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Going on the long race? Employment duration and (de)regulation of experimental stochastic labor markets

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Going on the Long Race?
– Employment Duration and (De)Regulation of
Experimental Stochastic Labor Markets –

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September 2009

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Abstract

If the future market wage is uncertain, engaging in long-term employment is risky, with the risk depending on how regulated the labor market is. In our experiment long-term employment can result either from offering long-term contracts or from repeatedly and mutually opting for rematching. Treatments differ in how regulations restrict the employer's flexibility in adapting the employment contract to changes of the market (wage). All treatments allow for longer contract duration as well as for mutually opting to be rematched. Effort is chosen by employees after a contract is concluded. Treatments vary from no flexibility to no restriction at all. Will more (downward) flexibility be used in ongoing employment but reduce efficiency? If so, deregulation may weaken rather than promote labor market efficiency. And will regulation crowd out long-term employment, either in the form of long-term contracts or voluntary rematching?

JEL classification: C72, C90, F16, J21, J24, L10

Keywords: deregulation, employment contracts, wage flexibility, principal-agent theory, experimental economics, repeated interaction

1 Introduction

Offering an employment contract that regulates working conditions for many periods, although little is known about the future market conditions, can be dangerous. If market wages drastically decline, one may hire labor more cheaply. Furthermore, an employee may turn out less reliable than expected. Such risks are by no means far-fetched but concern crucial aspects of long term employment.¹ So why is long-term employment still predominant and short-term employment, e.g. in the form of rented labor, rare, albeit increasing (see Alewell, Friedrich, Güth, & Kuklys, 2007)? An explanation might be the increasing institutional flexibility regarding wage adjustments. In our paper, we want to study, if more flexibility in wage adjustment (from none to full flexibility) increases the duration of accepted employment contracts. This dependence of contract duration on contract flexibility constitutes our first hypothesis (**Hypothesis A**) which we want to test experimentally.

One obvious argument for long-term employment is that offering a short-term contract reveals distrust in the newly hired worker and encourages shirking. But what is wrong with long-term employment, resulting from both partners, employer and employee, repeatedly and mutually opting for rematching? Another reason for long-term employment could be that, on the long race, the interacting parties can more easily overcome efficiency losses due to opportunistic behavior. In our experimental scenario, regulations prevent efficient employment contracts when workers react opportunistically. But do long-term employees care more for efficiency by investing more than optimal efforts?

Deregulation² has been the major policy recommendation for nearly all developed market economies. However, earlier experimental findings (Berninghaus et al., 2008) question that labor market efficiency is higher in deregulated markets. To answer more systematically whether the usual intuition that wage rigidities question efficiency or earlier results are more reliable we want to analyze more thoroughly the interdependency of wage flexibility and employment duration. Our second hypothesis claims that long-term contracts are substituted by renewed contracts when contracts become more inflexible (**Hypothesis B**). Compared to our previous study where we varied only the flexibility of fixed wages, now also piece rates may be adapted periodically.

In the experiment of Brown, Falk, and Fehr (2004) where work contracts just last for one period long-term relationships between employers and employees can only be established if the employer offers in each period a new contract to the same employee. We also allow for voluntary renewal of contracts at the end of each period. But in addition to the possibility of offering contracts which extend for more than one period.

With respect to employment duration our discussion is related to the (in)completeness of employment contracts (for contract theory, see Schmidt, 1996; Schweizer, 1999) and thereby to the crowding out or crowding in of long-term employment. Will more reg-

¹Similar problems can, of course, show up in love relationships (see Berninghaus, Bleich, & Güth, 2008). Here we will not refer to and elaborate such analogies any further.

²See e.g. Galt (1995), McCabe (1994), Spiller and Cardilli (1997) for the telecommunication industries and Briggs and Buchanan (2000), Esping-Andersen and Regini (2000) for labor markets.

ulated labor markets crowd out contractual and crowd in voluntary long-term employment, e.g. in the sense that that long-term employment is intended but not contractually codified, or will long-term employment be crowded-out altogether?

In section 2, we introduce the stochastic, multi-period labor market model which we have experimentally implemented. This model is theoretically analyzed in section 3. Section 4 contains the experimental design and the statistical analysis of our results. The major findings concerning our two main hypotheses show a strong tendency for shorter contracts in more regulated markets (Hypothesis A) and more contract renewals in less flexible labor markets (Hypothesis B). Section 5 contains a detailed discussion on policy implications.

2 The Stochastic Multi-period Environment

In the following we present the multi-period model which is suited for experimental testing. The employers are allowed to offer either one-period or multi-period contracts in reality are mostly open-ended.³

In every period $t = 1, 2, \dots$, the n (≥ 2) employers $i = 1, 2, \dots, n$ and workers $j = 1, 2, \dots, n$ are matched to pairs. Each such pair can establish employment. If not, there is no employment relation involving this employer and employee in this period. In our view, such momentary take-it-or-leave-it power is rather realistic because usually it is the employer who is aware of the job opportunity. Due to the multi-period interaction such power is, however, restricted.

The first period $t = 1$ precludes already existing employment relations. In $t = 1$, each employer i is randomly matched with one worker j . First, all $2n$ agents are informed about the market wage w_1^c in this period without providing any clue about future market wages w_t^c in periods $t > 1$. In each pair (i, j) , employer i then offers worker j an employment contract

$$(w_i^j, s_i^j, T_i^j),$$

with w_i^j (≥ 0) denoting the fixed wage⁴, $s_i^j \in [0, 1]$ the revenue share for the worker, and T_i^j (≥ 1) the employment duration. If worker j accepts, he finally chooses his effort level e_i^j (≥ 0). In case of an established employment relation, worker j earns

$$U_j = w_i^j + p_i s_i^j e_i^j - \frac{c_j}{2} (e_i^j)^2,$$

where p_i (> 0) is firm i 's sale price and c_j (> 0) worker j 's effort cost parameter, whereas employer i earns

$$\Pi_i = p_i(1 - s_i^j) e_i^j - w_i^j,$$

³Since in an experiment the number of periods is limited, our long-term contracts cannot be open-ended.

⁴Except for very rare instances like waiters in US-restaurants who sometimes must buy their tables, wages cannot be negative although negative wages might alleviate the moral hazard problem of employment contracts.

i.e., effort costs are private costs of workers. If worker j does not accept i 's employment offer, he is employed externally at the market wage w_1^c , whereas i earns nothing in that period.

In periods $t > 1$, the market wage w_t^c is made known first without any clue concerning w_τ^c for $\tau > t$. What may differ from period 1 is that some pairs (i, j) have already decided to go on with their employment relationship, possibly after adjusting the contract where the flexibility depends on the treatment. In all periods $t \geq 1$:

- In ongoing relationships (i, j) , employer i decides whether and how to adjust the contract to which employee j can react by his effort choice e_i^j , whereas
- in newly matched pairs (i, j) , the process is the same as in the first period (i offers a contract which j either rejects to be employed externally at the market wage w_t^c or accepts and chooses his effort e_i^j).

Clearly, there can be at most n ongoing relations (i, j) , and each employer i without employee can be matched with an unemployed worker j . Only newly matched pairs can, furthermore, fail to establish employment, meaning that i earns nothing and j the market wage w_t^c . It may appear unrealistic, that the employee cannot simply leave her employer in case of a long-term contract.⁵ But if the employee can simply run away, this questions long-term contracts altogether. Furthermore, even when staying with her employer, the employee is by no means defenseless since she can react to unfair treatment by zero effort.

When an employment relation expires, both partners can opt for rematching. Only when both agree, will these two be rematched; otherwise i and j will be randomly matched with any of the unemployed workers j , respectively employers i without a worker. Full flexibility can be achieved irrespective of the flexibility treatment by renewed short-term contracts with the same partner. We can thus test the crowding out of long-term employment in two ways: restricting flexibility in adjusting employment contracts reduces either contract length T_i^j or voluntary employment duration, i.e., by reducing mutual rematching.

Of course, an employer may not exploit the flexibility in adjusting the contract terms and, when the employer exploits downward flexibility, the employee may accept such adjustments to market conditions without reducing efforts. In view of our earlier preliminary findings (Berninghaus et al., 2008), and also the inspiring and illustrative discussion of Irlenbusch (2008) we predict the opposite: flexibility of downward adjustments will be used by employers, and this encourages shirking by employees to an extent that renders such downward adjustments unprofitable and inefficient.

3 Theoretical Analysis

The following rational choice analysis assumes common (knowledge of) risk neutrality and first discusses the one-period interaction before continuing with repeated interaction

⁵Think about soccer professionals who would not be hired otherwise unless their contract has expired.

(see also Berninghaus et al., 2008). The one-period interaction analysis explores the strategic problem of an employer and an employee concluding a new contract in the only, respectively the final period of the experiment or of myopic actors.

One-shot interaction: In a given pair (i, j) with employer i and worker j , the optimal effort is

$$e_i^j = \frac{p_i s_i^j}{c_j}.$$

If the market wage w^c also determined the fixed wages, i.e., for $w_i^j = w^c$, the optimal revenue share would result in $s_i^j = \frac{1}{2}$. Thus worker j would earn $w^c + p_i^2/8c_j$. This benchmark behavior could be justified by a collectively negotiated legal minimum wage.

If firms are restricted in $t = 1$ to $w_i^j \geq 0$, respectively in a later round t to $w_i^j \geq \bar{w}$ for some given positive \bar{w} in ongoing employment, the optimal revenue share can be derived by maximizing

$$\begin{aligned} \Pi_i &= p_i(1 - s_i^j) \frac{p_i s_i^j}{c_j} - w_i^j \\ \text{s.t. } w_i^j + \frac{(p_i s_i^j)^2}{2c_j} &\geq w^c \end{aligned}$$

and $w_i^j \geq 0$, respectively $w_i^j \geq \bar{w}$. If optimality requires

$$w_i^j + \frac{(p_i s_i^j)^2}{2c_j} = w^c,$$

one can substitute w_i^j and obtain

$$\Pi = p_i(1 - s_i^j) \frac{p_i s_i^j}{c_j} - w^c + \frac{(p_i s_i^j)^2}{2c_j} = \frac{p_i^2 s_i^j}{c_j} \left(1 - \frac{s_i^j}{2}\right) - w^c.$$

Since $\frac{\partial \Pi_i}{\partial s_i^j} > 0$ for all $0 \leq s_i^j < 1$, the global optimum would be obtained for $s_i^j = 1$. This fulfills the requirement of $w_i^j \geq 0$ if $w^c \geq \frac{p_i^2}{2c_j}$, what is violated for all possible market wages w^c in our experiment. Similarly, one must have $w^c \geq \bar{w} + \frac{p_i^2}{2c_j}$ for a positive wage \bar{w} due to long-run employment and inflexibility of w_i^j . Revenue shares $s_i^j = 1$ would of course mean that the employer is renting out her firm to the employee for a fixed fee in the sense of $w_i^j < 0$ what we exclude by restricting w_i^j to non-negative levels.

When $s_i^j = 1$ is excluded, a boundary solution requires $\frac{1}{2} < s_i^j < 1$ since $s_i^j = \frac{1}{2}$ is optimal for given fixed wages and $s_i^j = 1$, when fixed wages can be varied freely. For $w^c < \frac{p_i^2}{2c_j}$ the binding constraint $w_i^j = 0$ requires

$$s_i^j = \frac{\sqrt{2c_j w^c}}{p_i}.$$

For new contracts in the last period, respectively for myopic players, we expect to observe only one-period offers with a piece rate depending on the market wage of that period and a zero fixed wage. This combination guarantees the employee the market wage, given an optimal effort choice.

Finitely repeated interaction: When T is finite and commonly known, the usual backward induction can be applied. The benchmark solution of the one shot–interaction applies in the last round $t = T$, when a pair is voluntarily or randomly formed in the last round, or when both parties are (known to be) myopic. But this does not provide the usual starting point for a stationary benchmark solution as in repeated games without any structural dependencies across rounds.

To illustrate the possible gains by contractual *effort smoothing*, consider the second last round of a finitely repeated interaction with a uniform distribution of market wages on the integers of the interval $[\underline{w}^c, \bar{w}^c]$ with $\underline{w}^c < \bar{w}^c$. For a newly formed pair (i, j) one option in the second last round is to implement a contract with $T_i^j = 1$ and opt for rematching in the last round. This would guarantee j the payoff w_{T-1}^c in the current round and the expected payoff $0.5 \cdot (\underline{w}^c + \bar{w}^c)$ in the last round. To demonstrate efficiency gains due to effort smoothing we derive the optimal contract with $T_i^j = 2$, which makes employee j indifferent between accepting a *two-period contract*, yielding $w_{T-1}^c + \frac{\underline{w}^c + \bar{w}^c}{2}$, and the *one-period* option. Guaranteeing j the same requires a *two-period* contract with s^+ satisfying

$$2[p_i s^+ \frac{p_i s^+}{c_j} - \frac{c_j}{2} (\frac{p_i s^+}{c_j})^2] = w_{T-1}^c + \frac{\underline{w}^c + \bar{w}^c}{2}$$

or

$$s^+ = \sqrt{c_j \left(w_{T-1}^c + \frac{\underline{w}^c + \bar{w}^c}{2} \right)} / p_i.$$

Offering $(w_i^j = 0, s^+, T_i^j = 2)$ would grant employer i all possible gains from contractual effort smoothing. It thus only remains to show that employer i prefers this contract which, due to j 's indifference, is acceptable to employee j . Neglecting the same constant labor costs of employing worker j , contract $(w_i^j = 0, s^+, T_i^j = 2)$ yields for employer i

$$2[p_i(1 - s^+) \frac{p_i s^+}{c_j}] = 2 \frac{p_i^2}{c_j} (1 - s^+) s^+,$$

whereas i , in case of the $T_i^j = 1$ -option, earns

$$\frac{p_i^2}{c_j} [(1 - s^*(w_{T-1})) s^*(w_{T-1}) + E[(1 - s^*(w^c)) s^*(w^c)],$$

where $s^*(\cdot)$ is the optimal revenue share with arguments $w^c \in [\underline{w}^c, \bar{w}^c]$. Thus we have to prove

$$2(1 - s^+) s^+ - (1 - s^*(w_{T-1})) s^*(w_{T-1}) - E[(1 - s^*(w^c)) s^*(w^c)] > 0$$

for all w^c . One can easily show that this inequality holds for our particular parameter constellations $\underline{w}^c = 13$ and $\bar{w}^c = 30$ (see Appendix A).

In a similar vein, parties can perceive the last two rounds as just one terminal period and convince themselves that contractual effort smoothing is even more profitable when extending it over more than just two rounds. Proceeding inductively, this would finally prove that effort smoothing is optimally achieved by offering the longest possible contract duration.⁶

The previous analysis applies to all situations with no downward flexibility of piece rates which guarantee the employee a certain positive payoff. One of our experimental treatments allows up- and downward changes of fixed wage and piece rate over a long-term contract. As the employer has full flexibility after the employee once accepted the contract, his preferred contract includes $s_i^j = \frac{1}{2}$ and $w_i^j = 0$. The employee takes this into account when accepting a contract in a treatment with full flexibility, the employer's offer, therefore, has to compensate the employee for giving up the sum of the expected market wages for the duration of the offered contract⁷

There is experimental evidence (e.g. Anderhub, Gächter, & Königstein, 2002) that parties, especially employees, react optimally to whatever contract they are facing. As shown by Brown et al. (2004), being together on a long race may encourage the parties, however, to behave less opportunistically and be more efficiency minded instead. For the case at hand, maximizing the total surplus of a given employer i and employee j -pair means to invest the effort level $e_j^+ = \frac{p_i}{c_j}$ (i.e., *efficient production*), yielding the surplus of $\frac{p_i^2}{2c_j}$, which both parties can freely allocate among themselves by an appropriate fixed wage w_i^j in the range $w_i^j \geq 0$ and, if necessary, by a revenue share $s_i^j \in [0, 1]$. Of course, such a policy would have to rely on trust and reciprocity. In the full flexibility treatment F_+ , for instance, the employee would have to trust in the reciprocity of her employer, whereas in case of no flexibility at all (treatment N), this would be reversed. Such efficiency-enhancing cooperation can also be achieved by voluntary and mutual rematching, i.e., without any codified obligation (see the corresponding evidence of Brown et al., 2004).

4 Experimental Procedures

4.1 Experimental Setting

The experiment was conducted at the University of Karlsruhe. Subjects were students of different faculties. Treatments differed in flexibility of contracts in ongoing long-term employment due to $T_i^j > 1$.

⁶For a detailed derivation of the results, see Bleich (2009).

⁷For further analysis, see Bleich (2009): for the particular parameter values of our experimental design, only a two-period contract would be offered with $s^{F+} = \frac{2}{3}$ and $w^{F+} = 0$, with the fixed wage remaining at zero and the piece rate decreasing to one half for the rest of the contract's periods.

The software was developed at the University of Karlsruhe (Institute WIOR) for the experiment in discrete time. In each session, the ten participants represented a matching group. Members of a matching group interacted for 10 rounds and were partitioned into a group of five employers and a group of five employees⁸. Subjects without a given partner were randomly rematched within their matching group after each round. All subjects received an initial endowment of 7.50 Euro at the beginning of the experiment. After reading the instructions (see Appendix B for the translated instructions) they all had to fill out a computerized control questionnaire checking whether the rules are understood. The experiment started when all questions were answered correctly.

In each round, after the employer-employee pairs were formed and the market wage had been announced, the employer proposed a contract which could be accepted or rejected by the employee, except when the pair was already engaged in a long-term contract. After each round, a participant was informed about her current payoff. Once each participant in the matching group had made her decision, the next round started. Participants were able to recall their payoffs of previous rounds at any time on the computer screen.

Employer subjects had to choose fixed wages w_i^j , revenue shares s_i^j , and duration of contract T_i^j . Employee participants had to fix their effort level e_j in each period after accepting the contract. At the beginning of each period, the prevailing market wage w_t^c , a random number uniformly distributed over a given interval of integers, was announced to all subjects.

The choices were restricted in the following way:

s_i^j	$\in [0, 1]$
w_i^j	$\in [0, 60]$
T_i^j	integer with $1 \leq T_i^j \leq$ “number of remaining rounds”
w^c	$\in \{13, 14, \dots, 30\}$
e_j	$\in [0, 499]$

Our five treatments differed in labor market restrictions which limited wage or revenue share flexibility during contract duration. Starting with treatment N , exhibiting complete regulation but still allowing effort choices to react to market wages, we ordered the remaining treatments according to decreasing degrees of regulation in Table 1. Each session involved one matching group (consisting of 10 subjects). Thus we employed 400 participants in total.

⁸Although one faces only five potential candidates for the other role, a participant hardly ever met the same participant twice (without, of course, being informed about this) due to the frequent constant pair either by contract or by mutual consent. Furthermore, when meeting again the pair faces a different market wage than before.

Table 1: Overview of all treatments

Treatment	Flexibility		Number of Sessions	Average Payoff [Euro]		
	w_i^j	s_i^j		Employer	Employee	Both
N	No	No	6	18.14	18.11	18.12
I	↑	No	11	14.98	20.13	17.03
I_+	↑	↑	6	13.88	19.17	16.52
F	↑ ↓	No	11	13.79	18.94	16.38
F_+	↑ ↓	↑ ↓	6	18.55	18.71	18.63

An upward arrow means that the respective variable may be increased, a downward arrow that the variable can be decreased during contract duration. One could have distinguished further treatments like no w_i^j but full s_i^j -flexibility or full flexibility of one component and only upward flexibility of the other. But in our view, the five treatments systematically explore and compare the effects of (de)regulation and should suffice to check the robustness of whatever findings. Accumulated payoffs of each participant were paid out in cash anonymously shortly after the experiment.⁹ The average payoff for all treatments is given in the last three columns of Table 1 revealing already that employer participants did not suffer from inflexibility.

In the following data analysis we will

- compare the experimental findings qualitatively with what (game) theory predicts,
- try to answer our basic research question whether stricter labor market restrictions crowd out contractual or mutually consented employment duration.

4.2 Experimental Results

First, we give a descriptive overview of the data set. Table 2 provides the averages of the most important variables. All averages except for efforts are calculated for the periods in which a new contract was offered. We did this for a better comparison of treatments with different rules of contract adjustment.¹⁰ Effort, however, is averaged over all effort choices, i.e., periods with rejected contracts are omitted.¹¹

⁹The exchange rate is 0.05 Euro per 1 ECU (experimental currency units).

¹⁰Thus the values in Table 2 represent the average values of the respective variables proposed in contract offers.

¹¹A rather simple idea is that direction (improved or worse contract terms) of contract changes parallels the development of the (increased or decreased) market wage. We, however, could only confirm

Table 2: Average experimental results for all treatments

	N	I	I_+	F	F_+
Market wage	21.712	22.119	21.890	20.917	20.096
Fixed wage	13.039	11.449	9.667	12.075	11.718
Revenue share	0.493	0.532	0.534	0.523	0.541
Accepted [%]	72.0	73.1	76.8	70.7	71.8
Offered duration	1.311	1.539	1.430	1.737	1.973
Effort	8.000	6.466	6.506	6.568	7.695

We find the highest acceptance rate in treatment I_+ , providing maximal insurance against wage reductions without excluding upward wage adjustments. Employers offer the shortest contract duration in case of no flexibility (N) and the longest in case of full flexibility (F_+). Efforts are highest in treatment N : employees seem to prefer certain wage incomes and reward employers by higher efforts for such certainty. Purely opportunistic employees should invest lowest effort levels in Treatment N . Revenue shares are all near 0.5, seemingly a focal point for employers.¹² Actually, the correlation between changes in the market wage $\Delta w_t^c = w_t^c - w_{t-1}^c$ and fixed wage changes $\Delta w_t = w_i^j(t) - w_i^j(t-1)$ is highly significant¹³.

4.2.1 Interdependence Between Degree of Regulation and Contract Duration

A completely myopic employer would offer one-period contracts only, whereas a less myopic employer may aim at “contractual effort smoothing” whenever possible, i.e., when allowed by wage flexibility. Thus, we test which type of employer is prevailing in the experiment. We expect to observe far-sighted employers, who offer long-term contracts whenever optimal. Maximal duration always exceeds significantly the actually offered duration (Table 3), but the average offered contract duration is significantly longer than $T_i^j = 1$.

Result 1 *Participants offer significantly shorter than maximal contract duration, but the average offered contract duration significantly exceeds one period.*

this for treatments I_+ and F , where there is a positive correlation between changes in w^c and changes in the workers’ utility.

¹²The relative frequencies of 0.5 piece rate offers are for increasing flexibility of the treatment: 37%, 26%, 29%, 36%, and 28% respectively. These offers are the most frequent ones for all treatments.

¹³ χ^2 -test on the independence of moving directions of Δw_t and Δw_t^c at 5% significance level.

¹⁴Because of effort smoothing, each employer should in each period offer a contract with maximum duration.

Table 3: Offered contract duration in treatments

	N	I	I_+	F	F_+
Average	1.311	1.539	1.430	1.737	1.973
Average optimal ¹⁴	5.498	5.468	5.536	5.637	5.878
Sign-Test on max. duration	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Sign-Test on one-period	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Overall we expected longer contracts in the less regulated treatments, especially for treatments F and F_+ where employers can positively and negatively respond to workers' effort choices in a long-term contract. We tested the first hypothesis applying a Jonckheere-Terpstra Test on increasing duration with increasing flexibility (from N to F_+). To test the second hypothesis, we applied a non-directional Kruskal-Wallis One-Way ANOVA on Ranks¹⁵ and isolated by Dunn's Method the treatments causing the difference. Both tests support our hypotheses:

Result 2 *Offered contract duration is increasing with increasing contractual flexibility. Treatments F and F_+ differ significantly from the remaining treatments.*

As an offer does not necessarily lead to a contract, we also tested the duration of concluded contracts for trends over treatments. Again, a Jonckheere-Terpstra test shows that *duration of accepted contracts* increases with increasing flexibility of wages.

Result 3 *The duration of accepted contracts increases with increasing flexibility of contracts what altogether supports our Hypothesis A: more flexibility in adapting contract conditions to the actual environment favors contracts with larger duration.*

4.2.2 Acceptance Decisions

Confronted with a contract offer, a rational worker should check whether the expected income of the contract is larger than, or equal to, the expected income from only one-period contracts based on optimal values of piece rate s and effort e .¹⁶ We look at actual and optimal acceptance of contract offers in Table 4. A contract is called "optimally accepted", whenever the worker's income from it is larger than the expected income from one-period contracts over the same number of periods.

¹⁵The difference is highly significant ($H=51.427$; $P < 0.001$). To isolate the treatments causing the difference, we compare pairwise with Dunn's Method. The values of the test variable Q indicate, at the 5% level, significant differences between treatments F , respectively F_+ and the remaining treatments.

¹⁶These contracts give a worker just the period's market wage.

Table 4: Optimality of contract acceptance rates

	N	I	I_+	F	F_+
Actual acceptance [%]	72.0	73.1	76.8	70.7	71.8
Optimal acceptance [%]	87.5	88.8	89.9	69.2	62.8
Sign-Test	< 0.001	< 0.001	< 0.001	0.245	0.011

Actual acceptance rates significantly differ from acceptance rates based on optimality in all treatments except F . For treatments with only upward flexibility, contracts are less often than optimal accepted, in treatments with a possibility to lower the wage(s) more contracts are accepted. Workers do not seem to fear exploitation in treatments allowing employers to punish employees with low efforts. To answer whether the acceptance rate of long-term contracts is higher in treatments with a more restricted adaptation of revenue shares, an ANOVA on Ranks has been performed, showing no significant difference in acceptance behavior of workers across treatments regarding long-term contracts.

Result 4 *Workers' contract acceptance behavior is neither optimal nor can it be explained by fear of exploitation.*

To explore the determinants of the workers' acceptance decision in more detail, we ran regressions whose detailed results are presented in Appendix C, Table 7. Revenue share and fixed wage have a positive effect on acceptance. All other determinants (offered duration, a new-contract dummy and the market wage) deter employees from acceptance. These results additionally confirm Result 4 that contract acceptance does not depend on the treatment.

4.2.3 Effort Choices

After accepting a contract, workers choose effort, where their choice is limited to positive values. The optimal effort $e^* = 10 \cdot s$ does not depend on the fixed wage. Hence, our next aim is to test the optimality of effort choices given offered piece rates. Table 5 gives an overview of the results.¹⁷ All workers' effort choices were compared pairwise with the optimal effort in the respective period by applying a Sign-Test for each treatment separately. As can be seen from the Pearson Product-Moment correlations in Table 5, the correlation between actual and optimal effort choice is positive and highly significant. The Sign-Tests show that in all treatments, except N , there is a significant difference in the distribution of actual and optimal effort in the sense that workers exert more effort

¹⁷Here we excluded effort choices leading to detrimental losses and reflecting highly irrational behavior.

Table 5: Effort choice

	N	I	I_+	F	F_+
Actual effort	5.226	5.928	5.523	6.189	5.780
Optimal effort	5.119	5.373	5.353	5.468	5.499
Pearson Corr.	0.833	0.589	0.797	0.590	0.707
P(Pearson)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
P(Sign-Test)	0.360	< 0.001	0.0013	< 0.001	< 0.001

than optimal. This may be due to the inflexibility of treatment N , where workers' efforts can neither be rewarded nor punished.

Result 5 *Workers' effort choices in treatment N are nearly optimal, otherwise workers exert more effort than optimal.*

To analyze the determinants of effort choices in more detail, we ran three regressions on selected variables. The results in Table 8 (Appendix C) show that both, the fixed wage rate and the revenue share, have a significantly positive influence on the workers' effort decision.¹⁸ The coefficient for revenue shares is much higher than that for fixed wages. We conclude – in line with theory – that piece rates are the most important determinant for workers' effort choices. Furthermore, the regressions reveal some learning. The negative time trend together with our results in Table 5 (higher than optimal efforts in almost all treatments) show that higher than optimal effort levels are mainly observed in the early periods, suggesting early reputation concerns of employee participants.

4.2.4 Are Long-term Contracts More Profitable?

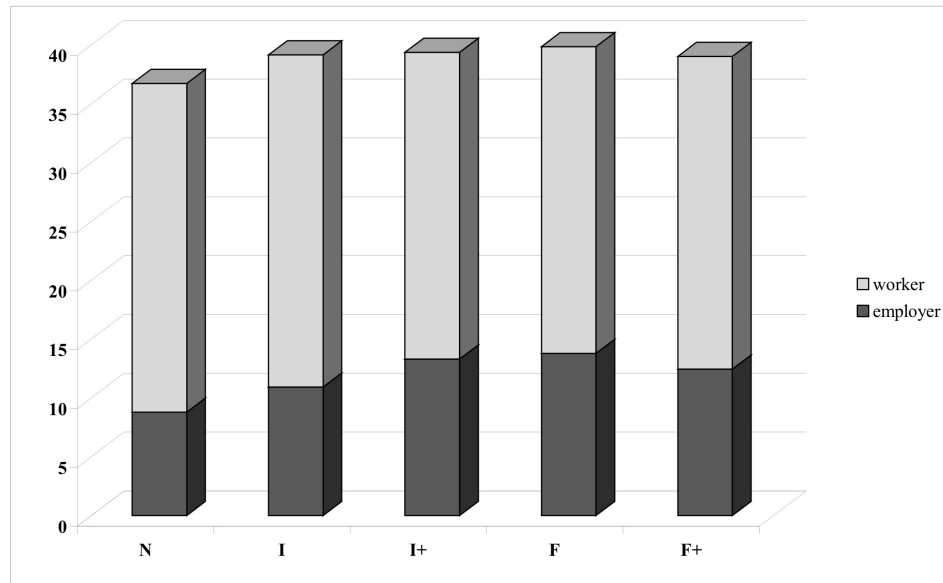
To gain from effort-smoothing (see section 3) firms should prefer long-term contracts. To check the interdependence between contract duration and profits we computed Pearson-Moment Correlations between the duration of accepted contracts and the resulting profits to employers for all treatments separately. We did not find any significant interdependence and thus conclude:

Result 6 *Employers do not profit from increased contract duration: there are no gains from effort smoothing to employers in long-term contracts.*

According to Result 6 effort smoothing seems a rather far fetched theoretical possibility which participants either do not recognize or simply discard.

¹⁸We included a last contract period dummy to isolate endgame effects. To avoid collinearity problems with the last period dummy, we did not include contract duration.

Figure 1: Workers' and Employers' Average Gains



If deregulation in form of higher contractual flexibility increases efficiency, we should find this in our data. First, we test employers' gains from concluded contracts over treatments. A Jonckheere-Terpstra test on increasing employer gains results in significantly increasing gains, when flexibility is increased. Although we found in Result 3, that also contract duration increases with flexibility, we cannot support a causal interdependence between contract duration and employer gains (from effort smoothing). We executed the same test for workers' profits and also for the sum of profits (net joint profits). Net joint profits, which can be seen as an indicator for efficiency, also significantly increase, whereas workers' profits significantly decrease. Thus deregulation increases efficiency, regardless of contract duration. Workers' decreasing payoffs have to be interpreted with caution: They result mainly from their high efforts (see Result 5). In Figure 1, we see that workers' average profits are higher than employers' for all treatments.

Result 7 *Employers' gains and net joint profits increase with contractual flexibility. Workers' gains are lower in case of more flexible contracts.*

4.2.5 Are Long-term Contracts Crowded Out by Renewed Contracts?

Table 6 shows how employers and employees deal with short-term, long-term, and renewed contracts. The percentages of short- and long-term contracts offered add up to 100%. Renewed contracts may be short-term or long-term. Offered and accepted contract duration increases with the flexibility of the treatment. The same unambiguous assertion cannot be made for renewed contracts: Between 19 and 34% of the contracts

are renewed ones. We also had a closer look at participants who opted for a renewed pairing: if only one contract partner opts for rematching, in most cases it is the employer and this tendency seems to increase with contractual flexibility. Overall, employers opt for another round with the same employee at about 75% of ending contracts only, in treatment N they do this in about 60% of all cases.

Table 6: Short- and long-term contracts

percentages	N	I	I_+	F	F_+
Short-term offer	76.7	74.3	75.1	62.9	53.7
and conditional acceptance ¹⁹	77.2	77.5	80.3	78.9	78.2
Long-term offer	23.3	25.7	24.9	37.1	46.3
and conditional acceptance	55.0	60.4	66.1	56.8	64.4
Renewed offer	22.2	30.1	34.2	30.8	18.6
Only <i>one</i> opts for renewal	52.1	41.5	41.8	39.1	50.0
The <i>one</i> is the employer	45.9	56.2	65.2	69.6	87.3
Employers opting for rematching	58.9	74.9	78.5	79.5	74.5

Treatments significantly differ with respect to the percentage of contract offers in renewed pairings and the percentage of offering long- and short-term contracts.²⁰ We find support for our main hypothesis (Hypothesis B), that in more regulated markets long-term contracts are replaced by contract renewals (more short-term and fewer long-term contracts from treatment N to F_+).

Result 8 *The percentages of contract offers in renewed relationships as well as those of long-term contracts differ significantly over treatments.*

The missing trend in the frequency of renewed contracts may be caused by heterogeneous durations of renewed contracts. What determines the decision to opt for rematching? Do employers offer a new contract to a worker when the match was successful in the sense of positive profits? And do workers opt for rematching after a positive experience with an employer? We used the χ^2 -test to see how opting for rematching depends on the payoffs of both partners. For employers, this decision always depends on the period's payoff, whereas for workers such dependency exists only in treatments I and F .

Result 9 *Opting for rematching does not correlate with contractual flexibility. Employers' behavior is influenced mainly by the payoff extracted from the match; for employees this is observed only in treatments I and F .*

¹⁹Conditional acceptance is, e.g., the percentage of accepted short-term contracts.

²⁰ χ^2 -test at 5% significance level.

5 Conclusions

In both, our theoretical analysis as well as in our experimental scenario, “going on the long race” in the sense of long-term employment has been possible in two ways: by offering and accepting longer contract duration or by mutually agreeing on rematching. Thus, although the five treatments cover nearly the full spectrum of no to full flexibility in adapting contract terms, one could always have established long-term employment without bothering how regulated the labor market is.

In the experiment employers seem to follow a behavioral benchmark instead of acting optimally: fixed wages are significantly positive, piece rates divide the returns from effort equally and offered contract duration is significantly shorter than would be optimal for effort smoothing. Also employees’ answers differ from optimal ones. They accept more contracts than optimal for N to I_+ and less for F and F_+ . Effort is higher than optimal: to piece rates of about 50% offered by employer participants, they react with effort levels between 6.5 and 8, whereas optimal efforts range only between 5.2 and 6.2. Nevertheless, the offered and accepted contract durations (Results 2 and 3), effort levels (Result 5), as well as opting for rematching (Result 9) differ significantly between treatments.

Employers offer contracts with longer duration in treatments with higher flexibility and the accepted contract length increases. Thus, our hypothesis regarding the influence of labor market flexibility on contract duration is confirmed (Hypothesis A). Employers’ profits increase when regulation decreases. Longer contract duration, however, does not generate increasing gains for employers. Workers’ gains are lower when contracts are more flexible, but (see Figure 1) they always get more than 50% of the pie. Opting for rematching by employers also seems to increase in a more flexible labor market regime (Hypothesis B). Employees seem to exploit the situation with inflexible contracts where they cannot be punished for low efforts. This leads to low gains for employers, who do not want to be matched again with the same worker (Result 9).

After all, what can we say about policy implications? Does (de)regulation of labor markets really pay? Do deregulated markets work more efficiently? Unfortunately, our results do not reflect an unambiguous answer. This can mainly be reduced to the problem of ordering increasing market flexibility “correctly”. The tables in our paper suggest a flexibility ordering \prec of treatments like $N \prec I \prec I_+ \prec F \prec F_+$, where $A \prec B$ means that market organization B is more flexible than market organization A . However, this ordering of our treatments is not a “natural” one. One could, e.g., similarly argue that $F \prec I_+$ constitutes a reasonable flexibility ordering between two labor market institutions. Thus, measuring flexibility of markets by a simple binary ordering is not a trivial task.

Keeping this caveat in mind, we will, nevertheless, argue that, given a generally accepted flexibility ordering of markets which might be based on the ordering \prec above and regarding the average efforts choices as a measure of market efficiency we actually find a *strictly increasing monotone relationship between market flexibility and market efficiency* provided treatment I_+ is omitted. Unfortunately, there is a sharp monotone decrease in efficiency from treatment I to treatment I_+ what destroys a monotone relation over all treatments.

It is difficult to find a reasonable explanation for this phenomenon without doing further research. Employees might feel “disappointed” in treatment I_+ that employers do not exercise the, compared to the restrictions in treatment I , upward flexibility of piece rates in adapting to a new market environment and, therefore might react by effort reduction.²¹

Finally, how affects (de)regulation the average employment duration between employer–employee pairs? Assuming the same flexibility ordering \prec between our treatments as above and omitting the critical treatment I_+ again we obtain a *hump-shaped* curve describing the dependence between market flexibility and average employment duration. Maximum employment duration is obtained in treatment I .²²

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²¹Remember that we found employers’ piece rate choices to be rather stable around $s = \frac{1}{2}$ over all treatments.

²²This result is based on the following calculations of average employment duration over the treatments:

treatment	N	I	I_+	F	F_+
employment	1,621	2,253	2,188	2,392	2,299
duration					

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Appendix

A The Efficiency of Effort Smoothing

To show that $T_i^j = 2$ is preferred by employer i to repeated one-period contracts, we have to check that the following inequality

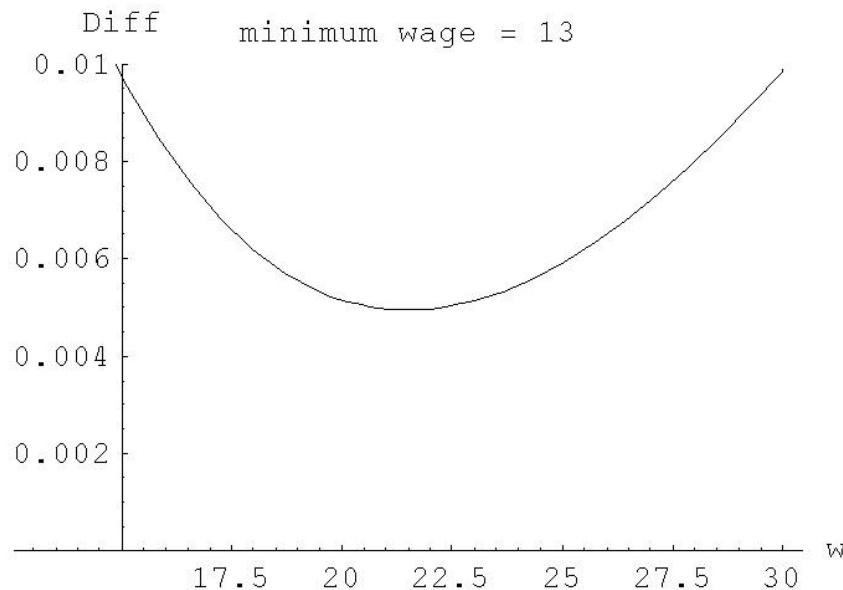
$$2(1 - s^+)s^+ - (1 - s^*(w_{T-1}))s^*(w_{T-1}) - E[(1 - s^*(w^c))s^*(w^c)] > 0$$

holds for any $w_{T-1} \in \{13, \dots, 30\}$.

Let us denote the left-hand side of this inequality by $Diff(w)$. Inserting the parameter values of our experimental design $p = 10$, $c = 1$, we obtain the explicit expression

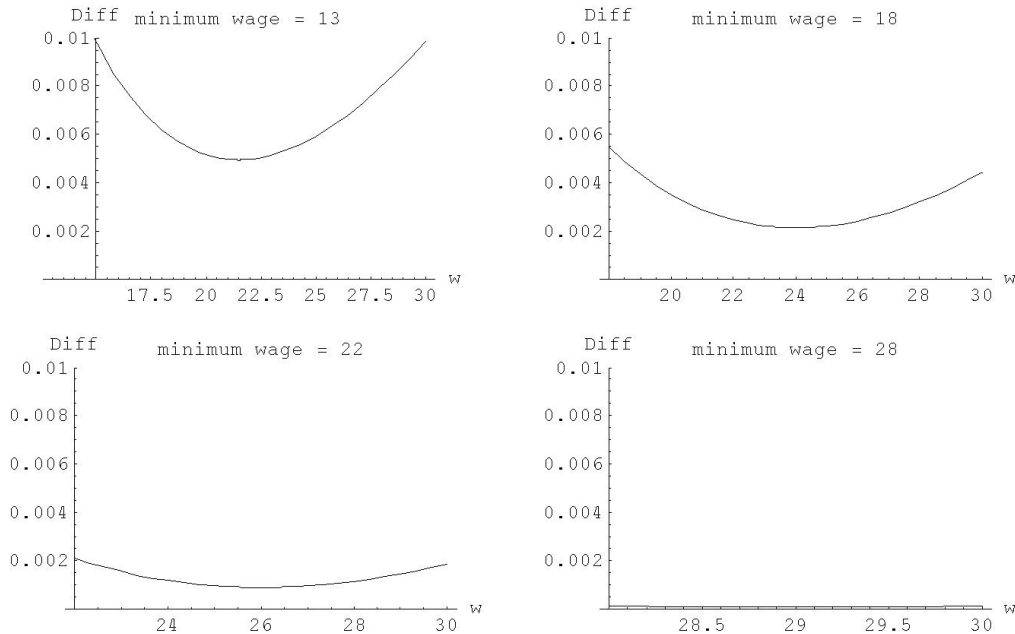
$$Diff(w) = 0.141421\sqrt{43 + 2w} - 0.141421\sqrt{w} - 0.650804.$$

The diagram shows how $Diff(\cdot)$ depends on w .



$Diff$ remains positive over the whole range of wages $w \in \{13, \dots, 30\}$, supporting our statement that **contractual effort smoothing pays** (in the two-period scenario). By reformulating the problem, we analyze how the profitability advantage of a two-period contract depends on the range of the distribution of market wages. To avoid technicalities, we consider uniform market wage distributions with increasing minimum wage \underline{w}^c while keeping the maximum wage \bar{w}^c constant.²³ We vary the minimum wage from 13 to 30. The result is illustrated for selected \underline{w}^c -values by the second diagram.

²³By shifting the probability mass of the original uniform wage distribution equally onto larger w -values, the resulting distributions with larger \underline{w}^c -values dominate the preceding distributions with respect to *first order Stochastic Dominance*.



We conclude from this that the advantage of a two-period contract shrinks when the variance of the market wage shrinks. Intuitively, this is what one would expect. It pays more to offer a long-term contract when the “uncertainty” of the market wage increases.

B Translated Instructions

The instructions presented below are those for treatment I. It is easy to see how they should be used for the remaining treatments. The German instructions use a shorthand for variables which we related to German vocabulary used. We kept this notation for reasons of authenticity rather than substituting them by those in the theoretical analysis, related to the English vocabulary.

In this experiment you can earn real money, which will be paid out in cash at the end of the experiment. The experiment lasts for **10 periods**. How much you earn depends on your decision and the decisions of the other participants. Every participant makes her decisions isolated from the others, sitting at separate computer terminals. Communication among participants is not allowed.

A participant will be randomly assigned the role of an employer (AG) or a worker (AN). She will be informed about her role at the beginning of the experiment and will keep this role until the end.

Every participant receives an initial endowment of **150 CU** (currency units).

General procedure

At the beginning of each period, the period's market wage M will be announced to all members of a group. For this wage rate each worker will be able to find employment in case of not being contracted by an employer. Only the market wage of the present period will be announced, market wages of future periods are not known. Every employer is randomly matched with one of the workers and offers her a contract. This consists of the **fixed wage**, the **contract duration**, and the **revenue share** of the produced quantity. Each worker can accept or refuse this contract offer. If she accepts, she chooses the planned product quantity. Employers and workers are paid according to the contract. When a contract expires, employers and workers are asked if they want to interact again with the same person in the next period. If both agree, they are matched again in the next period.

First-round procedure

1. The random market wage for the present round is announced, which can vary between 13 and 30.
2. Employer-worker pairs are randomly selected.
3. The employer offers a contract characterized by the following items:
 - A fixed wage F (in CU), where $F \geq 0$.
 - A share a , where $0 \leq a \leq 1$ of the total production.
 - The contract duration L , where

$$1 \leq L \leq \text{number of remaining periods.}$$

4. Workers see the contract offered by "their" employers and decide to accept it or not. If the contract is not accepted, the worker receives the prevailing market wage M , and the employer has zero return.
5. If the contract is accepted, the worker chooses the production quantity Q , which is sold for 10 CU. The division of the production quantity is determined by a .

The worker's return from an accepted contract in this round is given by:

$$F + 10 \cdot aQ - 1/2 \cdot Q^2.$$

The employer's return is given by:

$$10 \cdot (1 - a)Q - F.$$

If the worker refuses the contract, she receives the prevailing market wage. The employer has zero return.

6. Per-period earning and the sum of all previous periods' earnings are presented (in CU) on the computer screen.

Procedure in the following rounds

For participants not yet restricted by a long-term contract, the procedure in the following rounds does not differ from the first round, where the offered contract duration is restricted to the number of the remaining rounds. For employer-employee pairs bound by a long-term contract, the employer may increase the fixed wage after the market prevailing in this round has been announced. Then the workers decide how much to produce.

If a contract has expired, both partners are asked if they want to be matched again with the same partner in the next period. If both agree, they can enter a new contract in the next round. Otherwise, both are randomly matched with another participant.

Please consider that in a long-term contract the worker's production share and the contract duration do not change, while the fixed wage may be raised by the employer in each round. In a contract modified in this way, the increased fixed wage is automatically accepted. The worker may change the production quantity in every contract period.

“History”

During the experiment you can call up your “history” at any time by pressing the button at the lower border of your computer screen or by pressing the F1 key. The following information about previous rounds is given: prevailing market wage, fixed wage, production share, remaining contract periods, acceptance of offers, quantity produced, employer's return, employee's return.

Payoff

You will be paid immediately after the experiment is finished. The return of all rounds is added up and converted into euro at the exchange rate of 0.05 euro per CU. Payment is made anonymously.

Questionnaire

Before the experiment starts, you will be asked, via the computer screen, some questions on the rules of the experiment. If you do not understand a question, please ask the experimenter.

Summary of notation

a	worker's production share, $0 \leq a \leq 1$
F	fixed wage, $0 \leq F \leq 60$
L	contract duration, $1 \leq L \leq$ number of remaining periods
M	market wage $M \in 13, 14, \dots, 30$
Q	production quantity, $0 \leq Q \leq \dots$
GE	currency units
AN	worker
AG	employer

C Regression Results

Table 7: Logit regression of contract acceptance

	1	2	3	4
Constant ²⁴	-0.909 (0.459) <i>0.047</i>	-0.779 (0.428) <i>0.069</i>	-0.842 (0.439) <i>0.055</i>	-0.723 (0.408) <i>0.077</i>
Offered duration	-0.461 (0.062) <0.001	-0.467 (0.062) <0.001	-0.468 (0.062) <0.001	-0.473 (0.062) <0.001
Fixed wage	0.163 (0.015) <0.001	0.162 (0.014) <0.001	0.162 (0.015) <0.001	0.161 (0.014) <0.001
Revenue share	8.410 (0.705) <0.001	8.424 (0.705) <0.001	8.421 (0.707) <0.001	8.433 (0.707) <0.001
New contract	-0.752 (0.162) <0.001	-0.770 (0.161) <0.001	-0.762 (0.162) <0.001	-0.779 (0.160) <0.001
Market wage	-0.143 (0.016) <0.001	-0.143 (0.016) <0.001	-0.141 (0.016) <0.001	-0.141 (0.016) <0.001
<i>I</i>	0.129 (0.202) <i>0.523</i>	0.125 (0.202) <i>0.537</i>	–	–
<i>I</i> ₊	0.376 (0.232) <i>0.104</i>	0.370 (0.231) <i>0.110</i>	–	–
<i>F</i>	-0.059 (0.200) <i>0.767</i>	-0.064 (0.200) <i>0.748</i>	–	–
<i>F</i> ₊	0.030 (0.247) <i>0.904</i>	0.028 (0.247) <i>0.910</i>	–	–
Period	0.019 (0.024) <i>0.429</i>	–	0.018 (0.024) <i>0.456</i>	–
Likelihood Ratio	337.159	336.532	332.342	331.786
p-Value	<0.001	<0.001	<0.001	<0.001

²⁴The first entries in Table 7 represent the β -values of the regression, the numbers in brackets denote the standard deviation, and the term below indicates the p-value.

Table 8: Multiple linear regression of effort

	1	2	3
Constant	4.883 (1.836)	4.973 (1.529)	3.951 (1.388)
	<i>0.008</i>	<i>0.001</i>	<i>0.004</i>
Fixed wage	0.059 (0.028)	0.066 (0.027)	0.063 (0.026)
	<i>0.037</i>	<i>0.013</i>	<i>0.016</i>
Revenue share	8.184 (1.958)	8.434 (1.905)	8.193 (1.900)
	<i><0.001</i>	<i><0.001</i>	<i><0.001</i>
Period	-0.398 (0.104)	-0.407 (0.103)	-0.412 (0.103)
	<i><0.001</i>	<i><0.001</i>	<i><0.001</i>
I	-1.839 (0.925)	-1.801 (0.921)	–
	<i>0.047</i>	<i>0.051</i>	
I_+	-1.560 (1.038)	-1.520 (1.036)	–
	<i>0.133</i>	<i>0.143</i>	
F	-1.565 (0.932)	-1.515 (0.923)	–
	<i>0.093</i>	<i>0.101</i>	
F_+	-0.521 (1.056)	-0.463 (1.036)	–
	<i>0.622</i>	<i>0.655</i>	
Market wage	0.027 (0.056)	–	–
	<i>0.629</i>		
Last contract period dummy	-0.389 (0.655)	–	–
	<i>0.553</i>		
R^2	0.0252	0.0249	0.0215
Adjusted R^2	0.0197	0.0206	0.0197