# Monitoring, Organizational Culture, and the Efficiency of Public Procurement

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ABSTRACT. We use a cluster randomized field experiment to study the effect of performance monitoring on the efficiency of public procurement in Chile. We leverage a new amazon-like online procurement system based on Framework Agreements (FA) that substantially reduces monitoring costs. In collaboration with the Chilean Public Procurement Office, we provided monthly reports on the purchasing performance of individual procurement officers and services to a sample of 8,300 procurement officers in 184 public services purchasing units. We randomly varied whether the individual performance was disclosed to managers (public) or not (private). After 5 months of treatment exposure, we find that the reports generated significant reductions in overspending in the public treatment group but not in the private treatment group, i.e., only when individual performance was observable for managers. This is consistent with the mechanism being that extrinsic motivation and not intrinsic motivation drives the behavior of procurement officers. We further find that most of the treatment effect comes from purchasing units where the value (utility) of efficiency is highly aligned between managers and officers, suggesting that organizational culture plays a key role in mediating the impact of performance monitoring and preventing the misuse of public resources.

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# 1. Introduction

Efficiency is rarely a first order priority in public services delivery. Since public service units use "other peoples'" money to deliver services, moral hazard problems are everywhere (Laffont and Tirole, 1993). Public service procurement in particular is characterized by contractual incompleteness and high transaction costs that aggravate moral hazard problems (Bajari and Tadelis, 2001). Public employees may also have a strong preference for leisure and therefore put little effort into getting value for money (Bandiera et al., 2021b). On top of this, wishful thinking (e.g., denial of inefficiency) and willful blindness (e.g., avoidance of information about inefficiency) are individual behaviors that can easily spread throughout organizations reinforcing the belief that efficiency does not matter (Bénabou, 2013).

Still, pursuing efficiency can be a valuable source of budgetary savings for bureaucratic organizations under tight resource constraints. One approach to improving efficiency is to monitor employee performance and provide that information to managers. However, monitoring costs can be high and the associated increase in bureaucracy might lead to more inefficiency and not less (Kelman, 1990)[1].

Chile recently introduced a new amazon-like online procurement system based on a Framework Agreements (FA) mechanism that substantially reduces monitoring costs. The new system induces more competition among suppliers thereby enhancing competitive bidding for products of similar quality. More importantly, the new system facilitates a low-cost information-based monitoring technology that tracks the purchasing behavior of individual procurement officers, and based on adjusted-quality product standardization methods is able to observes overspending on individual items. By 2020, FAs accounted for about 20% of total expenses and 46% of the purchase transactions, both of which have been growing steadily.

Together with the Public Budget Office (DIPRES) and the Public Procurement Office (Chilecompra), we used this system to develop monthly reports about the purchasing performance (overspending) of individual purchasing officers that are sent to both managers and procurement officers. This approach provides performance information cheaply in real time, and it leaves organizational structure and contracts unchanged avoiding conflict with civil service rules.

[1]Other approaches include granting more autonomy in the exercise of public spending (Bandiera et al., 2021a) and introducing financial incentives that reward (penalize) efficient (inefficient) behavior. However, introducing pecuniary incentives may require modifying public sector payment laws, and monetary incentives may backfire if they distort the *intrinsic* motivation (Bénabou and Tirole, 2003).

We test the effectiveness of this technology by means of a cluster randomized field experiment with 184 public service purchasing units and more than 8,300 procurement officers. We first randomly assigned 2/3 of purchasing units to be trained on best practices for searching low-cost products with an online course, as well as to receive the monthly performance reports delivered by DIPRES to both managers and individual procurement officers. The remaining 1/3 (control) was not trained and did not receive any performance information.

We also randomly varied the amount of performance information that was provided to managers. In a “public" treatment arm, the manager received information both on the performance of individual procurement officers as well as the overall performance of their unit. Individual procurement officers were made aware of the fact the their managers were provided their individual performance reports. In the “private" treatment arm, managers were only given information on the overall performance of their units and not on the individual performance of procurement officers. Accordingly, procurement officers were informed that managers did not have access to their individual performance reports and only had access to the overall performance of the unit.

Note that isolating whether managers can and cannot monitor individual procurement officer performance allows us to examine the mechanisms by which performance monitoring is playing any role in changing purchasing behavior. It is possible that the information improves performance of intrinsically motivated procurement officers as opposed to the extrinsic incentives associated with performance being reported to managers. The public and private arms allow us to test the role of *intrinsic* versus *extrinsic* motivation of procurement officers as mediators of the effects of performance information on efficiency (Bénabou and Tirole (2003)). Since the private treatment does not allow the manager to monitor individual performance, the reports on individual performance can only improve efficiency if procurement officers are intrinsically motivated.

After 5 months of treatment exposure, we find that the monthly performance reports generated statistically significant reductions in overspending in the public information treatment arm but not in the private information treatment arm. This suggests that the mechanism that generated improved efficiency was through the *extrinsic* motivation incentives from monitoring as opposed to officers acting on the information due to *intrinsic* motivation.

The estimated treatment effects are large and substantial. On average, the reductions in overspending are on the order of 1.5 *pp.*, which represents 33% of the control group mean. In the year prior to treatment, average overspending per purchase was 5.6% or about US $7.5

MM dollars for the items under study. The treatment effect, then, amounts to approximately $US 2.5 MM dollars a year. If we extrapolate the treatment effects to all transactions made in the Chilean public procurement system, the potential savings are on the order of 0.25 billion dollars or 0.09% of Chilean GDP in 2019. Overall, our results show that public performance monitoring can greatly boost efficiency in public spending.

On potential mechanisms, we examine the role of organizational culture, i.e., the extent to which the value of organizational goals are *shared* between principal (managers) and agents (workers) (Van den Steen, 2010)[2]. Organizational culture is thought to be important for performance. For example, when values are shared communication is likely to be more informative (Crawford and Sobel, 1982) and managers are more likely to delegate (Aghion and Tirole, 1997). If efficiency matters for both the worker and the manager, the less effort a manager has to exert to convince a worker to use cost saving technologies and practices.

Divergent values, on the other hand, create organizational distrust and thus an incentive to monitor performance more (Rotemberg and Saloner, 1995; Dewatripont and Tirole, 1999). Additional performance monitoring then could have a larger effect in organizations that have divergent values than in those that have shared values. This is because managers in divergent value organizations already have more information on performance, i.e., they are already conducting more monitoring on their own, and thus the marginal value of the new information is lower. We formalize this intuition in a simple principal-agent model based on Van den Steen (2010) where the principle and agent may have different individual values of payoffs.

We test the predictions of our model by building a measure of organizational culture based on an index of shared values of efficiency using our baseline survey of managers and procurement officers. The survey includes a battery of questions designed to elicit values and preferences associated to the importance of efficiency in public purchasing, the determinants of efficiency, and perceptions regarding how costly is overspending for the organization.

As predicted by our theoretical model, we document a statistically significant negative correlation between value of efficiency alignment and manager monitoring efforts. A one standard deviation increase in the value of efficiency misalignment between procurement officers and managers is associated to a 12% increase in managers reporting that they monitor purchasing performance of the organization. Moreover, we find the effect of

[2]Gorton et al. (2021) defines corporate culture more generally as "...elements like norms, values, knowledge, and customs...[based in] unwritten codes, implicit rules, and regularities in interactions."

the public treatment arm is statistically significantly larger in organization units whose values of efficiency are more aligned between managers and procurement officers than in organizational units where there are less aligned, which is again consistent with our model predictions. Specifically, we find that a one standard deviation increase in misalignment reduces the effect of the public information treatment in 1.3 *pp*. Overall, our results suggest that organizational culture (measured through value alignment) play a key role in mediating the positive effects of implicit monitoring tools on efficiency in public procurement, as alignment in efficiency values reduces monitoring costs.

## 2. Related literature

We speak to a growing literature on how to best tackle inefficiency in public spending. Historically, the debate has concentrated on the roles of rules versus discretion in public procurement. On one side, OECD (2009) advocate for reinforcing monitoring through bureaucratic organizations that implement strict rules with explicit costs for those incurring in inefficient purchases. In contrast, Kelman (1990) makes the case for increased discretion by arguing that governments face many constraints on their ability to implement effective monitoring plans without increasing bureaucracy costs at the same time, sometimes leading to more inefficiency, not less. Indeed, a number of recent empirical papers show the potential benefits of discretion in a variety of settings, including public procurement offices (Bandiera et al. (2021a), Decarolis et al. (2020), Coviello et al. (2018))[3], but also educational organizations (Bloom et al. (2015a), Bloom et al. (2015b)), bureaucracies (Rasul and Rogers (2018), Rasul et al. (2019)), and environmental regulators (Duflo et al. (2018)).

Our motivation is similar, yet relative to these studies, we investigate how innovative management practices meant to monitor and motivate workers affect efficiency in public organizations, while holding their architecture (e.g., rules and discretion) fixed. In that sense, our paper is closer to works that treat the organizational problem from the lens of a single-layer principal-agent framework, e.g., papers focusing on the role of pecuniary and non-pecuniary rewards (Bandiera and Rasul (2011), Bandiera and Rasul (2013)) and management practices (Bloom and Van Reenen (2007), Bloom et al. (2019)) on productivity.

Yet most of this evidence concentrate in the context of firms. In contrast, we study the effect of managerial innovations in public organizations. A series of papers studying the

[3]Discretion may not always be beneficial. Using cross-country comparisons, Bosio et al. (2021) show that laws that constraint procurement outcomes are beneficial in most low income countries but detrimental in richer countries.

role of pecuniary and non-pecuniary incentives in the government of Punjab, Pakistan, are somewhat more related to ours and constitute an exception in this field. Khan et al. (2016) document that exposing tax collectors to performance pay schemes boost revenue, but at the cost of augmenting bribes through an increase in the bargaining power of tax collectors vis-à-vis taxpayers. Likewise, Khan et al. (2019) find that exposing property tax inspectors to non-pecuniary incentives where a performance-ranked serial dictatorship mechanism post them into better or worse locations depending on their performance generate a significant increase in annual tax revenue growth. Bandiera et al. (2021a) show that providing financial incentives to procurement officers do not improve performance, except when officers face a monitor who does not delay approvals for purchases, meaning that the effect of providing incentives on performance may depends on how authority is allocated between agents. Also related, Rasul and Rogers (2018) study how the management practices bureaucrats operate under correlate to the quantity of public services delivered in Nigeria, and find that while increasing bureaucrats' autonomy is positively associated with completion rates, practices related to incentives/monitoring of bureaucrats are negatively associated with completion rates. Our paper contributes to this literature by showing that information-based, "implicit" monitoring practices are an alternative low-cost strategy that can greatly boost efficiency in public procurement without altering the organizational structure and contracts, hence avoiding the political economy frictions embedded in hierarchy changes.

This paper also falls into a rich literature of the role of organizational culture on performance[4]. Bloom et al. (2012) show that firms headquartered in high-trust regions are significantly more likely to decentralize, increasing aggregate productivity by affecting the organization of firms. Guiso et al. (2015b) show that when employees perceive top managers as trustworthy and ethical, firm's performance is stronger. Using personnel data from a large high-tech firm, Hoffman and Tadelis (2021) show that survey-measured people management skills have a strong negative relation to employee turnover. Bandiera et al. (2009) study how social connections between workers and managers (an indirect attribute of organizational culture) affects productivity in firms, and find that while social connections increase the performance of connected workers, favoring connected workers is detrimental for the firm's overall performance. Related to this, Cullen and Perez-Truglia (2019) show that when employees have more face-to-face interactions with their managers, they are promoted at a higher rate, a mechanism that could explain increases in the gender pay gap. Moreover, by using data from a multi-billion dollar corporation in Southeast Asia, Cullen and

[4]See Guiso et al. (2015a) for a thorough review.

Perez-Truglia (2022) document large misperceptions among employees about the salaries of their managers and smaller but still significant misperceptions of the salaries of their peers, and that these misperceptions have a significant causal effect on the employees' own behavior in terms of effort and performance. Our paper adds to this literature by measuring the level of misalignment between managers and officers regarding values associated to the importance of efficiency in public procurement, thereby examining the organizational culture within public organizations and how value connections across members interacts with monitoring efforts oriented to improve performance.

Lastly, our paper contributes to the vast literature on monitoring efforts to improve public procurement (see Dimitri et al. (2006b) and Bandiera et al. (2021b) for a review). The manipulation of contracts is not uncommon in procurement systems (Palguta and Pertold (2017)). An increase in audit risk has been shown to curb corruption in this setting (Zamboni and Litschig (2018)), and the use of reputational mechanisms (e.g., past performance information to select contractors) can stimulate the entry of new firms (Spagnolo (2012)). In the context of the Chilean procurement system, Engel et al. (2021) implemented an audit experiment with Chilean public agencies where these were randomly assigned to receive a letter from the Comptroller General two weeks before the end of the fiscal year with an audit threat. The authors find that treated agencies reduced their floating debt and procurement spending relative to control agencies, reflecting that random audits can deter potentially wasteful spending. In contrast, Gerardino et al. (2022) use a regression discontinuity approach to show that audits lowered the use of auctions for public procurement (and correspondingly increased the use of direct contracts), reduced supplier competition, and increased the likelihood of incumbent, small, and local firms winning contracts, a backfire effect that goes against the goals of the procurement audits are intended to enforce. Our paper differ from these in that we shows that instead of audits, low-cost implicit monitoring tools like monthly information reports with overspending behavior can avoid backfire effects and effectively prevent the misuse of public resources.

## 3. A Model of Information, Organizational Culture and Performance

In the following section, we provide a simple principal-agent model describing how facilitating monitoring may affect organizational performance. Our model relies heavily on Van den Steen (2010). The main feature of the model is that monitor and agent may have different individual values about payoffs. We found conditions in which the marginal effect

of improving technology is lower in organizations with larger difference in values.

Consider an organization composed by a Manager $J$ and a single agent $I$. The agent must choose between two possible actions, $A$ and $B$. The first option, $A$, represents the regular action performed by the organization, or status quo, and is well known by both individuals, whereas $B$ stands for an alternative. $J$ and $I$ value action $A$'s payoff equally, whereas they may have different individual values for action $B$'s payoff. Thus, whether $J$ and $I$ consider best the same course of action, will depend on how they value action $B$'s payoff. The Manager $J$ can exert effort $e$ on monitoring to convince $I$ to choose the option that she believes is best. In addition, the effectiveness of monitoring depends on the organization's level of monitoring technology, $s > 0$. For instance, technology can facilitate information collection about $I$'s historical performance. Thus, the larger $s$, the less effort $J$ has to exert to convince $I$. A key feature of the model is that $J$'s utility can be written in terms of how different is her individual value $\mu_J$ from $I$'s value $\mu_I$. Let's define $\delta = |\mu_J - \mu_I|$ the difference in values within the organization. We seek to characterize the optimal level of monitoring in terms of $\delta$ and $s$.

Formally, let action $A$'s payoff be a random variable $X \sim U(0,1)$, which is publicly drawn before decisions are made. Action $B$'s payoff is an unknown random variable. However, each player, say $i$, has an individual value of action $B$'s expected payoff, denoted by $\mu_i > 0$. If $J$ decides to exert effort $e$, then she can force $I$ to choose the action that she believes is best with probability $P(e,s)$. Let $c(e)$ be $J$'s cost of effort for $e > 0$. We assume that both $J$ and $I$ are risk neutral, $\frac{\partial P(e,s)}{\partial e}, \frac{\partial P(e,s)}{\partial s}, c'(e), c''(e) > 0$ and $c(0) = P(0,0) = 0$. In addition, we assume that effort and technology are substitutes, i.e. $\frac{\partial^2}{\partial e \partial s} P(e,s) < 0$. Finally, functions $P$ and $c$ are smooth.

Since individuals have different values about $B$'s payoff, they have different criteria for choosing the action. Player $i$ would prefer $A$ if $X$ is larger than $\mu_i$, otherwise $i$ prefers $B$. Thus, from the Manager's perspective, if **she chooses the action**, then her expected payoff is:

$$\int_0^{\mu_J} \mu_J dx + \int_{\mu_J}^1 x dx = \frac{1+\mu_J^2}{2}.$$

By the other hand, if $I$ **chooses the action**, then $J$'s payoff is:

$$\int_0^{\mu_I} \mu_J dx + \int_{\mu_I}^1 x dx = \frac{1+\mu_J^2-\delta^2}{2}$$

Hence, if $J$ decides to exert effort $e$ on monitoring, her expected payoff is given by:

$$\pi(e,\delta,s) = P(e,s)\left(\frac{1+\mu_J^2}{2}\right) + (1-P(e,s))\left(\frac{1+\mu_J^2-\delta^2}{2}\right) - c(e). \tag{1}$$

Let $e^* = e^*(\delta, s)$ the optimal monitoring effort maximizing (1), which we assume is an interior solution of the Manager's problem. It follows that $e^*$ is increasing in $\delta$ and optimal payoff $v(\delta, s) = \pi(e^*, \delta, s)$ is decreasing in $\delta$. Hence, the larger the misalignment in organizational values, the larger is the effort that the manager has to exert on monitoring, leading to smaller optimal utility. In addition, we prove that $e^*$ is decreasing in $s$ and the optimal payoff is increasing in $s$. This follows directly from the fact that $s$ increase the effectiveness of monitoring, i.e. increase $P(e, s)$.

In despite of the previous results, whether to invest or not in technology may also depend on the magnitude of it's marginal effect on the optimal payoff $v(\delta, s)$, which can be affected by the degree of organization misalignment $\delta$. Indeed, we proved that, if the following holds:

$$\frac{\frac{\partial P(e^*,s)}{\partial s}}{\frac{\partial P(e^*,s)}{\partial e}} < \frac{\frac{\partial^2 \pi(e^*,\delta,s)}{\partial s \partial e}}{\frac{\partial^2 \pi(e^*,\delta,s)}{\partial e^2}} \tag{2}$$

then $\frac{\partial^2}{\partial s \partial \delta} v(\delta, s) < 0$. That is, the larger $\delta$ the smaller is the (positive) effect of $s$ on performance. The discussion above is summarized in Proposition 1.

**Proposition 1.** *Information $s$ decreases manager's monitoring effort, while it increases the optimal payoff. Yet, the difference in values within the organization $\delta$ increases monitoring effort and decreases optimal payoff. Further, if (2) holds, a larger difference in values diminish the (positive) effect of information.*

The prediction of the model shows that more information decreases Manager's monitoring effort, while it increases the optimal payoff. As such, the manager has to exert less effort on convincing the agent to do what she believes is best, which reduces monitoring costs. Second, misalignment increases Manager's monitoring effort, while it decreases the optimal payoff, i.e., the larger misalignment there is within the organization, the worst is for the manager if the agent decides the action. Thus, the manager must exert larger effort on convincing the Agent to do what she believes is best. Finally, the positive effect of information on the optimal payoff decreases with misalignment. Hence, a larger misalignment implies larger monitoring effort and decreases in the marginal effect of better information.

# 4. Background

## 4.1. Types of Public Procurement Systems and their Trade-offs

The design of public procurement systems typically involves some degree of centralization through Central Procurement Bodies (CPB), combined with local purchasing decisions by government units. Globally, there is an increasing trend among countries to increase centralization through CPBs (OECD (2019b)), with about 1-10% of public purchases achieved through centralized procurement agencies in OECD countries (Carpineti et al. (2006)). Some advantages of centralized procurement include: (i) a tighter control of expenditures; (ii) achieve economies of scale with fewer suppliers; (iii) increase bargaining power to lower supplier prices; (iv) reduce administrative costs by eliminating duplication of procurement function; (v) increase productivity and efficiency of procurement units through learning by doing and specialization. In contrast, decentralizing purchases can be more effective when localized units have an information advantage in selecting efficiency local suppliers or to adjust to local market dynamics which could not be achieved through a centralized procurement system (Dimitri et al. (2006a) a more detailed discussion on the trade-off between centralized vs. local procurement decisions). In addition, there are often secondary objectives that could be better achieved by local procurement agencies, such as the inclusion of small/medium firms to develop local economies.

A second design aspect of public procurement systems is the type of contract used. The most widely adopted mechanism used to award suppliers are auctions, which usually combine bid prices with quality scores and other dimensions. This approach, termed "value for money", has been recommended as best practice by multiple regulatory organizations (OECD (2009), OECD (2017)). However, Bajari et al. (2009) show that the efficiency of procurement auctions – relative to other mechanisms such as direct negotiations with suppliers – can be lower for more complex and incomplete specifications of procurement needs. This type of situation may arise for products or services with low levels of standardization, or when procurement needs vary significantly across purchasing units; developing complete contracts that account for these various sources of uncertainty might involve too much effort in a practical implementation. A decentralized approach providing decision rights to local units to negotiate directly with suppliers could be more effective in these situations, and might require moving from a fixed-price contract to a cost-plus payment mechanism. Albano and Sparro (2010) analyzes in further detail on how alternative procurement contract strategies relate to flexibility, supply/demand risks and the degree of standardization in

product specifications. For these reasons, most countries used a hybrid system that combines auctions with other types of purchasing mechanisms, which can be managed centrally or delegated to local authorities depending on the nature of the product/service to be procured.

### 4.2. Procurement Mechanisms and Centralized Purchases in Chile

Chile re-structured its public procurement system in 2003, which included a Central Procurement Body – Direccion de Compras y Contratacion Publica, known as Chilecompra – hosted within the Finance Ministry. This new regulation of public purchases (Ley 19.886 de Compras Publicas) establishes three purchasing mechanisms mandated for all central government units, which account for annual purchases of $13 billion worth of goods and services per year ($\approx$ 5% of 2019 GDP). The first purchasing mechanism are **Procurement Auctions**, which consists on a open call for tenders where suppliers submit bids based on pre-established auction rules, which details the characteristics and volumes of the goods/services to be purchased, the format of the bids to be submitted and the allocation rule used to determine the auction winners. Typical formats are first-price sealed-bid auctions, which are implemented as score-auctions that balance price with technical requirements are also widely used. Prior to the call for tenders, the auction rules need to be audited by the government's General Comptroller, which may take several months and therefore introduces significant transaction costs for the buyer. This procurement mechanism is required for purchases above USD $62.500, and during 2019 accounts for more than 50% of government expenditures and 33% of the purchase transactions.

The second mechanism are **Direct Purchases** ("Trato directo") with a supplier, without any formal competitive process. They are used for purchases below USD $625, and buyers are required to demonstrate that the product was not available to purchase through a competitive tendering process. In some cases, direct purchases also require having three or more quotes from different suppliers, choosing the one with the lowest price. This purchase mechanism provides the buyer more flexibility to select among a wider variety of products/services, but is typically discouraged to use due to the difficulties in tracing the purchase decision, leading to lower transparency in the procurement process. Direct purchases may be subject to further scrutiny by the General Comptroller, leading to investigation when anomalies are found. During 2019, direct purchases accounts for 16.7% of public purchases.

These two purchasing mechanisms – auctions and direct purchases – provide a good example of the trade-off between transaction costs and competition discussed by Bajari

et al. (2009). Auction mechanisms enhance competition among suppliers through objective and transparent selection criteria, but involve significant effort and time in the definition of auction rules. For product categories which are less standard and present heterogenous requirements across government units, auction mechanisms may become too costly to implement. In contrast, direct purchases involve lower transaction costs by allowing open access to the external markets, but can lead to higher procurement costs when buyers have favoritism or are not willing to exert search effort to find lower prices. In general, Chilecompra plays a minor role in the implementation of these two purchases mechanisms, and the decision of which mechanism to use and their design is descentralized to local government units

The third purchasing mechanism – **Framework Agreements** (FAs) – seeks to find a balance between transaction costs and competition. FAs follow a two stage process: (i) the first stage is a competitive process to select a group of pre-qualified suppliers through an auction mechanism with competitive bidding; (ii) the second stage establishes the criteria to allocate demand from government units to the selected group of suppliers during the operation of the procurement contract. The main objective of this purchase mechanism is to reduce the transaction costs for purchase units, both in term of administrative costs and the search costs to identify products/service that fit their needs, thereby facilitating their procurement process while ensuring competitive prices for the government. The first stage induces competition to enter the market, establishing minimum quality standards and ceiling prices that suppliers can charge during the execution of the FA contract. The second stage provides flexibility to allocate supply to demand, allowing to satisfy heterogenous needs of government units and adapt to changing market conditions. As discussed by Saban and Weintraub (2021), FAs uses competition both to *enter* the market and *within* the market, which can be effective at reducing prices in the marketplace.

Chilecompra plays an active role in the design and operation of FAs. As central purchasing unit, they are in charge of the design of the contracts and the auction rules to pre-select suppliers (which is also subject to the scrutiny of the Central Comptroller), thereby taking advantage of centralized purchasing to reduce administrative costs and exploit bargaining power. For the second stage, they operate a web-based marketplace platform where buyers can make direct purchases from the pre-selected suppliers. Awarded contracts last between one and four years. Although FAs and electronic platforms are ubiquitous in government procurement systems (see Albano and Nicholas (2016)), the Chilean system presents important differences. First, it operates with a larger number of pre-selected

suppliers – prior to 2017 about 70% of participating bidders were awarded (OECD (2019a)) – providing broader variety to buyers in the online marketplace at the expense of lower competition to enter the market. Moreover, the second stage of the FA fully decentralizes the purchasing decision to the buyer, providing them flexibility to choose among the pre-selected suppliers in the marketplace with no restrictions. [5]

### 4.3. The role of Product Standardization Technology to encourage Efficient Public Purchases in Framework Agreements

Given these special features in Chile's FA implementation, Chilecompra initiated efforts to generate a standardized classification of the products offered by suppliers in the FAs, identifying attributes that can describe both vertical and horizontal differentiation in the market. [6] This product standardization was used to induce more competition among suppliers to enter the market, enhancing competitive bidding for products of similar quality. It also enabled improvements in the online platform's search algorithms, reducing search costs for buyers which has been shown to induce price competition among suppliers in online marketplaces (Dinerstein et al. (2018)). Consequently, Chilecompra implements FAs for product categories that can be adequately described by objective product attributes and which are regularly purchased by a broad set of government units, such as office supplies, food, computer hardware, transportation, household cleaning, among others. During 2019 FAs accounted for about 20% of total expenses and 50% of the purchase transactions and has been growing steadily.

The standardization of FA product catalogues also enabled Chilecompra to conduct a more efficient monitoring of the market, facilitating price comparisons across products with similar attributes and quality. For those categories where attributes capture adequately the differentiation among products, Chilecompra partitions the catalogue into subsets of products – named the *reference group* – that were considered reasonable substitutes in terms of their attributes, based on quality and functionality criteria. For every buyer transaction, this monitoring system compares the purchasing price with the lowest price alternative in the corresponding reference group, calculating an over-price associated to each transaction and the potential savings that could be gained by switching buyers to the lower price

[5] Within market competition in FAs is further discussed in Albano and Sparro (2010) and Albano and Nicholas (2016), describing different alternatives used in practice to allocate demand across suppliers.

[6] This analysis is conducted using Natural Language Processing algorithms to analyze free-text product descriptions and identify common attributes. The algorithm was adapted from Sun et al. (2014), combining automated classification with crowd-sourced manual supervision to identify new attributes.

alternatives. A pilot of this system began in 2019 including food, computer hardware and desk supplies FAs, and was later expanded to other product categories that are purchased across all government institutions, which encompass around 5,500 purchasing units with 15,500 procurement officers. This type of performance evaluation of public procurement systems has been recommended by the European Comission [7], but has presented a slow adoption even in developed countries (OECD (2019b)).

### 4.4. Organizational Structure and Budgeting Process in Chile

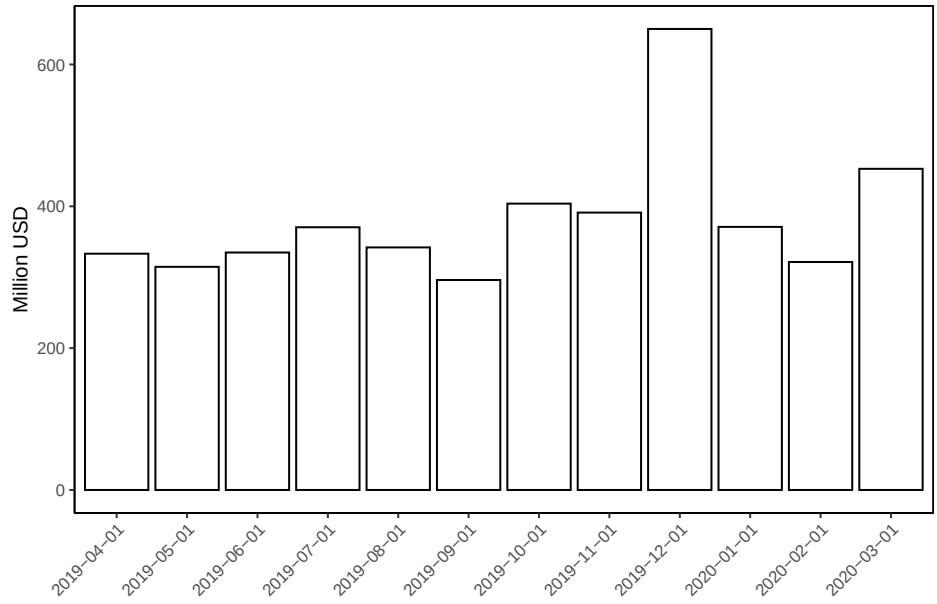
Public services typically have a Director (DIR), whose objective is to get approval for the budget required to implement next-year plan, as that is a measure of success of their budget execution in the previous year. Second on board is the Finance Manager (DAF) who is in charge of managing all financial administrative duties. His responsibility is to guarantee that the public service's plan can be successfully implemented given the assigned budget, for which he leads a small group of intermediate managers, who in turn are in charge of leading the buyers team. On average, there are 50 buyers per public service, although this number can vary from service to service.

The Government Budgeting Office (DIPRES) have had no access to *ChileCompra* procurement data nor have used aggregate data for budget assignment decisions. If anything, for purposes of budget evaluation DIPRES check the extent to which the assigned budget for the year has been spent, and public services run the risk of not getting approval for the next-year budget if the amount spent in the previous-year goes too low relative to the assigned budget. Then, public services have the implicit mandate of fully spending all the assigned resources in the current year. A corollary of this is the empirical fact that December is the month where public services show the largest share of purchases in a year (see Figure 1 below).

The latter is consistent with subjective values of public service Manager/DAFs. Jointly with DIPRES and *Chilecompra*, during February - May 2020 we implemented a baseline survey to more than 350 public services' top-level executives to examine what they believe about the process of public budget assignment and the extent to which they believe overspending matters to the Public Budget Office. First, 55% believe there are no clear rules to assign public budget to services, yet 87% of them agree with the statement "There is a

[7] "Making Public Procurement work in and for Europe" Strasbourg, March 2017 ( extracted from https://ec.europa.eu/docsroom/documents/25612)

Figure 1: Total Amount of Public Expenses, April 2019 - March 2020




Note: Distribution of total amounts of public expenses (excluding public tenders) by month between April 2019 and March 2020. All figures in $US dollars of 2019.

pressure within Public Services to spend all the assigned resources", and 44% recognize that public procurement officers sometimes make public purchases at higher prices in order to avoid under-execution. Importantly, when respondents are asked about the level of importance that DIPRES attribute to overspending in public purchases when assigning the public budget to services, they score an average of 3.9 in a scale of 1 to 7 (with 1 “not important at all" and 7 “very important"), and an average of 4.0 when asked about how strong is the monitoring of DIPRES to the efficiency of public spending (with 1 “no monitoring at all" and 7 “very strong monitoring"). Overall, the latter reveals that public services have little incentives to reduce overspending in public purchases.

## 5. Data and Measurement

### 5.1. Electronic records of public purchases

We have access to multiple administrative microdata to construct our measure of efficiency in purchases for the 184 Public Services that participate in the intervention: (i) *Transaction Data*, which contain information of each purchase made since January 2019 including

purchasing unit ID, buyer ID, product/service code, seller ID, unit price, number of units, total amount spent, date of the purchase, shipping costs, among other characteristics; (ii) *Historical Store Price Data*, which contain all in-store prices available for each product offered by providers within the *Convenio Marco* marketplace, including product/service code, the price offered by each seller, and the period for which that price was available in the Online Platform, among other characteristics; (iii) *Data of Public institutions and Buyers*, with data on all institutions that make purchases through *ChileCompra* including institutional ID and user ID; (iv) *Data of Products*, with data of all products offered within the *Convenio Marco* marketplace, including ID, product's name, categories, number of units per package, and descriptions containing product's attributes; and (v) *Data on Regional and Commercial Conditions*, which contain the geographical zones to be supplied by each seller for each *Convenio Marco*. It also specifies shipping rates associated to each zone, among other features.

### 5.2. Survey data

We also collected data through an online baseline survey for Manager/DAFs and buyers. The main goal of the survey was to measure values and preferences of each member on how important is efficiency in public purchasing, the determinants of efficiency and how costly is overspending for the organization. The survey was implemented during the period February - May 2020, and follow up surveys were implemented during 2021 to track the evolution of beliefs over time. Different questions were asked to analyze the following dimensions: (i) Preferences/values about budget's under-execution (i.e., whether the manager believes that under-spending assigned budget assigned affects next year's allocation); (ii) Preferences/values about purchasing behavior (i.e., whether Manager/DAFs of services believe that buyers typically make purchases at higher prices in order to avoid under-spending); (iii) Preferences/values about monitoring of public spending (i.e., whether the manager believes that DIPRES monitors overspending); and (iv) Preferences/values about costs associated to high levels of overspending.

### 5.3. Measuring efficiency in public purchases

Each transaction is registered through a purchase order and uniquely identified. We observe the price paid for each purchase order. We also observe all possible products that were available on the Online platform during the same week of each purchase made. To construct

a benchmark of efficiency we do the following. For each purchase observed, we construct a reference group of comparable alternative products to build each buyers' choice set during a specific calendar week. Then, within the buyers' choice set, we take the price that is equal to the $1^{st}$ percentile in the price distribution, which represents the minimum price that a buyer could have picked during the calendar week of the purchase.

Reference groups are identified based on product attributes in the descriptions that are typed into the Online platform. Table 1 shows an example of how products (scissors) are described in the platform. In this example these two scissors would go to the same possible choice set based on Size, Type, Point Type, and Units.

Table 1: Example of product description

| ID | P. Type | Description | Brand | Size | Type | Point Type | Units |
|---|---|---|---|---|---|---|---|
| 1110476 | SCISSORS | FULTONS SCHOOL ROUNDED SCISSORS 13 CM UNIT | FULTONS | 13 CM. | SCHOOL | ROUNDED | 1 |
| 1560463 | SCISSORS | ATLANTIK SCHOOL ROUNDED SCISSORS 13 CM UNIT | ATLANTIK | 13 CM. | SCHOOL | ROUNDED | 1 |

The product types for which we are able to build reference choice sets are distributed across specific marketplaces, including the marketplaces for *Food*, where reference groups are available for 35.7% of all transactions; *Office Supplies*, where reference groups are available for 80% of all transactions; and *Hardware*, where reference groups are available for 100% of transactions.

We construct two measures of efficiency for each purchase in our sample. First, for each purchase in our data, we observe the price that each buyer $i$ paid at purchase $p$ for product $k$ at date $t$, $p_{ipkt}$. This price corresponds to the price per unit bought. In addition, using data from the online platform we are able to observe all possible prices available for that same product $k$ during the week of the purchase. We take all prices available for that exact same product during the calendar week of a particular purchase as a comparison benchmark. As such, we observe a distribution of prices for that same product during the calendar week of the purchase. We want to use a measure of efficiency that reflects the potential savings that the user could have obtained for that purchase had she bought at the minimum price possible. To obtain this reference threshold we compute the 1st percentile of the price distribution of each product during the calendar week of the purchase, defined as $p_{kt}^{min}$. Taking the minimum price is not possible since there are large outliers in the online purchase data that likely reflect purchases that were wrongly entered so the 1st percentile is a reasonable threshold.

With these two points of data, $p_{ipkt}$ and $p_{kt}^{min}$, we are able to compute a measure, $op_{ipkt}$,

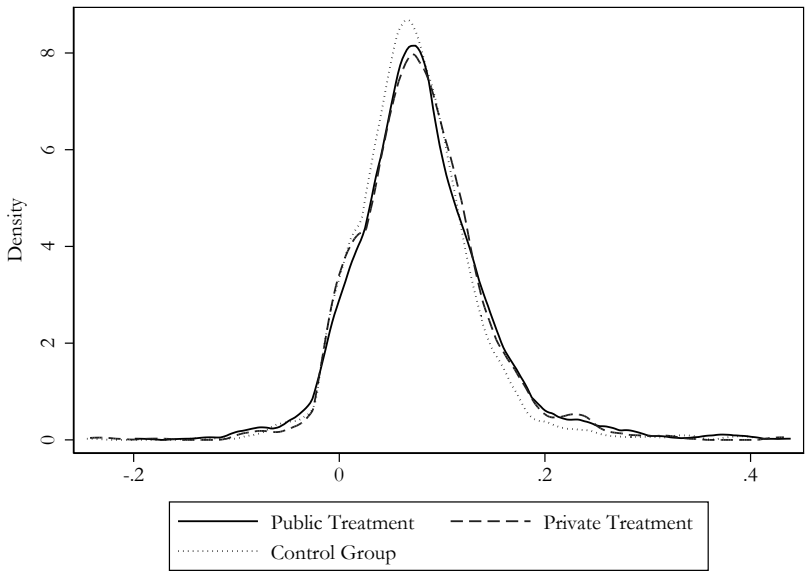
that we call "overprice" for each buyer $i$'s purchase $p$ of product $k$ at each date $t$ during the whole time period in our data series (Jan 2019- Jan 2021). This is our main measure of analysis.

Formally we define overprice as:

$$op_{ipkt} = \frac{p_{ipkt} - p_{kt}^{min}}{p_{kt}^{min}} \tag{3}$$

Figure 2 shows the distribution of average overprice for purchases made by buyers in each treatment group at pre-treatment period. The median overprice is 7.2%, with an interquartile range of [4.0%; 10.7%].

Figure 2: Distribution of Over Price by Treatment Status




Note: Distribution of over price paid by buyers in the pre-intervention period, by treatment group. Observations with negative overprice are purchases with prices below the reference threshold $p_{kt}^{min}$, i.e., the 1st percentile of the price distribution of each product during the calendar week of the purchase.

## 6. The Information Experiment

Starting June of 2020, we implemented different information interventions in the purchasing units of 184 public services in Chile. These aim at reducing information gaps about efficiency performance of the organization. Interventions target different levels of hierarchy within the organization: some information pieces were designed only for Director/Finance Manager (principal); others only for buyers (agent); and some apply to both. Second, treatment assignment is at the service level. Since within a service we have both Director/Finance Manager and buyers, then treatment is assigned in bundles of information pieces. See Table 2 below for a detailed description of each piece, the respective targeted group within each public service, and how pieces are bundled across treatment groups.

Note there are two treatment arms: Public Information and Private Information groups, which differ in two ways. First, buyers working in services assigned to Public Information treatment receive monthly reports that include a message highlighting that "all the information contained in the report has also been sent to the Manager/DAF of the service". Second, for these services, the monthly report received by the top-level executives includes information about overspending at the buyer level for each buyer working in the public service. That is, at the end of the report showing Performance Information at Service level (Figure A.1) we create a list containing the name of all buyers in that organization and the range of their overspending, ranked by largest to lowest. This way, the Public Information intervention allows full knowledge of individual purchasing performance of every buyer in the service to Manager/DAF, while the buyer is also aware that their information on purchasing performance is known by the Manager/DAF. In contrast, services assigned to the Private Information arm do not include the message to the buyers and Manager/DAFs do not receive reports about individual buyer performance[8].

The rationale behind our experimental design is testing whether providing information at the organization level rather than privately changes performance of organizations. In addition, by measuring values or preferences over public spending at baseline we are able to test a theoretical result: whether the effects of information are more/less effective when members of the same organization hold similar values about organizational goals.

[8]Note that the public procurement data containing the records of public purchase transactions is confidential data managed by *ChileCompra* for designing reports on the global spending of the Government. It is not available to the public, and not even to government institutions like public services. Not having access to this data makes implausible for public services to be able to calculate their level of overspending on their own, and anecdotal evidence corroborate this.

Table 2: Information Interventions

| Intervention | Target Group w/ Service | Treatment Group | Description |
|---|---|---|---|
| Training video | Manager/ DAF & Buyers | Public & Private Info. Groups | Managers/DAFs and buyers in the organization receive an invitation by DIPRES for a 10-minutes online course designed by *ChileCompra* and DIPRES that aims at improving knowledge about the importance of efficiency in public procurement. Performance indicators of efficiency, recommendations, and tools on how to reduce overspending are provided. To access to the training video, click here. |
| Performance Info. at Service level | Manager/ DAF & Buyers | Public & Private Info. Groups | Managers/DAFs and buyers receive a monthly report signed by DIPRES including information about: (i) Performance indicators of efficiency at the organization level (explained in the training video) during the last 12 months; and (ii) List of recommendations and tools oriented to help buyers to reduce overspending. Monthly reports can be downloaded from a centralized platform (www.gastoeficiente.cl) by using login credentials provided privately. See Appendix Figure A.1 for an example of the report. |
| Performance Info. at Service level + Personal's Performance Info. | Buyers only | Public & Private Info. Groups | Buyers receive a monthly report signed by DIPRES including information about: (i) Performance indicators of efficiency at the service level (explained in the training video) during the last 12 months; (ii) List of recommendations and tools oriented to help buyers reduce overspending; and (iii) Indicators about their own performance on efficiency relative to peer buyers in the same organization during the last 12 months. Monthly reports can be downloaded from a centralized platform (www.gastoeficiente.cl) by using login credentials provided privately. See Appendix Figure A.2 for an example of the report. |
| Performance Info. at Buyer level | Manager/ DAF only | Public Info. Group only | Attached to the report of Performance Information at Service level, Managers/DAFs also receive a ranked list of all buyers within the service and their respective levels of overspending accumulated during the past 12 months. |
| Public Info. Message | Buyers only | Public Info. Group only | The following phrase is added at the end of the first paragraph of the report: "All the information contained in the report has also been sent to the Manager/DAF of the service". |

### 6.1. Experimental Design

Our sample frame consists of 184 public services, which comprise approximately 8,400 buyers, for approximately 50 buyers per service. The experiment is run at the service level. Table 3 below summarizes the experimental design. Out of 184 services, we randomly assign 61 services to T1 ("Public Information treatment"; 2,887 buyers), 62 services to T2 ("Private Information treatment"; 2,916 buyers), and 61 services to the control group (2,570 buyers). To improve statistical power and ensure statistical balance across groups, randomization was stratified by Ministry to which the service belongs to and by whether the overspending of the service in the previous fiscal year was above or below the median. Appendix Table

A.1 shows means and differences across treatment arms for different variables measured at baseline using administrative data and survey data. The table shows that groups are well balanced across different dimensions.

Table 3: Details of Experiment

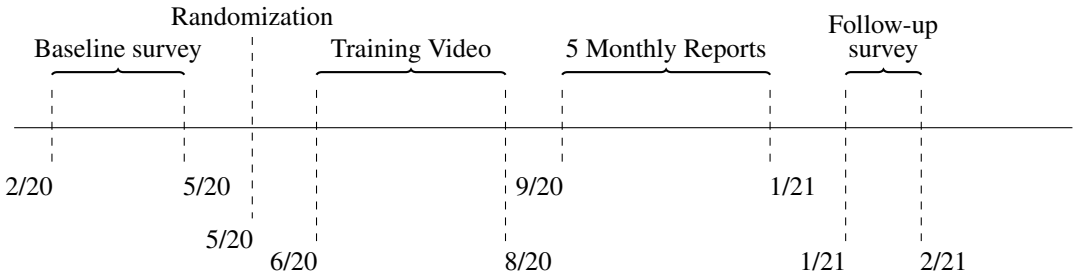
| | Public Treatment | Private Treatment | Control | Total |
|---|---|---|---|---|
| # Public Services | 61 | 62 | 61 | 184 |
| Information Piece: *Do Director and DAF receive...?* | | | | |
| Training video (June-August 2020) | Yes | Yes | No | |
| Performance info. at Service level (Sept 2020 - Jan 2021) | Yes | Yes | No | |
| Performance info. at Buyer level. (Sept 2020 - Jan 2021) | Yes | No | No | |
| # Buyers | 2,887 | 2,916 | 2,570 | 8,373 |
| # Non-Placebo Buyers (3/4 of Buyers) | 2,165 | 2,187 | 2,570 | 6,922 |
| Information Piece: *Do Non-Placebo Buyers receive...?* | | | | |
| Training video (June-August 2020) | Yes | Yes | No | |
| Performance info. at Service level (Sept 2020 - Jan 2021) | Yes | Yes | No | |
| Personal's Performance info. (Sept 2020 - Jan 2021) | Yes | Yes | No | |
| Public Information message (Sept 2020 - Jan 2021) | Yes | No | No | |
| # Placebo Buyers (1/4 of Buyers) | 722 | 729 | 0 | 1,451 |
| Information Piece: *Do Placebo Buyers receive...?* | | | | |
| Training video (June-August 2020) | Yes | Yes | | |
| Performance info. at Service level (Sept 2020 - Jan 2021) | No | No | | |
| Personal's Performance info. (Sept 2020 - Jan 2021) | No | No | | |
| Public Information message (Sept 2020 - Jan 2021) | No | No | | |
| Placebo message (Sept 2020 - Jan 2021) | Yes | Yes | | |

Importantly, information treatments (either Public or Private) can influence buyers' spending behavior either due to the direct effect of the information contained in the reports

or due to the indirect effect of realizing that are being monitored (Hawthorne effects). To test for this, within Public and Private groups, we randomly assign one fourth of buyers to receive only a “Placebo treatment". This treatment consists in the buyer receiving, on a monthly basis, a simple message indicating that her overspending is being monitored, but do not provide any type of information about individual performance. This way we can test for the presence and magnitude of Hawthorne effects on performance. As is shown Appendix B, we reject the presence of Hawthorne effects in our experiment.

Figure 3 details the timeline of the experiment. Between February and May 2020 (i.e., before treatment implementation), a baseline survey was implemented on Manager/DAFs and buyers to capture their values/preferences about public spending. The survey includes modules on values/preferences about budget’s under-execution, questions about purchasing behavior of buyers and services, questions about how public budget is assigned to services, and questions about the monitoring process of public spending. See Appendix Tables A.2 and A.3 for examples of these questions indicators. Overall, we were able to collect baseline responses of Manager/DAFs in 89% of services, while buyers in all 184 services responded the survey, for a total of 2,600 responses.

Figure 3: Timeline of Experiment




By June, 2020 we started treatment implementation, with DIPRES sending an invitation to Manager/DAFs and buyers in services assigned to Private and Public treatments for a 10-minutes online course. During the three months of exposure to the training video, take-up rate is expected to be large as Manager/DAFs and buyers from at least 92% of Public and Private treatment services opened the email with the invitation. The take-up rate is equally balanced across the two treatment arms. Then, from September 2020 to January 2021, Manager/DAFs and buyers were sent 5 monthly reports. The across-months average take

up rate was 99% in case of Manager/DAFs, meaning the reports were largely read by the intended users. In the case of buyers, the take up rate was considerably smaller, reaching 36%. Again, in all cases the take up rate is well balanced across treatment arms[9]. Finally, after sending the last report (January 2021), we started the implementation of the follow up survey to both Manager/DAFs and buyers, which took about a month to be fully collected and covered 88% of the sampled services.

## 7. Effects of Information on Procurement Efficiency and Behavior of Organization Members

To analyze the effect of the intervention on efficiency we run the following regression at the purchase level:

$$op_{ijct} = \alpha + \delta_1 T_j^{Public} + \delta_2 T_j^{Private} + X'_{ijct}\beta + \varepsilon_{ijct} \quad (4)$$

Where $op_{ijct}$ is a measure of efficiency for each purchase of buyer $i$ who works in organization/service $j$, of a product in category $c = \{Food, Office\ Supplies, Hardware\}$, at calendar month $t$. $T_j^{Public}$ and $T_j^{Private}$ are binary indicators that equal to one if the organization was randomly assigned to either the Public or Private treatment. $X_{ijct}$ is a vector of control characteristics that includes sample strata fixed effects, fixed effects of product category $c$, calendar month fixed effects, and average overprice during the pre-intervention period.

Finally $\varepsilon_{ijct}$ is an error term allowed to be correlated across services $j$. Treatment allocation was implemented at the service level and w cluster standard errors at the service level. To account for potential issues related to small number of clusters we also implement randomization inference were we permute treatment status across services.

### 7.1. Improving Efficiency in Purchasing Performance

In this section we analyze effects on our main results related to purchasing behavior of buyers and find large effects on efficiency of purchasing behavior. First, we analyze whether there are any effects on the extensive margin of the purchasing process, i.e. deciding which purchase mechanism to use. Indeed, using competitive bidding mechanisms like

[9] In the case of reports, we measure the take up rate by tracking whether the users logged in the centralized platform (www.gastoeficiente.cl) by using login credentials provided privately.

*Convenio Marco* may not be the optimal decision in all cases. For instance, auctions may perform poorly when projects are complex, contractual design is incomplete, or there are few available bidders. Furthermore, auctions may stifle communication between buyers and sellers, preventing the buyer from utilizing the contractor's expertise when designing the project (Bajari et al. (2009)). The extensive margin test is relevant since our efficiency measures of over price and over spending are observed within purchases that occur in the marketplace *Convenio Marco*. Column (1) in Table 4 shows the controlled version of equation (4), at the buyer's level, for the dependent variable of percentage of purchases made in *Convenio Marco*. On average, during the study period 55.2% of total purchases were made in Convenio Marco by the control group. A similar average is observed for treated buyers, regardless of the treatment arm they were assigned. These results show that the intervention did not affect the decision of which channel to use to make purchases so we reject that exploring effects on measures constructed from data within *Convenio Marco* is subject to sample selection bias.

Secondly, we estimate the effect of the information treatments on overprice paid and quantity of products acquired per purchase. Column (2) of Table 4 shows the results for overprice as defined in section 5.3. On average, overprice by purchase in the control group was 8.7% during the study period. The results show that overprice decreased by 2.1 percentage points (pp) for purchases in the group that received the Public information treatment. This corresponds to a 24.1% reduction of overprice paid by purchase in this group. We find no significant differences in overprice paid in the Private information intervention. We also analyze the effect of information on the quantity of products acquired on each purchase, to test for whether the lower price was obtained by switching to purchases that showed larger quantities and so lower price per unit (wholesales). We reject this hypothesis in column (3) as we find no significant effects on quantities bought. Thus, while the public treatment reduces the overprice paid, it doesn't change the quantity of products per purchase.

Finally, we analyze whether there exist effects on the number of purchased orders executed by each buyer, another proxy measure for wholesales. A purchase order is an administrative unit comprising purchases of a number of products from the same Framework Agreement. The results suggest that there are no effects of the information treatments on the number of purchases.

Table 4: Extensive and Intensive Margin Effects.

| | Extensive Margin | Intensive Margin | | |
|---|---|---|---|---|
| | % of Purchases in CM | Overprice | Log(Quantity) | Log(# P.O.) |
| | (1) | (2) | (3) | (4) |
| Treat: Public | -0.012 | -0.021*** | 0.139 | 0.051 |
| | (0.018) | (0.007) | (0.105) | (0.080) |
| Treat: Private | 0.007 | 0.005 | -0.033 | 0.115 |
| | (0.017) | (0.005) | (0.101) | (0.074) |
| Control mean | 0.552 | 0.087 | 3.42 | 1.54 |
| N Observations | 2,402 | 134,151 | 134,151 | 2,402 |
| N Buyers | 2,402 | 2,402 | 2,402 | 2,402 |
| N Agencies | 160 | 160 | 160 | 160 |
| $p$-value $H_0$: Public=Private | 0.249 | 0.000 | 0.233 | 0.422 |

*Notes*: Effects of treatment assignment on extensive and intensive margin outcomes. The extensive margin outcome refers to the share of purchases executed through *Convenio Marco* (CM, the framework agreement mechanism) instead of alternative procurement mechanisms including *Public Procurement Auctions* and *Direct Purchases*. Intensive margin outcomes all refer to purchases made through CM mechanism. Regression in models (1) and (4) uses outcomes at the buyers' level, while regressions in models (2) and (3) are at the purchase level. The Overprice of a purchase is the relative difference of the purchase price with respect to the best price available for that purchase, while Quantity stands for the amount of items purchased (in logs). A Purchase Order (P.O.) is a request of purchase made by a buyer to a single seller. While a P.O. may contain more than one product, all of them must belong to the same *Convenio Marco* (either Food, Office Supplies, or Hardware). All regressions control for baseline outcome and include stratification groups (randomization) fixed effects. Models (2) and (3) include product's category and calendar month fixed effects. Standard errors clustered at the organization level are shown in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

### 7.2. Treatment Effects on Knowledge and Preferences of Organization members

In this section we explore potential mechanisms related to the information intervention. In particular we test whether the treatment changed knowledge of measures of efficiency, monitoring practices by Manager/DAFs[10], and buyers' values about managing the budget in an efficient manner.

We first analyze the effects of the intervention on two measures that were intended to change with the information treatment. One is the manager's belief that DIPRES, the office of budgeting of Chile, cares about efficiency in spending and so monitors overspending of services. We gather data on salience about DIPRES' monitoring by asking managers to provide, on a scale of 1 to 7, what is the degree that DIPRES monitors purchases made by public organizations. Column (1) of Table 5 shows that on average the degree of salience is 4.2 for the control group. The treatment effects reveal that DIPRES monitors is more salient

[10]For simplicity, Manager/DAFs and managers means the same, and we refer to them interchangeably.

for managers in both Public and Private information. Next, we ask managers whether they know of how much overspending is happening within their organization. While 32% of managers in the control group report that they are aware of overspending, the intervention increases knowledge in 60 percentage points in both groups. As such, the intervention significantly improves monitoring salience and information in both treated groups.

A possible effect of the information treatment is that organizations change their management practices in order to reduce overspending. To assess these effects, we implemented a follow-up survey in which we elicit a battery of question about how the information provided led public services to incorporate or increase their management practices. Results are summarized in Table 5, columns (3) to (6). We find no effect of the treatment interventions on implementing management practices.

To analyze the effect of information on buyer's values, we implemented a second follow up survey measuring the extent to which buyers consider important to choose a product with the lowest price. In particular, buyers were asked whether they would choose lower price as main product selection criteria in the hypothetical situation in which DIPRES audits 1% of total purchases. The results are shown in Table 5, column (7). We find that those buyers who received the Public Information Treatment are 10.7 percentage points more likely to choose lower price as selection criteria. This corresponds to a 21.5% decrease with respect to the control group mean shown below. Buyers in the Private information treatment show no significant difference with respect to the control group.

To construct value alignment we use data for 2,661 buyers who answered the baseline survey that we implemented. In this survey we asked 8 questions regarding values/preferences phrased in the same way to buyers and managers in the same organizations. Tables A.2 and A.3 list all questions and answers provided in the items we use to construct organization alignment. [11]

[11] Because of institutional restrictions by ChileCompra we were not able to ask all belief questions to buyers because the institution considered the survey to be too long. We chose the eight questions that were more relevant to the study.

Table 5: Treatment Effects Measures of Knowledge, Management Practice, and Buyer Preferences

| | Managers' Actions | | | | | | Buyers' Actions |
|---|---|---|---|---|---|---|---|
| | DIPRES monitors unit spending | Knows about unit's level of Overspending | More monitoring Purchases | More monitoring Overspending | Create new Admin. positions to improve monitoring | Reward Buyers achieving low Overspending | If Dipres audit 1% purchases, buyer chooses price criteria |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Treat: Public | 1.060*** | 0.596*** | 0.088 | 0.032 | -0.011 | -0.013 | 0.107 *** |
| | (0.336) | (0.094) | (0.093) | (0.100) | (0.057) | (0.051) | (0.040) |
| Treat: Private | 0.895** | 0.581*** | -0.005 | -0.055 | -0.022 | -0.003 | 0.018 |
| | (0.351) | (0.102) | (0.093) | (0.097) | (0.054) | (0.051) | (0.042) |
| Control mean | 4.192 | 0.320 | 0.642 | 0.509 | 0.094 | 0.075 | 0.454 |
| N Observations | 155 | 151 | 156 | 156 | 156 | 156 | 961 |
| N Agencies | 155 | 151 | 156 | 156 | 156 | 156 | 153 |

*Notes*: This table reports coefficients of a regression using as outcome different questions from the survey administered to managers and buyers of the organizations in the sample. In Models (1)-(2) we use as outcome salience about DIPRES' monitoring on a scale of 1 to 7 (Column 1) and the report of managers for whether they know how much overspending there is within their organization (Column 2). In Models (3)-(6) we assess if the managers incorporated or increased monitoring practices. Regressions (1) to (6) are at the manager/organization level. In Model (7) we assess whether the buyers consider price as a main criteria for selecting items when purchasing. The regression in this column is at the buyer level. Robust standard errors in parentheses in Models (1)-(6). Robust standar errors are clustered at agency level in Model (7). $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

## 8. Value alignment within an organization and efficiency

In this section we explore how the effects found on overprice vary with alignment of values within organizations. We find that the Public information intervention has a larger effects in organizations where managers and buyers are more aligned in values regarding the importance of overspending.

Questions also had the same alternatives as possible answers. For each alternative $k$ in organization $j$, and buyer $i$, we compute the euclidean distance $dist_{kij} = |A_{Mkj} - A_{kij}|$ for $k = 1, \ldots, 8$, and $j = 1, \ldots, J$. $A_{Mjk}$ is the answer that manager of organization $j$ provided for question $k$ and $A_{kij}$ is the answer of each buyer $i$ of organization $j$ provided for the same question $k$.[12] As such we obtain eight values of $dist_{kij}$ for each user in organization $j$ that represents the distance in responses between their individual answer and their manager's.

[12] Van den Steen (2010) uses the same approach to measure distance in values between workers of the same firm.

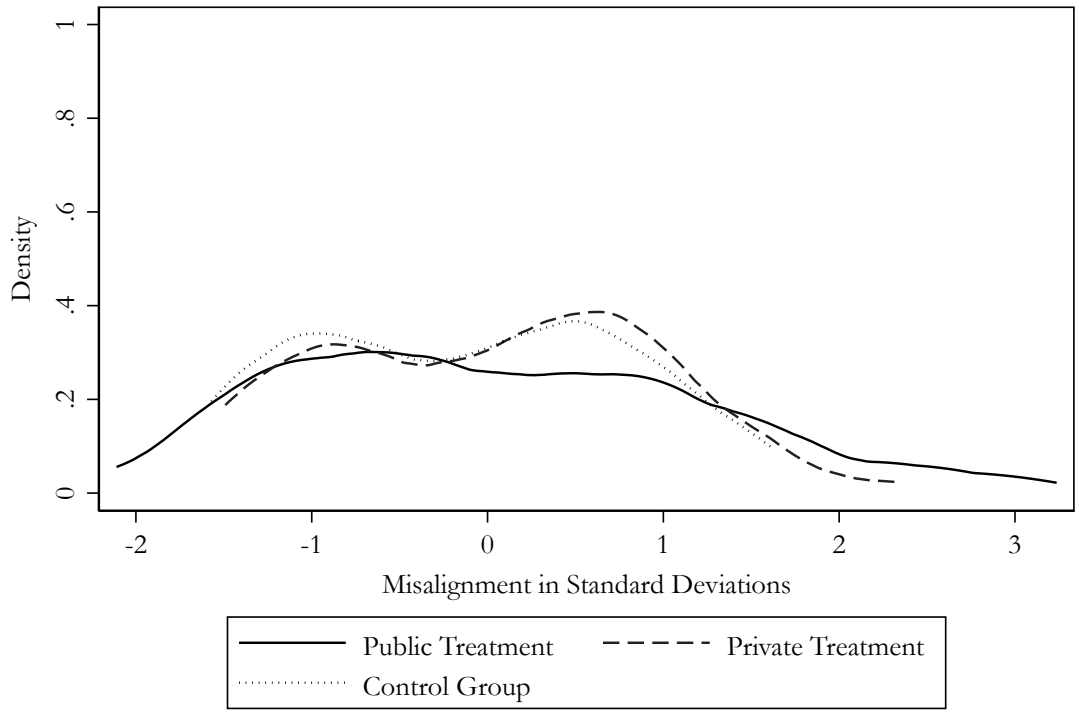
Since all these measure are intended to build a construct for organizational vertical alignment, we are interested in using them all in one measure. To do so, and to add similar units of measurement, we standardize each of the eight distance measures for each buyer using the sample distribution and obtain $dist_sd_{kij}$. Next, we average each measure separately at the organization level to obtain $\overline{dist}_sd_{kj}$. Next we add horizontally $\overline{dist}_sd_{kj}$ within each organization $j$ to obtain $MA_j = \sum_{k=1}^{8} \overline{dist}_sd_{kj}$. Finally we standardized this measure using the sample distribution. We use this final measure as our measure of value alignment at the organization level, $M.A(\sigma)_j$. The final standardisation is made to have interpret a magnitude change in alignment relative to the sample distribution. The larger the measure the less alignment there is within the organization.

The distribution across services of $M.A(\sigma)_j$ is shown in Figure 4 for each experimental group. At the bottom of the table we present *p-values* for the Kolmogorov –Smirnov equality-of-distributions test for each group pair. The results show that the distributions are not significantly different from one another, so that organizational alignment at baseline is balanced across groups. The figure also shows that our measure covers a large range of different values of alignment so that there is variation in our measure.

The model in section 3 shows that the optimal monitoring effort invested by managers is lower for organizations were values between principals and agents are more aligned. To test whether this correlation holds in our data we regress baseline measures of a proxy variable for monitoring effort by principals with our measures of value alignment during this same period. In our baseline survey, managers were asked the following question: "Who supervises/monitors the purchasing process?" Among the six non-exclusive possible answers the survey showed the alternative "The Service Manager". We code a binary indicator that equals to one if the manager reports at least once the alternative "The Service Manager", and equal to zero if they never report this answer. Table 6 shows the results of an OLS regression of this binary indicator as an outcome and our measures of misalignment at the service level at baseline. The first column shows a bi variate regression while column (2) controls for proxies of organization size: total expenditures during the baseline period and total number of buyers that work in that organization.

On average a one standard deviation increase in misalignment in values within an organization is associated to a 8.8 pp increase in the probability that the manager reports that monitoring is done by managers of the organization, among other institutions. This

Figure 4: Distribution of Service Belief Misalignment by Experimental Group in Baseline Survey




KS-Test: Public - Private (p-value) = .963 Public - Control (p-value) = .791 Private - Control (p-value) = .844

*Note*: Distribution of misalignment of values ($BA_j$) in the baseline survey by experimental group. *p-values* for Kolmogorov –Smirnov equality-of-distributions test are shown at the bottom of the Figure.

association holds after controlling for size of the organization. Relative to the average report of manager's monitoring performance (57.5%), a one standard deviation increase in misalignment is associated to a 15% increase in managers reporting that they monitor purchasing performance of the organization.

Table 6 show that, descriptively, misalignment is associated to more investment in principal's optimal monitoring effort. We would expect that exogenous provision of monitoring systems or information would affect, to a larger extent, those organizations that invest less in monitoring. These organizations on average are those that are more vertically aligned in values. If our intervention can be interpreted as improving monitoring tools to organizations then we would expect that the effects are larger for organizations that at baseline show more vertical alignment of values or preferences.

Table 6: Association between Belief Misalignment and Manager Monitoring Performance

| | Manager reports monitoring purchasing performance (= 1) | |
|---|---|---|
| | (1) | (2) |
| Misalingment ($\sigma$) | 0.088*** | 0.090*** |
| | (0.032) | (0.033) |
| Log. Total Expenditures | | 0.022 |
| | | (0.035) |
| Log. Total Buyers | | -0.015 |
| | | (0.042) |
| Average Report at Baseline | 0.575 | 0.575 |
| N Observations | 161 | 161 |

*Notes*: This table reports coefficients of an OLS regression using as outcome whether the manager of a service reports monitoring purchasing performance of buyers on our measure of vertical misalignment at the service level at baseline. The first column shows a bivariate regression while column (2) controls for proxies of organization size: total expenditures during the baseline period and total number of buyers that work in that organization. Robust standard errors are reported in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

To test for how treatment effects vary with vertical misalignment within the organization at baseline we interact treatment allocation with our measure of organizational alignment using a version of equation (4) . The regression we estimate is the following:

$$\begin{aligned} op_{ijct} =& \alpha + \delta_1 T_j^{Public} + \delta_2 T_j^{Private} + \delta_3 T_j^{Public} \times M.A(\sigma)_j + \delta_4 T_j^{Private} \times M.A(\sigma)_j \\ &+ \gamma M.A(\sigma)_j + X'_{ijct}\beta + \varepsilon_{ijct} \end{aligned} \tag{5}$$

The results are shown in Table 7. We show main results for the sub-sample of organizations for which we are able to construct vertical misalignment since in some organizations we were not able to gathered survey data from Manager/DAFs, buyers, or both. Column (1) shows very similar coefficients to the results using the full sample (shown in Table 4) which evidences that survey non-response does not affect our main estimates. Column (2) shows the coefficients associated to the interaction terms in equation (5). The results show that a one standard deviation ($\sigma$) increase in misalignment reduces the effect of the Public information treatment in 1.9 pp. We find no statistically significant differences of the Private

Table 7: Treatment Effects on Inefficiency and Misalignment

| | Overprice | |
|---|---|---|
| | (1) | (2) |
| Treat: Public | -0.025*** | -0.019*** |
| | (0.009) | (0.007) |
| Treat: Private | 0.004 | 0.007 |
| | (0.007) | (0.007) |
| Misalingment ($\sigma$) | | -0.018*** |
| | | (0.007) |
| Treat: Public $\times$ Misalingment ($\sigma$) | | 0.019** |
| | | (0.009) |
| Treat: Private $\times$ Misalingment ($\sigma$) | | 0.010 |
| | | (0.009) |
| Control mean | 0.086 | 0.086 |
| N Observations | 116,585 | 116,585 |
| N Buyers | 2,122 | 2,122 |
| N Agencies | 145 | 145 |
| $p$-value $H_0$: Public=Private | 0.000 | 0.000 |

*Notes*: Regressions are at the purchase level. The Overprice of a purchase is the relative difference of the purchase price with respect to the best price available for that purchase. All regressions control baseline outcome and include product's category, month and stratification groups (randomization) fixed effects. Standard errors clustered at the service level are shown in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

information treatment across organizations with different degrees of alignment.

## 9. Discussion

Public organizations usually work under tight resource constraints and so pursuing efficiency in spending a fixed budget can be valuable to create surplus. To this goal public organizations may invest in different management tools, one of them being monitoring to gather information on employee's performance. However, investments can be costly and public organizations usually do not have the appropriate incentives to do so. Also, the associated increase in bureaucracy might lead to more inefficiency and not less (Kelman (1990)).

The prediction of our model in section 3 shows that more information reduces monitoring costs and so the manager has to exert less effort on convincing the agent to do what she believes is best. Our results show that managers in intervened organizations learn about their organization's performance as managers in both groups report almost a two fold

increase in knowledge of their organization's overspending and why it matters. Hence, more information about overall organization performance is passed onto managers in both groups, however, managers in the Public treatment also know the performance of buyers within their organization. As such, managers in Public treatment organizations have to exert less effort in promoting efficiency on their employees. Consistently, we show that employees' performance in Public treatment organizations reduces overprice of purchases in 24.1%.

Furthermore, we find that buyers' in Public treatment organizations increase their value of choosing a lower price as a criteria when choosing which product to buy. The results show that buyers are 24% more likely to value a lower price. As such, increasing knowledge of managers about overspending and increasing buyers' values for reaching a lower price are potential pathways to how Public information on organizational performance improve efficiency in purchases. Improving value for a lower price when confronting a singular purchase is also consistent with the fact that we do not find any effects on switching away from *Convenio Marco* to other purchasing mechanisms.

Moreover, our model predicts that the marginal effect of better information decreases with misalignment of values between managers and buyers within an organization (Van den Steen (2010)). This is mainly explained because in organizations that are misaligned managers are already exerting a larger effort on convincing the agent to do what she believes is best. In fact, we find that managers in organizations that are less aligned in values before the intervention report larger monitoring efforts (15%) during this same period. In addition, when values are shared communication is likely to be more informative (Crawford and Sobel (1982)) and managers are more likely to delegate more (Aghion and Tirole (1997)). If efficiency matters for both the worker and the manager, the less effort a manager has to exert to convince a worker to use cost saving technologies and practices. As such, organizations that exert larger efforts in monitoring are expected to have a lower response to exogenous changes in information or monitoring tools as these will have lower returns.

Our findings show that there is large heterogeneity in value alignment across organizations in our sample and that a one standard deviation increase in misalignment reduces the effect of the public information treatment on efficiency in in 1.3 *pp*; while we find null effects of misalignment for organizations in the private information treatment (i.e., where monitoring tools were absent since information was private).

These results are consistent with organizational culture (measured through value alignment) playing a key role in mediating the positive effects of implicit monitoring tools on efficiency in public procurement, as vertical alignment in efficiency values reduce monitoring costs.

## 10. Conclusion

In this paper, we design a field experiment to study how information-based, implicit monitoring technologies affect performance in public services while keeping organizational structure fixed. In collaboration with the Chilean Public Procurement Office, we randomly assigned monthly reports with systematic information about the purchasing performance of procurement officers and services to a sample of 8,300 procurement officers in 184 public services, and randomly varied whether the individual performance was disclosed to managers (public) or not (private).

After 5 months of treatment exposure, we find the reports generated significant reductions in overspending, but only when individual performance was observable for managers. We conclude that monitoring tools are necessary for performance information to generate a change in purchasing behavior of officers. We further find that most of the treatment effect comes from organizations where values associated to efficiency were highly aligned across managers and officers, suggesting that organizational culture plays a key role in easing the impact of implicit monitoring technologies in preventing the misuse of public resources.

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# A. Appendix Tables and Figures

Table A.1: Baseline Balance at Service and Buyer level

| | Control | Public | Private | Control vs Public | Control vs Private | Public vs Private |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Baseline Balance at the Service level* | | | | | | |
| Belief about future budget in case of underspending. | 2.027 | 2.048 | 1.945 | 0.095 | -0.133 | 0.047 |
| | (0.522) | (0.666) | (0.524) | (0.161) | (0.151) | (0.199) |
| Belief about future budget in case of underspending and savings. | 1.909 | 2.058 | 2.009 | 0.131 | -0.077 | 0.089 |
| | (0.528) | (0.591) | (0.486) | (0.145) | (0.117) | (0.172) |
| Degree of agreement that future budget depends on execution. | 3.236 | 3.250 | 3.173 | 0.288 | -0.051 | 0.214 |
| | (0.999) | (1.153) | (1.028) | (0.270) | (0.300) | (0.334) |
| Degree of agreement that future budget will decrease if there exists savings. | 2.982 | 2.712 | 2.709 | -0.063 | -0.199 | 0.052 |
| | (1.076) | (1.117) | (0.843) | (0.294) | (0.290) | (0.284) |
| Degree of agreement that there exists purchases with overprice. | 2.555 | 2.452 | 2.364 | -0.099 | -0.423 | -0.177 |
| | (1.017) | (1.130) | (1.034) | (0.301) | (0.296) | (0.302) |
| Degree of agreement that there exists pressure to execute the total of the budget. | 4.291 | 4.192 | 4.291 | 0.054 | 0.199 | -0.214 |
| | (0.843) | (0.823) | (0.780) | (0.151) | (0.208) | (0.261) |
| Degree of agreement that there is no clarity on how the budget is defined | 3.100 | 2.981 | 3.345 | -0.419 | 0.296 | -0.552 |
| | (1.025) | (1.142) | (1.130) | (0.273) | (0.300) | (0.315) |
| How much important is savings on public purchases to DIPRES. | 4.156 | 3.721 | 3.815 | -0.256 | -0.381 | 0.132 |
| | (1.334) | (1.704) | (1.526) | (0.316) | (0.306) | (0.360) |
| Monitoring level on public purchases exerted by DIPRES. | 4.064 | 3.846 | 3.973 | -0.063 | -0.276 | -0.297 |
| | (1.334) | (1.385) | (1.544) | (0.318) | (0.420) | (0.393) |
| Number of Services | 61 | 62 | 61 | 103 | 102 | 103 |
| *Baseline Balance at the Buyer level* | | | | | | |
| Overprice in 2019 | 0.068 | 0.077 | 0.073 | -0.004 | 0.004 | 0.002 |
| | (0.054) | (0.072) | (0.062) | (0.004) | (0.004) | (0.005) |
| Responded baseline survey (1=Yes. 0=No) | 0.356 | 0.268 | 0.332 | -0.001 | -0.003 | 0.006 |
| | (0.479) | (0.443) | (0.471) | (0.018) | (0.018) | (0.020) |
| Qualification Status (1=Valid. 0=Expired) | 0.898 | 0.922 | 0.916 | 0.025 | -0.002 | 0.002 |
| | (0.303) | (0.269) | (0.278) | (0.024) | (0.013) | (0.012) |
| Blocked User (1=Blocked. 0=Unblocked) | 0.005 | 0.002 | 0.004 | 0.001 | -0.000 | -0.002 |
| | (0.068) | (0.050) | (0.062) | (0.002) | (0.002) | (0.004) |
| Number of buyers | 2,570 | 2,892 | 2,927 | 5,462 | 5,497 | 5,819 |

*Notes*: Columns (1)-(3) report mean and standard deviation (in parenthesis) of different variables measured before the intervention, by treatment arm. The last three columns report mean differences across groups and its associated standard errors (in parenthesis), after controlling for strata fixed effects. ***p<0.01, **p<0.05, * p<0.10.

Table A.2: Questions used to construct vertical alignment

| Question | Values | Choices |
|---|---|---|
| Suppose that the Public Service in which you work fails to execute 100% (or a percentage close to 100%) of the budget allocated for this year. Regardless of the economic projections that the Government manages for the following year, what would you expect to happen with the budget approved for your Service the following year? | 1 | I would expect the budget to decrease from this year's budget. |
| | 2 | I would expect the budget to remain the same as this year's budget. |
| | 3 | I would expect the budget to increase from this year's budget. |
| This question is about what you think the Head (the Head of Administration and Finance) of the Public Service in which you work thinks. What do you think he or she would answer about what would happen to next year's budget if 100% of the budget (or close to it) allocated for this year is not executed?* | 1 | I think he/she thinks the budget would decrease next year. |
| | 2 | I think he/she thinks the budget would stay the same next year |
| | 3 | I think he/she thinks the budget would increase next year |
| Suppose that the Public Service in which you work does not manage to execute 100% (or a percentage close to 100%) of the budget allocated for this year, but manages to demonstrate that it generated considerable savings in the use of resources. Regardless of the economic projections that the Government manages for the following year, what would you expect to happen with the budget approved for your Service the following year? | 1 | If savings are generated, I would expect the budget to decrease from this year's budget. |
| | 2 | If savings are generated, I would expect the budget to remain the same as this year's budget. |
| | 3 | If savings are generated, I would expect the budget to increase from this year's budget. |
| This question is about what you think the Head (Head of Administration and Finance) of the Public Service in which you work thinks: What do you think he/she would answer about what would happen to next year's budget if he/she does not manage to execute 100% of the budget (or a close percentage) allocated for this year, but manages to demonstrate that he/she generated considerable savings in the use of resources?* | 1 | If savings are generated, I believe he or she thinks the budget would decrease next year. |
| | 2 | If savings are generated, I believe he or she thinks the budget would remain the same next year. |
| | 3 | If savings are generated, I believe he or she thinks the budget would increase next year |
| Next year's budget is largely determined by how much of this year's budget is executed. | 1 | Strongly disagree |
| | 2 | Disagree |
| | 3 | Neither agree nor disagree |
| | 4 | Agree |
| | 5 | Strongly agree |

Table A.3: Questions used to construct vertical alignment (cont.)

| Question | Values | Choices |
|---|---|---|
| If savings are generated, the budget will be reduced next year. | 1 | Strongly disagree |
| | 2 | Disagree |
| | 3 | Neither agree nor disagree |
| | 4 | Agree |
| | 5 | Strongly agree |
| Executing the budget allocated to your Service involves making spending decisions and savings strategies. Some believe that the level of publicsavings is a relevant variable for The Chilean Budgetary Office (DIPRES) in the process of negotiating the budget for the following year. Others, on the other hand, believe that DIPRES has little interest in the level of public savings generated by the Services and does not consider this variable in the budget negotiation process. From your perspective, what is the level of relevance that DIPRES gives to the public savings generated by a department when making budget allocation decisions? Being 1 "Not relevant" and 7 "Extremely relevant" | 1 | Not relevant |
| | 2 | |
| | 3 | |
| | 4 | |
| | 5 | |
| | 6 | |
| | 7 | Extremely relevant |
| One of the main mechanisms through which the budget is executed is the Public Procurement System ("Licitaciones", "Convenio Marco" or "Trato Directo"). Some think that DIPRES monitors and supervises on a recurrent basis the purchases made by each Public Service. Others, on the other hand, think that DIPRES does NOT monitor or supervise the purchases made by each service. From 1 to 7, what do you think is the level of monitoring exercised by DIPRES on public purchases made by your service? Being 1 "No monitoring" and 7 "High level of monitoring". | 1 | No monitoring |
| | 2 | |
| | 3 | |
| | 4 | |
| | 5 | |
| | 6 | |
| | 7 | High level of monitoring |
| Utilizing the maximum budget is a pressure within the public services. | 1 | Strongly disagree |
| | 2 | Disagree |
| | 3 | Neither agree nor disagree |
| | 4 | Agree |
| | 5 | Strongly agree |
| Sometimes, in the Public Services, purchases are made at high prices to comply with budget execution. | 1 | Strongly disagree |
| | 2 | Disagree |
| | 3 | Neither agree nor disagree |
| | 4 | Agree |
| | 5 | Strongly agree |

*Buyers are asked about what the Head of Administration and Finance thinks

Figure A.1: Monthly Reports received by Principals

DIPRES

CSP · INGENIERÍA INDUSTRIAL UNIVERSIDAD DE CHILE · CENTRO DE SISTEMAS PÚBLICOS

**Informe Mensual de Sobregasto**

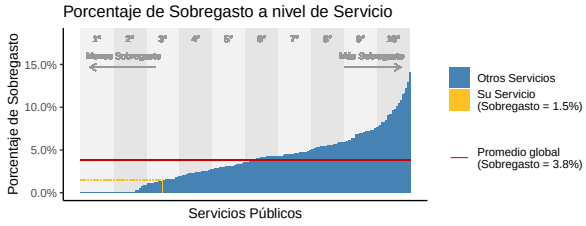
Nombre Servicio Público

Octubre, 2020

Estimado Nombre Apellido,

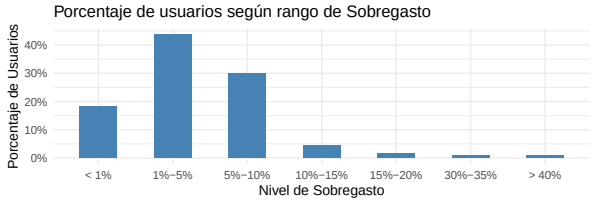
A continuación le presentamos información relevante sobre el estado del gasto público ejecutado por el Servicio en el cual usted se desempeña, para el período Septiembre 2019 - Septiembre 2020. El informe incluye un análisis de compras a nivel agregado de su Servicio, de modo de facilitar la gestión del Sobregasto dentro de su Servicio. **Su Servicio se encuentra entre los 50 Servicios con menor Sobregasto**, de un total de 184 Servicios (se excluyen Servicios Autónomos y Subsecretarías). Usted puede realizar cualquier consulta relativa a este informe a gastoeficiente@dipres.gob.cl.

**Recuerde que la planificación del gasto en su Servicio le permite realizar compras más eficientes**, lo que puede llevar a ahorros significativos. Para este fin, los/as usuarios/as de ChileCompra tienen a su disposición el uso de distintos procedimientos de compra como Convenio Marco, Compra Ágil o Licitaciones, los cuales permiten hacer compras más planificadas que aquellas realizadas por otras alternativas de compra, como Trato Directo.



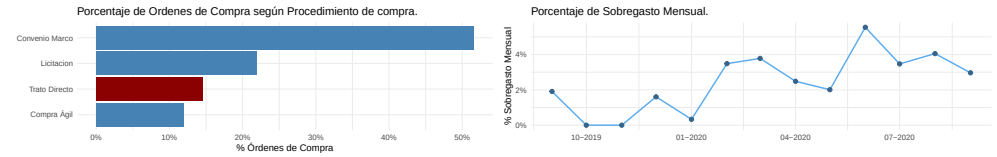

Este gráfico muestra el Sobregasto realizado por cada Servicio Público del Estado, ordenados de menor a mayor Sobregasto (ver definición en Anexo). En **amarillo** se indica la posición relativa de su Servicio [1].

El promedio de Sobregasto en su Servicio equivale a 1.5%, lo que implica que se encuentra entre los 50 Servicios con menor Sobregasto, de un total de 184 Servicios (se excluyen Servicios Autónomos y Subsecretarías). Sólo a modo de ejemplo, si tomamos en consideración únicamente compras realizadas vía Convenio Marco, el Sobregasto en su Servicio asciende aproximadamente a $200 millones de pesos en este período.




Este gráfico muestra el porcentaje de usuarios/as de ChileCompra pertenecientes a su Servicio según su nivel de Sobregasto. Por ejemplo, un 18% de los usuarios dentro del Servicio poseen un nivel de Sobregasto menor a 1%.

En promedio, los usuarios de su Servicio han realizado un nivel de Sobregasto de un 5.1%. **Para que su Servicio pueda mejorar la eficiencia en gasto público, puede ser importante que usted le recuerde a los usuarios de su Servicio sobre la importancia de reducir lo más posible el Sobregasto en las compras.**




El gráfico a la izquierda muestra cómo se distribuye el total de compras por tipo de procedimiento. Su Servicio realiza el 51.6% de sus compras mediante Convenio Marco. **Recuerde preferir procedimientos de compra, como Convenio Marco, Licitaciones y Compra Ágil, los cuales permiten planificar de mejor forma el gasto y obtener mejores precios**. El gráfico a la derecha muestra cómo ha evolucionado el Sobregasto mensual de su Servicio en el período reportado.

**Recuerde que haciendo búsquedas detenidas y planificando compras puede reducir su Sobregasto.**

[1] Para más información sobre buenas prácticas en la ejecución de compras públicas, DIPRES ofrece un curso online, al cual Usted puede acceder en el siguiente link. El acceso al curso es individualizado. En caso que Usted desee que otras personas dentro de su Servicio accedan al curso, por favor escribir a gastoeficiente@dipres.gob.cl.

1

Note: This figure shows the information displayed in the monthly reports sent to principals within each organization.

Figure A.2: Monthly Reports received by Agents

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# Informe Mensual de Sobregasto

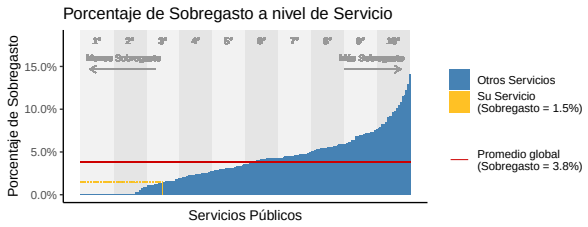
Nombre Servicio Público

Octubre, 2020

Estimado Nombre Apellido,

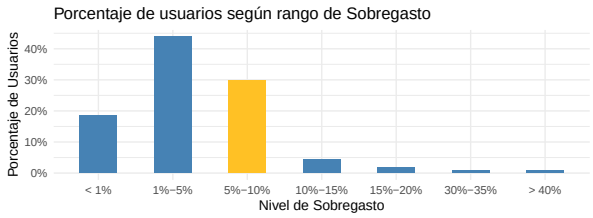
A continuación le presentamos información relevante sobre el estado del gasto ejecutado por el Servicio en el cual usted se desempeña, para el período Septiembre 2019 - Septiembre 2020. El reporte incluye un análisis de compras a nivel agregado, como también desagregado para cada usuario que ejecuta compras dentro de la plataforma de Mercado Público. Le informamos que **su promedio de Sobregasto como usuario es de un 7%. Usted se encuentra entre el 25% de los usuarios de su Servicio con mayor Sobregasto**. Usted puede realizar cualquier consulta relativa a este informe a gastoeficiente@dipres.gob.cl.

**Recuerde que la planificación de los gastos que realiza para su Servicio le permite hacer compras más eficientes**, lo que puede llevar a ahorros significativos. Para este fin, los/as usuarios/as de ChileCompra tienen a su disposición el uso de distintos procedimientos de compra como Convenio Marco, Compra Ágil o Licitaciones, los cuales permiten hacer compras más planificadas que aquellas realizadas por otras alternativas de compra, como Trato Directo.




Este gráfico muestra el Sobregasto realizado por cada Servicio Público del Estado, ordenados de menor a mayor Sobregasto (ver definición en Anexo). En **amarillo** se indica la posición relativa de su Servicio [1].

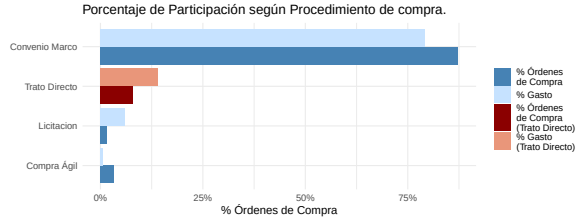
El promedio de Sobregasto en su Servicio equivale a 1.5%, lo que implica que se encuentra entre los 50 Servicios con menor Sobregasto, de un total de 184 Servicios (se excluyen Servicios Autónomos y Subsecretarías). Sólo a modo de ejemplo, si tomamos en consideración únicamente compras realizadas vía Convenio Marco, el Sobregasto en su Servicio asciende aproximadamente a $200 millones de pesos en este período.




Este gráfico muestra el porcentaje de usuarios/as de ChileCompra pertenecientes a su Servicio según su nivel de Sobregasto. Por ejemplo, un 18% de los usuarios dentro del Servicio poseen un nivel de Sobregasto menor a 1%.

La barra **amarilla** indica al rango en donde Usted se ubica, relativo al resto de los usuarios de su Servicio. Su promedio de Sobregasto como usuario es de un 7 %

En promedio, los usuarios de su Servicio han realizado un nivel de Sobregasto de un 5.1%.




Este gráfico muestra cómo se distribuye sus compras, según el tipo de procedimiento de compra.

Usted realizó el 87.3% de sus compras mediante Convenio Marco, lo cual corresponde a un 79.2% del gasto total que ha efectuado.

**Recuerde preferir procedimientos de compra, como Convenio Marco, Licitaciones y Compra Ágil, que permiten planificar de mejor forma el gasto y obtener mejores precios.**

**Recuerde que haciendo búsquedas detenidas y planificando sus compras puede reducir su Sobregasto.**

[1] Para más información sobre buenas prácticas en la ejecución de compras públicas, DIPRES ofrece un curso online, al cual Usted puede acceder en el siguiente link. El acceso al curso es individualizado. En caso que Usted desee que otras personas dentro de su Servicio accedan al curso, por favor escribir a gastoeficiente@dipres.gob.cl.

1

Note: This figure shows the information displayed in the monthly reports sent to agents within each organization.

## B. Appendix: Hawthorne Effects of Information Treatments

In order to test for the presence of Hawthorne effects of the information treatment at the user level, we will replicate the same estimation strategy in (4), but will add two additional dummies to the model. One is a dummy that equals 1 if the buyer works for a service assigned to T1 but was assigned to the Placebo treatment (and zero otherwise), and the other is a dummy that equals 1 if the buyer works for a service assigned to T2 but was assigned to the Placebo treatment (and zero otherwise). The results in Table B.1 below shows that there are no effects on purchases made by buyers in the placebo treatments.

Table B.1: Placebo Analysis of Treatment Effects on the Extensive and Intensive Margin of Purchases in the Marketplace

| | Purchases in Marketplace (%) | | Over Price Paid | | Over Spending Paid | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Treat: Public placebo | 0.028 * | 0.017 | 0.002 | 0.003 | -0.000 | -0.001 |
| | (0.014) | (0.014) | (0.003) | (0.003) | (0.005) | (0.006) |
| Treat: Private placebo | 0.011 | 0.017 | -0.003 | -0.001 | -0.011 | -0.011 |
| | (0.022) | (0.023) | (0.003) | (0.003) | (0.012) | (0.012) |
| Observations | 2,649 | 2,649 | 2,649 | 2,649 | 2,649 | 2,649 |
| Control Mean | 0.628 | 0.628 | 0.059 | 0.059 | 0.045 | 0.045 |
| Strata FE | Y | Y | Y | Y | Y | Y |
| Controls | N | Y | N | Y | N | Y |

*Notes*: This table reports coefficients of equation (4) using as outcome the percentage of purchases made trough marketplace (column 1-2), the average overprice paid (column 3-4) and average overspending (column 5-6). Controls include baseline level of each outcome. Bottom rows report *p-values* for different procedures. Robust standard errors clustered at the service level in parentheses. ***p<0.01, **p<0.05, * p<0.10.

## C. Appendix: Theoretical Results

From equation (1), Manager's optimization problem can be written as follows:

$$\max_{e>0} \pi(e,\delta,s) = \frac{1+\mu_J^2}{2} - (1-P(e,s))\frac{\delta^2}{2} - c(e) \tag{C.1}$$

Let $e^* = e^*(\delta, s)$ be an interior solution of (C.1). Since $\frac{\partial^2\pi(e,\delta,s)}{\partial\delta\partial e} > 0$ and $\frac{\partial^2\pi(e,\delta,s)}{\partial s\partial e} < 0$ for each $e$, it follows from Topkis's Theorem that the optimal effort $e^*$ is increasing in $\delta$ and decreasing in $s$. Furthermore, from the Envelope Theorem we obtain that the optimal payoff $v(\delta, s) = \pi(e^*(\delta, s), \delta, s)$ is decreasing in $\delta$ and increasing $s$.

Since $e^*(\delta, s)$ is optimal, it satisfies:

$$\frac{\partial\pi(e^*,\delta,s)}{\partial e} = 0,, \quad \text{for each } \delta, s$$

Let's fix a pair $(\delta, s)$. Since $\pi(e, \delta, s)$ is strictly concave, the Implicit Function Theorem implies that the optimal effort $e^*(\delta, s)$ is locally differentiable in $(\delta, s)$ and

$$\frac{\partial e^*(\delta,s)}{\partial s} = -\frac{\frac{\partial^2\pi(e^*,\delta,s)}{\partial s\partial e}}{\frac{\partial^2\pi(e^*,\delta,s)}{\partial e^2}} \tag{C.2}$$

By the other hand,

$$\frac{\partial v(\delta,s)}{\partial\delta} = -\delta(1-P(e^*,s)),$$

which implies that

$$\frac{\partial^2 v(\delta,s)}{\partial s\partial\delta} = \delta\left(\frac{\partial P(e^*,s)}{\partial e}\frac{\partial e^*}{\partial s} + \frac{\partial P(e^*,s)}{\partial s}\right). \tag{C.3}$$

Finally, combining (C.2) and (C.3) we obtain that:

$$\frac{\partial^2 v(\delta, s)}{\partial s \partial \delta} < 0 \Longleftrightarrow \frac{\frac{\partial P(e^*, s)}{\partial s}}{\frac{\partial P(e^*, s)}{\partial e}} < \frac{\frac{\partial^2 \pi(e^*, \delta, s)}{\partial s \partial e}}{\frac{\partial^2 \pi(e^*, \delta, s)}{\partial e^2}}.$$