The Behavioral Economics of Incentives

The Role of Sanctioning Threats & Loss Aversion

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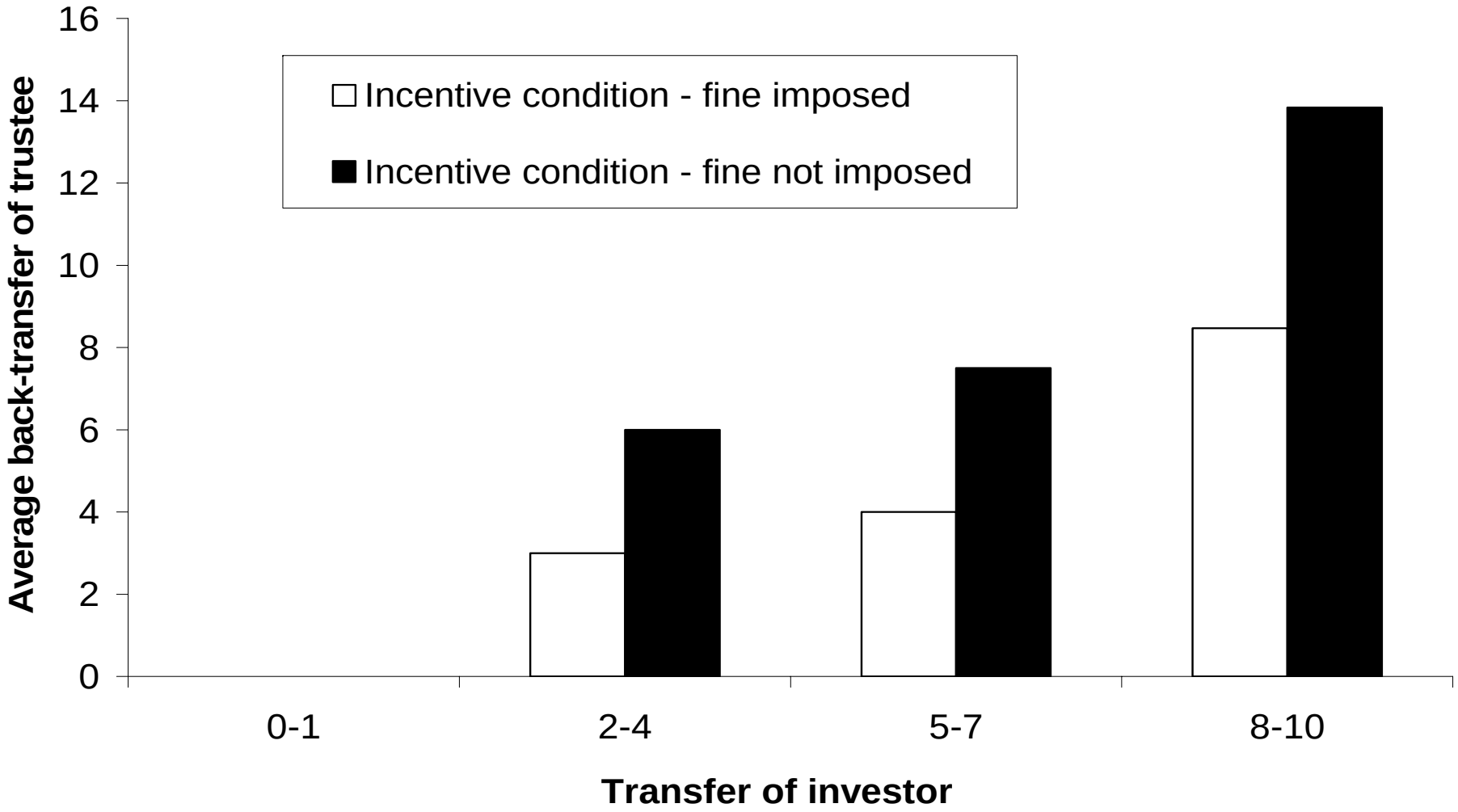
Trust & Sanctioning Threats

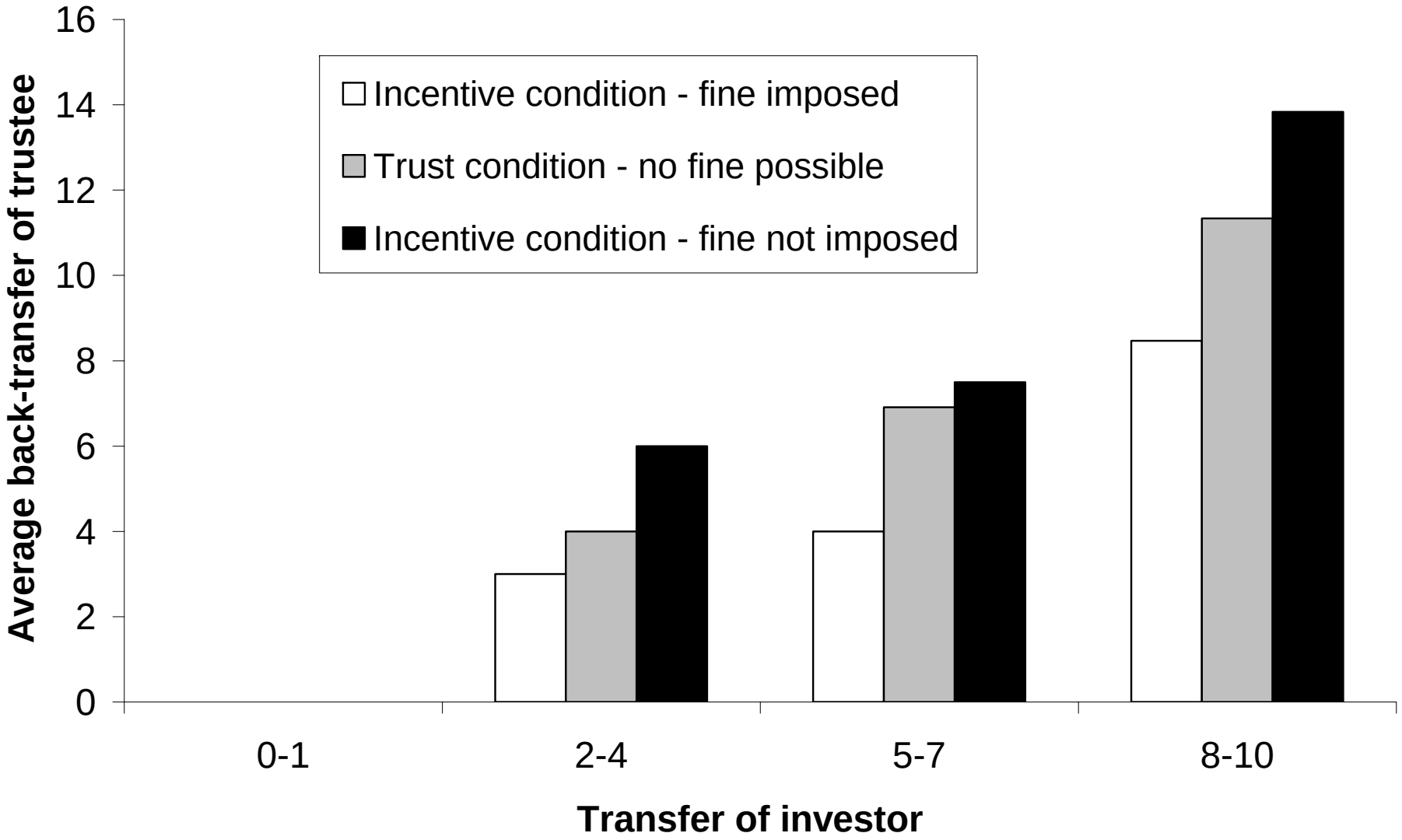
(Fehr & Rockenback, Detrimental Effects of Sanctions on Human Altruism, Nature 2003)

- Investor and a trustee receive 10 DM.
- Investor can send any amount between 0 and 10 to the trustee. Each DM sent is tripled by the experimenter. Investor also announces a desired back-transfer.
- Trustee is free to send back any amount. Back-transfer is not tripled.
- Trust treatment and a punishment treatment
- In the punishment treatment the trustee's payoff is reduced by 4 DM if she sends back less than desired.

Detrimental Effects of Sanctions on Voluntary Cooperation



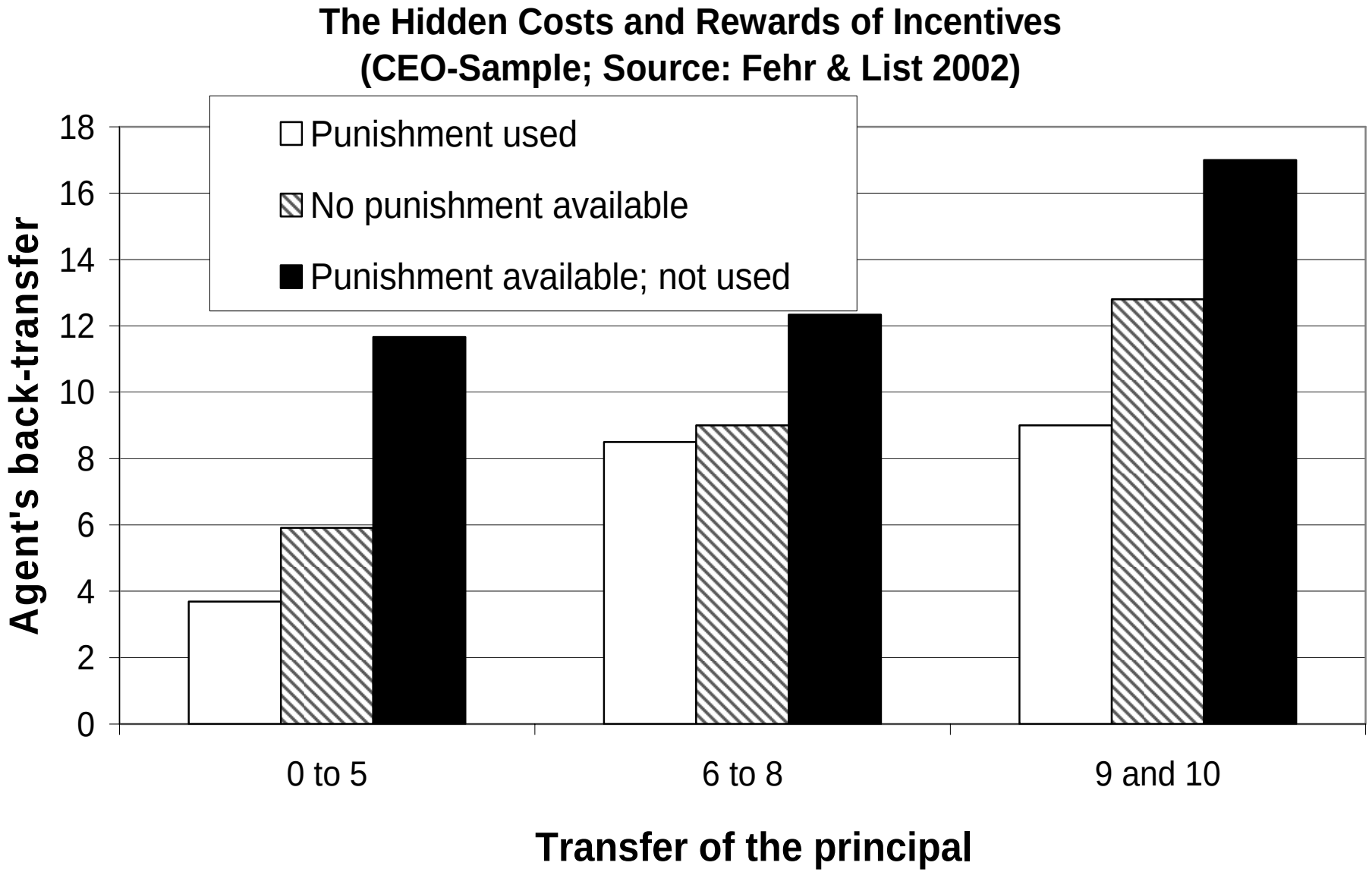
The Hidden Rewards of Non-Used Sanctions



Comparison of the Trust and the Punishment Game

	Average over all observations in ...		
		Punishment Game with ...	
	Trust Game	**no punishment (P0)**	**punishment of 4 (P4)**
Investment	6.5	8.7	6.8
Desired in % of tripled investment	59.9	63.7	67.4
Payback in % of tripled investment	40.6	47.6	30.3
Investor payoff	11.3	13.8	9.2
Responder payoff	21.8	23.5	22.4

- Average surplus produced by investment has the following order: **P0 > P4 ≈ Trust**
- Payback in % of tripled investment and investor payoff have the following order: **P0>Trust>P4**


The Hidden Costs and Rewards of Incentives
(CEO-Sample; Source: Fehr & List 2002)
Punishment used
No punishment available
Punishment available; not used
Agent's back-transfer
0
2
4
6
8
10
12
14
16
18
0 to 5
6 to 8
9 and 10
Transfer of the principal

Loss Aversion & Incentives

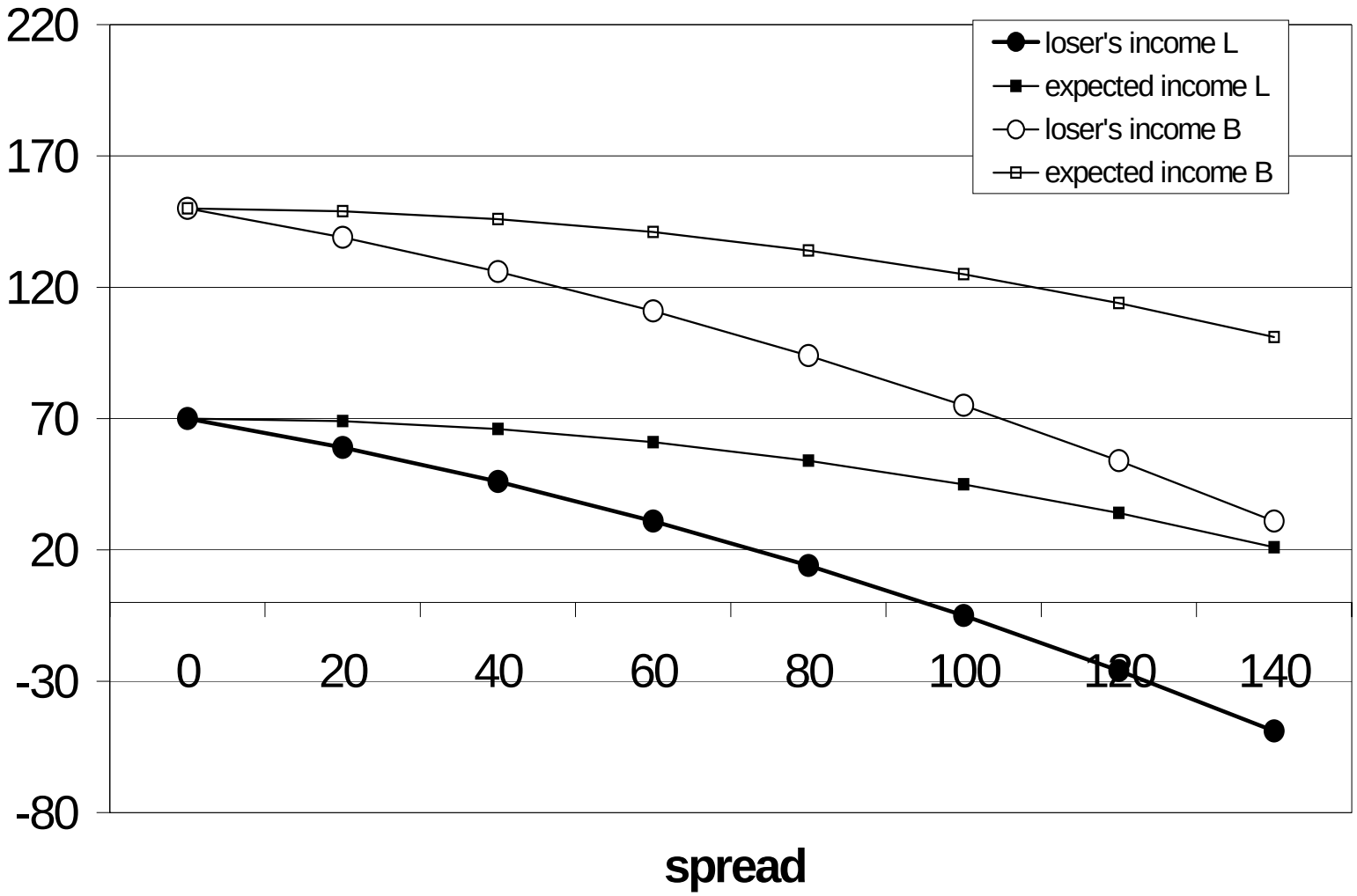
- The disutility of losses is roughly twice as large as the utility of equal sized gains. Losses and gains are inherently reference dependent concepts. Discontinuity of the slope of the value (utility) function at the reference point (Kahneman & Tversky 1979).
- Conjecture: People's behaviour is affected by attempts to avoid losses if possible.
- If income goals serve as reference points people try hard to achieve their goals but reduce effort once they have achieved their goals.
- Increases in performance wages may diminish effort because it is easier to meet the target.

Tournaments and Loss Aversion

(Falk & Fehr, Power&Limits of Tournament Incentives)

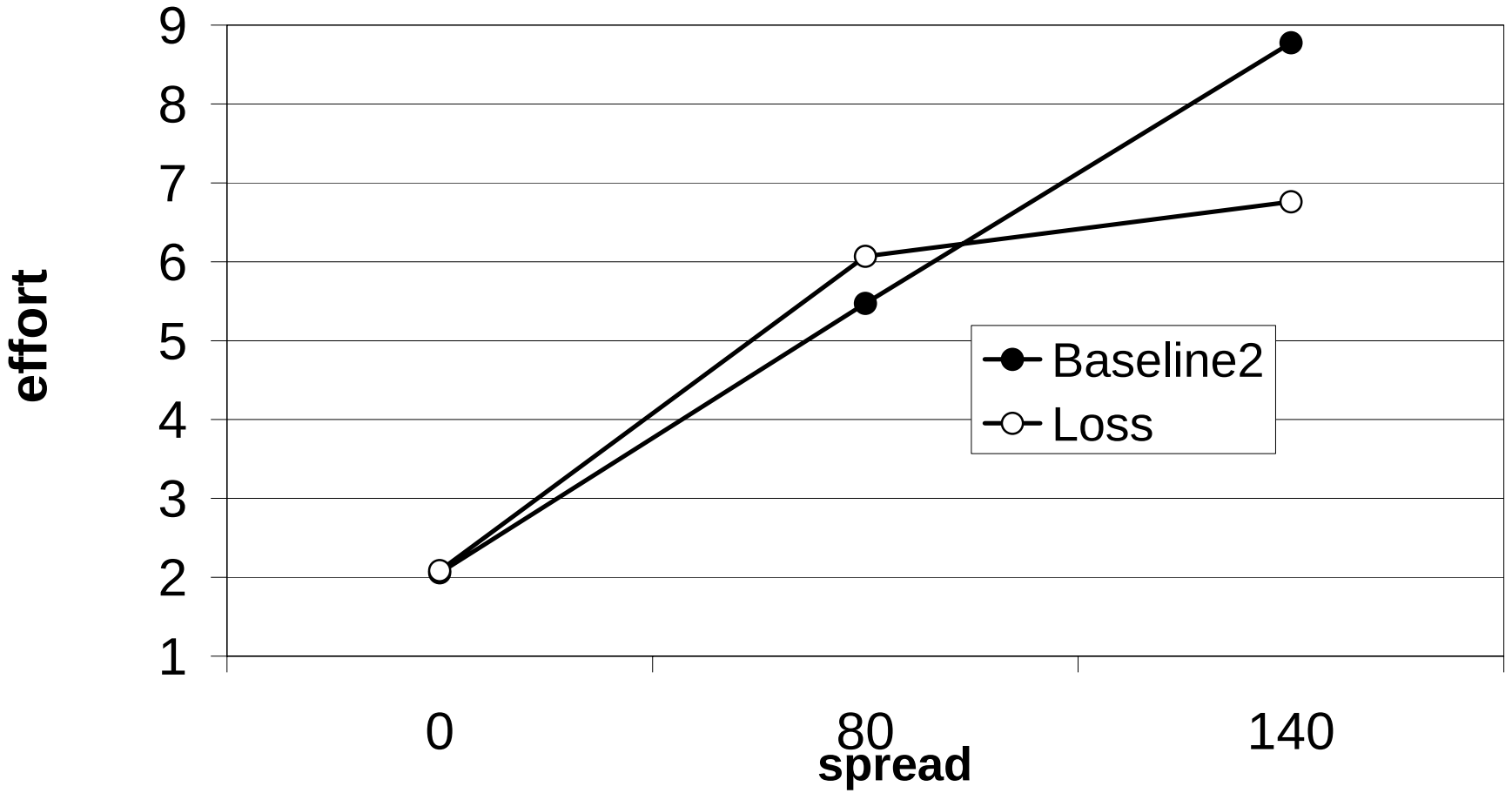
- In the Baseline the wage sum is 300, in the Loss treatment it is only 140.
- Irrelevant change if workers are expected utility maximizers because only the wage spread and not the wage level affects effort.
- At high effort levels the loser of the tournament incurs losses, which may decrease his willingness to put forward high effort levels.
- Principals have an incentive to compress pay relative to the standard prediction.

Workers' expected income and ex-post income for loser



Effort in Loss- and Baseline2-treatment (Source: Falk & Fehr 2001)

OLS-estimates, robust standard errors, session clusters, n=1776

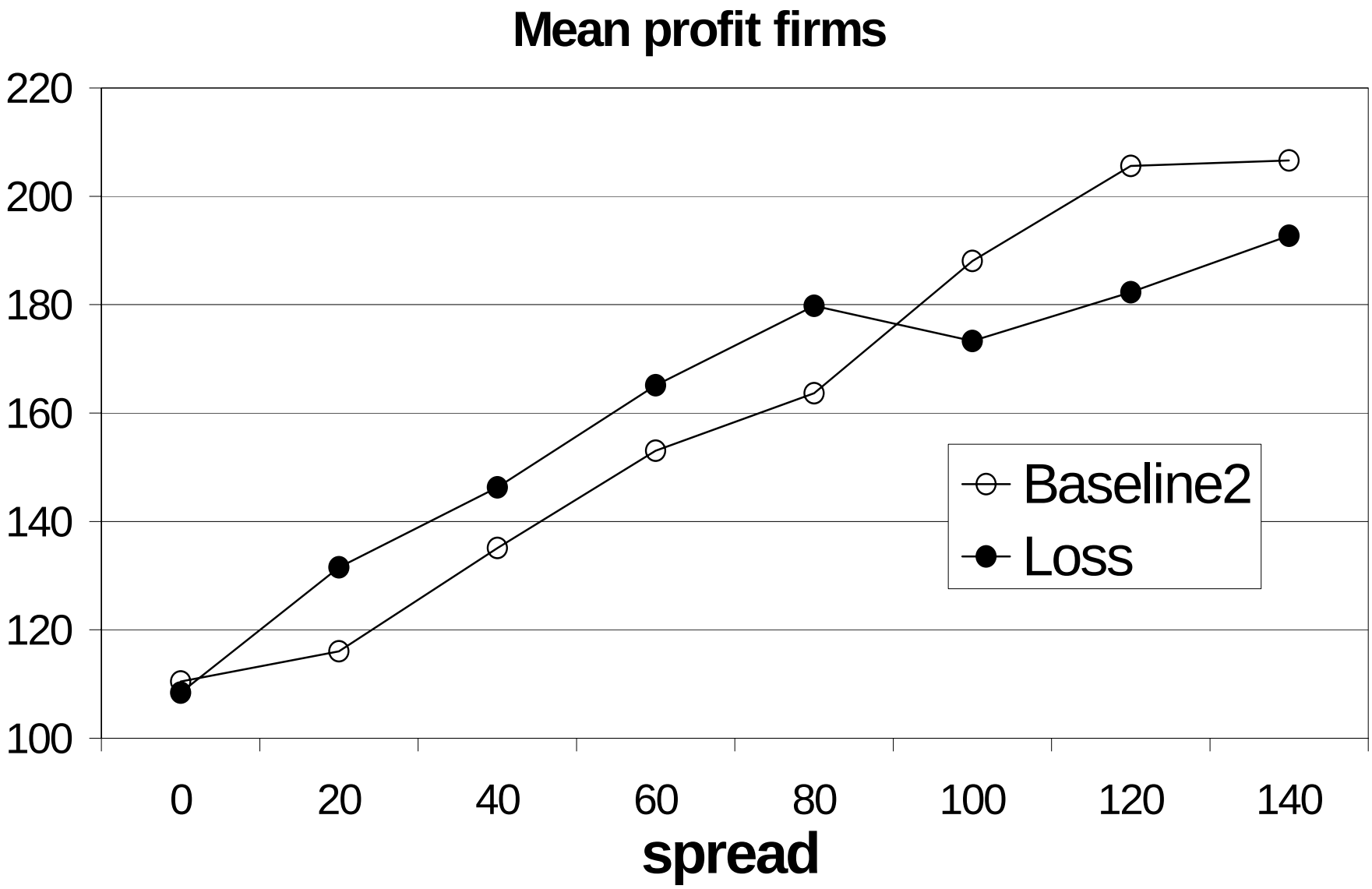


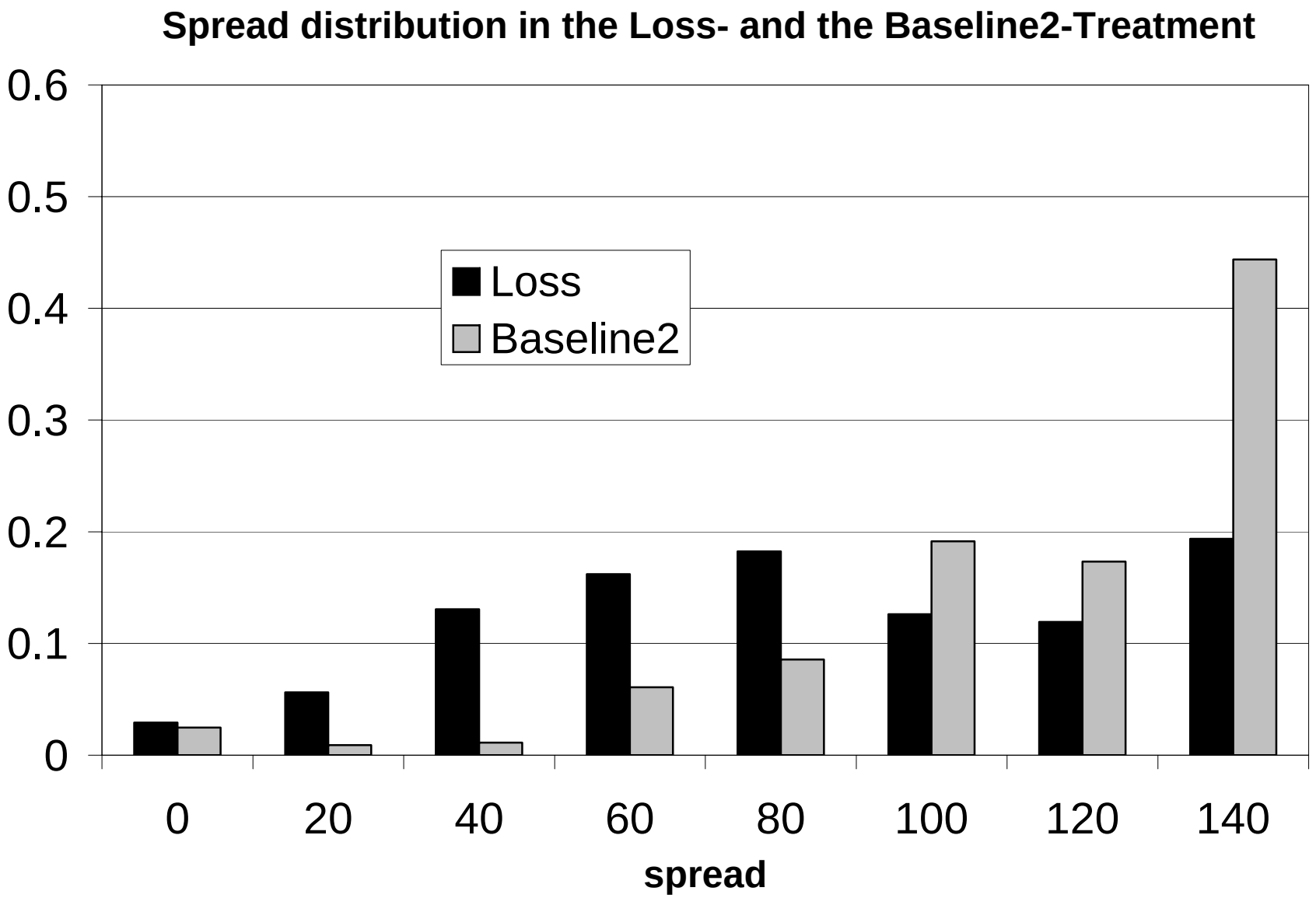
Effort responses in the L- and the B2-treatment

Dependent Variable: Effort

	Model 1		***Model 2***		***Model 3***
	L-treatment	B2-treatment	**L-treatment**	**B2-treatment**	**L- & B2-treatment**
Spread	0.0299**	0.0422**			
	(0.0056)	(0.0049)			
Low Spreads			0.0515**	0.0426**	0.0514**
			(0.0070)	(0.0065)	(0.0066)
High Spreads			0.0115	0.0420**	0.0115
			(0.0099)	(0.0066)	(0.0099)
Low Spreads×B2					-0.0088
					(0.0096)
High Spreads×B2					0.0306*
					(0.0108)
Treat					-0.6450*
					(0.2282)
Period	-0.0524	-0.0546	-0.0641	-0.0545	-0.0592**
	(0.0413)	(0.0279)	(0.0351)	(0.0283)	(0.0107)
Constant	3.3909**	2.4164*	6.5123**	5.8051**	6.4790**
	(0.2343)	(0.6380)	(0.4458)	(0.3033)	(0.3005)
n	888	888	888	888	1776
Prob. > F	0.0024	0.0004	0.0025	0.0001	0.0675
R-squared	0.1480	0.1922	0.1692	0.1922	0.2133

Note: *Low Spreads* are all spreads ≤ 80, *High Spreads* are all spreads > 80. The estimation procedure is an OLS-regression with robust standard errors (in parentheses) clustered on sessions (*n* of clusters = 5).** indicates significance on the 1-percent level and * on the 5-percent level, respectively.


Mean profit firms
220
200
180
160
140
120
100
0
20
40
60
80
100
120
140
spread
Baseline2
Loss


Spread distribution in the Loss- and the Baseline2-Treatment
0.6
0.5
0.4
0.3
0.2
0.1
0
Loss
Baseline2
0
20
40
60
80
100
120
140
spread

A Field Experiment on Loss Aversion & Intertemporal Labour Supply

(Fehr & Götte IEW WP 125)

- Whether intertemporal substitution of labour supply occurs is a key question for labour and macroeconomics. Decisive for the interpretation of unemployment. Rationing vs. voluntary unemployment.
- Previous macro-evidence shows little intertemporal substitution.
- Almost no studies with effort measures.
- Camerer et al. report even a negative elasticity. NYU cab drivers seem to work less hours on good days. Consistent with target income hypothesis.
- Oettinger reports the opposite. Stadium vendors are more likely to go to work when there is a well-attended baseball game.

Bicycle Messengers in Zurich, Switzerland

- Delivery records of Veloblitz and Flash Delivery Services, 1999 - 2000. Contain large number of details on every package delivered.
- Observe hours (shifts) and a good proxy for effort (revenues per shift).
- Messengers can freely choose the number of shifts and whether they want to provide a delivery, when offered by the dispatcher.
- Messengers are paid a commission rate w of their revenues r_{it}. (w = "wage"). Earnings: wr_{it}.
- Highly volatile earnings because demand varies strongly across days. Workers familiar with intertemporal changes in incentives.

→ **ideal test environment for the neoclassical model. If it fails here why should it work better in worse environments?**

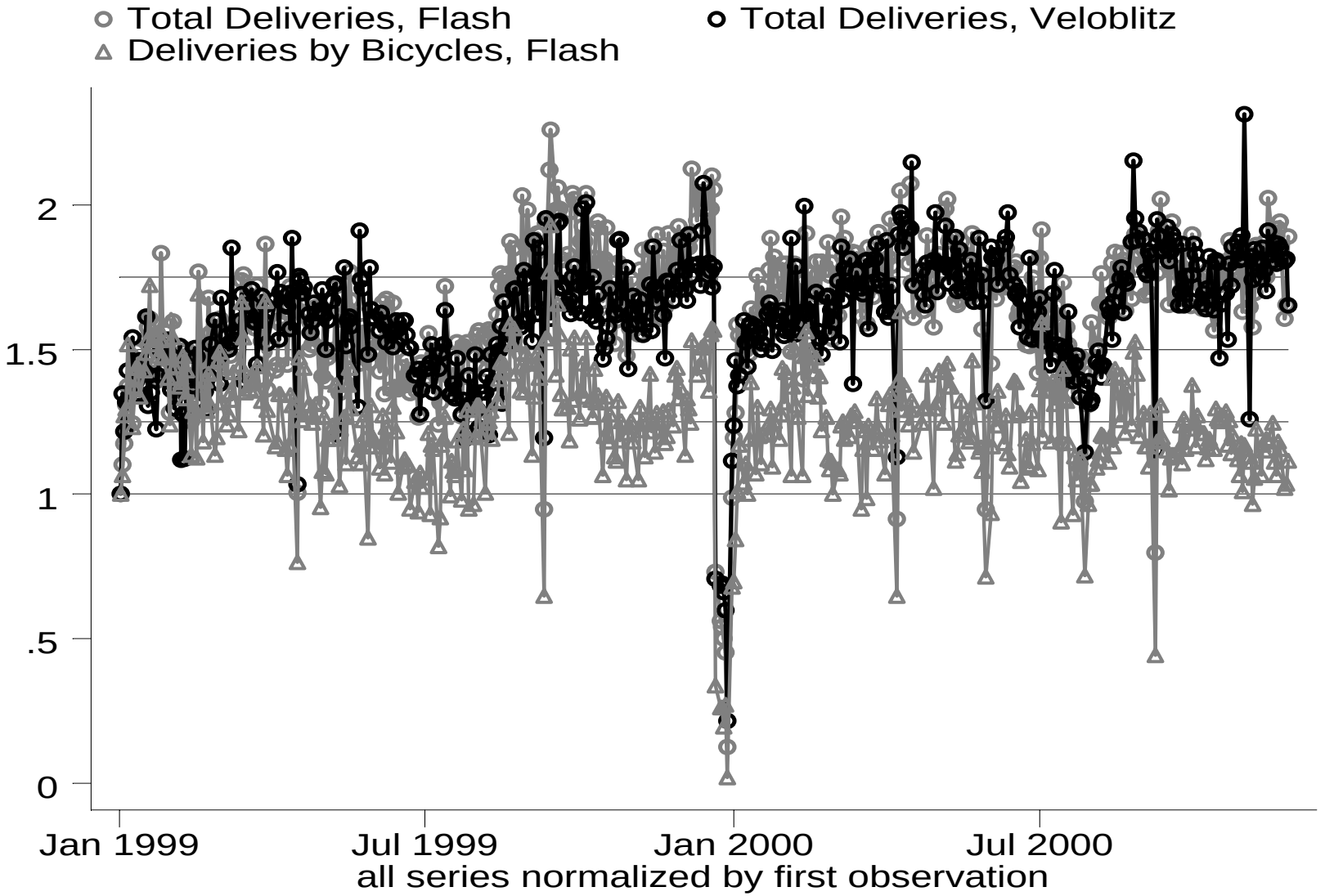


Figure 2: The Demand For Messenger Services

The Experiment

- Workers are randomly assigned to two treatment groups.
- Temporary wage increase for group A in September 2000. Group B serves as a control.
- Temporary wage increase for group B in November 2000. Group A serves as a control.
- Both temporary wage increases announced already in August 2000.
- Experimental earnings paid out in December for both groups.
- Comparison between A and B measures the pure substitution effect. Income effect (change in multiplier for the life-time budget constraint) takes place immediately after announcement.
- Standard time-separable model predicts more shifts and more effort per shift.

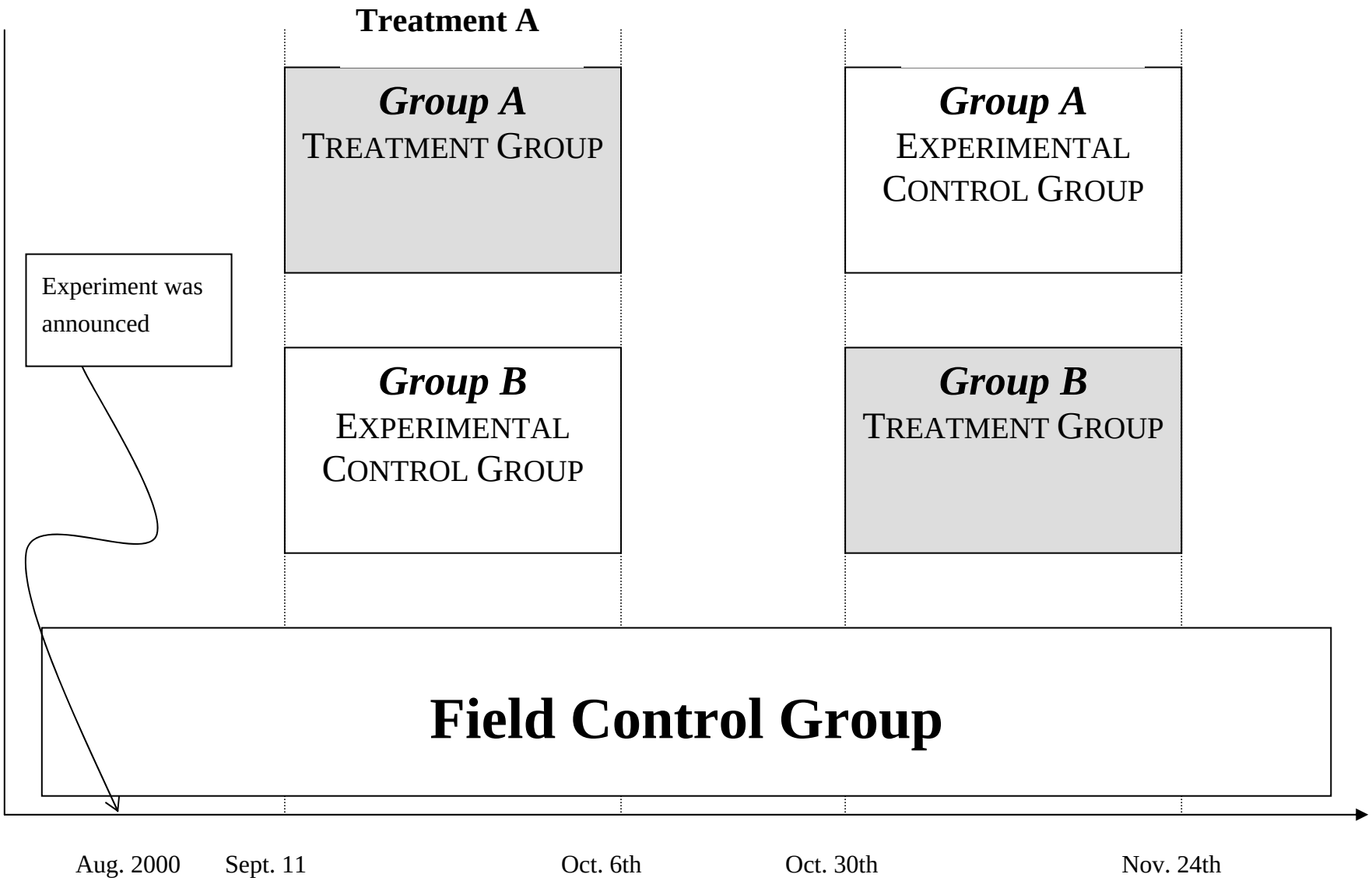


Figure 4: The Timing of Events

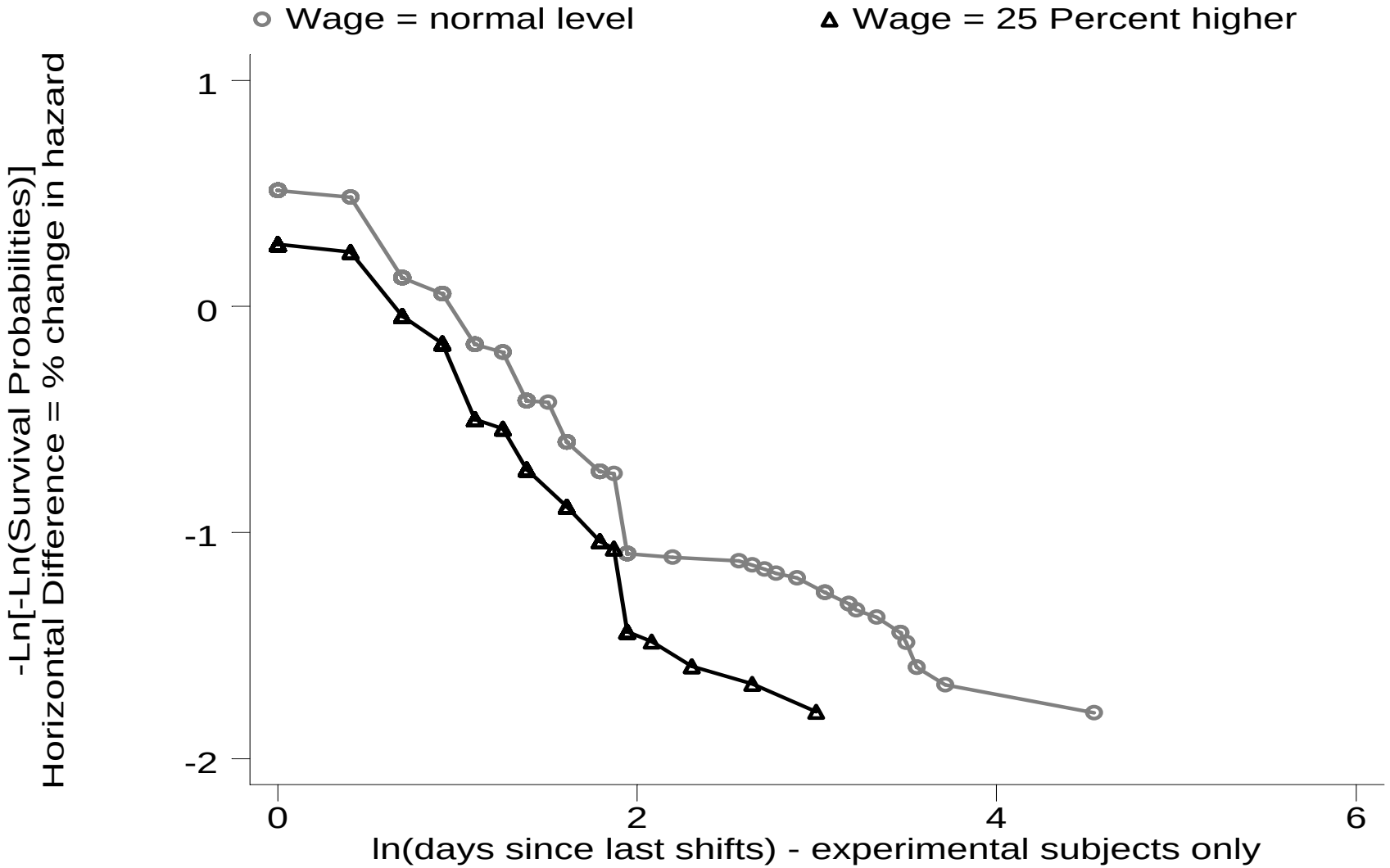


Figure 6: The Working Hazard during the Experiment

Results for Hours (Shifts)

- Treatment group works 12 shifts, control group only 9 shifts during four weeks.
- Difference significant ($X^2(1) = 4.57$, $p < 0.05$).
- Implied Elasticity: 0.8

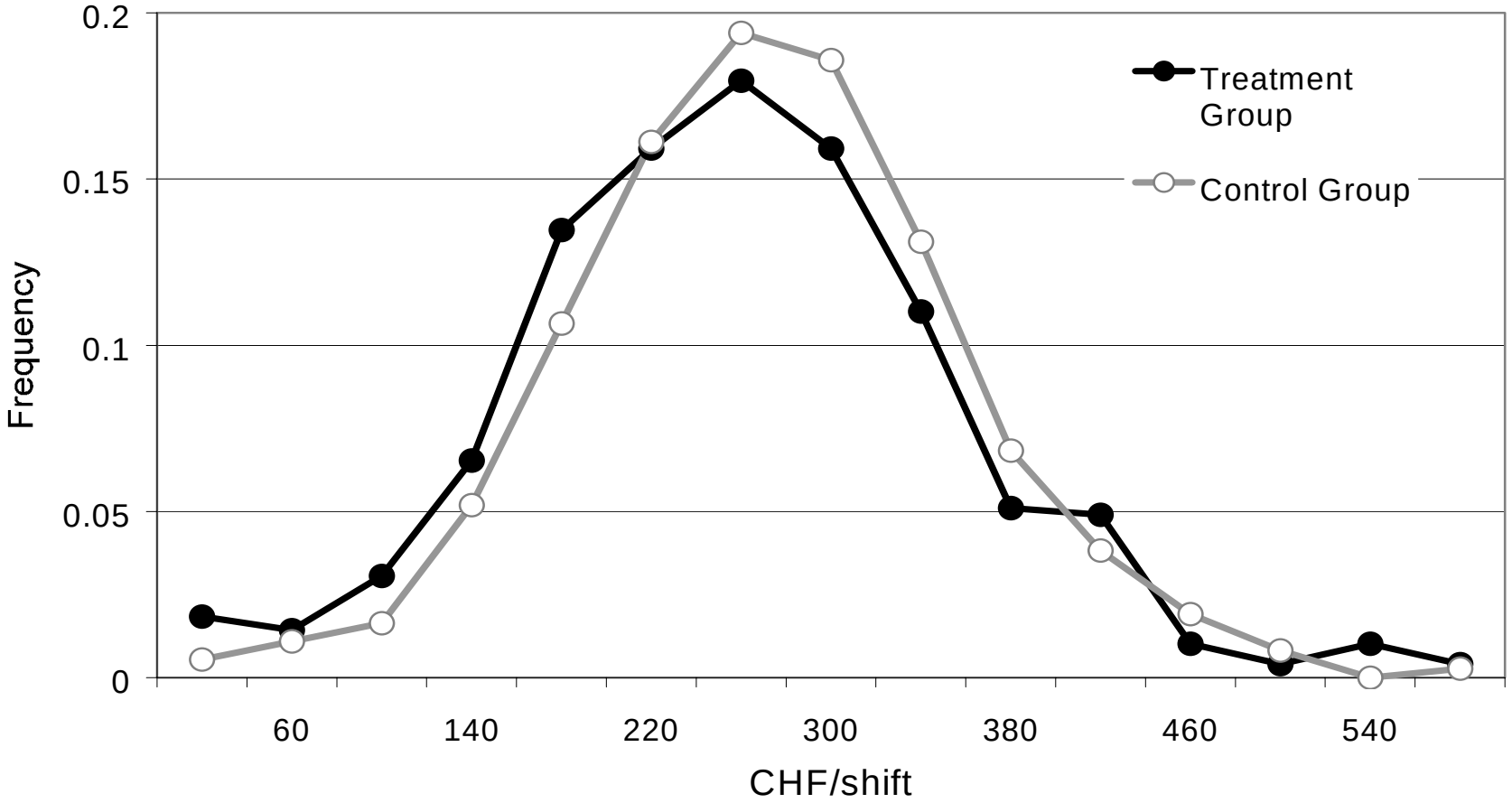
COX REGRESSIONS: PROBABILITY OF WORKING, CONDITIONAL ON DAYS SINCE LAST SHIFT

	(1)	(2)
Intertemporal Elasticity of Substitution (relative to messengers in control group)	0.896*** (2.875)	0.802** (2.462)
Control Variables		
Log(Experience)	1.127*** (14.840)	1.261*** (10.083)
Log(Tenure)	0.854*** (-13.1)	0.831*** (-8.248)
First Month (DV)	0.967 (-.775)	1.01 (0.193)
Last Month (DV)	0.885*** (-3.654)	0.884*** (-2.868)
Female (DV)	0.854*** (-5.26)	
Controls for Months (DVs)	Yes***	Yes***
Stratified according to	Firm	Messenger
Log Likelihood	-182,677.36	-93,408
Number of failures	21,455	21,455

Results for Effort (Revenues)

- Treatment group has 6 percent lower revenues per shift ($t = 2.2338$, $p < 0.05$)
- Distributions of revenues between Treatment and Control group are significantly different (KS test, $p < 0.05$)
- Implied negative elasticity of – 0.25.

Figure 7: The Distribution of Revenues per Shift during the Field Experiment



Do lower revenues reflect lower effort or something else?

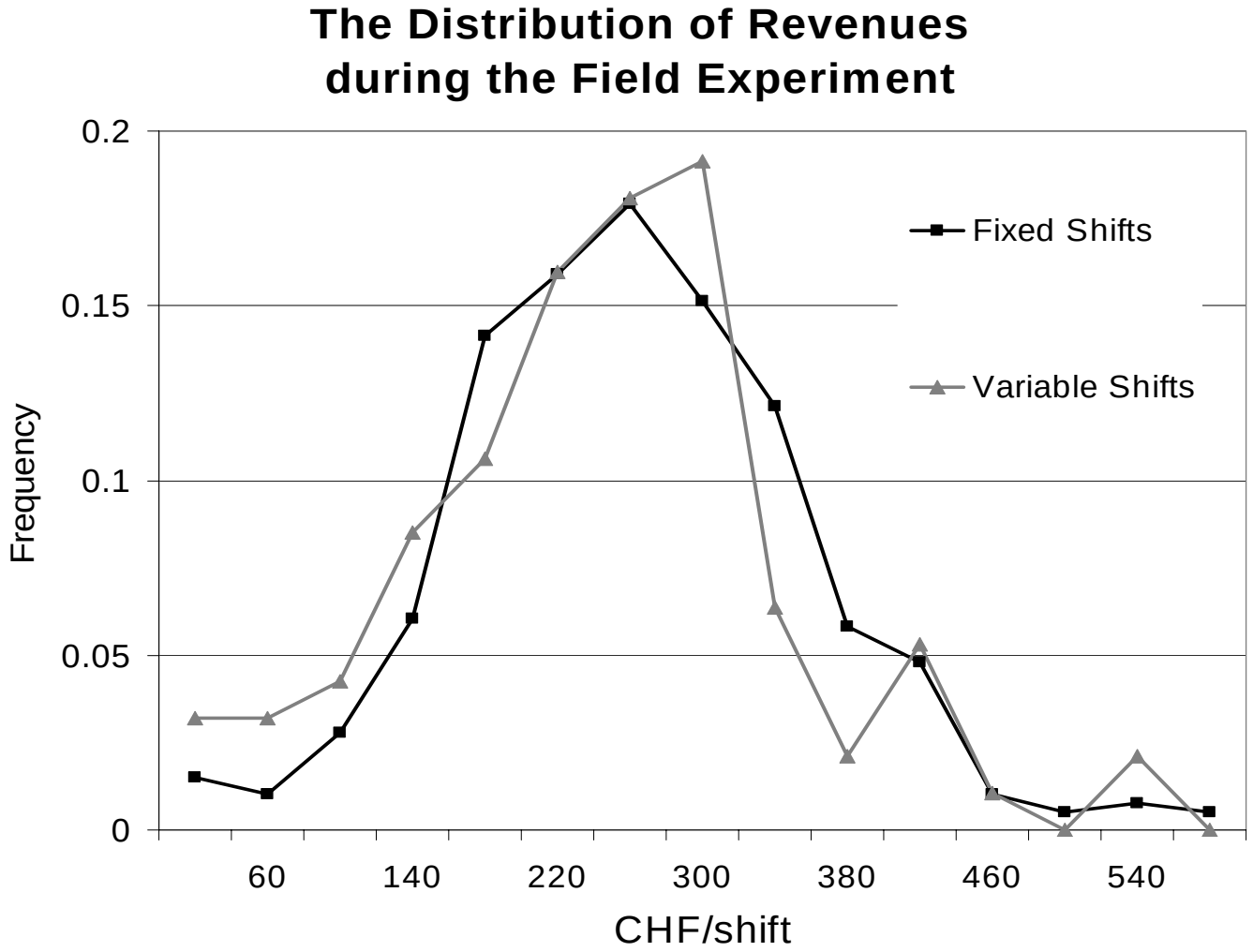
- Could it be fatigue? Control for “worked yesterday” and “will work tomorrow” leave the main effect intact.
- Potential selection bias: Treatment group works on bad days, low ability members of the treatment group are induced to work more shifts.
- Controls for experience profile, messenger fixed effects, daily fixed effects.
- There are fixed shifts and variable shifts. Fixed shifts represent long-term commitments. If selection a problem the reduction in revenues should only show up in variable shifts.

BASELINE RESULTS: CHOICE OF EFFORT
DEPENDENT VARIABLE: LOG(REVENUES PER SHIFT)
OLS REGRESSIONS

	(1)	(2)
Intertemporal Elasticity of Substitution (relative to messengers in control group)	-0.332*** (-3.521)	-0.255*** (-2.689)
Control Variables		
Log(Experience)	0.187*** (14.4)	0.095*** (5.415)
Log(Experience)^2	-0.014*** (-9.165)	-0.001 (-0.19)
Will work on next day (DV)	0.075*** (8.778)	0.045*** (5.099)
Worked yesterday (DV)	0.028*** (2.89)	0.001 (0.064)
Will work on next day, has worked yesterday (DV)	0.041*** (3.274)	0.051*** (4.223)

CHOICE OF EFFORT, CONT.
DEPENDENT VARIABLE: LOG(REVENUES PER SHIFT)
OLS REGRESSIONS

	(1)	(2)
# Competing Bicycle Messengers	-0.036*** (-8.765)	-0.034*** (-8.074)
# Competing Car Messengers	-0.049*** (-9.181)	-0.045*** (-7.228)
Daily Fixed Effects	Yes***	Yes***
Messenger Fixed Effects	No	Yes***
Within Days R^2	0.121	0.396
Fraction of unobserved variance due to daily fixed effects	0.585	0.67
Number of Observations	21,737	21,737



Kolmogorov-Smirnov Test for Equality of Distributions: *p = 0.332*

CHOICE OF EFFORT:
SELECTIVITY ON UNOBSERVABLES?

DEPENDENT VARIABLE: LOG(REVENUES PER SHIFT)
OLS REGRESSIONS

Point Estimate of Intertemporal Elasticity of Substitution	
From Column (1) in last table	
Including Fixed and Variable Shifts	-0.332*** (-3.521)
Separate Estimates from	
Fixed Shifts	-0.305*** (3.015)
Variable Shifts	-0.421** (1.978)
Test for significant difference between the two estimates	*p = 0.61*

Revenue reduction reflects effort reduction

Which factors can explain the negative effort effect?

- Perhaps a modified version of the standard model with non-separable preferences for periods of less than one month.
- Reference dependent preferences exhibiting loss aversion. To test for this we conducted a further experiment 8 months later.

Measuring Loss Aversion

- Lottery A: Win CHF 8 or lose CHF 5 with equal probability.
- Lottery B: Six independent plays of lottery A.
- Lottery C: Win CHF 5 or lose 0 with equal probability instead of getting CHF 2 for sure.
- Lottery D: Six independent plays of lottery C instead of CHF 12 for sure.

Outcomes of the Lottery Experiments
(eight months after the field experiment)

Percentage of messengers rejecting …		Percentage of messengers rejecting …	
Lottery *A*	54 %	Lottery *C*	28 %
Lottery *B*	42 %	Lottery *D*	14 %

- Rejections indicate loss aversion. Degree of relative risk aversion to reject any lottery >> 100.
- LA1 takes on value of 1 if A or C is rejected.
- LA2 is zero if A&C are accepted, is 1 if A or C are rejected and 2 if A&C are rejected.
- LA3 is one if B or D are rejected.

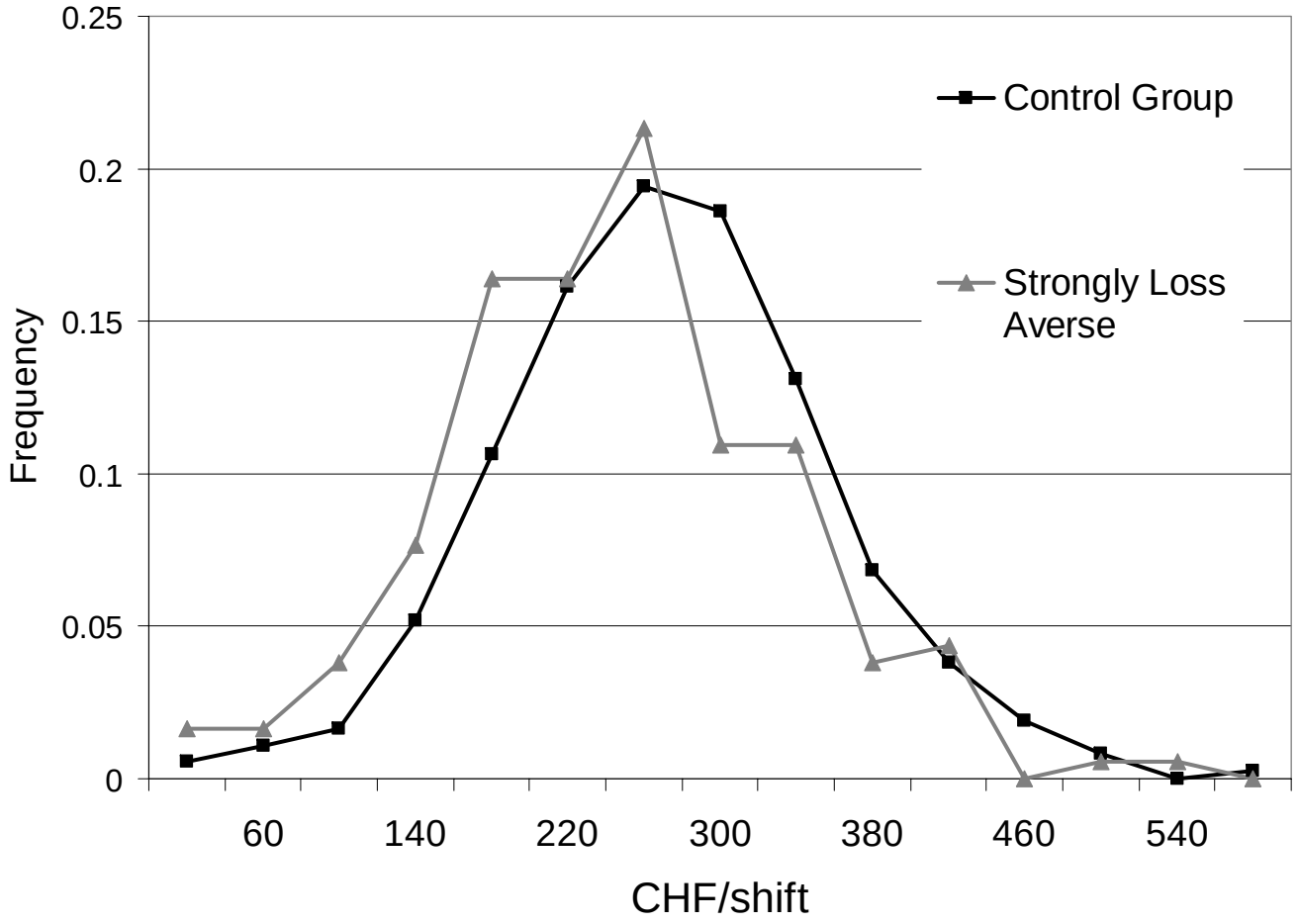
Do individual differences in loss aversion predict effort behavior?

Dependent Variable: Log(Revenues per shift)

SAME CONTROLS AS IN BASELINE REGRESSION

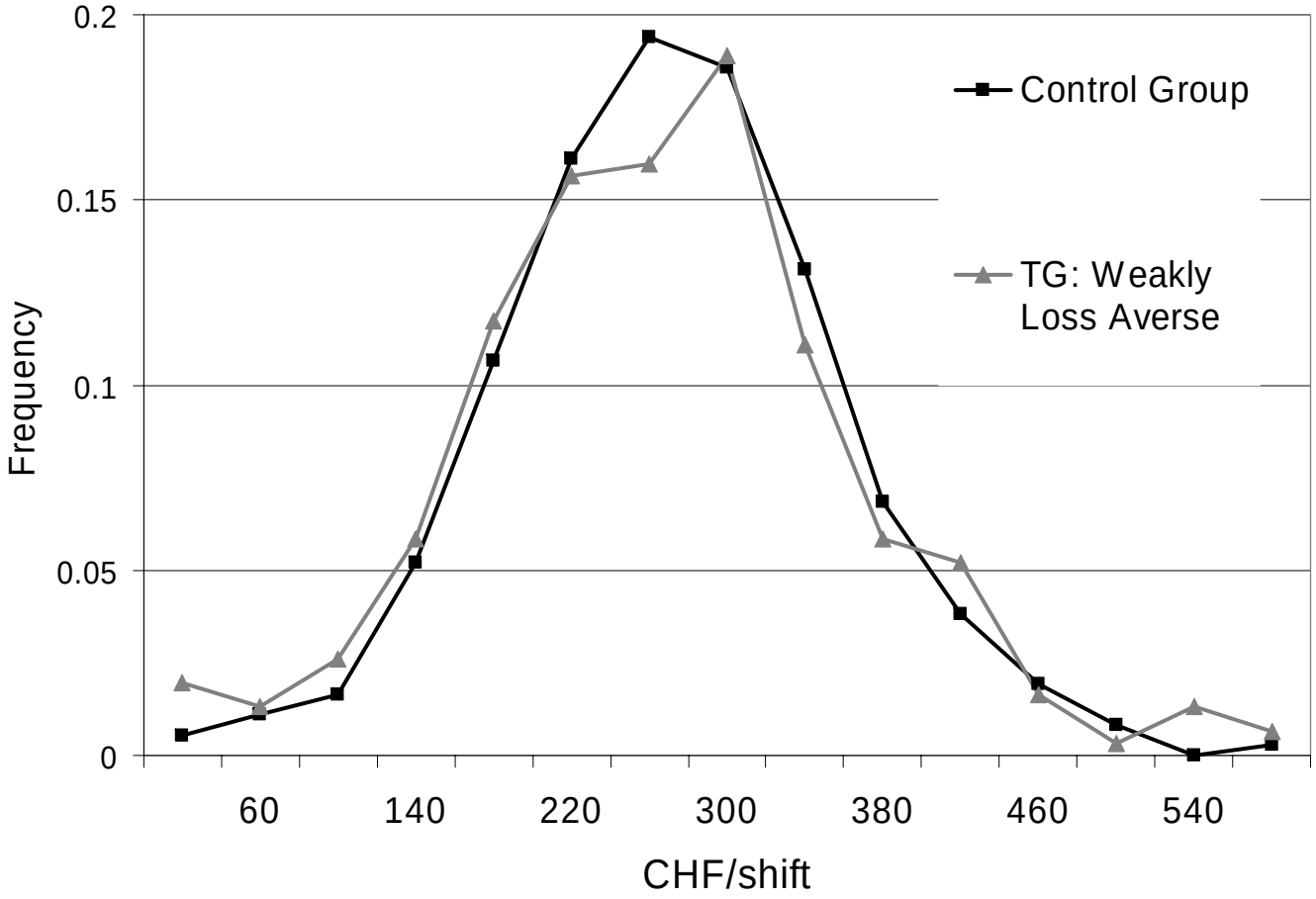
	Model (1) Interaction with: LA Measure 1	**Model (2)** Interaction with: LA Measure 2	**Model (3)** Interaction with: LA Measure 3
Intertemporal Elasticity of Substitution			
Constant (Treatment Group Dummy)	-0.112 (-0.606)	-0.099 (-0.543)	-0.067 (0.417)
LA x Treatment Group Dummy	-0.385** (-1.939)	-0.273** (-2.101)	-0.318** (-2.287)
Test for joint significance	significant***	significant***	significant***
Interaction alone			
Interaction Term	-0.475*** (-3.66)	-0.323*** (-3.788)	-0.359*** (-3.627)
Interaction, Messenger FEs			
Interaction Term	-0.345*** (-2.588)	-0.229*** (-2.564)	-0.273*** (-2.758)

The Distribution of Revenues during the Field Experiment



Kolmogorov-Smirnov Test for Equality of Distributions: *p = 0.001*

The Distribution of Revenues during the Field Experiment



Kolmogorov-Smirnov Test for Equality of Distributions: *p = 0.32*

Figure 8a: The Distribution of Revenues per Shift in the Treatment Group

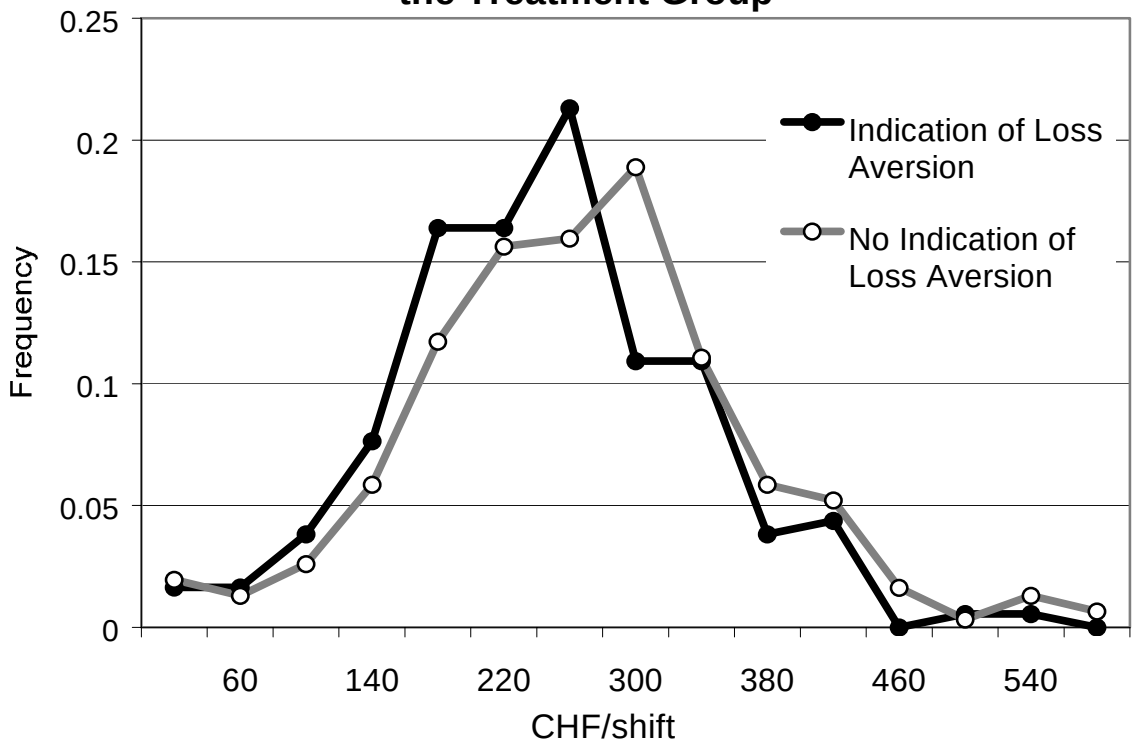
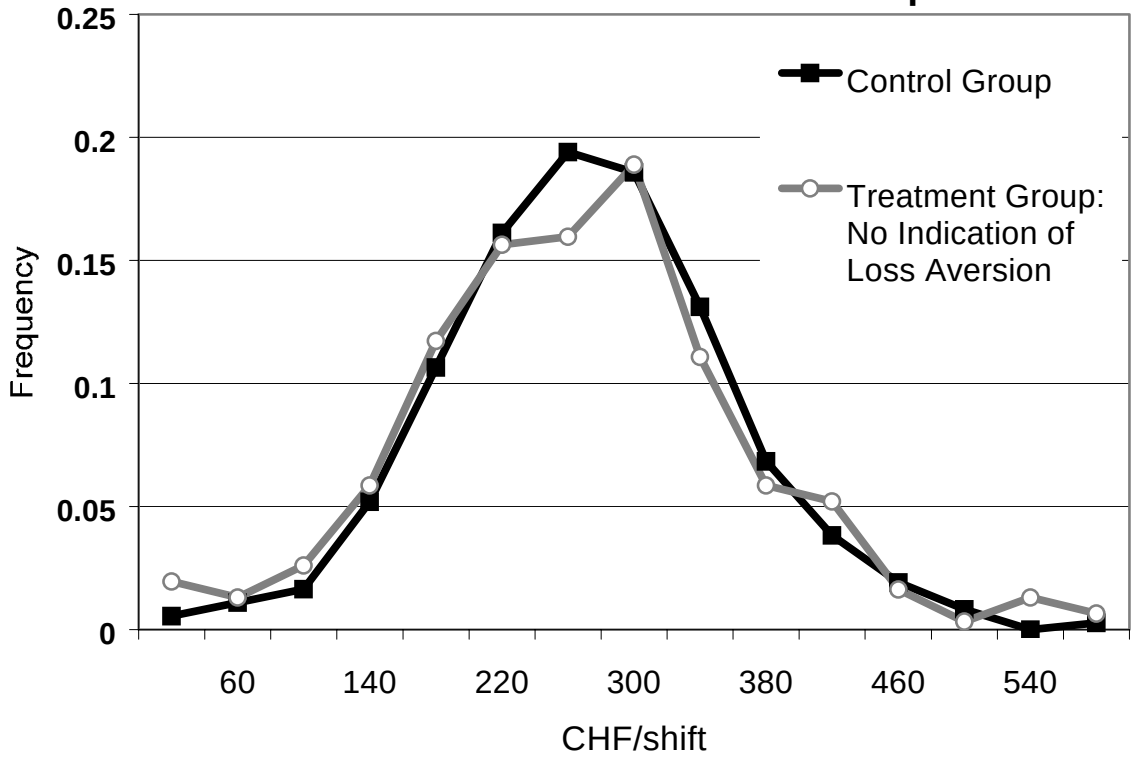


Figure 8b: The Distribution of Revenues per Shift across Control and Treatment Group



Summary on Loss Aversion & Incentives

1) Loss aversion affects tournament incentives. If losers fall below the reference income at high performance levels effort is reduced.
2) In response the principals compress wage differentials.
3) Field experiment indicates that workers substitute intertemporally with regard to shift.
4) However, higher incentive wages reduce effort.
5) Loss averse workers generate less revenue; workers with no indication of loss aversion generate the same revenue.
6) Loss aversion does not affect the choice of shifts.