Online Appendix: Incentives for Public Goods Inside Organizations: Field Experimental Evidence [NOT FOR PUBLICATION][1]

Andrea Blasco Olivia S. Jung Karim R. Lakhani Michael Menietti

Last updated: 05 April, 2017

[1]Blasco: Harvard Institute for Quantitative Social Science, Harvard University, 1737 Cambridge Street, Cambridge, MA 02138 (email: ablasco@fas.harvard.edu). Jung: Harvard Business School, Soldiers Field, Boston, MA 02163 (email: ojung@hbs.edu), Lakhani: Harvard Business School, Soldiers Field, Boston, MA 02163, and National Bureau of Economic Research (email: k@hbs.edu). Menietti: Harvard Institute for Quantitative Social Science, Harvard University, 1737 Cambridge Street, Cambridge, MA 02138 (email: mmenietti@fas.harvard.edu). We gratefully acknowledge the financial support of the MacArthur Foundation (Opening Governance Network), NASA Tournament Lab, and the Harvard Business School Division of Faculty Research and Development. This project would not have been possible without the support of Eric Isselbacher, Julia Jackson, Maulik Majmudar and Perry Band from the Massachusetts General Hospital's Healthcare Transformation Lab.

Abstract

In this online appendix, we present a formal proof of the result of sorting in the extended model with heterogenous costs, as discussed in the main paper. We report additional tables and results to support the analysis discussed in the main text. We also provide copy of the solicitation sent, the graphics used for the headings of the website, and the text of the 'rules of the competition' page of the contest's website.

1 Extended model with heterogenous costs

In this section, consider the case of two types of individuals $j = 1, 2$ forming two groups of equal size $n_1 = n_2 = n$. Individuals can decide to contribute with a single proposal or not.

When an agent of type j decides to contribute, the expected utility is as follows.

$$u_1^j = \gamma \hat{Y} + \delta_j + \sum_{k_j=1}^{n} \sum_{k_l=0}^{n} \Pr(Y = k_j + k_l) \frac{R}{k_j + k_l} - c_j. \tag{1}$$

The utility of not contributing is as follows.

$$u_0^j = \gamma(\hat{Y} - 1). \tag{2}$$

Equating these two conditions for all individuals gives the following mixed-strategy equilibrium condition:

$$\sum_{k_j=1}^{n} \sum_{k_l=0}^{n} \Pr(Y = k_j + k_l) \frac{R}{k_j + k_l} = c_j - \delta_j + \gamma \tag{3}$$

for all $j = 1, 2$. To examine differences in equilibrium probabilities p_1^* and p_2^*, we use the ratio between the above equilibrium condition for individuals of type $j = 1$ and the same expression for agents of type $j = 2$. This gives:

$$\frac{\sum_{k_1=1}^{n} \sum_{k_2=0}^{n} \Pr(Y = k_1 + k_2) \frac{R}{k_1+k_2}}{\sum_{k_1=0}^{n} \sum_{k_2=1}^{n} \Pr(Y = k_1 + k_2) \frac{R}{k_1+k_2}} = \frac{c_1 - \delta_1 + \gamma}{c_2 - \delta_2 + \gamma}. \tag{4}$$

The left hand side can be rearranged as follows.

$$\frac{\Pr(k_2 = 0) \sum_{k_1=1}^{n} \Pr(Y = k_1) \frac{R}{k_1} + \sigma R}{\Pr(k_1 = 0) \sum_{k_2=1}^{n} \Pr(Y = k_2) \frac{R}{k_2} + \sigma R} \tag{5}$$

where $\sigma = \sum_{k_1=1}^{n} \sum_{k_2=1}^{n} \Pr(Y = k_1 + k_2) \frac{1}{k_1+k_2}$. Using $1 - p_2 = \Pr(k_2 = 0)$ and $1 - p_1 = \Pr(k_1 = 0)$ together with the density of the binomial distribution, we obtain the following simpler expression.

$$\frac{(1 - p_2) \frac{(1-(1-p_1)^n)}{np_1} R + \sigma R}{(1 - p_1) \frac{(1-(1-p_2)^n)}{np_2} R + \sigma R}. \tag{6}$$

If $c_1 - \delta_1 > c_2 - \delta_2$, then the above expression in equilibrium needs to be larger than one. This inequality can be expressed as follows:

$$\frac{p_2(1-p_2)}{(1-(1-p_2)^n)} > \frac{p_1(1-p_1)}{(1-(1-p_1)^n)}. \tag{7}$$

Hence, the inequality is satisfied only if p_2 is greater than p_1. This proves the last statement reported in the Section with predictions in this paper.

2 Additional tables and figures

In this section, we provide additional tables and figures to support the analysis discussed in the main text.

Tables 1, 2 and 3 reports the poitn estimates of the difference in the probability of submitting proposals, rating proposals, and being selected for implementation respectively. Figure 1 shows that the results concerning participation rates are robust to bootstrap resampling and Holm-Bonferroni adjustments to take into account a multiple comparison problem. Likewise Figure 2 shows that the results concerning gender are robust as well.

Concerning the lack of effects on the "intensive margin," Figure 3 plots the distributions of the count of projects and words per submission in each condition showing there was no clear difference across treatments.

As discussed in the main text, there was no difference in the the probability of rating proposals in the peer-evaluation phase. We also fail to detect differences in the count of rated proposals per evaluator. Here, Figure 4 plots the histogram of the count of rated proposals in each condition, showing that the distributions were indeed pretty similar.

Table 1: Difference in the probability of submitting project proposals

	Group 1	Group 2	p1	p2	n1	n2	Diff	SE	Z
1	PRIZE	WPLACE	7.4	5.2	312	307	2.2	1.9	1.1
2	PRIZE	PCARE	7.4	4.5	312	310	2.9	1.9	1.5
3	PRIZE	FUND	7.4	2.3	312	308	5.1	1.7	3
4	WPLACE	PCARE	5.2	4.5	307	310	0.7	1.7	0.4
5	WPLACE	FUND	5.2	2.3	307	308	2.9	1.5	1.9
6	PCARE	FUND	4.5	2.3	310	308	2.2	1.5	1.5

Table 2: Difference in the probability of rating project proposals

	Group 1	Group 2	p1	p2	n1	n2	Diff	SE	Z
1	WPLACE	PCARE	16.3	15.8	307	310	0.5	3	0.2
2	WPLACE	PRIZE	16.3	13.8	307	312	2.5	2.9	0.9
3	WPLACE	FUND	16.3	11.7	307	308	4.6	2.8	1.6
4	PCARE	PRIZE	15.8	13.8	310	312	2	2.8	0.7
5	PCARE	FUND	15.8	11.7	310	308	4.1	2.8	1.5
6	PRIZE	FUND	13.8	11.7	312	308	2.1	2.7	0.8

Table 3: Difference in the probability of submitting finalist project proposals

	Group 1	Group 2	p1	p2	n1	n2	Diff	SE	Z
1	PRIZE	WPLACE	4.5	3.2	312	307	1.2	1.5	0.8
2	PRIZE	PCARE	4.5	2.2	312	310	2.2	1.4	1.5
3	PRIZE	FUND	4.5	0.6	312	308	3.8	1.3	3
4	WPLACE	PCARE	3.2	2.2	307	310	1	1.3	0.8
5	WPLACE	FUND	3.2	0.6	307	308	2.6	1.1	2.3
6	PCARE	FUND	2.2	0.6	310	308	1.6	1	1.7

Figure 1: Pairwise comparisons of the percentage of employees submitting a project proposal in the different treatments with Holm-Bonferroni method and bootstrap resampling

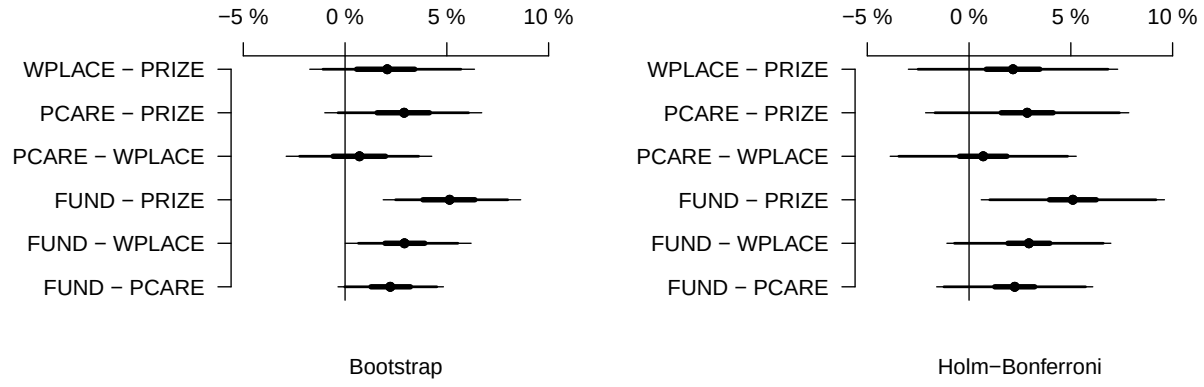


Figure 2: Difference in the probability of submitting between men and women with Holm-Bonferroni method and bootstrap resampling

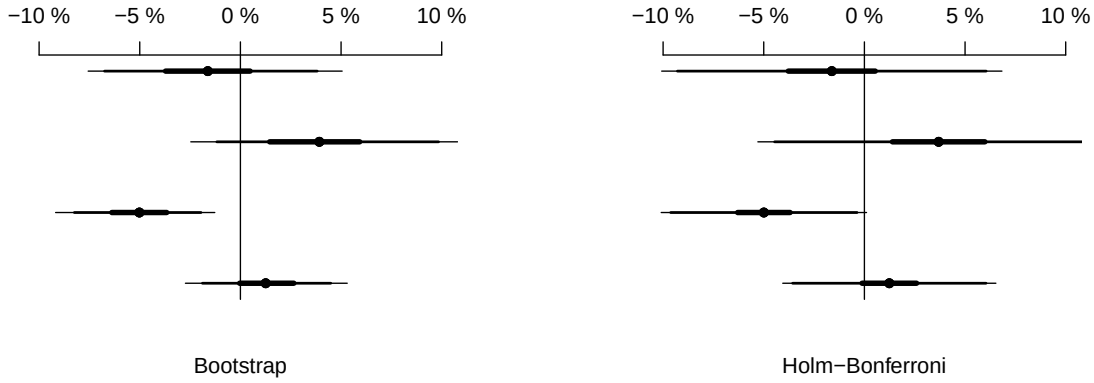


Figure 3: Count of projects (left panel) and words (right panel) per submission by treatments

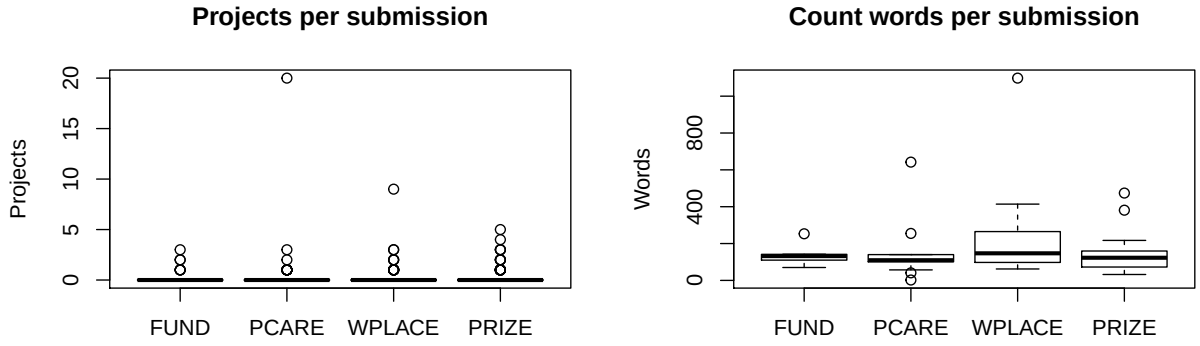
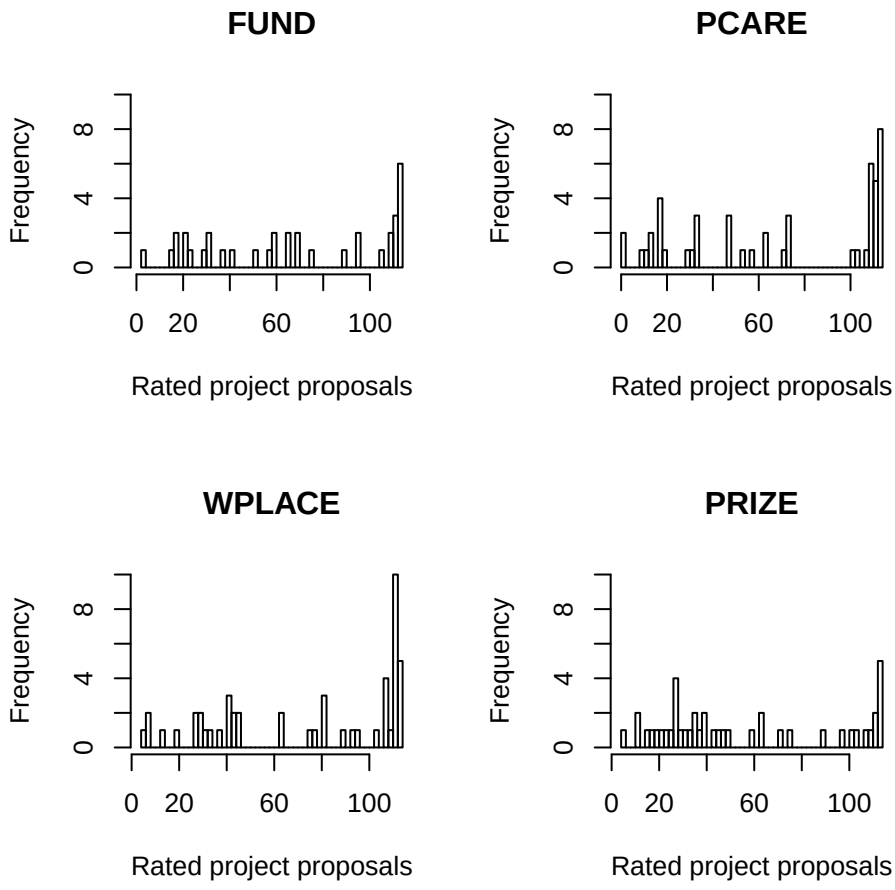


Figure 4: Count of the rated project proposals per evaluator



3 Solicitation and website

In Section 3.1, Figure 5 shows copy of the solicitation sent via email and Figure 6 shows the graphics automatically matching the treatment of the employee signing in to the contest's website. In Section 3.2, we report the text displayed in the "Rules of the Competition" section of the contest's website.

3.1 Solicitation and Graphics

Figure 5: Copy of the solicitation sent via email to the employees in our subject pool

Dear Heart Center team member-

Submit your ideas to win project funding up to $20,000 to turn your ideas into action!

WATCH VIDEO INVITE - CLICK HERE

You're invited to participate in the first annual Open Innovation Contest!

ETHER DOME CHALLENGE

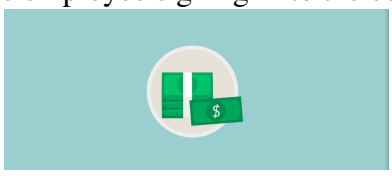
The Ether Dome Challenge is your chance to submit ideas on how to improve the MGH Corrigan Minehan Heart Center, patient care & satisfaction, workplace efficiency and cost. All Heart Center Staff are eligible to submit ideas online. We encourage you to submit as many ideas as you have: no ideas are too big or too small!

Submissions will be reviewed and judged in two rounds, first by the Heart Center staff via "crowd-voting," and then by an expert panel. Winning ideas will be eligible for project implementation funding in the Fall of 2014!
Learn more and submit your ideas on the Ether Dome Challenge website at www.etherdomechallenge.org.

Submissions accepted: **July 28th – August 22nd, 2014**

Figure 6: Graphics matching the treatment of the employee signing in to the contest's website

FUND



PRIZE

PCARE

WPLACE

3.2 Rules of the competition

- The Ether Dome Challenge is an ideas competition to improve the Heart Center workplace, patient care, patient satisfaction, workplace efficiency and cost.

- If you've noticed something about patient experience, employee satisfaction, workplace efficiency, or anything that could be improved; if you've had an inspiration about a new way to safeguard health; or if you simply have a cost-saving idea, then now is the time to share your idea. We would like to encourage all members of the Heart Center to participate in this initiative. We encourage you to submit as many ideas as you have: no ideas are too big or too small! You never know… your idea could be the next big thing!

Timeline

- Ideation Contest Launch
- Idea Submission Closes
- Crowd-Voting on Submitted Ideas
- Top 3 Crowd Voting Winners Announced (winners will receive iPads) & Final Round Idea Selections Announced
- Final Round Idea "Brainstorming" Support Sessions & Team Submissions Accepted
- Final Round Submissions Due
- Judging Panel Review of Final Round Submissions
- Ether Dome Challenge Final Award Event - Grant Winners Announced!

Logistics of Idea Submissions

- All Heart Center Staff (physicians, nurses, administrators, etc.) are eligible to submit Ideas.
- Ideas should be submitted electronically via this site. Please click the "Submit Your Ideas" button at the top of the page, to enter the Challenge.
- Submit as many ideas as you'd like!

To promote all kinds of ideas… even the zanny ones!

- All ideas submitted during the challenge will be posted on this website to be voted on by all Heart Center staff. The best ideas will be awarded a prize. To keep voting fair, ideas will be anonymously posted to the voting site. If your idea wins, you will be able to choose whether or not you'd like recognition for the idea. To ensure everyone feels free to submit all types of creative ideas - no matter how disruptive - all ideas will remain anonymous and shared only with the Harvard Business School study designers and the MGH Healthcare Transformation Lab staff. Individual information/ideas will not be shared with your managers/division

heads, unless you elect for it to be shared publicly after the voting period. De-identified idea submissions will be shared with all levels of hospital administration deemed appropriate by the Healthcare Transformation Lab staff.

Areas of focus - but don't limit your thinking!

- Areas of focus for the Ether Dome Challenge include, but are not limited to: New models of care delivery; Enhancing the patient experience; Improving the MGH workplace, Improving efficiency, quality and safety; Lowering the cost of care