Money, Time, and Grant Design

NBER SI: Science of Science Funding

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HBS & LISH

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Funders think longer grants can spur more "risk-taking"

> We're introducing the new seven-year appointment in recognition of the fact that what many of these scientists are trying to do – open up new areas of research – is very difficult ... seven years of stable support allows them to take more risk and achieve more transformative advances.
>
> Howard Hughes Medical Institute

Funders think longer grants can spur more "risk-taking"

> ...longer grants are available, designed to encourage a broad range of applications, increased diversity of candidates, and bold projects.
>
> Wellcome Trust

> NIH is piloting the concept of awarding longer grants...It is our hope that with more sustained support, investigators will have more freedom to innovate and explore new lines of inquiry
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> National Institutes of Health

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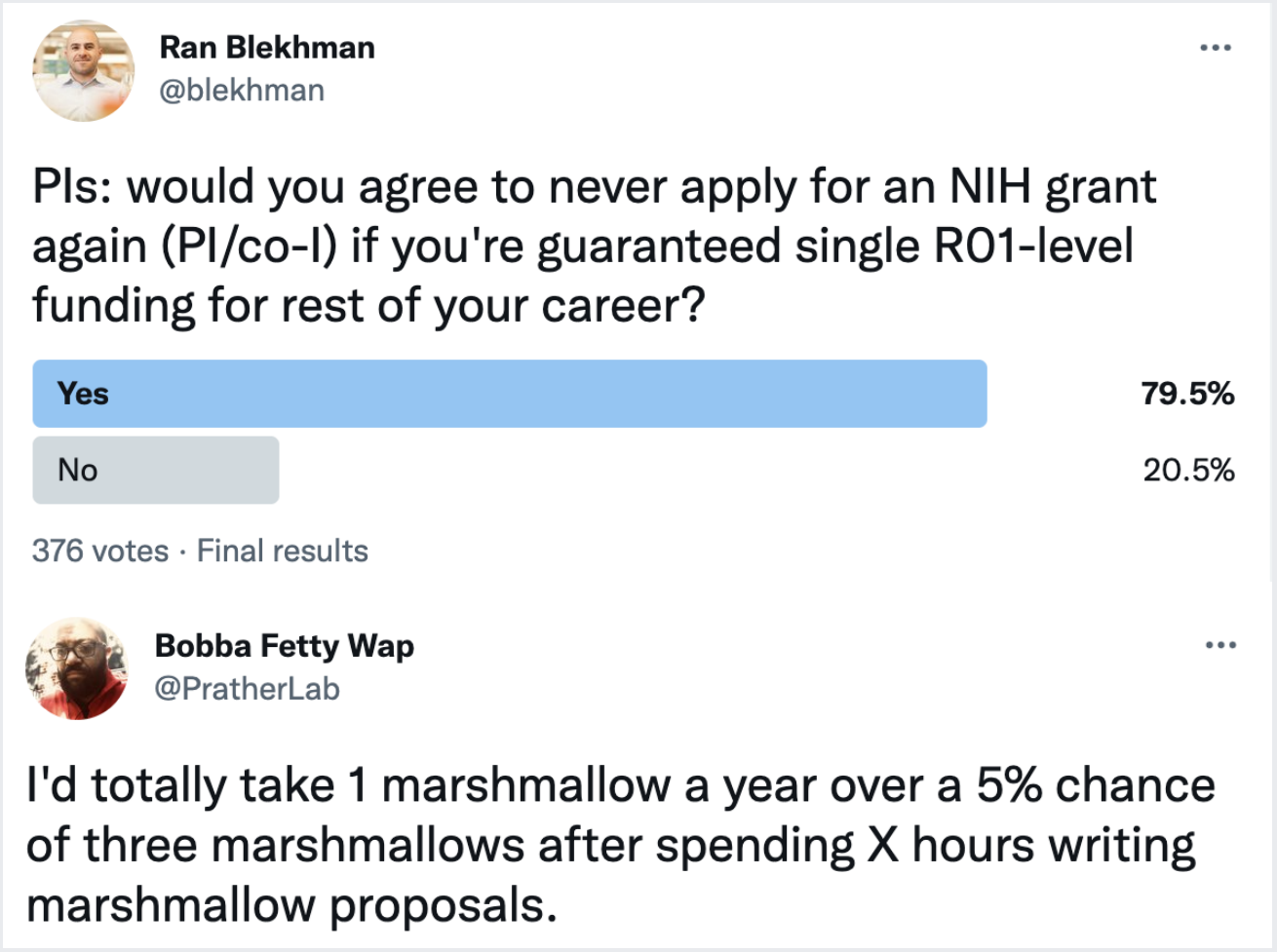
Some researchers do value stability

> I was very happy to trade less funding for more stability of funding and more flexibility to pursue new research directions

> Having a MIRA will allow me to make commitments to new postdocs even toward the end of a grant cycle, knowing that my budget is highly unlikely to disappear in one fell swoop.

Quotes from Genetics Society of America report

Some researchers do value stability



Are funders' intuitions right?

Can grant design be a policy tool?

How can we answer this question?

- Field experiment?

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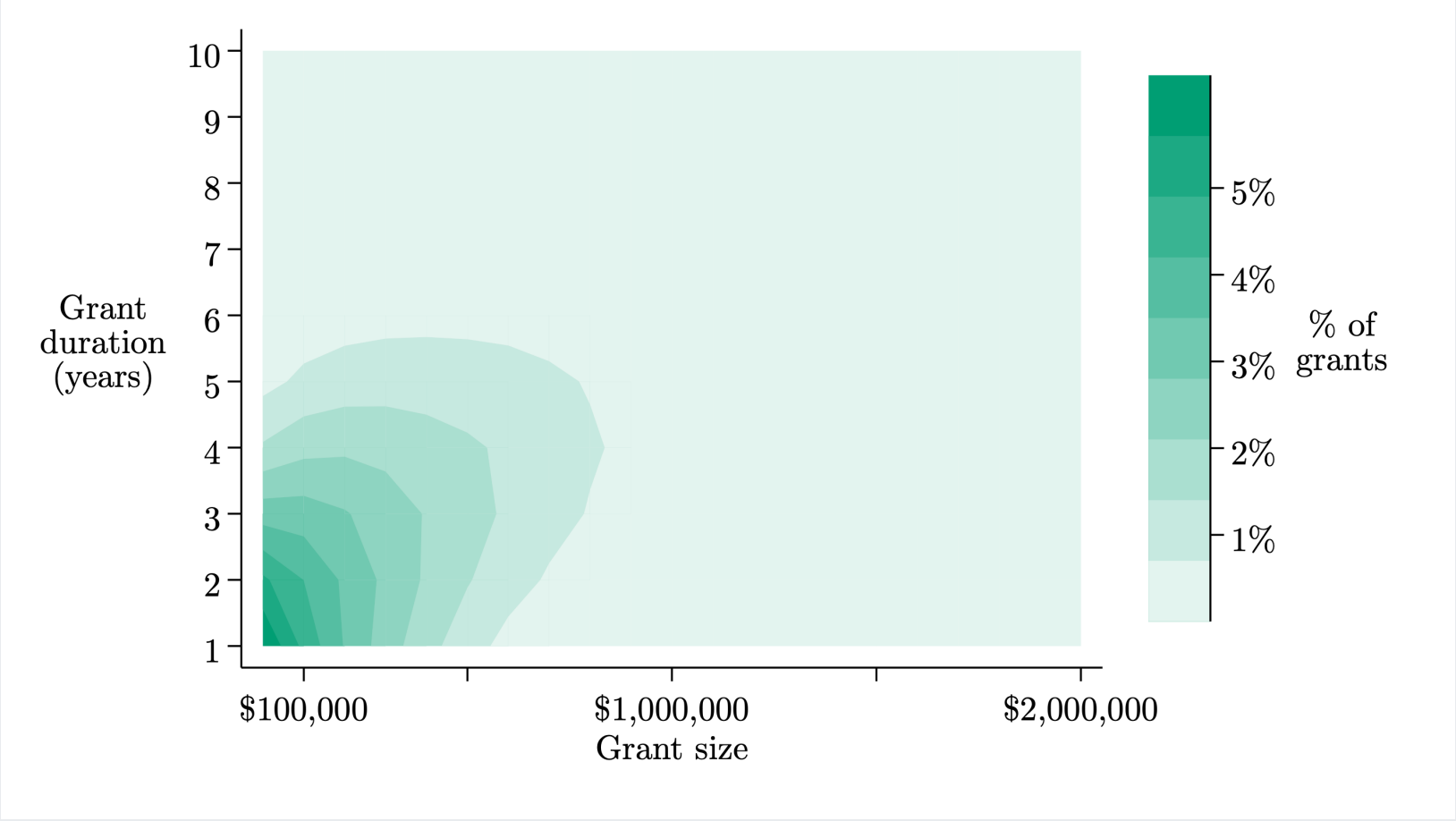
- Natural experiment?



How can we answer this question?

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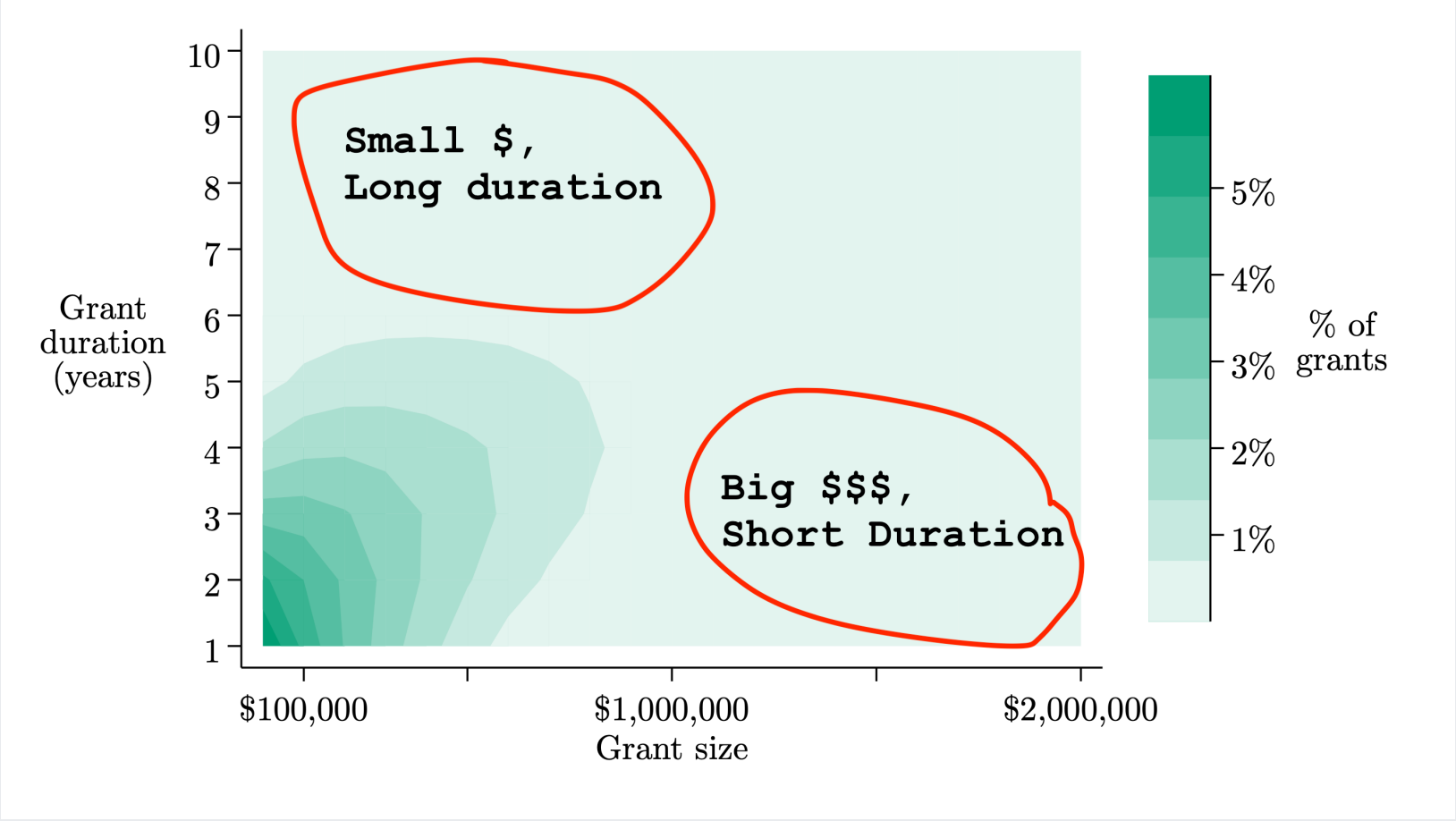


Outline

- Survey of US research professors
- **Question 1:** Can grant design change researchers' strategies?
  - **Experiment:** How would you change your research when given a grant of random size and duration?
- **Question 2:** What are researchers’ preferences for grant size vs. duration?
  - **Experiment:** How much less grant funding would you be willing to accept for a longer grant?

Outline

- Survey of US research professors
- **Question 1:** Can grant design change researchers' strategies?
  - **Results:**
    - Longer grants don't increase risk-taking, *except* among tenured professors
    - Larger grants lead to expanding ongoing projects (more exploiting), smaller grants lead to starting new projects (more exploring)
- **Question 2:** What are researchers' preferences for grant size vs. duration?
  - **Results:** Researchers value money 3-4 times more than grant duration

National Survey of Academic Researchers

Nina Cohodes, Karim Lakhani, Rachel Mural, Kyle Myers, Kate Powell, Wei Yang Tham, Jerry Thursby, Marie Thursby, Yilun Xu

Population

- Research professors at major US institutions of higher education
- Data collection:
  - ~150 largest US institutions by total R&D spending
  - Individuals listed on website as "professor"
  - Name, email, and rank
  - Institutional tiers (e.g. university, college, department)
  - ~260,000 unique emails

Sample

- Sampling
  - Field of study (22) × rank (4)
  - Randomly sample 50% of emails within each stratum

130,000 e-mails → 4,300 completed → 4,100 research active →

3,281 STEM & social science research professors

Addressing sample selection

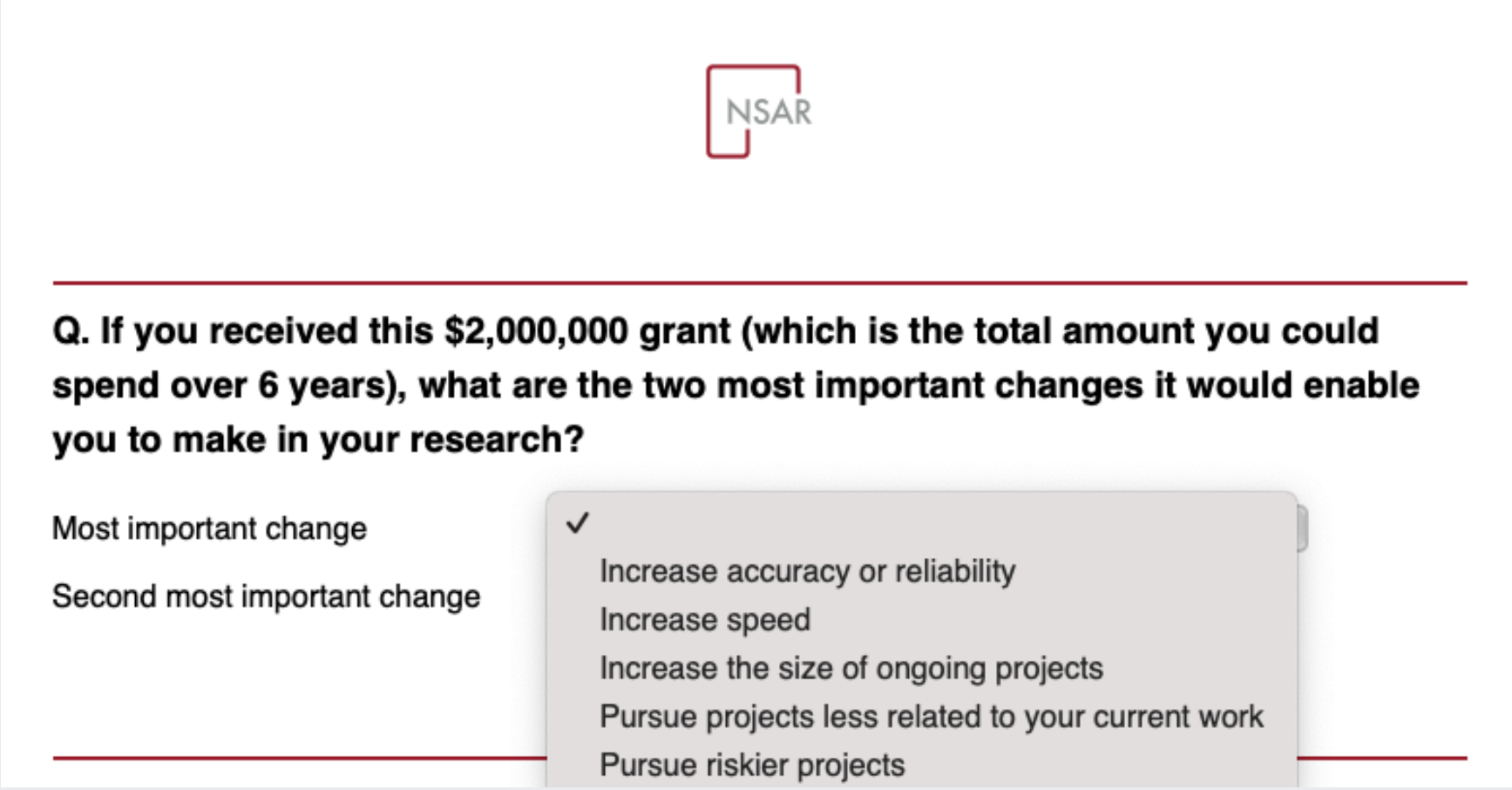
- Randomly assign incentives and reminders
  - Incentives = {none, gift card lottery, charity, both}
  - Reminders = {0, 1, 2}
- Use randomized incentives and reminders as instruments in Heckman correction
- Invitees and respondents come from institutions with similar R&D funding levels (slide)

Experiment 1: Can grant design change researchers' strategies?

Thought experiment

- Researcher imagines they have just received a grant of size S_i and duration D_i
    - S_i drawn from {$100K, $250K, $500K, $1M, $2M}
    - D_i drawn from {2, 3, 4, 5, 6, 7, 8, 9, 10} years
- Researcher is asked to select two of the following strategies as the most important changes this grant would enable:
    - Increase the **size of ongoing** projects
    - Increase **accuracy** or reliability
    - Increase **speed**
    - Pursue projects **less related** to your current work
    - Pursue **riskier** projects

Thought experiment in survey



Estimation

- When researcher i is given a grant of S_i dollars and D_i years, do they choose strategy j?

$$\mathbf{1}(Choose\ strategy\ j) = f(S_i, D_i, \mathbf{X}_i, \epsilon_i)$$

- Estimate five regressions (one for each strategy j)

- Main specifications:

  - Linear probability model
  - Heterogeneous causal effects: Causal forests (Wager & Athey 2018)

No effect on risk detected

	More Risk (1)	Faster (4)	New Directions (2)	Larger Ongoing Projects (3)	More Accurate (5)
log(Duration)	0.020 (0.017)	-0.044*** (0.017)	-0.001 (0.017)	0.013 (0.017)	0.012 (0.013)
log(Size)	0.009 (0.008)	-0.012 (0.008)	-0.023*** (0.008)	0.022*** (0.008)	0.005 (0.006)
dep. var. mean	0.56	0.35	0.34	0.59	0.16
N obs.	3,281	3,281	3,281	3,281	3,281

Longer grants $\Longrightarrow$ less speed

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Accuracy not affected by either dimension

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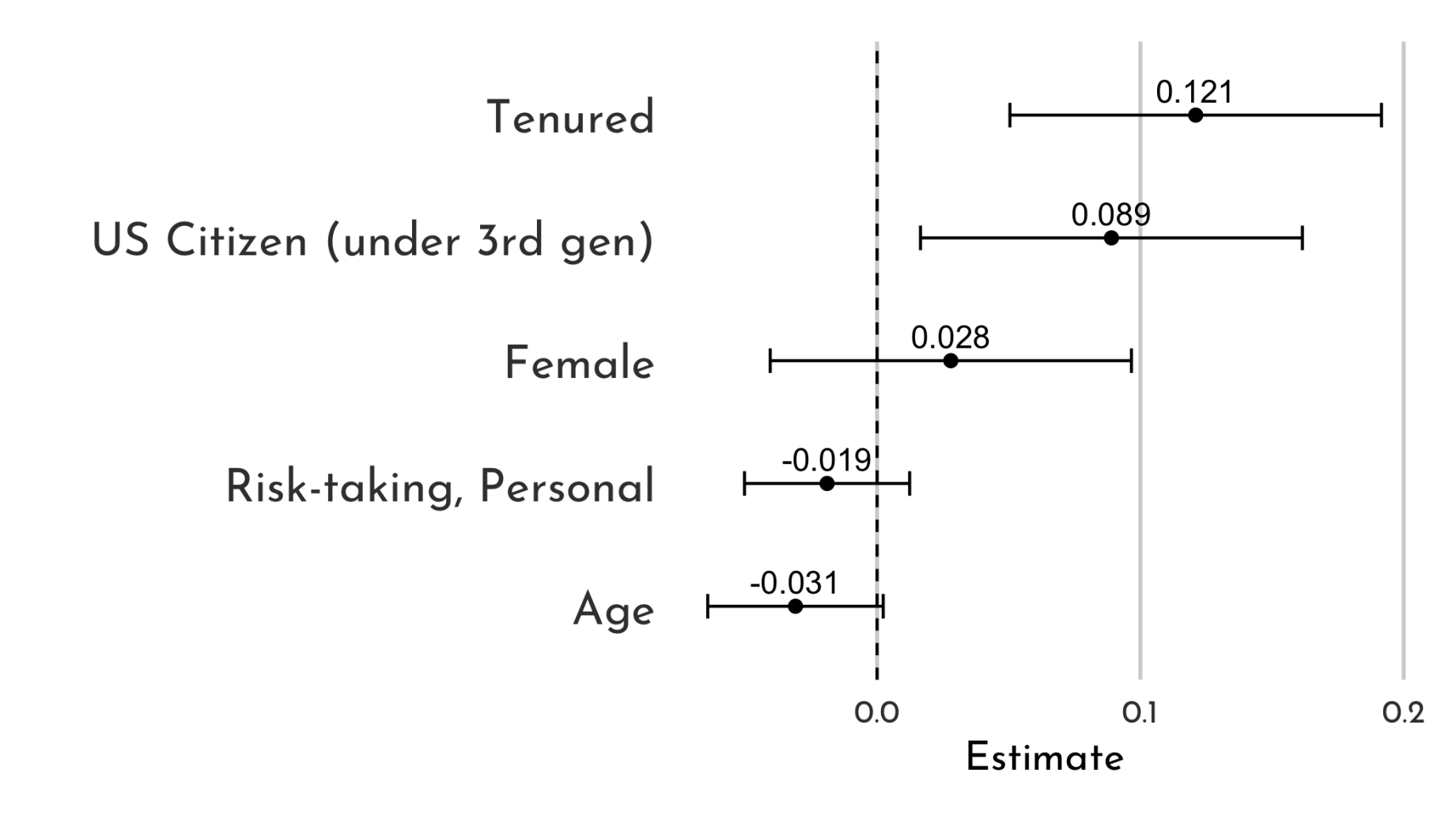
- Literature (on firms, scientists) suggests long-term incentives can induce risk-taking
- Re-estimate with causal forests method: are certain respondent characteristics associated with larger effects?

Effect distribution

Tenured researchers take more risks with longer grants



Experiment 2: What are researchers' preferences for grant size vs. duration?

Thought Experiment

- Show researcher a *short* grant A: (S_{iA}, D_{iA})
  - S_{iA} drawn from {\$100K, \$250K, \$500K, \$1M, \$2M}
  - D_{iA} drawn from {2, 3, 4, 5} years
- Show researcher a *long* grant B: $(???, D_{iB})$
  - D_{iB} drawn from {6, 7, 8, 9, 10}
- What value of S_{iB} would make you indifferent between grants A and B?

NSAR

Thought experiment:
Grant size versus duration

An anonymous donor has decided to give you research funding and is allowing you to choose between two options, Grant A or Grant B. You may only choose one. The features of these grants are described below:

Note: All funding awarded in the first year. After expiration, unused funds are forfeited, and no extensions are permitted.

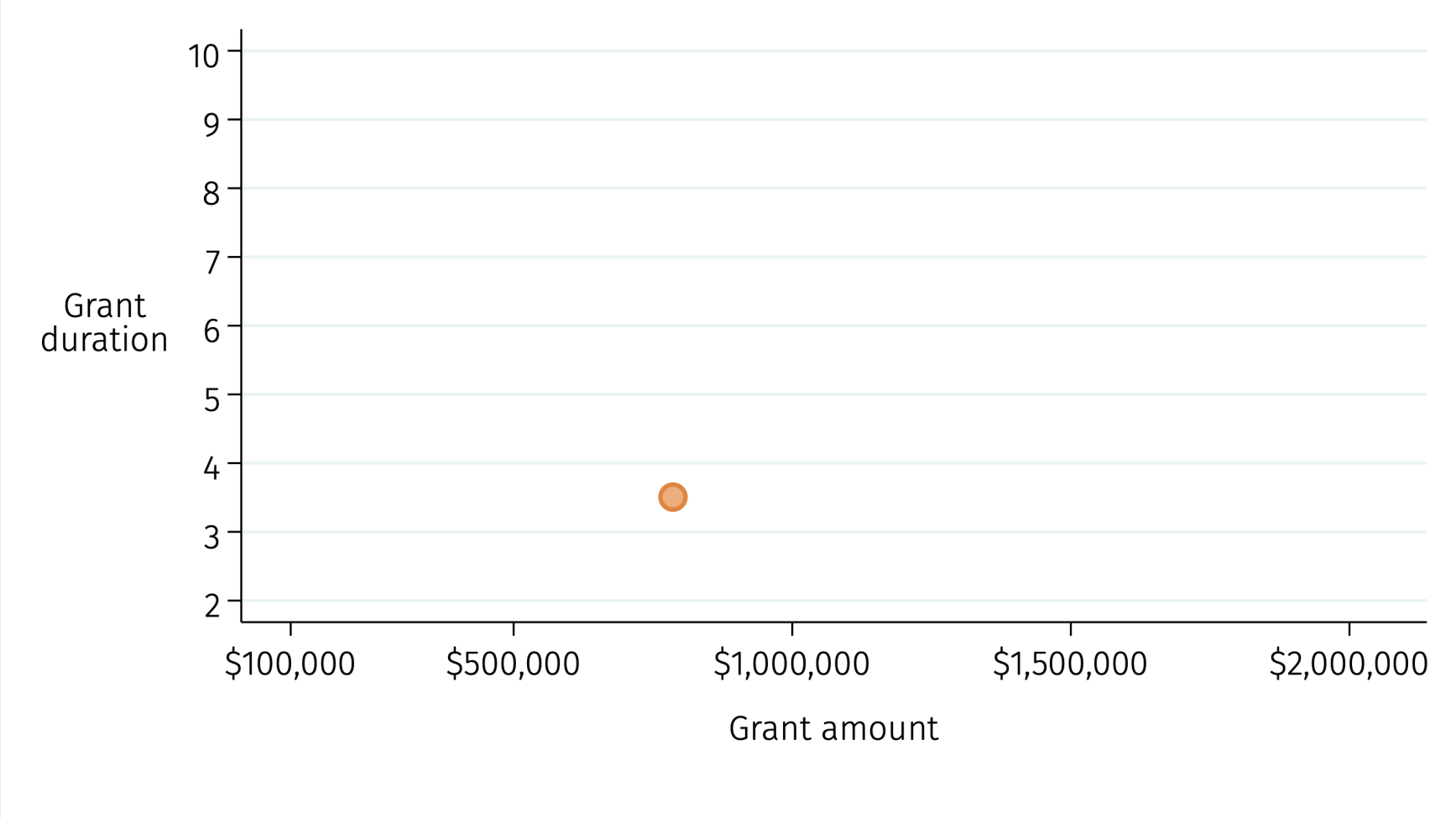
	Funds expire after	*Total funding amount*
Grant A:	4 years	$500,000
Grant B: *more time less funding*	8 years	$_____?

Q. What is the smallest amount of funding that Grant B could contain to make you prefer it over Grant A?

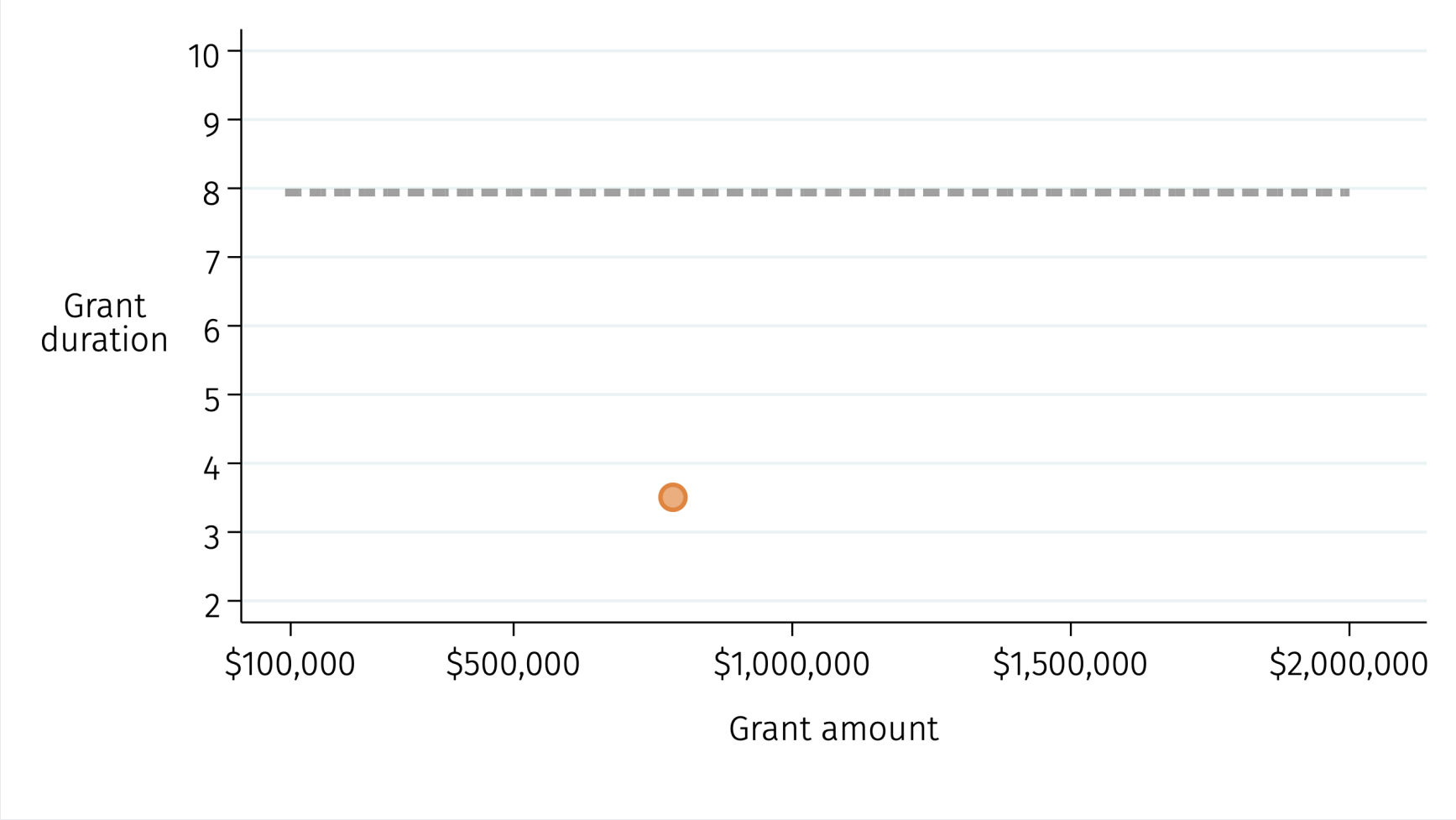
Note: Complete the following sentence by typing numbers in the box. Your answer must be less than or equal to the size of Grant A, $500,000

You would prefer Grant B as long it included at least $[ ] in total, but if it included any less than that, you would prefer Grant A.

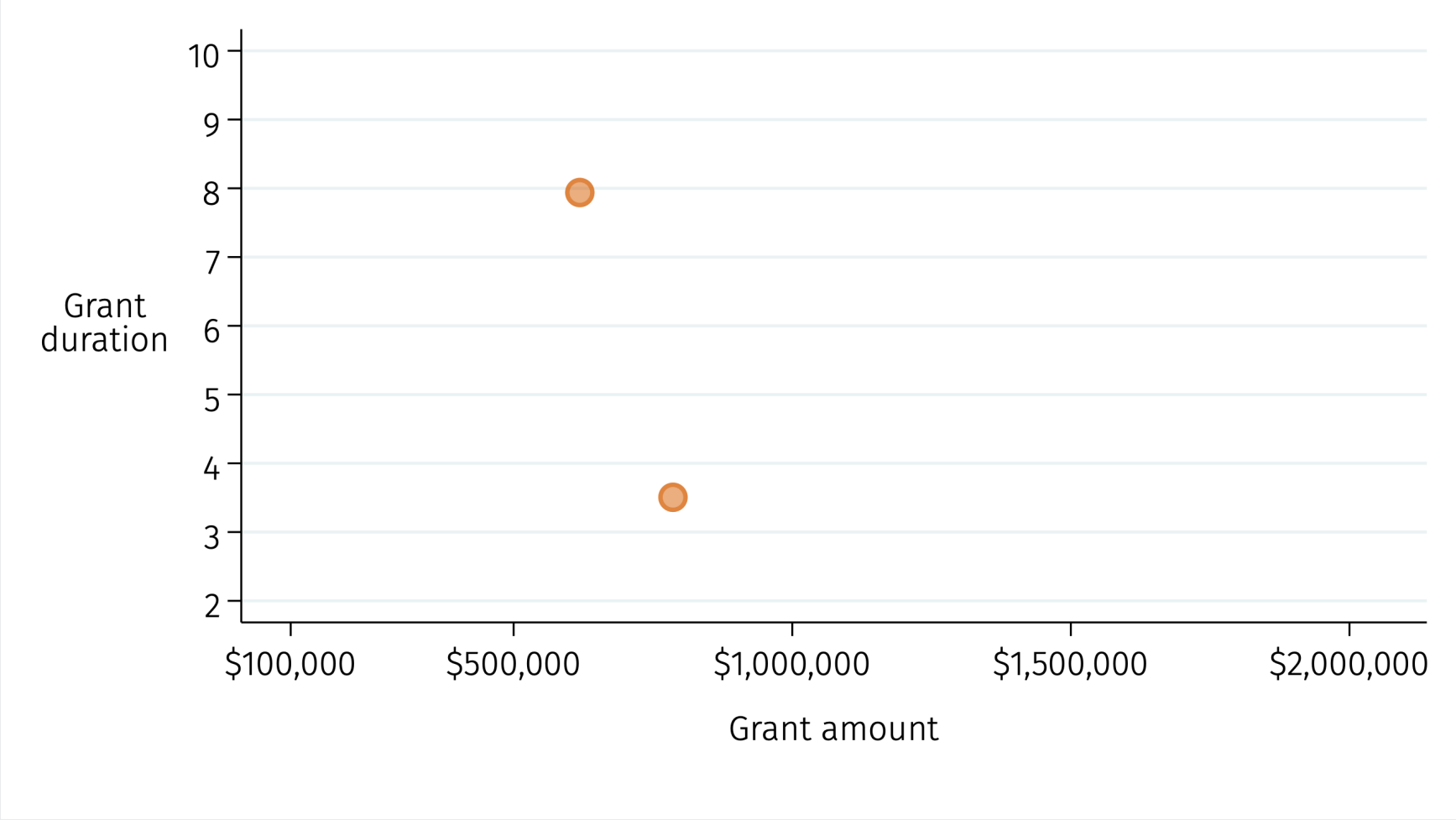
Avg short grant, A



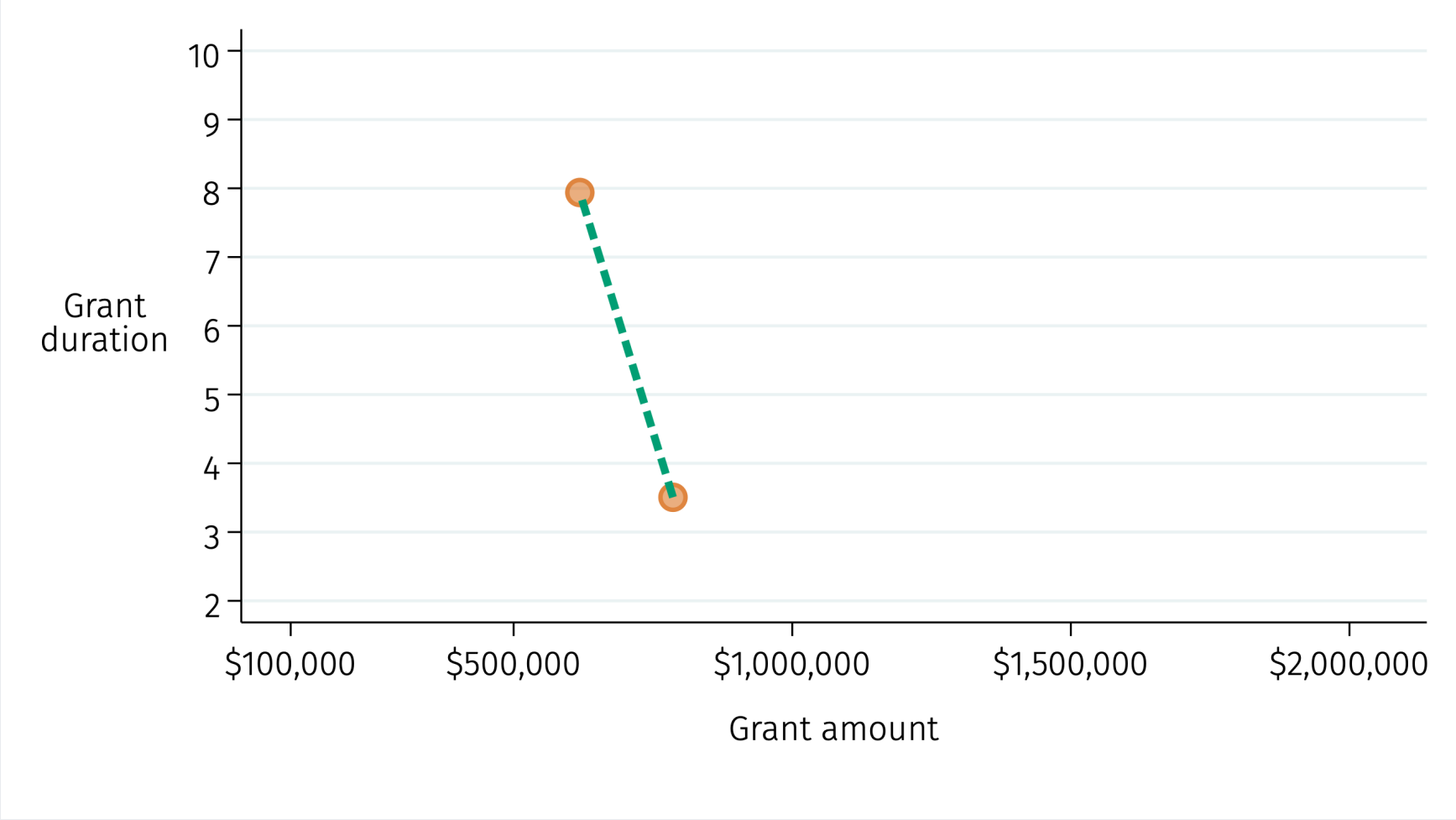
Avg length of long grant, B



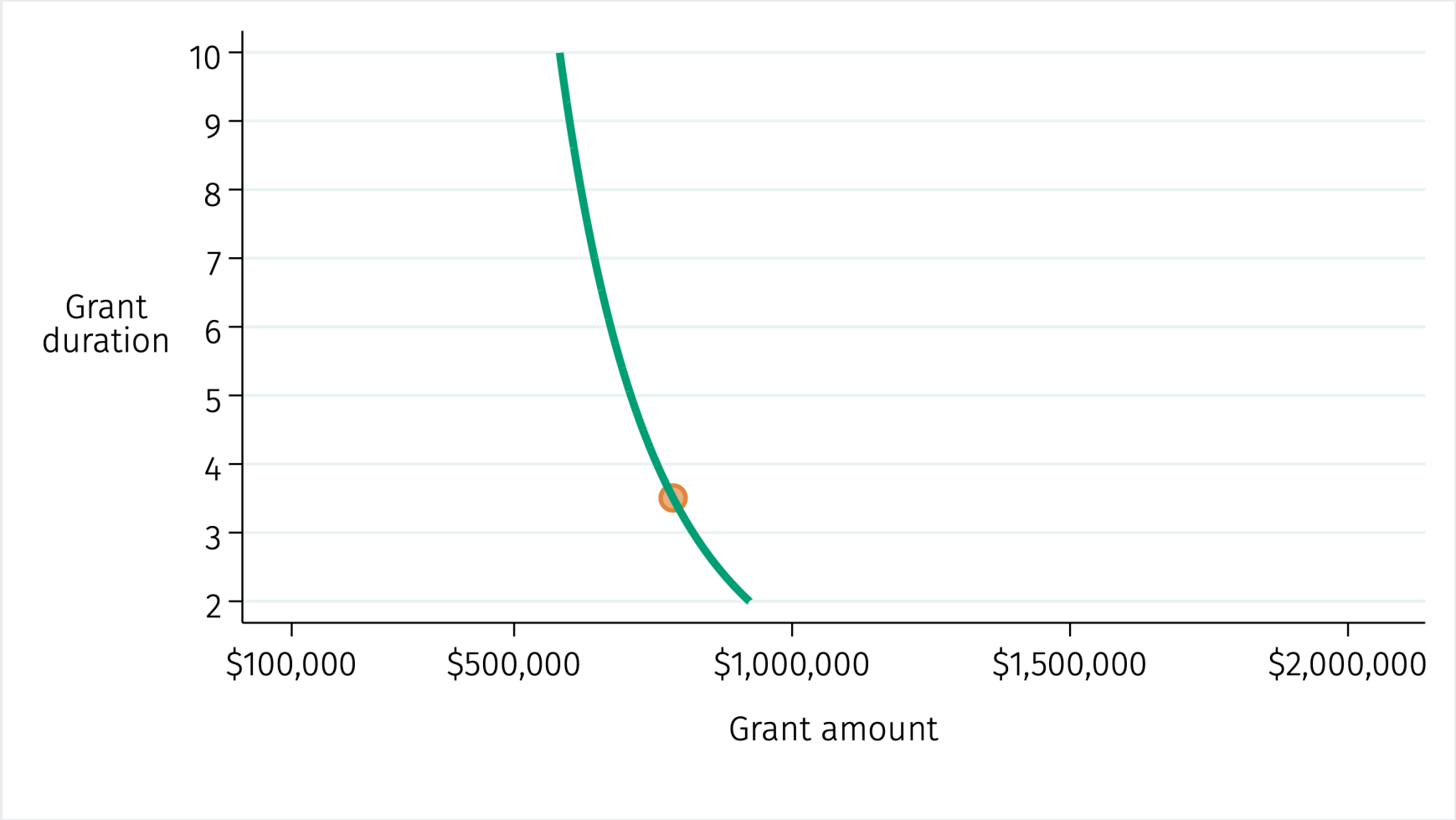
Avg survey response



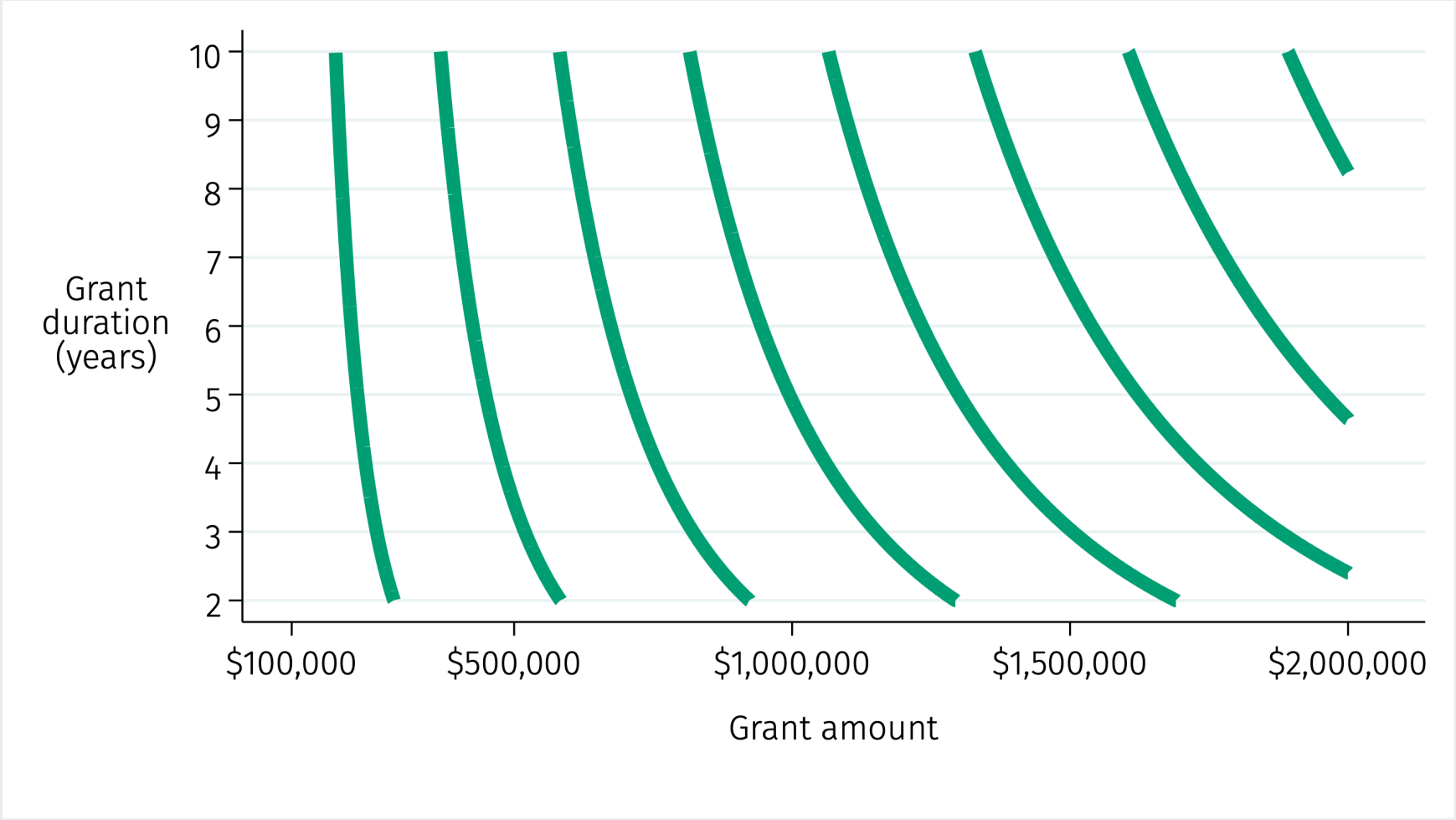
Find the indiff curve that connects these two points



$$v(S, D) = \alpha S^{\gamma} D^{1-\gamma}, \boldsymbol{\gamma = 0.78}$$



$\gamma = 0.78 \implies$ Money is 3-4 $\times$ more valuable than time
(MRS = $40-50k per year)



Preference for $ *relative to* time remains across subgroups

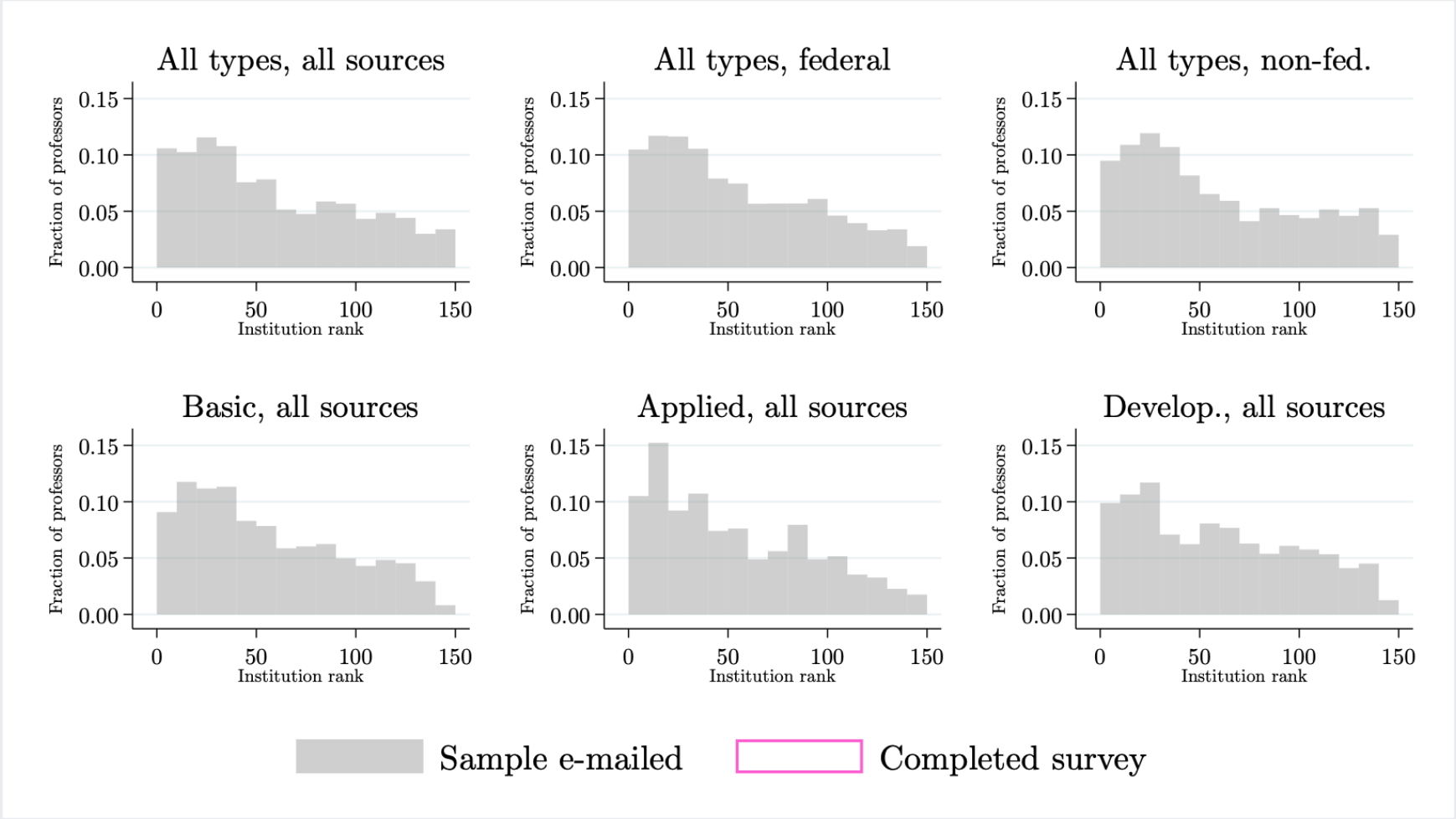
- No significant variation across broad fields (natural sciences, medical school, social sciences)
- Strongest preferences for larger $ grants amongst: old, capital-intensive, risk-takers, less effective fundraisers
- But across subgroups, respondents prefer money at least 3 $\times$ more than time (i.e., γ at least 0.75)

Summary

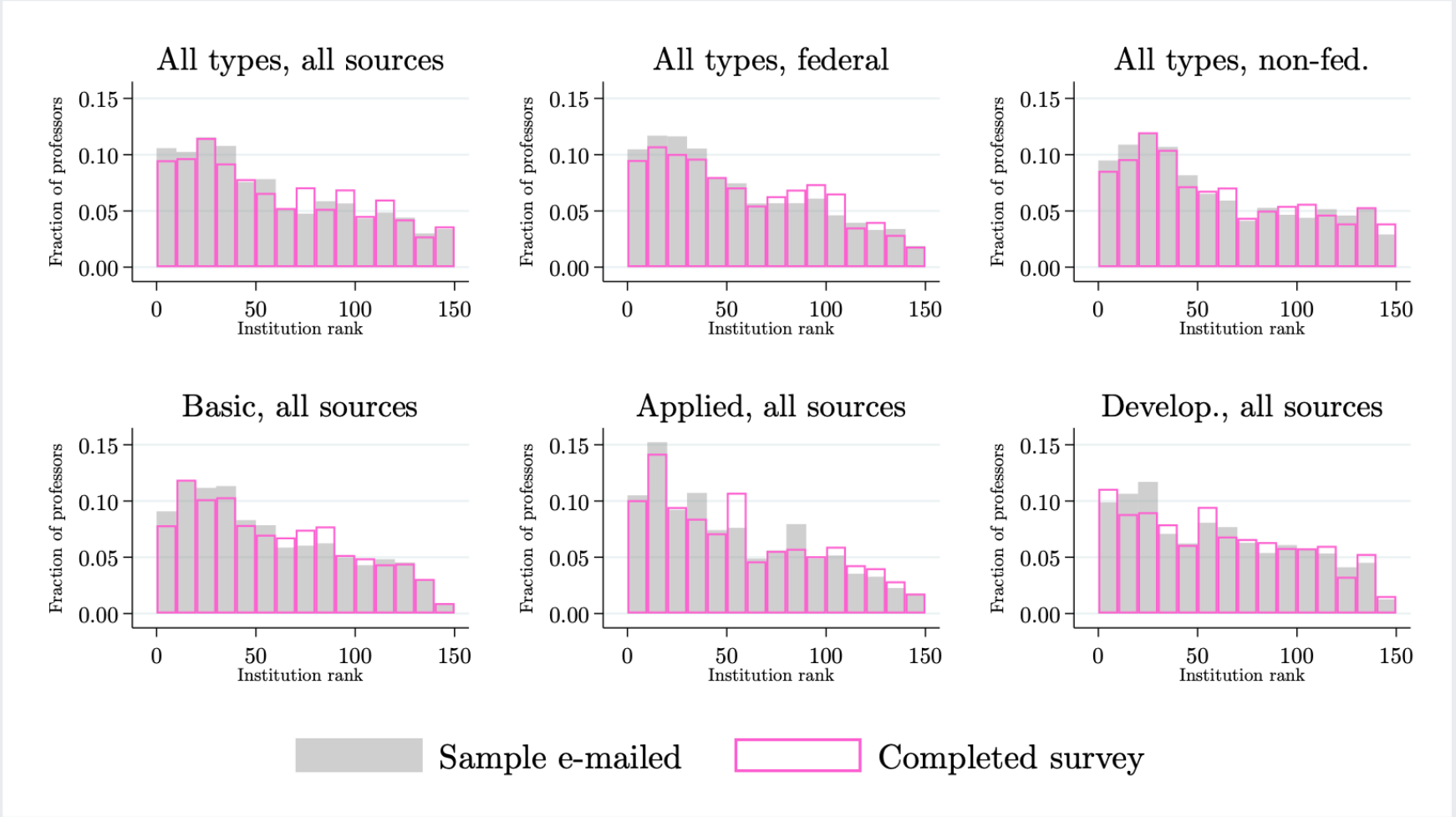
Summary

- Longer grants can incentivize risk-taking, but only if tenured
  - Suggests grant duration and tenure/job security are complementary incentives
- Researchers have much stronger preferences for money compared to time
  - Suggests that *at the current level of funding*, researchers don't view grant duration as a key constraint on their work
  - May explain why insurance-style long, small grants are rare

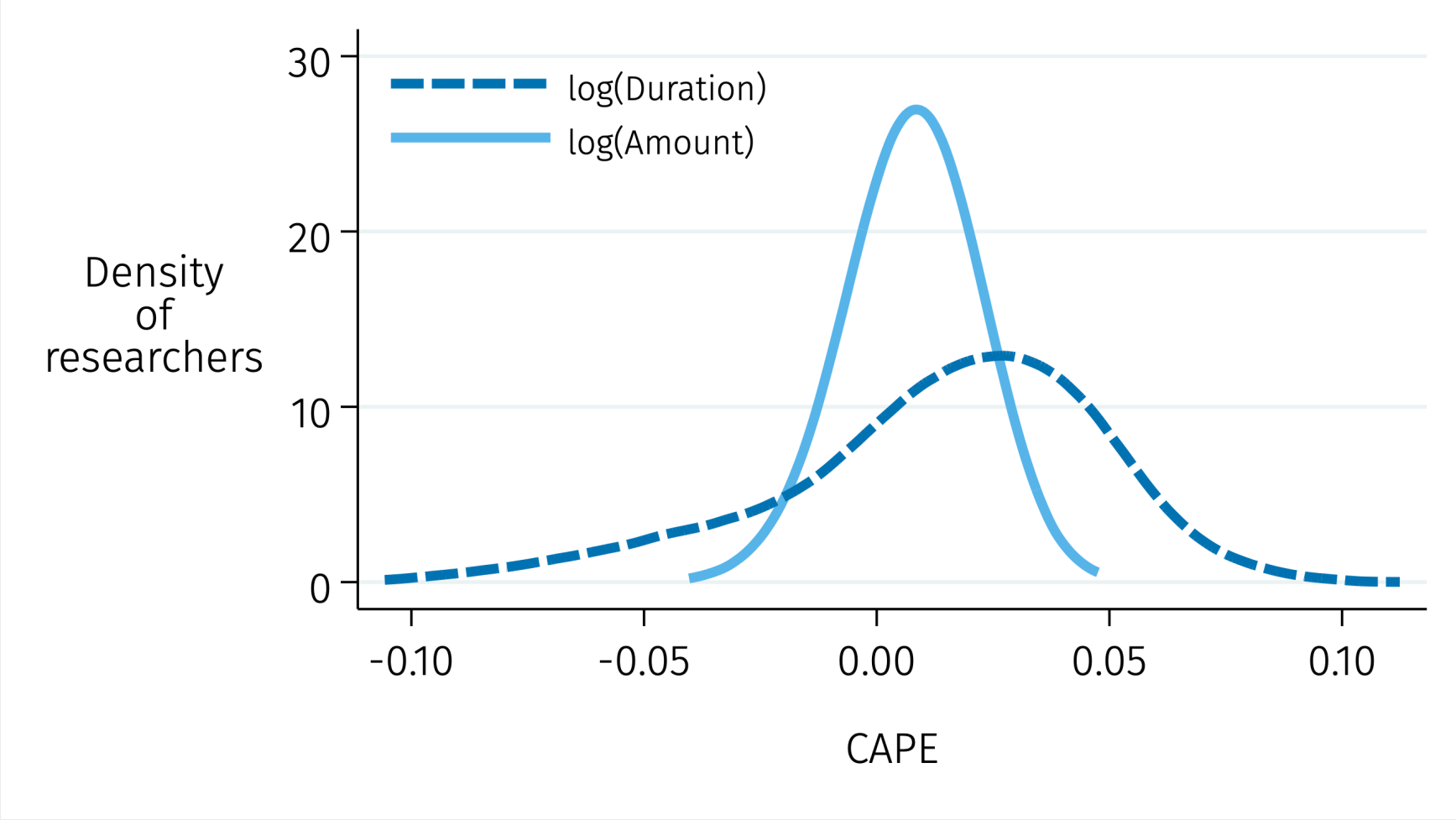
Institution R&D funding of invited emails



Invitees and respondents come from similarly-funded institutions



Substantial heterogeneity wrt risk-taking



Best linear projection

- What characteristics drive the heterogeneity, if any?
- Best linear projection: $\hat{\beta}_i = \alpha + \beta \mathbf{X}_i + \epsilon_i$

Simple model of grant preferences

Assume researcher i has a reduced form utility function over grant g of size, S_{ig}, and duration D_{ig}

$$v_i(S_{ig}, D_{ig}) = \alpha_i S_{ig}^{\gamma} D_{ig}^{(1-\gamma)}$$

- α: taste shifter (i.e., absolute value of grant funding)
- γ: relative value of size versus duration