



GOVERNANCE AND THE EFFICIENCY
OF ECONOMIC SYSTEMS
GESY

Discussion Paper No. 359

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Contracts:
The Role of Unemployment as
a Disciplinary Device**

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May 2011

Financial support from the Deutsche Forschungsgemeinschaft through SFB/TR 15 is gratefully acknowledged.

Sonderforschungsbereich/Transregio 15 · www.sfbtr15.de
Universität Mannheim · Freie Universität Berlin · Humboldt-Universität zu Berlin · Ludwig-Maximilians-Universität München
Rheinische Friedrich-Wilhelms-Universität Bonn · Zentrum für Europäische Wirtschaftsforschung Mannheim

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Competition and Relational Contracts: The Role of Unemployment as a Disciplinary Device

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Abstract

When workers are faced with the threat of unemployment, their relationship with a particular firm becomes valuable. As a result, a worker may comply with the terms of a relational contract that demands high effort even when performance is not enforceable by a third party. But can relational contracts motivate high effort when workers can easily find alternative jobs? We examine how competition for labor affects the emergence of relational contracts and their effectiveness in overcoming moral hazard in the labor market. We show that effective relational contracts do emerge in a market with excess demand for labor. Long-term relationships turn out to be less frequent when there is excess demand for labor than they are in a market characterized by exogenous unemployment. However, stronger competition for labor does not impair labor market efficiency: higher wages induced by competition lead to higher effort out of concerns for reciprocity.

JEL: D82, J3, J41, E24, C9

Keywords: Relational Contracts, Involuntary Unemployment.

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1. Introduction

Firms and workers often rely on relational contracts that specify mutual obligations in implicit, non-verifiable agreements (Williamson 1975; MacLeod, 2000; Baker et. al., 2002). Implicit agreements are arguably widely used because complete, explicit labor contracts are costly to design and enforce. Relational contracts need to be self-enforcing in the sense that both firms and workers voluntarily adhere to their obligations. Self-enforcing agreements can only be achieved if the future value of the relationship is sufficient for both parties (Bull, 1987). The value of a particular employment relationship to the firm or worker will depend on labor market conditions. In a market characterized by high unemployment, a worker who has a job is less likely to shirk because doing so might jeopardize his future employment prospects (Shapiro and Stiglitz, 1984). If, however, there is full employment, a worker may be more tempted to shirk because he can always switch to another firm if his behavior is detected.

In this paper, we report data from an experiment that examines how competitive conditions in the labor market affect the emergence and effectiveness of relational contracts. Our main question is whether unemployment is a precondition for relational contracting or whether effective relational contracts emerge even when there is excess demand for labor. Our experimental design builds on the experiment reported in Brown, Falk and Fehr (2004), which we will refer to as BFF2004 for the rest of the paper. Our main treatment implements a labor market in which worker effort is not enforced by a third party and firms and workers can choose to engage in bilateral relations. We compare this main treatment to two control treatments. In the first control treatment, worker effort is not third-party enforceable. However, unlike in the case of the main treatment, information conditions prevent the emergence of bilateral relations. In the second control treatment, bilateral relations can emerge but are not necessary to enforce worker effort because effort is third-party enforceable. BFF2004 implements these three treatments in a market characterized by an excess supply of labor. For this study we implemented the same three treatments in a market with excess demand for labor. This design

allows us to examine the emergence of relational contracts under full employment. By comparing our data to that of the experiment reported in BFF2004, we can also compare the impact of competition for workers on the prevalence and consequences of relational contracting.

We present three main results. First, we find that *even when there is excess demand for labor, bilateral relations between firms and workers emerge. The reputation incentives provided in these relationships discipline workers to provide high effort.* We find that in our main treatment, a much higher share of trades take place in the context of multi-period bilateral relations than is the case for our control treatment featuring third-party enforcement of effort. In addition, we find that average worker effort in our main treatment is significantly higher than in our control treatment, in which bilateral relations are not feasible.

Secondly, *stronger demand for labor makes it more difficult to maintain long-term firm-worker relations.* Our results suggest that firms in our main treatment are equally likely to offer contract renewals to well-performing incumbent workers under excess demand for labor and excess supply of labor. However, under excess demand for labor, workers are more likely to reject these offers and switch to a new firm. As a result, we find that in our main treatment, a lower share of trades take place in long-term relations under excess demand than in those under excess supply.

Thirdly, *although competition for workers makes it more difficult to sustain long-term firm-worker relations, it does not reduce market performance.* Aggregate effort in our main treatment is almost identical under excess demand for labor as it is under excess supply of labor. Our data suggest that this result is driven by higher wages in the market with excess demand for labor, leading to the provision of more pronounced reciprocal effort outside of relations.

Our findings support the conjecture that relational labor contracts can be sustained even in the absence of unemployment as a disciplinary device. MacLeod and Malcolmson (1998) show that implicit agreements between firms and employees can be sustained in a market with either unemployment or full employment. They show that it is merely the nature of relational contracts that changes with market conditions; as proposed by Shapiro and Stiglitz (1984), relational contracts are characterized by simple rents (i.e., efficiency wages) when workers are threatened

by unemployment. In contrast, under full employment, firms must offer relation-specific quasi-rents to workers to motivate high performance.¹

Several empirical studies have analyzed the role of quasi-rents in self-enforcing relational contracts. Studies of wage profiles within firms show that wages increase strongly with seniority but that this positive tenure-earnings relationship is hardly related to individual productivity gains (Medoff and Abraham, 1980, Flabbi and Ichino, 2001; Dohmen, 2004). Although these studies suggest that seniority wages are offered to provide incentives to workers (as in Lazear 1982), the data do not allow one to identify how seniority wages affect worker performance or whether the effect of such deferred payments varies with competitive conditions in the labor market. Examining the payment schemes of young workers in the US, MacLeod and Parent (2000) show that bonus payments are more frequent in countries in which the labor market is tight. Their data, however, cannot distinguish discretionary bonus payments from explicitly guaranteed ones. It is therefore unclear whether the observed bonus payments are actually components of explicit or implicit contracts. Huck et al. (2010) provide experimental evidence that deferred compensation increases worker effort. However, in their experiment, firms and workers are randomly matched on a one-to-one basis. This means that they cannot relate deferred payments to relational contracting or study how they are affected by labor market conditions.

Our results also suggest that relational contracts may be harder to sustain in macroeconomic upswings. Field evidence shows that employment relations may be more difficult to sustain when the labor market is tight. Examining data from 16 industrialized countries, Auer and Cazes (2000) finds that job tenure drops when economic growth leads to high demand for labor.

¹ In MacLeod and Malcolmson (1998) post-effort bonus payments generate such quasi-rents within a relationship. In general, however, any remuneration package that offers quasi-rents through deferred payments—such as “seniority wages” (Lazear, 1982) or explicit “bonding” (Carmichael, 1985)—or on the basis of informational advantages (Boot and Thakor, 1994) can sustain an implicit agreement under full employment.

Examining worker flow data from the United States, Bleakley et al. (1999) show that workers' switching behavior is responsible for this breakdown of long-term employment relationships. They find that significantly more workers voluntarily leave their jobs during expansionary periods of the business cycle than during recessions. However, these studies can hardly identify whether long-term employment is a result of relational contracts between firms and workers, specific human capital investment, or switching costs in the labor market. As a result, the fact that many employment relationships appear to collapse under full employment does not imply that it is implicit agreements that are falling apart.

This paper contributes to the growing experimental literature on implicit agreements and reputation incentives in competitive labor markets. BFF2004 shows that bilateral relations do emerge and discipline workers to provide high effort in a labor market characterized by exogenous unemployment. Implementing a similar gift-exchange game with endogenous partner choice, Wu and Roe (2007) show that bilateral firm-worker relations also motivate firms to deliver promised wages, whereas Linardi and Camerer (2008) show that firm-worker relations can survive economic shocks—i.e., economic downturns in which firms cannot hire. Most recently, Roe and Wu (2009) conducted one-shot social preference decisions prior to a labor market game; they confirm that reputation incentives discipline selfish workers and selfish firms. Each of the above studies implements a labor market with exogenous unemployment in which efficiency wages and the threat of unemployment can discipline workers. In this paper, we show that implicit agreements between firms and workers can at least partly be maintained in a market in which workers must not fear unemployment.

The rest of this paper is organized as follows. We present our experimental design and predictions in Section 2. In Section 4, we present our results, and Section 5 concludes the paper.

2. Experimental design

2.1. Gift-exchange game with endogenous partner choice

Our experimental labor market lasts 15 periods with two stages in each period. During the first stage, firms make contract offers that specify a non-contingent wage w and a desired effort \tilde{e} , whereas workers decide whether to accept or reject these offers. The posting and acceptance of contracts is conducted during a continuous auction involving all firms and workers. A firm can make private or public offers. In a private offer, the firm specifies the identification number (ID) of the worker with whom it wants to trade. Only this worker is informed about the offer. In a public offer, all workers and all other firms are informed about the offer. As a result, any worker can accept a public offer. In a given trading period, firms can make as many private and public offers as they want to make. As soon as a worker has accepted one of the offers, the firm that has made the offer is matched with this worker and informed of the worker's ID. Each firm can hire one worker at most, and each worker can accept only one wage offer. Once an offer has been accepted, all of the firm's other standing offers are immediately removed from the market. At all times during a trading period, firms are informed about the workers who remain in the market. This is done to prevent private offers to workers who have already signed a contract.

Once all firms or workers have concluded a trade, or once the maximum time for the trading stage has elapsed, the second stage of the period begins. At this stage, the actual effort e of the worker is determined, as are the payoffs for each firm and worker.

The material payoff of a firm per period is given by

$$\pi(w, e) = \begin{cases} 10 \cdot e - w & , \text{ if a contract is concluded} \\ 0 & , \text{ if no contract is concluded} \end{cases}$$

The material payoff of a worker is given by

$$v(w, e) = \begin{cases} w - c(e) & , \text{ if a contract is concluded} \\ 5 & , \text{ if no contract is concluded} \end{cases}$$

where $c(e)$ denotes the cost of supplying effort e .

The set of feasible wage levels is given by $w \in [1, \dots, 100]$. The cost of effort schedule $c(e)$ for workers is strictly increasing and exhibits increasing marginal costs (see Table 1).

Table 1 here

The payoff functions, the number of firms and workers, the cost of effort, and the fact that there were 15 trading periods are all common knowledge. At the end of each period, each participant is informed about the contract $[w, \tilde{e}]$ he has concluded, the actual effort level, e , his own payoff, the payoff of his trading partner and the ID of his trading partner. Participants write this information on a separate sheet of paper to ensure that they are always fully informed about their own trading history.

2.2. Treatments

We examine two labor market conditions. The first is a labor market with an **excess demand for labor (D market)**. Under this condition, there are 10 firms and 7 workers in the market. We compare the market with excess demand for labor to one with an **excess supply of labor (S market)**: i.e., 7 firms and 10 workers. The data for the market with excess supply of labor are taken from the experiment reported in BFF2004.

Table 2 here

For both market conditions (D and S), we implement three treatments in which contract enforcement and information conditions are varied. Our main treatment is the **Incomplete**

Contracts with Fixed identification (ICF) treatment. In this treatment, contracts are not exogenously enforced: i.e., workers can choose any feasible effort e irrespective of the contractually proposed level \tilde{e} . Also, in this treatment, firms and workers have the option of trading repeatedly with each other because the subjects have fixed IDs throughout the experiment. A firm can thus make offers to the same worker (same ID) in consecutive periods, and if the worker accepts the offers, a long-term relationship is established.

Our first control treatment is the **Complete Contracts (C)** treatment. In this treatment, the proposed effort of the firm is exogenously enforced: i.e., $e = \tilde{e}$. Otherwise, all procedures and parameters are identical to those in the ICF treatment. In particular, all participants have fixed IDs, such that a firm can establish a relationship with a particular worker (and vice versa). This control treatment generates benchmark results for the frequency of long-term relationships and for firms' contract offers when effort is third-party enforceable.

Our second control treatment is the **Incomplete Contracts with Random Identification (ICR)** treatment. As in the ICF, effort is not enforceable in this treatment. Unlike in the ICF, however, information conditions prevent firms and workers from establishing relationships. This is ensured by randomly assigning IDs to participants during each period (both firms and workers). Participants are therefore unable to identify whom they have traded with in the past and thus cannot deliberately maintain relationships. This control treatment provides benchmark results for effort when contracts are not third-party-enforceable and when relational contracts are not feasible.

2.3. Procedures

The experimental instructions were framed in a neutral goods market language.² Firms were called “buyers,” and their contract offers were framed as “price offers” for “desired quality”.

² We framed the experiment in neutral market terminology to avoid eliciting behavior based on participants' preconceptions about how the labor market works. We acknowledge that this

Workers were called “sellers,” and their actual effort choice was framed as “actual quality”. A translated version of the original (German) experimental instructions is provided in Brown et al. (2008).

The experiment was conducted using the “z-tree” software (Fischbacher, 2007). Prior to the 15 periods, participants completed two practice periods to acclimate to the computer environment. During both practice periods, the subjects only went through the first stage of the experiment (posting and accepting offers), and no money could be earned during these periods.

We conducted five sessions for each treatment except the ICR-S, for which 4 sessions were implemented. All sessions for the ICF-D and C-D treatment were conducted in November 2002, while the sessions for the ICR-D treatment were conducted in May/June 2004. As mentioned above, the data for the ICF-S, ICR-S, and C-S treatments were taken from the experiment reported in BFF2004. The sessions for these treatments were conducted between June 1999 and May 2001. The subjects in all sessions were students from the University of Zurich and the ETH Zurich.³ No subject participated in more than one session, so 493 subjects in total (17 in each session) participated in the experiment. On average, a session lasted 120 minutes, and each subject earned roughly CHF 60. Average earnings were thus roughly 20 US\$ per hour.⁴

procedure cannot fully prevent subjects from associating the experiment with the labor market or other markets with which they may or may not have experience. Because there is no reason to believe that such associations vary across our treatments, they should not bias or invalidate our cross-treatment comparisons.

³ Subjects were recruited by telephone from a database of students who had expressed interest in taking part in an experiment. Students with economics and psychology majors were excluded from the experiment.

⁴ US\$ 1 = CHF 1.55 in 2002.

2.4. Behavioral predictions

All participants were informed that the experiment would last exactly 15 periods. Assuming **common knowledge of selfish behavior** each treatment would therefore constitute a finite game of complete information. In this case, the ICF and ICR conditions in which effort is not third-party-enforced should yield minimum effort for both the excess demand and the excess supply markets. Firms anticipate that all workers perform $e=1$ in period 15, no matter the history of the experiment. They therefore offer wages that just meet the workers' participation constraint (in the ICR-S) or their own participation constraint (ICR-D), assuming minimum effort provision. Via backward induction, firms will offer the same contract in periods 1 through 14, and workers' performance will always be minimal. These predictions regarding the ICF and ICR conditions are in strong contrast to that for the C condition in which effort is third-party enforceable and thus the value-maximizing effort level $e=10$ can be implemented.

Brown et al. (2008) offer behavioral predictions for our experiment assuming the presence of some **non-identifiable "fair" workers**.⁵ Under this assumption, our ICF condition constitutes a repeated game of incomplete information. In such games, reputation concerns can motivate

⁵ Experimental studies find that fairness concerns motivate the behavior of some subjects in gift-exchange games similar to that implemented in this experiment (Fehr et al., 1993; Fehr and Falk, 1999; as well as in a wider range of economic settings (see e.g. Camerer, 2003). The importance of fairness motives in experiments is mirrored by worker behavior in the labor market. Interview studies with human resources managers suggest that the performance of workers is strongly affected by the fairness of their remuneration (Bewley, 1995; Blinder and Choi, 1990). In Brown et al. (2008), we derive formal predictions for our treatments assuming that there is a share p of fair workers who adhere to a contract $[w, \tilde{e}]$ if and only if it offers them at least a fair share of earnings: $w - c(\tilde{e}) \geq q\tilde{e} - w$. If the contract does not offer them an equal share of the earnings, fair workers simply maximize their monetary payoffs. We assume that the remaining share $1-p$ of workers maximize their monetary payoffs.

money-maximizing agents to imitate the behavior of non-money maximizing agents even if the horizon is finite (see Kreps et al. 1982). In the ICF-D treatment, reputation incentives must be based on quasi-rents in bilateral relations, with incumbent firms offering higher *future* wages to high-performing workers than “outside” firms offer in the public market. We show that “outside” firms will offer lower wages in the public market if they expect that selfish workers will be more likely to switch firms.⁶ These reputation incentives raise the aggregate worker effort level beyond that of the ICR-D treatment, in which bilateral relations are not feasible. In the spirit of MacLeod and Malcolmson (1998) relational contracts in the ICF-D treatment may generate equally high effort levels as in the ICF-S treatment, in which relational contracts are driven by efficiency wages and the threat of unemployment. However, with the ICF-D and ICF-S being dynamic games of incomplete information, both treatments have multiple equilibria. It is therefore an empirical question how competition for workers truly affects relational contracting.

Under the ICR condition, the presence of some fair workers implies a positive wage-effort relationship. However, firms can only profitably induce non-minimal effort (i.e., $e > 1$) if there are sufficiently many fair-minded workers in the market. Competition among firms in the ICR-D treatment implies that firms will offer higher wages than in the ICR-S treatment. Indeed, for a wide range of beliefs about the share of fair workers, we predict that competition for workers in the ICR-D will force firms to offer wages that induce non-minimal effort ($e > 1$), whereas the effort level that we predict for the ICR-S treatment is still minimal ($e = 1$). Thus we expect higher wages and aggregate effort in the ICR-D than in the ICR treatment.

The presence of some fair workers does not change the aggregate effort predictions in our C condition. In this treatment, effort is third-party-enforceable, so that maximum effort is implemented even if all workers are selfish. This will also be the case with some fair workers. Note, however, that effort provision in the C-D and C-S treatments is not dependent on the

⁶ Alternatively, quasi-rents could emerge in our experiment from deferred compensation in the form of rising wage schedules within relationships, as in Lazear (1982).

formation of relationships. As a result, we predict fewer long-term relationships under the C condition than under the ICF condition.

In summary, we expect the following outcomes regarding labor market competition and relational contracting. Despite full employment in the ICF-D treatment, bilateral relations emerge, and the reputational incentives that are part of these relationships raise aggregate effort. We expect more firm-worker relations in the ICF-D treatment than in the C-D treatment and higher effort in the ICF-D treatment than the ICR-D treatment. Competition for workers may not reduce the prevalence or efficacy of relational contracts. We expect a similar pattern of firm-worker relations and similar effort provision in the ICF-D and ICF-S treatments.

3. Results

In presenting our results, we proceed as follows. First, we present an overview of the aggregate outcome of our six treatments. To examine the emergence of relational contracts under excess demand for labor, we compare the outcome of the ICF-D treatment to that of the ICR-D and C-D treatments. To study the impact of competition on relational contracting, we contrast the outcome of the ICF-D treatment with that of the ICF-S treatment. This sets the stage for a more detailed analysis of relationship formation and effort provision.

3.1. Main treatment effects

In this section, we present summary statistics for each treatment (see Table 3) and compare treatments using Mann-Whitney tests based on session averages for each statistic.

Our first observation from Table 3 is that our treatments were successful in inducing competition for labor. Our first indicator of competition is the number of contracts posted by firms per period. Firms make more offers in the ICF-D, ICR-D and C-D treatments than they do in the ICF-S, ICR-S and C-S treatments. For example, the number of contract offers posted by

firms is almost four times higher in the ICF-D (4.6 per firm and period) than the ICF-S treatment (1.2).⁷ Moreover, competition is persistent throughout the ICF-D treatment, with at least 3.5 offers per firm in all periods.⁸ Our second indicator of competition is the share of firms' offers that are public and thus contribute to a competitive market place. The share of public offers is substantially higher in the ICF-D treatment than in the ICF-S treatment (43% vs. 27%).⁹ In contrast, excess demand for labor does not raise the share of public offers under our two control conditions (C-D vs. C-S or ICR-D vs. ICR-S).

To provide a further indication of competition for workers, we compare wages offered by firms in public offers, private offers to their incumbent workers, and private offers to non-incumbent workers. We find that the difference between private incumbent wages and public wages is lower in the ICF-D treatment (14.6) than in the ICF-S treatment (23.5). Similarly, the difference between private incumbent wages and private non-incumbent wages is lower in the ICF-D (8.7) than the ICF-S treatment (16.7).¹⁰ Considering the dispersion of wage offers (measured by the coefficient of variation), we find that the dispersion of private incumbent offers is similar in the ICF-D (.30) and ICF-S (.28), whereas the dispersion of public wages (.36

⁷ One-sided Mann-Whitney tests using session averages as observations show that there are more offers in the ICF-D than in the ICF-S ($p=.004$), more offers in the ICR-D than in the ICR-S ($p=.004$), and more in the C-D than the C-S ($p=.008$).

⁸ There is no major decline in the number of offers made by firms in the ICF-D over time. There are 4.2 offers per firm in period 1; this figure rises gradually to 5.7 per firm in period 5 and then declines gradually to 3.5 in period 13, after which it rises again to 4.26 per firm in period 15.

⁹ A one-sided Mann-Whitney test using session averages as observations shows that there are more public offers in the ICF-D than the ICF-S ($p=.075$).

¹⁰ One-sided Mann-Whitney tests using session averages as observations show that the difference between private incumbent and public wage offers ($p=.008$) and the difference between private incumbent and private non-incumbent wage offers ($p=.048$) is lower in the ICF-D than in the ICF-S.

vs. .48) and private non-incumbent wages (.33 vs. .48) is lower in the ICF-D treatment than in the ICF-S treatment.¹¹ Together, these results suggest that workers in the ICF-D are more likely to get higher wage offers from outside firms than workers in the ICF-S treatment.

Table 3 here

Our second observation from Table 3 is that *despite strong competition for workers, bilateral relations do emerge in the ICF-D treatment, and reputational incentives in this treatment do raise the aggregate effort level.* The table displays the share of trades that take place in one-shot transactions (1 period), short relationships (2-5 periods) and long relationships (6-15 periods) by treatment. In the ICF-D treatment, 24% of trades take place in relationships of 2-5 periods and 23% in relationships of 6-15 periods. In comparison, in the C-D treatment with third-party enforcement of effort, more than 85% of all trades take place in one-shot transactions.

The presence of reputational incentives in the ICF-D treatment is associated with higher aggregate effort: we find significantly higher effort in the ICF-D (6.7) than in the ICR-D (4.9) where reputational incentives are absent by design.¹² The development of effort over time in the ICF-D provides further support for the conjecture that reputation incentives were strong in this treatment. Figure 1 shows that mean effort rises slightly from period 1 through period 11 and then suffers a substantial end-game effect as reputation incentives wear off at the end of the

¹¹ One-sided Mann-Whitney tests using session averages as observations show that the coefficient of variation for private incumbent wage offers is not lower in the ICF-D treatment as in the ICF-S treatment ($p=.917$), while the coefficient of variation for public wage offers ($p=.076$) and private non-incumbent wage offers ($p=.076$) is lower in the ICF-D than in the ICF-S.

¹² One-sided Mann-Whitney tests of session averages show that multi-period relations are significantly more frequent in the ICF-D than in the C-D treatment ($p=.004$) and that effort is higher in the ICF-D than the ICR-D treatment ($p=.028$).

experiment. The ICR-D treatment, by contrast, shows a more or less constant mean effort level over time.

Figure 1 here

Our third observation from Table 3 is that *stronger competition for workers under the ICF condition reduces the number of long-term relationships but does not significantly alter aggregate effort*. In the ICF-D treatment, 47% of all trades take place in multi-period relationships, and 23% take place in relationships of 6 or more periods. This percentage is substantially smaller than in the ICF-S treatment, in which 62% of all trades take place in multi-period relationships and 45% take place in relationships of 6 or more periods.¹³

Surprisingly, the lower number of long-term relationships in the ICF-D treatment compared to the ICF-S treatment does not imply lower market efficiency. Average effort in the ICF-D (6.7) is practically identical to that in the ICF-S (6.9). Moreover, as displayed in Figure 1, the time trend for mean effort is almost identical in the ICF-D and ICF-S treatments: mean effort in both treatments first rises gradually and then is subject to a significant drop in the final periods of the experiment. In the ICF-D treatment, however, the end-game effect on effort starts earlier and is larger than in the ICF-S treatment, providing the first evidence that reputation incentives may be more difficult to sustain.

Although efficiency in the ICF-condition seems unaffected by competition, the distribution of gains from trade is tilted to the benefit of workers. Table 3 shows that the average wage paid

¹³ Due to strong variation in relationship duration across sessions, we cannot reject the hypothesis that the frequency of bilateral relations is equal in the two treatments. Using the share of trades in one-shot transactions (versus multi-period relationships) per session as our observations, we conduct a one-sided Mann-Whitney Test that yields a p-value of .1548.

by firms is significantly higher in the ICF-D treatment (54.2) than the ICF-S treatment (40.1).¹⁴ As a result, workers' payoffs are higher and firms' profits are lower in the ICF-D than in the ICF-S. Figure 1b shows that the difference between the mean wages for the ICF-D and ICF-S is quite stable prior to the end-game effect, which (as discussed above) is stronger in the ICF-D treatment. The difference between the mean wages for the two treatments begins at 14.4 in period 1 and reaches 13.8 in period 12 before falling to 7.3 in the final period.

Wages under the ICF condition react much more weakly to competition for labor than in the C condition, wherein effort is third-party-enforced. Table 3 shows that wages in the C-D treatment are 39.7 points higher than in the C-S treatment. In contrast, the difference in wages between the ICF-D and ICF-S is only 14.1 points. This substantial difference suggests that contractual incompleteness causes pronounced wage rigidity: wages are less sensitive to changes in market conditions when effort is not third-party-enforced. This is further supported by a comparison between the ICR-D and ICR-S treatments. Table 3 shows that the wage difference between the ICR-D and ICR-S is on average 18.3 points and is thus also much smaller than between the C-D and C-S. Figure 1b shows that the wage difference between the ICR-D and ICR-S increases over time from 10.6 in period 1 to 21.6 in period 15. This mirrors the widening gap between the levels of effort provision between the two treatments, as displayed in Figure 1a.

In summary, the results presented in Table 3 and Figure 1 suggest that there are substantial reputation incentives for workers in the ICF-D treatment even though they are not threatened by unemployment. However, stronger competition for workers seems to make it harder to sustain the firm-worker relations that underlie these incentives. In the following, we examine the impact of competition on the formation of relations and worker effort in more detail.

¹⁴ A one-sided Mann-Whitney test based on session averages suggests that wages are higher in the ICF-D treatment than in the ICF-S treatment ($p=.004$). A two-sided test does not reject the hypothesis that the effort level is identical in these two treatments ($p=.841$)

3.2. Competition and firms' contract offers

Theory suggests that firms in the ICF-D and ICF-S treatment maintain reputational incentives for workers by conditioning their contract offers and wages on past effort performance. Are firms less tough on their workers when they face outside competition in the ICF-D, or do firms pursue a similar contingent contract policy irrespective of competitive conditions in the labor market? In Table 4, we examine firms' contract offers, relating their contract renewals and wage offers to (i) workers' prior effort, (ii) whether the worker met the firms' expectations for prior performance, and (iii) whether the experiment is in its final periods (controlling for potential end-game effects).

The results presented in Table 4 suggest that competition for workers does not affect the contingent contract policy of firms. Columns (1-3) of the table examine a firms' probability of renewing a contract with an incumbent worker. The results reported in columns (1-2) show that in both ICF-D and ICF-S, firms are more likely to renew contracts if the worker provided higher effort in the prior period. Controlling for worker effort, however, we do not find a robust effect of complying with firms' expectations on contract renewal. In column (3), we analyze whether there are treatment differences in this contingent renewal policy by including interaction terms of our explanatory variables with a treatment dummy for the ICF-D. The estimated coefficients for these interaction terms suggest no treatment differences. In columns (4-6) of Table 4, we examine the rents offered by firms in repeat contracts. The dependent variable in these columns is the difference between the wage offered by a firm to its incumbent worker and the mean public wage offered in the market in that period. We find that in both the ICF-D and ICF-S firms offer higher rents to workers who provide higher effort in the prior period. Again, the pooled regression in column (6) suggests that there is no significant difference in firms' contract offers across treatments.¹⁵

¹⁵ Note that the contingent contract renewal policy observed in the ICF-D and ICF-S treatments could be driven by reciprocal behavior on the part of firms rather than by relational contracts. Some firms may simply "reward" workers for past performance without thinking of the

Table 4 here ¹⁶

3.3. Competition, contract acceptance and worker effort

The previous section suggests that firms' contract offer policies are not strongly influenced by labor market conditions. In this section, we examine how competition affects workers' acceptance of contracts and their effort provision.

In the ICF-D and ICF-S treatments, firms offer workers who delivered the level of desired effort a renewed contract in 80% of cases. Our summary statistics in Table 3 show, however, that there are fewer long-term firm-worker relations in the ICF-D than in the ICF-S treatment.

incentive effect of this contract policy on selfish workers. If this were the case, we should observe that contract offers by firms, contingent on prior effort, do not vary over time. To disentangle the forward-looking incentive effect from the backward-looking reward effect, we regress firms' wage offers to their incumbent worker in periods 11-15 on prior effort, a period 15 dummy, and the interaction term of the two. We find that the interaction term is significantly negative, suggesting that wage offers to incumbent workers are not fully driven by backward-looking reward considerations.

¹⁶ The estimates reported for the ICF-D and ICF-S treatments in Table 4 are based on probit estimates and thus do not account for the inherently dynamic nature of our data in the ICF condition: contract offers, contract renewals and worker performance depend on past values of each other. We therefore conduct robustness tests, using the Arellano-Bond estimation method, which accounts for the effects of lagged variables. The results confirm the qualitative findings for the ICF-D and ICF-S treatments in the table. We conduct further robustness tests to account for the time-varying effects of our explanatory variables. We replicate columns (1, 2, 4, and 5) in Table 4, including the interaction terms *Period 11-15*Effort* and *Period 11-15*Negative surprise*. Neither interaction term is significant in any of the models.

This suggests that the higher break-up rate for relationships in the ICF-D is due to workers' rejecting contracts from their incumbent firms in favor of an offer from an outside firm. Our data show that this is indeed the case. In the ICF-S treatment, 98% of the workers who receive a contract offer from their incumbent firm accept this offer. In contrast, in the ICF-D treatment, only 72% of renewed contract offers are accepted. This lower acceptance rate for offers in the ICF-D as compared to the ICF-S is confirmed by a regression analysis that relates contract acceptance by workers to a treatment dummy, controlling for the wage offered by firms and whether the offer was made in the final periods of the experiment.

Looking more closely at those instances in which a worker rejects a contract offer from his incumbent firm in the ICF-D treatment, we find that in 74% of these cases, the worker accepts an outside offer with a wage at least as high as that offered by his current firm. An interesting finding arises from those cases where a worker rejects a renewed offer by his current firm and accepts a lower wage from an outside firm. In 14 of these 16 cases, the current firm had either lowered its wage offer or not increased it from that offered in the prior period. Together, these findings suggest that these workers broke off relationships when they saw better outside opportunities or when their current firm did not meet their wage expectations.

Table 5 examines how labor market conditions affect workers' effort provision. The regressions presented in columns (1-3) of the table relate worker effort in the ICF-D and ICF-S treatments to (i) the *wage* offered by the firm, (ii) whether the offer was *private* or public, and (iii) whether the trade took place in the final periods of the experiment: i.e., *periods 11-15*. As argued in BFF 2004, both reciprocal motives and reputation concerns imply that workers should perform higher effort if the wage offered by the firm is higher. Likewise, private contract offers may induce higher effort because they may be perceived as a kind act or may signal that the firm is interested in a long-term relationship. Finally, if reputation concerns motivate effort provision in the ICF-D and ICF-S treatments, we expect lower effort provision in the final periods of the experiment, in which such concerns wear off.

The results reported in Table 5 show a similar qualitative pattern of effort provision in the ICF-D (column 1) and ICF-S (column 2) treatments. Higher wages and private offers induce

workers to provide higher effort. Moreover, the negative coefficient of the *Period 11-15* dummy confirms the presence of significant reputation incentives in *both* treatments: workers respond to the same contract offer with higher effort in earlier periods than in later ones.

While the main pattern of effort provision is similar in the ICF-D and ICF-S treatments, the pooled regression reported in column (3) of Table 5 displays some differences in terms of the quantitative impact of wages, private offers and the end-game effect on effort. In particular, the weaker effort-wage relationship in the ICF-D than in the ICF-S suggests that stronger competition for labor does reduce reputation incentives. The weaker effort-wage relationship in the ICF-D than in the ICF-S treatment is confirmed in Figure 2, which displays the mean effort provided in both treatments for four different wage-classes (0-20, 21-40, 41-60, and 61-100). The figure shows that mean effort provision in the ICF-D is higher than in the ICF-S for wages below 40 and lower for wages above 40, leading to a less steep effort-wage profile.

Table 5 here ¹⁷

The results above suggest that relational contracting is partly impaired by stronger competition for labor. It therefore remains to be explained why aggregate effort is almost identical in the ICF-D and ICF-S treatments: if excess demand for labor implies that workers get

¹⁷ We again conduct robustness tests using the Arellano-Bond estimation method to account for the dynamic nature of our data in the ICF-D and ICF-S treatments. The qualitative results in Table 5 are confirmed. We also conduct robustness tests to account for the time-varying effects of our explanatory variables. We replicate columns (1, 2, 4 and 5) of Table 5, including the interaction times *Period 11-15*Wage* and *Period 11-15*Private*. The interaction term *Period 11-15*Private* is not significant in any of the regressions. The interaction term *Period 11-15*Wage* is not significant in the regressions for the ICF-S or ICR-S treatments but is significant, positive and of similar magnitude in the ICR-D and ICF-S treatments. This result suggests that given excess demand for labor, the effort-wage relationship becomes weaker over time, independent of reputation effects.

better outside offers, even if they shirk on their incumbent firm, how then can we then explain the fact that aggregate effort is not lower? One potential explanation is that weaker reputation incentives in the ICF-D treatment (as compared to the ICF-S treatment) may be compensated for by an increase in reciprocal effort provision due to higher market wages. Our summary statistics in Table 2 show that the mean wage level in the ICF-D treatment is significantly higher than in the ICF-S treatment (54.2 vs. 40.1). Thus, if the reciprocal reaction to a wage offer is similar across market conditions, this wage increase should indeed induce higher effort provision based on reciprocal motives in the ICF-D.

To isolate the impact of labor market conditions on reciprocal effort provision, columns (4-6) of Table 5 examine worker performance in the ICR-D and ICR-S treatments in which reputation incentives are absent and only concerns for reciprocity can explain non-minimal effort provision. Again, we relate worker effort to (i) the wage offered by the firm, (ii) whether the offer was private, and (iii) whether the trade took place in the final periods of the experiment. If some workers exhibit reciprocal preferences, we should expect a positive relation between effort and wages in both treatments. Moreover, private offers may be viewed by some workers as a kind action that could also lead to higher effort. The extent to which workers perceive wages and private offers as generous and reciprocate this generosity is likely to depend on labor market conditions. In particular, in the ICR-D treatment, high wages are less likely to signal generous intentions on the part of firms because competition forces firms to offer higher wages. Likewise, receiving a private offer may be perceived as kinder in a situation with an excess supply of labor. Existing theory (Dufwenberg and Kirchsteiger, 2004, Falk and Fischbacher, 2006) and evidence (Brandts and Charness, 2004) suggest that first-mover intentions may affect second-mover behavior in our gift-exchange game. Thus, we may find that effort is less sensitive to wages and private offers in the ICR-D treatment than in the ICR-S treatment.

The results presented in Table 5 show, as expected, that workers reward higher wages and private offers with higher effort in the ICR-D and the ICR-S treatments (see columns 4-5).¹⁸ The pooled regression reported in column (6) of the table displays a surprising result: competition for workers does not seem to weaken the reciprocal provision of effort under the ICR condition. The insignificant treatment effect *Excess demand* and interaction terms *Excess demand*Wage* and *Excess demand*Private* suggest that the reaction of workers to higher wages and private offers is similar in the ICR-D and ICR-S treatments.¹⁹

The similar effort-wage relationship in the ICR-D and the ICR-S treatments is again confirmed in Figure 2. For wages below 60, which account for over 60% of trades in the ICR-D treatment and 85% of trades in the ICR-S, we find almost identical mean effort provision. The figure does suggest that effort provision in the ICR-S is substantially higher than in the ICR-D for wages exceeding 60: i.e., wages that provide the worker with more than an equal split of the surplus if he provides the maximum effort. However, such wages are paid in less than 5% of trades in both treatments.

Figure 2 here

¹⁸ Because reputation incentives cannot emerge under the ICR condition we expect that effort will not fall towards the end of the experiment in either the ICR-D or the ICR-S treatment. The results presented in columns (4-5) show, indeed, that there is no end-game effect on effort in either treatment.

¹⁹ In the appendix, we classify each worker according to the average share of the surplus that his effort choice has allocated to the firm. We find that a substantial share of workers in both treatments display strong “reciprocal” preferences: 46% of workers in the ICR-D and 60% in the ICR-S provide effort so that at least 30% of the surplus goes to the firm. Non-parametric tests (Pearson Chi-square test and Kolmogorov-Smirnov distribution test) cannot reject the hypothesis that the distribution of fairness attitudes is the same in the ICR-D and ICR-S.

All in all, our results suggest that higher effort provision by fair workers explains why aggregate effort is similar in the ICF-D than in the ICF-S despite less relational contracting. The stable wage-effort relationship for reciprocal workers across market conditions (as observed in the ICR-D and ICR-S treatments), combined with the higher wage level in the ICF-D treatment (compared to the ICF-S treatment) seem to offset lower effort by selfish workers due to weaker reputational incentives.

4. Conclusion

In this paper, we examine the emergence and impact of relational contracts under excess demand for labor and compare them to a labor market with exogenous unemployment. We show that workers provide a high level of effort even when they are not threatened by unemployment. High-performing workers receive higher wage offers from their current firm than from outside firms. This motivates workers to perform at a high level rather than to shirk and switch firms.

Confirming prior field studies (Bleakley et al., 1999), we find that workers are more likely to quit their jobs under full employment than when unemployment prevails and that this leads to fewer long-term employment relationships. However, this reduction in relational contracting does not undermine aggregate effort provision because higher wages induce an increase in reciprocal effort provision. Thus, our results suggest that unemployment is not a necessary disciplining device in labor markets.

Appendix: Fairness attitudes of workers in our sample

The ICR-D and ICR-S treatments in which information conditions prevent reputation incentives allow us to measure “fair” or “reciprocal” behavior in our experiment. In Table A1, we classify the fairness attitudes of each worker in our ICR-D and ICR-S treatments based on the distribution of the surplus induced by the worker’s effort choice in each trade. For each worker, we calculate the average share of the surplus that the worker provides to firms across all of the worker’s trades. Following the Fehr and Schmidt (1999) model, this share should increase with a worker’s aversion to advantageous inequality but should not exceed 50% if workers are averse to disadvantageous inequality. Our results show that a substantial share of workers display strong “fairness” preferences: 46% of workers in the ICR-D and 60% in the ICR-S provide effort so that at least 30% of the surplus goes to the firm. Non-parametric tests (the Pearson Chi-square test and Kolmogorov-Smirnov distribution test) do not reject the hypothesis that the distribution of fairness attitudes is identical in the ICR-D and ICR-S treatments.

Table A1 here

The proportion of fair workers in our sample is comparable to that found in previous studies. Andreoni and Vesterlund (2001) and Andreoni et al. (2003) find that roughly one-half of their subjects display social preferences. At the upper bound, Fischbacher and Gächter (2008) find that only 71% of their subjects display non-free-riding behavior. At the lower bound, Roe and Wu (2009) classify 28% of their participants as non-selfish.

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Figure 1. Effort and wage by period

Figure 1a. Effort

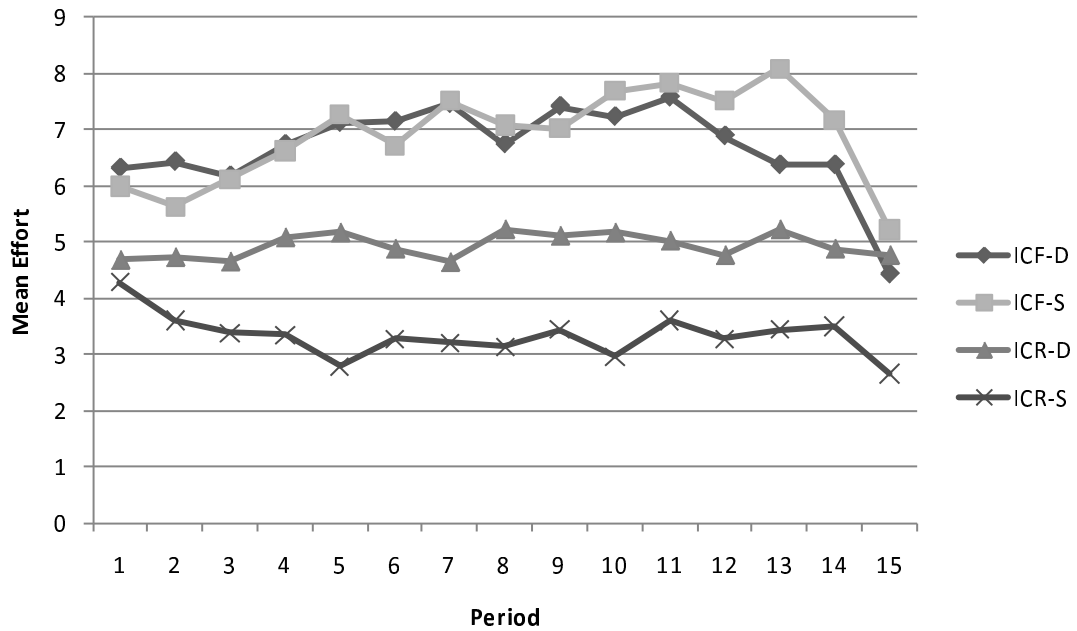


Figure 1b. Wage

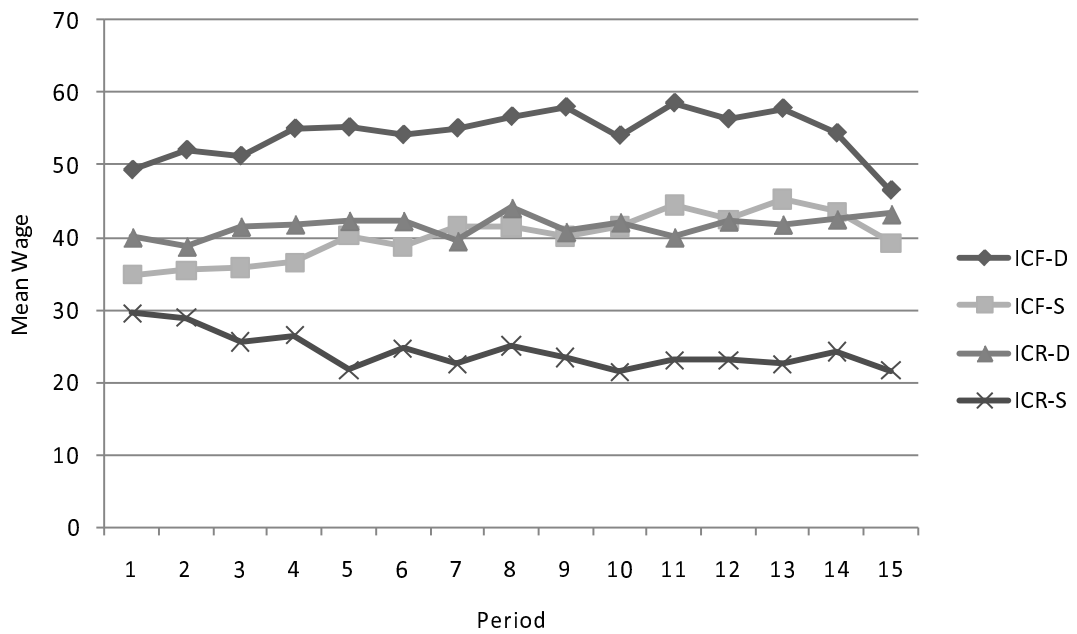
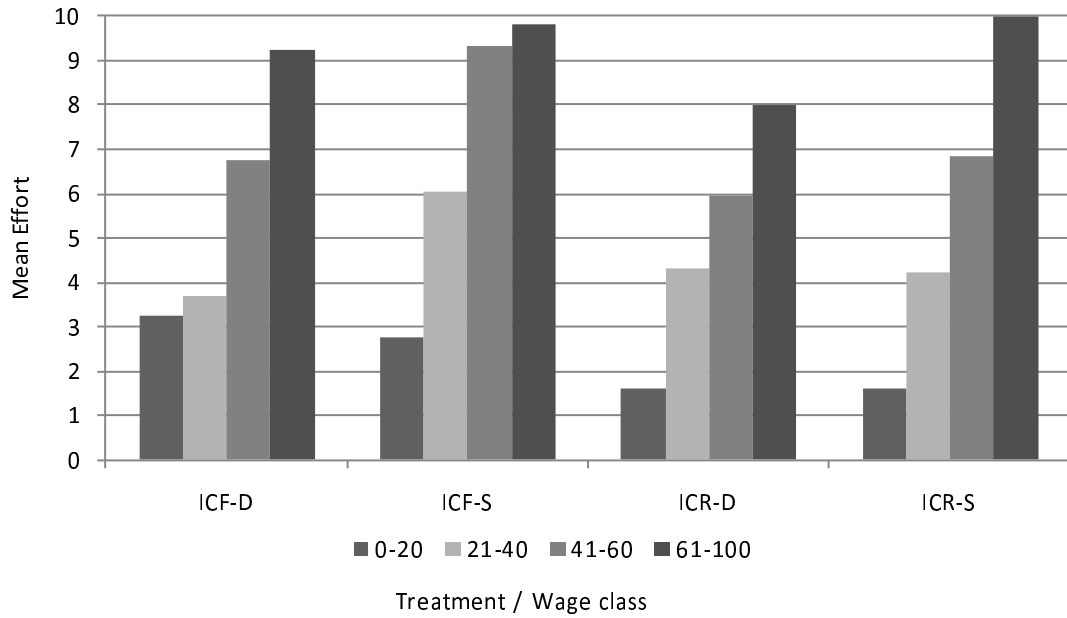


Figure 2. Effort-wage relationship



Notes. This figure displays the mean effort provided by workers in relation to the offered in the accepted contract. We display the mean effort for four wage classes: 0-20, 21-40, 41-60 and 61-100.

Table 1. Cost of effort schedule

Effort	1	2	3	4	5	6	7	8	9	10
Cost of effort	0	1	2	4	6	8	10	12	15	18

Table 2. Treatments

	Excess demand for labor (10 firms, 7 workers)	Excess supply of labor (7 firms, 10 workers)
Effort: no 3rd party enforcement Relations: feasible	ICF -D	ICF-S
Effort: 3rd party enforcement Relations: feasible	C-D	C-D
Effort: no 3rd party enforcement Relations: not feasible	ICR-D	ICR-S

Notes. Data for the ICF-S, ICR-S and C-S treatments are taken from the experiment reported in BFF2004. In that paper these treatments were labeled ICF, ICR, and C respectively.

Table 3. Summary statistics by treatment

Competitive conditions	Excess demand (10 firms, 7 workers)			Excess supply (7 firms, 10 workers)		
	Treatment	ICF-D	ICR-D	C-D	ICF-S	ICR-S
Sessions	5	5	5	5	4	5
Potential trades	525	525	525	525	420	525
Contract offers	4.6	4.1	4.8	1.2	1.8	2.4
Public offers	.43	.54	.59	.27	.61	.58
Private incumbent wage	53.8	35.0	67.7	48.9	21.0	35.6
Public wage	39.2	34.7	67.8	25.4	20	31.4
Private non-incumbent wage	45.1	36.1	67.3	32.2	25.5	33.0
Realized trades	520	523	518	523	417	519
in 1 period interaction	.53	.91	.85	.38	.92	.89
in 2-5 period relations	.24	.09	.14	.17	.08	.07
in 6-15 period relations	.23		.02	.45		.04
Efficiency & distribution						
Effort	6.7	4.9	9.6	6.9	3.3	9.3
Wage	54.2	41.6	72.6	40.1	24.3	33.3
Payoff firm	13	8	23	29	9	60
Payoff worker	44	35	56	29	21	17

Notes. This table presents mean statistics by treatment. *Contract offers* is the number of offers posted by firm per period. *Public offers* is the share of offers which were public. *Private incumbent wage* is the maximum wage offered by a firm to its incumbent worker in a given period. *Public wage* is the maximum wage offered by the firm in a public offer in a given period. *Private non-incumbent wage* is the maximum wage offered by a firm in a private offer to another worker in a given period. *Realized trades* is the total number of trades realized in a treatment. Trades in 1 period, 2-5 period, and 6-15 period relations show the share of trades which take place in relations with this final duration. *Effort*, *Wage*, *Payoff firm*, and *Payoff worker* are the means for realized trades.

Table 4: Firms' contract offers

Dependant variable	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Contract renewal</i>			<i>Rent offered</i>		
Treatment	ICF-D	ICF-S	ICF-D & ICF-S	ICF-D	ICF-S	ICF-D & ICF-S
Prior effort	0.457 [0.059]***	0.363 [0.047]***	0.088 [0.009]***	4.469 [0.365]***	5.256 [0.610]***	5.527 [0.526]***
Negative surprise	-0.299 [0.323]	-0.443 [0.228]*	-0.1 [0.049]**	-1.604 [2.025]	1.281 [3.133]	1.501 [2.816]
Period 11-15	0.36 [0.273]	0.4 [0.179]**	0.085 [0.033]**	6.218 [1.255]***	3.99 [1.602]**	3.68 [1.446]**
Excess demand			0.132 [0.100]			-5.78 [6.090]
Excess demand * Prior effort			-0.011 [0.011]			-0.924 [0.685]
Excess demand * Negative surprise			0.051 [0.067]			-2.952 [3.654]
Excess demand * Period 11-15			-0.044 [0.047]			2.224 [2.020]
Constant	-2.357 [0.494]***	-2.186 [0.384]***	-0.031 [0.074]	-23.363 [3.290]***	-16.751 [5.419]***	-18.451 [4.632]***
Observations	485	488	973	306	288	594
Number of firms	50	35	85	47	35	82
Method	Probit	Probit	OLS	OLS	OLS	OLS
Firm random effects	yes	yes	yes	yes	yes	yes

Notes. The dependant variable in columns (1-3) is the dummy variable *Contract renewal* which equals 1 if the firm offered a private contract to its incumbent worker and equals 0 otherwise. The dependant variable in columns (4-6) is the *Rent offered* in repeat contracts, i.e. the wage offered by the firms minus the mean wage in public contract offers in that period. *Prior effort* is the effort provided by the worker in the prior period. *Negative surprise* is a dummy variable which equals 1 if the worker provided less effort than expected by the firm in the prior period, and 0 otherwise. *Period 11-15* is a dummy variable which is 1 for periods 11 -15 and 0 for periods 2-10. *Excess demand* is a dummy variable which equals 1 for the observations from the ICF-D treatment and 0 for observations from the ICF-S treatment. Standard errors are reported in brackets. *, **, *** denote significance at the 10%, 5%, and 1% level respectively. The estimates reported in column (3) are based on OLS due to the difficulties with interpreting interaction terms in the probit model (see Ai and Norton, 2003).

Table 5. Worker effort

	(1)	(2)	(3)	(4)	(5)	(6)
Treatments	ICF-D	ICF-S	ICF-D & ICF-S	ICR-D	ICR-S	ICR-D & ICR-S
Wage	0.103 [0.008]***	0.143 [0.005]***	0.143 [0.006]***	0.097 [0.007]***	0.11 [0.005]***	0.108 [0.005]***
Private	1.21 [0.214]***	0.514 [0.183]***	0.51 [0.218]**	0.324 [0.150]**	0.38 [0.148]**	0.392 [0.166]**
Period 11-15	-0.782 [0.178]***	-0.397 [0.138]***	-0.397 [0.164]**	-0.098 [0.142]	0.052 [0.140]	0.043 [0.155]
Excess demand			-0.343 [0.505]			0.222 [0.427]
Excess demand* Wage			-0.039 [0.010]***			-0.011 [0.008]
Excess demand * Private			0.749 [0.289]***			-0.066 [0.216]
Excess demand * Period 11-15			-0.393 [0.228]*			-0.141 [0.204]
Constant	0.566 [0.485]	0.816 [0.230]***	0.819 [0.273]***	0.811 [0.396]**	0.535 [0.197]***	0.578 [0.259]**
Observations	520	523	1043	523	417	940
Number of workers	35	50	85	35	40	75
Method	OLS	OLS	OLS	OLS	OLS	OLS
Worker random effects	yes	yes	yes	yes	yes	yes

Notes. The dependant variable is *Effort*. *Wage* is the wage offered by the firm in the contract accepted by the worker. *Private* is a dummy variable which equals 1 if the accepted contract was a private offer and 0 if it was a public offer. *Period 11-15* is a dummy variable which is 1 for periods 11 -15 and 0 for periods 2-10. *Excess demand* is a dummy variable which equals 1 for the observations from the ICF-D (ICR-D) treatment and 0 for observations from the ICF-S (ICR-S) treatment. Standard errors are reported in brackets. *, **, *** denote significance at the 10%, 5%, and 1% level respectively.

Table A1. Classification of workers by fairness attitudes

Fairness class (1= low, 6=high)	1	2	3	4	5	6
Mean share of surplus to firm	<10%	10%-20%	20%-30%	30% - 40%	40% -50%	>50%
ICR-D	0.05	0.23	0.18	0.23	0.23	0.10
ICR-S	0.17	0.23	0.20	0.23	0.11	0.06

Notes. The table displays the share of workers by fairness class for the ICR-D and ICR-S treatments. We classify individual workers according to the mean share of surplus which their effort implies for their firm across all their trades. The firm's share of surplus from a trade is defined as: $(10e-w) / (10e-c(e))$. For trades in which the firm earns negative profits we set its share to 0. For trades in which the workers earn negative profits we set the firm's share of surplus to 1.