

The Role of Exponential-Growth Bias and Present Bias in Retirement Saving Decisions

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Motivation

Dramatic change in pension plan landscape in past 35 years

	1979	2011	Change
DB only	62%	7%	-89%
DB & DC	22%	24%	+9%
DC only	16%	69%	+331%

Note: Defined Benefit (DB) and Defined Contribution (DC) Plans among private sector employees with a plan according to EBRI

Implications for retirement saving

- Employees responsible for managing contributions to DC plans
- Some evidence that retirement saving levels are inadequate for retirement income needs

Cognitive and Motivational Barriers to Retirement Saving

Low financial literacy

- Just 34% of Americans score 3 out of 3 on basic financial literacy test (Lusardi and Mitchell 2014)
- Few Americans have accurate understanding of compound (or exponential) growth (Levy and Tasoff *forthcoming*)
- Those with exponential growth (EG) bias systematically underestimate benefits to saving (Levy and Tasoff *forthcoming*; McKenzie and Liersch 2011)

Inertia in behavior

- Powerful effect of default rules: “opt-out” has substantial effect on contribution behavior (Madrian and Shea 2001)
- Individuals with present bias systematically underweight future consumption relative to present in an *inconsistent* manner that prevents enrollment despite intentions to enroll

This Paper

Research Questions:

- What is the prevalence of EG bias and present bias in the U.S.?
- Are these biases related to retirement savings?
- Is there causal evidence as to the effect of these biases on retirement saving decisions?
- What policies can mitigate effect of biases?

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- What policies can mitigate effect of biases?

Approach:

- Online survey using U.S. representative sample
- Careful elicitation of biases
- Development of treatments designed to target biases
- Assess treatment effects by level of biases using hypothetical retirement saving scenario

Findings and Contribution

Preview results:

- Incidence of bias not related: having one bias does not increase likelihood of having the other.
- Each bias is a significant predictor of retirement savings levels; evidence of interaction effect
- Evidence that biases have causal effect on response to retirement saving opportunities

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- Incidence of bias not related: having one bias does not increase likelihood of having the other.
- Each bias is a significant predictor of retirement savings levels; evidence of interaction effect
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Contribution:

- First to measure both biases and relate them to retirement savings
- Show causal evidence of impact of biases on saving decisions
- Assessment of policy tools for improving retirement saving decisions

Framework: Present Bias Influences Preferences

Present bias implies time *inconsistent* preferences: We assume individual i has quasi-hyperbolic utility (c.f., Laibson 1997) over a vector of consumption $x \in \mathbb{R}^{T-t+1}$ of the form:

$$U_{i,t}(x) \equiv u_i(x_t) + \beta_i \sum_{\tau=t+1}^T \delta_i^{\tau-t} u_i(x_\tau) \quad (1)$$

- δ_i is long-run discount factor
- $1 - \beta_i$ is degree of present bias (i.e., $\beta = 1$ implies not present biased)

How does *inconsistency* manifest? Individual uses

- δ_i when comparing tradeoffs between future dates.
- $\beta_i \times \delta_i$ when considering tradeoffs involving the present.

Framework: EG Bias Influences Budget Constraint

Let $p(\vec{i}, t; \alpha)$ be the agent's perception of the period- T value of one dollar invested at time t (c.f. Tasoff and Levy *forthcoming*):

$$p(\vec{i}, t; \alpha) = \prod_{s=t}^{T-1} (1 + \alpha i_s) + \sum_{s=t}^{T-1} (1 - \alpha) i_s \quad (2)$$

- $\alpha = 1$: individual correctly perceives growth to be exponential
- $\alpha = 0$: individual incorrectly perceives growth to be linear
- $\alpha \in [0, 1]$: individual perceptions between linear and exponential growth

Framework: EG Bias Influences Budget Constraint

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How might β and α work together to explain retirement saving?

- Low α may reduce perceived cost of delaying enrollment.
- Even if individuals has α close to 1, low β may prevent ever enrolling.

Survey Sample

RAND American Life Panel (ALP)

- Representative sample of 18 years or older
- Invited at least once a month; paid based on length
- Randomly invited 3,500 over three “cohorts”

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Two-Wave Survey Design:

- Survey 1: Background + EG bias (α)
 - Retirement savings + other wealth and debt; employer retirement plan and participation
 - α : 5 questions on compound growth; varied in difficulty (Levy and Tasoff *forthcoming*)

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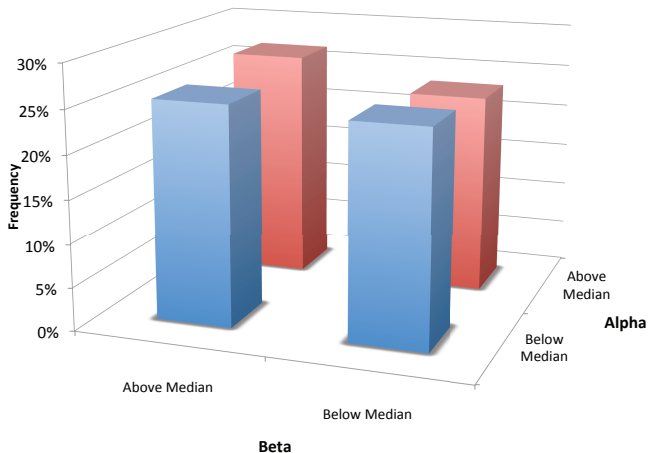
Two-Wave Survey Design:

- Survey 1: Background + EG bias (α)
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 - α : 5 questions on compound growth; varied in difficulty (Levy and Tasoff *forthcoming*)
- Survey 2: Present Bias (β) + Treatment Scenario
 - δ and β : Trading off payments today vs. 12 months and 12 months vs. 24 months (Falk et al. 2014)
 - Treatment scenario: Contributions to hypothetical employer-provided retirement plan (without and with employer match)

Descriptive Statistics for Sample

	Mean	St. Dev.
α	0.579	0.485
β	1.023	0.203
δ	0.709	0.173
Any Retirement Savings	0.677	0.468
Retirement Savings (Winsorized)	\$112,369	\$193,002
Age (years)	52.396	15.237
Female	0.569	0.495
White	0.785	0.179
Black/African American	0.114	0.318
Asian or Pacific Islander	0.029	0.167
Other Race	0.082	0.274
Latino/Hispanic	0.158	0.365
Highschool Degree (or less)	0.188	0.258
Some College, No Degree	0.254	0.435
Associates Degree	0.119	0.324
Bachelors Degree	0.260	0.439
Masters, Professional, Doctorate	0.179	0.384
Married or Partner	0.605	0.489
IQ Proxy (out of 5)	2.382	1.529
Basic Financial Literacy (out of 3)	2.298	0.702
Observations	1628	

Frequency of Biases



	α	β	δ
Age (years)	-0.005 (0.005)	0.006*** (0.002)	0.001 (0.002)
Age, Squared	0.000 (0.000)	-0.000** (0.000)	-0.000 (0.000)
Female	-0.047** (0.024)	0.001 (0.010)	-0.007 (0.008)
Black/African American	-0.066* (0.040)	-0.030* (0.016)	-0.036*** (0.013)
Asian or Pacific Islander	-0.071 (0.071)	-0.024 (0.028)	-0.011 (0.024)
Other Race	0.014 (0.048)	-0.047** (0.019)	-0.021 (0.016)
Latino or Hispanic	-0.053 (0.038)	0.036** (0.015)	-0.020 (0.013)
High School or less	-0.067* (0.037)	-0.006 (0.015)	-0.030** (0.013)
Some College, No Degree	-0.045 (0.033)	-0.031** (0.013)	-0.035*** (0.011)
Associates Degree	-0.048 (0.041)	-0.009 (0.016)	-0.012 (0.014)
Masters, Professional, Doctorate	-0.032 (0.036)	0.041*** (0.014)	0.016 (0.012)
IQ Proxy (Std.)	0.093*** (0.013)	0.001 (0.005)	0.023*** (0.004)
Financial Literacy (Std.)	0.007 (0.012)	0.004 (0.005)	-0.002 (0.004)
δ	0.221*** (0.074)	-0.432*** (0.028)	
β	-0.061 (0.062)		-0.303*** (0.019)
α		-0.010 (0.010)	0.025*** (0.008)
R^2	0.09	0.17	0.20

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 1 : Retirement Savings, EGB, and PB – OLS

	(1)	(2)	(3)	(4)	(5)
α	33,268.67*** (8,474.16)	22,461.30*** (7,973.17)	21,398.24*** (8,000.84)	19,714.57** (7,971.27)	16,896.40** (8,056.86)
β	58,018.49** (23,059.62)	44,184.10** (20,514.35)	44,802.71** (20,581.59)	45,827.04** (20,587.12)	40,944.80** (19,921.68)
δ	169,487.42*** (31,666.81)	120,745.45*** (30,048.04)	122,287.74*** (30,039.93)	119,055.23*** (30,046.82)	106,491.74*** (30,423.62)
IQ Proxy				6,104.69 (4,334.81)	6,949.27 (4,454.23)
Financial Literacy				-1,852.57 (3,788.46)	-1,996.12 (3,860.60)
R^2	0.29	0.48	0.49	0.49	0.52
N	1,628	1,628	1,628	1,628	1,628
Income+IncomeXAge Dummies	No	Yes	Yes	Yes	Yes
Risk Preference Dummies	No	No	Yes	Yes	Yes
State Dummies	No	No	No	No	Yes

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Dependent variable is winsorized retirement savings, top censored at the 95th percentile. Imputed time preference parameters are included and controlled for with a dummy. IQ proxy and financial literacy are in units of standard deviations. Controls include risk preferences, age category dummies (10-year spans) crossed with 17 dummies for household income. Controls also include cohort dummies, current living situation (e.g. marital status), education category, size of household, number of children, job status, and ethnicity. Robust standard errors in parentheses.

Summary of Findings on Retirement Savings

Incidence of EG bias and Present bias not related

Correlates of biases:

- EG bias: Female (+), Black (+), High school degree (+), IQ proxy (−), δ (−)
- Present bias: Age (−), Black (+), Other race (+), Latino (−), Some college (+), Prof. degree (−)

Present bias and EG bias related to retirement savings:

- α : a one s.d. increase in α relates to a \$8,194 increase in retirement savings.
- β : a one s.d. increase in β relates to a \$8,311 increase in retirement savings.

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Is there a causal effect on retirement savings?

Hypothetical Retirement Saving Scenario

Scenario: Adoption of match to employer-provided retirement plan

- Asked annual contributions under *no match*
- Told about new policy: employer *matches* \$0.50 (\$1.00) per dollar of contribution
- Ask annual contribution under match + timing of making the change

Design elements:

- Required to use on-screen calculator to show value of match.
- Told that paperwork for contribution change takes 60 minutes.
- Participants asked to make decisions keeping all other aspects of financial situation they currently face unchanged (*except for employer-provided plan*) and considering time commitments they face.

Description of Treatments

EG Bias Treatments delivered via on-screen calculator

- *Control*: Year-end value of employer match
- *Balance Projection*: Value of employer match stated as **account balance** at retirement
- *Income Projection*: Value of employer match stated as **annual income** in retirement
- Investment return and retirement age randomized; participant could change values

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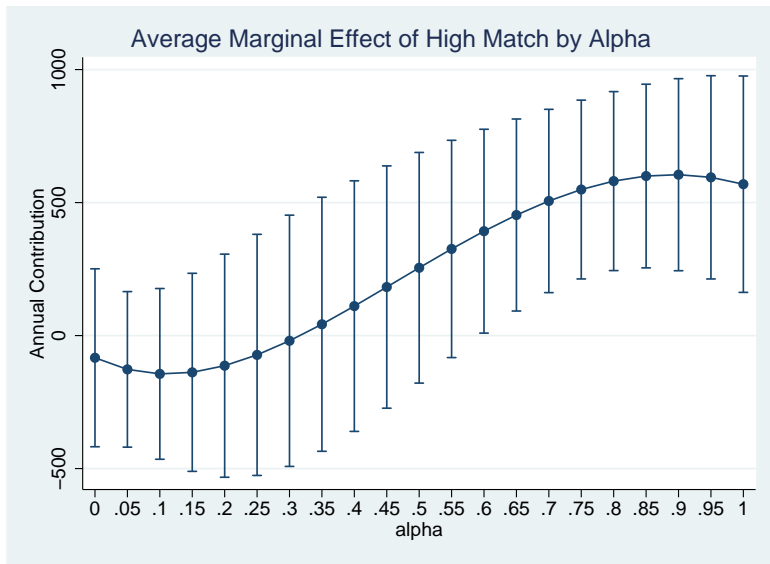
Present Bias Treatments involved incentive for completing paperwork

- *Control*: No incentive
- *Unlimited Incentive*: \$50 if complete (ever)
- *Limited Incentive*: \$50 if complete within 1 week
- Note: Completing paperwork does not require changing contribution

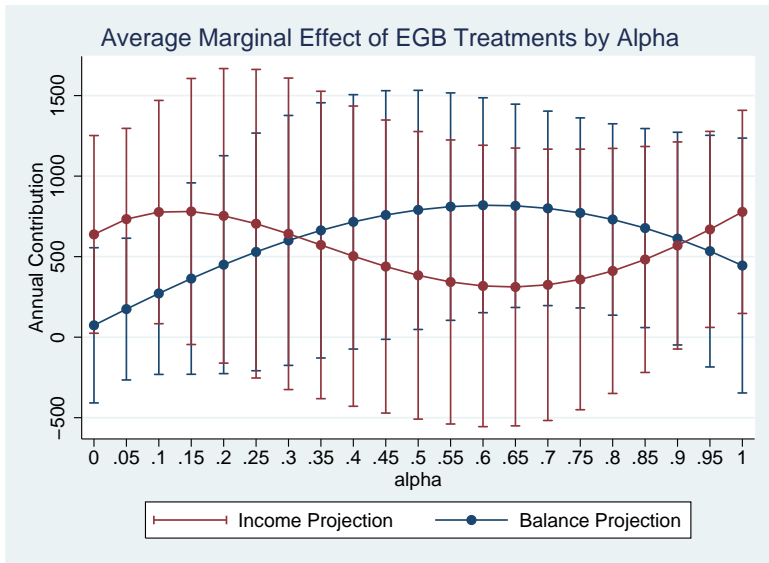
Descriptive Statistics for Treatment

	Mean	St. Dev.
Income Treatment (Proj. Annual Income in Retirement)	0.146	0.353
Balance Treatment (Proj. Account Balance at Retirement)	0.135	0.341
Limited Treatment (\$50 to Complete Paperwork Within 1 Week)	0.148	0.355
Unlimited Treatment (\$50 to Complete Paperwork Any Time)	0.138	0.345
Annual Contribution to Hyp. Plan (Non-match scenario)	\$2,882	\$3,488
Annual Contribution to Hyp. Plan (Match scenario)	\$4,007	\$4,618
Complete paperwork today	0.472	0.499
Complete paperwork within the week	0.806	0.395
Observations	2896	

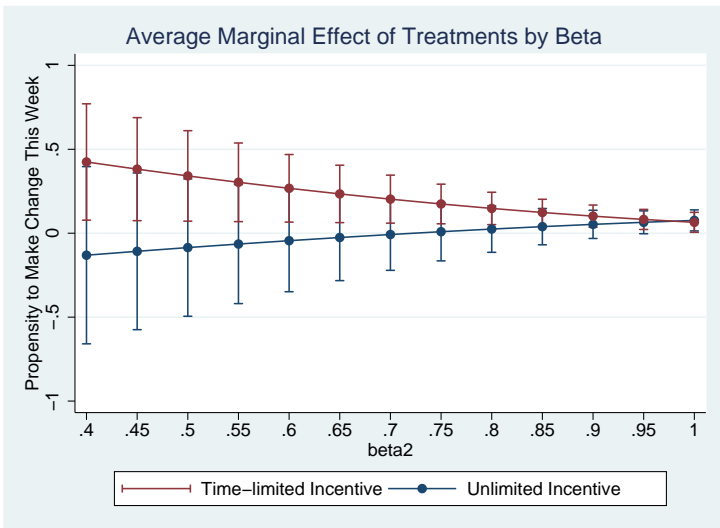
Effect of High relative to Low Match



Effect of Balance vs. Income Treatments on Contributions



Unlimited vs. Limited Treatments on Completing Paperwork “This Week”



Summary of Findings on Treatments

EG Bias Treatments: Response depends on bias

- Individuals with most EG bias (i.e. low α) increase contributions when shown *income* value of match
- Individuals with moderate EG bias (i.e. middle range of α) increase contributions when shown *balance* value of match
- Individuals with least EG bias (i.e. higher α) increase contributions when shown *income* value of match

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Present-Bias Treatments:

- Individuals who are more present biased (i.e. low β) respond most to time-limited incentives
- Individuals who are less present biased respond equally to limited and unlimited incentives

Conclusions

EG bias and present bias are:

- Prevalent, but incidence is not related
- Related to retirement savings; evidence of interaction
- Likely have causal effects on retirement saving

Implications for policy

- Response to opportunities for saving depends on EG bias
- Effect of treatment on (hypothetical) contributions depends on level of EG bias
- Interventions need to address cognitive and behavioral biases

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Limitations

- Measurement error in measuring biases
- Evaluation of treatments used hypothetical saving scenario