ATTRIBUTION AND RECIPROCITY IN A SIMULATED LABOR MARKET: AN EXPERIMENTAL INVESTIGATION[*]

Gary Charness
Department of Economics
Universitat Pompeu Fabra
Ramon Trias Fargas 25-27
08005 Barcelona, Spain
e-mail: charness@upf.es

July, 1998

Abstract: While papers such as Akerlof and Yellen (1990) and Rabin (1993) argue that psychological considerations such as fairness and reciprocity are important in individual decision-making, there is little explicit empirical evidence of reciprocal altruism in economic environments.   This paper tests whether attribution of volition in choosing a wage has a significant effect on subsequent costly effort provision. An experiment was conducted in which subjects are first randomly divided into groups of employers and employees. Wages were selected and employees asked to choose an effort level, where increased effort is costly to the employee, but highly beneficial to the employer. The wage-determination process was common knowledge and wages were chosen either by the employer or by an external process. There is evidence for both distributional concerns and reciprocal altruism. The slope of the effort/wage profile is clearly positive in all cases, but is significantly higher when wages are chosen by the employer, offering support for the hypothesis of reciprocity. There are implications for models of utility and a critique of some current models is presented.

---

1. INTRODUCTION

Standard economic models presume that people maximize their own financial interest, without regard for social norms and issues such as fairness and reciprocity. This assumption is parsimonious and facilitates analysis; however, while it is generally quite useful and often innocuous, it leads to unrealistic predictions of behavior in some economic situations. While it is difficult to isolate the influence of social preferences in the field, a large number of laboratory experiments, such as the ultimatum game, the dictator game, and public good provision, have demonstrated that often one cannot adequately explain individual choice behavior on the basis of pecuniary maximization alone. Although these experiments demonstrate that social forces can have substantial effects on the economic decisions made by individuals, the underlying composition and determinants of these social forces are often left unconsidered.

This paper describes the results of an experiment designed to test whether causal attribution influences the level of material payoffs an individual is willing to sacrifice to benefit another person. We find that the source of the wage has a substantial effect on an employee's level of costly effort provision. While we observe increased effort with higher wages in all cases, the effort/wage gradient is significantly steeper when the wage is determined by the firm. Employer volition in wage-setting is a factor in a worker's choice of effort and subsequent productivity. One implication could be that wage increases which are perceived to be a "gift" rather than a requirement will have a greater effect on marginal productivity and that perceived employer meanness guarantees a poor employee response.

Causal attribution refers to beliefs about the determinants of an outcome. One key aspect of attribution is whether a result has been decided through the volition of a party whose material payoffs are affected by the choice. The psychology literature strongly suggests that people often consider context and interpersonal history when determining their actions in social exchange situations. Heider (1958) introduced the idea that causal inference, where a person takes into account another actor's motives and situational constraints, is an important cognitive process for perceiving social contexts. Individuals have a need to infer causes and to attempt to assign

responsibility for outcomes. When volition is absent, feelings of revenge and gratitude dissipate or vanish.[1] More recently, models of social utility theory indicate that these feelings are quite sensitive to normative expectations about "appropriate" behavior. An abundance of psychology experiments supports these views - for example, Greenberg and Frisch (1972) find that help which is deliberately given leads to more reciprocity than does accidental help.[2] Blount (1995) examines negative reciprocity in a socio-economic environment, finding that the minimum acceptable offer in an ultimatum game is significantly higher when the offer was believed to have been generated either randomly or by a third party than when it is believed to have been chosen by a self-interested party.[3]

There has been a growing focus on psychological concerns as an explanation for deviations from pure material self-interest. Akerlof (1982) and Akerlof and Yellen (1990) ["A&Y"] present formal models which demonstrate how issues of social custom and fairness can affect wages. Rabin (1993) models reciprocal altruism, the notion that people take into consideration the actions and intentions of others when determining their own actions, and provides a game-theoretic explanation for the non-minimal effort levels and wages predicted by the A&Y gift-exchange model. His model assumes, however, that a player is neutrally disposed toward another player if the other player has no choice of actions. If an employer has not chosen the wage, we should expect minimum effort regardless of the wage, since an employee should be unwilling to sacrifice any material payoff to benefit a non-volitional employer. In addition, the Rabin model does not apply formally to extensive-form games; however, extensions to sequential games can be made (Dufwenberg and Kirchsteiger, 1998).

---

[1] "Feelings of both revenge and gratitude become markedly attenuated ... upon the discovery that the harm or the benefit [to the individual] was not the true goal of the agent. ... Gratitude is determined by the will, the intention, of the benefactor. Attribution to source and intention has similar significance in the case of revenge." (Heider, 1958, p. 265)

[2] See also Thibaut and Riecken (1955), Goranson and Berkowitz (1966), Kelley and Stahelski (1970), Kelley (1972), and Kahn and Tice (1973).

[3] Blount also tests for significance between minimum acceptable offers in the random and third-party conditions, but has mixed results. In both Study 1 and Study 2, minimum acceptable offers are lower with perceived random-generation; however, this difference is only statistically significant in Study 2.

While these papers argue convincingly that fairness is important in economic environments, there is little direct evidence for reciprocal altruism in such a context. Fehr, Kirchsteiger, and Riedl (1993) and Fehr, Kirchler, Weichbold, and Gächter (1998) perform "gift-exchange" experiments and find that social forces play a major role in this context. A self-interested worker should provide the minimum possible effort, yet effort levels at higher wages tended to be much higher, rewarding firms for setting high wages. These results contradict the standard money-maximizing theory. Yet it is not clear whether employees are simply choosing to share their greater wealth with the firm, or whether workers are truly acting reciprocally. Does the slope of the wage/effort profile depend on the causal attribution for the wage-determination process?

The experiment presented in this paper adapts the Blount (1995) and Fehr et al (1998) experiments, using a simulated labor market and separate treatments in which wages are determined by either the employer or by an external process. Blount does not examine generosity in an economic environment, whereas Fehr et al do not test for the source of the apparent worker generosity. If intentions are irrelevant, we should expect the effort/wage slope to be the same, regardless of the causal attribution. On the other hand, if a firm's volition matters, this slope should be significantly higher when the wage is chosen by the employer. We find a voluntary higher wage leads to greater effort and productivity than does an externally-imposed higher wage, while an intentionally low wage guarantees minimal effort.

2. EXPERIMENTAL DESIGN

A total of 122 subjects participated in this experiment; 61 had the role of "employee" and the other 61 had the "employer" designation. Average earnings, including a $5 show-up fee, were between $16 and $17 for about 100 minutes of time. All subjects were students at UC - Berkeley. A full description of the instructions and record sheets issued to the subjects is in Appendix A. There were, in general, ten employers and ten employees in an experiment which consisted of ten periods. Employers and employees initially all met in one large room; after a

brief introduction and a random assignment of roles, the employers were moved to another room. Having all participants meet in one room at the outset made it more credible that another real person's payoffs were dependent on the employee's action choice. Pairings were anonymous and it was common knowledge that workers and firms were matched only once, so that reputation-formation should not be a concern.[4]

An employee was given a wage, which she knew had been assigned by either an employer or an external process. This external process was either a draw from a bingo cage or an assignment made by the experimenter.[5] Balls were drawn individually, in front of successive subjects. In the third-party condition, subjects were informed that wages had been pre-selected by the experimenter for each employee in each period.[6] Each employee was in only one of the treatments and each session was a different treatment. Once assigned a wage, each employee was asked to record an effort choice (between 0.1 and 1.0, inclusive) on a record sheet and to fold this sheet before turning it in to the experimenter. This sheet was then given to her employer in the other room, so that the employer had salient physical evidence of the employee's choice. Unlike the Fehr et al (1998), employees could not reject the wage;[7] thus, an employer could guarantee herself a monetary payoff of at least 10 guilders in each round by choosing a wage of 20.[8] Absent strategic, repeated-game considerations, a high wage can be seen as either a "gift" or an attempt to elicit positive reciprocity.

---

[4]There were sessions with less than 10 pairs, so that there were occasional anonymous re-pairings. However, this issue didn't appear very salient and, as will be seen, the data does not show any indication of reputation-building, which might occur if a subject expected his choice to be a factor in a re-pairing.

[5] In the 1st case, wages assigned in the employer-determined case were mapped onto the numbers of the balls in the bingo cage, with wages increasing with ball numbers.

[6] As shall be seen, the slope-coefficients for the two exogenous conditions are nearly identical (.0089 and .0086, in the fixed-effect Tobit regressions) and the data are pooled. A likelihood-ratio test of the restricted model (see section 4) gives $\chi^2 = .214$, n.s.

[7] I thank Ernst Fehr for this suggestion, which allows a cleaner comparison across treatments.

[8]Experimental "guilders" were converted to dollars at the rate of 25 to $1.

The combination of wage and effort determined outcomes and monetary payoffs for each pair of subjects in a period. Each employer was given an endowment of 120 "income coupons" in each period. The monetary payoff functions were given by:

$$\Pi_F = (120 - w) * e \qquad\qquad (1)$$
$$\Pi_E = w - c(e) - 20 \qquad\qquad (2)$$

where F represents the employer, E the employee, e denotes the employee's effort, w is the wage, and c(e) is the cost of effort, a function increasing in e.[9] Wages were constrained to be between 20 and 120, inclusive. The payoff functions were common knowledge and participants were required to calculate both employer and employee payoffs in three exercises with hypothetical wage-effort pairs. These exercises (see Appendix A) were reviewed before proceeding with the experiment, insuring that subjects understood the payoff mechanism and that higher effort meant higher employer earnings, but lower employee earnings. The only difference across the attribution treatments was the wage-generating mechanism. In all cases, for the purposes of calculating income, the wage was subtracted from the employer endowment of 120. At the conclusion of a session, all participants were paid privately.

The experimental design helps shed light on some theoretical models. The Akerlof (1982) gift-exchange model characterizes the offer of employment as an offer to "exchange gifts" and the worker's effort level indicates the size of the reciprocal gift. A natural interpretation of this model is that an exogenous wage would not be considered a gift, so that effort choice should be dependent on causal attribution and the slope of the effort/wage profile should differ across treatments. Bolton (1991) presents a bargaining model to explain behavior in a sequential version of the ultimatum game, concluding that relative payoffs play an important role in a subject's utility. Relative payoffs are indeed found to be important in this experiment,

---

[9]Note that the cost of minimum effort (.1) is 0. This functional form was used in Fehr et al (1998) and was replicated here to allow comparisons. While it is not the usual profit/wage/effort relationship, it does ensure that profits are non-negative. This multiplicative set-up allows an employee to greatly increase an employer's earnings, at a fairly low cost to the employee. The functional form has the feature that more productivity (effort) generally leads to greater joint income, so that higher levels of effort are encouraged from the standpoint of total welfare.

but this model offers no role for intentionality and predicts minimal effort in all cases. The Rabin model allows for both positive and negative reciprocity, including psychological payoffs in the utility function.[10] This notion suggests that different causal attributions will lead to different rates of marginal transformation between pecuniary and psychological payoffs, implying a difference in the effort/wage profile. A newer generation of models includes Bolton and Ockenfels (1997) and Fehr and Schmidt (1997). These models account for distributive effects, but offer no role for intentional reciprocity.

If psychological considerations are important, we should expect to see deviations from "rational self-interest." If we represent the wage-effort relation by:

$$e = \alpha + \beta * w \tag{3}$$

The Fehr et al (1998) experiment finds that $\beta > 0$.[11] It was expected that this result would be replicated here. In addition, my specific hypothesis is:

The slope of the wage-effort relationship will be significantly higher when wages are determined by employers than when wages are determined exogenously.

If we represent the wage-effort relation by:

$$e_1 = \alpha_1 + \beta_1 * w_1 \tag{4}$$
$$e_2 = \alpha_2 + \beta_2 * w_2 \tag{5}$$

---

[10] I use a later formulation, which is: $U_i(a_i, a_j, r_i) = \Pi_i(a_i, a_j) + r_i * f_i(a_i, a_j)$. The original 1993 paper uses $1 + f_j(a_i, a_j)$, rather than r_i. Here U_i is the utility function for player i, Π_i is the monetary payoff to player i, $f_i(a_i, a_j)$ is the kindness function, which measures how "kind" player i is being to player j by choosing strategy a_i, and r_i is player i's disposition towards player j. Both f_i and r_i can be either positive or negative. One's disposition toward another player influences the choice of f_i; if player i is positively (negatively) disposed to player j, she will increase her utility by choosing a positive (negative) f_i. Player i's disposition toward player j is the result of j's choice and i's perception of j's motivation for this choice.

[11] Given that $P_F = (120-w) * e$ and $P_E = w - c(e) - 20$, note that β should be <u>less</u> than 0 for pure altruists. Since a higher level of effort yields greater benefits for the employer when the wage is low, as the effort level would then multiply a larger number of employer income coupons, this effectively allows the altruist to trade-off welfare at a more favorable ratio.

where the subscripts 1 and 2 refer to the exogenous and employer cases, respectively, this hypothesis states that $\beta_2 > \beta_1$. The residual ($\beta_2 - \beta_1$) can be attributed to reciprocal altruism. Note that α_1 and α_2 cannot be assumed to be the same and in fact differ substantially.

3. RESULTS

The results from all treatments indicate that $\beta > 0$, at very high levels of significance.[12] Only 13 of the 61 employees acted in accordance with the predictions for rational money-maximizers by always selecting the minimum effort regardless of the wage offered. The remaining 79% of the subject population demonstrated a contingent willingness to consider an employer's welfare and choose higher effort with a higher wage.

Table 1 presents a summary of the data. Detailed results are presented in Appendix B. Figures 1 and 2 illustrate the distribution of the wage/effort pairs.

Table 1: **Results by wage bracket**

Wage range		Average effort				
	Employer		Random		Third party	
		N		N		N
20-59	.1827	104	.2431	72	.2108	74
60+	.4293	116	.4093	118	.3873	126
Total	.3127	220	.3463	190	.3220	200

Figure 1

---

[12] Full results for all regressions are available from the author upon request.

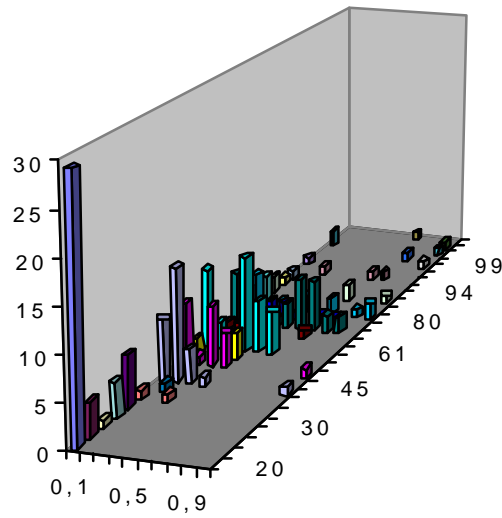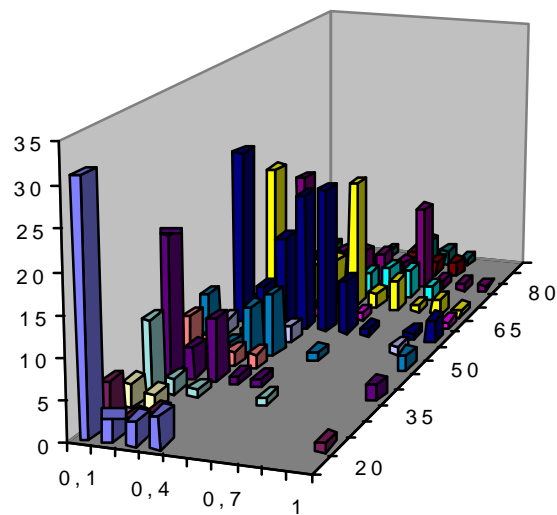Wage/effort pairs for employer-generated wages

Figure 2

Wage/effort pairs for exogenous wages

As effort was bounded on both sides (259 of 610 observations had extreme effort values), a two-sided Tobit regression was used to account for the censoring problem. The effort/wage slope is very similar for the third-party and random treatments and these data have been pooled

as exogenous wages. A likelihood ratio test on the restriction of identical slopes shows that we cannot reject the hypothesis that the slopes are the same (LR test $= 2[(-696.611) - (-696.718)]$ $\Rightarrow \chi^2 = .214$, n.s.). Table 1 shows the values for α and β in the two treatments:

Table 1

Treatment	N	α	β	$t(\beta)$	p-value
Employer	220	-.0941	.00951	10.93	.0000
Exogenous	390	.0123	.00738	10.41	.0000

Note that the value for α is the intercept at w=20 and recall that the range of effort was from 0.1 to 1.0, so that these lower values indicate that less effort would have been provided at w = 20 if this had been possible. The difference between α_1 and α_2 is substantial and shows that there is considerable negative reciprocity for intentional low wages. This is highlighted by an examination of the effort choices in response to low wages: In the 50 occasions where an employer chose a wage less than 40, an employee chose costly effort only twice. This compares with 17 of 66 choices of costly effort in this wage range in the exogenous cases ($\chi^2 = 9.8$, p < .01).

While there were the 610 wage-effort pairs obtained in the experiment, this was comprised of 10 observations for each of 61 subjects. A fixed-effects model specifies individual intercepts within each set of 10 periods. This regression model is:

$$e = \alpha_1\delta_1 + \alpha_2\delta_2 + ... + \alpha_{61}\delta_{61} + \beta w + D\tau w \qquad (6)$$

Here δ_i is a dummy representing employee i and D is a dummy which takes on a value of 1 in the exogenous case and is 0 otherwise. This fixed-effect regression gives the result that:

EFFORT = (Individual dummies) + .00900*WAGE + .00211*DUMMY*WAGE
          (15.7)   (2.49)

          610 observations   Log-likelihood = -696.718

The numbers in parentheses are the t-statistics. If the effort/wage profile is steeper when there is employer volition, the coefficient for τ should be significantly positive; we see that this is confirmed at $p < 01$. This confirms the hypothesis that reciprocal altruism is a significant influence on workers' choice of effort, apparently generating about 20% of the magnitude of the positive effort/wage slope. Separate fixed-effect Tobit regressions for the random and third-party treatments give similar slope coefficients of .0089 and .0086, respectively,

For an estimation of the relative importance of distributive and reciprocal forces, it may be more informative to only include observations where non-minimal effort was provided, since minimal effort choices do not shed light on this issue. The regression on only these observations shows a substantially larger relative effect for intentional sequential reciprocity:

EFFORT = (Individual dummies) + **.00712*WAGE + .00430*DUMMY*WAGE**
                                             (14.1)   (4.30)

                363 observations   Log-likelihood = -551.708

The coefficient for τ is significantly positive, with $p < .001$. This regression suggests that 38% of the observed positive slope can be attributed to reciprocity.

In both of these regressions, there is a concern that the effort choices may be serially correlated and therefore not independent. One test for serial correlation in a fixed effects model is to test whether a lagged independent variable significantly affects the dependent variable (Heckman, 1981). Here we can test if the previous period's wage influences the effort choice. The two-sided Tobit fixed-effects regression on all 549 observations for periods 2-10:

EFFORT = (Individual dummies) + **.01024*WAGE + .00034*LAGWAGE**
                                             (21.7)   (0.73)

                549 observations   Log-likelihood = -608.750

The coefficient for the lagged wage is not significant. Running this test on only the corresponding observations for employer-generated wages, we have:

EFFORT = (Individual dummies) + **.01273*WAGE - .00005*LAGWAGE**
                                             (12.0)   (-0.07)

It appears that there is little or no evidence of serial correlation with respect to effort provision.

Some may still not be satisfied with this fixed-effects model. As an alternative, we can perform a nonparametric test on individual employees' behavior across treatments. Here this approach treats each individual's actions as one data point. Each employee's effort/wage slope is estimated for his or her ten observations, using a two-sided Tobit regression. A Wilcoxon rank-order test (see Siegel and Castellan, 1988) on these estimated slopes finds a difference significant at p = .05. (W_x = 574 for the 22 employees in the intentionality condition $\Rightarrow$ z = 1.622). Thus, even the possibly less efficient nonparametric test, which discards size and only retains order, confirms statistical significance for the difference in slopes across treatments.

There was a surprising phenomenon with random wage-determination. Here, when the wage was 20, subjects voluntarily chose a <u>negative</u> payoff in 5 cases of 22 (23%), opting to greatly enhance a blameless employer's payoffs at a small personal cost.[13] Such behavior is in conflict with the influence of loss-aversion and, along with the intentionality effect, is not predicted by existing models of comparative payoffs. While Bolton and Ockenfels (1997) and Fehr and Schmidt (1997) can explain the positive effort/wage slope, these models expect a person to never be generous when all choices result in lower comparative payoffs.[14]

Finally, it is interesting to check whether employers learn to offer their payoff-maximizing optimal wage. While the data is not conclusive at conventional standard levels of statistical significance, there does appear to be movement in this direction; perhaps 10 periods is insufficient for adequate learning. Appendix D shows the relationship over time.

---

[13] Note that, in the third-party treatent, voluntary negative earnings occurred only in 1 of 15 cases when the wage was 20 (and never occurred when the employer set the wage at 20). Apparently, this charitable impulse is muted if it is possible to consider a person responsible for the wage determination.

[14] Given these payoff parameters, this was only possible when the wage was less than 30.

Discussion

A potentially serious concern is whether the results might be caused by repeated game effects. For example, one explanation for costly effort provision is that employees are attempting to develop a reputation, either for themselves or for the group of employees as a whole. Even though the structure of the experiment would seem to rule out individual reputations, it could still be the case that a subject would attempt to develop one. We can check this by testing for changes in subjects' choices over time, as reputation effects should diminish sharply near the end of a session. Graphs of effort measures over time are presented in Appendix C. Two tests of period effects using OLS regressions give the following results:

Employer-generated wages
EFFORT = .3015 + .001381*PERIOD   RATIO = .00620 - .0000380*PERIOD
               (0.473)   (-0.686)

Exogenous wages
EFFORT = .3338 + .000094*PERIOD   RATIO = .00635 - .0000342*PERIOD
               (0.040)   (-0.567)

Effort increases very slightly with time in both treatments, at a statistically insignificant rate. A better test is to look at the ratio of non-minimal effort to non-minimal wage, where RATIO = (EFFORT - .1)/(WAGE - 20). Here we see that there is a very slight decline in the ratio over time in both treatments. In no case are the slope t-statistics close to significance and it is clear that the difference across treatments is not significant. While one cannot be certain that no subject was trying to establish a reputation (even with a bingo cage), the lack of a substantial time trend and the comparison across regressions provides no evidence for reputation effects.

Although the values of β may appear small,[15] they lead to dramatic differences in effort level and consequent employer profits over the wage range. In the employer case, the expected value for effort given a wage of 45 is .13. In contrast, with an assigned wage of 75, the expected effort is .42. When an employer assigns a wage of 75, her expected earnings of 19

---

[15] By comparison, in Fehr et al (1998), values for β ranged from .0035 to .0087, depending on the regression and treatment. Given that employees could not reject wages in my experiment, one should expect β to be higher here.

guilders (calculated using the fitted values for α and β from Table 1) are nearly double her expected earnings of 10 guilders when she chooses a wage of 20. The results from the employer treatment indicate that employer profits were in fact highest when the wage was 70, while the fitted values tell us that the profit-maximizing wage should be 74.9. The money-maximizing model would recommend selecting the minimum wage of 20.

The proportion of the effort/wage gradient that is a direct consequence of reciprocity is estimated at 20-35%. This may seem unrealistically low to some; however, this calibration must be viewed with caution, since the relative size of the components of the positive effort/wage slope is likely to be sensitive to the functional form of the monetary payoffs. In addition, the effort choice reflects the credibility of the causal attribution. One might expect this effect to be stronger in the field, where actions in a real labor market are perhaps more salient and credible than in an artificial laboratory environment.[16]

The positive effort/wage slope in all cases might be expected by some and is seen in the volitional case in Fehr et al (1993) and Fehr et al (1998). However, it is not the prediction that would be made by a number of economic models, even some that acknowledge the influence of fairness. The money-maximizing model would predict a complete lack of costly effort provision. The Bolton (1991) model captures the importance of comparative payoffs, but does not explain non-minimal effort at high wages, as one should never wish to decrease one's relative share. Assumption 4 of this model states (p. 1110) that "if a bargainer receives a share larger than or equal to the share received by his partner, the only way to make him better off is to increase his money holdings." An employee who receives a wage of at least 30 can guarantee a payoff greater than that of the employer by choosing minimum effort and so can be considered to be "endowed" with a default higher monetary payoff. Thus, even an employee given a very generous wage by an employer could not increase his utility by exerting any costly effort. The Rabin (1993) model predicts the volitional effects, but since the psychological payoffs (and the

---

16 There is evidence that reciprocity is a learned phenomenon and that it is stronger in a homogeneous population. The considerable heterogeneity and the relative lack of work experience of the subject pool might indicate the proportion found here is a lower bound.

utility incentive to sacrifice monetary payoffs) are induced only when player have a choice of actions, it predicts minimum effort and a slope of 0 with exogenous wages.   There is no doubt that comparative payoffs are important, but it would appear that reciprocal altruism plays a key role as well. The Bolton and Ockenfels (1997) and Fehr and Schmidt (1997) focus on distributive effects.   In principle, these models can readily account for most of the data. However, both models rule out a role for intentionality, although Fehr and Schmidt (p. 30) admit this may not be realistic.   The significant difference in slopes found here cannot be explained by either approach.   In addition, the poor do sometimes give to the rich, in contradistinction to the Fehr and Schmidt assertion.[17] We may observe altruism (at favorable transformation rates) even when comparative payoffs rule it out. Charness (1998) is an attempt to generalize these distributive models to include reciprocal altruism.

In any event, the results indicate that an individual is, in many situations, willing to contribute a portion of her monetary payoff in order to increase another's payoffs.   The willingness to do so at any specified exchange rate depends on the payoffs which would be the consequence of one's choice. When the employer does not determine the wage, this cannot be viewed as reciprocal altruism, but instead reflects distributive concerns.

While it is difficult to accurately assess the economic significance of the prediction errors of the more recent preference theories, the impact seems greatest at the extremes of the wage distribution.   At the high end, the comparative payoff models underestimate the likely productivity with intentional high wages.[18] Productivity could be 10-20% higher if a high wage is perceived to be a voluntary gift. On the low end, it may seem that, regardless of the wage-generation method, there is generally minimum effort with low wages. However, in a natural setting, a worker may be able to exert "negative effort" if resentful, in the sense of sabotage or

---

[17] For example, a poor person might hold an elevator door for a rich person hurrying to catch the elevator or a poor person might rescue a rich person's baby from danger.

[18] The nature of the payoff function in the traditional gift-exchange experiment hinders the effectiveness of high effort, as the effective transformation rate from increased effort into higher employer payoffs declines substantially in the upper wage ranges. For example, at a wage of 60, a marginal unit of effort is worth 6 to the employer, while at a wage of 100, it is only worth 2. With a wage of 120, nothing can help the employer financially.

unobserved shirking. Given that monitoring is expensive and imperfect, it can be costly for a firm to be considered to be taking advantage of its employees. The economic consequences of resentment and sabotage could be substantial.

4. CONCLUSION

There is little doubt that pecuniary concerns are the most important factor in most economic choices made. However, as is suggested by Kahneman, Knetsch, and Thaler (1986) and A&Y, fairness considerations cannot be ignored in socio-economic environments. In this experiment, we see costly effort provision, the extent of which depends on both the wage and the mechanism for its determination. Distributive concerns have a large role here, but the hypothesis of reciprocity is also well-supported by the results. The slope of the effort/wage profile in the self-interested volitional case is substantially larger than the slope when wages are exogenous - an employer receives greater rewards for high wages and more "punishment" for low wages when the employer chooses the wage. The difference in the effort/wage slope reflects both positive and negative reciprocity: we see that when wages are employer-determined, employees provide more effort at high wages and consistently minimal effort at low wages. This result ties in with experiments in the psychology literature.

If we believe that reciprocal altruism is an important factor, there are some potential policy implications. One prediction is that workers will not respond as well to a higher wage if it is imposed by an external agency or is perceived to have been extracted from the employer by union pressure as they would if this same wage is voluntarily employer-generated. We also see that considerations of fairness act as constraints on profit-seeking. An employer who selects the minimum wage has, on average, much lower income than one who chooses a wage of 70. The results also suggest that it is beneficial for a firm to credibly signal its "good intentions," where they exist. Parties' intentions can be key in negotiations and dispute resolution, with the "settlement range" potentially affected: if dispositions are important in the utility function,

mutually positive dispositions will increase the settlement range; negative ones will shrink it.[19] The procedural justice literature gives evidence that the process (and, by inference, intentions) can be as important as the outcome in the resolution of a dispute.[20]

In summary, this paper has reported the results of an experiment designed to explore the importance of causal attribution for the effort levels chosen by employees in a simulated labor market. While effort/wage slopes are always positive, indicating the importance of distributive concerns, reciprocal altruism is found to be a significant factor and accounts for perhaps 20-35% of the positive slope observed. People respond with more effort when they feel they are being intentionally well-treated and less when they perceive poor treatment. The evidence presented helps to foster a better understanding of individual choice behavior in environments featuring a high degree of interpersonal interaction.

REFERENCES

Akerlof, G., "Labor Contracts as Partial Gift-Exchange," Quarterly Journal of Economics, 1982, **97**, 543-569

Akerlof, G. and J. Yellen, "The Fair Wage-Effort Hypothesis and Unemployment," Quarterly Journal of Economics, 1990, **105**, 255-283

Blount, S., "When Social Outcomes Aren't Fair: The Effect of Causal Attributions on Preferences," Organizational Behavior and Human Decision Processes, 1995, **63**, 131-144

Bolton, G., "A Comparative Model of Bargaining: Theory and Evidence," American Economic Review, 1991, **81**, 1096-1136

Bolton, G. and A. Ockenfels, "ERC: A Theory of Equity, Reciprocity, and Competition," 1997, mimeo

Charness, G., "Alternative Dispute Resolution and the Settlement Gap," in Dispute Resolution: Bridging the Settlement Gap, 1996, D. Anderson, ed., 205-235

---

[19] This is treated in Charness (1996).

[20] See, for example, Tyler (1988).

Charness, G., "A Model of Altruism, Reciprocity, and Intentionality," 1998, mimeo

Dufwenberg, M. and G. Kirchsteiger, "A Theory of Sequential Reciprocity," CentER Discussion Paper #9837, 1998

Fehr, E., E. Kirchler, A. Weichbold, and S. Gachter, "When Social Forces Overpower Competition: Gift Exchange in Experimental Labor Markets," Journal of Labor Economics, 1998, **16**, 324-351

Fehr, E., G. Kirchsteiger, and A. Riedl, "Does Fairness Prevent Market Clearing? An Experimental Investigation," Quarterly Journal of Economics, 1993, **108**, pp. 437-459

Fehr, E. and K. Schmidt, "A Theory of Fairness, Competition, and Cooperation," mimeo, 1997

Goranson, R. and L. Berkowitz, "Reciprocity and Responsibility Reactions to Prior Help," Journal of Personality and Social Psychology, 1966, **3**, 227-232
Greenberg, M. and D. Frisch, "Effect of Intentionality on Willingness to Return a Favor," Journal of Experimental Social Psychology, 1972, **8**, 99-111

Heckman, J., XXXX, in Structural Analysis of Discrete Data with Econometric Applications, D. McFadden and C. Manski, eds., 1981

Heider, F., The Psychology of Interpersonal Relations, 1958

Kahn, A. and T. Tice, "Returning a Favor and Retaliating Harm: The Effects of Stated Intentions and Actual Behavior," Journal of Experimental Social Psychology, 1973, **9**, 43-56

Kahneman, D., J. Knetsch, and R. Thaler, "Fairness as a Constraint on Profit-Seeking: Entitlements in the Market," American Economic Review, 1986, **76**, pp. 728-741

Kelley, H., "Attribution in Social Interaction," in Jones et al, Attribution: Perceiving the Causes of Behavior, 1971, 1-26

Kelley, H. and A. Stahelski, "Errors in Perception of Intentions in a Mixed-Motive Game," Journal of Experimental Social Psychology, 1970, **6**, 379-400

Ochs, J. and A. Roth, "An Experimental Study of Sequential Bargaining," <u>American Economic Review</u>, 1989, **79**, 354-384

Rabin, M., "Incorporating Fairness into Game Theory and Economics," <u>American Economic Review</u>, 1993, **83**, 1281-1302

Siegel, S. and N. Castellan, <u>Nonparametric Statistics for the Behavioral Sciences</u>, 1988

Thibaut, J. and H. Riecken, "Some Determinants and Consequences of the Perception of Social Causality, <u>Journal of Personality,</u> 1955, **24**, 113-133

Thomas, G. and D. Batson, "Effect of Helping under Normative Pressure on Self-Perceived Altruism," <u>Social Psychology Quarterly</u>, 1981, **44**, 127-131

Tyler, T., "What Is Procedural Justice? Criteria Used by Citizens to Assess the Fairness of Legal Procedures," <u>Law and Society Review</u>, 1988, **22**, 103-135

APPENDIX A: EXPERIMENTAL INSTRUCTIONS

<u>You are an employee</u>

GENERAL INFORMATION FOR EMPLOYEES

You will be taking part in a study of the labor market. This research is being funded by the Vice Chancellor for Research at UC - Berkeley. If you read these instructions carefully, you may earn a significant sum of money. During the experiment your income will be calculated in Guilders. At the end of the experiment, Guilders will be converted into dollars at the rate of:

25 Guilders = $1

You will also receive a $5 payment for showing up for the experiment on time. At the end of the experiment your income will be paid to you in cash.

<u>Stage 1</u>: Each of the participants will be randomly assigned to one of two groups: half will be "employees" and half will be "employers". This is known by each participant. Whether you are an employer or an employee is noted at the top right hand corner of this page. [**Employer-generated wages:** At the first stage employers offer employees wages. **Randomly-generated wages:** At the first stage employees will be offered wages. These wage offers will be randomly determined by draws from a bingo cage. **Third-party generated wages:** At the first stage employees will be offered wages. These wage offers are determined by a neutral third-party.]

18

Employees must accept a wage offer, which must be at least 20 Coupons. After 3 minutes the second stage begins.

Stage 2: At the second stage, each employee makes a decision. According to the procedure described below, they determine how much they work (quantity or amount of work).

Attached to these instructions you will find decision-sheets on which you must record the wage. Furthermore, you will record the amount of work which you have chosen. After this you will calculate the income you have earned. At this point the first period of the labor market will be over. Overall, there will be ten periods in this experiment. You will generally be matched exactly once with each person in the employer group. You will never be matched with the same person in successive periods. Further, you will not know with whom you have been matched in any of the periods. Your total income for the participation in this market will be the sum of the earnings in each of the ten periods.

How the Labor Market Works

1. At the beginning of each period we will open the labor market. In the first stage of the labor market each employer may offer a wage to an employee. This employee must accept this wage offer, forming a labor contract with the employer.

2. You must **immediately record the wage on the decision sheet for that period**.

3. You will have travel costs of 20 Guilders, which are subtracted from your wage..

4. **No employer will know with which employee s/he has concluded a contract, and no employer will know the employee**.

5. After all wage offers are collected, the second stage begins. After seeing a wage offer, you must now choose a quantity of work. We will then relay your chosen quantity of work to your employer. Please do not tell anyone what quantity of work you chose. No other employee and no other employer will be informed about your chosen quantity of work.

How do you Calculate Your Income in Each Period?

1. You will receive the wage you have accepted. From this wage you must then subtract the travel costs and the costs of your amount of work.

2. You determine your quantity of work by choosing a number between 0.1 and 1.0 from the schedule below. The lowest amount of work you can choose is 0.1, 0.2 is a slightly higher amount, and so on up to 1.0, the highest amount.

3. The higher the quantity of work you choose, the better it is for your employer. The higher the number you choose, that is, the quantity of work, the higher "your" employer's income.

4. The higher the amount of work you choose the higher your work related costs will be. You can find out how these costs are related to quantity of work by looking in the schedule below.

5. Your income in Guilders will be determined by the following formula:

Income(4) = Wage(1) - Costs of Quantity of Work(2) - Travel Costs(3)

Schedule of feasible amounts of work (AW) and corresponding
work related costs to employees (COST)

AW	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
COST	0	1	2	4	6	8	10	12	15	18

How do you Calculate the Income of Your Employer in Each Period?

1. Each employer receives from the experimenter 120 coupons which he may use to pay for wages. If s/he offers you a wage of 120 Guilders, then s/he will have no income coupons left. If s/he offers you a wage of 20 Guilders then s/he will have 100 income coupons left. In general, your employer will have

120 coupons - wage

income coupons left.

2. How are the remaining coupons converted into Guilders? The number of coupons retained by the employer, whose wage offer you accepted, is multiplied by the quantity of work you choose. This result is the income of your employer in Guilders. Thus:

Employer's Income in Guilders = Coupons Retained x Quantity of Work

Please Note: The income of all employees and employers will be computed according to the same rules. Every employer has 120 Coupons and the work related cost-schedule as well as the travel costs are the same for every employee. Every employer is able to compute the income of "his" or "her" employee, and every employee is able to compute the income of "his" or "her" employer.

Let's Have an Exercise

1. Let's assume that an employer, who has 120 Coupons, offers a wage of 110 Guilders, which you accept. At the second stage of this period you choose a quantity of work of 0.5.

What will your income and the income of your employer be?

       My Income   = ... Guilders

       Employer's Income   = ... Guilders

2. Let's assume that an employer, who has 120 Coupons, offers a wage of 28 Guilders, which you accept. At the second stage of this period you choose a quantity of work of 0.6.

What will your income and the income of your employer be?

       My Income   = ... Guilders

       Employer's Income   = ... Guilders

3. Now let's assume again that an employer, who has 120 Coupons, offers a wage of 28 Guilders, which you accept. However, suppose that at the second stage of this period you now choose a quantity of work of 0.1.

What will your income and the income of your employer be?

       My Income   = ... Guilders

       Employer's Income   = ... Guilders

Schedule of feasible amounts of work (AW) and corresponding
work related costs to employees (COST)

AW	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
COST	0	1	2	4	6	8	10	12	15	18

23

Employee Number:

Period Number:

Wage (1)   ....

Amount of Work Chosen   ....

Cost of Amount of Work Chosen (2)   ....

Travel Costs (3)   20 Guilders

Your Income in Guilders (4)   .... Guilders

Employer's Income in Guilders   =   (120 Coupons - Wage) x Amount of Work Chosen

----

Employees will choose one of the feasible amounts of work (AW) from the first row. The higher the number, the higher the amount of work.

The second row of the schedule shows the cost of each amount of work (COST) for the employee. The higher the amount of work, the higher the costs to the employee.

<div align="center">

Schedule of feasible amounts of work (AW) and corresponding
work related costs to employees (COST)

</div>

AW	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
COST	0	1	2	4	6	8	10	12	15	18

GENERAL INFORMATION FOR EMPLOYERS

You will be taking part in the study of the labor market. This research is being funded by the Vice Chancellor for Research at UC - Berkeley. If you read these instructions carefully, you may earn a significant sum of money. During the experiment your income will be calculated in Guilders. At the end of the experiment, Guilders will be converted into dollars at the rate of:

$$25 \text{ Guilders} = \$1$$

You will also receive a $5 payment for showing up for the experiment on time. At the end of the experiment your income will be paid to you in cash.

Stage 1: Each of the participants will be randomly assigned to one of two groups: half will be "employees" and half will be "employers". This is known by each participant. Whether you are an employer or an employee is noted at the top right hand corner of this page. [**Employer-generated wages:** At the first stage employers offer employees wages. **Randomly-generated wages:** At the first stage employees will be offered wages. These wage offers will be randomly determined by draws from a bingo cage. **Third-party generated wages:** At the first stage employees will be offered wages. These wage offers are determined by a neutral third-party.] Employees must accept a wage offer, which must be at least 20 Coupons. After 3 minutes the second stage begins.

Stage 2: At the second stage, each employee makes a decision. According to the procedure described below, they determine how much they work (quantity or amount of work).

Attached to these instructions you will find decision-sheets on which you must record the wage you have offered. Furthermore, you will record the amount of work that the employee has chosen. After this you will calculate the income you have earned. At this point the first period of the labor market will be over. Overall, there will be ten periods in this experiment. You will generally be matched exactly once with each person in the employer group. You will never be matched with the same person in successive periods. Further, you will not know with whom you have been matched in any of the periods. Your total income for the participation in this market will be the sum of the earnings in each of the ten periods.

How the Labor Market Works

1. At the beginning of each period we will open the labor market. In the first stage of the labor market each employer may offer a wage to an employee. This employee must accept this wage offer, forming a labor contract. **Wage offers must be no less than 20 Guilders and no more than 120 Guilders**.

2. You must **immediately record this wage on the decision sheet for that period**.

3. Each employee has to bear travel costs of 20 Guilders.

4. **No employer will know with which employee s/he has concluded a contract, and no employer will know the employee**.

5. After all wage offers are collected, the second stage begins. Now employees must choose a quantity of work. We will then relay "your" employee's chosen quantity of work to you. Please do not tell anyone what quantity of work s/he chose. No other employee and no other employer will be informed about the quantity of work "your" employee has chosen.

.

How do you Calculate Your Employee's Income in Each Period?

1. An employee will receive the wage s/he has accepted. From this wage s/he must, however, subtract the travel costs of 20 Guilders and the costs of the quantity of work s/he has chosen.

3. Employees determine their quantity of work by choosing a number between 0.1 and 1.0 from the schedule below. The lowest amount of work you can choose is 0.1, 0.2 is a slightly higher amount, and so on up to 1.0, the highest amount.

3. The higher the quantity of work s/he chooses, the better it is for you. The higher the number s/he chooses, that is, the quantity of work, the higher your income.

4. The higher the amount of work s/he chooses, the higher the work related costs will be. You can find out an employee's work related costs by looking in the schedule below.

5. An employee's income in Guilders will be determined by the following formula:

Income(4) = Wage(1) - Costs of Quantity of Work(2) - Travel Costs(3)

Schedule of feasible amounts of work (AW) and corresponding
work related costs to employees (COST)

AW	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
COST	0	1	2	4	6	8	10	12	15	18

How do you Calculate Your Income in Each Period?

1. You will receive from the experimenter 120 coupons which you may use to pay wages. If you offer a wage of 120 Guilders, then you will have no income coupons left. If you offer a wage of 20 Guilders then you will have 100 income coupons left. In general, you will have

120 coupons - wage

income coupons left.

2. How are the remaining coupons converted into Guilders? The number of coupons retained by you is multiplied by the quantity of work your employee has chosen. This result is your income in Guilders. Thus:

Your Income in Guilders(4) = {# of Coupons(1) - Wage(2)} x Quantity of Work(3)

Please Note: The income of all employees and employers will be computed according to the same rules. Every employer has 120 Coupons and the work related cost-schedule as well as the travel costs are the same for every employee. Every employer is able to compute the income of "his" or "her" employee, and every employee is able to compute the income of "his" or "her" employer.

Let's Have an Exercise

1. Let's assume that you used your 120 Coupons to offer a wage of 110 Guilders, which is accepted. At the second stage of this period this employee chooses a quantity of work of 0.5.

What will your income and the income of your employee be?

      My Income   = ... Guilders

      Employee's Income   = ... Guilders

2. Let's assume that you used your 120 Coupons to offer a wage of 28 Guilders, which is accepted. At the second stage of this period this employee chooses a quantity of work of 0.6.

What will your income and the income of your employee be?

      My Income   = ... Guilders

      Employee's Income   = ... Guilders

3. Now let's assume again that you used your 120 Coupons to offer a wage of 28 Guilders, which is accepted. However, suppose that at the second stage of this period this employee now chooses a quantity of work of 0.1.

What will your income and the income of your employer be?

      My Income   = ... Guilders

      Employer's Income   = ... Guilders

Schedule of feasible amounts of work (AW) and corresponding
work related costs to employees (COST)

AW	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
COST	0	1	2	4	6	8	10	12	15	18

29

Employer Number:

Period Number:

# of Coupons (1)	120
Wage (2)	....
Amount of Work Chosen by	....
Your Income in Guilders (4)	.... Guilders

Travel Costs   =   20 Guilders

Employee's Income in Guilders   =   Wage - Costs of Amount of Work Chosen - Travel Costs

----

Employees will choose one of the feasible amounts of work (AW) from the first row. The higher the number, the higher the amount of work.

The second row of the schedule shows the cost of each amount of work (COST) for the employee. The higher the amount of work, the higher the costs to the employee.

Schedule of feasible amounts of work (AW) and corresponding
work related costs to employees (COST)

AW	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
COST	0	1	2	4	6	8	10	12	15	18

APPENDIX B- Wage/effort pairs

Employer-generated wages

					Effort					
Wage	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
20	30									
21	5									
22	1									
25	5									
30	6									
35	1		1							
37		1								
40	7	13	4	1						1
45		3								
50	7	1	7	4						1
55	2			3						
60	9	3	2	10	6	5				
61				1						
65	1	1	1	1			1			
70	6		2	1	5	5	6	2	2	
75	3		1	2			1	1		
79	1						1			
80	5		1		2		2		1	2
85	3									
90	3						2			1
92	1									
94	1									
95			1				1	1		
97	1									
98										1
99								1		
100	2						1			1
101										1
105							1			

Random-generated wages

					Effort					
Wage	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
20	17	3	2							
25	2		1	1						1
30	2									
35	2	2								
40	9	1	3							2
45	5	2			1					
50	4	1	2	3		1				2

Wage	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
55		1		1					1	
60	10	4	7	10	5		1		1	3
65	1		2							1
70	8	4	1	2	7		4	1		1
75	4	3		1	2	3		2		
80	4	1	4	3	1	1	4	1	1	
85						2	1	1		
90	2					1		2	1	

Third-party-generated wages

Effort

Wage	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
20	14		1							
25	3		2							
30	1	2								
35	7		1		1					
40	9	3	4	1						
45	1	2	3	2						
50	3		4	5			2			
55	2			1						
60	13	2	4	7	14	2	1			
65			2	1		1				
70	10	2	2	5	10	2			2	
75	2	2	2	1	1	2	3			
80	10			1	2	2	7			1
85	1			1		1	1	1		
90	1			1		2	1			

Results by wage bracket

Wage range	Average effort					
	Employer		Random		Third party	
		N		N		N
20-29	.1000	41	.1778	27	.1300	20
30-39	.1333	9	.1333	6	.1833	12
40-49	.2241	25	.2348	23	.2120	25
50-59	.2880	29	.4062	16	.3235	17
60-69	.3561	41	.3711	45	.3489	47
70-79	.4718	39	.3954	43	.3848	46
80-89	.4000	16	.4708	24	.4393	28
90+	.5200	20	.5500	6	.4800	5
Total	.3127	220	.3463	190	.3220	200

Wage range			Average effort			
	Employer		Random		Third party	
		N		N		N
20-39	.1060	50	.1697	33	.1500	32
40-59	.2537	54	.3051	39	.2571	42
60-79	.4125	80	.3829	88	.3667	93
80+	.4667	36	.4867	30	.4455	33
Total	.3127	220	.3463	190	.3220	200

APPENDIX C -PERIOD EFFECTS

Average effort by period
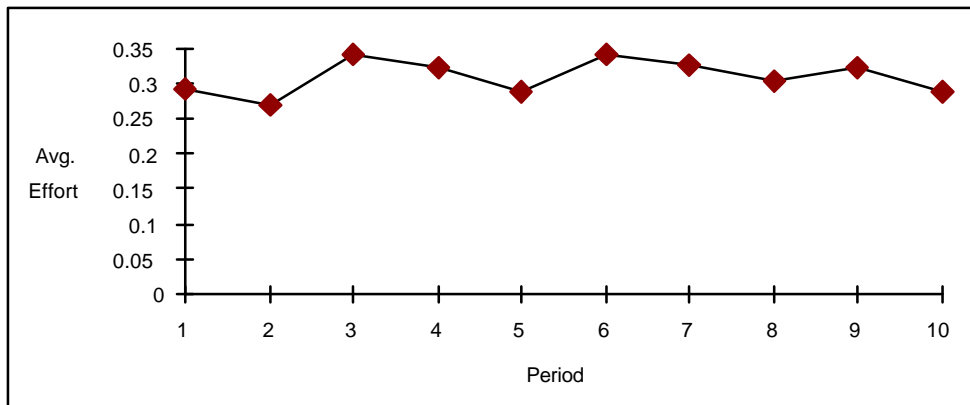
Effort/wage ratio by period
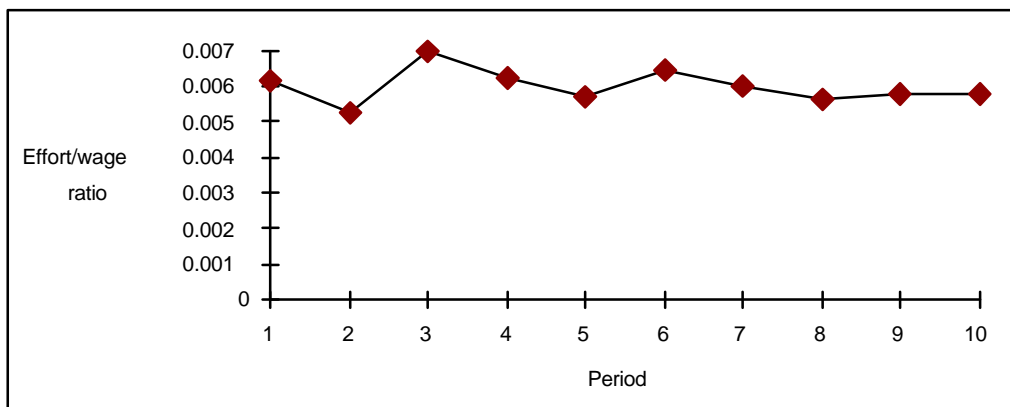
If reputation were important in effort determination, we should expect effort, or the (effort - .1)/(wage - 20) ratio, to decrease over time.

Time Trends

Period	Avg. Wage Intentional	Avg. Effort Intentional	(Effort - .1)/ (Wage - 20) Intentional	Avg. Wage Non-Intentional	Avg. Effort Non-Intentional	(Effort - .1)/ (Wage - 20) Non-Intentional
1	51.2	.2909	.00612	58.1	.3513	.00660
2	52.0	.2682	.00526	57.6	.3333	.00621
3	54.6	.3409	.00697	57.3	.3180	.00584
4	55.8	.3227	.00623	56.8	.3513	.00683
5	52.8	.2864	.00569	57.7	.3231	.00592
6	57.2	.3409	.00647	55.9	.3000	.00557
7	57.7	.3273	.00603	56.7	.3154	.00587
8	56.6	.3046	.00559	53.3	.3359	.00708
9	58.4	.3227	.00580	56.7	.3026	.00552
10	52.4	.2864	.00575	64.4	.3744	.00618

APPENDIX D -LEARNING EFFECTS

	Period									
	1	2	3	4	5	6	7	8	9	10
Avg. wage	51.2	52.0	54.6	55.8	52.8	57.2	57.7	56.6	58.4	52.4

Average wage by period
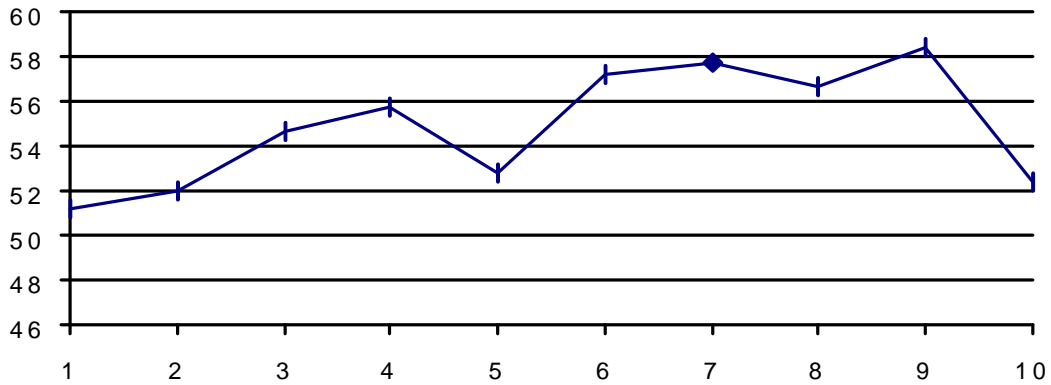
The wages do appear to be generally increasing over time and thus approaching the optimal wage. A regression of average wage against period gives a t-statistic for the period coefficient of 0.86, n.s.

An informal survey was conducted with 5 employers in a bingo cage session. In the last period, they were asked to state what wage they would choose if they could. These subjects specified wage levels of 60, 60, 60, 65, and 75.