Distortion by Audit

Evidence from Public Procurement*

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Abstract

Public sector audits are a key element of state capacity. However, we find that they can create unintended distortions. Regression discontinuity analysis from Chile shows that audits lowered the use of auctions for public procurement, reduced supplier competition, and increased the likelihood of incumbent, small, and local firms winning contracts. Looking inside the black box of the audit process reveals that relative to comparable direct contracts, auctions underwent more than twice as many checks and led to twice as many detected infractions. Procurement officers perceive the consequences of such detected infractions as severe. These findings show that standard audit protocols can mechanically discourage the use of more regulated, complex and transparent procedures that involve more auditable steps.

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1 Introduction

No state can successfully execute its functions, ranging from infrastructure provision to regulation and redistribution, without a reliable way of monitoring rule compliance through audits. While the economics literature usually considers audits as neutral information collection tools (e.g. Becker, 1968), we show that they can create (unintended) distortions. In particular, looking into the black box of the audit process reveals that commonly used mechanical "auditing by checklist" approaches may inadvertently discourage the use of more regulated, complex and transparent procedures and ultimately reduce the transparency and competitiveness of the process that audits were designed to improve.

We empirically analyze this issue in public procurement: an important but understudied area of public finance and a key focus of government auditing. We present four main empirical findings. First, using regression discontinuity analysis, we find that when public entities undergo an audit, this triggers a subsequent shift away from transparent auctions towards less competitive direct contracting. This distortion goes against the goals of the national public procurement regulation the audits are intended to enforce. Second, this leads to a significant reduction in supplier competition and, consistent with a process that favors insiders, subsequent contracts are more likely to be awarded to incumbent, small, and local firms. We also find suggestive evidence of a price increase. Third, we collect additional data on the audit process itself and find that relative to comparable direct contracts, auctions mechanically undergo more than twice as many checks and lead to twice as many detected infractions and follow-up investigations. Fourth, a novel survey on procurement officer beliefs shows that while formal sanctions for detected infractions are perceived to be relatively rare, other consequences, including career concerns, social-image concerns and self-image concerns, are frequent, and officers perceive overall consequences as severe. Overall, these results suggest that the audit design distorted procurement officers' incentives against the use of auctions in public procurement.

Such distortions can have important impacts, given the large role public procurement plays in many markets. Public procurement includes most public spending other than salaries and transfers and represents a large share of the economy (about 13% of GDP and 29% of total general government expenditures in the OECD (OECD, 2016a)). The government is the largest buyer in most countries, and public procurement contracts can have significant impacts on supplier firms (e.g. Ferraz et al., 2015; Carrillo et al., 2019; Hjort et al., 2020; Barrot and Nanda, 2020). Free and fair competition for government contracts is therefore of great importance not only for the quality and cost of government purchases, but also to create a level playing field for all firms. In contrast to private sector procurement, where firms are free to choose their suppliers as they wish, governments have an obligation to provide equal access and not to discriminate in their choice of suppliers. Privileging incumbents and connected firms creates barriers to entry for new firms, with potential detrimental effects on innovation and economic growth. For these reasons, many governments and international organizations promote the use of competitive and transparent public auctions over direct contracting procedures while still providing for some degree of discretion in the choice of procedure (e.g. OECD, 2015; World Bank, 2016).

Measuring impacts of undergoing an audit on subsequent behavior is notoriously difficult since entities selected for an audit are usually different from others in many observable and unobservable ways. To overcome this challenge, we exploit cutoffs in the audit selection process of the Chilean Comptroller Agency.[1] This allows us to employ a fuzzy regression discontinuity design (RDD) using administrative data on the universe of public purchases in the country in 2011-2012. We compare the procurement behavior of public entities just above and below the cutoffs above which a higher proportion of entities was audited.

Our analysis reveals that entities that experienced an audit strongly reduced their subsequent use of auctions and correspondingly increased direct contracting. The shift surprised

[1]In these audits, the comptroller verifies whether procurement by public entities has been implemented according to regulation, similarly to audits carried out e.g. by the Office of Management and Budget or the U.S. Government and Accountability Office.

the leadership of the Chilean Comptroller Agency, since prior to the study period, the government had started to increasingly promote the use of auctions and discourage the overuse of direct contracting, both through regulatory changes (Chile Compra, 2009, 2010a,c, 2016) and trainings for procurement officers (Chile Compra, 2010b). Comptrollers assumed that, if anything, audits would induce entities to increase the use of auctions. They were especially concerned about the finding that more than half of the shift towards direct contracting was justified as "emergency", the justification known to be most prone to overuse.[2]

Next, we analyze whether the shift has real impacts. We find a significant reduction in competition: Experiencing an audit leads to a particularly strong move away from auctions with more than three bidders and towards direct contracts that only require one quote. This has implications for the type of firms that win the contracts: More contracts are awarded to incumbents that have sold to the same entity before, as well as to small and local firms. At the same time, entities do not reduce their total spending or change their product choice. Finally, we also find a substantial increase in prices within the subset of products for which we can compare prices and for which there is a sizeable shift towards direct contracts.

To study the mechanism underlying the shift away from auctions, we worked with the Comptroller Agency to collect data on the content of the audit itself.[3] These data revealed that, during an audit, auctions undergo more than twice as many checks than direct contracts, lead to twice as many detected infractions, and are twice as likely to trigger formal follow-up investigations. This stems mechanically from the fact that audit protocols typically include many more checks for auctions than for direct contracts, not only in Chile, but in many jurisdictions.[4] It is, of course, possible that contracts for which auctions and

[2]This is the case not only in Chile but also in other settings, e.g. Robinson and Weigel (2018).

[3]This type of analysis was not possible previously, as typical audit reports only include detected infractions, not information on the audit process at the level of individual purchases. To overcome this data limitation, the Comptroller agreed to conduct additional audits to gather such micro-level information.

[4]In Chile, the number of potential checks focusing especially on auctions is 53, whereas it is 4-7 for direct contracts, depending on the size of the purchase. See Appendix B for the Chilean audit protocol. For the U.S. federal government, see e.g. Office of Management and Budget (2018) and Governmental Auditing Standards and Title 2 U.S. Code of Federal Regulations (2020). For U.S. state governments, see e.g. Minnesota Auditor General Office (2018), Arizona Auditor General Office (2020). For the EU see e.g. The Contact Committee

direct contracting are used differ along observable or unobservable dimensions. We deal with this in two ways. First, we show that the differences in number of checks and detected infractions remain very similar when controlling for contract characteristics such as purchase amount and type of product. Second, we find that most of these differences stem from the awarding stage, where the process differs most between procurement procedures, rather than from the execution stage, which is very similar irrespective of procedure.

These results suggest that if agents run the risk of making a mistake in any given step of the process, procedures involving more steps, and correspondingly more checks, will mechanically lead to a higher probability of being found incompliant during an audit. When procurement officers learn - as a result of undergoing an audit - that, despite the recent push for auctions by the government, using auctions leads to more detected infractions and a higher likelihood of a follow-up investigation, this incentivizes them to use more direct contracting instead. We provide a simple conceptual framework to illustrate this mechanism and discuss potential ways to address it through improved audit protocols, or differential audit probabilities and penalties by type of procedure.

To shed light on how severe the consequences of detected infractions are, we implemented a country-wide online survey among procurement officers from entities with recent audit experience. While much of the analysis of deterrence from audits—building on the seminal model of crime by Becker (1968)—has focused on legal consequences of detected infractions, such as prosecutions and penalties, we document that additional consequences can play an important role, including career concerns, social-image concerns, and self-image concerns. Even though the risks of purely legal penalties are relatively low, 73% of officers perceive the overall consequences as equally or more severe than having a 5% lower income in the following year.

The survey evidence also helps to investigate—in combination with administrative

of the Supreme Audit Institutions of the European Union (2018). For other countries, see e.g. Secretaría de la Función Pública de Mexico (2009) or Sri Lanka Auditor General's Department (2016).

data—two alternative mechanisms. First, entities might increase the use of direct contracts in year t because the likelihood of another audit in year $t+1$ might be low, and contracts awarded in year t might therefore be less subject to scrutiny. Analysis of actual re-audit probabilities shows that this is not the case and the survey confirms that the vast majority of procurement officers is aware that contracts made during the year of an audit are not less likely to be audited subsequently. Second, the audits might increase the workload of procurement officers to the point that they fall behind and run into true emergencies. However, the survey shows that, in our context, being audited is only minimally disruptive.

This paper contributes to multiple strands of literature. First, it speaks to the literature on audits and audit design, by identifying a distortionary mechanism that can be caused by audits. Existing work finds that public sector audits can reduce corruption (Avis et al., 2018), improve firm performance (Colonnelli and Prem, 2021), and increase electoral accountability (Ferraz and Finan, 2008).[5] Scholars have also noted limits to effective auditing, such as inefficient targeting (e.g. Duflo et al., 2018), predictable timing (Gonzalez-Lira and Mobarak, 2019), substitution of illicit behavior to other less measurable margins (e.g. Yang, 2008; Niehaus and Sukhtankar, 2013; Carrillo et al., 2017; Lichand and Fernandes, 2019), and the integrity and effort of auditors themselves (e.g. Kahn et al., 2001; Khan et al., 2016; Chu et al., 2021; Bandiera et al., 2021).[6]

Our results show that audits can not only be ineffective but can actually backfire (even in low-corruption, high-capacity settings) by creating unintended distortions. Our findings highlight the importance of audit (protocol) design. In particular, the widespread mechanical auditing approach that we call "auditing by checklist" can inadvertently discourage the use

[5]Similarly, an increase in the *risk* of undergoing an audit has been shown to curb corruption in road construction (Olken, 2007) and public procurement (Zamboni and Litschig, 2018). In the case of taxes, Kleven et al. (2011), DeBacker et al. (2015), DeBacker et al. (2018) and Advani et al. (2021) analyze the impacts of audits of individuals in Denmark and the U.K, and of firms and individuals in the US, respectively, and Kleven et al. (2011) and Pomeranz (2015) study the effects of increased tax audit risk. See Pomeranz and Vila-Belda (2019) for an overview of recent research with tax authorities.

[6]In the case of government mandated, privately provided audits, limited effectiveness has been found to result from collusion (e.g. Duflo et al., 2013a,b).

of more regulated, complex, and transparent procedures that tend to involve more steps and leave a longer paper trail. The mechanism we identify is both simple and quite general. It can apply in any setting—in the public or private sector—where audits are designed to maximize the detection of infractions but agents have some discretion over the choice of procedure. While this is typically the case in public procurement (see e.g. Spagnolo, 2012; Palguta and Pertold, 2017; Szucs, 2023; Baltrunaite et al., 2020), the mechanism applies more broadly, including e.g. for medical staff choosing between shorter or more complex procedures, or sales personnel choosing to sell simpler or more expensive but complex services. Such distortions in the choice of procedures can undermine underlying policy goals, and can have substantial economic impacts, as we show in our setting.

Second, our paper contributes to the literature on public procurement. A growing body of evidence shows the important role that different procurement procedures play in strengthening the procurement process.[7] Several studies find improved outcomes under auctions compared to direct contracts in terms of lower prices and higher quality (Lalive et al., 2015), lower prices and more productive suppliers (Szucs, 2023), and more productive and less politically connected contractors (Baltrunaite et al., 2020).[8] At the same time, a recent set of papers investigates the trade-offs between rules and discretion in public procurement and find that higher levels of discretion can lead to improved procurement outcomes in terms of both costs and quality, particularly in high state capacity settings (e.g. Coviello et al., 2018; Bosio et al., 2022; Decarolis et al., 2023; Carril, 2022; Coviello et al., 2022).[9] While this literature documents the importance of the procurement procedure

[7]For an overview of the theoretical literature see e.g. (Coviello et al., 2018).

[8]Similarly, comparing procedures with varying degrees of openness to competition, Auriol et al. (2016) and Zamboni and Litschig (2018) document that more open procedures are less likely to involve corruption.

[9]Relatedly, a number of studies find that access to information can improve procurement outcomes such as increased entry, lower costs, better quality or shorter contracting times (e.g. Coviello and Mariniello, 2014; Lewis-Faupel et al., 2016; Kovalchuk et al., 2019). Another related literature looks at the role of bureaucrats in public procurement management, finding that passive waste can play a more important role than active rent taking (Bandiera et al., 2009) and that higher bureaucratic competence can improve procurement outcomes (Decarolis et al., 2020b). Finally, a number of papers, such as Tran (2011), Decarolis (2014), Banerjee et al. (2019) and Decarolis et al. (2020a) investigate how auction design affects efficiency in public procurement.

choice for real economic outcomes, our paper focuses on bureaucrats' incentives in making that choice. It is, to the best of our knowledge, the first to show that audit protocols can shape bureaucrats' incentives, and that widely used, standard audit protocols can distort the procurement process.

Finally, this paper also contributes to the literature on public governance and bureaucrats' beliefs about audit probabilities and consequences of detected infractions (see, e.g., De Mot and Faure, 2014, for an overview). Our finding that consequences other than legal sanctions play an important role is in line with, e.g., Benabou and Tirole (2011), who stress the important role of intrinsic motivation and social image concerns in addition to outright legal sanctions or penalties.[10] More broadly, the finding that audits effectively discouraged certain procedures by inadvertently subjecting them to disproportionate scrutiny highlights that optimal design of organizations is perhaps a poor description of how large institutions operate in practice (e.g. Simon, 1972). This seems to be the case even in a high-capacity, low-corruption environment such as Chile.[11] For optimal audit design, organizations should take incentives across all margins of behavior into account (e.g. Stigler, 1970).

2 Background

2.1 Public Procurement

Procurement regulations typically include two main procedures to award contracts: direct contracting and public auctions. Under direct contracting, entities make purchases directly from suppliers they select. In auctions, purchasing entities need to specify the selection criteria explicitly in advance and any qualified firm can participate. Auctions have a built-in control mechanism, in that losers have a vested interest in checking whether the process was executed fairly and correctly. If they suspect irregularities, they can launch a complaint. For all these reasons, public auctions are considered to be conducive to transparency and

[10] See also Bursztyn and Jensen (2017) for an overview on the role of social image concerns.

[11] In our study period, Transparency International ranked Chile as the 20th least corrupt out of 176 countries. For comparison, the US ranked 19th (Transparency International, 2012).

competitiveness and are often recommended over single-source procurement methods (e.g. OECD, 2015; World Bank, 2016).

However, not all purchases lend themselves to auctions. In certain circumstances, conducting an auction can be inappropriate or inefficient (Bajari et al., 2009). This can be the case if there is only a single supplier in the market for a particular product; if there is an emergency and the time it would take to organize an auction would lead to bigger problems; if the amount involved is small compared to the cost of organizing an auction, etc. Regulations therefore typically allow for exceptions under which auctions are not required and direct contracting is allowed. While procurement officers need to indicate the justification for using direct contracting instead of auctions, there is some discretion inherent in the choice of procedure.

Many countries have a third procurement procedure, so-called framework agreements. These are typically managed by a central agency which runs auctions or negotiates conditions for products that are used by many entities, such as office materials. Individual public entities can then simply order products from a list of options. Framework agreements are typically also considered a competitive procurement procedure, so when a product is available in a framework agreement, the entity does not need to organize an auction.

The Chilean Context: *Chile Compra* (henceforth "Procurement Agency") manages the public procurement system and the online platform on which most public procurement takes place. The platform serves practically all public entities in Chile[12] with about 1,350 entities making purchases and over 100,000 firms supplying goods and services each year (Chile Compra, 2012). During our study period, purchases on the platform represented about 3.1% of GDP (Chile Compra, 2018). Prior to our study period, the Procurement Agency started to increasingly promote the use of auctions and discourage the overuse of direct contracting, through both regulatory changes (Chile Compra, 2009, 2010c,a, 2016) and trainings for

[12]There are a few exemptions such as for the armed forces. Large public works like construction of an airport or highway are not part of the online procurement system and are handled by a different agency.

procurement officers (Chile Compra, 2010b). While historically, most purchases used to be made through direct contracting, these efforts succeeded in motivating entities to conduct a large share of purchases through auctions, mirroring similar efforts in many other countries (see e.g. OECD, 2016b). During our study period, auctions represent the largest share of purchases, followed by direct contracts and framework agreement purchases.

Auctions are conducted on the online platform, where all information about the process and specifications is publicly available. Once an auction is finalized, bids of all competing firms are also published. Chile uses so-called "scoring-auctions" in which points are given depending on a number of characteristics such as price, specific quality dimensions, experience of the supplier, qualification of their staff, etc. At least two characteristics need to be specified such that points are not only given based on price. For direct contracting, the regulation stipulates 21 possible justifications. They include cases where only one supplier exists, emergency, trust in a particular supplier, situations in which organizing an auction would represent a disproportionate cost, or purchases below about 750 USD.[13] Depending on the justification, officers are required to get one or three quotes from suppliers. About 80% of direct contracts require one quote and about 20% require three. The awarding process for direct contracts is offline and information about the purchase is subsequently uploaded to the platform. When a product is available through a framework agreement, entities are required to use this option, unless they can obtain better terms through another procedure. Products that are available through framework agreement but are purchased through other procedures therefore make up a very small share of total purchases. Finally, for small purchases below about 225 USD, the use of the electronic procurement system is not required.

[13]The specific threshold is 10 UTM (Unidad Tributaria Mensual, an inflation-adjusted Chilean unit of account). See Online Data Appendix B for the full list of justifications.

2.2 Audits

Public Sector Audits: Supreme audit institutions or comptroller agencies[14] are in charge of monitoring public entities and state-owned enterprises. They play an important role for state capacity by enhancing public sector transparency, performance and accountability and ensuring correct execution of regulation (e.g. INTOSAI, 2010; OECD, 2014). One of their primary monitoring activities consists of implementing audits (INTOSAI, 2010), typically including a strong focus on procurement. Auditors from the comptroller agency usually visit the public entity being audited and work behind closed doors to examine documents.

Auditors often follow a checklist to investigate whether processes were executed in accordance with the regulation (e.g. The Contact Committee of the Supreme Audit Institutions of the European Union, 2018). In the case of public procurement, common checks include the choice of purchase procedure, correct implementation of awarding criteria, supplier selection and contract execution. Following the audit, many comptroller agencies issue a preliminary report and entities can file a response explaining how the infractions occurred and what they will do to remedy the issue. Taking the entity's response into account, the comptroller releases an official final report, which in many countries is publicly available.

The Chilean Context: *Contraloría* is the Chilean national comptroller agency (henceforth "Comptroller"). Compared to other countries, it is particularly well-functioning and well-funded (Engel et al., 2017). Figure A1 illustrates the relationship between Procurement Agency, Comptroller, and public entities which make procurements (e.g. hospitals, schools, ministries). The timeline is as follows. At the end of each year t-1, the Comptroller determines which entities will be audited in year t. At the beginning of year t, selected entities are notified that they will be audited and told which documents they need to prepare. At this point, entities start getting a sense of what aspects of the procurement will be under scrutiny. Most audits begin early in the year, almost half in the first quarter. Audits usually

[14]These are known in different countries as "National Comptroller'', "Auditing Agency'', "Court of Auditors'' or "General Accountability Office''.

examine completed contracts from year t-3 to year t-1. The impacts we measure are those on new purchases made in year t, which are not subject to the audit.

Audits last 2 months on average. Following standard procedure, contact between auditors and entity staff is kept at a minimum and no social interactions are allowed. Upon receipt of a preliminary report, entities learn in more detail what the auditors focused on. In the following weeks, entities prepare a response to the interim report. Based on this response, the Comptroller releases a final report publicly on the internet. In severe cases, the Comptroller can initiate a formal investigation. This serious step can involve disciplinary proceedings, restitutions for improper payments, referral to the Court of Auditors to initiate a quasi-judicial examination, or referrals for legal prosecution to the Public Prosecutor.

During the preparation of the response to the Comptroller, procurement officers who committed the infractions are typically required to explain themselves internally to their superiors. In our qualitative interviews, officials described this as a painful experience that can severely affect their career prospects. Through our country-wide procurement officer survey, we investigate the nature and severity of such consequences for the responsible procurement officers in Section 7.1 below.

2.3 Audit Selection Process

As is the case in many auditing agencies, the selection of entities to be audited depends in part on quantifiable criteria and in part on subjective, qualitative factors. To optimize cost-benefits, auditing agencies tend to target resources on entities that are large enough, and at high enough risk of malpractice to warrant the effort. At the same time, to maintain deterrence power, even small and low-risk entities are subject to some audits. Auditing agencies increasingly use scoring rules to weigh these different considerations.

In 2011–2012, the Chilean Comptroller used a secret scoring system with cutoffs to guide the decision of which public entities to audit. We exploit these cutoffs to measure

the impact of being audited using a regression discontinuity design.[15] Among public entities that the Comptroller considered to be of medium non-compliance risk, the decision to audit depended in part on an "importance score".[16] This score combined different aspects of entity size such as level and variation of the budget, total assets and liabilities, number of employees in management, technical professions and other roles, transfer payments to the private sector, as well as sector-specific indicators, such as the complexity of a hospital or the number of health clinics managed by a given health department. An entity's importance score was formed by multiplying these indicators with a set of weights that varied from year to year and were never made public. We find that a unit increase in the importance score is associated with about 3.5% higher total purchases.

Public entities of medium risk were divided into three groups according to their importance score: high, medium, or low. This ranking and the cutoffs were determined each year separately for each internal unit of the Comptroller.[17] We therefore refer to a stratum as a cell defined by year and internal unit. Within each internal unit, the Comptroller divided the range of the score into three equally-sized parts that determined the cutoffs. These calculations were kept secret within a small team at the central control office. Neither the existence of the score nor the cutoffs were known to entities subject to the audit. Entities only learned whether or not they had been selected for an audit, no justification was given.

2.4 Conceptual Framework

The following provides a simple conceptual framework to illustrate the challenge of avoiding distortions by audit when agents subject to the audit have some discretion over multiple procedures. Beyond procurement, this can apply in many contexts, such as medical professionals choosing to use a shorter or a more complex procedure, sales staff choosing whether

[15] In later years, the scoring rule was changed such that there was no discontinuity anymore.

[16] Almost 59% of entities were considered medium-risk. Among the 38% considered high-risk, a large share was audited independently of their importance score, while among the 3% considered low-risk, few were audited. The risk classification was based on factors like low compliance in previous audits or complaints from civil society.

[17] Each internal unit is responsible to monitor and audit a group of public entities.

to sell a simpler or more expensive but complex service, etc.

Consider two such procedures that differ in the number of auditable steps involved in their execution. Agents have a prior about what to expect during an audit with regards to the audit protocol, i.e. what will be checked by the auditors and with what intensity. In cases where they do undergo an actual audit, they have an opportunity to update this prior. In particular, agents can learn about the relative scrutiny of each of the two procedures. Such updating can happen when agents are not previously aware of this pattern—for example because audit protocols recently changed or because the auditing agency announces that it will more vigorously pursue the overuse of direct contracts and promote auctions, but leaves the audit protocol unchanged, as was the case in our context.

When agents learn that using the more complex procedure leads to a higher risk of being called out for errors during an audit, this gives them an incentive to avoid this procedure and use the shorter or simpler one instead, even if that procedure is otherwise not optimal. In our context, the procedure with fewer steps is direct contracting, while the alternative, longer procedure is an auction. Many factors may affect whether agents choose one procedure over the other. In the context of public procurement, these include for example whether there are enough suppliers in the market, or whether the amount of the purchase is large enough to warrant an auction, as well as potential private benefits in the form of differential opportunities for corruption across procedures. The fact that agents have to take multiple considerations into account is often the reason why they are given some discretion in the choice of procedure. One key consideration we focus on here is that, at each step, agents run the risk of making a mistake leading to an infraction.[18] For the rest of the discussion, we focus only on this aspect and take other considerations as given.

Agents choose the level of effort to reduce the risk of making infractions, taking into account the effort cost and the expected penalty. At each step, infractions are detected with

[18]In an auction, for example, the agent may write an incomplete specification of the call for bids.

some probability, and agents receive a sanction per detected infraction. Appendix C discusses the auditing agency and the procurement officers' incentives, and derives the framework's implications more formally. It also analyzes considerations regarding whether and how it can be optimal to eliminate the resulting distortions. The framework implies that in settings where agents have no discretion over the choice of procedure, maximization of deterrence for each auditable step independent of procedure has no further implications. However, if agents do have some discretion, this gives rise to a distortionary incentive against procedures with more auditable steps. Switching to a procedure with fewer auditable steps allows agents to reduce their expected detected infractions without increasing effort to avoid mistakes.

Optimal audit design should take these considerations into account. Auditing agencies that are aware of this distortionary mechanism could employ a number of counterbalancing measures. The government could instruct the auditing agency to not only maximize detection of infractions, but to also include minimizing distortions between procedures into the agency's objective function. Eliminating this distortionary incentive would require equalizing the expected number of discovered infractions and corresponding penalties across the two procedures.

A first set of possible approaches involve adjustments to the audit protocol. One such adjustment involves (potentially randomly) sampling fewer steps of the longer procedure, such that the number of audited steps is equal across procedures, or increasing audit hours per auditable step in the shorter procedure relative to the longer one.[19] Other possible changes to the audit protocol include focusing in more depth on key steps within the particular procedures, and especially on the validity of the justification given for the use of the shorter procedure (where such a justification is required). A second set of possible adjustments involve changes to the audit probabilities. In particular, auditors could increase the

[19]However, there can be trade-offs between removing the distortionary incentive and maximizing detection of infractions. For example, if there are decreasing returns to auditing intensity within a given step, changing the auditing hours per step may fail to maximize the overall number of detected infractions. Appendix C discusses these issues more formally.

audit probability for entities with a particular large use of the shorter procedures, or within audits, increase the sampling of cases where the shorter procedure was used. A final type of possible adjustments focuses on penalties. This could take the form of making consequences more severe for overuse of the shorter procedure or for infractions detected in the shorter procedure, or conversely lowering the penalties for minor infractions committed in the process of executing all steps of the longer procedure correctly.

3 Data

We combine transaction-level data from the Procurement Agency (Chile Compra, 2009-2014) with audit data from the Comptroller (Contraloria General de la Republica, 2010-2013).[20] To complement these administrative data sources, the Comptroller conducted additional audits to collect information on what happens during procurement audits, including which contracts are audited, which checks are executed and what infractions are found. Finally, we conducted a country-wide online survey with procurement officers to shed light on some of the underlying mechanisms, as well as qualitative interviews with procurement officers, suppliers, and auditors.

3.1 Data on Procurement

We collected data from the Procurement Agency on the full universe of purchases conducted on the online platform. For each purchase, this includes the purchasing entity, purchase procedure, justification in case of direct contracts, number and characteristics of bidders in case of auctions, date of the purchase, 8-digit product codes, verbal description of each item, value of the purchase, quantity purchased, unit of measurement, and identification number and characteristics of the seller (e.g. firm size, location).

Table 1 Panel A presents summary statistics for the universe of purchases in our estimation period. With 4.4 million purchases for USD 6.6 billion, auctions make up about 51% of purchases and 64% of amounts spent, while direct contracts represent around 15%

[20] Online Data Appendix A explains the construction of the dataset.

of purchases and 18% of amounts spent. The average number of quotes obtained per direct contract is 1.4, while an average of 13 bidders compete in public auctions. Framework agreements cover about 27% of purchases, but only 17% of total dollars spent, as they are commonly used for lower-cost purchases, such as office supplies or cleaning materials. Finally, about 8% of purchases but less than 0.5% of the value was for very small purchases, for which use of the electronic procurement platform is optional. Panel B shows the same statistics for entities in the estimation sample, i.e. those of medium risk within a ± 10 range around the cutoff of the importance score. The numbers are quite similar.

3.2 Data on Audits

Administrative Data: The Comptroller provided data on audits (which entities were audited and when), on the importance score and the risk classification of each public entity, as well as on the internal unit in charge of monitoring each entity. We also collected information on political affiliations of the leadership of each entity from the Chilean Electoral Service (Chilean Electoral Service, 2014) to construct a control variable.[21]

Additional Audits: Information routinely collected by the Comptroller during audits was rather limited at the time. It included only the detected infractions, but no data on which purchases were audited and what checks were conducted. Findings from many purchases were grouped together, so that it was not possible to study differences by procurement procedure. This limits the scope of possible analyses of what happened during the audits in our RDD sample. To shed more light on the audit process, the Comptroller agreed to undertake additional audits to collect more information. These audits were conducted in the same way as usual, with the key difference that auditors recorded more information, namely which contracts were audited, which checks were applied and which infractions were detected for each contract. This allows us to examine differences in the way auctions and direct contracts are audited in terms of the number and type of checks applied and the

[21] Political affiliations are right-wing coalition, left-wing coalition, or independent. National and regional entities were assigned to the right-wing coalition since they were part of the right-wing coalition government in office at that time. Affiliation of municipal entities was assigned according to the mayor.

frequency and severity of detected infractions. The audits in the RDD analysis took place in 2011–2012, while the additional audits were implemented in 2015 (see Figure A2 for a timeline). However, the audit protocol of the Comptroller had remained unchanged.

The audit protocol includes 95 checks, most of which correspond clearly to either the contract awarding or the contract execution stage. The contract awarding stage includes all steps leading up to awarding of the contract, such as choosing the procurement procedure, writing the specifications for auctions, requesting quotes for direct contracts, and evaluating the bids or offers. The contract execution stage refers to all activities following contract awarding, such as timing of delivery, quality of the product or service, and delivery according to specification.[22] The additional audits took place in two waves in July and September 2015. Eighteen out of 1,278 entities were selected randomly from internal units that had remaining auditing capacity. In each entity, the Comptroller audited three purchases of goods and up to three purchases of services, for a total of 105 audited contracts.[23]

Survey Evidence: To complement the administrative data, we collected both qualitative and quantitative data from key agents in the procurement process (Gerardino et al., 2021). First, we conducted focus groups and over 50 interviews with auditors of the Comptroller Agency, with procurement officers of over twenty public entities and with owners of supplying firms in 2014–2015. This allowed us to generate testable hypotheses that informed the quantitative analysis. Second, we implemented a country-wide online survey with procurement officers to investigate several aspects of the mechanism. For this, we partnered with the procurement agency to access contact information of procurement officers. The survey was then sent from the researchers' account and clarified that all responses would be treated confidentially. The survey was piloted in June–July 2021 and rolled out in August–November 2021.

The sample frame consists of the universe of public entities for which the data from the

[22] Appendix B shows the audit protocol and classifies checks by awarding or execution stage.
[23] A few entities had less than 3 service contracts during the audited period.

Comptroller and the Procurement Agencies could be matched and which had experienced a regular audit in the previous two years. The goal was that respondents would have recently experienced an audit.[24] Within these entities, we sent the survey to all operators and supervisors for public procurement who had substantial experience with procurement in recent times.[25] Despite the challenges of Covid-19, we managed to get responses from 213 officers via this online survey, corresponding to a response rate of 27%. Respondents have very similar characteristics to the full sample frame. They have used the system for 5.9 years on average and 52% are male, while in the sample frame, the mean is 6.1 years and also 52% are male. Respondents cover half of all entities in the sample frame and come from 13 out of the 16 regions in the country.[26]

4 Empirical Strategy

4.1 Regression Discontinuity Design (RDD) Specification

Based on the audit-selection process described in Section 2.3, we estimate the impact of an audit by comparing entities above and below the cutoffs in the importance score. While these entities are otherwise similar, a higher share of those above the cutoff is audited. We use a fuzzy RDD, since factors other than the importance classification are also taken into account when entities are selected for audit. The RDD captures the effect for entities classified as medium-risk in the vicinity of the cutoffs. In terms of external validity, this implies that we measure impacts on relatively "typical" entities, which are in the middle of the risk distribution and neither extremely large nor extremely small.

Since cutoffs were determined separately in each stratum, we normalize scores at the stratum level, so that the normalized score indicates distance from the cutoff (following e.g. Kaufmann et al., 2013; Pop-Eleches and Urquiola, 2013; Hastings et al., 2014). Our main

[24]Excluded from the sample frame were any entities that had experienced a different type of audit in the last five years, to avoid any confusion in the responses between the regular audits that this paper studies and special types of audits in which the mechanisms may differ.

[25]The sample consists of officers who have worked in public procurement for at least two years and had used the online system within the last two years.

[26]The non-represented regions are small and cover only 3.2% of Chile's population.

specifications include stratum fixed effects and entity characteristics as controls.[27] The location of the significant discontinuity varied across years.[28] In our period, the discontinuity occurred between low and medium levels of importance in 2011 and between medium and high in 2012. We therefore focus on these two cutoffs in our main specifications. For robustness, we also provide estimates that pool across all four potential cutoffs. The normalized distance to the cutoff ranges from -62.5 to 38.9.

We use four different specifications: 1) Local linear regressions around the cutoffs following Hahn et al. (2001) and Imbens and Lemieux (2008). 2) Quadratic specification in a larger bandwidth following Lee and Lemieux (2010). Based on visual inspection, these specifications use bandwidths of ± 4 and ± 10 respectively.[29] 3) Outcome-specific bandwidths that are Mean Square Error-optimal using triangular kernels as proposed by Imbens and Kalyanaraman (2012) as well as 4) the same bandwidths with bias-corrected estimates and robust standard errors following Calonico et al. (2014).[30]

The local linear specification for observations within distance h of the cutoff is:

$$D_{is} = \pi \mathrm{I}[X_{is} \geq 0] + \rho_0 + \rho_1 X_{is} + \rho_2 X_{is} \times \mathrm{I}[X_{is} \geq 0] + a_s + \gamma W_{is} + V_{is} \quad (1)$$

$$Y_{is} = \tau \mathrm{I}[X_{is} \geq 0] + \beta_0 + \beta_1 X_{is} + \beta_2 X_{is} \times \mathrm{I}[X_{is} \geq 0] + a_s + \theta W_{is} + U_{is} \quad (2)$$

where Y_{is} is an outcome for entity i in stratum s; D_{is} a dummy equal to 1 if an entity is audited; X_{is} the importance score normalized with respect to cutoff c_s, $\mathrm{I}[X_{is} \geq 0]$ an indicator for an importance score above the cutoff; τ the effect of crossing the cutoff on outcome Y_{is}; a_s the stratum dummies; W_{is} a vector of entity characteristics; U_{is} and V_{is} are error terms.

[27] For robustness, we also run regressions with interactions of stratum dummies and distance to the cutoff.

[28] The share of entities audited was generally low among entities with low importance score and high among those with high importance score. For entities in the medium range, the audit rate depended on the available auditing resources in a given year.

[29] These estimations use a rectangular kernel, which in effect amounts to giving higher weight to observations closer to the cutoff.

[30] Originally, we intended to include subgroup analysis by type of entity or product. For this, we developed a new empirical approach based on propensity score reweighting, which allows running RDD analyses by subgroup while holding other characteristics constant (see description and Stata code in Carril et al., 2018). Unfortunately, there is not enough statistical power to detect any potential differential impacts in our data.

Control variables include: a dummy for having been audited a year prior to treatment,[31] dummies for entities' political affiliation, as well as first and second lags of log (+1) of the total amount purchased by the entity, of the shares of spending through auctions and direct contracts, and of the outcome variable (where the outcome is different from auction or direct contracting shares). For robustness, we also show specifications without control variables, and specifications in first differences.

Our analysis of impacts on purchase procedures is at the level of the public entity. For effects on supplier characteristics and prices, we use data at the purchase level to control for additional factors such as month of the purchase and product-unit fixed effects.[32] Standard errors are clustered at the stratum level. We focus on the reduced form rather than IV estimates, as the reduced form is sufficient to establish whether the audit impacts procurement outcomes. This also allows us to maintain a close correspondence with the graphical evidence and to avoid potential weak instrument problems that could arise with IV in our context (Chernozhukov and Hansen, 2008; Feir et al., 2016).

4.2 Specification for the Analysis of the Additional Audits

The data from the additional audits allow us to analyze the audit process by purchase procedure. We run OLS regressions of the number and type of checks and infractions on whether a purchase was done through auction or direct contracting. Clearly, the purchase procedure is not exogenous. We undertake two steps to investigate whether the differences in the number of checks and infractions are indeed related to the purchase procedure and not based on other differences between the purchases.

First, we show that results are robust to the inclusion of key covariates: product dummies, month of the purchase, amount of the purchase, month of the audit, and internal unit implementing the audit. Second, we analyze results separately for the awarding and execution stages of the contract (as defined in Section 3.2). While the awarding process differs

[31] Audit data are only available for one year prior to 2011.

[32] These are dummies for each product by unit of measurement, e.g. kilograms of salt.

substantially between purchase procedure, the execution stage is similar. If differences in the number of checks or detected infractions are mostly concentrated in the awarding stage, this would suggest that the purchase procedure itself is likely driving these results, rather than unobserved differences between purchases made through direct contracts and auctions.

4.3 RDD Internal Validity Checks

The RDD effects are identified under two main assumptions. 1) No other characteristics change discontinuously at the cutoff. 2) The exclusion restriction—crossing the cutoff does not affect outcomes through any other channels. As shown in Lee and Lemieux (2010), a sufficient condition for the first assumption is that the density of the variable determining treatment assignment is continuous. This is fulfilled if there is no precise manipulation to be on either side of the cutoff. This is likely the case here for the following reasons. As discussed above, the existence of a score is unknown to public entities. In addition, the cutoffs are determined after all scores have been calculated, and are based on the range of the score in a particular stratum. So entities would not only need to know their own score, but also every other entity's score to be able to locate precisely on the side of the cutoff with lower share of audited entities. Moreover, the components and weights of the importance score change each year. Finally, the fact that the cutoff does not shift the share of audited entities from zero to one reduces the incentives for such manipulation. If a control department and a public entity wanted to collude, it would be easier to simply not select that entity for audit rather than manipulate its score.

While the assumption of continuity is not directly testable, it has testable implications. Figure 1 shows results of a McCrary density test (McCrary, 2008). Consistent with no manipulation, the test does not reject the null hypothesis that the density is smooth around the cutoff (log difference = -0.1, standard error = 0.2). Table 2 tests for imbalance of covariates at the cutoff by running RDD analyses for each covariate as the outcome, as in Equation (2). Columns (1) and (4) show comparison means, i.e. estimated means to the left of the cutoff in the ± 4 and ± 10 range, respectively. Each coefficient in Columns (2)–

(3) and (5)–(6) shows the result of a separate regression to test for discontinuity. Columns (2) and (3) show linear discontinuity estimates in the ±4 range without and with stratum fixed effects. Columns (5) and (6) show the same for quadratic estimates in the ±10 range. Variables are either time invariant or from the pre-treatment period. The F-statistic is from a test of the joint hypotheses that all discontinuities in a given column are zero. The p-values for joint significance range from 0.59 to 0.74, indicating no significant discontinuity at the cutoff. However, not all characteristics have point estimates that are close to zero, and in one of the four specifications, a pre-treatment outcome is significantly different from zero at the 10% level. Our preferred specifications therefore control for all variables in Table 2. For outcomes other than direct contracting and auction shares, we also control for the first and second lags of the outcome variable. Finally, we also show impacts on the main outcomes (purchases via auction and direct contracts) on a quarterly basis over time, to confirm that the impacts start at the time of the audit.

The exclusion restriction is unlikely to be violated in our context given that the running variable is an internal score constructed by a small unit within the Comptroller Agency, not shared with other departments. Moreover, the score is different for every stratum and in every year. In our extensive conversations with many representatives at the Comptroller Agency, it became clear that this score was not used for any other purpose.

5 First Stage and Impacts on Purchase Procedures

5.1 RDD First Stage: Effect on the Share of Audited Entities

Figure 2 presents first stage results pooling across 2011 and 2012.[33] The x-axis represents the importance score normalized by stratum-specific cutoffs. The y-axis shows the residual share of audited entities after controlling for stratum fixed effects and the control variables. Each dot represents a two-point wide bin. Linear and quadratic fitted lines are also included.

[33] As discussed in Section 4.1, based on the audit selection process, the significant discontinuity can differ for different years. It occurs between low and medium levels of importance in 2011 and between medium and high in 2012. Our main specifications therefore focus on these cutoffs. For robustness, we also report estimates pooling all four potential cutoffs. See Table A1 in the Appendix for the corresponding first stage.

A number of aspects stand out. First, there is a jump in the share of audited entities at the cutoff. Second, the share of audited entities is generally increasing with the importance score (i.e. moving from left to right in the figure), but this increase is not linear. As discussed above, the choice of which entity to audit within a level of importance is based on subjective considerations, which can result in non-linearities. This does not affect our estimates, which are based solely on the discontinuity at the cutoff.

Table 3 displays the first stage numerically for 8 specifications: Columns (1) to (3) show a bandwidth of ± 4 with a linear local polynomial and Columns (4) to (6) a bandwidth of ± 10 with a quadratic local polynomial with varying inclusion of covariates. Column (7) employs the optimal bandwidth proposed by Imbens and Kalyanaraman (2012) and Column (8) adds bias-corrected RD estimates and robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014). All estimates are statistically significant at the 5% or 1% level. In our preferred specifications with control variables, i.e. Columns (3), (6), (7) and (8), the share of audited entities increases at the cutoff by 15.8 to 19.3 percentage points.

5.2 Effects on Purchase Procedures

Next, we analyze the impact on the share of spending by procurement procedure. Figure 3 presents the graphical evidence. Public entities just to the right of the cutoff have a lower share of spending through auctions (Panel A) and a higher share of direct contracts (Panel B). The similar magnitude and opposite direction suggest that entities increase direct contracts at the expense of auctions. Panels C and D show no impacts on procurement made through framework agreements or as small purchases.

Table 4 displays the results for auctions and direct contracts in regression form, following Equation (2). Results are quite robust across specifications, even though magnitudes and levels of significance vary. In our preferred specifications, i.e. including control variables, the estimates range from -6.9 to -8.9 percentage points for auctions and from 6.1 to 7.7 percentage points for direct contracts. Undergoing an audit therefore seems to induce public entities to

reduce the use of the more transparent and competitive procedure of public auctions and to increase the use of direct contracts.[34]

While the reduced form estimates above are sufficient to establish whether the audit impacts procurement outcomes, measuring the magnitude of the impact of an audit would require scaling them up by the inverse of the first stage. This would suggest an impact of 34 to 41 percentage points in the specifications with controls for the shift towards direct contracts and 38 to 49 percentage points for auctions, which seems quite large. However, these point estimates have to be interpreted with caution for two reasons. First, the IV standard errors are very large, making the specific point estimate less informative. Second, and more importantly, the first stage estimates may be too weak to provide reliable IV inference (Chernozhukov and Hansen, 2008; Feir et al., 2016). Specifically, the first stage F-statistics in our preferred specifications (Table 3) range from 5.3 to 6.9, while the critical value of an F-test for a size distortion of no more than 5 percentage points for a 5 percent significance test is about 16.4 (Andrews et al., 2019).

To further assess whether the effect indeed stems from the audits, we also show the evolution of the effect over time. Figure 4 displays the effects on a quarterly basis for two years before to two years after the beginning of the audit. While the quarterly results are relatively noisy, there is no impact in the pre-treatment periods. The effect starts at the beginning of the audit year and grows over the course of that year. This may reflect that, as discussed above, entities begin to learn about the content of the audits in the first part of the year, and additional information is revealed over the course of the process. Procurement officers gradually learn that, despite the government's recent increased push for auctions, they run a higher risk of being scrutinized and called out for infractions in auctions rather

[34]For robustness, we also estimate these effects including interactions between stratum dummies and distance to the cutoff (Table A2). This allows for the relationship between outcome and running variable to differ within each stratum. Results are quite similar. We also show reduced form estimates pooling across all four potential cutoffs (Table A3). Results are similar in terms of the sign of the effects but with smaller coefficients, as expected given the smaller first stage. Finally, Table A4 shows the effect on the first differences of auctions and direct contracting.

than in direct contracting (as shown empirically below in section 7).

The effect then starts to decrease over the following year. In year 2, the effect is about half in magnitude of year 1 (see Table A5). The effect therefore clearly lasts substantially beyond the duration of the audits themselves (almost 90% of audits are already over at the beginning of the last quarter of year 1, as shown in Figure A3). Nevertheless, it might seem surprising that the effect is relatively short-lived.[35] If the shift to fewer auctions is a result of entities learning during the audits that purchases made by auction undergo more scrutiny than those made through direct contracts, one might expect the effect to be permanent. Several factors could drive this dynamic. On the one hand, the difference between treated and comparison entities falls when comparison entities catch up. This can happen for two reasons. First, many entities that are below the cutoff in one year are audited in the following year. Second, information that the audit protocol did not reflect the recent official push for more use of auctions is likely to spread among procurement officers across the different entities.[36] On the other hand, the effect may have waned within the treated entities themselves, both due to staff turnover and because entities could reasonably expect that the audit protocol would continue to evolve due to further regulatory changes (Chile Compra, 2016).

Overall, the results of Section 5.2 suggest that being audited induced entities to reduce the use of auctions for their subsequent purchases and increase the use of direct contracts instead.

Direct Contracting Justifications: Entities need to provide a justification for using direct

[35]Figure A3 shows how many entities are under audit in each quarter. Most audits start in the first half of the year and last about 2 months on average. As a result, most audits are already over before the fourth quarter of year *t*. In contrast, as shown by Figure 4, the treatment effect on purchase modalities is largest in the fourth quarter of year *t* and the first quarter of year *t+1*. This suggests that the effect is not driven by currently ongoing audits directly impacting procurement decisions.

[36]Results from the country-wide procurement survey reveal that 80% of officers learn about the auditing process from other public entities. The most frequent channels are joint trainings or meetings, documents, and conversations with officers from other entities. Information also flows indirectly from colleagues in the same entity who have information from another entity (see Figure A4).

contracts. Analyzing which justifications drive the higher use of direct contracting in audited entities can shed additional light on the mechanism. Out of the 21 possible justifications, the emergency justification is known to be particularly prone to overuse and mentioned as such in the regulation. This is both because it is difficult to monitor ex-post, whether a purchase was indeed urgent, and because if a buyer waits long enough, almost any purchase can become justifiable on emergency grounds (Robinson and Weigel, 2018).

Table A6 shows RDD estimates for the five most frequent justifications and all other justifications grouped together. Recall that the shift towards direct contracting is around 7 to 9 percentage points of amounts purchased. Over half of this increase is based on the emergency justification. Direct contracting using the emergency justification is 4 to 5 percentage points higher above the threshold, compared to the base share of 0.8 to 1.4 percentage points. All specifications are significant at the 1% or 5% level. Direct contracts using the unique supplier justifications start at a higher base share of around 2.5 percentage points and increase by 1.2 to 1.8 percentage points (varying from insignificant to significant at the 5%-level). The coefficients for the other justifications are small and not significant. The finding that the increase in direct contracting is driven to a large degree by the justification most prone to overuse is consistent with the interpretation that after an audit, procurement officers intentionally increased the use of direct contracting, using the justification that is the easiest to manipulate.

Product Choice and Total Spending: One concern regarding the interpretation of the results may be that the change in purchase procedures might be driven by a change in product choice. To test this hypothesis, we analyze the impact of undergoing an audit on the share of spending by procurement procedure using product-level procurement shares with product-level fixed effects. The dependent variable in this analysis is the share of spending through auctions/direct contracts, respectively, out of total spending on a given product by a given entity. In order to account for the importance of different products in an entity's spending composition, the regression weighs each observation with the share of

the corresponding product in an entity's total spending. Results are very robust to these product-level specifications, as shown in Table 5.[37]

We also analyze whether there is a discontinuity in auction and direct contract shares purely based on the product mix, using the pre-treatment shares of purchase procedures for each product. We proceed as follows. First, for each 8-digit product we calculate the share of spending on that product that is done through each purchase procedure in year *t-1*. For each entity, we then construct the auction and direct contracting shares that would be expected under the actual (potentially shifted) product mix from year t but using the above product-level procedure shares that are constant based on year *t-1*. If a changed product mix (towards less auction-intensive and more direct contract-intensive products) were driving our results, we would expect a similarly sized impact on these expected auction and direct contract shares as we find in our main analysis.[38]

Table D1 shows the results, which confirm that the shift from auctions to direct contracting is not a result of a shift towards less auction-intensive and more direct contract-intensive products: The discontinuity estimates at the cut-off in Table D1 are close to zero and the confidence intervals exclude the effects found in our main analysis (i.e. -0.089 for auctions and +0.077 for direct contracting, as shown in Table 4 Column (8)).

We provide two sets of additional analyses regarding product choice, shown in Appendix D. First, we analyze whether audits led to a change in the type of products purchased. We look at the impact on the spending share for each product for the 6 main product groups as well as at the more disaggregated levels of 2-digit and 8-digit product codes. Tables D3

[37]For robustness, we also estimate additional product-level specifications without controls and with varying granularity of product fixed effects (Table D2). Results are very similar.

[38]In detail, we proceed as follows. First, for each 8-digit product q, we calculate P, the share of spending on that product that is done through each purchase procedure j, in the year before the audit: $P_{q,j,t-1} = \frac{\sum_i \text{Spending}_{i,q,j,t-1}}{\sum_j \sum_i \text{Spending}_{i,q,j,t-1}}$, where i denotes a given entity and purchase procedures are direct contracting, auctions and other. $P_{q,j,t-1}$ are constant across entities. We then compute for each entity i the share of spending on product q out of total spending by that entity in year t: $S_{i,q,t} = \frac{\text{Spending}_{i,q,t}}{\sum_q \text{Spending}_{i,q,t}}$. Our new outcome variable is then the expected spending share by entity i through purchase procedure j, based on the actual product mix in year t and procedure shares of these products in year *t-1*: $Y_{i,j} = \sum_q S_{i,q,t} P_{q,j,t-1}$.

and D4 show that there was no systematic shift at any of these levels of disaggregation. Second, we test the robustness of the impacts on procurement procedures using a subset of products which have a meaningful choice of purchase procedure, i.e. where not almost all of the purchases of this product are made through one procedure. Appendix Table D5 shows that the impact on purchase procedures is very similar for these products as well.

Another question that might arise is whether the shift in procurement procedures might stem from a change in total spending. Table A7 shows that this is not the case.[39] Finally, to understand the relevance of the procedure shift it is also interesting to look at the size of the affected contracts. Are the effects concentrated on relatively small purchases for which using an auction may not be worthwhile? Table A8 shows that on the contrary, the shift seems to stem mostly from contracts of above-average size.

6 Effects on Competition, Suppliers and Prices

6.1 Competition

One reason many governments promote auctions over direct contracting is that auctions are believed to be more competitive. However, a move from auctions to direct contracting does not necessarily imply a decrease in the number of competitors, since some auctions only attract a small number of bidders and certain direct contracts require 3 quotes from different firms. If the reduction in auctions stems mainly from auctions with few bidders, while the increase in direct contracting stems mainly from cases requiring three quotes, the number of competitors involved might not actually fall or could in principle even increase. Table A9 presents regression results estimating the impact on auctions and direct contracts with high vs. low number of competitors. Following the Procurement Agency's assessment, we classify an auction as competitive if it has more than 3 bidders. Panels A and B show that most of the shift goes from competitive auctions to direct contracts requiring only 1 quote. The reduction in auction share is, if anything, larger among auctions with more than 3 bidders.

[39]It is not surprising that total spending remains unchanged, since Chilean legislation does not allow entities to deviate substantially from their budget.

At the same time, the entire increase in direct contracts stems from purchases based on only one quote. Overall, there is a reduction in the share of purchases made through a competitive process (more than 3 competitors) by 5 to 8 percentage points.

6.2 Type of Suppliers

One important measure of whether there were real economic impacts beyond the reduction in the number of competitors is whether this affected the type of supplier that won contracts. Less competition might benefit incumbent firms with prior contracts with the procuring entities (Coviello et al., 2018), smaller firms that might not be able to compete in an open competition and local suppliers who might have more connections with the procuring entities (Lewis-Faupel et al., 2016). When analyzing effects on the type of suppliers that win the contracts, an additional assumption is required to attribute these effects to the procedure shift: that the audits do not have a direct effect on these outcomes. Specifically, being audited cannot induce public entities to sell more to incumbent, small, and local firms for other reasons than the shift from auctions towards direct contracts. A similar assumption is required for the analysis of impacts on prices in the next subsection. While this is not testable, if anything, it would seem plausible to expect the direct effect of an audit to go in the opposite direction (consistent with findings by Colonnelli and Prem, 2021).

Table 6 displays impacts on supplier characteristics. Panel A shows a reduction for new suppliers that have not sold to this entity before (within the 4 preceding years for which we have data). Their probability to win a contract falls by 2.4 to 4.6 percentage points. This is quite substantial compared to the baseline probability of around 17%. The coefficient is statistically significant for three out of our four main specifications. Panel B shows that the probability of large firms winning contracts also falls by between 4.8 and 7.2 percentage points from a baseline of around 30%.[40] The effect is significant at the 1% or 5% level. Finally, Panel C analyzes the impact on suppliers from another region. The chance of suppliers to win a government contract falls by between 3.4 and 6.5 percentage points from

[40]The Chilean tax authority officially classifies firms with over about USD 4 million in sales as large.

a baseline of around 45%, significant at the 5% to 10% level.[41]

Overall, these results show real impacts on suppliers who compete to win government contracts. The fact that the shift away from auctions came with an increase of contracts given to small, local, incumbent suppliers is consistent with the view that direct contracting facilitates favoritism of insiders with special connections to the procuring entity.

6.3 Prices

The shift towards less competition and more incumbent, small, and local suppliers raises the question whether this leads to higher prices. However, measuring impacts on prices is notoriously difficult, and we will have to restrict this analysis to a small subgroup of products for which this is possible. There are three challenges in this regard. First, for many purchases there are no clear units of measurement in the data. Purchase orders may contain measures such as "a sack of rice", "a month's supply of gas", or a "training workshop in IT". Such vague units do not allow for a reliable comparison of prices. We therefore have to restrict the analysis to purchases with clear units of measurement such as meters, liters, or kilograms. This leaves about 7.6% of the total number of purchases and 2.2% of the value of purchases.[42] This price analysis therefore does not necessarily generalize to other types of purchases. Impacts on purchases without comparable units, such as many services, may be different. In particular, selection criteria for such purchases are typically more difficult to specify ex-ante, making it more challenging to procure them efficiently through auctions.

The second challenge is that when we implement the RDD among products with clear units of measurement, there is no significant overall shift in purchase procedure. This may be expected, since these products are more standardized and therefore more likely to be always purchased through the same procedure, including framework agreements. To be able

[41]The analysis by region excludes entities in the Metropolitan Region (RM), since a large part of the Chilean economy is based there, so that the vast majority of purchases by entities in that region are from firms in the same region. This analysis therefore focuses on purchases from entities in other regions, for which it is more likely that competitive suppliers exists outside the region. Table A10 shows results including entities from RM. As expected, estimates are much smaller.

[42]The biggest categories among the purchases with comparable units of measurement are foods, fuel and hardware. The biggest category of purchases with non-comparable units are services (60% of the value).

to analyze a sample in which there actually is a shift in procurement procedure, we do the following. First, we run RDD regressions for each product to estimate the shift in the auction share. We then divide products into two groups: those with above-median and those with below-median absolute size of procedure shifts. The analysis of the impact on prices focuses on the former group. In the below-median effect group, as expected, we find no effect on prices.[43] Third, while we control for 8-digit product fixed effects and focus on products with comparable units, we cannot control for potential unobserved quality differences. It is possible that having more discretion when using direct contracts, purchasing officers choose supplies with unobserved higher quality. At the same time, it is important to remember that auctions in Chile are not first price, but scoring auctions, which allow purchasing entities to award contracts based on points for quality and previous supplier experience as well.

Table 7 shows the impact on prices based on these considerations. It presents RDD estimates on the log of unit prices in the sample of products with comparable units and above-median procedure shift (which includes 22,066 to 44,612 observations, depending on the bandwidth). Prices increase quite substantially, by about 10% to 15%, statistically significant in three out of the four specifications.

Overall, the results of Section 6 show that the audits had real economic effects on public procurement. First, there is a significant reduction in competition: We see a particularly strong shift away from auctions with more than three bidders and towards direct contracts that only require one quote. Second, we find that there is not only a change in the procedure, but also an impact on the type of firms that end up winning the contracts: More contracts are awarded to incumbents that have sold to the same entity before, as well as to small and local firms. Finally, we also find a substantial increase in prices within the subset of

[43]The median effect on auctions is a reduction of 30% in the group with above-median shifts and an increase of 7% in the group with below-median shifts. See Online Data Appendix A for a detailed description of the steps involved in this analysis. For the results in Table 7, we implement this process using entities in the ± 4 bandwidth. As a robustness check, Table A11 shows the results for purchases selected using entities in the ± 10 bandwidth. The estimates are quite similar.

products for which we can compare prices and for which there is a sizeable shift towards direct contracts. Given these effects, the distortion in purchase procedures resulting from the audits is likely more than just an innocuous bureaucratic change, but a shift in how public funds are spent with tangible welfare implications.

7 Mechanisms

7.1 Differential Scrutiny of Auctions and Direct Contracts

In order to gain a better understanding of the mechanisms that could lead to the impact of audits on the purchase procedure, we worked with the Comptroller to collect more detailed data through additional audits, as described previously. This allows us to compare the audit process for purchases made through auctions with those made through direct contracts.

Figure 5 displays the number and type of checks and detected infractions by whether a purchase was done through auction or direct contracting. The left-hand set of bars in Panel A show that purchases made with direct contracts undergo around 19 checks on average. In contrast, contracts made through auctions undergo about 32 more checks, for a total of almost 51 checks on average, 2.7 times as many as direct contracts.

As discussed in Section 4.2, we deal with the potential differences in the type of contracts for which auctions and direct contracts are used in two ways. First, we add purchase-level controls for the amount of the purchase and product codes, month of purchase, responsible internal unit, and month of the audit. Table A12 in the Appendix shows the same analysis as in Figure 5 in regression form, both with controls (Panel A) and without (Panel B). The number of additional checks for auctions is 31.67 with controls and 31.74 without. Reassuringly, the results thus change very little, while the R-squared increases substantially to over 0.9, which does not leave much room for bias from unobserved factors.

Second, we analyze impacts separately for the contract awarding stage (which is directly affected by the purchase procedure) and the execution stage. The middle and right-hand set of bars in Panel A show the number of checks separately for these stages. About 90% of

the difference in the number of checks between purchase procedures stems indeed from the awarding stage. The number of checks in the awarding stage is 4.9 times larger for auctions than for direct contracts. This suggests that the bulk of the difference is related to differences in the procurement procedure.[44] If the difference in the number of checks resulted from other unobserved factors, such as project complexity, this would be expected to also lead to more checks in the contract execution stage. Again, adding the control variables changes point estimate very little: Without controls, the number of additional checks in the awarding stage is 28.29, with controls it is 28.54, while the R-squared increases substantially to 0.93.

Next, we analyze whether the higher number of checks results in more detected infractions. The left-hand set of bars in Panel B show that purchases via direct contracts have an average of 1.8 detected infractions. Purchases by auction have 2.7 additional detected infractions. The middle- and right-hand set of bars in Panel B show detected infractions separately for the awarding and the execution stage. Over 80% of the difference in detected infractions stems from the awarding stage. Table A12 shows all these results in regression form. In addition, Column (7) displays the probability of a contract having a detected infraction so serious that it is marked for a formal follow-up investigation to determine individual responsibilities and sanctions for the infraction. The likelihood of such a follow-up investigation is twice as high for auctions as for comparable direct contracts (24% vs. 12%).

Undergoing an audit therefore allows procurement officers to update their beliefs about the audit protocol and the consequences of an audit. In particular, they learn that using an auction implies a higher likelihood of detected infractions and follow-up investigations compared to using a direct contract for a similar purchase. Next, to understand the implications of this difference between direct contracts and auctions, we analyze procurement officers' beliefs about the consequences of detected infractions.

[44]The few additional checks in the execution stage could either be a result of auditors conducting more checks in the execution stage in cases where they find more infractions in the awarding stage, or it could be due to remaining unobserved differences.

Beliefs about Consequences of Detected Infractions: Given the higher number of detected infractions for auctions vs. direct contracts, the question arises whether the consequences are severe enough to cause officers to change their behavior. We investigate this question in our procurement officer survey from two angles: 1) we ask about the types of consequences of detected infractions for the responsible procurement officers, and 2) we elicit the perceived severity of such consequences. (For details, see Appendix E.)

First, respondents were asked about the consequences of detected infractions for the responsible procurement officers.[45] Figure E1 shows the percentage of respondents who indicated that a given consequence was very likely. While much of the analysis of deterrence from audits—building on the seminal model of crime by Becker (1968)—has focused on formal sanctions, these results show that other consequences can play an important role, including career concerns, social-image concerns and self-image concerns. In terms of career concerns, 45%, 66% and 28%, respectively, say that impacts on the professional career, reprimands by supervisors and work-place harassment are very likely. Regarding social image concerns, over half say that detected infractions are very likely to affect the professional prestige and about one third indicate this for shame vis-à-vis the supervisor. About half of respondents believe they would very likely experience personal feelings of inadequacy. Almost everyone agrees that there would likely be additional work. In contrast, less than 20% indicate that penal sanctions, demotions or dismissals are very likely.

The question then arises how severe such consequences are for the affected officers. To quantify the perceived severity, we used a vignette approach. Officers were asked to indicate for a number of situations how bad they would be for them on a scale from 0 to 10. The first scenario is about the detection of the type of infractions for which our study audits showed a higher likelihood for auctions, while the other vignettes involve financial losses. Our analysis reveals that officers perceive the consequences of the type of infractions detected in our study

[45] We created this list of potential consequences based on extensive piloting of the survey, which included open answers, qualitative interviews, as well as points raised by referees.

audits as severe. Figure E2 shows that 73% of officers rank the consequences of the detected infractions as equally severe or more severe than a salary reduction of 5%, and 84% do so regarding a 5% additional expense in the coming month.

Overall, these findings show that purchases made through auctions are subject to more scrutiny than those via direct contracts. Procurement officers who follow the government's new recommendation and use auctions for their purchases are therefore more likely to be found incompliant in an audit compared to those who use more direct contracts. As a result, this mechanical "auditing by checklist" approach may inadvertently discourage the use of auctions. In our setting, it is likely that procurement officers update their beliefs on how audits are implemented because the government recently changed its stance on the importance of auctions and indicated that it would more vigorously enforce the use of auctions rather than direct contracts. Procurement officers who realize that the current auditing protocol leads to relatively more scrutiny for auctions compared to otherwise similar direct contracts may choose to reduce their use of—already more work-intensive—auctions and increase the use of direct contracts instead. More generally, mechanically checking each step of a regulation, as is done in many types of audits, may disincentivize the use of processes that involve more steps and leave a longer paper trail.

7.2 Alternative Explanations

Does the Subsequent Audit Probability Fall? One alternative hypothesis we originally considered was a change in the subsequent audit probability. Specifically, entities might increase the use of direct contracts in year t if the likelihood of an immediate re-audit in year t+1 were low, and contracts awarded in year t would therefore be less subject to scrutiny. However, both administrative data and survey evidence show that this is not the case. As Table A13 shows, the audit probability in year t+1 is not lower to the right of the cut-off, but if anything even slightly higher (not statistically significant).[46]

[46]The overall probability that an entity in our sample which is audited in year t is audited again in year t+1 is 44% in the ±4 bandwidth, and 49% in the ±10 bandwidth, (while the unconditional audit probability in year t is 25%). Note that these are not the overall audit probabilities in the country, but those of entities

The survey evidence also reveals that the vast majority of officers are aware that the scrutiny does not fall after an audit. Only 4.2% of respondents believe that contracts made during the year of an audit are less likely to be audited because the subsequent audit probability falls in the year after an audit.[47]

Congestion: Another hypothesis we originally considered was that audits might increase the workload for officers to the point that they fall behind on procurement work, leaving them with less time to implement auctions and leading them to resort to direct contracting. However, both qualitative interviews and survey evidence revealed that this hypothesis was unrealistic. Officers reported that the audits were only minimally disruptive to their work, since there was minimal interaction with the auditors and all that was required of them was to provide the auditors with the documentation of past procurement processes. In the procurement officer survey, we elicited information about the time burden of audits and potential delays. The median number of hours over the entire auditing process was 5. Not surprisingly, given this limited time burden, less than 4% of procurement officers said that this ever resulted in delays leading to the use of a direct contract with emergency justification (the main type of direct contract for which we see an increase).

8 Conclusion

This paper investigates the role of audit design in the context of public procurement in Chile. We first analyze the impacts of government audits on subsequent procurement practices. Contrary to the official policy goal, audits led public entities to reduce the use of public auctions and correspondingly increase the use of the less transparent and less competitive purchase procedure of direct contracting. The increase is concentrated among direct

considered "medium-risk''. The audit probability of "low-risk'' entities is close to zero.

[47]This is consistent with statements made in focus groups and qualitative interviews we conducted in 2014–15 with both procurement officers at over twenty public entities and auditors at the Comptroller Agency. Both procurement officers and auditors asserted that it would be unreasonable for procurement officers to expect less scrutiny following an audit for two reasons: First, they (correctly) asserted that the audit probability was not lower in the year following an audit. Second, even if the audit probability were to temporarily fall, that would not leave entities "protected" from scrutiny, since audits typically covered contracts from several prior years.

contracts justified by emergency, which are particularly prone to overuse and only require a quote from one firm. At the same time, there is a large reduction in auctions with more than 3 bidders, so the overall competitiveness of the procurement process falls. The reduction in competition seems to have had real economic impacts, hurting new, large, and out-of-region suppliers, who are less likely to win the contracts. This type of favoritism risks undermining entrepreneurship and innovation, as it creates barriers for new entrants. In addition to the effect on suppliers, we also find suggestive evidence of a price increase in the subset of products with clear units of measurement and for which there is a substantial shift from auctions to direct contracts.

To shed light on the underlying mechanisms, we worked with the Comptroller to collect more information through additional audits. Results from these audits show that holding the amount and type of purchase constant, auctions undergo about 2.7 times as many checks as purchases through direct contracts, and lead to twice as many detected infractions and follow-up investigations. The effects are concentrated in the awarding stage of the procurement process, where the purchase procedure makes a big difference, rather than in the contract execution stage, where the process is similar, independent of the purchase procedure.

When procurement officers realize—as a result of undergoing an audit—that they are more likely to be called out for infractions when using auctions, it can discourage them from using this purchase procedure even though the regulation aims to promote it. This pattern points to a more general issue: When audit protocols follow a simple checklist approach, which is standard in many settings, more heavily regulated processes with more steps, which leave a longer paper trail, may mechanically lead to more checks during an audit. If agents risk making a mistake in any given step of the process, procedures involving more steps will lead to a higher probability of being found to be incompliant. This can create unintended distortions.

Avoiding such distortions is a big challenge for anyone designing audit systems—both

in the public or private sector—when audit protocols differ by procedure and when agents have some discretion over the choice of procedure. All else equal, institutions may want to equalize the expected cost of being audited across the different procedures. To set correct incentives and counterbalance the fact that some processes involve more auditing checks, they may consider adjusting a) the audit protocol, b) procedure-specific audit probabilities, or c) penalties. In the case of procurement this could mean a) equalizing the number of checks across different purchase procedures by sampling only a subset of steps from the lengthy auction procedure, or focusing in more depth on the key step involved in using a direct contract, i.e. the validity of the justification given for the use of this procedure; b) increasing the overall audit probability for purchases awarded through direct contracting or for entities with higher use of direct contracts;[48] or c) increasing the penalties for overuse of direct contracts or for infractions committed in direct contracts compared to auctions.

Overall, these results suggest that it is key not to think of audits merely as "neutral" verification and information extraction mechanisms, but to carefully consider potential impacts and incentives created by the specifics of the audit design. This is in line with a growing number of findings showing that details of institutional design can have important impacts (Duflo, 2017). Given the widespread use and important functions of auditing, the audit design can have fundamental consequences for the functioning of the state and the private sector. While there is a large literature related to audit probabilities and detection risk, little economic research has focused on the incentives created by the audit design itself. Audit procedures are often developed by lawyers and administrative specialists. Getting economists involved in audit design promises high returns.

[48]This was, in fact, one of the policy changes the Chilean Comptroller implemented in response to the findings of this study.

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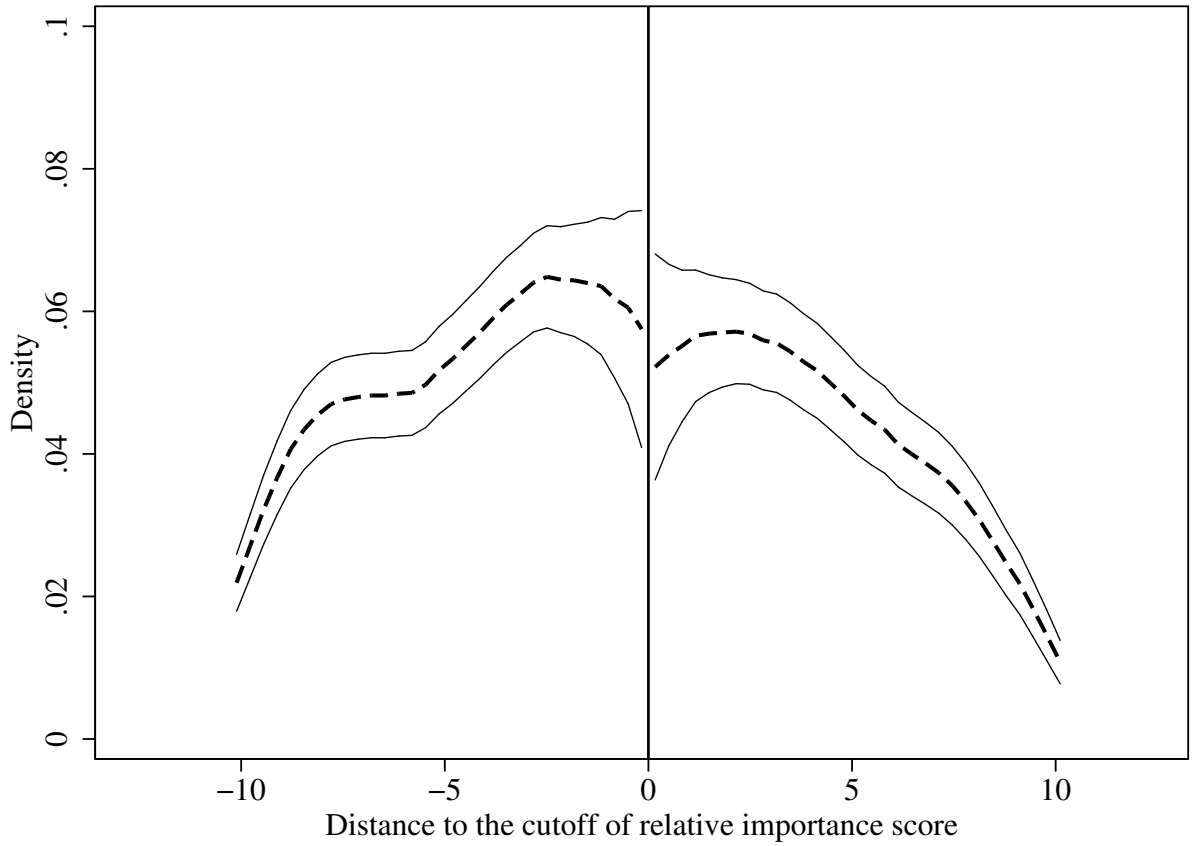
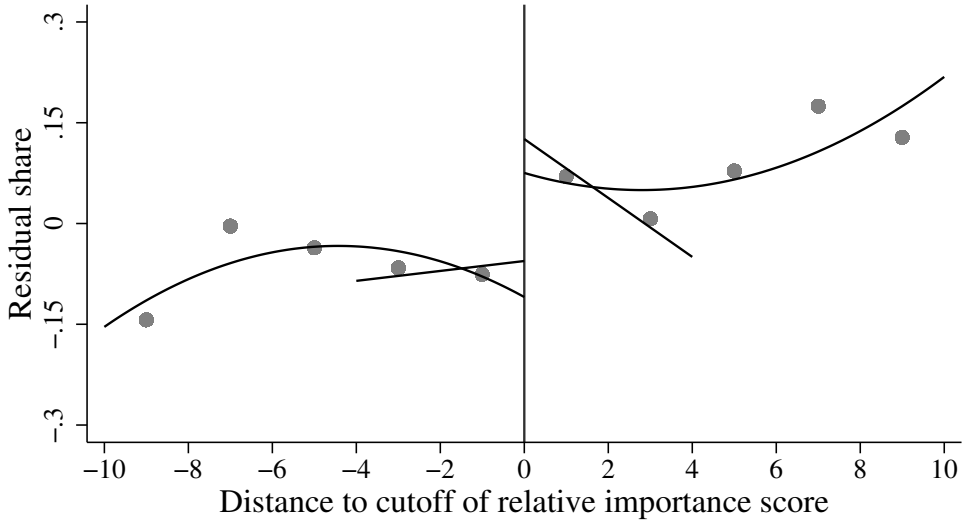
Figure 1:
McCrary Density Test



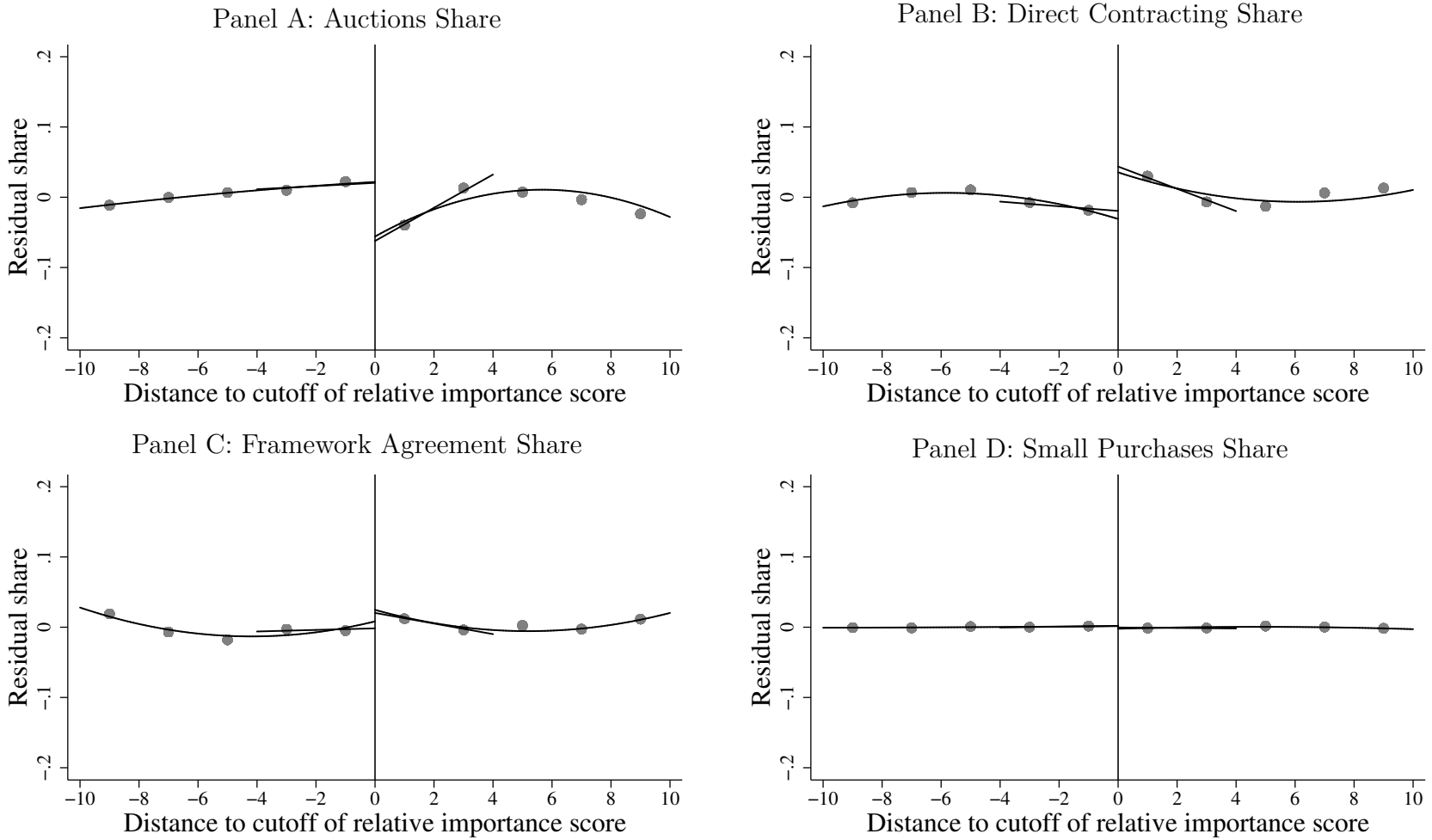
Notes: This figure shows the McCrary density test (McCrary, 2008) to analyze whether there is systematic bunching on one side of the cut-off. The dashed line indicates the density estimate, the solid lines show the 95% confidence interval. The estimated log difference in the heights at the cutoff is -0.1 and it has a standard error of 0.2. The analysis includes the pooled sample of entities in 2011-2012 with medium level of risk in the ± 10 range around the cutoffs of the importance score used in our main analysis. Zero indicates the cutoff at the stratum level. A stratum refers to a cell defined by year and internal unit.

Figure 2:
Residual Share of Audited Entities (First Stage)



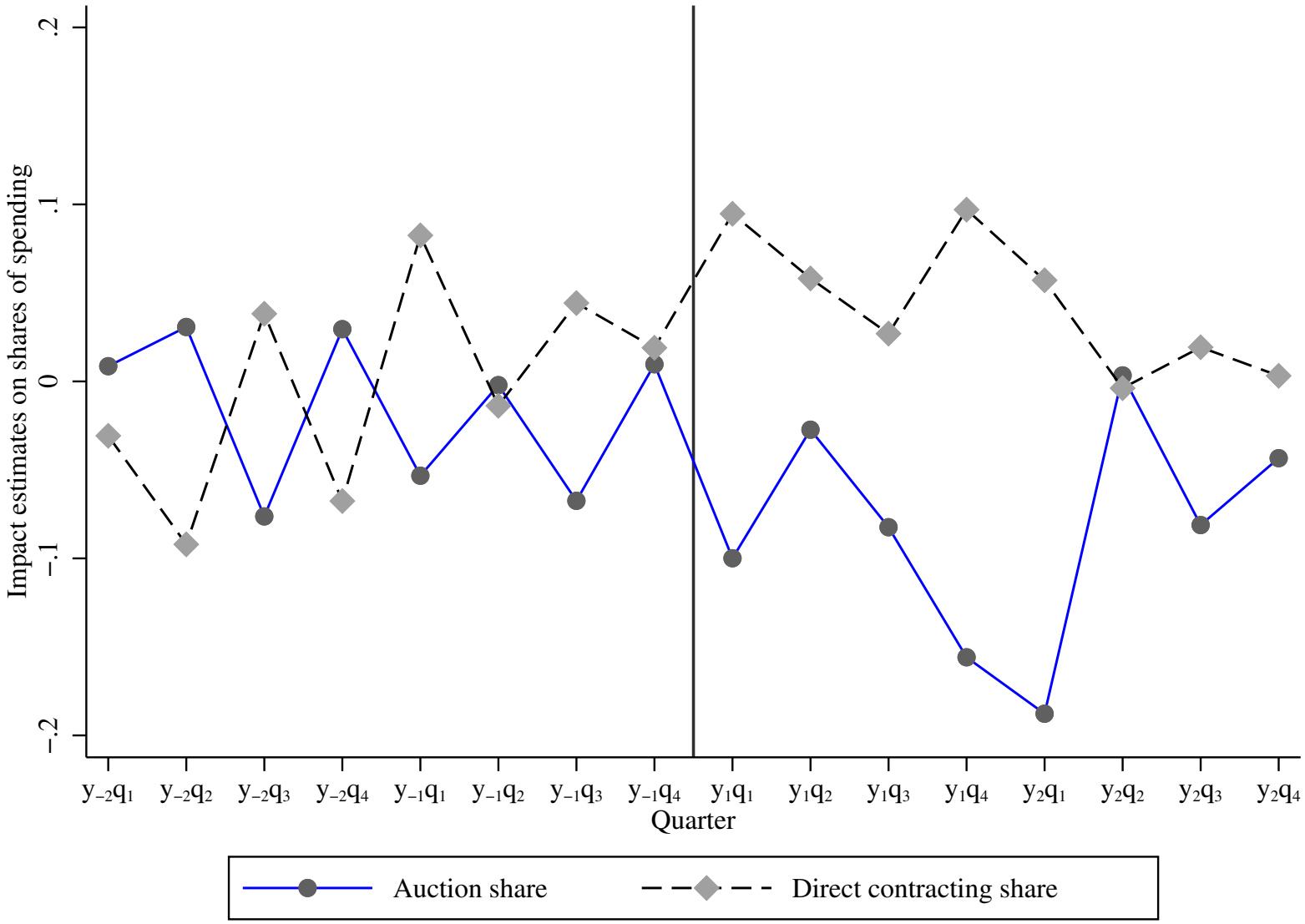
Notes: This figure shows the share of audited entities with medium level of risk in the ±10 range of the importance score for the years 2011 and 2012. The dots represent residual audit probabilities averaged within 2-point-wide intervals of the importance score. The residuals are obtained from a regression of the dummy for having been audited in a given year on stratum fixed effects and control variables. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Importance scores are normalized by stratum-level cutoff. A stratum refers to a cell defined by year and internal unit. Solid lines show linear and quadratic fits. Appendix Figure A6 shows the same with 1-point-wide intervals.

Figure 3:
Share of Spending by Purchase Procedure



Notes: This figure shows the value of purchases made through auctions (Panel A), direct contracting (Panel B), framework agreement (Panel C) and small purchases (Panel D), as a share of total procurement spending by a given entity with medium level of risk in the ±10 range of the importance score threshold for the years 2011 and 2012. The dots represent residual procedure shares averaged within 2-point-wide intervals of the importance score. The residuals are obtained from a regression of the outcome in a given year on stratum fixed effects and control variables. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, of auction and direct contract shares, and of the outcome variable (where different). The importance score for each entity is normalized by the stratum-level cutoff. A stratum refers to a cell defined by year and internal unit. Solid lines show linear and quadratic fits. Appendix Figure A7 shows the same with 1-point-wide intervals.

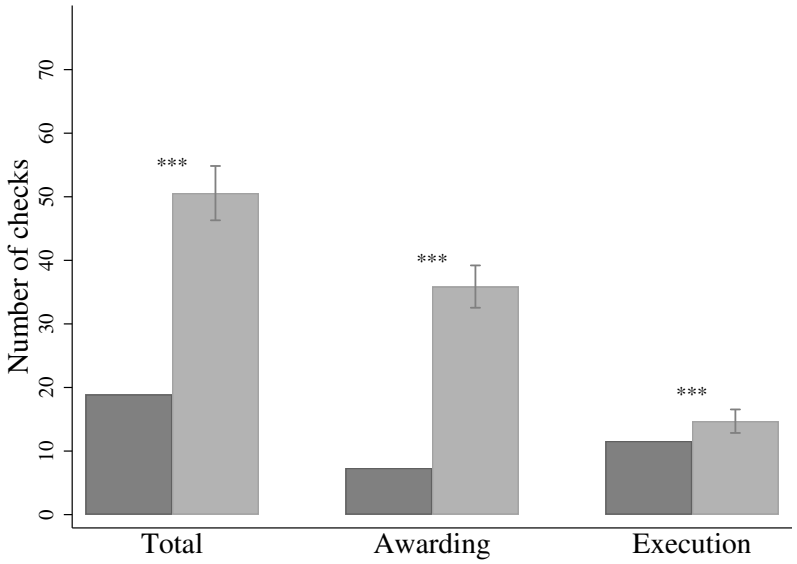
Figure 4: Impacts on Shares of Spending Through Auctions and Direct Contracting Over Time



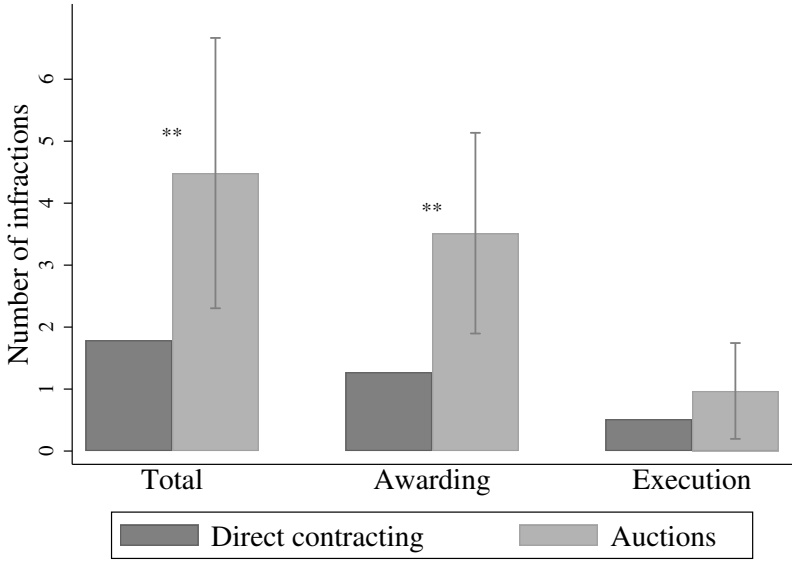
Notes: This figure shows the evolution of reduced form RDD estimates of impacts on auction and direct contracting shares over time, following Equation (2) on a quarterly basis. Coefficients plotted correspond to the bias-corrected estimates using the MSE-optimal bandwidth. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Period y_1q_1 corresponds to the first quarter of the treatment year.

Figure 5: Additional Audits: Checks and Infractions by Purchase Procedure

Panel A: Checks



Panel B: Detected Infractions



Notes: Panel A shows the number of checks per audited contract and Panel B shows the number of detected infractions. The left-hand set of bars displays the total number, the center bars show the number in the awarding stage, and the right-hand bars show the execution stage. The dark gray bars indicate mean numbers for direct contracts. The light gray bars show expected outcomes for auctions based on OLS regressions of the outcome on an auction dummy and controls for purchase amount, product, month of purchase, month of audit, and internal unit (as in Table A12 Panel B). The 95% confidence interval is based on the standard error of the difference estimate. Standard errors are clustered at the entity level. Appendix Figure A5 plots the same analysis without controls.

Table 1:
Summary Statistics

Purchase Procurement Procedure	(1) Amount in Millions of USD	(2) Share of Total Amount Purchased	(3) Number of Purchases	(4) Share of Purchases	(5) Average Number of Bidders/Quotes
			Panel A: Full Sample		
Auction	6,597	63.92%	4,350,037	50.81%	13.1
Direct contract	1,882	18.24%	1,285,021	15.01%	1.4
Framework agreement	1,803	17.47%	2,279,560	26.63%	
Small purchases	39	0.38%	646,932	7.56%	
			Panel B: Estimation Sample		
Auction	2,597	66.58%	1,827,455	52.76%	13.0
Direct contract	675	17.30%	482,816	13.94%	1.4
Framework agreement	613	15.72%	889,745	25.69%	
Small purchases	16	0.40%	263,575	7.61%	

Notes: The full sample consists of all 2,720 procuring public entity-years in 2011 and 2012. The estimation sample consists of the 1,002 public entity-years with medium risk whose normalized importance scores for the year in question was within the ±10 range of the cutoff. Column (5) shows the average number of bidders in auctions and the average number of required quotes for direct contracting.

Table 2:
Balance Test

	(1)	(2)	(3)	(4)	(5)	(6)
	Comparison mean (±4)	Discontinuity estimate (linear) (±4)	Discontinuity estimate (linear) (±4)	Comparison mean (±10)	Discontinuity estimate (quadratic) (±10)	Discontinuity estimate (quadratic) (±10)
Auctions share, t-1	0.656	-0.007	-0.026	0.695	-0.035	−0.048*
		(0.035)	(0.026)		(0.035)	(0.026)
Direct contracting share, t-1	0.146	0.050	0.023	0.123	0.050	0.036
		(0.032)	(0.026)		(0.033)	(0.026)
Framework agreement share, t-1	0.183	-0.044	-0.004	0.168	-0.021	0.004
		(0.029)	(0.021)		(0.030)	(0.022)
Log (+1) of total amount purchased, t-1	13.331	0.317	-0.123	13.244	0.096	-0.100
		(0.322)	(0.128)		(0.311)	(0.130)
Auctions share, t-2	0.694	0.009	-0.032	0.731	-0.005	-0.056
		(0.041)	(0.036)		(0.039)	(0.036)
Direct contracting share, t-2	0.128	0.020	0.004	0.111	0.019	0.025
		(0.028)	(0.030)		(0.032)	(0.029)
Framework agreement share, t-2	0.155	-0.028	0.021	0.138	-0.014	0.024
		(0.029)	(0.026)		(0.028)	(0.024)
Log (+1) of total amount purchased, t-2	13.176	0.233	-0.001	13.079	-0.001	-0.096
		(0.349)	(0.178)		(0.339)	(0.140)
Audited, t-1	0.187	0.042	0.002	0.163	0.085	0.067
		(0.069)	(0.055)		(0.074)	(0.069)
Right-wing	0.671	-0.047	0.107*	0.695	-0.092	-0.003
		(0.099)	(0.056)		(0.111)	(0.058)
Independent	0.108	0.069	0.011	0.103	0.071	0.049
		(0.052)	(0.042)		(0.057)	(0.043)
F-statistic		0.70	1.20		0.84	1.50
[p-value]		[0.744]	[0.278]		[0.596]	[0.124]

Notes: This table tests whether there is a systematic imbalance of covariates at the cutoff by running RDD analyses for each covariate as the outcome, as in Equation (2). Each coefficient in Columns (2)–(3) and (5)–(6) shows the result of a separate regression to test for discontinuity. Columns (2) and (3) show linear estimates in the ±4 range, without and with stratum fixed effects, respectively. Columns (5) and (6) display the corresponding quadratic estimates. The F-statistic is from a test of the joint hypotheses that all discontinuities in a given column are zero. Columns (1) and (4) show comparison means, i.e., estimated means to the left of the cutoff in the ±4 and ±10 range, respectively. Each observation is an entity-year. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table 3:
First Stage: Impact on Share of Audited Entities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Audit Probability							
1{Relative importance $\geq$ cutoff}	0.296***	0.203**	0.181**	0.299***	0.220**	0.193**	0.158**	0.183**
	(0.074)	(0.078)	(0.069)	(0.088)	(0.087)	(0.084)	(0.067)	(0.076)
Bandwidth	±4	±4	±4	±10	±10	±10	±6.53	±6.53
Observations	482	482	477	1,002	1,002	992	717	717
R-squared	0.035	0.311	0.396	0.050	0.276	0.354	0.403	0.403
Comparison mean	0.136	0.136	0.136	0.071	0.071	0.071	0.118	0.118
Local polynomial	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

Notes: First stage RDD estimates following the specification of Equation (1). Columns (1) to (3) show estimations for the ±4 bandwidth and Columns (4) to (6) for the ±10 bandwidth with varying number of control variables. Columns (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (8) in addition reports bias-corrected estimates and robust standard errors following Calonico et al. (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the level of the strata. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table 4:
Impact on Share of Spending Through Auctions and Direct Contracting

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Auctions				
1{Relative importance ≥ cutoff}	-0.065	−0.073*	−0.069**	−0.081**	−0.126***	−0.085***	−0.079***	−0.089**
	(0.045)	(0.043)	(0.032)	(0.038)	(0.036)	(0.027)	(0.030)	(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 ≥ cutoff}	0.087***	0.079**	0.061**	0.097***	0.109***	0.073***	0.069***	0.077***
	(0.032)	(0.037)	(0.028)	(0.032)	(0.038)	(0.025)	(0.024)	(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
Local polynomial	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

Notes: Reduced form RDD estimates following the specification of Equation (2). Columns (1) to (3) show estimations for the ±4 bandwidth and Columns (4) to (6) for the ±10 bandwidth with varying number of control variables. Columns (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (8) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table 5:
Impact on Product Level Share of Spending Through Auctions and Direct Contracting

	(1)	(2)	(3)	(4)
		Panel A: Auctions		
1{Relative importance ≥ cutoff}	−0.060**	−0.060**	−0.067**	−0.076**
	(0.024)	(0.025)	(0.028)	(0.033)
Bandwidth	±4	±10	±4.83	±4.83
Observations	189,771	387,337	229,585	229,585
R-squared	0.464	0.451	0.462	0.462
Comparison mean	0.614	0.651	0.627	0.627
		Panel B: Direct Contracting		
1{Relative importance ≥ cutoff}	0.057**	0.056**	0.056**	0.064**
	(0.022)	(0.023)	(0.025)	(0.029)
Bandwidth	±4	±10	±5.04	±5.04
Observations	189,771	387,337	239,492	239,492
R-squared	0.328	0.294	0.313	0.313
Comparison mean	0.151	0.117	0.141	0.141
Local polynomial	Linear	Quadr.	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes
8-digit product fixed effects	Yes	Yes	Yes	Yes

Notes: Reduced form RDD estimates following the specification of Equation (2). The dependent variable is the share of spending through auctions/direct contracts, respectively, out of total spending on a given product by a given entity. Column (1) shows estimations for the ±4 bandwidth and column (2) for the ±10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years), political affiliation, as well as first and second lags of $log(+1)$ of total amount purchased, and of auction and direct contract shares. Regressions are weighted using entity product shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table 6:
Probability That the Supplier Is New, Large or From Out-of-Region

	(1)	(2)	(3)	(4)
		Panel A: New Supplier		
1{Relative importance ≥ cutoff}	−0.043**	−0.046***	−0.024*	-0.026
	(0.017)	(0.017)	(0.014)	(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 ≥ cutoff}	−0.048**	−0.060***	−0.065***	−0.072***
	(0.019)	(0.017)	(0.021)	(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 ≥ cutoff}	−0.036*	−0.034*	−0.055**	−0.065**
	(0.020)	(0.017)	(0.027)	(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
Local polynomial	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: Reduced form RDD estimates following the specification of Equation (2). Each observation corresponds to a purchase. Results show impacts on the probability that the supplier has not sold to this entity in the preceding four years (Panel A), is a large firm (Panel B), or is from another region (Panel C). Panel C excludes procuring entities in the Metropolitan Region. Column (1) shows estimation for the ±4 bandwidth and Column (2) for the ±10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, first and second lags of log (+1) of total amount purchased and of auction and direct contract shares, as well as month and product-unit fixed effects. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

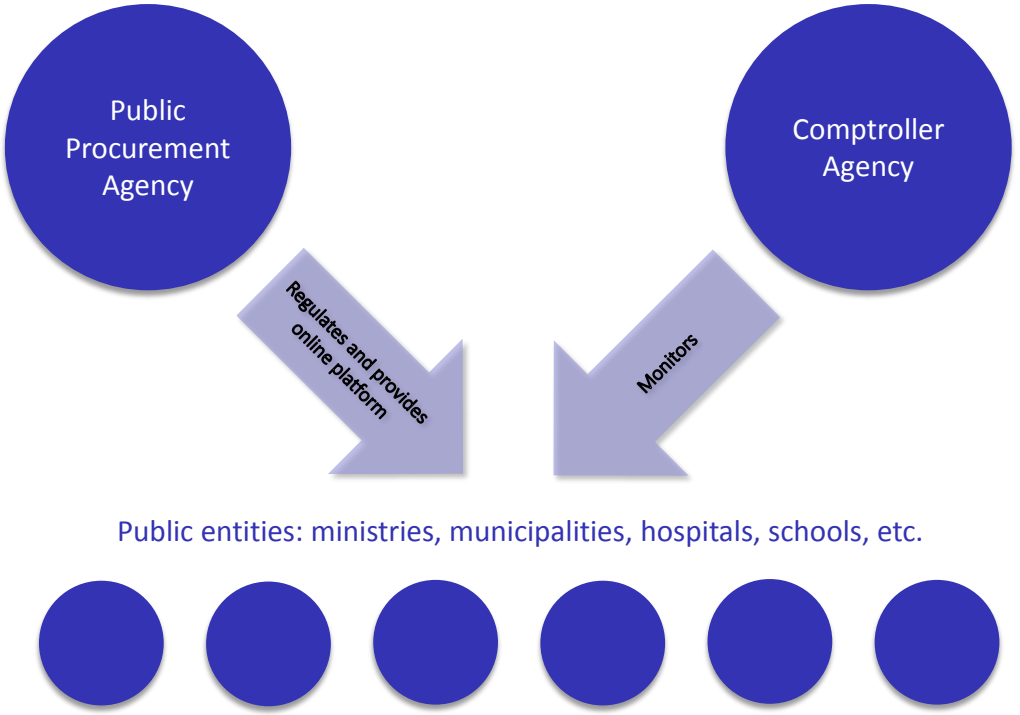
Table 7:
Impact on the Log of Unit Prices

	(1)	(2)	(3)	(4)
1{Relative importance $\geq$ cutoff}	0.113	0.148*	0.101**	0.137**
	(0.101)	(0.084)	(0.048)	(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
Local polynomial	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: Reduced form RDD estimates following the specification of Equation (2). Each observation corresponds to a purchase. Sample includes products with clear and comparable units and a sizeable shift in purchase procedure. Column (1) shows estimation for the ±4 bandwidth and Column (2) for the ±10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, first and second lags of log (+1) of total amount purchased and of auction and direct contract shares, as well as month and product-unit fixed effects. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year, internal unit and type of entity. ***p<0.01, **p<0.05, *p<0.1

A Appendix Figures and Tables

Figure A1:
Institutions in the Chilean Public Procurement Process



Notes: This figure shows the public entities involved in the procurement process. The Public Procurement Agency "ChileCompra" regulates the procurement process and provides the online platform. The Comptroller Agency "Contraloría" implements audits and other monitoring functions of all public entities. Public procurement is implemented by entities from small schools or hospitals to entire ministries.

Figure A2:
Timeline

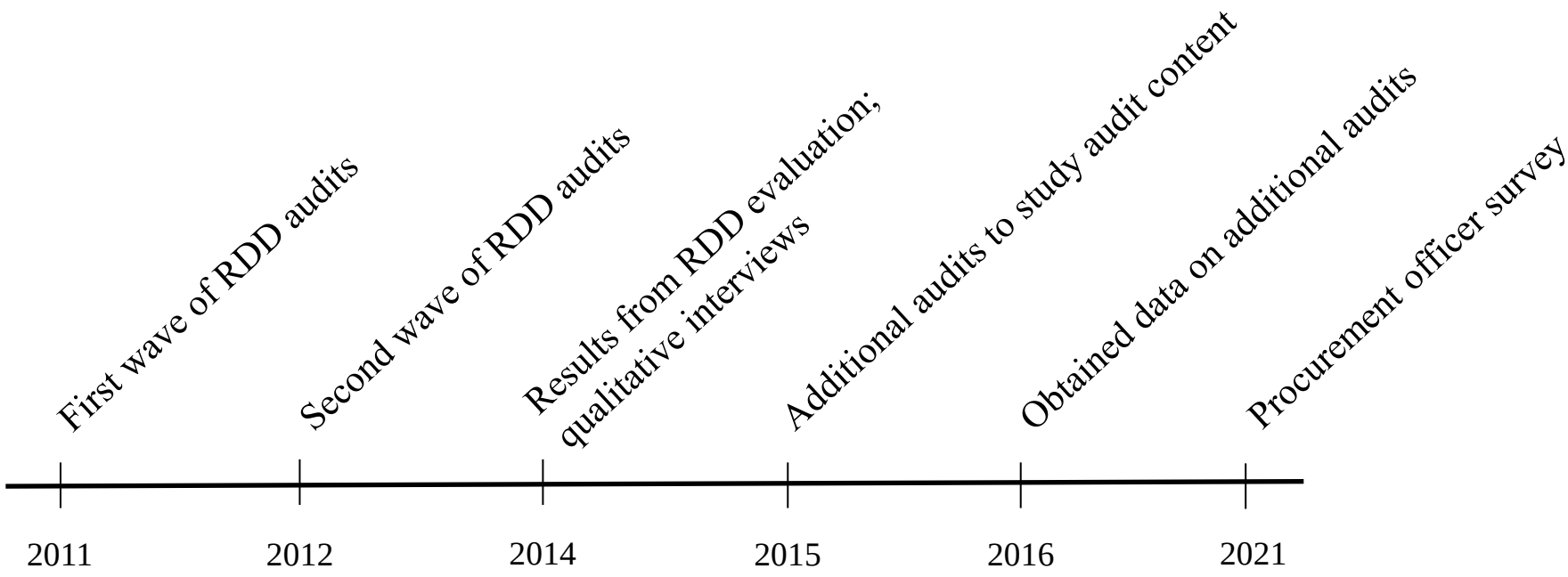
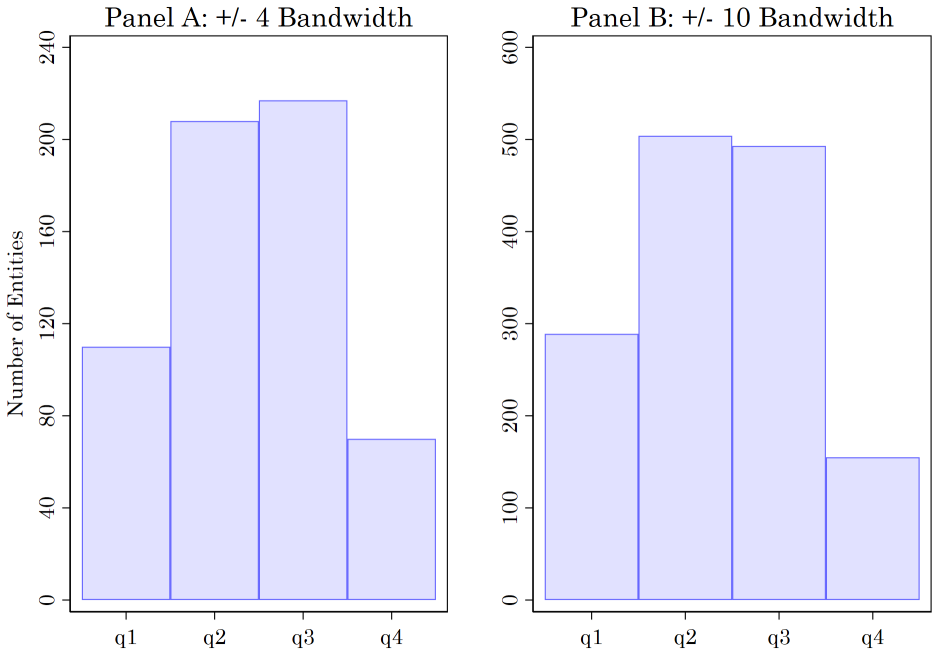
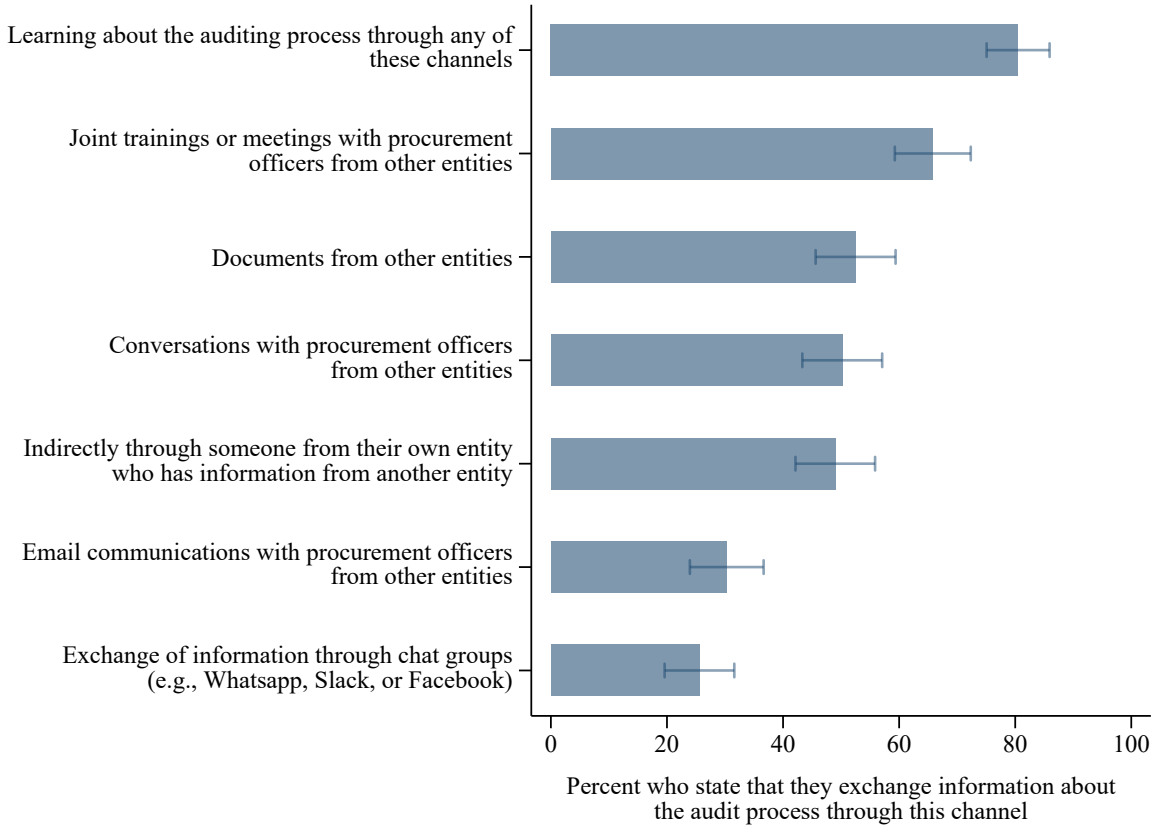


Figure A3: Number of Entities Under Audit by Quarter in Year t



Notes: This figure plots the number of entities under audit by quarter in year t (combining 2011 and 2012). Sample: medium risk entities in the ± 4 bandwidth and ± 10 range, respectively.

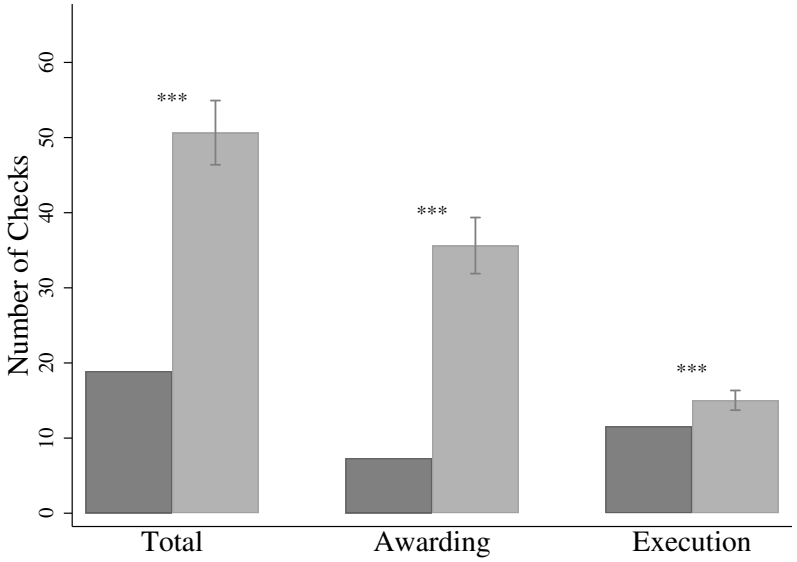
Figure A4:
Channels of Information Dissemination About the Auditing Process Between Public Entities



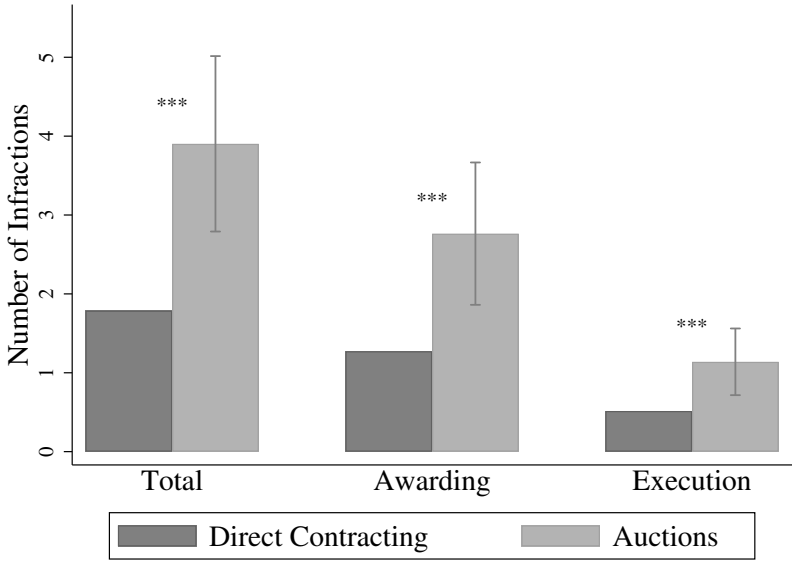
Notes: Survey responses on whether and how procurement officers exchange information about the auditing process with officers from other public entities. The figure shows the percentage who learned about the auditing process through a given channel (or any channel) with 95% confidence intervals.

Figure A5: Additional Audits: Checks and Infractions by Purchase Procedure Without Control Variables

Panel A: Checks

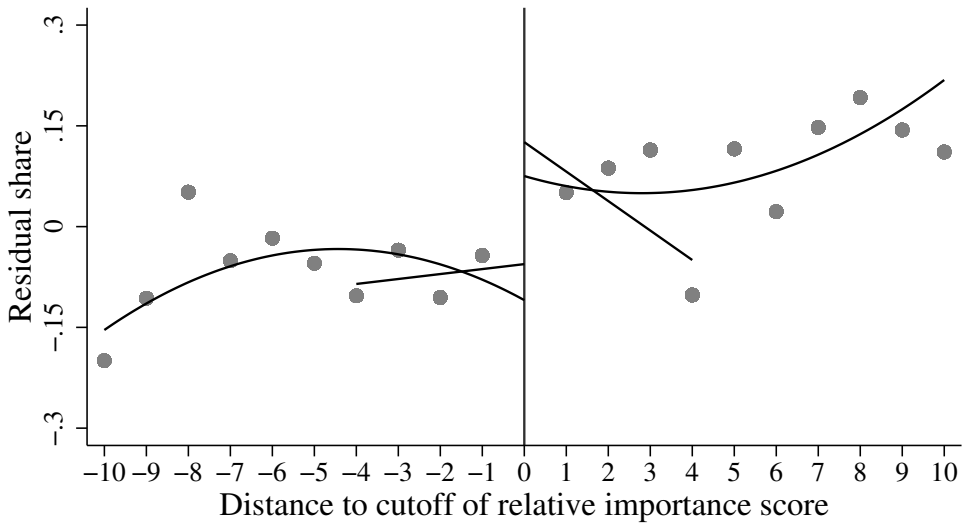


Panel B: Detected Infractions



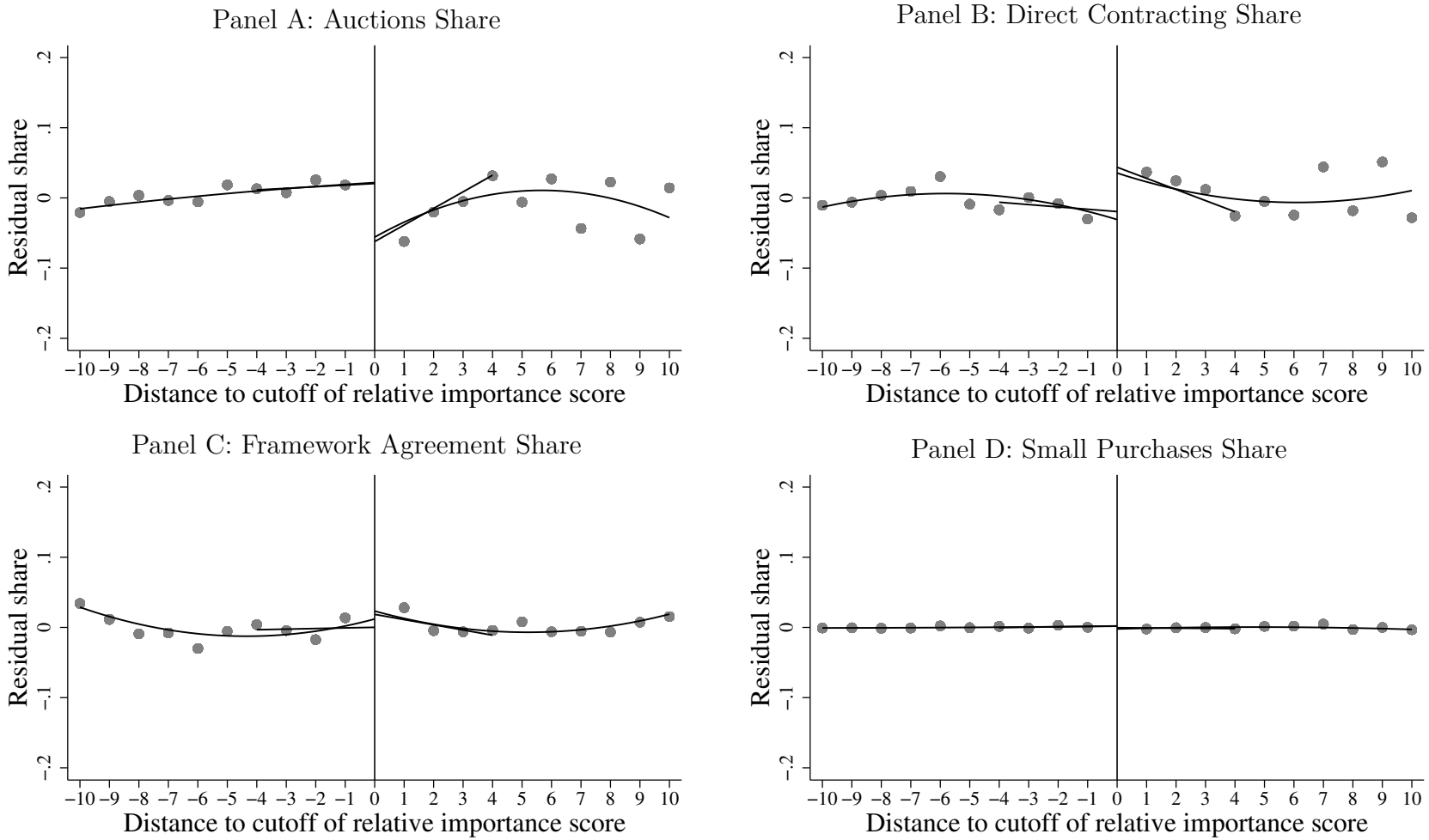
Notes: Panel A shows the number of checks per audited contract and Panel B shows the number of detected infractions. The left-hand set of bars displays the total number, the center bars show the number in the awarding stage, and the right-hand bars show the execution stage. The dark gray bars indicate mean numbers for direct contracts. The light gray bars show expected outcomes for auctions based on OLS regressions of the outcome on an auction dummy (as in Table A12 Panel A). The 95% confidence interval is based on the standard error of this adjusted difference estimate. Standard errors are clustered at the entity level. Figure 5 plots the same analysis with controls.

Figure A6:
Residual Share of Audited Entities (First Stage, One-Point Bins)



Notes: This figure shows the share of audited entities with medium level of risk in the ±10 range of the importance score for the years 2011 and 2012. The dots represent residual audit probabilities averaged within 1-point-wide intervals of the importance score. The residuals are obtained from a regression of the dummy for having been audited in a given year on stratum fixed effects and control variables. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Importance scores are normalized by stratum-level cutoff. A stratum refers to a cell defined by year and internal unit. Solid lines show linear and quadratic fits. Figure 2 shows the same with 2-point-wide intervals.

Figure A7:
Share of Spending by Purchase Procedure (One-Point Bins)



Notes: This figure shows the value of purchases made through auctions (Panel A), direct contracting (Panel B), framework agreement (Panel C) and small purchases (Panel D), as a share of total procurement spending by a given entity with medium level of risk in the ±10 range of the importance score threshold for the years 2011 and 2012. The dots represent residual procedure shares averaged within 1-point-wide intervals of the importance score. The residuals are obtained from a regression of the outcome in a given year on stratum fixed effects and control variables. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, of auction and direct contract shares, and of the outcome variable (where different). The importance score for each entity is normalized by the stratum-level cutoff. A stratum refers to a cell defined by year and internal unit. Solid lines show linear and quadratic fits. Figure 3 shows the same with 2-point-wide intervals.

Table A1:
Impact on the Share of Audited Entities (First Stage), Pooling Across All Four Potential Cutoffs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Audit Probability							
1{Relative importance $\geq$ cutoff}	0.159***	0.107*	0.103*	0.162**	0.114	0.119*	0.079*	0.087*
	(0.058)	(0.061)	(0.056)	(0.074)	(0.072)	(0.066)	(0.042)	(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
Local polynomial	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

Notes: RDD estimates following the specification of Equation (1). Columns (1) to (3) show estimations for the ±4 bandwidth and Columns (4) to (6) for the ±10 bandwidth with varying number of control variables. Columns (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (8) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the level of the strata. A stratum refers to a cell defined by year, internal unit and type of entity. Table 3 presents first stage results pooling across 2011 and 2012. ***p<0.01, **p<0.05, *p<0.1

Table A2:
Share of Spending Through Auctions and Direct Contracts
Interacting the Running Variable with Stratum Dummies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Auctions				
1{Relative importance ≥ cutoff}	-0.065	−0.092**	−0.089***	−0.081**	−0.110***	−0.083***	−0.086***	−0.095***
	(0.045)	(0.045)	(0.033)	(0.038)	(0.037)	(0.029)	(0.028)	(0.034)
Bandwidth	±4	±4	±4	±10	±10	±10	±5.16	±5.16
Observations	482	482	477	1,002	1,002	992	603	603
R-squared	0.030	0.456	0.675	0.016	0.329	0.628	0.630	0.630
Comparison mean	0.637	0.637	0.637	0.665	0.665	0.665	0.668	0.668
				Panel B: Direct Contracting				
1{Relative importance ≥ cutoff}	0.087***	0.081**	0.056**	0.097***	0.093**	0.062**	0.064***	0.072***
	(0.032)	(0.039)	(0.027)	(0.032)	(0.041)	(0.027)	(0.023)	(0.027)
Bandwidth	±4	±4	±4	±10	±10	±10	±5.30	±5.30
Observations	482	482	477	1,002	1,002	992	615	615
R-squared	0.043	0.367	0.604	0.017	0.183	0.576	0.575	0.575
Comparison mean	0.136	0.136	0.136	0.110	0.110	0.110	0.117	0.117
Local polynomial	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

Notes: Reduced form RDD estimates following the specification of Equation (2) and additionally interacting each stratum dummy with the distance to the cutoff. Columns (1) to (3) show estimations for the ±4 bandwidth and Columns (4) to (6) for the ±10 bandwidth with varying number of control variables. Columns (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (8) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year, internal unit and type of entity. Table 4 presents the same results without interactions. ***p<0.01, **p<0.05, *p<0.1

Table A3:
Impact on Share of Spending Through Auctions and Direct Contracting
Pooling Across All Four Potential Cutoffs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Auctions				
1{Relative importance ≥ cutoff}	-0.040	−0.072**	-0.041	-0.042	−0.082***	−0.037*	−0.038**	−0.041**
	(0.034)	(0.035)	(0.024)	(0.031)	(0.029)	(0.019)	(0.015)	(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 ≥ cutoff}	0.061**	0.057**	0.022	0.064***	0.068***	0.033*	0.032***	0.036**
	(0.025)	(0.028)	(0.021)	(0.023)	(0.025)	(0.017)	(0.012)	(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
Local polynomial	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

Notes: Reduced form RDD estimates following the specification of Equation (2). Columns (1) to (3) show estimations for the ±4 bandwidth and Columns (4) to (6) for the ±10 bandwidth with varying number of control variables. Columns (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (8) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year, internal unit and type of entity. Interaction between stratum and distance to the cutoff is included. Table 4 presents the same results for 2011 and 2012. ***p<0.01, **p<0.05, *p<0.1

Table A4:
Impact on Share of Spending Through Auctions and Direct Contracting, First Differences

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Auctions				
1{Relative importance ≥ cutoff}	−0.062*	-0.049	−0.069**	-0.046	−0.056*	−0.085***	−0.079***	−0.089**
	(0.036)	(0.035)	(0.032)	(0.032)	(0.032)	(0.027)	(0.030)	(0.036)
Bandwidth	±4	±4	±4	±10	±10	±10	±5.19	±5.19
Observations	480	480	477	998	998	992	604	604
R-squared	0.013	0.219	0.440	0.009	0.148	0.364	0.377	0.377
Comparison mean change	-0.018	-0.018	-0.018	-0.030	-0.030	-0.030	-0.025	-0.025
				Panel B: Direct Contracting				
1{Relative importance ≥ cutoff}	0.041	0.042	0.061**	0.047*	0.046*	0.073***	0.069***	0.077***
	(0.029)	(0.030)	(0.028)	(0.027)	(0.026)	(0.025)	(0.024)	(0.028)
Bandwidth	±4	±4	±4	±10	±10	±10	±5.05	±5.05
Observations	480	480	477	998	998	992	593	593
R-squared	0.008	0.258	0.425	0.009	0.145	0.341	0.404	0.404
Comparison mean change	-0.010	-0.010	-0.010	-0.013	-0.013	-0.013	-0.006	-0.006
Local polynomial	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

Notes: Reduced form RDD estimates following the specification of Equation (2). The outcome variable is the first difference of the share of spending through a purchase procedure. Columns (1) to (3) show estimations for the ±4 bandwidth and Columns (4) to (6) for the ±10 bandwidth with varying number of control variables. Columns (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (8) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. Table 4 presents the same results but without taking the first difference. ***p<0.01, **p<0.05, *p<0.1

Table A5:
Impact on Share of Spending through Auctions and Direct Contracting, Year 2

	(1)	(2)	(3)	(4)
		Panel A: Auctions		
1{Relative importance ≥ cutoff}	-0.039	-0.050	-0.044	-0.055
	(0.039)	(0.035)	(0.031)	(0.037)
Bandwidth	±4	±10	±5.48	±5.48
Observations	476	990	632	632
R-squared	0.544	0.495	0.478	0.478
Comparison mean	0.605	0.620	0.627	0.627
		Panel B: Direct Contracting		
1{Relative importance ≥ cutoff}	0.018	0.033	0.025	0.030
	(0.030)	(0.028)	(0.022)	(0.027)
Bandwidth	±4	±10	±6.25	±6.25
Observations	476	990	696	696
R-squared	0.514	0.433	0.451	0.451
Comparison mean	0.168	0.159	0.143	0.143
Local polynomial	Linear	Quadr.	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: Reduced form RDD estimates following the specification of Equation (2). Column (1) shows estimation for the ±4 bandwidth and Column (2) for the ±10 bandwidth with varying number of control variables. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lag of log (+1) of total amount purchased. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table A6:
Impact on Share of Spending Through Direct Contracting by Justification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unique Supplier				Emergency			
1{Relative importance ≥ cutoff}	0.012	0.012	0.015*	0.018**	0.042**	0.049***	0.044**	0.049**
	(0.009)	(0.008)	(0.008)	(0.009)	(0.018)	(0.017)	(0.018)	(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 ≥ cutoff}	-0.004	0.001	0.004	0.004	-0.001	-0.002	-0.001	-0.001
	(0.006)	(0.006)	(0.003)	(0.004)	(0.003)	(0.003)	(0.002)	(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 750 USD				Other			
1{Relative importance ≥ cutoff}	0.001	-0.004	-0.004	-0.005	0.008	0.021	0.015	0.017
	(0.005)	(0.004)	(0.004)	(0.005)	(0.017)	(0.018)	(0.016)	(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
Local polynomial	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

Notes: Reduced form RDD estimates following the specification of Equation (2). Columns (1) and (5) show estimations for the ±4 bandwidth and Columns (2) and (6) for the ±10 bandwidth. Columns (3), (4), (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Columns (4) and (8) in addition report bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, of auction and direct contract shares, and of the outcome variable. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table A7:
Impact on Log of Total Amount Purchased

	(1)	(2)	(3)	(4)
1{Relative importance $\geq$ cutoff}	-0.106	-0.033	-0.009	-0.002
	(0.134)	(0.109)	(0.062)	(0.076)
Bandwidth	± 4	± 10	± 10.45	± 10.45
Observations	477	992	1,019	1,019
R-squared	0.923	0.912	0.913	0.913
Comparison mean	13.667	13.522	13.856	13.856
Local polynomial	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: Reduced form RDD estimates of log (+1) of the annual amount purchased by the public entity following the specification of Equation (2). Column (1) shows estimations for the ± 4 bandwidth and Column (2) for the ± 10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year, internal unit and type of entity. ***p<0.01, **p<0.05, *p<0.1

Table A8:
Impact on Share of Spending Through Auctions and Direct Contracting by Size of Purchase

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Auctions							
	Below Mean Contract Amount				Above Mean Contract Amount			
1{Relative importance ≥ cutoff}	-0.001	-0.003	0.000	-0.004	−0.061*	−0.076***	−0.073***	−0.095**
	(0.005)	(0.004)	(0.004)	(0.004)	(0.033)	(0.027)	(0.028)	(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 ≥ cutoff}	0.003	0.001	0.001	0.002	0.056**	0.071***	0.063***	0.073**
	(0.005)	(0.004)	(0.004)	(0.004)	(0.027)	(0.025)	(0.023)	(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
Local polynomial	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

Notes: Reduced form RDD estimates following the specification of Equation (2). Panel A shows small vs. large purchases made through auctions (contract amount below vs. above the mean amount of all purchases by entity). Panel B shows the same for direct contracting. Columns (1) and (5) show estimation for the ±4 bandwidth and Columns (2) and (6) for the ±10 bandwidth. Columns (3), (4), (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012) for all purchase sizes combined (as in Table 4) so that it is constant for a given procedure. Columns (4) and (8) in addition report bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, of auction and direct contract shares, and of the outcome variable. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table A9:
Impact on Share of Spending Through Auctions and Direct Contracting
by 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 ≥ cutoff}	-0.051	-0.052	−0.073**	−0.084**	0.052*	0.061**	0.050**	0.058**
	(0.036)	(0.032)	(0.031)	(0.035)	(0.031)	(0.028)	(0.024)	(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 ≥ cutoff}	-0.044	-0.039	-0.028	-0.031	-0.005	-0.007	-0.002	-0.003
	(0.046)	(0.043)	(0.026)	(0.031)	(0.004)	(0.005)	(0.005)	(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
Local polynomial	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

Notes: Reduced form RDD estimates following the specification of Equation (2). Panels A to D show the impact on the share of spending through auctions with > 3 bidders, direct contracts that require only 1 quote, auctions with ≤ 3 bidders and direct contracts that require 3 quotes, respectively. Columns (1) and (5) show estimations for the ±4 bandwidth and Columns (2) and (6) for the ±10 bandwidth Columns (3), (4), (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Columns (4) and (8) in addition report bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, of auction and direct contract shares, and of the outcome variable. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table A10:
Probability That the Supplier Is From Out-of-Region,
Including Entities in the Metropolitan Region

	(1)	(2)	(3)	(4)
1{Relative importance $\geq$ cutoff}	-0.026	-0.016	-0.022	-0.032
	(0.019)	(0.018)	(0.022)	(0.027)
Bandwidth	± 4	± 10	± 3.90	± 3.90
Observations	1,141,996	2,442,604	1,126,069	1,126,069
R-squared	0.468	0.447	0.469	0.469
Comparison mean	0.407	0.422	0.401	0.401
Local polynomial	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: Reduced form RDD estimates following the specification of Equation (2). Each observation corresponds to a purchase. Results show impacts on the probability that the supplier has not sold to this entity in the preceding four years (Panel A), is a large firm (Panel B), or is from another region (Panel C) (not excluding the Metropolitan Region). Column (1) shows estimates for the ± 4 bandwidth and Column (2) for the ± 10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares, as well as month and product-unit fixed effects. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. Table 6 shows the same analysis without entities in the Metropolitan Region. ***p<0.01, **p<0.05, *p<0.1

Table A11:
Impact on the Log of Unit Prices

	(1)	(2)	(3)	(4)
1{Relative importance ≥ cutoff}	0.071	0.126*	0.062*	0.088*
	(0.084)	(0.074)	(0.037)	(0.049)
Bandwidth	±4	±10	±4.93	±4.93
Observations	27,671	54,899	35,381	35,381
R-squared	0.792	0.770	0.813	0.813
Comparison mean	0.374	0.401	0.504	0.504
Local polynomial	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: Reduced form RDD estimates following the specification of Equation (2). Each observation corresponds to a purchase. Sample includes products with clear and comparable units and a sizeable shift in purchase procedure. Column (1) shows estimations for the ±4 bandwidth and Column (2) for the ±10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares, as well as month and product-unit fixed effects. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. Table 7 shows the same analysis using entities in the ±4 bandwidth. ***p<0.01, **p<0.05, *p<0.1

Table A12:
Additional Audits: Checks and Infractions by Purchase Procedure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Checks			Infractions			Follow-Up Investigation
	Total	Awarding	Execution	Total	Awarding	Execution	
	Panel A: Without Control Variables						
Auction	31.74***	28.29***	3.45***	2.11***	1.49***	0.62***	0.09*
	(2.18)	(1.90)	(0.67)	(0.57)	(0.46)	(0.22)	(0.05)
Constant	18.91***	7.33***	11.58***	1.79***	1.27***	0.52***	0.12
	(1.36)	(1.32)	(0.50)	(0.49)	(0.42)	(0.16)	(0.07)
Observations	105	105	105	105	105	105	105
R-squared	0.692	0.757	0.166	0.076	0.056	0.066	0.011
	Panel B: With Control Variables						
Auction	31.66***	28.54***	3.12***	2.70**	2.24**	0.45	0.12
	(2.18)	(1.70)	(0.94)	(1.11)	(0.83)	(0.39)	(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	0.692	0.701	0.748	0.463	0.648

Notes: OLS estimations. Each observation is an audited purchase. The constant term captures the mean for direct contracts and the coefficient on "auction" measures the difference to direct contracts. Column (1) shows the total number of checks conducted. Columns (2) and (3) show the number of checks in the awarding and execution stages of the purchase, respectively. Column (4) shows the total number of infractions detected. Columns (5) and (6) show the number of infractions in the awarding and execution stages. Column (7) shows the probability of a formal follow-up investigation for serious infractions to determine individual responsibilities and sanctions. Panel B has one less observation since control variables were missing for that purchase. Standard errors are clustered at the entity level. ***p<0.01, **p<0.05, *p<0.1

Table A13:
Impact on the Share of Audited Entities in the Subsequent Year

	(1)	(2)	(3)	(4)
	Probability of Audit in Year 2			
1{Relative importance $\geq$ cutoff}	0.039	0.062	0.085	0.076
	(0.120)	(0.109)	(0.068)	(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
Local polynomial	Linear	Quadratic	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: RDD estimates following the specification of Equation (1). Column (1) shows estimation for the ± 4 bandwidth and Column (4) for the ± 10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

B Audit Protocol

Goal	Specific audit check	Stage

Auctions

1) Auction Call	1. Verify the existence of the mayoral (municipality) decree or resolution that approves the auction call.	Awarding
	2. Check the publication of the auction in the ChileCompra system.	Awarding
	3. Verify the existence of technical and administrative tender documents.	Awarding
	4. Verify that the tender documents are approved by mayoral decree or resolution.	Awarding
2) Verify that the call contains the minimums established in article 24 of Regulation No. 250	Verify that the call has at least:	
	1. Description of the good or service.	Awarding
	2. Name of the contracting entity.	Awarding
	3. Modalities and dates for the clarification of tender documents.	Awarding
	4. Date and time of receipt and opening of bids.	Awarding
	5. Amount and type of required guarantees.	Awarding
	6. Full name and email of the officer in charge of the procurement process.	Awarding
3) Verify that the bases contain at least the aspects referred to in article 20 and 22 of Regulation No. 250	Verify that the bases establish at least:	
	1. The requirements and conditions to be met by bidders.	Awarding
	2. The generic specification of goods or services to be procured.	Awarding
	3. The stages and deadlines for bidding and contracting.	Awarding
	4. The conditions, time and way of payment of the good or service contracted.	Awarding
	5. The deadline for the delivery of the good or service.	Awarding
	6. The nature and amount of guarantees, as well as how and when they will be restored.	Awarding
	7. The means to establish whether the supplier has outstanding balances with employees and dates by which they will be requested.	Awarding
	8. The designation of the evaluation committee.	Awarding
4) Analyze the tender documents and check whether they favor a given provider	Evaluate the tender documents and verify that they do not contain any features that favor a given provider, such as: technical conditions that only one provider can accomplish or tailored evaluation criteria.	Awarding
5) Presentation of the bids	Verify that the submission of bids is done according to what is stated in the tender document:	
	1. That they contain all the required documents, such as technical and administrative bids.	Awarding
	2. Validate the guarantee of seriousness of the offer in terms of amount, dates and validity.	Awarding
	3. That bid was presented within the deadline established.	Awarding
	4. That they are available in the ChileCompra system.	Awarding
6) Bid opening report and evaluation of bids	1. Verify that the following is accomplished:	
	a. Existence of a bid opening report.	Awarding
	b. Bid opening report is signed by the evaluation committee.	Awarding
	c. Verify that the deadlines (date and time) for the opening of technical bids as stipulated in the tender documents are met.	Awarding
	d. Verify that the deadlines (date and time) for the opening of economic bids as stipulated in the tender documents are met.	Awarding
	2. Check the following:	
	a. The existence of an evaluation report of the bids.	Awarding

	b. Check in the evaluation report that the designation of members of the evaluation committee is done according to the tender document.	Awarding
	c. Check that the evaluation report is endorsed by all the members of the committee.	Awarding
	3. Validate that the criteria used for selecting the winning bid are consistent with the tender document.	Awarding
	4. Verify that the awarded provider presents the best offer according to the parameters set out in the tender document.	Awarding
7) Committee for auctions greater than 1,000 UTM	1. Verify the existence of a committee for auctions higher than 1,000 UTM.	Awarding
	2. Verify that the administration has a mechanism for verifying that members of the evaluation committee do not present conflicts of interest.	Awarding
	3. Verify that the administration evaluates the financial situation and technical suitability of hired committee members.	Awarding
	4. Check the suitability of the members of the evaluation committee in terms of their professional qualifications or position in relation to the nature of the tender.	Awarding
8) Verify the existence of the declaration of kinship of providers	1. Verify that the administration has a control mechanism to prevent people linked by kinship with senior officials of the entity to be hired.	Awarding
	2. Verify that the administration evaluates the financial position and technical expertise of hired personnel.	Awarding
	3. Verify that the administration has a procedure to verify that it has not hired people convicted for anti-union practices or for violating fundamental rights of workers.	Awarding
9) Awarding and contract signing	1. Verify the existence of an award decision duly signed by the committee.	Awarding
	2. Verify the existence of a mayoral decree or resolution that approves the award decision duly signed by the competent authority.	Awarding
	3. Verify that the award decision is published in the ChileCompra system.	Awarding
	4. Check that the contract is signed by the date specified in the tender documents.	Awarding
	5. Check that the contract is published in the ChileCompra system.	Awarding
	6. Verify that the contract is approved by a mayoral decree or resolution (if applicable).	Awarding
	7. Verify that the contract does not apply retroactively.	Awarding
10) Verify the correct emission of the purchase order	1. Corroborate that the purchase order has been issued after the resolution approving the contract.	Execution
	2. Corroborate that the purchase order matches its description with the requirements and provisions stipulated in the contract and/or tender documents.	Execution
11) Contract extension	Identify and analyze the pertinence of consecutive extensions of contract whose validity is extended indefinitely.	Execution

12) Verify the existence, custody, validity and accounting registry of performance guarantees	1. Verify the existence and corresponding custody of the performance guarantee. 2. Verify the following: a. Amount b. Name of beneficiary c. Emission date d. Validity e. Delivery 3. Verify that, when appropriate, the guarantee was actually used. 4. Corroborate that the performance guarantees are registered in the accounting system according to CGR regulation.	Execution Execution Execution Neither

Direct Contracting

13) Direct purchases of less than 3 UTM	1. Validate the respective quotation process. 2. Verify the emission of the corresponding purchase order. 3. Verify that the purchase order was issued after the resolution. 4. Check the emission of the corresponding resolution.	Awarding Execution Execution Awarding
14) Purchases or contracts exceeding 3 UTM and less than 100 UTM	1. Verify that the procurement process and contracts have been developed within the ChileCompra platform, except for cases under article 53 of the regulation. 2. Confirm that the reports, documents and resolutions are published. 3. Verify the resolution authorizing the direct contracting. 4. Verify the reasons for using this exceptional type of contract. 5. Check that the contracts have been formalized by the respective purchase order in accordance with article 63 of the regulation. 6. Verify that the purchase orders are issued prior to receiving the invoice. 7. Determine the existence of at least 3 quotations as required by article 51.	Awarding Awarding Awarding Awarding Execution Execution Awarding
15) Purchases or contracts higher than 100 UTM and lower than 1000 UTM	1. Determine that the procurement process and contracts have been developed within the ChileCompra platform, except for cases under article 53 of the regulation. 2. Confirm that the reports, documents and resolutions are published. 3. Verify sufficient accreditation of elements that allow for direct contracting. 4. Verify the existence of a resolution authorizing the direct contracting. 5. Verify that the resolution explains the reasons for resorting to direct contracting. 6. Check that the contract has been formalized by signature. 7. Determine the existence of at least 3 quotations as established in article 51.	Awarding Awarding Awarding Awarding Awarding Awarding Awarding

Overall Checks

16) Procurement plan	Verify the existence of a procurement plan and its publication: 1. Verify the existence of a purchasing plan. 2. Verify that the purchase plan has been approved and published.	 Neither Neither

	3. If there are changes to the plan, verify that they are published as well.	Neither
17) Review of the payment decrees or resolutions.	Validate the following: 1. Verify that the amounts paid correspond exactly to what was offered and contracted. 2. Confirm that the decrees or resolutions are duly endorsed by the corresponding authority. 3. Verify that the expense vouchers record date and signature of the person withdrawing the check. 4. Confirm that the payment decree authorizes the operation. 5. Check that the decrees or resolutions of payments have the relevant supporting documentation, including at least: purchase order, invoice, document issued by authorized officer certifying the correct reception of the good or service. 6. Verify that the payment in question corresponds to a pertinent expenditure. 7. Verify that the payments were made within the prescribed period, checking that there is no delay between the date of the invoice, its accounting and the respective payment.	Execution Execution Execution Execution Execution Execution Execution
18) The acquisition or provision of service should be according to the tender documents and the defined need.	1. Verify that goods and/or services correspond to the effectively auctioned and contracted (technical specifications). 2. Verify compliance with the terms of the contract. 3. Check if there are changes to the contracts and their adequate formalization. 4. Check, when applicable, whether penalties for late delivery of goods or services, partial delivery, technical specification or other (detailing "others") were applied. 5. Verify that the amount of penalties charged is according to what is established in the tender documents. 6. Verify that services are adequately provided.	Execution Execution Execution Execution Execution Execution
19) Control of purchased goods	1. Confirm that the goods acquired have been received. 2. Verify that the good acquired is registered in inventory. 3. Verify that the goods are in the respective departments and appropriately used.	Execution Execution Execution
20) Aspects of internal control	1. Existence of a regulation/purchasing procedures manual approved and published in the system. 2. Verify that users of the ChileCompra system are formally appointed. 3. Verify that documents are endorsed by those who are authorized (including delegation of signature). 4. Corroborate that the administration maintains adequate segregation of duties between the officials who are involved in the different stages of the procurement process.	Neither Neither Neither Neither

C Details on the Conceptual Framework

The following derives the conceptual framework introduced in Section 2.4 more formally. The framework illustrates the challenge of avoiding distortions by audit when agents subject to the audit have some discretion over multiple procedures. When agents learn that using the more complex procedure entails a higher risk of detecting infractions during an audit, agents have an incentive to avoid this procedure and use the shorter or simpler procedure, even if that procedure is not optimal otherwise.

Consider two such procedures, $j = \{1, 2\}$, that differ in the number of auditable steps in their execution. Reflecting the Chilean setting, the procedure with fewer steps is direct contracting, while the alternative procedure, i.e. auctions, is more complex. As discussed in Section 2.4, many factors could affect agents' choice of procedure. In the following framework, we focus on the aspect that, at each step, agents run the risk of making a mistake leading to an infraction of the chosen procedure.

The agent's problem builds on the standard Becker deterrence model of crime (e.g. Becker, 1968). The probability ϵ of an infraction at each step k can be reduced by exerting additional effort to avoid mistakes. Thus, agents choose the level of effort to reduce the risk of making infractions while taking into account the effort cost and the expected penalty. At each step, infractions are detected with probability p_k. Agents receive sanction s per detected infraction.

The auditing agency attempts to deter infractions. If, as is often the case, the sanction is given by law and not a choice variable for the agency, deterrence will be maximized by maximizing the likelihood of detection p_k. The agency chooses which steps to audit and with what intensity. Define as n the total number of auditable steps executed by all agents across all procedures. The probability of detection $p_k = p(h_k)$ in a given step is increasing in audit hours h_k, $p'(h_k) > 0$. The agency's problem is then to maximize the likelihood of infraction detection $\sum_{k=1}^{n} p(h_k)\epsilon$, subject to a budget constraint $\sum_{k=1}^{n} h_k = B$, where B refers to the total audit hours available across all agents and procedures. The n first order conditions are $p'(h_k^*)\epsilon = L$, where L is the Lagrange multiplier associated with the budget constraint.

If there are decreasing returns to auditing hours within a given step, then $p(h_k)$ is concave in auditing hours, $p''(h_k) < 0$. In this case, $h_k^* = B/n$ maximizes the detection probability: It is optimal for the auditing agency to investigate each auditable step with the same intensity. This may explain why the "auditing by checklist" approach is so common. If, on the other hand, $p(\cdot)$ is non-concave or if there is a fixed cost to auditing each step, then the objective function is maximized by selecting a subset of steps and auditing them fully. If the budget constraint is binding, such that not all steps can be audited, optimizing agencies will randomly select steps to be audited.

The following shows that this approach can mechanically lead to a higher expected penalty for procedures j involving more auditable steps. For the concave case, consider the expected number of discovered infractions per procedure, $E_j = n_j p(h_k^*)\epsilon$. The ratio of expected discovered infractions for two procedures is then

$$\frac{E_2}{E_1} = \frac{n_2 p(h_k^*)\epsilon}{n_1 p(h_k^*)\epsilon} = \frac{n_2}{n_1},$$

where $h_k^* = B/n$, and B and n refer to the total budget and total number of steps across all agents and procedures. n_2 and n_1 refer to the number of steps in procedures of type 2 and 1 respectively.

A similar result is obtained for the non-concave case, where every step has the same probability of being randomly selected for audit. So irrespective of whether there are increasing or decreasing returns to audit hours within a given step, procedures with more steps lead to a higher number of expected infractions and associated sanctions. If, for example, procedure 2 has twice the number of steps as procedure 1, the expected number of discovered infractions will be twice as high in procedure 2.

Eliminating this distortionary incentive would require equalizing the expected number of discovered infractions across the two procedures: $E_2 = E_1$. In the non-concave case, auditors can achieve this simply by randomly sampling fewer steps of the longer procedure, such that the number of audited steps is equal across procedures. In the concave case, equalizing the expected number of discovered infractions requires increasing audit hours per auditable step in procedure 1 relative to procedure 2 such that

$$\frac{p(h_{k1})}{p(h_{k2})} = \frac{n_2}{n_1}.$$

Steps in the shorter procedure 1 are then audited more intensely than in the longer procedure 2. But given the decreasing returns to auditing intensity within a given step, the marginal detection likelihood is now lower in the shorter procedure $p'(h_{k1}) < p'(h_{k2})$ and this deviation from h_k^* fails to maximize the overall number of detected infractions. In the concave case, there is therefore a trade-off between removing the distortionary incentive and maximizing detection of infractions.[49]

Whether it is optimal to eliminate the distortion depends on several factors, including a) the extent to which the choice of procedure is affected by the differential number of detected infractions, and b) the social cost of distortions in the choice of procedure. In the case of procurement, a) relates to how strongly procurement officers shift from auctions to direct contracting when learning that the former leads to more detected infractions. The social costs b) of this distortion can include, for example, higher prices for public expenditures or higher barriers to entry for new firms.

[49]The extent of the distortion is mitigated or amplified depending on the relative likelihood of a mistake. The distortion would be mitigated or even reversed if $\epsilon_1 > \epsilon_2$. In this case the auditing agency would naturally want to increase monitoring of the shorter procedure, such that $p'(h_{k1}^*)\epsilon_1 = p'(h_{k2}^*)\epsilon_2$. With a concave detection probability, this would require increased audit hours in the shorter procedure, leading to an increased likelihood of detection in a given step, compared to the longer procedure $p(h_2)/p(h_1) < 1$.

D Additional Robustness Checks on Product Choice

This appendix shows two robustness checks regarding the alternative explanation that the impact on purchase procedures might be driven by a change in products.

1. Did Audits Lead to a Change in the Type of Products Purchased?

First, we analyze the results for spending shares for each of the 6 main product groups, and then we proceed to more disaggregated analysis, at the 2-digit and 8-digit product codes. Appendix Table D3 below shows the impact of being above the RDD cutoff on the share of spending by a given entity on each of the six main UN product categories.[50] All point estimates are close to zero and there is no statistically significant change in the share of spending made on any of the six categories. Further, F-tests of joint significance across all categories have p-values of 0.99 for the linear and 0.97 for the quadratic specifications, respectively, indicating that the audits had no impact on these product categories. Table D4 shows the further disaggregated analysis at the 2-digit product codes. Again, the results indicate no systematic change in spending composition. Most point estimates are small, and out of 220 point estimates, only 12 are statistically significant at 5 percent, in line with what would be expected due to random chance. F-tests of joint significance have p-values of 0.21 and 0.78 for the linear and quadratic specification respectively.

Finally, we test whether there are shifts at the most disaggregated — 8-digit — product level within each 2-digit category. We restrict the product space to those products that are bought by a minimum of 100 entities and conduct robustness checks with a minimum of 80 and 120 entities.[51] For a minimum of 100 entities there are 43 2-digit product groups. At the 5%-level, F-tests are significant for 3 products in the linear and 3 products in the quadratic specification, again close to what one would expect purely by chance. Results are similar for 80 and 120 minimum number of entities per product.[52]

2. Restricting to Goods with a Meaningful Choice of Procurement Procedure

Next, we test the robustness of our main results using a subset of products which have a meaningful choice of purchase procedure, i.e. where not almost all of the purchases of this product are made through one procedure. Table D5 below show these results for three sets of products, excluding those products with the least procedure choice. The first set excludes the products with the smallest procedure shares such that the removed products account for 10% of total spending for entities at the cutoff on average. The second and third set excludes products with the least procedure choice representing 20% and 30% of total spending, respectively.[53] As the new Table D5 below shows, the impact on purchase procedure shares remains very similar among these products.

[50] We use the five UNSPSC highest-level product classifications and disaggregate services further into construction and non-construction.

[51] A restriction is necessary because many 8-digit products are only bought by a very small number of entities in a given year, leading to very low degrees of freedom.

[52] More precisely, with a minimum of 120 entities 3 out of 39 (linear) and 2 out of 39 (quadratic) are significant, and with a minimum of 80 entities 4 out of 46 (linear) and 2 out of 46 (quadratic).

[53] The included products, respectively for the three subsets, have auction or direct contracting shares less than 97%, 93%, and 90%.

Table D1:
Expected Impact on Share of Spending Through Auctions and Direct Contracting Based on Products' Pre-Treatment Purchase Procedure Shares

	(1)	(2)	(3)	(4)
		Panel A: Auctions		
1{Relative importance ≥ cutoff}	-0.012	0.001	0.004	0.002
	(0.031)	(0.027)	(0.016)	(0.020)
Bandwidth	±4	±10	±8.05	±8.05
Observations	477	992	853	853
R-squared	0.012	0.423	0.398	0.398
Comparison mean	0.545	0.551	0.567	0.567
		Panel B: Direct Contracting		
1{Relative importance ≥ cutoff}	0.000	0.006	0.009	0.009
	(0.011)	(0.010)	(0.007)	(0.009)
Bandwidth	±4	±10	±6.98	±6.98
Observations	477	992	755	755
R-squared	0.247	0.214	0.197	0.197
Comparison mean	0.165	0.161	0.162	0.162
Local polynomial	Linear	Quadr.	Linear	Linear
Stratum fixed effects	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes

Notes: This table tests the alternative explanation that the shift from auctions to the use of more direct contracting is driven by a change in the product mix. It consists of reduced form RDD estimates following the specification of Equation (2), where the outcome variable is the expected share of spending under the actual (potentially shifted) product mix but using product-level procedure shares that are constant based on year $t-1$. For details, see Subsection on Product Choice. Column (1) shows estimations for the ±4 bandwidth and column (2) for the ±10 bandwidth. Columns (3) and (4) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaram (2012). Column (4) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years), political affiliation, as well as first and second lags of $log(+1)$ of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table D2:
Impact on Product-Level Share of Spending Through Auctions and Direct Contracting with Varying Granularity of Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Panel A: Auctions			
1{Relative importance ≥ cutoff}	-0.060	-0.064	−0.067*	−0.072**	−0.076**	−0.079**	−0.076**
	(0.051)	(0.040)	(0.039)	(0.036)	(0.036)	(0.035)	(0.033)
Bandwidth	±7.50	±5.92	±5.67	±5.36	±5.07	±4.92	±4.83
Observations	327,623	274,116	260,724	248,638	240,234	235,501	229,585
R-squared	0.002	0.103	0.121	0.262	0.310	0.394	0.462
Comparison mean	0.667	0.655	0.648	0.649	0.642	0.631	0.627
				Panel B: Direct Contracting			
1{Relative importance ≥ cutoff}	0.092**	0.070**	0.069**	0.072**	0.062**	0.060**	0.064**
	(0.039)	(0.032)	(0.030)	(0.031)	(0.030)	(0.030)	(0.029)
Bandwidth	±6.48	±5.48	±5.43	±5.22	±5.45	±5.26	±5.04
Observations	294,870	255,059	253,612	244,920	253,611	245,595	239,492
R-squared	0.005	0.096	0.120	0.165	0.203	0.275	0.313
Comparison mean	0.114	0.132	0.132	0.126	0.133	0.126	0.141
Local polynomial	Linear	Linear	Linear	Linear	Linear	Linear	Linear
Stratum fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Product fixed effects	No	No	No	2-digit	4-digit	6-digit	8-digit

Notes: Reduced form RDD estimates following the specification of Equation (2). The dependent variable is the share of spending through auctions/direct contracts, respectively, out of total spending on a given product by a given entity. All columns employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012) and report bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years), political affiliation, as well as first and second lags of $log(+1)$ of total amount purchased, and of auction and direct contract shares. Regressions are weighted using entity product shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table D3:
Impact on Share of Spending by Sector

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Raw Materials				Industrial Equipment			
1{Relative importance ≥ cutoff}	0.003	0.002	0.004	0.005	-0.002	0.010	0.011	0.013
	(0.013)	(0.012)	(0.010)	(0.013)	(0.016)	(0.015)	(0.012)	(0.015)
Bandwidth	±4	±10	±6.89	±6.89	±4	±10	±6.54	±6.54
R-squared	0.605	0.561	0.518	0.518	0.442	0.335	0.387	0.387
Comparison mean	0.090	0.097	0.105	0.105	0.064	0.060	0.061	0.061
Observations	477	992	746	746	477	992	718	718
	Equipment Components and Supplies				Manufactured Products			
1{Relative importance ≥ cutoff}	-0.006	0.005	-0.001	0.001	0.006	0.004	0.001	-0.002
	(0.022)	(0.020)	(0.011)	(0.013)	(0.025)	(0.022)	(0.017)	(0.021)
Bandwidth	±4	±10	±9.37	±9.37	±4	±10	±5.97	±5.97
R-squared	0.459	0.380	0.378	0.378	0.724	0.705	0.735	0.735
Comparison mean	0.087	0.092	0.096	0.096	0.307	0.314	0.310	0.310
Observations	477	992	954	954	477	992	673	673
	Construction				Non-Construction Services			
1{Relative importance ≥ cutoff}	0.011	-0.003	0.001	0.006	-0.013	-0.011	-0.026	-0.034
	(0.034)	(0.029)	(0.022)	(0.026)	(0.031)	(0.025)	(0.024)	(0.028)
Bandwidth	±4	±10	±7.66	±7.66	±4	±10	±5.20	±5.20
R-squared	0.593	0.529	0.547	0.547	0.621	0.596	0.607	0.607
Comparison mean	0.102	0.102	0.124	0.124	0.350	0.336	0.328	0.328
Observations	477	992	810	810	477	992	604	604
Local polynomial	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

Notes: Reduced form RDD estimates following Equation (2). Columns (1) and (5) show estimations for the ±4 bandwidth and Columns (2) and (6) for the ±10 bandwidth. Columns (3), (4), (7) and (8) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012) (as in Table 4). Columns (4) and (8) report bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Panels show the share of spending by sector using the 6 sector grouping based on the UNSPSC Classification (2004). Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, of auction and direct contract shares, and of the outcome variable. Standard errors clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table D4:
Impact on Share of Spending by 2-Digit Product Classification

	(1)	(2)	(3)	(4)	(5)
	Comparison mean (±4)	Linear estimate (±4)	Quadratic estimate (±10)	Linear estimate (optimal BW)	Linear estimate (optimal BW)
Live Plant and Animal Material and Accessories and Supplies	0.001	-0.000	0.000	0.000	0.000
		(0.001)	(0.000)	(0.000)	(0.000)
Mineral and Textile and Inedible Plant and Animal Materials	0.005	-0.004	-0.001	-0.001	-0.000
		(0.003)	(0.002)	(0.002)	(0.002)
Chemicals including Bio Chemicals and Gas Materials	0.007	-0.002	-0.000	-0.002	−0.002*
		(0.002)	(0.001)	(0.001)	(0.001)
Resin and Rosin and Rubber and Foam and Film and Elastomeric Materials	0.000	0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Paper Materials and Products	0.026	0.001	0.004	-0.000	0.000
		(0.005)	(0.005)	(0.004)	(0.005)
Fuels and Fuel Additives and Lubricants and Anti corrosive Materials	0.037	0.004	0.004	0.007	0.008
		(0.012)	(0.010)	(0.008)	(0.010)
Mining and Well Drilling Machinery and Accessories	0.002	0.006	0.005	0.006*	0.006*
		(0.004)	(0.003)	(0.003)	(0.004)
Farming and Fishing and Forestry and Wildlife Machinery and Accessories	0.000	0.001	-0.000	-0.000	-0.000
		(0.001)	(0.001)	(0.001)	(0.001)
Building and Construction Machinery and Accessories	0.005	−0.014**	-0.007	−0.013***	−0.015***
		(0.005)	(0.005)	(0.005)	(0.006)
Industrial Manufacturing and Processing Machinery and Accessories	0.002	0.001	0.001	0.001	0.001
		(0.002)	(0.002)	(0.001)	(0.002)
Material Handling and Conditioning and Storage Machinery and Accessories	0.005	0.000	0.002	0.001	0.000
		(0.002)	(0.002)	(0.002)	(0.002)
Commercial, Military, Private Vehicles and Accessories and Components	0.042	0.000	0.004	0.005	0.006
		(0.013)	(0.012)	(0.009)	(0.011)
Power Generation and Distribution Machinery and Accessories	0.005	-0.003	-0.000	-0.001	-0.001
		(0.003)	(0.003)	(0.002)	(0.003)
Tools and General Machinery	0.002	-0.001	-0.001	-0.000	-0.000
		(0.001)	(0.001)	(0.001)	(0.001)
Structures, Building, Construction, Manufacturing Components and Supplies	0.025	0.007	0.017	0.013	0.016
		(0.015)	(0.013)	(0.009)	(0.011)
Manufacturing Components and Supplies	0.008	-0.002	-0.002	-0.001	-0.001
		(0.004)	(0.003)	(0.002)	(0.002)
Electronic Components and Supplies	0.002	-0.001	-0.001	-0.000	-0.000
		(0.001)	(0.001)	(0.000)	(0.001)
Electrical Systems and Lighting and Components and Accessories and Supplies	0.009	0.003	0.002	0.003	0.001
		(0.008)	(0.007)	(0.006)	(0.007)
Distribution and Conditioning Systems and Equipment and Components	0.005	0.000	0.000	0.000	0.000
		(0.001)	(0.001)	(0.001)	(0.001)
Laboratory and Measuring and Observing and Testing Equipment	0.038	−0.012*	-0.007	−0.008*	-0.008
		(0.007)	(0.007)	(0.004)	(0.005)

Impact on Share of Spending by 2-Digit Product Classification, Part 2

	(1)	(2)	(3)	(4)	(5)
	Comparison mean (±4)	Linear estimate (±4)	Quadratic estimate (±10)	Linear estimate (optimal BW)	Linear estimate (optimal BW)
Medical Equipment and Accessories and Supplies	0.061	-0.004	-0.005	-0.005	-0.008
		(0.009)	(0.009)	(0.006)	(0.007)
Information Technology Broadcasting and Telecommunications	0.050	-0.008	-0.005	-0.008	-0.009
		(0.011)	(0.008)	(0.007)	(0.009)
Office Equipment and Accessories and Supplies	0.035	-0.001	0.002	0.001	0.002
		(0.008)	(0.006)	(0.004)	(0.004)
Printing and Photographic and Audio and Visual Equipment and Supplies	0.005	0.001	0.001	0.001	0.001
		(0.002)	(0.002)	(0.001)	(0.002)
Defense and Law Enforcement and Security and Safety Equipment and Supplies	0.007	0.005	0.008	0.005	0.006
		(0.007)	(0.007)	(0.005)	(0.006)
Cleaning Equipment and Supplies	0.007	0.003	0.002	0.003*	0.003**
		(0.002)	(0.002)	(0.001)	(0.002)
Service Industry Machinery and Equipment and Supplies	0.001	-0.000	0.000	-0.000	-0.000
		(0.001)	(0.001)	(0.001)	(0.001)
Sports and Recreational Equipment and Supplies and Accessories	0.008	-0.000	-0.003	-0.002	-0.001
		(0.005)	(0.003)	(0.002)	(0.002)
Food Beverage and Tobacco Products	0.022	-0.002	-0.004	-0.002	-0.003
		(0.004)	(0.003)	(0.003)	(0.003)
Drugs and Pharmaceutical Products	0.050	0.009	0.005	0.005	0.005
		(0.010)	(0.008)	(0.004)	(0.006)
Domestic Appliances and Supplies and Consumer Electronic Products	0.006	0.000	0.002	0.000	0.000
		(0.002)	(0.001)	(0.001)	(0.002)
Apparel and Luggage and Personal Care Products	0.009	-0.000	-0.003	-0.002	-0.002
		(0.002)	(0.002)	(0.002)	(0.002)
Timepieces and Jewelry and Gemstone Products	0.000	-0.000	-0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Published Products	0.013	-0.002	-0.003	-0.003	-0.005
		(0.004)	(0.005)	(0.004)	(0.004)
Furniture and Furnishings	0.016	0.001	0.002	0.000	0.001
		(0.005)	(0.004)	(0.003)	(0.004)
Musical Instruments, Games, Toys Arts, Crafts and Educational Materials	0.015	0.002	0.005	0.003	0.004
		(0.009)	(0.007)	(0.005)	(0.006)
Farming and Fishing and Forestry and Wildlife Contracting Services	0.018	-0.007	-0.007	-0.008	-0.010
		(0.008)	(0.006)	(0.006)	(0.007)
Mining and oil and gas services	-0.000	-0.001	0.001	-0.000	-0.000
		(0.002)	(0.003)	(0.001)	(0.002)
Building and Facility Construction and Maintenance Services	0.102	0.011	-0.003	0.001	0.006
		(0.034)	(0.029)	(0.022)	(0.026)
Industrial Production and Manufacturing Services	0.006	-0.003	-0.002	-0.003	-0.004
		(0.002)	(0.003)	(0.002)	(0.002)

Impact on Share of Spending by 2-Digit Product Classification, Part 3

	(1)	(2)	(3)	(4)	(5)
	Comparison mean (±4)	Linear estimate (±4)	Quadratic estimate (±10)	Linear estimate (optimal BW)	Linear estimate (optimal BW)
Industrial Cleaning Services	0.017	0.003	0.005	0.004	0.005
		(0.011)	(0.010)	(0.008)	(0.010)
Environmental Services	0.000	-0.001	-0.000	-0.001	-0.001
		(0.001)	(0.001)	(0.001)	(0.001)
Transportation and Storage and Mail Services	0.049	0.002	0.005	0.001	0.000
		(0.007)	(0.008)	(0.005)	(0.007)
Management and Business Professionals and Administrative Services	0.063	0.001	-0.001	-0.003	-0.007
		(0.023)	(0.020)	(0.014)	(0.017)
Engineering and Research and Technology Based Services	0.024	0.009	0.007	0.001	0.003
		(0.012)	(0.011)	(0.009)	(0.011)
Editorial and Design and Graphic and Fine Art Services	0.030	−0.012*	−0.015*	-0.008	-0.010
		(0.007)	(0.007)	(0.007)	(0.009)
Public Utilities and Public Sector Related Services	0.004	0.006	-0.001	-0.001	-0.001
		(0.005)	(0.004)	(0.003)	(0.003)
Financial and Insurance Services	0.006	0.006	0.005	0.006	0.006
		(0.007)	(0.007)	(0.006)	(0.007)
Healthcare Services	0.041	-0.003	0.009	0.006	0.007
		(0.011)	(0.009)	(0.006)	(0.007)
Education and Training Services	0.028	-0.004	0.002	-0.001	-0.000
		(0.009)	(0.009)	(0.006)	(0.008)
Travel and Food and Lodging and Entertainment Services	0.027	-0.005	-0.004	-0.004	-0.004
		(0.007)	(0.008)	(0.005)	(0.006)
Personal and Domestic Services	0.009	0.001	-0.000	0.000	0.001
		(0.002)	(0.001)	(0.001)	(0.001)
National Defense and Public Order and Security and Safety Services	0.014	-0.004	-0.001	0.000	0.002
		(0.003)	(0.004)	(0.003)	(0.004)
Politics and Civic Affairs Services	0.008	0.001	0.001	0.001	0.002
		(0.004)	(0.006)	(0.006)	(0.008)
Organizations and Clubs	0.006	-0.002	-0.004	-0.003	-0.004
		(0.003)	(0.002)	(0.002)	(0.003)

Notes: Each coefficient stems from a separate reduced form RDD regression following the specification of Equation (2). The outcome variable is the share of spending by product using the 2-digit product classification in the UNSPSC Classification (2004). Column (1) shows control means in the ±4 bandwidth. Column (2) shows estimations for the ±4 and Column (3) for the ±10 bandwidth. Columns (4) and (5) employ the mean-squared-error-optimal bandwidth following Imbens and Kalyanaraman (2012)). Column (5) in addition reports bias-corrected estimates and robust standard errors following Calonico, Cattaneo and Titiunik (2014). Each observation is an entity-year. All specifications contain control variables including a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lag of log (+1) of total amount purchased, and of auction, direct contract shares, and the outcome variable. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

Table D5: Impact on Share of Spending Through Auctions and Direct Contracting, Robustness Check: Products With Meaningful Choice of Procurement Procedure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Product sample	100%		≈ 90%		≈ 80%		≈ 70%	
				Panel A: Auctions				
1{Relative importance ≥ cutoff}	−0.079***	−0.089**	−0.076**	−0.083**	−0.079**	−0.087**	−0.077**	−0.086**
	(0.030)	(0.036)	(0.030)	(0.036)	(0.032)	(0.038)	(0.033)	(0.040)
Bandwidth	±5.19	±5.19	±5.70	±5.70	±5.91	±5.91	±5.74	±5.74
Observations	604	604	646	646	667	667	646	646
R-squared	0.573	0.573	0.551	0.551	0.520	0.520	0.515	0.515
Comparison mean	0.666	0.666	0.649	0.649	0.660	0.660	0.644	0.644
				Panel B: Direct Contracting				
1{Relative importance ≥ cutoff}	0.069***	0.077***	0.065***	0.072***	0.058***	0.064**	0.052**	0.058**
	(0.024)	(0.028)	(0.023)	(0.027)	(0.022)	(0.026)	(0.023)	(0.027)
Bandwidth	±5.05	±5.05	±5.26	±5.26	±5.89	±5.89	±6.08	±6.08
Observations	593	593	610	610	664	664	673	673
R-squared	0.498	0.498	0.526	0.526	0.518	0.518	0.518	0.518
Comparison mean	0.125	0.125	0.129	0.129	0.132	0.132	0.137	0.137
Stratum fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table provides a robustness check for results in Table 4, Columns (7) and (8) (optimal bandwidth specification following Equation (2). It shows the results for the subset of products with a meaningful choice of purchase procedure. Columns (1) and (2) correspond to the full sample. The following columns exclude the products with the least variation in procurement procedures. Columns (3) and (4) exclude the ∼10% of spending on those products with the smallest auction or direct contracting shares (i.e. such that the share of total spending at the cutoff corresponds to ∼90%). Columns (5), (6) and (7), (8) exclude ∼20% and ∼30% of spending respectively. The included products for each of the three subsets have auction or direct contracting shares of less than ∼97%, ∼93%, and ∼90%, respectively. Each observation is an entity-year. Control variables include a dummy for having been audited in the preceding year (audits data are not available for two years earlier), political affiliation, as well as first and second lags of log (+1) of total amount purchased, and of auction and direct contract shares. Standard errors are clustered at the stratum level. A stratum refers to a cell defined by year and internal unit. ***p<0.01, **p<0.05, *p<0.1

E Survey Evidence on Penalties and Other Consequences for Detected Infractions

To shed light on the consequences of detected infractions in audits, our country-wide survey investigated procurement officers' beliefs about the nature of consequences and their perceived severity. While much of the analysis of deterrence from audits—building on the seminal model of crime by Becker (1968)—has focused mainly on legal consequences of detected infractions, such as prosecutions and penalties, we document that there are many additional consequences that play an important role in our setting, including career concerns, social-image concerns and self-image concerns. Even though the expected risk of legal penalties is relatively low, officers perceive overall consequences as severe.

The survey contains two parts to investigate these issues: First, participants were asked about the range of consequences that arise when the Comptroller detects infractions related to public procurement. Second, we asked officers to indicate for a number of situations how bad they would be for them on a scale from 0 to 10. Three of these vignettes involve financial losses, while one is about an audit in which the Comptroller detects the type of infractions for which our study audits showed a higher likelihood for auctions. This allows us to analyze beliefs on how severe the detection of infractions is compared to financial losses.

1. Consequences That Arise When the Comptroller Finds Infractions in Procurement

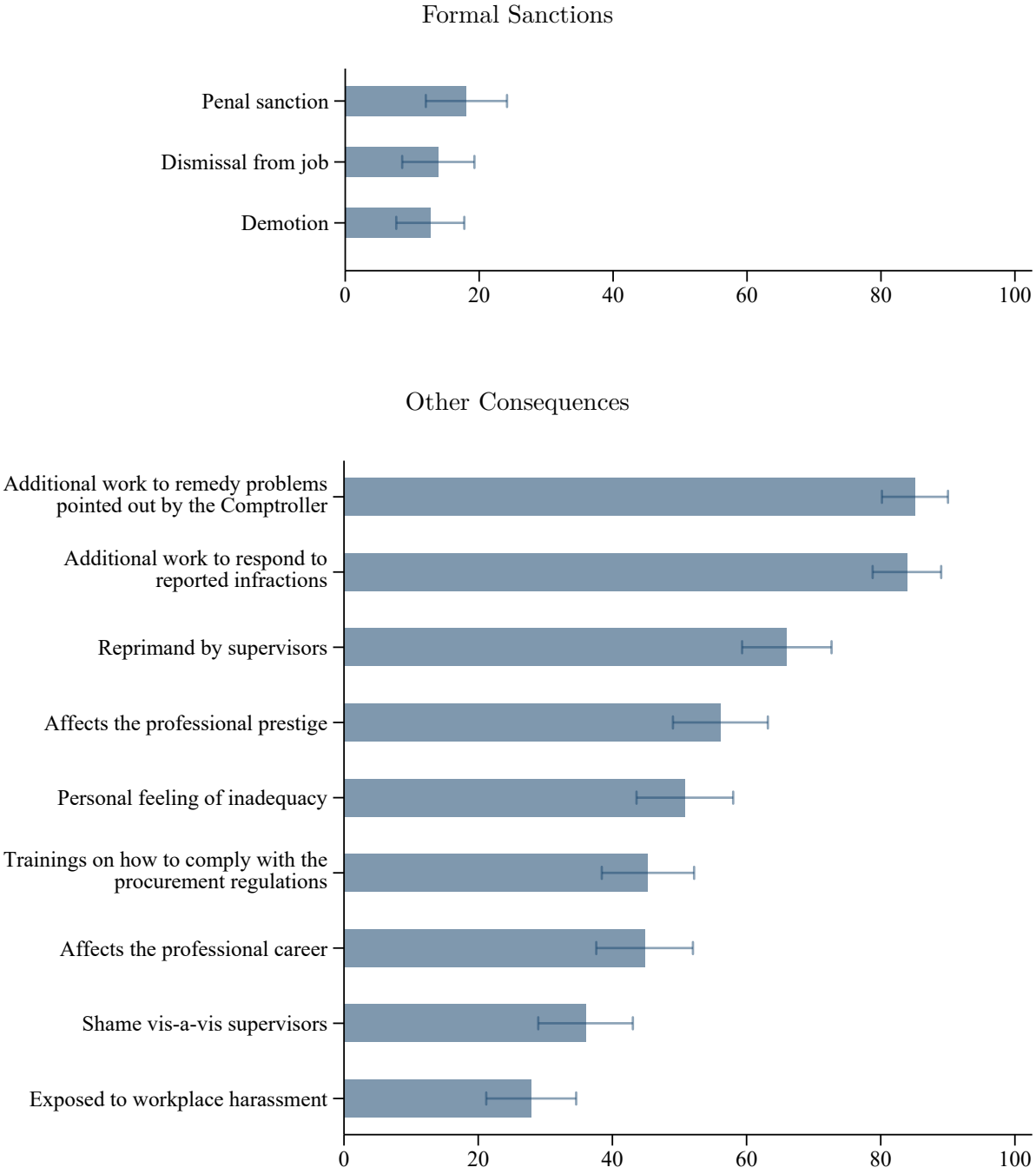
Respondents were asked about the consequences for procurement officers who are involved in the awarding of a contract, when the Comptroller finds infractions in the procurement process of that contract. Participants indicated how likely they believed a number of potential consequences to be. We created the list of potential consequences based on extensive piloting of the survey, which included open answers and qualitative interviews as well as points raised by referees.

The figure below shows the percentage of respondents who indicated that a given consequence was very likely to happen. The first thing that stands out is that fewer respondents see formal sanctions as very likely than is the case for other consequences. Fewer than 20%

indicate that penal sanctions, dismissal or demotion are very likely. At the same time, the share of respondents who say other consequences are very likely ranges from 27.9% (workplace harassment) to 85.1% (additional work).

Issues of professional standing figure prominently. Over 65% say that reprimands by supervisors are very likely. Over 55% state this with regards to impacts on the professional prestige, and over 40% about impacts on the professional career. Personal impacts are another key affected area. Over half state that personal feelings of inadequacy are very likely and about $\frac{1}{3}$ indicate this for shame vis-à-vis their supervisor. Finally, almost all respondents agree that there would likely be additional work to remedy the problems pointed out by the Comptroller and to respond to the Comptroller's report. (Over 80% say this is very likely.)

Figure E1: Consequences of Detected Infractions in the Procurement Process
Share of Respondents Who Say a Given Consequence Is Very Likely



Notes: This figure shows procurement officer beliefs about the consequences that arise when the Comptroller finds infractions in the procurement process. Bars show the percentage of respondents who indicate that a given consequence is very likely, with 95% confidence intervals.

2. Quantifying Severity of Audit Detection in Comparison to Financial Loss Scenarios

Given the non-formal nature of many of these consequences, the question arises how severe such consequences are for the affected officers. To quantify the perceived severity, we used a vignette approach. We showed respondents four scenarios and asked them to indicate for each of them on a scale of 0 to 10 how bad they would be for them. The goal of these vignettes was to benchmark how severe procurement officers experience the impacts of being detected by an audit compared to tangible financial losses. We first asked about the following audit scenario, then about 3 financial scenarios.

The audit vignette is a situation where the Comptroller detects infractions in the awarding process of procurement contracts, such as for example that the contract did not go to the best offer according to the criteria stipulated in the auction, or that the deadlines for opening of technical bids were not met.

We chose those two examples of infractions based on the data from our study audits, where they represent the most frequently detected serious and less serious infractions for the awarding stage. Hence they are typical kinds of additional infractions incurred when officers would choose an auction over a direct contract. (By "serious'' we refer to the type of infraction that often leads to follow-up investigations. As Table A12 shows, the likelihood of such follow-up investigations is twice as high for auctions as for comparable direct contracts.)

The three financial scenarios were as follows:

- A situation in which the respondent's entity does not obtain half of their institutional bonus for institutional effort. (This corresponds to a 3.8% lower pay.[54] In addition, when an entity fails to get the institutional bonus, this may also lead to reorganizations, etc.)

- A situation in which the respondent's household has an additional expenditure of 5%

[54]In Chile, public entities have incentive pay at the institutional level. If the institutional goals are met 90% or more, each employee receives a 7.6% bonus. If the goals are met between 75 and 90%, they receive a 3.8% bonus. If less than 75% of the goals are met, there is no bonus. The bonus is paid 4 times a year.

in the coming month.

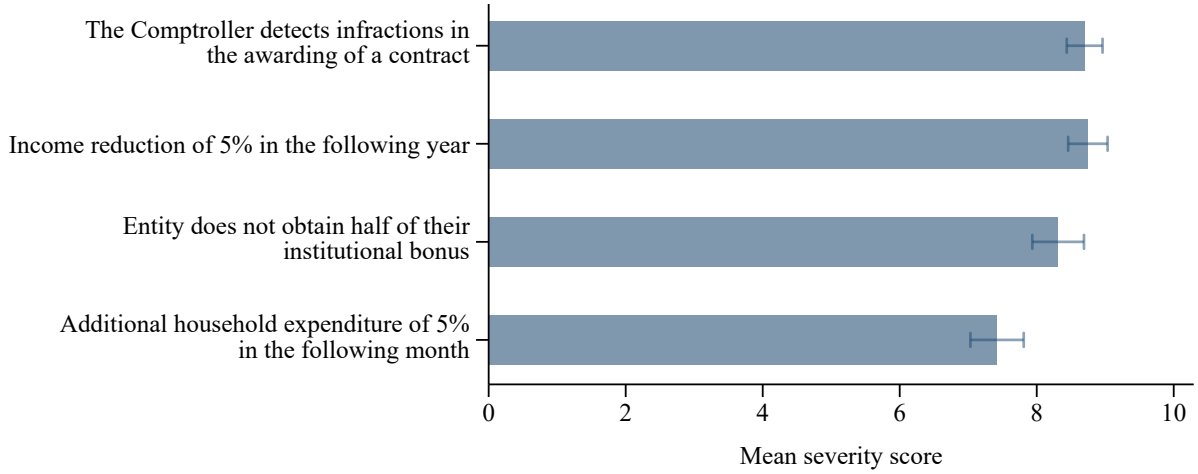
- A situation in which there are budget cuts, which result in a reduction of the respondent's income of 5% in the coming year.

The results show that procurement officers on average ranked the consequences of the detections of infractions by the Comptroller as similar to a salary reduction of 5% in the following year (severity scores of 8.7 and 8.8 respectively), and more severe than a loss of half of the annual bonus for their entity (8.3) or a 5% additional expense in the coming month (7.4).

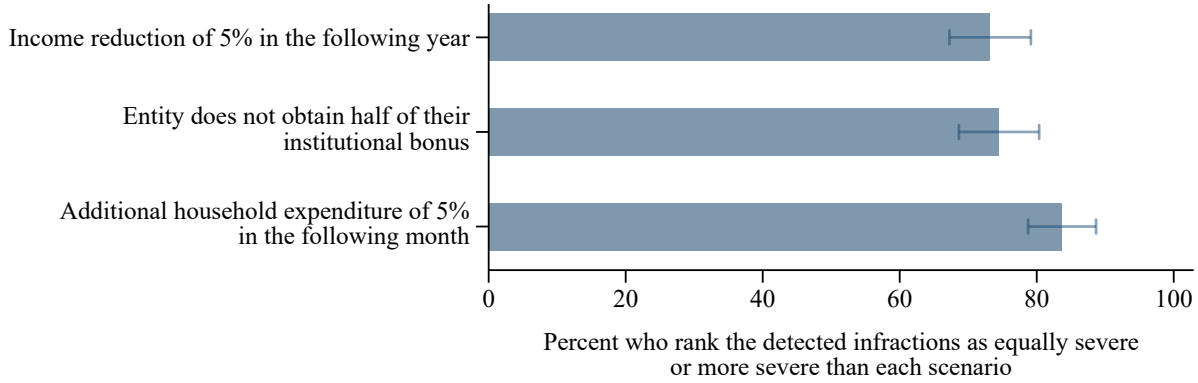
Comparing the audit vignette score to the financial vignettes for a given individual, we find that 84% of respondents gave the audit vignette a severity score that was as high or higher than the score for the 5% additional expense. Similarly, about 79% scored the audit vignette at least as severe as the 5% wage reduction or the foregone institutional bonus scenario.

Figure E2: Severity of Consequences of Detected Infractions

Panel A. Average Severity Score



Panel B. Share of Procurement Officers Who Rank the Consequences of Detected Infractions as Equally Severe or More Severe Than a Given Scenario



Notes: This figure shows the perceived severity of consequences of detected infractions in comparison with three types of financial shocks. The vignette of "detected infractions in the awarding of a contract" refers to two examples of detected infractions, corresponding to the type of infractions that were most commonly detected in our study audits. Panel A indicates the average severity score (on a scale from 0 to 10) of the four different vignettes. Panel B shows the share of procurement officers who ranked the vignette of detected infractions as equally severe or more severe than the respective financial vignette. 95% confidence intervals shown to the right.