The Limits of Decentralized Data Collection: Experimental Evidence from Colombia

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State information gathering

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- Modern states collect vast amounts of data for use in policymaking and public administration.
  - The classics: censuses, vital statistics, land cadasters
  - Increasingly, methods of passive surveillance/monitoring
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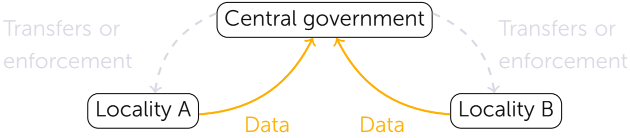
- Our focus: decentralized data production
  - Origin of many administrative datasets
  - Data requests from central to decentralized bureaucracies.



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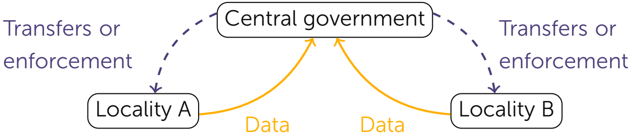

- Is this really a thing?
  - Local bureaucrats complain about these requests.
  - **Time-use surveys** of local bureaucrats suggest that these requests are time consuming Kalaj, Rogger, and Somani (2022)
  - National bureaucrats **seek advice** on eliciting complete, honest reports.

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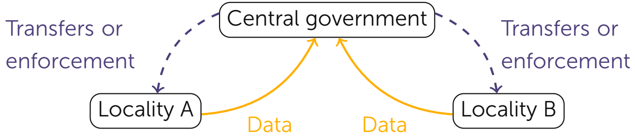

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Overview

Framework: Simple decision theoretic model maps the behavior of decentralized bureaucrats onto statistical measurement framework.

- Bureaucrats choose how much **effort** to exert and whether to purposefully **distort** their reports to the central government.

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Framework: Decision theoretic model that maps the behavior of decentralized bureaucrats onto statistical measurement framework.

Design: A field experiment in collaboration with the Colombian Procuraduría General de la Nación on the annual national transparency index (ITA).

- Manipulates of the visibility of PGN in using the data → measure the responses of bureaucrats in decentralized entities to increased oversight.
- An independent audit of a subset of items allows us to describe data quality.

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Framework: Decision theoretic model that maps the behavior of decentralized bureaucrats onto statistical measurement framework.

Design: A field experiment in collaboration with the Colombian Attorney Inspector General's office on the annual national transparency index (ITA).

Findings:

- Reporting behavior responds to the visibility of oversight in both **selection into reporting** and the **information reported**.
- The audit suggests that three pathologies of measurement: **selection**, **intentional distortions**, and the **random error** in reports covary with true quality.

Related Literature

- State information about individual citizens like censuses and vital statistics

  (Scott, 1998; Lee and Zhang, 2017; Bowles, 2020; Sánchez-Talanquer, 2020)

- Administrative data quality usually in two settings:
  - Autocratic regimes, esp. with respect to economic data (Guriev and Treisman, 2019; Martínez, 2021; Trinh, 2021; Lorentzen, 2014; Wallace, 2016; Edmond, 2013)
  - Police data quality in the US (Eckhouse, 2022; Cook and Fortunato, 2022)

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Theoretical Framework

The output: administrative data

- Central government asks decentralized entities to report some quantity, θ, to the central government.
  - E.g., public service outputs, budget execution, or transparency practices.
- A bureaucrat (or office) in the entity chooses whether to report, r.
  - If they do not make a report, $r = \emptyset$.
  - If they do report, $r \in \mathbb{R}$.

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    - Intentional distortion, d.
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Data outputs

- Maps onto standard formulations of measurement error in statistics (e.g., Cochran, 1968; Rubin, 1976)
- The central government wants to know θ but observes r, which can suffer from:
  - Missingness when the bureaucrat does not report $r = \varnothing$.
  - Measurement error due to:
    - Intentional distortions (d)
    - Unintentional distortions (ε)

$$\underbrace{r}_{\text{Report}} = \begin{cases} \underbrace{\theta}_{\text{Truth}} + \underbrace{d}_{\substack{\text{Intentional} \\ \text{misreporting}}} + \underbrace{\varepsilon}_{\substack{\text{Random} \\ \text{error}}} & \text{if bureaucrat reports} \\ \varnothing & \text{otherwise} \end{cases}$$

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  - Target oversight or enforcement: **sticks** → **our empirical setting**.
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  - Penalties imposed when oversight reveals poor outcomes (θ) or reporting behavior (r): $P(\theta, r) > 0$.

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What are bureaucrats doing?

- When reporting, bureaucrats exert effort and choose intentional distortions
  - Effort, $e \geq 0 \rightarrow$
    - Missingness: when $e = 0$.
    - Unintentional distortions: $\uparrow e \rightarrow \downarrow \text{Var}(\epsilon)$.
  - Intentional distortions, d
- Bureaucrat's utility:

$$U_B = \underbrace{\underbrace{-\rho(r)}_{\text{Pr(Audit)}} \; \underbrace{P(\theta, r)}_{\text{Penalty}}}_{\text{Oversight}} - \underbrace{c(e)}_{\text{Cost of effort}}$$

- Note: bureaucrats may not know precisely how oversight is exercised.

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Learning about the observed administrative data

- An exogenous increase in (perceived) oversight:
  - Should ↑ **rates of reporting**.
  - Changes the aggregate distribution of reports, conditional on reporting, by:
    1. ↑ Entities reporting;
    2. Changing incentives for intentional misreporting;
    3. ↓ Unintentional errors.
- Observation of the joint distribution of quality, θ, and reported quality, r, allow for learning about:
  - Bureaucrats' reporting behavior, including both effort and intentional distortions.
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Case Context

Our partner: The PGN

- The Procuraduría General de la Nación (PGN), is the principal watchdog agency in Colombia.
- PGN is implementing of the National Transparency Law of 2014.
  - This law mandated the creation of the National Transparency Index (ITA), the measure that we study.

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The National Transparency Index (ITA)

- The Indice de Transparencia y Acceso a la Información, ITA, was first implemented in 2018.
  - We study the production of the 2020 index.
- $\approx 50k$ entities to report their compliance with ≈ 200 transparency practices.
  - All items are binary (yes/no).
  - Weighted to generate the 100-point ITA.
  - Used in PGN's preventative actions to guide monitoring/investigation.

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- Unit of measurement, the entity, classified as:
  1. Traditional public sector entities including public entities, oversight bodies, and state-owned companies $\rightarrow$ **our focus**.
  2. Non-traditional entities are persons or legal entities that contract with the state to provide public services or manage public funds.
  3. Political parties or social movements.

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Research Design

Overview

1. A field experiment conducted in collaboration with the PGN in the collection of the 2020 ITA index. Allows us to answer:
    - How does the reporting behavior of bureaucrats respond to changes in the salience of oversight?
2. An independent audit of a subset of responses provided by a random sample of public sector (traditional) entities. Allows us to answer:
    - How does the reported data we observe relate to the truth?

Experimental design: treatment level 1

Status quo communication from sector heads in central government about ITA obligations	↔	Status quo communication from sector heads **and** direct communication from PGN watchdog agency via email about ITA obligations

- Interpretation of contrast and ATE:
  - Make PGN's role and use of the data more visible.
  - From ex-post semi-structured interviews with bureaucrats who filled out ITA:
    - PGN is known as a watchdog agency, seen as having some teeth.
    - Entities regularly asked to send data to different central government entities.
    - ... but PGN has distinct oversight powers.

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Experimental design: treatment level 2

- Nudges—variation in message content—randomly assigned in $2 \times 2 \times 2 \times 2$ factorial design

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1. Past oversight: 2019 status

$\times$

2. Future oversight Possible audit

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3. Reminder email $\approx \uparrow$ dosage

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4. Training Links to training videos

- Benefits of the "nudge" manipulations:
  - For PGN: sending direct messages has costs, can benefits be maximized at no additional cost?
  - For us: (helps to) unbundle direct communication treatment.

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Experimental design: sample and treatment assignment

- Sample consists of 6,556 public sector entities in Colombia.
- Blocked assignment: random assignment within blocks of 18 entities:
  - Exact blocking on 2019 ITA completion
  - Minimize Malahnobis distance on (1) PGN's classification of organizational or entity type; (2) department.

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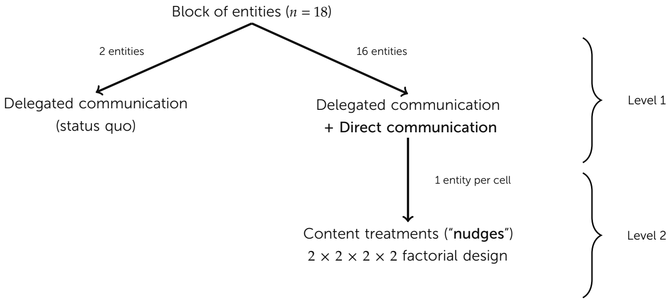

Estimation of treatment effects

- We estimate the ATE of direct communication and AMCEs of the nudge treatments effects by OLS:

$$\begin{aligned} Y_{ib} = &\beta_1 \text{Direct Communication}_i + \beta_2 \text{Reminder}_i + \beta_3 \text{Training}_i + \\ &\beta_4 \text{Retrospective Oversight}_i + \beta_5 \text{Prospective Oversight}_i + \psi_b + \epsilon_{ib} \end{aligned}$$

- The estimators of the treatment effects are:
  - β_1: The ATE of direct communication
  - β_2, β_3, β_4, β_5: The AMCEs of the factorial message treatments.

Independent audit design

- Stratified random sample of 2,400 of 6,556 public sector entities
  - Crucially, we sampled entities regardless of whether they **completed the 2020 ITA**.
  - So we observe reporters and non-reporters symmetrically in the audit.
- Provides validation of self-reported transparency practices through an independent audit of a subset of index items:
  - Conducted outside partnership with PGN.
  - Audited items worth 27.75/100 points on the index.
  - We **measure** θ (quality) for this subset of the index.

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Measurement of parameters of interest

- **Reported data** (r):
  - Submission of the ITA matrix (yes/no)
  - ITA score (0-100) conditional on submission.
- **Quality** (θ for subset of index):
  - Use index weighting scheme from full index to construct a "true" score between 0 and 27.75 points.
  - We can also reconstruct the reported score on this subset from micro-data.

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  - By assumption $E[\epsilon] = 0$, so we will examine $E[r - \theta]$.
  - Link between variance of r and effort (e).

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Results I: Experimental Findings

Experimental results

- ATE and AMCE estimates on submission of ITA matrix.

	Completed ITA	
	(1)	(2)
Direct communication	0.029	0.030
	(0.022)	(0.020)
Oversight of past completion	0.000	-0.001
	(0.012)	(0.011)
Possible future audit	-0.005	-0.005
	(0.012)	(0.011)
Direct reminder	0.013	0.012
	(0.012)	(0.011)
Training	-0.008	-0.007
	(0.012)	(0.011)
Observations	6556	6556
Sample	All	All
Block FE		✓
Control mean	0.68	0.68
Control std. dev.	0.47	0.47
DV range	{0,1}	{0,1}

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Private sector benchmark Past ITA completion

Experimental results

- "Post-treatment" estimand on reported scores.

	Completed ITA		ITA Score	
	(1)	(2)	(3)	(4)
Direct communication	0.029	0.030	-6.066***	-5.886***
	(0.022)	(0.020)	(1.477)	(1.473)
Oversight of past completion	0.000	-0.001	0.587	0.540
	(0.012)	(0.011)	(0.950)	(0.936)
Possible future audit	-0.005	-0.005	-0.453	-0.666
	(0.012)	(0.011)	(0.950)	(0.936)
Direct reminder	0.013	0.012	-2.836***	-2.763***
	(0.012)	(0.011)	(0.949)	(0.932)
Training	-0.008	-0.007	-1.094	-1.191
	(0.012)	(0.011)	(0.950)	(0.939)
Observations	6556	6556	4446	4446
Sample	All	All	Completed	Completed
Block FE		✓		✓
Control mean	0.68	0.68	73.37	73.37
Control std. dev.	0.47	0.47	29.4	29.4
DV range	{0,1}	{0,1}	[0,100]	[0,100]

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Private sector benchmark

Decomposing the "effect" on scores

- Post-treatment estimates suggests that direct communication →↓ scores, but there are two possible explanations.
    1. **Treatment effect**: Those that would always report submit lower scores when subjected to oversight.
    2. **Selection/compositional change**: Those that report because of treatment report lower average reported scores than those that always report.

- Assuming monotonicity, we can decompose post-treatment estimand into:
    - CATE on always-reporters → Lee (2009) trimming bounds!
    - Average outcomes (scores) of if-treated reporters → boundable if we have post-treatment estimate, treatment effect on reporting, and CATEs.

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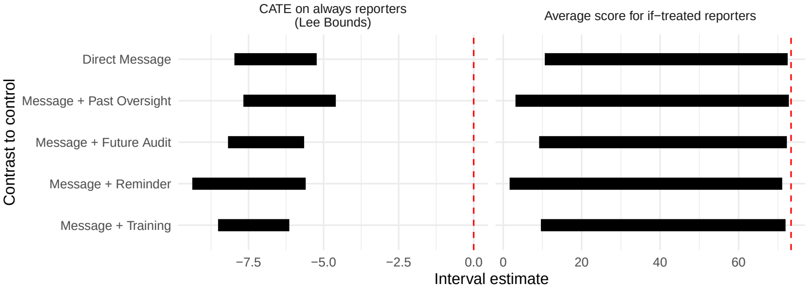
Treatment effects or selection?

- Evidence of both treatment effects and selection:
  - ↓ scores among always reporters.
  - Lower-than-average scores among if-treated reporters.



What do/don't we learn from the experiment?

- Manipulation of the role of the PGN/visibility of oversight:
  - Induce public sector entities to report **less desirable** scores.
  - Change the **composition** of entities that report to the national government.
- What we cannot observe from the experiment:
  - Who **selects** into reporting?
  - **Accuracy**: how do reported scores relate to actual quality?

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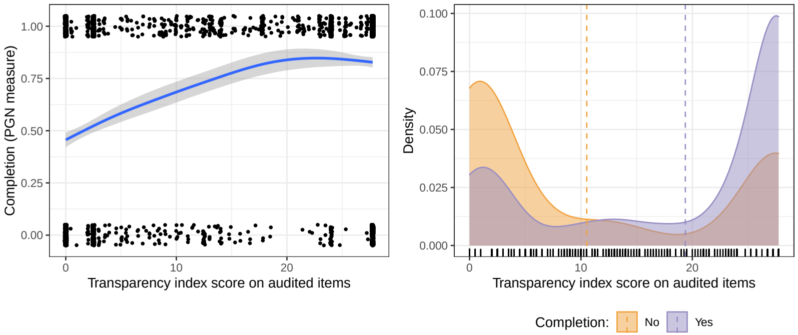
  - Induce public sector entities to report **less desirable** scores.
  - Change the **composition** of entities that report to the national government.
- What we cannot observe from the experiment:
  - Who **selects** into reporting?
  - **Accuracy**: how do reported scores relate to actual quality?

Results II: Audit Findings

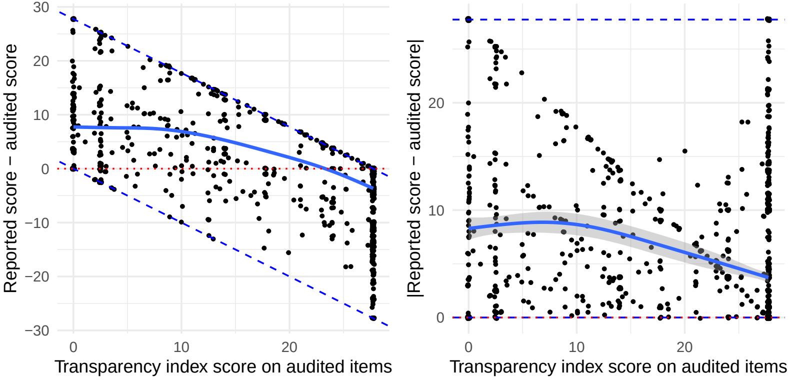
Which entities select into reporting?

- Positive selection into reporting as a function of "true" transparency practices, θ.



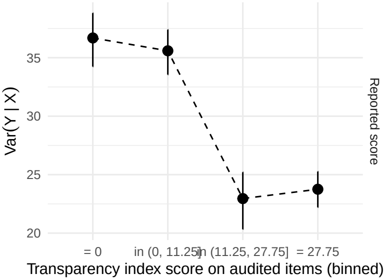
Are reported scores accurate?

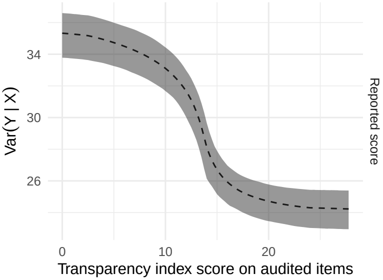
- At lower levels of θ, reported scores are less accurate.
  - In general, scores are over-reported.



When are reported scores less noisy?

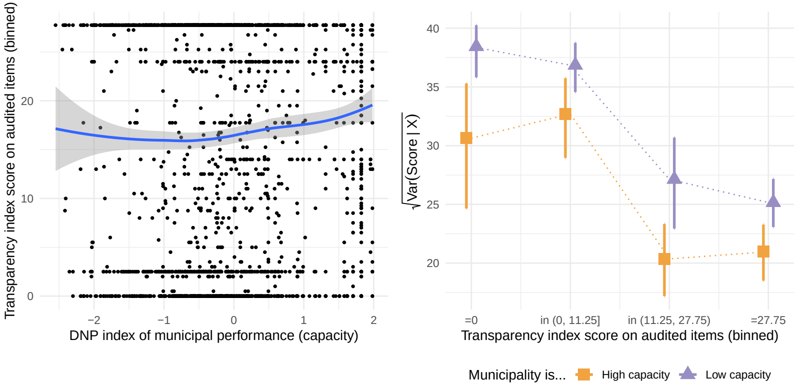
- Variance of reported scores is decreasing in θ.
  - Observed pattern not driven (exclusively) by **state capacity** or **intentional distortion**.
  - Within framework, suggests that lower θ entities exert less effort.





Is this all just variation in state capacity?

- State capacity arguably increases costs of effort, $c(e)$.
  - Should ↓ effort → ↑ variance of ε
- Using Departmento Nacional de Planeación's mendición de desempeño municipal we stratify on **municipal capacity**
  - We still observe decrease in conditional variance in θ.



Discussion

The central government's problem

- By experimenting, we have abstracted away from the central government's problem: When can data collected from decentralized entities be used to inform policies concerning those entities?
  - A preoccupation of central government entities.
- In our problem, recall that there are two policy instruments that central governments set:
  - Probability of oversight: $\rho(r) \in (0,1)$.
  - Penalties imposed when oversight reveals poor outcomes: $P(\theta, r) > 0$.

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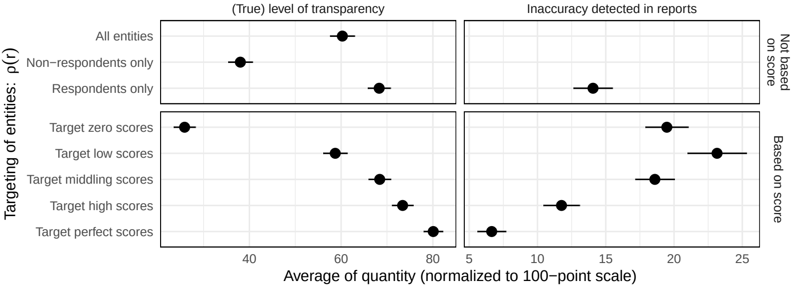
Reporting behavior conditions what PGN find

- We **simulate** what the PGN should observe depending on how they target preventative efforts, $\rho(r)$.
  - PGN sees **reports** (r).
  - We observe **reports** (r) and the **truth** (⊠).



Take-aways

- Administrative data as a bureaucratic output and political outcome matters:
  - to you as a producer/consumer of empirical social science.
  - to governments that collect data in order to use it.
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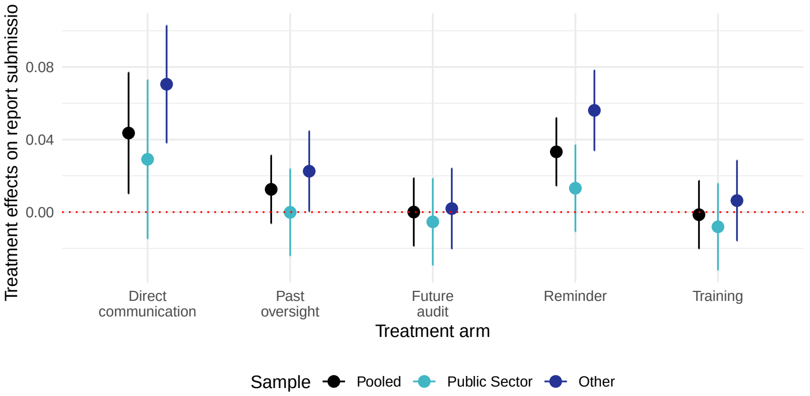
Thank you!

Benchmark: Private Sector Entity Completion

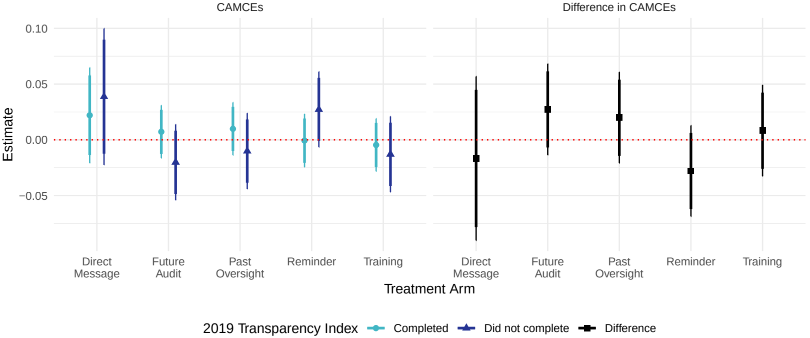
- We estimate the ATE of direct communication and the AMCEs of the messages in the factorial design. Estimator
- Outcome: Indicator for ITA data submission.



Back

Was treatment solely informational?

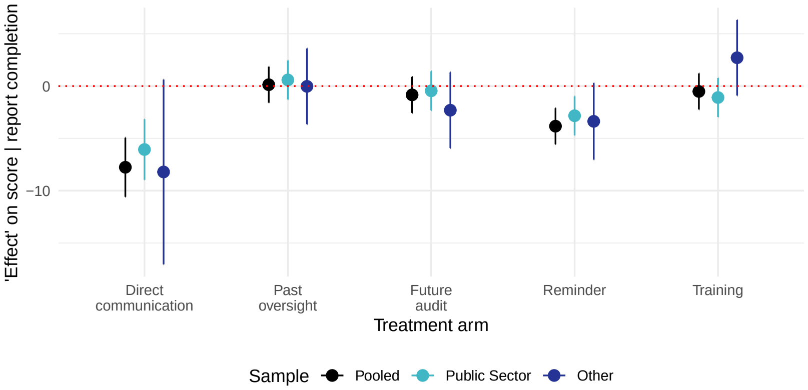
- We estimate the CATE of direct communication and the CAMCEs of the messages conditioning on 2019 ITA completion. Estimator
- Outcome: Indicator for ITA data submission.



Back

Benchmark: Private Sector Entity Scores

- We estimate the same specification with scores as the outcome, but condition on reporting.
- Estimates of a post-treatment estimand that contains both a causal effect and a "selection" effect.



Back

Decomposition of post-treatment estimand

- Under monotonicity, there are three strata: Always reporters, if-Treated reporters, Never reporters
  - Denote types by $j \in \{A, T, N\}$ with shares π_j, where $\sum_j \pi_j = 1$.
- The "post-treatment" estimand is $\mathscr{P}$. We can express this quantity as:

$$\begin{aligned}\mathscr{P} = & \underbrace{\frac{\pi_A}{\pi_A + \pi_T}\Big(E[S(Z=1)|j=A] - E[S(Z=0)|j=A]\Big)}_{\text{Change in scores reported}} + \\ & \underbrace{\frac{\pi_T}{\pi_A + \pi_T}\Big(E[S(Z=1)|j=T] - E[S(Z=0)|j=A]\Big)}_{\text{Change in composition of reporters}} \\ = & \frac{\pi_A}{\pi_A + \pi_T} CATE + \frac{\pi_T}{\pi_A + \pi_T}\Big(E[S(Z=1)|j=T] - E[S(Z=0)|j=A]\Big)\end{aligned} \tag{1}$$

- We have point estimates for: $\mathscr{P}$, $\frac{\pi_A}{\pi_A+\pi_T}$, $\frac{\pi_T}{\pi_A+\pi_T}$, and $E[S(Z=0)|j=A]$ (under monotonicity).
- We can use Lee (2019) bounds to generate an interval estimate of $CATE$.
- We can then use algebra to generate an interval estimate of $E[S(Z=1)|j=T]$.

Back