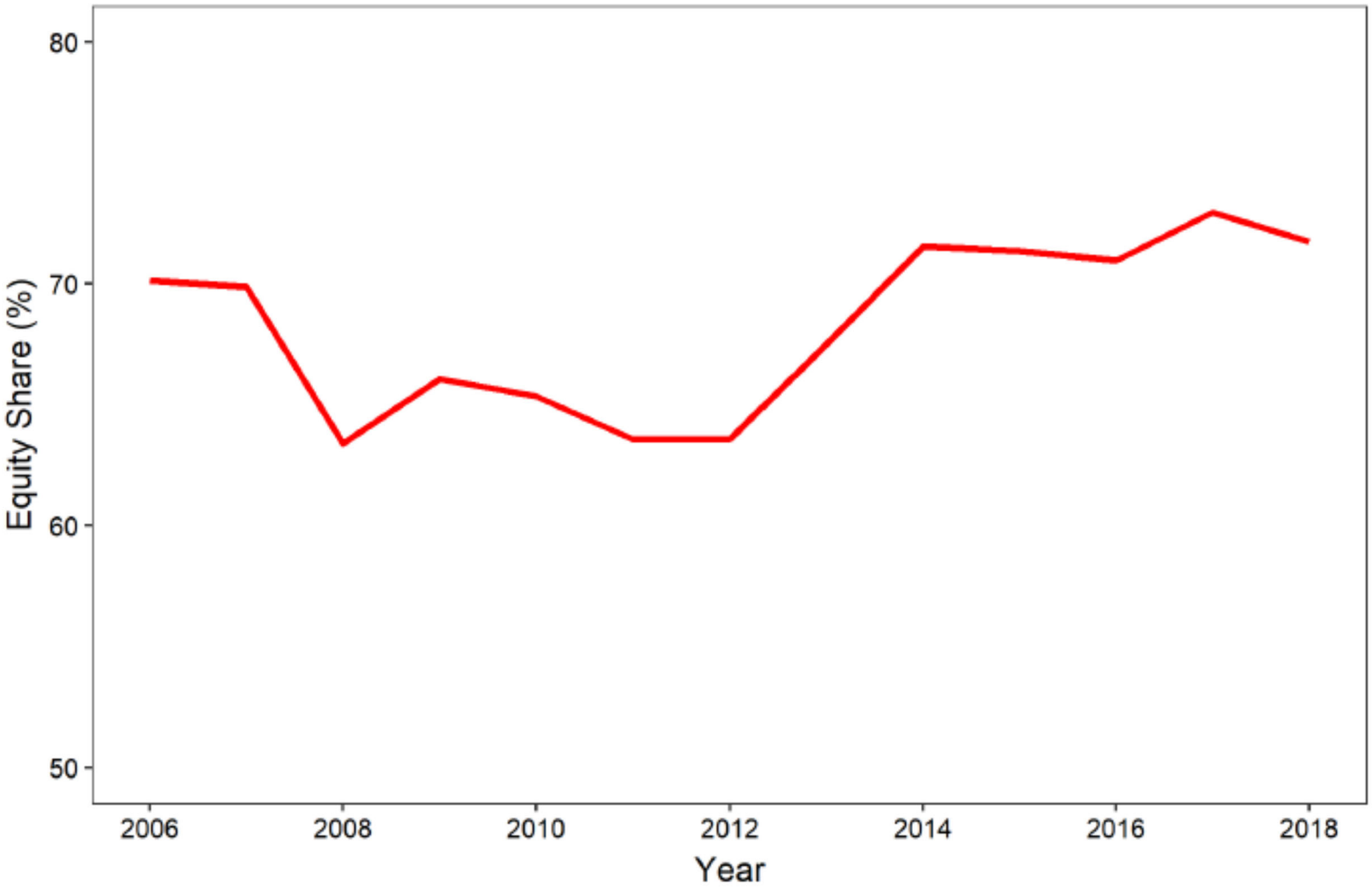
Define subsample of individuals so:

- Reflects an large/important set of US investors
- Can be constructed in our data and nationally representative to understand subsample relative to US population
  - E.g. What share of population? What share of wealth?

Retirement Investors: Individuals age 25-65, with retirement wealth between 10th and 90th age-specific percentiles (from 2016 SCF)

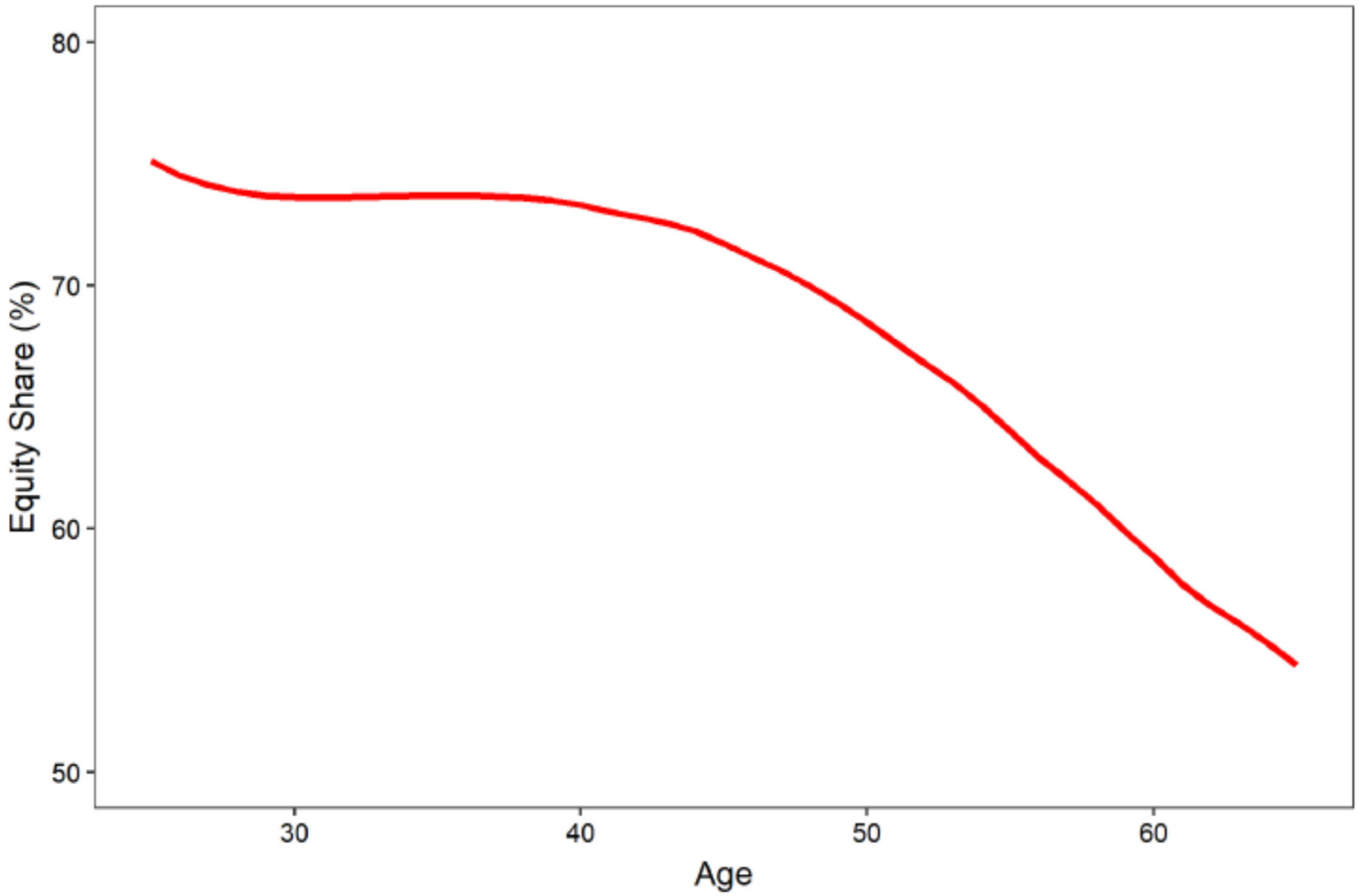
Portfolio behavior over time

Average equity share



Equity share > SCF due partly to TDFs

Equity shares decreasing in age

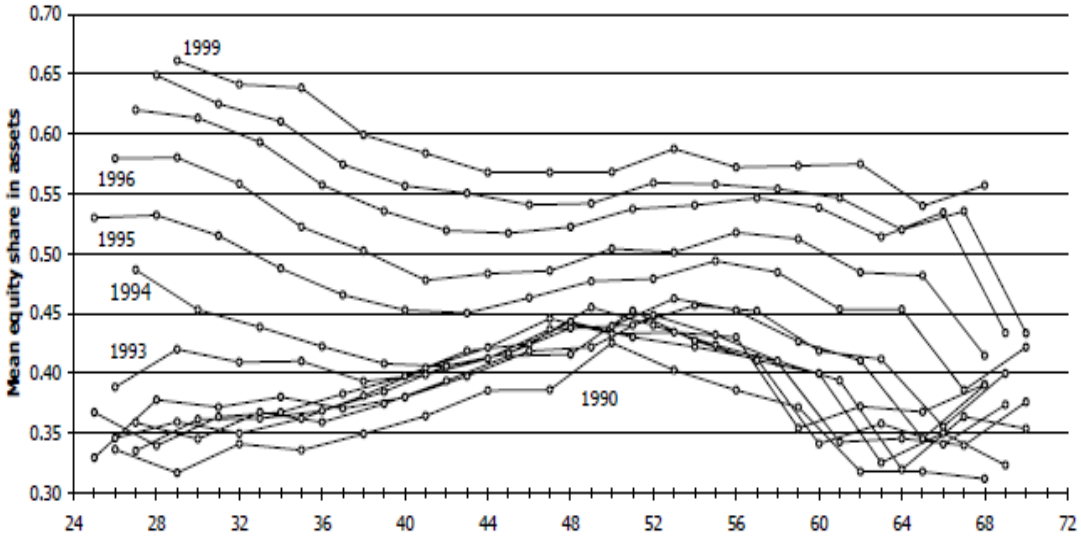


- Not driven by income: controlling for log income leads to more decline in first half of working life (Table IV)
- Declining pattern holds within each third of (initial) income distribution (Table IV)
- Similar with "price-constant" portfolios (Table A.8)

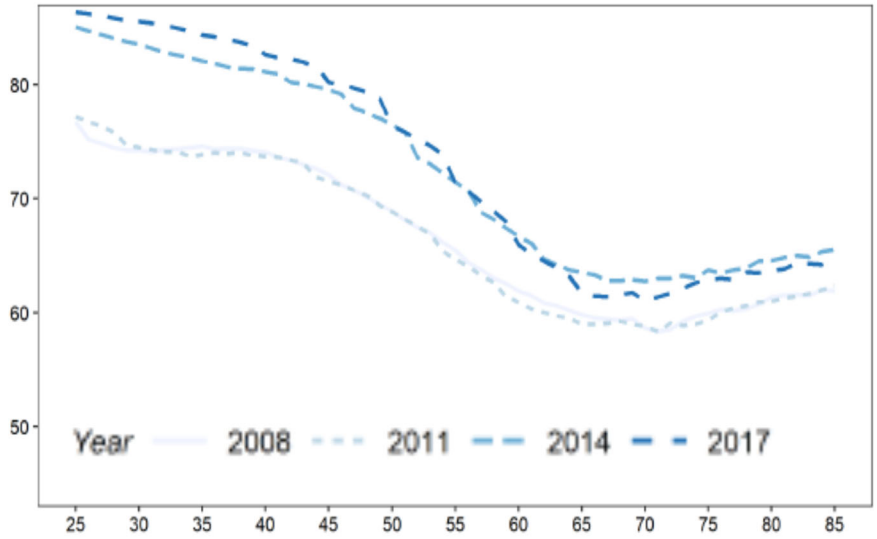
New: Now high and decreasing

Equity share across ages

Ameriks Zeldes (1990s)



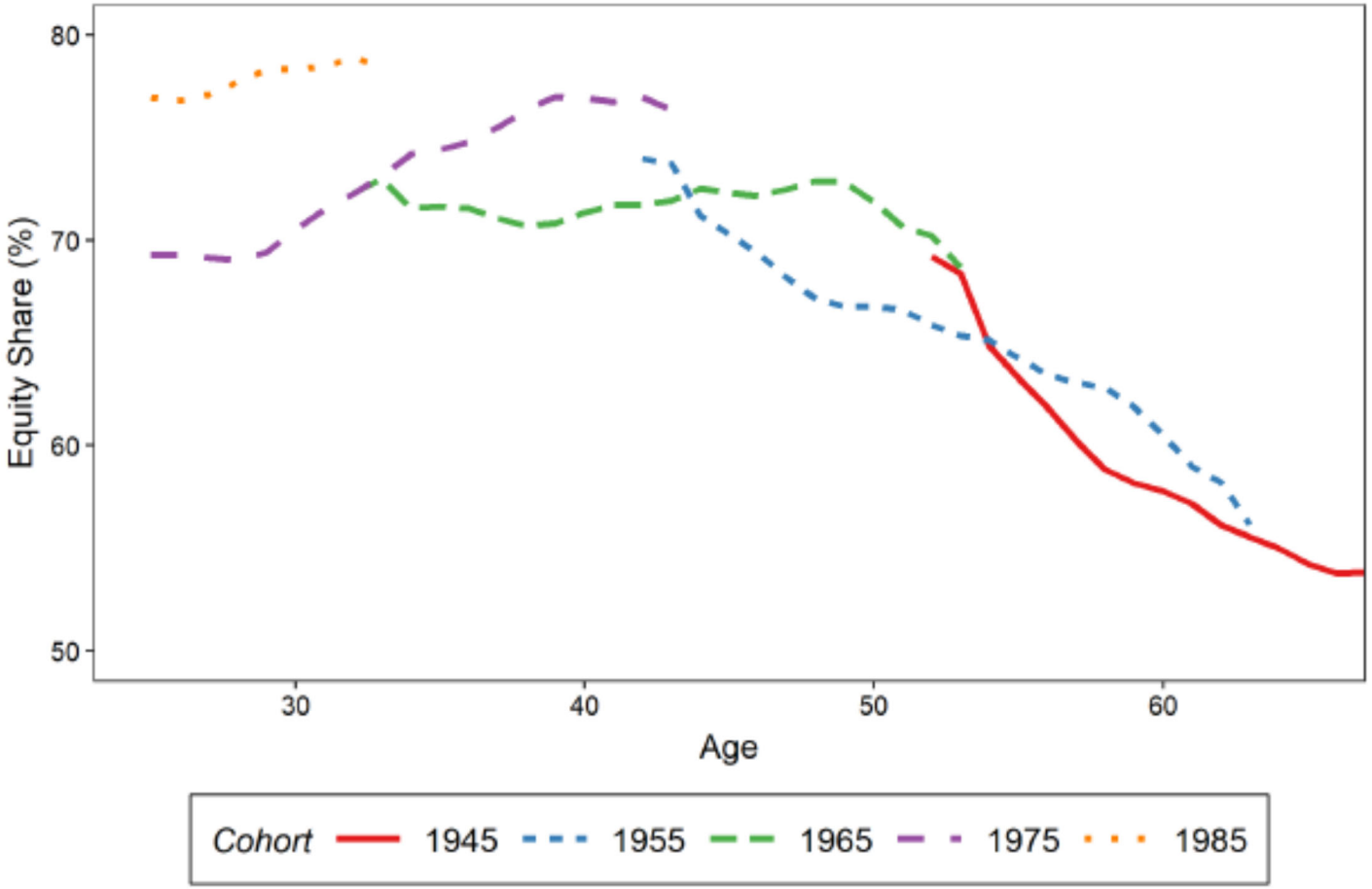
Our sample (2006-18)



This declining pattern in the cross-section is a change from pre-2000

Note: Sample from AZ that most closely matches: equity owners

Cohort equity shares by age

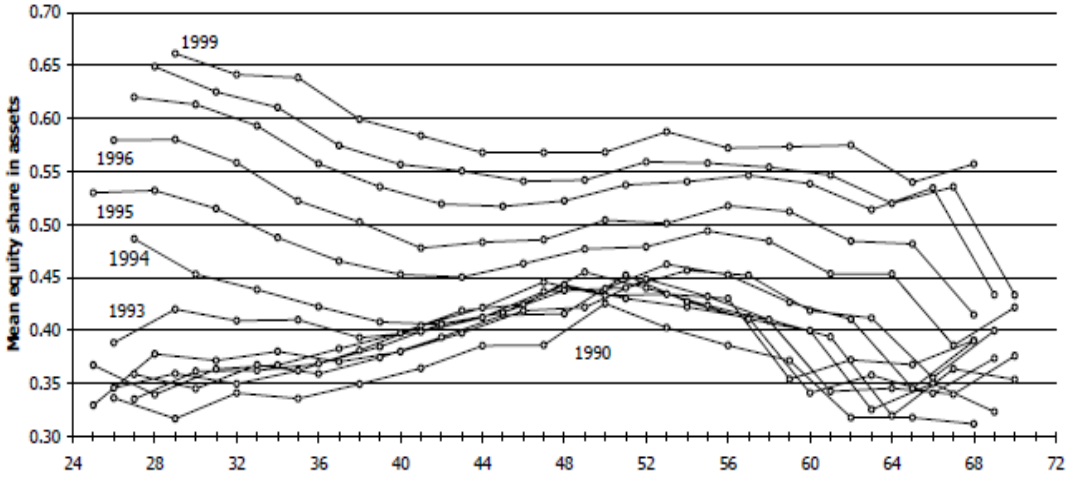


- Consistent with the effect of TDFs:
  - At younger ages: equity shares are increasing for each cohort and are higher for younger cohorts
  - At older working ages: decline with age following age 45

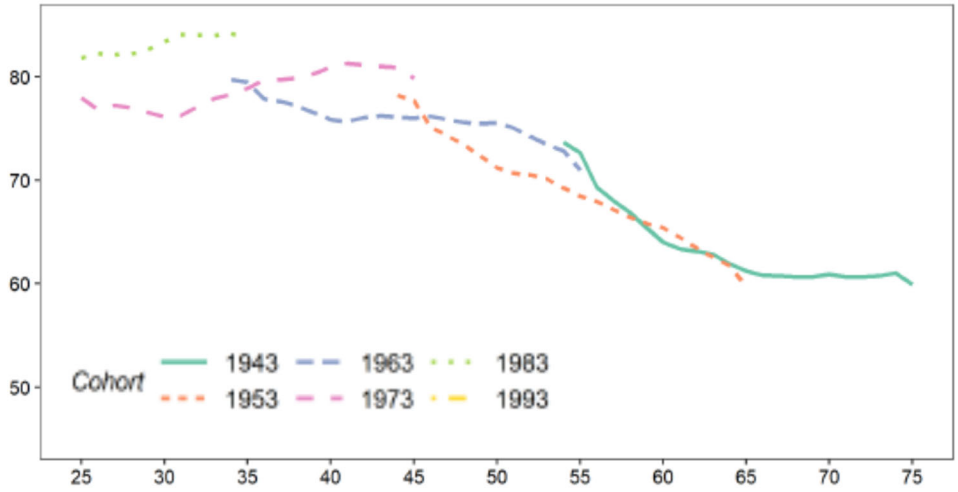
People decrease share as age

Cohort equity shares by age

Ameriks Zeldes



Our sample

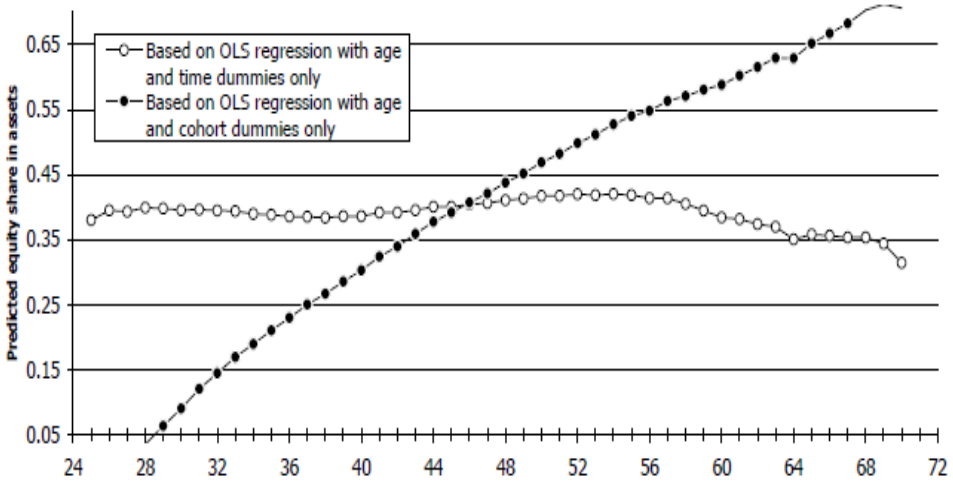


New: equity shares increasing for young cohorts, decreasing for older cohorts vs. all cohorts were increasing equity shares pre-2000

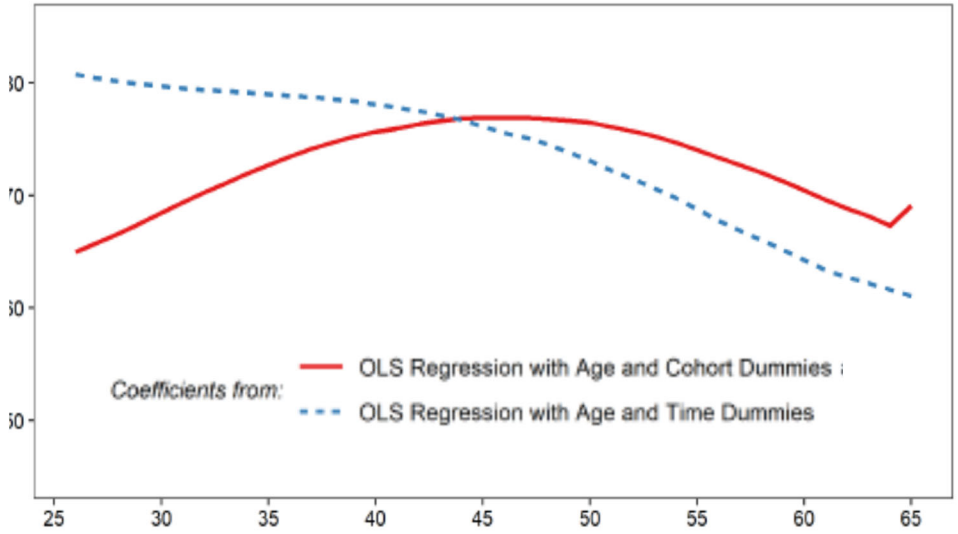
Note: Sample from AZ that most closely matches: equity owners

Lifecycle investment patterns

Ameriks Zeldes



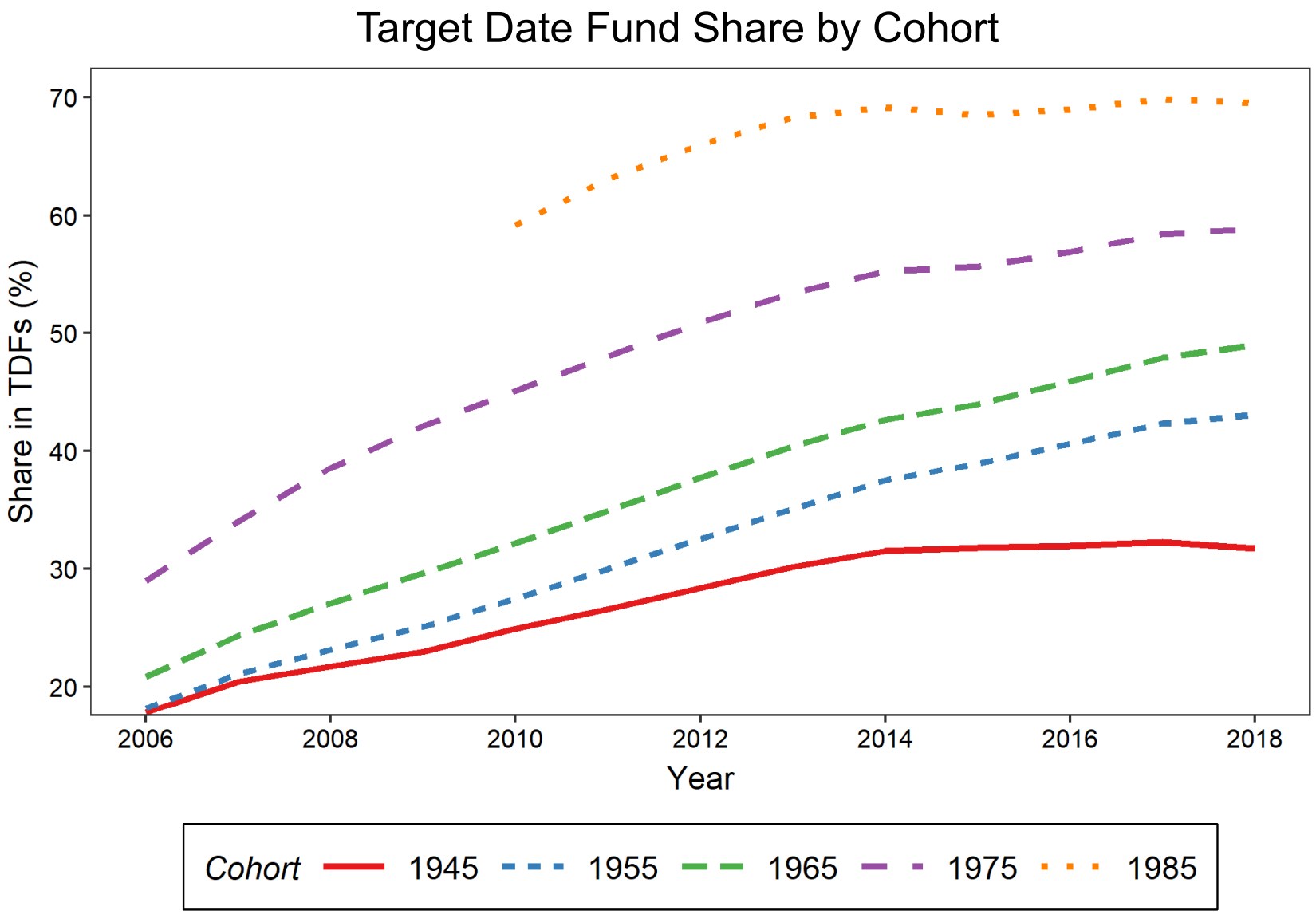
Our sample



Controlling for time effects or controlling for cohort effects, the new **hump-shaped pattern** is a change from pre-2000 where flat or increasing

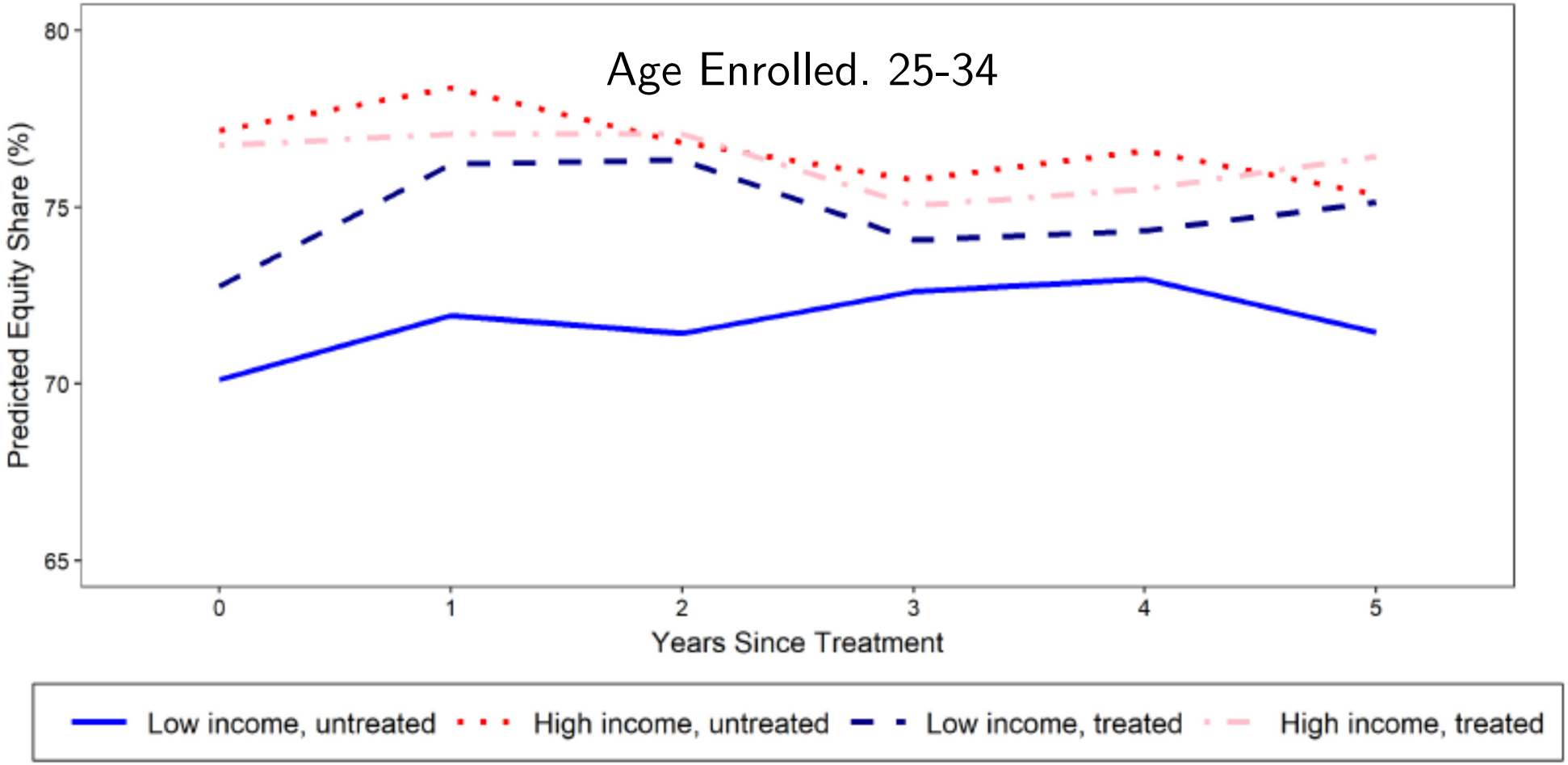
Note: Sample from AZ that most closely matches: equity owners

Why?

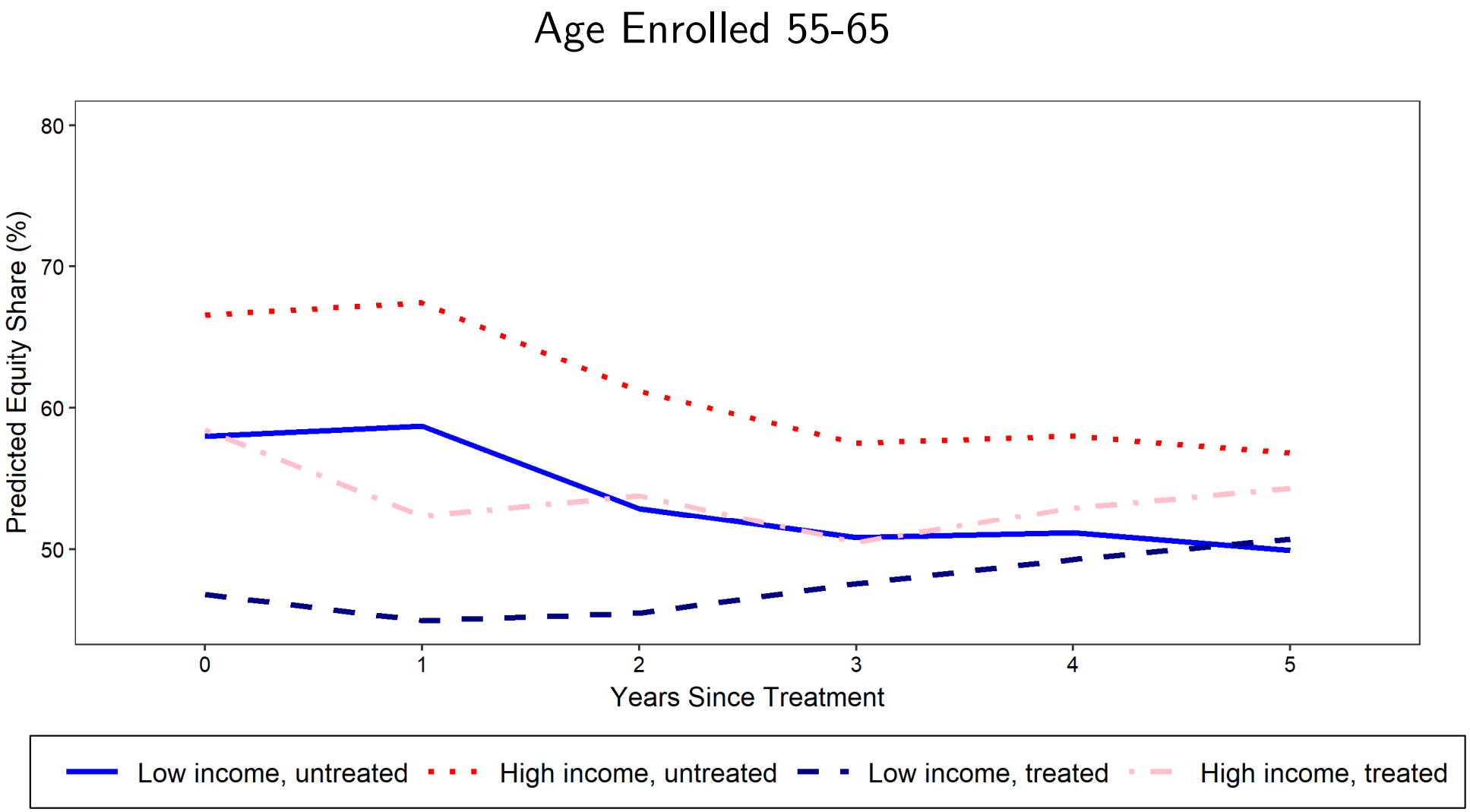

Target Date Fund Share by Cohort
Share in TDFs (%)
70
60
50
40
30
20
2006
2008
2010
2012
2014
2016
2018
Year
Cohort
1945
1955
1965
1975
1985

Did TDFs cause changes in portfolios?

Compare employees arriving at firm in 2 years pre-PPA 2006 and non-TDF default investment to those arriving in 2 years after and having a TDF as QDIA fund

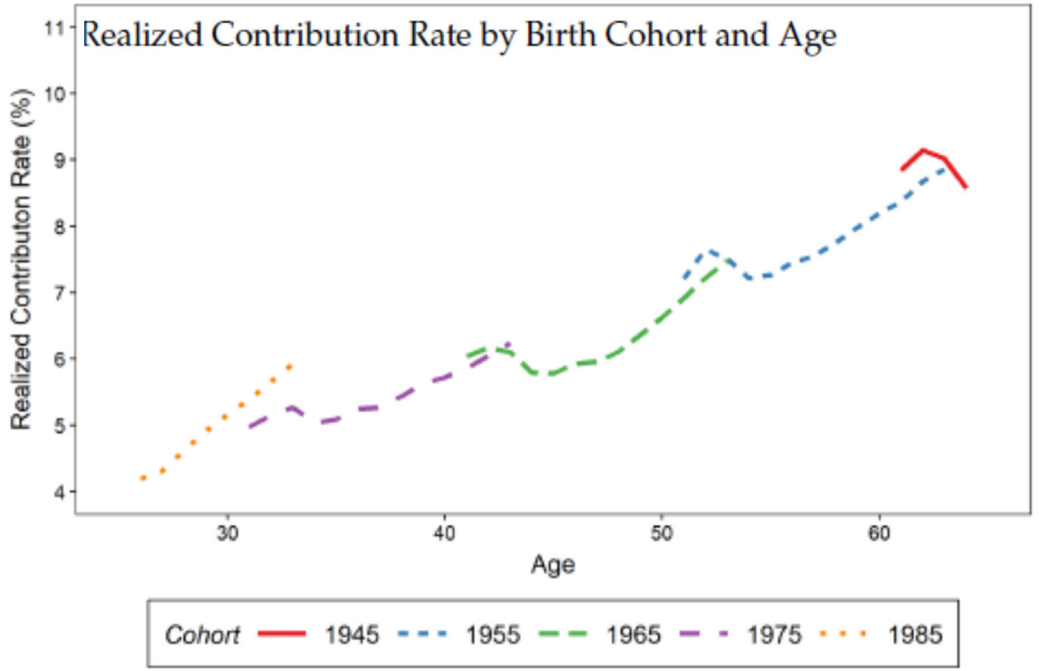


Equity shares over time: middle age



Savings Rates

1. Average retirement savings rates increase steadily as over the working life, doubling from age 25 to 65
2. In contrast to portfolio behavior, saving behavior has been stable over time, and w/in a few years no difference if hired before or after PPA 2006 and adoption of TDF as default
3. Thus financial innovation and regulation have had modest (or offsetting) effects on retirement saving behavior



Outline of talk

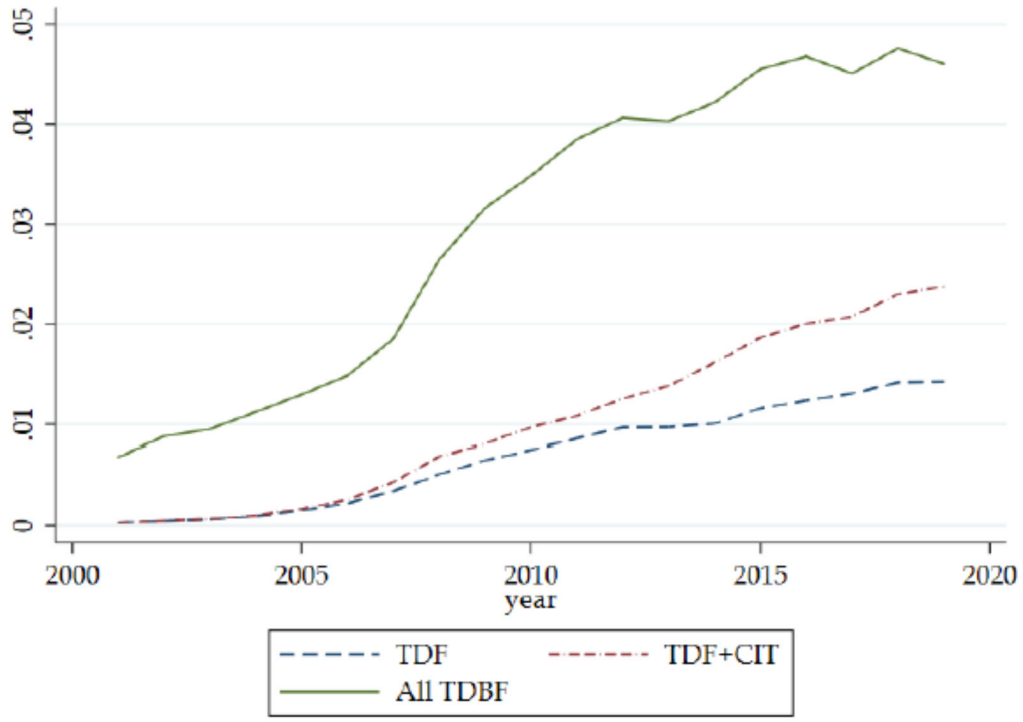
1. TDFs have contributed to households investing a greater share of their wealth in stocks, and changed the lifecycle pattern

2. TDFs have changed stocks market dynamics

3. Are TDFs optimal? How can they can and will become more customized

The rise of TDFs

Fractions of U.S. stock market held by TDBFs

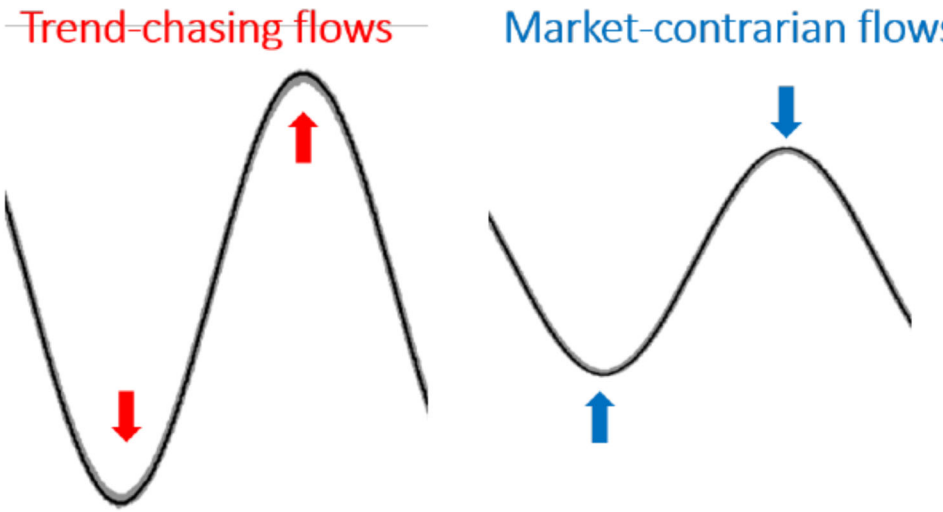


- Collective investment trusts (CITs): target date strategies with lower fees than mutual fund series
- Balanced funds: simply maintain fixed allocations in stocks and bonds
- Total assets: \$4.1 trillion in 2019, almost \$5 trillion in 2020

TD(B)Fs actively trade

TD and Balanced Funds pursue contrarian trading strategies

- TDBFs maintain fixed shares of asset classes → Sell equity after equity gains, buy after equity losses
  - In contrast with letting asset class shares rise and fall with returns
  - "Market contrarian" strategy



- *Market contrarian trading may dampen asset-price fluctuations*
- Previously retirement investors were passive (Agnew, Balduzzi, Sunden 2003, Ameriks Zeldes 2004, Brunnermeier Nagel 2008, Sialm Starks Zhang 2015)
- Or trend-chasing (Choi Laibson Madrian Metrick 2009)

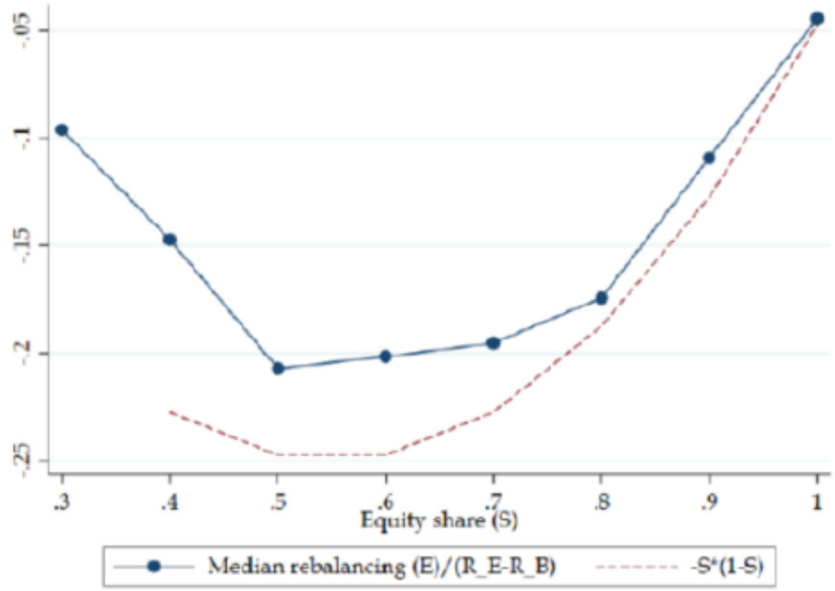
Key implications

1. **Rebalancing:** TDFs actively rebalance out of asset classes after good returns, consistent with their mandate
2. **Flows:** Typically, following good stock market returns, money flows into equity mutual funds. But TDF rebalancing significantly reduces flows to equity funds following good stock market returns
3. **Returns:** Individual stocks held *more* by TDFs have *lower* returns after *high* stock market returns in the cross-section and comparing similar stocks included and not in S&P500
   - When equity outperforms bonds by 10% in a month, stocks with 1% TDF ownership have 0.1% lower one-month 4-factor alpha
   - Why are the price effects are "large"? Hypotheses
     - Because balanced funds hold similar?
     - Because pensions, endowments, trade similarly?
     - Because trading against TDFs loses money!
4. **Implication:** Continued rise of TDBFs will stabilize the stock market and increase the correlation between stock and bond market returns

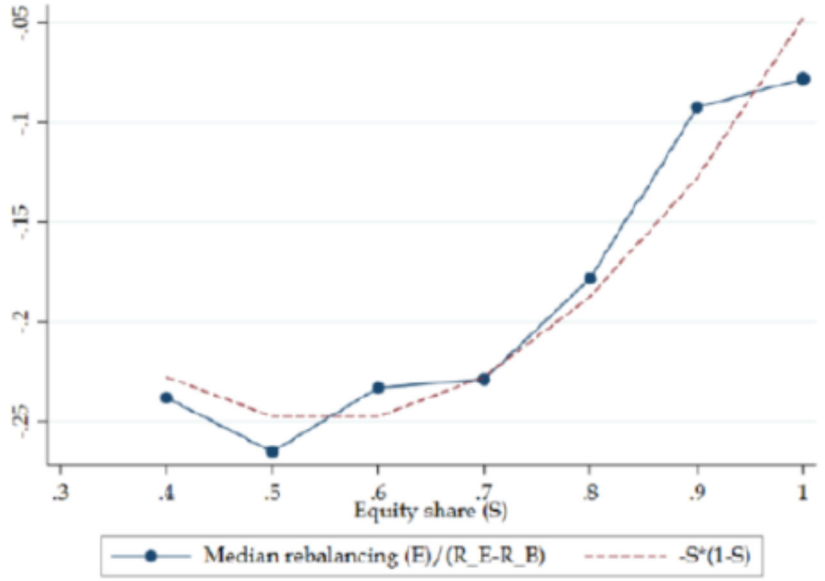
TDFs do maintain equity share

Predicted equity rebalancing fraction, $Rebal(E) = -S^*(1 - S^*)$, vs. median ratio $Rebal(E)/(R^E - R^B)$ for different S^* bins

Active



Passive

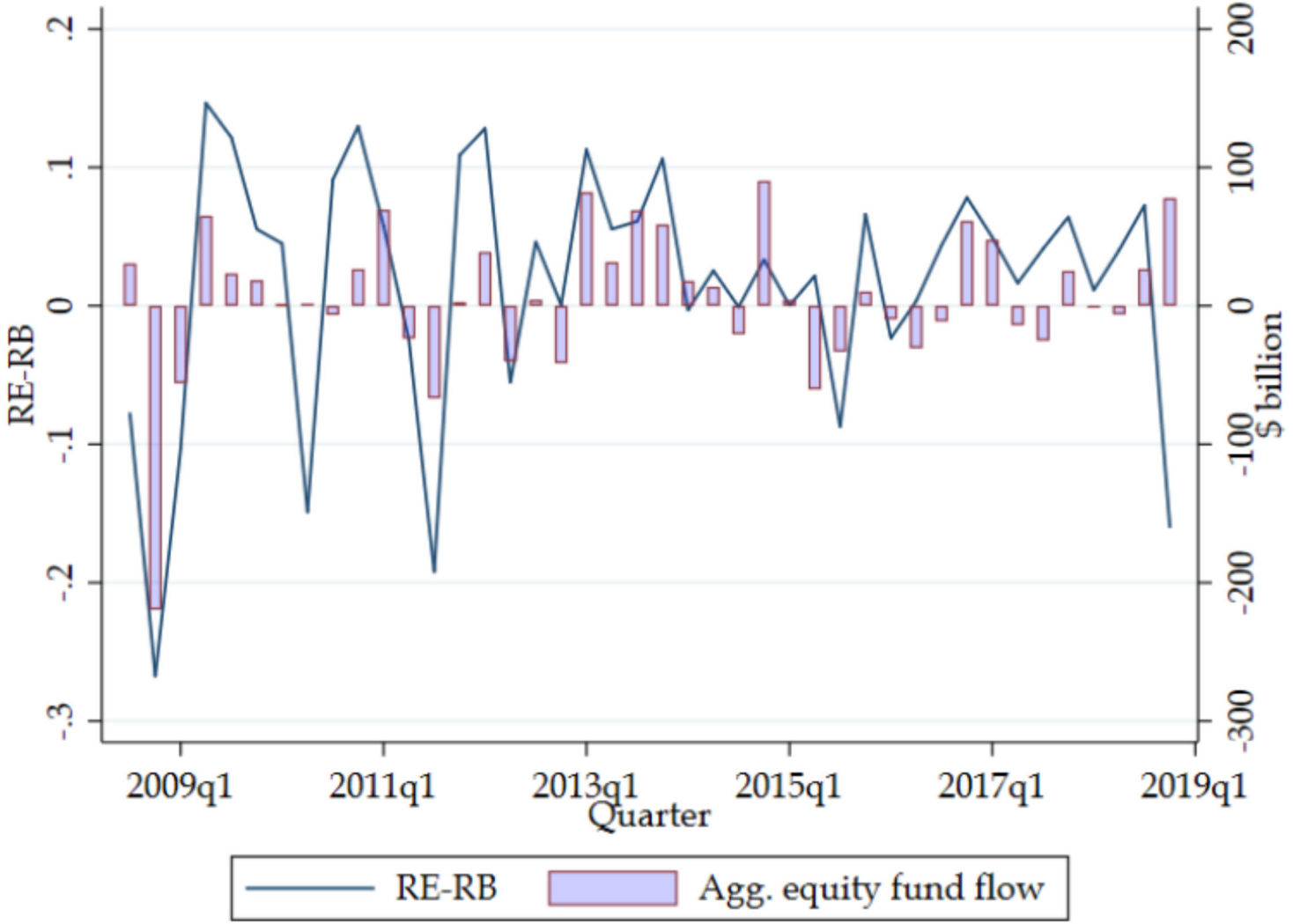


Passive TDFs = TDF with more than 50% in index funds

- Typically, passive TDFs follow desired allocations closely
- Active TDFs often have "tactical glide path deviation" provisions (e.g., $\pm 10\%$) and may pursue temporary momentum strategies

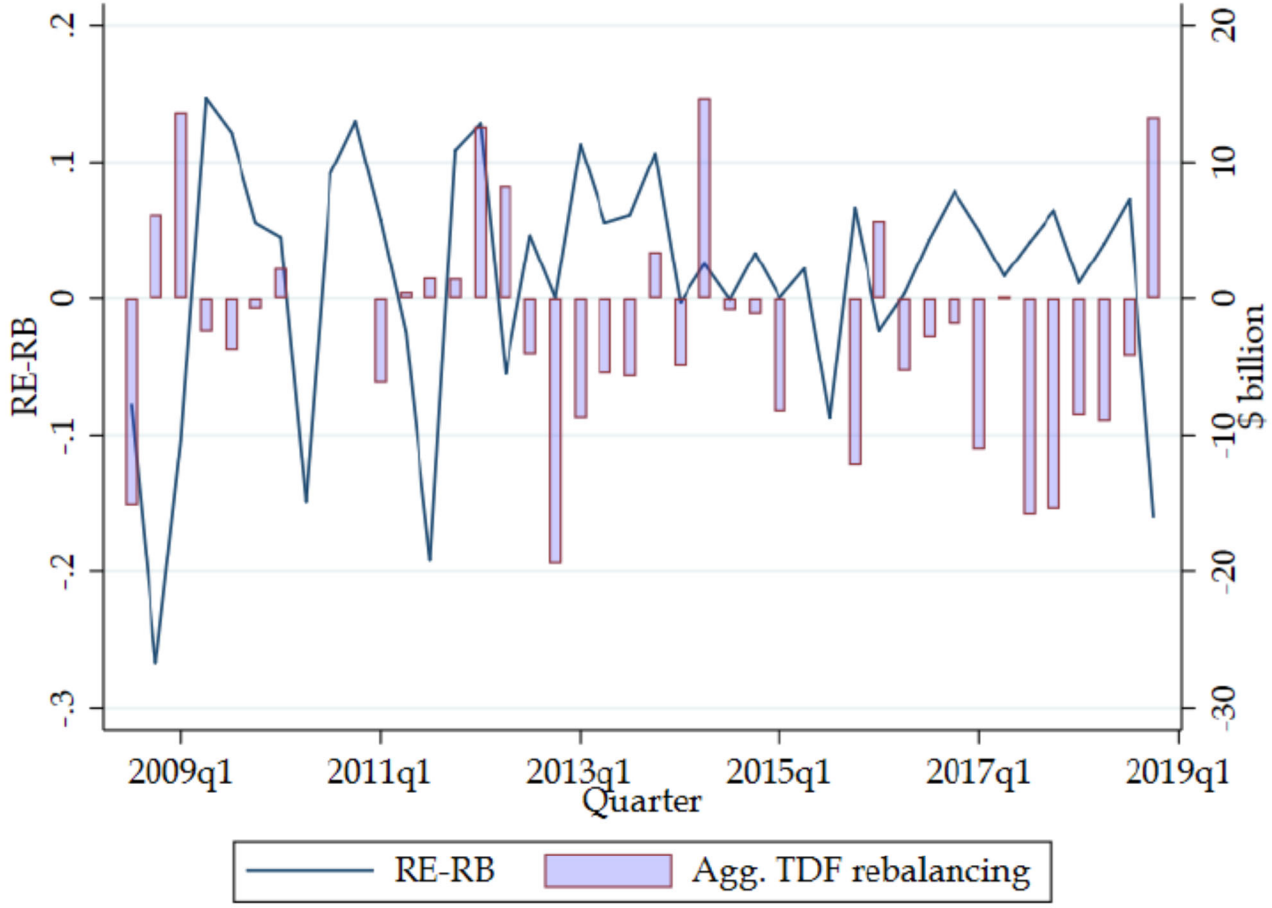
Flows to US equity funds

Total US retail and intuitional share purchase/sale in dollars and stock market return less bond index return



Flows to US equity funds

TDF fund share purchase/sale in dollars and stock market return less bond index return



- Rebalancing by TDFs offsets about 1/5 of mutual fund flows

At the fund level

With equity mutual fund level monthly data, we estimate:

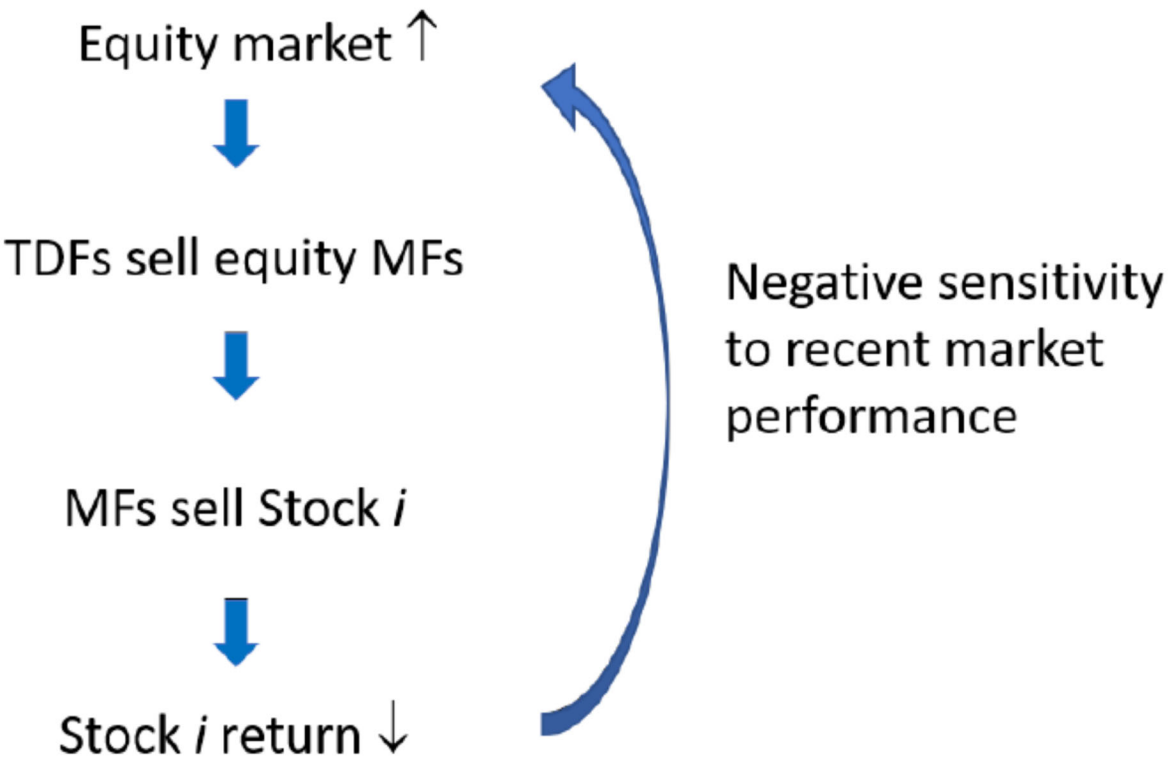
$$FundFlow_{jt} = \beta_1(R^E - R^B)_t + \beta_2(R^E - R^B)_t \times Frac.TDF_{jq-1} + \beta_3(R^E - R^B)_{t-1} + \beta_4(R^E - R^B)_{t-1} \times Frac.TDF_{jq-1} + Frac.TDF_{jq-1} + X_{jt} + \xi_j + \epsilon_{jt}$$

	Fund flow, t		
	All	Index	Active
$R^E - R^B$, t × Frac. by TDFs, q-1	-0.145***	-0.228***	-0.132**
	(0.050)	(0.080)	(0.052)
$R^E - R^B$, t-1 × Frac. by TDFs, q-1	-0.089*	-0.139	-0.081*
	(0.048)	(0.095)	(0.049)
$R^E - R^B$, t	0.067*	0.112***	0.065*
	(0.038)	(0.036)	(0.038)
$R^E - R^B$, t-1	0.026	0.071*	0.025
	(0.023)	(0.038)	(0.023)
Control variables	yes	yes	yes
Fund FE	yes	yes	yes

- 20% TDF holding reduces trend-chasing by (.145*.2)/.067=40%

Price impact?

If Stock *i* has high indirect TDF investment (through mutual funds)



Price impact!

Regression analysis implies that

- For a stock with 1% TDF (indirect) ownership
- When the excess return on the stock market is 10% return
- The stock earns 0.1% lower return in that month than one with no TDF ownership
  - Even conditional on 4-factor model of stock returns

This effect is **large**

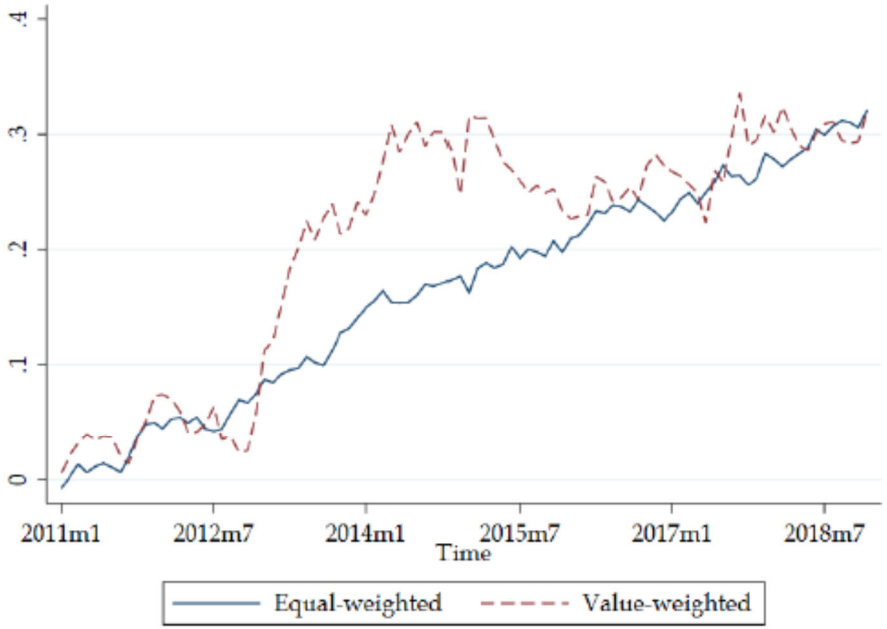
Similar estimate using S&P index inclusion

Price impact!

Why is this effect so large?

- Consider 3-way sorts of stocks according to (1) size (NYSE breakpoints), (2) mutual fund ownership, and (3) TDF ownership
- Quintiles of TDF ownership: LOW TDF, 2, 3, 4, HIGH TDF
- If **contemporaneous** month $R^E - R^B, t > 0$: buy LOW TDF, short HIGH TDF; if $R^E - R^B, t < 0$: buy HIGH TDF, short LOW TDF

Cumulative 4-factor adjusted return of this (impossible) strategy:

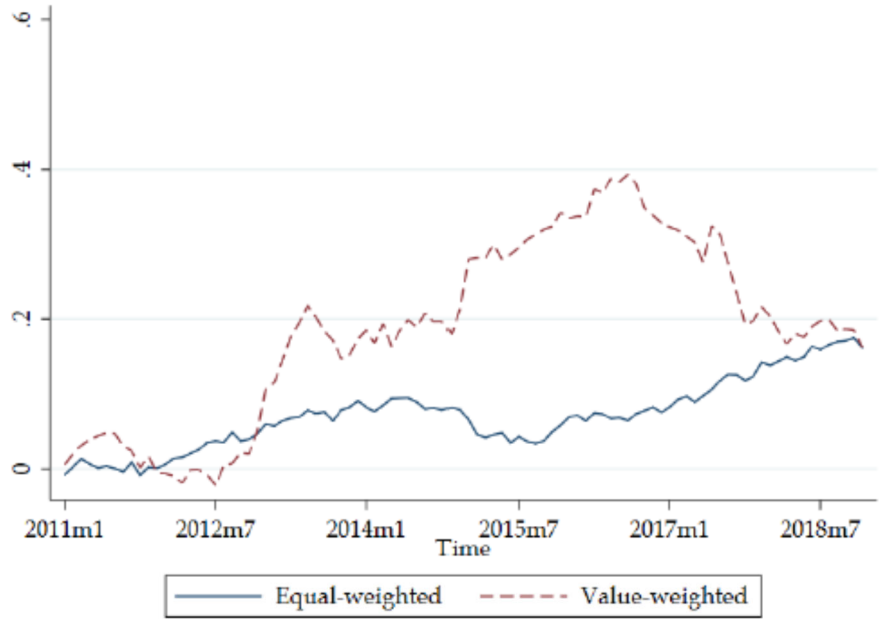


Price impact!

Why is this effect so large?

- If **previous** month $R^E - R^B, t > 0$: buy LOW TDF, short HIGH TDF; if $R^E - R^B, t < 0$: buy HIGH TDF, short LOW TDF

Cumulative 4-factor adjusted return of this feasible strategy:



Feasible trading along with TDFs makes money!

Implications

- TDBFs move passive or trend-chasing retail investor money into market contrarian strategies that affects fund flows (results 1 and 2)
- TDBF trading may be having some price impact, reducing returns of over-weighted stocks following good stock market returns and possibly contributing to increased reversal (result 3)
- TDBFs may eliminate some anomalies or reduce market volatility (d/P movements), but may create other anomalies (to keep d/P stable), since innovations to dividends increase the share of stocks in the market portfolio
- TDBFs propagate changes in interest rates (e.g. QE-type policies) into the stock market, and stock returns into bond markets

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Are TDFs "optimal"?

- Optimal portfolio allocation can be constant over the life cycle and independent of age and wealth (Samuelson 1969, Merton 1969)
- Beyond these assumptions:
  - With non-tradable (bond-like) labor income: equity share declines as age
    - Became the advice from economists and practitioners
  - But many other factors, typically studied in isolation
- Current research: Solve for optimal saving and portfolio behavior in a realistic(?) environment
  - How well do simple rules like embedded in TDFs do at mimicking optimal behavior?

Realistic environment

Consider complex (realistic?) saving and portfolio problem

- Husband and wife
- Housing and non-housing consumption
- Gender-specific earnings profiles w/ stochastic, left-skewed, shocks correlated over time
- Invest in stocks, bonds, ST accounts, with returns correlated over time and with labor income
- Housing purchase vs. rent, and mortgages
- Realistic retirement accounts
- Simple tax and benefit system
- Bequest utility
- During retirement:
  - pension that is a function of lifetime labor income
  - mortality risk
  - stochastic medical expenses.

Deep reinforcement learning

Overview:

1. Decision rule parameterized as fully connected feedforward neural networks as cells for multiple recurrent neural networks
2. Stochastic gradient descent to maximize expected lifetime utility over a large number of simulated lives

Benefits:

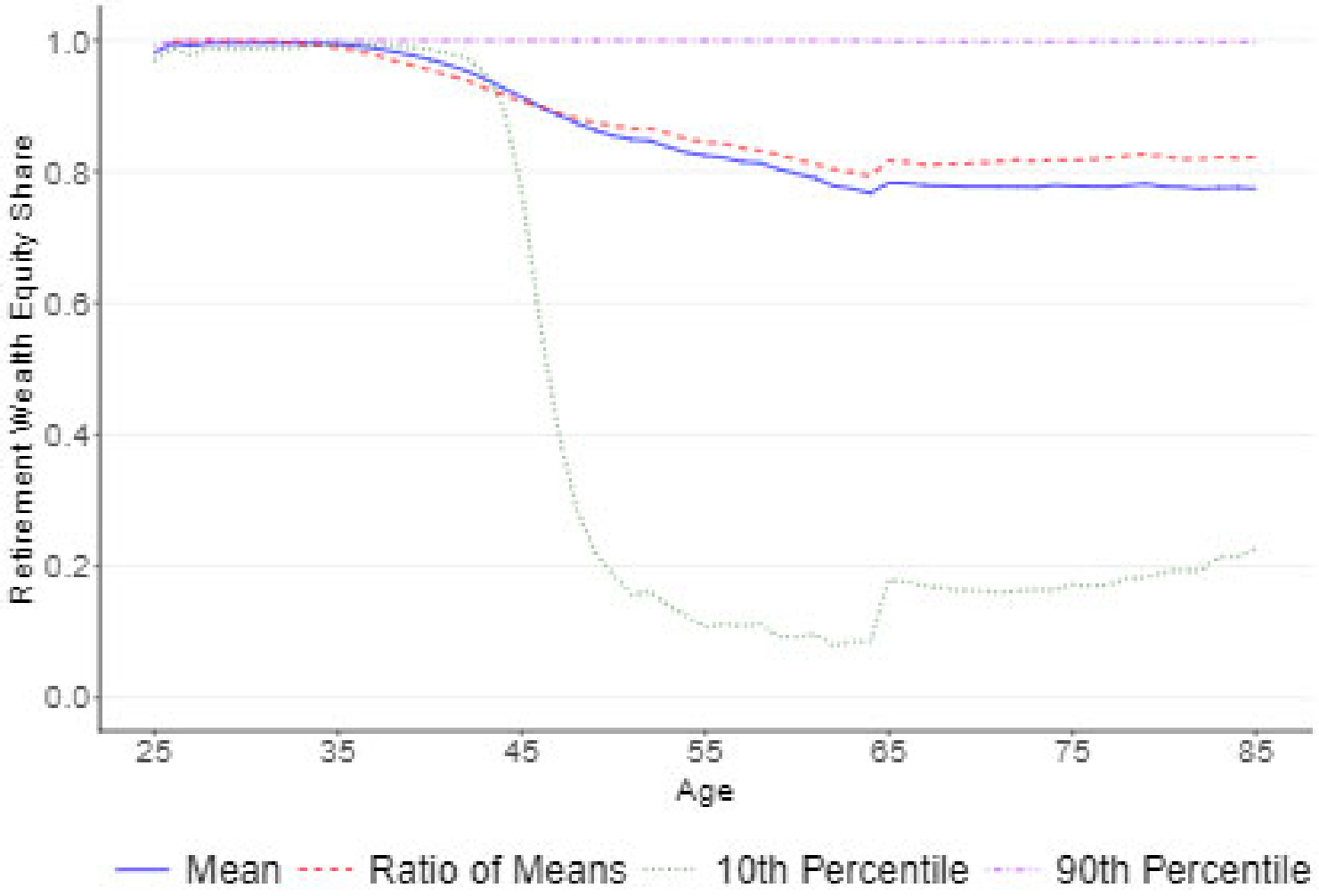
1. Faster
   - Avoids numerical integration, handles discrete and continuous choices
2. Easier to use/program than dynamic programming methods
3. Mimics how investors, practitioners, or data scientists actually determine optimal behavior: learning from how well different choices work out

Lessons so far

1. Higher average equity shares are optimal relative to those embodied in current investment advice and in current TDFs.
2. Substantial variation.
   - The 90th percentile of optimal equity share is ≈100"% after age 45
   - The 10th percentile: roughly 20% for age 50 and older

Lessons so far

Distribution of the optimal share of assets invested in stocks in retirement accounts, by age (low risk aversion case)



Lessons so far

1. Higher average equity shares are optimal relative to those embodied in current investment advice and in current TDFs.
2. Substantial variation.
   - The 90th percentile of optimal equity share is ≈100"% after age 45
   - The 10th percentile: roughly 20% for age 50 and older
3. Following the portfolio of the typical (index, low-fee) TDF rather than optimal costs the equivalent of roughly 5% of consumption per year
4. But this is a significant improvement over holding a constant equity share such as 2/3 or, closer to the average optimum in our model across ages, 85%

My prediction: customization is coming, not just on financial adviser desktop, or robo-adviser, but in fund form

Conclusion

- TDFs have changed the lifecycle portfolio allocations of typical American investors
  - Higher share of financial wealth in equity: nearly 70% over the life cycle, compared to 58% prior to 2000
  - Average portfolio share of equity is hump shaped in age, peaking around age 50 and then decreasing as retirement approaches
  - Due to general adoption, not just an enrollment and default effect of TDFs
  - Little change in retirement saving rates
- TDFs have dampened the tendency for retail investor money to flow into stock funds when the stock market is performing well
  - And is changing the return dynamics across stocks
  - And may dampen aggregate market volatility as they grow
- There is a large scope for improving how well TDFs serve investors by customizing them