

Topic 4 – Gift-exchange games

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Course in Behavioral and Experimental
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Motivation

- The “fair wage-effort” hypothesis of Akerlof (1982) has triggered a broad literature on whether non-market clearing prices may be due to fairness concerns.
- This would imply that involuntary employment (due to prices above market clearing levels) would be due to fairness concerns of employers and employees.
- Akerlof’s hypothesis states that due to reciprocity higher than market-clearing wages evoke higher than minimal efforts in labor relationships with incomplete contracts.

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Motivation

- Incomplete contracts imply the impossibility of specifying each single aspect of a good (like labor) in a contract between buyers and sellers. This feature not only applies in labor markets, but also in many others (when sellers have discretion over a good’s quality).
- The gift-exchange game of Fehr et al. (1993) has become *the* workhorse for examining experimentally the efficiency-wage hypothesis by studying labor market relations between firms and workers in the laboratory.

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Preview of topic 2

Gift-exchange games

- + Fehr et al. (1993) – The “seminal” gift-exchange game
- + Fehr and Falk (1999) – Gift-exchange under stress test
- + Brown et al. (2004) – Long-term relationships in the gift-exchange game
- + Kocher et al. (2007) – The gift-exchange game with multiple workers

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The gift-exchange game – Fehr, Kirchsteiger and Riedl (1993)

Two-stage game

Stage 1:

- Firms can offer wage (w) to workers in a one-sided oral auction (with improvement rule).
- Excess supply of workers (to sharpen competition for contracts). Typically 6 firms and 9 workers.
- Workers can accept any of the standing offers. Then a contract is concluded.

Stage 2:

- Workers with a contract decide on an effort level (e) that determines the ultimate payoffs.

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The gift-exchange game

Cost function of effort (by now a “classic”)

e	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$c(e)$	0	1	2	4	6	8	10	12	15	18

Payoffs

Workers: $\pi_w = w - c(e) - c_{\text{fix}}$

Firms: $\pi_F = (v - w) \cdot e$

$v = 126.$

$c_{\text{fix}} = 26.$

w had to be set in multiples of 5.

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More on the design

- 12 periods.
- Firms can hire at most one worker per period.
- No identification across periods. Hence, long-term relationships and reputation-building are not possible.
- All parameters common knowledge.
- Payoffs are private information.
- Note that workers cannot make offers for which wage they would be willing to bid (but see the double-auction design in Fehr and Falk, 1999).

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Fehr et al. (1993) – Predictions

With money-maximizing agents:

$w = 30$ and $e = 0.1$

If the fair wage-effort hypothesis holds:

Hypothesis 1: The effort level is increasing in the wage.

Hypothesis 2: Average wages are considerably greater than the market-clearing wage.

Hypothesis 3: The average effort is above e_{\min} .

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Fehr et al. (1993) – Results

TABLE II
THE WAGE-EFFORT RELATION

Wage	Average observed effort level	Median observed effort level
30–44	0.17	0.1
45–59	0.18	0.2
60–74	0.34	0.4
75–89	0.45	0.4
90–110	0.52	0.5

Effort levels increase with the wage → reciprocity prevails!

Average effort level: 0.40

Average wage: 72

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Fehr et al. (1993) – Results

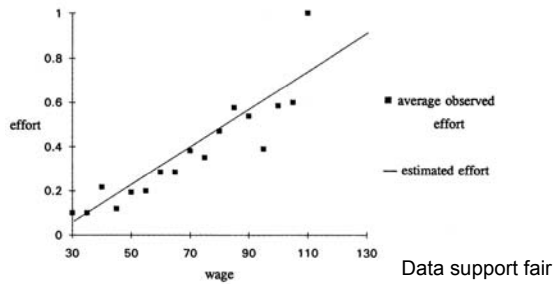


FIGURE I
The Wage-Effort Relation

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Data support fair wage-effort hypothesis.

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Falk and Fehr (1999)

Same cost function as in Fehr et al. (1993)

e	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
c(e)	0	1	2	4	6	8	10	12	15	18

Payoffs

Workers: $\pi_w = w - c(e) - c_{fix}$

Firms: $\pi_F = (v - w) \cdot e$

$v = 120$.

$c_{fix} = 20$.

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Fehr and Falk (1999) – Double-auction

- Double auction with 7 firms and 11 workers.
- Both firms and workers can make wage offers.
- Both firms and workers could accept *any* going wage bid (i.e. not only the highest or lowest one)! This feature allows to observe whether underbidding occurs.
- 10 periods.
- Firms can hire at most one worker per period.
- No identification.

- Standard predictions: $w = 20$ and $e = 0.1$.

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Fehr and Falk (1999) – Main treatments

- Double-auction with effort choice (AE on next slide)
- Double-auction without effort choice (A). This mirrors a situation with complete contracts. Payoffs are:

Workers: $\pi_W = W - C_{fix}$
 Firms: $\pi_F = V - W$

With these treatments it is possible to study the effects of positive reciprocity (which is not possible in the Control treatment without effort choice).

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Fehr and Falk (1999) – Results

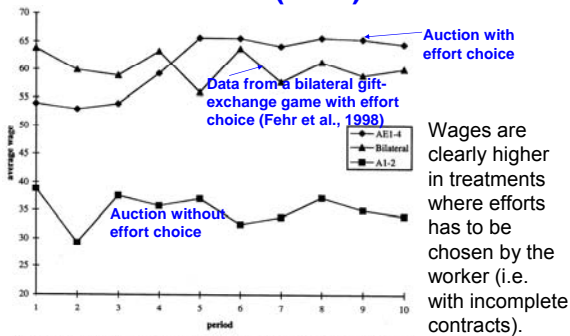


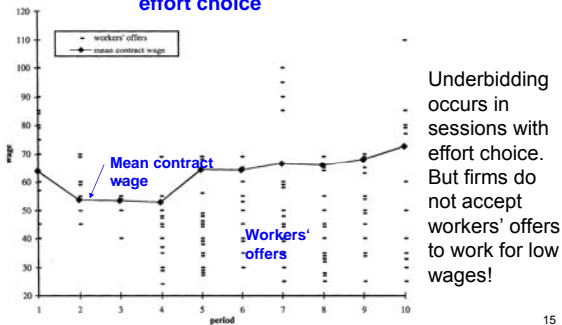
FIG. 1.—Evolution of average wages in the auction with effort (AE1-4), the auction without effort (A1-2), and the bilateral case.

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Does underbidding occur in AE?

Data from one session with effort choice



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Does underbidding occur in Control?

Data from one session
without effort choice

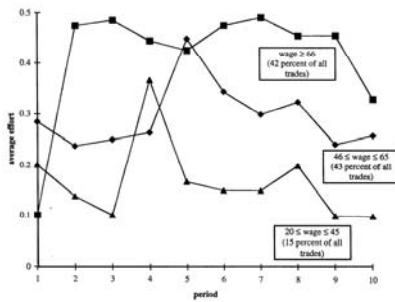


Underbidding can hardly take place in sessions without effort choice, because firms offer very low wages (since there is no need to elicit reciprocity).

FIG. 2.—Workers' offers and mean contract wages: a, in the auction with effort session AE4; b, in the auction without effort session A1.

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Fehr and Falk (1999) – Wages and efforts

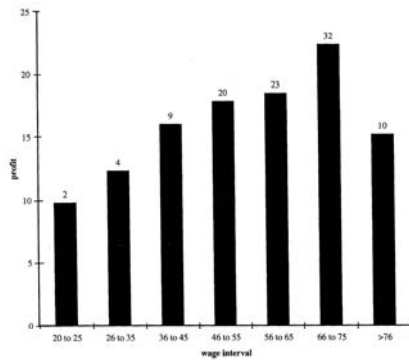


Higher wages lead to higher efforts!
→ Clear sign of positive reciprocity!

FIG. 4.—Evolution of average effort for given wage intervals

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Fehr and Falk (1999) – Wages and profits



Does it pay to pay higher wages?
Yes, it does (in general), because workers respond with higher efforts!

FIG. 6.—Wage-profit relation (relative frequency of observations above bars)

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On the role of negative reciprocity

The previous treatments have documented the important role of positive reciprocity. Is there also a role of negative reciprocity (which means that subjects are willing to bear some costs to punish actions that are viewed as hostile)?

Negative reciprocity may be important when firms have a relatively powerful enforcement technology.

Fehr and Falk (1999) introduce two additional treatments:

- Double-auction with effort choice (AE) and cost function

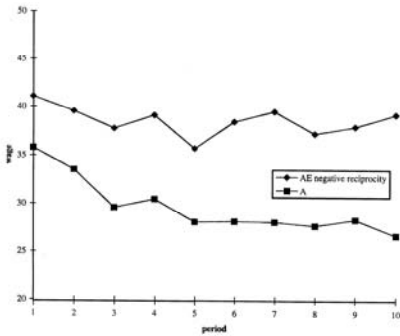
e	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
c(e)	18	15	12	10	8	6	4	2	1	0

- Double-auction without effort choice (A).

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Fehr and Falk (1999) – Negative reciprocity



Wages stay higher than in the control treatment also in the negative reciprocity-treatment! This is to avoid negative reciprocity of workers in case of choosing low wages.

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FIG. 7.—Evolution of average wages in the auction with effort sessions with negative reciprocity and in the auction without effort sessions.

Parameters	Treatments		
	One-sided Auction (Fehr, Kirchsteiger and Riedl 1993)	Double Auction (Fehr and Falk 1999)	Bilateral Bargaining (Fehr, Kirchler, Weichhold and Gächter 1998)
redemption values v and fixed costs c_0	$v = 126, c_0 = 26$	$v = 120, c_0 = 20$	$v = 120, c_0 = 20$
feasible effort levels e (quality levels q)	$q \in [0.1, 1]$	$e \in [0.1, 1]$	$e \in [0.1, 1]$
feasible wages w (prices p)	$30 \leq p \leq 125$ (multiples of five)	$c_0 \leq w \leq v$	$c_0 \leq w \leq v$
wage (price) determination	one-sided oral auction buyers are price setters	double auction firms and workers are wage setters	firms commit themselves to a wage level
matching process	via acceptance of price offers	via acceptance of wage offers	exogenous
# firms (buyers) # workers (sellers)	5 – 8 buyers 8 – 12 sellers (exogenous excess supply of at least 50%)	7 firms 11 workers	10 firms 10 workers
# sessions	4	4	4
# periods	12	10	10
information conditions	$v, c(q), c_0$, number of buyers and sellers were common knowledge; identity of trading partners unknown	$v, c(e), c_0$, number of firms and workers were common knowledge; identity of trading partners unknown	$v, c(e), c_0$, number of firms and workers were common knowledge; identity of trading partners unknown
predictions with rational money maximizers	convergence towards $p = 30$ and $q = 0.1$	convergence towards $w = 20$ and $e = 0.1$	convergence towards $w = 20$ and $e = 0.1$
framing	goods market	labor market	labor market

A comparison of the early gift-exchange experiments

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A note on stake sizes

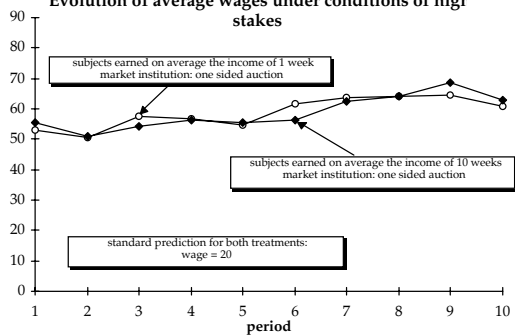
- One of the objections against the results of gift-exchange experiments and the role of reciprocity in these games is that behavior might look different if larger stakes (above student hourly wages) are involved.
- Fehr and Tougareva (Working Paper 1995) addressed this objection by running experiments on the “standard” gift-exchange game in Russia.
- The following two slides document that reciprocity remains a driving force of behavior also when high stakes are involved.

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Fehr and Tougareva (1995)

Evolution of average wages under conditions of high stakes

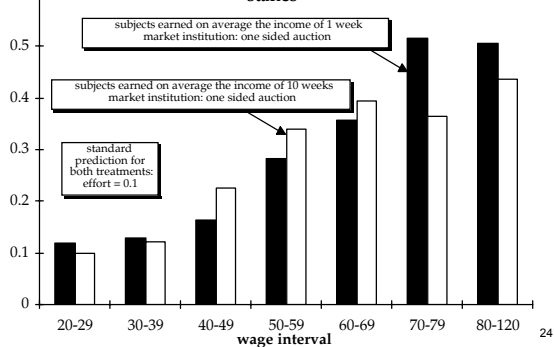


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Fehr and Tougareva (1995)

Wage-effort relationship under conditions of high stakes



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Long-term relationships in the lab

- Brown et al. (2004) study the endogenous emergence of long-term relationships between trading parties and how that affects the nature of market interactions.
- For this purpose, two features of their design are important:
- First, workers and firms can be identified by an ID (in some of the treatments).
- Second, firms could make both public offers (to all workers) and private offers (to a worker with a particular ID). [This design feature was earlier introduced by Kirchsteiger et al., 2005.]

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Brown, Falk and Fehr (2004) – Design

- 10 workers and 7 firms.
- Firms can make contract offers that specify the wage (w), a desired effort (\bar{e}), and the firm's ID.
- Such contract offers can be made public to all workers or private to a particular worker (via his or her ID).
- As soon as a worker accepts a contract offer, this is concluded, and all other offers from the firm are removed.
- Each firm can only hire at most one worker.
- 15 periods.

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Brown et al. (2004) – Design

Costs of effort

e	1	2	3	4	5	6	7	8	9	10
c(e)	0	1	2	4	6	8	10	12	15	18

Payoffs

Workers: $\pi_w = w - c(e)$ if contract concluded
otherwise $\pi_w = 5$.

Firms: $\pi_F = 10e - w$ if contract concluded
otherwise $\pi_F = 0$

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Brown et al. (2004) – Treatments

- **ICF** (*incomplete contracts, fixed ID*). Workers can freely choose effort. Identification possible.
- **C** (*complete contracts, fixed ID*). Workers are bound to choose . Identification possible.
- **ICR** (*incomplete contracts, random ID*). Workers can freely choose effort. Identification is no longer possible. Long-term relations cannot build up.

Comparing C and ICF shows the role of reciprocity and how it affects long-term relationships.

Comparing ICF and ICR tells to what extent the possibility of forming and terminating long-term relations contributes to the enforcement of more efficient effort levels.

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Brown et al. (2004) – Predictions

Standard predictions would be

$w = 5$ and $e = 1$ in the ICR- and ICF-treatment, and $w = 23$ and $e = 10$ in the C-treatment.

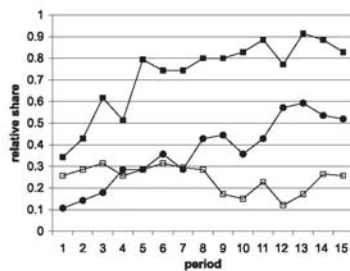
Applying the inequity aversion-model of Fehr and Schmidt (1999) yields also an equilibrium in ICF where high efforts can be enforced up to period 14, and in period 15 only the fair workers deliver high efforts.

Efforts should be higher in ICF than in ICR because the threat of terminating a relationship in ICF increases the incentives for workers to uphold high effort-levels.

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Brown et al. (2004) – Results



The share of private offers is highest in ICF, and it is increasing over time. Markets split up in bilateral bargaining!

FIGURE 1.—Relative share of trades initiated by private offers (—■— ICF; —●— ICR; —□— C).

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Brown et al. (2004) – Contract renewal

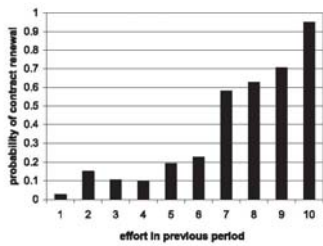


FIGURE 4.—Probability of contract renewal as a function of the worker's effort in the previous period (ICF condition).

Higher efforts make contract renewal more likely in ICF!

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Brown et al. (2004) – Contract renewal

TABLE III
PROBABILITY OF CONTRACT RENEWAL
IN THE ICF CONDITION^a

Effort in previous period	.125** (.052)
Positive surprise	.192** (.077)
Negative surprise	-.836** (.381)
Previous length	2.449*** (.653)
Constant	-5.045*** (1.535)
Controls for session fixed effects	YES

N = 488

Effort, surprise, and length of relationship make contract renewal more likely!

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Brown et al. (2004) – Starting relationships

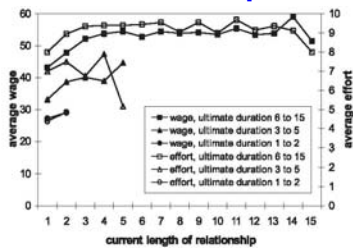


FIGURE 7.—Average wages and effort levels dependent on the current duration of a relation for different classes of ultimate durations.

Ultimately long-term relations start out with higher wages and efforts. This pays off (see next slide)!

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Brown et al. (2004) – Profits

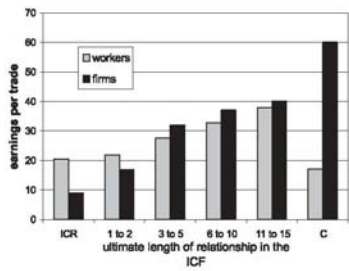


FIGURE 6.—Earnings of firms and workers per trade across treatments (earnings are displayed in the ICF as a function of the ultimate length of relationships).

The surplus is shared rather equally in ICF, but not in C or ICR!

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Brown et al. (2004) – Summary

- If contracts are enforceable (in C), the identity of the trading partner is irrelevant and hardly any long-term relations build up. Firms exploit their advantage.
- If contracts are incomplete and long-term relationships possible (in ICF), then wages are higher and relations last for longer due to workers choosing high efforts and firms making private offers. Gains from trade are shared almost equally.
- If contracts are incomplete, but long-term relations are inhibited (in ICR), efforts drop, and the most frequently chosen effort is indeed the minimal effort.

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On the importance of contractual limitations in a multiple-workers setting

- Kocher et al. (2007) examine whether standardized contracts within firms have an impact on wages, efforts and overall efficiency.
- In order to study the effects of standardized contracts they extend the typical one principal-one agent setting to a setting with one principal and multiple workers.
- Collective agreements play an important role across many countries. Little is known how they affect labor market outcomes.

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Kocher, Luhan and Sutter (2007) – Treatments

They extend the paper by Brown et al. (2004) by extending their ICF-treatment such that each firm can hire up to three workers.

They consider the following two treatments.

- **IC: Individualized contracts.** The firm is allowed to make different offers to different workers.
- **SC: Standardized contracts.** The firm can offer different contract, but as soon as one offer is accepted by the first worker, the firm can only offer this particular contract to all other workers.

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Kocher et al. (2007) – Procedure

- 20 market participants
 - 4 firms (principals)
 - 16 workers (agents); i.e. excess supply of 4 workers
 - Fixed assignment of roles and identification numbers
- Each employer can employ at most 3 employees in any period
- 15 periods (common knowledge)
- zTree (Fischbacher, 2007)
- 10 sessions / 198 participants
- 2 hours / 17 Euros

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Kocher et al. (2007) – Design

Stage 1: Trading stage: Firms can offer any contract $\{w, \bar{e}\}$, with \bar{e} as the desired, non-binding effort level; either privately to specific workers or publicly. Firms can employ at most 3 workers. Workers can accept at most one contract.

Stage 2: Effort determination stage: An employed worker chooses an effort level e with costs $c(e)$.

e	1	2	3	4	5	6	7	8	9	10
$c(e)$	0	1	2	4	6	8	10	12	15	18

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Kocher et al. (2007) – Payoffs

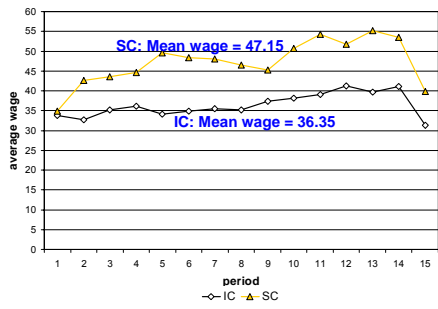
$$\text{Firms } \pi_f = \begin{cases} 10 \left(\sum_{i=1}^N e_i \right) - \left(\sum_{i=1}^N w_i \right) & \text{with contracts} \\ 0 & \text{without contracts} \end{cases}$$

$$\text{Workers } \pi_w = \begin{cases} w - c(e) & \text{with contract} \\ 5 & \text{without contract} \end{cases}$$

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Kocher et al. (2007) – Results

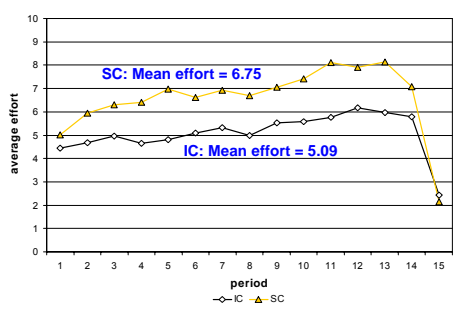


Wages are significantly higher with standardized contracts.

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Kocher et al. (2007) – Results



Efforts are significantly higher with standardized contracts.

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Kocher et al. (2007) – Explanations

- Observation 1: The important treatment effect happens after the first period.
- Observation 2: Higher wages in period 2 of the SC treatment trigger the effect.
- Assume that principals evaluate their contracts after the first period in terms of profits either against an expectation, in relative terms against each other or against a behavioral cut-off point k in terms of generated revenue.
- In the IC treatment principals will typically try to employ those agents again that “meet” these evaluations.

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Kocher et al. (2007) – Explanations

- In IC, the firms will offer contract renewal (with an at least as generous offer) to the reciprocal workers and “sack” the shirkers. To replace them a firm will offer a “careful” contract to another agent.
- In SC, contracts cannot be targeted. If a firm wants to reward some of her workers with a (more) generous contract in period $t+1$, she has to offer this contract to every other worker.
- Thus, firms overuse their power to target contracts individually in the IC treatment
- Their incentive not to do so is rather small and insignificant in terms of the payoff differential (though firms that offer standardized contracts in IC fare better). The beneficiaries from the SC institutions are workers.

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