Management Science

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http://pubsonline.informs.org

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To cite this article:
Ruth Beer, Ignacio Rios, Daniela Saban (2021) Increased Transparency in Procurement: The Role of Peer Effects. Management Science 67(12):7511-7534. https://doi.org/10.1287/mnsc.2020.3894

http://pubsonline.informs.org/journal/mnsc

MANAGEMENT SCIENCE
Vol. 67, No. 12, December 2021, pp. 7511–7534
ISSN 0025-1909 (print), ISSN 1526-5501 (online)

Increased Transparency in Procurement: The Role of Peer Effects

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Received: August 10, 2018
Revised: September 28, 2019; September 24, 2020
Accepted: October 4, 2020
Published Online in Articles in Advance: April 9, 2021

https://doi.org/10.1287/mnsc.2020.3894

Abstract. Motivated by recent initiatives to increase transparency in procurement, we study the effects of disclosing information about previous purchases in a setting where an organization delegates its purchasing decisions to its employees. When employees can use their own discretion, which may be influenced by personal preferences, to select a supplier, the incentives of the employees and the organization may be misaligned. Disclosing information about previous purchasing decisions made by other employees can reduce or exacerbate this misalignment, as peer effects may come into play. To understand the effects of transparency, we introduce a theoretical model that compares employees' actions in two settings: one where employees cannot observe each other's choices and one where they can observe the decision previously made by a peer before making their own. Two behavioral assumptions are central to our model: that employees are heterogeneous in their reciprocity toward their employer, and that they experience peer effects in the form of income inequality aversion toward their peer. As a result, our model predicts the existence of negative spillovers as a reciprocal employee is more likely to choose the expensive supplier (which gives the employee a personal reward) when the employee observes that a peer did so. A laboratory experiment confirms the existence of negative spillovers and the main behavioral mechanisms described in our model. A surprising result not predicted by our theory is that employees whose decisions are observed by their peers are less likely to choose the expensive supplier than the employees in the no-transparency case. We show that observed employees' preferences for compliance with the social norm of appropriate purchasing behavior explain our data well.

History: Accepted by Yuval Victor Martinez de Albeniz, operations management.
Funding: Funding for this research was provided by the Center for International Business Education and Research at the Kelley School of Business, Indiana University.
Supplemental Material: Data and the online appendix is available at https://doi.org/10.1287/mnsc.2020.3894.

Keywords: behavioral operations • transparency • procurement • peer effects • laboratory experiments

1. Introduction

As part of recent initiatives to increase operational transparency, several organizations have launched online platforms to make information related to procurement transactions visible to various parties within the organization. For example, the government of Buenos Aires, Argentina, launched in 2017 a new platform, BuenosAiresCompra, that allows government employees to search for and buy products and services from a set of preselected suppliers, and to observe the past purchases of other government employees, among other features. ProZorro, an open public procurement platform launched by the government of Ukraine in 2014, goes even further and, under the motto "Everyone can see everything," discloses public procurement data to the general public, including the list of all potential suppliers with their bids, the decisions of the evaluation committee, contracts, and all certification documents. Similar initiatives have been adopted by the governments of Chile (ChileCompra), the United Kingdom (ContractsFinder), California (CaleProcure), and other governments and private companies through third-party platforms such as OpenGov and Procurify. As opposed to ProZorro, most of these platforms provide only aggregate information to the public and, as in BuenosAiresCompra, individual decisions are observable only to employees within the organization.

Most transactions recorded by these platforms can be broadly classified into two types. The first type comprises the purchases of products and services that are central to the operation of the organization (e.g., the purchase of meals by a school district). As such, these purchases are the responsibility of procurement teams that must follow well-specified purchasing protocols. The second type comprises those purchases that, instead of being carried out by specialized procurement teams, are delegated to individual

employees who will be the ones using these products and services. Examples of the latter include employees booking their own airline tickets and hotel accommodations for business travel purposes, or choosing which work computer to buy. Although employees still must follow some purchasing guidelines, they are typically allowed much more freedom in selecting products and suppliers. This freedom can be problematic as the incentives of employees and organizations are not always fully aligned: whereas organizations typically care about price and quality, employees' preferences may be influenced by personal considerations. For example, employees might prefer to choose airlines for which they obtain reward points for personal use, ignoring lower-priced alternatives. This can be concerning for organizations because, even though individually delegated purchases generally involve small expenses, they can add up to large amounts. For instance, in 2014 the U.S. government spent $17.1 billion through the Government Purchase Card Program, which allows public agencies to pay for small purchases (Billingsley 2015).

Disclosing information about others' purchasing decisions can reduce or exacerbate this misalignment, as social comparisons and peer effects may come into play. Moreover, mechanisms to mitigate the misalignment are typically unavailable—individuals' needs are idiosyncratic and purchases are usually small, making punishment and monitoring unfeasible—and therefore understanding the impact of increased transparency on purchasing decisions is particularly important in this setting.

The goal of this paper is to study, both theoretically and experimentally, the impact of increased transparency on delegated purchasing behavior. Our contribution is threefold. First, we introduce a theoretical model incorporating employees' social preferences in the presence of transparency into the employees' utility, and derive testable hypotheses. Second, we design a procurement game to test the predictions of our model and to analyze the main drivers leading to changes in behavior. Finally, based on our results, we provide concrete managerial insights for organizations seeking to understand the potential consequences of increased transparency on their procurement costs.

More precisely, we introduce a stylized model of an organization consisting of a director and two employees, whose wages are identical and determined by the director. The organization needs to purchase two identical items and the director delegates the supplier choice to the employees: each of the employees must choose one of two suppliers to provide an item, which will be paid for by the organization, and their decisions can be neither overruled nor punished by the director. Purchasing from the expensive supplier provides an extra personal benefit for the employees (such as purchasing a flight from a preferred airline), but also results in a higher procurement cost for the organization. This model captures the main features of the real-world settings described earlier and, at the same time, it is simple enough to allow us to squarely focus on studying the impact of transparency on employees' purchasing decisions, both theoretically and experimentally.

To understand the effect of transparency, we compare the employees' actions in two settings: one where employees make their decisions simultaneously and cannot observe each other's choices (baseline), and one where the decisions are made sequentially and the second employee can observe the first employee's supplier choice before making a choice (peer). We assume that, besides the motivation to maximize monetary payoffs, two behavioral factors drive employees' decisions. First, we assume that (some) employees have reciprocal preferences toward the employer, that is, the employees are willing to forgo the personal benefit and choose the cheaper supplier if they perceive that their employer is treating them kindly. Second, employees are subject to peer effects, which we model as income inequality aversion toward their peer's payoff. In line with previous work, we assume that the latter is only present among employees who can observe their peer's decisions.

We show that in both the baseline and peer settings, the probability that employees choose the expensive supplier is decreasing in the wage offered by the director, in the price difference between suppliers, and in how much employees care about reciprocity. Importantly, we show the existence of a negative spillover price difference region where reciprocal employees are more likely to choose the expensive supplier (relative to the baseline) if they observe that their peers did so. This effect results from the interaction of two behavioral assumptions: the heterogeneity in employees' reciprocity toward the employer, and the aversion to disadvantageous income inequality relative to their peers. Our model also predicts the absence of positive spillovers, that is, observing that a peer chose the cheapest option does not affect employees' behavior, regardless of their reciprocity type.

To test these predictions, we conduct a laboratory experiment that replicates exactly the settings of the theoretical model. In the baseline treatment, both employees choose a supplier simultaneously, whereas in the peer treatment, employees make their decisions sequentially. The main experimental finding is that increasing transparency has a heterogeneous effect on buyers. In line with our theoretical results, we find evidence of negative spillover effects on reciprocal employees, suggesting that increasing transparency negatively affects reciprocal employees who observe their peers' decisions. Besides confirming the existence of

negative spillover effects, which have previously been uncovered experimentally in related settings (see Section 2 for a detailed discussion), our theoretical model and experimental design allow us to identify the heterogeneity in reciprocity toward the employer as a key behavioral mechanism leading to this effect.

Moreover, we analyze how buyers' behavior changes when they are being observed by a peer. The effects on observed employees have been mostly overlooked by the previous literature on peer effects, which mainly focuses on the effects on observers. We find evidence that employees who are observed are less likely to choose the expensive option. This result is particularly significant among nonreciprocal employees, suggesting that reciprocity is not the main mechanism driving their behavior. We propose an alternative explanation based on preferences for compliance with the *social norm*, that is, the collective agreement about the appropriateness of choosing the expensive supplier. To test it, we conduct two social norm elicitation treatments to measure the appropriateness of choosing the expensive supplier in the baseline and peer settings, respectively. We find that it is less appropriate to choose the expensive supplier when employees are observed by others, and that the differences between the elicited social norms are consistent with the differences in purchasing behavior. These results suggest that a preference for compliance with the social norm of appropriate behavior better explains the purchasing decisions of observed employees.

Finally, a new experimental treatment confirms that the two effects of transparency that we identify—the negative spillovers on observers and the positive effect of being observed—persist when an employee is both an observer of a peer's action and one whose action is observed by a peer. Specifically, the positive effects of being observed are attenuated when an employee also observes that a peer chose the expensive supplier, and the negative spillovers on an employee who observes that a peer chose the expensive supplier are less salient when the employee's decision will be subsequently observed by a peer.

Our results provide useful managerial insights that can be applied when designing procurement platforms that increase transparency. In particular, firms' internal communication policies should emphasize that employees' decisions will be observed by their peers. This would help reduce overspending by nonreciprocal employees, which in turn would mitigate the negative spillovers on reciprocal employees, leading to lower procurement costs. In addition, our results show that overspending is perceived to be less appropriate when an employee's decision will be observed by other employees. This should also be exploited by the organization to reduce procurement costs: as employees comply, to a certain level, with what is perceived as socially appropriate, organizations should make communication efforts that reinforce what is perceived as appropriate spending behavior in an attempt to increase compliance with the social norm. Finally, although our experiment captures decision making in a procurement setting, we believe our findings and the behavioral mechanisms we identify (and, consequently, the managerial implications we derive) can more broadly explain the effects of increased transparency in related settings.

The remainder of this paper is organized as follows. In Section 2, we discuss the related literature. In Section 3, we present the theoretical model. Section 4 describes the experimental design and the hypotheses derived from our model, and Section 5 presents the experimental results. Finally, Section 6 describes the managerial implications of this research and concludes.

2. Related Literature

Our paper lies at the intersection of several streams of literature. First, it contributes to a growing literature studying the effects of transparency in operations management. So far, this literature has focused mostly on the positive effects of transparency on consumers' valuations for a product or service by, for example, allowing service providers to signal they exerted effort (Buell and Norton 2011), allowing customers to observe operational processes and employees to observe customers (Buell et al. 2017), or showing a firm's social responsibility practices (Kraft et al. 2018). Our paper shifts the focus toward the effects of the transparency of employees' procurement decisions on the behavior of those same employees and their peers, and provides insights into how transparency initiatives can be effectively implemented in procurement settings.

Our paper is also related to the literature studying the impact of human behavior on the design of procurement policies; see Elmaghraby and Katok (2017) for a comprehensive overview. Several papers focus on comparing the outcomes of alternative mechanisms (Engelbrecht-Wiggans and Katok 2006, Katok and Kwasnica 2008, Wan and Beil 2009, Wan et al. 2012, Tunca et al. 2014, Chaturvedi et al. 2018, among others) and on analyzing the behavioral factors affecting bidders' decisions (Kwasnica and Katok 2007, Davis et al. 2011). In particular, Elmaghraby et al. (2012) and Haruvy and Katok (2013) identify adverse effects of increased information transparency on suppliers' bidding behavior. Elmaghraby et al. (2012) find that rank-based feedback leads to lower prices than full price feedback. Haruvy and Katok (2013) find that bidders act more aggressively under a sealed-bid first-price format than under open-bid dynamic auctions. Although suppliers' monetary payoffs directly depend on other suppliers' bids, our focus is on the increased

visibility of employees' decisions, where their choices do not affect each other's monetary payoffs.

Our paper studies a procurement setting where an organization delegates the supplier choice to its employees, resembling the setting introduced in the seminal paper by Aghion and Tirole (1997). Recent papers have studied whether a decision should be delegated or not in different settings (Hamman et al. 2010, Charness et al. 2012). By contrast, we study a setting where the choice of delegating purchases has already been made, and focus on understanding how increasing transparency affects the procurement outcome.

Evidence of peer effects has been found in various related settings. The closest papers study peer effects in a three-person gift-exchange game, where an employer first chooses a wage for each of two workers, who then individually choose—either simultaneously or sequentially—a costly effort level that benefits the employer and has no monetary effect on the coworker. Gächter and Thöni (2010) and Gächter et al. (2012) find that reciprocal preferences toward the employer play an important role in explaining employees' behavior, and that higher wages are associated with higher effort. These papers focus on employees' responses to unequal treatment from the employer, and find that effort comparisons are present when the employer pays equal and generous wages to both employees. Instead, we focus squarely on the peer effects resulting from increased transparency of the procurement decision and only allow for equal wages. Gächter et al. (2013) and Thöni and Gächter (2015) identify spillover effects when one worker can observe the other worker's effort before choosing the worker's own. The former find a positive correlation between the decisions of employees making their choices sequentially, and show that the second worker's behavior is better explained by income inequality aversion toward the peer (Fehr and Schmidt 1999) than by preferences for compliance with social norms. The latter find that agents follow a low-performing but not a high-performing peer. This asymmetry is also identified by Dimant (2019), who shows that unethical behavior is more contagious than ethical behavior in a two-stage dictator game where subjects can donate to or withhold money from charity. In the operations management literature, Ho et al. (2014) study peer effects when two retailers interact with the same supplier and find that, due to the retailers' peer-induced and distributional fairness (Ho and Su 2009), the second retailer has a higher wholesale price, makes a lower profit, and has a lower share of the total supply chain profit than the first retailer. We make three important contributions to this literature. First, we show that the negative spillover effects are a robust result, as they also arise in our procurement game. Second, our experimental design allows us to test the mechanisms leading to this result by identifying that the negative spillovers affect primarily reciprocal employees. Third, we show the existence of positive effects on employees who are observed by their peers, a result that has been mostly overlooked in previous literature,[1] and analyze the behavioral drivers leading to it.

Finally, our paper is also broadly related to the behavioral operations management literature studying the effects of social preferences in supply chain management and procurement (see part III in Donohue et al. 2018 for a detailed overview). This stream of literature has established that factors such as fairness (Haitao Cui et al. 2007, Loch and Wu 2008, Katok and Pavlov 2013), trust and trustworthiness (Özer et al. 2011, Özer et al. 2014, Özer and Zheng 2017, Spiliotopoulou et al. 2016, Beer et al. 2018), and long-term relational concerns (Davis and Hyndman 2017) are crucial to understanding how firms make procurement decisions and how they relate with their suppliers. Whereas most of these papers focus on firm-level decisions, our focus is on employee-level decisions and particularly on how employees affect each other's decisions when transparency is introduced.

3. Model

We consider an organization comprised of three players: a director (D) and two employees (E_1 and E_2). The organization needs to purchase two items and the director delegates this task to the employees, such that each employee is in charge of buying one item. The employees can purchase the item from one of two suppliers, supplier H and supplier L (S_H and S_L), who offer identical items at prices p_H and p_L, respectively. For simplicity, p_L is fixed and $p_H = p_L + \Delta$, where Δ is a random variable uniformly distributed in $[0, \bar{\delta}]$. That is, supplier H is at least as expensive as supplier L, and the realized price difference δ is randomly determined.[2] These prices are exogenously given, that is, suppliers are nonstrategic and/or employees have negligible market power, as in the motivating examples. Finally, employees obtain a personal reward $r > 0$ when purchasing from S_H that is commonly known. This reward can represent the mileage obtained from choosing the preferred airline, the extra utility of choosing a preferred brand, and so on.

The interactions between the director and the employees are described in terms of a two-stage procurement game. In the first stage, the director chooses a wage $\omega \in [\underline{\omega}, \infty)$ that is the same for both employees. The director chooses the wage knowing the distribution of the price difference but not its realization. The director's goal is to minimize the total procurement cost, given by the sum of the employees' wages and the prices of the suppliers selected by the employees. In the second stage, after observing the wage chosen

by the director and the realized prices p_H and p_L, each employee chooses a supplier. Employees' decisions can be neither overruled nor punished by the director.

In the absence of social preferences (i.e., when all agents maximize their own monetary payoff), this game has a unique equilibrium: both employees always choose supplier H, and the director chooses the minimum wage, that is, $\omega = \underline{\omega}$. However, previous work has found evidence that agents not only care about their monetary payoff, but also incorporate social considerations in their utility function (e.g., Rabin 1993, Fehr and Schmidt 1999, Bolton and Ockenfels 2000, Charness and Rabin 2002). We focus on the interplay of two such social considerations: (1) reciprocity toward the director, which reflects the desire to reward kind actions (high wage) and punish hostile ones (low wage); and (2) distributional preferences toward the peer, which we model as income inequality aversion.[3] In the next subsections we consider two variants of the model. We start with a baseline model, where employees cannot observe each other's decisions. Then, we consider a peer model, where employees make their decisions sequentially, starting with E_1 and followed by E_2, and E_2 can observe E_1's supplier choice before making a decision.

3.1. Baseline Model

In the baseline model, both employees choose a supplier simultaneously. As employees have no information about each other's payoff, we assume that they have no distributional preferences toward their peer and thus only reciprocity toward the director appears in their utility function.

We consider employees who are heterogeneous in their sensitivity to reciprocity, and denote employee i's sensitivity to reciprocity by γ_i. We assume that employees can be classified into two types, that is, $\gamma_i \in \{\gamma_L, \gamma_H\}$ with $0 \le \gamma_L \le \gamma_H$. We let $\gamma_i = \gamma_H$ with probability q, and let $\gamma_i = \gamma_L$ with probability $1 - q$, and assume that this distribution is commonly known. We focus on the special case where $\gamma_L = 0$ and $\gamma_H = \gamma > 0$, and say that employee i is reciprocal if $\gamma_i = \gamma$ and is nonreciprocal otherwise. This is consistent with previous work (Englmaier and Leider 2012, Beer et al. 2018) and, as we shall see in Section 5, it is consistent with our own experimental results.

The strategy for employee $i \in \{1, 2\}$ can be described by a function[4] $\sigma_i : [\underline{\omega}, \infty) \times [0, \bar{\delta}] \times \{0, \gamma\} \to \{S_H, S_L\}$, where $\sigma_i(\omega, \delta, \gamma_i)$ represents the supplier chosen by employee i given wage ω, price difference δ, and the employee's reciprocity coefficient γ_i. When there is no risk of confusion, we sometimes omit the arguments and simply denote by σ_i the decision made by employee i.

We model the utility of employee i as a function of the given wage, the realized price difference, the employee's reciprocity type, and the employee's strategy as the sum of three terms:

$$u_i(\omega, \delta, \gamma_i, \sigma_i) = \omega + r \cdot \mathbb{1}_{\{\sigma = S_H\}} + \gamma_i \cdot R_\rho(\omega, \delta, \sigma_i),$$

where the first two terms represent the monetary payoff (the wage and the reward if the expensive supplier is chosen), and the last term captures the additional utility from reciprocity. We model the latter as the product of the employee's sensitivity to reciprocity, γ_i, and a function R_ρ that depends on the employee's belief about how kind the director is (how the received wage compares to a reference wage) and the employee's kindness toward the director. For simplicity, we assume that all employees have the same reference wage, which we denote by ρ. Formally, the function $R_\rho : [\underline{\omega}, \infty) \times [0, \bar{\delta}] \times \{S_H, S_L\} \to \mathbb{R}$ is defined as

$$R_\rho(\omega, \delta, \sigma_i) = \underbrace{(\omega - \rho)}_{\substack{:=\lambda_\rho(\omega) \\ \text{director's kindness}}} \cdot \underbrace{\frac{\delta}{2} \cdot (\mathbb{1}_{\{\sigma_i = S_L\}} - \mathbb{1}_{\{\sigma_i = S_H\}})}_{\substack{:=\kappa_i(\delta, \sigma_i) \\ \text{employee's reciprocation}}}. \tag{1}$$

The first term, $\lambda_\rho(\omega)$, captures the employee's belief about how generous the wage offered by the director is. We extend Dufwenberg and Kirchsteiger (2000) and assume that E_i's assessment of the director's kindness (or unkindness) is proportional to the difference between the wage received and the reference wage ρ, that is, $\lambda_\rho(\omega) = \omega - \rho$. That is, the wage offered by the director is perceived as (un)kind if it is (below) above the reference wage ρ. The second term, $\kappa_i(\delta, \sigma_i)$, captures the employee's kindness toward the director. We again follow Dufwenberg and Kirchsteiger (2000) and assume that $\kappa_i(\delta, \sigma_i) = \frac{\delta}{2}(\mathbb{1}_{\{\sigma_i = S_L\}} - \mathbb{1}_{\{\sigma_i = S_H\}})$, that is, employee i is kind if $\sigma_i = S_L$ (unkind if $\sigma_i = S_H$), and the magnitude of E_i's (un)kindness is equal to the average impact of the employee's decision on the director's payoff, which is equal to $\delta/2$ (that is, $-\delta$ if $\sigma_i = S_H$ and 0 if $\sigma_i = S_L$).

Notice that, when $\omega > \rho$, the probability of choosing S_H is nonincreasing in ω and δ as

$$\begin{aligned} &\mathrm{P}(\sigma_i = S_H \mid \omega, \delta) \\ &\quad = \mathrm{P}\big(u_i(\omega, \delta, \gamma_i, S_H) > u_i(\omega, \delta, \gamma_i, S_L)\big) \\ &\quad = \mathrm{P}\Big(r + \gamma_i \cdot [R_\rho(\omega, \delta, \gamma_i, S_H) - R_\rho(\omega, \delta, \gamma_i, S_L)] > 0\Big) \end{aligned} \tag{2}$$

is nonincreasing in both ω and δ. This captures the fact that it is more costly to be unkind when the director offers a high wage or when the employee's decision has a higher impact on the director's payoff. By contrast, if $\omega < \rho$, then $R_\rho(\omega, \delta, S_H) - R_\rho(\omega, \delta, S_L)$ is nonnegative and nondecreasing in both ω and δ,

so that the employees will always choose the expensive supplier.

The goal of the director is to choose a wage ω that minimizes the director's expected cost, defined as

$$c_D(\omega) = 2\omega + \mathbb{E}_{\delta,\gamma_1,\gamma_2}\left[p_{\sigma_1(\omega,\delta,\gamma_1)} + p_{\sigma_2(\omega,\delta,\gamma_2)}\right]. \quad (3)$$

This cost includes the wages paid to the employees and the expected sum of the prices of the suppliers chosen by the employees, whose choices depend on the realized price difference and on the reciprocity coefficients, both of which are unknown to the director at the time the director chooses a wage.

The next proposition characterizes the equilibrium in the baseline model.

Proposition 1. *For a given wage ω and price difference δ, employee i's optimal strategy function can be characterized as a function of his reciprocity type as follows:*

$$\sigma_i(\omega,\delta,0) = S_H, \quad \text{and}$$
$$\sigma_i(\omega,\delta,\gamma) = \begin{cases} S_H & \text{if } \lambda_\rho(\omega) \le 0, \\ S_H & \text{if } \lambda_\rho(\omega) > 0 \text{ and } \delta \le \frac{r}{\gamma\lambda_\rho(\omega)}, \\ S_L & \text{if } \lambda_\rho(\omega) > 0 \text{ and } \delta > \frac{r}{\gamma\lambda_\rho(\omega)}. \end{cases} \quad \square \quad (4)$$

The director's optimal wage ω_B^* is given by:

$$\omega_B^* = \begin{cases} \rho + \psi & \text{if } r < q\gamma\bar{\delta}^2,\ 2(\rho - \underline{\omega}) < q\bar{\delta} - 3\psi \\ \underline{\omega} & \text{otherwise,} \end{cases} \quad (5)$$
$$\text{where} \quad \psi = (q/\bar{\delta})^{\frac{1}{3}} \times (r/\gamma)^{\frac{2}{3}}.$$

All proofs can be found in the online appendix. Intuitively, when employees are nonreciprocal ($\gamma_i = 0$), they always choose supplier H, regardless of the wage and the price difference. By contrast, reciprocal employees (those for which $\gamma_i > 0$) always choose S_H if the wage is below the reference wage. If the wage is above the reference wage, they employ a threshold strategy: they select supplier H for low price differences ($\delta \le \frac{r}{\gamma\lambda_\rho(\omega)}$) and supplier L otherwise. Based on the problem primitives and on the employees' responses, the director will either choose to pay the minimum wage or will offer $\rho + \psi$ to incentivize prosocial behavior and achieve a lower procurement cost.

3.2. Peer Model

Consider now the case where E_2 observes E_1's decision before making a decision. In this context, we refer to E_1 and E_2 as the *observed* and the *observer* employees, respectively. As E_2 can perfectly observe E_1's monetary payoff, we assume that E_2 incorporates distributional preferences in E_2's utility, which becomes

$$u_2(\omega,\delta,\gamma_i,\sigma_2) = \pi_2 + \underbrace{\gamma_2 \cdot R_\rho(\omega,\delta,\sigma_2)}_{\text{reciprocity}} + \underbrace{(\pi_1 - \pi_2)\cdot(\alpha \cdot \mathbb{1}_{\{\pi_2>\pi_1\}} - \beta \cdot \mathbb{1}_{\{\pi_2<\pi_1\}})}_{\text{peer effects}}, \quad (6)$$

where α and β are nonnegative constants, $R_\rho(\omega,\delta,\sigma_2)$ is defined as in Equation (1), and π_i is a shorthand for the function $\pi_i(\omega,\sigma_i) = \omega + r \cdot \mathbb{1}_{\{\sigma_i = S_H\}}$, representing the monetary payoff. As in Ho and Su (2009) and Ho et al. (2014), we assume that only employee 2 incorporates distributional concerns as this is the only employee who can perfectly infer monetary payoffs. Thus, the utility functions of the director and employee 1 remain unchanged. Moreover, following Fehr and Schmidt (1999), we restrict our attention to distributional preferences for difference aversion, that is, α and β reflect the strength of E_2's aversion to advantageous and disadvantageous income inequality, respectively. Previous related work on trilateral gift-exchange games finds estimates for α and β in $[0,1]$ (Gächter et al. 2013, Thöni and Gächter 2015), therefore, we focus our analysis on α and β in this range.

Proposition 2 characterizes the equilibrium outcome of the peer model. Note that employee 2 now conditions actions on the decision of employee 1, whereas employee 1 is not affected by the decision of employee 2. We solve for the equilibrium using backward induction.

Proposition 2. *Employee 1's optimal strategy σ_1 is as characterized in Proposition 1. Suppose that $\alpha, \beta \in [0,1]$. Then, given wage ω, price difference δ, and employee 1's optimal strategy σ_1, employee 2's optimal strategy can be characterized based on the employee's reciprocity coefficient as follows:*

$$\sigma_2(\omega,\delta,0,\sigma_1) = S_H, \quad \text{and}$$
$$\sigma_2(\omega,\delta,\gamma,\sigma_1) = \begin{cases} S_H & \text{if } \lambda_\rho(\omega) \le 0 \text{ or } \lambda_\rho(\omega) > 0 \text{ and } \delta < \frac{r}{\gamma\lambda_\rho(\omega)}, \\ S_H & \text{if } \lambda_\rho(\omega) > 0, \delta \in [\frac{r}{\gamma\lambda_\rho(\omega)}, \frac{r(1+\beta)}{\gamma\lambda_\rho(\omega)}] \text{ and } \sigma_1 = S_H, \\ S_L & \text{if } \lambda_\rho(\omega) > 0, \delta \in [\frac{r}{\gamma\lambda_\rho(\omega)}, \frac{r(1+\beta)}{\gamma\lambda_\rho(\omega)}] \text{ and } \sigma_1 = S_L, \\ S_L & \text{if } \lambda_\rho(\omega) > 0, \delta > \frac{r\cdot(1+\beta)}{\gamma\lambda_\rho(\omega)}. \end{cases} \quad (7)$$

Finally, let ψ be defined as in Equation (5) and define

$$\xi = \left[\frac{(1+q)}{2}\right]^{\frac{1}{3}} \quad \text{and}$$

$$\zeta = \left[\frac{(1+q)+(1+\beta)^2\cdot(1-q)}{2}\right]^{\frac{1}{3}}.$$

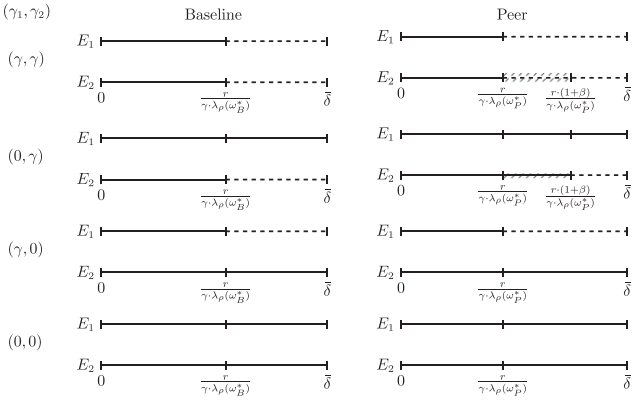
Then, the optimal wage ω_P^* is given by:

$$\omega_P^* = \begin{cases} \rho+\psi\zeta & \text{if } \xi \in \left(\frac{r}{\gamma\delta\psi}, \frac{r(1+\beta)}{\gamma\delta\psi}\right),\ \zeta \in \left(\frac{r(1+\beta)}{\gamma\delta\psi}, \infty\right), \\ & 2(\rho-\underline{\omega}) < q\bar{\delta} - 3\psi\zeta, \\ & 3\psi(\zeta-\xi) < \frac{q(1-q)\bar{\delta}}{2}, \\ \rho+\psi\zeta & \text{if } \xi \notin \left(\frac{r}{\gamma\delta\psi}, \frac{r(1+\beta)}{\gamma\delta\psi}\right),\ \zeta \in \left(\frac{r(1+\beta)}{\gamma\delta\psi}, \infty\right), \\ & 2(\rho-\underline{\omega}) < q\bar{\delta} - 3\psi\zeta, \\ \rho+\psi\xi & \text{if } \xi \in \left(\frac{r}{\gamma\delta\psi}, \frac{r(1+\beta)}{\gamma\delta\psi}\right),\ \zeta \in \left(\frac{r(1+\beta)}{\gamma\delta\psi}, \infty\right), \\ & 2(\rho-\underline{\omega}) < \frac{q(1+q)\bar{\delta}}{2} - 3\psi\xi, \\ & 3\psi(\zeta-\xi) \geq \frac{q(1-q)\bar{\delta}}{2}, \\ \rho+\psi\xi & \text{if } \xi \in \left(\frac{r}{\gamma\delta\psi}, \frac{r(1+\beta)}{\gamma\delta\psi}\right),\ \zeta \leq \frac{r(1+\beta)}{\gamma\delta\psi}, \\ & 2(\rho-\underline{\omega}) < \frac{q(1+q)\bar{\delta}}{2} - 3\psi\xi, \\ \underline{\omega} & \text{otherwise.} \end{cases} \tag{8}$$

The equilibrium strategy for employee 1 is equal to that in the baseline model, but now employee 2 uses a different strategy. If employee 2 is nonreciprocal ($\gamma_2 = 0$), employee 2 always chooses supplier H. If employee 2 is reciprocal ($\gamma_2 > 0$), employee 2 always chooses supplier H if the wage is below the reference wage, and uses a threshold strategy when the wage is above the reference wage: if the price difference is below $\frac{r}{\gamma\lambda_\rho(\omega)}$, then employee 2 chooses supplier H; if the price difference is above $\frac{r\cdot(1+\beta)}{\gamma\lambda_\rho(\omega)}$, then employee 2 chooses supplier L; finally, if the price difference is in the intermediate region (i.e., $\delta \in [\frac{r}{\gamma\lambda_\rho(\omega)}, \frac{r(1+\beta)}{\gamma\lambda_\rho(\omega)}]$), then employee 2 mimics employee 1's choice. That is, in the latter region, reciprocal employees choose supplier H when they observe that their peer did so, whereas in the absence of transparency, reciprocal employees always choose supplier L. Finally, and similarly to the baseline case, the director will either choose to pay the minimum wage or will incentivize prosocial behavior to achieve a lower procurement cost by offering either $\rho+\psi\xi$ or $\rho+\psi\zeta$, depending on the problem primitives.

In Figure 1 we summarize the equilibria described in Propositions 1 and 2 in the case where both ω_B^* and ω_P^* are above ρ and $\omega_B^* \leq \omega_P^*$. As the director knows neither the price difference nor the reciprocity type of the employees, the figure shows what the director expects for each possible combination of γ_1 and γ_2 and each price difference. We note two things. First, the most notable difference between the two equilibria is the decision made by E_2 for price differences in the region $[\frac{r}{\gamma\lambda(\omega_B^*)}, \frac{r\cdot(1+\beta)}{\gamma\lambda(\omega_P^*)}]$ when $(\gamma_1,\gamma_2) = (0,\gamma)$ and[5] $\beta > 0$. In the baseline model, E_2 chooses S_L, whereas in the peer model the employee chooses S_H. We refer to this as the *negative spillover region*, as a nonreciprocal E_1 can negatively influence a reciprocal E_2. Second, a direct consequence of $\alpha \leq 1$ is the absence of positive spillover effects when E_1 is reciprocal and E_2 is nonreciprocal. This is because the benefit from choosing the expensive supplier, r, outweighs the harm from the aversion to advantageous income inequality, $r\alpha$. We conclude this section by observing the following.

Figure 1. Equilibrium Comparison: Baseline vs. Peer



Notes. The left (right) column represents the equilibrium in the baseline (peer) model. For each combination of (γ_1,γ_2), two lines represent the range of possible price differences. The top line illustrates E_1's best response, and the bottom line represents E_2's best response. The solid and dashed lines represent the regions of price differences δ where the employees select S_H and S_L, respectively. Finally, the slashed area represents the region where E_2 chooses S_H if E_2 observes that E_1 chose S_H, and chooses S_L if E_1 chose S_L.

Remark 1. (The Role of Heterogeneity in Reciprocity Toward the Director). The aforementioned differences disappear if $\gamma_L = \gamma_H = \gamma$, as $\omega_B^* = \omega_P^*$ and all the cases reduce to $(\gamma_1,\gamma_2) = (\gamma,\gamma)$.

4. Experimental Design

To test the predictions derived from our theoretical model, we designed a computerized laboratory experiment consisting of a procurement game that reproduces the game presented in the theory section. At the beginning of each session, subjects are randomly assigned to the role of director or employee, and they keep their role for the entire session. Subjects then play six rounds of the procurement game, where the sequence of events is as follows. At the beginning of each round, subjects are randomly and anonymously matched into an organization consisting of one director and two employees (employee 1 and employee 2).[6]

The random rematching in between rounds prevents punishment or reputation effects from carrying over from one round to the next. After the matching occurs, the director chooses a wage of either 25 or 40 points that is paid to both employees. Each employee then separately chooses between supplier L, whose price is $p_L = 20$, and supplier H, whose price is $p_H = p_L + \delta$. The price difference between suppliers, δ, is randomly determined and takes one of three values, 10, 25, or 40, all with equal probability. As in the theoretical model, choosing supplier H results in an additional benefit for the employees, which is set to $r = 10$ points. We elicit employees' decisions by having them follow the strategy method so that they would provide a full contingency plan, that is, a decision for each combination of wage the director might offer $\omega \in \{25, 40\}$ and price difference that might be randomly realized $\delta \in \{10, 25, 40\}$—six decisions in total.[7] The strategy method has the advantage that it allows us to elicit subjects' complete strategies, including their choices under those scenarios that arise less frequently in the experiment. In addition, previous literature has shown that subjects' strategies do not change significantly under the strategy method relative to the direct-response method (Brandts and Charness 2011), and this especially holds in the case of gift-exchange games (Falk and Kosfeld 2006, Gächter et al. 2013), which are similar to our procurement game.

At the end of each round, a price difference δ is randomly chosen by the computer for each organization and each subject's payoff is computed. The director's payoff is

$$\pi_D = 200 - 2 \cdot \omega - p_{\sigma_1(\omega,\delta)} - p_{\sigma_2(\omega,\delta)},$$

where $p_{\sigma_i(\omega,\delta)}$ is the price of the supplier selected by E_i, $i \in \{1, 2\}$, and each employee's payoff is

$$\pi_i = 50 + \omega + 10 \cdot \mathbb{1}_{\{\sigma_i(\omega,\delta)=S_H\}}.$$

Note that, to prevent negative payoffs and associated loss aversion effects, we have the director start with an initial endowment of 200 points, and each employee starts with 50 points. After each round, the director learns the realized price difference δ between the suppliers, the decisions $\sigma_1(\omega, \delta)$ and $\sigma_2(\omega, \delta)$ made by each employee (based on the wage chosen by the director and the realized price difference), and the director's own total profit. Similarly, the employees learn the wage chosen by the director, the realized price difference, and their own payoff in the round.

Our experimental design consists of two treatments. In the baseline treatment, both employees choose a supplier simultaneously (without observing each other's choices), as in the theoretical model. In the peer treatment, the employees make their decisions sequentially, with E_1 choosing first and E_2 observing E_1's choice in each situation (i.e., for each pair ω, δ) before making a decision. To keep a clear distinction between the roles of observed and observer employees, subjects play either in the role of E_1 or E_2 throughout a session. At the end of the experiment, one of the six rounds of the procurement game is randomly selected for payment and subjects are paid \$0.10 per point earned in that round.

We make three important design decisions. First, the values of the parameters for the price difference and the extra reward are carefully chosen to capture different focal circumstances. When $\delta = 10$, choosing either supplier results in the same total surplus (recall that $r = 10$), and the employees face the dilemma of benefiting themselves or the director. The values of $\delta = 25$ and 40 capture settings where choosing S_H maximizes the employees' own monetary payoff, but it is inefficient in terms of total surplus. In addition, the reward the employees get from choosing the expensive supplier is relatively low compared with their wage (it is at most half the wage). This is consistent with our motivating examples, where the extra benefit employees get from delegated procurement is not their main source of compensation. Second, the director chooses between two wages, $\omega \in \{25, 40\}$, rather than from a continuum of possible wages. We make this simplification for two reasons: first, a simple choice set for the director allows us to use the strategy method for the employees' decisions, which are our main focus. Second, both wage alternatives, 25 and 40, are significantly higher than the reward and are thus likely to be perceived by the employees as being higher than the reference (fair) wage. Finally, the initial endowments are chosen so that there is a large asymmetry between the director's and the employees' endowments. This is intended to emulate the actual relation between a large organization and its employees.

Reciprocity Measure Elicitation. After playing six rounds of the procurement game, subjects participate in an additional trust game (Berg et al. 1995). The trust game aims to measure preferences for trust and reciprocity. As reciprocity is one of the main behavioral drivers in our model, we use the outcome of this game to construct an exogenous measure of a subject's reciprocity. In this game, a sender and a receiver are initially endowed with 10 points. The sender moves first and decides how much of the sender's endowment to send to the receiver. The amount sent is tripled by the experimenter. The receiver moves second and decides how much of the amount received to return to the sender. Following the strategy method, subjects make decisions as senders (how much to send) and as receivers (how much to return for each possible

amount received, ranging from zero to 30 in increments of three points). Subjects are then randomly matched and assigned a role for payment, which consists of \$0.10 per point earned. Based on the results of this game, we derive an exogenous measure of reciprocity (details in Section 5.2) that we use to distinguish between reciprocal and nonreciprocal employees.

Our first hypothesis aims to test the role of employees' reciprocity as a main behavioral driver. The theory predicts that, whereas nonreciprocal employees will choose the expensive supplier regardless of the wage and the price difference between suppliers, reciprocal employees will be less likely to choose the expensive supplier as the wage and the price difference increase. Therefore, we expect reciprocal employees to be less likely to choose the expensive supplier than nonreciprocal employees, both in the baseline and in the peer treatment, and we expect these differences to increase when the wage and the price difference are high.

Hypothesis 1 (Effects of Reciprocity)**.** *A reciprocal employee is less likely to choose the expensive supplier than a nonreciprocal employee. The difference between a reciprocal and a nonreciprocal employee is higher when the wage and the price difference between suppliers are high.*

Our theoretical model also predicts changes in employees' behavior when transparency is introduced (peer treatment) (see the discussion in Section 3.2). First, the theory predicts the existence of negative spillovers, by which a reciprocal E_2 is more likely to choose S_H when the employee observes that E_1 chose S_H than when the employee observes that E_1 chose S_L. Second, as in the peer treatment a reciprocal E_2 mimics the decision of E_1, we expect that the region where a reciprocal E_2 chooses S_H if the employee observes that the peer chose S_H will be larger than the region where a reciprocal employee in the baseline chooses S_H. Therefore, we expect that a reciprocal employee who observes that a peer chose S_H will choose S_H more frequently than a reciprocal employee in the baseline.[8] Moreover, the theoretical model predicts an absence of effects on observed employees, as E_1's behavior remains unchanged in the peer treatment relative to the baseline. These predictions are formalized in Hypothesis 2.

Hypothesis 2 (Effects of Transparency: Peer Effects)**.** Two predictions arise from increased transparency:

a. *Existence of negative spillovers on observer employees: A reciprocal employee who observes that a peer chose the expensive supplier is more likely to choose the expensive supplier than a reciprocal employee who observes that a peer chose the cheapest one and compared with a reciprocal employee in the baseline.*

b. *Absence of effects on observed employees: An observed employee in the peer treatment is equally as likely to choose the expensive supplier as an employee in the baseline treatment.*

Finally, our theory predicts two additional results. First, there is an absence of positive spillovers on reciprocal employees, that is, a reciprocal E_2 is not more likely to choose S_L when the employee observes that a peer did so than the counterpart in the baseline treatment. Second, there is an absence of peer effects on nonreciprocal employees, that is, a nonreciprocal E_2 who observes that a peer chose S_H is equally as likely to choose S_H as a nonreciprocal E_2 who observes that a peer chose S_L.

5. Experimental Results

The experiment was conducted using z-Tree (Fischbacher 2007) at a public university in the Midwest of the United States between September and November 2017. Average payoffs were \$15 (including a \$5 show-up fee) and each session lasted approximately one hour. In total, 165 students participated in the experiment, and no subject participated in more than one session.[9] Of these students, 48 participated in four sessions of the baseline treatment and 117 in ten sessions of the peer treatment.

5.1. Preliminaries and General Results

As described in Section 4, we use the strategy method to elicit employees' decisions for each wage $\omega \in \{25, 40\}$ and for each price difference $\delta \in \{10, 25, 40\}$. Considering all the possible combinations of these parameters, we obtain six situations, which we order lexicographically by wage and later by price difference. That is, situations one to three consider a wage of 25 and an increasing price difference, and situations four to six consider a wage of 40 and an increasing price difference. We denote by $\sigma_{ist} \in \{S_H, S_L\}$ the decision made by employee i in situation s in round t, and we record it as a binary variable y_{ist} such that

$$y_{ist} = \begin{cases} 1 & \text{if } \sigma_{ist} = S_H \\ 0 & \text{if } \sigma_{ist} = S_L. \end{cases}$$

At no risk of confusion, we sometimes omit the subindices s and t.

First, we confirm that in the baseline treatment there are no differences in subjects' behavior in the roles of E_1 and E_2, as expected. Therefore, for the rest of the analysis we pool the data from E_1 and E_2 in the baseline treatment. In the peer treatment, the frequency of choosing the expensive supplier (S_H) varies by role. Specifically, we find that E_2 is more likely to choose S_H compared with E_1, and these differences are significant in all situations where $\delta \geq 25$. Given these differences, in the peer treatment we analyze

separately the behavior of employees who are observed (E_1) from those who are observers (E_2).[10]

When we analyze the frequency of choosing the expensive supplier aggregated at the subject level, we find that, in both treatments, the probability of choosing the expensive supplier is decreasing in the wage offered by the director and in the price difference between suppliers. In the baseline treatment, the effect of wage is significant under all price differences, and the effect of price difference is significant, both when the wage is 25 and 40. In the peer treatment, the frequency of choosing S_H is decreasing in wage (statistically significant separately for observers and observed when $\delta = 25$ and marginally significant for observers when $\delta = 40$) and in price difference under both wages, for observers and observed separately. The next subsections explore each of the hypotheses with a detailed statistical analysis.

5.2. Effect of Reciprocity

The predictions derived from the theoretical model rely on the assumption that employees are heterogeneous in their reciprocity toward the director. Specifically, we assume that employees are either reciprocal ($\gamma_i = \gamma > 0$) or nonreciprocal ($\gamma_i = 0$). As stated in Hypothesis 1, we expect reciprocal employees to be less likely than nonreciprocal employees to choose the expensive supplier . This should especially hold for high wages and price differences, as nonreciprocal employees are expected to choose S_H regardless of the wage and the price difference, whereas reciprocal employees choose S_L if the wage and the price difference are sufficiently high.

To test how reciprocity affects subjects' behavior in the procurement game, we elicit subjects' individual level of intrinsic reciprocity with an additional trust game that participants play at the end of the session.[11] We create a measure of reciprocity for each subject by taking the difference between the maximum and the minimum of the amount a subject returned in the role of receiver (as in Beer et al. 2018). The metric of reciprocity ranges between 0 and 30 and its distribution (presented in Figure A.1 in the appendix) confirms that there is high heterogeneity among subjects. We then characterize subjects as nonreciprocal if their reciprocity is within the lowest 30th percentile (less than or equal to eight) and as reciprocal otherwise.[12]

Table 1 presents the frequency of choosing the expensive supplier aggregated across rounds at the subject level for reciprocal and nonreciprocal employees separately. The table shows that nonreciprocal employees are more likely to choose S_H than reciprocal employees in all conditions (that is, employees in the baseline treatment, and observer and observed employees in the peer treatment), providing support for Hypothesis 1. In addition, as predicted by Hypothesis 1, the differences between reciprocal and nonreciprocal employees are larger and statistically significant when the wage and the price difference are high.

We confirm the previous results with panel probit models (one for each wage and price difference) with subject random effects, using as a dependent variable

Table 1. Comparison Between Reciprocal and Nonreciprocal Employees by Condition

		Probability of Choosing S_H					
		$\omega = 25$			$\omega = 40$		
		$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Baseline	Reciprocal	0.89 (0.25)	0.61 (0.39)	0.39 (0.43)	0.73 (0.37)	0.34 (0.41)	0.27 (0.36)
	Nonreciprocal	0.97 (0.11)	0.87 (0.27)	0.80 (0.35)	0.95 (0.16)	0.87 (0.20)	0.73 (0.42)
	Difference (p-value)	0.403	*0.061*	**0.015**	*0.054*	**0.001**	**0.009**
Observed	Reciprocal	0.79 (0.32)	0.55 (0.36)	0.25 (0.32)	0.75 (0.37)	0.32 (0.31)	0.19 (0.24)
	Nonreciprocal	0.85 (0.25)	0.74 (0.30)	0.62 (0.39)	0.83 (0.22)	0.61 (0.40)	0.56 (0.38)
	Difference (p-value)	0.665	0.104	**0.004**	0.899	**0.030**	**0.003**
Observer	Reciprocal	0.88 (0.18)	0.72 (0.26)	0.53 (0.36)	0.79 (0.30)	0.56 (0.35)	0.46 (0.38)
	Nonreciprocal	0.95 (0.11)	0.93 (0.16)	0.88 (0.26)	0.95 (0.11)	0.85 (0.21)	0.83 (0.26)
	Difference (p-value)	0.235	**0.008**	**0.003**	*0.096*	**0.017**	**0.005**

Notes. Standard errors reported in parentheses. We report the p-values of Wilcoxon rank-sum tests comparing reciprocal and nonreciprocal employees for each condition. Bold and italic values represent significant differences at the 5% and the 10% level, respectively.

the employee's choice (i.e., y_{ist}), and as the independent variable a binary variable that takes a value of 1 if subjects are reciprocal and 0 otherwise. We find that the coefficients are negative for most conditions, confirming the hypothesis that reciprocal subjects are less likely to choose the expensive supplier. In addition, we observe that the result is significant in all situations among subjects in the baseline treatment, and it is significant when the price differences are high (i.e., $\delta \geq 25$) among observed and observer employees in the peer treatment. For example, the marginal effects when $\omega = 40$ and $\delta = 40$ are -0.415 in the baseline, -0.417 for observed employees in the peer treatment, and -0.390 for observer employees in the peer treatment. That is, reciprocal employees are 41.5%, 41.7%, and 39.0% less likely to choose the expensive supplier than nonreciprocal employees, in each condition respectively.[13] (The marginal effects of all the probit regressions are presented in the online appendix.)

5.3. Effects of Transparency (Peer Effects)

5.3.1. Observer. Hypothesis 2(a) predicts that observing that a peer chose S_H results in negative spillovers on a reciprocal E_2. To test this, we divide observers (E_2 in the peer treatment) into two conditions: observes H, for those who observe that their peer, E_1, chose supplier H; and observes L, for those who observe that E_1 chose supplier L. Note that subjects in the role of E_2 (which is fixed throughout a session) may in some rounds observe that E_1 chose S_H and in other rounds observe that E_1 chose S_L. Thus, for each E_2 in the peer treatment, we compute separately the frequency of choosing S_H when E_2 observes that E_1 chose S_H and S_L, by taking the average of E_2's decisions in all the rounds where E_2 is in each of these two conditions.

Figure 2 shows the frequency of choosing S_H for each pair (ω, δ) and condition ("baseline" and, in the peer treatment, "observes H," "observes L," and "observed"). For the rest of this section, we focus on the analysis of the first three. The analysis of observed employees (E_1) in the peer treatment is presented in Section 5.3.2. The figure suggests that the probability of choosing S_H is higher for an employee who observes that the peer chose S_H than for an employee who observes that the peer chose S_L or for an employee in the baseline treatment, providing a first indication of the existence of negative spillovers on observer employees.[14] In order to formally test the behavioral drivers derived from the theoretical model—the presence of negative spillovers on reciprocal observer employees (Hypotheses 2(a))—we next examine separately the behavior of reciprocal and nonreciprocal observer employees in the peer treatment.

Table 2 presents the results of panel probit regressions with subject random effects, pooling the data of reciprocal observers (E_2 who observe that E_1 chose S_H or S_L) in the peer treatment and reciprocal employees in the baseline treatment. For each situation (ω, δ), we regress the employees' decisions in each round, y_{ist}, on indicator variables for observer employees who observe that the peer chose S_L and for employees in the baseline treatment. The omitted case is observer employees who observe that the peer chose S_H. Unless otherwise stated, all regressions have errors clustered at the session level and control for round and demographics (age, gender, race, income, and major). First, we observe that the coefficients of the dummy variable *Observes L* are negative and significant for almost all wages and price differences, confirming that reciprocal employees are more likely to choose S_H if they observe that their peer chose S_H than if they observe that their peer chose S_L. For example, when $\omega = 40$ and $\delta = 40$, a reciprocal employee who observes that the peer chose S_H is 20.8% more likely to choose the expensive supplier than a reciprocal employee who observes that the peer chose S_L. Second, we observe that the coefficient of the dummy variable *Baseline* is negative and significant when $(\omega, \delta) \in \{(25, 40), (40, 25), (40, 40)\}$,

Figure 2. Frequency of Choosing S_H: Baseline and Peer Treatments

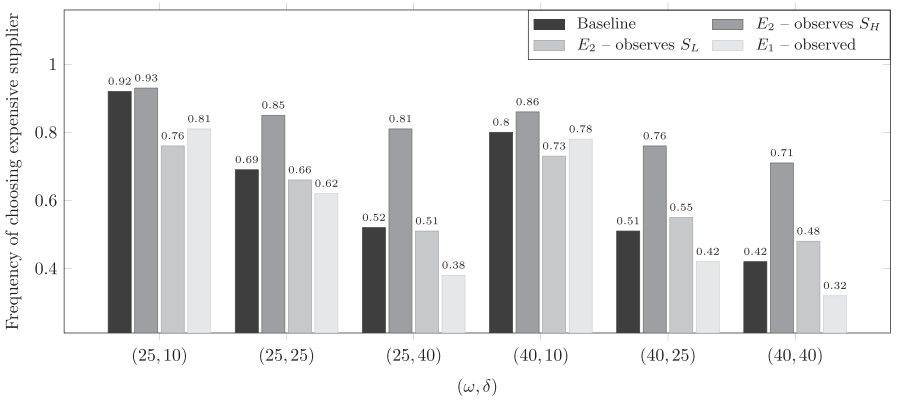


Table 2. Reciprocal Employees: Baseline vs. Observes H vs. Observes L

	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Observes L	−0.782***	−0.554*	−0.899**	−0.767**	−0.560	−1.006***
	(0.203)	(0.298)	(0.394)	(0.373)	(0.348)	(0.325)
Baseline	0.192	−0.743	−1.437**	−0.354	−1.452**	−1.575***
	(0.517)	(0.476)	(0.640)	(0.414)	(0.651)	(0.555)
Constant	2.360**	1.773**	0.663	1.570	1.013	1.229
	(1.113)	(0.778)	(1.399)	(1.403)	(0.942)	(1.039)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	306	306	306	306	306	306

Notes. Panel probit regressions with subject random effects. Standard errors clustered at the session level reported in parentheses. The table pools data from reciprocal employees in the baseline and reciprocal employees who are observers in the peer treatment. We control for round.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

implying that the probability of choosing the expensive supplier after observing that the peer did so is significantly higher compared with the baseline, and that this holds particularly when the price difference is high. For example, when $\omega = 40$ and $\delta = 40$, a reciprocal employee who observes that the peer chose S_H is 31.6% more likely to choose the expensive supplier than a reciprocal employee in the baseline. Taken together, the results in Table 2 provide support for Hypothesis 2(a).

We also test two additional predictions on observer employees derived from our theoretical model. Consistent with our theory, we confirm the absence of positive spillovers on reciprocal employees (i.e., reciprocal employees who observe that the peer chose S_L are not more likely to choose S_L than employees in the baseline), and the absence of peer effects on nonreciprocal employees. In the interest of space, a lengthier discussion is deferred to the online appendix.

Overall, the results in this section confirm that Hypothesis 2(a) is well supported by the experimental results, and that the underlying behavioral mechanisms obtained from the theoretical model explain the data well.

5.3.2. Observed. Hypothesis 2(b) predicts that there are no differences between the decisions of observed employees in the peer treatment and employees in the baseline. However, Table 3 shows that the coefficient of the dummy variable *Observed*, which is equal to 1 if the employee is observed in the peer treatment and 0 if the employee is in the baseline, is negative and significant for all price differences when the wage is low. This result uncovers a positive effect of transparency: when the wage is low, observed employees in the peer treatment are less likely to choose the expensive supplier than the employees in the baseline.

One possible explanation for this result is that observed employees anticipate the negative spillovers associated with the decision of choosing the expensive supplier, that is, an observed employee choosing the expensive supplier generates the "extra punishment" for the director of increasing the probability that the employee who observes this action

Table 3. Effect on Observed Employees

	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Observed	−1.684***	−0.750**	−1.287*	−0.585	−0.413	−0.367
	(0.493)	(0.379)	(0.750)	(0.637)	(0.404)	(0.428)
Constant	0.208	−0.856	−1.990	−0.549	−1.988**	−1.993*
	(0.740)	(0.647)	(1.446)	(0.720)	(0.911)	(1.119)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	426	426	426	426	426	426

Notes. Panel probit regressions with subject random effects. Standard errors clustered at the session level reported in parentheses. The table pools data from employees in the baseline and observed employees in the peer treatment. We control for round and demographics.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

will choose the expensive supplier as well. This concern for inflicting a double punishment on the director should be stronger among reciprocal employees who were offered a high wage. To test whether this interpretation explains our data, in Table 4 we report the results of interacting the dummy variable *Observed* with the employees' reciprocity. If the differences in the probability of choosing S_H between observed employees in the peer treatment and employees in the baseline are driven mainly by reciprocal preferences, we would expect the differences in behavior to be significant among reciprocal employees (and to be particularly salient when the wage is high). However, the tests in Table 4 show that the differences among reciprocal employees are only significant when $(\omega, \delta) = (25, 10)$. By contrast, the lower probability of an observed employee choosing S_H relative to the baseline is significant in all situations where $\delta < 40$ among nonreciprocal employees. This suggests that nonreciprocal employees that are observed by a peer are significantly less likely to choose the expensive supplier than nonreciprocal employees in the baseline.

In summary, the results show a positive effect of transparency that was not predicted by our theory: observed employees in the peer treatment are less likely to choose the expensive supplier than employees in the baseline treatment. In addition, we find that reciprocity does not provide an explanation for the effect of transparency on observed employees. We next explore an alternative explanation for this finding.

5.4. Alternative Model for the Effect on Observed Employees

We conjecture that a possible explanation for the finding that observed employees are less likely to choose the expensive supplier (which was not predicted by our theory) is the employees' desire to comply with social norms, which are defined as collective agreements about the appropriateness of different behaviors or actions (Fehr and Gächter 2000, Krupka and Weber 2013).[15]

Previous literature has explored the role of preferences for compliance with the social norm of appropriate behavior in settings related to ours, with a focus on their effect on the behavior on an observer of a peer's action (Gächter et al. 2013, Gächter et al. 2017). Building on this literature, we study whether a preference for compliance with the social norm provides a plausible explanation of the behavior of an observed employee as one can imagine that the social appropriateness of an action depends on whether an employee will be observed by the individual's peers or not. In particular, we conjecture that the appropriateness of choosing the expensive supplier changes when transparency is introduced. Note that the social norm of appropriate behavior is highly dependent on the context (Gächter et al. 2017). If transparency affects the social norm (i.e., choosing the expensive supplier is perceived as less appropriate when an employee is observed by a peer), a model that incorporates an observed employee's preference for compliance with

Table 4. Effect on Observed Employees: Reciprocity

	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Baseline × Reciprocal	−2.208***	−2.111***	−3.905***	−3.166***	−3.005***	−2.383***
	(0.432)	(0.482)	(0.929)	(0.526)	(0.544)	(0.638)
Observed × Reciprocal	−3.671***	−2.564***	−4.744***	−3.293***	−2.908***	−2.630***
	(0.766)	(0.524)	(1.114)	(0.662)	(0.402)	(0.559)
Observed × Nonreciprocal	−2.987***	−1.595**	−2.249*	−2.820***	−1.457***	−0.707
	(0.809)	(0.711)	(1.273)	(0.784)	(0.558)	(0.678)
Constant	1.261*	0.196	0.004	1.219	−0.341	−0.751
	(0.765)	(0.723)	(1.101)	(0.755)	(0.632)	(1.045)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	426	426	426	426	426	426
Tests (p-value)						
(1) Baseline = Observed | Reciprocal	**0.008**	0.200	0.133	0.834	0.855	0.611
(2) Baseline = Observed | Nonreciprocal	**0.000**	**0.050**	0.155	**0.001**	**0.018**	0.595

Notes. Panel probit regressions with subject random effects. Standard errors clustered at the session level reported in parentheses. The table pools data from employees in the baseline and observed employees in the peer treatment. Bold values represent significant differences at the 5% level. We adjust p-values using the Holm method (Holm 1979) for multiple-hypothesis testing. We control for round and demographics.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

the social norm of appropriate behavior could explain why observed employees in the peer treatment are less likely to choose the expensive supplier compared with the baseline. In addition, although one could conjecture that the social norm may incorporate reciprocal considerations (i.e., it is less appropriate to choose the expensive supplier when the wage and the price difference are high), the social norm should be empirically elicited as this may not necessarily be the case. In fact, a social norm that (at least to some extent) deviates from reciprocity may explain why the difference in the behavior of observed employees is mostly present among nonreciprocal employees.

5.4.1. Model. We consider nonreciprocal employees' preferences for compliance with the social norm as follows. Let $N : [\underline{\omega}, \infty) \times [0, \bar{\delta}] \times \{S_H, S_L\} \to \mathbb{R}_+$ be a function such that $N(\omega, \delta, \sigma_i)$ represents the perceived social appropriateness of choosing supplier σ_i when the wage is ω and the price difference is δ. Then, the utility of employee i is

$$u_i(\omega, \delta, \sigma_i) = \omega + r \cdot \mathbb{1}_{\{\sigma_i = S_H\}} + \varphi_i \cdot N(\omega, \delta, \sigma_i), \quad (9)$$

where φ_i represents employee i's preference for complying with the social norm. This utility function is the same for employees in the baseline and for those who are observed in the peer model; however, we conjecture that the social appropriateness of choosing the expensive supplier changes when transparency is introduced, such that it is less appropriate for an employee to choose the expensive supplier if the decision is observed by a peer. This prediction is formalized in Hypothesis 3.

Hypothesis 3. (Effect of Transparency on the Social Norm). *The social appropriateness of choosing S_H is lower when the employee's decision is observed by a peer than when there is no observability of the employee's action (baseline treatment).*

5.4.2. Social Norm Elicitation. To test Hypothesis 3, we empirically derive the social norm under each of the two settings, that is, with and without transparency. To accomplish this, we design two incentivized norm elicitation treatments. In the first (second) treatment, subjects are given a description of the setting in the baseline (peer) treatment of the procurement game. After the setting is described, participants evaluate how socially appropriate it is to choose the expensive supplier for each situation $(\omega, \delta) \in \{25, 40\} \times \{10, 25, 40\}$, rating it as "very socially inappropriate," "somewhat socially inappropriate," "somewhat socially appropriate," or "very socially appropriate." For the analysis, we translate these answers into an appropriateness scale ranging from one to four, corresponding to each of the four ratings, respectively. To avoid experimenter demand effects, we use a between-subjects design, that is, subjects who participate in one norm elicitation treatment do not participate in the other norm elicitation treatment or in any of the procurement game treatments.

We incentivize the norm elicitation treatments following the procedure in Krupka and Weber (2013), by offering participants an extra \$10 (in addition to the \$5 show-up fee) if their rating in a randomly selected situation coincides with the mode among all participants' ratings in the session. This coordination game incentivizes participants to respond with what they perceive is the most socially accepted answer rather than what they personally believe is most appropriate.

5.4.3. Results. Twenty-six subjects participated in the baseline norm elicitation treatment, and 26 in the peer norm elicitation treatment. Each session had four to eight subjects and lasted around 30 minutes.

Figure 3 shows the average social appropriateness of choosing supplier H in the baseline and peer norm elicitation treatments. First, we observe that the appropriateness is decreasing in the price difference (Kruskal–Wallis test; $p < 0.001$ for all wages and conditions considered), but it does not vary significantly with wage (Wilcoxon signed-rank test; $p > 0.157$ for all prices and for both baseline and observed employees). This suggests that the price difference between suppliers has higher influence than the wage on the changes in the appropriateness of choosing the expensive supplier. Second, we observe that the appropriateness of choosing S_H is significantly lower for observed employees in the peer treatment than it is for employees in the baseline. Table 5 reports the estimates of ordered probit models regressing subjects' ratings of the appropriateness of choosing S_H on the dummy variable *Observed*. We find that choosing the expensive supplier is significantly less appropriate for an observed employee when the wage and the price difference are low (the coefficient is statistically significant when $(\omega, \delta) \in \{(25, 25), (25, 40), (40, 10)\}$ and marginally significant when $(\omega, \delta) = (25, 10)$). Comparing these results with those reported in Table 3, we observe that

Figure 3. Social Norm: Appropriateness of Choosing S_H

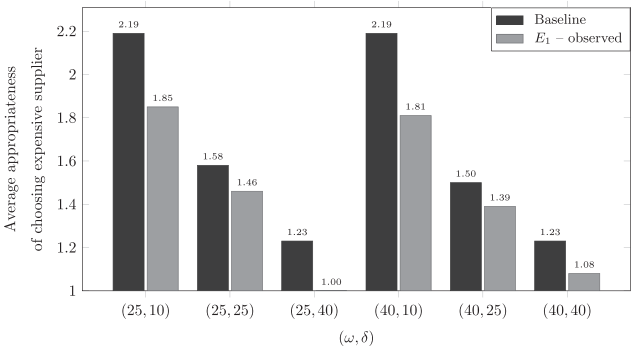


Table 5. Social Norm—Observed Employees

	Appropriateness of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Observed	−0.689*	−0.240***	−4.762***	−0.576***	−0.247	−0.151
	(0.360)	(0.090)	(0.393)	(0.195)	(0.182)	(0.476)
Observations	52	52	52	52	52	52

Notes. Ordered probit regressions with errors clustered at the session level reported in parentheses. The dependent variable is the *social appropriateness of choosing* S_H (on a scale of 1 to 4). The independent variable is a dummy that takes a value of 1 when subjects evaluate the appropriateness of observed employees' decisions in the peer norm elicitation, and 0 when subjects evaluate the appropriateness of employees' decisions in the baseline norm elicitation.

*$p < 0.1$; ***$p < 0.01$.

whenever observed employees are significantly less likely to choose S_H than employees in the baseline (procurement game), it is significantly less appropriate to do so (norm elicitation treatments).

We also compare the changes in behavior in the procurement game with the changes in the social norm separately for nonreciprocal and reciprocal employees. For nonreciprocal employees, we confirm that whenever observed employees are significantly less likely to choose S_H than employees in the baseline, it is significantly less appropriate to do so. On the contrary, for reciprocal employees, the difference in behavior in the procurement game is only significant in one situation, which does not coincide with the significant changes in the social norm. (In the interest of space, these results are deferred to Tables A.3 (nonreciprocal) and A.4 (reciprocal) in the appendix.) The fact that the situations where there are significant differences in the decisions of nonreciprocal employees coincide with the situations where there are significant differences in the appropriateness of choosing S_H suggests that preferences for compliance with the social norm provide a more compelling explanation of the differences in behavior between observed employees in the peer treatment and those in the baseline.

5.5. The Overlap of Effects on Employees Who Are Both Observed and Observers

Our baseline and peer treatments allow us to isolate the effects of transparency absent the reflection problem (Manski 1993) that arises when an employee's action is affected both by the other employee's decision and by the employee's own concern about being observed. However, in real-life situations, some employees may be both observed and observers. Hence, we devote this subsection to studying how the effects of increased transparency interact with each other in such cases.

Recall that Section 5.3 finds that two effects result from increased transparency: (1) a negative spillover effect by which observer employees become more likely to choose the expensive supplier when they observe that their peer did so, which affects mostly reciprocal employees, and (2) a positive effect by which observed employees are less likely to choose the expensive supplier, which is more salient among nonreciprocal employees. We conjecture that if an employee is both observed and observer, these effects will be attenuated due to their interaction but will nevertheless survive, as employees are affected differently depending on their reciprocity type.

To study how the effects of increased transparency interact with each other when employees are observers and observed, we introduce a new treatment consisting of an organization with a director and three employees, E_1, E_2, and E_3. After the director has chosen a wage (which is the same for the three employees), the employees make their decisions sequentially, with E_1 choosing first, E_2 choosing second after observing E_1's decision, and E_3 choosing last after observing E_2's decision. (We allow E_3 to observe E_2's decision but not E_1's so that each employee observes and/or is observed by at most one other employee, analogously to the peer treatment.) As in previous treatments, the employees' decisions are elicited using the strategy method. Subjects keep their role and are randomly rematched for the following round. Note that E_2 in this treatment is both an observer of E_1's decision and one whose action is observed by E_3, who will make a decision after observing E_2. We denote this treatment *peer with overlap of effects* (*peer-OE*).

We focus on E_2 in the peer-OE treatment and we conjecture that (1) the positive effects of being observed are attenuated, that is, an observed employee, who in addition observes that the peer chose the expensive supplier, is more likely to choose it than an employee who is only observed, and (2) the negative spillovers from observing that a peer chose the expensive supplier are attenuated when being observed,

that is, an observer employee who observes that the peer chose the expensive supplier, and who in addition is observed, is less likely to choose it than an observer employee who observes that the expensive supplier was chosen and who is not observed. Based on our observations in Section 5.3, we expect the first effect to be larger among reciprocal employees and the second effect to be larger among nonreciprocal ones.

A total of 136 subjects participated in the peer-OE treatment, which was conducted between February and April 2019 at the same university and with the same subject pool and recruiting protocol as in the original treatments. To test whether the positive effect of being observed is attenuated, we compare an employee who is only observed (E_1 in the peer treatment) with an employee who is observed but also observes that the expensive supplier was chosen (E_2 in the peer-OE treatment who observes that E_1 chose S_H). In line with our conjecture, Figure 4 shows that the frequency of choosing S_H is significantly lower for E_1 in the peer treatment than for E_2 in the peer-OE treatment who observes that S_H was chosen. To test this formally, in panel A of Table 6, we compare the probability of choosing the expensive supplier in these two cases, distinguishing between reciprocal and nonreciprocal employees. We find that, among reciprocal employees, E_2 in the peer-OE treatment who observe that S_H was chosen are more likely to choose S_H than E_1 in the peer treatment (this holds directionally for all situations and is significant in four). These differences are present among nonreciprocal employees only in one situation. As predicted, these results suggest that the positive effects of being observed are diminished by the negative spillovers associated with observing that a peer chose S_H, affecting mostly reciprocal employees.[16]

To test whether the negative spillovers are attenuated by being observed, we compare E_2 in the peer treatment with E_2 in the peer-OE treatment (in both cases who observe that S_H was chosen). In Figure 4, we note that when the wage and the price difference are sufficiently high, the frequency of choosing S_H after observing S_H is significantly higher for E_2 in the peer treatment than E_2 in the peer-OE treatment, supporting our conjecture. To confirm this, in panel B of Table 6, we compare the probability of choosing the expensive supplier among E_2 who observe S_H in the peer and peer-OE treatments, distinguishing between reciprocal and nonreciprocal employees. We find that E_2 in the peer-OE treatment (who are observed by E_3) are significantly less likely to choose the expensive supplier than E_2 in the peer treatment (who are not observed by a peer). Consistent with our previous results, this effect is only present among nonreciprocal employees.

Overall, we observe that our previous results are robust to settings where employees both observe and are observed. First, the negative spillovers associated with observing that a peer chose the expensive supplier also affect employees who are themselves observed. Second, the positive effects associated with being observed by a peer are also present in employees who observe that a peer chose the expensive supplier. Moreover, the main behavioral mechanisms we identified in the peer treatment—that negative spillovers affect mostly reciprocal employees, and the positive effects from being observed affect nonreciprocal ones—are still present when an employee both observes and is observed.

5.6. Effect on Procurement Cost

The theoretical model predicts that as a result of the negative spillovers, the average procurement cost per employee should be higher in the peer treatment than in the baseline (Corollary 1 in the online appendix). However, the experimental results show no significant differences in the average cost per employee between the two treatments ($c_B = 60.208$ versus $c_P = 61.314$; Wilcoxon rank-sum test; $p = 0.335$). This mismatch is

Figure 4. Frequency of Choosing S_H: Peer and Peer-OE Treatments

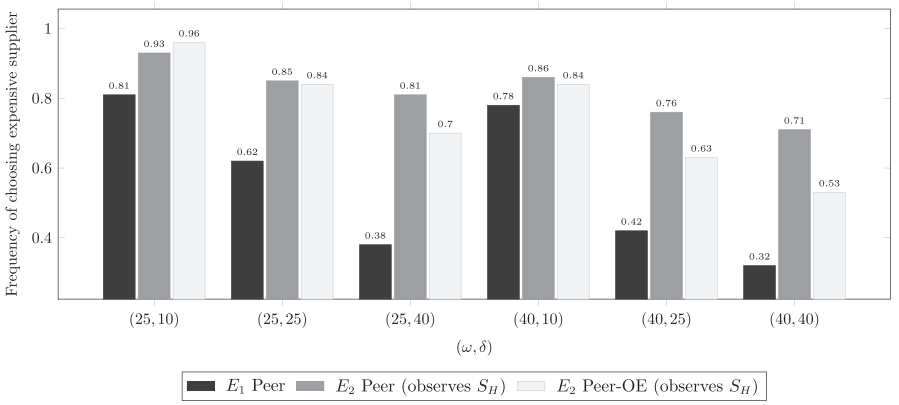


Table 6. Attenuated Effects When Employee Is Both Observed and Observer

Panel A. Positive effects of being observed are attenuated by observing S_H

	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
E_1-peer × Reciprocal	–0.579*	–0.777**	–1.936**	–0.493	–1.255***	–1.592***
	(0.337)	(0.317)	(0.809)	(0.374)	(0.478)	(0.398)
E_2-peer-OE × Reciprocal	0.611	0.305	0.297	–0.382	–0.322	–0.305
	(0.480)	(0.415)	(0.852)	(0.420)	(0.726)	(0.564)
E_2-peer-OE × Nonreciprocal	2.622***	0.962*	0.809	0.864	0.611	–0.178
	(0.500)	(0.537)	(0.775)	(0.689)	(0.782)	(0.508)
Constant	–1.545**	–1.093	–0.933	0.141	–0.481	–0.183
	(0.717)	(0.690)	(1.188)	(0.720)	(1.077)	(1.030)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	421	392	355	389	336	312
Tests: E_1-peer = E_2-peer-OE (p-value)						
(1) Reciprocal	**0.034**	**0.002**	**0.002**	0.832	0.121	**0.011**
(2) Nonreciprocal	**0.000**	*0.073*	0.297	0.421	0.435	0.725

Panel B. Negative spillovers are attenuated when being observed

	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
E_2-peer × Reciprocal	–0.863**	–1.242***	–2.049***	–1.305**	–1.734***	–1.337**
	(0.339)	(0.270)	(0.764)	(0.632)	(0.457)	(0.590)
E_2-peer-OE × Reciprocal	–0.675	–1.266***	–2.037***	–1.499**	–2.118***	–1.520***
	(0.420)	(0.403)	(0.669)	(0.748)	(0.463)	(0.460)
E_2-peer-OE × Nonreciprocal	–0.109	–0.705	–1.604***	–0.619	–1.209***	–1.383***
	(0.496)	(0.431)	(0.558)	(0.731)	(0.463)	(0.416)
Constant	1.758***	1.831***	2.963**	3.835***	3.198***	3.043**
	(0.464)	(0.669)	(1.174)	(1.153)	(0.973)	(1.552)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	376	302	210	338	201	154
Tests: E_2-peer = E_2-peer-OE (p-value)						
(1) Reciprocal	1.000	0.929	0.986	0.662	0.419	0.738
(2) Nonreciprocal	0.825	0.203	**0.008**	0.794	**0.018**	**0.002**

Notes. Panel probit regressions with subject random effects. Standard errors clustered at the session level reported in parentheses. Panel A pools data from E_1 in the peer treatment and E_2 in the peer-OE treatment who observe that S_H was chosen. Panel B pools data from E_2 in the peer treatment and E_2 in the peer-OE treatment, all of whom observe that S_H was chosen. (The number of observations per situation varies as the number of employees who observe S_H changes across situations.) Bold and italic values represent significant differences at the 5% and 10% level, respectively. We adjust p-values using the Holm method (Holm 1979) for multiple-hypothesis testing. We control for round and demographics.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

because our theory does not account for the positive effects of transparency on observed employees. Although negative spillover effects work to increase the procurement cost, the effects on observed employees work in the opposite direction and contribute to reducing it. In fact, when comparing the overall frequency with which employees choose the expensive supplier in the baseline and peer treatments (we look at the average across E_1 and E_2 in each treatment) we find that there is no significant difference, except in one situation where this probability is lower in the peer treatment (see Table A.5 in the appendix). Consistent with this observation, the experimental results show that the average wage is not significantly different across baseline and peer treatments ($w_B = 28.125$ versus $w_P = 28.269$; Wilcoxon rank-sum test; $p = 0.915$).

When we compare the overall frequency of choosing S_H in the peer and peer-OE treatments (by looking

at the average across E_1 and E_2 in the peer treatment, and across E_1, E_2, and E_3 in the peer-OE treatment), we observe that the frequency of choosing S_H is higher in the peer-OE treatment than in the peer treatment, and that the difference is significant when the wage is low (see Table A.5 in the appendix). However, we find no significant differences in the average wage between the peer and the peer-OE treatments ($\omega_P = 28.27$ versus $\omega_{P-OE} = 28.51$; Wilcoxon rank-sum test; $p = 0.775$). Overall, the difference in the average cost between the peer and peer-OE treatments is not statistically significant ($c_P = 61.31$ versus $c_{P-OE} = 63.58$; Wilcoxon rank-sum test; $p = 0.121$).

6. Conclusions

Motivated by recent initiatives to increase transparency in procurement, we study the effects of disclosing information about previous purchases in a setting where an organization delegates its purchasing decisions to its employees. We develop a theoretical model that captures the main dynamics of such settings and makes two behavioral assumptions: that employees are heterogeneous in their reciprocity toward the employer and that they are averse to disadvantageous income inequality relative to their peer. We show the existence of a price region where increased transparency leads to negative spillovers on reciprocal employees, who in the absence of peer effects would have chosen the cheaper supplier to benefit their employer. Our model also predicts a lack of peer effects on employees who are observed by their peer.

We design a laboratory experiment to test these predictions and to shed light on the behavioral mechanisms driving decisions. Our experimental results confirm the existence of negative spillovers on reciprocal employees, by which they are more likely to choose the expensive supplier after observing that their peer did so. A result that is not predicted by our model is that employees whose decision will be observed by their peer are less likely to choose the expensive supplier. This effect is especially significant among nonreciprocal employees and when the wage is low, suggesting that reciprocity is not the main mechanism driving this behavior. We propose an alternative explanation based on employees' desire to comply with the social norm by taking the action that is socially perceived as most appropriate. Through additional norm elicitation treatments, we find that choosing the expensive supplier is less appropriate when employees' decisions are observed by a peer than in the no-transparency baseline, and that these differences in the social norm are consistent with the differences in purchasing behavior between employees in the baseline and those who are observed in the peer treatment. This result suggests that employees' desire to comply with social norms provides a plausible explanation for the behavior of observed employees. Finally, although we initially identify the effects of transparency separately on observer and observed employees, an additional treatment confirms that our main findings are still present when an employee both observes and is observed. Specifically, the negative spillovers associated with observing that a peer chose the expensive supplier also affect employees who are themselves observed, and the positive effects associated with being observed by a peer are also present in employees who observe that a peer chose the expensive supplier.

6.1. Managerial Implications

Our results provide valuable insights for organizations seeking to implement transparency initiatives in their procurement processes, and suggest some concrete recommendations to be incorporated when designing such procurement platforms.

First, we find that increased transparency affects employees' purchasing behavior: observing overspending negatively affects reciprocal employees and being observed by a peer positively affects nonreciprocal employees. Hence, firms' internal communication policies should emphasize that employees' decisions will be observed: this would help reduce overspending by nonreciprocal employees and in turn mitigate the negative spillovers on reciprocal employees, leading to lower procurement costs. A second effect of increased transparency we identify is the change in the perceived appropriateness of choosing the expensive supplier. In particular, overspending is perceived to be less appropriate when an employee's decision is observed by other employees. Our results also show that observed employees comply, to a certain extent, with what is perceived as socially appropriate. Therefore, organizations should make communication efforts that reinforce what is perceived as appropriate spending behavior in an attempt to increase compliance with the social norm and to reduce procurement costs.

We believe that a great opportunity for future research would be to test the aforementioned ideas in a field experiment setting. For instance, in line with what we just described, two concrete suggestions arise. First, it would be interesting to implement an intervention where employees are reminded of the fact that other employees will observe their decisions later on. Second, it would be interesting to elicit the perceived appropriateness of choosing the expensive suppliers, and make that visible to employees when they make their choices. This intervention would be in line with previous literature that has shown that communication that makes the social norm salient can be effective at influencing behavior in settings such as alcohol and cigarette use, energy consumption, and pro-environmental behavior (Cialdini et al. 2006, Schultz et al. 2007, Reid et al. 2010). In addition, in

public procurement settings, it would be of interest to study the impact of purchasing decisions being observed not only by peers but also by citizens.

Finally, we note that our study is not without limitations. First, to focus on the effects of transparency about employees' decisions, we assume a common wage and reward r for all employees. Our setup provides a good approximation for many real-life situations where employees do not know the wage that other employees receive or the personal benefit other employees derive from their choices. Nevertheless, allowing for different wages and rewards could shed light on more nuanced forms of inequality aversion between the employees. In addition, allowing for a larger choice set of wages and/or manipulating the personal benefit r could provide additional robustness checks of the behavioral mechanisms. Another limitation of our work is that we focus on settings, such as contract agreements, where employees have the discretion to choose a supplier from a subset of preselected options. The employer delegates this decision to the employees who can choose freely, without punishment. Cases of fraud or corruption could be interesting directions for future research.

Acknowledgments

The authors are grateful to Buenos Aires Compra, Provincia de Buenos Aires Compra, and the governments of Ciudad Autónoma de Buenos Aires, Provincia de Buenos Aires, and, in particular, to Mariana San Martín for all the insightful discussions on transparency. They thank Damian Beil, Ryan Buell, Yan Chen, Andrew Davis, Kyle Hyndman, Evgeny Kagan, Elena Katok, Erin Krupka, Stephen Leider, Greg Macnamara, Muriel Nierdele, Anton Ovchinnikov, Xavier Warnes, Karen Zheng, and attendants at the Stanford Behavioral Economics Lunch Seminar and the Operations, Information and Technology Brown Bag Lunch seminar for their constructive feedback.

Appendix. Additional Tables and Figures

Figure A.1. Reciprocity Distribution

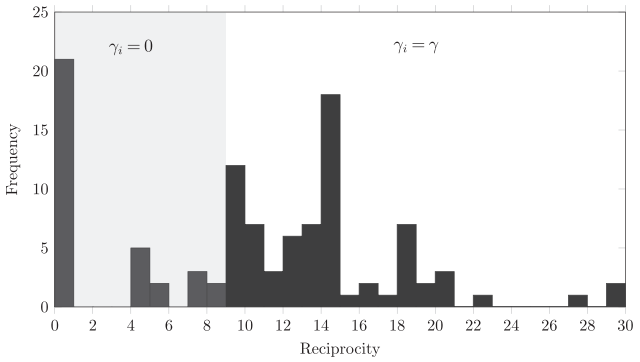


Table A.1. Frequency of Choosing S_H by Role and Treatment

	Panel A. Baseline					
	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
Employee	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
E_1	0.92	0.70	0.48	0.81	0.49	0.38
	(0.21)	(0.36)	(0.44)	(0.31)	(0.42)	(0.41)
E_2	0.92	0.69	0.55	0.80	0.52	0.45
	(0.21)	(0.38)	(0.44)	(0.34)	(0.44)	(0.44)
Difference (p-value)	0.319	0.391	0.147	0.772	0.193	0.171
	Panel B. Peer					
E_1	0.81	0.62	0.38	0.78	0.42	0.32
	(0.29)	(0.34)	(0.38)	(0.32)	(0.36)	(0.34)

Table A.1. (Continued)

	Panel B. Peer					
	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
E_2	0.90	0.77	0.62	0.83	0.64	0.56
	(0.17)	(0.26)	(0.36)	(0.27)	(0.34)	(0.39)
Difference (p-value)	0.243	**0.048**	**0.007**	0.513	**0.009**	**0.011**

Notes. Standard errors reported in parentheses. Panel A reports Wilcoxon signed-ranked tests for subject-level pairwise comparisons when subjects' roles are E_1 and E_2. Panel B reports the Wilcoxon rank-sum tests for differences between E_1 and E_2. Bold values represent significant differences at the 5% level.

Table A.2. Effect of Reciprocity

	Panel A. Baseline					
	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
Coefficient	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Reciprocity	–2.506***	–2.229**	–5.570***	–3.923***	–3.754***	–2.789**
	(0.351)	(1.074)	(1.621)	(1.240)	(1.371)	(1.273)
Constant	5.185***	2.435**	2.614	2.300	1.471	0.159
	(1.690)	(1.052)	(1.629)	(2.131)	(1.117)	(0.992)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	168	192	192	168	192	192
	Panel B. Peer-observed					
	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Reciprocity	–0.703*	–0.966**	–2.136***	–0.510	–1.456***	–1.831***
	(0.417)	(0.399)	(0.829)	(0.511)	(0.417)	(0.430)
Constant	–2.532***	–2.608***	–2.822*	–1.451	–2.443***	–1.577
	(0.738)	(0.797)	(1.556)	(1.214)	(0.891)	(1.024)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	234	234	234	234	234	234
	Panel C. Peer-observer					
	Probability of Choosing S_H					
	$\omega = 25$			$\omega = 40$		
	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Reciprocity	–0.702	–1.648***	–2.670***	–1.532***	–1.490***	–1.954***
	(0.505)	(0.273)	(0.480)	(0.504)	(0.301)	(0.510)
Constant	2.089*	2.906***	3.010***	3.458***	2.545***	3.034***
	(1.264)	(0.670)	(0.913)	(1.226)	(0.593)	(1.063)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	234	234	234	234	234	234

Notes. Panel probit regressions with subject random effects. Standard errors clustered at the session level reported in parentheses. Panel A pools data from employees in the baseline. Panel B pools data from employees who are observed in the peer treatment. Panel C pools data from employees who are observers in the peer treatment. Missing observations for $\delta = 10$ in panel A are due to perfect separation. We control for round and demographics.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table A.3. Procurement Game vs. Social Norm: Observed Employees (Nonreciprocal)

		Probability of Choosing S_H					
		$\omega = 25$			$\omega = 40$		
		$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Procurement game	Observed	—	−1.741**	−2.655*	−1.730***	−1.452	−0.413
		—	(0.823)	(1.512)	(0.582)	(0.970)	(1.097)
	Constant	2.207***	−1.022	−2.132	1.901***	−0.832	−1.492
		(0.412)	(1.215)	(2.272)	(0.620)	(1.404)	(2.106)
	Controls	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	72	132	132	132	144	144
		Appropriateness of choosing S_H					
Social norm	Observed	−0.689*	−0.240***	−4.762***	−0.576***	−0.247	−0.151
		(0.360)	(0.090)	(0.393)	(0.195)	(0.182)	(0.476)
	Observations	52	52	52	52	52	52

Notes. The top panel reports the results of panel probit regressions using y_{ist} (from the procurement game) as the dependent variable, pooling data from nonreciprocal employees in the baseline and observed conditions only. Missing observations when $\omega = 25$ and $(\omega, \delta) = (40, 10)$ are due to perfect separation. The bottom panel corresponds to the norm elicitation treatments, and reports the estimates of ordered probit regressions with errors clustered at the session level reported in parentheses. The dependent variable is the *social appropriateness of choosing* S_H (on a scale of 1 to 4). The independent variable is a dummy that takes a value of 1 when subjects evaluate the appropriateness of observed employees' decisions in the peer norm elicitation, and 0 when subjects evaluate the appropriateness of employees' decisions in the baseline norm elicitation. We control for round and demographics.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table A.4. Procurement Game vs. Social Norm: Observed Employees (Reciprocal)

		Probability of Choosing S_H					
		$\omega = 25$			$\omega = 40$		
		$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$
Procurement game	Observed	−1.561**	−0.283	−0.448	−0.027	0.289	−0.040
		(0.619)	(0.393)	(0.574)	(0.745)	(0.595)	(0.481)
	Constant	−1.150	−1.039	−2.422*	−3.194**	−3.139***	−2.210*
		(1.099)	(0.785)	(1.278)	(1.527)	(1.015)	(1.244)
	Controls	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	282	282	282	282	282	282
		Appropriateness of choosing S_H					
Social norm	Observed	−0.689*	−0.240***	−4.762***	−0.576***	−0.247	−0.151
		(0.360)	(0.090)	(0.393)	(0.195)	(0.182)	(0.476)
	Observations	52	52	52	52	52	52

Notes. The top panel reports the results of panel probit regressions using y_{ist} (from the procurement game) as the dependent variable, pooling data from reciprocal employees in the baseline and observed conditions only. The bottom panel corresponds to the norm elicitation treatments, and reports the estimates of ordered probit regressions with errors clustered at the session level reported in parentheses. The dependent variable is the *social appropriateness of choosing* S_H (on a scale of 1 to 4). The independent variable is a dummy that takes a value of 1 when subjects evaluate the appropriateness of observed employees' decisions in the peer norm elicitation, and 0 when subjects evaluate the appropriateness of employees' decisions in the baseline norm elicitation. We control for round and demographics.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table A.5. Differences Across Treatments: General Results

	Probability of Choosing S_H							
	$\omega = 25$			$\omega = 40$				
Coefficient	$\delta = 10$	$\delta = 25$	$\delta = 40$	$\delta = 10$	$\delta = 25$	$\delta = 40$	Average wage	Average cost
Baseline	0.917	0.693	0.516	0.802	0.505	0.417	28.125	60.208
	(0.216)	(0.374)	(0.443)	(0.329)	(0.433)	(0.430)	(6.124)	(11.651)
Peer	0.853	0.694	0.502	0.806	0.530	0.440	28.269	61.314
	(0.243)	(0.313)	(0.392)	(0.296)	(0.366)	(0.384)	(6.206)	(12.363)
Peer-OE	0.938	0.799	0.629	0.809	0.515	0.376	28.514	63.581
	(0.119)	(0.248)	(0.343)	(0.281)	(0.372)	(0.370)	(6.367)	(12.721)
Tests (p-value)								
(1) Peer vs. baseline	**0.042**	0.653	0.741	0.543	0.774	0.734	0.915	0.335
(2) Peer vs. peer-OE	**0.017**	**0.025**	**0.033**	0.878	0.712	0.262	0.775	0.121

Notes. Standard errors reported in parentheses. The first six columns consider the average probability of choosing S_H. The next column considers the average wage, and the last column considers the average cost per employee. In each case we consider the data that is aggregated at the subject level. Tests 1 and 2 are Wilcoxon rank-sum tests. Bold values represent significant differences at the 5% level.

Endnotes

[1] Mittone and Ploner (2011) study a five-person trust game, with one sender and four receivers, who are paired and make their choices sequentially. They find evidence of higher returns in receivers who move first, but only when the investment is high.

[2] When there is no risk of confusion, we abuse notation and use δ for both the random price difference Δ and its realization.

[3] One could also consider including distributional fairness toward the director. However, since employees' actions follow the director's wage decision, we expect the employees' social preferences to be primarily driven by their perception of how kind the employer's action is. Indeed, Ho and Su (2009) show that, in ultimatum games played sequentially by a leader and two followers, peer-induced fairness between the followers is significantly stronger than the followers' distributional fairness toward the leader. Consistent with this result, we focus on employees' reciprocity rather than employees' distributional fairness toward their employer.

[4] We restrict our attention to pure symmetric strategies, and in the case of indifference we assume that the employees choose supplier H and the director chooses the lowest wage.

[5] Considering $\beta > 0$ ensures that $\frac{r}{\gamma\lambda(\omega_B^*)} < \frac{r\cdot(1+\beta)}{\gamma\lambda(\omega_P^*)}$. Otherwise, if $\beta = 0$, then $\zeta = 1$ and $\omega_B^* = \omega_P^*$.

[6] In the instructions we refer to the employees as employee A and employee B, respectively, to avoid inducing any perceptions of hierarchy. Similarly, suppliers H and L are labeled supplier A and B, respectively.

[7] We also included $\delta = 0$ to check for consistency. We omit these results from the analysis because all subjects in the baseline chose the expensive supplier, as expected.

[8] This especially holds when the observer's income inequality aversion, β, is sufficiently high, as this increases the length of the interval where the negative spillovers occur.

[9] Subjects were undergraduate students. Average age was 21.98, 57.27% were female and 42.73% were male, and 17.27% were economics or business majors and 82.73% were other majors. Subjects were recruited using the online recruiting system ORSEE (Greiner 2004).

[10] See panels A and B of Table A.1 in the appendix for the baseline and the peer treatment, respectively. A detailed analysis of the effects of price and wage can be found in the online appendix.

[11] As subjects had played the procurement game before the trust game, we check whether their behavior in the trust game was affected by the treatment and by the role played in the first game. We find no significant differences in the amount sent or in the amount returned for each amount received across subjects' conditions: baseline, observed, and observer.

[12] The percentile for the cutoff is chosen based on the distribution of the metric of reciprocity presented in Figure A.1 in the appendix. The results remain qualitatively unchanged if the cutoff is set at the 10th or 25th percentile.

[13] The results are presented in Table A.2 in the appendix.

[14] We also analyze how the dynamics at play evolve as rounds in a session elapse. We find that the existence of negative spillovers and other main results are still present in later rounds of a session. In the interest of space, a detailed analysis of the session dynamics is relegated to the online appendix.

[15] Note that our focus is on injunctive norms, which are defined as what one ought to do, rather than descriptive norms, which are customs or actions that people regularly take (Krupka et al. 2016).

[16] To further test whether the positive effects of being observed are attenuated when an employee observes that the peer chose the expensive suppler, we conducted a different treatment with 111 new subjects. As in the peer treatment, the organization in the new treatment consists of a director and two employees; the director chooses a wage that is common to both employees, E_1 chooses a supplier first, and E_2 observes E_1's choice before making a decision. However, in the new treatment, after E_2 has made a decision, E_1 observes E_2's choice but cannot update E_2's own decision. Thus, in this treatment, E_1 is not only an observed employee but he is also a weak observer: E_1's decision in round two and onward may be influenced by a previous observation of an E_2 the employee is no

longer paired with. We find that the positive effects of being observed are attenuated by being a weak observer: a nonreciprocal E_1 who observes that E_2 in the previous round chose S_H is more likely to choose it than an E_1 in the peer treatment. Understanding the extent to which the effects are attenuated when employees are both observed and observers in different settings is an interesting area for future research.

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