Title: Responsibility-Alleviation and Other-Regarding Preferences with Peer Workers in Labor Markets: An Experimental Investigation

Corresponding Author: Mark F. Owens *

Date: December 17, 2010

Address:
Mark F. Owens
Department of Economics and Finance
Middle Tennessee State University
Box 27
Murfreesboro, TN 37132

Phone 1-615-898-5617,
Fax 1-615-898-5596,
E-mail: mfowens@mtsu.edu.

---

* This research has been partially supported by a Faculty Research and Creative Projects Grant at Middle Tennessee State University and by the Department of Economics at Ohio State University. The author thanks John Kagel for his help and financial support, Adam Hogan for valuable research assistance and Susan Rose and J. Laron Kirby for their help in conducting experiments. All experimental materials, instructions and data are available upon request from the author at: mfowens@mtsu.edu.
Title: Responsibility-Alleviation and Other-Regarding Preferences with Peer Workers in Labor Markets: An Experimental Investigation

ABSTRACT:
A peer worker is introduced in a controlled labor market experiment characterized by unobservable effort and incomplete contracts. Workers make decisions independently and without knowledge of each others’ actions in a modified gift exchange experiment. Introducing a peer worker into an ongoing market has a negative and significant effect on effort. This decrease in effort is consistent with responsibility-alleviation on the part of employees and not with other-regarding equity concerns for the manager’s payoffs.

JEL classifications: D03, C91

Key words: peer effects, responsibility-alleviation, other-regarding behavior, gift exchange, experiment
1. Introduction

Economists have become increasingly interested in the influence of social factors on individual behavior. Different channels of social influence have been investigated in the field and through controlled experiments. One branch of the literature that is relevant in labor markets deals with how the presence of peers influences an individual’s behavior. The presence of peers has been shown to have different effects on behavior depending on the characteristics of the interaction. Peers may have a positive effect by encouraging an individual to act in a more productive or more pro-social manner when actions are viewed by another. These positive influences on productivity between workers in labor markets has been demonstrated in the laboratory by Falk and Ichino (2006) and in an actual workplace setting by Mas and Moretti (2009) which an individual’s behavior can be influenced by observing the behavior of others in their peer group.

However, the presence of another decision maker can act to diminish pro-social behavior. Charness (2000) finds evidence of responsibility-alleviation in that an individual who bears responsibility for an outcome will act in a manner that is more pro-social than an individual who does not bear responsibility for an outcome. This study seeks to identify if this influence exists between two employees facing the same effort choice.

This study presents a series of controlled laboratory experiments to investigate the extent to which these factors enter with peers in the labor market. It extends the bilateral gift exchange framework established by Fehr et al. (1998) by introducing a second peer employee to study how this addition affects the effort provided in labor markets with unobservable effort and incomplete contracts. The introduction of a peer in this experiment does not change in any way the monetary incentives for providing effort. However, other non-monetary factors may increase the
temptation for employees to free ride. These include changes in the impact of individual
decisions as they relate to managers’ earnings which may trigger changes in other regarding
equity concerns and also shared responsibility for the manager’s outcome.

In this experiment peer workers are introduced under treatments with different
formulations of manager profits to generate differences based on other-regarding equity
concerns. Comparing the effect on effort between treatments isolates the impact of the presence
of an additional worker while holding manager and worker profit opportunities constant. The
employees are paid according to the same profit functions whether one or two workers are
employed so the monetary incentives are held constant throughout. Holding employee profit
functions constant minimizes as much as possible any changes in managers’ intentions that
employees may perceive. The decisions of both employees are made independently from one
another and their decisions have no impact on the earnings of another employee. The primary
treatments introduce a peer employee into an ongoing labor market which initially has
unemployed workers.

The data indicate the introduction of a peer worker to share responsibility for the
manager’s outcome has a negative and statistically significant influence on effort even if the
addition is independent of employee payoffs. This decrease in effort is consistent with study of
gift exchange with multiple workers by Maximiano et al. (2007) which finds a statistically
significant, but small decrease in effort when four workers are employed. However, the present
study shows the negative peer effects to be robust to three formulations of manager’s profits
which differ in terms of manager’s earnings relative to the employee and suggests that outcome
oriented preferences for equity are not driving the decrease in effort. Since the decrease cannot
be attributed to concern for equitable outcomes or to differences in intentions, the data suggest
that employees change their behavior when responsibility is reduced when actions by peers are not observable. This finding suggests that responsibility-alleviation does emerge between workers in a labor market setting. The number of agents in a market can have either a positive or negative behavioral effect on effort depending on the characteristics of the interactions.

This paper is organized as follows. The following section presents a brief background of related literature and hypotheses. Section 3 presents the experimental design. The fourth section contains results and statistical analysis. The final section concludes and discusses the findings and limitations.

2. Background and Hypotheses:
Recent studies have investigated the influence that peers may have on productivity in the workplace. Falk and Ichino (2006) and Mas and Moretti (2009) find that workers increase personal productivity out of concern for how peers will view their actions. The impact of peers is a greater influence in situations where individual workers can easily observe the output of a peer. Another experiment by Bellemare et al. (2010) in a static setting with unobservable actions does not find evidence of peer pressure. Together these results highlight that peer influences depend on the observability of actions.

Labor markets characterized by implicit contracts would seem especially prone to peer influences between workers. Versions of the Fehr et al. (1993) gift exchange experiment have been used to investigate behavioral patterns in labor markets with incomplete contracts, unobservable effort and gains from cooperation. There are many variations in the payoffs and procedures of the gift exchange experiment. The vast majority of these examine outcomes that

---

1 These findings are not limited to laboratory experiments. Al-Ubaydli et al. (2008) and Kube et al. (2008) find gift exchange behavior in field experiments and Campbell and Kamlni (1997) and Bewley (1998) find evidence of
result from one worker interacting with one manager but recently the study of gift exchange has been extended to include multi-worker settings. Charness and Kuhn (2007) pair two employees who have different productivity schedules with a single manager. The study compares between treatments where wage offers are public versus private and finds that workers do not respond to coworker’s wages in the public setting. Abeler et al. (2010) pair one principal with two agents and find that lower effort is observed when the same wage must be offered to both workers than when wages can vary. In this experiment effort is selected first and then the wage is offered.

The study most closely related to the present is Maximiano et al. (2007) which compares gift exchange behavior between sessions with one worker per manager versus four workers per manager. They find that gift exchange persists, but is slightly lower in the four employee sessions. In their setup firms have profit opportunities which are four times larger with four employees than with one and the authors attribute lower effort to other-regarding fairness concerns between the outcomes of firms and workers. The outcome based preference explanation is somewhat at odds with results from other gift exchange experiments that also vary managers’ payoffs and labor supply. Hannan et al. (2002) fails to find differences in effort provided to high productivity and low productivity firms by employees for given wages. Brandts and Charness (2004) find comparable levels of gift exchange with an excess supply of managers and an excess supply of workers. Both of these studies suggest employees’ responses are not sensitive to the market conditions facing managers.

other-regarding behavior in employer surveys. See Gächter and Fehr (2002), for a survey of the gift exchange literature as well as other experiments on fairness.

2 To the extent that employees care about equality of payoffs in the sense of Fehr and Schmidt (1999) and Bolton and Ockenfels (2000), a worker may be willing to give higher effort when their earnings are higher than the manager's because effort costs are outweighed by the utility gained from reducing inequality in profits. The purpose of Maximiano et al. (2007) was not to investigate peer effects.

3 Other experiments which utilize multiple second movers in prisoners’ dilemma games have not generally found differences with the number of agents. Guth and Van Damme (1998) find the division of the money in an ultimatum game with a third player (with no decision making capability) to be similar to the standard game. The effect of the
In addition to changing the earnings outcomes for managers there are other potential differences in the non-monetary incentives to free ride in the presence of a peer. Charness (2000) finds evidence of responsibility-alleviation whereby an individual who bears responsibility for another’s outcome will act in a manner that is more pro-social than an individual who does not bear responsibility. Charness (2000) demonstrates responsibility-alleviation between workers and firms but the introduction of a peer clearly reduces the share of responsibility that an employee has for the manager’s outcome.

In gift exchange experiments the presence of a peer worker is entirely irrelevant to employees with preferences for self interested money-maximization because choosing low effort is always optimal for them. It is also irrelevant to employees whose behavior is driven solely by reciprocity since the wage offer made by a manager represents the same cost to the manager and benefit to the employee independent of the peer. However, as a consequence of responsibility-alleviation an employee may not feel obligated to reciprocate a manager’s generosity to the same extent when working with a peer as he or she would when acting alone and having full responsibility for a manager’s earnings. Formally I test Hypothesis 1:

**Hypothesis 1:** Gift exchange behavior will be unaffected by the addition of a peer worker.

I anticipate that hypothesis 1 will not hold based on findings of decreased gifts when more workers are present reported in Maximiano et al. (2007) and with the possibility for responsibility-alleviation to alter incentives in the sense of Charness (2000).
Depending on changes in the characteristics of the payoffs upon the introduction of a peer, both the relative payoffs between the manager and employee and the workers’ share of the responsibility for the manager’s outcome can differ. In order to determine the root cause of the decrease in effort it is critical to isolate these two influences. Sessions are conducted under three different treatments which vary the managers’ profit potential, but hold constant the decrease in responsibility with the addition of a second worker. By separating changes in responsibility for manager’s payoffs from changes in the relative size of the payoffs it is possible to identify whether the decrease in effort can be attributed to outcome oriented other-regarding preferences, or to a different behavioral response with shared responsibility. Formally this presents a test of Hypothesis 2:

*Hypothesis 2:* Holding constant the employees’ payoffs, and also their share of the responsibility for the managers’ outcome, the differences in the managers' payoff structure will have no effect on the decrease in gift exchange behavior observed when peers are introduced.

If other-regarding equity concerns are at play differences in manager payoffs will have a significant effect and Hypothesis 2 will be rejected. Conversely, if employees do not alter their behavior in response to differences in manager profits the data will fail to reject Hypothesis 2.

3. **Experimental Design:**

In each session, and across all treatments, a gift exchange experiment was conducted with the same basic procedures. All sessions were conducted with pen and paper. Subjects were divided

---

4 The experimental materials and matching grid are available online at: http://frank.mtsu.edu/~mfowens/Exp_materials_Peer_GE.docx.
into two main groups, with one group randomly chosen to be “managers” and the other group chosen to be “employees.” In each period each manager chooses a wage for their employee(s). These wage offers were written directly on the employees’ record sheet so that only the manager and employee in a pair know the wage offer. Employed workers observe the wage offer and choose an effort level, which is then transmitted back to the manager concluding the period. 

Both wage offers and effort levels were private information for the manager and worker in each pairing and are not observable to any other market participants.

The pairings between a worker and a manager were reassigned randomly before each period so that no employee and manager were paired together more than twice in the same session or paired in two consecutive periods. Details regarding the random assignment of pairings were explained before the start of each session and were repeated before each of the first several periods within each session. Each participant was given a written copy of the instructions, which were also read aloud to all participants.

Different treatments are conducted to test for the influence of adding a peer employee with shared responsibility for the manager’s outcome to the market. For ease of presentation periods in which a single employee is paired with one manager are hereafter denoted as FR periods (for full responsibility) because a single employee determines the manager’s payoff. Periods for which two employees are paired with each manager are denoted SR periods (for shared responsibility). Baseline FR sessions serve to replicate prior findings. In addition three different treatments introduce peer workers into the labor market (AddPeer) for SR periods. In AddPeer sessions, the participants were divided into three groups with the same number of managers, “Regular” workers, and “Unemployed” workers. These sessions contain 10 market

---

5 The term “effort” is used throughout this paper but in the experiment “amount of work” was used in its place.
6 This matching procedure follows that of Charness (2000) and creates a series of one-shot games so that the only motivation for offering efficiency wages is the potential gain from higher effort.
periods. In the first 3 periods each Regular worker receives a wage from a manager whereas the Unemployed workers do not receive a wage or make decisions.\(^7\) Starting in period 4 the previously unemployed enter the market and all workers are employed with peers for the remainder of the session.

In SR periods the manager chooses a single wage to pay to both employees.\(^8\) An employee’s profits are determined entirely by the wage received and his or her own effort choice. It is critical that the presence of a peer has no direct effect on employee earnings. The two employees in SR periods make decisions anonymously and independently from one another and workers are unable to observe the effort choice of the other worker in the pair.\(^9\) The situation for the first worker is completely unchanged except for the presence of a peer working for the same manager and receiving the same wage.

The employee’s profits in all periods and treatments were determined by the following:

\[ \Pi_{\text{Employee}} = \begin{cases} 100 - e + 5w & \text{if employed} \\ 70 & \text{if unemployed} \end{cases} \tag{1} \]

where \(w\) is the wage offer and \(e\) is the effort provided. Both wages and effort were chosen as integers from the interval \([0, 100]\). In those periods where the Unemployed workers were unemployed they receive a fixed payment of 70 experimental dollars. This amount is strictly less than the 100 experimental dollars that an employed worker can earn by providing an effort of

\(^7\) Gift exchange experiments have been conducted both with unemployed workers (see for example Fehr et al., 1993 and Brandts and Charness, 2004; in the ESL treatment) and without unemployed workers (see for example Charness, 2004). However, in previous studies with unemployed workers, the unemployed in a market period do not necessarily remain unemployed in the next period because wage offers are selected on a first-come, first-served basis. The unemployed workers in our study remain out of the labor market for three periods in order to generate enough data for analysis.

\(^8\) In Maximiano et al. (2007) the same wage is given to all employees, whereas Charness and Kuhn (2007) and Abeler et al. (2010) allow different wages to be offered. In the latter effort is chosen first by employees and then wages are chosen second by managers.

\(^9\) The complete independence of worker’s decision differs from Charness and Kuhn (2007) and from Bellemare et al. (2010) study of peer pressure.
zero regardless of the wage received. This value was chosen in order to make unemployment less attractive than employment as is likely the case in most labor markets. Employees’ payoffs increase in wage and decrease in effort and the marginal cost and benefit are constant. Manager payoffs vary across treatments.

In the Baseline sessions, and in all FR periods of the AddPeer treatments, the managers' payoffs were each calculated according to equation (2).

$$\Pi_{\text{Manager}} = 100 - w + 5e$$  \hspace{0.5cm} (2)

where $w$ is the wage offer and $e$ is the effort provided. Both wages and effort were chosen as integers from the interval $[0, 100]$. The manager payoffs increase in effort and decrease in wage, whereas the employee payoffs in equation (1) increase in wage and decrease in effort. The Nash equilibrium, in absence of gift exchange, for these profit functions (and all that follow) has employees providing zero effort, and managers offering a wage of zero. That both the employee’s and manager’s profit function is linear holds the marginal costs and benefits constant for any given effort level. These functions represent one of the many formulations of payoffs found in the literature. They are selected mainly because they are easy to adapt to include a second employee while still maintaining a straightforward calculation of earnings for participants. The data for FR periods generate a basis of comparison with both SR periods and with prior studies.

Three versions of the AddPeer treatment vary the way in which manager payoffs are determined to test for the source of changes in other-regarding behavior. The payoffs in the Average, Double and Subsidy versions of the AddPeer treatments are all derived from the

---

10 The payoff functions for employees and the managers (described below) are a rescaled version of the profit functions used in Brandts and Charness (2004).
baseline manager payoffs. In the Average treatment each manager's income, for SR periods, is calculated according to equation (3):

\[ \Pi_{\text{Manager}} = 100 - w + 5 \times \frac{1}{2} (e_1 + e_2) \]

\[ \Pi_{\text{Manager}} = 100 - w + 5(\text{average } e) \quad (3) \]

where \( e_1 \) and \( e_2 \) are the effort levels provided by each employee. This payoff function holds the expected total profit for managers constant between FR and SR periods, \( ceteris paribus \). Thus, the introduction of the peer employee does not change the total expected profits for managers. The addition of a peer worker under this function will not change effort responses if employees are concerned with their individual earnings capability relative to the manager’s.

In the Double treatment each manager's income, for SR periods, is calculated according to equation (4). This function sums the two the profit functions used in FR periods (compare to equation (2)) - effectively doubling the manager's expected payoff within the session, \( ceteris paribus \).

\[ \Pi_{\text{Manager}} = (100 - w + 5e_1) + (100 - w + 5e_2) \]

\[ \Pi_{\text{Manager}} = 200 - 2w + 5(e_1 + e_2) \quad (4) \]

where \( e_1 \) and \( e_2 \) are the effort levels provided by each employee. This function holds constant the value of earnings generated for the manager for a given effort choice by the employee. The addition of a peer worker under this function will not change the effort response if an employee is concerned only with how their own choice affects the earnings of the manager. If other-regarding concerns for equitable outcomes between employees and managers are important, the SR periods of the Double treatment would exhibit lower effort than those in the Average treatment because, \( ceteris paribus \), managers will earn double the profits.
The Subsidy treatment is similar to the Double treatment except that the cost to the manager for wages paid is lowered, as if the wage of the unemployed worker is subsidized. The manager's income, for SR periods in the Subsidy treatment is calculated according to equation (5).

\[ \Pi_{\text{Manager}} = (100 - w + 5e_1) + (100 - \frac{1}{2}w + 5e_2) \]

\[ \Pi_{\text{Manager}} = 200 - 1.5w + 5(e_1 + e_2) \quad (5) \]

where \( e_1 \) and \( e_2 \) are the effort levels provided by each employee. The expected profits for managers in the Subsidy treatment are strictly greater than profits in the FR periods and in the double treatment, \textit{ceteris paribus}. Again, if employees are concerned about the relative total payoffs between their individual earnings and the manager’s total earnings this treatment would generate lower effort in SR periods.

In addition to the AddPeer treatments, which are the primary treatments of interest, additional sessions are conducted with a Reverse treatment that uses the same payoff functions as the Average treatment but in the reserve order. These sessions begin with seven SR market periods with full employment, and then half of the workers become unemployed so that the final three periods are FR periods. This treatment serves primarily to compare between sessions starting with SR periods and those starting with FR periods.

Across all sessions the payoff functions were provided to all managers and all employees so that this information was common knowledge. Participants were provided with calculators and were required to compute, correctly, the payoffs for both managers and employees in several examples prior to the start of the experiment. The sessions did not begin until all subjects were

---

11 The subsidy sessions were conducted prior to other peer treatments. After analyzing these results the double treatment was conducted to test whether the subsidy on wages was responsible for the decrease in effort. When these two revealed no differences the double treatment was abandoned in favor of the average treatment since the contrast in manager payoffs between the subsidy and average treatments is greater.
clear about how the payoffs were determined. In peer treatments which involved a change in payoffs during the session, a new set of instructions was distributed prior to starting the periods with new payoffs. These instructions explained the payoff functions, pairing system, and other details. After these instructions were read aloud subjects were again required to correctly calculate a new set of examples.\textsuperscript{12}

Each player's total payoff was the sum of the payoffs earned in each of the periods played. Participants were paid privately and individually at the rate of 250 experimental dollars to 1 US dollar, along with a $6 participation fee.

Table 1: Summary of Treatments

<table>
<thead>
<tr>
<th></th>
<th>Sessions</th>
<th>Employees</th>
<th>Managers</th>
<th>Market periods</th>
<th>Total observations</th>
<th>SR periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>6</td>
<td>58</td>
<td>58</td>
<td>5</td>
<td>290</td>
<td>NA</td>
</tr>
<tr>
<td>Average</td>
<td>2</td>
<td>26</td>
<td>13</td>
<td>10</td>
<td>214</td>
<td>4-10</td>
</tr>
<tr>
<td>Double</td>
<td>1</td>
<td>14</td>
<td>7</td>
<td>10</td>
<td>109</td>
<td>4-10</td>
</tr>
<tr>
<td>Subsidy</td>
<td>2</td>
<td>26</td>
<td>13</td>
<td>10</td>
<td>221</td>
<td>4-10</td>
</tr>
<tr>
<td>Reverse</td>
<td>2</td>
<td>28</td>
<td>14</td>
<td>10</td>
<td>238</td>
<td>1-7</td>
</tr>
<tr>
<td>Totals</td>
<td>13</td>
<td>152</td>
<td>105</td>
<td></td>
<td>1072</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 presents a summary of the session and treatments. Data are generated from a total of 13 sessions. Six sessions of the Baseline gift exchange game from a total of 116 students from Ohio State University and Middle Tennessee State University.\textsuperscript{13} A total of five AddPeer and two Reverse sessions were conducted at The Ohio State University and Middle Tennessee State University.

\textsuperscript{12} Monitors made every attempt to ensure that all subjects completely understood the payoffs before beginning the session so that the introduction of new payoffs and subsequent practice problems would not influence the play of the game. In every case subjects completed the second set of practice problems in far less time than the first. The timing of the Reverse treatment offers a test to see if this pause in the game has an effect on the provision of effort.

\textsuperscript{13} The data from both locations are pooled after regressions testing for differences by location failed to find any significant difference. The baseline data consists of the first five market periods of observations presented in Owens and Kagel (2010) for a different experiment.
University with 141 students enrolled in general education courses. Average earnings were approximately $20.00 for regular workers, $17.00 for unemployed workers and $19.00 for managers. Sessions lasted about one hour and twenty-five minutes.

4. Results

Table 2 shows the mean values of wage and effort by treatment and by the presence or absence of a peer. The average values by period, for the Baseline, AddPeer and Reverse treatments, can be seen in Figure 1. Consistent with previous studies of gift exchange, employees generally respond to higher wages with higher effort. For the entire sample the average wage and effort in FR periods are 58.76 and 30.05 respectively, and in SR periods the average wage and effort are 53.70 and 22.84. In every treatment average effort is lower when responsibility can be shared with a peer worker.

Figure 1: Wage and Effort by Period
The primary comparisons of interest relate to the effect of introducing a peer into a market that starts initially with a single employee per manager. Wilcoxon Signed Rank tests using session averages as the unit of observation reject that effort in AddPeer treatments is equal in FR periods versus SR periods after the peers are introduced within a session (Z = 2.023, p=0.043) and also reject that wages are equal in FR versus SR periods within a session (Z = 1.753, p=0.080).

### Table 2: Mean Effort and Wage by Treatment

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Average</th>
<th>Double</th>
<th>Subsidy</th>
<th>All AddPeer</th>
<th>Reverse</th>
<th>All peer sessions</th>
<th>All All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FR Periods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>59.01</td>
<td>71.51</td>
<td>58.05</td>
<td>57.56</td>
<td>63.16</td>
<td>46.62</td>
<td>58.23</td>
<td>58.76</td>
</tr>
<tr>
<td></td>
<td>(1.78)</td>
<td>(3.59)</td>
<td>(4.62)</td>
<td>(3.44)</td>
<td>(2.27)</td>
<td>(5.53)</td>
<td>(2.37)</td>
<td>(1.42)</td>
</tr>
<tr>
<td></td>
<td>[290]</td>
<td>[39]</td>
<td>[21]</td>
<td>[39]</td>
<td>[99]</td>
<td>[42]</td>
<td>[141]</td>
<td>[431]</td>
</tr>
<tr>
<td>Effort</td>
<td>28.97</td>
<td>40.64</td>
<td>43.67</td>
<td>24.21</td>
<td>34.53</td>
<td>27.26</td>
<td>32.32</td>
<td>30.05</td>
</tr>
<tr>
<td></td>
<td>(1.80)</td>
<td>(5.21)</td>
<td>(8.29)</td>
<td>(3.21)</td>
<td>(3.08)</td>
<td>(5.86)</td>
<td>(2.79)</td>
<td>(1.52)</td>
</tr>
<tr>
<td></td>
<td>[290]</td>
<td>[39]</td>
<td>[18]</td>
<td>[39]</td>
<td>[96]</td>
<td>[42]</td>
<td>[138]</td>
<td>[428]</td>
</tr>
<tr>
<td><strong>SR Periods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.38)</td>
<td>(2.18)</td>
<td>(2.07)</td>
<td>(1.33)</td>
<td>(2.21)</td>
<td>(1.15)</td>
<td>(1.15)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[91]</td>
<td>[49]</td>
<td>[91]</td>
<td>[231]</td>
<td>[98]</td>
<td>[329]</td>
<td>[329]</td>
<td></td>
</tr>
<tr>
<td>Effort</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.02)</td>
<td>(3.29)</td>
<td>(1.74)</td>
<td>(1.26)</td>
<td>(2.25)</td>
<td>(1.11)</td>
<td>(1.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[175]</td>
<td>[91]</td>
<td>[182]</td>
<td>[448]</td>
<td>[196]</td>
<td>[644]</td>
<td>[644]</td>
<td></td>
</tr>
<tr>
<td><strong>All Periods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage</td>
<td>59.01</td>
<td>59.01</td>
<td>58.34</td>
<td>52.31</td>
<td>57.05</td>
<td>48.49</td>
<td>54.50</td>
<td>55.70</td>
</tr>
<tr>
<td></td>
<td>(1.78)</td>
<td>(1.78)</td>
<td>(1.96)</td>
<td>(1.81)</td>
<td>(1.17)</td>
<td>(2.06)</td>
<td>(1.04)</td>
<td>(0.90)</td>
</tr>
<tr>
<td></td>
<td>[290]</td>
<td>[290]</td>
<td>[70]</td>
<td>[130]</td>
<td>[330]</td>
<td>[140]</td>
<td>[470]</td>
<td>[760]</td>
</tr>
<tr>
<td>Effort</td>
<td>28.97</td>
<td>28.97</td>
<td>28.94</td>
<td>19.05</td>
<td>23.54</td>
<td>26.73</td>
<td>24.51</td>
<td>25.72</td>
</tr>
<tr>
<td></td>
<td>(1.80)</td>
<td>(1.80)</td>
<td>(3.12)</td>
<td>(1.57)</td>
<td>(1.19)</td>
<td>(2.11)</td>
<td>(1.05)</td>
<td>(0.91)</td>
</tr>
<tr>
<td></td>
<td>[290]</td>
<td>[290]</td>
<td>[109]</td>
<td>[221]</td>
<td>[544]</td>
<td>[238]</td>
<td>[782]</td>
<td>[1072]</td>
</tr>
</tbody>
</table>

Notes: Standard Errors of the mean in parentheses, number of observations in brackets.
Since both wages and effort decrease in the periods with a peer employee it is necessary to explore the effect of a peer on effort for given wages. Figure 2 displays the mean effort provided for given wage ranges in the Baseline, and AddPeer sessions for FR and SR periods. This figure shows lower effort for all given wage ranges in AddPeer sessions when a peer worker who shares responsibility is present. The mean effort for given wages in the baseline sessions is comparable to unshared periods of the AddPeer sessions.\textsuperscript{14}

Figure 2: Effort for Given Wages: Baseline and AddPeer

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Effort for Given Wages: Baseline and AddPeer}
\end{figure}

Note: The Columns represent the mean. The error bars represent the standard errors at the mean.

Formal statistical analysis to test for effort differences in peer sessions is performed using random effects Tobit regressions as in equation (6).

\textsuperscript{14} Formal statistical analysis is performed using the following random effects Tobit regression to test for differences in response between the baseline sessions and the periods of the peer treatment prior to the peer workers’ employment. $\text{Effort}_{it} = \beta_0 + \beta_1 \text{Wage} \times \text{Baseline} + \beta_2 \text{Wage} \times \text{AddPeer} + \mu_i + \epsilon_{it}$. The regression coefficients are $\beta_1 = 0.66 (0.05)$ and $\beta_2 = 0.69 (0.08)$ are both significant at the 1 percent level. A test fails to reject equality of the two coefficients ($\chi^2 (1) = 0.10, p = 0.758$) which indicates that initial effort responses in peer sessions with one worker per manager are not different from the baseline sessions.
\[ \text{Effort}_{it} = \beta_0 + \beta_3 \text{Wage} \times FRP_{it} + \beta_4 \text{Wage} \times SRP_{it} + \mu_{it} + \epsilon_{it} \]  

where the subscripts \( i \) and \( t \) index the individual employee and the market period respectively. \( \text{Effort} \) is the effort choice of employee \( i \) in period \( t \), \( \text{Wage} \) is wage offer made by manager \( i \) in period \( t \), \( \text{FRP} \) is an indicator variable (equal 1 if one worker is employed per manager in the period and 0 otherwise), and \( \text{SRP} \) is an indicator variable (equal 1 if two workers are employed per manager in the period and 0 otherwise). These regressions account for censoring of employees' decisions at the minimum of zero and the maximum of one hundred and they include an individual specific random error term \( \mu_{it} \) to account for subject specific factors.

Table 3 displays regression results (from equation (6)). Columns 1-4 display coefficients for each treatment in isolation and columns 5 and 6 show the estimates for pooling all the data in the AddPeer sessions. Column 5 includes the data from baseline sessions, and column 6 does not. The last row (row 6) in Table 3 displays the results for F-tests for the equality of the coefficients on the interaction terms in rows 1 and 2. In each individual treatment the data indicate that wage offers have a positive and significant impact on effort in both FR and SR periods (rows 2 and 3) as is typical in gift exchange. However, coefficients clearly show a difference in response to wages when responsibility becomes shared. The test statistics in row 6 all reject that effort responses for given wages are equal in FR and SR periods at better than the 5% level of significance.

All else constant, the presence of a peer worker sharing responsibility decreases the effort provided by employees by about 13 units of effort in peer sessions.\(^{15}\) Considering that the

\(^{15}\) This result is generated from a regression (not reported) that includes the wage and also an indicator variable for SR periods. Regressions were also performed to test for differences between the behavior of regular and unemployed workers. The results did not reveal any significant differences between the responses of those employed throughout and those who were unemployed.
average Effort provided by employees working alone in these sessions is 34.5 (Table 2, column 5), this represents about a 38% drop in effort on average. The data reject Hypothesis 1 leading to Result 1:

Result 1. Effort for given wages declines with the addition of a peer employee.

Having established that introducing peer workers has a negative impact on effort, the next step is to determine whether this change results from responsibility-alleviation or from changes in the manager's expected profit (Hypothesis 2). An initial test of Hypothesis 2 can be found in the second column of Table 3 which indicates a significant difference in effort responses in the Average sessions comparing SR versus FR periods ($\chi^2(1)=11.69$, $p=0.001$). Since the Average treatment holds manager’s earnings potential constant with the introduction of a peer, the fact
that a decrease in effort occurs without a change in manager profits suggest factors other than manager profits are the driving force. A further test for whether the effort responses differ with managers’ payoff functions between the Average, Double and Subsidy treatments is conducted with equation (7):

\[ Effort_{it} = \beta_0 + \beta_5 Wage \times FRP_{it} + \beta_6 Wage \times SRP_{it} \times treatment + \mu_{it} + \epsilon_{it} \quad (7) \]

Where \textit{treatment} is a vector of indicator variables corresponding to the three manager profit formulations in AddPeer treatments. The results for these regressions are shown in Table 4. Chi-squared tests of the \(Wage \times SRP \times treatment\) interaction terms in the AddPeer sessions fail to reject equality of all treatments (\(\chi^2(2) = 0.12, P = 0.942\)).\textsuperscript{16} The same trend emerges in Double and Subsidy treatments where the introduction of a peer simultaneously increases the earnings of

<table>
<thead>
<tr>
<th></th>
<th>AddPeer and Baseline</th>
<th>AddPeer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage×FRP</td>
<td>0.699*** (0.038)</td>
<td>0.731*** (0.056)</td>
</tr>
<tr>
<td>Wage×SRP×Average</td>
<td>0.516*** (0.051)</td>
<td>0.530*** (0.056)</td>
</tr>
<tr>
<td>Wage×SRP×Double</td>
<td>0.497*** (0.078)</td>
<td>0.511*** (0.082)</td>
</tr>
<tr>
<td>Wage×SRP×Subsidy</td>
<td>0.529*** (0.054)</td>
<td>0.541*** (0.058)</td>
</tr>
<tr>
<td>Observations</td>
<td>834</td>
<td>544</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-3076.5</td>
<td>-1958.3</td>
</tr>
<tr>
<td>Test of equality of (Wage \times SRP \times treatment) variables</td>
<td>(\chi^2(2) = 0.14) (P = 0.933)</td>
<td>(\chi^2(2) = 0.12) (P = 0.942)</td>
</tr>
</tbody>
</table>

Notes: Standard errors are in parentheses. *** Significantly different from 0 at the 1% level, two-tailed test. None of the treatments are significantly different from each other.

\textsuperscript{16} No individual treatment is significantly different from any other treatment.
the manager and in Average treatment which holds expected earnings of managers constant. The decrease in effort observed from the addition of a second employee (Result 1) does not appear to be driven by other-regarding concerns for equity in payoffs between employees and their manager. Thus the data fail to reject Hypothesis 2. This leads to result 2:

*Result 2.* The decrease in effort by employees with the introduction of a peer worker is not sensitive to differences in earnings capacity of the managers.

Results for the Reverse sessions presented in Figure 3 show similar mean effort provision with either type of responsibility. Table 5 presents statistical results for the effect of wages in SR and FR periods within the Reverse sessions alone (column 1) and in the reverse and baseline (column 2). There is no difference in the initial effort responses comparing between the first 3 periods of AddPeer sessions and Reverse sessions (column 3). That the responses in FS periods do not differ by the timing of the unemployment (column 4) is not surprising. However, it is also true that statistically significant differences do emerge when comparing between effort responses in SR periods in the Reverse and AddPeer treatments. The SR periods that follow FR periods in AddPeer sessions exhibit significantly lower effort than the SR periods of the Reverse sessions which begin with workers sharing responsibility (column 5) ($\chi^2(1)=3.39$, $p= 0.066$). Perhaps increasing the employee’s share of responsibility is less obvious than decreasing the share.

The negative effect on effort from adding a peer, and the lack of impact comparing between sessions starting with and without a peer likely arises from the lack of contrast in the between comparison. Employees observe a clear change in the decision making environment
when a peer is introduced within an ongoing market. The changing share of their personal responsibility is more salient and they respond by providing lower effort. The contrast is not present in the between comparison because workers making decisions in the shared environment have not experienced any other situation.\textsuperscript{17} In addition the potential earnings for managers in Reverse sessions with shared responsibility are identical to the potential earnings of managers in sessions without responsibility.

\textsuperscript{17} It is worth noting that Maximiano et al. (2007) found no difference between two treatments (labeled 1-4 and 1-4E) which differed in their initial endowments suggesting that participants largely ignored them. The within design makes these differences more salient.
5. Conclusion

This study examines how the introduction of a peer work to share responsibility influences effort in cases where contracts are incomplete and actions are unobservable. An experimental labor market is constructed in which a bilateral gift exchange game is extended with the addition of a second peer employee. The two employees make decisions anonymously and independently from one another and their decisions do not impact the other employee’s earnings in any way. The employees’ earning function is held constant throughout and the employees’ share of responsibility for the managers’ outcome upon introduction of a second worker is held constant across treatments. The treatments vary the payoff to the managers so that outcome based other-

### Table 5: Random Effects Tobit Regressions on Effort: Analysis of Reverse Treatment

<table>
<thead>
<tr>
<th></th>
<th>Reverse Only Periods (1)</th>
<th>Reverse and Baseline Periods (2)</th>
<th>Periods 1-3 (3)</th>
<th>Only FR Periods (4)</th>
<th>Only SR Periods (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage×FRP</td>
<td>0.587***</td>
<td>0.637***</td>
<td>0.609***</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.097)</td>
<td>(0.046)</td>
<td>(0.091)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wage×SRP</td>
<td>0.587***</td>
<td>0.612***</td>
<td>0.602***</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.046)</td>
<td>(0.092)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wage×AddPeer</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.615***</td>
<td>0.526***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.096)</td>
<td>(0.046)</td>
</tr>
<tr>
<td>Wage×Reverse</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.588***</td>
<td>0.650***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.121)</td>
<td>(0.060)</td>
</tr>
<tr>
<td></td>
<td>(6.053)</td>
<td>(3.798)</td>
<td>(5.946)</td>
<td>(7.016)</td>
<td>(3.592)</td>
</tr>
<tr>
<td>Observations</td>
<td>238</td>
<td>528</td>
<td>180</td>
<td>138</td>
<td>644</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>−873.5</td>
<td>−1995.5</td>
<td>−729.0</td>
<td>−534.7</td>
<td>−2313.0</td>
</tr>
<tr>
<td>Wage×FRP=χ²(1)=0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage×SRP=χ²(1)=0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage×AddPeer=χ²(1)=0.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage×Reverse=χ²(1)=3.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Standard errors are in parentheses. *** Significantly different from 0 at the 1% level, two-tailed test. * Significantly different from 0 at the 10% level, two-tailed test.
regarding preferences can enter. In this way it isolates the effect of the change in responsibility from concerns for equity in outcomes.

The results indicate that adding a peer worker into an ongoing labor market has a negative and significant effect on effort when effort is unobservable. The decrease in effort with peers is consistent with Maximiano et al. (2007), who compare between gift exchange sessions with one employee and sessions with four employees. However, the present study shows the decrease in effort to be robust to changes in the manager’s payoff function, which is not consistent with equity concerns being the driving force for the behavioral change. Instead, the decrease in effort seems to be due to responsibility alleviation brought on by the presence of the second employee to share the responsibility for the manager’s earnings.

While the results from this experiment indicate that adding a peer worker to an ongoing labor market can diminish incentives for other-regarding behavior when actions are unobservable, one should not, and cannot, claim that a reduction in effort will necessarily occur when additional workers are included in the workplace. First, the addition of employees may increase productivity through other channels such as gains from specialization, and any increase in the tendency for workers to free ride that may occur could be entirely offset by these productivity gains. Second, Mas and Moretti (2009) and Falk and Ichino (2006) find greater effort in the presence of peers in situations where an individual’s actions are observable to peers. The present experiment highlights the fact that peer workers can also have a negative effect on productivity in markets with unobservable actions and suggest that firms could benefit by trying to make employee effort as transparent to other employees as possible.
References


Andreoni J. Giving gifts to groups: How altruism depends on the number of recipients. Journal of Public Economics 2007;91; 1731-1749.


