Cooperation and Mistrust in Relational Contracts*

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Abstract

Work and trade relationships are often governed by relational contracts, in which incentives for cooperative action today stem from the prospective future benefits of the relationship. In this paper, we study how reductions in clarity about the financial consequences of actions, induced by a lack of hard information about the costs of providing quality, affect relational contracts in buyer-seller relationships. The absence of verifiable information can impede the joint understanding of what constitutes cooperative behavior, and may thus inject mistrust into relationships. Comparing seller-buyer relationships with hard (verifiable) and soft (non-verifiable) information about seller costs in the laboratory, we find that such a lack of clarity has strong effects on the terms of relational contracts. However, these effects only concern the distribution of rents, and not efficiency.

Keywords: Relational Contracts; Non-Verifiable Information; Experiments.

JEL Classification: D01, D03, L14, L20.

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1 Introduction

The theory of relational contracts investigates the conditions under which cooperative and efficient behavior is sustainable through repeated interaction even if contracts are not enforceable through third parties. If the individual benefits of upholding the relational contract are sufficiently large for each trading party, and this is common knowledge, then it is in everybody's self-interest to act cooperatively. Thus the terms of the relational contract need to ensure that each party benefits more from upholding the relationship than from reneging on the relational contract. In this sense, sustaining relational contracts is a matter of credibility.

According to this view, maintaining relational contracts should be relatively simple whenever the gains from trade are sufficiently high. However, Gibbons and Henderson (2012; 2013) have recently argued that the sole focus on credibility may be insufficient, because efficient relational contracts need to solve the "twin problem of credibility and clarity" (Gibbons and Henderson (2012), p. 1350). In addition to credibility, a mutual understanding of the terms of the relational contract is required: The parties need to know which actions are in the spirit of the contract and which actions violate it. To gain such an understanding, mutual "task knowledge" as well as "relational knowledge" are required. Task knowledge encompasses the "actions that constitute cooperation", whereas relational knowledge encompasses "the payoff to cooperation for each party, of each party's ability and incentive to defect, and of the actions and payoffs that constitute punishment" (Gibbons and Henderson (2012), p. 1355).

In this paper, we study the effects of clarity on the terms and efficiency of relational contracts, focusing on the role of relational knowledge. We do so by experimentally varying one element of relational knowledge, the payoff to cooperation for each party, while controlling for credibility.[1] To this end, we conducted a series of experiments in which a seller and a buyer are matched in pairs and repeatedly engage in the transaction of a good of heterogeneous quality that is structured as a *trust contract*. We deliberately chose an experimental design that is closely related to the established gift-exchange paradigm (Fehr et al., 1997; Brown et al., 2004). Higher quality is valuable to the buyer, but costly to the seller. In the first stage of each transaction, the buyer pays a price upfront. In the second stage, the seller chooses the quality q of the good. Quality q is chosen from $\{1, ..., 10\}$, and the value of the good to the buyer is $10q$. The price p is

[1] In unpublished ongoing work, Kartal et al. (2017) study the related but different question of how uncertainty about a player's patience affects the build-up of relational contracts.

chosen from $\{0, ..., 100\}$. Neither quality nor price are contractible. There are two seller types, which differ in their cost of providing quality. For the high cost type, the absolute and marginal costs of providing positive quality are always larger. Each pair engaged in 15 transactions. Relational knowledge about the payoff from transacting is manipulated by exogenously varying the reliability of the buyer's information about the seller's true costs: In the hard information treatments, costs are common knowledge, whereas in the soft information treatments, they are private information. However, at the beginning of the latter treatments, the seller can send a cheap talk cost signal to the buyer. Consequently, the buyer only knows the ex-ante probabilities of high or low costs and observes the non-verifiable cost signal.

Relational knowledge is therefore reduced in the soft information treatment, since the buyer cannot know the seller's payoff with certainty. However, when focusing on high cost sellers, our treatment variation induces no reduction of credibility. The intuition is that future rents following a high cost signal in the soft information treatment are either the same as in the hard information treatment conditional on high costs (if the cost signal was truthful), or higher (if the seller has low costs).[2]

Why then should the reduction in relational knowledge impede relational contracts? First, it has been argued that mutual trust is crucial for upholding relationships (Zaheer and Venkatraman, 1995; Bachmann and Zaheer, 2006). Second, evidence suggests that dishonest actions and attempts to gain unfair advantages through acts of cheating often meet with resistance and punishment (Brandts and Charness, 2003). In the soft information treatment, a trading partner may interpret high cost signals as such dishonest attempts by low cost sellers, and he may therefore doubt their truthfulness. In turn, buyer and seller may have diverging views on what constitutes fair contractual terms and how the gains from trade should be distributed. The lack of relational knowledge may therefore lead to diverging views on fair contractual terms and appropriate actions, creating a clarity problem in the spirit of Gibbons and Henderson (2012).

To see this logic more clearly, consider the following intuitive reasoning:

(S1) When buyers believe that a seller has high costs, they are prepared to compensate quality increases with higher price increases.

(S2) Under soft information, buyers doubt that high signals are truthful.

(S3) Thus, a buyer might compensate a seller who signals high cost less for

[2] We provide a deeper discussion of credibility and a justification of these points in Section 3.

higher quality than she would with hard information.

(S4) This can trigger a quality reduction by high-cost sellers: Even if they understand the informational constraints of the buyer, they may think they do not receive sufficient compensation for their quality.

If steps (S1)-(S4) hold, high cost relationships may be more difficult to sustain with soft information because mutual understanding about what constitutes a cooperative action in the relationship is harder to achieve.

Turning to our data, we find that the average quality provided in high cost relationships is 5.4 under hard information, whereas it is 5.6 in the soft information treatments, contradicting the hypothesis that reductions in relational knowledge reduce efficiency. To understand this finding better, we examine the data more closely.

First, we find that high cost sellers receive a higher price for the same quality than low cost sellers under hard information, which is consistent with (S1). Buyers are indeed willing to compensate sellers for higher costs, implying that the terms of trade depend on relational knowledge.

Second, consistent with (S2), the cost signal is not truthful in general, though it has some informational value: Almost without exception, the high cost sellers state their type correctly. Two thirds of the low cost sellers, however, also claim to have high costs. Moreover, the buyers' beliefs reveal that they anticipate this behavior, so that doubts about true seller types indeed exist following high cost signals. Thus, under soft information, buyers do not know the true cost type of sellers following high cost signals. Hence the proper compensation of a seller who signals high costs is ambiguous.

Indeed, when buyers observe a high cost signal in the soft information treatment, they indicate significantly higher desired quality for a given price in the first period, compared to the high cost hard information case. It hence appears that they desire altered contractual terms. Nonetheless, step (S3) does not hold: Despite the buyers' doubts and higher demanded quality, the empirical relationship between price and quality in high cost relationships under hard and soft information is not significantly different. This implies that buyers end up compensating sellers as if the cost signal was truthful, so that doubts about seller costs do not lead to lower prices for a given quality. In turn, the expected downward spiral for efficiency (S4) does not materialize. Pairs build and maintain relational contracts on the same terms as under hard high cost information, consistent with the view that maintaining relational contracts is purely a matter of credibility.

Our data also shows that sellers capture 20-50% higher profits than buyers. One cause for this asymmetry might be that sellers move second in the transaction, and their quality choice effectively controls the distribution of rents. For the terms of the contract, it may therefore be decisive who moves second. In particular, the buyers may have been unable to translate doubts about the honesty of sellers into actions because they moved first.

To understand whether this hypothesis has merit, we conducted a second experiment in which we switched the order of moves within the transaction, and structured the transaction via a *bonus contract*. The seller moves first, chooses quality and indicates a desired price. The buyer then moves second and chooses a price. All other aspects of the experiment remain unchanged. The altered order of moves enables the buyer to determine the distribution of the gains from trade through the price choice, potentially better enabling him to directly translate concerns about honesty into action.

This second experiment indeed reveals significant effects of relational knowledge on the terms of the relational contracts in high cost relationships. Under soft information, prices react less to quality, as buyers are not willing to compensate sellers as in the hard information benchmark. However, this reduction in compensation does not negatively affect the efficiency of the relationships. Sellers accept the altered terms under soft information and are willing to provide similar quality as under hard information, despite the reduction in compensation. Consequently, Step (S4) does not apply.

Our paper contributes to the understanding of the role of clarity in building and maintaining relational contracts. We focus on one particular element of clarity, namely relational knowledge about the payoff to cooperation to each party. When sellers have an informational advantage and move second in the relationship, it unfolds as if the cost signal was hard information. If, however, buyers move second, the terms of the relational contract rather seem to reflect the buyers' expectation about the sellers' payoffs from trade and thereby his doubts about the truthfulness of the cost signal. In both cases, however, the efficiency of the relationship is unaltered. Our findings therefore imply that reduced relational knowledge from informational incompleteness can affect relational contracts, although, at least in our setting and with our manipulation through the verifiability of information, not in a way that harms efficiency. The role of clarity in relational contracts has many facets, and our experiment provides initial evidence on the consequences of one key element of clarity.

More generally, our paper contributes to the experimental literature on relational contracting by providing evidence on the formation of relational contracts

with exogenous variation of the informational condition. Brown et al. (2004, 2012) study relationship formation in markets under complete information but with varying market power.[3] Camerer and Linardi (2012) extend the setup of Brown et al. (2004) and include stochastic hiring shocks in which firms cannot hire, and they show that relationships are robust to such shocks. Renner and Tyran (2004) study buyer-seller relationships in markets for experience goods when temporary cost shocks change the terms of the implicit contract. They show that beneficial long-term relationships prevail in such settings, but are prone to price stickiness. Our paper differs from this literature by dealing with persistent asymmetric information about cost types in relational contracts.

By studying asymmetric information in repeated gift exchange games, our paper also relates to the literature on asymmetric information in bargaining (for reviews, see Huck, 1999; Camerer, 2003). For instance, several authors have studied one-shot ultimatum games in which the proposer has private information about the pie size. Most of these papers show that responders give proposers the benefit of the doubt and are more likely to accept low offers (Mitzkewitz and Nagel, 1993; Straub and Murnighan, 1995; Croson, 1996). Our result that buyers take cost signals at face value under soft information in trust contracts is reminiscent of these findings. Ellingsen and Johannesson (2005) study a one-shot game in which sellers first make a sunk cost investment in producing a good, and then make a take-it-or-leave-it offer to a buyer who has a fixed and known valuation of the good. When the seller's investment costs are private information, high cost sellers price less aggressively and low cost sellers price more aggressively, anticipating altered buyer acceptance behavior. This relates to our result in the bonus contract treatments that high cost sellers must accept lower prices under soft information.

The evidence presented in our paper is also broadly related to a growing theoretical literature analysing (infinitely) repeated buyer-seller relationships with persistent hidden information, usually specified as principal-agent relations (Levin, 2003; Halac, 2012; Yang, 2013; Li and Matouschek, 2014; Malcomson, 2015). However, there are several differences between this literature and our set-up which aims at testing the pure effect of reduced relational knowledge on the terms of relational contracts, something that has been proven to be difficult to formalize so far. This literature focuses on questions such as: When can cooperative equilibria with high quality levels be sustained? How do the equilibrium

[3] Brown et al. (2004) show that bilateral long-term relationships in which rents are shared emerge endogenously in markets with excess supply of labor. In Brown et al. (2012), they show that these results extend to markets with excess demand for labor, but bilateral long-term relationships are less frequent.

dynamics look like? Are the equilibria separating, that is, do they reveal the private information to the uninformed party? Most importantly, contrary to our paper, this literature focuses mainly on cases where the efficient actions depend on types, so that efficiency requires separation.

The remainder of the paper proceeds as follows: Section 2 describes the details of our experimental implementation. Section 3 derives hypotheses. Section 4 presents our empirical results for trust contracts. In Section 5, we discuss bonus contracts. Section 6 concludes.

2 Experimental Design

Our experimental design modifies Brown et al. (2004) by considering fixed relationships and allowing for persistent asymmetric information. Subjects are randomly allocated as sellers or buyers. These roles and the relationships remain fixed for the whole experiment, with 15 transactions. In each transaction, the buyer of a good pays a price p and the seller provides this good with costly quality q. The stage game involves "trust contracts": The buyer moves first, paying the price and indicating a desired quality. The seller observes the price and the desired quality, and can then freely choose quality. Thus, quality cannot be enforced.

We vary the buyer's information about the seller's cost type. In each session, it is common knowledge that 50 percent of the sellers will be randomly assigned to high and low cost types, respectively. Prior to the interaction, each seller learns his own type. In our hard information treatments, a buyer also learns the seller's true type before the interaction begins. In the soft information treatments, the seller holds private information about his type, and he can send the buyer a cheap talk signal about his type after learning it. The seller can select the signal independent of his true type, and the buyer knows this.

2.1 Parameters

In each transaction, the buyer chooses a price p from $[0, 100]$ and the seller selects a quality q from $\{1, 2, \ldots, 9, 10\}$. The desired quality q^d is chosen from the same set. For given choices of p and q within a round, a buyer's material payoff $\Pi_B(p, q)$ and the seller's material payoff $\Pi_S(p, q, \theta)$ are given by

$$\Pi_B(p, q) = 10 \cdot q - p \text{ and } \Pi_S(p, q, \theta) = p - c(q, \theta)$$

where $c(q, \theta)$ is the cost of quality q given cost type $\theta \in \{L, H\}$ as summarized in Table 1 below. Costs are strictly and marginal costs are weakly increasing in quality, for each cost type. For any $q > 1$, $c(q, L)$ is strictly lower than $c(q, H)$. The difference between high and low costs, $c(q, H) - c(q, L)$, is increasing in q. Yet, since the marginal benefit of quality for a buyer always strictly exceeds the marginal cost, the efficient quality is 10 under both cost regimes.

In all treatments, and before the interaction took place, every seller is randomly assigned to type L or H and then privately informed about it. After observing their type, sellers in the soft information treatments choose between the message "I have low costs." and the message "I have high costs.", irrespective of their actual type. Hence, sellers are free to either be honest or to lie about their type. A message can only be chosen at the beginning of the experiment and cannot be reversed later. A buyer receives the message selected by her seller and is informed that she will never obtain definite information about her seller's true costs. In the hard information treatments, a buyer receives either the message "Your seller has high costs." or the message "Your seller has low costs.", depending on the true costs of her seller.

2.2 Procedures

Assignment to the roles of buyers and seller as well as the matching of buyers and sellers are random, and each match persists for fifteen rounds. At the end of each period, both players receive a summary of their choices in the current round including the price and quality as well as the desired quality. Every subject is additionally informed about the own material payoff in the current round in terms of the experimental currency "Punkte" (points). The sum of payoffs, taken over all rounds, is converted into real money at the end of the experiment (10 points=1 CHF($1)) and paid out with the show up fee (10 CHF). In the soft information treatments, we additionally elicited buyers' first-order beliefs about the accuracy of the cost signal after the last interaction. We furthermore elicited sellers' second order beliefs about their buyers' first order beliefs.[4]

The experiment was computerized using the software z-tree (Fischbacher,

[4]We asked each buyer about all sellers' message choices, rather than about his actual seller. For instance, in a session with 16 sellers where 8 are assigned to low costs, we asked: "8 out of 16 sellers were assigned to low costs. How many of these sellers with true low costs sent the message "I have low costs." to their buyers?". In a session with 16 sellers where 8 are assigned to low costs, sellers were asked: "Your buyer was asked the following question: '8 out of 16 sellers were assigned to low costs. How many of these sellers with true low costs sent the message "I have low costs." to their buyers?' What do you believe: which answer did your buyer provide in response to this question?". Subjects earned an extra 20 points for each question if their stated belief was correct.

2007). For organizing and recruitment, we used the software hroot (Bock et al., 2014). Our subject pool consists primarily of students at the University of Zurich and the Swiss Federal Institute of Technology in Zurich. In total, 244 subjects participated in the experiment between Fall 2013 and Summer 2014. No subject participated in more than one session. On average, a session lasted 95 minutes with an average payment of 44.7 CHF ($ 45). An overview of the treatments and number of subjects and sessions is shown in Table 2.

3 Hypotheses

Our hard information treatment corresponds to a finite horizon game with complete information which clearly has a unique subgame-perfect equilibrium with minimal qualities and prices in every period. Similarly, there are no perfect Bayesian equilibria with cooperation in the incomplete information game corresponding to the soft information treatment. Previous repeated games experiments suggest, however, that cooperation is likely to arise.

One potential reason for cooperation in finitely repeated games is that some players are committed to fair behavior.[5] We suppose that players are privately informed about whether they have such a "fair type" rather than a standard "selfish type".[6] Specifically, we assume that a fair type chooses an equal split of the surplus as long as he is not certain that the other player is a selfish type.[7] Thus, even the case with complete cost information becomes a game of incomplete information. For sufficiently high shares of fair types, there exists an equilibrium with pooling at the highest quality level where the selfish types imitate the fair types until the penultimate period, and, in the last period, the

[5]One can also take an as-if approach by arguing that subjects have limited foresight and hence behave in a way that is broadly consistent with equilibrium behavior in infinitely repeated versions of the game, except for end game effects. The advantage of this approach is that it generates simple results on the equilibrium sets.For instance, it is straightforward to show that the quality-price combinations that are sustainable as trigger-strategy equilibria for complete information with high costs for any given discount factor are identical to those that arise in pooling equilibria in trigger strategies under incomplete information. Credibility is therefore unaffected and, in this sense, the infinite horizon approach provides no reason why behavior in high cost relationships with hard and soft information should differ. This approach as well as the predictions based on fairness types are spelled out in detail in the Web Appendix.

[6]In other contexts, commitment types have been used for a long time ((Kreps et al., 1982)).

[7]Thus, fair sellers choose qualities such that the surplus calculated on the basis of this quality and the previous price of the buyer is the same for both players. For instance, the low type who has received a price of 53 chooses the efficient action 10, which generates a buyer surplus 100-10-53=37 and a seller surplus 53-16=37. Fair buyers choose prices such that the surplus calculated on the basis of this price and the previous quality of the buyer is the same for both players. For instance, a fair buyer who observes quality 10 in the previous period sets a price of 53. In period 1, fair buyers choose a price that would split the surplus in half for the highest quality choice of the seller, that is, they give the seller the benefit of the doubt.

selfish buyers still pool with the fair buyers so as to induce high qualities from the fair sellers (see Web Appendix, Section 2.1).

What happens in this game when incomplete cost information is introduced? In this case, the buyer can no longer know with certainty which price is "fair" in the sense that it splits the surplus equally. We consider two extreme cases in which the buyer and seller mutually agree on a fair price.

As a first polar case, suppose that the high-cost seller considers the complete information (surplus-splitting) fairness price (for high costs) as an adequate response to a high cost signal. Suppose further that the fair buyer is credulous, that is, prepared to pay this fairness price, accepting the signal at face value. In this case, the game has an efficient pooling equilibrium under exactly the same conditions as with complete information (See Proposition 5 in the Web Appendix).[8] This leads to the following null hypothesis (or *credibility hypothesis*):

Hypothesis 1. *The average quality in actual high cost relationships is the same with soft and with hard information.*

We now provide arguments for why the verifiability of information might nevertheless matter for quality (and thus for efficiency). First, in the above fairness model, we consider the second polar case, and assume that the buyer is sceptical, that is, she thinks the signal is completely uninformative about the cost type (Web Appendix 2.2.1). As a result, she is prepared to pay a fairness price that equalizes expected surplus, that is, a weighted average of the fairness price under complete information with high and low costs, respectively. Suppose that the seller has the same perception of what a fair price is. In such a setting, it turns out that the efficient pooling equilibrium is easier to sustain than under complete information: The required share of fair sellers is lower, because the high-cost sellers understand they cannot ask for as much as under complete information. Consequently, it might even become easier to sustain efficient pooling equilibria with high cost types.

When we move away from these two polar cases, disagreements about what constitutes the fair price can arise more easily then in the case in which the

[8] In this argument, we have ignored the possibility that fair sellers also have a preference to truthfully reveal their cost type. If this were the case, unfair low cost sellers could be more likely to send a high cost signal. In consequence, the share of fair sellers conditional on a high cost signal might be reduced. However, it is not clear at all whether fairness and honesty are correlated in such a setting. It has been shown that people exploit so called "moral wiggle room" (Dana et al., 2007; Lazear et al., 2012) in order to behave more selfishly. Applied to our game, fair low cost sellers exploit the lack of transparency with respect to costs in the cost signal stage to gain higher rents in the relationship. Once they engage in the buyer-seller relationship, however, there is transparency with respect to fairness conditional on the signal, so fairness preferences of sellers induce them to behave like high cost fairness commitment types.

generated surplus is common information. If buyer and seller lack a common understanding of what is fair due to the reduction of relational knowledge in the soft information treatment, building and sustaining the relational contract becomes difficult. To illustrate this scenario, consider a setting where fair sellers are committed to surplus sharing and both players regard a weighted average of the complete information fairness prices for high and low costs as adequate (Web Appendix, Section 2.2.2). However, they disagree about weights. A seller who knows he has high costs regards a higher price as fair than a buyer is prepared to pay when he is uncertain about the true costs. Even small disagreements of this kind can lead to an equilibrium where cooperation slowly breaks down. After a high cost signal, the buyer pays a slightly lower price than a high-cost seller considers adequate for the highest quality level. As the resulting quality of the seller does not quite satisfy the buyer, she responds with a slight price reduction. By iteration, a downward spiral of qualities and prices emerges in equilibrium, implying the *clarity hypothesis*:

Hypothesis 2. *With soft information, the average quality in high cost relationships is lower than with hard information.*

In general terms, the analysis shows that, as long as trading parties can agree on the fair price, the constraints on sustaining a relational contract following a high cost signal are either the same or weaker than with soft information, compared to the complete information high cost case. However, incomplete information introduces ambiguity about what price is fair. The implied potential for a mismatch in fairness views between buyers and sellers can then lead to a breakdown of cooperation, as outlined in our steps (S1) - (S4) in the introduction.

4 Results

We have argued that with soft information there may be disagreements about fair prices, and thus it may be more difficult to sustain relational contracts under high costs than with hard information, despite the fact that credibility constraints are not tightened. In this section, we present our main results and relate them to the four steps (S1) - (S4) that we outlined in the introduction.

The two panels in Figure 1 show average quality over time for high and low cost relationships, conditional on whether cost information is hard or soft.[9] Because our hypotheses are derived for high cost relationships, we will first

[9]Here, we ignore the cost signal sent by the seller at the beginning. However, high cost sellers are our main focus, and all but one high cost seller indicated high costs.

focus on these. Later we will discuss some insights for low-cost relationships. The left panels strongly suggests that the informational environment has no systematic effect on quality in high cost relationships. Average quality on high cost relationships under hard information is 5.4, and 5.6 under soft information. This difference is insignificant, using a t-test (p-value: 0.75).[10] This observation leads to our first result:

Result 1. *[The Effect of Information] In high cost relationships, the average quality is not significantly different with hard and soft information.*

Our data therefore does not allow us to reject our *credibility hypothesis*. Contrary to the clarity hypothesis, reduced relational knowledge due to soft information seems to have no effect on the average quality in high-cost relationships. To understand where our four-step logic failed, we will consider each step in detail.

Step (S1) in our chain of reasoning suggests that, under hard information, high cost sellers should receive more compensation for quality than their low cost counterparts. Our data confirms this intuition:

Result 2. *[Price-Quality Relationship] (i) There is a positive relation between average price and average quality for any cost level. (ii) Quality is significantly less sensitive to prices in low cost relationships than in high cost relationships.*

Evidence for this result is shown in Figure 2, which plots average prices and average qualities for every trading relationship conditional on costs. The quality-price relationship is positive for both cost structures, and it appears to be flatter for low cost relationships. Column (1) of Table 3 confirms this observation. In a Tobit regression of paid prices in the hard information treatment, we first see a large and significant coefficient of 7.4 on *Quality*, indicating that one unit of higher quality is compensated with a 7.4 points higher price in high cost relationships. Moreover, the interaction between quality on low costs is -1, implying that the slope of the price-quality relationship is flatter under low costs. The difference is significant ($p < 0.05$).

Do buyers doubt whether signals are true? Table 4 shows the relative frequency of high cost signals, conditional on true costs. High cost sellers almost unanimously indicate high costs, as do roughly two thirds of the low cost sellers. Further, the table shows that the buyers approximately expected this frequency, as indicated by the first order beliefs, and sellers believed that buyers believed

[10] The t-test is conducted using the average quality provided in a trading relationship as one observation. Hence, there are 29 observations from hard information high cost relationships and 32 observations from soft information high cost relationships.

that low cost sellers would indicate high costs with roughly the actual empirical frequency (as indicated by the second order beliefs).[11] Hence, the empirical frequency of high cost signals by low cost sellers coincides with the beliefs of buyers as well as sellers.[12] Consistent with step (S2), the belief data therefore implies that buyers had (justified) doubts about the cost type of sellers with high signals.

Moreover, when buyers are confronted with a high cost signal in the first period, they translate these doubts into action. They ask for higher quality increases in response to any price increase than buyers in the hard information treatment who are matched with high cost sellers. This follows from column (1) of Table 5, which shows results from a Tobit regression of desired quality on a hard information treatment dummy, interacted with the price paid up front.[13] In column (1), we focus on the first period. As there has been no previous interaction, but the buyer already received the cost signal, the first period provides the cleanest indication for the quality that buyers consider appropriate for the price paid by them. Here, we include all buyers who observed a high cost signal in the regression, independent of their sellers' true costs. From the hard information treatment, only high cost relationships are included.

Column (1) shows that, for 10 additional points paid up front to the seller, buyers demand .64 units of quality less when they know for sure that the seller has high costs, compared to the case in which they received the non-verifiable high cost signal. This interaction is significant at the 10% level. However, it turns out that, contrary to our conjecture in Step (S3), these doubts did not translate into lower prices for a given quality: Column (2) of Table 3 shows tobit regressions on prices that control for the different treatments, taking into account cost signals and quality. HL is a dummy for relationships with hard information and low cost. SH stands for relationships with soft information and high cost, independent of the cost signal.[14] SLL and SLH are dummies for relationships with soft information and low cost, with low and high signal, respectively. The baseline category consists of high cost relationships under hard information.

The highly significant coefficient on quality again captures the positive relation between quality and prices in high cost relationships under hard information.

[11] t-tests show that the actual frequencies of signalling high costs are not significantly different from the elicited first order beliefs of buyers ($p = 0.53$, t-test) and the second order beliefs of sellers ($p = 0.76$, t-test).

[12] For the more obvious case of high cost sellers, it was generally expected that they truthfully signal high costs, which is also what is empirically observed.

[13] We use Tobit regressions for all our regression analyses of chosen prices and quality levels to account for corner solutions, which appear frequently, in particular for quality choices.

[14] This signal was high in all but one case.

The interactions of our treatment and signal dummies with quality are of particular interest, since they directly indicate whether the quality-price relationship is different from the baseline case with high costs and hard information. Indeed the quality-price relationship is significantly flatter in low cost hard information relationships and in relationships in the soft information treatment in which low cost sellers indicated low costs. However, such a difference to the baseline neither arises for high cost relationships with soft information nor for low cost relationships with soft information in which the seller indicated high costs. This implies that the compensation of sellers who signal high costs with soft information is similar as for sellers with high costs under hard information. Moreover, the coefficient on the interaction for sellers who signal low costs with soft information is not significantly different from the coefficient on the interaction for actual low cost sellers under hard information. Thus, we obtain the following result.

Result 3. *[Quality-Price Relationships with soft information] In the trust contract games with soft information, buyers compensate sellers as if the cost signal was truthful.*

The result shows why soft information has no adverse effect on efficiency: Even though buyers doubt that high costs are truthful, they behave as if they were taking them at face value. This also becomes evident in column (2) of Table 5, where observations from all periods are considered. The sizeable and significant negative interaction between hard information and paid prices from Period 1 essentially disappears when all periods are considered. Consequently, buyers appear to accept similar terms as in the hard information case. This behavior helps to maintain the same efficiency levels as under hard information.

Our data from low cost relationships also provides some noteworthy insights. First, Figure 1 suggests that the average quality is lower in high cost relationships than in low cost relationships with hard information. The difference in average quality between low and high cost relationships with hard information amounts to 1.35 points ($p = 0.03$, Mann-Whitney test).[15] The lower prospective future rents in high cost relationships have a detrimental effect on cooperation and efficiency, as one would expect from standard results on relational contracting.

Moreover, at first sight Result 3 seems to suggest that low cost sellers profit from signalling high costs with soft information, as it enables them to obtain

[15] Average quality is higher in low cost relationships in 14 out of 15 periods. The quality difference between low and high cost relationships is also confirmed in a tobit regression that accounts for the frequent corner observations at quality levels of 1 and 10 as well as for period fixed effects that account for the end game effect. The coefficient on the high cost relationship dummy in this regression is significant at the $p = 0.06$ level.

higher prices for a given quality. However, the evidence does not support this conjecture, because costs affect quality as well as prices: Low cost relationships with high cost signals are less efficient than low cost relationships with low cost signals. Table 6 provides evidence for this finding. It shows results from a Tobit regression of quality on dummy variables for different combinations of true costs and cost signals.[16]

Relationships in which the seller sent a low cost signal under incomplete information are significantly more efficient than high cost relationships under complete and soft information ($p = 0.05$ for the latter). Low cost relationships in which a high signal was sent, however, are not significantly more efficient than actual high cost relationships, and they are also significantly less efficient than low cost relationships in which a low cost signal was sent ($p = 0.08$). There are two potential explanations for these patterns in the low-cost relationship data. First, reflecting our discussion of credulous buyers in Section 4, players under soft information might behave as if the cost signal was truthful, which would explain why relationships with soft information conditional on the cost signal so closely mirror their hard information counterparts. Second, instead the cost signal might not have an efficiency effect, and the quality differences might simply reflect selection of specific seller types with different abilities to maintain efficient relationships based on the cost signal.[17]

While we have already seen that efficiency in high cost relationships is unaffected, we see that the terms of the relational contract have changed and that buyers and sellers coordinate on different equilibria with soft information, resulting in differences in distributional outcomes. From Figure 2 above, we see that prices are generally higher than the equal split price, indicated by the solid lines. Thus, sellers get a disproportionately large share of the surplus: Table 7 summarizes the average profits earned by buyers and sellers across the different treatments.

Table 7 confirms the pattern already visible in Figure 2. Sellers capture significantly larger rents than buyers, except in low cost relationships with soft

[16]The analysis of the impact of cost signals should not be understood as causal, since cost signals are endogenous to individual characteristics, and hence selection may take place conditional on the signal. Nevertheless, the associations in the data are interesting.

[17]These hypotheses could be analysed in future experiments. For example, one could conduct a within-subject design in which subjects participate in both a complete and the soft information treatment. This would allow to test the hypothesis that those sellers who are involved in less efficient relationships under hard information are more likely to signal high costs with soft information. Another possibility would be to conduct a treatment in which the cost signal is random. If there is a treatment effect related to the high cost signal in the latter case, selection cannot be the explanation. Since these questions are not the main focus of this paper, we leave these suggestions for future research.

information in which low costs were signalled. The largest payoff difference materializes in low cost relationships with soft information in which high costs were signalled. However, somewhat surprisingly, the table also reveals that low cost sellers who signal high rather than low cost are not better off than those who signal truthfully. The fact that relationships on average feature a lower quality following a high cost signal fully makes up for the higher prices conditional on quality, so that sellers' payoffs under complete and soft information are about the same. The efficiency loss relative to complete information low cost relationships is fully borne by the buyers, who make significantly smaller profits when the seller signals high rather than low costs.[18]

One potential reason for the high payoff share of the sellers might be that they move second and therefore control the distribution of rents. This suggests that the order of moves may play an important role in selecting the terms of the contract. We now deal with this point in detail.

5 Bonus Contract Games

Since our hypothesis on possible adverse effects of reduced relational knowledge relates to uncertainty about rent distribution, the uninformed party may require power over the distribution of rents within a transaction to translate its uncertainty into meaningful action. To test the role of second-mover rent control, we conducted another experiment in which the buyer moves second and therefore directly controls the distribution of rents through his action.

5.1 Experimental Design: The Bonus Contract Game

We carried out eight sessions of a "bonus contract game", which is similar to the trust contract game, except that the order of moves within the stage game is reversed. In every period, the seller moves first, chooses quality and incurs the associated cost. In addition, he indicates a desired price. After observing these choices, the buyer sets the transaction price. Thus, again neither quality nor price is contractible.

As before, the stage game is repeated for 15 periods. We conducted 4 sessions with hard information and 4 sessions with incomplete information. As in the trust contract games, information concerns the cost type of the seller ("high" or

[18] Again, this is an association and not a causal relationship. It could be the consequence of selection, as discussed before. Considering low cost relationships independent of the cost signal, buyers on average earn 4 points less per period with soft information than under hard information, but this difference is not statistically significant ($p = 0.15$).

"low)". In the hard information treatments, the seller's cost type was common knowledge, whereas in the soft information treatments, the seller could send a non-verifiable cost signal.[19] In total, 252 subjects participated in the additional experiments. No subject participated in more than one session, and no subject had previously participated in the trust contract treatments. On average, a session lasted 95 minutes with an average payment of 52 CHF ($ 52).

5.2 Results

Figure 3 shows average quality in low and high cost bonus contract relationships during the 15 periods under hard and soft cost information. Again, we assess our main hypothesis by only considering high cost relationships, in which credibility is not reduced by soft information. Average quality in hard and soft information treatments is similar, 7.39 and 7.07, respectively. The difference is not statistically significant ($p = 0.51$, Mann-Whitney Test). Therefore, as in the trust contract experiments, the lack of payoff clarity does not appear to have a negative impact on efficiency in relational contracts.

Table 8 analyses the determinants of quality using Tobit regressions, containing observations from both the trust contract and the bonus contract experiments. Column (1) shows coefficients of a regression of quality in high cost relationships on treatment dummies and their interactions. If, as hypothesized, the second mover advantage affects quality, the bonus treatment dummy and the soft information treatment dummy should interact negatively. Column (1) confirms that this interaction is indeed negative and roughly equal to 0.9 quality points. This suggests that moving from the trust contract games to the bonus contract games, an efficiency-reducing effect of soft information may be present, but the interaction is not significant. Consequently, we cannot reject the hypothesis that soft information does not reduce efficiency, no matter who controls rent distribution in the stage game. A lack of payoff clarity therefore does not seem to negatively impact the efficiency of relational contracts.[20]

Result 4. *[Verifiability of Information and Bargaining Power] Keeping credibility constraints constant, the efficiency of relational contracts does not differ significantly with hard and soft information, independent of who controls the rent distribution in the stage game.*

[19] Again, the experiment was computerized using the software z-tree (Fischbacher, 2007). For organizing and recruitment, we used the software hroot (Bock et al., 2014).

[20] Column (2) in Table 8 shows that information does not have a significant impact on average quality in low cost relationships either, even though the cost signals are not all truthful.

Table 8 provides a further interesting insight that is independent of the informational condition: The coefficient on the bonus contract dummy in Columns (1) and (2) in Table 8 reveals that bonus contract relationships significantly outperform trust contract relationships.[21]

Turning back to the impact of the verifiability of information on efficiency, we again analyse Steps (S1)-(S4)in detail and assess which of these do not apply. To this end, Figure 4 shows a scatter plot of the average quality and price in each hard information bonus contract relationship over the course of the 15 periods. The solid lines again depict the price that would lead to an equal split of the rent, given average quality.

As in the trust contract case, higher quality is rewarded with higher prices, and sellers with higher costs are rewarded with higher prices for a given quality than low cost sellers. This can be seen in Table 9, which shows results from a tobit regression on paid prices. The coefficient on *Quality* shows the significant and positive relationship between average prices and quality in high cost relationships under hard information. The coefficient on the interaction between hard information low costs and quality is significantly negative, indicating that the quality-price relationship is significantly flatter for low cost relationships with hard information, consistent with (S1).

Moreover, similar to the trust contract games, all high cost sellers and 77.4% of the low cost sellers signal high costs in the bonus contract games. First and second order beliefs are again well aligned with these numbers.[22] Thus, buyers have significant (and justified) doubts about true costs when they observe a high cost signal, consistent with (S2).

Further, we argued that buyers might change their behavior in the bonus contract game because they control the distribution of rents in the stage game. First, as conjectured, Figure 4 shows that the second mover controls the rent distribution in the stage game: Quite strikingly, almost all observations are now to the right of the equal rent split line. This implies that, on average, the seller receives a lower price than the rent splitting price, and the buyers consequently receive a larger share of the rents.

But do they use this additional control to translate their doubts in the soft information treatment into lower prices? In Table 9, we see that the quality-price relationship changes significantly when information is incomplete. In actual high

[21] Similar observations have been made in comparisons of one-shot trust and bonus games, the latter usually outperforming the former (see Fehr and Schmidt (2004) and Fehr et al. (2007)).

[22] Buyers on average believe that 69% of low cost sellers would signal high costs. Sellers second order belief about this belief is 68%. These beliefs are not significantly different from the actual frequency ($p = 0.28$ and $p = 0.23$, respectively; t-tests).

cost relationships, buyers on average receive .69 points less compensation for a one point quality increase than with hard information, and this difference is significant.[23] Therefore, the verifiability of information has a clear effect on the quality-price relationship in the bonus contract games. High cost sellers have to accept a lower compensation for the same quality with soft information than with hard information. The buyers' doubts about the truthful revelation of high costs translate into lower prices for a given quality.[24]

Result 5. *[Quality-Price Relationships under Soft Information] In bonus contract games, sellers indicating high costs under soft information get paid significantly less for the same quality than under high information.*

All told, (S1)-(S3) hold: When buyers know that costs are low, they provide less compensation for quality than when they are high. This gives low cost sellers an incentive to mimic high-cost buyers, which leads to doubts of the buyers regarding the truthfulness of high cost signals. As expected, they are therefore less willing to compensate high-cost sellers for quality increases.

The fact that these lower prices did not result in lower average quality means that the final step (S4) in our reasoning is not borne out empirically: Sellers accepted the lower prices without in turn lowering their quality provision. Relationships coordinated on a different quality-price pair than with hard information. It appears that sellers understood the doubts of the buyers and their price reaction, and therefore did not react to the lower prices by reducing quality. Consequently, efficiency was unaffected.

The differences in control over rent distribution translate into considerable profit differences. Table 10 summarizes profits in the bonus contract games. Non-verifiability of information does not harm buyers in high cost relationships. To the contrary, their profits are significantly higher with soft information. This reflects lower prices for a given quality in the soft information treatment, and the fact that these lower prices did not lead to reduced quality. The increase

[23] Moreover, the slope of the quality-price relationship is 1.3 points smaller in relationships with low cost sellers that signalled high costs, and there is no difference in the quality-price relationship for low cost sellers with soft information conditional on the signal. Finally, for low cost relationships with high cost signals, the quality-price relationship is also not significantly different ($p = 0.14$) from the one of high cost relationships under incomplete information.

[24] In the bonus contract treatments, sellers had the possibility to signal a desired price after they provided the quality up front. In a tobit regression of desired prices on provided quality levels interacted with the information treatment, we find that, in the first period, sellers who signalled high costs desire prices that are even 6.4% larger than the prices desired by high cost sellers with hard information. This difference is, however, not significant. Also when all periods are considered, desired prices are no different between the hard and soft information treatments. Hence, sellers would like the buyer to treat the cost signal as truthful. However, as our analysis has shown, they fail to achieve this goal.

in buyer profits therefore corresponds almost one-to-one to a reduction in seller profits, whose profits significantly decrease with soft information.

Further, we again observe that low cost sellers barely benefit from signalling high costs. This result also reflects the lower quality-sensitivity of prices with soft information. Since buyers who received a high cost signal are not willing to pay a considerable premium for a given quality, sellers do not benefit from signalling incorrect costs.

6 Conclusion

This paper has shown that the clarity of experimental trading relationships is adversely affected if information about the rents earned by each party is non-verifiable. If sellers have private information about their costs, a majority of those with low costs signals high cost, presumably in the expectation of gaining an income advantage. When the stage game is structured as a trust contract game in which the buyer pays a price up front and the seller provides quality subsequently, this lack of clarity does, however, not translate into any differences in behavior. Despite their doubts about the truthfulness of the cost signal, buyers compensate quality as if the cost signal was truthful. Consequently, trading relationships in which high costs are signalled are equivalent in terms of average quality and average prices to full information high cost relationships.

However, in the bonus contract setting where the buyer moves second, uncertainty about sellers' costs does affect outcomes. Buyers are less willing to compensate sellers for supposedly high costs. But true high cost sellers accept lower prices in the soft information treatment. Consequently, the reduced compensation of quality does again not translate into reduced efficiency in the relationship. It does, however, lead to less compensation of higher quality by higher prices and thus to effects on the distribution of rents within the relationship.

The effects of the non-verifiability of information on relational contracts are therefore complex. While we find no evidence that the reduction in relational knowledge reduces efficiency, buyers and sellers do coordinate on different price-quality combinations conditional on the relational knowledge and the structure of the stage game. One might ask whether alternative parameterizations of the model would lead to qualitatively different results. Potentially, conflicts could become more pronounced with soft information when the gains from cooperation are smaller than in the current setting. We believe that further exploring the determinants of the formation of relational contracts with soft information and other sources of lack of clarity is a fruitful avenue for future research.

References

Bachmann, R. and A. Zaheer (2006). *Handbook of trust research.* Edward Elgar Publishing.

Bock, O., I. Baetge, and A. Nicklisch (2014). hroot: Hamburg registration and organization online tool. *European Economic Review 71*, 117–120.

Brandts, J. and G. Charness (2003). Truth or consequences: An experiment. *Management Science 49*(1), 116–130.

Brown, M., A. Falk, and E. Fehr (2004). Relational contracts and the nature of market interactions. *Econometrica 72*(3), 747–780.

Brown, M., A. Falk, and E. Fehr (2012). Competition and relational contracts: the role of unemployment as a disciplinary device. *Journal of the European Economic Association 10*(4), 887–907.

Camerer, C. (2003). *Behavioral game theory: Experiments in strategic interaction.* Princeton University Press.

Camerer, C. and S. Linardi (2012). Can relational contracts survive stochastic interruptions? Experimental evidence. University of Pittsburgh, Department of Economics, Working Paper No. 483.

Croson, R. T. (1996). Information in ultimatum games: An experimental study. *Journal of Economic Behavior & Organization 30*(2), 197–212.

Dana, J., R. A. Weber, and J. X. Kuang (2007). Exploiting moral wiggle room: experiments demonstrating an illusory preference for fairness. *Economic Theory 33*(1), 67–80.

Ellingsen, T. and M. Johannesson (2005). Sunk costs and fairness in incomplete information bargaining. *Games and economic behavior 50*(2), 155–177.

Fehr, E., S. Gï¿½chter, and G. Kirchsteiger (1997). Reciprocity as a contract enforcement device: Experimental evidence. *Econometrica 65*, 833–860.

Fehr, E., A. Klein, and K. M. Schmidt (2007). Fairness and contract design. *Econometrica 75*(1), 121–154.

Fehr, E. and K. M. Schmidt (2004). Fairness and incentives in a multi-task principal–agent model. *The Scandinavian Journal of Economics 106*(3), 453–474.

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

Gibbons, R. and R. Henderson (2012). Relational contracts and organizational capabilities. *Organization Science 23*(5), 1350–1364.

Gibbons, R. and R. Henderson (2013). What do managers do? In R. Gibbons and J. Roberts (Eds.), *Handbook of Organizational Economics*. Princeton University Press.

Halac, M. (2012). Relational contracts and the value of relationships. *American Economic Review 102*(2), 750–779.

Huck, S. (1999). Responder behavior in ultimatum offer games with incomplete information. *Journal of Economic Psychology 20*(2), 183–206.

Kartal, M., W. Müller, and J. Tremewan (2017). Building trust: The costs and benefits of gradualism. *work in progress*.

Kreps, D., P. Milgrom, J. Roberts, and R. Wilson (1982). Rational cooperation in the finitely repeated prisoners' dilemma. *Journal of Economic Theory 27*(2), 245–252.

Lazear, E. P., U. Malmendier, and R. A. Weber (2012). Sorting in experiments with application to social preferences. *American Economic Journal: Applied Economics 4*(1), 136–163.

Levin, J. (2003). Relational incentive contracts. *American Economic Review 93*(3), 835–857.

Li, J. and N. Matouschek (2014). Managing conflicts in relational contracts. *American Economic Review 103*(6), 2328–2351.

Malcomson, J. (2015). Relational incentive contracts with persistent private information. University of Oxford, Department of Economics, Economics Series Working Papers No. 634.

Mitzkewitz, M. and R. Nagel (1993). Experimental results on ultimatum games with incomplete information. *International Journal of Game Theory 22*(2), 171–198.

Renner, E. and J.-R. Tyran (2004). Price rigidity in customer markets. *Journal of Economic Behavior & Organization 55*(4), 575–593.

Straub, P. G. and J. K. Murnighan (1995). An experimental investigation of ultimatum games: Information, fairness, expectations, and lowest acceptable offers. *Journal of Economic Behavior & Organization 27*(3), 345–364.

Yang, H. (2013). Nonstationary relational contracts with adverse selection. *International Economic Review 54*(2), 525–547.

Zaheer, A. and N. Venkatraman (1995). Relational governance as an interorganizational strategy: An empirical test of the role of trust in economic exchange. *Strategic management journal 16*(5), 373–392.

Tables and Figures

Table 1: Cost of Quality

q	1	2	3	4	5	6	7	8	9	10
$c(q, L)$	0	0.5	1	2	4	6	8	10	13	16
$c(q, H)$	0	3	6	10	15	20	25	30	36	42

Table 2: Overview: Treatments, Sessions and Participants

Treatment	Number of Sessions	Total Number of Subjects
Trust Hard Information (TH)	4	116
Trust Soft Information (TS)	4	128

Table 3: Prices paid by treatment and cost signal

	(1)		(2)	
hard info - low cost (HL)	–1.372		–1.081	
	(3.940)		(4.043)	
Quality	7.420	***	7.458	***
	(0.415)		(0.423)	
HL X Quality	-1.000	**	–1.043	**
	(0.484)		(0.499)	
soft info - high cost (SH)			0.939	
			(4.073)	
soft info - low cost - low cost signal (SLL)			–4.021	
			(4.092)	
soft info - low cost - high cost signal (SLH)			0.480	
			(4.524)	
SH X Quality			–0.197	
			(0.518)	
SLL X Quality			–1.365	**
			(0.552)	
SLH X Quality			0.091	
			(0.553)	
Constant	1.429		10.573	***
	(3.000)		(0.593)	
Period Fixed Effects?	Yes		Yes	
Pseudo R^2	0.202		0.195	
Observations	870		1830	

Tobit Regressions on paid prices. Lower limit: 0; upper limit: 100. To control for end game effects, period fixed effects are included in the regression. Standard Errors are clustered at the relationship level (122 clusters). Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 4: Fraction of High Cost Signals with Soft Information

	Trust Contract
Overall	81.3 %
High Cost Seller	96.9 %
Low Cost Seller	65.6 %
1st order beliefs (low cost sellers)	71 %
2nd order beliefs (low cost sellers)	63 %

Table 5: Desired quality levels conditional on paid prices and information treatment

	(1)	(2)
hard information treatment	2.082	–0.710
	(1.607)	(1.398)
Paid price	0.127***	0.126***
	(0.016)	(0.013)
hard information*price	–0.064*	–0.008
	(0.037)	(0.028)
Constant	2.558***	3.950***
	(0.684)	(0.666)
Pseudo R^2	0.165	0.155
Observations	81	1215

Tobit Regressions on desired quality on observations for which high costs were common knowledge (hard info treatment) or high costs were signaled (soft info treatment). Lower limit: 1; upper limit: 10. Column (1) only contains observations from the first period. Column (2) contains observations from all periods. In column (2), standard errors are clustered at the relationship level (81 clusters)

Table 6: Tobit Regressions: Incorporating the Cost Signal

	(1)	
hard info - low cost (HL)	2.073	*
	(1.108)	
soft info - high cost (SH)	0.232	
	(1.052)	
soft info - low cost - low cost signal (SLL)	3.371	**
	(1.647)	
soft info - low cost - high cost signal (SLH)	0.492	
	(1.161)	
Constant	5.208	***
	(0.812)	
Pseudo R^2	0.01	
Observations	1830	

Tobit Regression on provided quality. Lower limit: 1; upper limit: 10. Standard Errors in parentheses, clustered at the relationship level (122 clusters). Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 7: Average Profits by Treatment and Cost Signal

	Trust Contracts	
	Buyer	Seller
Hard Info - High Cost	14.27	20.88
Hard Info - Low Cost	26.44	32.24
Soft Info - High Cost	15.27	20.98
Soft Info - Low Cost	22.60	32.48
Soft Info - Low Cost - Low Cost Signal	29.32	31.93
Soft Info - Low Cost - High Cost Signal	19.08	31.34

Table 8: Tobit Regressions: Effect of Non-Verifiability of Information on Quality

	(1)		(2)	
	High Cost		Low Cost	
Soft Info	0.234		–0.652	
	(1.109)		(1.093)	
Bonus Contract	3.808	***	2.529	**
	(1.199)		(1.173)	
Bonus X Inc. Info	–0.891		0.954	
	(1.596)		(1.537)	
Constant	5.178	***	7.313	***
	(0.858)		(0.772)	
Pseudo R^2	0.018		0.017	
Observations	1860		1860	

Tobit Regressions on provided quality. Lower limit: 1; upper limit: 10. Standard Errors are clustered at the relationship level. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 9: Prices paid in Bonus Contract Relationships

	(1)	
hard info - high cost (HL)	0.297	
	(2.203)	
soft info - high cost (SH)	0.171	
	(2.333)	
soft info - low cost - low cost signal (SLL)	1.329	
	(2.308)	
soft info - low cost - low cost signal (SLH)	3.941	
	(4.504)	
Quality	7.467	***
	(0.161)	
HL X Quality	–1.498	***
	(0.320)	
SH X Quality	–0.686	**
	(0.322)	
SLL X Quality	–1.678	***
	(0.406)	
SLH X Quality	–1.302	***
	(0.346)	
Constant	–8.186	***
	(1.410)	
Pseudo R^2	0.165	
Observations	1890	

Tobit Regressions on paid prices. Lower limit: 0; upper limit: 100. To control for end game effects, period fixed effects are included in the regression. Standard Errors are clustered at the relationship level (126 clusters). Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 10: Average Profits in the Bonus Contract Games

	Buyer	Seller
Hard Info - High Cost	26.48	18.81
Hard Info - Low Cost	38.48	27.85
Soft Info - High Cost	30.12	13.65
Soft Info - Low Cost	37.69	31.8
Soft Info - Low Cost - Low Cost Signal	40.2	33.53
Soft Info - Low Cost - High Cost Signal	36.96	33.39

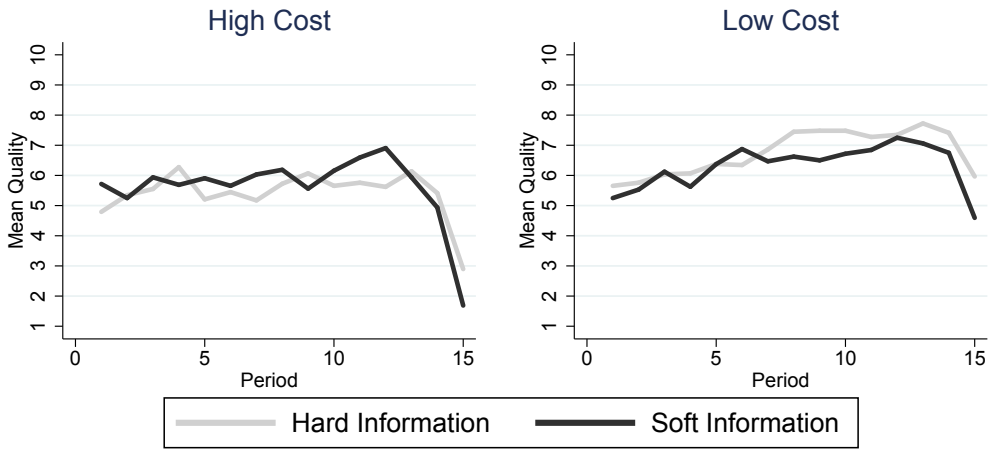

Figure 1: Quality over time in Trust Contract relationships. Left Panel: High Cost relationships under hard and soft information. Right Panel: Low Cost relationships under hard and soft information.

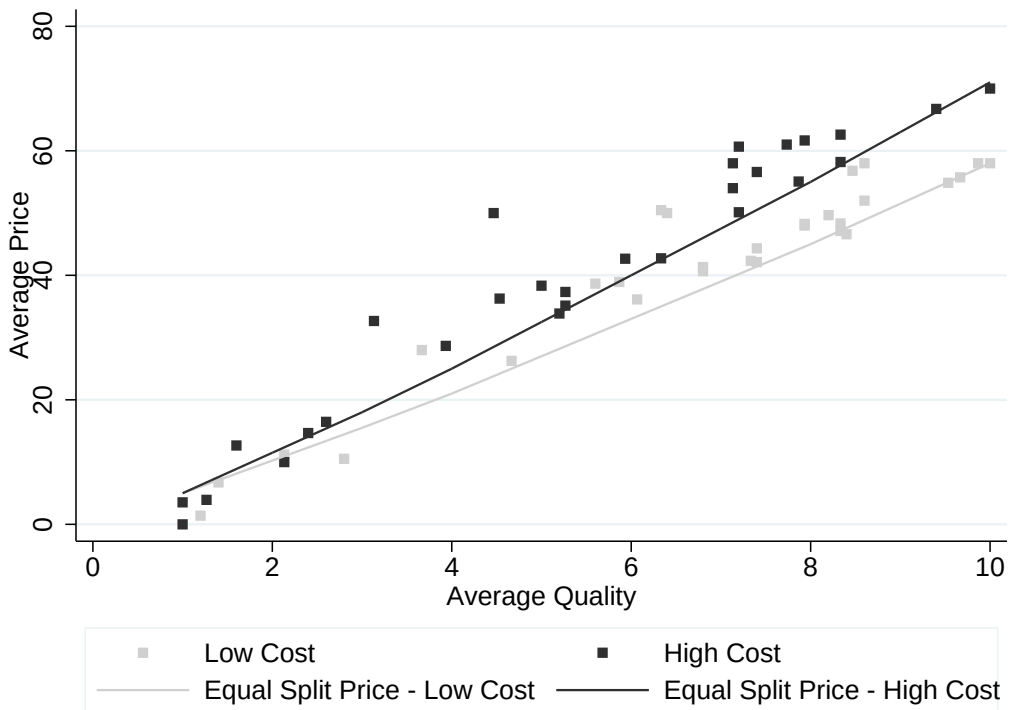

Figure 2: Association between price and quality. Each dot represents one relationship and depicts the average price and quality provided over the 15 periods in the relationship.

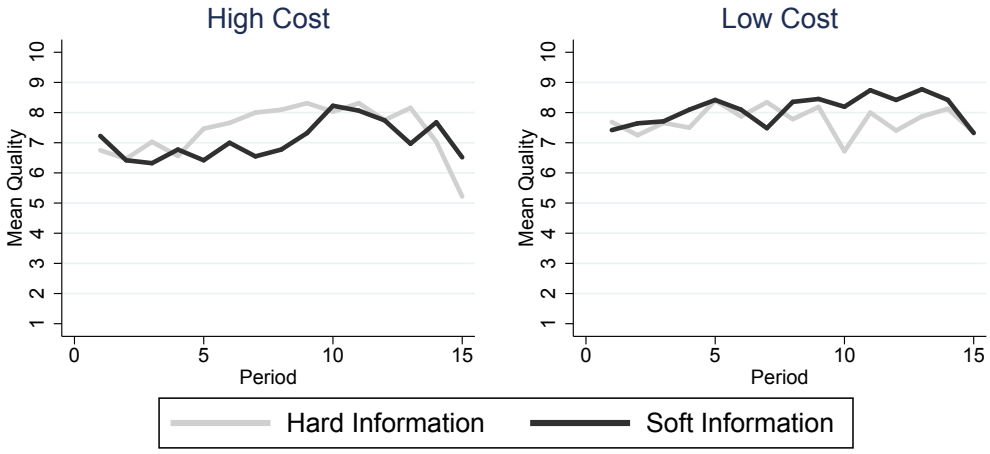

Figure 3: Quality over time in Bonus Contract relationships. Left Panel: High Cost relationships under hard and soft information. Right Panel: Low Cost relationships under hard and soft information.

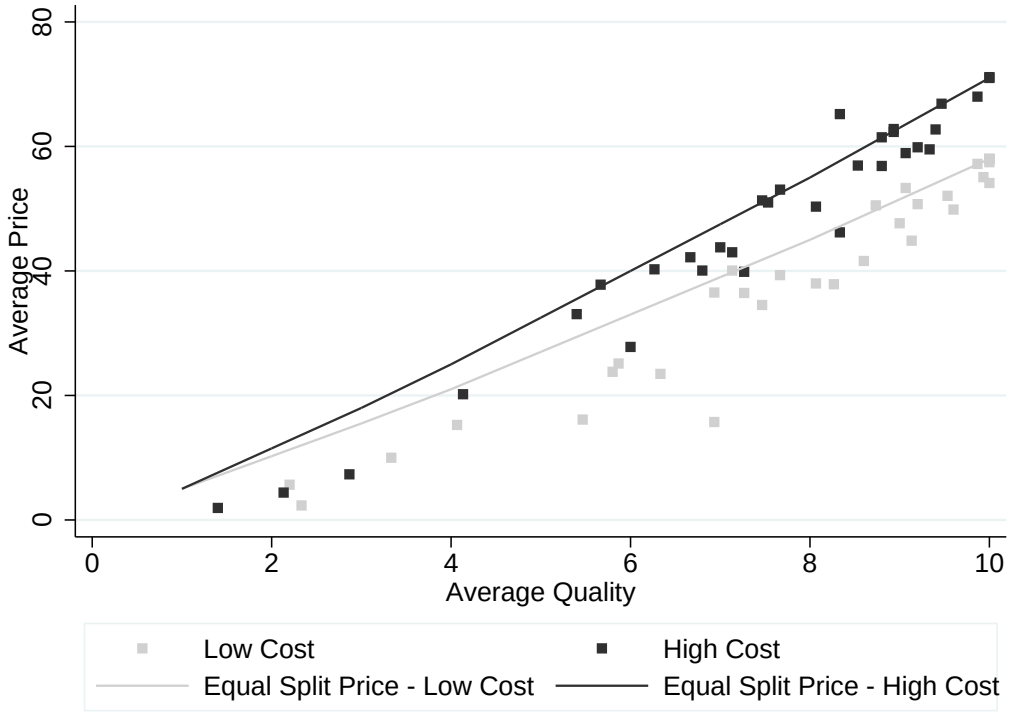

Figure 4: Association between price and quality in bonus contract relationships. Each dot represents one relationship and depicts the average price and quality provided over the 15 periods in the relationship.