Rebate rules in reward-based crowdfunding: Introducing the bid-cap rule

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Definition of crowdfunding

- Raising money from (many) people (via an internet platform)

Types of crowdfunding

- Donation-based
- Equity-based
- Lending-based
- Reward-based
  - Backers get non-monetary reward if their pledge exceeds pre-set entry fee

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  - Allows project creator to contract with future customers **before** investment costs are sunk

All-or-nothing rule superior to *keep-it-all rule* (Coats et al., 2009; Cumming et al., 2020; Strausz, 2017; Wash and Solomon, 2014)

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Solutions to this include:

- Encourage early contributions (Ansink et al., 2017; Solomon et al., 2015)
- Dissemination of positive opinions (Comeig et al., 2020)
- Highlighting of specific projects (Corazzini et al., 2015)
- Timing of promotions (Li and Wang, 2019)

→ All these options aimed at increasing the backer base and helping backers to coordinate

What to do if the number of backers is exhausted, but pledges are short of the provision point? $\rightarrow$ A residual public good game arises

A recently proposed solution to this: refund bonuses (Zubrickas, 2014; Cason and Zubrickas, 2017, 2019; Cason et al., 2021)

$\rightarrow$ How practical is this really?

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→ How practical is this really?

Different solution: **rebates** of excess pledges

→ all excess pledges above funding goal are returned to backers according to some *rule*

→ works for threshold public goods (see: Marks and Croson, 1998; Rondeau et al., 1999; Spencer et al., 2009; Donazzan et al., 2016)

In this paper:

- Introduce rebate rules to the reward-based crowdfunding setting
- Establish the novel **bid-cap** rule
- Adaption of proportional rebate rule to reward-based crowdfunding
- Experimentally test these rebate rules

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Preview of findings:

- Under both rebate rules increased bids and project successes compared to the all-or-nothing rule
- Under the **bid-cap** rule there is less variance in payments, less overbidding and less free riding compared to the proportional rebate rule

Model

- N **active** individuals $i \in \{1, \ldots, N\}$ with endowment E_i
- One **passive** individual ("project creator")
- **Active** individuals decide on pledge $b_i \in [0, E_i]$ towards project
- If $\sum b_i \geq PP$ (exogenous Provision Point) $\Rightarrow$ project realized
- Upon project realization **active** individuals are considered **investors** and receive valuation v_i^a iff $b_i \geq r$ (reservation price)Not Found
- **Passive** individual receives v^P iff $\sum b_i \geq PP$ else a default d

$\Longrightarrow \sum v_i \geq PP > N \cdot r$ (socially desirable, residual public good game)

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Experimental parameters

- $N = 10$, $E_i^a = 65$, $PP = 300$ and $r = 15$
- $v_i^a = 45$ (1st round) and $v_i^a \sim \text{unif}\{30, 60\}$ (next 10 rounds)
- $v^p = 110$ $d = 65$

Experiment

3 Treatments

All-or-nothing: Excess pledges are payed to the project creator

Proportional rebate: Excess pledges are payed back to investors proportional to their excess pledge

Bid-Cap: Algorithm determines the smallest maximal pledge (cap) which high bidders have to pay

- 40 active people per treatment (44 total)
- One shot game followed by a surprise 10 time repetition with random individual valuation $v_i \sim \text{unif}\{30, 60\}$

All-or-nothing

Active's payoff π_i^a

$$\pi_i^a = \begin{cases} E_i - b_i + v_i & \text{if} \quad \sum b_i \geq PP \text{ and } b_i \geq r \\ E_i - b_i & \text{if} \quad \sum b_i \geq PP \text{ and } b_i < r \\ E_i & \text{if} \quad \sum b_i < PP \end{cases}$$

Passive's payoff

$$\pi^p = \begin{cases} v^p + (\sum b_i - PP) & \text{if} \quad \sum b_i \geq PP \\ d & \text{if} \quad \sum b_i \geq PP \end{cases}$$

Proportional rebate

- Rebate proportional to excess pledge $e_i := \max\{0, b_i - r\}$

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Bid-cap

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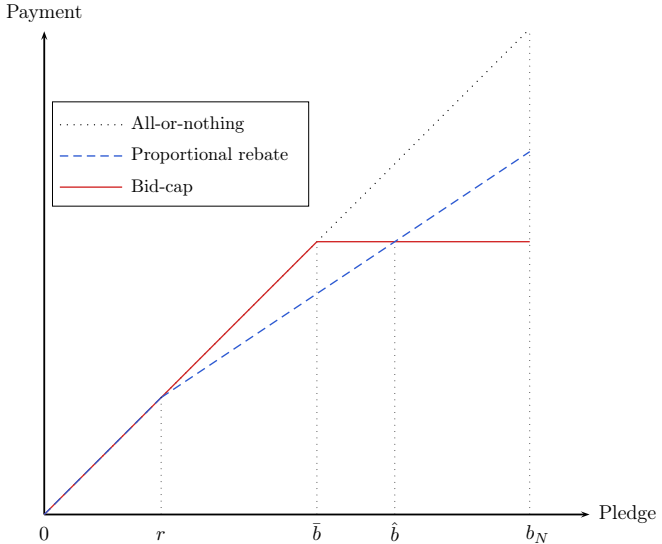
Pledge to paid by treatment



Hypothesis 1: *The pledges will be higher under the rebate rules compared with the all-or-nothing model.*

Hypothesis 2: *The project realization rates will be higher under the rebate rules compared to the all-or-nothing model.*

Hypothesis 3: *The variance of payments will be smaller under the bid-cap rule compared to the proportional rebate rule.*

All main hypothesis preregistered under:
`https://aspredicted.org/blind.php?x=X97_FHC`

	All-or-nothing	Proportional	Bid-cap
Part 1:			
Mean Pledges b_i	28	33.75[a]	33.08
	(13.91)	(14.00)	(13.48)
Demand revelation b_i/v_i	0.62[b]	0.75[b]	0.74[b]
	(0.27)	(0.31)	(0.30)
Proportion of projects funded	0.25	0.75	0.75
Payment when project funded	31.2	30	30
	(10.69)	(10.07)	(6.54)
Part 2:			
Mean pledges b_i	**27.84**	**35.77[a]**	**33.63[a]**
	(14.07)	(17.12)	(14.41)
Demand revelation b_i/v_i	0.63[b]	0.82[b]	0.77[b]
	(0.30)	(0.40)	(0.35)
Proportion of projects funded	0.35	0.88	0.85
Payment when project funded	32.56	30	30
	(13.28)	(12.23)	(9.28)

[a]Significantly different from symmetric equilibrium prediction of 30.
[b]Bids are significantly different from valuation

Table: Descriptive statistics of Part 1 and Part 2 by experimental condition with standard deviations in brackets.

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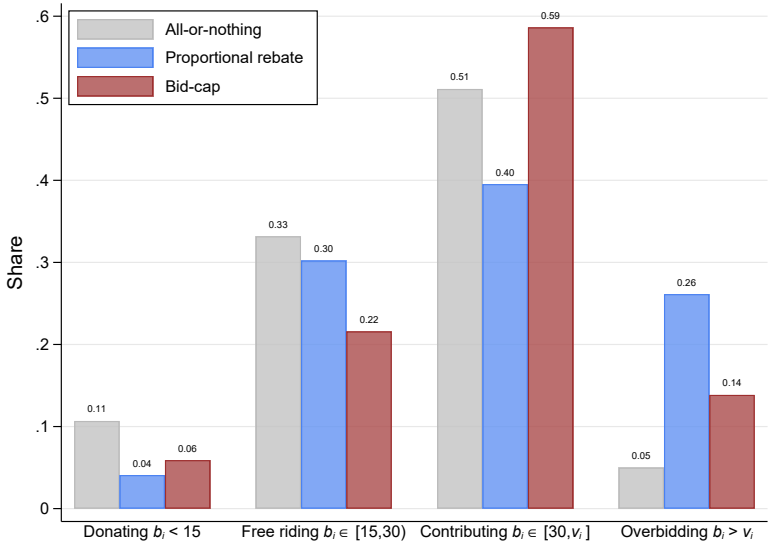
Regression results

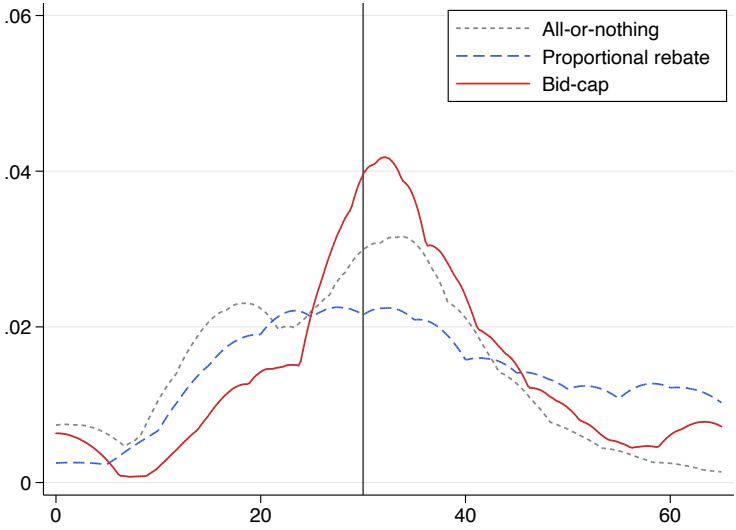
	Part 1 (One round)	Part 2 (Ten rounds)	
	$b_i \in [0, 65]$	$b_i \in [0, 65]$	Funded $\in \{0, 1\}$
Proportional	5.75*	7.93***	0.53**
	(2.950)	(2.690)	(0.207)
Bid-cap	5.07*	5.79**	0.50**
	(2.888)	(2.507)	(0.217)
Constant	28.00***	27.84***	0.35*
	(1.950)	(1.693)	(0.188)
Level of observations	Subject	Subject	Group
Number of observations	120	1200	120
Postestimation Wald tests to compare proportional rebate and bid-cap treatments:			
H_0: Proportional rebate = bid-cap	$p = 0.83$	$p = 0.44$	$p = 0.86$

Standard errors in parentheses. Estimation by OLS regression with robust standard errors for Part 1 and estimation by random-effects regression with clustering on level of observations for Part 2. The baseline category is All-or-nothing in all specifications. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

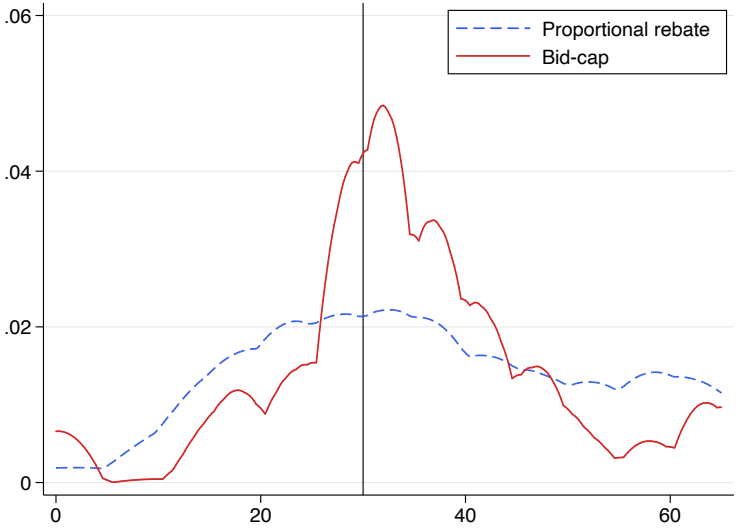
Biding behavior pooled



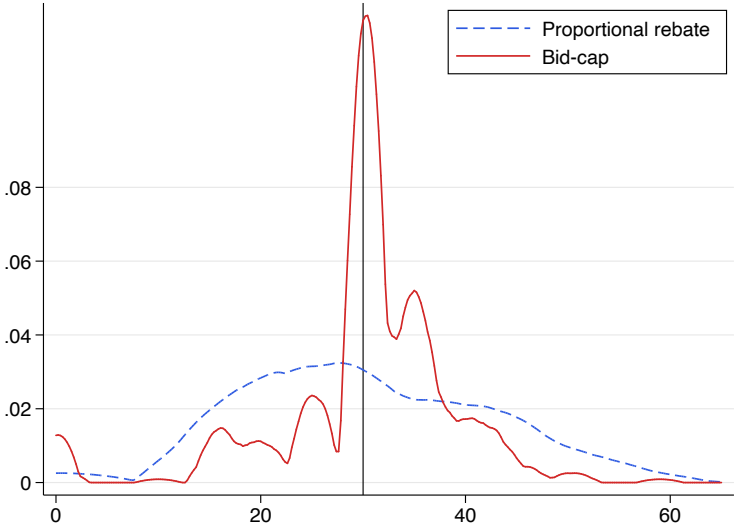
Kernel density of pledges



Kernel density of pledges (only funded projects)



Kernel density of payments (only funded projects)



Summary of findings:

- Rebate rules improve project success rates in reward-based crowdfunding by enticing backers to place higher pledges.
- Pledging is similar between proportional rebate and bid-cap rules, Although bid-cap induces less variance in payments, less free riding and less overbiding

Thank you for your attention!

Any Questions?

Link to the working paper:

Marginal penalty of over-pledging **All-or-nothing**

$$\frac{\partial \pi_i^a}{\partial b_i} = -1$$

Marginal penalty of over-pledging **Proportional rebate**

$$\frac{\partial \pi_i^a}{\partial b_i} = \begin{cases} -1 + \frac{\left(\sum b_i - PP\right)\left(\sum e_i - e_i\right) + \left(e_i \sum e_i\right)}{\left(\sum e_i\right)^2} & \text{if} \quad b_i \geq r \\ -1 & \text{if} \quad b_i < r \end{cases}$$

Marginal penalty of over-pledging **Bid-cap**

$$\frac{\partial \pi_i^a}{\partial b_i} = \begin{cases} 0 & \text{if} \quad b_i \geq \bar{b} \\ -1 & \text{if} \quad b_i < \bar{b} \end{cases}$$

Regression on *bids − equilibrium prediction*

	Part 1 (One round)			Part 2 (Ten rounds)		
	$b_i - 30$	$b_i - 30$	$b_i - 30$	$b_i - 30$	$b_i - 30$	$b_i - 30$
Constant	-2.00	3.75*	3.08	-2.16	5.77***	3.63*
	(1.950)	(2.213)	(2.131)	(1.706)	(2.106)	(1.862)
Treatment	All-or-nothing	Proportional rebate	Bid-cap	All-or-nothing	Proportional rebate	Bid-cap
Observations	40	40	40	400	400	400

Standard errors in parentheses. Estimation by OLS regression with robust standard errors for Part 1 and estimation by random-effects regression with clustering on subject level for Part 2. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Regression on *bids − valuation*

	Part 1 (One round)			Part 2 (Ten rounds)		
	$b_i - v_i$	$b_i - v_i$	$b_i - v_i$	$b_i - v_i$	$b_i - v_i$	$b_i - v_i$
Constant	-17.00***	-11.25***	-11.93***	-16.18***	-8.25***	-10.83***
	(1.950)	(2.213)	(2.131)	(1.644)	(2.134)	(1.962)
Treatment	All-or-nothing	Proportional rebate	Bid-cap	All-or-nothing	Proportional rebate	Bid-cap
Observations	40	40	40	400	400	400

Standard errors in parentheses. Estimation by OLS regression with robust standard errors for Part 1 and estimation by random-effects regression with clustering on subject level for Part 2. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Explanatory example:

- Check if $PP - donations$ is reached if all that want the good pay lowest pledge
- If **yes** all pay lowest pledge and excess contributions equally rebated among investores
- If **not** lowest bidder(s) pay the lowest pledge and it is checked if all others pay second highest pledge the PP reached
- If **yes** lowest bidders pay lowest all others pay second lowest pledge and potential excess is equally split among the people paying the most
- If **not** continue process

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- Consider an ordered sequence of unique pledges $(b_1, b_2, ..., b_N)$
- Suppose that $\sum b_i > PP$ and each of the first j bids is smaller than r
- Algorithm checks if $(N-j) \cdot b_{j+1} \geq PP - \sum_1^j b_i$
  - If yes all $N-j$ Individuals pay $b_{j+1} - \frac{1}{N-j} \cdot excess$
  - If no check if $(N-j-1) \cdot b_{j+2} > PP - \sum_1^j b_i - b_{j+1}$
    - If yes Indiv. $(j+1)$ pays b_{j+1} all other $N-j-1$ pay $b_{j+2} - \frac{1}{N-j-1} \cdot excess$
    - If no check if $(N-j-2) \cdot b_{j+3} > PP - \sum_1^j - b_{j+1} - b_{j+2}$
    - ...

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Kickstarter

All projects on kickstarter.com

Projects and Dollars

Category	Launched Projects	Total Dollars	Successful Dollars	Unsuccessful Dollars	Live Dollars	Live Projects	Success Rate
All	601,692	$7.51 B	$6.88 B	$587 M	$41 M	2,914	40.84%

Successful projects on kickstarter.com

Successfully Funded Projects

Most successfully funded projects raise less than $10,000, but a growing number have reached six, seven, and even eight figures. Currently funding projects that have reached their goals are not included in this chart — only projects whose funding is complete.

Category	Successfully Funded Projects	Less than $1,000 Raised	$1,000 to $9,999 Raised	$10,000 to $19,999 Raised	$20,000 to $99,999 Raised	$100 K to $999,999 Raised	$1 M Raised
All	244,514	31,415	129,534	35,379	37,210	10,218	758

Kickstarter

Unsuccessful projects on kickstarter.com

Unsuccessfully Funded Projects

Funding on Kickstarter is all-or-nothing in more ways than one. While 9% of projects finished having never received a single pledge 79% of projects that raised more than 20% of their goal were successfully funded.

Category	Unsuccessfully Funded Projects	0% Funded	1% to 20% Funded	21% to 40% Funded	41% to 60% Funded	61% to 80% Funded	81% to 99% Funded
All	354,264	56,271	231,971	36,820	16,200	7,036	5,964

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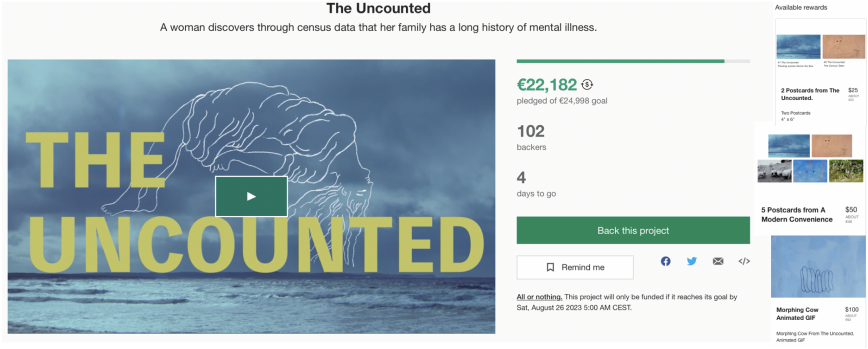
https://www.kickstarter.com/help/stats?ref=global-footer

Example project



/web/20230823090623/https://www.kickstarter.com/projects/thecounted/the-uncounted?ref=section-film-projectcollection-6-staff-picks-category-ending-soon

back

References I

Ansink, E., Koetse, M. J., Bouma, J., Hauck, D., and van Soest, D. (2017). Crowdfunding public goods: An experiment.

Cason, T. N., Tabarrok, A., and Zubrickas, R. (2021). Early refund bonuses increase successful crowdfunding. *Games and Economic Behavior*, 129:78–95.

Cason, T. N. and Zubrickas, R. (2017). Enhancing fundraising with refund bonuses. *Games and Economic Behavior*, 101:218–233.

Cason, T. N. and Zubrickas, R. (2019). Donation-based crowdfunding with refund bonuses. *European Economic Review*, 119:452–471.

Coats, J. C., Gronberg, T. J., and Grosskopf, B. (2009). Simultaneous versus sequential public good provision and the role of refunds—an experimental study. *Journal of Public Economics*, 93(1-2):326–335.

References II

Comeig, I., Mesa-Vázquez, E., Sendra-Pons, P., and Urbano, A. (2020). Rational herding in reward-based crowdfunding: An mturk experiment. *Sustainability*, 12(23):9827.

Corazzini, L., Cotton, C., and Valbonesi, P. (2015). Donor coordination in project funding: Evidence from a threshold public goods experiment. *Journal of Public Economics*, 128:16–29.

Cumming, D. J., Leboeuf, G., and Schwienbacher, A. (2020). Crowdfunding models: Keep-it-all vs. all-or-nothing. *Financial Management*, 49(2):331–360.

Donazzan, M., Erkal, N., and Koh, B. H. (2016). Impact of rebates and refunds on contributions to threshold public goods: evidence from a field experiment. *Southern Economic Journal*, 83(1):69–86.

References III

Li, G. and Wang, J. (2019). Threshold effects on backer motivations in reward-based crowdfunding. *Journal of Management Information Systems*, 36(2):546–573.

Marks, M. and Croson, R. (1998). Alternative rebate rules in the provision of a threshold public good: An experimental investigation. *Journal of public Economics*, 67(2):195–220.

Rondeau, D., Schulze, W. D., and Poe, G. L. (1999). Voluntary revelation of the demand for public goods using a provision point mechanism. *Journal of public Economics*, 72(3):455–470.

Solomon, J., Ma, W., and Wash, R. (2015). Don't wait! how timing affects coordination of crowdfunding donations. In *Proceedings of the 18th acm conference on computer supported cooperative work & social computing*, pages 547–556.

References IV

Spencer, M. A., Swallow, S. K., Shogren, J. F., and List, J. A. (2009). Rebate rules in threshold public good provision. *Journal of Public Economics*, 93(5-6):798–806.

Strausz, R. (2017). A theory of crowdfunding: A mechanism design approach with demand uncertainty and moral hazard. *American Economic Review*, 107(6):1430–76.

Wash, R. and Solomon, J. (2014). Coordinating donors on crowdfunding websites. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*, pages 38–48.

Zubrickas, R. (2014). The provision point mechanism with refund bonuses. *Journal of Public Economics*, 120:231–234.