

WHO IS CHEATING ON YOUR SURVEY?

A DETECTION APPROACH WITH DIGITAL TRACE DATA



[Find our manuscript](#)

**Sebastian Ramirez-Ruiz (Hertie School)
(in collaboration with Simon Munzert,
Pablo Barberá, Andrew M. Guess,
and JungHwan Yang)**

**EPSA 2022
June 25, 2022**

Motivation



Motivation

- Self-administered online surveys in social science research are becoming **increasingly popular**



Motivation

- Self-administered online surveys in social science research are becoming increasingly popular
- Many in the research community voice **concerns** about data quality



Motivation

- Self-administered online surveys in social science research are becoming increasingly popular
- Many in the research community voice concerns about data quality
- One major consideration is that online surveys present a **conducive environment** for consultation of outside sources on the web



Motivation

- Self-administered online surveys in social science research are becoming increasingly popular
- Many in the research community voice concerns about data quality
- One major consideration is that online surveys present a conducive environment for consultation of outside sources on the web
- This can potentially **inflate estimates** and distort **models** employing these responses.



Motivation

Quite some research has looked the prevalence of cheating in political knowledge questions

Motivation

Quite some research has looked the prevalence of cheating in political knowledge questions

Table A1: Prevalence of cheating in online assessments of political knowledge in selection of studies

Article	Prevalence	Detection method	Sample type	Item type	Effort
Clifford and Jerit (2016)	23%	Self-report	Student	Closed	DR
Clifford and Jerit (2016)	41%	Self-report	Student	Closed	FS+T+C
Clifford and Jerit (2016)	19-27%	Self-report	Student	Closed	C
Clifford and Jerit (2016)	14%	Self-report	Campus	Closed	C
Clifford and Jerit (2016)	13%	Self-report	Quota - Gen pop	Closed	T+C
Clifford and Jerit (2016)	14%	Self-report	Quota - Gen pop	Closed	—
Clifford and Jerit (2016)	4-7%	Self-report	MTurks	Closed	—
Clifford and Jerit (2016)	7%	Self-report	MTurks	Closed	C
Gummer and Kunz (2019)	3-6%	Window switching log	Quota - Internet	Closed	—
Gummer and Kunz (2019)	4-9%	Window switching log	Quota - Internet	Open	—
Höhne et al. (2021)	28%	Window switching log	Quota - Internet	Closed	—
Höhne et al. (2021)	36%	Window switching log	Quota - Internet	Open	—
Jensen and Thomsen (2014)	22%	Self-report	Quota - Internet	Closed	—
Motta, Callaghan and Smith (2017)	25-26%	Catch question	MTurks	Closed*	—
Motta, Callaghan and Smith (2017)	5-13%	Catch question	MTurks	Closed*	DR
Motta, Callaghan and Smith (2017)	8%	Catch question	SurveyMonkey	Closed*	—
Motta, Callaghan and Smith (2017)	11%	Catch question	SurveyMonkey	Closed*	DR
Smith, Clifford and Jerit (2020)	20-22%	Catch and self-report	Student	Closed*	C
Smith, Clifford and Jerit (2020)	69-72%	Catch and self-report	Student	Closed*	AS
Smith, Clifford and Jerit (2020)	11%	Catch question	Quota - Internet	Closed*	—
Style and Jerit (2021)	15-25%	Catch question	Quota - Gen pop	Both*	DR

Notes: *Open-ended catch questions. DR: Direct request not to seek information; C: Commitment question; T: Time limits; FS: Forgiving statement; AS: Statement allowing to seek information

Motivation

Quite some research has looked the prevalence of cheating in political knowledge questions

Table A1: Prevalence of cheating in online assessments of political knowledge in selection of studies

Article	Prevalence	Detection method	Sample type	Item type	Effort
Clifford and Jerit (2016)	23%	Self-report	Student	Closed	DR
Clifford and Jerit (2016)	41%	Self-report	Student	Closed	FS+T+C
Clifford and Jerit (2016)	19-27%	Self-report	Student	Closed	C
Clifford and Jerit (2016)	14%	Self-report	Campus	Closed	C
Clifford and Jerit (2016)	13%	Self-report	Quota - Gen pop	Closed	T+C
Clifford and Jerit (2016)	14%	Self-report	Quota - Gen pop	Closed	—
Clifford and Jerit (2016)	4-7%	Self-report	MTurks	Closed	—
Clifford and Jerit (2016)	7%	Self-report	MTurks	Closed	C
Gummer and Kunz (2019)	3-6%	Window switching log	Quota - Internet	Closed	—
Gummer and Kunz (2019)	4-9%	Window switching log	Quota - Internet	Open	—
Höhne et al. (2021)	28%	Window switching log	Quota - Internet	Closed	—
Höhne et al. (2021)	36%	Window switching log	Quota - Internet	Open	—
Jensen and Thomsen (2014)	22%	Self-report	Quota - Internet	Closed	—
Motta, Callaghan and Smith (2017)	25-26%	Catch question	MTurks	Closed*	—
Motta, Callaghan and Smith (2017)	5-13%	Catch question	MTurks	Closed*	DR
Motta, Callaghan and Smith (2017)	8%	Catch question	SurveyMonkey	Closed*	—
Motta, Callaghan and Smith (2017)	11%	Catch question	SurveyMonkey	Closed*	DR
Smith, Clifford and Jerit (2020)	20-22%	Catch and self-report	Student	Closed*	C
Smith, Clifford and Jerit (2020)	69-72%	Catch and self-report	Student	Closed*	AS
Smith, Clifford and Jerit (2020)	11%	Catch question	Quota - Internet	Closed*	—
Style and Jerit (2021)	15-25%	Catch question	Quota - Gen pop	Both*	DR

Notes: *Open-ended catch questions. DR: Direct request not to seek information; C: Commitment question; T: Time limits; FS: Forgiving statement; AS: Statement allowing to seek information

Motivation

Quite some research has looked the prevalence of cheating in political knowledge questions

Table A1: Prevalence of cheating in online assessments of political knowledge in selection of studies

Article	Prevalence	Detection method	Sample type	Item type	Effort
Clifford and Jerit (2016)	23%	Self-report	Student	Closed	DR
Clifford and Jerit (2016)	41%	Self-report	Student	Closed	FS+T+C
Clifford and Jerit (2016)	19-27%	Self-report	Student	Closed	C
Clifford and Jerit (2016)	14%	Self-report	Campus	Closed	C
Clifford and Jerit (2016)	13%	Self-report	Quota - Gen pop	Closed	T+C
Clifford and Jerit (2016)	14%	Self-report	Quota - Gen pop	Closed	—
Clifford and Jerit (2016)	4-7%	Self-report	MTurks	Closed	—
Clifford and Jerit (2016)	7%	Self-report	MTurks	Closed	C
Gummer and Kunz (2019)	3-6%	Window switching log	Quota - Internet	Closed	—
Gummer and Kunz (2019)	4-9%	Window switching log	Quota - Internet	Open	—
Höhne et al. (2021)	28%	Window switching log	Quota - Internet	Closed	—
Höhne et al. (2021)	36%	Window switching log	Quota - Internet	Open	—
Jensen and Thomsen (2014)	22%	Self-report	Quota - Internet	Closed	—
Motta, Callaghan and Smith (2017)	25-26%	Catch question	MTurks	Closed*	—
Motta, Callaghan and Smith (2017)	5-13%	Catch question	MTurks	Closed*	DR
Motta, Callaghan and Smith (2017)	8%	Catch question	SurveyMonkey	Closed*	—
Motta, Callaghan and Smith (2017)	11%	Catch question	SurveyMonkey	Closed*	DR
Smith, Clifford and Jerit (2020)	20-22%	Catch and self-report	Student	Closed*	C
Smith, Clifford and Jerit (2020)	69-72%	Catch and self-report	Student	Closed*	AS
Smith, Clifford and Jerit (2020)	11%	Catch question	Quota - Internet	Closed*	—
Style and Jerit (2021)	15-25%	Catch question	Quota - Gen pop	Both*	DR

Notes: *Open-ended catch questions. DR: Direct request not to seek information; C: Commitment question; T: Time limits; FS: Forgiving statement; AS: Statement allowing to seek information

Motivation

Quite some research has looked the prevalence of cheating in political knowledge questions

Table A1: Prevalence of cheating in online assessments of political knowledge in selection of studies

Article	Prevalence	Detection method	Sample type	Item type	Effort
Clifford and Jerit (2016)	23%	Self-report	Student	Closed	DR
Clifford and Jerit (2016)	41%	Self-report	Student	Closed	FS+T+C
Clifford and Jerit (2016)	19-27%	Self-report	Student	Closed	C
Clifford and Jerit (2016)	14%	Self-report	Campus	Closed	C
Clifford and Jerit (2016)	13%	Self-report	Quota - Gen pop	Closed	T+C
Clifford and Jerit (2016)	14%	Self-report	Quota - Gen pop	Closed	—
Clifford and Jerit (2016)	4-7%	Self-report	MTurks	Closed	—
Clifford and Jerit (2016)	7%	Self-report	MTurks	Closed	C
Gummer and Kunz (2019)	3-6%	Window switching log	Quota - Internet	Closed	—
Gummer and Kunz (2019)	4-9%	Window switching log	Quota - Internet	Open	—
Höhne et al. (2021)	28%	Window switching log	Quota - Internet	Closed	—
Höhne et al. (2021)	36%	Window switching log	Quota - Internet	Open	—
Jensen and Thomsen (2014)	22%	Self-report	Quota - Internet	Closed	—
Motta, Callaghan and Smith (2017)	25-26%	Catch question	MTurks	Closed*	—
Motta, Callaghan and Smith (2017)	5-13%	Catch question	MTurks	Closed*	DR
Motta, Callaghan and Smith (2017)	8%	Catch question	SurveyMonkey	Closed*	—
Motta, Callaghan and Smith (2017)	11%	Catch question	SurveyMonkey	Closed*	DR
Smith, Clifford and Jerit (2020)	20-22%	Catch and self-report	Student	Closed*	C
Smith, Clifford and Jerit (2020)	69-72%	Catch and self-report	Student	Closed*	AS
Smith, Clifford and Jerit (2020)	11%	Catch question	Quota - Internet	Closed*	—
Style and Jerit (2021)	15-25%	Catch question	Quota - Gen pop	Both*	DR

Notes: *Open-ended catch questions. DR: Direct request not to seek information; C: Commitment question; T: Time limits; FS: Forgiving statement; AS: Statement allowing to seek information

Motivation

Quite some research has looked the prevalence of cheating in political knowledge questions

Table A1: Prevalence of cheating in online assessments of political knowledge in selection of studies

Article	Prevalence	Detection method	Sample type	Item type	Effort
Clifford and Jerit (2016)	23%	Self-report	Student	Closed	DR
Clifford and Jerit (2016)	41%	Self-report	Student	Closed	FS+T+C
Clifford and Jerit (2016)	19-27%	Self-report	Student	Closed	C
Clifford and Jerit (2016)	14%	Self-report	Campus	Closed	C
Clifford and Jerit (2016)	13%	Self-report	Quota - Gen pop	Closed	T+C
Clifford and Jerit (2016)	14%	Self-report	Quota - Gen pop	Closed	—
Clifford and Jerit (2016)	4-7%	Self-report	MTurks	Closed	—
Clifford and Jerit (2016)	7%	Self-report	MTurks	Closed	C
Gummer and Kunz (2019)	3-6%	Window switching log	Quota - Internet	Closed	—
Gummer and Kunz (2019)	4-9%	Window switching log	Quota - Internet	Open	—
Höhne et al. (2021)	28%	Window switching log	Quota - Internet	Closed	—
Höhne et al. (2021)	36%	Window switching log	Quota - Internet	Open	—
Jensen and Thomsen (2014)	22%	Self-report	Quota - Internet	Closed	—
Motta, Callaghan and Smith (2017)	25-26%	Catch question	MTurks	Closed*	—
Motta, Callaghan and Smith (2017)	5-13%	Catch question	MTurks	Closed*	DR
Motta, Callaghan and Smith (2017)	8%	Catch question	SurveyMonkey	Closed*	—
Motta, Callaghan and Smith (2017)	11%	Catch question	SurveyMonkey	Closed*	DR
Smith, Clifford and Jerit (2020)	20-22%	Catch and self-report	Student	Closed*	C
Smith, Clifford and Jerit (2020)	69-72%	Catch and self-report	Student	Closed*	AS
Smith, Clifford and Jerit (2020)	11%	Catch question	Quota - Internet	Closed*	—
Style and Jerit (2021)	15-25%	Catch question	Quota - Gen pop	Both*	DR

Notes: *Open-ended catch questions. DR: Direct request not to seek information; C: Commitment question; T: Time limits; FS: Forgiving statement; AS: Statement allowing to seek information

WHAT DID WE DO?

What did we do?



What did we do?

- We implemented a direct yet unobtrusive approach to detect **cheating** behavior in the wild



What did we do?

- We implemented a direct yet unobtrusive approach to detect cheating behavior in the wild
- We detected cheating with high precision at the item level by combining survey and web-tracking data



What did we do?

- We implemented a direct yet unobtrusive approach to detect cheating behavior in the wild
- We detected cheating with high precision at the item level by combining survey and web-tracking data
- We assess the prevalence of cheating in political knowledge questions



What did we do?

- We implemented a direct yet unobtrusive approach to detect cheating behavior in the wild
- We detected cheating with high precision at the item level by combining survey and web-tracking data
- We assess the prevalence of cheating in political knowledge questions
- We used this evidence to explore **predictors** as well as **practical consequences** of cheating



HOW DID WE DO IT?

How did we do it?

- We used data from an online panel survey recruited from the German and U.S. American YouGov Pulse panel

How did we do it?

- We used data from an online panel survey recruited from the German and U.S. American YouGov Pulse panel
- The panel enabled **passive metering** of individuals' web usage on their registered laptop, desktop, and mobile devices

How did we do it?

- We used data from an online panel survey recruited from the German and U.S. American YouGov Pulse panel
- The panel enabled passive metering of individuals' web usage on their registered laptop, desktop, and mobile devices

This allowed us to observe every URL that respondents visited on these devices during the study period.

How did we do it?

- We used data from an online panel survey recruited from the German and U.S. American YouGov Pulse panel
- The panel enabled passive metering of individuals' web usage on their registered laptop, desktop, and mobile devices
- We **screened all the parallel navigation during the survey interval** of our respondents to see if they consulted the web to answer any of the 68 political knowledge items (4 question types) across 4 survey waves

How did we do it?

Survey

A.

USER ID	STARTTIME	ENDTIME
ID:1310	2017-08-13 21:26:42 UTC	2017-08-13 21:34:48 UTC
•		
•		
•		
•		
ID:2808	2017-08-08 19:28:01 UTC	2017-08-08 19:36:13 UTC

Web tracking data

B.

USER ID	TIME	URL	KEYWORD HIT	VALIDATED
ID:1310	2017-08-13 21:26:45 UTC	G4-EMEA.YOUGOV.COM/...	-	-
•				

ID:1310	2017-08-13 21:31:14 UTC	GOOGLE.COM/SEARCH?Q=MERKEL+PAR TEI...	TRUE	TRUE
•				
ID:1310	2017-08-13 21:35:51 UTC	YOUGOV.COM/OPI/ ... SURVEY_EXIT	-	-

C.

ID:2808	2017-08-08 19:28:10 UTC	G4-EMEA.YOUGOV.COM/...	-	-
•				

ID:2808	2017-08-08 19:29:10 UTC	YOUTUBE.COM/WATCH?vgsFDPin8fyg	TRUE	FALSE
•				

ID:2808	2017-08-08 19:36:17 UTC	YOUGOV.COM/OPI/ ... SURVEY_EXIT	-	-
•				

The granularity of our data helps us pinpoint browsing behavior during the survey-taking interval

WHAT DID WE FIND?

1. Cheating is prevalent in the wild

**1. Cheating is prevalent in
the wild**

**2. Anti-cheating commitment
pledges may help**

**1. Cheating is prevalent in
the wild**

**2. Anti-cheating commitment
pledges may help**

**3. We find correlates of
cheating.**

**Correcting for it post hoc?
Well, that's another story...**

**1. Cheating is prevalent in
the wild**

**2. Anti-cheating commitment
pledges may help**

**3. We find correlates of
cheating.**

**Correcting for it post hoc?
Well, that's another story...**

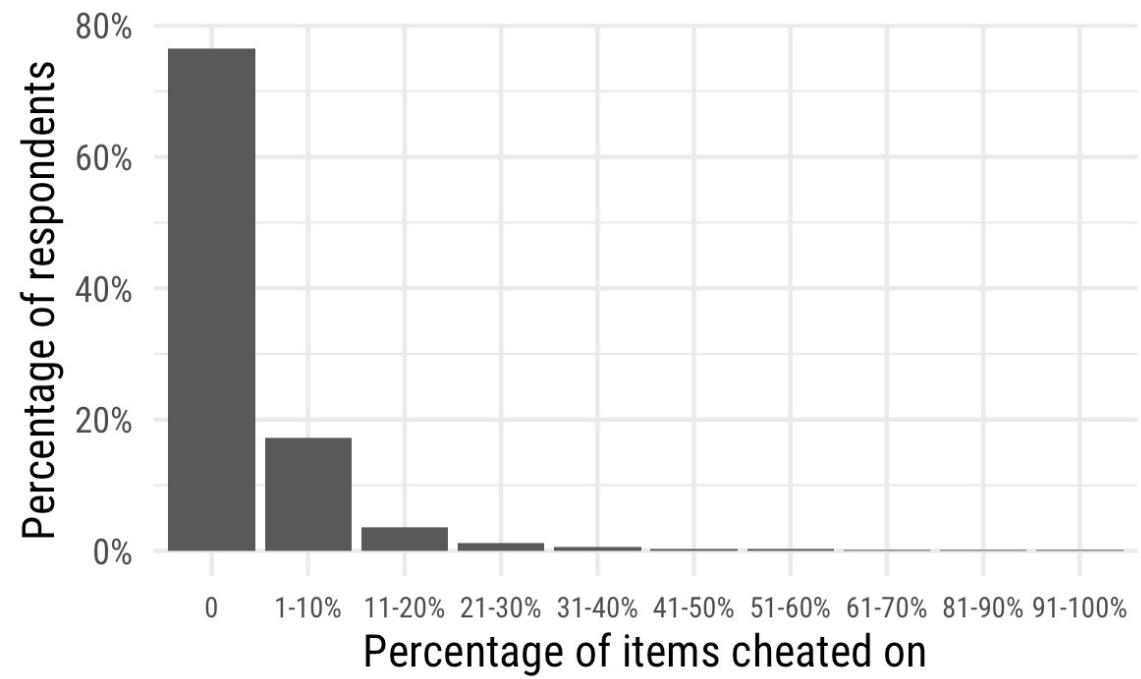
**4. Cheating does not seem to
distort models of political
knowledge**

Cheating is prevalent in the wild



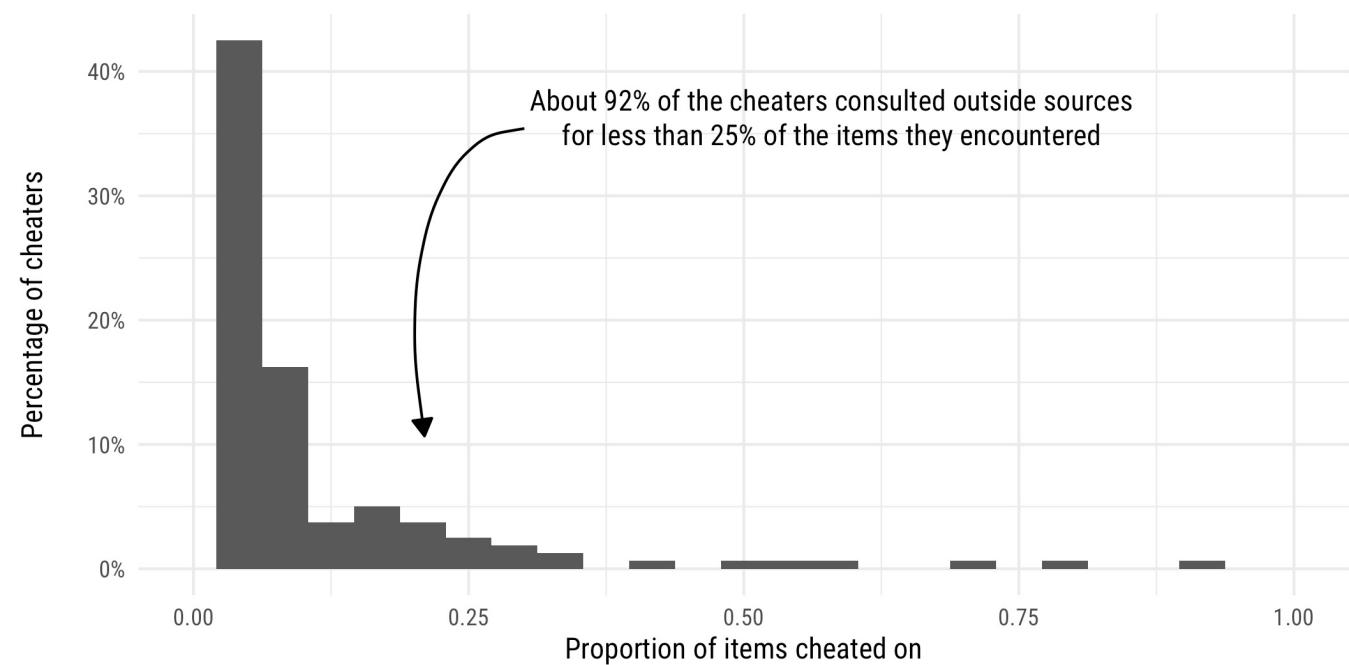
Cheating is prevalent in the wild

- In the German survey panel, 23% of the respondents engage at least once with outside sites for answers



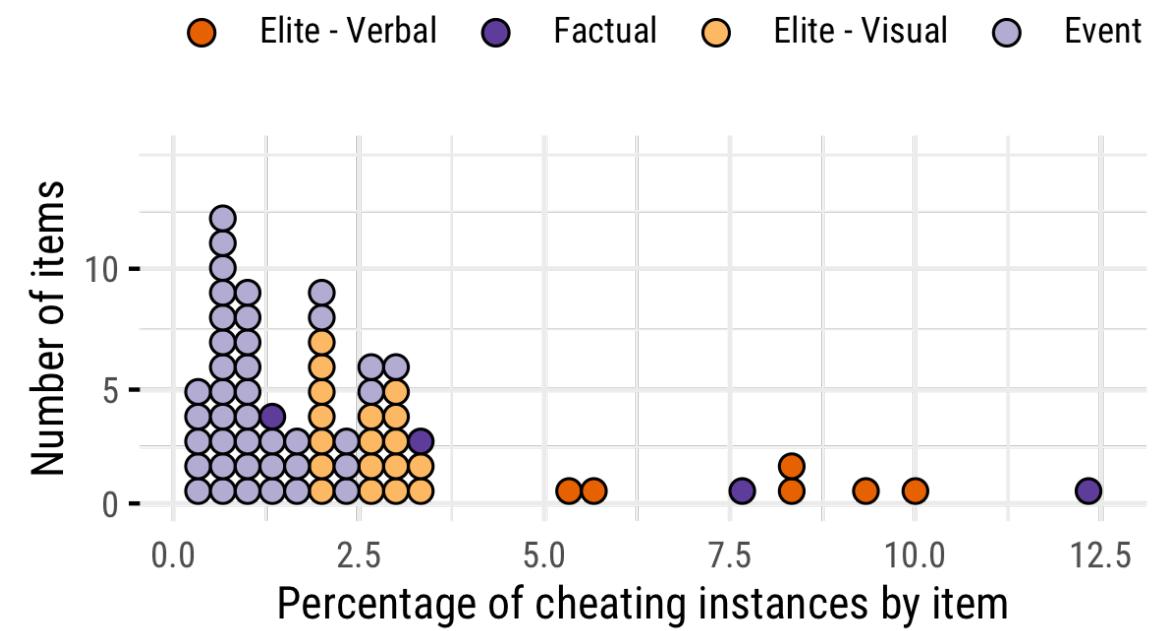
Cheating is prevalent in the wild

- In the German survey panel, 23% of the respondents engage at least once with outside sites for answers
- Serial cheaters are rare



Cheating is prevalent in the wild

- In the German survey panel, 23% of the respondents engage at least once with outside sites for answers
 - Serial cheaters are rare
 - The prevalence of cheating instances varies across question types from on average 1% in event items to 8% in open-ended elite-verbal items.



Anti-cheating commitment pledges may help



Anti-cheating commitment pledges may help

The U.S. survey differed in that we included an anti-cheating commitment pledge just before the knowledge questions.

Anti-cheating commitment pledges may help

The U.S. survey differed in that we included an anti-cheating commitment pledge just before the knowledge questions.

Since the pledge was not randomly assigned, we cannot identify its effect on cheating. Still, we provide some evidence that suggests they do.

Anti-cheating commitment pledges may help

The U.S. survey differed in that we included an anti-cheating commitment pledge just before the knowledge questions.

Since the pledge was not randomly assigned, we cannot identify its effect on cheating. Still, we provide some evidence that suggests they do.

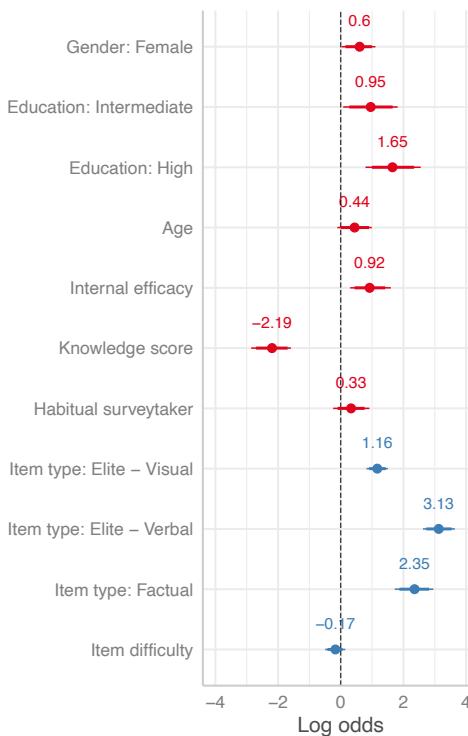
The prevalence in the U.S. setting was **minimal** (less than 1% of the respondents)

We find correlates of cheating.
Correcting for it post hoc? Well, that's another story...

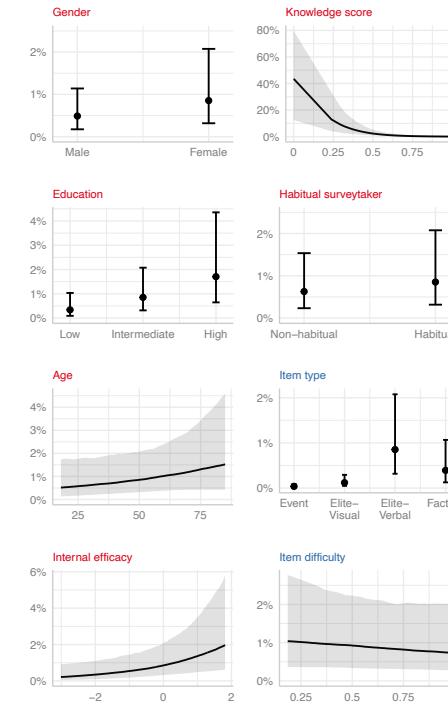


We find correlates of cheating

(A) Fixed effects estimates



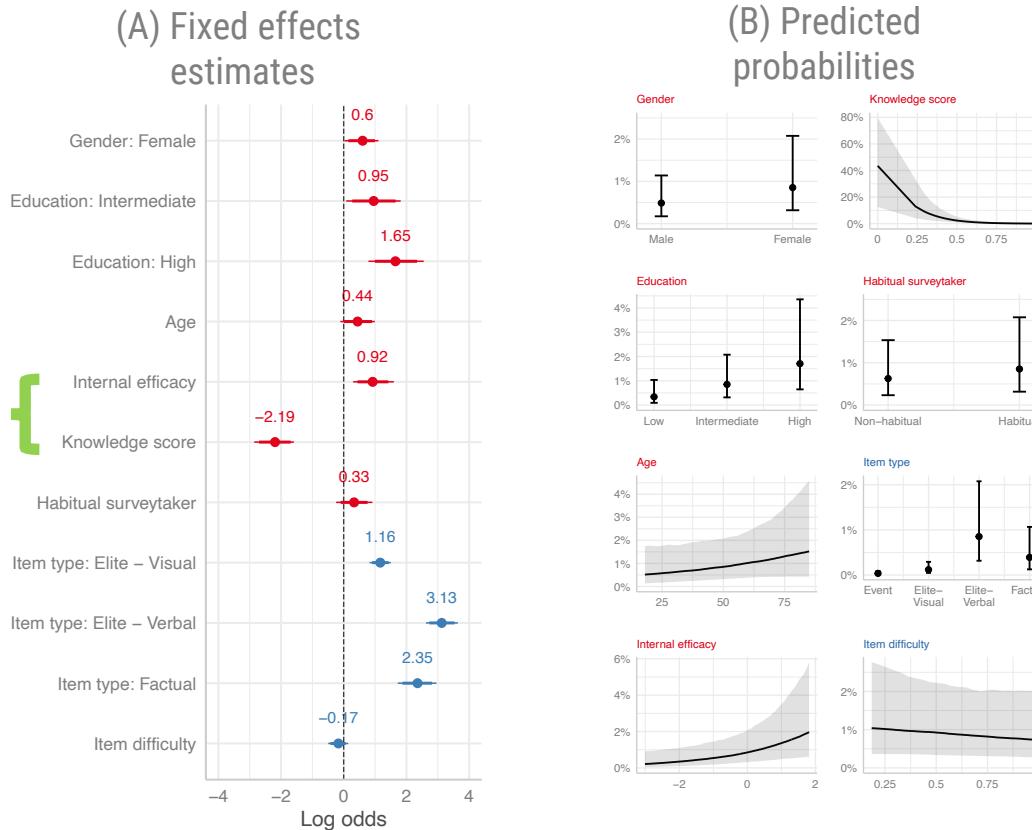
(B) Predicted probabilities



We find robust person- and item-level correlates of cheating.

Note: Results from a Bayesian logistic mixed-effects model with person and item random effects. Posterior means along with 95% credible intervals reported. Number of observations: 35,486; number of respondents: 656; number of items: 68. To compute the predicted probabilities, numeric covariates are held at their means and the other covariates are set to: female, intermediate education, item type "Elite - Verbal", and habitual survey-taker.

We find correlates of cheating

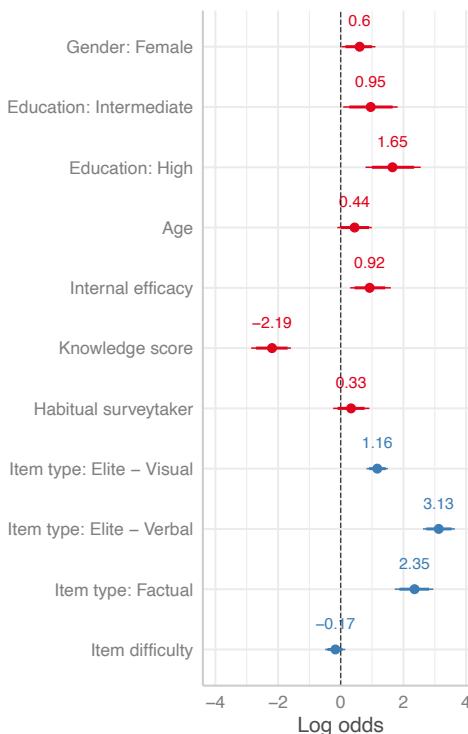


For instance, we find an interesting difference between perceived and actual competence: Cheating is more likely among those with high levels of internal efficacy, but less likely among those who actually know more about politics.

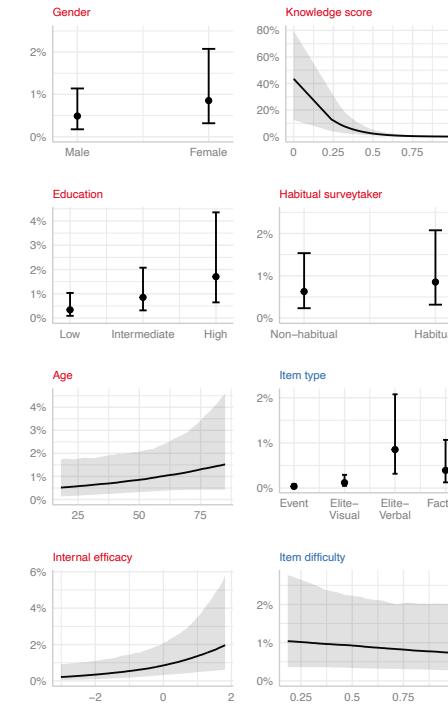
Note: Results from a Bayesian logistic mixed-effects model with person and item random effects. Posterior means along with 95% credible intervals reported. Number of observations: 35,486; number of respondents: 656; number of items: 68. To compute the predicted probabilities, numeric covariates are held at their means and the other covariates are set to: female, intermediate education, item type "Elite - Verbal", and habitual survey-taker.

We find correlates of cheating

(A) Fixed effects estimates



(B) Predicted probabilities



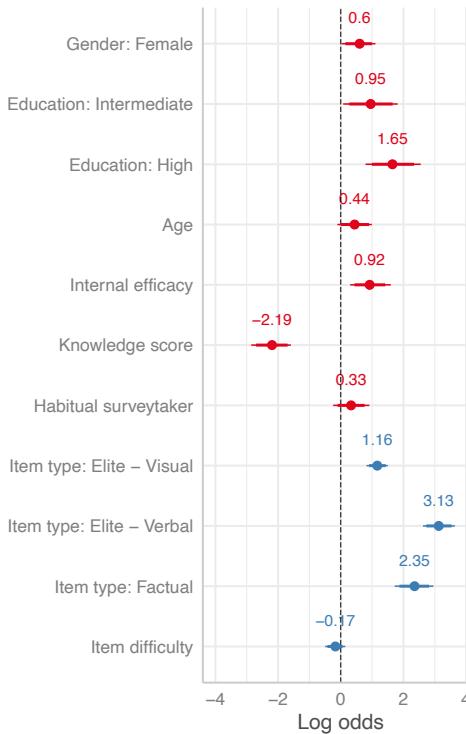
For instance, we find an interesting difference between perceived and actual competence: Cheating is more likely among those with high levels of internal efficacy, but less likely among those who actually know more about politics.

Also, cheating is particularly likely for open-ended items.

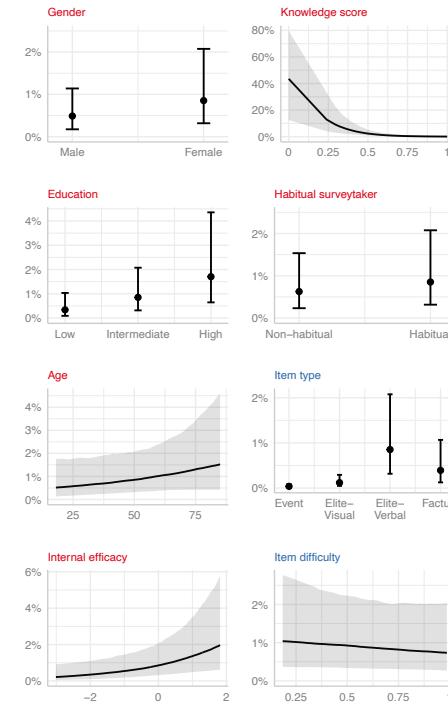
Note: Results from a Bayesian logistic mixed-effects model with person and item random effects. Posterior means along with 95% credible intervals reported. Number of observations: 35,486; number of respondents: 656; number of items: 68. To compute the predicted probabilities, numeric covariates are held at their means and the other covariates are set to: female, intermediate education, item type "Elite - Verbal", and habitual survey-taker.

Correcting for it post hoc? Well that's another story...

(A) Fixed effects estimates



(B) Predicted probabilities



Note: Results from a Bayesian logistic mixed-effects model with person and item random effects. Posterior means along with 95% credible intervals reported. Number of observations: 35,486; number of respondents: 656; number of items: 68. To compute the predicted probabilities, numeric covariates are held at their means and the other covariates are set to: female, intermediate education, item type "Elite - Verbal", and habitual survey-taker.

For instance, we find an interesting difference between perceived and actual competence: Cheating is more likely among those with high levels of internal efficacy, but less likely among those who actually know more about politics.

Also, cheating is particularly likely for open-ended items.

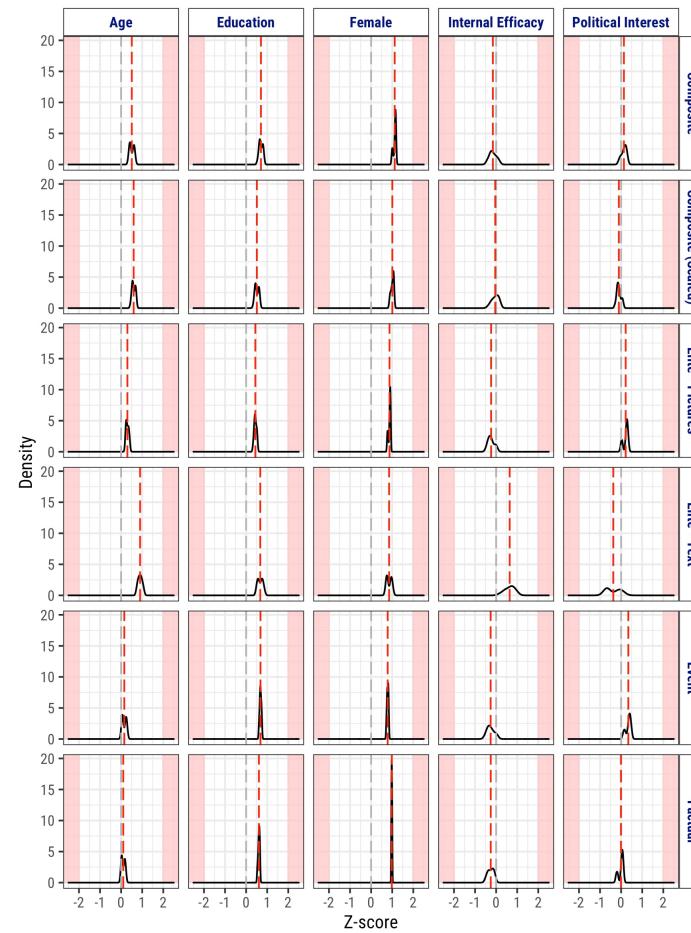
Despite these patterns, due to the low base rate, it is **extremely difficult to reliably classify cheating instances.**

Cheating does not seem to distort models of political knowledge



Cheating does not seem to distort models of political knowledge

- We compared estimates for predictors of political knowledge using unadjusted and cheating-adjusted measures



Note: Distributions of Z-scores in difference-in-coefficients tests. Rows correspond to different measures of political knowledge, columns to covariates used as predictors. Results based on difference-in-coefficients tests of the corresponding covariate for 31 linear models (each run twice, once with naive and once with cheating-adjusted knowledge measure as outcome).

Cheating does not seem to distort models of political knowledge

- We compared estimates for predictors of political knowledge using unadjusted and cheating-adjusted measures
- We explored how political knowledge differed between cheaters and non-cheaters in predicting various related outcomes (Political interest, vote certainty, internal efficacy, and likelihood to vote)

Table C1: Political interest and cheating interaction model. Rows correspond to different measures of political knowledge, columns to the outcomes predicted

	Composite	Composite (Scaled)	Elite - Pictures	Elite - Text	Event	Factual
(Intercept)	-1.873 (0.264)	-1.155 (0.240)	-1.025 (0.244)	-1.196 (0.267)	-1.672 (0.323)	-0.784 (0.263)
Political knowledge	2.723 (0.256)	1.788 (0.151)	1.765 (0.152)	1.063 (0.137)	1.743 (0.349)	0.634 (0.123)
Cheated	0.392 (0.395)	0.379 (0.228)	0.391 (0.198)	0.410 (0.207)	0.006 (0.552)	0.319 (0.212)
Female	-0.281 (0.071)	-0.280 (0.071)	-0.282 (0.073)	-0.400 (0.079)	-0.399 (0.076)	-0.413 (0.079)
Education	0.052 (0.050)	0.047 (0.050)	0.041 (0.051)	0.131 (0.056)	0.118 (0.053)	0.089 (0.057)
Age	0.001 (0.003)	0.001 (0.003)	-0.001 (0.003)	0.006 (0.003)	0.005 (0.003)	0.006 (0.003)
Political knowledge x Cheated	-0.594 (0.567)	-0.633 (0.333)	-0.509 (0.296)	-0.592 (0.272)	0.075 (0.770)	-0.427 (0.284)
Num.Obs.	679	656	618	548	679	618
R2	0.230	0.257	0.265	0.187	0.127	0.122
R2 Adj.	0.223	0.250	0.258	0.178	0.120	0.113
F	33.487	37.450	36.791	20.773	16.348	14.127

OUR CONCLUSIONS

Our conclusions

Our data framework provides us with a rare opportunity to observe the prevalence of cheating with a high level of detail.

Our conclusions

Our data framework provides us with a rare opportunity to observe the prevalence of cheating with a high level of detail. Our empirical strategy offers an effective strategy to correct for cheating post hoc.

Our conclusions

Our data framework provides us with a rare opportunity to observe the prevalence of cheating with a high level of detail. Our empirical strategy offers an effective strategy to correct for cheating post hoc. Nevertheless, **this data collection setup is unique and not available to most researchers in the social sciences.**

Our conclusions

Our data framework provides us with a rare opportunity to observe the prevalence of cheating with a high level of detail. Our empirical strategy offers an effective strategy to correct for cheating post hoc. Nevertheless, this data collection setup is unique and not available to most researchers in the social sciences. Given these constraints, we recommend that researchers take **measures against cheating before it occurs.**

Our conclusions

Our data framework provides us with a rare opportunity to observe the prevalence of cheating with a high level of detail. Our empirical strategy offers an effective strategy to correct for cheating post hoc. Nevertheless, this data collection setup is unique and not available to most researchers in the social sciences. Given these constraints, we recommend that researchers take measures against cheating before it occurs. Our findings suggest that **normative commitment pledges** discouraging the use of external sources and **question types** that are more robust to cheating, such as visual knowledge questions, are two viable options.

Our conclusions

Our data framework provides us with a rare opportunity to observe the prevalence of cheating with a high level of detail. Our empirical strategy offers an effective strategy to correct for cheating post hoc. Nevertheless, this data collection setup is unique and not available to most researchers in the social sciences. Given these constraints, we recommend that researchers take measures against cheating before it occurs. Our findings suggest that normative commitment pledges discouraging the use of external sources and question types that are more robust to cheating, such as visual knowledge questions, are two viable options. Finally, while researchers face **trade-offs** between self- and interviewer-delivered survey modes, the validity of political knowledge measures does not need to be one of them, since it can to a large extent be addressed through **survey design features**.

Thank you!



Find our manuscript



ramirez-ruiz@hertie-school.org

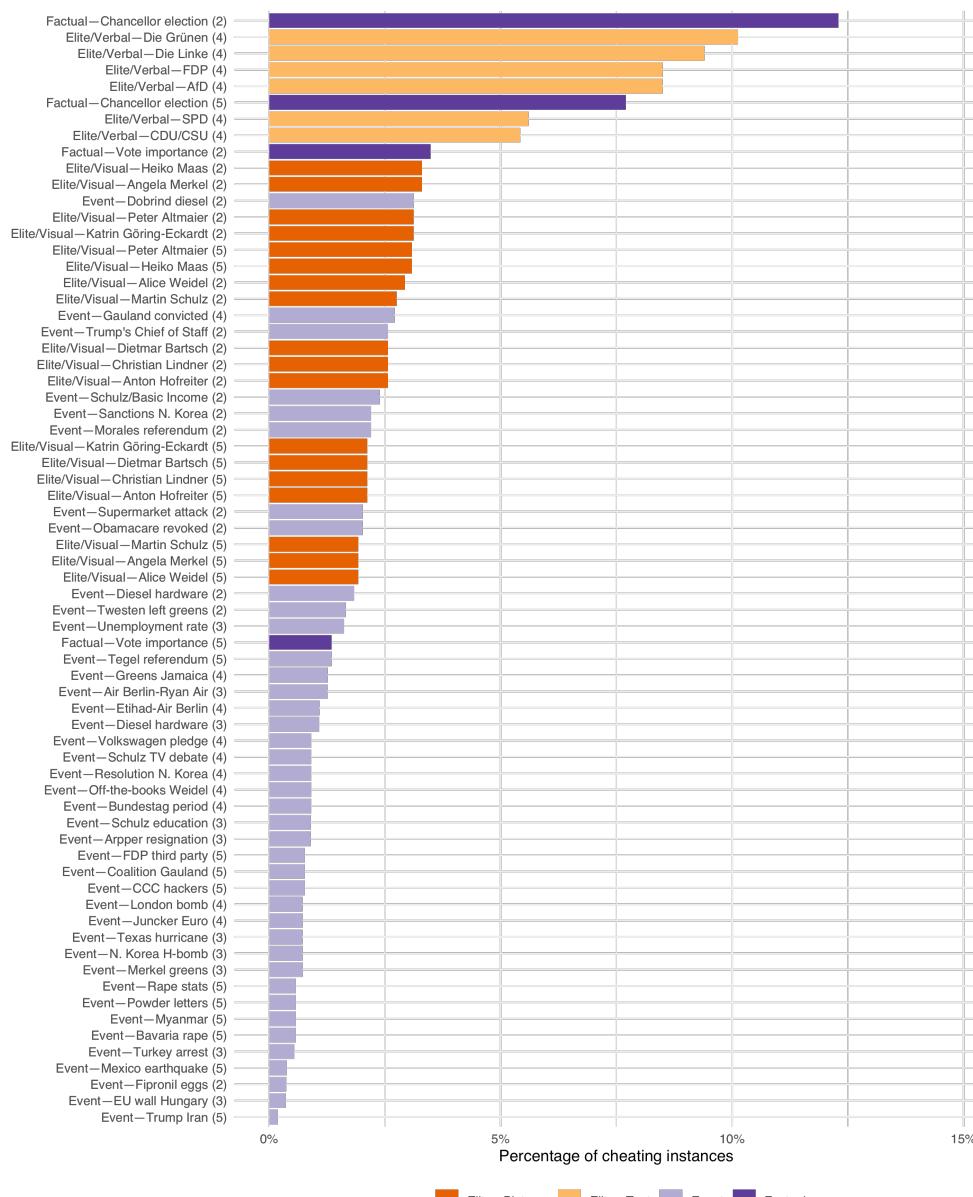


@seramirezruiz

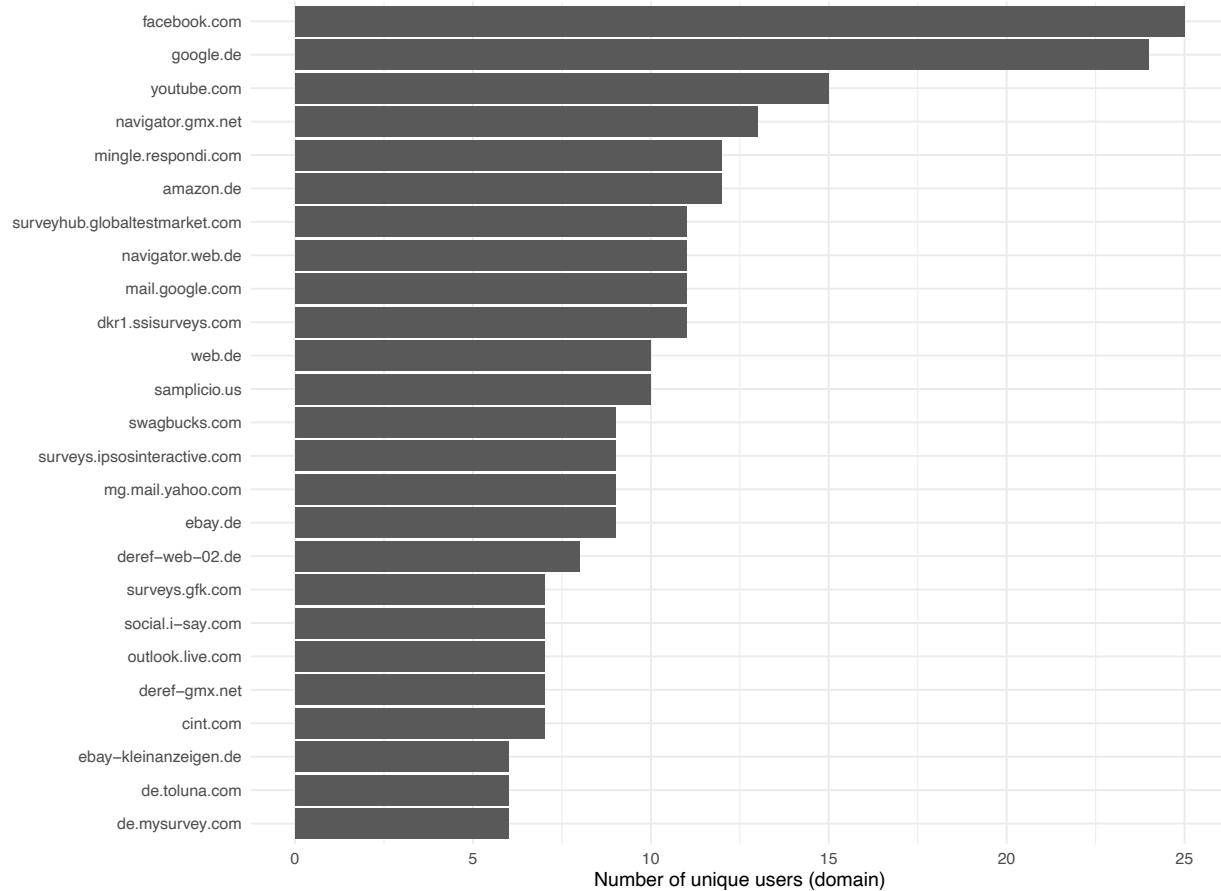


seramirezruiz.github.io

Figure C7. Percentage of cheating instances by item



(GER)



(USA)

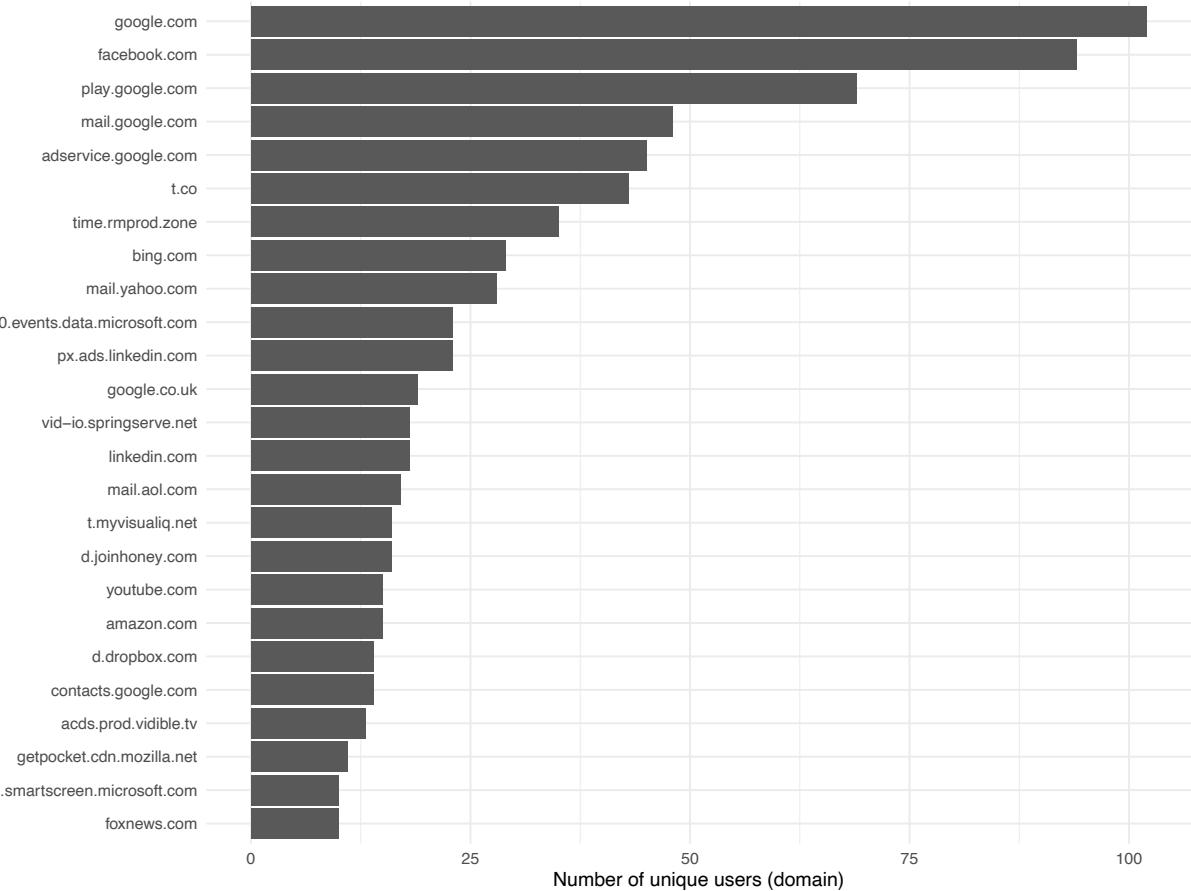
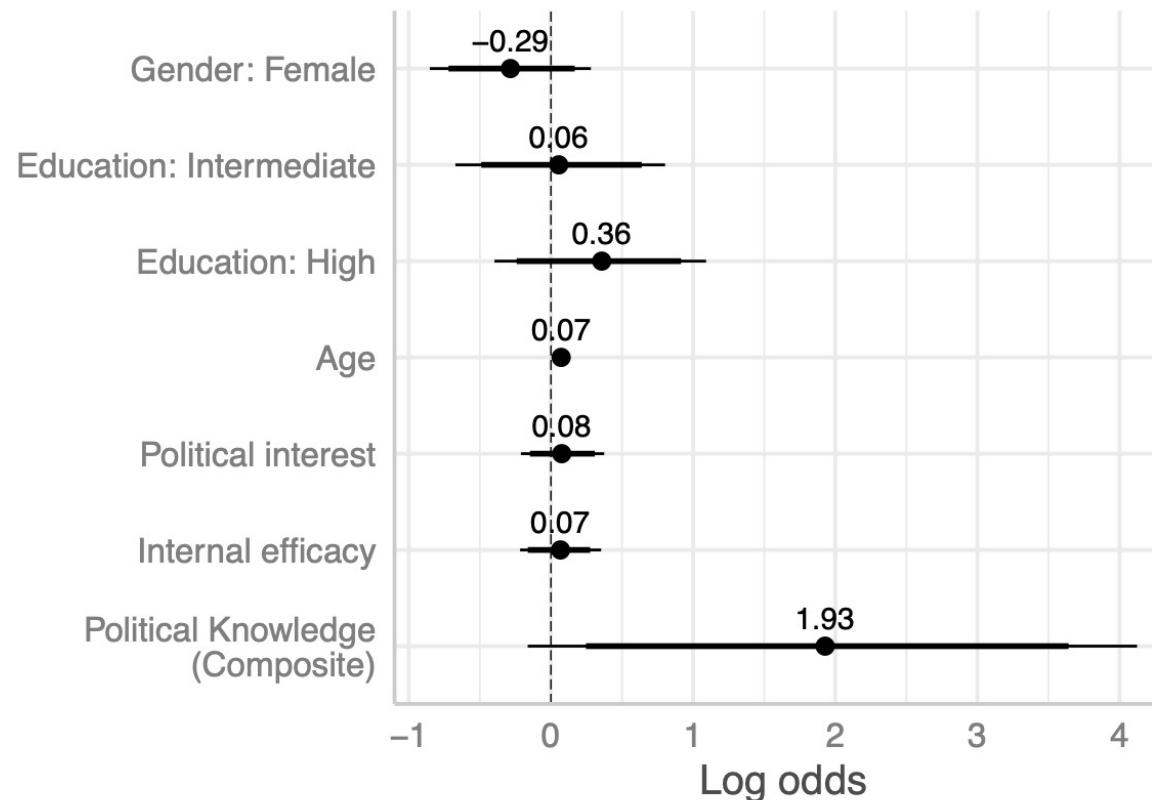
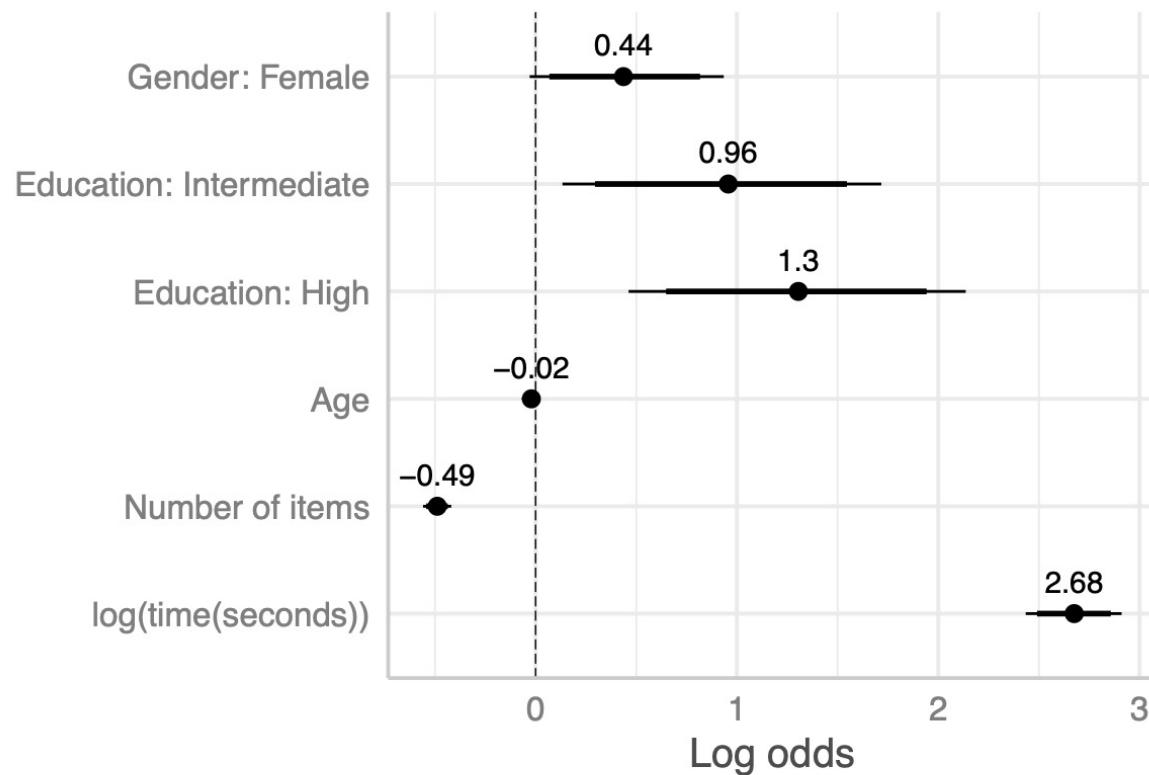


Figure C3: Estimated effects of respondent characteristics on the availability of web-tracking data



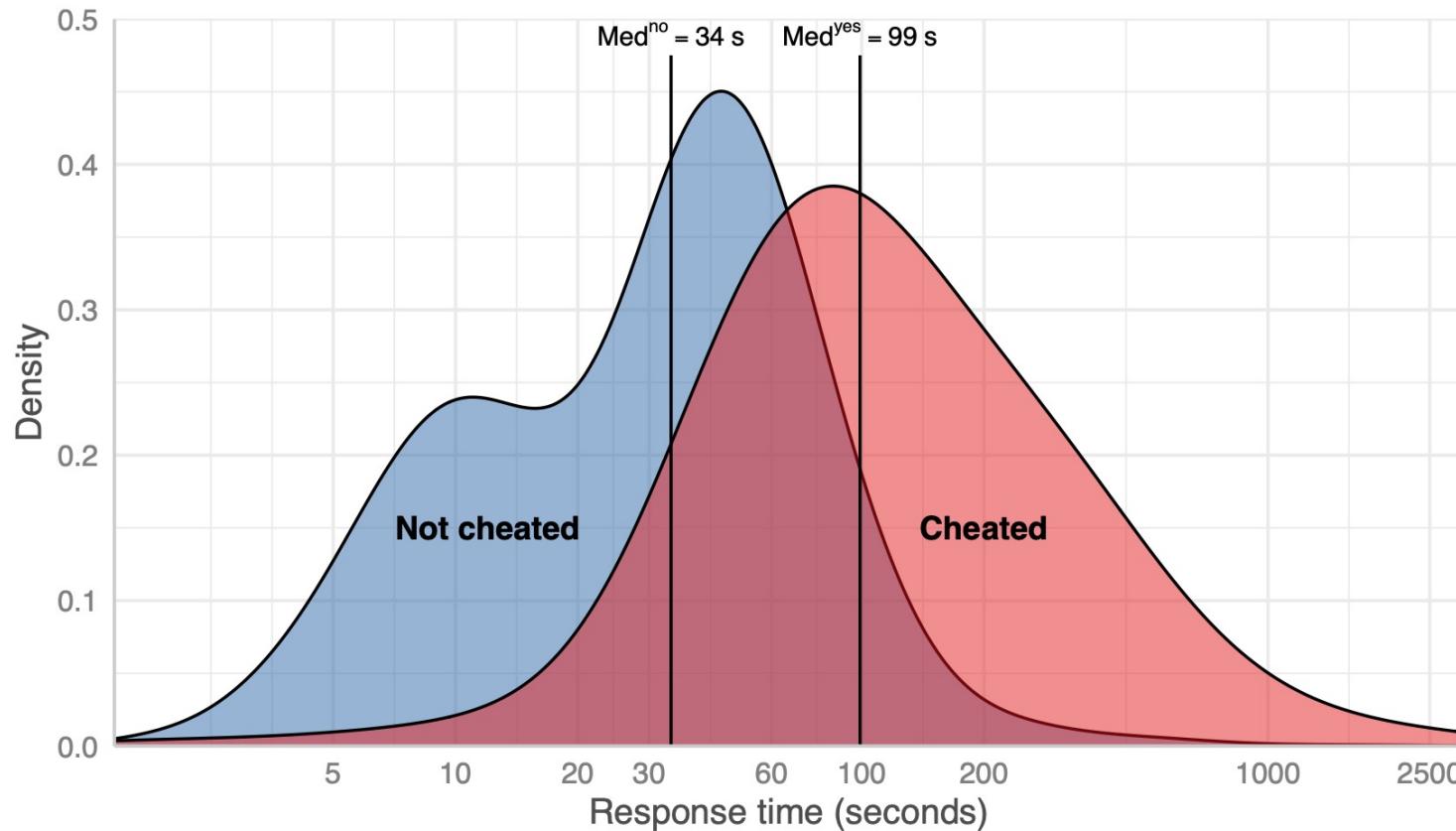
Note: Results from a Bayesian logistic mixed-effects model with person and wave random effects. Posterior means along with 80% and 95% CIs reported. Number of observations: 4,446; number of respondents: 1,140; number of waves: 4.

Figure C5: Estimated effects of respondent and question characteristics as well as response time on question-level cheating



Note: Results from a Bayesian logistic mixed-effects model with person and question random effects. Posterior means along with 80% and 95% CIs reported. Number of observations: 5,860, number of respondents: 679, number of questions: 11.

Figure C6: Density plots of question response times by cheating status



Note: 5,574 question responses involving no cheating compared to 345 question responses involving cheating. Median difference is 99s (under cheating) - 34s (under no cheating) = 65s.