

Can Audits Backfire? Evidence from Public Procurement in Chile

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Motivation

- Auditing processes are pervasive in government, corporations and other institutions
 - Intended to be neutral monitoring of rule compliance
 - However, audits may by themselves create (unintended) distortions through the specific way in which they are executed
 - This paper investigates the effects of audits on public procurement practices in Chile
 - Looking into the black box of the audit process
 - Audits can undermine goals of the procurement legislation by distorting the choice of procurement modality when audit protocols differ
 - “Auditing by check list”, which may be optimal when holding the type of process constant, puts more regulated processes under more scrutiny and can therefore lead to distortions
- ⇒ Thinking more carefully about incentive effects of audit design is key

Background on Public Procurement

- Government procurement in OECD countries is about 13% of GDP and 29% of total government expenditures on average
 - Free and fair competition for government contracts plays a key role for
 - quality and cost of government purchases
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 - Auctions found to reduce prices, increase quality, select more productive suppliers
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- Legislation typically allows for exceptions (e.g. Spagnolo 2012)
 - E.g. unique supplier, emergency
- Procurement officers may underuse auctions, due to corruption or convenience (Zamboni & Litschig 2018)
 - One key enforcement tool: external auditing

Related Literature

- Public sector audits found to improve corruption, firm performance, electoral accountability
 - e.g. Olken 2007; Ferraz et al. 2008; Avis et al. 2018; Zamboni and Litschig 2018; Colonnelli and Prem 2019
- Audits can be ineffective due to collusion, limited auditor effort, inefficient targeting or timing
 - e.g. Duflo et al. 2013; Khan et al. 2016; Gonzalez-Lira and Mobarak 2019; Bandiera et al. 2019
- We typically assume audit design is aligned with overall policy goals
 - We show that well-executed audits can even backfire by creating distortions that go counter to such policy goals
 - Taking incentives of bureaucrats subject to audits into account is key for effective design of audit protocols

Preview of Results Part 1: Impact of Audit on Procurement Modality

- We analyze the impact of an external audit on subsequent choice of procurement modality
 - Regression discontinuity design based on audit selection rule of Chile's National Comptroller Agency in 2011 and 2012
 - Data on the universe of purchases made by public entities in Chile

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 - Data on the universe of purchases made by public entities in Chile
- Audits cause entities to shift from auctions to less transparent and competitive direct contracting
- Contracts more likely awarded to incumbents, small and local firms
 - Increase in prices (in small sub-sample)

Preview of Results Part 2: Mechanisms

- Worked with Comptroller Agency to conduct special audits that record findings at the inspection level
 - ⇒ Auctions get over 2.5 times as many checks and detected infractions as direct purchases
 - Holding the amount and type of purchase constant
 - Concentrated on contract awarding (vs. execution)

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- Audit protocol creates incentives to reduce use of auction and increase use of direct contracts
- More generally, auditing by checklist may inadvertently discourage more regulated procedures with more steps and longer paper trails.
 - Common in many countries, European Union, Brazil, Mexico, etc.

Outline

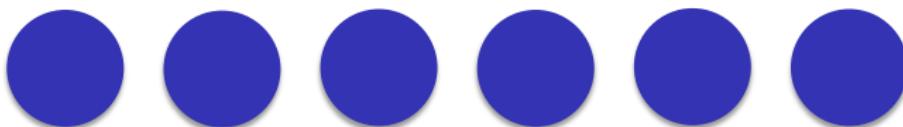
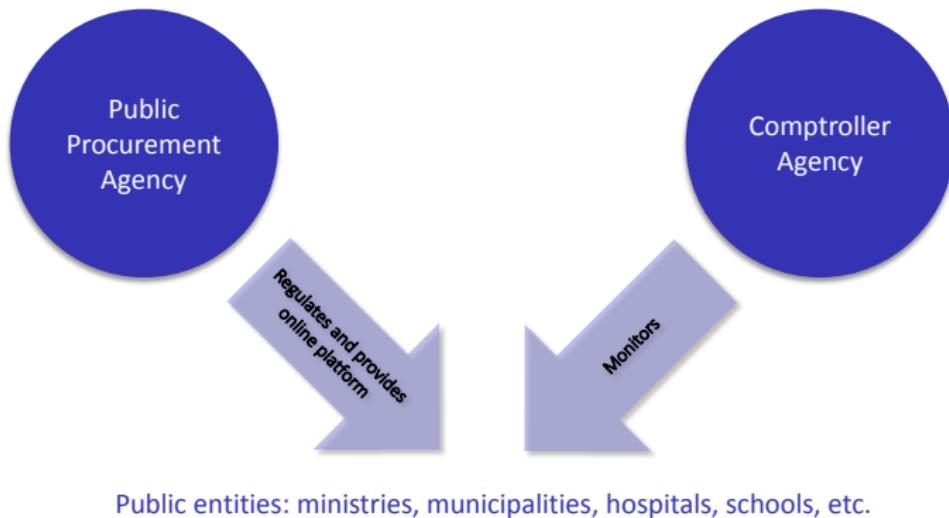
- ① Background on public procurement and external auditing
 - Procurement modalities
 - Audit selection
- ② Regression discontinuity evidence on impacts of the audit on procurement modalities
 - Validity of the RDD
 - RDD estimates of impact on purchase modalities
- ③ RDD estimates of impacts on competitiveness, suppliers and prices
- ④ Special audits to test mechanism

Purchasing Modalities

- ① Online auction (64% in Chile)
 - Public auctions, transparent, online
- ② Direct contracting (18% in Chile)
 - Less transparent, often less than 3 quotes
 - Allowed in special circumstances, including:
 - Unique supplier, cost below 750 USD, emergency, trust in suppliers and disproportionate cost of running an auction
- ③ Framework agreements for standardized goods (17% in Chile)
 - “Online Supermarket”
- ④ Small purchases (below about 200 USD) (<0.5% in Chile)
 - Can be done outside the online system

► Size of Public Procurement in Chile

Institutions in the Public Procurement Process in Chile



Audit Selection

- The audit probability among public entities of medium compliance risk depends on their “relative importance score”
 - A measure based on the entity’s budget size, transfers to the private sector, etc.
- Public entities are ranked according to their relative importance score, and divided into three groups
 - By dividing the range of values in each stratum into equally sized parts
 - High, medium, low
 - ⇒ Cut-offs between these classifications of relative importance allow for RD design.
- Cutoffs are determined separately each year for each organizational unit of the Comptroller Agency
 - ⇒ Run RDD conditional on strata indicators: year*organizational unit

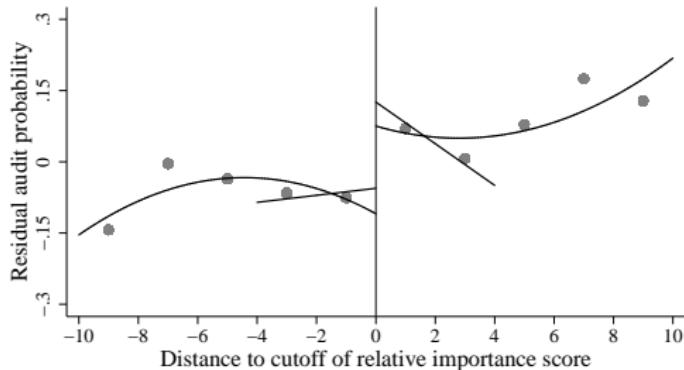
Regression Discontinuity Analysis

Overview

- ① Establish that there is a discontinuity in the audit probability around the cut-offs
- ② Tests of validity of the regression discontinuity design
- ③ Discussion of untestable identifying assumptions
- ④ Results

RDD First Stage Results

Figure: Residual audit probability in t



Controls include:

- stratum fixed effects
- political affiliation
- log of total amount purchased one and two years prior
- direct contracting share and auction share one and two year prior
- dummy for having been audited in the preceding year

▶ First Stage without Controls

▶ First Stage by Year and Threshold

RDD Regression Specifications

- Local linear regression (“linear spline”) in small bandwidth around the cut-off
 - Bandwidth based on visual inspection (Lee and Lemieux, 2010)
 - In our case $-/+ 4$
- Quadratic spline in larger bandwidth around the cut-off
 - Similar to above, but including $(\text{Distance to cutoff})^2$
 - Bandwidth based on visual inspection (Lee and Lemieux, 2010)
 - In our case $-/+ 10$
- Linear spline with “optimal bandwidth” choice
 - Mean-squared-error-optimal bandwidth (Imbens and Kalyanaraman, 2011)
 - In our case $-/+ 5.19$ for auctions and $-/+ 5.05$ for direct contracting
 - As above, but with bias correction for estimates and standard errors (Cattaneo et al., 2014)

RDD First Stage Results

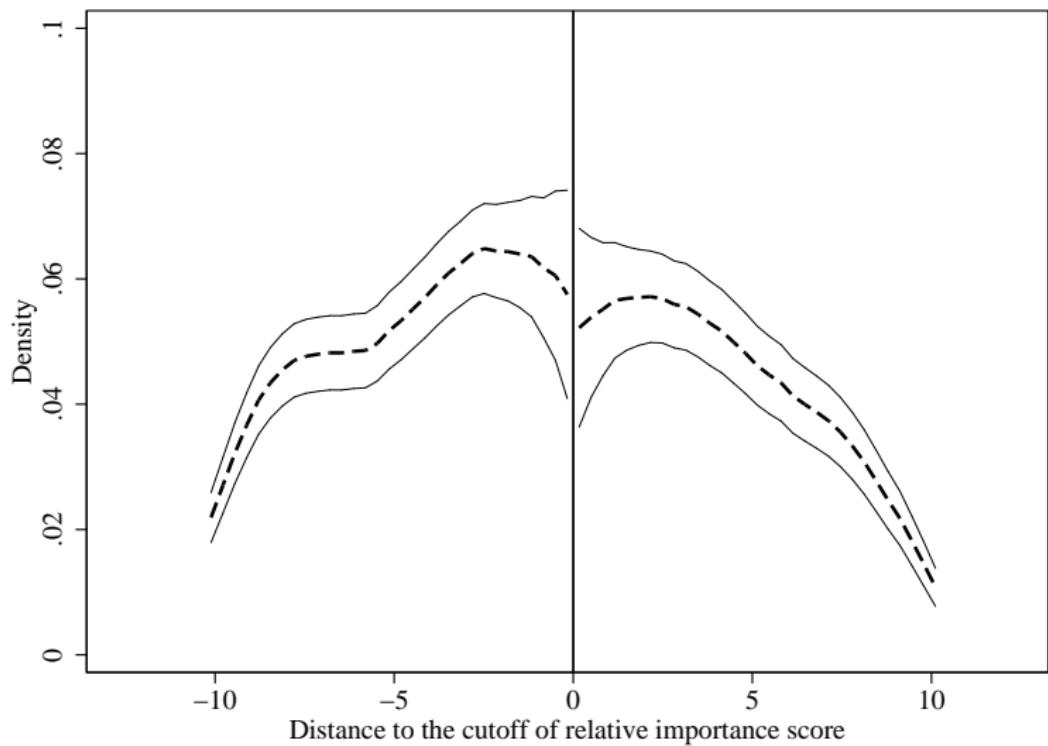
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Audit probability								
1{Relative importance \geq cutoff}	0.296*** (0.074)	0.203** (0.078)	0.181** (0.069)	0.299*** (0.088)	0.220** (0.087)	0.193** (0.084)	0.158** (0.067)	0.183** (0.076)
Bandwidth	± 4	± 4	± 4	± 10	± 10	± 10	± 6.51	± 6.51
Observations	482	482	477	1,002	1,002	992	716	716
R-squared	0.035	0.311	0.396	0.050	0.276	0.354	0.402	0.402
Comparison mean	0.136	0.136	0.136	0.071	0.071	0.071	0.118	0.118
Spline	Linear	Linear	Linear	Quadr.	Quadr.	Quadr.	Linear	Linear
Stratum fixed effects	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Additional controls	No	No	Yes	No	No	Yes	Yes	Yes

► Pooled Results with All Four Cutoffs

Validity Tests

- Continuity of characteristics around the cutoff
 - Seems likely that entities cannot control on which side of the relative importance cut-off they fall
 - Scores vary every year, are secret & determined internally at headquarters
 - Cutoffs split the support in three & are determined after the score
- Formal tests
 - McCrary density test
 - Balance of observable characteristics at the cutoffs

McCrory Density Test



Discussion of Untestable Identifying Assumptions

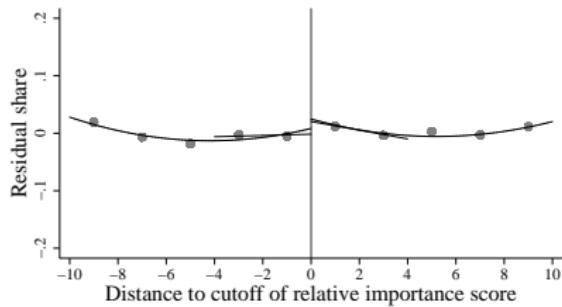
- Exclusion restriction: nothing else varies at the same cut-offs
 - Seems likely because scores vary every year \Rightarrow no other policies do that as far as we know
 - Entities do not know their score \Rightarrow cannot react to it

RDD Reduced Form Results

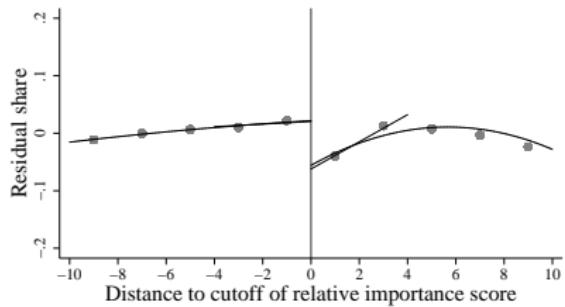
- What happens to purchase modalities when a public entity is audited?

Impact on Share of Purchases by Modality

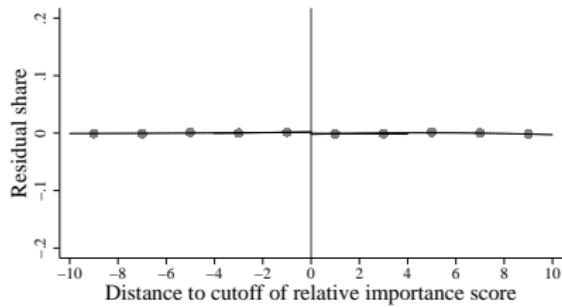
(a) Framework agreement share



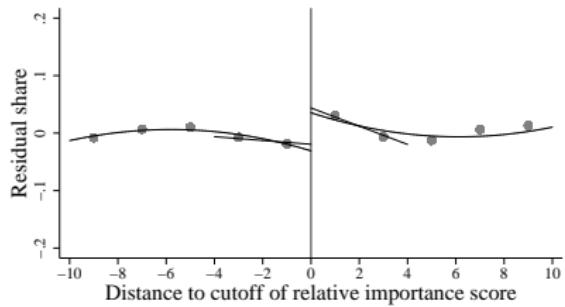
(b) Auctions share



(c) Small purchases share



(d) Direct contracting share

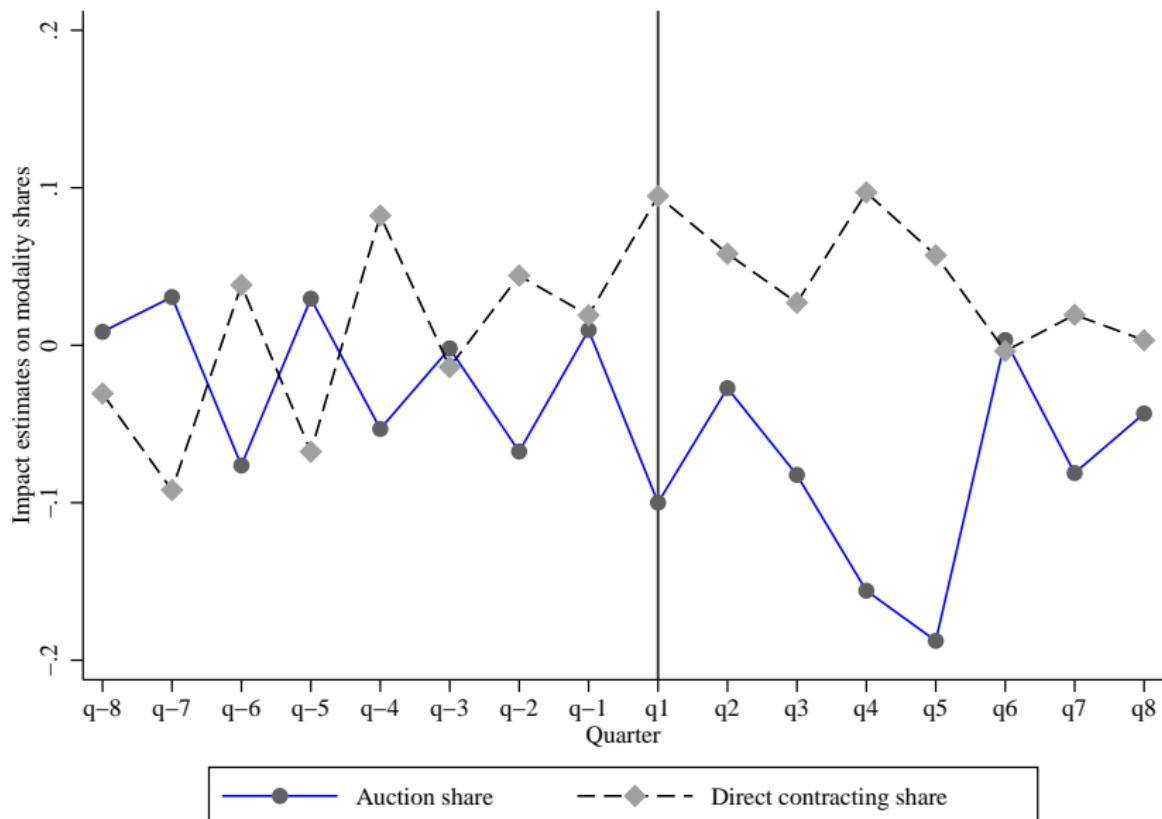


Impact on Share of Purchases by Modality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Auctions								
1{Relative importance \geq cutoff}	-0.065 (0.045)	-0.073* (0.043)	-0.069** (0.032)	-0.081** (0.038)	-0.126*** (0.036)	-0.085*** (0.027)	-0.079*** (0.030)	-0.089** (0.036)
Bandwidth	± 4	± 4	± 4	± 10	± 10	± 10	± 5.19	± 5.19
Observations	482	482	477	1,002	1,002	992	604	604
R-squared	0.030	0.350	0.614	0.016	0.257	0.578	0.573	0.573
Comparison mean	0.637	0.637	0.637	0.665	0.665	0.665	0.666	0.666
Panel B: Direct contracting								
1{Relative importance \geq cutoff}	0.087*** (0.032)	0.079** (0.037)	0.061** (0.028)	0.097*** (0.032)	0.109*** (0.038)	0.073*** (0.025)	0.069*** (0.024)	0.077*** (0.028)
Bandwidth	± 4	± 4	± 4	± 10	± 10	± 10	± 5.05	± 5.05
Observations	482	482	477	1,002	1,002	992	593	593
R-squared	0.043	0.221	0.535	0.017	0.114	0.508	0.498	0.498
Comparison mean	0.136	0.136	0.136	0.110	0.110	0.110	0.125	0.125
Spline	Linear	Linear	Linear	Quadr.	Quadr.	Quadr.	Linear	Linear
Stratum fixed effects	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Additional controls	No	No	Yes	No	No	Yes	Yes	Yes

► Pooled Results with All Four Cutoffs

Treatment Effects over Time



Dynamics over Time

- Effect starts at the beginning of audit year and goes up
 - In the first part of the year when audits tend to start, entities begin to learn about content of audits
- Effect starts to decrease over the course of following year
 - Many entities below cutoff in one year were audited in following year
 - Information that audit protocol did not reflect the recent official push for more use of auctions is likely to have spread
 - Staff turnover
 - Continued regulatory changes

Justifications of Direct Contract Purchases

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unique Supplier							Emergency
1{Relative importance \geq cutoff}	0.012 (0.009)	0.012 (0.008)	0.015* (0.008)	0.018** (0.009)	0.042** (0.018)	0.049*** (0.017)	0.044** (0.018)	0.049** (0.021)
R-squared	0.491	0.404	0.430	0.430	0.307	0.210	0.276	0.276
Comparison mean	0.025	0.026	0.027	0.027	0.014	0.008	0.014	0.014
Observations	477	992	553	553	477	992	535	535
Bandwidth	± 4	± 10	± 4.69	± 4.69	± 4	± 10	± 4.51	± 4.51
	Trust in Suppliers							Disproportionate Cost
1{Relative importance \geq cutoff}	-0.004 (0.006)	0.001 (0.006)	0.004 (0.003)	0.004 (0.004)	-0.001 (0.003)	-0.002 (0.003)	-0.001 (0.002)	-0.001 (0.002)
R-squared	0.515	0.445	0.431	0.431	0.311	0.278	0.327	0.327
Comparison mean	0.014	0.012	0.012	0.012	0.003	0.004	0.003	0.003
Observations	477	992	967	967	477	992	843	843
Bandwidth	± 4	± 10	± 9.50	± 9.50	± 4	± 10	± 7.95	± 7.95
	Cost Less than 720 USD							Other
1{Relative importance \geq cutoff}	0.001 (0.005)	-0.004 (0.004)	-0.004 (0.004)	-0.005 (0.005)	0.008 (0.017)	0.021 (0.018)	0.015 (0.016)	0.017 (0.019)
R-squared	0.649	0.544	0.648	0.648	0.682	0.563	0.621	0.621
Comparison mean	0.017	0.015	0.017	0.017	0.062	0.045	0.044	0.044
Observations	477	992	472	472	477	992	730	730
Bandwidth	± 4	± 10	± 3.96	± 3.96	± 4	± 10	± 6.66	± 6.66
Spline	Linear	Quadr.	Linear	Linear	Linear	Quadr.	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Impacts on Competition, Suppliers and Prices

Effect on Number of Competitors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Auction with Bidders > 3					Panel B: Direct Contracting with 1 Quote			
1{Relative importance \geq cutoff}	-0.051 (0.036)	-0.052 (0.032)	-0.073** (0.031)	-0.084** (0.035)	0.052* (0.031)	0.061** (0.028)	0.050** (0.024)	0.058** (0.028)
R-squared	0.413	0.370	0.388	0.388	0.462	0.441	0.406	0.406
Comparison mean	0.319	0.326	0.322	0.322	0.106	0.089	0.097	0.097
Observations	475	989	548	548	475	989	601	601
Bandwidth	± 4	± 10	± 4.65	± 4.65	± 4	± 10	± 5.15	± 5.15
Panel C: Auction with Bidders ≤ 3					Panel D: Direct Contracting with 3 Quotes			
1{Relative importance \geq cutoff}	-0.044 (0.046)	-0.039 (0.043)	-0.028 (0.026)	-0.031 (0.031)	-0.005 (0.004)	-0.007 (0.005)	-0.002 (0.005)	-0.003 (0.006)
R-squared	0.471	0.399	0.401	0.401	0.626	0.398	0.412	0.412
Comparison mean	0.340	0.354	0.381	0.381	0.020	0.016	0.016	0.016
Observations	475	989	960	960	475	989	587	587
Bandwidth	± 4	± 10	± 9.47	± 9.47	± 4	± 10	± 5.00	± 5.00
Spline	Linear	Quadr.	Linear	Linear	Linear	Quadr.	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

► Effects by Size of the Purchase

Effects on Type of Supplier

	(1)	(2)	(3)	(4)
Panel A: New Supplier				
1{Relative importance \geq cutoff}	-0.043** (0.017)	-0.046*** (0.017)	-0.024* (0.014)	-0.026 (0.017)
Bandwidth	± 4	± 10	± 5.45	± 5.45
Observations	1,141,996	2,442,604	1,556,309	1,556,309
R-squared	0.210	0.179	0.195	0.195
Comparison mean	0.163	0.172	0.172	0.172
Panel B: Large Supplier				
1{Relative importance \geq cutoff}	-0.048** (0.019)	-0.060*** (0.017)	-0.065*** (0.021)	-0.072*** (0.023)
Bandwidth	± 4	± 10	± 3.59	± 3.59
Observations	1,141,996	2,442,604	1,017,045	1,017,045
R-squared	0.383	0.364	0.393	0.393
Comparison mean	0.308	0.299	0.303	0.303
Panel C: Out of Region				
1{Relative importance \geq cutoff}	-0.036* (0.020)	-0.034* (0.017)	-0.055** (0.027)	-0.065** (0.031)
Bandwidth	± 4	± 10	± 2.99	± 2.99
Observations	974,540	2,093,256	703,570	703,570
R-squared	0.511	0.496	0.529	0.529
Comparison mean	0.431	0.445	0.467	0.467
Spline	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

- New Supplier: Probability that supplier has never sold to this entity in the past 4 years
- Large Supplier: Probability that the supplier is a large-sized enterprise
- Out of Region: Probability of supplier being from a different region (excluding Santiago)
- Analysis at the purchase order level and includes product-unit and month-year fixed effects

Effects on Prices

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- Restrict analysis to products and purchases with clear units of measurement
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 - This leaves us with about 8% of all purchases
- Challenge #2: Among these purchases, there is no significant shift from auctions to direct contracting
 - We look at the impact on prices for products that have an above median shift from auctions towards direct contracting

Effects on Prices (in logs)

	(1)	(2)	(3)	(4)
1{Relative importance \geq cutoff}	0.113 (0.101)	0.148* (0.084)	0.101** (0.048)	0.137** (0.063)
Bandwidth	± 4	± 10	± 4.27	± 4.27
Observations	22,066	44,612	24,101	24,101
R-squared	0.800	0.813	0.809	0.809
Comparison mean	0.325	0.387	0.373	0.373
Spline	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

- Products with clear units of measurement and above-median treatment effect
- Log of unit price, analysis at the purchase order level
- Includes product-unit and month-year fixed effects

► Subgroup Analysis

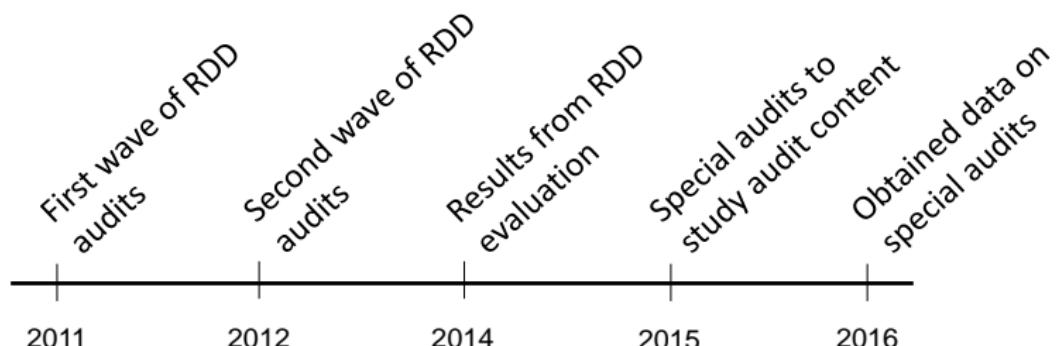
Mechanisms

Additional Audits & Data Collection to Test Mechanism

- The comptroller agency conducted procurement audits for the study
 - 18 public entities, 105 procurement contracts
- Same as regular audits, except more information collection
 - Record contracts and checks that are done even where no irregularity is detected
- Measure whether auctions lead to more “problems” for procuring entities

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Study Audits: Checks and Irregularities (without Controls)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Checks			Infractions			Investigation
	Total	Awarding	Execution	Total	Awarding	Execution	
Auction	31.74*** (2.18)			2.15*** (0.55)			
Constant	18.91*** (1.36)			1.76*** (0.49)			
Observations	105			105			
R-squared	0.692			0.078			

► Examples of Checks

Study Audits: Checks and Irregularities (with Controls)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Checks			Infractions			Investigation
	Total	Awarding	Execution	Total	Awarding	Execution	
Auction	31.67*** (2.18)			2.73** (1.11)			
Amount of purchase	Yes			Yes			
Product code	Yes			Yes			
Month of purchase	Yes			Yes			
Control department	Yes			Yes			
Audit in September	Yes			Yes			
Observations	104			104			
R-squared	0.922			0.705			
Direct contracting mean	18.91***			1.76***			

Study Audits: Checks and Irregularities (with Controls)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Checks			Infractions			Investigation
	Total	Awarding	Execution	Total	Awarding	Execution	
Auction	31.67*** (2.18)	28.54*** (1.69)	3.13*** (0.95)	2.73** (1.11)	2.27** (0.82)	0.46 (0.40)	0.12* (0.07)
Amount of purchase	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product code	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month of purchase	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control department	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Audit in September	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	104	104	104	104	104	104	104
R-squared	0.922	0.933	0.691	0.705	0.752	0.462	0.648
Direct contracting mean	18.91***	7.33***	11.58***	1.76***	1.24***	0.52***	0.12

► Alternative Hypothesis: Does the Audit Probability Fall?

Conclusion and Policy Impacts

- Contrary to government policy goal
 - Audits lead to reduction of auctions & increase of direct contracting
 - Shift concentrated in “emergency” justification
 - Significantly lower number of competitors
 - More purchases from incumbent, small, and local suppliers
 - Increase in prices (in small sub-sample)

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 - Shift concentrated in “emergency” justification
 - Significantly lower number of competitors
 - More purchases from incumbent, small, and local suppliers
 - Increase in prices (in small sub-sample)
- Results from study audits
 - Auctions undergo over 2.5 times as many checks and detected infractions as direct purchases
 - Effects concentrated on ‘contract awarding’- stage

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- Contrary to government policy goal
 - Audits lead to reduction of auctions & increase of direct contracting
 - Shift concentrated in “emergency” justification
 - Significantly lower number of competitors
 - More purchases from incumbent, small, and local suppliers
 - Increase in prices (in small sub-sample)
- Results from study audits
 - Auctions undergo over 2.5 times as many checks and detected infractions as direct purchases
 - Effects concentrated on ‘contract awarding’- stage
- When mechanically applying auditing by legal check list, more regulated processes may be discouraged
 - Key to think carefully about incentives created by audit design
 - Optimizing audit protocol for any given modality may differ from optimal design when taking choice of modality into account.
- Reforms by comptroller
 - Increased scrutiny of emergency contracts
 - Considering revision of audit protocol

Many Thanks!

Appendix

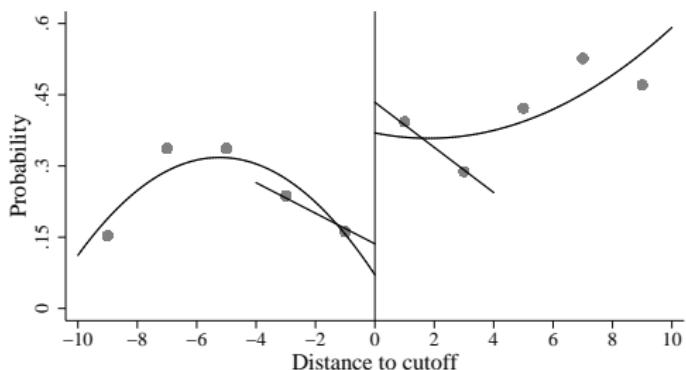
Public Procurement System in Chile (2012)

- Transactions worth over 3% of GDP
- 100,000 participating firms
- 1,350 purchasing public entities
- 4 Purchase modalities

[◀ Procurement Modalities](#)

First Stage without Controls

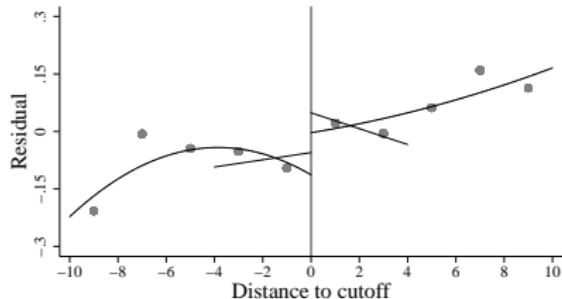
Figure: Audit probability in t



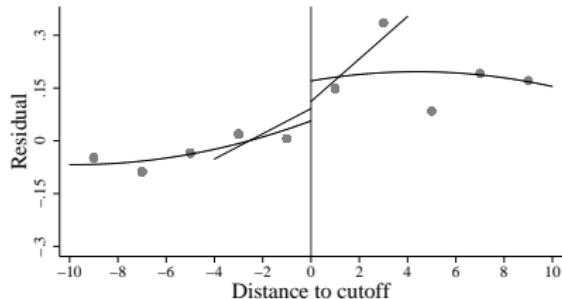
◀ First Stage with Controls

First Stage by Year and Threshold (Medium Level of Risk)

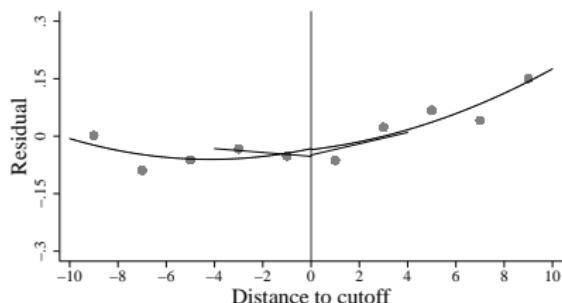
(a) Cutoff between low and medium level of relative importance, 2011



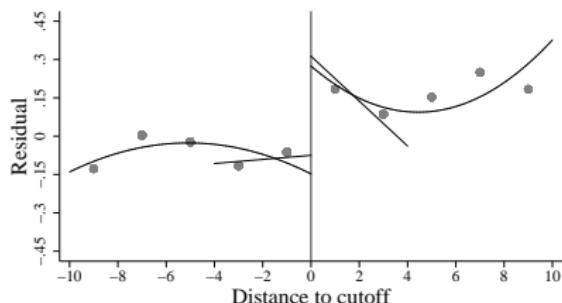
(b) Cutoff between medium and high level of relative importance, 2011



(c) Cutoff between low and medium level of relative importance, 2012



(d) Cutoff between medium and high level of relative importance, 2012



RDD First Stage Results with All Four Cutoffs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Audit Probability							
1{Relative importance \geq cutoff}	0.159*** (0.058)	0.107* (0.061)	0.103* (0.056)	0.162** (0.074)	0.114 (0.072)	0.119* (0.066)	0.079* (0.042)	0.087* (0.050)
Bandwidth	± 4	± 4	± 4	± 10	± 10	± 10	± 7.29	± 7.29
Observations	872	872	859	2,040	2,040	2,014	1,525	1,525
R-squared	0.014	0.169	0.292	0.030	0.170	0.289	0.288	0.288
Comparison mean	0.205	0.205	0.205	0.181	0.181	0.181	0.224	0.224
Spline	Linear	Linear	Linear	Quadr.	Quadr.	Quadr.	Linear	Linear
Stratum fixed effects	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Additional controls	No	No	Yes	No	No	Yes	Yes	Yes

◀ First Stage with Two Cutoffs

Covariate Balance Tests around the Cutoff

	(1)	(2)	(3)	(4)	(5)	(6)
	Comparison mean (±4)	Linear estimate (±4)	Linear estimate (±4)	Comparison mean (±10)	Quadratic estimate (±10)	Quadratic estimate (±10)
Direct contracting share, $t-1$	0.146	0.050 (0.032)	0.041 (0.036)	0.123	0.050 (0.033)	0.062 (0.038)
Auctions share, $t-1$	0.656	-0.007 (0.035)	-0.026 (0.041)	0.695	-0.035 (0.035)	-0.069* (0.038)
Framework agreement share, $t-1$	0.183	-0.044 (0.029)	-0.018 (0.030)	0.168	-0.021 (0.030)	-0.000 (0.028)
Log (+1) of total amount purchased, $t-1$	13.331	0.317 (0.322)	0.228 (0.357)	13.244	0.096 (0.311)	-0.089 (0.319)
Direct contracting share, $t-2$	0.128	0.020 (0.028)	0.025 (0.033)	0.111	0.019 (0.032)	0.037 (0.033)
Auctions share, $t-2$	0.694	0.009 (0.041)	-0.019 (0.043)	0.731	-0.005 (0.039)	-0.053 (0.039)
Framework agreement share, $t-2$	0.155	-0.028 (0.029)	-0.007 (0.030)	0.138	-0.014 (0.028)	0.010 (0.024)
Log (+1) of total amount purchased, $t-2$	13.176	0.233 (0.349)	0.198 (0.423)	13.079	-0.001 (0.339)	-0.072 (0.387)
Audited, $t-1$	0.187	0.042 (0.069)	0.033 (0.060)	0.163	0.085 (0.074)	0.070 (0.075)
Right-wing	0.671	-0.047 (0.099)	0.102* (0.058)	0.695	-0.092 (0.111)	0.011 (0.063)
Independent	0.108	0.069 (0.052)	0.010 (0.040)	0.103	0.071 (0.057)	0.040 (0.042)
F-statistic		0.70	0.73		0.84	0.85
[p-value]		[0.744]	[0.710]		[0.596]	[0.590]

▶ Validity Test

Impact on Share of Purchases by Modality with All Four Cutoffs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Auctions								
1{Relative importance \geq cutoff}	-0.040 (0.034)	-0.072** (0.035)	-0.041 (0.024)	-0.042 (0.031)	-0.082*** (0.029)	-0.037* (0.019)	-0.038** (0.015)	-0.041** (0.019)
Bandwidth	± 4	± 4	± 4	± 10	± 10	± 10	± 8.32	± 8.32
Observations	872	872	859	2,040	2,040	2,014	1,712	1,712
R-squared	0.011	0.305	0.628	0.008	0.241	0.591	0.597	0.597
Comparison mean	0.627	0.627	0.627	0.638	0.638	0.638	0.668	0.668
Panel B: Direct Contracting								
1{Relative importance \geq cutoff}	0.061** (0.025)	0.057** (0.028)	0.022 (0.021)	0.064*** (0.023)	0.068*** (0.025)	0.033* (0.017)	0.032*** (0.012)	0.036** (0.015)
Bandwidth	± 4	± 4	± 4	± 10	± 10	± 10	± 8.35	± 8.35
Observations	872	872	859	2,040	2,040	2,014	1,715	1,715
R-squared	0.015	0.171	0.521	0.006	0.101	0.474	0.490	0.490
Comparison mean	0.142	0.142	0.142	0.131	0.131	0.131	0.129	0.129
Spline	Linear	Linear	Linear	Quadr.	Quadr.	Quadr.	Linear	Linear
Stratum fixed effects	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Additional controls	No	No	Yes	No	No	Yes	Yes	Yes

◀ Reduced Form with Two Cutoffs

Effects by Size of the Purchase

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Auctions								
	Below Mean Contract Amount					Above Mean Contract Amount		
1{Relative importance \geq cutoff}	-0.001 (0.005)	-0.003 (0.004)	0.000 (0.004)	-0.004 (0.004)	-0.061* (0.033)	-0.076*** (0.027)	-0.073*** (0.028)	-0.095** (0.045)
Comparison mean	0.071	0.079	0.077	0.077	0.566	0.586	0.589	0.589
Bandwidth	± 4	± 10	± 5.19	± 5.19	± 4	± 10	± 5.19	± 5.19
Observations	477	992	604	604	477	992	604	604
Panel B: Direct Contracting								
	Below Mean Contract Amount				Above Mean Contract Amount			
1{Relative importance \geq cutoff}	0.003 (0.005)	0.001 (0.004)	0.001 (0.004)	0.002 (0.004)	0.056** (0.027)	0.071*** (0.025)	0.063*** (0.023)	0.073** (0.037)
Comparison mean	0.024	0.023	0.024	0.024	0.112	0.088	0.101	0.101
Bandwidth	± 4	± 10	± 5.05	± 5.05	± 4	± 10	± 5.05	± 5.05
Observations	477	992	593	593	477	992	593	593
Spline	Linear	Quadr.	Linear	Linear	Linear.	Quadr.	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

▶ Effect on Number of Competitors

Subgroup Analysis

- New method to conduct subgroup analysis in RDD, while holding other variables constant
 - Cannot use simple interaction term with treatment in RDD
 - Our approach uses reweighting on the propensity score
 - Stata code “rddsga”

◀ Effects on prices (in logs)

Examples of Checks Leading to Investigative Action or Follow-Up

- Absence of official document for the evaluation of offers
- Hiring without verifying that the provider is registered in the “providers registry”
- There was contact between the buyer and the bidder before awarding the contract
- Purchase orders issued before awarding decree
- Amount of guarantee is below the due amount
- Use of direct contract without the proper authorization from the head of the entity
- Absence of the minimum of 3 quotes for direct contracting
- Payments above due amounts
- Services and payments carried out not included in the agreement
- Fines due to delays in service provision not charged

Audit Probability in $t+1$ Does not Fall

	(1)	(2)	(3)	(4)
Probability of Audit in $t+1$				
1{Relative importance \geq cutoff}	0.039 (0.120)	0.062 (0.109)	0.085 (0.068)	0.076 (0.085)
Bandwidth	± 4	± 10	± 8.86	± 8.86
Observations	477	992	915	915
R-squared	0.381	0.275	0.288	0.288
Comparison mean	0.162	0.161	0.191	0.191
Spline	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

- ▶ Study Audits: Checks and Irregularities (with Controls)