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Managing Labor under Monetary Instability - Experimental Evidence on Wage and Effort Inertia

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Managing Labor under Monetary Instability

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Experimental Evidence on Wage and Effort Inertia

By KARINA HELD AND ABDOLKARIM SADRIEH[1]

Abstract

In a controlled laboratory experiment, we study the impact of monetary instability on work relationships with incomplete contracts. We observe wage inertia, i.e. the reluctance to fully adjust nominal wages to the changes in the value of the currency, and effort inertia, i.e. the reluctance to fully adjust the work effort to the alterations of the real wages. Under inflation, these effects lead to cheaper labor and a shift of payoff shares to employers. Under deflation, we observe a higher cost of labor and a shift of payoff shares to employees. Additionally, inflation and deflation lower productivity and per capita earnings.

JEL Codes

C91, E31, J31, M54

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1. Introduction

Organization science and behavioral economics are relatively mute on the effects that monetary instability may have on the interplay of wages, effort, and productivity in reciprocal labor relationships.[2] This is especially astonishing since many labor relationships are trust-based with incomplete contracts in nominal terms.[3] Monetary instability can affect these relationships, because fluctuations in the value of the currency may induce contract renegotiations that provide opportunities for self-interested behavior and can be disruptive to the trust relationship. To our knowledge, this is the first experimental study investigating the effect of monetary instability on wage and effort choices in reciprocal labor relationships.[4] Using controlled variations of the value of the experimental currency, we observe and analyze labor productivity and the distribution of earnings with inflation, deflation, and monetary stability.

When contracts are in nominal terms, monetary instability creates incentives to adjust contracted wages. If the ensuing nominal adjustment is not to the full extent, real wages fall under inflation and increase under deflation. Outside the lab, there are two ways in which nominal wages adjustments can be insufficient. First, wages may be only partially adapted to changes in the real factor markets. There is a rather large literature on the nominal downward wage rigidity that discusses employer's reluctance to adjust wages downwards when facing a change in real factor markets, e.g. a surplus of labor supply in a recession. Our experiment does not study this first type of nominal wage rigidity that is linked to fluctuations in the factor markets and is often referred to as wage stickiness.

We study the second type of nominal wage rigidity that we call wage inertia. It describes the incomplete adjustment of wages to purely monetary fluctuations (i.e. it can occur even if the factor markets are stable). The literature on wage inertia is generally concerned with incomplete wage adjustments under inflation. In these situations, deferred nominal wage adjustment may lead to decreasing real wages, making labor cheaper compared to other input factors, but at the same time reducing incentives to work and shifting earnings from employees to employers.

The literature discusses several reasons why nominal wage adjustments may be limited or slow. On the one hand, informational frictions (Lucas, 1972), staggered contracts (Fisher, 1977; Taylor, 1979), menu costs (Akerlof and Yellen, 1985; Mankiw, 1985), and reciprocity towards employees (Akerlof, 1982; Kahneman, Knetsch, and Thaler, 1986; Fehr, Kirchsteiger, and Riedl, 1993; Campbell and Kamlani, 1997; Bewley, 1998; Fehr and Gächter, 2000) have been suggested as possible reasons both for sticky wages and

2 At the same time, there is a plethora of studies covering the interplay of inflation, growth, and unemployment in the macroeconomic literature (for an overview see Blanchard 1990).

3 The literature on incomplete labor contracts is vast. Fehr and Gächter (2000) provide an excellent point of entry.

4 Reviewing theoretical and empirical literature on wage setting behavior, Fehr, Goette, and Zehnder (2009) find that the connection between monetary instability and reciprocal labor relationships remains an important open issue.

for wage inertia. On the other hand, money illusion – sometimes also referred to as nominal illusion – (Blinder and Choi, 1990; Kahn, 1997; Shafir, Diamond, and Tversky, 1997; Fehr and Tyran, 2001; Fehr and Tyran, 2008) is mainly discussed in the context of wage or price inertia in inflation.[5]

While there is some empirical evidence on wage inertia, it is rather difficult to control for all aspects of the labor relationships in the field. Identification is especially difficult, because wages, effort choices, and inflation rates tend to be highly correlated in field data. Our experimental approach allows us to circumvent the empirical measurement obstacles. In our setup, monetary instability (i.e. the alteration of the real value of the experimental currency) is fully controlled and exogenous. We induce inflation and deflation scenarios by varying the exchange rate between the experimental currency unit and the real payment in Euro. This allows us to compare employer and employee behavior in three treatments: *Control* (full monetary stability), *Inflation* (the real value of the experimental currency decreases over time), and *Deflation* (the real value of the experimental currency unit increases over time).

We observe wage inertia in both settings with monetary instability, i.e. nominal wages increase slower than the inflation rate in *Inflation* and they decrease slower than the deflation rate in *Deflation*. Additionally, we also find clear evidence for the reluctance of employees to adjust their chosen efforts to the real wages they are offered. We call this behavioral phenomenon effort inertia. Note that this aspect of labor relationships has not been reported in the literature so far.

Overall, wage and effort inertia in *Inflation* lead to cheaper labor (i.e. a decreasing real wage per effort ratio) and a shift of payoff shares from employees to employers, but also to less productivity and lower per capita earnings than in *Control*. In *Deflation*, wage and effort inertia lead to a higher cost of labor (i.e. an increasing real wage per effort ratio), to a shift of payoff shares from employers to employees, to slightly less productivity, and to lower per capita earnings than in *Control*. All in all, we find that monetary instability leads to the predicted cost of labor effects both under inflation and under deflation. However, since productivity adapts to the real wages changes (albeit with a deferred reaction due to effort inertia), neither inflation nor deflation can generate positive effects on the real economy. To the contrary, both inflation and deflation burden the trust-based labor relationships and lower per capita earnings.

Our study contributes to the literature on behavioral sources of nominal rigidity, i.e. the deferred adjustment to changes of real values that are not reflected in nominal values (e.g. money illusion). Our results are generally well in line with the findings of Fehr and Tyran (2001 and 2008), who provide laboratory evidence for the deferred adjustment of market prices to monetary fluctuations. Our results go beyond those findings by providing evidence for the nominal rigidity of wage and effort choices in work relationships with incomplete contracts.

5 Note however, that this literature generally does not consider the link between wages, work incentives, and productivity on firm level.

2. Experimental Design

We use a classical gift exchange game (Fehr, Kirchsteiger, and Riedl, 1993) to investigate the influence of inflation and deflation on wage and effort choices in labor relationships with incomplete contracts.[6] In this study, we induce monetary instability by varying the exchange rate between the experimental currency and the real currency paid to the subjects at the end of the experiment.

A. Treatments and the Game

Table I shows the three treatments in our study. The first treatment is our control treatment, in which the exchange rate remains stable throughout all 20 rounds. In our second treatment, *Inflation*, the exchange rate is stable for the first 6 rounds, but increases by 10 percent in each round from round 7 to 20. In *Deflation*, our third treatment, the exchange rate also remains stable in the first 6 rounds, but decreases by 10 percent in each round from round 7 to 20. Subjects are informed at the outset of the experiment that the exchange rate may vary over the rounds, but they do not know the long-term pattern of exchange rate development in their treatments. However, the exchange rate of the current round is announced at the beginning of each round, i.e. before the subjects make their decisions. Hence, even though subjects do not know the long-term development of exchange rates, they are fully aware of the exchange rate that is relevant for their decisions in the current round. Note that the three treatments are identical in rounds 1-6. Participants of all treatments also received the identical instructions (see the Appendix).

TABLE I: TREATMENTS

Treatment	Exchange Rate Development		# subjects	# ind. obs.
	rounds 1-6	rounds 7-20		
Control	Constant	Constant	60	15
Inflation	Constant	+10 % per round	60	15
Deflation	Constant	–10 % per round	60	15
Total			180	45

We study a gift exchange game with one employer and three employees ($i = (1,2,3)$). In this version of the game, the employer incurs a loss when the sum of effort choices is smaller than the total amount of real

6 The gift-exchange paradigm has been used to study work relationships with incomplete contracts under a number of market conditions. Riedl and Tyran (2005) study the influence of different taxation regimes. Brandts and Charness (2004) study fluctuations in supply and demand of labor. For an extensive survey of the laboratory studies, see Casoria and Riedl (2013). Reciprocal work relationships are also observed under various conditions in the field (e.g. Gneezy and List, 2006; Hennig-Schmidt, Sadrieh, and Rockenbach, 2010; Kube, Maréchal, and Puppe, 2013; Cohn, Fehr, and Goette, 2015; Gilchrist, Luca, and Malhotra, 2016). The results of those studies, however, are generally not as clear cut as in the laboratory, due to the substantially greater difficulties to control the exogenous influences.

wages.[7] The employer deals with each of the three work relationships independently. In the first stage of the game, the employer decides which of the three employees to hire ($h_i = 1$). Employees who are not hired ($h_i = 0$) receive an unemployment benefit of Euro 0.10. While the real value of the unemployment benefit remains constant, the nominal amount of the unemployment benefit payment varies with the exchange rate.

All hired employees learn the total number of hires. Each hired employee receives an individual wage offer from the employer. Subsequently, each employee *i* who received a wage offer either rejects (r_i=1) or accepts (r_i=0) the wage offer. Both the employer and the employee receive zero earnings from the work relationship if the employee rejects the wage offer. However, the employer may receive earnings from her work relationships with the other hires. In case the employee *i* accepts the wage offer, he must choose an effort level e_i between 10 and 100, for which he incurs a non-linear, monotonously increasing cost of effort $c(e_i)$. The cost of effort may be based on any type of physical or psychological strain as well as all kinds of opportunity costs. In the model, we aggregate all these costs of exerting effort and present the total cost of effort in currency units. Without monetary instability, the cost of effort is:

$$c(e)^{real} = \begin{cases} -1 + 0.1 \cdot e & \text{for } 10 \leq e \leq 30 \\ -4 + 0.2 \cdot e & \text{for } 30 < e \leq 80 \\ -12 + 0.3 \cdot e & \text{for } 80 < e \leq 100 \end{cases}$$

Starting in round 7, we introduce a constant inflation (deflation) rate of 10% (-10%). In these rounds, while the cost of effort physically and in real terms remains unchanged, its evaluation in nominal terms changes from round to round:

$$c(e)^{nominal} = c(e)^{real} \cdot k_t$$

Where k_t represents the scaling parameter:

$$k_t = \begin{cases} (1 + 0.1)^{t-6} & \text{in } Inflation \\ (1 - 0.1)^{t-6} & \text{in } Deflation \end{cases}$$

Table II exhibits the cost of effort in real and nominal terms for selected values of effort:[8]

TABLE II: COST OF EFFORT $c(e_i)$

7 Brown, Falk, and Fehr (2004) use a similar game with two players and a labor market. Maximiano, Sloof, and Sonnemans (2007) use a five-player version of the game with one employer and four employees but without a labor market. Gose and Sadrieh (2014) use a 13-player version without a labor market.

8 The cost of effort schedule that we use corresponds to the schedule used in most of the experimental gift exchange literature following Fehr et al. (1993). While effort has to be a multiple of 10 in most existing studies, we allow employees to pick any integer value of effort between 10 and 100.

rounds 1-6										
effort e_i	10	20	30	40	50	60	70	80	90	100
c(e) Real=Nominal	0	1	2	4	6	8	10	12	15	18

rounds 7-20										
effort e_i	10	20	30	40	50	60	70	80	90	100
$c(e)^{real}$	0	1	2	4	6	8	10	12	15	18
$c(e)^{nominal}$	*0*	$1 \cdot k_t$	$2 \cdot k_t$	$4 \cdot k_t$	$6 \cdot k_t$	$8 \cdot k_t$	$10 \cdot k_t$	$12 \cdot k_t$	$15 \cdot k_t$	$18 \cdot k_t$

rounds *t*	1	...	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
k_t *Inflation*	1	...	1	1.10	1.21	1.33	1.46	1.61	1.77	1.95	2.14	2.36	2.59	2.85	3.14	3.45	3.80
k_t *Deflation*	1	…	1	0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35	0.31	0.28	0.25	0.23

An employee's nominal round income depends on the nominal wage offer and the cost of effort, if a work contract is offered and accepted, the unemployment benefit, if no work contract is offered, and zero if the work contract is offered but rejected:

$$\text{Nominal Income}_{\text{employee}_i}^{\text{round t}} = \begin{cases} w_i^{nominal} - c(e_i)^{real} \cdot k_t & \text{if } h_i = 1 \text{ and } r_i = 0 \\ 5 \cdot k_t & \text{if } h_i = 0 \\ 0 & else \end{cases}$$

Nominal employer income accrues from all work relationships in which the wage offers are accepted. It amounts to the sum of the effort choices' values in nominal terms minus the total amount of nominal wages:

$$\text{Nominal Income}_{\text{employer}}^{\text{round}_t} = \sum_{i=1}^{3} (e_i \cdot k_t - w_i^{nominal}) \cdot h_i \cdot (1 - r_i)$$

Note that effort, cost of effort, and unemployment benefit are automatically and fully adjusted to the exchange rate variation i.e. real effort, real cost of effort, and real unemployment benefit are constant throughout the game. Wages, on the other hand, may vary throughout the game both in real and nominal terms, because the employer decides whether and to what extent to take the variation of the exchange rate into consideration when choosing the wage offer.[9]

9 As usual in gift exchange games of this type, in the only equilibrium with positive payoffs, the employers pay the minimum positive wage and the employees choose the smallest possible effort level. This is true for all rounds in all treatments.

To simplify the conversion of nominal into real terms, we provide a calculator in the interface of the experimental software. All participants can check the payoff consequences of different wage-effort combinations both in nominal (i.e. experimental currency units) and real terms (i.e. Euros). Participants also receive information on the last round's nominal wage and effort choices (employers see this information for all employees of their firm; an employee only sees his own last round information).

At the end of each round, the employer is informed of all effort levels chosen by the employees, the wages paid and all payoffs. Each employee observes his own wage as well as his own and the employer's payoff. Again, all payoffs are displayed in terms of nominal and real values. The employees do not observe each other's individual wage offers, effort choices, or payoffs. Note that an employer does not know the nominal wage levels of employees with whom she does not engage in a work relationship. Thus, one employer cannot imitate wage decisions from other employers. Therefore, imperfect wage adjustments cannot spread between employers.

B. Experimental Procedure

We recruited subjects using Orsee (Greiner, 2015). All participants were university students with a major or a minor in economics or management. Participants were randomly assigned to visually isolated cubicles in the laboratory and had no possibility to identify each other's roles in the experiment. Since the number of participants in a session was much larger than the number of players in a single firm (one employer and three employees), subjects could not determine those who were in their independent interaction group.

Instructions for the experiment were distributed to the subjects and read aloud. Subjects' questions were answered individually in the cubicles according to a standard protocol that allowed only explanations of the game but no suggestions on behavior or outcomes.

The experiment was computerized using z-Tree (Fischbacher, 2007). The game was played for 20 rounds in the same matching groups. The sum of earnings over all rounds was paid individually to each participant after the experiment. Each session lasted about 60 minutes with earnings ranging between 1.60 Euro and 28.40 Euro.[10]

C. Hypotheses

We derive our first hypothesis (H1) based on the wage inertia literature (see section 1). We assert that on average employers fail to adjust nominal wages sufficiently to counterbalance exchange rate variations. Wage inertia leads to different consequences in the three treatments. In *Control*, it obviously plays no role,

10 1 Euro = 1.2967 USD at the time of the experiment.

because the stable exchange rate leaves nominal and real wages equal throughout the experiment. In *Inflation* (*Deflation*), nominal wage inertia leads to decreasing (increasing) real wages.

In line with nominal loss aversion (Kahneman and Tversky, 1979; Genesove and Mayer, 2001), empirical evidence suggests reluctance to nominal wage cuts. In fact, with incomplete contracts in labor relationships reciprocity may enhance downward wage inertia (Akerlof, 1982; Fehr et al., 1993; Campbell and Kamlani, 1997; Bewley, 1998; Fehr and Gächter, 2000). However, Kahneman, Knetsch, and Thaler (1986) provide evidence that workers may consider wage cuts fair when firm profits are threatened. Thus, in *Deflation*, where incomplete nominal wage adjustments can lead to firm bankruptcy, wage inertia may be less pronounced than in *Inflation*, where the negative effect of the incomplete nominal wage adjustment is spread over all employees and – due to the reduced incentives to work – partially shifted to the firm, reducing the employer's profits.[11]

H1: (Wage Inertia) Nominal wage adjustments are less pronounced than the exogenous exchange rate variations.

H1a: (Downward Nominal Wage Adjustment) In Deflation, nominal wage adjustments are closer to the exogenous exchange rate variations than in Inflation.

We may also observe inertia in the behavior of employees. In this case, we expect a reluctance to adjust effort choices to the preceding real wage change (H2). Effort inertia, in combination with wage inertia, leads to reduced employee earnings in *Inflation*. The literature on loss aversion suggests that employees will try to avoid these losses by adjusting their effort to the new real wage. Hence, there is reason to believe that we will observe little effort inertia in *Inflation*. However, in *Deflation*, the combined effects of effort and wage inertia lead to increased employee earnings. Thus, effort inertia may be pronounced in *Deflation*. This leads us to a second hypothesis on effort inertia, H2a.

H2: (Effort Inertia) Effort choice adjustment is less pronounced than the preceding real wage variation.

H2a: (Upward Effort Inertia) Effort choice adjustment is more pronounced in Inflation than in Deflation.

An alternative to H2a arises from the literature on money illusion, which suggests that both real and nominal representations of payoffs have real consequences. Changes in nominal terms should not lead to a distortion of real consequences, if all agents are fully informed and rational. However, studies have found money illusion to be a driver for boundedly rational human behavior (e.g. Shafir, Diamond, and Tversky, 1997; Fehr and Tyran, 2001). Although nominal and real presentations describe an identical situation, decision makers are biased towards a nominal evaluation. Given our argumentation following H1a, we

11 Another possible reason for wage inertia is the cognitive cost of nominal wage adjustment. If we observe long sequences of play in which wages are not changed, we can conclude that wage inertia (at least partially) is due to this type of "menu cost." However, the frequent nominal wage adjustments that we observe in the experiment (and that are insufficient to neutralize the exchange rate fluctuations) are not in line with menu cost minimization.

expect nominal wages to increase in *Inflation*. This increase, however, will not be strong enough to match the exogenous exchange rate variation and, thus, will decrease employees' real wage offers. If employees are prone to money illusion (i.e. take nominal variations into account, when making their effort choices), we may observe real wages per unit of effort that are smaller in *Inflation* than in *Deflation*. Thus, H3 arises:

H3: (Money Illusion) Employees in Inflation take both real and nominal values of wage offers into account when choosing their effort response.

So far, our hypotheses suggest that the real cost of labor will be lowest under inflation and highest under deflation. With effort inertia in place, this will lead to higher employer earnings in *Inflation* than in *Deflation* (H4) when measured in real terms. On the other hand, we expect real employee earnings to be lower in *Inflation* than in *Deflation* (H5).

H4: (Employer Income) Real employer earnings are greater in Inflation than in Deflation.

H5: (Employee Income) Real employee earnings are greater in Deflation than in Inflation.

Since we assume that wage and effort inertia lead to the lowest real wage per effort unit in *Inflation*, hiring workers is less costly than in the other two treatments. Hence, we hypothesize that employers in *Inflation* hire more workers than in the other treatments, i.e. there are less workers who are not offered a work contract in *Inflation* (H6). This hypothesis is in line with the evidence indicating that downward nominal wage rigidity fuels unemployment (Akerlof, Dickens, and Perry, 1996; Fehr and Goette, 2005; Dickens et al., 2006; Fehr et al., 2009).

H6: (Cost of Labor) More workers are offered a work contract in Inflation than in Control or Deflation.

While H6 stipulates that there are more contract offers in *Inflation*, the number of rejected work contracts might actually be at its highest level, because real wages may be low enough to impede stable gift exchange relationships (see e.g. Fehr et al. 1993). This leads us to H7.

H7: (Opportunity cost of Employment) In Inflation, the number of rejected work contracts is highest.

3. Results

A. The Wage-Effort Relationship

Experimental studies of the gift exchange game generally show a strong and positive correlation between wages and effort choices. The left panel of Figure I shows that we replicate this result in our control treatment. The rank correlation between wages and effort level choices for all hires (i.e. accepted labor contracts) in *Control* is at about 94% (one-tailed spearman rank correlation, $\rho = 0.939$, significant at the 1% level). Average wages start at about 30 and rise to about 50 in the course of the game. Average effort choices start at around 40 and rise to 70 in the second half of the experiment. In fact, we find a significant increase of wages and effort choices over time (one-tailed spearman correlations, $\rho_{\text{effort}} = 0.651$ and $\rho_{\text{wage}} = 0.830$, both significant at the 1% level). We observe an end effect (i.e. a breakdown in cooperation) in round 20 both in wages and effort choices. Even though the end effect is rather moderate, we do not use the round 20 data in our regression analyses.[12]

The right panel in Figure I shows average effort choices for ten different wage brackets over all rounds of the game. The size of the circles indicates the number of work relationships with wage offers within the ten brackets. While wage-effort combinations above the diagonal are profitable for the employers (the farther above the line, the higher the average employer earnings), wage-effort combinations below the line are not. Clearly, all real wage brackets except the top bracket are profitable for the employers in *Control*.

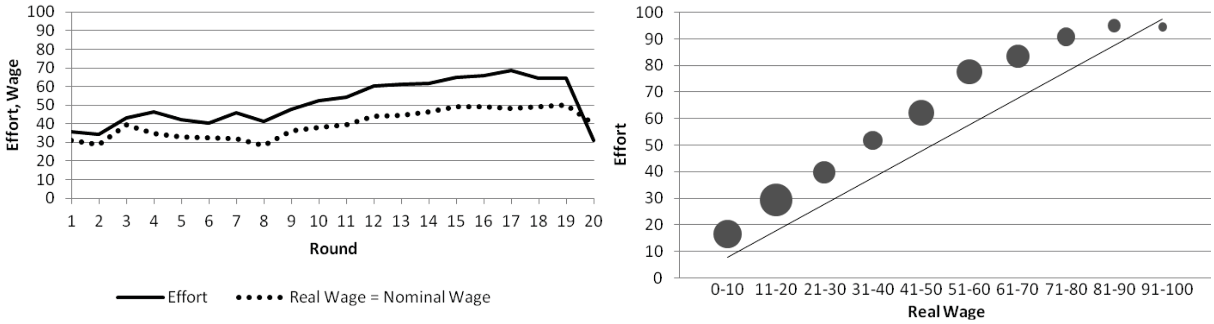

FIGURE I: DEVELOPMENT OF WAGES AND EFFORT CHOICES IN CONTROL (ALL ACCEPTED HIRES)

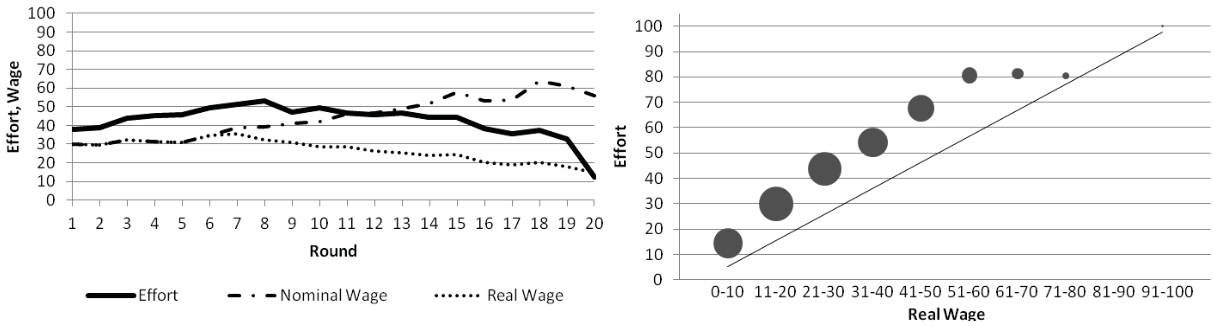

FIGURE II: DEVELOPMENT OF WAGES AND EFFORT CHOICES IN INFLATION (ALL ACCEPTED HIRES)

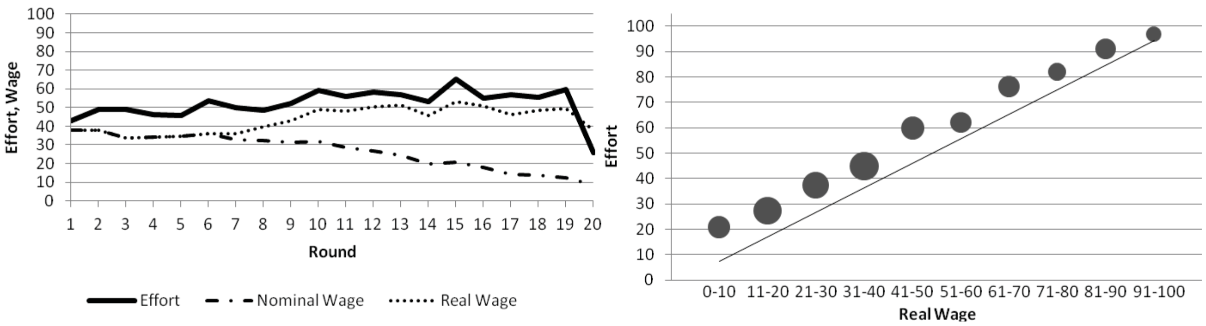

FIGURE III: DEVELOPMENT OF WAGES AND EFFORT CHOICES IN DEFLATION (ALL ACCEPTED HIRES)

12 We ran all analyses with and without the round 20 data. Significant results are not affected in any way by including or excluding that data. Nevertheless, we choose to omit round 20 data and include round 7 – 19 data to retain unbiased quantitative estimates of effect sizes.

We also find the reciprocal relationship of wage and effort choices in *Inflation* and *Deflation* (one-tailed spearman correlation coefficients, $\rho_{Inflation} = 0.854$ and $\rho_{Deflation} = 0.925$, both significant at 1%). As the left panels in Figures II and III show, effort choices seem to follow the path of real wages after round 7. However, we also see that the effort profile in *Inflation* lies farther above the real wage profile than it is the case in *Deflation* where the two profiles seem to move closer to each other. This hints at the type of deferred adaptation process we describe in our hypotheses. In both treatments, nominal wages and effort choices are not adjusted at a pace that would keep the gap between effort choices and real wages stable over time. Thus, the visual inspection seems to confirm wage and effort inertia according to hypotheses H1 and H2 both in *Inflation* and in *Deflation*. The right sides of Figures II and III support these findings. In *Inflation*, we observe only very few work relationships in which real wages above 50 are offered, while in *Deflation* we observe the entire wage spectrum with average wage offers being similarly distributed (Table III shows averaged real values for wages, effort, cost per unit of effort and earnings). We observe that wage-effort combinations in *Inflation* lie well above the diagonal (Figure II, right panel) in contrast to the wage-effort combinations in *Deflation* which are close to the diagonal (Figure III, right panel), indicating substantially higher employer earnings in *Inflation* than in *Deflation*.

TABLE III: AVERAGE WAGES, EFFORT CHOICES, COST PER UNIT OF EFFORT, AND EARNINGS FOR ALL TREATMENTS (ROUNDS 7-19)

Treatment	Real Wage	Effort	Real Cost per Unit of Effort	Real Earnings	
				Employer	Employee
Control	42.93	58.31	1.50	41.86	34.52
Inflation	25.64	43.96	1.96	49.51	20.32
Deflation	47.02	55.74	1.34	22.78	39.11

Average effort levels are highest in *Control* and lowest in *Inflation* – this difference is significant (one-sided U-Test, p = 0.004). Effort in *Inflation* is also significantly smaller than in *Deflation* (one-sided U-Test, p = 0.028) while there is no significant treatment difference concerning work effort between *Control* and *Deflation*. We further find that average real wages in *Inflation* are significantly smaller than in the other two treatments (one-sided U-Tests, p = 0.002 (difference to *Control*), p = 0.000 (difference to *Deflation*)).

Since nominal wages are not perfectly adjusted to the exchange rate variation, we find treatment effects on real wages. The results of a random effects[13] regression (Table IV) indicate that real wages are decreasing over time in *Inflation* (interaction term between treatment dummy and round is significantly negative), while in *Deflation* the pattern of real wages follows that in *Control* (interaction term between treatment dummy and round is not significantly different from zero).

13 All our models are clustered at the employer level and standard errors are cluster robust.

TABLE IV: DEVELOPMENT OF REAL WAGES OVER TIME

Real Wage	Coef.	Robust Std.Err.	P>|z|
Constant	12.502	3.529	0.000
Round	0.489	0.194	0.012
Inflation	4.919	4.806	0.306
Deflation	6.390	6.481	0.324
Inflation x Round	-1.329	0.276	0.000
Deflation x Round	-0.100	0.394	0.799
Effort Previous Round	0.441	0.036	0.000

Random effects regression, N = 1,567, Wald chi2(6) = 438.800, Prob > chi2 = 0.000, R-sq overall = 0.604; 45 groups. Inflation x Round - Deflation x Round = 0: chi2(1) = 9.460, Prob > chi2 = 0.002.

Calculating the logarithmic nominal wage adjustments from one round to the next allows us to further examine wage inertia in our treatments with nominal instability. We find that the average nominal wage adjustments in *Inflation* and *Deflation* equal 6.42% and -2.68%, respectively, i.e. employers in *Inflation* fail to adjust the nominal wage to the increase in the exchange rate by 3.58% while employers in *Deflation* fail to adjust the nominal wage to the decrease in the exchange rate by 7.32%. A one-sided U-test shows that the treatment difference in failure to adjustment to the previous exchange rate variation is statistically insignificant (p = 0.152). Apparently, nominal wages in *Deflation* are not adjusted to a greater extent than in *Inflation*. This finding runs contrary to our hypothesis H1a but is in line with the literature on downward wage stickiness. We provide a corresponding regression analysis in Table V. The model explains the difference between the log nominal wage adjustment and the exchange rate variation. Positive values can be interpreted as an adjustment in the direction of the exchange rate variation, i.e. a nominal wage increase by more than 10% in *Inflation* or a nominal wage decrease by more than 10% in *Deflation*. Negative values indicate nominal wage adjustments of less than 10% in *Inflation* and nominal wage adjustments larger than -10% in *Deflation*. Zero indicates a nominal wage adjustment of 10% (-10%) in *Inflation* (*Deflation*).

TABLE V: WAGE INERTIA

Failure to Adjust to exchange rate variation	Coef.	Robust Std.Err.	P>|z|
Constant	-0.039	0.070	0.577
Round	0.005	0.005	0.289
Real Wage Offer	-0.017	0.004	0.000
Previous Round Real Wage Offer	0.015	0.005	0.002
Previous Round Effort	-0.000	0.002	0.934
Inflation	-0.243	0.101	0.016
Inflation x Real Wage Offer	0.008	0.003	0.003

Random effects regression, N = 977, Wald chi2(6) = 72.80, Prob > chi2 = 0.000, R-sq overall = 0.202; 30 groups.

The analysis contains the data from *Inflation* and *Deflation*. While the treatment effect (dummy variable *Inflation*) is highly negative – employers in *Inflation* reduce nominal wages – the difference between the log nominal wage adjustment and the exchange rate variation positively depends on the amount of the real wage offer (interaction term dummy variable *Inflation* and real wage offer). This makes intuitive sense, as a higher real wage offer necessitates a positive nominal wage adjustment in *Inflation*.

We further check for treatment differences in effort adjustment. Note that average log effort adjustment is -0.05 for *Inflation* and -0.017 for *Deflation*, i.e. it appears that in line with our hypothesis H2a, effort choice adjustment is more pronounced in *Inflation* than in *Deflation*. The result of a one-sided U-test shows that this difference is statistically significant (p = 0.049). Apparently, employees in both treatment conditions downward adjust their effort choice. However, employees in *Inflation* show a stronger response as they are faced with falling real wages.

The regression analysis in Table VI allows us to study treatment differences in effort adjustment following real wage changes (H2). The data shows that for each unit of a logarithmic wage increase we observe a logarithmic increase in effort choice by 0.531, i.e. effort choice adaptation in *Deflation* is less pronounced than a preceding real wage variation. The same holds for *Inflation* (H2), where the effort response to a preceding real wage increase is less pronounced than in *Deflation*. However, the reluctance to adjust effort choices (i.e. effort inertia) runs contrary to H2a. In H2a we conjecture that with falling real wages, employees will make sure to adjust their effort choices downward in *Inflation*. As the results in Table VI show, falling real wages (negative values of log real wage adjustment) lead to less pronounced effort adjustments in *Inflation* than in *Deflation*, i.e. with falling real wages, employees are hesitant to decrease their effort response (see interaction between the treatment dummy and the log real wage adjustment). In *Deflation*, employees are more prone to adjust wage offers to previous changes in the real wage.

TABLE VI: EFFORT INERTIA

Log Effort Adjustment	Coef.	Robust Std.Err.	P>|z|
Constant	-0.097	0.060	0.107
Round	0.004	0.004	0.357
Log Real Wage Adjustment	0.531	0.093	0.000
Inflation	0.155	0.082	0.058
Inflation x Round	-0.011	0.006	0.064
Inflation x Log Real Wage Adjustment	-0.251	0.144	0.081

Random effects regression, Rounds 7-19, N = 941, Wald chi2(5) = 48.64, Prob > chi2 = 0.000, R-sq overall = 0.191; 30 groups.

To further test for effort inertia, we need to examine the development of the relationship between real wages and effort choices. If effort choices are perfectly adjusted to the real wage variations, we should observe real wage to effort ratios that are indistinguishable across treatments. However, the distances between the real wage and effort profiles in Figures I, II, and III already indicate that the real wage to effort ratios are different across treatments. The results of a random effects regression (see Table VII) show that real wage to effort ratios are largest in *Deflation* and lowest in *Inflation*, with the ratios in *Control* in between. These differences are significant. One-sided U-Tests support this finding (p = 0.001 (difference *Control* and *Inflation*), p = 0.008 (difference *Control* and *Deflation*), p = 0.000 (difference *Inflation* and *Deflation*). Figure IV provides the corresponding graphical representation.

TABLE VII: REAL WAGE PER UNIT OF EFFORT

Real Wage per Effort Unit	Coef.	Robust Std.Err.	P>|z|
Constant	0.739	0.075	0.000
Round	0.005	0.005	0.340
Inflation	-0.161	0.047	0.001
Deflation	0.162	0.057	0.004

Random effects regression, Rounds 7-19, N = 1,567, Wald chi2 = 40.31, Prob > chi = 0.000, R-sq overall = 0.064; 45 groups. Inflation - Deflation = 0: chi2(1) = 37.35, Prob > chi2 = 0.000.

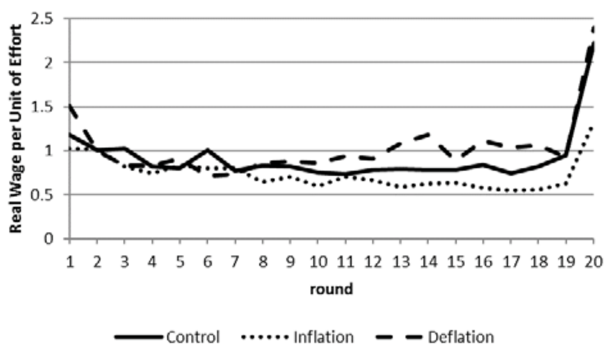

FIGURE IV: REAL WAGE PER EFFORT UNIT (ALL ACCEPTED HIRES)

Our results show that a unit of effort is significantly less costly in *Inflation* than in *Control* or *Deflation*. One reason for this result could be money illusion, i.e. the employees' tendency to evaluate wage offers not only in real terms but also in nominal terms.[14] In our game structure, nominal wage growth always leads to real wage growth in *Control* and *Deflation*. In *Inflation*, however, nominal wages may increase while real wages remain constant or even fall.[15] A disparity between the development of nominal and real wages is conducive to money illusion, because subjects' cognition may be confused by the simultaneous perception of a wage increase (in nominal terms) and a wage decrease (in real terms). We refer to this confusion as

14 Weber, Rangel, Wibral, and Falk (2009) provide neuro-economic support for money illusion.

15 Real wages in *Inflation* fall when round to round nominal wage increases are smaller than 10%.

money illusion and conjecture that it may explain why we observe significantly smaller real labor costs in *Inflation* than in *Deflation*.

To test for money illusion, we run a random effects regression with effort as the dependent variable (see Table VIII). We include real wage, squared real wage, round and treatment dummies into our model. These treatment dummies describe two situations: 1) a nominal wage gain while real wages fall and 2) a nominal wage loss while real wages actually rise. Note that situation 1) can only occur in *Inflation* while situation 2) can only be observed in *Deflation*. The two treatment effects thus describe situations in which nominal and real wages run in different directions and, thus, open opportunities for money illusion to set in. We find that real wages significantly drive effort choices in all treatments. The same holds for nominal wages, but the effect size is very small. At the same time, a nominal wage gain that is smaller than the exchange rate variation (and causes a real wage cut) leads to increased effort choices. Thus, in *Inflation* employees seem to be taking nominal and real values of wages into account when deciding on their effort choice. In *Deflation*, a nominal wage cut that is smaller than the preceding exchange rate variation (and causes a real wage gain) decreases the effort reaction. While this is also in line with money illusion, this effect is not significant. Thus, we conclude that money illusion significantly drives employee decision making in *Inflation* (H3). Evidently, it is difficult for participants to pierce the nominal veil of money, although they are provided with a calculator enabling them to compute real consequences of nominal changes.

TABLE VIII: MONEY ILLUSION IN INFLATION AND DEFLATION

Effort	Coef.	Robust Std.Err.	P>|t|
Constant	8.787	3.424	0.010
Round	-0.031	0.167	0.853
Real Wage	8.787	0.128	0.000
Squared Real Wage	-0.005	0.001	0.000
Deflation	-9.697	2.436	0.000
Nominal Wage Gain & Real Wage Loss	3.661	1.707	0.032
Nominal Wage Loss & Real Wage Gain	-1.895	2.686	0.480

Random effects regression including treatments Inflation and Deflation, Rounds 7-19, N = 1,036, Wald chi2(6) = 2496.42, Prob > Prob > chi2 = 0.000, R-sq overall = 0.711; 30 groups.

B. Income distribution and unemployment

Given that the cost of an effort unit for employers is lowest in *Inflation*, the question arises whether we can also expect their payoffs to be highest in that treatment? It turns out that the answer is mixed. In line with our hypothesis H4, we find employers' payoffs (in real terms) are significantly greater in *Inflation* than in *Deflation* (one-sided U-Test, p = 0.000). However, we do not find a significant difference in employers' payoffs comparing *Inflation* to *Control*. The reason is that the higher cost of labor in *Control* is fully compensated by a higher productivity of labor. This is not true in *Deflation* where the cost of labor is highest, but labor productivity is not high enough to recoup the employers' wage expenses. Hence, employers' payoffs lag behind in *Deflation* and are also significantly smaller than in *Control* (one-sided U-Test, p = 0.005).

Our data also corroborates H5 as real employees' earnings are significantly higher in *Deflation* than in *Inflation* (one-sided U-test, p = 0.000). Note that employees' earnings in *Deflation* do not differ significantly from those in *Control*, while employees' earnings in *Inflation* are actually significantly smaller than those in *Control* (one-sided U-test, p = 0.002).

To gain insights into the combined effect of employees' and employers' earnings, we calculate the per capita income (in real terms) for all three treatments (e.g. the sum of all payoffs divided by four). Figure V shows the corresponding graph. We find that per capita earnings are significantly larger in *Control* than in *Inflation* (one-sided U-test, p = 0.018). At the same time, per capita earnings are also larger in *Control* than in *Deflation* – this difference is, however, not statistically significant. While we find treatment differences in employer and employee earnings between *Inflation* and *Deflation*, the aggregate effect indicates that per capita earnings are larger in *Deflation* than in *Inflation* (one-side U-test, p = 0.087). We conclude that per capita earnings are greatest in the setting with monetary stability (*Control*). As Figure V shows, the high per capita earnings in *Control* are embedded in a stable growth path, suggesting that monetary stability in a reciprocal labor relationship also supports the advancement of trust over time.

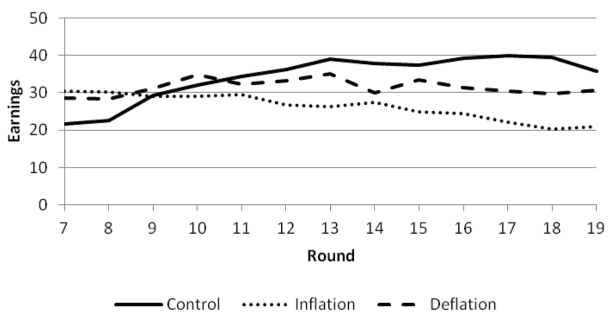

FIGURE V: PER CAPITA EARNINGS

Another aspect of income distribution concerns the number of unemployed, who generally earn less than the employees in labor relationships do. Table IX shows the total number of employees who were not offered a work contract, the number of contract offers, the number of contracts rejected by employees, and the number of accepted contracts. About 8% of the workers in *Control* and *Deflation* do not receive a contract offer. For *Inflation*, this number is significantly lower at about 5% (see Table X for test results). This supports hypothesis H6.

Using the data from Table IX, we can also check hypothesis H7, which states that the higher opportunity cost of employment in *Inflation* will lead to a greater number of contract rejections than in *Control* or *Deflation*. While we do see significantly more contract rejections in *Inflation* than in *Control*, we do not see a statistically significant difference between *Inflation* and *Deflation* (see Table XI for test results). Surprisingly, there are also significantly more contract rejections in *Deflation* than in *Control*, perhaps suggesting that contract rejections are not due to opportunity cost differences but due to monetary instability.

TABLE IX: CONTRACT OFFERS AND UNEMPLOYMENT

			Contract Offers	
Round 7-19	No Contract Offer	Contract Offers	Rejected	Accepted
Control	44	541	10	531
Inflation	30	555	28	527
Deflation	45	540	31	509

TABLE X: TEST RESULTS CONTRACT OFFERS

No Contract Offer: One-sided p-values chi-squared test (contract offers vs. no contract offer)	*Inflation*	*Deflation*
Control	0.059	0.500
Inflation	/	0.047

TABLE XI: TEST RESULTS CONTRACT REJECTIONS

Rejected work contracts: One-sided p-values chi-squared test (rejected work contracts vs. accepted work contracts)	*Inflation*	*Deflation*
Control	0.003	0.001
Inflation	/	0.353

4. Conclusions

In a controlled laboratory experiment, we study the impact of monetary instability on trust-based labor relationships with incomplete contracts. With monetary stability, the reciprocal employer-employee interactions in our control treatment prove to be profitable for both players. After an initial phase of stability, we introduce monetary instability in our other two treatments, *Inflation* and *Deflation*, using controlled variations of the exchange rate between the experimental and the real currency. In *Inflation*, the exchange rate increases by ten percent every round, letting the real value of a constant nominal wage (in experimental currency) decrease from one round to the next. In *Deflation*, the exchange rate develops in the opposite direction, decreasing by 10 percent per round. Consequently, the real value of a constant nominal wage (in experimental currency) increases from one round to the next.

For *Inflation*, we find that employers do not fully adjust their nominal wage offers to the exchange rate variations. On average, they choose nominal wages that increase at a lower rate than inflation and, thus, lead to decreasing real wages. Employees, on the other hand, seem to be subject to money illusion and fail to fully adjust their work effort to the decreasing real wages. Thus, the inertia in adapting wages and efforts to the decreasing currency value results in a falling cost of labor in *Inflation*. Compared to our control treatment, the low cost of labor in *Inflation* increases the number of jobs offered by the employers, but also increases the number of labor contracts rejected by potential employees. Hence, inflation pushes real wages down, decreases the cost of labor, but increases the shirking on the job and the voluntary unemployment. In total, inflation has a negative impact on productivity in our experiment.

In *Deflation*, we also observe an overall negative effect of wage and effort inertia on per capita earnings, but through a different path than in *Inflation*. While inflation creates opportunities for self-interested behavior by the employers, deflation does so for the employees. The reluctance of employers to cut nominal wages to the same extent as the currency devaluates (i.e. wage inertia) leads to increasing real wages in *Deflation*. However, since the employees do not fully adjust their effort choices to the increasing real wage (i.e. effort inertia), the cost of labor rises sharply and reaches the highest levels that we observe among our three treatments. Because the high cost of labor is not fully compensated with high effort levels, employer earnings are low and their reluctance to offer labor contracts grows. Hence, deflation pushes real wages upwards, shifts income from employers to employees, and affects per capita earnings negatively without revealing any clear economic advantage.

Overall, we find monetary instability detrimental to productivity and per capita earnings when labor contracts are incomplete and work relationships are based on reciprocity. The reluctance of individuals to quickly and fully adapt their wage and effort choices to the changing value of the currency (i.e. wage and effort inertia) affects the payoff distribution and, thus, disrupts the trust relationship between employers and employees. As usual, disrupted trust in reciprocal work relationships leads to reduced effort provision and a decline of the per capita income. Hence, our experiment unambiguously points at monetary stability as the most favorable setting for sustained productivity and income in reciprocal work relationships.

Our results indicate that firms predominantly operating based on reciprocal work relationships (e.g. due to incomplete labor contracts) will seek to minimize monetary instability. For example, they may lobby for a stable currency or move their operations to locations with stable currencies. Alternatively, employers and employees may seek to use indexed wage contracts that eradicate wage inertia, hoping that this will relieve the work relationship from the negative effects of monetary instability. However, indexed wages can only solve the problem, if they are non-renegotiable. Otherwise, monetary instability will destabilize these employment contracts, because employers have short-term incentives to renegotiate the contract terms in periods of inflation (i.e. when the indexed nominal wages rise) and because employees have short-term incentives to renege on the contracts in periods of deflation (i.e. when the indexed nominal wages decline). While our study seems to suggest that exogenously implemented monetary stability offers the best environment for economic prosperity when work relationships are based on reciprocal exchange, further research is needed to clarify whether indexed wage contracts present a successful alternative to exogenous monetary stability.

Clearly, the aggregate effects on productivity and income distribution that we find are only part of the whole story. One the one hand, our model does not include all features of labor contracts present in the field. On the other hand, our experiment is not intended to capture all potential sources of wage inertia that the literature has uncovered.[16] However, our findings clearly show that the behavioral rigidities that we observe in our experiment (i.e. the reluctance to fully adjust wages and effort choices to alterations of the currency value) can be sufficient to trigger real distortion effects of monetary instability, even in absence of all other suggested causes of nominal rigidities, such as contractual or institutional rigidities.

16 Given the fact that we only study one of the possible sources, wage inertia may actually be even more pronounced in reality than it already is in our experiment.

References

Akerlof, George. 1982. "Labor Contracts as Partial Gift Exchange" In Quarterly Journal of Economics, 97(4), 543-569.

Akerlof, George A., Dickens, William T., and Perry, George L. (1996). The Macroeconomics of Low Inflation. Brookings Papers on Economic Activity, 1, 1-76.

Akerlof, George A., and Yellen, Janet L. (1985). "A Near-rational Model of the Business Cycle, with Wage and Price Inertia" In Quarterly Journal of Economics, 100, 823-838.

Bewley, Truman F. (1998). "Why Not Cut Pay?" In European Economic Review, 42 (3-5), 459-490.

Blanchard, Olivier J. (1990) "Why Does Money Affect Output? A Survey" In Handbook of Monetary Economics, 2, 779-835.

Blinder, Alan S., and Choi, Don H. (1990). "A Shred of Evidence on Theories of Wage Stickiness" In Quarterly Journal of Economics, 105 (4), 1003-1015.

Brandts, Jordi and Charness, Gary. (2004). "Do Labour Market Conditions Affect Gift Exchange? Some Experimental Evidence" In Economic Journal 114 (497), 684-708.

Brown, Martin, Falk, Armin, and Fehr, Ernst. (2004). "Relational Contracts and the Nature of Market Interactions" In Econometrica, 72 (3), 747-780.

Campbell, Carl M., and Kamlani, Kunal S. (1997). "The Reasons for Wage Rigidity: Evidence from a Survey of Firms" In Quarterly Journal of Economics, 112 (3), 759-789.

Casoria, Fortuna and Riedl, Arno. (2013). "Experimental Labor Markets and Policy Considerations: Incomplete Contracts and Macroeconomic Aspects" In Journal of Economic Surveys, 27 (3), 398-420.

Cohn, Alain, Fehr, Ernst, and Goette, Lorenz. (2015). "Fair Wages and Effort Provision: Combining Evidence from a Choice Experiment and a Field Experiment" In Management Science, 61 (8), 1777-1794.

Dickens, William T, Goette, Lorenz, Groshen, Erica L, Holden, Steinar, Messina, Julian, Schweitzer, Mark E, Turunen, Jarkko, and Ward, Melanie (2007). "How Wages Change: Micro Evidence from the International Wage Flexibility Project" In Journal of Economic Perspectives, 21(2), 195-214.

Fehr, Ernst, and Gächter, Simon. (2000). "Fairness and Retaliation: The Economics of Reciprocity" In Journal of Economic Perspectives, 14 (3), 159-181.

Fehr, Ernst, Goette, Lorenz, and Zehnder, Christian (2009). "A Behavioral Account of the Labor Market: The Role of Fairness Concerns" In Annual Review of Economics, 1, 355-384.

Fehr, Ernst, and Goette, Lorenz. (2005). "Robustness and Real Consequences of Nominal Wage Rigidity" In Journal of Monetary Economics, 52, 779-804.

Fehr, Ernst, Kirchsteiger, Georg, and Riedl, Arno. (1993). "Does Fairness Prevent Market Clearing? An Experimental Investigation" In Quarterly Journal of Economics, 108 (2), 437-459.

Fehr, Ernst, and Tyran, Jean-Robert. (2001). "Does Money Illusion Matter?" In American Economic Review, 91 (5), 1239-1262.

Fehr, Ernst, and Tyran, Jean-Robert. (2008). "Limited Rationality and Strategic Interaction: The Impact of the Strategic Environment on Nominal Inertia" In Econometrica, 76 (2), 353-394.

Fischbacher, Urs. (2007). "z-Tree: Zurich toolbox for Ready-made Economic Experiments" In Experimental Economics, 10 (2), 171-178.

Fischer, Stanley. (1977). "Long-Term Contracts, Rational Expectations, and the Optimal Money Supply Rule" In Journal of Political Economy, 85 (1), 191-205.

Genesove, David, and Mayer, Christopher. (2001). "Loss Aversion and Seller Behavior: Evidence from the Housing Market" In Quarterly Journal of Economics, 116 (4), 1233-1260.

Gilchrist, Duncan S., Luca, Michael, and Malhotra, Deepak. (2016). "When 3 + 1 > 4: Gift Structure and Reciprocity in the Field" In Management Science, 62 (9), 2639-2650.

Gneezy, Uri and List, John. (2006). "Putting Behavioral Economics to Work: Field Evidence of Gift Exchange" In Econometrica 74 (5), 1365-1384.

Gose, Karina, and Sadrieh, Abdolkarim. (2014). "Strike, Coordination, and Dismissal in Uniform Wage Settings" In European Economic Review, 70, 145-158.

Greiner, Ben (2015). "Subject Pool Recruitment Procedures: Organizing Experiments with ORSEE" In Journal of the Economic Science Association, 1 (1), 114-125.

Hennig-Schmidt, Heike, Sadrieh, Abdolkarim, and Rockenbach, Bettina. (2010). "In Search of Workers' Real Effort Reciprocity—A Field and a Laboratory Experiment" In Journal of the European Economic Association, 8 (4), 817-837.

Kahn, Shulamit. (1997). "Evidence of Nominal Wage Stickiness from Microdata" In American Economic Review, 87 (5), 993-1008.

Kahneman, Daniel, Knetsch, Jack L., and Thaler, Richard. (1986). "Fairness as a Constraint on Profit Seeking: Entitlements in the Market" In American Economic Review, 76 (4), 728-741.

Kahneman, Daniel, and Tversky, Amos. (1979). "Prospect Theory: An Analysis of Decision under Risk" In Econometrica, 47 (2), 263-292.

Kube, Sebastian, Maréchal, Michel A., and Puppe, Clemens. (2013). "Do Wage Cuts Damage Work Morale? Evidence from a Natural Field Experiment" In Journal of the European Economic Association, 11 (4), 853-870.

Lucas, Robert E. Jr. (1972). "Expectations and the Neutrality of Money" In Journal of Economic Theory, 4 (2), 103-124.

Mankiw, N. Gregory. (1985). "Small Menu Costs and Large Business Cycles: A Macroeconomic Model" In Quarterly Journal of Economics, 100 (2), 529-537.

Maximiano, Sandra, Sloof, Randolph, and Sonnemans, Joep. (2007). "Gift Exchange in a Multi-Worker Firm" In Economic Journal, 117 (522), 1025-1050.

Riedl, Arno and Tyran, Jean-Robert. (2005). "Tax Liability Side Equivalence in Gift-Exchange Labor Markets" In Journal of Public Economics, 89 (11-12), 2369-2382.

Shafir, Eldar, Diamond, Peter, and Tversky, Amos. (1997). "Money Illusion" In Quarterly Journal of Economics, 112 (2), 341-374.

Taylor, John B. (1979). “Staggered Wage Setting in a Macro Model” In American Economic Review, 69 (2), 108-113.

Weber, Bernd, Rangel, Antonio, Wibral, Matthias, and Falk, Armin. (2009). “The medial prefrontal cortex exhibits money illusion” In Proceedings of the National Academy of Sciences of the United States of America, 106 (13), 5025-5028.

Appendix

Instructions

You are participating in a study of the labor market and you are able to earn money in this experiment. Your payoff will be calculated in Talers during the experiment. At the end of the experiment, these Talers will be converted into Euros. You will receive your cash earnings after the end of the experiment.

Please not that you may only interact with the other participants of the experiment through the computer software. Other types of communication are not allowed and you may be expelled from the experiment for engaging in other forms of communication.

You will be randomly assigned to groups of 4. Within each group, there are one employer and three employees. You will know your role from your computer's start screen. This 4-person constellation will be maintained until the end of the experiment. The labor market in the experiment lasts for 20 rounds. Be aware that you will be interacting with the same employer and the same employees during each of these 20 rounds.

Your decisions are processed automatically and your payoff is calculated automatically. Your payoff at the end of the experiment is the sum over all payoffs that you receive during the rounds of the experiment.

In the course of the experiment, the exchange rate between Talers and Euros may change. You find the current exchange rate on your computer screen.

Information concerning the labor market

- At the beginning of each round, the employer decides which of the 3 employees to hire. Every hire i receives a wage offer of $w_i \geq 0$ Talers. The non-hires receive an unemployment benefit. The employer may differentiate between the employees, i.e. each employee may receive an individual wage offer. Each hire will learn his individual wage offer and the total number of hires.
- After the hires know their wage offers, each hire decides individually whether and how much to work.
- The effort choice is connected to a cost of effort. Low work effort costs less than high work effort. The employee's choice, whether and how much to work, is forwarded to the employer.

Calculation of round income in Talers – employee

- If employee *i* decides to reject the wage offer, his payoff equals 0 Talers during this round of the experiment.
- If employee *i* decides to accept the wage offer and chooses an effort level e_i, he receives the wage offer from which the cost of effort will be deducted.

- Employee *i* decides how much effort to supply by choosing an effort level between 10 and 100 percent. Where 10 percent is the smallest possible work effort and 100 percent is the highest work effort.
- The cost of effort depends on the effort choice in a way that low effort costs less than high effort.
- The round payoff of employee *i* amounts to:

$$Payoff_{Employee\,i} = \begin{cases} 0 & \text{if employee i rejects the wage offer} \\ w_i - c(e_i) & \text{if employee i chooses an effort level } e_i \end{cases}$$

- Every participant can use the income calculator to compute—for different effort choices (you may enter every integer value between 10 and 100)—the cost of effort and the corresponding employee and employer earnings.
- At the end of the round, each employee gets to know his own round payoff and the employer's round payoff from the work relationship. The payoffs will be shown in Talers and Euros.
- If an employee is not hired during a round, he will earn an unemployment benefit of 5 Talers. The unemployment benefit will be adjusted to the exchange rate in a way that the Euro value will remain the same over all rounds.
- An employer, who is not hired during a round, may be re-hired by the employer in the next round.

Calculation of round income in Talers – employer

- The employer decides which employees to hire during every round.
- The employer only receives payoffs from work relationships, i.e. from the collaboration with hired employees.
- At the beginning of each round, the employer decides on a wage offer $w_i \geq 0$ in Talers for every hire.
- The highest possible wage offer is restricted to the highest benefit the employer may potentially receive from the employee's effort choice. During round 1, this value is 100. It will be adjusted to changes in the exchange rate.
- If employee *i* decides not to work for the wage offer, the employer receives a payoff of 0 from the work relationship during this round. The employer may, however, receive earnings from the other work relationships during the round. This depends on the decisions of the other hires.
- If employee *i* chooses a work effort, the employer receives the following payoff from the work relationship:

$$Payoff_{Employer} = x_i - w_i$$

- Where x_i is the benefit that the employer receives from employee *i*'s effort choice in Talers. At the beginning of the experiment this values equals employee *i*'s effort choice e_i. The value will be automatically adjusted to the exchange rate such that its Euro value remains constant over all rounds.
- The round payoff of the employer is the sum over all payoffs from the different work relationships.

- At the end of each round, the employer learns the effort choices, the corresponding wage offers, the different employees‘ payoffs and the employer payoff. Payoffs are displayed in Talers and in Euros.
- Please be aware that the employer incurs a loss whenever the wage offer is too high given the effort choice. The computer program will display losses as a negative number (minus sign). If the employer tries to offer a wage that is so high that even the highest possible work effort will lead to a negative employer payoff, the computer program will ask the employer to adjust the wage offer.

Exchange rate in the experiment

- The computer program includes an exchange rate calculator. Therefore, you may compute the Euro value of different amounts of Talers.
- The exchange rate of Talers to Euros may vary during the experiment.
- If the exchange rate of Talers to Euro increases from one round to the next, a Taler will be worth fewer Euros during the current round than it used to be in the previous round. To compensate for this, the cost of effort and the benefit the employer receives from the employee's effort choice will be increased such that their Euro values remain constant.
- If the exchange rate of Talers to Euros falls from one round to the next, a Taler will be worth more Euros during the current round than it used to be in the previous round. To compensate for this, the cost of effort and the benefit the employer receives from the employee's effort choice will be decreased such that their Euro values remain constant.
- Accordingly, the same wage offer is worth less Euros in a round with a higher exchange rate than in a round with a lower exchange rate. Wage offers are not automatically adjusted to the exchange rate.

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