

What motivates experts to contribute to
public information goods?
A field experiment at Wikipedia

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Motivation

Literature Review

Experimental Design

Results

Conclusion

User-Generated Content as Public Information Good

- ▶ User-generated content
 - ▶ Online reviews: Amazon, Yelp
 - ▶ Internet encyclopedia: Wikipedia
 - ▶ Online health support networks: ACS Cancer Support Network

User-Generated Content as Public Information Good

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 - ▶ Online reviews: Amazon, Yelp
 - ▶ Internet encyclopedia: Wikipedia
 - ▶ Online health support networks: ACS Cancer Support Network
- ▶ Public information goods
 - ▶ Non-rivalrous
 - ▶ Non-excludable (by choice)
 - ▶ **Expertise** matters: inputs are not perfect substitutes
 - ▶ quality
 - ▶ marginal cost
 - ▶ (affect)

Research Questions

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 - ▶ Voluntary contribution to public goods
 - ▶ Free-riding problem

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 - ▶ 40% decrease after exogenous reduction in readership in Chinese Wikipedia (Zhang and Zhu, 2011)

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- ▶ How motivating are private benefits?

Introduction: Wikipedia

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 - ▶ 5.4 million articles in the English Wikipedia
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- ▶ 2016: Wikipedia Year of Science
- ▶ How do we motivate domain experts (scientists, etc.) to contribute?

Example: Instrumental Variable

“... , the method of instrumental variables (IV) is used to estimate causal relationships when controlled experiments are not feasible ...”

Instrumental variable

From Wikipedia, the free encyclopedia

In *statistics*, *econometrics*, *epidemiology* and related disciplines, the method of **instrumental variables** (IV) is used to estimate *causal relationships* when *controlled experiments* are not feasible or when a treatment is not successfully delivered to every unit in a randomized experiment.^[1] Intuitively, IV is used when the correlation between the explanatory variable and the dependent variable does not plausibly reflect the causal relationship between the two. A valid instrument induces changes in the explanatory variable but has no independent effect on the dependent variable, allowing a researcher to uncover the causal effect of the explanatory variable on the dependent variable.

Instrumental variable methods allow for *consistent* estimation when the *explanatory variables* (covariates) are *correlated* with the *error terms* in a regression model. Such correlation may occur when changes in the dependent variable change the value of at least one of the *covariates* ("reverse" causation), when there are *omitted variables* that affect both the dependent and independent variables, or when the *covariates are subject to measurement error*. Explanatory variables which suffer from one or more of these issues in the context of a regression are sometimes referred to as *endogenous*. In this situation, *ordinary least squares* produces biased and inconsistent estimates.^[2] However, if an *instrument* is available, consistent estimates may still be obtained. An instrument is a variable that does not itself belong in the explanatory equation but is correlated with the *endogenous* explanatory variables, conditional on the value of other covariates. In linear models, there are two main requirements for using IV:

- The instrument must be correlated with the endogenous explanatory variables, conditional on the other covariates. If this correlation is highly statistically significant, then the instrument is said to have a **strong first stage**. A weak correlation may provide misleading inferences about parameter estimates and standard errors.^[3]
- The instrument cannot be correlated with the error term in the explanatory equation, conditional on the other covariates. In other words, the instrument cannot suffer from the same problem as the original predicting variable. If this condition is met, then the instrument is said to satisfy the **exclusion restriction**.

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Literature

- ▶ Laboratory and field experiments on public goods
 - ▶ Ledyard (1995)
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 - ▶ Better matching and lower cost (Cosley et al. 2007)

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 - ▶ Symbolic awards (Gallus 2016)
 - ▶ Better matching and lower cost (Cosley et al. 2007)
- ▶ What motivates domain experts (**outsiders**)?
 - ▶ Taraborelli, Mietchen, Alevizou and Gill (2011)

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Experimental Design: 2×3 factorial design

- ▶ Social impact

1. Average view: # of views of a typical WP article (426)
2. High view: # of views of the recommended articles ($> 1,000$)

Experimental Design: 2×3 factorial design

- ▶ Social impact
 1. Average view: # of views of a typical WP article (426)
 2. High view: # of views of the recommended articles ($> 1,000$)
- ▶ Private benefits
 1. No Cite: no citation benefit mentioned
 2. Citation:
 - ▶ might cite your work
 - ▶ may include include some of your publications in their references
 - ▶ might refer to some of your research
 3. Citation & acknowledgement:
 - ▶ citation
 - ▶ acknowledge your contributions publicly

Experimental Design: 2×3 factorial design

	No Citation	Citation	Citation & Acknowledge
Average View	AvgView-NoCite ($n = 678$)	AvgView-Cite ($n = 669$)	AvgView-CiteAcknowledge ($n = 672$)
High View	HighView-NoCite ($n = 636$)	HighView-Cite ($n = 661$)	HighView-CiteAcknowledge ($n = 658$)

Total number of participants:

- ▶ Intent to treat: $n = 3,974$
- ▶ Treated group: $n = 3,288$

Domain experts in this experiment: Academic economists

- ▶ Participant information retrieved from RePEc:
<https://ideas.repec.org>

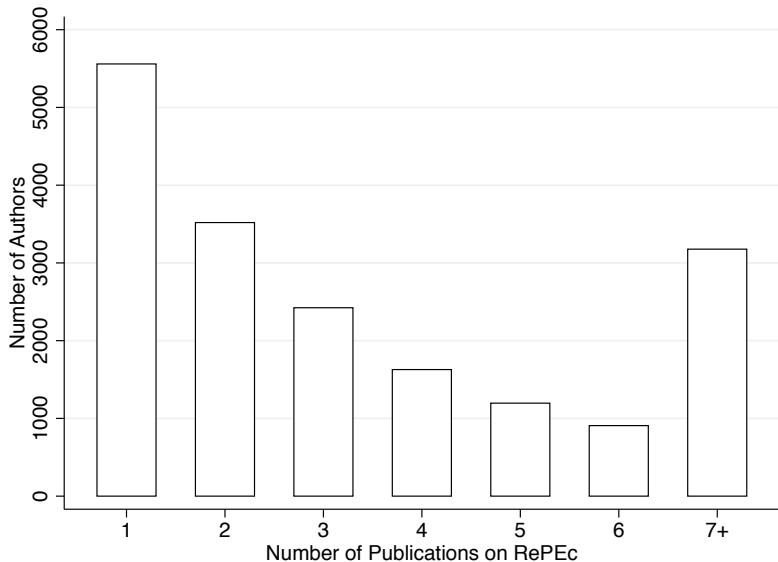
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- ▶ Participant information retrieved from RePEc:
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- ▶ Why RePEc?
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 - ▶ Paper archive: matching experts with WP articles
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 - ▶ RePEc ranking

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 - ▶ RePEc ranking
- ▶ Expert selection
 - ▶ Post at least six articles in English: 3,974
 - ▶ Accuracy of recommender system

Expert selection: Distribution of # of publications on RePEc



Wikipedia article selection

- ▶ Under namespace 0 (Main/Article)
- ▶ Not edit protected
- ▶ Not a “stub”
- ▶ At least 1,500 characters
- ▶ Viewed at least 1,000 times in the past 30 days (dynamically updated)

Implementation: Three-phase design

▶ Phase 1

- ▶ Send **personalized** email invitations to experts
- ▶ Treatments implemented

▶ Phase 2

- ▶ Recommend **relevant** articles to interested experts
- ▶ Articles selected to match experts' recent work

▶ Phase 3

- ▶ Send thank-you email
- ▶ Links to posted comments on Talk Page
- ▶ Links to tutorial on editing Wikipedia articles

Phase 1: Personalized email

Dear Dr. Chen,

Would you be willing to spend 10 - 20 minutes providing feedback on a few Wikipedia articles related to behavioral and experimental economics? Wikipedia is among the most important information sources the general public uses to find out about a wide range of topics. A Wikipedia article is viewed on average 426 times each month. While many Wikipedia articles are useful, articles written by enthusiasts instead of experts can be inaccurate, incomplete, or out of date.

If you are willing to help, we will send you links to a few Wikipedia articles in your area of expertise. We will select only articles, with over 1,000 views in the past month, so that your feedback will benefit many Wikipedia readers.

These articles may include some of your publications in their references.

Please click one of the following links to continue:

[Yes, please send me some Wikipedia articles to comment on.](#)

[No, I am not interested.](#)

Thank you for your attention.

Sincerely,

Yan Chen, Daniel Kahneman Collegiate Professor of Information, University of Michigan

Robert Kraut, Herbert A. Simon Professor of Human-Computer Interaction, Carnegie Mellon University

Phase 2: Recommending relevant articles

Dear Dr. Bebchuk,

Thank you for your willingness to provide feedback on the quality of Wikipedia articles. The following articles are suggested by our algorithm as related to law & economics.

Please comment on the articles most relevant to your research. Your feedback can significantly improve these articles' accuracy and completeness, and the comments and the references that you provide will be incorporated therein. These articles might refer to some of your research. We would appreciate receiving your comments by Jan 14, 2017. Thank you very much for your help.

Wikipedia Article Title	Number of views in the past month	Link to review the article
Shareholder value	6,298	Click here
Corporate governance	38,351	Click here
Managerial economics	17,771	Click here
Economic nationalism	8,931	Click here
University of Delaware	17,123	Click here
Corporatocracy	10,479	Click here

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Phase 2: Interface design - lowering entry cost

SCHOOL OF INFORMATION
UNIVERSITY OF MICHIGAN

Dear Dr. Chen,

By giving us feedback about the Wikipedia article to the right, you will help improve the quality of Wikipedia. Please rate the article and add suggestions for improvement.

Once you submit your comment, we will post your comments so that Wikipedians following this page will be notified about your feedback.

Overall quality: **Rating**

Poor ☆☆☆☆☆ Excellent

If you see any inaccuracies, wrong interpretations, or omissions in the article, please copy and paste the original paragraph, followed by your comments or changes. You can also indicate how to update the article with new developments in the field. It is extremely important to support your comments with references.

In my opinion, references 4 to 7 are rather poor concerning their methodological content. In addition, I think that the statement that "loss aversion is so important to the fields of marketing and behavioral finance" is incomplete in the sense that it neglects Experimental Economics and modern Behavioral Economics (including theory). This statement may therefore be misleading.

A new wave of Economic research on loss aversion includes the concept of expectation-based loss aversion of Koszegi and Rabin (2006, 2007). Recent experimental work from the laboratory and in the field provides a large body of evidence that concludes that economic outcomes are well explained by the concept of expectation-based loss aversion of Koszegi and Rabin (2006, 2007). These works consist of exchange and valuation experiments (see Ericsson and Fuster, 2011), consumption-choice experiments with sanctions (see Karle et al., 2015), experiments in which participants are compensated for exerting effort in a tedious and repetitive task (see Abeler et al., 2011), and of equity-preference tournaments (see Gill and Prosew, 2012). There is also evidence that expectation-based reference dependence affects golf players' performance (see Pope and Schweitzer, 2011) and

Feedback box

Submit Comment

Would appreciate it if you refer us to other scholars who can potentially improve this article.

First name: Last name:

University/Organization: Specialty: **Referrals** Add More Scholars

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42,811 edits

Article **Talk**

Loss aversion

From Wikipedia, the free encyclopedia

In **economics** and **decision theory**, **loss aversion** refers to people's tendency to strongly prefer avoiding losses to acquiring gains. Most studies suggest that losses are twice as powerful, psychologically, as gains.^[1] Loss aversion was first demonstrated by **Amos Tversky** and **Daniel Kahneman**.^[2]

This leads to **risk aversion** when people evaluate an outcome comprising similar gains and losses, since people prefer avoiding losses to making gains.

Loss aversion implies that one who loses \$100 will lose more satisfaction than another person will gain satisfaction from a \$100 windfall. In marketing, the use of trial periods and rebates tries to take advantage of the buyer's tendency to value the good more after the buyer incorporates it in the status quo.

Note that whether a transaction is framed as a loss or as a gain is very important to this calculation: would you rather get a \$5 discount, or avoid a \$5 surcharge? The same change in price framed differently has a significant effect on consumer behavior. Though traditional economists consider this "endowment effect" and all other effects of loss aversion to be completely irrational, that is why it is so important to the fields of **marketing** and **behavioral finance**. The effect of loss aversion in a marketing setting was demonstrated in a study of consumer reaction to price changes to insurance policies.^[3] The study found price increases had twice the effect on customer switching, compared to price decreases.

A concept related to loss aversion is also differential framing of decision attributes, which can affect people's relative loss aversion.^[4]

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- Loss aversion and the endowment effect
- Questions about the existence of loss aversion
- Loss aversion in nonhuman subjects
- Loss aversion within education
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Loss aversion and the endowment effect


Humans are hardwired to be risk averse. All organisms use the basics of survival, which is to seize favorable circumstances and overcome or avoid threats. A primal example of our ancestors would be the idea of a loss of resources necessary for survival to potentially fatal therefore a major focus would be on not losing any resources. This is where the concept of risk aversion stems from, survival. Although many economic dealings of today aren't life and death, it is a natural reflex to be averse to loss.^[5]

Loss aversion was first proposed as an explanation for the **endowment effect**—the fact that people place a higher value on a good that they own than on an identical good that they do not own—by Kahneman, Knetsch, and Thaler (1990).^[6] Loss aversion and the endowment effect lead to a violation of the **Coase theorem**—that "the allocation of resources will be independent of the assignment of property rights when costless trades are possible" (p. 1326).

In several studies, the authors demonstrated that the endowment effect could be explained by loss aversion but not five alternatives: (1) transaction costs, (2) misunderstandings, (3) habitual bargaining behaviors, (4) income effects, or (5) trophy effects. In each experiment half of the subjects were randomly assigned a good and

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Daniel Kahneman

- ▶ Lower entry barrier: no need to learn how to edit wiki
- ▶ Separate expert's comments from incorporation into WP article

Email Sending Procedure

- ▶ Emails sent 6:00 AM – 7:00 PM of expert's local time (based on location of primary affiliation)
- ▶ System tracks if each expert opens email
 - ▶ 84% opened first email (**treated group**)
- ▶ Responses:
 - ▶ **Yes**: phase 2 email sent immediately
 - ▶ **No**: dropped
 - ▶ **No response** after 2 weeks: 4 reminders
- ▶ Comments: manually verified before posting to article Talk page

What happened to these comments?

- ▶ **ExpertIdeas Bot**
 - ▶ Post comments on article talk page
 - ▶ Alert Wikipedia editors who watch this page
- ▶ Three scenarios
 - ▶ Best case: editors incorporate these comments
 - ▶ Intermediate case: editors comment on the comments
 - ▶ Worst case: nothing happens
- ▶ Students working with Wiki Ed to incorporate these comments
 - ▶ SI 563 (Game Theory)
 - ▶ 100% edits stayed after 4 months

Theory

- ▶ Public good: $y > 0$
- ▶ Number of consumers of this public good: $n \geq 0$
- ▶ Contribution level, a , from a choice set, $A \in [0, \bar{a})$
- ▶ Cost function, $c(a)$, is convex
- ▶ Social impact of public goods: $v(n)(y + ay)$
- ▶ Private benefit from contributions: $w(n)a$

$$\max_{a \in A} v(n)(y + ay) + w(n)a + \gamma(A - a) - \frac{c(a)}{s}. \quad (1)$$

Assuming $c(a) = ca^2/2$, we obtain optimal contribution level:

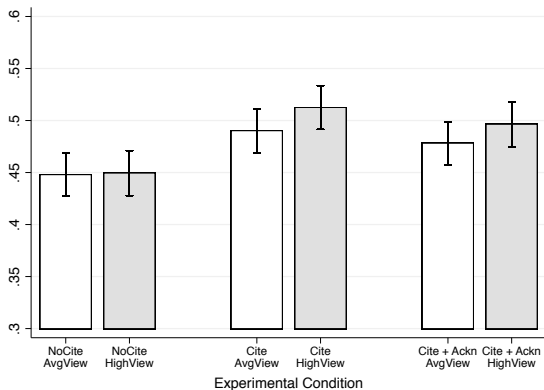
$$a^* = [v(n)y + w(n) - \gamma] \frac{s}{c}, \quad (2)$$

Hypotheses

- ▶ Experts will be more interested to contribute when citation benefit is made salient: $\frac{\partial a^*}{\partial w} = \frac{s}{c} > 0$.
- ▶ Experts will be more interested to contribute with increasing # of views: $\frac{\partial a^*}{\partial n} = [v'(n)y + w'(n)]\frac{s}{c} > 0$.
- ▶ An expert with a higher reputation will contribute less: $\frac{\partial a^*}{\partial \gamma} = -\frac{s}{c} < 0$.
- ▶ Better matching between the content of the public information good and the agent's expertise leads to an increased level of contributions, i.e., $\frac{\partial a^*}{\partial s} = [v(n)y + w(n) - \gamma]/c \geq 0$ if and only if $v(n)y + w(n) \geq \gamma$.

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Phase 1: Treatment effects on positive response



- ▶ NoCite & AvgView (baseline: 45%): high compared to APS campaign
- ▶ High View by itself: positive but insignificant effect
- ▶ Citation & High View: the highest positive response rate

Treatment effects: Average marginal effects of multinomial logistic regression on participation

	Positive	No response	Negative
HighView	0.002 (0.030)	0.021 (0.026)	-0.022 (0.027)
Citation	0.040 (0.030)	0.022 (0.026)	-0.064** (0.027)
Acknowledgment ((Interaction terms snipped))	0.030 (0.029)	0.019 (0.026)	-0.050* (0.027)
HighView+HighView×Citation	0.022 (0.030)	-0.002 (0.026)	-0.020 (0.025)
Citation+HighView×Citation	0.063** (0.030)	-0.001 (0.027)	-0.062** (0.026)
HighView+HighView×Acknowledgement	0.018 (0.030)	0.017 (0.027)	-0.036 (0.026)
Acknowledgement+HighView×Acknowledgement	0.047 (0.030)	0.016 (0.027)	-0.063** (0.027)

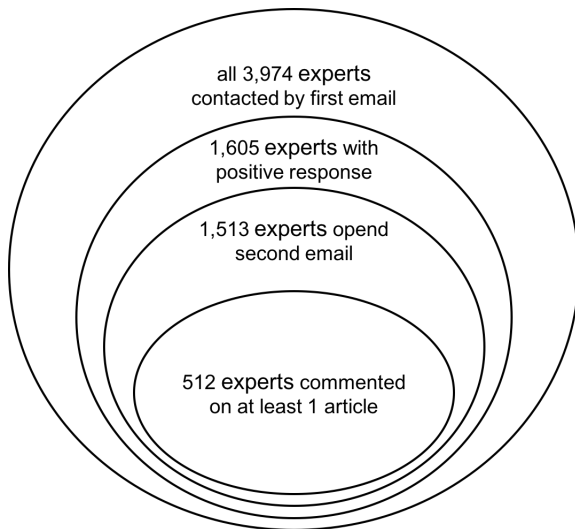
1. Citation at HighView increases positive response by 6 p.p.;
2. Citation decreases negative response by 6 p.p. at both views;
3. Acknowledgement at HighView decreases negative response by 6 p.p.

Reputation and social distance

	Positive Response	No Response	Negative Response	Positive Response	No Response	Negative Response
HighView	0.002 (0.030)	0.021 (0.026)	-0.022 (0.027)	0.004 (0.030)	0.019 (0.026)	-0.023 (0.027)
Citation	0.040 (0.030)	0.022 (0.026)	-0.064** (0.027)	0.038 (0.030)	0.026 (0.026)	-0.064** (0.026)
Acknowledgment ((Interaction terms snipped))	0.030 (0.029)	0.019 (0.026)	-0.050* (0.027)	0.020 (0.030)	0.024 (0.026)	-0.045* (0.027)
Author Abstract Views				0.033 (0.188)	-0.417** (0.192)	0.384*** (0.145)
English Affiliation				-0.017 (0.018)	-0.043*** (0.015)	0.060*** 0.015
Behavioral & experimental econ.				0.210*** (0.034)	-0.075*** (0.028)	-0.134*** (0.025)

- Reputation:** A 1,000-view increase in the number of **author abstract views** is associated with a 0.83 p.p. increase in the likelihood of a negative response. ABV normalized to [0, 1] from [51, 46,057].
- Social distance:** Behavioral and experimental economists are 21 (13.5) p.p. more (less) likely to respond positively (negatively) than others.

Samples through Phases 1 and 2



Phase 2: Contribution Quantity

- ▶ 1,513 (94%) opened phase-2 email
- ▶ 512 (34%) commented on at least one WP article
- ▶ 1,190 comments received by November 30, 2016
- ▶ Large variance in quantity (word count)
 - ▶ Some wrote one-line comments
 - ▶ Some rewrote the entire article

Table: Participants' responses in Phase 2, by experimental conditions

	AvgView NoCite (1)	AvgView Cite (2)	AvgView CiteAckn. (3)	HighView NoCite (4)	HighView Cite (5)	HighView CiteAckn. (6)
Comment at least 1 article	0.331 (0.471)	0.314 (0.465)	0.335 (0.473)	0.363 (0.482)	0.316 (0.466)	0.376 (0.485)
Number of articles commented	0.884 (1.658)	0.783 (1.492)	0.708 (1.295)	0.843 (1.451)	0.665 (1.263)	0.849 (1.432)
Average word count	44 (177)	41 (160)	65 (219)	96 (600)	43 (131)	60 (160)
Observations	242	258	257	223	275	258

Example 1: Traveler's Dilemma

- ▶ Original:
“When the game is played experimentally, most participants select a value close to \$100.”

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“When the game is played experimentally, most participants select a value close to \$100.”
- ▶ Proposed change:
“When the game is played experimentally, most participants select a value higher than the Nash equilibrium and closer to \$100. More precisely, the Nash equilibrium strategy solution proved to be a bad predictor of people's behaviour in a TD with small bonus/malus and a rather good predictor if the bonus/malus parameter was big.”

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- ▶ Expert: Piergiuseppe Morone, Professor of Economic Policy at University of Rome
- ▶ Expertise inferred from this paper:
Morone, A., P. Morone and A.R. Germani. “Individual and group behaviour in the traveler's dilemma: An experimental study.” *JEBO*, 2014.

Example 2: Repeated Game

- ▶ Article
https://en.wikipedia.org/wiki/Repeated_game
- ▶ Talk Page
https://en.wikipedia.org/wiki/Talk:Repeated_game
- ▶ Consent obtained from Oleg Korenok and Karl Schlag

Cosine similarity

- ▶ Cosine similarity of two documents measure the similarity between them in terms of overlapping vocabulary
 1. Doc 1: Expert's abstract, a
 2. Doc 2: Wikipedia article, b

Cosine similarity

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 1. Doc 1: Expert's abstract, a
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- ▶ Construct two vectors, **A** and **B**
 - ▶ enter both text files into a **tokenizer**, which divides text into a sequence of tokens, which roughly correspond to “words”
 - ▶ results processed by a **stemmer**, which reduces inflected or derived words to their word stem, base or root form
 - ▶ results passed to a **tf-idf vectorizer** (term frequency–inverse document frequency)

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 - ▶ results passed to a **tf-idf vectorizer** (term frequency–inverse document frequency)
- ▶ Calculate **cosine similarity** between **A** and **B**:

$$\cos(\theta) = \frac{\mathbf{A}^T \cdot \mathbf{B}}{\|\mathbf{A}\| \|\mathbf{B}\|} = \frac{\sum_{i=1}^n A_i B_i}{\sqrt{\sum_{i=1}^n A_i^2} \sqrt{\sum_{i=1}^n B_i^2}}$$

Contribution quantity: Compound Poisson Linear Model

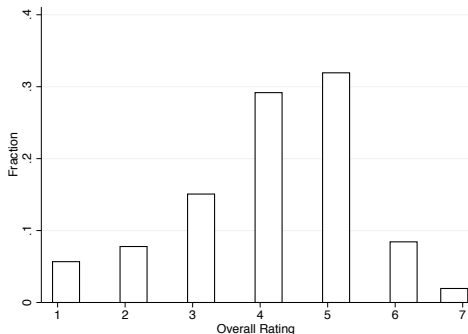
Dependent Variable	log(Word Count)		
HighView	0.165 (0.275)	0.109 (0.282)	0.068 (0.281)
Citation	0.017 (0.270)	-0.025 (0.277)	-0.058 (0.275)
Acknowledgement	0.152 (0.267)	0.154 (0.273)	0.086 (0.275)
Cosine Similarity		2.138*** (0.459)	2.219*** (0.461)
log(Page Length)		-0.012 (0.079)	-0.017 (0.080)
Author Abstract View			0.729 (1.545)
English Affiliation			0.148 (0.156)
Behavioral & Experimental Econ.			0.619** (0.235)
<i>N</i>	8,825	8,659	8,559

Contribution quantity

- ▶ **Cosine similarity**: The more similar an article is to an expert's published abstract, the longer the corresponding comment is. More specifically, a one-unit increase in cosine similarity leads to 9 times increase in the length of the expert's comments.
- ▶ **Social distance**: Behavioral and experimental economists contribute 16% more than experts in other fields.
- ▶ **Cosine similarity** has a similar significant effect on overall contribution quality.

Contribution quality

- ▶ Each comment independently rated by 3 trained coders
 - ▶ Doctoral students in Information Economics
 - ▶ Masters students in Economics and Information Economics
 - ▶ Junior and senior undergraduate economics majors
- ▶ Assignment based on courses taken
- ▶ Use median rating for analysis
- ▶ Distribution of median “overall quality”



Quality of comments: Self citation (logit)

Dependent Variable	Self-citation		
HighView	0.008 (0.059)	0.019 (0.062)	0.014 (0.060)
Citation	-0.011 (0.057)	-0.015 (0.058)	-0.010 (0.058)
Acknowledgement	0.093 (0.060)	0.095 (0.061)	0.103* (0.062)
Cosine Similarity		0.001 (0.186)	-0.011 (0.186)
log(Page Length)		-0.012 (0.031)	-0.017 (0.031)
Author Abstract View			-0.763* (0.462)
English Affiliation			0.057* (0.156)
Behavioral & Experimental Econ.			-0.021 (0.049)
HighView+HighView×Acknowledgement	-0.187*** (0.052)	-0.207*** (0.052)	-0.206*** (0.253)
Acknowledgement+HighView×Acknowledgement	-0.102** (0.051)	-0.130** (0.053)	-0.118** (0.052)

- ▶ Compared to AvgView-Acknowledgement, HighView-Acknowledgement discourages self-citation.

Motivation
Literature Review
Experimental Design
Results
Conclusion

Concluding Remarks

- ▶ Eliciting interests from experts
 - ▶ Citation benefit at High View increases participation;
 - ▶ Public acknowledgement at High View decreases negative response.
 - ▶ Longer social distance and higher reputation decrease participation

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- ▶ Generalizable to other expert communities? arXiv