The Informational and Incentive Effects of Supplier Awards

Ruth Beer
Kelley School of Business, Indiana University, Bloomington, IN 47405, ruthbeer@indiana.edu

Hyun-Soo Ahn
Ross School of Business, University of Michigan, Ann Arbor, MI 48104, hsahn@umich.edu

Stephen Leider
Ross School of Business, University of Michigan, Ann Arbor, MI 48104, leider@umich.edu

Many firms recognize exceptional supplier performance by giving out a "Supplier of the Year" or "Outstanding Supplier" award. These awards are usually symbolic since they have no immediate monetary value for a supplier and no direct cost to a buyer. Giving these awards can be beneficial for a buyer: if the employees working for a supplier care about being rewarded, symbolic awards can incentivize a supplier to exert higher effort. On the other hand, in a market with multiple buyers and suppliers, an award may have another effect, which we denote "competition effect". When an award is announced to other buyers indicating that a particular supplier is good, this can intensify a competition to do business with a good supplier. We develop a theoretical model that captures a supplier's value for the award in a setting with two buyers and two suppliers. We show that the average provision of quality is higher when awards are available whether these are private (only observable to the recipient) or public (observable to everyone). In addition, public awards result in buyers paying a higher price to get a good supplier. We then test these results with a laboratory experiment. Our experimental results show that private symbolic awards have incentive effects and lead to higher provision of quality and higher buyer's profits. When the awards are public this profit premium disappears. This happens for two reasons, first because buyers have to pay higher prices to get the good suppliers, and second because making the award public crowds out the intrinsic value of the award for suppliers. We also find that significant efficiency gains occur only when the award is private and the quality is public. This suggests that symbolic awards provide a noisy signal of a supplier's type and therefore fail to capture the full efficiency gain of transparent transactions.

Key words: collaboration in supply chains, behavioral operations, symbolic supplier awards

1. Introduction

One of the most important aspects of managing a good supply chain is to build and retain relationships with suppliers as what suppliers do affects a firm and its customers. The field of operations management has produced a vast literature in buyer-supplier relationships. Many papers in the area study objectives such as maximizing profits or minimizing fulfillment cost, and focus on the design of efficiency-improving contracts between the buyer and the supplier (e.g., Cachon 2003; Pasternack 2008; Cachon and Lariviere 2005). Although a contract can be an effective tool to agree on obvious metrics such as cost and order quantities, other aspects of the relationship where what suppliers do affects the firm's bottom line are often not contractible. For example, random disruptions and catastrophic events are difficult to predict, therefore, it is difficult for both parties to agree on specific actions (response, compensation, etc.) in a standard fulfillment contract. In case of a complex fulfillment deal, it may not be feasible to specify numerous details. For those, the supplier usually has a discretion to choose quality level or effort. For instance, if the noise level of a hard disc spindle is not specified in a contract, the supplier is not required (although noise reduction is certainly desired by the buyer) to sufficiently reduce the noise level of the product (Kaya and Özer 2009). In a similar vein, the quality of a multi-faceted service is not fully contractible and enforceable.

In these cases, non-contractual instruments based on behavioral and social preferences greatly impact the nature of a relationship and the supply chain performance. For example, reciprocal motives or concerns about reputation may provide incentives for suppliers to exert extra efforts. Similarly, a supplier's effort can be encouraged by a buyer's expression of approval or reward. Many firms give out "Outstanding Supplier" or "Supplier of the Year" awards to their best suppliers for their "above and beyond" efforts and commitment. The awards are typically given to suppliers who excel in creative cost-reduction solutions, teamwork, customer service, response to supply chain disruption, or sustainability. For example, in 2011, Verizon recognized Ciena with an "Outstanding Performance Award" for the outstanding performance of Ciena's packet-optical switches during a Japanese earthquake[1]. Johnson Controls issued a press release announcing that its power solutions division received the GM's 2009 Supplier of the Year Award for consistently exceeding GM's expectations[2]. The formats of these awards or recognitions vary highly from one company to another. Some companies hold a "supplier day" and *publicly* award outstanding suppliers. Other companies choose more *informal* and *private* ways to recognize suppliers – dinner or golf invitation from the CEO of a buying firm or a complimentary communication sent to a manager of a supplier. One of the unique contributions of this paper is studying whether the impact of a symbolic award is different depending on whether the award is publicly announced or not. Specifically, we compare a setting where the award is privately given to a setting where the award is public. Our theoretical model and experiments compare the outcomes of these two settings and extract two different effects

[1] Source:http://www.ciena.com/connect/blog/Verizon-recognizes-Ciena-with-Supplier-of-the-Year-award.html

[2] Source:http://www.prnewswire.com/news-releases/johnson-controls-receives-2009-supplier-of-the-year-award-from-general-motors-corp-89136407.html

associated with a symbolic award – incentive and competition effects. The insights from our model and ensuing experiments will shed light on how the firm should convey positive recognition to its suppliers.

There are a number of reasons why some suppliers may care about symbolic awards, even when these are non-monetary. For example, suppliers may seek free press coverage and advertising or preferential treatment in future transactions with the buyer. In some cases, a supplier's corporate culture and incentives encourage its managers to seek awards from business counterparts. For instance, if a manager's performance incentives (i.e., promotion, bonuses) are tied to the buying firm's recognition or feedback, awards will affect his/her efforts and responses to the buying firm. Another plausible explanation is that even in a supplier-buyer relationship, decision makers who are involved in forming, retaining, and dissolving the relationship are, after all, individuals. Even in large corporations such as GM, a relationship with a key supplier is often managed by a handful of individuals whose social preferences and behavior will influence the relationship that develops between the firms. Thus, if symbolic awards induce intrinsic motivation of individuals working in the supplier as verified through a number of experiments in behavioral economics (Lacetera and Macis 2010b, Kosfeld and Neckermann 2011, Ashraf et al. 2012, Bradler et al. 2013), their actions affect relationships at a corporate level.

From a buying firm's perspective, it looks as if these symbolic awards can do no harm at all. After all, most awards have little direct cost to the buyer, yet a positive feedback recognizes a supplier's effort and improves the nature of a relationship between two firms. Since these awards are given to suppliers who put above and beyond efforts for the buyer, a symbolic award seems to be an effective tool to help the buyer recognize and retain its supplier. However, when there are multiple firms on both the buying side and the supply side, the effect of a symbolic award is more complicated than in a setting with one buyer and one supplier or a setting with one buyer and multiple suppliers (Kosfeld and Neckermann 2011, Eriksson and Villeval 2012, Bradler et al. 2013). For instance, if there are multiple buyers (and they want to locate good suppliers), it is not clear whether these "symbolic" awards are indeed cost-free. A publicized award informs which supplier is good to other buyers. If the gain from working with a good supplier is significant and/or there is scarcity of good suppliers (e.g., a good supplier is hard to find or the capacity of a good supplier is limited), the presence of other buying firms make it costly for the firm to build and retain the relationship with a good supplier. In a market with multiple buyers, a supplier may leverage the award to increase its profits. Thus, it is possible that a "selfish" supplier could initially exert high efforts to get a favorable contract and then reap off benefit by shirking later on.

The main question of this paper is whether giving a symbolic award to a supplier enhances or disrupts a supply-chain relationship when there are multiple buyers and suppliers. Two opposite effects are central to our paper. The first is a motivational effect by which symbolic awards improve suppliers' effort. The other force is a competition effect whereby awards intensify competition among buyers. Our main research questions are as follows: (1) Do awards have the motivational effect? (2) In a market with multiple buyers, how significant is the competition effect in undercutting the motivational benefit of an award? (3) Considering both effects combined, when is giving out an award most beneficial for the buyer and what type of award does the buyer prefer? To answer these questions, we develop a model where we analyze four different settings: a benchmark case with no awards, a setting where the awards are private, a setting where awards are public, and a setting where the awards are private but the supplier's choice of quality is public information.

We analyze a stylized model and derive testable hypotheses. We then test the validity of our theoretical hypotheses with a series of lab experiments that reproduce the settings of our theoretical model. Our results show that symbolic awards do have the incentive effect and lead to higher provision of quality. At the same time, the competition effect forces buyers to pay higher prices to transact with good suppliers when awards are public. We also discuss the implications of a symbolic award to the firm's profit and show that, while a symbolic award increases total profits, it does not fully restore the efficiency loss to a supply chain.

2. Literature Review

As supply chain structure becomes more complex and decentralized, one of the key issues is how to design and manage an efficient supply chain. Earlier papers in this area focus on optimal mechanisms and/or creative contracts (see Cachon 2003 for an extensive review) using levers such as quantity, price, quality, or capacity. However, both academics and practitioners well recognize that a good relationship goes beyond price and quantity negotiation (Liker and Choi 2004). A relationship between a supplier and a buyer is often multi-faceted, and many aspects that define a relationship cannot be explicitly written in a contract. One way to improve supply chain efficiency in such case is to recognize and utilize social attributes and preferences such as social norms, fairness, and trust. Haitao Cui et al. (2007), Loch and Wu (2008), Katok and Pavlov (2013) find that fairness plays an important role in supply chain performance. Özer et al. (2011), Özer et al. (2014), Spiliotopoulou et al. (2015) show that trust and trustworthiness impact how a buyer and a supplier share information for demand planning. These results show that incorporating social preferences is important in understanding how supply chains can be managed more effectively.

In our paper, we investigate how a symbolic award affects the provision of unenforceable quality in a buyer-supplier relationship. Behavioral aspects of quality decisions in supply chains are still relatively unexplored. Davis and Hyndman (2016) study the efficacy of mechanisms for managing suppliers' quality. They find that deferred payment mechanisms, under which a buyer offers a bonus payment after a review of a supplier's work, can incentivize a supplier to exert higher effort. Our paper, on the other hand, focuses on aspects of quality which are not contractible (even when they are potentially observable to both parties). They also find that relational mechanisms, such as a long-term relationship where there is the threat of punishment, improve quality and supply chain efficiency. On the contrary, we focus on a setting where concerns about building a long-term relationship are absent or insufficient to drive suppliers' behavior.

Awards work as a form of feedback from buyers to suppliers by communicating appreciation, recognition, or gratitude. In the economics literature, multiple papers establish that feedback on status or relative comparison incentivizes agents: Lazear and Rosen (1979), Green and Stokey (1982), and Nalebuff and Stiglitz (1983) study principal-agent problems in a tournament or contest and show that linking monetary reward to rank orders or relative performance outperforms the payment based on absolute performance. A stream of literature in behavioral economics shows that negative or positive feedback has motivational effects in a situation where a moral hazard or free riding exists. Fehr and Gächter (2000) shows that a costly (monetary) sanction reduces free-riding and increases contribution in a public goods game. Noussair and Tucker (2005) and Masclet et al. (2003) further show that even informal sanctions such as an expression of disapproval can increase contributions towards a public good. Similarly, Ellingsen and Johannesson (2008) allow unrestricted verbal feedback in a dictator game and show that allowing for feedback reduces extreme split (e.g., 100-0) and increases the likelihood of equal splits. In a similar vein, the experiments by Gächter and Fehr (1999) show that verbal approvals or praises induce cooperative actions. In Bolton et al. (2004) feedback improves transaction efficiency in an online market.

The motivational effects of non-pecuniary rewards have been studied in principal-agent settings as well. Using a field experiment, Kube et al. (2012) show that gifts that are costly to an employer are effective in inducing reciprocal actions from employees (even when they do not provide monetary gains). In particular, they show that non-monetary gifts have larger impact than monetary gifts of similar value. Baron and Kreps (1999) propose that workers endow a higher value to a gift if the gift is costly to an employer. The paper finds that, even when an award is non-monetary, the fact that the award is costly to a buyer influences an agent's action. The existing literature shows that rewards do not need to be monetary or tangible gifts to motivate agents. Theoretical work by Besley and Ghatak (2008) shows that status rewards (such as a job title or medal) can work as incentive devices. In a laboratory experiment, Peeters and Vorsatz (2013) find that sending approval with a "smiley face" increases contributions in a public goods game. A field experiment by Lacetera and Macis (2010b) shows that the frequency of blood donation increases when symbolic awards (i.e., rewarding donors with symbolic "medals") are given in public. Ashraf et al. (2012) show that non-financial awards (e.g., a star) are more effective in increasing workers' effort than financial incentives in a public health setting. Bradler et al. (2013) and Kosfeld and Neckermann (2011) show that congratulatory cards have motivational effects on individuals performing a data entry task. While these papers establish the effectiveness of symbolic awards in incentivizing effort, most papers focus on settings with a single principal (employer). In contrast, we explicitly consider a setting where there are multiple buying firms (principals) and multiple suppliers (agents), representing a typical supply chain landscape. We posit that awards may have different implications when there are multiple buying firms. We find that symbolic awards which appear to be costless to the principal (they have no direct monetary cost), can be quite costly to the buyer depending on how the award is instrumented.

The study that is perhaps most relevant to our work is Eriksson and Villeval (2012). They study the effects of symbolic awards on the length of employment by conducting an experiment where an employer can issue a costly award to an employee. In their experimental design, the award is only visible to a recipient (private) and is interpreted as an expression of recognition or "respect". They show that a costly symbolic award works as a coordinating device to initiate a relational contract and is used strategically by the employer to prolong a profitable relationship. They analyze different settings varying in labor market condition (excess supply, excess demand, balanced), and find that the impact of an award changes depending on the market condition. For instance, when there is excess supply of labor, employers strategically use awards to prolong profitable relationships. On the other hand, when there is excess demand of labor, suppliers have a stronger bargaining power, thus awards do not play a significant role. They show that the incentive role of a symbolic award is the most significant in a balanced market.

Our paper is different from theirs in several ways. First, unlike their setting in which awards are symbolic to agents but costly to the principal, we consider truly symbolic awards as most supplier awards incur no or very little direct cost to the buyer (they usually take the form of a plaque of a negligible monetary cost[3]). More importantly, we reflect the industry practice that many of these awards are announced in public (through press releases and/or events) by explicitly comparing private and public award settings. This allows us to disentangle the incentive and competition effects. Making awards private (i.e., they are only visible to the recipient) allows us to test a purely motivational effect of the award. Public awards (which are also visible to other buyers) allow us to study how the award impacts the competition between buyers to get a "good" supplier. Finally, to examine how the nature of a relationship between a buyer and a supplier changes with an award, we consider a two-period game and examine how price and efforts change over time as we vary the award setting from private to public.

[3] See for example: http://www.ciena.com/connect/blog/Verizon-recognizes-Ciena-with-Supplier-of-the-Year-award.html and http://about.usps.com/suppliers/performance-awards.htm

3. Theoretical Model

We consider a two-period model with two buyers and two suppliers – we denote them supplier (he) i, $i=1$ or 2, and buyer (it) j, $j=1$ or 2. A two-period model is useful for the purpose of answering our research questions. The second period is important since it allows us to examine the effects a first-period award has on a future interaction (competition effect). In addition, a two-period model enables us to examine the intrinsic value of the award in a final period, when concerns about reputation and future interactions are not present (incentive effect). In the experiment, subjects play several rounds of two-period games in a session. This provides several observations of final-period play, while it still allows for the competition effect to arise.

In each transaction period t ($t=1,2$), each buyer makes an offer to a supplier. The offer consists of two parts, a price that it will pay to the supplier, $p_t \geq 0$ and the minimum effort level that it wishes the supplier will exert, $\hat{q}_t \geq 0$. If the supplier accepts the buyer's offer, he must decide how much effort to exert towards quality, denoted by $q_t \geq 0$. The effort is costly and the cost of effort, $C(q)$, is strictly convex and increasing in effort level, q. Once a buyer sees the supplier's efforts, the buyer decides whether to give out a symbolic award to the supplier. We note that, while effort level is observable *ex post*, it is neither contractible nor enforceable. This means that an offer does not enforce the supplier to deliver the requested quality, $\hat{q}_t$. Once the buyer observes the effort, it can choose to give an award to the supplier at its discretion.

In the first transaction period, each buyer is initially matched with one supplier and can make an offer only to the matched supplier. In the second transaction, both buyers are free to trade with any of the two suppliers. We assume that the buyer chooses one of the three actions: (1) making a new offer to the other supplier, (2) making a new offer to the existing supplier, (3) keeping the existing offer to the existing supplier (we call this a continuing offer) with an option to match any competing offer from the other buyer. Option (2) allows an incumbent buyer to change the terms of a contract with the supplier (for example, lowering the price). Option (3) captures an incumbent buyer's advantage over his competitors (the option to match other buyers' offers) when everything else remains equal. In addition, if a buyer fails to secure a deal with a supplier (e.g., his offer is either out-bid or rejected), he is free to make a new offer to a different supplier.

We assume that there are two types of suppliers in the marketplace, differing in how they value a symbolic award[4]. A "low-(motivational) type" supplier has no intrinsic value for a symbolic award,

[4] For expository simplicity, we focus on motivation to receive an award as the only non-selfish utility component. This emphasizes the role of the award in changing behavior. This simple model predicts a price of zero absent the competition effect. We can easily extend the model to generate positive prices by including fairness concerns. For example, if we assume that both types will only accept offers with price $p \geq \underline{p}$, and after accepting such an offer will give effort at least $q \geq \underline{q}$, there is an interval of ($\underline{p}$, $\underline{q}$) values such that there exists a separating equilibrium of the form we consider in the main text. The effect of the award is essentially the same in this extended model. In our experiment we observe that most prices and qualities are non-zero.

therefore, he chooses an action that maximizes his monetary profit over two periods (in each period, his profit is the price minus the cost of effort). On the other hand, a "high-(motivational) type" supplier draws intrinsic value from winning a symbolic award. Thus, the utility of a high-type supplier accounts for both monetary payoffs and transaction utility from winning an award. To formalize this, let ϕ be the transaction utility a high-type supplier draws from an award. Then, the high-type supplier's utility is given by

$$U^h(A_t, q_t) = \sum_{t=1}^{2}[p_t + \phi A_t - C(q_t)] \tag{1}$$

where A_t is an indicator function that takes value 1 if the supplier gets the award in period t. The low-type supplier's utility, $U^l(\cdot)$ is just the monetary profit over two periods. We assume that a supplier is a high-type with probability π, and a supplier's type is his own private information. We also assume that the types of two suppliers are independent.

On the other hand, the payoff that the buyer receives from a supplier's effort, q_t, is αq_t, where α is an *efficiency coefficient*. Since the award is costless for the buyer, the buyer's utility is given as follows, reflecting how valuable the supplier's effort is to the buyer

$$U^B(p_t, \hat{q}_t | q_t) = \sum_{t=1}^{2}[\alpha q_t - p_t]. \tag{2}$$

To draw hypothesis, we analyze the equilibrium in four different scenarios. In the no-award case (denoted by NA), no award is allowed. In the private award case (PrA), a buyer can give a private award, thus the award is not known to the other buyer and supplier. In the public award case (PuA), a buyer can give an award, which will be announced in public. Finally, in the public quality case (PuQ), the award is private but the supplier's effort level is public information. A comparison between the no-award and private award cases allows us to examine the effect of the award on suppliers' effort in absence of competition effects. In particular, a comparison of effort in the second (and final) period allows us to isolate the incentive effect as concerns about reputation and future interactions are not present in the last period. The public award case allows us to explore the competition effect, as the award will be announced to the other buyer and supplier. Finally, the public quality case serves as a benchmark with full transparency of suppliers' efforts. A comparison between this case and the public award case allows us to examine how much of the efficiency of fully transparent transactions can be achieved with a symbolic award.

We first analyze the no-award case and show that, in equilibrium, no supplier exerts efforts. All proofs are relegated to the Appendix.

Lemma 1. *If awards are not available (scenario NA), suppliers exert zero effort in both periods. Buyers' offers have zero price and any requested quality can be supported in equilibrium.*

To see why this is the case, note that effort is not enforceable, thus it is a dominant strategy for suppliers to exert no effort in the last period. Anticipating this, no buyer will pay positive prices in equilibrium. Since there is no award, both types of suppliers act exactly the same and the equilibrium has zero price and zero effort in both periods. Establishing this as a benchmark, the next result shows that a high-type supplier will act differently from a low-type supplier if the buyers have the option to give out a symbolic award.

We now consider the setting where buyers can give awards. We first show that, in the private award setting, there exists a separating equilibrium in which a low-type supplier exerts no efforts and does not get the award, and a high-type supplier gets the award in both periods by meeting the requested quality ($q_t = \hat{q}_t$)[5]. We focus on equilibria where the buyer gives a supplier an award if and only if the supplier chooses a quality that is greater or equal to the requested quality (from now onward denoted "truth-telling" equilibria). While there exist other equilibria, for example, an equilibrium where the buyer's decision to give an award is independent of the supplier's effort[6], we focus on truth-telling equilibria since this criterion seems to be consistent with firms' practices in real settings. Buyers would undermine the reputation and credibility of the award if they did not follow this criterion (for example, if the awards were given at random or if firms systematically gave an award to their worst supplier)[7].

Lemma 2. *In the private award scenario (PrA), there exists a separating equilibrium in which a low-type supplier exerts no effort and does not receive an award while a high-type supplier exerts strictly positive effort and receives an award in both periods. As a result, in the first period, all buyers offer* $p_1 = 0$ *and* $\hat{q}_1 = C^{-1}(\phi)$*, low-type suppliers choose* $q_1 = 0$ *and do not get the award, and high-type suppliers choose* $q_1 = \hat{q}_1$ *and get the award. In the second transaction, all buyers make continuing offers to their own suppliers with* $p_2 = 0$ *and* $\hat{q}_2 = C^{-1}(\phi)$*, low-type suppliers choose* $q_2 = 0$ *and do not get the award, and high-type suppliers choose* $q_2 = \hat{q}_2$ *and receive the award.*

To see why a buyer who is matched with a low-type supplier is not better-off by deviating from equilibrium and making an offer to the other supplier, remember that making a continuing offer gives a buyer the option to match the other buyer's offer. Therefore, if the other supplier is a high-type, a new offer to this supplier will be matched by the other buyer (who has made a

[5] The proof in the Appendix shows that the equilibrium exists and that it survives equilibrium refinement by the intuitive criterion (Cho and Kreps 1987).

[6] For example, the symmetric equilibrium where both buyers give the supplier an award with the same probability $\gamma \in [0, 1]$ independent of effort, and resulting in $p_1 = p_2 = 0$ and $q_1 = q_2 = 0$, can be sustained both in private and public award settings.

[7] The first hypothesis of our experiment is aimed at testing the buyers' criterion for giving out awards. Figure 1 shows that choosing a quality greater or equal to the requested quality increases a supplier's probability of receiving an award from roughly 30% to almost 100%.

continuing offer in the first period)[8]. Also note that, in this equilibrium, the buyers have a first mover's advantage and set the quality level so that they extract the entire surplus of a high-type supplier, resulting in a high-type supplier fully working for the intrinsic value of an award.

The truth-telling equilibrium with private awards in Lemma 2 has zero price in both periods. In contrast, the nature of an equilibrium changes when the award is announced in public. In Lemma 3 we show that strictly positive price is possible in equilibrium. In preparation, let us define $\bar{p} = \alpha\hat{q}_2$ as the maximum price that allows a buyer to earn positive profits in the second period in a truth-telling equilibrium.

LEMMA 3. *In the public award scenario (PuA), there is an equilibrium with strictly positive price in period 2. In this equilibrium, buyers offer $p_1 = 0$ and $\hat{q}_1 = C^{-1}(\phi + (1-\pi)\bar{p})$ in the first period. All high-type suppliers choose $q_1 = \hat{q}_1$ and get the award while all low-type suppliers choose $q_1 = 0$ and do not get the award. In the second period:*

(i) If a buyer believes that both suppliers are of high type, this buyer makes a new offer to its own supplier with $p_2 = 0$ and $\hat{q}_2 = C^{-1}(\phi)$. The high-type supplier accepts the offer, chooses $q_2 = \hat{q}_2$ and gets the award in the second period.

(ii) If a buyer believes that both suppliers are of low type, it makes a continuing offer with $p_2 = 0$ and $\hat{q}_2 = C^{-1}(\phi + (1-\pi)\bar{p})$. The low-type supplier chooses $q_2 = 0$ and does not get the award.

(iii) If a buyer believes that its own supplier is of high type and the other supplier is of low type, it makes a new offer to its own supplier with price $p_2 = \bar{p}$ and a request $\hat{q}_2 = min\{C^{-1}(\phi), C'^{-1}(\alpha)\}$. The high-type supplier accepts the offer, chooses $q_2 = \hat{q}_2$ and gets the award in the second period.

(iv) If a buyer believes that its own supplier is of low type and the other supplier is of high type, it offers the high-type supplier $p_2 = \bar{p}$ with a request $\hat{q}_2 = min\{C^{-1}(\phi), C'^{-1}(\alpha)\}$. The supplier receives two identical offers and rejects this buyer's offer. The buyer then offers $p_2 = 0$ to its own low-type supplier, who chooses $q_2 = 0$ and does not get the award.

In this equilibrium, p_2 is strictly positive when one supplier is a high-type and the other supplier is a low-type. The frequency of this interesting case depends on π, and it is maximized when $\pi = 0.5$. The equilibrium is fully characterized in the proof presented in the Appendix. Intuitively, the difference between the private and public awards cases is that in the private award setting, the buyer's belief about the other supplier remains unchanged in the second period. On the other hand, when the award is public, a buyer can update its belief about the other supplier's type after observing whether he receives an award in the first period. In our truth-telling equilibrium, a buyer

[8] We assume a tie-breaking rule where, if both offers are equal, a supplier chooses to close a deal with the same buyer as in period 1.

who believes that its own supplier is a high type and the other is not will make an offer with a positive price to its own supplier to keep him in the second period. This is because, if the buyer does not do that, the other buyer can steal the high-type supplier with a positive price.

Finally, the scenario with public quality and private award (PuQ) has a truth-telling equilibrium which is the same as that under the public award scenario (PuA). The only difference is that rather than updating their beliefs about the suppliers' types based on whether they received an award in the first period, buyers update their beliefs based on actual observations of efforts. This result is stated in Lemma 4, with the formal proof presented in the Appendix.

LEMMA 4. *In the public quality scenario (PuQ) the same equilibrium as in the public award setting (PuA) can arise, where buyers update their beliefs based on suppliers' quality in period* 1.

Based on previous results, the next proposition establishes how a buyer's expected profit varies across scenarios. The proofs of Lemmas 1 to 3 presented in the Appendix, show that both the private and public award scenarios (PrA and PuA) result in higher expected buyer's profits than the no-award case (NA). To see why, note that: (1) both the no-award and the private award cases result in $p = 0$ in equilibrium, but while the no-award case has zero quality in both periods, the private award scenario can still induce positive quality (Lemma 2), and (2) while buyers earn zero profits in the no-award case, we show that in the public award scenario the buyers' expected profit is strictly positive (Lemma 3). When comparing the private and public award settings, the equilibria in Lemmas 2 and 3 prescribe that both quality in period 1 and price in period 2 will be higher in the public award setting. While higher quality in period 1 leads to higher buyer's profit, higher price in period 2 leads to lower buyer's profit. The next proposition states that when the symbolic award is sufficiently valuable to the suppliers, buyers' expected profit is higher when awards are private than when awards are public. Specifically, a buyer's expected profit when awards are private is $\pi 2\alpha C^{-1}(\phi)$ and when awards are public it is $\pi[\alpha C^{-1}(\phi + (1-\pi)\alpha C^{-1}(\phi)) + \pi\alpha C^{-1}(\phi)]$. The former expression is greater than the latter when $(2-\pi)C^{-1}(\phi) - C^{-1}(\phi + (1-\pi)\alpha C^{-1}(\phi)) > 0$, which holds for sufficiently large values of ϕ (that is, when the value of a symbolic award is high enough). Finally, from Lemma 4, buyers' expected profit in the public quality scenario is as in the public award scenario.

PROPOSITION 1. *(i) A buyer's average profit is higher in both private and public award scenarios (PrA and PuA) than in the no-award case (NA), (ii) if the symbolic award is sufficiently valuable for the supplier (ϕ is sufficiently high), the buyer's expected profit is higher with private awards (PrA) than with public awards (PuA), (iii) in the public quality scenario (PuQ), a buyer's expected profit is as in the public award scenario (PuA).*

The proof of proposition 1 is presented in the Appendix. Based on these theoretical results, we derive hypotheses for the incentive and competition effects to be tested with a laboratory experiment.

4. Experimental Design

The experimental setup is identical to our theoretical model. In each session of the experiment, subjects play six rounds of a computerized game within which two buyers and two suppliers transact in two periods. We conducted the experiment using the z-Tree software package (Fischbacher 2007). In each round, subjects are matched in groups of four. The groups remain together for the entire round (two periods) and are dissolved when the round is over. New groups are formed for the following round. At the beginning of each round, the members of a group are assigned a role (two subjects play as buyers and two subjects play as suppliers) and a label (Buyer 1, Buyer 2, Supplier 1, Supplier 2) which they keep for the entire round.

For the first period, each buyer is randomly paired up with a supplier in the same group and can only make an offer to that supplier. The first transaction consists of the following four stages: 1) The buyer makes an offer to the supplier. The offer consists of a price it is willing to pay for the good, which can range between 0 and 100 and a requested quality, which can range between 0 and 10. 2) The supplier decides whether he accepts or rejects the offer. If rejected, both players get a zero payoff. 3) If the supplier accepts the offer, he chooses a quality level for the good he provides. The buyer's requested quality level from the contract is non-binding so the supplier can choose quality freely. Quality can range between 0 and 10 and is costly for the supplier. We assume that the cost of quality takes a canonical form of $c(q) = \frac{1}{2}q^2$. In order to simplify the subjects' task, they are presented with table 1 on their screens. 4) If awards are available, the buyer sees the quality chosen by the supplier and decides if it gives him a symbolic award. Whether the award is only shown to the supplier or if it is shown to everyone varies by treatment.

Table 1 Cost of Quality Function

q	0	1	2	3	4	5	6	7	8	9	10
$c(q)$	0	0.5	2	4.5	8	12.5	18	24.5	32	40.5	50

In the second transaction, buyers can make an offer to any of the two suppliers in their group. The stages are as follows: The buyer chooses between the following options: a) Making a continuing offer to the same supplier, in which case the offer (price and requested quality) remains the same as in the first transaction. This option gives the buyer a right to match if the other buyer makes an offer to its supplier. b) Making a new offer to the same supplier with different price and requested quality level. In this case, the buyer does not have the opportunity to match the other buyer's offer to its supplier. c) Making an offer, of any price and any requested quality, to the other supplier. If a buyer made a continuing offer to its own supplier and the other buyer also made an offer to this same supplier, the former can choose between matching the other buyer's offer and keeping its original continuing offer. Then, the supplier observes the offer (or offers) he received and accepts at most one offer or opts out of the second period of the game. If the supplier accepts an offer, then he chooses a quality level. In the case where both buyers made an offer to the same supplier, the buyer who was not picked can make an offer to the other supplier. It makes a new offer (price and requested quality) and the supplier decides whether he accepts the offer and if so a quality level. If awards are available, each buyer decides whether they give the supplier a symbolic award. When the second trading period is over, new groups are formed for the following round and subjects are randomly assigned a new role. Note that there are six rounds in a session, therefore most subjects get to play both as buyers and suppliers.

The symbolic award is an image of a ribbon that appears for a few seconds on the screen of the supplier who is granted the award. Figure 4 in Appendix shows a screenshot of the award screen. Giving an award has no cost for the buyer and does not grant extra profit for a supplier. That is, the award has no direct effect on the participants' monetary payoffs. To ensure that subjects were fully aware of this, after the instructions were read out loud, subjects were presented with examples of different possible scenarios of play and were asked to compute the profits for the buyer and the supplier in the example. Subjects could not exit the screen until they entered the correct answer.

We conducted the following four treatments. The first treatment is a No-Award case (NA) where awards are not available and the quality choices are only shown to the respective buyer. The second treatment is a Private Award/Private Information case (PrA) in which only the corresponding buyer and supplier can observe the quality chosen and the award, if there is one. The third treatment is a Public Award/Private Information case (PuA) in which the award can be seen by everyone but the quality level can only be observed by the corresponding buyer. The last treatment is a Private Award/ Public Information case (PuQ) in which the award is private, but suppliers' quality choices are shown to everyone. The treatments are summarized in Table 2.

The payoffs are expressed in tokens and converted into dollars (at a rate of \$0.05/token) for payment at the end of the experiment. One of the ten rounds played is randomly chosen for payment. In each round, the subjects' payoff is the sum of their payoff in both transactions. The supplier begins each round with 60 points, and the retailer with 100 points, to avoid negative payoffs. For each transaction, the payoffs are calculated as follows: the buyer's payoff is 100 plus ten times the quality chosen by the supplier minus the price he pays, $\Pi^B = 100 + 10q - p$, or $\Pi^B = 0$

Table 2 Experimental Design - Treatments Summary

Treatment	Award	Information about Quality
No Award (NA)	N/A	Private
Private Award (PrA)	Private	Private
Public Award (PuA)	Public	Private
Public Quality (PuQ)	Private	Public

The stage in which suppliers may receive a symbolic award, is only present in the PrA, PuA, and PuQ treatments.

if his offer is rejected. The supplier's payoff is 60 plus the price she gets for the good minus her cost of quality, $\Pi^S = 60 + p - c(q)$, or $\Pi^S = 0$ if she rejects all offers and opts out of the trading period. Subjects receive a \$7 participation fee, plus their earnings from the experiment (which can range between \$0 and \$20).

5. Hypotheses

We derive hypotheses for the incentive and competition effects of a symbolic award based on our previous theoretical results. The results in Lemmas 2 and 3 are based on "truth-telling" equilibria where a buyer gives out an award if and only if the supplier chooses a quality that is greater or equal to the requested quality. In order to test this assumption, the first hypothesis is that there exists a threshold level above which a buyer gives out a symbolic award. In the experiment, we expect buyers' decision to give an award to be positively correlated with the provision of a quality level that is equal or greater than the requested level.

HYPOTHESIS 1. [Award Criterion] *Buyers offer awards predominantly to suppliers who meet or exceed the requested quality.*

Based on Lemma 2, the second hypothesis predicts that suppliers will provide a higher quality when awards are available. When awards are available, a separating equilibrium arises in which buyers request some positive level of quality to give out the award. Thus, suppliers who care about the award, are willing to provide additional positive quality in order to receive an award.

HYPOTHESIS 2. [Quality Effects of Awards] *The average quality when awards are available is higher than in the no-awards case.*

The third hypothesis predicts that, due to the competition effect, buyers pay higher prices to good suppliers when awards are public. This prediction is based on Lemma 3, which states that in the public-award case, the expected price is higher than the price in the private-award case. In the equilibrium described in Lemma 3, a high type supplier receives an award in the first transaction. Because the award is observable to all players, in the second transaction both buyers compete to win the deal with the high-type supplier. As a result, the winning buyer pays a higher price than if the awards are private or if awards are not available.

HYPOTHESIS 3. [Competition Effects] *The expected price paid in the second period to a supplier who received an award in the first period is higher when the award is public than when the award is private or unavailable.*

Lastly, the fourth hypothesis makes predictions about buyers' profits based on Proposition 1(i). According to Lemmas 2 and 3, buyers' profits are higher when awards are available than when they are not. This is because, when a supplier cares about the award, additional motivation driven by an award increases the supplier's effort, which results in higher profit for the buyer. However, whether the award is given in an informal or public setting matters. In the private award case, the only effect that can arise is the incentive effect. Thus, an increase in buyers' profit relative to the no-award case would capture the buyer's increased surplus from the incentive effect of the award. This is not the same for the public setting. When the award is announced in a marketplace with multiple buyers, the award creates a competition and increases the cost of maintaining a relationship with a good supplier. This reduces the gain derived from the motivational effect. Proposition 1(ii) predicts that, when a symbolic award is highly valued by a supplier, buyers' profits are higher with private awards than with public awards. Finally, the public quality case is expected to be equivalent to the public award case, based on Proposition 1(iii).

HYPOTHESIS 4. [Profits] *Buyers' profits are higher when awards are available than when they are not. In addition, buyers' profits are higher when awards are private than when they are public. The public award and public quality cases have equal buyers' profits.*

6. Experimental Results

The experiment was conducted at the University of Michigan in the months of March and April of 2013. The subjects were undergraduate students from a variety of Departments at the University. We conducted sixteen sessions of the experiment, with eight or twelve subjects per session. 44 subjects participated in the no award treatment, 40 subjects in the private award treatment, 36 subjects in the public award treatment, and 36 subjects in the public quality treatment.

Sessions lasted on average an hour an a half. In each session, subjects played six rounds of the game and in the end, one of the six rounds was randomly selected for payment. In addition, subjects earned a 7 dollar participation fee. In total, subjects earned on average 15.8 dollars.

6.1. General Results

Table 3 presents a summary of our results based on all offers (columns one to three) and based on accepted offers (columns four to eight). We observe that, while price offers are slightly lower in the second period relative to the first period, the average price when we consider only the accepted offers remains stable across periods. Average accepted price ranges between 30 and 40 and is directionally higher in the public award and public quality treatments, providing initial support for the competition effect (although the difference is only statistically significant in the public quality case, Wilcoxon rank-sum test for periods 1 and 2: PuQ vs. NA: $p = 0.003$ and $p =< 0.001$; PuQ vs. PrA: $p = 0.002$ and $p < 0.001$). Average requested quality follows a pattern that is consistent with the previous result. When we observe all offers, requested quality slightly decreases in the second period relative to the first period, however it remains stable across periods when we consider accepted offers only. This suggests, that buyers lower their price offers in the second period, but they also lower the requested quality. Average quality in accepted offers is the lowest in the no-award treatment and it is higher in the treatments where awards are available, providing support for the incentive effect. While the difference relative to the NA treatment is only statistically significant in the PuQ treatment ($p < 0.001$ and $p = 0.003$ in periods 1 and 2 respectively), the regressions on Table 5 show that the effects are significant in the PrA and PuA treatments once we control for price and subject-level random effects. Similarly, the probability of suppliers choosing a quality that is greater or equal than the requested quality is higher in the three treatments where awards are available than in the no-award treatment in both periods (PrA vs. NA: $p = 0.003$ and $p = 0.084$; PuA vs. NA: $p < 0.001$ and $p = 0.022$; PuQ vs. NA: $p = 0.003$ and $p = 0.353$[9]). Finally, Table 3 presents the frequency with which buyers give out awards in each treatment. We find that there are no significant differences across treatments and that buyers give awards only slightly more often in the first period than in the second period.

Table 3 General Results

	Treatment	All offers Price	All offers Requested Quality	All offers Accept (%)	Accepted offers Price	Accepted offers Requested Quality	Accepted offers Quality	Accepted offers Quality ≥ Req. Qty (%)	Accepted offers Award (%)
Period 1	NA	29.1	5.27	80.3	31.4	5.37	2.198	15.1	
	PrA	25.4	4.72	75	30.3	4.89	2.767	33.3	42.2
	PuA	31.8	4.67	85.19	32.1	4.53	2.848	40.2	46.7
	PuQ	38	5.38	79.63	40.4	5.65	3.872	33.7	48.8
Period 2	NA	25.3	4.14	81.1	31.3	5.10	2.084	16.8	
	PrA	23	3.84	80.8	28.5	4.75	2.486	26.8	36.1
	PuA	27.6	3.71	77.8	35.5	4.77	2.262	31.0	40.5
	PuQ	32.1	4.32	75	42.8	5.77	3.185	22.2	37.0

[9] The lack of significance in this last case is due to a right shift in the distribution of the quality requested by the buyers in the second period of the PuQ treatment. While 70% of the accepted offers had a requested quality greater or equal to 5 in the PuQ treatment, this was only true in 59% of the accepted offers in the NA treatment, and in 51% and 50% in the PrA and PuA treatments respectively.

6.2. Incentive Effect

The following subsections test the two hypotheses related to the incentive effect. First, we observe whether buyers follow a criterion to give out awards. In particular, we test whether buyers give awards predominantly to those suppliers who meet or exceed the requested quality (Hypothesis 1). Second, we test whether suppliers choose higher quality when awards are available (Hypothesis 2).

6.2.1. Award Criterion We observe that the frequency with which buyers give out symbolic awards is correlated with higher average quality, suggesting that the buyers follow a criterion to give out awards. As shown in Table 12 in the Appendix, conditional on acceptance, there were 38 observations of play of the first period where suppliers received awards and 52 observations where suppliers did not get awards in the first period. The average quality in the observations where suppliers received awards was 3.868 while it was 1.962 in the observations where suppliers did not receive awards. In the second period, average quality in the 35 observations where suppliers received awards was 3.629 and in the 62 observations where suppliers did not receive awards it was 1.839. These results are from the PrA treatment. The PuA treatment shows similar results. In the first period, the average quality when suppliers received awards (43 observations) was 3.464 while average quality was 2.306 when suppliers did not receive awards (34 observations). In the second period, there were 34 observations where suppliers received awards and average quality was 3.647, and 50 observations where suppliers did not receive awards and average quality was 1.32. In addition, as predicted by Hypothesis 1, buyers give awards to those suppliers whose quality choice meets or exceeds their request. Figure 1 shows the probability of a buyer giving out an award as a function of the difference between the quality chosen by the supplier and the buyer's requested quality. In both periods we observe a significant increase in the probability of giving out an award when quality meets the requested quality: the probability of receiving an award increases from around 30% to close to 100%. These results are presented formally in Table 4. We present a regression of the probability of receiving an award on the choice of a quality level that is greater or equal to the requested quality separately for each treatment. The coefficients are positive and significant in all cases where awards are available, both in transactions 1 and 2. This indicates that meeting or exceeding the buyer's quality expectations leads to higher probability of receiving an award in all treatments.

6.2.2. Quality Effects of Awards Our second hypothesis regarding the incentive effect predicts that average quality is higher when awards are available than in the no-awards case. Figure 2 provides initial support for this hypothesis. The kernel densities of quality for the treatments where awards are available present a shift to right relative to the no-award treatment in both periods. A comparison that is of particular interest is that between the no-award and the private award

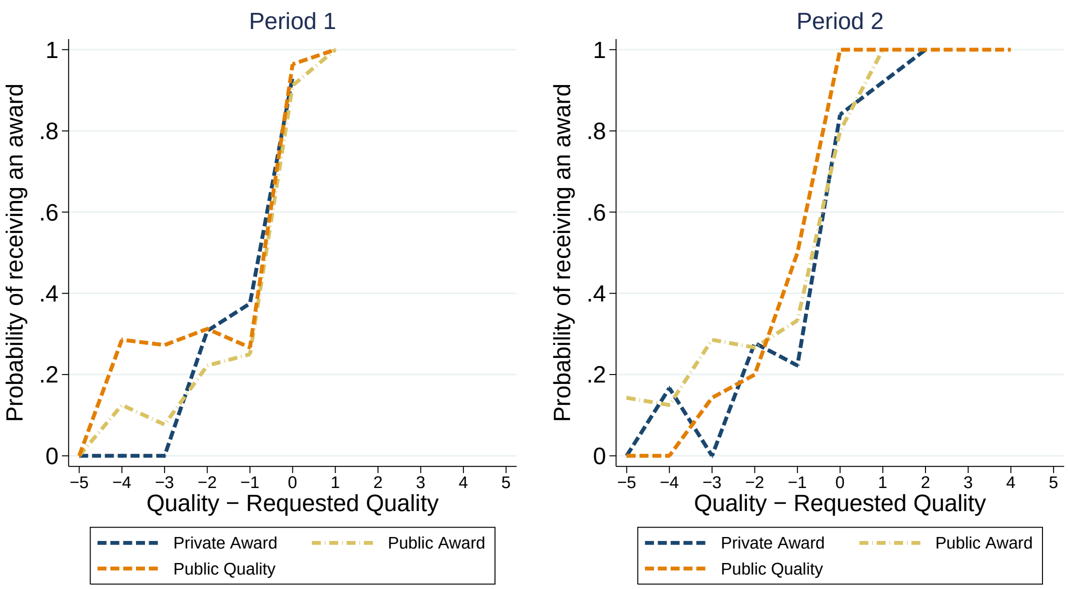

Figure 1 **Probability of receiving award as a function of the difference between quality and requested quality**

Table 4 **Interaction effects of quality and treatment on the award decision**

Coefficients	Award Period 1	Award Period 2	Award Period 1	Award Period 2	Award Period 1	Award Period 2	Award Period 1	Award Period 2
Quality $\geq$ Req. Quality x PrA	0.748***	0.717***					0.772***	0.719***
	(0.074)	(0.078)					(0.069)	(0.078)
Quality $\geq$ Req. Quality x PuA			0.756***	0.624***			0.761***	0.632***
			(0.072)	(0.077)			(0.070)	(0.078)
Quality $\geq$ Req. Quality x PuQ					0.752***	0.845***	0.719***	0.819***
					(0.070)	(0.060)	(0.073)	(0.059)
Public Award							-0.005	0.031
							(0.068)	(0.082)
Public Quality							0.073	0.019
							(0.078)	(0.087)
Price	-0.003	0.001	0.0001	0.005**	0.004**	-0.002	0.001	0.002
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Constant	0.262***	0.142	0.158*	0.044	0.066	0.286***	0.141**	0.126**
	(0.091)	(0.087)	(0.090)	(0.089)	(0.070)	(0.091)	(0.064)	(0.061)
Observations	90	97	92	84	86	81	268	262
Nr. of Subjects	38	38	36	35	35	33	109	106

OLS regression with subject random effects. Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Note: Probit estimates show similar results but present high standard errors in columns 6 and 8 due to lack of observations for the case “Quality Higher than Requested Quality and No Award” in period 2 of the public quality treatment. Marginal effects from Probit regressions are 0.774, 0.875, 0.756, 0.726, 0.840, 0.900 for columns 1 to 6 respectively.

treatments. Since the award is private, any increase in quality relative to the no award case can be attributed exclusively to the supplier’s value for the symbolic award. This is especially true in the second (and final) period, where there are no strategic reasons to exert higher effort. We observe that in the second period, the density in the private award treatment presents a rightward shift relative to the no-award treatment, with lower densities for low values of quality and higher densities for higher values of quality.

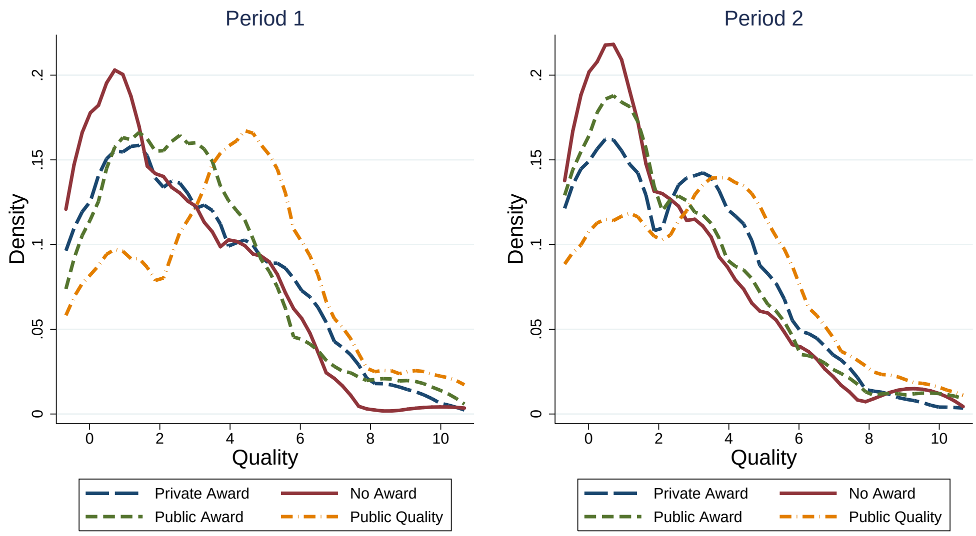

Figure 2 Quality in periods 1 and 2 by treatment - Kernel Densities

Table 5 confirms the predictions in Hypothesis 2 with formal statistical results. The first two columns correspond to the comparison between the no-award and private award treatments. We regress quality on a dummy for the private award treatment controlling for price and requested quality[10]. We find that the private award treatment leads to higher quality in both transactions (regression coefficients $\beta = 0.721$ and 0.728 in transactions 1 and 2 respectively). As before, since the only difference between these two treatments is the opportunity to give a private award to the suppliers, we attribute this increase in quality exclusively to the supplier's value for the symbolic award. Columns three and four in Table 5 compare the no-award treatment with the public award treatment. Interestingly, the public award treatment leads to higher quality than the no-award treatment in the first transaction but not in the second transaction. In transaction 1, the coefficient is 0.783 and it is statistically significant, while in transaction 2 it is 0.073 and not significant. We find similar results in columns five and six when we compare the no-award and the public quality treatments (in transaction 1 the coefficient is 0.965 and significant, while in transaction 2 it is 0.283 and not significant). These results suggest that suppliers do not value public awards enough to exert

[10] We conducted the same regression using the difference between quality and requested quality as dependent variable (instead of controlling for requested quality in the original regression) as a robustness check. We find that the results provide the same insights as those on Table 5.

a high effort in the second period. One explanation for this is that some suppliers perceive public awards more as a tool to get better contracts in the following transaction than as a recognition for their effort. While a recognition for high effort would keep its intrinsic value in a second (and final) period, a tool to get a higher price would not as the game ends in the second period. This "crowding out" of the incentive effect when the awards are public is consistent with previous studies which found that public rewards (both monetary and non-monetary) can have detrimental effects on performance when completing a task (Gneezy and Rustichini 2000, Harackiewicz 1979, Charness et al. 2013) or in contributions for charity (Lacetera and Macis 2010a, Ariely et al. 2009). Two explanations have been provided to justify this phenomena. First, individuals may refrain from exerting effort when a public non-tangible reward is at stake out of concerns for being perceived as gullible (this argument would explain why the "crowding out" effect is also present in the PuQ treatment where a supplier's quality is public information). Second, extrinsic incentives make it harder for "good" suppliers to show their true intentions. Suppliers, who are intrinsically motivated to provide high quality cannot clearly reveal their selfless intentions if in return they receive a public award for it.

Table 5 Effects of Treatments on Quality

	PrA vs. NA		PuA vs. NA		PuQ vs. NA		(PrA, PuA, PuQ) vs. NA	
	Quality	Quality	Quality	Quality	Quality	Quality	Quality	Quality
Coefficients	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2
Private Award	0.721*	0.728**					0.775*	0.693**
	(0.417)	(0.341)					(0.412)	(0.339)
Public Award			0.783**	0.073			0.763**	0.060
			(0.376)	(0.409)			(0.372)	(0.405)
Public Quality					0.965**	0.283	1.059***	0.425
					(0.409)	(0.428)	(0.388)	(0.419)
Requested Quality	0.030	0.075	0.127	0.096	0.093	0.073	0.113	0.109*
	(0.095)	(0.065)	(0.088)	(0.085)	(0.084)	(0.071)	(0.075)	(0.060)
Price	0.048***	0.067***	0.050***	0.049***	0.069***	0.071***	0.058***	0.055***
	(0.014)	(0.011)	(0.012)	(0.014)	(0.012)	(0.011)	(0.009)	(0.010)
Constant	0.551	-0.450	-0.033	0.008	-0.472	-0.553*	-0.224	-0.219
	(0.397)	(0.314)	(0.338)	(0.357)	(0.298)	(0.307)	(0.339)	(0.313)
Observations	196	204	198	191	192	188	374	369
Nr. of Subjects	81	82	78	79	79	77	150	150

OLS regression with subject random effects. Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

In order to quantify the suppliers' value for the award in the PrA treatment, we estimate how the likelihood of choosing a quality level depends on the probability of receiving an award given that quality. The estimates are derived by maximum likelihood estimation from a conditional logit model. Table 11 in the Appendix presents estimates of the value of the parameter ϕ in Equation (1) in monetary terms. In period 1, the award is valued at 1.39 dollars (equivalent to 36% of suppliers' average first-period payoff) and in period 2 at 1.92 dollars (equivalent to 49% of a suppliers' average second-period payoff). A detailed analysis is presented in the Appendix.

6.3. Competition Effect

The third hypothesis predicts that when either the award or quality is public in the second transaction, buyers pay higher prices to those suppliers who received an award in the first transaction than to those who did not. Table 6 shows a regression of price in transaction 2 on a dummy variable indicating whether the supplier received an award in the first transaction, separately for each treatment. The first column presents all offers and the second column presents accepted offers only. We observe that when awards are public, receiving an award in the first transaction has a stronger impact on the price offers received in the second transaction that when the awards are private (coefficients: 8.261 and 17.30 for the private and public award treatments respectively, both statistically significant). When considering only the accepted offers, we find that the prices in period 2 are also higher in the public award treatment than in the private award treatment (coefficients: 5.44 and not significant in the private awards case, and 10.32 and significant in the public awards case). This result shows the existence of a competition effect and supports the third hypothesis.

We present further analysis on the competition effect in Figure 3. The left chart shows the average price paid in transaction 2 to those suppliers who received an award in period 1 (the column in gray) and to those suppliers who did not receive an award in period 1 (the column in black). We observe that average prices paid to suppliers who received an award in period 1 are higher in the treatments where either the award or quality is public. In addition, we note that, the price premium in period 2 relative to the average price in the first period (shown in Table 3) for suppliers who received an award in period 1 is also higher in the public award treatment than in the private award treatment. In the private award treatment average price in accepted offers in period 1 was 30.3 and the average price in period 2 for suppliers who received an award in period 1 was 31.42. In the public award treatment it was 32.1 and 40.33 respectively. These results support the third hypothesis which proposes that public awards increase competition for the good suppliers and make buyers have to pay more for them. A possible explanation for why buyers pay a higher price in period 2 to suppliers who received an award in period 1 in the public award setting than in the private award setting, is that they have a higher expectation about the suppliers' provision of quality. Our experimental results show exactly the opposite. The chart on the right in Figure 3 shows average quality in period 2 for suppliers who received an award in period 1 and for suppliers who did not receive an award in period 1. We observe that, average quality in suppliers who received an award in the first period is lower in the public award treatment than in the private award treatment. While this result was not predicted by our hypotheses, it reinforces the notion of a competition effect: the public award treatment not only results in buyers paying a higher price for suppliers who received an award in the first period, but additionally, these suppliers provide lower average quality than in the private award setting.

Table 6 Interaction Effects of Award Treatments on Price

Coefficients	Price in period 2	Price in period 2 (accepted offers)
Award in period 1 x PrA	8.261**	5.44
	(4.04)	(4.36)
Award in period 1 x PuA	17.30***	10.32**
	(4.45)	(4.66)
Award in period 1 x PuQ	16.27***	7.883*
	(4.78)	(4.3)
PuA	-2.01	4.023
	(4.49)	(5.1)
PuQ	5.177	12.29**
	(5.15)	(5.02)
Constant	21.60***	25.98***
	(3.08)	(3.41)
Observations	268	221
Nr. of Subjects	106	100

OLS regression with subject random effects. Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

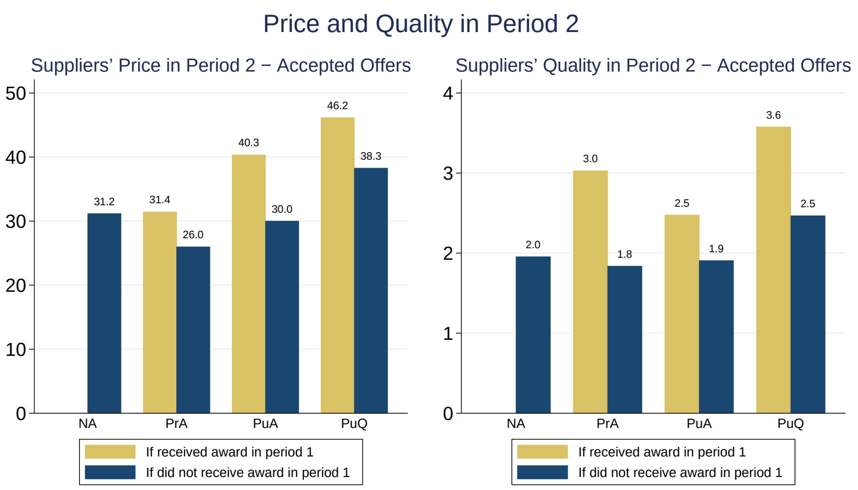

Figure 3 Competition Effect

6.4. Profits and Efficiency

We now test Hypothesis 4, which predicts that buyers' profits will be higher when awards are available (either private or public) than when awards are not available. Average profits are presented in Table 7 and regressions with the effects of the different treatments on profits are presented in Table 8. We find that buyers' profits are only higher with private awards. When awards are public, there is no significant difference with the no-awards case. The third column on Table 7 shows that total buyer's profit across both periods is 184 in the no-awards case while it is 195.1 in the private awards case (NA vs. PrA: $p = 0.003$) and 186.5 in the public awards case (NA vs. PuA: $p = 0.463$). The third column on Table 8 shows similar results: the effect of a PrA treatment dummy relative to the NA baseline is 11.597 points ($p = 0.003$), while the effect of a PuA treatment dummy is 3.321 points ($p = 0.470$). This suggests that the incentive effect alone has a positive impact on buyers' profits. However when the award becomes public, the competition effect wipes away this profit premium. In our experiment, the competition effect was strong enough that symbolic awards are no longer useful in increasing the buyer's profit.

Hypothesis 4 further predicts that buyers' profits are higher with private awards than with public awards. We find that buyers' profits are significantly higher under private awards than with public awards, providing support for this hypothesis (further evidence is presented on Table 13 in the Appendix). Notice that in both settings, the incentive effect increases effort levels in period 1 (relative to the no-award setting). The difference between the two cases lies in what happens in the second period. As Table 6 shows, the price in period 2 is higher in the public award setting since the public award triggers competition for a good supplier. This reduces the profit premium from higher efforts in the first period. In addition, the buyer's profit is further reduced by the crowding out effect (i.e., efforts in the second period are lower under the public award setting). Combining these two, the buyer's profit is significantly lower under the public award setting than under the private award setting. Our experimental results further show that the two adverse effects of a symbolic award – competition and crowding-out – reduce the profit premium to the extent that the buyer's profit with a public award is not even significantly higher than the profit under the no-award case.

Hypotheses 4 predicts that the public award and public quality treatments are equivalent. The experimental results show that buyers' profit is not different in the public quality setting than in the public award setting. In Table 8 we observe that the coefficients for the effects of the public award and public quality treatments on buyers' profits are 3.312 and 6.946 respectively and not significantly different (p-value = 0.435).

Tables 7 and 8 also present suppliers' monetary payoffs. We do not derive formal hypotheses for suppliers' profits since, unlike buyers' profits, these are an imperfect measure of total utility as they do not capture the utility generated by the awards (i.e. transaction utility is ignored). The experimental results show that, contrary to what happens with buyers' profits, suppliers' profits are lower when awards are private than when awards are public and when awards are not available (156 with private awards, and 164.8 and 162.8 with public and no awards respectively). This result indicates that the private awards treatment leads simultaneously to the highest buyers' profit and the lowest suppliers' profit. An interesting question then is how total supply chain profit changes by treatment.

Table 7 Buyers and Suppliers Profit

	Average Profit - Buyers			Average Profit - Suppliers		
Treatment	Period 1	Period 2	Periods $1+2$	Period 1	Period 2	Periods $1+2$
No Award	92.439	91.55	184	81.44	81.34	162.8
Private Award	98	97.05	195.1	77.7	78.32	156
Public Award	96.944	89.97	186.9	81.49	83.3	164.8
Public Quality	98.6	91.8	190.4	83.53	85.5	169

Table 8 Effects of Treatments on Profit

	Buyers Profit			Suppliers Profit		
Coefficients	Period 1	Period 2	Periods $1+2$	Period 1	Period 2	Periods $1+2$
Private Award	5.853**	5.652**	11.597***	-4.079	-3.126	-7.433*
	(2.721)	(2.372)	(3.942)	(2.617)	(2.219)	(4.056)
Public Award	4.816**	-1.519	3.312	-0.074	1.79	1.479
	(2.398)	(3.174)	(4.581)	(2.648)	(2.658)	(4.136)
Public Quality	6.438***	0.416	6.946*	2.095	4.165	6.279
	(2.205)	(2.805)	(3.885)	(2.727)	(2.842)	(4.929)
Constant	92.086***	91.446***	183.488***	81.547***	81.393***	163.033***
	(1.626)	(1.858)	(2.685)	(1.937)	(1.389)	(2.986)
Observations	468	468	468	468	468	468
Nr. of Subjects	155	155	155	155	155	155

OLS regression with subject random effects. Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table 9 Total Surplus

	Total Surplus - Buyers' dyads			Total Surplus per Group
Treatment	Period 1	Period 2	Periods $1+2$	Periods $1+2$
No Award	173.845	172.8	345.4	690.7
Private Award	175.492	175.4	350.9	701.7
Public Award	178.435	173.1	351.5	703
Public Quality	182.069	177.3	359.4	718.7

Table 10 Effects of Treatments on Total Surplus

	Total Surplus - Buyers' dyads			Total surplus per group
Coefficients	Period 1	Period 2	Periods $1+2$	Periods $1+2$
Private Award	1.258	2.377	4.576	12.75
	(2.366)	(2.396)	(4.3)	(8.98)
Public Award	4.363**	-0.022	5.356	14.24*
	(2.176)	(2.388)	(4.2)	(7.73)
Public Quality	8.335***	4.647*	14.160***	31.94***
	(2.506)	(2.615)	(4.61)	(8.35)
Constant	173.934***	172.905***	345.742***	688.5***
	(1.433)	(1.54)	(2.8)	(5.83)
Observations	468	468	468	234
Nr. of Subjects	155	155	155	129

OLS regression with subject random effects. Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table 9 presents the results for total surplus. The first three columns show the buyers' dyads[11] and the fourth column shows the sum of the profits of all four members of a group. Average total surplus is only significantly higher in the public quality treatment (at a group level, the average total profit was 718.7 in the public quality treatment while it was 703 or less in all other treatments). Similar results are found in Table 10, which shows the regression of total profits on treatment dummies. The public quality treatment has an increase in total surplus of more than 30 points relative to the no-awards case and this coefficient is statistically higher than those of the private and public award treatments. In the public quality treatment, buyers can observe the actual suppliers' quality choice in the first transaction, as opposed to some imperfect signal (the award). This leads to higher prices and higher quality benefitting both buyers and suppliers. This result is consistent with previous literature that shows that clear signals of performance lead to higher efficiency. For example, Bolton et al. (2004) find experimentally that while online feedback systems have positive effects on transaction efficiency between strangers, they cannot fully capture the benefits of reputation building in markets where the same people interact with each other repeatedly.

Finally, we note that total surplus, on average, is not significantly different in the no award and private awards treatments. This is because due to the incentive effects, in the private award treatment buyers' profits increase and suppliers' profits decrease relative to the no awards treatment. Similarly, total profits are not statistically different in the private and public awards treatments. This indicates that making the awards public results in a transfer of profits from buyers back to the suppliers, and it is not a loss in efficiency.

[11] We calculate total surplus across the two periods keeping the buyer fixed. That is if a buyer was matched with one supplier in period one and with the other supplier in period two, we calculate total surplus as the sum of the buyer's profits in both periods plus the sum of the profits of each of the two suppliers in the respective period in which they were matched with the buyer.

7. Discussion

Our results contribute to the discussion of where the value of symbolic awards stems from. Frey and Neckermann (2008) identify several reasons why awards may have motivational effects: (1) because they make the recipient feel good about about themselves, (2) because recipients value the opinion of the authority who gives out the award, (3) because awards generate social prestige and bring recognition within the peer group, or (4) because some subjects enjoy competing for an award. The first and second explanations are more salient in cases where the awards resemble feedback or praise, as it is usually the case in supplier awards. If the supplier's employees care about their hard work being recognized by the firm's clients, managers may seek to get these awards to motivate their workers to provide higher effort. The third and fourth explanations are usually associated with competition prizes. In line with this last group, some previous experiments find that awards that are scarce generate status. In this case, the more visible the awards are, the larger the motivational effect is. In practice, we observe that supplier awards are not easy to get but also not particularly scarce. For example, in 2013 USPS granted seven supplier awards (in different categories such as innovation, diversity, sustainability). In year 2014, Whole Foods Market gave twenty supplier awards including best partnership, best new product, product quality, innovation, etc. In our setting both suppliers may simultaneously get an award, thus there is no competition for the award between suppliers. This may explain why in our setting, the experimental results show that making the awards public, rather than increasing the value of the award, crowds out their motivational value.

Some previous studies have found evidence of awards crowding out motivation. For example, a few papers have shown that monetary awards can decrease intrinsic motivation. Lacetera and Macis (2010a) find a substantial drop in blood donation if awards are given in form of small cash. Similarly, Ariely et al. (2009) find that monetary incentives have no effects on efforts made in public but they do increase efforts made in private. Gneezy and Rustichini (2000) find that in high-school and university students performing a task, monetary incentives decrease intrinsic motivation if awards are not sufficiently large. It is unclear in the previous literature whether, in the case of symbolic awards, higher visibility (public awards) strengthens or crowds out intrinsic motivation (relative to private awards). Charness et al. (2013) conduct an experiment where participants perform a task and show that public symbolic awards (a medal for an out-performer or a donkey hat for an under-performer) crowd out the positive effect of ranking feedback on performance. On the other hand, Lacetera and Macis (2010b) and Ashraf et al. (2012) find that increased visibility of a symbolic award allows for peer comparison and makes the award more valuable. In our setting, a public award not only allows social comparison, but also works as a signal which grants the recipient of the award a higher price in a subsequent period. Our experimental results show that public awards are no longer valuable to suppliers in a second (and final) period, while private awards are valuable in both periods. This suggests that public awards may be perceived by some suppliers merely as a "tool" to get better contracts and as a result, publicizing the award crowds out the intrinsic value of the award to suppliers.

In addition to the above, another reason why suppliers may care about receiving the award is that it indicates a higher probability of a continuing relationship. This explanation seems plausible; our results show that when awards are available, receiving an award leads to a continuing offer in 52% of the cases compared to only 18% when suppliers do not receive an award. However, this argument is not sufficient to fully explain the outcomes we obtain from our experiment. In the private award treatment, suppliers exert higher effort than in the no-award scenario not only in the first transaction, but also un the second transaction. Concerns about the continuation of the relationship fail to explain higher quality in the second (and final) transaction. A natural path for future research would be to analyze the case of longer buyer-supplier relationships. Based on previous literature, we conjecture that longer relationships (repeated interactions between the firms) can lead to more collaborative and efficient outcomes. Analogous to the results in Beer et al. (2017), this could potentially be attributed to highly motivational suppliers choosing higher quality in expectation of future profits and awards, and to low motivational type suppliers mimicking high type suppliers to get better price.

8. Conclusions

Our paper provides insights about how a buyer can incentivize suppliers to provide "above and beyond" quality with a symbolic award. In our experiment, we observe that –when available– buyers give out symbolic awards to those suppliers who meet or exceed their quality expectations. These symbolic awards are valuable to some suppliers, and thus the awards induce them to exert higher effort.

However, our study also shows that if a symbolic award for exceptional performance is highly publicized, a symbolic award can be quite costly to a buyer. This happens in particular when all buyers seek to transact with a few "good" suppliers. In contrast to the existing body of literature which considers only the direct cost of awards, our theoretical results and ensuing experiments explore lingering effects that an award has in a marketplace. When an award is public, an award can trigger competition among buyers and increases the cost of transacting with a good supplier. In addition, an award can even induce a "bad" supplier to behave nicely when doing so can increase the transaction price. These adverse effects can potentially wipe out the gain from the motivational effect. Our study suggests that, when good suppliers are scarce and suppliers cannot change their capacity freely, awards that are informal and private can effectively motivate suppliers while minimizing harmful effects associated with a symbolic award.

Subjects' profits in our experiments confirm the previous results. In our experiment, buyers' profits are higher with private awards than when awards are not available, which suggests that the incentive effect has a positive impact on buyers' profits. However when awards are instead public, the profit premium buyers get in the private awards case is no longer present. This is because, while public awards lead to higher prices for good suppliers, they do not result in higher provision of quality. In fact, public awards "crowd out" the incentive effect of the award and hinder buyer's profit relative to the private awards case. Suppliers' monetary profits, on the other hand, increase in the public awards case relative to the private awards case. This suggests that by increasing the visibility of the award, the monetary benefits derived from the incentive effect of the award are transferred from the buyer to the supplier. Finally, total surplus is significantly higher (than in the no-award case) only when awards are private and quality is public. While a public award can be informative of the supplier's type, this signal carries noise and requires certain level of interpretation from the buyers. When the quality is public the information is clear, which reduces the inefficiency derived from asymmetric information. As a result, average price and average quality are higher in both periods making both buyers and suppliers better off.

Our results explain some of the current trends observed in the industry. While suppliers strive to loudly announce their awards, buyers devise creative ways of generating informal awards which, have the ability of inducing incentive effects, but are also hard to publicize. Our results suggest that when contemplating ways of rewarding suppliers' high efforts, expressing praise or gratitude in private – at a private corporate event or in daily verbal or email communication – can go a long way.

Appendix A: Theory Section

Proof of Lemma 1: In the last stage of period 2, it is easy to see from equation (1) that $q_2 = 0$ is a dominant strategy when there is no award. Knowing this, a buyer maximizes its utility (equation (2)) by offering $p_2 = 0$. Considering this subgame outcome, the first period transaction is identical as the second transaction. Each buyer makes an offer of $p_1 = 0$ and any requested quality, and suppliers choose $q_1 = 0$.

Proof of Lemma 2:

First, let $\pi_k^i \in (0,1)$ be a buyer's prior belief that its own supplier's type is k, $k \in \{\text{h = high, l = low}\}$. Analogously, let $\pi_k^{-i} \in (0,1)$ be a buyer's belief about the other supplier's type. At the end of period 1, the buyer updates its belief about its own supplier's type based on the observation of quality. Specifically, let $\pi(i,k|q_1)$ be the buyer's updated belief about its own supplier's type after observing the quality level q_1 from the supplier. The buyer cannot update its prior about the other supplier's type, $\pi_h^{-i} = \pi$, since both the supplier's quality and award are private.

We show that the following is a truth-telling equilibrium of the game, where the buyer gives the supplier an award if and only if the supplier's quality is greater or equal to the buyer's requested quality. The buyers' initial beliefs are that each supplier is of high type with probability π and of low type with probability $(1-\pi)$. In the first transaction, buyers offer $p_1 = 0$ and $\hat{q}_1 = C^{-1}(\phi)$, all low-type suppliers choose $q_1 = 0$ and do not get the award, and all high-type suppliers choose $q_1 = \hat{q}_1$ and get the award. After the first transaction period, a buyer's updated beliefs about its own supplier's type are $\pi(i,h|q_1 \geq \hat{q}_1) = 1$ and $\pi(i,h|q_1 < \hat{q}_1) = 0$. Since buyers cannot see whether the other supplier has received an award or not, buyers do not update their beliefs about the other supplier's type; the supplier is of high type with probability π and of low type with probability $(1-\pi)$. In the second transaction, buyers make a continuing offer to their own suppliers, all low-type suppliers continue to choose $q_2 = 0$ and do not get the award, and all high-type suppliers choose $q_2 = \hat{q}_2$ and receive the award.

Note that, a buyer whose supplier chose $q_1 = 0$ in the first period cannot profit from making a new offer to the other supplier, hence it makes an offer to the existing supplier. This is because if the other supplier is high-type, the offer will be matched and the buyer does not close a deal with the other supplier. Since it can only win if the other supplier is low-type, the buyer is indifferent between switching and continuing with its own (low-type) supplier in equilibrium.

Under this equilibrium, if the buyer is initially matched with a high-type supplier, he earns $2\alpha C^{-1}(\phi)$ after two periods. If it is matched with a low-type supplier, it earns zero profits after two periods.

We show that no one has an incentive to deviate from this equilibrium. Consider first a low-type supplier. In the second transaction he chooses $q_2 = 0$ regardless of the offered price since he does not derive any utility from the award. In the first transaction, if he chooses $q_1 = \hat{q}_1$ he induces the buyer to believe that he is high-type, and if he chooses $q_1 = 0$ he induces the buyer to believe that he is low-type. However, in either case, the buyer makes an offer with $p = 0$. Thus, a low-type supplier chooses $q_1 = 0$ in transaction 1.

Consider now a high-type supplier. In the second transaction, a high type supplier solves:

$$\max_{q_2 \geq 0} \begin{cases} \phi + p_2 - C(q_2) & \text{if } q_2 \geq \hat{q}_2 \\ p_2 - C(q_2) & \text{otherwise.} \end{cases}$$

There are two candidates for the optimal solution: $q_2 = 0$ or $q_2 = \hat{q}_2$. If the cost of getting the award, $C(\hat{q}_2)$ exceeds the surplus the supplier gets from the award, ϕ, the supplier chooses $q_2 = 0$ and does not get the award. Otherwise, he chooses $q_2 = \hat{q}_2$ and gets the award. Thus, a high-type supplier will choose $q_2 = \hat{q}_2$ if and only if $\phi \geq C(\hat{q}_2)$ or equivalently, $\hat{q}_2 \leq C^{-1}(\phi)$. Under the truth-telling equilibrium, the requested quality is $\hat{q}_2 = C^{-1}(\phi)$, therefore a high-type supplier (weakly) prefers getting the award with some efforts to not getting the award at all. Now consider the first transaction period. If a high-type supplier chooses $q_1 = 0$, the buyer will believe he is of low type. On the other hand, if $q_1 = \hat{q}_1$, the buyer will believe that he is of high type. Since the buyer's price in the second period is not affected by the buyer's belief about the supplier's type (the buyer continues to offer $p_2 = 0$ regardless of its updated beliefs), the supplier faces the same decision problem as he faced in period 2. Thus, in the first transaction period, a high-type supplier chooses $q_1 = \hat{q}_1 = C^{-1}(\phi)$ and gets the award. As a result, the high-type supplier derives utility $\phi - C(C^{-1}(\phi)) = 0$ in both periods in equilibrium since the buyer sets the requested quality at a level that extracts all the supplier's surplus.

Finally, consider a buyer's incentives to deviate from the truth-telling equilibrium. In equilibrium, both buyers offer $p_1 = 0$ and $\hat{q}_1 = C^{-1}(\phi)$ in the first transaction period, and make a continuing offer to their own supplier in the next period.

Suppose that a buyer (say buyer 1) believes that its supplier is of low type at the beginning of period 2. If the offer in period 1 was $p_1 = 0$, making a continuing offer is a (weakly) dominating strategy. If p_1 was not zero, making a new zero-price offer to its own supplier is a (weakly) dominating strategy. To see why, note that if buyer 1 chooses to make a new offer to its own supplier (who is believed to be a low-type), buyer 1 can earn at most zero. Now suppose that buyer 1 switches and makes an offer to the other supplier – whom it believes to be a high-type with probability π and a low-type with probability $(1-\pi)$. If the other supplier is of high type, it must be the case that the other buyer (buyer 2) received $q_1 = \hat{q}_1$ in the first period. In our truth-telling equilibrium, buyer 2 will make a continuing offer with a matching option. Hence, any offer that is made by the buyer will be matched by buyer 2. The supplier stays with the incumbent buyer if the offers from both buyers are the same. Thus, if buyer 1 chooses to make an offer to the other supplier, it will win the deal only with a low-type supplier who will exert no effort. Consequently, buyer 1 does not gain by switching.

Consider now buyer 1 who believes its own supplier is a high-type. If $p_1 = 0$, it is (weakly) dominant to make a continuing offer. If $p_1 > 0$, he makes a new offer to its own supplier with $p_2 = 0$, since in equilibrium the other buyer makes a continuing offer to its own supplier and will not attempt to "steal away". Rolling back to the first period, making an offer with $p_1 = 0$ and $\hat{q}_1 = C^{-1}(\phi)$ grants buyer 1 the maximum profit. As before, it is never profitable to switch suppliers in period 2.

The argument for buyer 2 is symmetric. Summarizing all cases, a buyer earns $2\alpha C^{-1}(\phi)$ when it is matched with a high-type supplier, but earns zero if matched with a low-type.

We next show that this equilibrium survives the intuitive criterion. We show the following holds for our truth-telling equilibrium: For any belief an uninformed player may have after seeing a deviation, if one type of supplier has a worse payoff by deviating than her equilibrium payoff and the other does not, then the deviation is not attributed to the supplier whose payoff decreases.

In our equilibrium, a low-type supplier chooses $q_1 = 0$ and a high-type supplier chooses $q_1 = \hat{q}_1 = C^{-1}(\phi)$. Two possible deviations from the equilibrium exist: $0 < q_1 < \hat{q}_1$ and $q_1 > \hat{q}_1$.

Consider first the buyer's belief about a supplier who chooses q_1 such that $0 < q_1 < \hat{q}_1$. This supplier will not receive an award for his effort (recall that the buyer only gives an award if $q_1 \geq \hat{q}_1$). If the supplier is a low-type, his payoff is $-C(q_1)$, making him worse off than the equilibrium payoff, 0. Now consider a high-type supplier. The maximum he can derive from the deviation is $-C(q_1) + \phi - C(\hat{q}_2) < 0$. Since any q_1 in $0 < q_1 < \hat{q}_1$ results in a payoff that is dominated by the equilibrium payoff for both types of supplier, the equilibrium does not violate the intuitive criterion.

Consider a deviation of $q_1 > \hat{q}_1$. Since a low-type supplier does not derive any utility from a symbolic award, and the price in the second period is zero regardless of the supplier's choice of quality, the maximum payoff the low-type supplier can earn is $-C(q_1)$. A high-type supplier earns at most $-C(q_1) - C(q_2) + 2\phi < 0$ with this deviation. Hence, all suppliers are worse off from this deviation and the equilibrium does not violate the intuitive criterion.

Proof of Lemma 3: First, let us define $\pi(-i, k|A_1)$ as the buyer's updated belief that the other supplier is a high-type supplier after period 1. Let $\bar{p}$ be the maximum price at which the buyer earns non-negative profits in the second period when the requested quality is $\hat{q}_2 = C^{-1}(\phi)$. Since the supplier's optimal quality is either $q_2 = 0$ or $q_2 = \hat{q}_2$, then $\bar{p} = \alpha C^{-1}(\phi)$.

We show that the equilibrium described in Lemma 3 exists by showing that none of the players wants to deviate. In this equilibrium, a buyer updates the belief about the other supplier's type as follows: $\pi(-i, h|A_1 = 1) = 1$ and $\pi(-i, h|A_1 = 0) = 0$.

Consider a high-type supplier's incentive to deviate. In period 2, a high-type supplier chooses $q_2 = \hat{q}_2$ if and only if $\hat{q}_2 \leq C^{-1}(\phi)$. Since this holds in equilibrium, he chooses $q_2 = \hat{q}_2$. In transaction 1, requested quality is $\hat{q}_1 = C^{-1}(\phi + (1-\pi)\bar{p})$. If he chooses $q_1 = \hat{q}_1$ and receives an award in the first period, both buyers will update their beliefs. Then, if the other supplier is of low type (with probability $1-\pi$), he will be offered $p_2 = \bar{p}$. If the other supplier is also of high type, $p_2 = 0$ is offered. This results in an expected utility of $\phi - C(C^{-1}(\phi + (1-\pi)\bar{p})) + (1-\pi)\bar{p} + \phi - C(C^{-1}(\phi)) = 0$. If the high-type supplier chooses $q_1 = 0$, his action induces the buyer to believe that he is of low type and this results zero utility in both periods. If he chooses any $q_1 > 0$ different from $\hat{q}_1$, this will result in a strictly negative utility. Thus, choosing $q_1 = \hat{q}_1$ is a (weakly) dominating strategy.

Consider now a low-type supplier. In period 2, it is always optimal for a low-type supplier to choose $q_2 = 0$. In the first transaction, a low-type supplier could potentially have incentive to mimic the high-type supplier and choose $q_1 = \hat{q}_1$ so that the buyer believes he is of high type. However, this is never optimal since it results in an expected profit of $[(1-\pi)\bar{p}] - C(C^{-1}(\phi + (1-\pi)\bar{p})) < 0$. Choosing $q_1 = 0$ results in zero expected profit and choosing any $q_1 > 0$ and different from $\hat{q}_1$ results in strictly negative expected profit. Thus, choosing $q_1 = 0$ is a dominant strategy.

Finally, consider a buyer's incentives to deviate from the equilibrium. In the second transaction, if the buyer believes that both suppliers are of high type, making a new offer to its own supplier with $p_2 = 0$ and $\hat{q}_2 = C^{-1}(\phi)$ is a dominant strategy since this will result in the expected profit of $\alpha C^{-1}(\phi + (1-\pi)\bar{p}) + \alpha C^{-1}(\phi)$.

If a buyer believes that both suppliers are of low type, it makes a continuing offer ($p_2 = 0$) and earns zero profits. No other offer would result in a positive buyer profit.

If the buyer believes that its own supplier is of low type and the other supplier is of high type, the buyer offers the high-type supplier $\bar{p} = \alpha\hat{q}_2$ with a request $\hat{q}_2 = min\{C^{-1}(\phi), C'^{-1}(\alpha)\}$. The supplier, who received an identical offer from the other buyer, rejects this buyer's offer. Thus, the buyer ends up making a $p_2 = 0$ offer to its own low-type supplier. In this case, both buyers earn zero profits in period 2. Note that there is no equilibrium where a buyer earns positive profits in this case and, therefore, no buyer has incentive to deviate from equilibrium and make a different offer. This is because if one buyer's offer to the high-type supplier earned the buyer positive profits, the other buyer would have incentive to deviate and undercut the offer to steal the deal. While several equilibria where the buyers earn zero profits could arise, the one that we characterize maximizes the supplier's profit in period 2. To see why, recall from a previous result that if $\hat{q}_2 \leq C^{-1}(\phi)$ the supplier chooses $q_2 = \hat{q}_2$ and if $\hat{q}_2 > C^{-1}(\phi)$ the supplier chooses $q_2 = 0$. Therefore, if $\hat{q}_2 > C^{-1}(\phi)$, the buyer's offer has $\bar{p} = 0$ and the supplier earns zero profit. On the other hand, if $\hat{q}_2 \leq C^{-1}(\phi)$ the supplier's profit is maximized at $q_2^* = C'^{-1}(\alpha)$ if $C'^{-1}(\alpha) \leq C^{-1}(\phi)$ and at $q_2^* = C^{-1}(\phi)$ otherwise. As a result, an equilibrium where the buyer offers $\bar{p} = \alpha\hat{q}_2$ with a request $\hat{q}_2 = min\{C^{-1}(\phi), C'^{-1}(\alpha)\}$ has zero buyer profit and maximizes the supplier's profit.

Rolling back to the first transaction, any price greater than zero is dominated by $p_1 = 0$, as p_1 does not affect the suppliers' actions. Requested quality $\hat{q}_1 = C^{-1}(\phi + (1-\pi)\bar{p})$ makes the high type supplier indifferent between choosing $q = \hat{q}$ and $q_1 = 0$ and is therefore, the maximum quality the buyer can get in transaction 1.

This equilibrium survives the intuitive criterion since for both supplier types, the payoffs from deviation are dominated by the equilibrium payoffs (considering again the two possible deviations, $0 < q_1 < \hat{q}_1$ and $q_1 > \hat{q}_1$). The proof is similar to that used in 2.

Proof of Lemma 4:

In truth-telling equilibria, a buyer gives the supplier an award when the supplier chooses $q_t \geq \hat{q}_t$. The equilibrium outcomes of the scenario with public quality and private award are equivalent to those in the scenario with public award and private quality. The only difference between the two settings is that when quality is public (and the award is not), buyers update their beliefs about the other supplier's type based on the quality he chose, $\pi(-i, k|q_1)$, instead of updating their beliefs based on whether the supplier received an award or not, $\pi(-i, k|A_1)$. If the supplier chose a quality greater or equal to the requested quality, the buyer believes the supplier is a high type and otherwise it believes the supplier is a low type (i.e. $\pi(-i, h|q_1 \geq \hat{q}_1) = 1$ and $\pi(-i, h|q_1 < \hat{q}_1) = 0$). Note that in equilibrium, if a supplier chooses $q_i \geq \hat{q}_i$, he receives an award and otherwise he does not receive an award. Thus, observing whether the supplier receives an award or not is equivalent to observing whether $q_i \geq \hat{q}_i$, and the analysis of the two cases is analogous.

Proof of Proposition 1: (i) The result follows from Lemmas 1, 2, and 3 which show that a buyer's expected profit in the no-award case is 0, while it is $\pi 2\alpha C^{-1}(\phi) > 0$ in the private award case and $\pi[\alpha C^{-1}(\phi + (1 - \pi)\alpha C^{-1}(\phi)) + \pi\alpha C^{-1}(\phi)] > 0$ in the public award case.

(ii) From the proof of Lemma 2, a buyer's expected profit in the private award case is $\pi 2\alpha C^{-1}(\phi)$. From the proof of Lemma 3, a buyer's expected profit in the public awards case is $\pi[\alpha C^{-1}(\phi + (1 - \pi)\alpha C^{-1}(\phi)) +$

$\pi\alpha C^{-1}(\phi)]$. Therefore, buyers' expected profits are higher when awards are private than when awards are public if $2\alpha C^{-1}(\phi) > \alpha C^{-1}(\phi + (1-\pi)\alpha C^{-1}(\phi)) + \pi\alpha C^{-1}(\phi)$, or equivalently, if $\Delta(\phi) = (2-\pi)C^{-1}(\phi) - C^{-1}(\phi + (1-\pi)\alpha C^{-1}(\phi)) > 0$. For fixed values of α and π, this condition holds for a sufficiently high value of ϕ. To see why, note that taking first derivative with respect to ϕ of the LHS we get $\frac{d\Delta(\phi)}{d\phi} = (2-\pi)\frac{1}{C'(C^{-1}(\phi))} - (1+(1-\pi)\alpha\frac{1}{C'(C^{-1}(\phi))})\frac{1}{C'(C^{-1}(\phi+(1-\pi)\alpha C^{-1}(\phi))}$. Since $C(\cdot)$ is a convex and strictly increasing function, $C^{-1}(\cdot)$ is strictly increasing, and $C'(\cdot)$ is positive and increasing. Thus, $\frac{1}{C'(C^{-1}(\phi))} > \frac{1}{C'(C^{-1}(\phi+(1-\pi)\alpha C^{-1}(\phi))}$. For sufficiently high value of ϕ, also $2-\pi > 1+(1-\pi)\alpha\frac{1}{C'(C^{-1}(\phi))}$ and therefore, $\frac{d\Delta(\phi)}{d\phi} > 0$.

(iii) The result follows from Lemma 4 which shows that the equilibrium outcomes of the scenario with public quality and private award are equivalent to those in the scenario with public award and private quality.

Appendix B: Experimental Section

Estimation of the Symbolic Award's Intrinsic Value (ϕ parameter) In order to capture a supplier's value for the award, we estimate how much more likely a supplier is to choose a quality level that increases his chance of receiving an award (Model 1). In addition, since in section 6.2.1 we show that a supplier's chance of receiving an award increases significantly when a supplier matches the buyer's requested quality, we also consider a model that estimates a supplier's utility from fulfilling the buyer's request (Model 2). We consider only the PrA treatment, since this treatment isolates the incentive effect from the competition effect.

Equation (1) in the paper expresses a supplier's utility across the two periods, $U(A_t, q_t) = \sum_{t=1}^{2}[p_t - C(q_t) + \phi A_t]$, where A_t is an indicator function that takes value 1 if the supplier gets the award in period t. Note that a supplier's quality choice not only affects his monetary payoff, but it also affects his chances of receiving an award. In each period t, we can estimate the probability that supplier i will receive an award, conditional on the quality chosen and the buyer's requested quality, as $Pr(A_{i,t}|q_{i,t}, \hat{q}_{i,t}) = \alpha_0 + \alpha_1 q_{i,t} + \alpha_2 \hat{q}_{i,t} + \varepsilon_{ij}$.

In each period t, conditional on accepting an offer, a supplier has several choices of quality level, $q_{i,t,j}$ with $j \in \{0, 1, 2, ..., 10\}$ so that the total number of alternatives to choose from is $J = 11$. We can empirically estimate the parameters of the following logit model for supplier i's utility in period t from choosing quality alternative j conditional on the buyer's requested quality and price:

$$U_{i,t}(q_{i,t,j}|\hat{q}_{i,t}, p_{i,t}) = \beta_{\$}[p_{i,t} - C(q_{i,t,j})] + \phi[Pr(A_{i,t}|q_{i,t,j}, \hat{q}_{i,t})] + \varepsilon_{i,t,j}$$

The parameter $\beta_{\$}$ affecting the first term in this model is the supplier's concern for his monetary payoff while the parameter ϕ affecting the second term is the supplier's concern for choosing an alternative that increases his chances of receiving an award. Higher quality increases a supplier's chances of receiving an award but is also more costly. The supplier's quality decision is therefore a trade-off between increasing his chance of getting an award (valued with a weight ϕ) and maximizing his monetary payoff (valued with a weight $\beta_{\$}$). We estimate the parameters in this model, where $\frac{\phi}{\beta_{\$}}$ captures the value of the award in monetary terms. The probability that supplier i chooses quality alternative j in period t is given by:

$$P(y_{i,t,j} = 1) = \frac{\exp(Z'_{i,t,j}\beta)}{\sum_{k=1}^{J}[\exp(Z'_{i,t,k}\beta)]},$$

where $y_{i,t,k}$ is a dummy variable that takes value 1 if alternative $k=j$ corresponds with the quality level actually chosen by supplier i in period t, and zero otherwise. $Z'_{i,t,k}$ is a vector consisting of the monetary payoff and the probability of getting the award, and β is the vector of parameters $[\beta_{\$},\ \phi]$. Based on this formulation, the likelihood function can be derived and maximized to obtain the vector β by maximum likelihood estimation.

The results of the estimation are presented in Table 11. The variable "Monetary Payoff" is computed for each observation and quality alternative as $price - C(alternative)$. In Model 1 "Award Probability" is the probability of getting an award for a given quality alternative conditional on requested quality. Since a supplier's chance of receiving an award is close to 100% when quality is equal to the requested quality, the alternatives that exceed the requested quality are strictly dominated by the alternative that is equal to the requested quality. To account for this, we truncated the "Award Probability" variable by setting the probability of getting an award equal to zero for all the alternatives greater than the requested quality. In Model 2 "Award Probability" is a dummy variable which takes value 1 when the alternative is equal to the requested quality level and zero otherwise.

Table 11 Estimation of Intrinsic Value of the Award

	Model 1		Model 2	
Coefficients	Period 1	Period 2	Period 1	Period 2
Monetary Payoff	0.079***	0.100***	0.073***	0.080***
	(0.015)	(0.016)	(0.013)	(0.013)
Award Probability	2.196***	3.831***	1.740***	1.324***
	(0.292)	(0.584)	(0.245)	(0.250)
Observations	990	1067	990	1067
Nr. of Subjects	90	97	90	97
Dollar value of a 100% increase in award probability $[0.05\frac{\phi}{\beta}]$	1.39	1.92	1.19	0.83
% of average payment/round	36	49	31	21

Conditional Logistic Model. Data corresponding to the private award (PrA) treatment. Significance is denoted: * $p<0.10$ ** $p<0.05$ *** $p<0.01$.

Supplementary Tables and Figures

Table 12 Award Criterion

	Treatment	# of rounds where awards were given	# of rounds where awards were not given	Quality in rounds where award was given	Quality in rounds where award was not given
Period 1	PrA	38	52	3.868	1.962
	PuA	43	34	3.464	2.306
Period 2	PrA	35	62	3.629	1.839
	PuA	34	50	3.647	1.320

Number of rounds and averages are conditional on acceptance of the buyer's offer.

Table 13 Differences between Private and Public Award

Coefficients	Suppliers' accepted price (Transaction 2)	Suppliers' accepted price if received award in transaction 1 (Transaction 2)	Buyers' Profit (Total)
Public Award	7.017**	8.908**	-8.293*
	(3.176)	(4.343)	(4.719)
Constant	28.495***	31.417***	196.080***
	(2.149)	(2.853)	(2.900)
Observations	181	76	228
Nr. of Subjects	73	46	75

OLS regression with subject random effects. Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

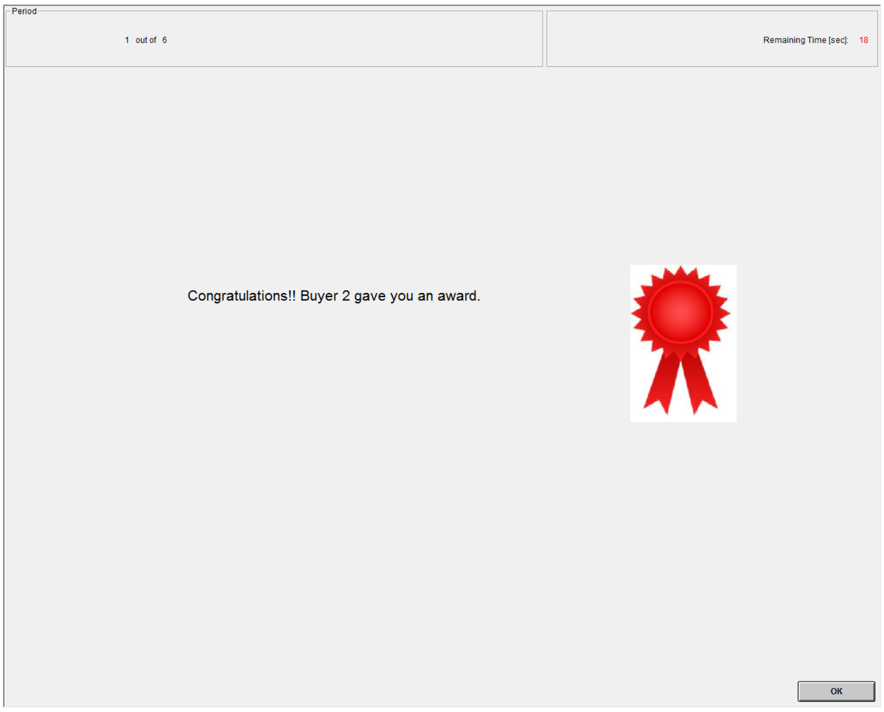

Figure 4 Award Screenshot

References

Ariely, Dan, Anat Bracha, Stephan Meier. 2009. Doing good or doing well? image motivation and monetary incentives in behaving prosocially. *The American Economic Review* 544–555.

Ashraf, Nava, Oriana Bandiera, Kelsey Jack. 2012. No margin, no mission. *A Field Experiment on Incentives for Pro-Social Tasks, CEPR Discussion Papers* **8834**.

Baron, James N, David M Kreps. 1999. *Strategic human resources: Frameworks for general managers*. Wiley New York.

Beer, Ruth, Hyun-Soo Ahn, Stephen Leider. 2017. Can trustworthiness in a supply chain be signaled? *forthcoming, Management Science* .

Besley, Timothy, Maitreesh Ghatak. 2008. Status incentives. *The American Economic Review* 206–211.

Bolton, Gary E, Elena Katok, Axel Ockenfels. 2004. How effective are electronic reputation mechanisms? an experimental investigation. *Management science* **50**(11) 1587–1602.

Bradler, Christiane, Robert Dur, Susanne Neckermann, Arjan Non. 2013. Employee recognition and performance: A field experiment. *ZEW-Centre for European Economic Research Discussion Paper* (13-017).

Cachon, Gérard P. 2003. Supply chain coordination with contracts. *Handbooks in operations research and management science* **11** 227–339.

Cachon, Gérard P, Martin A Lariviere. 2005. Supply chain coordination with revenue-sharing contracts: strengths and limitations. *Management science* **51**(1) 30–44.

Charness, Gary, David Masclet, Marie Claire Villeval. 2013. The dark side of competition for status. *Management Science* **60**(1) 38–55.

Cho, I.K., D.M. Kreps. 1987. Signaling games and stable equilibria. *The Quarterly Journal of Economics* **102**(2) 179–221.

Davis, Andrew M, Kyle Hyndman. 2016. An experimental investigation of managing quality through deferred payment mechanisms. *forthcoming, Management Science* .

Ellingsen, Tore, Magnus Johannesson. 2008. Anticipated verbal feedback induces altruistic behavior. *Evolution and Human Behavior* **29**(2) 100–105.

Eriksson, Tor, Marie Claire Villeval. 2012. Respect and relational contracts. *Journal of Economic Behavior & Organization* **81**(1) 286–298.

Fehr, Ernst, Simon Gächter. 2000. Cooperation and punishment in public goods experiments. *American Economic Review* 980–994.

Fischbacher, U. 2007. z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics* **10**(2) 171–178.

Frey, Bruno S, Susanne Neckermann. 2008. Awards. *Zeitschrift für Psychologie/Journal of Psychology* **216**(4) 198–208.

Gächter, Simon, Ernst Fehr. 1999. Collective action as a social exchange. *Journal of Economic Behavior & Organization* **39**(4) 341–369.

Gneezy, Uri, Aldo Rustichini. 2000. Pay enough or don't pay at all. *Quarterly journal of economics* 791–810.

Green, Jerry R, Nancy Stokey. 1982. A comparison of tournaments and contracts.

Haitao Cui, Tony, Jagmohan S Raju, Z John Zhang. 2007. Fairness and channel coordination. *Management Science* **53**(8) 1303–1314.

Harackiewicz, Judith M. 1979. The effects of reward contingency and performance feedback on intrinsic motivation. *Journal of Personality and Social Psychology* **37**(8) 1352.

Katok, Elena, Valery Pavlov. 2013. Fairness in supply chain contracts: A laboratory study. *Journal of Operations Management* **31**(3) 129–137.

Kaya, M., Ö. Özer. 2009. Quality risk in outsourcing: Noncontractible product quality and private quality cost information. *Naval Research Logistics (NRL)* **56**(7) 669–685.

Kosfeld, Michael, Susanne Neckermann. 2011. Getting more work for nothing? symbolic awards and worker performance. *American Economic Journal: Microeconomics* 86–99.

Kube, Sebastian, Michel André Maréchal, Clemens Puppea. 2012. The currency of reciprocity: Gift exchange in the workplace. *The American Economic Review* **102**(4) 1644–1662.

Lacetera, Nicola, Mario Macis. 2010a. Do all material incentives for pro-social activities backfire? the response to cash and non-cash incentives for blood donations. *Journal of Economic Psychology* **31**(4) 738–748.

Lacetera, Nicola, Mario Macis. 2010b. Social image concerns and prosocial behavior: Field evidence from a nonlinear incentive scheme. *Journal of Economic Behavior & Organization* **76**(2) 225–237.

Lazear, Edward P., Sherwin Rosen. 1979. Rank-order tournaments as optimum labor contracts. Working Paper 401, National Bureau of Economic Research. doi:10.3386/w0401. URL `http://www.nber.org/papers/w0401`.

Liker, Jeffrey K, Thomas Y Choi. 2004. Building deep supplier relationships. *Harvard business review* **82**(12).

Loch, Christoph H, Yaozhong Wu. 2008. Social preferences and supply chain performance: An experimental study. *Management Science* **54**(11) 1835–1849.

Masclet, David, Charles Noussair, Steven Tucker, Marie-Claire Villeval. 2003. Monetary and nonmonetary punishment in the voluntary contributions mechanism. *American Economic Review* 366–380.

Nalebuff, Barry J, Joseph E Stiglitz. 1983. Prizes and incentives: towards a general theory of compensation and competition. *The Bell Journal of Economics* 21–43.

Noussair, Charles, Steven Tucker. 2005. Combining monetary and social sanctions to promote cooperation. *Economic Inquiry* **43**(3) 649–660.

Özer, Özalp, Yanchong Zheng, Kay-Yut Chen. 2011. Trust in forecast information sharing. *Management Science* **57**(6) 1111–1137.

Özer, Özalp, Yanchong Zheng, Yufei Ren. 2014. Trust, trustworthiness, and information sharing in supply chains bridging china and the united states. *Management Science* **60**(10) 2435–2460.

Pasternack, Barry Alan. 2008. Optimal pricing and return policies for perishable commodities. *Marketing science* **27**(1) 133–140.

Peeters, Ronald, Marc Vorsatz. 2013. Immaterial rewards and sanctions in a voluntary contribution experiment. *Economic Inquiry* **51**(2) 1442–1456.

Spiliotopoulou, Eirini, Karen Donohue, Mustafa Çagri Gürbüz. 2015. Information reliability in supply chains: the case of multiple retailers. *Production and Operations Management* .