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Wage Flexibility in Ongoing Employment Relations – An Experiment with a Stochastic Labor Market[1] –

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Abstract

Facing a stochastic market wage, which is independent of their own hiring policy, employers offer contracts specifying fixed wage, revenue share and employment duration. In ongoing employment relations it depends on the treatment whether fixed wages can be only increased or also decreased. Will the uncertainty of the future market wage and less wage flexibility lead to temporary employment? And, if not, will employers adjust wages to changing market wages and will workers in ongoing employment relations react to wage decreases via effort choices? Our results partly question empirical claims, e.g. of Bewley (1995), and confirm the tendency to establish ongoing employment relations. Granting more wage flexibility to employers altogether questions rather than enhances efficiency since it induces opportunistic wage cuts to which employees react with lower efforts.

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

Keywords: noncooperative game, labor contracts, labor market flexibility, principal-agent theory, experimental economics

1 Introduction

Except for few worker groups, especially for low skill workers or workers with rarely required special skills, employment relations usually are long lasting. But like in human love relationships where cohabitation increasingly substitutes marriage, also employment relationships undergo major adjustments without, however, so far questioning the

> Fact: *Temporary employment contracts are still an exception.*

Given this predominance of ongoing employment[1] (Alewell et al., 2007, review the empirical literature concerning temporary employment) in spite of rapidly changing (labor) market conditions one wonders how employers and employees react to changes on the labor market. More specifically, the

> Former Claim: *In ongoing employment relations employers do not dare to reduce wages even when market wages decrease considerably.*

was readily accepted after its confirmation by questionnaire data (Bewley, 1995 and 1998) and has inspired some related experimental studies[2] (Burda et al., 2005, and Fehr and Falk, 1999). We presently, however, see many firms, e.g. in Germany the Volkswagen AG or the Deutsche Bank, cutting wages and/or increasing the number of weekly working hours. Furthermore, many fringe benefits (the 15th, 14th, 13th salary in the banking industry) have been abolished by firms claiming to suffer from too high labor costs in spite of their high(er) profits. What has been learned recently is thus the

> Lesson: *Former "facts or claims" do not necessarily survive the global economy.*

But if in ongoing employment relations wages are often adjusted does it still pay to engage in long duration employment? Again a comparison with love relationships may help: is the increasing divorce rate the reason for the increase of cohabitation? And what are the advantages of long (employment) duration when (labor) markets are dramatically changing? We analyze a stochastic labor market which we also explore experimentally. According to the (rational choice-)benchmark solution there may be long employment either trying to gain by effort smoothing or, if this is considered as too sophisticated, via continuously renewed contracts rather than long duration contracts.

In our view, behavioral tendencies do not adjust as fast as market conditions. Although we experience more temporary employment, we still maintain ongoing employment relations in order to enjoy firm loyalty, corporate identity etc., similarly to love relationships where cohabitation often precedes marriage. In our experiment we thus expect to observe a substantial share of long duration employment allowing us to test how wage flexibility affects employment duration and work efforts. We are especially interested how these depend on the unexpected changes of the market wage.

[1] Temporary employment contracts are partly used to extend the probation period but do not question that, in case of mutual acceptance, one aims at long lasting employment.

[2] Burda et al. (2005) assume a forseeable future allowing to perfectly anticipate future changes of the competitive wage; Fehr and Falk (1999) exclude employment contracts with longer duration.

Section 2 introduces the experimental scenario which is theoretically analyzed in section 3. After describing the experimental protocol in section 4 we analyze the experimental data in section 5. Section 6 concludes. Let us remark that, although we employ a standard principal-agent model as our experimental workhorse, we will not review the literature concerning principal-agent experiments but rather confine ourselves to the more related empirical studies exploring the evidence of wage reductions in (possibly) ongoing employment relationships.

2 The experimental scenario

In every period $t = 1, 2, ...$ the n (≥ 2) employers $i = 1, 2, \ldots, n$ and workers $j = 1, 2, \ldots, n$ are matched to pairs. Each such pair can engage in an employment relation. If they fail to do so, there is no employment relation at all involving this employer and employee. Let us start with the first period $t = 1$ which 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 w_t^c for $t > 1$. 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 wage, $s_i^j \in [0, 1]$ the revenue share 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) is worker j's effort cost parameter. Similarly, employer i would earn

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

If worker j does not accept i's employment offer, j is employed externally at the market wage income w_1^c, whereas i earns nothing in that period.

In periods $t > 1$ the market wage w_t^c is made known first. What may be different is that some pairs (i, j) have already decided to go on with their employment relationship. Nevertheless, this does not exclude adjusting the contract where the flexibility depends on the treatment.

The **Inflexibility Treatment I** tries to capture what is described by the "Former Claim" in the Introduction: all what employer i in an ongoing employment relationship with worker j can adapt is the fixed wage w_i^j which i can only improve, i.e., i can either keep the terms constant or increase the fixed wage what is automatically accepted. With the data of such pairs we hope to explore how employer-worker reciprocity[3] depends on

[3] In case of an increase in w_t^c, but also after a decrease, employer i may offer a higher wage w_i^j which worker j rewards by a higher (than optimal) effort.

market conditions like the w_t^c-development. Our main hypothesis is, however, that there will be fewer long duration contracts in the I-treatment.

In the **Flexibility Treatment F** employer i is free to vary w_i^j in the range $w_i^j \geq 0$ what again is automatically accepted where, of course, j can factually leave employer i by choosing $e_i^j = 0$. Contrary to former empirical findings (Bewley 1998) we expect wage flexibility in both directions and only fewer downward than upward adjustments. Suppressing downward adjustments should inspire worker reciprocity in the sense of higher (than optimal) effort choices (similar to the findings of Fehr, Kirchsteiger, and Riedl, 1993, for static market situations).

Thus in all periods $t \geq 1$

- first all n employers and all n workers j are informed about the market wage w_t^c in that period without being able to anticipate its future development $w_{t+1}^c, w_{t+2}^c, ...,$ then

- in ongoing relationships (i, j) the employer i decides whether to adjust w_i^j to which employee j can react by his effort choice e_i^j whereas

- in newly matched pairs 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.

To continue an employment relation when it expires both partners can opt for rematching. Only when both agree, these two will be rematched; otherwise i and j will be randomly matched with any of the unemployed workers j, respectively employers i without a worker. Thus full flexibility is possible by renewed short term contracts with the same partner. We want to test the eroding hypothesis: restricting flexibility in adjusting employment contracts crowds out long employment by reducing T_i^j.

3 Benchmark and behavioral hypotheses

The rational choice analysis will be performed in two steps, a first one analyzing the one shot interaction as resulting for the last round or, more generally, for myopic players, and a second one arguing why it may pay to engage in long run relationships. We then confront these with some behavioral hypotheses.

When arguing that parties may offer and accept long run employment we will focus on the efficiency gains due to effort smoothing, i.e., inducing constant effort in spite of varying market wages. Another reason might be common(ly known) risk aversion. The latter seems unlikely when participants know that they will interact quite often.

The following rational choice analysis will therefore assume common (knowledge of) risk neutrality.

One shot-interaction Let us first consider the one shot-interaction as it results, for instance, in the last round $T(< \infty)$ when T is commonly known or, more generally, for myopic players who disregard the future. The optimal effort is

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

If the market wage w^c would also determine the fixed wages, i.e., for $w_i^j = w^c$, the optimal revenue share would result as $s_i^j = \frac{1}{2}$. This could be interpreted as a market on which

- all employed workers receive the same fixed market wage w^c which could be interpreted as a minimum wage and where
- firms offer different piece rates yielding different extra-benefits.

In the case at hand the extra benefit of a worker would be given by

$$p_i s_i^j e_i^j - \frac{c_j}{2}(e_i^j)^2$$

which, in case of optimal efforts, amounts to

$$\frac{(p_i s_i^j)^2}{2c_j}$$

and to $p_i^2/8c_j$ when also including the optimal piece rates of $\frac{1}{2}$. The difficulty of such a model lies, of course, in the interpretation of the market wage w^c. One justification could be collective bargaining restricted to negotiating fixed wages, e.g., in the sense of a minimum fixed wage w^c. The other interpretation is that of a legal minimum wage. Both interpretations can be hardly coincided with the assumption that w_t^c is independently and randomly determined in each period t. We, therefore, refrain from experimentally exploring a treatment where employers cannot deviate from offering fixed market wages (in a follow up-study, Berninghaus et al., 2008, we compare such a treatment with the two treatments of this study). Nevertheless, we will see that the solution, derived for $w_i^j = w^c$ may explain the behavior of many participants.

If firms are not restricted to offering $w_i^j = w^c$ but only to $w_i^j \geq 0$, respectively to $w_i^j \geq \bar{w}$ for some given positive $\bar{w}$ in an ongoing employment, the optimal piece rate can be derived by maximizing

$$\Pi_i = p_i(1 - s_i^j)\frac{p_i s_i^j}{c_j} - w_i^j$$

$$s.t.: \quad w_i^j + \frac{(p_i s_i^j)^2}{2c_j} \geq w^c$$

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

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

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, however, only fulfills the requirement of $w_i^j \geq 0$ if $w^c \geq \frac{p_i^2}{2c_j}$, which is violated by 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 minimum wage $\bar{w}$ due to long run employment in the Inflexibility treatment. When these conditions do not apply, a boundary solution requires $\frac{1}{2} < s_i^j < 1$ since $s_i^j = \frac{1}{2}$ is optimal for 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

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

Similarly, $w^c < \bar{w} + \frac{p_i^2}{2c_j}$ and thus $w_i^j = \bar{w}$ (> 0) renders

$$s_i^j = \frac{\sqrt{2c_j(w^c - \bar{w})}}{p_i}$$

as optimal in case of $\bar{w} > 0$ due to long run employment in the Inflexibility treatment.

Finitely repeated interaction When T is finite and commonly known, the usual backward induction can be applied (Zermelo, 1913, and more generally Selten, 1975). The benchmark solution of the one shot-interaction above applies when a pair is voluntarily or randomly formed in the last round or when both parties are (known to be) myopic.

What could induce the two parties to offer and accept a long run contract with $T_i^j > 1$? To illustrate the possible gains by effort smoothing consider the second last round of a finitely repeated interaction with only two possible realizations of the random market wage $w^c = \underline{w}^c$ and $w^c = \bar{w}^c$ with

$$0 < \underline{w}^c < \bar{w}^c < \frac{p_i^2}{2c_j}.$$

For the 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 – in case of equal probabilities for $\underline{w}^c$ and $\bar{w}^c$ – the payoff $\frac{(\underline{w}^c+\bar{w}^c)}{2}$ in the last round. We prove the efficiency gains by effort smoothing by deriving the for i optimal contract with $T_i^j = 2$ which makes employee j indifferent between accepting $T_i^j = 2$ and the $T_i^j = 1$-option.

For both, $w_{T-1}^c = \underline{w}^c$ or $w_{T-1}^c = \bar{w}^c$, employee j earns

$$w_{T-1}^c + \frac{\underline{w}^c + \bar{w}^c}{2}$$

in case of the $T_i^j = 1$-option. Guaranteeing j the same requires a $T_i^j = 2$-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

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

Offering $(w_i^j = 0, s^+, T_i^j = 2)$ would grant employer i all possible gains from effort smoothing over the last two rounds. It thus only remains to show that employer i prefers this contract, which due to j's indifference is accepted by employer j, over the $T_i^j = 1$-option. Now, neglecting the constant labor costs due to employing worker j, acceptance of $(w_i^j = 0, s^+, T_i^j = 2)$ yields for employer i altogether

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

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

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

where $s^*(\cdot)$ is the optimal piece rate function for $w_{T-1} \in \{\underline{w}^c, \bar{w}^c\}$ in the second last round $T - 1$ as well as for $\underline{w}^c$ and $\bar{w}^c$ in the last round T.

Thus we have to prove the conditions

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

where for

i) $w_{T-1} = \underline{w}^c$:

$$s^+ = \sqrt{c_j(\frac{3}{2}\underline{w}^c + \frac{1}{2}\bar{w}^c)}\Big/p_i \quad \text{and} \quad s^*(w_{T-1}) = s^*(\underline{w}^c)$$

and for

ii) $w_{T-1} = \bar{w}^c$:

$$s^+ = \sqrt{c_j(\frac{1}{2}\underline{w}^c + \frac{3}{2}\bar{w}^c)}/p_i \quad \text{and} \quad s^*(w_{T-1}) = s^*(\bar{w}^c).$$

Since $s^*(w) = \frac{2c_j w}{p_i}$, we are comparing i's earnings for the two events $\underline{w}^c$ and $\bar{w}^c$ with weights $\frac{3}{2}$ and $\frac{1}{2}$ or $\frac{1}{2}$ and $\frac{3}{2}$, respectively, with i's earnings for the constant s^+-event which is a convex combination of the former events. The result thus follows from the strict convexity of $\frac{p_i^2}{c_j}(1 - s_i^j)s_i^j + \frac{(p_i s_i^j)^2}{2c_j}$ as a function of s_i^j (an analytic proof that the two inequalities are true is given in Appendix B where we rely on the experimental parameter configuration $p_i = 10, c_j = 1$, and specify $\underline{w}^c$ and $\bar{w}^c$ by the external values $\underline{w}^c = 13$ and $\bar{w}^c = 30$).

Behavioral hypotheses We are rather sceptical whether participants will actually grasp the sophisticated idea of effort smoothing but nevertheless expect participants to engage in long run employment relations, not only by mutually opting for rematching but also by $T_i^j > 1$. One reason could be to avoid the unpredictability of future market wages. If $s_i^j < 1$ also some pairs might establish some efficiency enhancing voluntary cooperation yielding a better than average surplus via effort smoothing which they can more or less freely distribute among themselves via the fixed wage w_i^j. Such pairs may want to establish an ongoing relation not by mutually opting for rematching each round but rather by i offering $T_i^j > 1$ and thereby signaling to j that he wants to employ worker j for longer.

In case of $T_i^j > 1$ we experimentally observe how wages w_i^j adjust to cuts in the market wage and how such possible adjustments depend on the treatment, i.e., on wage flexibility. Given such adjustments we can further explore whether the former claims concerning the fears and likely reactions to wage declines in ongoing employment relationships can be validated or must be questioned. Our experiment can be viewed as a best case scenario for confirming the claims by Bewley (1998) based on questionnaire data: the only pairs with good reasons for establishing long employment relations are those which are especially profitable. Such pairs may want to avoid being matched with less promising partners next. Thus employment relations should be maintained when partners have experienced their cooperation as mutually rewarding what suggests less opportunism, e.g., in the form of lower wages when outside option wages decrease.

Less related to our main theme how market wages affect the contract specification in ongoing employment relations only boundedly rational employers might

- offer piece rates near to $s_i^j = \frac{1}{2}$ due to neglecting - in the spirit of mental accounting (e.g. Thaler, 1980) - how both, piece rate and fixed wage, are substituting each other,
- offer piece rates which depend on market wages, e.g. in the sense of lower piece rates in periods t with $w_t^c < (\bar{w}+)\frac{p_i^2}{2c_j}$ than in periods with $w_t^c \geq (\bar{w}+)\frac{p_i^2}{2c_j}$, and more generally
- reveal a bimodal distribution of piece rates with one peak near $\frac{1}{2}$ and another close to 1.

4 Experimental setting

The experiment was conducted at the University of Karlsruhe. Subjects were selected from a pool of students of different faculties. The experiment was organized in eleven sessions for each treatment. **Treatment I** differs from **Treatment F** in that in Treatment I only wage increases are possible, while in treatment F wages can be adjusted in both directions.

The software was developed at the University of Karlsruhe (Institute WIOR) for the experiment in discrete time. In each session, the ten participants represent a matching group. Members of a matching group interact for 10 rounds and are partitioned into a group of five employers and a group of five employees. Subjects without a given partner are randomly rematched within their matching group after each round. All subjects get an endowment of 7.50 Euro at the beginning of the experiment.

In each round, after the employer/employee pairs are matched and the market wage has been announced, the employer proposes a contract which can be accepted or rejected by the employee, except where the pair is already engaged in a long-term contract. After each round a participant is informed about her current payoff. Moreover, she can recall her payoffs earned in the previous rounds on the PC screen. Once each player in the matching group has made her decision, the next round starts.

Employer subjects have to choose fixed wages w_i^j, revenue shares s_i^j, and duration of contract T_i^j. As an employee they have to fix their effort level e_j in each period after accepting the contract. At the beginning of each period the prevailing market market wage w_t^c, a random number which is supposed to be uniformly distributed over a given interval of integers, is announced to all subjects.

To avoid unreasonable results we restricted the choices 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	$\in \{13, 14, ..., 30\}$
e_j	$\in \mathbb{R}_+$

The payoffs for each subject are accumulated over 10 rounds and paid out in cash shortly after the experiment was finished.[4] The average payoff in both treatments is presented in Table 1 showing that it does not pay to be an employer. The same holds

Treatment	Treatment I	Treatment F
Employer	14,98	13,79
Employee	20,13	18,94
average	17,03	16,38

Table 1: Average payoffs in Euro

for the Flexibility Treatment F revealing that more wage flexibility of the employer does not result in higher payoffs or surplus. A more detailed analysis and discussion will follow.

[4]The conversion rate is 0.05 Euro per 1 ECU (Experimental currency units).

5 Experimental results

We are mainly interested in the evolution and the absolute level of (offered and accepted) wages and in the average contract duration.[5]

5.1 Aggregate results

Concerning fixed wage rates, we find that, due to positive extra-benefits, average fixed wages are smaller than market wages. This holds irrespectively of the particular treatment (see Table 2) and seems in line with our benchmark solution which prescribes fixed wage rates below the market wage.[6]

	Treatment I	Treatment F
market wage	21,92	20,83
actual wage income:		
contracted fixed wage		
a) realized	16,29	13,20
b) optimal	9,43	7,88
contracted revenue share		
a) realized	0,53	0,52
b) optimal	0,5	0,5
duration of contracts	3,14	2,82

Table 2: Descriptive aggregate results comparing treatments

As expected, the average fixed wage is lower in the F-treatment than in the I-treatment, while there is no essential difference in average revenue shares which are by far lower than the optimal ones.[7] The latter seems to confirm the mental accounting hypothesis (claiming that employers determine fixed wage and piece rate rather independently). Seemingly, employers utilize the additional wage decrease option in the F-treatment. At first sight it seems surprising that we observe longer contract duration in the I-treatment than in the F-treatment: employers in the F-treatment can more flexibly adjust to changing wages than in the I-treatment.

[5]Our analysis omits the results of *one* subject (out of 220) in period $t = 2$ who, assigned to the employee role, chose the maximal effort (which was internally fixed at 999) and, therefore, suffered from detrimental losses. Seemingly, the subject wanted to try out how our programs works under extreme conditions.

[6]But compared with the optimal fixed wage level, the realized average wages are larger.

[7]Since $s_i^j = 1$ for $w^c \geq (\bar{w}+)\frac{p_i^2}{2c_j}$ and $s_i^j \in (\frac{1}{2}, 1)$ we have computed the average of the respective optimal piece rates.

5.2 Treatment differences

A contract offered by an employer is composed of the fixed wage which can be changed in each round, the employee's revenue share and the duration of the contract (in periods) which cannot be changed until the contract expires. First, we will be interested in whether the Flexibility treatment will generate significantly different results from the Inflexibility treatment.

	offered in all periods	offered and accepted in all periods
Treatment I	15,113	16,285
Treatment F	11,780	13,196
p-value	0,002	0,080

Table 3: Treatment differences in fixed wage rates

The data in the second column of table 3 show offered wages irrespective of being accepted or not, that is, wage offers which are either offered in the first contract period or imposed by the employers (and automatically accepted by the employees) in the following contract periods. The third column presents the average accepted wage offers of all employers aggregated over all periods. Average *fixed wage* offers are significantly[8] smaller in the Flexibility treatment. In Table 4 we exclusively consider wage offers made in the first contract period for which we do not detect significant differences between treatments. We conclude from this that employers in treatment F initially expect to adjust wages from one period to the next.

	wage offers (accepted in 1^{st} contract period)	wage offers (refused in 1^{st} contract period)
Treatment I	11,804	10,486
Treatment F	12,294	11,547
p-value	0,317	0,672

Table 4: Treatment differences in fixed wages (1^{st} contract period)

There are, however, no significant differences between treatments for *revenue shares*. The observed average revenue share in Treatment I is 0,532, whereas it is 0,523 in Treatment F ($p = 0,103$). This misses the usual aspiration for significance but suggests that employers in the Flexibility treatment are less generous. In Figures 1 and 2 we compare

[8] In spite of possible repeated play effects all observations are regarded as independent.

the distributions of revenue shares offered and rejected for both treatments separately.[9] The distributions of accepted revenue shares show that most accepted contracts in both treatments are centered around the optimal value ($s_i^j = \frac{1}{2}$) when disregarding how optimal fixed wage and piece rate are interrelated. This may explain why the differences in the observed revenue shares are insignificant. The accepted revenue shares are significantly more generous ($p < 0,001$) than the rejected ones. When comparing revenue shares with fixed wage rates we find that higher revenue shares go hand in hand with lower wages.[10]

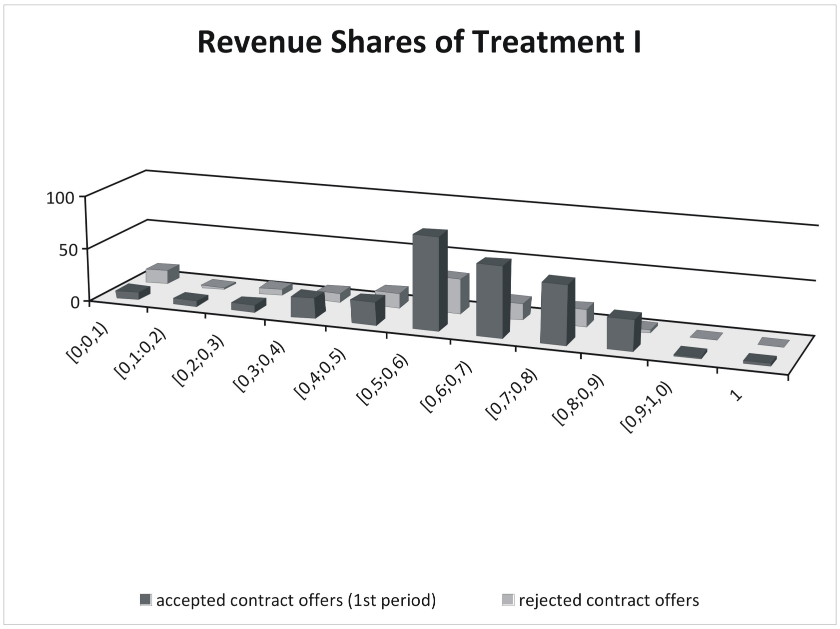

Figure 1: Revenue shares (offered, rejected), Treatment I

Table 5 shows significant differences in the contract duration offered by employers.[11] For the Flexibility treatment offered contracts have an average duration of 1,734 periods exceeding significantly the one of 1,538 in treatment I.

Long run contracts are contracts that last at least for two periods. According to Table 5 there is no significant difference in the duration of long run contracts. When, however, comparing offered (and accepted) contract periods for employer/employee pairs deciding to be rematched for another period (last column in Table 5), the treatment effect is significant. Note that many employers do not offer one-period contracts, as predicted by the benchmark solution, but also do not offer contracts with maximal duration. Do

[9] Since revenue shares cannot be changed during the contract, we consider only revenue shares offered in the first contract period.

[10] Indeed, one can show that there is a highly significant ($p < 0,001$) negative correlation between revenue shares and fixed wages (Spearman coefficients are strictly negative for all categories of accepted and rejected wages resp. revenue shares, in Treatment I and F).

[11] Note that the data show offered contract lengths irrespective of acceptance by employees.

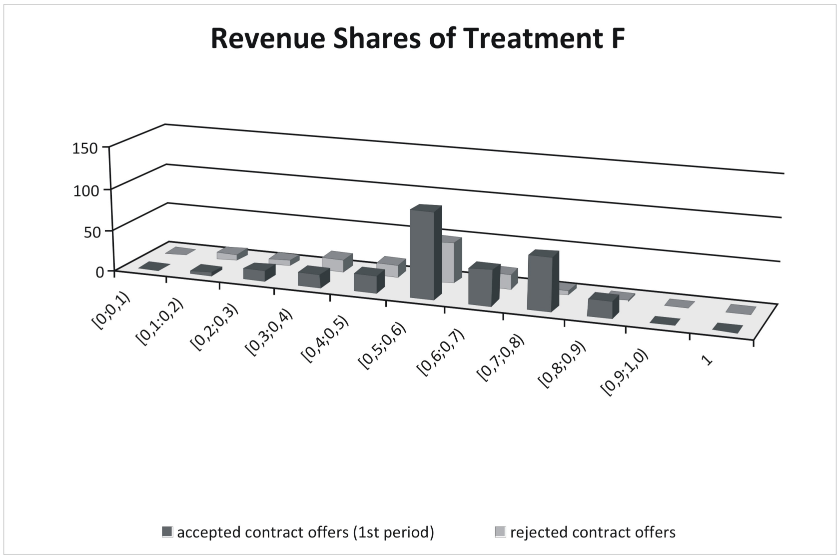

Figure 2: Revenue shares (offered, rejected), Treatment F

	contract duration (offered)	contract duration (long run)	contract duration (rematch)
Treatment I	1,538	3,143	2,883
Treatment F	1,734	2,818	2,810
p-value	0,005	0,473	(<) 0,001

Table 5: Treatment differences in contract periods

pairs, opting for rematching[12], aim at longer duration than pairs, implementing long duration? The data in Table 5 show that the average contract duration for rematched pairs is smaller (significantly only for Treatment I (p= $0,003$), but not for treatment F (p= $0,344$)).

According to Table 6 employees produce more than optimal in the Inflexibility treatment but less than optimal in the Flexibility treatment implying significantly larger efforts in the Inflexibility treatment. The p-values in the last row refer to treatment differences in observed (1^{st} column) and –due to differences in revenue shares– optimal (2^{nd} column) efforts while p-values in the last column rely on differences between observed and optimal efforts. The dramatically larger efforts of the Inflexibility treatment I question the usual demand of (labor) economists asking for a deregulation of labor markets. Apparently more flexibility of employers to adjust employment contracts triggers rather detrimental irritation rather than the often acclaimed efficiency improvements.

Figures 3 and 4 display the frequency distributions of realized and optimal efforts for

[12]By their past interaction rematched partners may have established mutual trust.

	effort level (observed)	effort level (optimal)	p-value
Treatment I	6,469	5,362	(<) 0,001
Treatment F	4,722	5,228	0,009
p-value	(<) 0,001	0,077	

Table 6: Treatment differences in effort levels

both treatments separately. They illustrate that the differences between observed and optimal efforts in (see Table 6) are rather small.

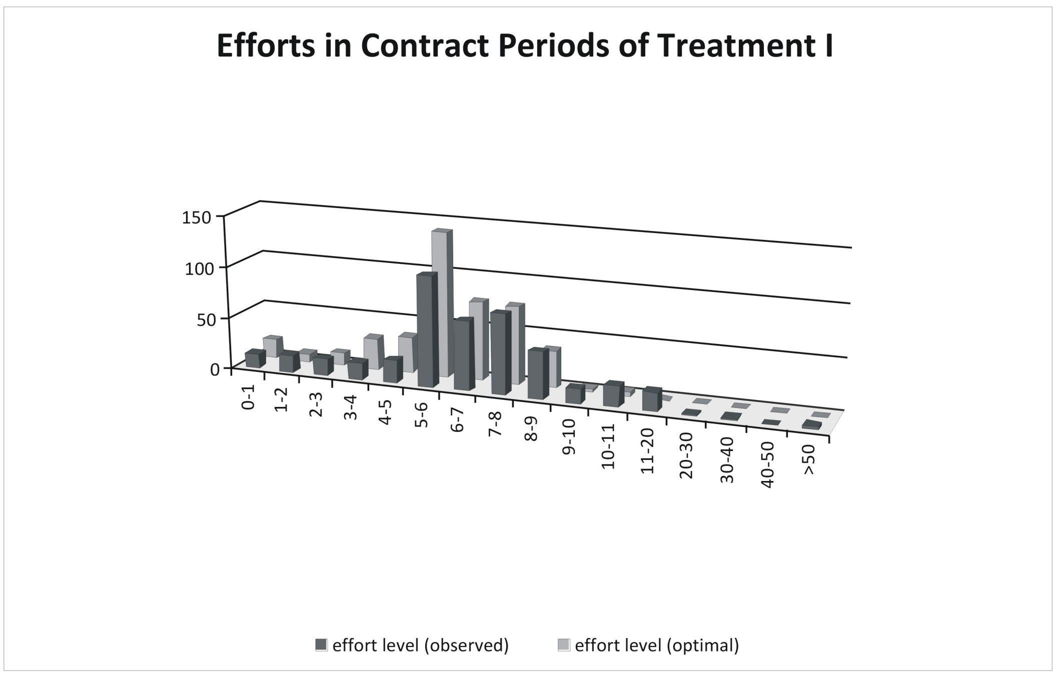

Figure 3: Efforts (observed, optimal), Treatment I

Following Falk and Fehr (1999), one could attribute the lower efforts in the Flexibility treatment to negative reciprocity meaning that employees respond to fixed wage decreases by shirking. When relating effort level changes to fixed wage changes, we observe a positive relationship between wage and effort changes although the correlations are not significant (see Table 7).

On average, employees "react" to wage decreases by effort decreases (Treatment F) and to wage increases by effort increases where, average wages in Treatment I are, of course, increasing while in Treatment F they are (on average) decreasing. Is this in line with our benchmark solution which predicts for the I-treatment no change at all and for

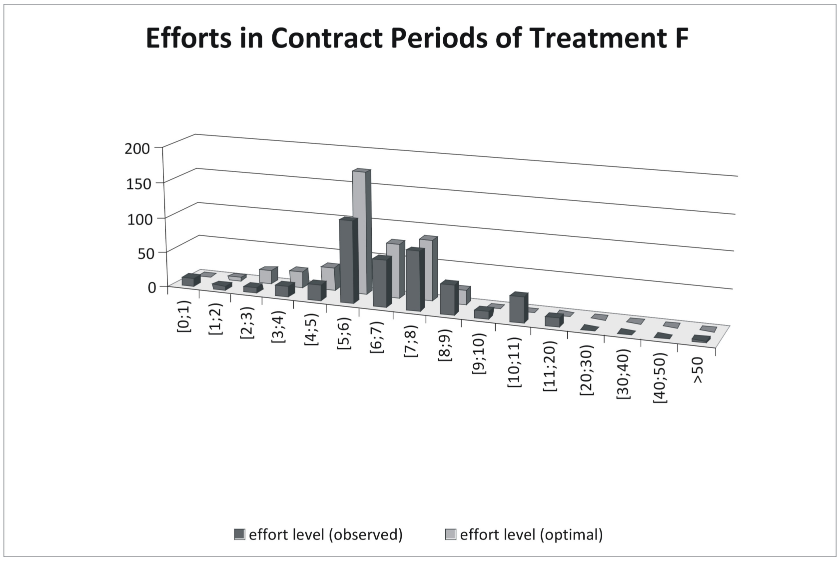

Figure 4: Efforts (observed, optimal), Treatment F

the F-treatment a drastic wage decrease to zero? Obviously, subjects do not follow this drastic policy but behave qualitatively as predicted.[13]

	fixed wage changes	effort level changes	Spearman coefficient	p-value
Treatment I	8,200	8,240	0,028	0,893
Treatment F	-6,330	-1,233	0,159	0,110

Table 7: Effort level reactions, only periods of wage changes

The data in Table 7 refer only to periods in which wage changes actually took place. In Table 8 we present wages and corresponding effort changes for all contract periods.

	fixed wage rate changes	effort level changes	Spearman coefficient	p-value
Treatment I	1,020	-0,0547	0,146	0,0383
Treatment F	-2,774	-0,566	0,131	0,0451

Table 8: Effort reactions, all contract periods

The correlation coefficient between wage and effort changes is now significantly positive

[13]For employers in Treatment F the (one sample) χ^2-test reveals a significant difference between the predicted and the actual wage change.

but the absolute level of wage changes (in both treatments) is smaller than in the previous table due to periods with no wage changes.

6 Conclusions

In our experimental scenario an employer and a potential worker can, when being matched, engage immediately in long term employment, avoid such contractual commitment but renew the partnership period by period, or rely on random assignment to new parters. The two treatments differ only in case of long duration contracts with the(In)Flexibility treatment (not) allowing decreases of the fixed wage. In spite of the usually acclaimed efficiency arguments by (labor) economists asking for deregulation of labor markets we observe just the contrary: more flexibility leads to more opportunistic employer behavior to which employees react by shirking (working less than optimally) rather than working (working more than optimally) what altogether reduces efficiency.

Although we do not confirm the "Fact: Temporary employment contracts are still an exception." we nevertheless have shown that one often aims at long duration contracts leading partly to significantly different behavior across treatments. As expected the "Former Claim: In ongoing employment relations employers do not dare to reduce wages even when market wages decrease considerably." is convincingly rejected. If employers can adjust (fixed) wages to market wages they usually do so. The intuition for the "Former Claim" is, however, confirmed since workers react to wage decreases in ongoing relationships by lower than optimal efforts. But the effort reduction is apparently too small to prevent wage cuts.

Regarding the "Lesson: Former "facts" do not necessarily survive the global economy." we, of course, must ask whether the global economy brought about new behavioral inclinations as captured by a transition from the Inflexibility to the Flexibility treatment. In our view, it is mainly due to increasingly world-wide competition for industries that employers nowadays dare to reduce wages or increase working hours per week not only for newly hired but also for already employed workers. It thus seems that our two treatments capture an essential aspect of the global economy for labor markets.

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A Experimental instructions

In the appendix we present the instructions for the Inflexibility Treatment I only. It is easy to see how the instructions have to be altered to deal with the Flexibility Treatment F.

Anleitung

In diesem Experiment können Sie Geld verdienen, das Ihnen unmittelbar nach dem Experiment ausbezahlt wird. Das Experiment dauert **10 Perioden**. Wie viel Sie verdienen, hängt von Ihren Entscheidungen und den Entscheidungen anderer Teilnehmer ab. Jeder Teilnehmer trifft seine Entscheidungen isoliert von den anderen an seinem Computerterminal. Kommunikation zwischen den Teilnehmern ist nicht erlaubt.

Jedem Teilnehmer wird zufällig entweder die Rolle eines Arbeitgebers (AG) oder die eines Arbeitnehmers (AN) zugeteilt. Diese Rolle wird Ihnen zu Beginn des Experiments mitgeteilt und bleibt im Verlauf der 10 Perioden konstant.

Jeder Teilnehmer erhält **zu Beginn** des Experiments eine Grundausstattung von **150 GE** (Geldeinheiten).

Allgemeiner Ablauf

Zu Beginn einer Periode wird der für diese Periode geltende Marktlohn M in GE allen Gruppenmitgliedern bekannt gegeben. Zu diesem Lohn findet jeder Arbeitnehmer eine Alternativbeschäftigung. Nur der Marktlohn der aktuellen Periode ist bekannt, nicht jedoch die Marktlöhne der künftigen Perioden. Jeder Arbeitgeber unterbreitet dem ihm zugelosten Arbeitnehmer ein Vertragsangebot. Dieses besteht aus **Fixlohn**, **Vertragslaufzeit** und **Anteil des Arbeitnehmers** an der Produktionsmenge. Jeder Arbeitnehmer entscheidet über Annahme bzw. Ablehnung des Vertrages und wählt dann die Produktionsmenge. Entsprechend der Entscheidungen werden die Arbeitnehmer bzw. Arbeitgeber bezahlt. Am Ende eines auslaufenden Vertrages kann der Wunsch geäußert werden, in der nächsten Periode auf den gleichen Partner zu treffen. Das Arbeitnehmer–Arbeitgeber–Paar bleibt zusammen, wenn beide diesen Wunsch äußern.

Ablauf der ersten Periode

1. Der zufällig bestimmte Marktlohn für diese Periode wird bekannt gegeben. Dabei kann der Marktlohn ganzzahlige Werte im Bereich von 13 bis 30 annehmen.

2. Die Arbeitgeber–Arbeitnehmer–Paare werden zufällig gebildet.

3. Der Arbeitgeber unterbreitet ein Vertragsangebot. Dieses legt folgende Größen fest:
   - Einen Fixlohn F in GE mit $F \geq 0$.
   - Einen Anteil a mit $0 \leq a \leq 1$ der Produktionsmenge für den Arbeitnehmer.
   - Die Vertragslaufzeit L mit ganzzahligen L im Bereich $1 \leq L \leq$ Zahl der Restperioden.
4. Die Arbeitnehmer sehen den Vertrag, den "ihr" Arbeitgeber anbietet, und entscheiden, ob sie diesen annehmen wollen oder nicht. Bei Nichtannahme wird der Arbeitnehmer zum Marktlohn M beschäftigt, der Arbeitgeber bekommt einen Erlös von Null.
5. Akzeptiert der Arbeitnehmer den Vertrag, so wählt er anschließend die Produktionsmenge Q, die je Einheit 10 GE einbringt. Die Aufteilung der Produktionsmenge wird durch a bestimmt.

   Der Erlös des Arbeitnehmers in dieser Periode entspricht bei Annahme des Vertrages:
   $$F + 10 \cdot aQ - 1/2 \cdot Q^2$$
   Der Erlös des Arbeitgebers in diesem Fall beträgt:
   $$10 \cdot (1-a)Q - F$$
   Nimmt der Arbeitnehmer den Vertrag nicht an, so entspricht sein Erlös in dieser Periode dem Marktlohn. Der Arbeitgeber hat in diesem Fall einen Erlös von Null.
6. Jedem Teilnehmer wird sein Periodenerlös sowie die Summe aller seiner bisherigen Erlöse (Kontostand) in GE angezeigt.

Ablauf späterer Perioden

Für die noch nicht durch einen längerfristigen Vertrag gebundenen Paare ist der Verlauf genau wie in der ersten Periode, wobei natürlich die angebotene Vertragslaufzeit die Anzahl der Restperioden nicht überschreiten darf. Bei Paaren in einem längerfristigen Vertrag darf der Arbeitgeber, nachdem der Marktlohn für diese Periode bekanntgegeben wurde, den Fixlohn beliebig erhöhen. Danach wählt der alt oder neu beschäftigte Arbeitnehmer die Produktionsmenge Q.

Falls der Vertrag für ein Paar endet, werden beide Partner am Ende der Periode gefragt, ob sie in der folgenden Periode den gleichen Partner wünschen. Wollen dies beide, so kann dieses Paar in der Folgeperiode einen neuen Vertrag abschließen. Sonst werden beiden zufällig neue Partner zugewiesen.

Man beachte: In einem **längerfristigen Vertrag** bleiben der **Anteil des Arbeitnehmers** an der Produktionsmenge und die Vertragslaufzeit erhalten, während der **Fixlohn** vom Arbeitgeber in jeder Periode beliebig erhöht werden kann. Der Vertrag mit geändertem Fixlohn wird automatisch angenommen. Der Arbeitnehmer wählt jedoch in jeder Periode neu die Produktionsmenge Q.

"Geschichte"

Während des ganzen Experiments haben Sie jederzeit die Möglichkeit, die Funktion "Geschichte" über ein Feld am unteren Bildschirmrand oder mit der Taste "F1" aufzurufen. Dort werden Ihnen die Ereignisse der vorherigen Perioden wie folgt angezeigt:

Periode	Marktlohn	Fixlohn	Anteil AN	Laufzeit	Annahme	Menge	Erlös AG	Erlös AN

Unter "Laufzeit" wird bei Annahme des Vertrages die Vertragslaufzeit ab der entsprechenden Periode angegeben. Wurde der Vertrag abgelehnt, wird die vom Arbeitgeber angebotene Vertragslaufzeit angegeben.

Auszahlung

Die Periodenerlöse werden für alle Perioden aufaddiert. Dieser Kontostand in GE wird in Euro umgerechnet, wobei **jede GE 0,05 Euro** entspricht. Ausbezahlt wird am Ende des Experiments. Die Auszahlung erfolgt individuell.

Kontrollfragen

Bevor das Experiment beginnt, werden Ihnen auf dem Bildschirm einige Fragen zu den Regeln des Experiments gestellt. Falls Sie etwas nicht verstehen, melden Sie sich bitte. Ihre Frage wird dann an Ihrem Platz beantwortet.

Zusammenfassung der Notation

a	Anteil des Arbeitnehmers an der Produktionsmenge, mit $0 \leq a \leq 1$
F	Fixlohn mit $0 \leq F \leq 60$
L	Laufzeit des Arbeitsvertrages mit $1 \leq L \leq$ Anzahl Restperioden
M	Marktlohn ($\in \{13, 14, ..., 30\}$)
Q	Produktionsmenge mit $0 \leq Q \leq ...$
GE	Geldeinheiten
AN	Arbeitnehmer
AG	Arbeitgeber

B The efficiency of effort smoothing

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

$$2(1-s^+)s^+ - [1-s^*(\underline{w}^c)]\frac{s^*(\underline{w}^c)}{2} - [1-s^*(\bar{w}^c)]\frac{s^*(\bar{w}^c)}{2} > [1-s^*(w_{T-1})]s^*(w_{T-1}) \quad (1)$$

holds for $w_{T-1} = \underline{w}^c$ and $w_{T-1} = \bar{w}^c$ as well.

Let us regard the left hand side of inequality 1 as depending on w_{T-1} and denote it by $F(w_{T-1})$, while the right hand side is denoted by $G(w_{T-1})$. Inserting the parameter values of our experimental design $p_i = 10, c_j = 1, \underline{w}^c = 13, \bar{w}^c = 30$ we obtain

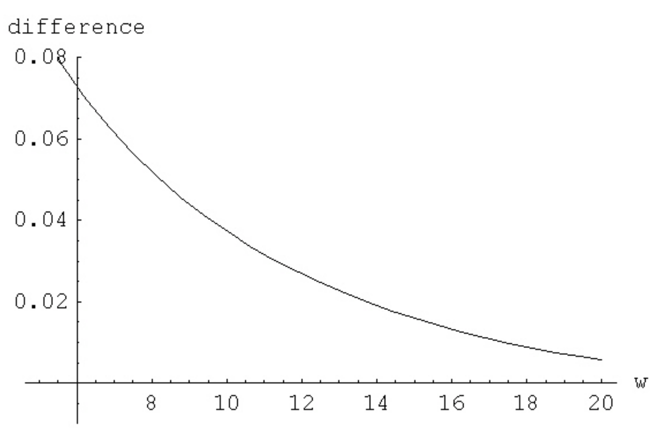
i) for $w_{T-1} = 13$:

$$F(13) = 0.273 > G(13) = 0.250,$$

ii) for $w_{T-1} = 30$:

$$F(30) = 0.193 > 0.175,$$

By reformulating the problem we analyze how the profitability of a two period contract compared to a one-period contract, depends on the range of the distribution of market wages. Let us denote the difference between $F(\cdot)$ and $G(\cdot)$ by $difference(\cdot)(:= F(\cdot) - G(\cdot))$ and vary $w_{T-1} = \underline{w}^c$ from 5 to 20, while keeping $\bar{w}^c$ constant. We obtain the following graphical illustration of the difference function:



We conclude from this figure that the advantage of a two period contract shrinks when the extreme values of the distribution of market wages. Intuitively, this is what one expects to gain by effort smoothing: It pays better to offer a long-term contract when the "uncertainty" incorporated in the market wage distribution increases.[14]

[14]For a two-point distribution increasing the lower value decreases the uncertainty of the distribution measured by the *second order Stochastic Dominance*.