Default Options and Retirement Saving Dynamics

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NBER (2019-2020), MIT Sloan (2020-)

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Motivation

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- High stakes setting: retirement savings plans

Default = non-participation	**Default = participation**
Call provider to enroll	Call provider to opt-out
~50% participate after 1yr	>90% participate after 1yr
"Opt-in regime"	"Autoenrollment"

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"Opt-in regime"	"Autoenrollment"

- Autoenrollment (AE) is affecting ~100 million people worldwide:
  - **NZ ('07), UK ('12), Turkey ('17):** all private sector workers
  - **US:** the majority of 401(k) plans already implements AE
    5 states are extending AE to workers without a 401(k)

This Project

Many studies on AE short-run impact but long-run effect unknown:

Q: What is the effect of autoenrollment on **lifetime** savings and **welfare**?

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Challenge: no long-run data because AE is a recent policy

This paper:

1. Identify the ***mechanism*** through which AE affects behavior
2. Build and estimate a ***lifecycle model*** to study AE long-run effect

Contribution

1. **New Empirical Facts** Madrian Shea '01, Choi al '04 and '06, Blumenstock al.'18
   - Document AE effect after a job switch
   - Empirical test between alternative theories

2. **Structural Model** Carroll al.'09, Bernheim al.'15, DellaVigna '18
   - Build/estimate a structural lifecycle model of AE
   - Fits the data well and predicts behavior out-of-sample

3. **Welfare Analysis** Carroll al.'09, Bernheim al.'15, Goldin Reck '18
   - Characterize optimal default option for lifetime welfare
   - Consider alternative assumptions about social pref. & incidence

Outline

1. Three Facts about Autoenrollment
2. A Lifecycle Model with Default Effects
   - Model
   - Estimation
   - Opt-out Cost
3. Results
   - External validity
   - Long-term effect
   - Optimal policies
4. Conclusion

Two Datasets

U.S. 401(k) Data:

- New proprietary dataset I obtained from a large US pension provider
- Data from ~600 firms and 4 million workers
- Monthly 401(k) contributions, balances, and asset allocations

U.K. Nationally Representative Data:

- ASHE 2006-16 : nationally representative 1% panel
- Follows workers across successive jobs

Three Facts about Autoenrollment

Two **new** facts**:**

Fact I: AE in current job $\downarrow$ saving in next job

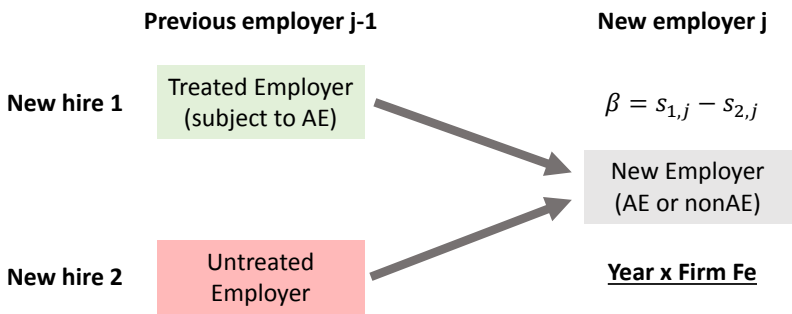
Fact I: AE Reduced Saving in Next Job

Mandatory Autoenrollement for all U.K. private sector employees

Policy roll-out by employer size between 2012-2017

Policy rollout

Identification:



Fact I: AE Reduced Saving in Next Job

AE reduced participation by 11% in next **opt-in** job!

Existing within-job estimates may overstate AE effect on lifetime savings

Policy start date	**Actual 2012**
	Panel A - Participation rate
AE to non-AE	**-0.109**** **(0.052)**
AE to AE	0.013 (0.017)
	Panel B - Contribution in (% of pensionable pay)
AE to non-AE	**-0.472**** **(0.185)**
AE to AE	-0.048 (0.066)
Observations	35,651
$Size_{j-1}$ X $Size_j$	✓
$Employere_j$ X Year	✓

Robust standard errors clustered by current employer ; *** p<0.01, ** p<0.05, * p<0.1

Sample: 22-60y &≤1y tenure in ASHE 2006-17. Additional controls: total pay, previous total pay, tenure, previous

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Policy start date	**Actual 2012**	2005	2006	2007	2008	2009	2010	2011
				Panel A - Participation rate				
AE to non-AE	**-0.109****	0.073	0.022	-0.003	0.022	0.046	0.008	-0.056
	(0.052)	(0.062)	(0.041)	(0.055)	(0.054)	(0.066)	(0.055)	(0.073)
AE to AE	0.013							
	(0.017)							
				Panel B - Contribution in (% of pensionable pay)				
AE to non-AE	**-0.472****	0.023	-0.092	0.161	-0.123	0.021	-0.234	-0.137
	(0.185)	(0.219)	(0.173)	(0.489)	(0.214)	(0.224)	(0.213)	(0.300)
AE to AE	-0.048							
	(0.066)							
Observations	35,651	35,651	35,651	35,651	35,651	35,651	35,651	35,651
$Size_{j-1}$ X $Size_j$	✓	✓	✓	✓	✓	✓	✓	✓
$Employee_j$ X Year	✓	✓	✓	✓	✓	✓	✓	✓

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Two **new** facts**:**

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$\Rightarrow$ **need a model** to extrapolate effect after many job switches

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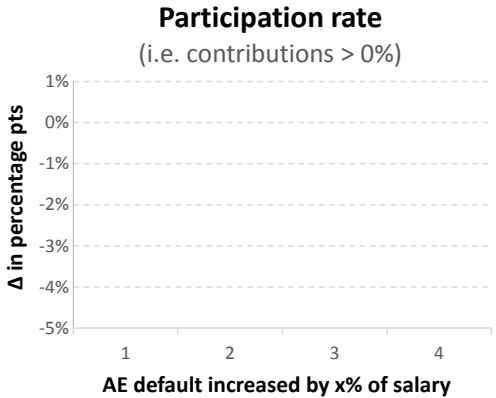
Fact II: Increasing the AE default $\downarrow$ participation

Fact II: Increasing Default ↓ Participation

Compare workers hired before/after 86 U.S. firms increased their default

Example: 3% → 6%



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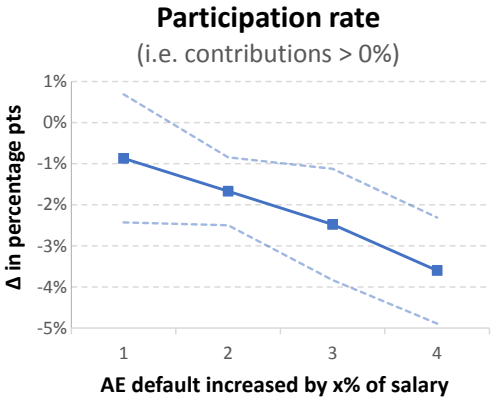

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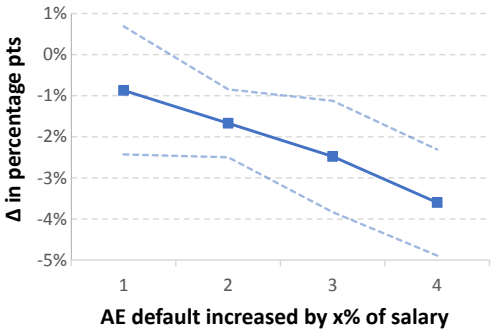
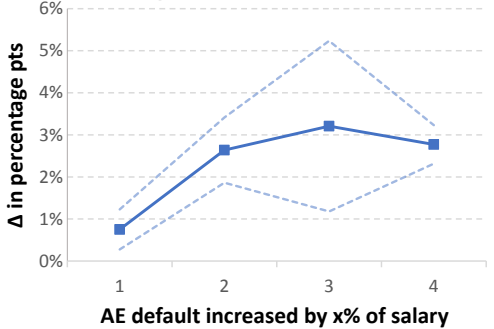
Participation rate

(i.e. contributions > 0%)



Positive contrib < initial default

(e.g. contributions at 1% or 2%)



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Fact II: Increasing Default ↓ Participation

Nudging workers to contribute more w/ higher default ....

... led more to drop-out and contribute at the lowest rates!

Opt-out cost: fits this evidence

- Ex. worker prefered contirbution rate 1%
- 3% default: stay at 3% (not worth bearing opt-out cost)
- 6% default: drop to 1% (far enough from prefered rate)

Other theories (loss aversion, anchoring): opposite prediction

Three Facts about Autoenrollment

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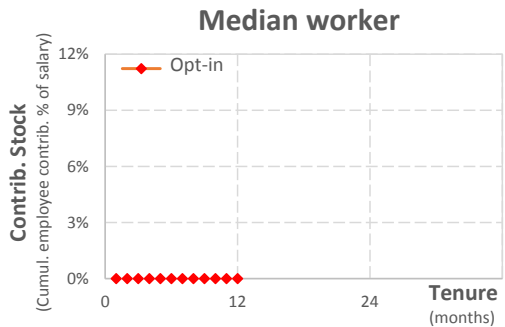
Fact III: Median non-AE Catch-up to AE

Workers hired in the 12 months before/after AE at 3% in 34 firms



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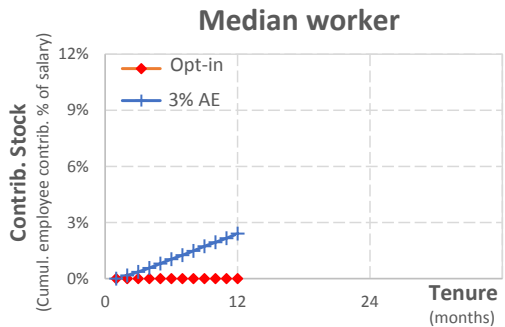

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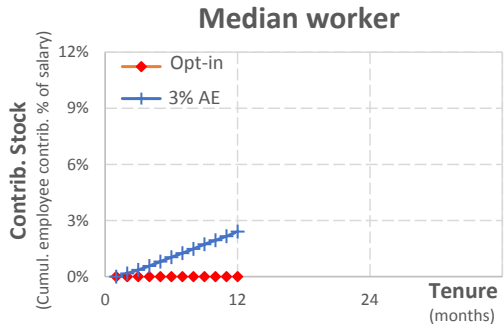

Static setting

Gains from switching:
- Tax benefit
- Generous employer match

$\Rightarrow$

Large opt-out cost:

DellaVigna ('06,'18): min. **$1,200**

Bernheim et al ('15): avg. **$2,200**

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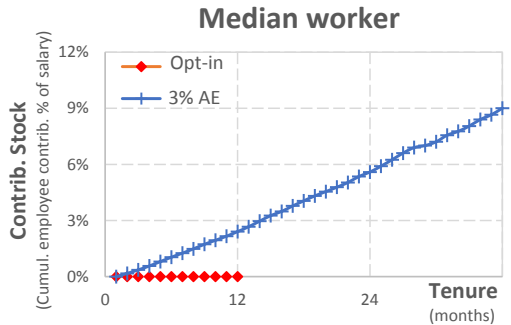

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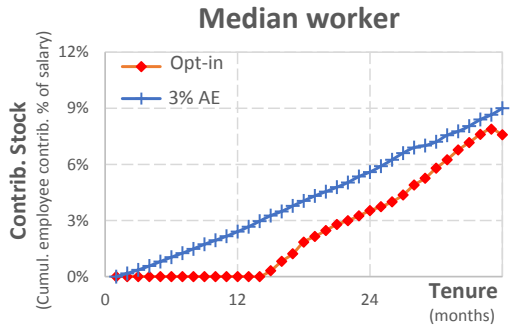

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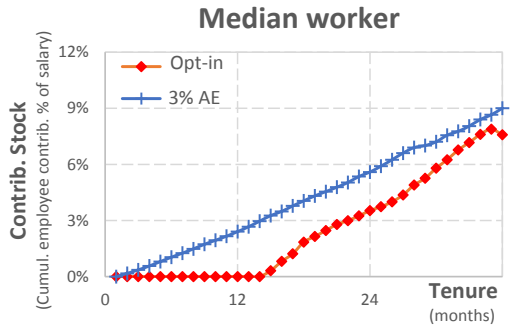

Dynamic setting

Gains from switching:

- ~~Tax benefit~~
- ~~Generous employer match~~

$\Rightarrow$

Smaller opt-out cost:

In a lifecycle model I estimate an opt-out cost of $\sim$ **\$250**

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$=>$ **... w/ an opt-out cost**

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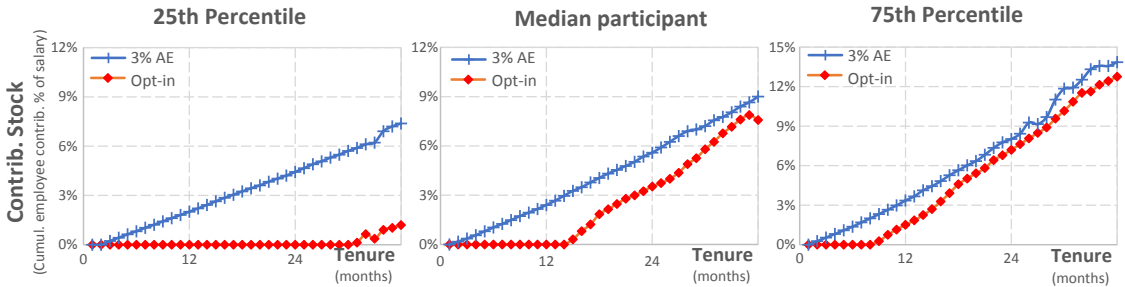
... but heterogeneity matters

Heterogeneity Matters

Firm A - Choi et al '04

In **the short run**: large treatment effects only at the bottom ...



... will these savings increase persist in **the long run** ?

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The Model

I build a rich lifecycle consumption model with default effects

- Three key features absent from previous models of AE:
  1. **Dynamics:** people can catch-up by contributing more in the future
  2. **Liquidity:** tax penalty makes DC wealth less liquid than other asset
  3. **Uncertainty:** about earnings and employment status

$\Rightarrow$ creates an option value of waiting ($\neq$ static model)

Default Mechanism

Agents bear a utility cost k to choose a contribution s other than the default d

$$u\left(c - \mathbb{1}_{(s \neq d)} . k\right)$$

Real costs	filling form / seeking professional financial advice
Attention costs	to consider the full menu of choices Masatlioglu et al '12
Optimization costs	to compare different savings scenarios Ortoleva,'13
Present bias Ext	makes small costs loom larger O'Donoghue, Rabin '99

Parsimonious: assume the same opt-out cost for everyone in all periods!

Model Environment

- Lifecycle consumption model: quarterly frequency btw ages of $22y$ and $90y$.
- Features rich economic environment:
  1. **Assets:** realistic retirement account (i.e. matching + vesting), liquid saving, and high-interest unsecured debt
  2. **Labor market:** unemployment, job-to-job transitions, and income risk vary with age and tenure (SIPP data)
  3. **Government:** progressive tax and benefit system (Social Security & UI). Tax benefit for DC saving and tax penalty for early withdrawals.
  4. **Demography:** mortality risk, and changing household composition over lifecycle

Agent's Problem

- 8 state variables ...
  - Age in quarters
  - Employment status
  - Labor productivity
  - Tenure in current job
  - Average lifetime income
  - Liquid wealth / debt
  - Retirement wealth
  - Default contribution rate

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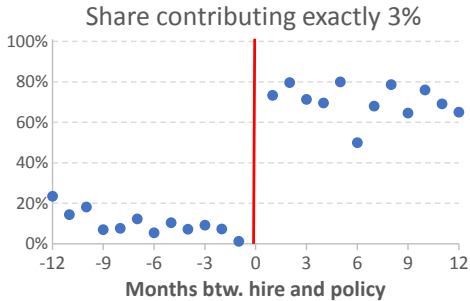
- 8 state variables ...
  - Age in quarters
  - Employment status
  - Labor productivity
  - Tenure in current job
  - Average lifetime income
  - Liquid wealth / debt
  - Retirement wealth
  - Default contribution rate
- ... and 2 choice variables:
  - Liquid wealth / unsecured debt next period
  - DC contribution rate
    - ≥ 0 when employed
    - ≤ 0 when unemployed or retired

Data and Identifying Variation

Estimation Sample:

- 34 plans w/ a 50% match up to 6% and no autoescalation
  - Opt-in group: hired in the year before AE at 3% (n=10,317)
  - AE group: hired in the year after AE at 3% (n=9,053)

$\Rightarrow$ **I use this quasi-natural experiment to estimate** the model



First-Stage Parameters

Labor market parameters: estimated using SIPP data

- **Earning process:** 2-steps Minimum Distance estimator

ρ	$\sigma^2_{\xi_1}$	σ^2_{ξ}	σ^2_m
0.974	0.184	0.0125	0.10

- **Labor-market transition:** quarterly EU, JJ and UE

$$Pr(emp_{t+1}|emp_t) = \sum_{k=0}^{5} \beta_k . a_i^k + \sum_{j=1}^{9} \iota_j . \mathbb{1}_{\left(ten_{i,t}=j\right)} + \varepsilon_{i,t}$$

- **Other labor market parameters:**

Initial unemp.	22%	J2J premium	4.8%	EU penalty	7.8%

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Other parameters:

R^{DC}	3%	Match rate	50%	Survival prob.	US life tables
R^{Liq}	2.5%	Match threshold	6%	UI replac. rate	40%
R^{cc}	11.5%	Vesting risk adjst	Plan data	Taxes	2006 fed. sched.
λ	0.74	Equiv. scale	PSID	Social Security	2006 formula

Identification of Second-Stage Parameters

In the second stage 3 preference parameters are jointly estimated:

$$[\sigma, \delta, k]$$

- **EIS (σ):** cap on matching at 6% creates kink in the budget set

  $=>$ bunching at 6% identifies the elasticity of savings to interest rate changes

  Best et al, '17

- **Discount factor (δ):** identified from the overall level of savings

- **Opt-out cost (k):** identified from bunching at the 3% default

Second-Stage Estimation

Simulated Method of Moments:

$$\min_{\sigma,\delta,k} M(\sigma,\delta,k)\, W^{-1}\, M(\sigma,\delta,k)'$$

M: vector of difference btw. data and model for 44 moments (shown next)

W^{-1}: inverse of the diagonal term of the variance matrix

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Estimation Results:

Estimates (quarterly freq.)

σ	δ	k
0.455	0.987	\$254
(0.013)	(0.001)	(11)
χ^2 stat. (41 df):		586

Robustness: Weighting Matrix | Opt-in only | AE only

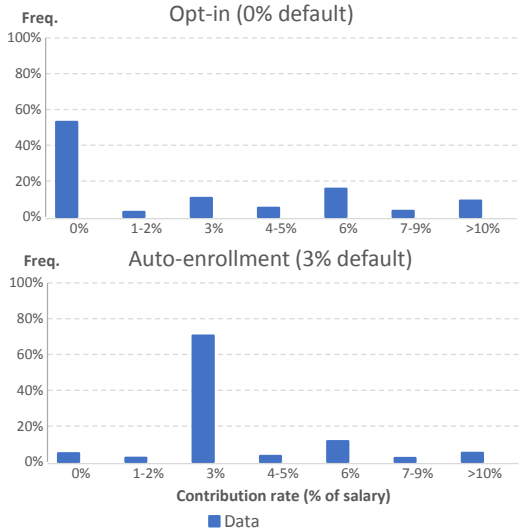
Extensions: Present Bias | Proportional Cost

Sensitivity: Andrews, Gentzkow, Shapiro '17

Estimation Moments

Distribution of Contribution Rates

Employees in their 1st year of tenure



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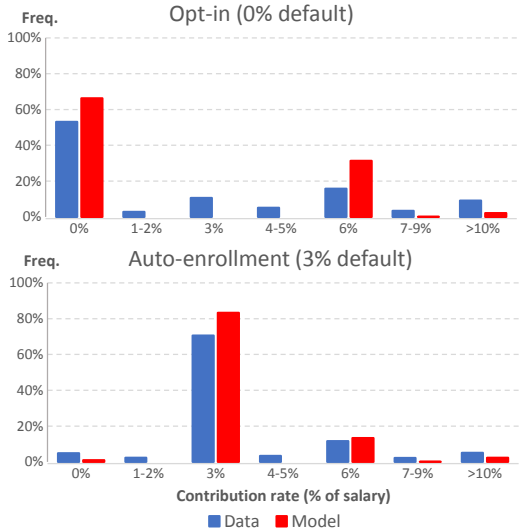
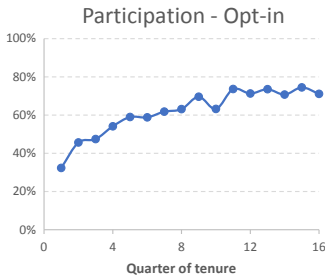
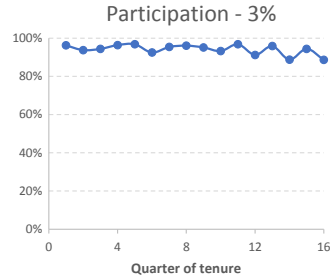
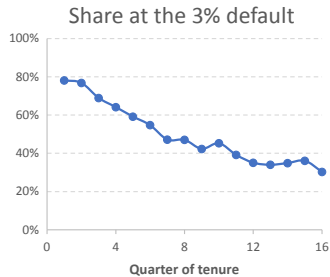


Evolution over Tenure







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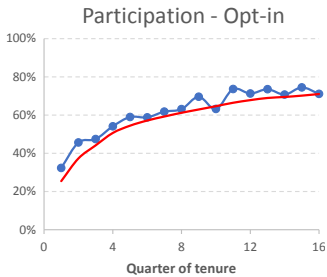
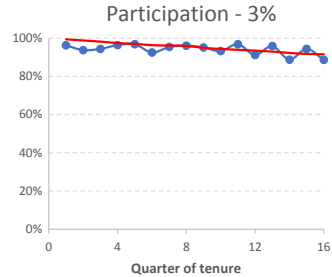
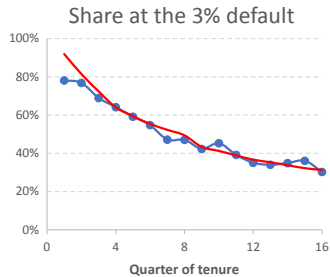






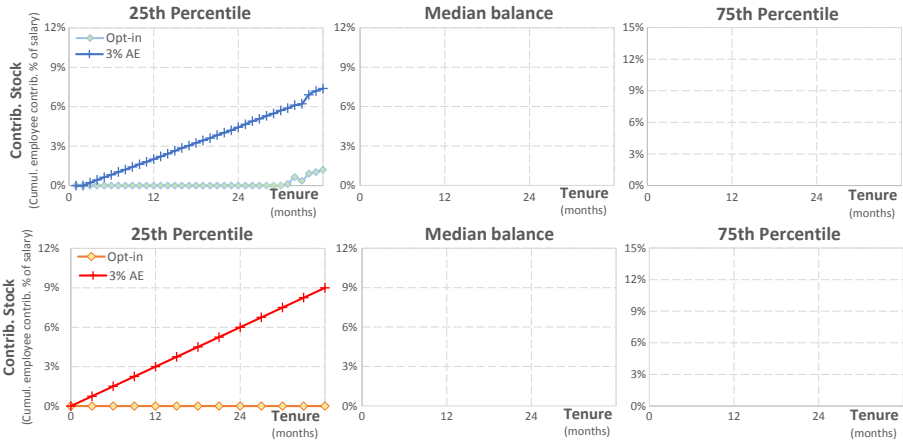
Untargeted Moments:

Heterogeneity over tenure

and by age and income

SCF overall wealth accumulation

Cumulative Employee Contributions



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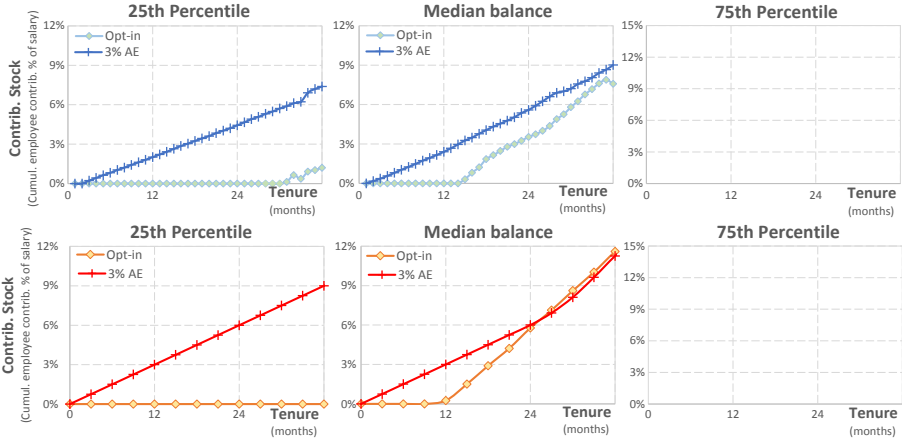

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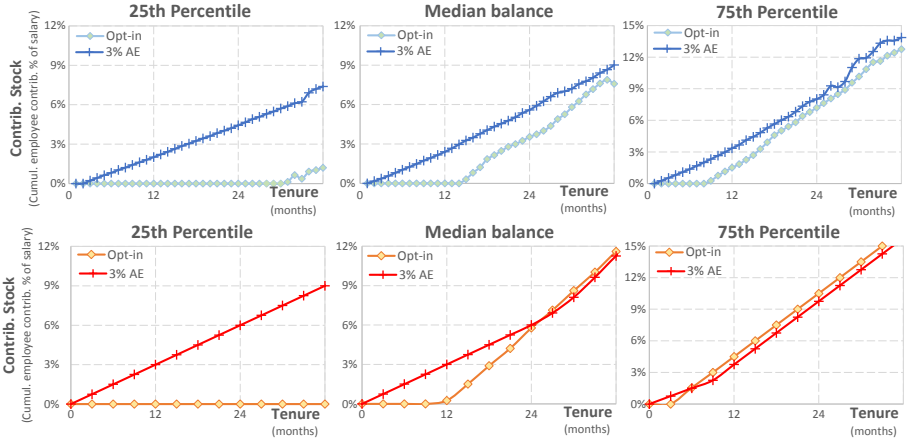
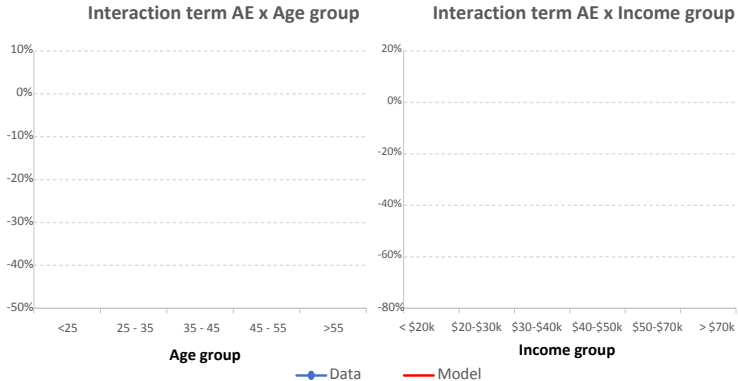


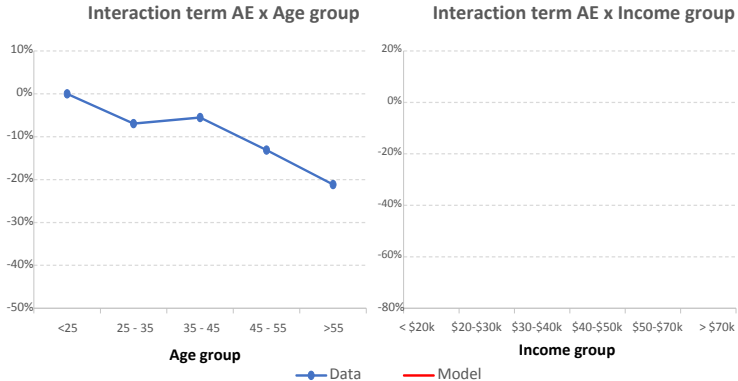
Age and Income Heterogeneity



Sample: employees w/ tenure $\leq$1y, hired before/after AE in 34 401k plans

Age and Income Heterogeneity

Younger = more time to catch-up (option value of waiting)



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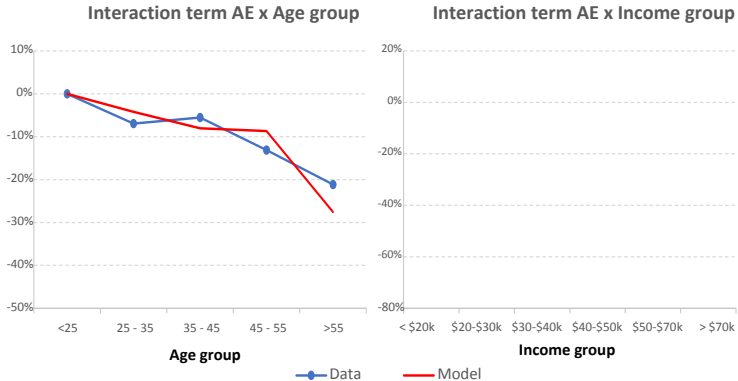

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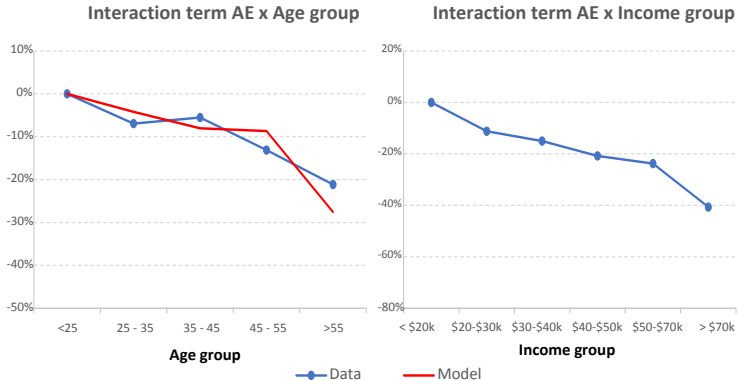
Low-income



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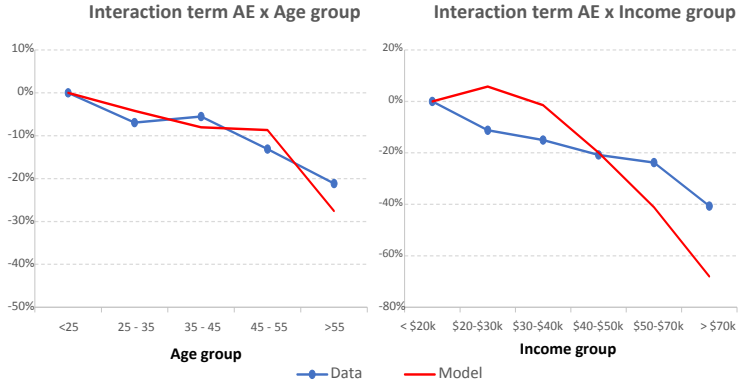
Younger = more time to catch-up (option value of waiting)

Low-income fixed opt-out cost matters more Proportional cost

less incentive to act due to progressive taxes/benefits



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Why is the Opt-out Cost Small?

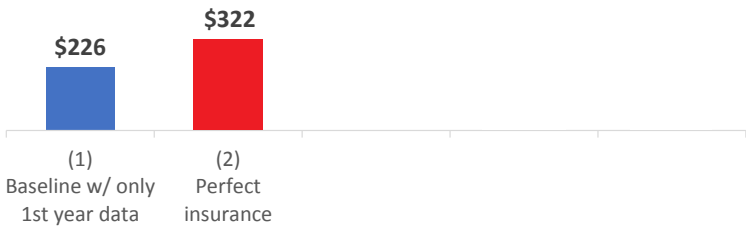
Fix (β, σ) and re-estimate the opt-out cost

Baseline: use only moments from 1st year of tenure

Why is the Opt-out Cost Small?

Fix (β, σ) and re-estimate the opt-out cost

Specification 2: all indiv. of same age receive the same income



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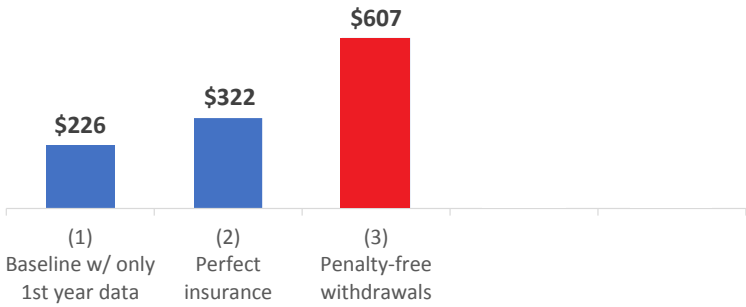
Specification 3: no tax/benefit penalty for early withdrawals



Why is the Opt-out Cost Small?

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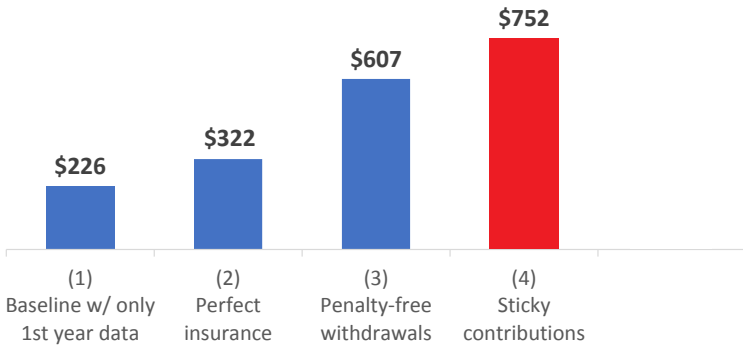
Specification 4: contribution changes are not allowed later in tenure



Why is the Opt-out Cost Small?

Fix (β, σ) and re-estimate the opt-out cost

Specification 5: pure arbitrage opportunity (no vesting + no tax penalty + fully liquid)

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External validity

Why should we believe the model long-run predictions?

Advantage of structural estimation:

extrapolate to another policy, population, institutional setting, time-frame

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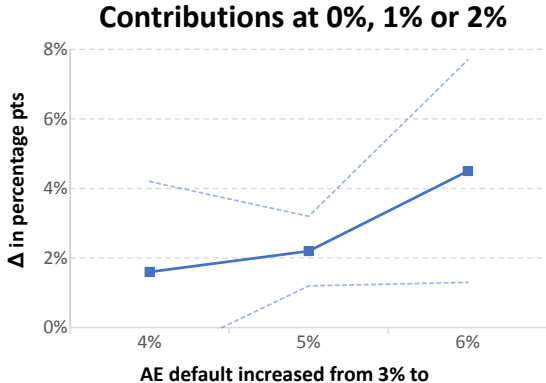
Out-of-Sample Validation I

Compare workers hired before/after AE default increased



Controls: plan, year, and age FEs, log tenure

Sample: 50 US 401k plans. 97,714 workers w/ $\leq$1y of tenure post grace-period

All cases: 85% success rate at the 10% level All

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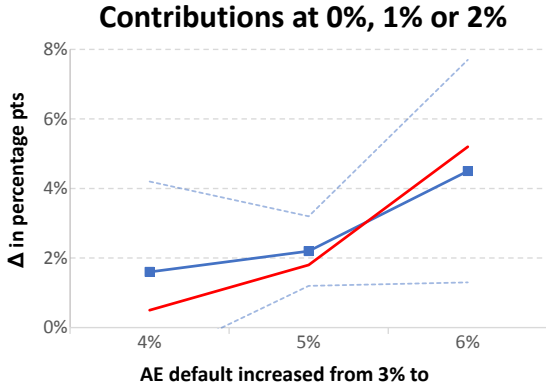

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Preference estimates from U.S. 401(k) plans ...
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Preference estimates from U.S. 401(k) plans ...

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US pref. estimates...

Opt-out cost at £160 (avg. exch. rate over 06-17)

Time pref. $\delta = 0.987$ and $\sigma = 0.455$

... w/ UK calibration:

Estimate the UK Income process using AShE

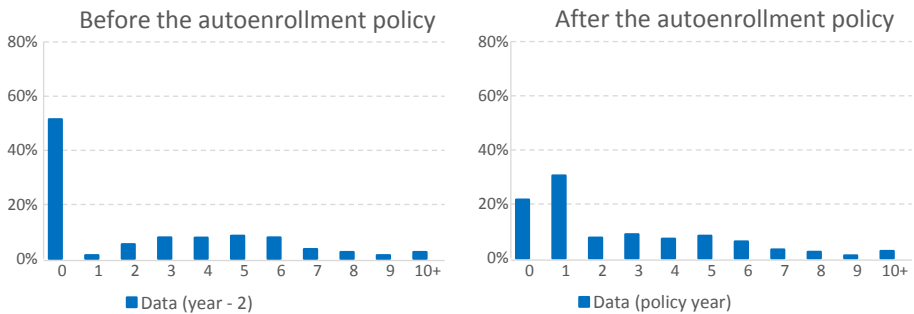
Estimate heterogeneity in employers contribution formulas (5 types)

Calibrate the UK tax and public pensions system

Out-of-Sample Validation II

Mandatory Autoenrollement for all U.K. private employees at 1%

Within-job effect:



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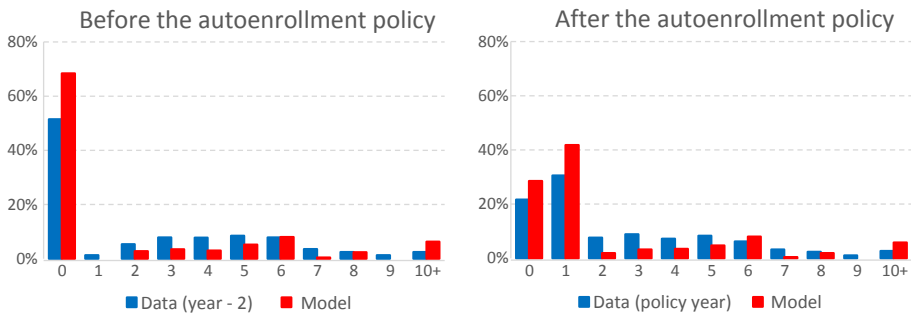

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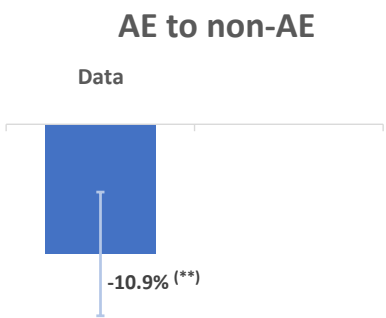

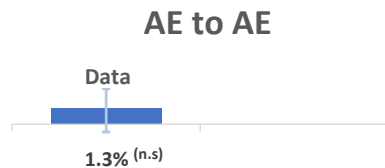

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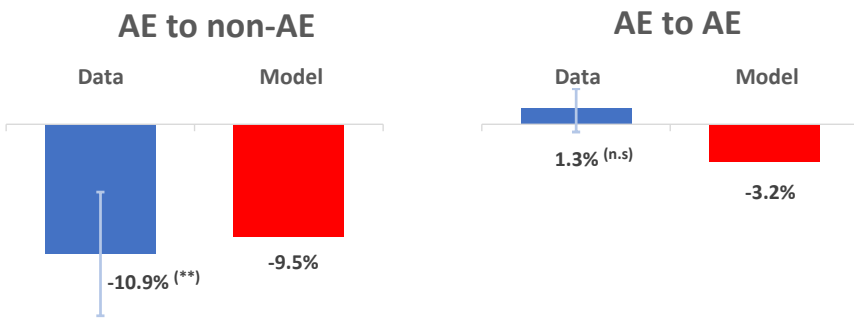


AE ↑ Lifetime Savings at the Bottom

Typical AE policy at 3% adopted by all employers

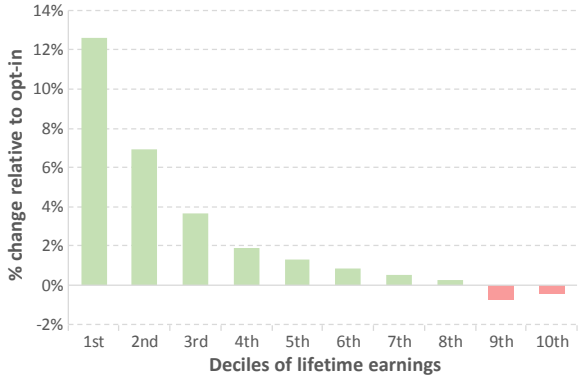
Incidence on workers | AE 6pct | AE 10pct | High Present Bias | Low Present Bias | Proportional Cost

AE ↑ Lifetime Savings at the Bottom

Typical AE policy at 3% adopted by all employers

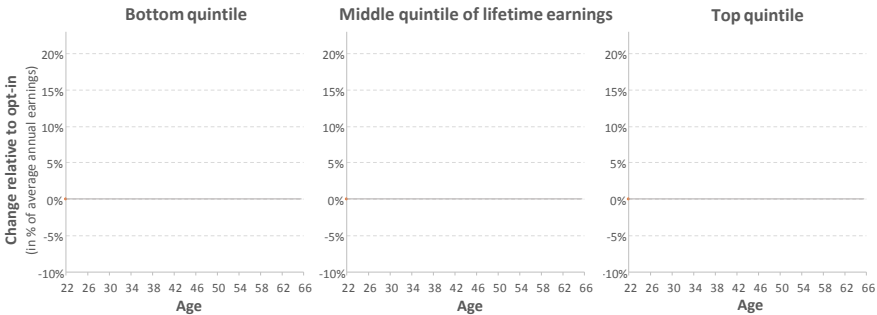
For most people: ↑ saving early-on ↓ saving later in life

BUT large effects at the bottom of the lifetime earnings distrib.



Incidence on workers | AE 6pct | AE 10pct | High Present Bias | Low Present Bias | Proportional Cost

Limited Crowd-out of Liquid Assets



Limited Crowd-out of Liquid Assets

Retirement asset: lifecycle saving motive

Intertemporal crowd-out

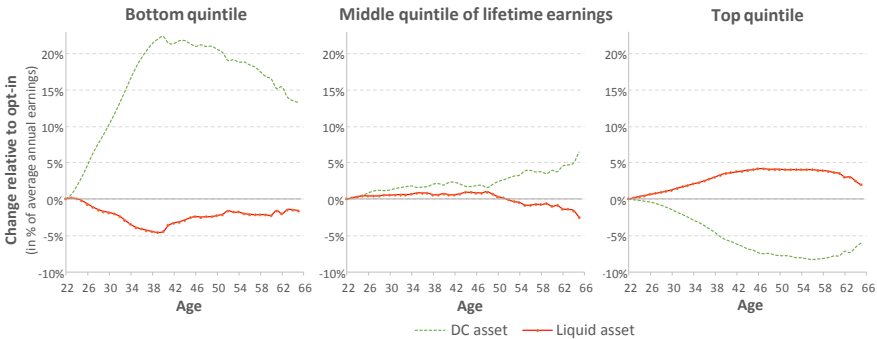
Limited Crowd-out of Liquid Assets

Retirement asset: lifecycle saving motive

Liquid asset: precautionary saving motive

Intertemporal crowd-out $>$ intratemporal substitution

Chetty et al, 2014 - Laibson et al, 2017



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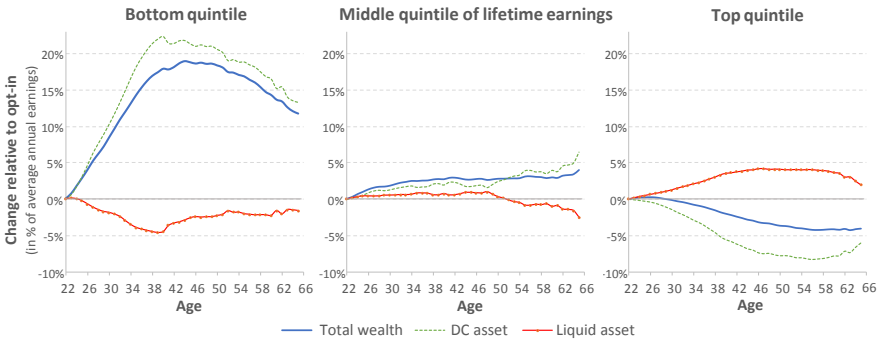


Three Results

I use the estimated model to derive **3 key results :**

External validity: AE effect stable across settings

$\Rightarrow$builds confidence in the long-run predictions

Long-run effect: Lifetime savings $\uparrow$ only at the bottom

Welfare: Optimal default characterization

Policymaker's Problem

Benevolent policymaker select default to max. welfare

Selected default adopted by all employers over a lifetime

Example 1: gvmt selects default for national or state level AE policy

Example 2: exemption from IRS discrim. test for qualified 401k plans

Two key questions:

1. **Social preferences?** possibly $\neq$ individuals' preferences
2. **Incidence?** higher demand for matching contrib. under AE

Social Preferences

Policymaker preferences can differ from invidividuals':

$$V^{SP}\left(d^{SP}\right) = \mathbb{E}_0\left[\sum_{t=1}^{A}\left(\delta^{SP}\right)^t\left(\prod_{k=1}^{t-1}(1-m_k)\right)\varphi_t u_t\left(c_t - \mathbb{1}_{(s_t \neq d_t)}\pi k\right)\right]$$

δ^{SP}: can be more patient than individuals $\delta^{SP} \geq \delta$

φ_t: can have different distributional preferences Saez '02

π: treat only a fraction of opt-out cost as welfare relevant Goldin, Reck '18

Policy Incidence

Subject to employers budget constraint:

$$\text{Total profits} + \text{wages} + \text{match costs} = \text{constant}$$

Employers can respond to AE in three ways:

1. **Reduce profits** (implicit assumption in previous studies)
2. **Reduce matching rate** cross-sectional evidence Butrica, Karamcheva '15
3. **Reduce wages**

Utilitarian Policymaker

$$\delta^{SP} = \delta,\ \varphi = 1 \text{ and } \pi = 0 \text{ or } 1$$

Match and tax incentives $\Rightarrow$ save more than implied by preference

AE shift cons. even more toward retirement $\Rightarrow \downarrow$ welfare

---

Utilitarian Policymaker

$$\delta^{SP} = \delta,\ \varphi = 1 \text{ and } \pi = 0 \text{ or } 1$$

Utilitarian policymaker prefers the **opt-in regime ...**

Match and tax incentives $\Rightarrow$ save more than implied by preference

AE shift cons. even more toward retirement $\Rightarrow \downarrow$ welfare

Levels	Employers profits	Matching rate	Wages adjustment
Utilitarian	Opt-in	Opt-in	Opt-in

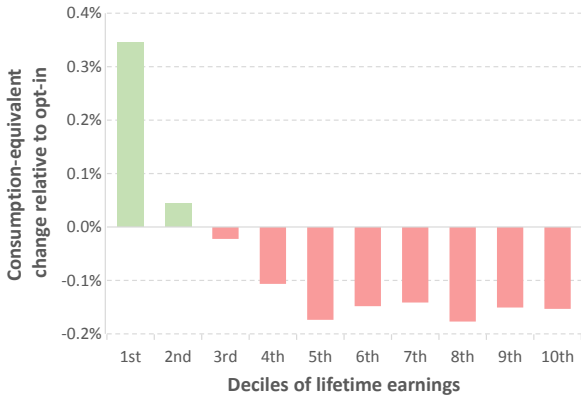
Proportional Cost | High Present Bias | Low Present Bias

Utilitarian Policymaker

$$\delta^{SP} = \delta,\ \varphi = 1 \text{ and } \pi = 1$$

Utilitarian lifetime utility decreases for most ...

... but **increases at the bottom** (ex. 6% AE)



Inequality-Averse Policymaker

$$\delta^{SP} = \delta,\ \varphi_t = \bar{y}\left(\theta_t, a_t, emp_t\right)^{-\nu} \text{ and } \pi = 0 \text{ or } 1$$

Specification of Saez '02 with $\nu = 1$. Invariant to policy changes.

wants to redistribute matching funds toward low-income individuals

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Specification of Saez '02 with $\nu = 1$. Invariant to policy changes.

Inequality-averse sets default near **match threshold**

wants to redistribute matching funds toward low-income individuals

Levels	Employers profits	Matching rate	Wages adjustment
Utilitarian	Opt-in	Opt-in	Opt-in
Inequality averse	AE 6%	AE 5%	AE 5%

Proportional Cost | High Present Bias | Low Present Bias

Paternalistic Policymaker

$$\delta^{SP} = 1,\ \varphi = 1 \text{ and } \pi = 0 \text{ or } 1$$

Why? Samaritan dilemma, limited self-control, or normative motive

Sleet, Yeltekin '06 Laibson '97 Caplin, Leahy'04

Wants to increase retirement wealth accumulation

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Paternalistic sets default at **match threshold**

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Proportional Cost High Present Bias Low Present Bias

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Summary of my Findings

People catch up over time ...

- workers undo much of AE positive effect by saving less later on
- AE in **current** job causes workers to save less at their **next** job

... therefore, a $250 opt-out cost can explain default effect

- Not so costly to remain at default because can compensate late

AE increases lifetime welfare/savings only at the bottom

- optimal default is either 0% or employer match threshold (depends on social planner's preferences)

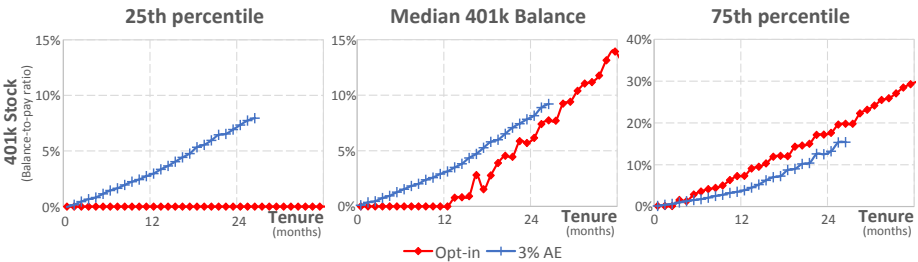
What have we learned?

- Life Cycle Hypothesis (LCH):
  - AE effect seen as a major challenge to the LCH
  - I show that w/ small friction LCH is consistent with AE effect
- Nudges:
  - in a dynamic setting savings nudges are less effective ...
  - ... but can still have important distributional effects
  - Insight extends to other settings in which:
    - there is uncertainty about the future
    - people can take corrective actions later on

Supplementary Material I

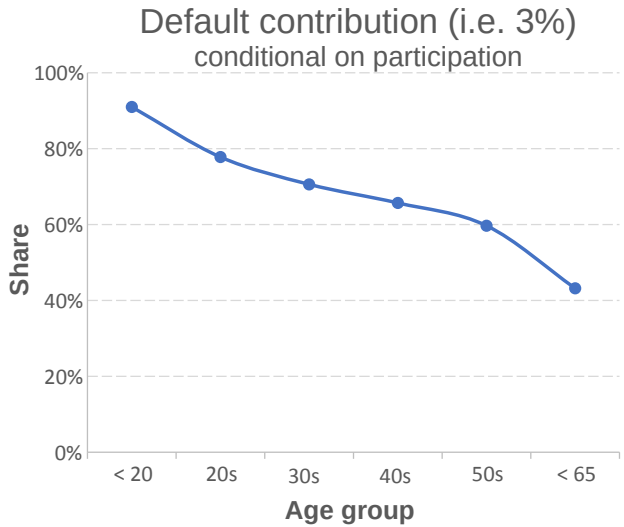
Choi et al '04 - Firm A

Back



Default Propensity by Age

Back



(source: Madrian, Shea '01)

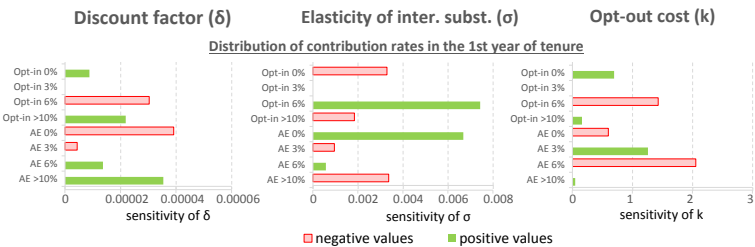
Robustness

Back

	(1) Baseline model	(2) Full var-cov weighting matrix	(3) Opt-in workers only	(4) Autoenrolled workers only
k	\$254	\$268	\$340	\$258
	(11)	(17)	(29)	(11)
δ	0.987	0.987	0.988	0.987
	(0.000)	(0.001)	(0.001)	(0.001)
σ	0.455	0.444	0.454	0.426
	(0.013)	(0.015)	(0.027)	(0.012)
χ^2 stat.	586	583	414	131
(df)	41	41	13	25

Sensitivity - Andrews, Gentzkow, Shapiro (2017)

Back



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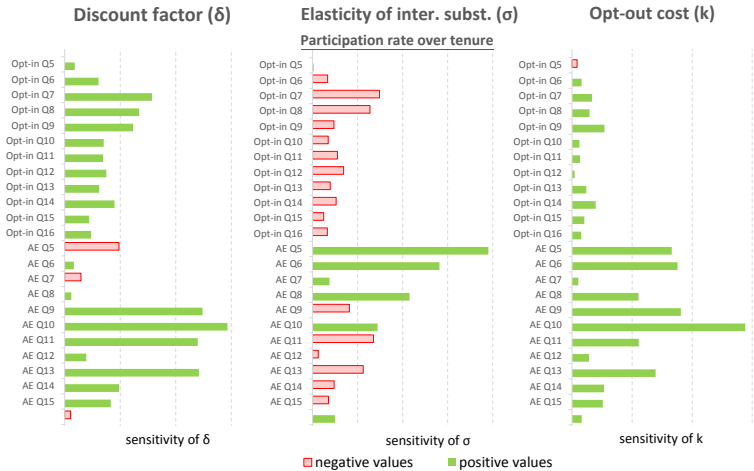

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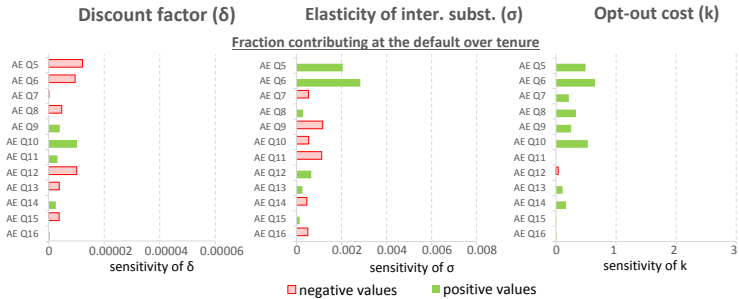


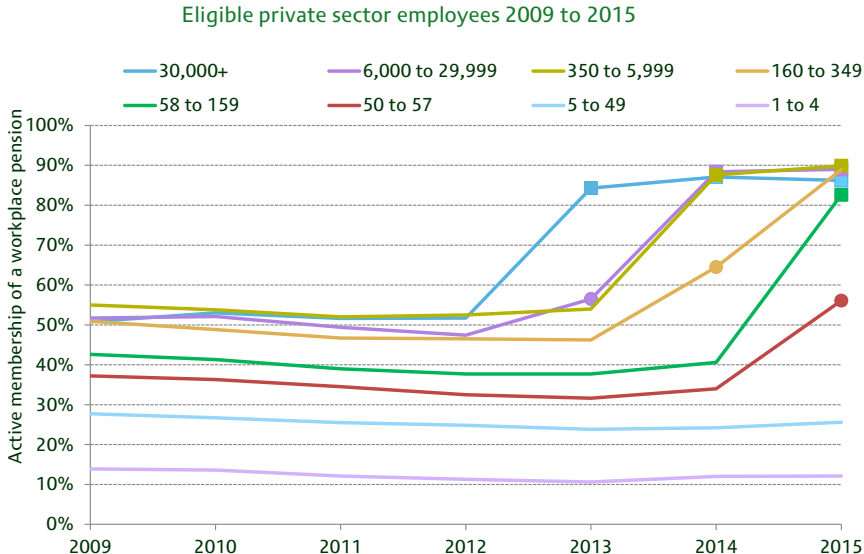
Roll-out of Autoenrollment in the UK

Back

Employer size	Policy staging date	Employer size	Policy staging date	Employer size	Policy staging date
120,000+	October, 2012	2,000+	August, 2013	61+	August, 2014
50,000+	November, 2012	1,250+	September, 2013	60+	October, 2014
30,000+	January, 2013	800+	October, 2013	59+	November, 2014
20,000+	February, 2013	500+	November, 2013	58+	January, 2015
10,000+	March, 2013	350+	January, 2014	54+	March, 2015
6,000+	April, 2013	250+	February, 2014	50+	April, 2015
4,100+	May, 2013	160+	April, 2014	40+	August, 2015
4,000+	June, 2013	90+	May, 2014	30+	October, 2015
3,000+	July, 2013	62+	July, 2014		

Roll-out of Autoenrollment in the UK

Back



Default Mechanism

Other Mechanisms: back

1. Convex Adjustment cost: button
   - One-sided: Temptation (Gul, Pesendorfer, '01) Loss aversion (Prelec, Loewenstein et al, '92)

$$U\left(c_\gamma|\bar{\tau}_\gamma^{def}\right)=\begin{cases}u_\gamma(c_t) & \text{if } \tau_\gamma \leq \bar{\tau}_\gamma^{def}\\ u_\gamma(c_t)-\alpha\left[\boldsymbol{u}\left(\boldsymbol{c}_\gamma\left(\bar{\tau}_\gamma^{\boldsymbol{def}}\right)\right)-\boldsymbol{u}\left(\boldsymbol{c}_\gamma\right)\right] & \text{if } \tau_\gamma > \bar{\tau}_\gamma^{def}\end{cases}$$

   - Two-sided: anchoring (Bernheim et al, '15)
     - ⋆ counterfactual prediction: ↑ default ⇒ ↑ paritcipation
2. Endorsement effects/ Default as advice:
   - Large effects despite public randomization into AE (Blumenstock et al, '17)
3. Unawareness: employees may not be aware of AE
   - Text reminders have no effect on default effect (Blumenstock et al, '17)
   - No effect from a financial education intervention (Choi et al, '11)

Opt-out Cost

Opt-out cost model: back

$$V^S(d) = u\left((1-s)w - \mathbb{1}_{(s \neq d)}.k\right) + \delta V(sw)$$

Assume $u' > 0$, $u'' < 0$ and $V' > 0$, $V'' < 0$

Proposition. With an opt-out cost, increasing the default contribution rate from $\underline{d}$ to $\overline{d}$ (weakly) increases contributions strictly below $\underline{d}$:

Loss Aversion

Loss aversion model: back

$$U(s,d) = \begin{cases} u_a(c_t(s)) + \eta\left(u_a(c_t(s)) - u_a(c_t(d))\right) & \text{if } s < d \\ u_a(c_t(s)) + \eta\lambda\left(u_a(c_t(s)) - u_a(c_t(d))\right) & \text{if } s \geq d \end{cases}$$

where $c(s)$ is the optimized consumption policy:

$$c_t(s) = \operatorname{argmax}\,(1+\eta)\,u_a(c_t) + \beta\,(1-m_a)\,\mathbb{E}_t\left(V_{t+1}(s)\right)$$

Proposition. Under loss-averse preferences, increasing the default contribution rate from $\underline{d}$ to $\overline{d}$ (weakly) decreases contributions strictly below $\underline{d}$:

$$Pr\left(s^* < \underline{d} \,|\, d = \underline{d}\right) \leq Pr\left(s^* < \underline{d} \,|\, d = \overline{d}\right)$$

Psychological Anchoring

Anchoring model: back

Following Bernheim et al (2015), I assume that the anchoring parameter χ shifts the participants preferences toward the value that would rationalize the default as an optimal choice:

$$V_t^S(d) = \begin{cases} u_a(c_t(s)) + (\beta + \chi)(1 - m_a)\mathbb{E}_t(V_{t+1}(d)) & \text{if } s < d \\ u_a(c_t(s)) + \beta(1 - m_a)\mathbb{E}_t(V_{t+1}(d)) & \text{if } s = d \\ u_a(c_t(s)) + (\beta - \chi)(1 - m_a)\mathbb{E}_t(V_{t+1}(d)) & \text{if } s > d \end{cases}$$

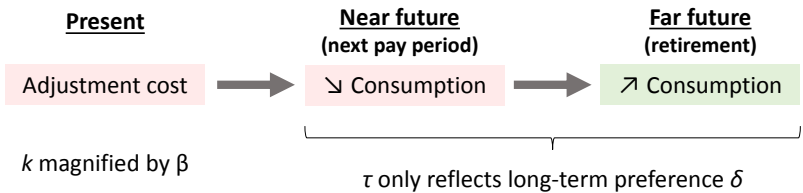
Proposition. When the default serves as a psychological anchor, increasing the default contribution rate from $\underline{d}$ to $\overline{d}$ (weakly) decreases contributions strictly below $\underline{d}$:

$$Pr(s^* < \underline{d} \,|\, d = \underline{d}) \leq Pr\left(s^* < \underline{d} \,|\, d = \overline{d}\right)$$

The Role of Present Bias

Specification I

back Mech back SMM



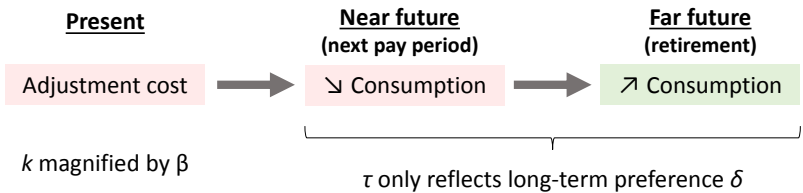
- Present bias ↗ inertia ...
- ... but does not affect contribution conditional on acting

Present bias ⇔ higher adj. cost

The Role of Present Bias

Specification I

back Mech back SMM



- Present bias ↗ inertia ...
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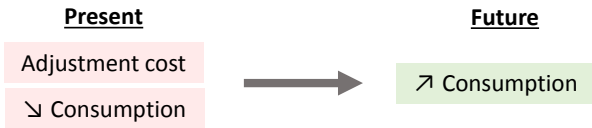
Present bias ⇔ higher adj. cost

The Role of Present Bias

Specification II

back Mech back SMM



τ reflects present biased preference $\beta\,\delta$

Estimation:

- I fix the short-term discount factor at (β) and re-estimate the model:

  $\{\beta = 0.5\,;\, \delta = 0.999\,;\, \sigma = 0.625\,;\, k = \$430\}$ and

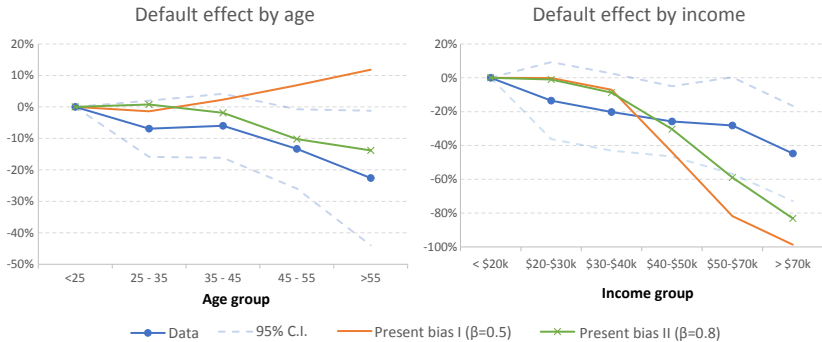
  $\{\beta = 0.8\,;\, \delta = 0.989\,;\, \sigma = 0.454\,;\, k = \$269\}$

With a higher long-term discount factor the model no longer fits the age-heterogeneity

The Role of Present Bias

Model Fit: back SMM

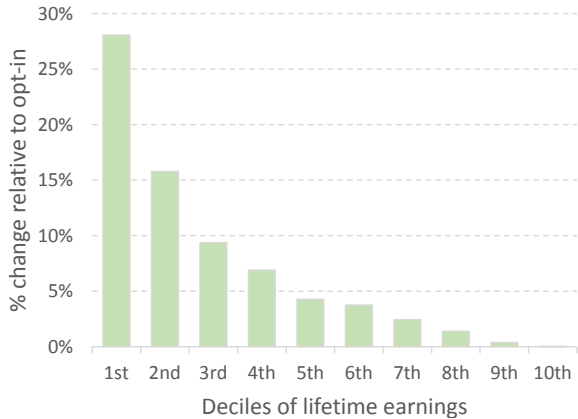
With a higher long-term discount factor the model no longer fits the age-heterogeneity



Long-Term Effect - Present bias $\beta = 0.5$

$$\{\beta = 0.5\,;\, \delta = 0.999\,;\, \sigma = 0.625\,;\, k = \$430\}$$

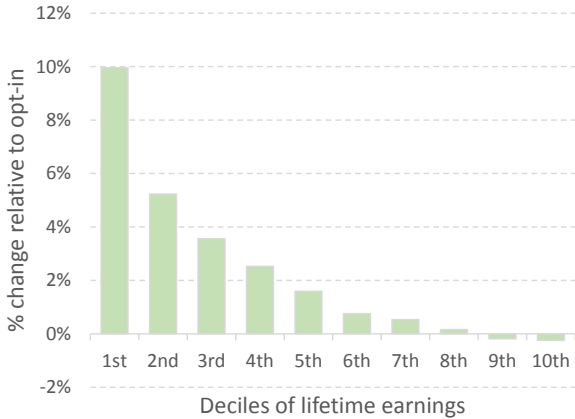
AE policy at 3% adopted by all employers: back



Long-Term Effect - Present bias $\beta = 0.8$

$$\{\beta = 0.8\,;\, \delta = 0.989\,;\, \sigma = 0.454\,;\, k = \$269\}$$

AE policy at 3% adopted by all employers: back



Optimal policies - Present bias $\beta = 0.5$

back

$$\{\beta = 0.5\,;\, \delta = 0.999\,;\, \sigma = 0.625\,;\, k = \$430\}$$

		Employers profits	Matching rate	Wages adjustment
Utilitarian	$\pi = 1$	AE 9%	AE 9%	AE 9%
	$\pi = 0$	AE 10%	AE 10%	AE 10%
Inequality averse	$\pi = 1$	AE 10%	AE 10%	AE 10%
	$\pi = 0$	AE 11%	AE 10%	AE 11%

Optimal policies - Present bias $\beta = 0.8$

back

$$\{\beta = 0.8\,;\, \delta = 0.989\,;\, \sigma = 0.454\,;\, k = \$269\}$$

		Employers profits	Matching rate	Wages adjustment
Utilitarian	$\pi = 1$	Opt-in	Opt-in	Opt-in
	$\pi = 0$	AE 15%	Opt-in	Opt-in
Inequality averse	$\pi = 1$	AE 6%	AE 5%	AE 5%
	$\pi = 0$	AE 6%	AE 5%	AE 6%

Extension: Proportional Opt-out Cost

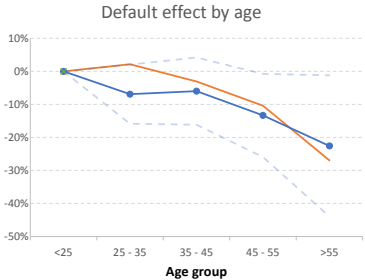
Model: back SMM back Heter

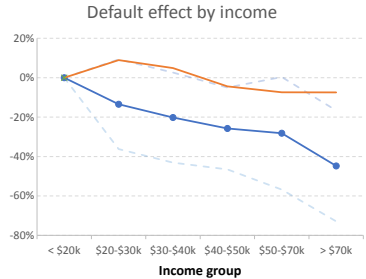
I introduce an opt-out cost $\tilde{k}$ that is proportional to earnings:

$$u_a\left(c_t - \mathbb{1}_{(s_t \neq d_t)}\tilde{k}.w_t\right)$$

Estimate:

I estimate $\tilde{k}$ to be equal to 3.16% of quarterly income (i.e. \$292 for average earner) - $\{\beta = 0.985; \sigma = 0.334; k = 3.2\%\}$

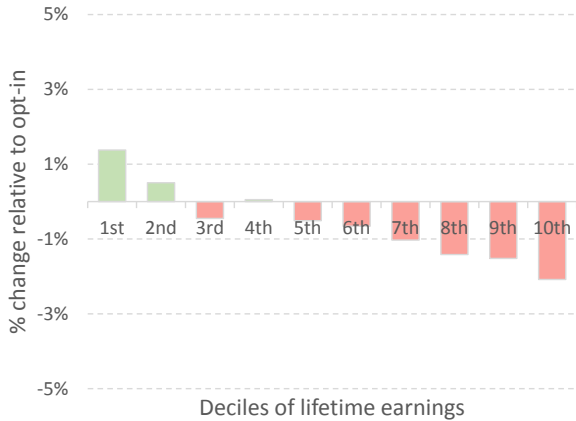




Long-Term Effect - Proportional Cost

$$\{\beta = 0.985\,;\, \sigma = 0.334\,;\, k = 3.2\%\}$$

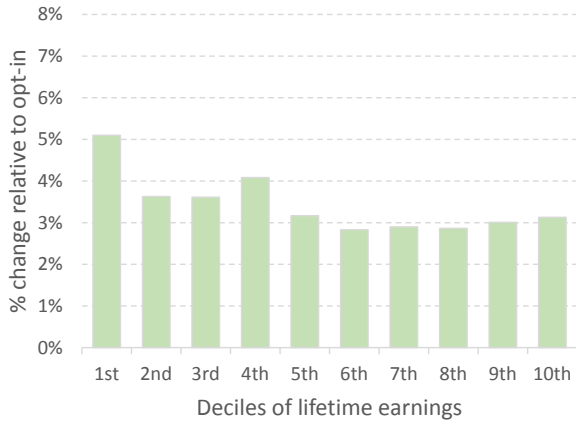
AE policy at 3% adopted by all employers: back



Long-Term Effect - Proportional Cost

$$\{\beta = 0.985\,;\, \sigma = 0.334\,;\, k = 3.2\%\}$$

AE policy at 6% adopted by all employers: back



Optimal policies - Present bias $\beta = 0.5$

back

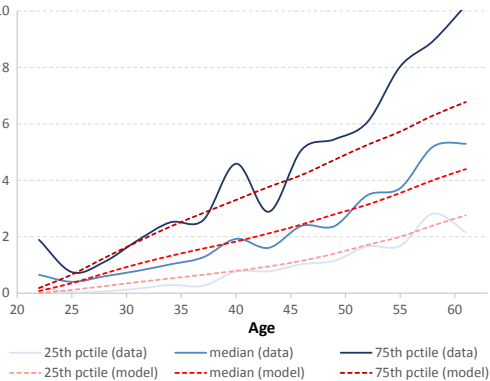
$$\{\beta = 0.985\,;\, \sigma = 0.334\,;\, k = 3.2\%\}$$

		Employers profits	Matching rate	Wages adjustment
Utilitarian	$\pi = 1$	AE 6%	AE 4%	AE 4%
	$\pi = 0$	Opt-in	Opt-in	AE 4%
Paternalistic	$\pi = 1$	AE 6%	AE 5%	AE 5%
	$\pi = 0$	AE 6%	AE 5%	AE 5%

Wealth to earnings ratio over the lifecycle

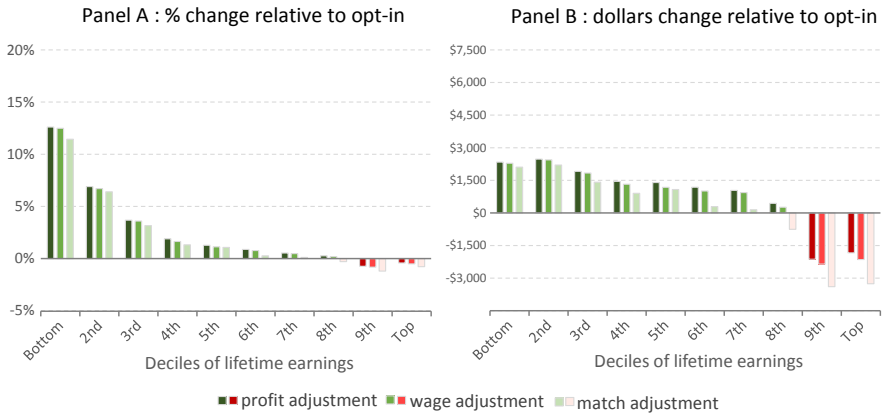
Ratio of net wealth to earnings by age: back

- Data: Survey of Consumer Finances 2016
- Sample: households where head or spouse has any type of account-based pension plan on current job
- Total wealth: all assets net of all outstanding debt



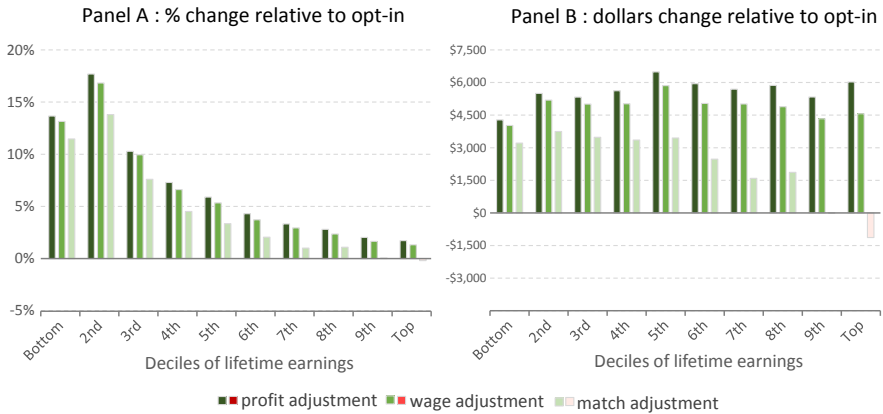
AE Adoption by all Employers

AE policy at 3% adopted by all employers: back



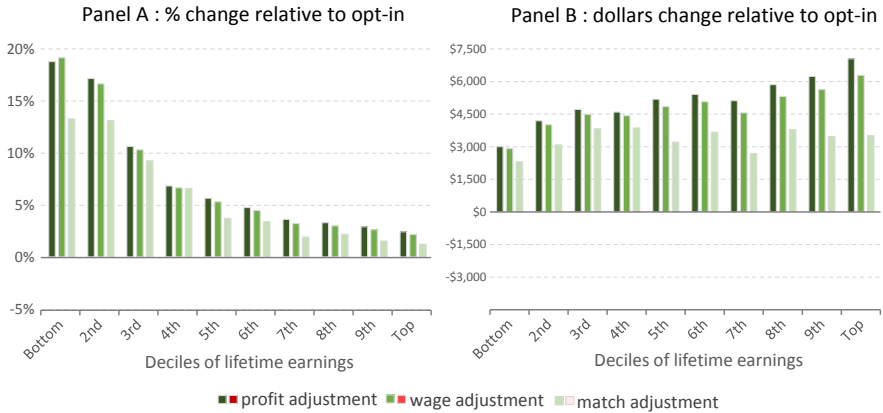
AE Adoption by all Employers

AE policy at 6% adopted by all employers: back



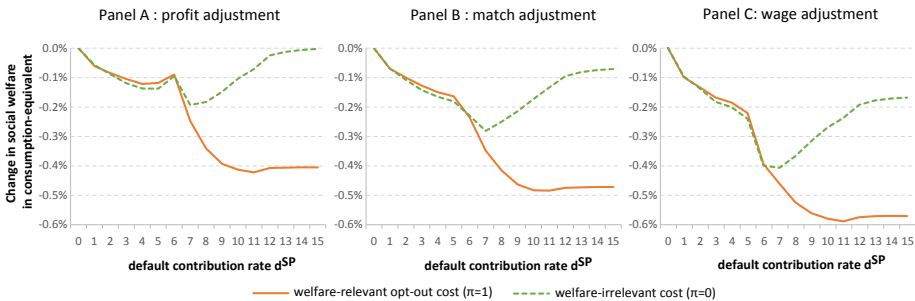
AE Adoption by all Employers

AE policy at 10% adopted by all employers: back



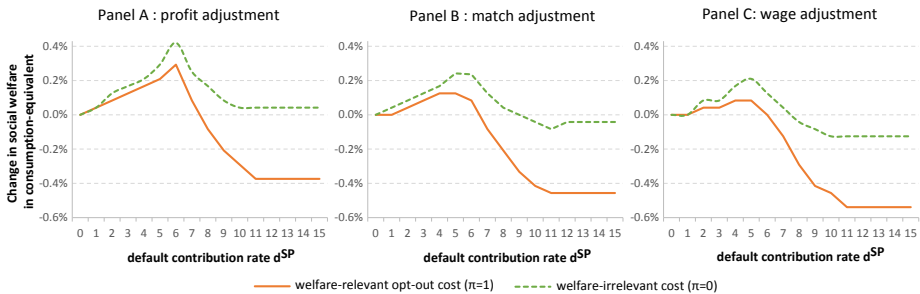
Utilitarian Policymaker

back



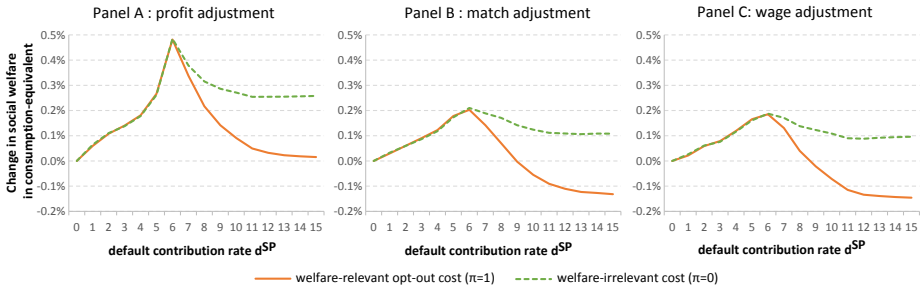
Inequality-Averse Policymaker

back



Paternalistic Policymaker

back



Out-of-Sample Validation I

back

	Contrib<initial default		Sample size		
	(1)	(2)	(3)	(4)	(5)
	Data	Model	Nbr. of	Nbr. of	P-value
	86 plans	prediction	plans	worker	difference
Default increased by 1%					
Default 2% → 3%	0.017	0.007	11	31,364	**[0.483]**
	(0.014)				
Default 3% → 4%	0.016	0.005	10	13,116	**[0.430]**
	(0.013)				
Default 4% → 5%	-0.003	0.013	3	1,821	**[0.513]**
	(0.020)				
Default 5% → 6%	-0.016	0.034	5	3,970	[0.005]
	(0.009)				
Individual's characteristics	✓				
Plan FE	✓				

Out-of-Sample Validation I

back

	Contrib<initial default		Sample size		
	(1)	(2)	(3)	(4)	(5)
	Data	Model	Nbr. of	Nbr. of	P-value
	86 plans	prediction	plans	worker	difference
Default increased by 2%					
Default 1% → 3%	0.023	0.020	1	1,067	**[0.917]**
	(0.025)				
Default 2% → 4%	-0.005	0.012	4	1,793	**[0.231]**
	(0.011)				
Default 3% → 5%	0.022***	0.018	14	56,011	**[0.456]**
	(0.005)				
Default 4% → 6%	0.031***	0.047	9	17,989	[0.048]
	(0.007)				
Default 6% → 8%	0.067***	0.148	1	673	[0.000]
	(0.021)				

Out-of-Sample Validation I

back

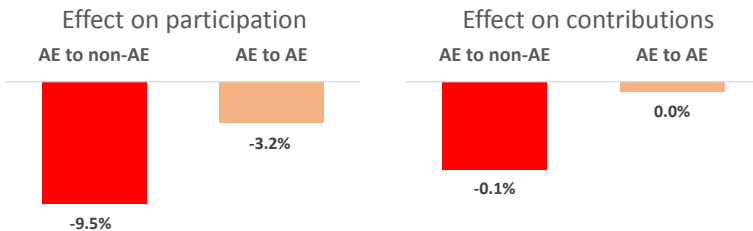
	Contrib<initial default		Sample size		
	(1)	(2)	(3)	(4)	(5)
	Data	Model	Nbr. of	Nbr. of	P-value
	86 plans	prediction	plans	worker	difference
Default increased by 3 or 4%					
Default 3% → 6%	0.045***	0.052	26	27,190	**[0.648]**
	(0.016)				
Default 3% → 7%	0.060	0.132	2	4,219	**[0.146]**
	(0.017)				
Individual's characteristics	✓				
Plan FE	✓				

* p<0.10, ** p<0.05, *** p<0.01

Out-of-Sample Validation II

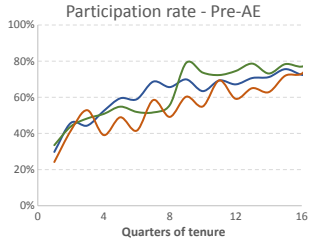
back

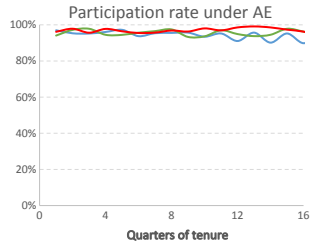
After job-switch (from AE to AE):

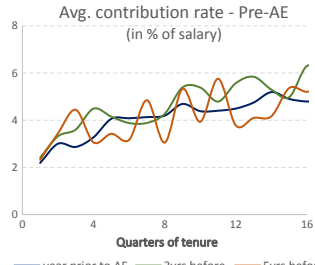


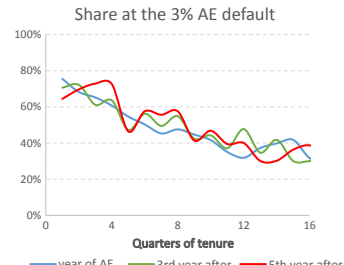
Peer Effects?

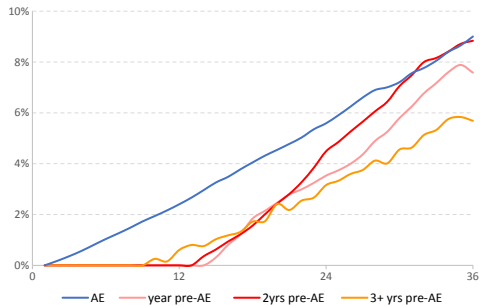
No difference in saving behavior btw. those hired in the 12 months prior to AE and those hired earlier back









Peer Effects?

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