The Complementarity Between Trust and Contract Enforcement

Björn Bartling, Ernst Fehr, David Huffman, and Nick Netzer*

April 14, 2021

Under weak contract enforcement the trading parties' trust, defined as their belief in other's trustworthiness, appears important for realizing gains from trade. In contrast, under strong contract enforcement beliefs about other's trustworthiness appear less important, suggesting that trust and contract enforcement are substitutes. Here we show, however, that trust and contract enforcement can be complements, and identify the key mechanisms that drives this complementarity. We demonstrate that under weak contract enforcement trust has no effect on gains from trade, but when we successively improve contract enforcement, larger effects of trust emerge. Likewise, improvements in contract enforcement lead to no increases in gains from trade under low initial trust, but generate high increases in gains from trade when initial trust is high. We identify three key mechanisms: (1) heterogeneity in trustworthiness; (2) strength of contract enforcement affecting the ability to elicit reciprocal behavior from trustworthy types, and screen out untrustworthy types; (3) trust beliefs determining willingness to try such strategies.

Keywords: Trust, contract enforcement, complementarity, equilibrium selection, causal effect, screening, belief distortions, institutions

JEL: C91, D02, D91, E02

* Bartling, Fehr, Netzer: Department of Economics, University of Zurich, Blümlisalpstrasse 10, 8006 Zurich, Switzerland, e-mail: bjoern.bartling@econ.uzh.ch, ernst.fehr@econ.uzh.ch, nick.netzer@econ.uzh.ch. Huffman: Department of Economics, University of Pittsburgh, 4901 Wesley Posvar Hall, 230 South Bouquet Street, Pittsburgh, PA 15260, USA, e-mail: huffmand@pitt.edu. A previous version of this paper has been circulated under the title "The Causal Effect of Trust."

1. Introduction

Incomplete and imperfectly enforceable agreements are ubiquitous in economic life. Informational constraints render it impossible in many cases to govern all conceivable contingencies in a contract and to verify all enforcement-relevant information. Moreover, weak judicial systems render it infeasible or extremely costly in many countries to enforce contractual promises even when informational constraints are not binding.[1] The contracting parties are therefore exposed to the threat of being cheated and they may only be willing to interact and realize the associated gains from trade if they trust that the other party will not take advantage of them. It has therefore been argued that trust is of fundamental importance for achieving economic efficiency (see, e.g., Banfield, 1958; Arrow, 1972; Coleman, 1990; Putnam, 1993, 2000; Fukuyama, 1995). The scope for trust to shape economic outcomes appears broad. Trust can affect individual-level economic interactions, the efficiency of organizations, the functioning of entire markets, and even economic development and growth at the country level.

It is quite evident that trust, which we define in this paper as people's beliefs in the trustworthiness of others, matters when contracts are incomplete or imperfectly enforceable. It is, however, less clear and to the best of our knowledge an unstudied question whether trust and contract enforcement are *substitutes* or *complements* for the realization of gains from trade. Depending on the answer to this question, fundamentally distinct policy implications result. In this paper, we study experimentally and theoretically the nature of the interaction of trust and contract enforcement.

Intuitively, trust appears to be more important in environments with lower contract enforcement because the scope for cheating on the trading partner is higher. Therefore, more trust is required to initiate or execute a trade. Thus, if both trust and contract enforcement are causal factors in the realization of gains from trade, it appears that a lower level of trust can be compensated for by a higher level of contract enforcement, and vice versa, to achieve a given realization of gains from trade. In other words, trust and contract enforcement would be substitutes that can be varied independently to increase the realization of gains from trade. If this were true,

[1] Djankov et al. (2008)—who study debt enforcement in 88 countries around the globe—report, for example, that a worldwide average of 48 percent of the asset's value is lost in debt enforcement, and North (1991) suggests that lack of contract enforcement is one of the key obstacles to economic development.

policies aimed at improving economic performance could be effective if they focused solely on formal institutions, for example seeking to improve the judicial system in order to enable better contract enforcement—even if levels of trust remained low. Likewise, policies aimed at moving a society out of a low-trust trap, such as public awareness campaigns that promote codes of conduct or advertise role models of trustful business relations, could be effective—even if formal institutions remained weak and ensured only very imperfect contract enforcement. If, however, trust and contract enforcement were complements, the above policies might remain fairly ineffective if pursued in isolation. Policies would then be more likely to be successful if they simultaneously improve formal institutions that ensure better contract enforcement *and* raise trust levels.

In this paper we report the results of controlled experiments showing that trust and contract enforcement can be complements for the realization of gains from trade. We show, in particular, that an independent improvement in contract enforcement at low levels of trust generates no or only small increases in gains from trade, while improvements in contract enforcement cause large increases in the average gains from trade at high trust levels. Likewise, our data indicate that an increase in trust leads to no improvement in the gains from trade if contract enforcement is weak but to high increases in gains from trade when contract enforcement is strong. Our results are based on the exogenous variation of trust and contract enforcement in a laboratory experiment involving principals and agents who face profitable trading opportunities in an experimental market. The key advantage of this approach is that it allows for a clean separation of the effects of trust and contract enforcement and their interaction on the realized gains from trade.

What are the economic and psychological mechanisms that drive the complementarity between trust and contract enforcement? To provide deeper intuitions into the underlying mechanisms, we need to provide a bit more detail about the experiment.

Our experiment involves principal-agent interactions, where the principals make contract offers in an experimental market by promising to pay a wage and requesting an effort level from the agents, while the agents choose the actual effort level after they accepted an offer. The gains from trade are increasing in effort, but there is a conflict of interest as higher effort benefits the principal while being costly for the agent. In all of our treatments, the enforcement of effort is imperfect because effort is not third party verifiable and thus not contractible. Subjects interact in

markets of seven principals and ten agents for 15 periods. In a given period, a match between a principal and an agent occurs if an agent accepts a principal's offer.

We implement variation in the contractual environment by varying the degree of contract enforcement as follows. In our *weak contracting environment*, the principal can pay any wage to the agent, irrespective of the wage that was promised in the contract.[2] The principal and the agent simultaneously choose the actual wage and actual effort after the agent accepted the contract. In addition, the parties face an informational constraint that prevents them from making contracts contingent on signals of past behavior. We implement this constraint by scrambling (i.e., re-randomizing) the ID numbers of principals and agents across periods such that interactions remain one-shot. In our *medium contracting environment*, we improve contract enforcement by rendering the principals' wage promises legally enforceable, i.e., the principal is forced to pay the promised wage. Otherwise, this treatment is identical to the weak contracting environment. Our *strong contracting environment* adds an additional improvement in contract enforcement by keeping identification numbers the same across rounds. This allows principals to make their contract offers contingent on signals about the agents' previous effort choices.

We implement (and verify) variation in principals' *initial trust* about the agents' trustworthiness by showing the principals, before the start of the experiment, examples of real historical effort choices in experimental sessions in which the agents either exhibit trustworthy behavior (shown in our high-trust treatments) or untrustworthy behavior (shown in our low-trust treatments). If the principals' trust has a positive causal effect we should observe it by comparing the high-trust treatments with the low trust treatments.

How do we explain our finding that the impact of trust actually depends on strength of contract enforcement, and vice versa? Our investigation of mechanisms suggest three key ingredients: (1) heterogeneity in agents' trustworthiness; (2) an impact of contract enforcement on the ability of principals to elicit high efforts from trustworthy agents, and to distinguish trustworthy from untrustworthy agents and engage in reciprocal relationships with the former; (3) an impact of principals' initial trust on their willingness to try such strategies.

[2] This contracting environment may reflect a weak or inefficient judicial system—as is often the case in developing countries—or informal contracting with merely verbal promises. In developing countries a large share of workers, sometimes even a majority, is employed casually in the informal sector (Banerjee and Duflo 2007, La Porta and Shleifer 2014, McCaig and Pavcnik 2015).

Regarding the first ingredient, a large experimental literature indicates that there is heterogeneity in trustworthiness, and our data are in line with this as well. Previous studies have shown that many agents are trustworthy, in that they are willing to reciprocate with high effort if they are offered high, generous wages that not only cover their cost but also give them a fair share of the available surplus. While a significant share of subjects have social preferences that imply such reciprocal, fairness-motivated responses, the literature also shows that there is typically a significant share of relatively selfish subjects who are untrustworthy in that they show only weak or no preference for fairness or reciprocal behavior (e.g., Konow, 2000, 2003; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Charness and Rabin, 2002; Cappelen et al., 2007, 2013). Our data also show signs of a mix of reciprocal and selfish behaviors of agents: If agents receive low wages before making their effort choices, almost all choose low efforts, but if they receive higher wages, there emerges substantial heterogeneity, with some agents choosing minimum effort (untrustworthy) but others responding with high effort levels (trustworthy).

Against this backdrop of heterogeneity, it turns out that the strength of the contracting environment affects the ability of principals to elicit high efforts from the reciprocal agents, thus generating high gains from trade. Under weak contracting, while principals typically promise to pay high wages, this is not contractually enforceable, and indeed principals rarely live up to their promises and actually pay very low wages. The agents quickly anticipate that they cannot rely on the principals' promises and, therefore, even reciprocal agents show little willingness to respond to high offered wages with high effort. As a consequence, the principals also have little reason to keep their promises because if they keep them they experience no return. In other words, the lack of legal enforcement of wage promises undermines agents' reciprocal behavior and generates a "low wage – low effort" equilibrium.

In the final part of the paper we present a theoretical model that captures key features of our experimental game, and heterogeneity in agent types, in a simplified way. The model explains the above described empirical regularities of our weak contracting environment. It shows that the "low wage – low effort" equilibrium is unique, and predicts, in particular, that an exogenous shock to the principals' beliefs about the agents' trustworthiness has no effects on wages, effort and gains from trade—which is what we observe in this contracting environment.

The legal enforcement of the principals' wage promises in our medium contract environment constitutes a major improvement in contract enforcement because the principals can

now credibly commit themselves to high wages. The agents therefore know that a high wage promise indeed offers them a generous share of the surplus, which prompts reciprocal agents to respond to higher wages with higher effort levels. Because our high-trust manipulation generates optimistic beliefs about the agents' trustworthiness, in the sense that principals believe that agents honor high wages with high effort, while in our low-trust manipulation they believe in a weaker reciprocal response, the principals have a reason to pay higher wages in the high- compared to the low-trust condition—which is confirmed by the data. Reciprocally motivated agents then respond with higher effort levels in the high- compared to the low-trust condition, which explains the positive average trust effect on gains from trade in the medium contracting environment.

Is the trust effect on the gains from trade in the medium contracting environment stable, i.e., an equilibrium phenomenon? Or is it due to a transitory effect of changing the principals' initial beliefs about the agents' trustworthiness? To answer this question, we need to examine whether the principals benefitted on average from paying high wages in the high-trust environment. It turns out that this is not the case, i.e., the agents' effort increase in response to a wage increase is insufficient to render the wage increase profitable on average; this modest average response reflects agent heterogeneity, with some agents having a strong response, but others choosing minimal effort regardless of the wage. Paying higher wages in the high-trust environment is not profitable on average, but the principals learn this only slowly over time. This learning process is indicated by the fact that wage offers in the high-trust condition are decreasing and towards the end they are so low that the agents provide statistically indistinguishable effort levels in the high- and the low-trust condition of the medium contracting environment.

Our theoretical model rationalizes the transitory nature of the increase in the gains from trade in the medium contracting environment. The model shows that if the agents' reciprocal effort responses are insufficiently strong (e.g., because the share of reciprocally motivated agents is too small) there is still a unique "low wage – low effort" equilibrium. However, the model also predicts that initially false (i.e., too optimistic) beliefs of the principals about the agents' trustworthiness induce the principals to make initially too high wage offers.

Finally, we show that there is a large and stable trust effect on agent efforts, and thus the gains from trade, in our strong contracting environment. In addition to making credible wage promises, principals can also condition their current contract offers on the agents' past performance signals in this environment. Principals can do this by making no offer, or an offer

with a lower wage to agents with low previous performance signals, and by targeting high wage offers to agents with high previous performance signals. Empirically, principals in the high-trust condition indeed screen agents in this way and target their high wage offers to agents who previously signaled their trustworthiness; therefore, the wage-effort relation is substantially steeper in the strong compared to the medium contracting environment. This in turn means that high wages can be profitable. In the low-trust condition, however, the principals believe that the wage-effort relation is relatively flat and, therefore, make only low wage offers right from the beginning, choosing not to try to screen for agents who respond to high wages with high efforts. These wage differences between the high and the low trust condition are large and stable over time and induce large and stable effort differences based on the agents' reciprocal effort responses.

Our theoretical model rationalizes these findings because it shows that there coexist a high-trust screening equilibrium, and a low-trust pooling equilibrium in the strong contracting environment. The initial variation in the principals' trust causes stable variation in the realized gains from trade by selecting between these equilibria.

Our paper makes several contributions to the literature. First, it documents experimentally that the effects of improvements in contract enforcement on gains from trade can be trust-dependent. To our knowledge, this is a novel empirical finding that may generally be interesting for the economics of contracts and institutions (e.g., Bolton and Dewatripont, 2005; North, 1991) and, in particular, for behavioral contract theory that examines the effects of non-standard motives and social norms on the functioning of contracts and incentives (e.g., Ellingsen and Johannesson, 2005, 2008; Sliwka, 2007; Hart and Moore, 2008; Hart, 2009; Hart and Holmström, 2010; Herweg and Schmidt, 2015; Bierbrauer and Netzer 2016; Danilov and Sliwka, 2017; Sliwka and Werner, 2017). In addition, our findings on the role of trust in our strong contracting environment are also of interest for the literature on relational contracting (e.g., MacLeod and Malcomson, 1998; MacLeod, 2007; Gibbons, 1998; Baker et al., 2002; Gibbons et al., 2020).

Second, it clarifies the conditions under which we can expect a causal effect of trust on gains from trade, and it shows the important role of the contracting environment in the transmission of initial trust differences on wages, efforts, and gains from trade. Our paper thus contributes to the debate on the effect of trust on economic outcomes (e.g., Knack and Keefer, 1997; La Porta et

al., 1997; Guiso et al., 2009; Algan and Cahuc, 2010; Bloom et al., 2012) by clarifying when we can expect no, only transitory, or stable and large long run effects of changes in trust.[3]

Third, by empirically showing conditions for the emergence of a stable and efficient reciprocal principal-agent interaction, our paper is also related to the literature on reciprocal gift exchange and trust using laboratory experiments (Fehr et al., 1993; Berg et al., 1995; Brown et al., 2004; Charness, 2004). Previous papers in the gift-exchange literature and more recent papers on the counterproductive effects of sanctions and other measures that constrain shirking by agents suggest that trust might be self-confirming (e.g., Bohnet et al., 2001; Bohnet and Huck, 2004; Falk and Kosfeld, 2006; Bartling et al., 2012). However, this literature does neither address the interaction of exogenous variations in trust and contract enforcement, nor does it identify the conditions or mechanisms under which we should expect that trust affects trading efficiency.

Finally, our paper offers a simple theoretical model that captures the main empirical regularities in our experiment and thus facilitates a coherent interpretation of the data. The model rationalizes, in particular, why an exogenous increase in trust has no effect on gains from trade in the weak contracting environment, only a transient effect in the medium contracting environment, and a stable effect in the strong contracting environment.

The theoretical literature has shown before that different levels of trust can arise in a given economic environment due to multiple equilibria (e.g., Tabellini, 2008; Aghion et al., 2010) or multiple stable long-run outcomes of dynamic learning processes (e.g., Bower et al., 1996). Our experiment provides a first explicit test of the general idea that trust can play a role due to multiple equilibria: the empirical result that an exogenous increase in trust has no stable effect in a unique equilibrium environment but leads to stable effects in a multiple equilibrium environment demonstrates this point. Our theoretical model, however, differs from the existing literature in two important ways. First, we follow a standard game-theoretic approach with fixed preferences, while Tabellini (2008) and Aghion et al. (2010) study behavior that is transmitted from generation to generation and coevolves slowly with external institutions. Our theoretical and empirical results show that trust is malleable rather quickly and can have immediate and stable causal effects even with fixed preferences and institutions. Second, in models like Bower et al. (1996), where agents

[3] Our paper varies trust exogenously and examines the consequences of trust. There is also a literature that studies the individual and collective determinants of trust (e.g. Alesina and LaFerrara 2000 and 2005). For a review of the literature on the determinants of trust see Fehr (2009).

learn about a given population state, long-run levels of trust and economic efficiency cannot be manipulated by interventions that select between different equilibria. By contrast, we show that selecting the right equilibrium is an important consideration in the design of organizations and mechanisms. This idea has also recently played an important role in organizational econonomics where it has been argued that a deeper understanding of the forces that enable organizations to "build" a more efficient equilibrium is key in understanding why some organizations persistently perform better than others (Gibbons and Henderson, 2012; Gibbons, 2020; Gibbons et al., 2020).[4]

The remainder of the paper is organized as follows. Section 2 explains our experimental design and contains a manipulation check showing that our exogenous variation of trust is effective. Section 3 presents our main empirical finding on the complementarity between trust and contractual enforcement. Section 4 reveals the behavioral mechanisms behind our main empirical findings by analyzing in detail how differences in the contractual environment shape the behavior of principals and agents. Section 5 presents our theoretical analysis of the principal-agent game, which helps us interpret and understand the empirical patterns described in the previous sections. Section 6 concludes.

2. Experimental Design

We study the impact of an exogenous variation in principals' beliefs about the trustworthiness of agents on wages, effort and gains from trade. To study the interaction between exogenous changes in principals' trust and the contract enforcement environment, we also vary the degree to which parties can enforce contracts. We adopt a typical principal-agent framework where a higher effort level by the agent increases the principal's expected payoff but providing higher effort is more costly for the agent. Principals and agents interact in an experimental market and we allow for 15 market periods, so that we can study how wages, effort and gains from trade evolve over time. This feature make it possible to study whether exogenous changes in trust or contract enforcement have stable or only transitory effects.

In our design, principals cannot directly observe effort levels but they receive an informative stochastic signal about the agents' effort choices, and higher effort levels are

[4] In this context, the complementarity between trust and contract enforcement (i.e., incentives) is also important. Our findings suggest that to reap the available gains from trade it sometimes needs a change in incentives *and* a change in trust.

associated with an increase in the probability of observing a high signal. In many types of economic interactions it is not possible to precisely identify whether effort or (bad) luck is responsible for the observed output. The effort signal is observable by the principal and the agent, but it is not verifiable by third parties and thus not directly contractible. Contracts are therefore necessarily incomplete and the effort choice of an agent cannot be legally enforced. The principal's belief that an agent is trustworthy may then be relevant for the principal's willingness to enter a trade with an agent and for the contract terms the principal offers. We define agents to be trustworthy when they are willing to reciprocate a high wage offer with a high effort choice although high effort reduces their material payoff. Untrustworthy agents, by contrast, always choose low effort levels irrespective of the offered wages.

Our treatments vary the degree to which the parties can enforce their agreement. In all treatments, the principal proposes a contract that offers a wage and requests an effort level from the agent. In the "weak contract enforcement" environment (WEAK), however, neither the offered wage nor the requested effort level is legally enforceable. This environment thus represents a situation with weak legal institutions. Furthermore, the identities of principals and agents are not observable, and thus contract terms cannot be conditioned on the agent's past performance signal. In the "medium contract enforcement" environment (MEDIUM) we increase the scope for contract enforcement by making the principals' wage offers legally binding but the agent is still free to choose any effort level, and it is still not possible to make contracts contingent on past performance signals. In our "strong contract enforcement" environment (STRONG), principals' wage offers are again legally binding and agents are still free to choose any effort, but the subjects now have fixed identification numbers over the course of the experiment. Principals can therefore target their offers to specific agents contingent on their past performance signals, which is a further expansion of the set of contractible contingencies relative to the other treatments. Performance signals from past periods are only observed by the respective principals with whom the agent interacted in a these periods.

2.1 Stage Game Payoffs

If a principal and an agent agree to trade, then the principal pays a wage $w \in \{1, \dots, 100\}$ to the agent and the agent chooses an effort level $e \in \{1, \dots, 9\}$. The agent's effort choice stochastically determines the value of the interaction for the principal. There are only two possible value levels,

100 and 10. The probability that the principal receives the high value is given by $e/10$, while the principal receives the low value with probability $1 - e/10$. The expected material payoffs of principals are thus given by

$$E[\Pi^{principal}] = \begin{cases} 100 \cdot \frac{e}{10} + 10 \cdot \left(1 - \frac{e}{10}\right) - w & \text{if principal and agent interact} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

$$\Pi^{agent} = \begin{cases} w - c(e) & \text{if principal and agent interact} \\ 5 & \text{otherwise} \end{cases} \quad (2)$$

where $c(e)$ denotes the agent's cost of providing effort. The outside option of an agent who does not interact with a principal is 5. Table 1 shows the cost function $c(e)$. The cost function is strictly increasing and exhibits weakly increasing marginal costs. Since the marginal cost of effort is at most 3, while the marginal expected value is always 9, the efficient effort level is $e = 9$.

Table 1: Agents' Cost Function

Effort	1	2	3	4	5	6	7	8	9
Cost	0	1	2	4	6	8	10	12	15

2.2 Contracting Environments

Principals can initiate trades by offering contracts to the agents. Agents can choose among the available contract offers but they cannot make offers to principals. There are 15 trading periods. Each period, a principal can interact with at most one agent, and an agent can accept at most one contract offer. A period has two stages. In stage one, the principals make contract offers and agents decide whether or not to accept a contract. If a principal and an agent conclude a contract, they enter stage two, where the principal pays a wage and the agent chooses an effort level.

A contract offer consists of a wage offer $w \in \{1, \dots, 100\}$, a requested effort level $\tilde{e} \in \{1, \dots, 9\}$, and the principal's identification number (ID). The wage offer w is third-party verifiable and thus contractible in treatments MEDIUM and STRONG, but not in treatment WEAK. The requested effort level $\tilde{e}$ is not binding. The principal can observe the realized value but not the agent's actual effort choice. Indeed, actual effort levels e are never third-party verifiable, which rules out that requested effort levels are legally enforceable in any of our contracting environments.

There are two types of offers, public and private. In private offers, a principal indicates the agent's ID with whom he or she wants to trade, and only this agent is informed about the contract

offer. In public offers, all agents (and also the other principals) are informed about the offer; hence, each agent has the chance to accept a public offer. A principal can make as many private offers and as many public offers as he or she wants in a given period. However, once an agent accepts one of the offers, the principal is matched with this agent, learns the ID of the matched agent (which is new information in case of a public offer), and his other outstanding offers are removed from the market.[5] The default at the beginning of each period is that no agent has a contract and no principal has made an offer. There are always ten agents and seven principals in a market, i.e., there is an excess supply of three agents.

At the end of each period, each subject is informed about the own payoff and reminded of the contract $(w, \tilde{e})$ he or she had concluded and the trading partner's ID. Agents are also informed about the payoff of their respective principal. Principals are not informed about the payoff of their respective agent, because a principal does not observe the agent's effort choice and thus the cost of providing this effort level. The subjects write this information on a printed form that is provided along with the experimental instructions. This procedure ensures that each subject can always remind herself about her own trading history.

2.2.1 Contracting Environment WEAK

An agent can choose any actual effort level $e \in \{1, \ldots, 9\}$ after having accepted a contract offer in our contracting environment WEAK, irrespective of the requested effort level $\tilde{e}$. Likewise, the principal can pay any wage to the agent, irrespective of the offered wage. Actual wages and effort levels are chosen simultaneously at the second stage of a period. Moreover, the subjects' identification numbers (IDs) are randomly reshuffled in each of the 15 periods of the experiment in contracting environment WEAK. Random IDs preclude the principals from conditioning future contract offers on past performance signals. Neither of the two contracting parties thus faces legal or economic incentives to stick to the terms of the contract in contracting environment WEAK, but intrinsic motivation or social preferences could still induce them to honor their mutual promises.

[5] To prevent principals from making private offers to agents who have already concluded a contract with another principal, principals are at all times informed about which agents remain in the market.

2.2.2 Contracting Environment MEDIUM

A principal is obliged to pay the offered wage if an agent accepts his or her contract offer in our contracting environment MEDIUM. An agent, however, can still choose any actual effort level $e \in \{1, \dots, 9\}$, irrespective of the requested effort level $\tilde{e}$. Principals must thus stick to the terms of the contract in contracting environment MEDIUM while agents face no legal or economic incentives to provide the requested effort level. Because IDs are still randomly shuffled in every period, as in contracting environment WEAK, principals cannot condition hiring and contract terms on signals about the past performance of specific agents.

2.2.3 Contracting Environment STRONG

Contract enforcement is strengthened further in our contracting environment STONG. The principal is obliged to pay the offered wage w if an agent accepts the contract, as in contracting environment MEDIUM. Moreover, while agents can still choose any actual effort level $e \in \{1, \dots, 9\}$, irrespective of the requested effort level $\tilde{e}$, IDs of all players are fixed in our contracting environment STONG. This feature provides principals with the opportunity to condition their contract offers on the identity of a specific agent and this agent's past performance signals. This provides principals with the ability to screen agents and selectively target high wages to those who have high past performance signals.[6]

2.3 Inducing Variation in Principals' Trust

To potentially induce exogenous variation the principals' initial trust levels, we randomly assigned them to two different information conditions. In the high-trust treatments, the principals were informed about a "historical example" in which agents behaved in a trustworthy manner; in the low-trust treatments, they were shown an example in which agents displayed a low level of trustworthiness. More specifically, for our high-trust treatments we selected the market from Brown et al. (2004) that had the steepest wage-effort relation, and for the low-trust treatments we selected the market with the flattest wage-effort relation.

[6] The idea of inducing one shot play by re-randomizing ID numbers every period and enabling long-run relationships by (i) fixing ID numbers throughout the experiment and (ii) allowing for private offers to specific agents is taken from Brown et. al. (2004). Their paper does however not vary exogenous trust levels and thus cannot study the interaction between the strength of contract enforcement and trust.

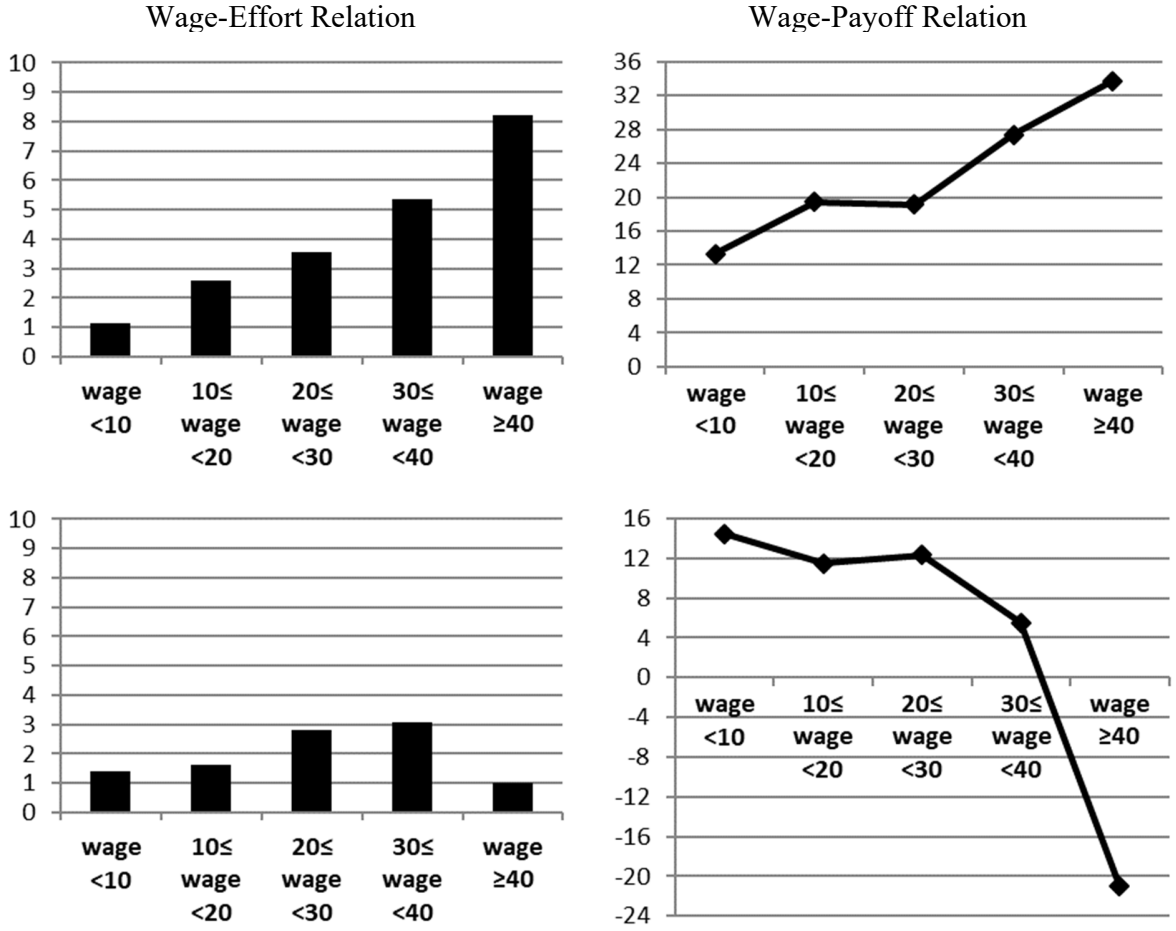
The example was provided at the end of the experimental instructions. Subjects were informed that the information provided was an "example," and that it showed how effort is related to wage levels "in a past session." Subjects were told that the information in the example was something that they "could use in their decisions today." The description of the source of the example was completely truthful but deliberately vague, and we did not claim that the information provided about a single past session was representative.

Figure 1 shows how we presented the examples to the subjects in the instructions. The top row was shown to the principals in the high-trust treatments, the bottom row to the principals in the low-trust treatments. On the left, the wage-effort relation is shown. The figure shows the average effort provided by the agents in the example for each of the given bins of offered wages. On the right, we show how this wage-effort relation translates into a wage-payoff relation, given the principals' payoff function in our experiment. The high trustworthiness example involved agents being trustworthy, in that those who are paid high wages also exert high effort levels. In the low trustworthiness example, agents were untrustworthy; they provided rather low effort for all wage levels.

Note that the examples contain no information about the historical frequency of wage choices by principals. They do indicate the range of wages that was used, but this was identical across the high and and low trustworthiness examples. This is deliberate because we wanted to rule out that the examples influence behavior by conveying information about historical behavior of principals. Rather, the differential information content across examples is solely about the trustworthiness of agents. Any impact should thus come through the beliefs of principals about trustworthiness. We will examine in Section 2.5 the extent to which our trust manipulation was effective in the sense that it differentially affected principals' beliefs.

Subjects in the role of agents did not receive any example, nor were they informed that the subjects in the role of principals received such information. The instructions for agents did not differ in the high- and low-trust treatments, which rules out any direct impact on outcomes through an influence on agents. This illustrates the advantages of an experimental setting for varying only the principals' trust, defined as the principals' beliefs in the trustworthiness of the agents.

Figure 1: The High and Low Trustworthiness Examples Shown to Principals.



Notes: The top row shows the example provided to the principals in the high-trust treatments, the bottom row shows the example provided in the low-trust treatments. The wage-effort relation is shown on the left, the corresponding expected wage-payoff relation on the right.

2.4 Experimental Procedures

We exposed all principals in a session to either the high-trust (HT) or the low-trust (LT) manipulation in the three contracting environments WEAK, MEDIUM, and STRONG. We thus implemented a 3x2 factorial design, crossing contracting environment and trust manipulation. This is indicated in the labels that we use to refer to the treatments. WEAK-HT, for example, stands for the treatment in which we implemented the weak contracting environment and exposed the principals to the high trustworthiness example. We conducted five markets for each of our six main treatments, as shown in Table 2. We also conducted two markets of a control treatment denoted

STRONG-HT-Long, which is identical to STRONG-HT, except that the game lasted 25 periods rather than 15 periods. We use STRONG-HT-Long to clarify the possible role of end-game effects[7].

Table 2: Treatment Overview

Treatment	Principals' Wage Offers	Identification Numbers	Trustworthi-ness Example	# Periods	# Markets
WEAK-LT	non-binding	random	low	15	5
WEAK-HT	non-binding	random	high	15	5
MEDIUM-LT	binding	random	low	15	5
MEDIUM-HT	binding	random	high	15	5
STRONG-LT	binding	fixed	low	15	5
STRONG-HT	binding	fixed	high	15	5
STRONG-HT-Long	binding	fixed	high	25	2

We implemented a between-subjects design, i.e., each subject participated in only one market in one treatment. Altogether we have 32 markets, with seven principals and ten agents each. Hence, 544 subjects participated in our experiment. Subjects were mainly students from the University of Zurich and the Swiss Federal Institute of Technology in Zurich. Students majoring in economics or psychology were not eligible to participate.

All sessions took place at the computer laboratory of the Department of Economics at the University of Zurich. The study was computerized with the software z-Tree (Fischbacher, 2007) and the recruitment was conducted with the software ORSEE (Greiner, 2015). Before the subjects entered the lab, they randomly drew a place card that specified at which computer terminal to sit. The terminal number determined a subject's role as either principal or agent, which remained fixed throughout the experiment.

[7] Endgame effects reliably occur in finitely repeated cooperation games such as the prisoner's dilemma and can typically be shifted into the future with a longer finite horizon (Embay, Frechette, Yuksel 2019). Similar effects can be observed in finitely repeated gift exchange experiments (see e.g., Brown, Falk and Fehr 2004). Thus, we conjectured that we will also observe an endgame effect in treatment STRONG-HT. Because we are interested in the stable effects of trust in STRONG-HT (i.e., in periods in which the endgame effect is not operative), we wanted to examine whether we can extend the effect of exogenous increases in trust by simply increasing the number of periods.

Subjects received written instructions including comprehension questions, which had to be answered correctly before a session could begin.[8] A summary of the instructions was read aloud by the experimenter to generate common knowledge of the instructions. There were also two practice periods before the actual experiment to make the subjects familiar with the market procedures. Subjects only went through the first stage of the experiment in both practice periods, so that principals did not observe payoffs and could not draw inferences about agents' actual effort choices. No money could be earned during the two practice periods.

Sessions lasted about 2.5 hours. Payoffs from the experiment, denominated in points, were converted into money at the rate of 10 points to CHF 1 (about $ 1.05 at the time of the experiments) at the end of a session. On average, subjects earned about CHF 47.65, which includes a show-up fee of CHF 20. The subjects received their payments privately.

2.5 Manipulation Check

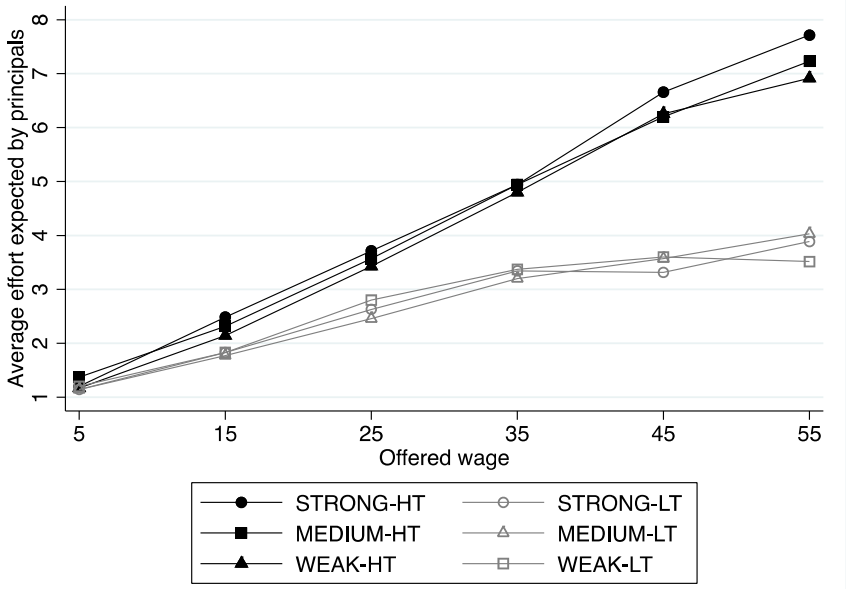
Our experimental approach aims at potentially inducing exogenous variation in the principals' beliefs about the agents' trustworthiness. Figure 2 provides a manipulation check by showing the principals' expectations about the empirical relationship between offered wages and chosen effort. These expectations were elicited at the beginning of the experiment, after reading the instructions but before entering the trading periods. We asked principals to predict what they thought would be the average effort level chosen by agents, conditional on different possible offered wages.

The figure reveals exogenous belief variation in all contracting environments, WEAK-HT vs. WEAK-LT, MEDIUM-HT vs. MEDIUM-LT, and STRONG-HT vs. STRONG-LT. Principals expected significantly higher average effort levels across the range of wages when they had received the high trustworthiness example rather than the low trustworthiness example, and also expected significantly steeper relationships between wage and effort. Regressions confirm that the differences in average expected effort across the high and the low trustworthiness example were statistically significant at the 1-percent level, as were the differences in slopes, in all three

[8] We provide the experimental instructions in the additional supplement to this paper. Since the terms "principal" and "agent" are not in common usage among student subjects, the experiment was framed in terms of "buyers" and "sellers," and we spoke about "price" and "quality" instead of "wage" and "effort."

treatment pairs.[9] On the other hand, we cannot reject the hypotheses that the average expected effort, and the slopes of the wage-effort relations, are identical when comparing across treatments involving the low trustworthiness example, and across treatments involving the high trustworthiness example.[10]

Figure 2: Manipulation Check



Notes: The black lines show the wage-effort relation that principals expect in the three high-trust treatments WEAK-HT, MEDIUM-HT, and STRONG-HT. The grey lines show expectations in the three low-trust treatments WEAK-LT, MEDIUM-LT, and STRONG-LT.

Since the agents do not receive historical examples about agents' trustworthiness in a previous experiment, random assignment should result in no differences in agents' beliefs across treatments involving high versus low trustworthiness examples. Indeed, we cannot reject the

[9] The results for average expected effort are from OLS regressions of principals' expectations about effort on the relevant treatment dummy, clustering standard errors at the subject level. All treatment dummy coefficients are significant at the 1-percent level. Results for the differences in slopes are from OLS regressions of expected effort on the relevant treatment dummy, the offered wage, and an interaction term, clustering on subject. All coefficients of the interaction terms are significant at the 1-percent level.

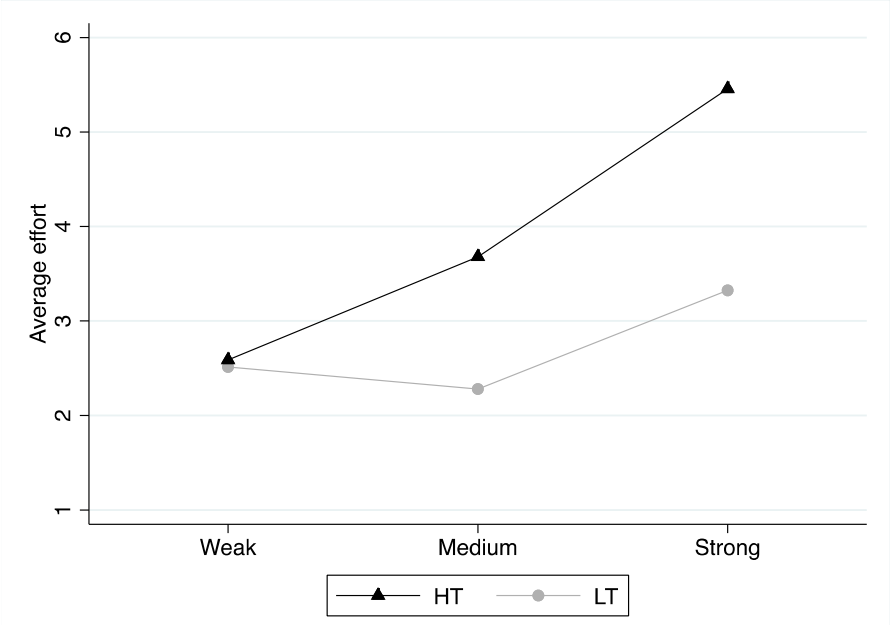
[10] The results are based on OLS regressions of principals' expectations about effort on the appropriate treatment dummies and interaction terms, clustering standard errors at the subject level.

hypothesis that the agents' expectations about average effort, and the slope of the wage-effort relations, are identical within each of the treatment pairs.[11] Since the agents indicate their "homegrown" beliefs, we can compare these beliefs with the beliefs that the principals indicate. We find that the principals' beliefs in the high-trust treatments roughly correspond to the agents' homegrown beliefs. Principals who received the low trustworthiness example thus have beliefs that are more pessimistic than homegrown beliefs.

3. The Complementarity of Trust and Contract Enforcement

In this section, we present our main result on the complementarity between trust and contract enforcement for the expected gains from trade. Figure 3 shows the average effort level in our three contracting environments, comparing the high-trust and the low-trust conditions. Effort is a sufficient statistic for the expected gains from trade, as higher effort levels directly generate higher average gains from trade.

Figure 3: Expected Gains from Trade



Notes: Effort is a sufficient statistic for expected gains from trade. The black line shows the average effort in the high-trust environment in treatments WEAK, MEDIUM, and STRONG. The grey line shows the respective average effort in the low-trust environment.

[11] The results are based on OLS regressions of agents' expectations about effort on the appropriate treatment dummies and interaction terms, clustering standard errors at the subject level.

First, Figure 3 reveals that an exogenous increase in trust has no effect in contracting environment WEAK, where principals are not obliged to pay the promised wage. This is in our view an interesting finding because it indicates that under weak legal and economic contract enforcement institutions, higher trust alone cannot increase trading efficiency.

Second, the figure reveals that the effect of trust on the expected gains from trade is positive under improved contract enforcement conditions. The causal effect of trust is positive and statistically significant in contracting environment MEDIUM, where the principals are contractually obliged to pay the offered wage (Wilcoxon rank-sum test of market averages; $p<0.02$).[12]

Third, the figure shows that the effect of trust is largest in contracting environment STRONG. Corresponding regressions show that the differences in the impact of trust are significantly different across the institutional environments (for MEDIUM vs. STRONG this is true excluding an end-game effect in STRONG, which we discuss in more detail later).[13]

Figure 3 also shows that the effect of exogenous improvements in the contracting environment are strongly trust-dependent. While improvements in contract enforcement induce a large increase in expected gains from trade in the high-trust environment, much smaller (if any) effects are observed in the low-trust environment. This again indicates the strong complementarity between trust and the legal/economic contract enforcement environment for trading efficiency. It is not sufficient to merely improve the contract enforcement environment alone or the actors' beliefs in the trustworthiness of their trading partners. Rather, the biggest increase in the gains from trade emerges when both contract enforcement and trust are simultaneously increased. We summarize these observations in our first result.

[12] All Wilcoxon rank-sum tests reported in the paper are based on market averages, i.e., taking markets as the unit of independent observation, to allow for potential interdependence between observations from the same market.

[13] Regressions reported in the paper have random effects on principals and bootstrapped standard errors clustering on market session (30 clusters). See the interaction terms HT×WEAK and HT×STRONG in model (4) in Table A3 where effort is regressed on the various institutional treatments (WEAK, MEDIUM, STRONG), the trust level (HT vs. LT) and their interactions. The positively significant coefficient of the interaction term HT×STRONG ($p<0.04$) indicates that the positive impact of HT in MEDIUM on effort becomes even larger in STRONG. The negatively significant coeffient of HT×WEAK ($p<0.01$) indicates that the positive impact of HT in treatment MEDIUM becomes negligible in WEAK.

Result 1: *(a) Trust and contract enforcement are complements with regard to gains from trade. While an exogenous increase in trust has no effect on expected gains from trade when contract enforcement is weak, higher levels of trust induce increasingly higher expected gains from trade when contract enforcement is exogenously strengthened. (b) Likewise, an exogenous improvement in contract enforcement causes no or little increase in the expected gains from trade at low trust levels but generates substantial increases in the gains from trade at high trust levels.*

4. Mechanisms

The previous section established a complementarity between trust and contract enforcement for gains from trade between principals and agents. In this section, we study the mechanisms underlying this finding, by analyzing the behaviors of principals and agents in more detail.

4.1 Weak Contract Enforcement

Principals are not obliged to pay the offered wages and agents are not obliged to choose the requested effort levels in contracting environment WEAK. Recall that interactions are one-shot, IDs are random across periods, and principals and agents, after they agreed on a contract, simultaneously choose their actual wages and effort levels, respectively.

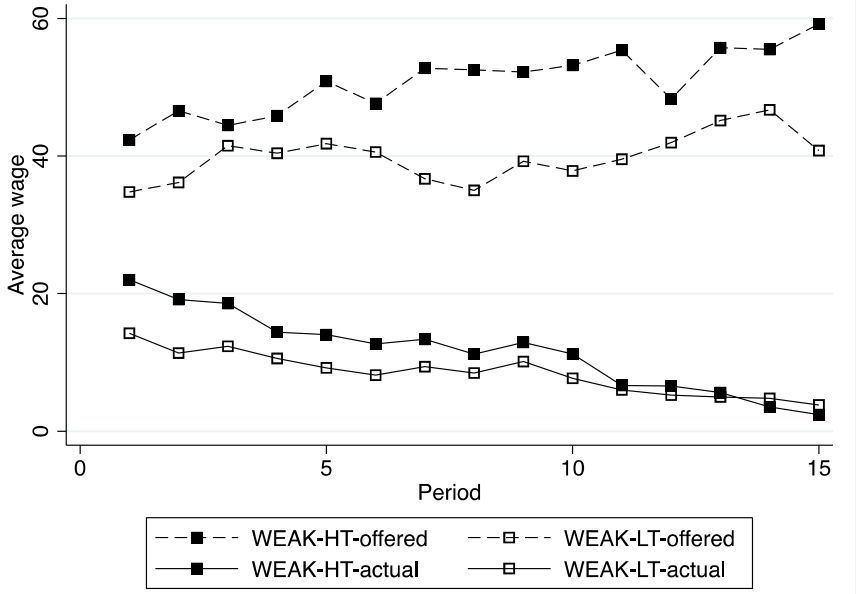
Figure 4 reveals that the principals, on average, do not honor their promises. The dashed lines show the average offered wages over the course of the 15 periods of the experiment in the high-trust treatment WEAK-HT (black) and in the low-trust treatment WEAK-LT (hollow). The solid lines show the average actual wages in WEAK-HT (black) and WEAK-LT (hollow). While offered wages even increase over the course of the 15 periods to values above 50 in WEAK-HT and above 40 in WEAK-LT, actually paid wages drop to values below 10 in both treatments. Principals paid the promised wages only in 13 and 10 percent of all transactions in WEAK-HT and WEAK-LT, respectively.

Actual wages are 11.6 on average in WEAK-HT and 8.5 in WEAK-LT (Wilcoxon rank-sum test, $p=0.08$). While there is a small and marginally significant effect of an exogenous increase in trust on actually paid average wages, Figure 4 reveals that this effect is driven by the earlier periods only; it declines and is entirely absent in the last five periods of the experiment. Regression (1) in Table A1 in the Appendix confirms that the difference in actually paid wages between

WEAK-HT and WEAK-LT is getting significantly smaller over time. We summarize these observations in our next result.

> ***Result 2:*** *With weak contract enforcement, the principals promise to pay high wages to the agents but rarely honor their promises, both in the high-trust and in the low-trust environment. Actual wages are low in both environments. While promised wages are always higher in the high-trust environment, actual wages in the high and low-trust environment converge towards the same level.*

Figure 4: Promised and Actual Wages in Contracting Environment WEAK

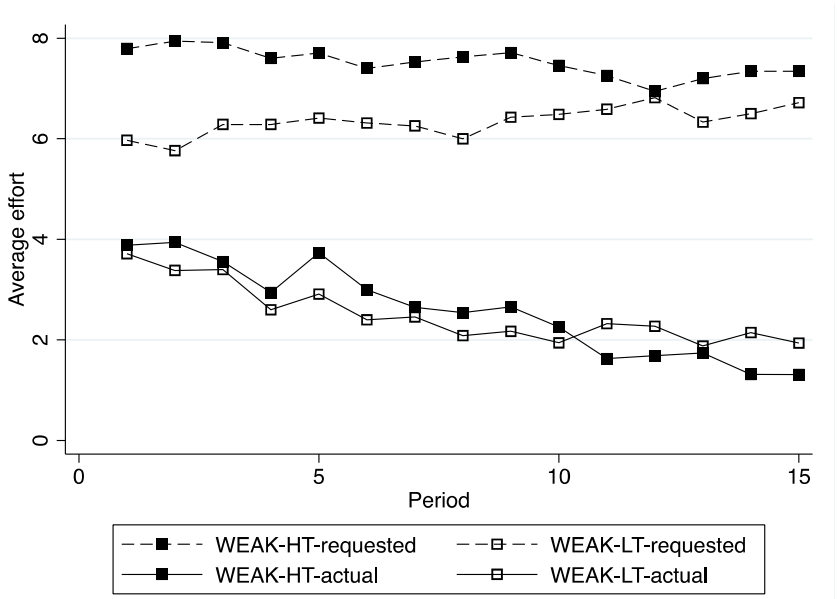


Notes: The black squares show offered (dashed line) and actual (solid line) wages in the high-trust environment. The hollow squares show offered (dashed line) and actual (solid line) wages in the low-trust environment.

Result 2 shows that the agents have little reason to believe that the principals pay the promised high wages. As a consequence, the agents—regardless of whether they are reciprocal or selfish types—have no reason to provide the effort levels requested by the principals in the contracts. Indeed, Figure 5 shows that the agents in contracting environment WEAK do not deliver the effort levels that the principals requested. The two dashed lines show the average effort levels requested by the principals over the course of the 15 periods in WEAK-HT (black) and WEAK-LT (hollow). The two solid lines show the average actual effort levels delivered by the agents in

WEAK-HT (black) and WEAK-LT (hollow). While requested effort levels range between 7 and 8 in the high-trust environment and between 6 and 7 in the low-trust environment, actually delivered effort levels drop to values around 2 in both environments. Agents delivered the requested effort level only in 7 and 16 percent of all transactions in WEAK-HT and WEAK-LT, respectively.

Figure 5: Requested and Actual Effort Levels in Contracting Environment WEAK



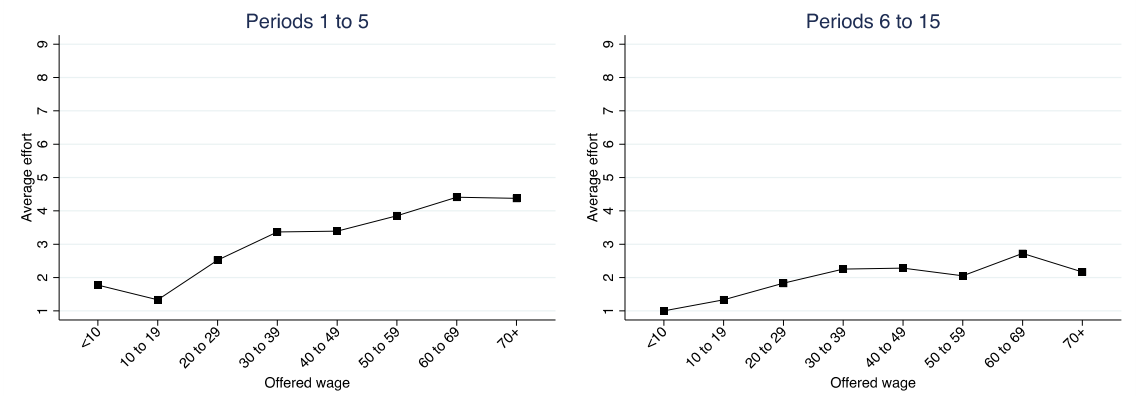
Notes: The black squares show requested (dashed line) and actual (solid line) effort levels in the high-trust environment. The hollow squares show requested (dashed line) and actual (solid line) effort levels in the low-trust environment.

Figure 5 shows that agents' effort is essentially identical in WEAK-HT and WEAK-LT. Effort levels in WEAK-HT start at slightly higher levels than in WEAK-LT but also decline slightly more over time (see the small but significantly negative coefficient on HT x Period in regression (1) in Table A2 of the Appendix; $p < 0.05$). No difference exists in average effort levels in WEAK-HT and WEAK-LT (2.5 and 2.6, Wilcoxon rank-sum test, $p=0.75$). We summarize this finding next.

Result 3: *With weak contract enforcement, the agents rarely honor their implicit promises to deliver the requested effort level, both in the high-trust and in the low-trust environment. Actual effort levels are very similar and low in both trust environments.*

A key feature of treatment WEAK is that the principals cannot commit to paying high wages and therefore the agents may not consider high offered wages as a credible promise. Thus, for agents with a reciprocity motive the desire to reciprocate to high wage offers with high effort choices is undermined in treatment WEAK. However, the agents may initially, i.e., during the early periods, not know the extent to which the principals' wage offers are credible. In fact, a closer look at the data reveals that traces of reciprocity exist, even in contracting environment WEAK. This holds, in particular, in early periods of the experiment, when reciprocal agents might not have fully realized that promised wages are rarely paid by the principals. Figure 6 shows actual effort levels as a function of *promised* wages. The left panel shows the relation for periods 1 to 5, the right panel for periods 6 to 15. The figure reveals that agents, on average, responded to high wage offers with somewhat higher effort levels in the early periods, but that the relation is substantially flatter in later periods (the Spearman correlation is 0.27 in periods 1 to 5, compared to 0.08 in periods 6 to 15).[14] Thus, the lack of a legal commitment opportunity for the principals in treatment WEAK together with the agents' experience during the early periods that the principals rarely honor their promises appears to have weakened the reciprocal agents' responses to high promised wages, explaining the dynamic of falling effort levels over time.

Figure 6: Promised Wages and Actual Effort Levels in Treatment Pair WEAK



Notes: The left panel shows the relation between promised wages and actual effort levels in periods 1 to 5; the right panel shows the relations for periods 6 to 15.

[14] The difference in slopes is also statistically significant. This can be seen in a panel regression of effort on offered price, a dummy variable for period>5, and an interaction term between this dummy and offered price (with random effects for principals, and bootstrapped standard errors clustering on session); the interaction term is highly significant and negative ($p<0.001$).

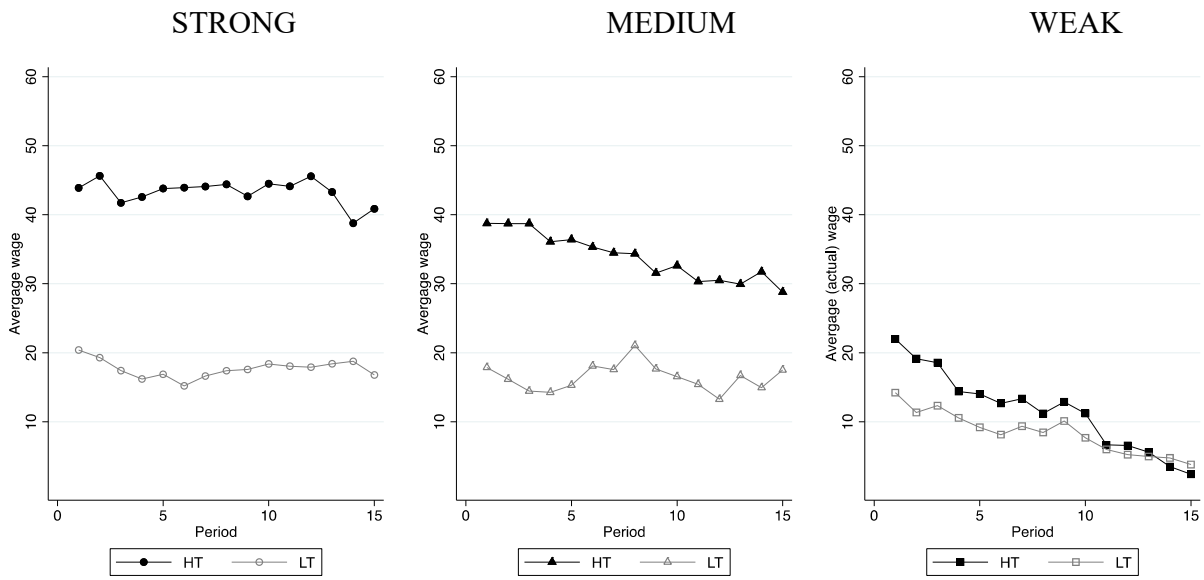
4.2 Medium Contract Enforcement

Contract enforcement is strengthened in treatment MEDIUM relative to treatment WEAK because the principals are contractually obliged to pay the offered wages. Agents continue to be free to choose whatever effort they like. On the one hand, the principals' one-sided commitment makes them more vulnerable to cheating agents. On the other hand, credible commitments to higher wages may induce reciprocal agents to provide higher effort levels when the wage is higher.

We first examine the wage behavior of the principals. The middle panel of Figure 7 shows actual wages in contracting environment MEDIUM. In contrast to contracting environment WEAK (shown again in the right panel to allow for easy comparisons across treatments), the exogenous increase in trust is associated with a significant, though unstable, difference in actual wages. Wages are 33.9 on average in MEDIUM-HT and 16.5 in MEDIUM-LT. This difference of about 17 points is statistically significant (Wilcoxon rank sum test, $p<0.01$). Regression analysis confirms that the impact of the exogenous increase in trust is significantly larger in contracting environment MEDIUM than in WEAK (see the large negative coefficient on the interaction term HT x WEAK in regression (1) in Table A3 in the Appendix; $p<0.01$). However, the effect of the exogenous trust increase in MEDIUM becomes smaller over time, showing that the initial impact of trust on actual wages is steadily declining (see the negative and significant interaction term HT x Period in regression (2) in Table A1 in the Appendix; $p<0.03$). We summarize this observation in our next result.

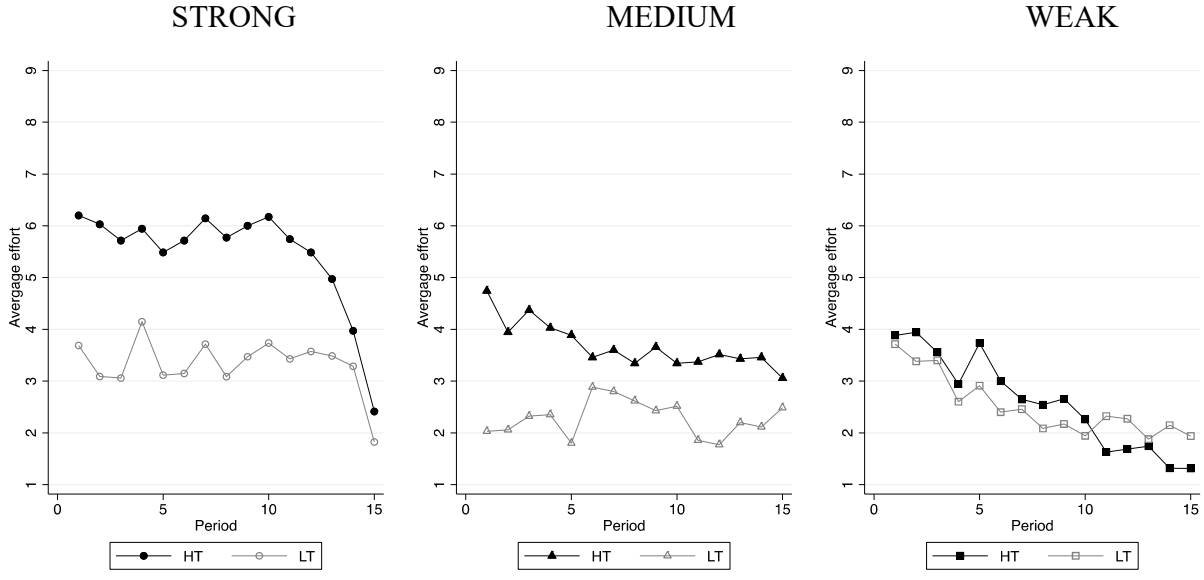
> ***Result 4:*** *With medium contract enforcement, an exogenous increase in trust induces an initial increase in principals' wage payments, but the wage difference across trust environments declines over time.*

Figure 7: Actual Wage Levels Over Time in All Treatments



Notes: The black lines show average wages in sessions with the high trust treatments and the grey lines show average wages in sessions with the low trust treatments.

Figure 8: Effort Levels Over Time in All Treatments



Notes: The black lines show average effort in sessions with the high trust treatments and the grey lines show average effort in sessions with the low trust treatments.

We now turn to the behavior of agents. Figure 8 shows effort levels over time in all treatments. The middle panel shows that average effort is significantly higher in MEDIUM-HT than in MEDIUM-LT (3.7 and 2.3, respectively, Wilcoxon rank-sum test, $p=0.03$). Regression analyses confirm that the difference in effort levels between the high-trust and the low-trust environment is significantly larger in contracting environment MEDIUM than in WEAK (see the coefficient of HT×WEAK in regression (3) of Table A3 in the Appendix; $p<0.011$). However, the effect of the exogenous increase in trust is declining over time. This time trend is significant as indicated by regression analysis and is driven by the decline in average effort levels in MEDIUM-HT (see the interaction term HT x Period in regression (2) in Table A2 of the Appendix; $p<0.01$). The small remaining effort difference between HT and LT in MEDIUM is no longer significant in the final period (Wilcoxon rank-sum test, $p=0.34$). We summarize this finding in Result 5.

> ***Result 5:*** *With medium contract enforcement, the higher wage payments in the high-trust environment are associated with higher average effort levels. However, the difference in effort levels between the high-trust and the low-trust environment declines over time and becomes small and insignificant in the final period.*

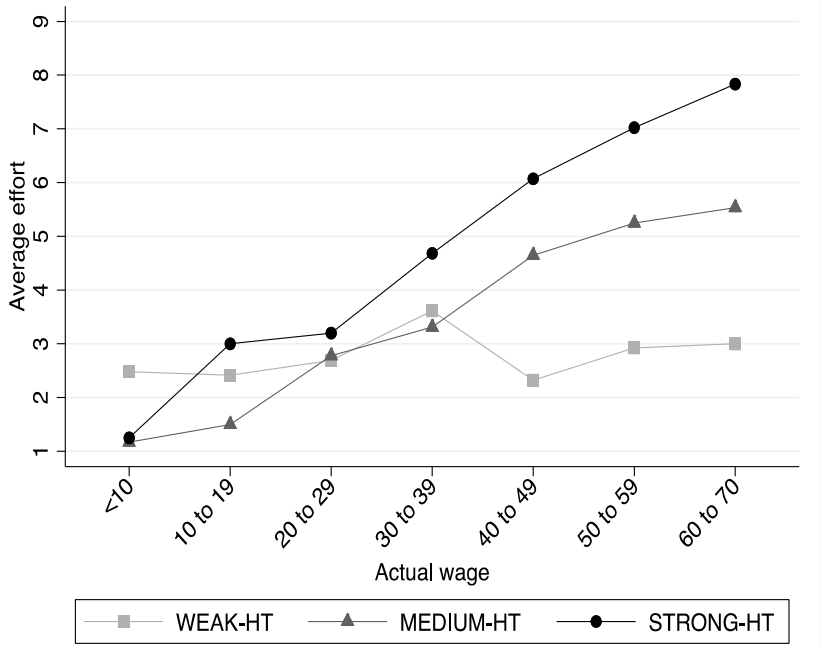
In the previous subsection we hypothesized that the lack of wage commitment among the principals in treatment WEAK undermined the possibility to elicit high efforts from reciprocal agents by promising high wages. In MEDIUM, by contrast, wage promises are credible. Thus, we hypothesize that the higher effort levels observed in MEDIUM-HT may reflect the ability of principals to elicit reciprocal responses from some agents. Indeed, Figure 9 shows that the effort levels delivered by the agents in MEDIUM-HT are on average responsive to the wages paid by the principals, unlike in WEAK, where the effort-wage relation is basically flat. Corresponding regressions relating effort to actual wages confirm that this difference in slopes is statistically significant (see Table A4 in the appendix): In regression (1) the coefficient on actual wages is significantly positive ($p<0.01$) while the interaction term between actual wages and WEAK is significantly negative and of a similar absolute size ($p<0.01$), indicating that the effort-wage relation is flat in WEAK. The positive average effort response to wages in MEDIUM is consistent with some agents being committed by their intrinsic preferences for reciprocal behavior. However,

since principals reduce their wage offers over time in MEDIUM-HT, the reciprocally motivated agents respond by reducing their effort levels over time. The next result summarizes these findings.

> ***Result 6:*** *Unlike with weak contract enforcement, in medium contract enforcement agents respond to higher actual wages with higher efforts on average. As principals reduce wages over time in the high trust condition, effort levels fall.*

The tendency for principals to reduce wages over time in MEDIUM-HT is understandable, because the average effort response to wages (Figure 9) is not strong enough to make high wages profitable for principals. As shown in Figure 10, average profits for principals in MEDIUM-HT are declining in actual wages. This decline is steep for wages above 50 but relatively flat for wages in the range 10 to 39, which may explain why principals only slowly learned that lowering wages in this range is more profitable. Corresponding regressions show that the relationship of profits to wages is negative in MEDIUM-HT (see the coefficient on "Actual wage" in regression (3) in Table A4 in the appendix, $p<0.01$). As expected, Figure 10 shows that paying non-minimal wages strongly reduces profits in WEAK; this is because there is no reciprocal response of effort to actual wages in WEAK. Corresponding regressions show that the difference in slopes for WEAK versus MEDIUM is statistically significant (see the interaction term Actual wage x WEAK in regression (3) in Table A4 in the appendix, $p<0.01$).

Figure 9: Wage-Effort Relation in High Trust Treatments

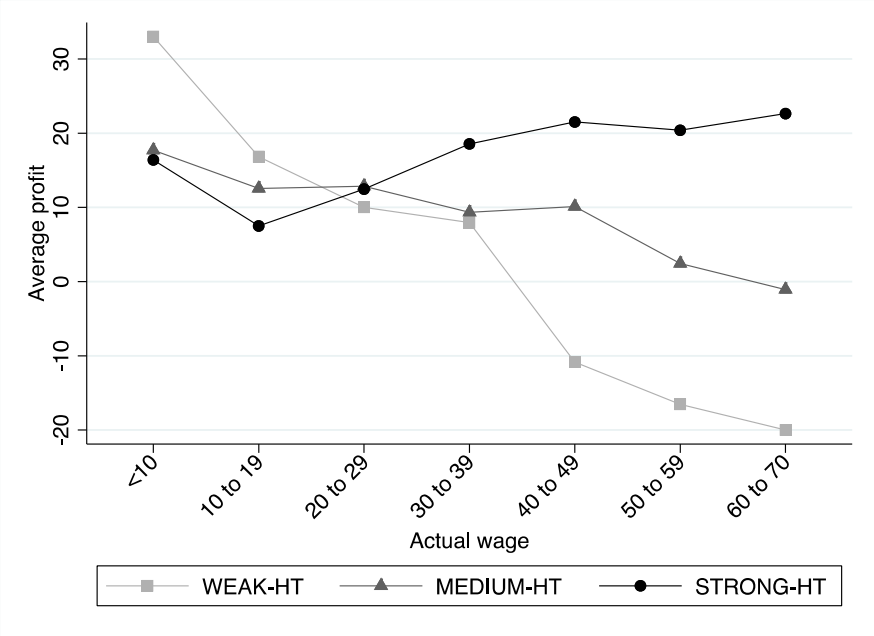


Notes: The figure shows the average effort level provided in the high trust treatments for different actual wage levels in contracting environments WEAK, MEDIUM and STRONG. Promised and actual wage payments coincide in MEDIUM and STRONG. The figure excludes the final five periods in contracting environment STRONG to show the relations absent the end-game effect. The figure also excludes categories of actual wages above 70 as there are too few observations for meaningful comparisons (e.g., only one observation in this range for WEAK).

A reason for the modest average response of effort to wages in MEDIUM-HT is heterogeneity in agent behavior. Some agents have a strong reciprocal response to high wages, but others behave selfishly and choose low efforts even for high wages. Indeed, as shown in the upper panels of Figure 11, for high (50+) and medium (25 to 50) wages, there is substantial heterogeneity in agent effort choices in MEDIUM-HT, with effort choices across the whole range. The effort distributions are also bi-modal, with modes at minimum effort, and relatively high (about 7) effort, respectively. With this heterogeneity, paying a high or even medium wage runs the risk of getting an agent who chooses low or minimum effort, thereby generating a large loss. As was shown in Figure 10, principals are better off paying relatively low wages, even though this means getting low efforts from both reciprocal and selfish agents (see upper left-hand panel of Figure 11). These findings are summarized in the next result:

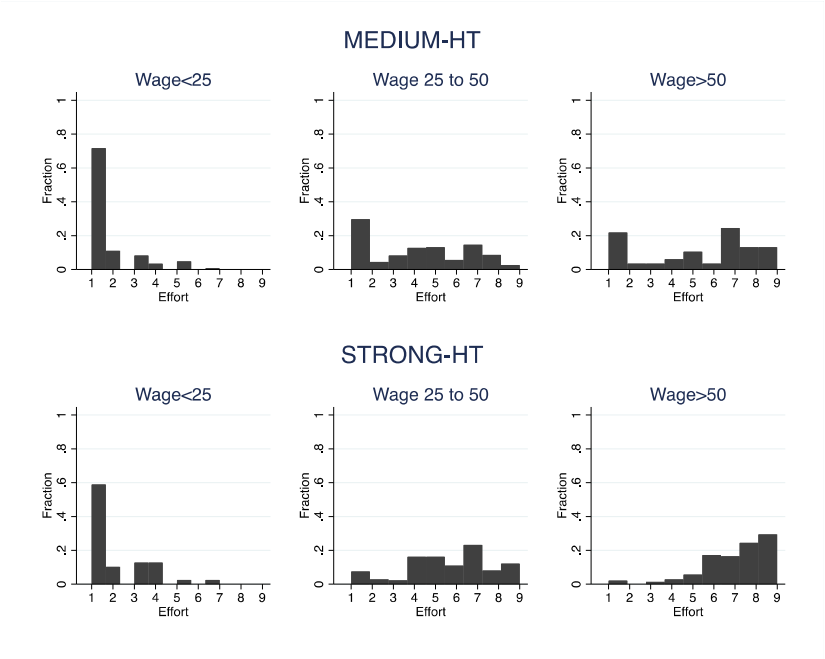
Result 7: *Paying high wages is not profitable in MEDIUM-HT, because the average effort response is too weak. The modest average response reflects underlying heterogeneity among agents, with some responding strongly, but many exhibiting a weak or zero response.*

Figure 10: Wage-Profit Relation in High Trust Treatments



Notes: The figure shows the principals' average profit level in the high trust treatments for different actual wage levels in contracting environments WEAK, MEDIUM and STRONG. The figure excludes the final five periods in contracting environment STRONG to show the relations absent the end-game effect. The figure also excludes categories of actual wages above 70 as there are too few observations for meaningful comparisons (e.g., only one observation in this range for WEAK).

Figure 11: Distributions of Agents' Effort Choices conditional on Wage Ranges in the High Trust Treatments.



4.3 Strong Contract Enforcement

4.3.1 Aggregate wages and effort levels

Contract enforcement opportunities are further increased in contracting environment STRONG. As in contracting environment MEDIUM, principals are obliged to pay the offered wages. The scope for enforcement is further expanded, however, because fixed identification numbers allow principals to condition their contract offers on signals about agents' past effort choices.

The left panel of Figure 7 shows actual wages in contracting environment STRONG. In contrast to MEDIUM, the exogenous increase in trust is associated not only with a significant but also with a stable increase in actual wages. Average wages are 43.3 in STRONG-HT and 17.7 in STRONG-LT, a difference that is highly significant (Wilcoxon rank sum test, $p<0.01$). Regression analysis confirms that the treatment difference is stable over time; there is no statistically significant time trend for the treatment difference in wages (see HT x Period in regressions (3) and (4) in Table A1 in the Appendix).

Notably, wages are similar in the case of low trust, regardless of strength of contract enforcement, whereas the same is not true for high trust. The average wages in STRONG-LT and MEDIUM-LT are not significantly different (17.7 vs. 16.5, Wilcoxon rank sum test, $p=0.81$) and

remain similar throughout the 15 periods of the experiment. By contrast, while wages are initially only slightly lower in MEDIUM-HT than in STRONG-HT, the gap between these treatments strongly increases over time because wages in MEDIUM-HT are steadily declining. Regression analysis shows that the overall impact of the exogenous trust increase on wages is significantly larger in contracting environment STRONG than in MEDIUM (see the interaction term HT x STRONG in regression (2) of Table A3 in the Appendix; $p<0.07$).[15] We summarize this observation in our next result.

Turning to agent behavior, the left panel of Figure 8 shows the average effort levels over time in contracting environment STRONG. The figure reveals that effort is substantially higher in STONG-HT than in STONG-LT. Average effort is 5.5 in STONG-HT and 3.3 in STONG-LT, a difference that is highly significant (Wilcoxon rank sum test, $p<0.01$). The difference is stable over the course of the experiment, except for an end-game effect that emerges in the final periods.[16]

To check whether the decline in effort towards the end of the game (i.e., in periods 11-15) is indeed an effect tied to the end of the game, as opposed to a time trend in the effect of high trust that happens to start after 10 periods, we conducted two markets of a control treatment, labeled STRONG-HT-Long. Treatment STRONG-HT-Long is identical to treatment STONG-HT, except that it lasted 25 periods rather than 15 periods. Figure 12 shows that effort remains high for 10 additional periods in STRONG-HT-Long, and starts to decline only as this longer game approaches its end. Increasing the length of the game thus extends the length of the stable effect of high trust, and moves the decline in effort to the periods near the end of the longer game. Note that treatment STRONG-HT-Long replicates the high level of efficiency observed in STRONG-HT. Average effort in STRONG-HT-Long is 5.6, which is almost identical to (and not significantly different from) the average effort of 5.5 in STRONG-HT. A regression analysis confirms that, excluding the end-game effect for effort, there is no statistically significant time trend for the treatment difference in effort levels (see the near-zero coefficient of HT x Period in regression (4)

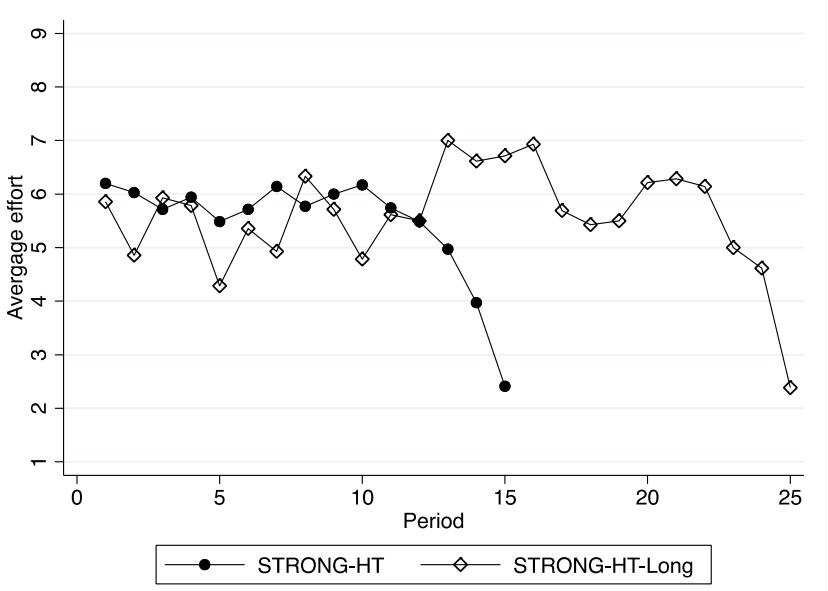
[15] If, instead of examining the average wage difference between STRONG-HT and MEDIUM-HT over all periods, we restrict attention to periods after the initial learning phase of principals in MEDIUM (restricting to 6-10 or 6-15), the wage difference becomes significant at $p < 0.02$ for both time intervals (based on panel regressions of wage on treatment dummy with random effects on principals and clustering on sessions).

[16] Such effects are a common feature of finitely repeated game environments, with some agents who display high effort in pre-final periods switching to minimal effort in the final periods when future interactions are no longer possible (see, e.g., Brown et al., 2004).

in Table A2 in the Appendix). We summarize these effects of exogenous trust on wages and effort in the following result:

> ***Result 8:*** *(a) Under strong contract enforcement, the principals pay substantially higher wages in the high-trust than in the low-trust environment. This wage difference is stable over time and, after the initial periods, significantly larger then the wage difference under medium contract enforcement. Wage levels are similar over time for strong and medium contract enforcement if trust is low. (b) The large positive effect of the exogenous trust increase on wages is associated with a large effort increase. Principals in STONG-HT offer high wages and end up receiving high effort on average. Principals in STRONG-LT, by contrast, pay low wages and end up receiving low effort on average.*

Figure 12: Robustness Check Verifying End-Game Effect in Final Periods of STRONG-HT



Notes: Average effort levels are more volatile over the course of the experiment in STRONG-HT-Long than in STRONG-HT because we conducted only two markets in STRONG-HT-Long, not five as in STRONG-HT.

Comparing the effect of the exogenous trust increase in contracting environment STRONG and MEDIUM, we find that the difference in the average effort between STRONG-HT and STRONG-LT (2.1) is larger than the difference between MEDIUM-HT and MEDIUM-LT (1.4).

Regression analysis confirms that the effect of trust is significantly larger in contracting environment STRONG than in MEDIUM (see the interaction term HT x Strong in regression (4) of Table A3, which excludes the end-game effect; $p<0.04$). This stronger impact of trust on effort levels explains the larger impact of trust on gains from trade in STRONG compared to MEDIUM.

4.3.2 Screening strategies

These findings raise the question, what is the mechanism underlying the higher wages and efforts in STRONG-HT, compared to MEDIUM-HT? And, why do principals in STRONG-LT behave similar to MEDIUM-LT? We hypothesize that principals in STRONG-HT are optimistic about the prevalence of agents who reciprocate higher wages with higher effort, and use the richer contracting environment to screen for such agents. For example, principals could pay medium wages in initial interactions with agents, and based on a positive signal, continue the relationship with similar or even higher wages. If this screening is successful, principals in STRONG-HT could selectively pay high wages only to agents who respond strongly, thus potentially making high wages profitable, unlike in MEDIUM-HT. In STRONG-LT, principals may be too pessimistic about the prevalence of agents who respond to high wages with high effort, and therefore eschew screening, and just pay low wages and elicit low efforts, similar to MEDIUM-LT.

A precondition for screening to be a meaningful strategy is heterogeneity in how agents respond to a given wage. We have already seen in MEDIUM-HT how agents respond when wages are exogenous to agent type by construction: For low wages almost all agents respond with low effort, but for high and medium wages there is substantial heterogeneity (top panels of Figure 11). An implication of this heterogeneity is that there may be a value to principals in STRONG-HT of screening, and assigning wages endogenously based on signals about agent behavior. Furthermore, the way to identify agents who will reciprocate is to pay medium or high wages, because for low wages almost all agents choose low effort. Notably, screening with high wages may be riskier than using medium wages.

Looking at the wage offers of principals in STRONG-HT in initial interactions with agents, and in later interactions, we find behavior consistent with such screening strategies. Principals in STRONG-HT tend to choose medium wages right from the outset in initial interactions with agents, on average paying a wage of 41. If the principal seeks out the same agent again—a sign of a successful previous interaction—the average wage tends to be even higher, 50 on average, so

moving into the range of high wages. Regressions confirm that in STRONG-HT wages are significantly higher in later (private offer) interactions with an agent than in the initial interaction ($p<0.01$).[17] This pattern is consistent with principals moving to high wages once they have seen positive signals. In STRONG-LT, by contrast, principals start with low wages in initial interactions, 13 on average. If principals in STRONG-LT interact with the same agent again, the average wage is higher, 21, but still in the low range, and regressions show that the difference in this case is not statistically significant. It makes sense that principals in STRONG-LT do not try to screen with medium or high level wages, if they are pessimistic about the prevalence of agents who respond reciprocally.

The tendency for principals in STRONG-HT to pay medium wages in initial interactions, when they do not know anything about an agent, and high wages only after positive signals, is apparent also in the distributions of effort choices conditional on wage ranges. As shown in the middle bottom panel of Figure 11, there is substantial heterogeneity in agent effort choice when principals choose to pay medium wages in STRONG-HT (the figure excludes the end game periods so this heterogeneity is not driven by end-game effects). Indeed, principals face a similar heterogeneity as what is observed for such wages in MEDIUM-HT. For high wages, however, there is a very different pattern in STRONG compared to MEDIUM (compare top and bottom right-hand panels of Figure 11): In STRONG-HT, when principals choose to pay high wages, efforts are almost uniformly high, with 88 percent of efforts being 6 or higher, and the unique mode at maximum effort of 9. This contrasts with MEDIUM-HT, where principals who pay high wages without the possibility of screening face the full range of effort outcomes, and frequently experience rather low effort levels. Regressions confirm that effort levels are significantly higher for high wages in STRONG-HT versus MEDIUM-HT ($p<0.001$).[18] Turning to low wages in STRONG-HT, we see that effort levels are almost always low (left-hand bottom panel of Figure 11). This is the main type of wage paid by principals in STRONG-LT, and in STRONG-LT the

[17] We regress wages on a dummy variable for later interactions using a private offer, with the omitted category being initial interactions (with private or public offer). The dummy variable is statistically significant. Estimation method is panel regression with random effects on principals, and boostrapped standard errors clustering on session.

[18] Results are based on regressing effort on a treatment dummy for STRONG, conditioning on wage greater than 50 (random effects on principal with boostrapped standard errors clustering on market session). The coefficient on the treatment dummy is large and significant at the one-percent level whether or not we include periods 11 to 15 for STRONG.

effort response is similarly low.[19] This helps explain why principals in STRONG-LT experience low effort levels, and why outcomes are similar to MEDIUM-LT, where principals also mainly pay low wages.

There is also direct evidence that principals in the STRONG-HT condition contract terms on past signals, consistent with screening for agents who choose high efforts in response to high wages. Specifically, if we regress the probability that an agent is "fired" (i.e., does not receive a repeat offer) on the previous period's effort signal (controlling for previous wage), in STRONG-HT we find that a negative effort signal increases the probability of "firing" by 27 percentage points ($p<0.01$). Likewise, among those who are rehired conditional on a negative effort signal (i.e, realization of the low value level) in t-1, the probability of a lower wage offer increases by 16 percentage points ($p<0.01$).[20]

A sign that these strategies allow principals in STRONG-HT to be successful in screening would be a stronger relationship of efforts to wage offers in STRONG-HT compared to MEDIUM-HT. As seen in Figure 9, the effort-wage relation is in fact steeper in STRONG-HT than in MEDIUM-HT, and corresponding regressions confirm that the difference is statistically significant (see the interaction term Actual wage x STRONG in regression (1) in Table A4 in the appendix; $p<0.05$).[21] This again suggests that when principals pay high wages in STRONG-HT, which we have seen tends to be in later interactions with an agent after positive signals, they are successfully targeting agents who respond with high effort levels, and avoiding agents who choose low efforts.[22]

---

[19] For low wages average effort is approximately 2 in both STRONG-HT and STRONG-LT, and there is no statistically significant difference (regression of effort on a treatment dummy for HT, conditional on contract enforcement being strong and wage less than 25; random effects on principals with bootstrapped standard errors clustering on market).

[20] These results are based on a linear probability model with random effects for the principals, clustering on sessions and bootstrapped standard errors. If we use, instead, a probit specification we find very similar effects.

[21] Results are similarly significant if we include the end-game periods 11 to 15 for STRONG (see regression (2) in Table A4).

[22] Note that the end-game effect in STRONG-HT suggests that some agents who act reciprocal in pre-final periods start acting selfish at the end of the game. Thus, screening in pre-final periods may not be fully distinguishing agents with intrinsic reciprocity preferences from selfish agents who strategically imitate these types. Regardless, it can still be beneficial for principals to identify agents who act reciprocal in pre-final periods, as these are better than those who act selfish in pre-final periods.

The stronger relationship of effort to wages in STRONG-HT means that paying high wages could be profitable. As seen in Figure 10, profits are in fact increasing in wages in STRONG-HT, while in MEDIUM-HT they are decreasing in wages. Corresponding regressions confirm that the profit response to wage increases is significantly better in STRONG-HT compared to MEDIUM-HT (see the interaction term Actual wage x STRONG in regressions (3) in Table A4 in the appendix; $p<0.05$).[23] Thus, in contrast to MEDIUM-HT, principals in STRONG-HT can gain from paying high wages, generating high efforts and high gains from trade. We summarize these findings in our next result.

> ***Result 9:*** *(a) Under strong contract enforcement high initial trust leads principals to engage in screening strategies to identify agents who respond strongly to high wages. These screening strategies are successful in that there is a stronger relationship between effort and wages compared to medium contract enforcement, which makes paying high wages more profitable. (b) With low initial trust, principals in strong contract enforcement do not try to screen for agents who respond to high wages, and pay low wages and elicit low efforts similar to principals in medium contract enforcement.*

5. Theory

In this section, we summarize our theoretical analysis of the principal-agent market game. We aim at providing an explanation for our main experimental finding, i.e., for why exogenous increases in trust have no effect on the gains from trade in WEAK, only a temporary effect in MEDIUM and a stable effect in treatment STRONG. The formal analysis can be found in the Appendix.

To keep the analysis tractable, the game that we solve is a simplified version of the game used in the experiment. We model contracting environment WEAK as a one-shot simultaneous-move game between one principal, who chooses a wage, and one agent, who chooses an effort level. The game is further simplified by omitting the contract offer stage, which is pure cheap talk, and by assuming that all actions are binary. The principal is assumed to be profit-maximizing,

[23] Results are statistically significant whether or not we include the end-game periods for STRONG (see Table A4 in the appendix).

while the agent can be either a selfish or a reciprocal type, but this type is unobservable to the principal.[24] Only reciprocal types would find it optimal to respond to a high wage with high effort in a one-shot interaction. However, since moves are simultaneous in contracting environment WEAK, there is a unique equilibrium in which wage and effort are always low. Importantly, this unique outcome is independent of the principal's belief about the share of reciprocal types in the agent population. Hence, even when our historical examples about the differential trustworthiness of agents in LT and HT changed a principal's belief about the share of reciprocal types, we predict that this has no effect on equilibrium play, in line with our experimental finding that there is no difference between WEAK-LT and WEAK-HT.

We model contracting environment MEDIUM as a one-shot sequential-move game, where the principal first chooses a binding wage and the agent responds by choosing a effort after observing that wage. A reciprocal agent then indeed responds to a high wage with high effort, while a selfish type always responds with low effort. Since the agent's type is not observable to the principal when she makes her wage offer, her belief about the share of reciprocal types determines whether she wants to offer the low or the high wage. We impose the assumption that the share of reciprocal agents is not too large, so that offering the high wage is less profitable than offering a low wage – an assumption that is in line with the empirical evidence in MEDIUM.[25] Hence, there is again a unique equilibrium in contracting environment MEDIUM, in which wage and effort are always low, in line with what we observe in treatment MEDIUM-LT. Now assume that the historical example about high trustworthiness of the agents in treatment MEDIUM-HT initially renders the principals' beliefs about the share of reciprocal agents more optimistic. The principals would then find it optimal to offer the high wage, in expectation that it will be rewarded with high effort sufficiently often to be profitable. It takes some time for them to learn that the high wage is actually not reciprocated frequently enough to be profitable, generating a slow

[24] One could assume that there is also a positive fraction of reciprocal principals but because preferences for reciprocal behavior matter mainly for second movers (i.e., agents) we assume selfish principals. Reciprocity may provide an additional reason for the principal to pay a high wage in the second period only if the stochastic signal indicates that the agent is a reciprocal type. However, we show below that this is also an equilibrium strategy for a selfish principal.

[25] The slope of the relationship between average effort and offered wages is not steep enough in this treatment to generate a positive slope between profits and offered wages. In fact, the relation between average profits and offered wages is negative in MEDIUM.

learning dynamics towards the actual equilibrium, exactly in line with the transient effect of the high trust condition that we observe in treatment MEDIUM.

Finally, we model contracting environment STRONG as a repeated sequential-move game. An essential feature of the experimental setting is the finite repetition of the stage game, coupled with an excess supply of agents. This allows principals to rehire or fire agents conditional on the stochastic outcome of their earlier interaction. We capture the dynamic interaction with just two periods. The feature of excess supply of agents is modelled by having one principal and two agents. With repeated interaction, the game exhibits coexistence of a low-trust and a high-trust sequential equilibrium for a large range of parameters, including parameters that closely resemble the payoff structure in the experiment.

The low-trust equilibrium replicates the outcome of the one-shot interaction. If the principal believes that agents will provide only low effort, she initially offers the low wage to one of the agents, and both types of that agent respond with low effort. The subsequent stochastic realization of the value is therefore not informative about the agent's type. As a consequence, the principal again offers the low wage in the second period, and both types of the agent respond with low effort. A reciprocal agent cannot signal his type by a first-period deviation from equilibrium because the effort choice is not directly observable to the principal. Thus, the low-trust equilibrium is a pooling equilibrium in which gift-exchange between the principal and the reciprocal types does not materialize.

In the high-trust equilibrium, the principal initially trusts an agent of unknown type. That is, she pays the high wage. A selfish type responds with low effort but a reciprocal type responds with high effort. The principal's belief that the agent is a reciprocal type declines if she receives the low value. She will then not offer the high wage again in the second period. A realized high value, by contrast, constitutes a positive signal about the type of the agent. Given the positively updated belief, the principal's expected profit is maximized by offering the high wage again to the same agent. A selfish type has no incentive to mimic a reciprocal type because he does not obtain the additional intrinsic benefit from responding to a high wage with high effort. Thus, the high-trust equilibrium is a separating equilibrium, where the initial trusting behavior of the principal serves to stochastically screen reciprocal types from selfish types.

We interpret the historical information about agents' trustworthiness used in the experiment as a device that selects between these multiple equilibria. The predictions of the high-trust and the

low-trust equilibrium are indeed in line with the experimental findings of higher wages and higher effort in STRONG-HT compared to STRONG-LT.

More specifically, consider the low-trust equilibrium first. The offered wage and the returned effort are predicted to be low in both periods on the equilibrium path, as confirmed by the experimental results in treatment STRONG-LT. Furthermore, if the principal trembled and offered the high wage in the first period, then both types of the agent would still respond with low effort in that equilibrium. This is sustained by the correct off-equilibrium belief that the principal subsequently reacts to a realized high value (which is uninformative because both types behave in the same way) by not rehiring the agent. The agent's off-equilibrium behavior thus confirms the flat wage-effort reaction as induced by the historical example in treatment STRONG-LT.

Consider the high-trust equilibrium next. The high first-period wage elicits an average effort strictly above the low level, as confirmed by our results in treatment STRONG-HT. If the principal trembled and offered the low wage instead, both types of the agent would respond with low effort in this equilibrium. This confirms the principal's belief in a positive wage-effort reaction as induced by the historical example in treatment STRONG-HT. A response of effort to wage can also be observed on the equilibrium path of the high-trust equilibrium. Depending on the stochastic realization of the value, the principal offers either the high or the low wage in the second period, and the induced expected effort is larger in the former case than in the latter.

6. Conclusions

This paper studies the *interplay* between trust and the strength of contract enforcement for the realization of gains from trade by systematically varying both factors independently. It is well-understood that informational constraints and weak judicial systems render contract enforcement imperfect. People may then only be willing to interact and realize gains from trade if they trust that their contract partner will not behave opportunistically. By contrast, little appears to be known about how trust affects the impact of contract enforcement on gains from trade and how contract enforcement shapes the causal impact of trust.

A better understanding of the interplay of trust and the strength of contract enforcement is important for designing policies aimed at improving economic performance. If trust and contract enforcement were substitutes, policies could be effective if they focused solely on, say, improving the judicial system in order to enable trading partners to better enforce their contracts—even if

levels of trust remained low. Policies could be equally effective if they focused solely on, say, advertising role models of trustful business relations in order to move a society out of a low-trust trap—even if the judicial system remained weak. Our results suggest, however, that such independent improvements along only one dimension – either only trust or only contract enforcement – may not work. We find, in particular, that improvements in the strength of contract enforcement have no or only limited effects on gains from trade when individuals are in our low-trust environment. Likewise, the results indicate that increases in exogenous trust have no or only a transitory impact on gains from trade in our weak and medium contract environment, respectively. In contrast, under strong contract enforcement trust increases have a large impact, and under high trust improvements in contract enforcement have also a large effect on the gains from trade. The strong complementarity between trust and the strength of contract enforcement indicates that simultaneous improvements along both dimensions may well be a preferred policy tool.

By documenting empirically that trust and contract enforcement can be complements, and by identifying the mechanisms underlying this complementarity, we also contribute to understanding the conditions under which trust does and does not exert a causal effect on the gains from trade.

As a general implication, research on the determinants of economic performance may benefit by focusing more on interactions between separate factors of influences. Controlling for trust and contract enforcement environments, but not for their interaction, might yield results that obfuscate the real effects. Similar issues may arise for the interaction between other institutional factors and informal norms of behavior. This raises a large range of novel questions for future research.

References

Aghion, Philippe, Yann Algan, Pierre Cahuc, and Andrei Shleifer (2010). "Regulation and Distrust," *Quarterly Journal of Economics*, 125(3), 1015-49.

Alesina Alberto and Eliana La Ferrara (2005). "Who Trusts Others?", *Journal of Public Economics*, 82(2), 207-234.

Algan, Yann and Pierre Cahuc (2010). "Inherited Trust and Growth," *American Economic Review*, 100(5), 2060-92.

Arrow, Kenneth J. (1972). "Gifts and Exchanges," *Philosophy and Public Affairs*, 1(4), 343-62.

Baker, George, Robert Gibbons, and Kevin Murphy (2002). "Relational Contracts and the Theory of the Firm." *Quarterly Journal of Economics*, 117(1), 39-84.

Banerjee, Abhijit and Duflo Esther (2007). "The Economic Lifes of the Poor," *Journal of Economic Perspectives*, 21(1), 141-167.

Banfield, Edward C. (1958). *The Moral Basis of a Backward Society*. Free Press.

Bartling, Björn, Ernst Fehr, and Klaus M. Schmidt (2012). "Screening, Competition, and Job Design: Economic Origins of Good Jobs," *American Economic Review*, 102(2), 834-64.

Berg, Joyce, John Dickhaut, and Kevin McCabe (1995). "Trust, Reciprocity, and Social History," *Games and Economic Behavior*, 10, 122-42.

Bierbrauer, Felix and Nick Netzer (2016). "Mechanism Design and Intentions, " *Journal of Economic Theory*, 163, 557-603.

Bloom, Nicholas, Raffaella Sadun, John Van Reenen (2012). "The Organization of Firms across Countries," *Quarterly Journal of Economics*, 127(4), 1663-1705.

Bohnet, Iris, Bruno S. Frey, and Steffen Huck (2001). "More Order with Less Law: On Contract Enforcement, Trust, and Crowding," *American Political Science Review*, 95, 131-44.

Bohnet, Iris and Steffen Huck (2004). "Repetition and Reputation: Implications for Trust and Trustworthiness When Institutions Change," *American Economic Review*, 94(2), 362-66.

Bolton, Patrick and Mathias Dewatripont (2005). *Contract Theory*. MIT Press.

Bolton, Gary E., and Axel Ockenfels (2000). "ERC: A Theory of Equity, Reciprocity, and Competition," *American Economic Review*, 90(1), 166-193.

Bower, Anthony B., Steven Garber, and Joel C. Watson (1996). "Learning About a Population of Agents and the Evolution of Trust and Cooperation," *International Journal of Industrial Organization*, 15, 165-90.

Brown, Martin, Armin Falk, and Ernst Fehr (2004). "Relational Contracts and the Nature of Market Interactions," *Econometrica*, 72, 747-80.

Cappelen, Alexander, W., Astri Drange Hole, Erik Ø. Sørensen, and Bertil Tungodden (2007). "The Pluralism of Fairness Ideals: An Experimental Approach," *American Economic Review*, 97 (3), 818-827.

Cappelen, Alexander W., James Konow, Erik Ø. Sørensen, and Bertil Tungodden (2013). "Just Luck: An Experimental Study of Risk Taking and Fairness," *American Economic Review*, 103(4), 1398-1413.

Charness, Gary (2004). "Attribution and Reciprocity in an Experimental Labor Market," *Journal of Labor Economics*, 22(3), 665-88.

Charness, Gary and Matthew Rabin (2002). "Understanding Social Preferences with Simple Tests," *Quarterly Journal of Economics*, 117(3), 817-869.

Coleman, James (1990). *Foundations of Social Theory*. Harvard University Press.

Danilov, Anastasia and Dirk Sliwka (2017). "Can Contracts Signal Social Norms? Experimental Evidence." *Management Science*, 63(2), 459–476.

Djankov, Simeon, Oliver Hart, Caralee McLiesh, and Andrei Shleifer (2008). "Debt Enforcement Around the World." *Journal of Political Economy*, 116(6), 1105-1150.

Ellingsen, Tore and Magnus Johannesson (2005). "Sunk Costs and Fairness in Incomplete Bargaining," *Games and Economic Behavior* 50, 155-177.

Ellingson, Tore and Magnus Johannesson (2008). "Pride and Prejudice: The Human Side of Incentive Theory," *American Economic Review* 98 (3), 990-1008.

Embrey, Matthew, Guillaume R. Frechette, and Sevgi Yuksel (2018). "Cooperation in Finitely Repeated Prisoner's Dilemma," *Quarterly Journal of Economics,* 133(1), 509-551.

Falk, Armin, and Michael Kosfeld (2006). "The Hidden Costs of Control," *American Economic Review*, 96, 1611-30.

Fehr, Ernst (2009). "On the Economics and Biology of Trust." *Journal of the European Economic Association*, 7(2-3), 235-266.

Fehr, Ernst, Georg Kirchsteiger, and Arno Riedl (1993). "Does Fairness Prevent Market Clearing—An Experimental Investigation," *Quarterly Journal of Economics*, 108, 437-59.

Fehr, Ernst, and Klaus M. Schmidt (1999). "A Theory of Fairness, Competition, and Cooperation," *Quarterly Journal of Economics*, 114(3):817-868.

Fischbacher, Urs (2007). "z-Tree: Zurich Toolbox for Ready-Made Economic Experiments." *Experimental Economics*, 10(2), 171–8.

Fukuyama, Francis (1995). *Trust: The Social Virtues and the Creation of Prosperity*. Free Press, New York.

Gibbons, Robert (1998). "Incentives in Organizations." *Journal of Economic Perspectives*, 12(4), 115-132.

Gibbons, Robert and Rebecca Henderson (2012). "Relational Contracts and Organizational Capabilities," *Organization Science*, 23 (5), 1350-1364.

Gibbons, Robert (2020). "Visible Hands: Governance of Value Creation – Within Firms and Beyond." *American Economic Review*, 110, 172-176.

Gibbons, Robert, Manuel Grieder, Holger Herz and Christian Zehnder (2020). "Building an Equilibrium: Rules versus Principles in Relational Contracts." *MIT Working Paper*, Sloan School of Management.

Greiner, Ben (2015). "Subject Pool Recruitment Procedures: Organizing Experiments with ORSEE," *Journal of the Economic Science Association*, 1(1), 114-25.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales (2009). "Cultural Biases in Economic Exchange?" *Quarterly Journal of Economics*, 124(3), 1095-131.

Hart, Olver and John Moore (2008). "Contracts as Reference Points," *Quarterly Journal of Economics*, 123(1), 1–48.

Hart, Oliver (2009). "Hold-up, Asset Ownership, and Reference Points." *Quarterly Journal of Economics*, 124(1), 267-300.

Hart, Oliver and Bengt Holmström (2010). "A Theory of Firm Scope," *Quarterly Journal of Economics*, 125(2), 483–513.

Herweg, Fabian, and Klaus M. Schmidt (2015). "Loss Aversion and Inefficient Renegotiation," *Review of Economic Studies*, 82(1), 297–332.

Knack, Stephen, and Philip Keefer (1997). "Does Social Capital Have an Economic Payoff? A Cross-Country Investigation," *Quarterly Journal of Economics*, 112, 1251-88.

Konow, James (2000). "Fair Shares: Accountability and Cognitive Dissonance in Allocation Decisions," *American Economic Review*, 90(4), 1072-1091.

Konow, James (2003). "Which Is the Fairest One of All? A Positive Analysis of Justice Theories," *Journal of Economic Literature*, 41(4), 1188-1239.

La Porta, Rafael, Florencio López-de-Silanes, Andrei Shleifer, and Robert Vishny (1997). "Trust in Large Organizations." *American Economic Review*, 87(2), 333–8.

La Porta, Rafael and Andrei Shleifer (2014). "Informality and Development," *Journal of Economic Perspectives*, 28(3), 109-126.

MacLeod, Bentley and James Malcomson (1998). Motivation and Markets. *American Economic Review*, 88(3), 388-411.

MacLeod, Bentley (2007). "Reputations, Relationships and Contract Enforcement." *Journal of Economic Literature*, 45(3), 595-628.

McCaig, Brian and Nina Pavcnik (2015). "Informal Employment in a Growing and Globalizing Low-Income Country," *American Economic Review*, 105(5), 545-550.

North, Douglass C. (1991). "Institutions." *Journal of Economic Perspectives*, 5(1), 97-112.

Putnam, Robert D. (1993). *Making Democracy Work*. Princeton UP, Princeton, NJ.

Putnam, Robert D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. Simon and Schuster, New York.

Sliwka, Dirk. (2007). "Trust as a Signal of a Social Norm and the Hidden Costs of Incentive Schemes," *American Economic Review*, 97 (3): 999-1012.

Sliwka, Dirk and Peter Werner (2017). "Wage Increases and the Dynamics of Reciprocity," *Journal of Labor Economics*, 35(2), 299-344.

Tabellini, Guido (2008). "The Scope of Cooperation: Values and Incentives," *Quarterly Journal of Economics*, 123(3), 905-50.

Online Appendix

A. Additional Tables

Table A1: Actual Wage Levels as Function of Trust and Time Period in the Different Contracting Environments

	WEAK	MEDIUM	STRONG	
	All periods	All periods	All periods	Periods < 11
	(1)	(2)	(3)	(4)
HT	8.09**	23.06***	26.83***	25.19***
	[3.33]	[2.04]	[3.42]	[3.19]
Period	-0.64***	-0.02	-0.01	-0.19
	[0.18]	[0.06]	[0.18]	[0.28]
HT x Period	-0.61*	-0.71**	-0.14	0.21
	[0.32]	[0.32]	[0.25]	[0.36]
Constant	13.58***	16.66***	17.69***	18.44***
	[1.90]	[1.43]	[2.46]	[2.43]
Observations	1031	1046	1042	694

Notes: Panel regression estimates with random effects for principals. Bootstrapped standard errors clustered on markets (30 clusters) shown in brackets. Columns (1) to (3) present regressions for the three contracting environments WEAK, MEDIUM, and STRONG, respectively, using all periods. Column (4) shows results for STRONG excluding the final five periods to eliminate the end-game effect. The regression for each column only uses data from the respective contracting environment. The omitted category in each case is the respective low-trust environment. "HT" is a dummy variable indicating the respective high-trust environment. "Period" takes on values 1 to 15, or 1 to 10 in Colum (4) indicating the respective period. ***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table A2: Effort Levels as Function of Trust and Time Period in the Different Contracting Environments

	WEAK	MEDIUM	STRONG	
	All periods	All periods	All periods	Periods < 11
	(1)	(2)	(3)	(4)
HT	0.76	2.05***	3.07***	2.55***
	[0.50]	[0.50]	[0.37]	[0.42]
Period	-0.11***	-0.00	-0.04	0.01
	[0.03]	[0.02]	[0.04]	[0.04]
HT x Period	-0.08**	-0.08***	-0.12**	-0.01
	[0.04]	[0.02]	[0.05]	[0.08]
Constant	3.42***	2.29***	3.59***	3.35***
	[0.21]	[0.30]	[0.20]	[0.23]
Observations	1031	1046	1042	694

Notes: Panel regression estimates with random effects for principals. Bootstrapped standard errors clustered on markets (30 clusters) shown in brackets. Columns (1) to (3) present regressions for the three contracting environments WEAK, MEDIUM, and STRONG, respectively, using all periods. Column (4) shows results for STRONG excluding the final five periods to eliminate the end-game effect. The regression for each column only uses data from the respective contracting environment. The omitted category in each case is the respective low-trust environment. "HT" is a dummy variable indicating the respective high-trust environment. "Period" takes on values 1 to 15, or 1 to 10 in Colum (4) indicating the respective period. ***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table A3: The Impact of Trust and Contractual Environments on Actual Wages and Effort Levels

	Actual wage		Effort	
	All periods	Periods < 11	All periods	Periods < 11
	(1)	(2)	(3)	(4)
HT	17.40***	17.40***	1.40***	1.40***
	[3.03]	[3.03]	[0.44]	[0.44]
WEAK	-8.06***	-8.06***	0.23	0.23
	[1.22]	[1.22]	[0.24]	[0.24]
STRONG	1.10	0.94	1.03***	1.13***
	[2.65]	[2.67]	[0.32]	[0.25]
HT x WEAK	-14.24***	-14.24***	-1.32**	-1.32**
	[3.35]	[3.35]	[0.52]	[0.52]
HT x STRONG	8.33*	8.89*	0.75	1.11**
	[5.02]	[4.91]	[0.58]	[0.55]
Constant	16.49***	16.49***	2.28***	2.28***
	[0.95]	[0.95]	[0.19]	[0.19]
Observations	3119	2771	3119	2771

Notes: Panel regression estimates with random effects for principals. Bootstrapped standard errors clustered on markets (30 clusters) shown in brackets. Columns (1) and (2) present regressions explaining actual wages as a function of contracting and trust environment. The estimations use data from all three contracting environments with LT x MEDIUM as the omitted category. "HT" is a dummy variable indicating the respective high-trust environment. Thus, HT measures the impact of the high-trust environment under medium contract enforcement. WEAK measures the impact of weak contract enforcement relative to MEDIUM in the low-trust environment and STRONG measures the effect of strong contract enforcement relative to MEDIUM in the low-trust environment. HT x WEAK and HT x STRONG give the differential effect of high trust in these respective contracting environments relative to the impact of high trust in MEDIUM. Columns (2) and (4) only use periods 1 to 10 for contracting environment STRONG to eliminate the end-game effect that is present in that environment. In columns (3) and (4) the dependent variable is actual effort levels. ***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

Table A4: Relationships of Effort and Profits to Actual Wages in the High Trust Treatments

	Effort		Profit of principal	
	All periods	Periods < 11	All periods	Periods < 11
	(1)	(2)	(3)	(4)
Actual wage	0.09***	0.09***	-0.25***	-0.25***
	[0.01]	[0.01]	[0.05]	[0.05]
WEAK	1.66***	1.68***	14.74***	14.74***
	[0.30]	[0.30]	[2.24]	[2.26]
STRONG	-0.02	0.09	-5.07	-5.21
	[0.31]	[0.50]	[6.55]	[8.98]
Actual wage x WEAK	-0.08***	-0.08***	-0.71***	-0.71***
	[0.01]	[0.01]	[0.11]	[0.11]
Actual wage x STRONG	0.02**	0.03**	0.33***	0.42**
	[0.01]	[0.01]	[0.13]	[0.17]
Constant	0.80***	0.78***	17.95***	17.95***
	[0.15]	[0.16]	[1.76]	[1.77]
Observations	1551	1379	1551	1379

Notes: Panel regression estimates with random effects for principals. Bootstrapped standard errors clustered on markets (15 clusters) shown in brackets. Columns (1) and (2) present regressions explaining effort levels as a function of actual wages and contracting environment. In columns (3) and (4) the dependent variable is profit levels of principals. The estimations use data from the high trust conditions of all three contracting environments with MEDIUM as the omitted category. WEAK is a dummy variable indicating the weak contracting environment, and STRONG indicates the strong contracting environment. "Actual wage" gives the relationship of the dependent variable to actual wages in MEDIUM. Actual wage x WEAK and Actual wage x STRONG give the differential relationship of the dependent variable to higher actual wages in these respective contracting environments relative to the relationship in MEDIUM. The sample excludes outlier wages above 70. Columns (2) and (4) only use periods 1 to 10 for contracting environment STRONG to check robustness to eliminating the end-game effect that is present in that environment. ***, **, * denote significance at the 1, 5, and 10 percent level, respectively.

B. Game-Theoretic Analysis

The games analyzed in this section are simpler than the games played in the experiment, but they capture their essential features. We model contracting environment WEAK as a one-shot simultaneous-move game between a principal, who chooses a wage, and an agent, who chooses a effort level. We model contracting environment MEDIUM as a one-shot sequential-move game where the principal first choses the wage, and the agent chooses the effort level after observing that wage. We model contracting environment STRONG as a simplified dynamic interaction with two periods, and we capture the excess supply of agents by considering one principal and two agents. Throughout, we simplify the strategy spaces by assuming that all actions are binary. Furthermore, the principal is assumed to be profit-maximizing, while the agents can be either selfish types or reciprocal types. We work with sequential equilibrium as our solution concept.

Stage Game Payoffs

The principal chooses a wage $w \in \{w_L, w_H\}$, where $0 \leq w_L < w_H$. The agent exerts effort $e \in \{e_L, e_H\}$ where $0 < e_L < e_H < 1$, to produce a good of uncertain quality. The good is either valuable, in which case it generates a payoff of v for the principal, or it is useless and does not generate any value. Effort e is the probability that the good is valuable. Denote by $\omega \in \{0,1\}$ the state of the world describing whether the good is valuable ($\omega = 1$) or not ($\omega = 0$). The agent's cost of providing low effort is normalized to zero; the cost of providing high effort is c. Given actions (w, e), the expected material payoffs of principal and agent are, respectively,

$$\pi^P(w,e) = ev - w \text{ and } \pi^A(w,e) = w - \left(\frac{e - e_L}{e_H - e_L}\right)c.$$

We assume that $0 < c < (e_H - e_L)v$, which implies that providing the high effort is efficient.

The principal is profit-oriented and maximizes $u^P(w,e) = \pi^P(w,e)$. The agent has a type $\alpha \in \{0, a\}$, where $0 < a < 1$, and maximizes

$$u^A(w,e,\alpha) = \pi^A(w,e) - \alpha|\pi^P(w,e) - \pi^A(w,e)|.$$

Type $\alpha = 0$ is selfish and cares only about own material payoff. Type $\alpha = a$ is inequity-averse, where the symmetric formulation of inequity-aversion is the simplest way of modelling a reciprocal motive.[26]

[26] To keep the analysis simple and tractable we use inquity averse preferences to generate reciprocal agent behavior. In principle, one could also model the motive for reciprocal effort

Let $e^*(w,\alpha) \in \text{argmax}_e\, u^A(w,e,\alpha)$ denote a best response of the α-type agent to wage w. For the selfish type, we obtain $e^*(w_L,0) = e^*(w_H,0) = e_L$. The following assumption makes sure that $e^*(w_L,a) = e_L$ and $e^*(w_H,a) = e_H$, so that the reciprocal type would indeed behave in a trustworthy way.

Assumption 1 (Trustworthiness)

$$u^A(w_L,e_L,a) > u^A(w_L,e_H,a) \text{ and } u^A(w_H,e_H,a) > u^A(w_H,e_L,a).$$

Suppose the prior probability of the agent being reciprocal is given by $0 < \lambda < 1$. We will be interested in environments where gift-exchange does not arise in the one-shot sequential-move game, when the principal's belief about the share of reciprocal types is given by the prior. However, gift-exchange should become possible in the dynamic sequential-move game, where the principal might be able to update her belief about the agent. Suppose there was an initial stage at which a selfish agent chooses e_L while an inequity-averse agent chooses e_H. Then, if the good turns out to be of high value, a simple application of Bayes' rule implies that the principal's posterior belief about the agent being a reciprocal type would increase to

$$\lambda\left(\frac{e_H}{\lambda\, e_H + (1-\lambda)e_L}\right).$$

The following assumption implies that this increase would make the principal change her behavior.

Assumption 2 (Value of Information)

$$\lambda v < \frac{w_H - w_L}{e_H - e_L} < \lambda\left(\frac{e_H}{\lambda\, e_H + (1-\lambda)e_L}\right)v.$$

choices with alternative social preference models but this would typically render the analysis more complicated. Note that our agent dislikes inequality in expected payoffs. One could also model aversion to the expectation of inequality in ex-post payoffs, after the stochastic value of the good has realized.

Contracting Environment WEAK

Suppose the principal and the agent interact only once and choose their actions simultaneously. It is straightforward to see that this game has a unique equilibrium in which wage and effort are low. For the principal, paying the low wage is a dominant strategy when choices are simultaneous, because her wage offer cannot affect the effort chosen by the agent. Both types of the agent then find it optimal to choose low effort, under Assumption 1. We summarize this in the following proposition, the formal proof of which is left to the reader.

> **Proposition 1.** *Under Assumption 1, the one-shot simultaneous-move game has a unique sequential equilibrium. In this equilibrium, the principal pays the low wage and both types of the agent respond with low effort.*

Contracting Environment MEDIUM

Now suppose the principal and the agent interact once but choose their actions sequentially. The wage offered by the principal becomes observable before the agent makes a choice, so that the principal could affect the effort chosen by the agent. Under Assumption 2, the principal will still not find it optimal to offer the high wage. This is summarized in the following proposition, the proof of which is again left to the reader.

> **Proposition 2.** *Under Assumptions 1 and 2, the one-shot sequential-move game has a unique sequential equilibrium. In this equilibrium, the principal pays the low wage and both types of the agent respond with low effort.*

Note, however, that this result depends on the prior belief of the principal about the agent's type being pessimistic enough, as embodied by Assumption 2. Suppose an intervention like the high trustworthiness example in our experiment initially distorts upwards the beliefs of some principals about the share λ of trustworthy types. With sequential moves, we could then expect some principals to offer high wages initially. It takes some time for them to learn that the high wage is not reciprocated frequently enough to be profitable, generating a slow learning dynamics towards the actual equilibrium, in line with our observation in treatment MEDIUM-HT.

Contracting Environment STRONG

Now suppose the interaction is repeated and the principal can adjust her contract offer over time. We consider the following simplified dynamic game between the principal and two agents:

1. The principal chooses wage w^1.
2. Nature determines agent 1's type α_1 ($\alpha_1 = a$ with independent probability λ).
3. Agent 1 chooses effort e^1.
4. Nature determines the state ω^1 ($\omega^1 = 1$ with independent probability e^1).
5. The principal chooses whether to keep agent 1 ($k = 1$) or to fire her and hire agent 2 instead ($k = 0$). The principal also chooses wage w^2 for the second period.
6. Nature determines agent 2's type α_2 ($\alpha_2 = a$ with independent probability λ).
7. The hired agent chooses effort e^2.
8. Nature determines the state ω^2 ($\omega^2 = 1$ with independent probability e^2).

For notational simplicity, we assume that nature determines agent 2's type α_2 even if the agent is not hired in the second period. The terminal nodes of the dynamic game are then given by $t = (w^1, \alpha_1, e^1, \omega^1, k, w^2, \alpha_2, e^2, \omega^2)$. The players' payoffs are

$$U^P(t) = u^P(w^1, \omega^1) + u^P(w^2, \omega^2),$$

$$U_1^A(t) = u^A(w^1, e^1, \alpha_1) + ku^A(w^2, e^2, \alpha_1),$$

$$U_2^A(t) = (1 - k)u^A(w^2, e^2, \alpha_2).$$

Note that we assume here that the inequity-averse agents compare themselves only with the principal, separately period by period, whenever they interact.

Concerning the information structure, we assume that an agent's type and effort choice is observable only to the agent herself, while everything else is observable to all players.[27] A (pure) strategy of the principal prescribes the wage to be chosen in the root of the game, $s^P(\emptyset) \in \{w_L, w_H\}$, as well as for each observed history (w^1, ω^1) a hiring decision and the wage offered in the second period, $s^P(w^1, \omega^1) \in \{0,1\} \times \{w_L, w_H\}$. A strategy of agent 1 prescribes an effort to be chosen in the first period for each observed wage-type combination, $s_1^A(w^1, \alpha_1) \in \{e_L, e_H\}$, and

[27] We could also assume that wage offers are only observable to the currently hired agent, and/or that the realized value of the good is observable only to the principal. This would complicate the notation of beliefs, but we would still obtain the equilibrium outcomes derived below.

an effort to be chosen conditional on all observables in case she is hired again in the second period, $s_1^A(w^1, \alpha_1, e^1, \omega^1, 1, w^2) \in \{e_L, e_H\}$. Finally, a strategy of agent 2 prescribes a effort to be chosen conditional on all observables in case she is hired in the second period, $s_2^A(w^1, \omega^1, 0, w^2, \alpha_2) \in \{e_L, e_H\}$. For each of the observable histories at which a player acts, she maintains a probabilistic belief over the nodes in the corresponding information set, i.e., a belief about the earlier unobservable actions that led to this information set.

In a first step, we describe conditions under which the game admits a sequential equilibrium that replicates the one-shot equilibrium outcome: The principal initially pays the low wage and both types of the first agent respond with low effort; the principal then always fires the first agent and offers the low wage to the second agent, who responds with low effort. We refer to such an equilibrium as a *low-trust equilibrium*. It can exist if the principal correctly believes that a high wage would not elicit high effort from any type of the first agent, and hence would also not facilitate learning about that agent's type. It will turn out that the binding constraint for this construction is the reciprocal first agent's incentive not to respond to a high wage with high effort. The following assumption makes sure that this constraint can be satisfied.

Assumption 3 (Low-Trust Incentive-Compatibility)

$$(e_H - e_L)u^A(w_L, e_L, a) > u^A(w_H, e_H, a) - u^A(w_H, e_L, a).$$

We can now state the following result.

> **Proposition 3.** *Under Assumptions 1, 2, and 3 the dynamic game has a low-trust sequential equilibrium.*

Proof: We first characterize agent 2's strategy in any sequential equilibrium. After observing any history $(w^1, \omega^1, 0, w^2, \alpha_2)$ she entertains a belief about (α_1, e^1), which must be consistent with the requirements imposed by sequential equilibrium. However, her optimal behavior does not depend on these beliefs. Under Assumption 1, we always obtain the unique sequentially rational choice $s_2^A(w^1, \omega^1, 0, w^2, \alpha_2) = e^*(w^2, \alpha_2)$. We next characterize agent 1's second-period strategy in any sequential equilibrium. After observing any history $(w^1, \alpha_1, e^1, \omega^1, 1, w^2)$ she entertains a belief about α_2, which must be consistent with the requirements imposed by sequential equilibrium.

However, her optimal behavior does not depend on these beliefs. Under Assumption 1, we obtain the unique sequentially rational choice $s_1^A(w^1, \alpha_1, e^1, \omega^1, 1, w^2) = e^*(w^2, \alpha_1)$.

We now subsume these choices directly into the players' payoff functions and treat the game as a reduced game between the principal and agent 1. It ends in the terminal nodes $\hat{t} = (w^1, \alpha_1, e^1, \omega^1, k, w^2)$ with payoffs

$$U^P(\hat{t}) = u^P(w^1, \omega^1) + ku^P\big(w^2, e^*(w^2, \alpha_1)\big) + (1-k)\big[\lambda u^P\big(w^2, e^*(w^2, a)\big) + (1-\lambda)u^P\big(w^2, e^*(w^2, 0)\big)\big],$$

$$U_1^A(\hat{t}) = u^A(w^1, e^1, \alpha_1) + ku^A(w^2, e^*(w^2, \alpha_1), \alpha_1).$$

This reduced game has two proper subgames, one starting after each possible first period wage offer. In each of these subgames, the only non-singleton information sets are those of the principal when observing (w^1, ω^1), where she entertains beliefs about (α_1, e^1). Since $e_L > 0$ and $e_H < 1$, these beliefs can always be determined by Bayes' rule when we start from the root of the respective subgame. This uniquely pins down the consistent beliefs in any sequential equilibrium.

Consider first the subgame starting after $w^1 = w_L$. Let the strategies in this subgame be given by

$$s_1^A(w_L, 0) = s_1^A(w_L, a) = e_L \text{ and } s^P(w_L, 0) = s^P(w_L, 1) = (0, w_L),$$

i.e., both types of the first agent respond with low effort, and, irrespective of the realized value of the good, the principal then hires the second agent and pays the low wage. Given any observation of (w_L, ω^1), the principal entertains a probabilistic belief about (α_1, e^1), but only the marginal distribution of α_1 matters for her sequentially rational choices (since e^1 is not payoff relevant conditional on ω^1, and later behavior also does not depend on e^1). Denoting the probability attached to $\alpha_1 = a$ by $\beta^P(w_L, \omega^1)$, we obtain $\beta^P(w_L, 0) = \beta^P(w_L, 1) = \lambda$ from Bayes' rule. It then follows immediately from Assumptions 1 and 2 that the principal's strategy is indeed sequentially rational. As for the agent, observe that deviations cannot affect the principal's second period behavior. It then follows from Assumption 1 that the agent's strategy is also sequentially rational. The resulting expected payoff of the principal in the root of this subgame is $U_L^P = 2u^P(w_L, e_L)$.

Consider now the subgame starting after $w^1 = w_H$. Let the strategies in this subgame be given by

$$s_1^A(w_H, 0) = s_1^A(w_H, a) = e_L \text{ and } s^P(w_H, 0) = (1, w_L), s^P(w_H, 1) = (0, w_L),$$

i.e., both types of the first agent respond with low effort and the principal always pays the low wage in the second period, keeping the first agent if and only if the good is of low value. We obtain the beliefs $\beta^P(w_H, 0) = \beta^P(w_H, 1) = \lambda$. Under Assumptions 1 and 2, the principal thus wants to pay the low wage in the second period and is indifferent between keeping and firing the agent, which makes her strategy sequentially rational. As for the agent, consider type $\alpha_1 = 0$ first. Assumption 1 implies that e_L maximizes her first-period payoff. Moreover, $u^A(w_L, e^*(w_L, 0), 0) = w_L \geq 0$ implies that the selfish agent (weakly) benefits from a larger probability of being hired again in the second period, which implies that her strategy is sequentially rational. Consider next type $\alpha_1 = a$, who faces a trade-off between her payoff-maximizing response in the first period and the probability of being hired again in the second period. The condition for $s_1^A(w_H, a) = e_L$ to be sequentially rational is

$$u^A(w_H, e_L, a) + (1 - e_L)u^A(w_L, e^*(w_L, a), a) \geq u^A(w_H, e_H, a) + (1 - e_H)u^A(w_L, e^*(w_L, a), a),$$

which is satisfied under Assumptions 1 and 3. The resulting expected payoff of the principal in the root of this subgame is $U_H^P = u^P(w_H, e_L) + u^P(w_L, e_L)$.

Given the strategies and payoffs in the two subgames, it follows that $s^P(\emptyset) = w_L$ is the sequentially rational first-period wage for the principal. ■

Next, we describe conditions under which the game admits an equilibrium in which gift-exchange occurs. The principal initially pays the high wage, to which a selfish agent responds with low effort and a reciprocal agent responds with high effort. The principal then always keeps the agent but offers the high wage in the second period if and only if the good turns out to be valuable. Thus, the principal tries to screen the reciprocal types from the selfish types. We refer to such an equilibrium as a *high-trust equilibrium*. Several constraints have to be satisfied for this equilibrium to exist, which we summarize in the following.

Assumption 4 (High-Trust Incentive-Compatibility)

$$(i) \quad u^A(w_H, e_L, 0) - u^A(w_H, e_H, 0) > (e_H - e_L)[u^A(w_H, e_L, 0) - u^A(w_L, e_L, 0)],$$

$$(ii) \quad u^A(w_H, e_H, a) - u^A(w_H, e_L, a) > (e_H - e_L)[u^A(w_L, e_L, a) - u^A(w_H, e_H, a)],$$

$$(iii) \quad u^P(w_H, \lambda e_H + (1-\lambda)e_L) + \lambda e_H u^P(w_H, e_H) + (1-\lambda)e_L u^P(w_H, e_L) > [2 - \lambda(1-e_H) - (1-\lambda)(1-e_L)]\, u^P(w_L, e_L).$$

We can now state the following result.

Proposition 4: *Under Assumptions 1, 2, and 4, the dynamic game has a high-trust sequential equilibrium.*

Proof: Consider again the reduced game between the principal and agent 1 constructed in the proof of Proposition 3. Also, let the strategies and beliefs in the subgame starting after $w^1 = w_L$ be the same as in the proof of Proposition 3, i.e.,

$$s_1^A(w_L, 0) = s_1^A(w_L, a) = e_L \text{ and } s^P(w_L, 0) = s^P(w_L, 1) = (0, w_L),$$

where $\beta^P(w_L, 0) = \beta^P(w_L, 1) = \lambda$, with a resulting expected payoff for the principal in the root of this subgame of $U_L^P = 2u^P(w_L, e_L)$.

Consider now the subgame starting after $w^1 = w_H$. Let the strategies be given by

$$s_1^A(w_H, 0) = e_L,\ s_1^A(w_H, a) = e_H \text{ and } s^P(w_H, 0) = (1, w_L),\ s^P(w_H, 1) = (1, w_H),$$

i.e., the selfish agent responds with low effort and the trustworthy agent responds with high effort, while the principal always keeps the agent but pays the high wage in the second period only if the good turns out to be valuable. Given these strategies, an application of Bayes' rule yields the following consistent beliefs:

$$\beta^P(w_H, 0) = \frac{\lambda\,(1-e_H)}{\lambda\,(1-e_H) + \,(1-\lambda)(1-e_L)} < \lambda,$$

$$\beta^P(w_H, 1) = \frac{\lambda e_H}{\lambda e_H + (1-\lambda)e_L} > \lambda.$$

Assumptions 1 and 2 now immediately imply that the principal's strategy is sequentially rational. As for the agent, consider type $\alpha_1 = 0$ first. The condition for $s_1^A(w_H, 0) = e_L$ to be sequentially rational is

$$u^A(w_H, e_L, 0) + e_L u^A(w_H, e^*(w_H, 0), 0) + (1 - e_L)u^A(w_L, e^*(w_L, 0), 0)$$
$$\geq u^A(w_H, e_H, 0) + e_H u^A(w_H, e^*(w_H, 0), 0) + (1 - e_H)u^A(w_L, e^*(w_L, 0), 0),$$

which is satisfied under Assumptions 1 and 4(i). Now consider type $\alpha_1 = a$. The condition for $s_1^A(w_H, a) = e_H$ to be sequentially rational is

$$u^A(w_H, e_H, a) + e_H u^A(w_H, e^*(w_H, a), a) + (1 - e_H)u^A(w_L, e^*(w_L, a), a)$$
$$\geq u^A(w_H, e_L, a) + e_L u^A(w_H, e^*(w_H, a), a) + (1 - e_L)u^A(w_L, e^*(w_L, a), a),$$

which is satisfied under Assumptions 1 and 4(ii). The resulting expected payoff of the principal in the root of this subgame is

$$\begin{aligned} U_H^P = {} & \lambda e_H[u^P(w_H, 1) + u^P(w_H, e_H)] \\ & + \lambda(1 - e_H)[u^P(w_H, 0) + u^P(w_L, e_L)] \\ & + (1 - \lambda)e_L[u^P(w_H, 1) + u^P(w_H, e_L)] \\ & + (1 - \lambda)(1 - e_L)[u^P(w_H, 0) + u^P(w_L, e_L)]. \end{aligned}$$

Now consider the principal's choice of the first-period wage. The condition $U_H^P \geq U_L^P$ is satisfied under Assumption 4(iii), which implies that $s^P(\emptyset) = w_H$ is sequentially rational for the principal. ■

It remains to be shown that Assumptions 1 – 4 can be satisfied simultaneously, so that the low-trust and the high-trust equilibrium coexist. In fact, it can be shown that they are jointly satisfied by a large range of values of the underlying parameters, including values that resemble the payoff structure in the experiment. For instance, let $v = 100$, $c = 15$, $w_L = 20$, $w_H = 40$, $e_L = 1/3$ and $e_H = 2/3$. Also choose $a = 0.4$ and $\lambda = 0.55$. It is easy to show that all assumptions are satisfied by these parameters. It holds that all players' expected payoffs are non-negative in equilibrium (even in each period separately), so that participation constraints would also be satisfied.

We interpret the historical examples about agent trustworthiness in our experiment as an equilibrium selection device, so that the high-trust equilibrium corresponds to treatment STRONG-HT and the low-trust equilibrium corresponds to treatment STRONG-LT.

Consider the low-trust equilibrium first. The offered wage and the returned effort are always low on the equilibrium path, in both periods. If the principal actually trembled and mistakenly

offered the high wage in the first period, both agent types would still respond with low effort. The off-equilibrium behavior thus confirms the pattern shown in the low trustworthiness example.

Now consider the high-trust equilibrium. On the equilibrium path, the first-period wage is always high, w_H, while the average second-period wage (across many independent repetitions of the game) is given by

$$[\lambda e_H + (1-\lambda)e_L]\, w_H + [\lambda(1-e_H) + (1-\lambda)(1-e_L)]w_L,$$

reflecting that the principal offers the high wage only if the first-period good turns out to be valuable. Hence, we predict some endgame effect in wages. As for effort, the average first-period effort is $\lambda e_H + (1-\lambda)e_L$ in equilibrium. The average second-period effort is $(\lambda e_H)e_H + (1-\lambda e_H)e_L$, reflecting that only trustworthy agents who produced a good of high value are induced to provide the high effort again in the second period. Hence, there should also be some endgame effect in effort. Notice that a response of effort to wage can be observed on the equilibrium path in the high-trust equilibrium. The high wage is associated with an average effort of $\lambda e_H + (1-\lambda)e_L$ in the first period and with an even larger average effort of $\bar{\beta} e_H + \left(1-\bar{\beta}\right)e_L$ in the second period, where

$$\bar{\beta} = \lambda\left(\frac{e_H}{\lambda\, e_H + (1-\lambda)e_L}\right).$$

By contrast, the low wage in the second period is always associated with the low effort. Similarly, if the principal trembled and offered the low wage in the first period, both agent types would respond with low effort. This confirms the responsive pattern where agents choose higher average effort when wages are higher, as shown in the high trustworthiness example.