

Role of Relative Information and Reciprocity in a Gift Exchange Game: An Experimental Study

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Abstract: Workers' reciprocity in a simple gift exchange game has been demonstrated in prior research to be a problem of enforcement. This paper showed that potential future interactions could not motivate the workers significantly because of assurance problems. Lack of information about employers' relative reciprocal type made workers reluctant to cooperate. Three experimental treatments were conducted to investigate effort patterns. The design was replicated from the paper Kean Siang *et al* (2010). It was found that workers' efforts, between those with and without repetition effect, were not significantly different. Workers did not cooperate much even when there was enforcement. The low effort problem was overcome when workers were able to judge the relative reciprocal type of the employer by comparing the current wage with the average wage. It was found that workers responded better to average wages than to current wages, and were significantly more cooperative.

I. INTRODUCTION

Generally the gift exchange game exhibits the characteristic of cooperation between employer and worker. The important feature of the game is the reciprocal type of the partner. There has been considerable research on repeated interaction, which assumes that future interaction enforces current effort (see for example in Gächter and Falk (2000), Fehr and Schmidt (1999), Fehr *et al.* (1997), Fehr *et al.* (1993), Simon and Fehr (2000)). The lack of enforcement, however, is not the only potential source of low cooperation in a gift exchange game. The worker will have an incentive to work harder if he is guaranteed that his efforts will be reciprocated. An environment with cooperation incentive but without guarantee is said to exhibit assurance problems (Issac *et al.* 1989).

The lack of information about the other partner's reciprocity discourages cooperation. When deciding on their effort level, workers face two important concerns: on one hand, if the employer imitates reciprocity strategically by increasing wages marginally to induce cooperation, workers will experience low profits; conversely, minimal effort levels induce

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low wage levels from the employer. Therefore, if the employee does not know the relative performance of employer, it is not assured that employer will reciprocate, nor that the employee will exert a low effort level.

This article examines the cooperation of workers. It extends the experimental design of Gächter and Falk to include average wage as a focal point so that workers can compare it with their own wages. The average wage also provides an idea of relative reciprocal type of the employer compared with other employers. Specifically, the average wage creates competition among employers; employees can observe the relative reciprocal type of employer if the offered wage level is lower than the average wage, before deciding on their effort level. Therefore, average wage information plays the role of enforcement device for the worker.

The change to average wage treatment should improve the cooperation between worker and employer. In this treatment, low offers are no longer a dominant strategy for worker or employer, as it is Pareto-dominated by the higher offer. The average wage serves as a focal point for employees to evaluate the type of employer with which they are dealing. Another reason is that the worker can be more confident as they can know whether they are being treated fairly, based on the comparison between the wage they received and the average wage.

Focal-point hypothesis has been tested in other set-ups. Among the pioneer papers are Issac *et al.* (1989), who tested the hypothesis in a Voluntary Contribution Game. In the experiment, players can observe the provisional point agreed by players through signalling and communication. Comparing the contribution between two treatments, contribution in the treatment with provisional point is significantly higher than the contribution in the treatment without provisional point. In other relevant papers by Kahneman *et al.* (1986) and Hoffman *et al.* (1994), they employ the observability of the provisional points to invoke equity concerns among players in an ultimatum game. Players formed expectation and demand a higher share when they believe they have ‘earned the right’.

The cooperation in the gift exchange game is usually tested by partner treatment, in which players meet the same partners more than once. The role of relative information mentioned above has not been tested. The closest analysis to our paper is by Gächter *et al.* (2002). In their paper, the overall effort levels increase significantly as the players can observe market effort. In another paper by Charness and Kuhn (2007), it was found that there was a limited effect of relative wage on effort level in a random matching treatment. The limited effect may be caused by the lack of enforcement from the same employer. This paper analyses the effect of average wage in a repeated game because in some industries, the average wage rather than market effort is observable.

The paper is organized as follows: Section II describes the experimental designs and procedures and also outlines the research expectations. Section III reports the results of the three treatments. Section IV concludes the paper.

II. EXPERIMENTAL DESIGNS AND PROCEDURES

Based on the model in Gächter and Falk (2002), the gift exchange game is a typical sequential game with the employer making moves first to offer a wage level to a worker. In the second stage, the worker can decide whether to accept or reject the offer. The decisions are known

only to the partners. If the wage is rejected, both players earn zero profit for the round. In total there are 10 rounds of interactions. If the worker accepts the offer, he has to decide how much to work for the employer.

In the experiment, both players know the profit function of their partner. The profit function of the employer is determined by,

$$\pi = (v - w)e \quad (1)$$

where v refers to some exogenously given value, w is wage offered to a worker and e is effort level exerted by the worker.

A worker's pay-off is the difference between the wage (w) and the incurred effort costs $C(e)$, minus the fixed travel cost of 20 unit of experimental money:

$$U = w - C(e) - 20 \quad (2)$$

In the experiment, $v = 120$, and wage offer has to be an integer number from 20 to 120 inclusive. The effort level and the associated costs are exhibited in *Table 1*.

Table 1: Effort Levels and the Associated Costs

Effort (e)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$C(e)$	0	1	2	4	6	8	10	12	15	18

Upon entering the experimental lab, the subjects were assigned randomly to the role of 'employer' and 'worker' and each was assigned randomly to a computer cubicle in two separate different rooms. The 'workers' and the 'employers' were then given about 7 minutes to read the instructions, which included a set of questions to calculate the pay-off of both worker and employer. The experimenter then announced the procedures during the experiment and answered the questions raised. The experiment was conducted in an economics experimental lab in the School of Social Sciences, Universiti Sains Malaysia. The experiment was programmed and conducted with the software z-Tree (Fischbacher 2007).

The three treatments are explained as follows:

1. *Stranger*. The subjects were paired randomly with an anonymous partner. Each subject was matched with a different partner after each round. At the end of each round the subjects were given the information about their pay-off and their partner's pay-off before proceeding to next round.

This benchmark treatment will be compared with *partner* treatment to test for repetition effect. Since players meet their partners only once, there should be no strategic reason for reciprocity. The hypothesis in *stranger* is that the effort should be at the minimal level and the relation between wage and effort is low.

If the repetition effect played a role, the effort in *partner* should be significantly higher than the effort in *stranger*, and the relationship between effort and wage should be significant.

2. *Partner*. Each subject interacted with the same anonymous employer throughout the experiment. After making the effort decision, workers were informed of the summary of pay-offs.

This treatment was then compared to *partner with average wage* to test for assurance problem hypothesis. If the hypothesis is true, that workers suffer from assurance problems, then effort should be low and the relationship between wage and effort is not significant in *partner*.

If the source of low effort level is because the worker cannot observe the relative reciprocal type of the employer, then workers do not have the confidence to build reputation to induce wage by exerting high effort. The reputation hypothesis is tested on the difference of effort level between periods 1 and 5 and periods 6 and 0. If workers do not establish their reputation, the effort level between these two periods is not significantly different.

3. *Partner with average wage*. The treatment was similar to *partner*, but with average wage information. The treatment allowed workers to compare wages received with the average wage.

Workers in this treatment can evaluate the relative reciprocal type of employers based on the difference between wage offered and average wage. It is expected that workers reciprocate to wage rent (i.e., $wage(t) - average\ wage(t-1)$) more than the current wage, and effort should be higher when wage rent is positive than when wage rent is negative.

The reciprocity of the workers causes employers to take into account the average wage when deciding on current wages offered. To elicit cooperation from the workers, employers will have to respond to the average wage by offering a current wage which is close to the average wage.

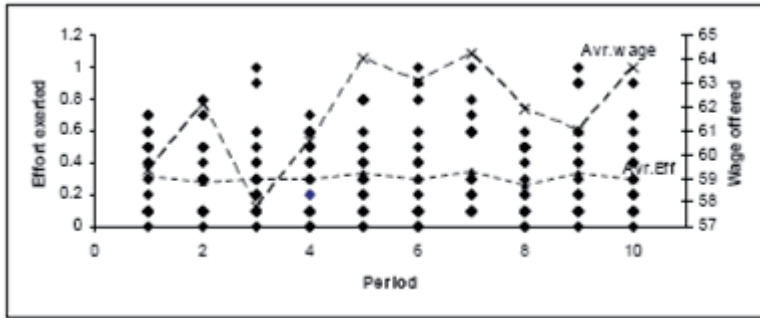
A total of 112 undergraduate students from Universiti Sains Malaysia participated in the experiment: 42 in *stranger*; 48 in *partner*; and 22 in *partner with average wage*. The subjects came from different backgrounds: Economics, Psychology, Chemistry, Biology, Management and Political Science. All the subjects had never participated in any experiments before.

At the beginning of each treatment, subjects were told that they would participate in an economic experiment in which they had to decide how much effort and wages to offer to an anonymous partner. Subjects in all the treatments could not know the type of partner assigned, as matching was done randomly by the computer and they were not allowed to communicate during the experiment. Subjects in the *partner with average wage* treatment were told that the average wage was the sum of all the wages offered by the employers divided by the number of employers, and this was observable to all subjects.

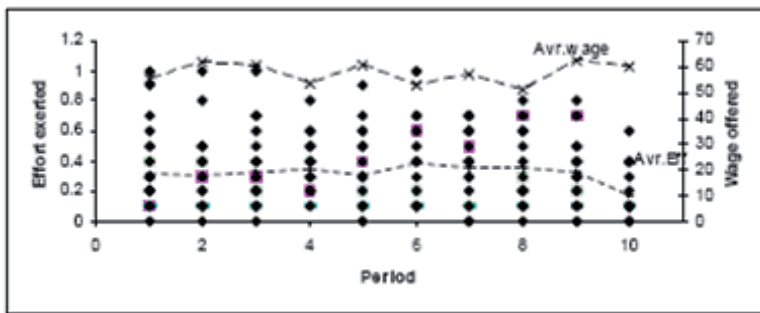
III. EXPERIMENTAL RESULTS

Figure 1 illustrates the data from the three different treatments for all ten periods. The left vertical axis represents the various effort levels, and the right vertical axis represents the wage levels. The dots in the figure are the different effort levels exerted by workers. The first long dotted line represents the average wage, and the second dotted line represents the average effort level.

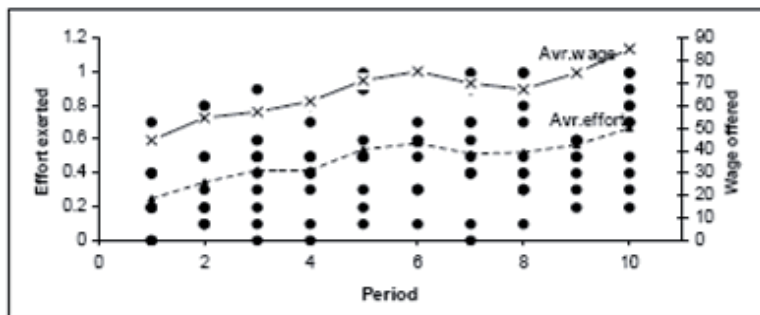
Figure 1: Response of Workers to Wages in Different Treatments



(a) Response of workers in *Stranger*



(b) Response of workers in *Partner*



(c) Response of workers in *Partner with average wage*

Comparing *stranger* and *partner*, the difference in effort is not statistically significant ($p=0.5820$, T-test). The average effort level in *partner with average wage* is significantly different from *partner* ($p=0.0000$). Efforts in both *stranger* and *partner* are static in the 0.3 to 0.35 range and do not respond to different wage levels.

The wage levels in *stranger* and *partner* are susceptible to fluctuation. Repetition effect does not improve the cooperation rate of employer with higher wage levels. The wage levels

fluctuate around the 50 to 60 range in *partner*, compared to the 40 to 90 range in *partner with average wage*. In the latter treatment, the increasing pattern in wage suggests positive relation between wage and effort.

More detail observations for each treatment are as follows:

Observation 1: The absence of relative information causes workers to not reciprocate.

Treatment of *stranger*. When workers and employers only meet once, there is no strategic reason to reciprocate. The effort levels appear to be static across all periods, irrespective of various levels of wage offered by employers. Spearman rank correlation between wage and effort reveals the relation is positive at 0.5015 ($p=0.0000$).

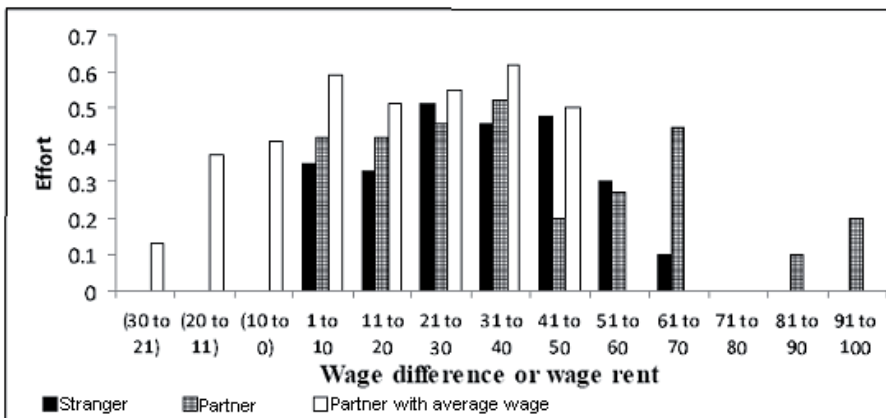
Treatment of *partner*. In the repeated play, workers are not assured that the wage offered is ‘really’ commensurate with the effort exerted, as workers cannot compare it with other wages. The correlation coefficient is 0.5404 and statistically significant ($p=0.0000$).

Treatment of *partner with average wage*. When average wage is observable to the workers, it provides a focal point so workers can compare it with the wage offered.

Spearman rank correlation coefficient reveals the relation between wage rent (own wage (t) – average wage ($t-1$)) and effort is 0.6432 ($p=0.0000$) whereby nine workers reciprocate to wage rent with significance level being less than 5%. The relation between current wage and effort is 0.4555 ($p=0.0000$). This shows that workers react to average wage more than to current wage.

The presence of the average wage eliminates the assurance problem of the workers as employers take into account the average wage when deciding on current wages. Simple Ordinary Least Square regression reveals that w_{t+1} is related positively to average wage (t), with regression coefficient of 0.8972 ($p=0.0000$) in *Partner with average wage* and -0.3609 ($p=0.317$) in *Partner* treatment.

Figure 2: Responses of Workers to Wage Differentials in Stranger, Partner and Partner with Average Sage Treatments



Observation 2: Observability of relative employer type through average wage encourages workers to offer high effort.

Wage difference is calculated as $\Delta w = w_t - w_{t-1}$. *Figure 2* shows the average effort in different ranges of Δw . The Wilcoxon Sign Rank test reveals the average effort when $\Delta w \in [0;30]$ and when $\Delta w \in [31;100]$ is not significantly different in *partner* treatment ($p=0.3841$) or in *stranger* treatment ($p=0.1616$). In the *partner with average wage* treatment, the average effort when wage rent is positive (i.e., $e=0.6016$) is significantly different from effort when wage rent is negative (i.e., $e=0.342$) ($p=0.0000$).

Observation 3: The level of average wage affects the cooperation decision.

Table 2 reports individual decisions by treatment. It is observed that the number of high effort workers does not increase from *stranger* to *partner* treatment, at 18% and 19% respectively. With *partner with average wage*, there is a large decrease in the incidence of low effort and a dramatic increase in high effort.

Table 2: Summary of Number of Effort Levels According to Treatments

	Stranger		Partner		Partner with average wage	
$0 < e < 0.3$ (low)	109	0.51	119	0.49	26	0.23
$0.3 < e < 0.6$ (medium)	63	0.31	74	0.30	44	0.40
$0.6 < e$ (high)	38	0.18	27	0.19	40	0.36

Notes:

'e' represents effort

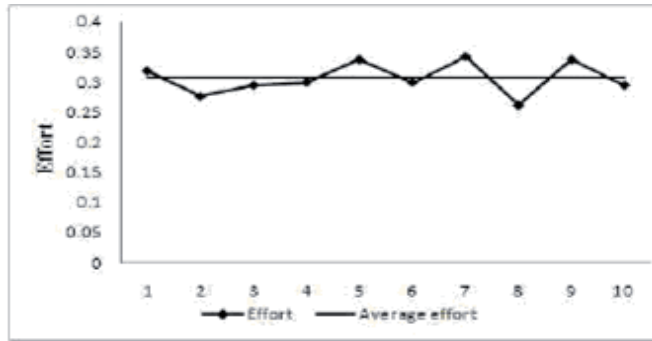
The number on the left hand side of each column represents frequency and the percentage on the right.

Observation 4: The assurance reduces tendency to build reputation.

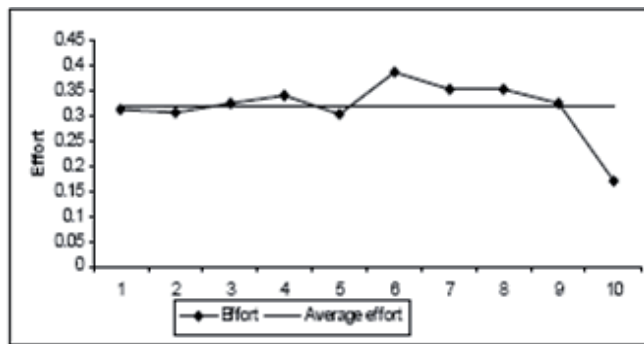
According to Kreps *et al.* (1982) and Andreoni and Miller (1993), in a finitely repeated interaction and when the partner type is not known, a rational player has the incentive to play cooperatively in the initial few rounds to build up a cooperative reputation, and will defect to low cooperation later.

Figure 3 shows the effort data for the three treatments. In *partner*, the effort levels in periods 1–5 is 0.34 and in periods 6–10 is 0.32, and the difference is statistically significant below the 10% level ($p=0.0672$). In *partner with average wage*, average effort from periods 1–5 is 0.3945 and in periods 6–10 is 0.5727. These findings support the reputation hypothesis that in *partner*, when employer's relative type is not known, workers have an incentive to build cooperative reputation. But when the relative reputation is known, through comparison between current wage and average wage in the treatment *partner with average wage*, workers do not have to build such a reputation.

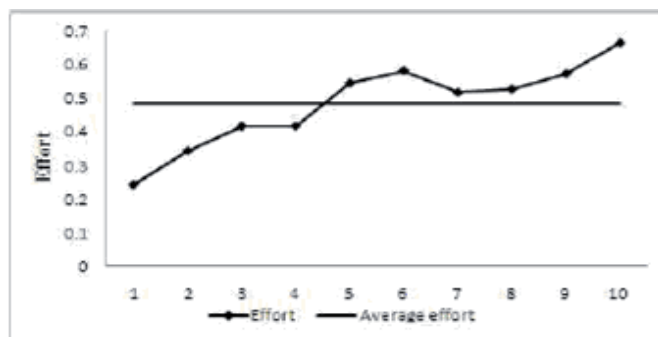
Figure 3: The Average Effort for the Three Different Treatments



(a) Effort behaviour in *Stranger*



(b) Effort behaviour in *Partner*



(c) Effort behaviour in *Partner with average wage*

IV. CONCLUSION

Three experimental treatments were conducted to test the role of repetition and average wage in a typical Gift Exchange Game. Under the repetition environment, workers did not behave differently from *stranger* treatment when workers and firms only met once. It was demonstrated that low effort levels exerted in *partner* was because the workers could not identify the relative type of employer they were dealing with. This caused the workers to not respond to the wages offered by employers. The problem was eradicated in the third treatment when workers could compare their *own wage* with *average wage*. The average wage provided a focal point for workers to judge *current wage*, and also gave an idea of the relative reciprocal type of employer compared to other employers. In this environment, workers were more confident in offering a high effort level. Workers responded to wage rent more than current wage when deciding on effort level.

The observability of the relative reciprocal type of the employers exerted 'pressure' on employers to offer a wage which was close to the average wage. The revelation of average wage information created competition among employers to elicit effort level from workers.

One practical implication is that the revelation of the average wage provides a benchmark for wage offers. The information creates an incentive for workers to evaluate and seek a generous employer. To attract effort, the wage offer will have to be determined by the external market. If the effort is not perfectly observable in an organization where the ownership is separated by control, this results in increased wages, which are not paralleled by higher effort.

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