THE TIMING OF UNCERTAINTY RESOLUTION
IN GIFT-EXCHANGE EXPERIMENTS

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THE TIMING OF UNCERTAINTY RESOLUTION

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DECLARATION OF ORIGINALITY

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ABSTRACT

The Timing of Uncertainty Resolution

in Gift-Exchange Experiments

In this study, we investigate the effect of random outcomes and timing of outcome realization on labor market by conducting gift-exchange laboratory experiment. The employer makes a wage offer and the agent, upon observing this offer, decided how much effort to extract. In baseline experiment named as simultaneous game, after deciding and committing effort level on computer screen, agent learns the random outcomes of each effort level at the same time. To test the effect of timing of outcome realization, we construct sequential game that agent learns random value of selected effort level immediately after increasing effort decision by one unit. According to findings, we found that timing of outcome realization has less power on subjects' decisions nevertheless they chooses wage and effort level above the competitive market outcomes under uncertain outcomes.

ÖZET

Hediye Değişim Deneylerinde
Belirsizlik Çözümlenmesinin Zamanlaması

Bu çalışmada, hediye değişim deneyleri yaparak, rastgele sonuçların ve sonucun gerçekleşme zamanlamasının işgücü piyasasına olan etkisini araştırdık. Deneylerde, işveren işçisine bir ücret verir ve işçi bu ücreti gözlemleyerek ne kadar çaba harcayacağına karar verir. Eşzamanlı oyun olarak adlandırılan deneyde, bilgisayar ekranında emek seviyesi işçi tarafından belirlendikten ve onaylandıktan sonra, işçi her efor seviyesinin rastgele sonuçlarını aynı anda öğrenir. Sonucun gerçekleşme zamanlamasının etkisini test etmek için, çaba kararını bir birim arttırdıktan hemen sonra işçi tarafından seçilen çaba seviyesinin rastgele değerinin öğrenildiği sıralı oyunu oluşturduk. Bulgulara göre, sonucun gerçekleşme zamanlamasının, deneklerin kararlarında çok etkili olmadığını, ancak deneklerin belirsiz sonuçlar altında bile rekabetçi piyasa sonuçlarının üzerinde ücret ve emek seviyesi seçtiğini gözlemledik.

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CHAPTER 1

INTRODUCTION

Common assumption in economics is that people are rational. Rational economic agent maximizes own utility being subject to some constraints and selects best response among strategies. However, individuals do not behave as rational in most time and they select strategies that can give lower utility to themselves. Sometimes agents may miscalculate their own payoff and may behave as an irrational or may focus on implicit reciprocal values rather then own material payoff. The idea of gift exchange proposed by Akerlof(1982) is that wage offer higher than minimum one stands for a gift for employee and to exchange this gift employee selects higher effort level.

In line with the gift-exchange theory, studies conducted by Akerlof(1982), Fehr et al.(1993), Fehr et al.(1998), Gachter and Falk(2002), Charness and Haruvy(2002), Brown et al. (2004), Gneezy and List(2006) and Rubin and Sheremeta(2012) show that the concern of fair transaction affects labor market outcomes and generates reciprocal solutions rather than pure competitive solutions that offering minimum wage and choosing minimum effort level. Some employers focus on long term labor productivity rather than short-term profit maximization by offering higher wages than minimum level and worker responds this offer by providing higher output. According to Akerlof(1982), Akerlof(1984) and Akerlof and Yellen(1990), firms are willing to pay wage above the market clearing wage and workers are willing to select higher effort level. The gift exchange experiments conducted by Fehr et al.(1993), Fehr et al.(1998), Gachter and Falk(2002) and Brown et al.(2004), Charness(2004) have extended gift-exchange experiment questions and focused on whether different wage offer, accepting and matching mechanism have an effect on subjects behavior.

Namely, subject who played as employer treated under different wage offer structures but subjects who played as employee only observes wage offer and decide the effort level if accepting wage. Charness and Haruvy(2002) and Charness(2004) modified earlier gift-exchange games and constructed labor market where worker has no right to reject wage offer. All of these papers show that offering more than minimum or market clearing wage leads to increase in effort choice and fixed matching generates excess wage offer than one-shot matching. However, all of these papers have certain outcomes where each 0.1 increase in effort level raises effort at the same rate beginning with 0.1 effort equals to 0.1 productivity. Employer and employee's decision may change if s/he experiences that effort level and the output of labor are different. The fairness concern might be lessened with uncertain outcomes and therefore wage offer and effort level might be close to competitive outcomes rather than reciprocal solutions.

Rubin and Sheremeta(2015) introduced random shocks to gift-exchange game where agents' outcome are subject to external random numbers. In baseline (effort-only) game, where there is no shock, worker observes the wage offer between 1 and 100 then selects the effort level between 0 to 14. After employer observes effort level, s/he can reward or punish to worker. Reward and punishment in this game is called as "adjustment" and takes value -5 and +5 where minus sign stands for punishment for agent and positive is as gift. Adjustment is costly for employer and it is as much as adjustment level. In the second game (effort-shock), after agents selects effort, s/he is exposed to positive or negative random shock which is integer value between -2 and 2 with equal probability (0.2). First information about effort level selected by worker and external shock level send to employer and then employer reward or punish to worker likewise baseline game. The third (outcome-only) treatment is in line with the second treatment; however, employer can only learn the outcome of worker where outcome equals to selected effort level plus random shock. They mainly tested whether employer adjustment level is based on effort or outcome level and how effort and wage level changes with random outcomes.They stated that employers select adjustment level based on outcome and random shocks decreases both wages and effort level independent from observing shock or not.

Andreoni and Bernheim(2009) stated that people tend to behave selfishly when they consider that random shocks are responsible for their actions. According to statement of them and findings of Rubin and Sheremeta(2015), one might say that uncertainty in labor market leads to selfish behavior in both parties. Uncertainty may shrink productivity of worker and, if employer reciprocates this action based on only outcome, then wage level might be also lowered. To test the effect of random outcomes on employment market, we modified gift-exchange game where the outcome of agent's effort takes random value between 0.1 and 1 rather than selected level. Agent can increase his/her effort level by one unit in each time and each marginal increase in effort level takes random value and effort is costly for agent. After agent decides effort level and confirms it, principal observes the values of each marginal increase in effort level and select one value among them. Rational principal chooses the maximum value of these random values and maximizes own profit. In order to investigate the effect of timing of outcome realization on effort choice, we designed simultaneous and sequential decision environment. In simultaneous decision treatment, agent commits how much effort s/he extracts and learns the value of random outcomes for each selected effort level(if any) at the same time. In sequential decision treatment, agent learns random value of selected effort level immediately after increasing the effort decision by one unit. By means of this design, we mainly investigate that how employer and labor decision are changing by timing of outcome realization in an uncertain environment. Focusing deeply on the relationship between wage and effort as well as their connection with other variables, we try to come up with some finding about labor market solutions.

This paper is organized as follows. Chapter 2 explains our experimental design, Chapter 3 shows the experimental procedure that we follow, Chapter 4 shows and discuses experimental results and Chapter 5 concludes our results.

CHAPTER 2

EXPERIMENTAL DESIGN

In our experiment, employer and employee match randomly and this pair is fixed for all 10 periods. In each period, the aim of the principal(employer) is to choose one box among 10 boxes for own business.However, the value of boxes is hidden and in each period value of boxes change. Random values are distributed uniformly and between 0.1 and 1, with 0.1 decimals. The distribution of the value of boxes is common knowledge.

In this setting, the job of agent(employee) is to learn the value of boxes for principal. Learning the value of boxes is costly for agent and the cost distribution for agent over the selected boxes in order to learn the value can be found at Table 1. The cost of value learning for agent is increasing with the number of boxes chosen by employee. Trivially, we set the cost of zero box selection is 0.

Table 1. The Cost of Box Selection for Agent

box	1	2	3	4	5	6	7	8	9	10
cost	0	1	2	4	6	8	10	12	15	18

The game begins with the employers wage offer to employee and wage offer is similar to earlier studies that principal can offer wage from his/her endowment ($e = 120$). We have set a mechanism that agent cannot reject to wage offer in line with Charness and Haruvy(2002) and all participant is informed about the minimum wage of 20. Thus, principal can make wage offer from the range of 20 and 120. For a given wage offer, agent chooses effort level and effort level selection is expressed as the number of box selection.

In this experiment, in order to measure the effect of outcome realization on individual's choice, we set two different games one is called as ”simultaneous game” and the other is as ”sequential game”. Wage offer mechanism is the same as in two treatments, but agent choice procedure differs to each other. In simultaneous game, agent decides how many box s/he opens and then marks these boxes on the experiment screen. Agent can change his/her decision among boxes until s/he confirms his/her selection. After agent confirms his/her decision, the value of opened box(es) is learned by both parties at the same time. If agent does not mark any boxes, principal does not get any information about the value of boxes and thus s/he has to decide one box among 10 boxes for own job. Contrary, if agent opens all 10 boxes, then principal chooses one box among all value-learned boxes. Namely, if agent decides to learn the value of ”n” boxes, then principal only knows the ”n” number boxes' values and remaining ”10-n” boxes' values are not revealed but principal make his/her choice among all 10 boxes. After, employer selects a box for business, participants are informed about their payoff and next period will begin.

In sequential game, after getting information about wage offer, agent decides how much effort s/he will extract in line with simultaneous game. However, in this treatment, agent learns the exact value of box that s/he picks immediately after s/he marks the box. If agent marks one box, this action cannot be reversed because cost is occurred while marking. After stopping to mark boxes and clicking confirm button, the information about the boxes sends to both parties and principal chooses one box.

Thanks to our baseline experiment(simultaneous game) and our control experiment(sequential game), we are trying to understand whether timing of uncertainty resolution affects labor market.

The payoff for agent in both treatments calculated as:

$$U_A(w, c(b)) = w - c(b)$$

where w is wage offer given by principal and ”b” is the number of boxes selected by agent to learn the value and c(b) is the cost function given by Table 1 that satisfies c(0)=0, c’$>$ 0 and c” $\geq$ 0. The payoff for principal is:

$$U_P(v, w) = (e - w) * v$$

where e=120 is the initial endowment and v $\in$ [0.1, 1] is the value of boxes chosen by principal.

In order to illustrate the simultaneous game, suppose principal makes wage offer as 40 Experimental Currency Unit (ECU). After agent observes wage offer, assume that agent decides 3 boxes to open. Before pressing confirm button, agent can change his/her box decision.

After pressing confirm button, box values are learned by both principal and agent. Assume that these three boxes have following values 0.4, 0.5, 0.9. If principal decides to choose his/her box among these three box, then one can expect that the box with 0.9 value has to be chosen and the payoff for principal is

$$U_P(v, w) = (120 - 40) * 0.9 = 72$$

and payoff for agent

$$U_A(w - c(b)) = 40 - c(3) = 38$$

On the other hand, principal can also select a box among the rest of 7 unknown boxes and suppose employer picks a box with value of 1 by chance. Then, employer payoff would be 80 and the agent payoff is still the same because cost function is independent from the value of boxes.

Now, assume that employer offers a 40 ECU to the employee in sequential game. After observing the wage offer, if agent decides to mark any box, s/he learns the exact value of box. Suppose that the value of first box is 0.3. The cost of selecting one box is cost free for agent but when he selects second box which has 0.5 value the cost turns out to be 1 on experiment screen. Because of the fact that the cost is embodied, this action cannot be reversed and changed. Then, if agent decides to continue to mark another box, the same procedure applies. Suppose agent decides to continue and marks third box that has a value of 1. A rational agent observes the value of third box and stops to mark due to the fact that he has reached one of the box that has maximum value.

After agent confirms his/her decision, employer observes value of boxes 0.3, 0.5 and 1, and with rationality assumption, one can expect that employer chooses a box with value of 1 and maximizes his/her profit. Given these values, principal payoff would be

$$U_P(v, w) = (120 - 40) * 1 = 80$$

and agent payoff is

$$U_A(w - c(b)) = 40 - c(3) = 38$$

By means of this design, we try to investigate whether timing of random outcome realization affects labor effort choice as well as wage offer. Instructions for sim game can be found at Appendix B and for seq. game at Appendix C.

CHAPTER 3

EXPERIMENTAL PROCEDURE

The experiment is conducted at Bogazici Finance Lab by using z-Tree 3.4.2 in late March 2016 (Fishbacher,2007). Subjects are called to this experiment via online platform of Boğaziçi University Experiment Laboratory and all subjects are undergraduate students from several departments of Boğaziçi University. In total, 194 subjects participated this experiment, 94 subjects played simultaneous game (47 as employer, 47 as employee) and 100 subjects played sequential game (50 as employer, 50 as employee) and each subject participated only one game. Each session, 14-16 participants have been called and half of each are randomly assigned as ”employer” and the other half as ”employee” and these matching are fixed for all 10 periods. 12 sessions have been conducted half of 12 session played as simultaneous game and the rest for sequential game.

In this experiment, we use a term ”gold” in the name for ECU and 1 gold is set as 30 Kuruş(0.3 Turkish Lira). After finishing the games, we send subjects a questionnaire which consists of several demographic and logic questions. All payment is made by Turkish Lira after game and questionnaire end including 10 Turkish Lira participation payment. The mean earning for employers is 28.26 Turkish Lira(TL) and for employee is 19.77 TL in simultaneous game whereas 26.93 TL and 19.76 TL in sequential game,including participation payment.

CHAPTER 4

EXPERIMENTAL RESULTS

4.1 Descriptive statistics on wage

Wage is an important variable in this experiment due to the fact that as wage offer increases, the employer payoff decreases whereas labor payoff increases. In order to test whether there is a significant difference in distribution of wage in two games , we have first created 10 wage intervals and one can found wage density for a given wage interval on Figure 1. Besides, wage offer in each period by each individual in simultaneous game and sequential game on Figure 7 and 8 in Appendix A.

We have used Pearson Chi Square test and the null hypothesis of chi-square test that the distribution on wage categories is dependent to each other between to games can be rejected with $\chi^2(10)$ = 21.64, p-value $<$ 0.01. Thus, we can say that the distribution of wage categories are likely to be independent in two games.

We have calculated mean wage by periods to test the significance of wage differences and the mean wage for 10 periods in simultaneous game is 32.336 (N=470) whereas in sequential game 34.274 (N=500). By using Mann-Whithey Test, the null hypothesis that the mean wage in simultaneous game equals to the mean wage in sequential game is rejected with p-value=0.0379 (N=970); thus, the difference in mean wage is statistically significant at 95% confidence interval. One can say that higher wage offer in sequential game in accordance with this result. However, when we analyze the mean wage in the first and last period, we observe the mean wage in simultaneous game for Period 1 is 32.48 (N=47) and Period 10 is 32.65 (N=47).

On the other hand, the mean wage in Period 1 is 36.24 (N=50) and in Period 10 is 30.9 (N=50) in sequential game. One may say that decreasing wage offer can be seen in sequential game while wage offer stays almost the same in simultaneous

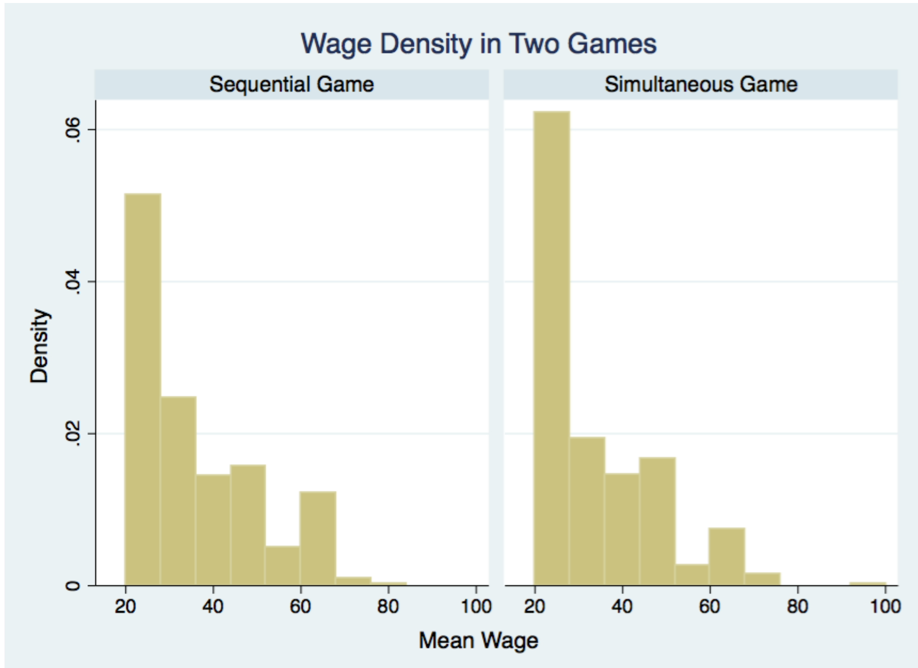

Figure 1. Wage density in two games

game. To test these, we construct null hypothesis that mean of wage offer in Period 1 equals to Period 10 for a given game. Wilcoxon signed rank test result show that null hypothesis can be rejected at 95% confidence interval in sequential game with p-value= 0.01 (N=50) but cannot be rejected for simultaneous game with p-value= 0.95 (N=47). Namely, wage offer differs from first period to last period in sequential game while it is not in simultaneous game.

Also, when we analyze the mean wages for Period 1 to 5 and 6 to 10, we observe that mean wage for simultaneous game for first five periods is 32.73 (N=235) and for last 5 periods is 31.94 (N=235). For sequential game, we observe the mean wage for the first five periods is as 34.93 (N=250) and for the last five periods is as 33.62 (N=250). Mann-Whitney test results show that there is no significant difference on wage offer for both first five and last five period in two treatments with p-value=

0.1129 (N=485) and 0.1621 (N=485), respectively. On the other hand, Wilcoxon signed rank test show that there is no significant difference in wage offer in the first five periods and the last five periods with p-value= 0.2921 (N=253) in simultaneous game. Similarly, we found that there is no significant difference in wage offer for first five and last periods in sequential game with Wilcoxon signed rank test p-value= 0.9919 (N=250).

By looking these results and Figure 7 and 8 in Appendix A, we can say that wage offer in sequential game is slightly higher than simultaneous game. In addition to this finding, fluctuations of mean wage offer in simultaneous game is minimal; however, decrease in mean wage by periods is perceivable in sequential game.

Table 2. The Mean of Wage in Two Treatment by Period

Period	Mean of Wage in Sim. Game	Mean of Wage in Seq. Game
1	32.48	36.24
2	33.08	36.3
3	32.59	35.2
4	33.08	33.44
5	32.38	33.46
6	31.93	33.32
7	32.31	34.84
8	30.10	35.28
9	32.70	33.76
10	32.65	30.9
1-5	32.73(N=235)	34.93 (N=250)
6-10	31.94(N=235)	33.62 (N=250)
Mean	**32.33**	**34.27**
N	470	500

4.2 Descriptive statistics on effort

In this experimental setting, effort level is crucial variable for both employer and employee's payoff. Labor payoff decreases as effort level rises.On the other hand, employer payoff might rise in line with effort increase because of the fact that the chance to find higher box value rises as more effort extracts. However, if high effort level is chosen in virtue of high wage offer and the maximum value found by employee is less than expected, then the employer payoff might be low even though effort level is high.

The effort density for two games can be seen in Figure 2 on below and effort density in two games by periods in Figure 9 on Appendix A. When we focus on the test on effort distribution, we get $\chi^2(10)$ = 13.67 and p-value=0.188. Therefore, we cannot reject the null hypothesis that the effort distribution in two games is not the same.

The mean effort is calculated by periods and the mean effort in all periods is 1.74 in simultaneous game (N=470) and 1.72 in sequential game (N=500). In accordance with Mann-Whitney test result, we cannot reject the null hypothesis which is the mean effort in simultaneous game equals to the mean effort in sequential game with p-value= 0.9075 (N=970). The mean effort in Period 1 is 2.72 (N=47) and Period 10 is 1.14 (N=47) in simultaneous game whereas 2.04 (N=50) and 1.06 (N=50) for sequential game, respectively. By looking these values and Table 4 second and third columns, one might notice that mean effort tends to decrease as period number increases. We observe that there is 58% decrease in effort from Period 1 to 10 in simultaneous game and 48% in sequential game. Effort in Period 10 is 28% less than effort in Period 9 in simultaneous game whereas 42% less in sequential game. The null hypotheses of the fact that the mean effort equals at first and last period in

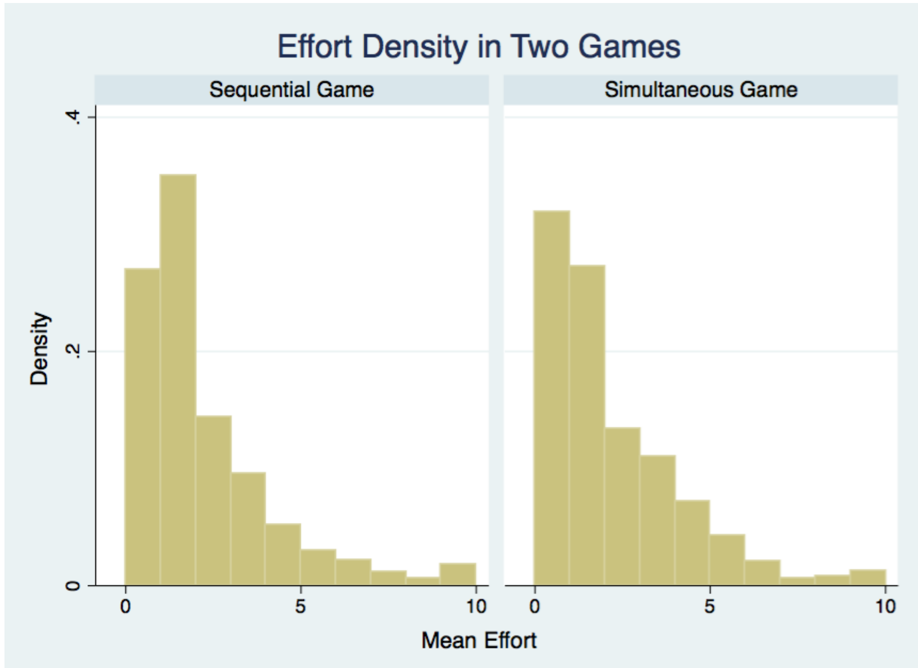

Figure 2. Effort density in two games

simultaneous game and sequential game can be rejected with p-value< 0.01 in both games. Thus we can say that mean effort in first period is different from last period. These findings are consistent with rational expectations. There is no incentive for worker to select higher effort choice rather than the one with zero cost because no more wage offer exist after Period 10. In addition to these findings, according to rank sum test results, the mean effort in Period 1 is statistically different at 95% confidence interval in two games with p-value= 0.0128 (N=97); however, there is no significant difference in mean effort on Period 10 with p-value= 0.8338 (N=97).

In simultaneous game, the mean effort for first five periods is 1.97 (N=235) and in sequential game, it is 1.83 (N=250). Besides, the mean effort for the last five periods is 1.51 (N=235) in simultaneous game while it is 1.61 (N=250) in sequential game. With two-sample Wilcoxon rank-sum test result, we can say that there is no significant difference on both first five and last five periods' mean effort choice between two treatments with p-value= 0.1323 (N=485) for first five and p-value= 0.0833 (N=485) for last five periods. In addition to these observations, Wilcoxon signed rank test says that we can reject the null hypothesis that the mean of effort first five period equals to the effort in last five period in simultaneous game in 99% confidence interval (p-value <0.01, N=235); on the contrary, we can only reject the null hypothesis in sequential game at 10% significance level (p-value=0.081, N=250).

Table 3. The Mean of Effort in Two Treatment by Period

Period	Mean of Effort in Sim. Game	Effort of Wage in Seq. Game
1	2.72	2.04
2	2.29	2.2
3	1.55	1.94
4	1.61	1.26
5	1.68	1.7
6	1.80	1.72
7	1.53	1.82
8	1.44	1.62
9	1.59	1.82
10	1.14	1.06
1-5	1.97	1.83
6-10	1.51	1.61
Mean	**1.74**	**1.72**

To sum up, we can say that negative change in effort level is more clearly observable in simultaneous game. According to results, the mean effort on Period 10 is the same in two game; however, first period effort differs to each other and, we might say that decrease in effort is mostly felt on simultaneous game.

4.3 The relationship between wage and effort

As we discuss in previous section, wage and effort are most crucial variables in this experiment. The game begins with the wage offer made by employer and employee chooses how much effort he will extract after observing wage offer. According to results above, in both games, principals offer wage above the minimum wage (more than 61% in sim. game, 71% in seq. game) and in response for that agents increases their effort choice (approximately 73% more effort level in two games). The wage elasticity of effort is calculated by dividing percentage change in effort to percentage change in wage offer. Wage elasticity of effort is 1.63 in simultaneous game and 1.02 in sequential game. According to calculations done by Esteves-Sorenson and Macera(2015), these findings are consistent with earlier gift-exchange literature that wage elasticity of effort is 2.14 in Fehr et al.(1993), are 1.21 and 1.54 in Fehr et al.(1998), 1.25 in Gachter and Falk(2002) and 0.61 in Brown et al.(2004).

Under this experimental settings where both zero and one box selection cost equal at 0, agents can evaluate minimum wage as unfair and may punish employer by selecting zero box. On the other hand, agent may express his effort choice by increasing productivity cost free. Table 4 shows the frequency of effort levels when wage offer is 20. In both games, almost half of agents select zero effort when minimum wage offered. We recorded 31 observations (18.5% of 167) in simultaneous game and 18 observations in sequential game (11.39% of 158) that select effort level more than 1 when wage is 20; however, in 53 observations out of 167 (sim. game,31.74%) and 67 out of 158 (seq. game, 42.41%) agents choose one effort level rather than zero where it might be counted as punishment to employer. By looking these results, one might say that workers are not tend to punish principals when minimum wages are offered. To test this view, we counted observations of zero effort level for all wage offer and 150 zero effort observations are recorded in simultaneous game whereas 135 observations in sequential game. Namely, 83 zero effort decisions out of 150 observations are taken where minimum wage are offered in simultaneous game (55.33% of 150) and 73 out of 135 observations are recorded in sequential game (54.07%). In both games, almost half of agents punish their employer by selecting antisocial outcome even if employers offer wage higher than minimum. By looking proportions of zero effort for a given wage offer in two games, we observe that punishment of worker is independent from wage offer.

Table 4. Frequency of Effort at Wage Offer is 20

	Sim Game		Seq. Game	
Effort	Freq.	Percent	Freq.	Percent
0	83	49.70	73	46.20
1	53	31.74	67	42.41
2	10	5.99	15	9.49
3	12	7.19	2	1.27
4	4	2.40	1	0.63
5	2	1.20		
6	1	0.60		
10	2	1.20		
Total	167	100	158	100

In the Figure 3 and 4 below, we have calculated mean effort level for each different wage offer and plotted by games. The mean effort mostly fluctuates in both figures; however, upward sloping fitted line might be evidence of the fact that the mean effort increases as wage offer rises in line with previous studies such as Fehr et al.(1993), Fehr et al.(1998),Gachter and Falk(2002) and Brown et al.(2004). Effort level for each period by each individual in simultaneous and sequential game can be seen in Figure 10 and 11 on Appendix A.

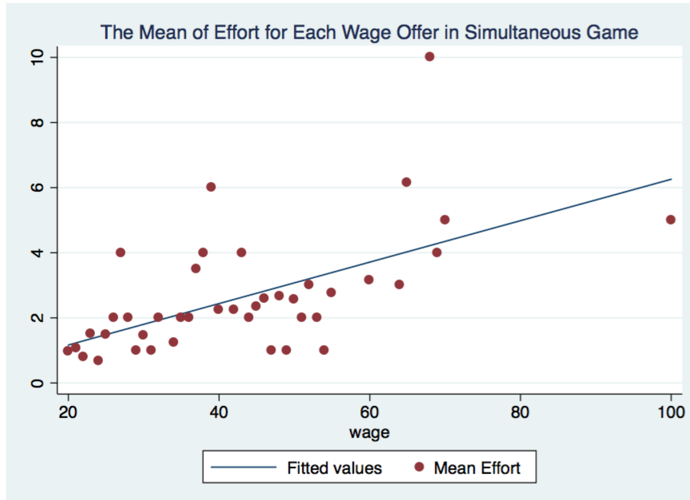

Figure 3. The mean of effort for each wage offer in simultaneous game

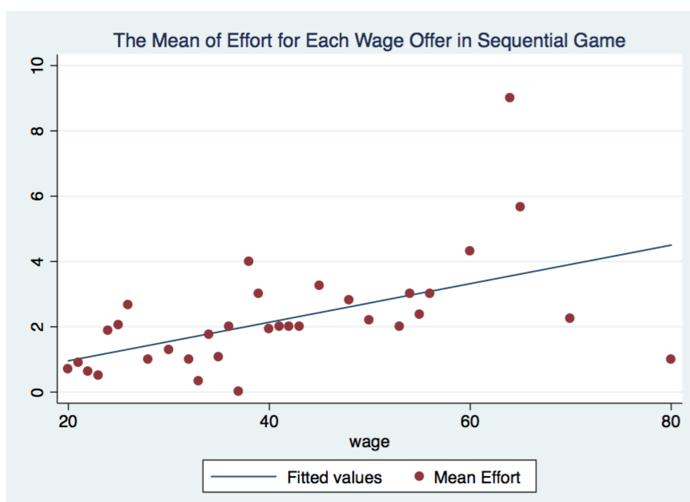

Figure 4. The mean of effort for each wage offer in sequential game

After wage offer is observed, effort level is selected by agent. Therefore, to test whether there is a positive relationship between wage and effort, we begin regression analysis by taking effort as dependent variable and wage as independent variable:

$$effort_{it} = \beta_0 + \beta_1(wage_{it}) + u_{it} \tag{1}$$

where $effort_{it}$ is effort level of employee "i" in Period t and $wage_{it}$ is wage offer to employee "i" at Period t and $t = 1, 2, 3, ...10$.

We have run panel regression by using Stata v.13 and the coefficient for regression model 1(R1) which is stated in second column on Table 5 is 0.065 and it is statistically significant with p-value <0.01 for simultaneous game (N=470).

Table 5. Regression Results for Simultaneous Game-Dependent Variable:Effort

	(R1) Effort	(R2) Effort	(R3) Effort	(R4) Effort	(R5) Effort	(R6) Effort	(R7) Effort
Wage	0.0646***		0.0580***	0.0641***		0.0575***	0.0554***
	(5.58)		(3.93)	(5.22)		(3.75)	(3.89)
Change in Wage		0.0510***	0.0200*		0.0511***	0.0204*	0.0199*
		(7.05)	(2.26)		(7.08)	(2.28)	(2.31)
Period				-0.113***	-0.0847*	-0.0763*	-0.0766*
				(-3.59)	(-2.16)	(-2.17)	(-2.17)
Constant	-0.348	1.630***	-0.244	0.291	2.138***	0.230	0.690
	(-1.06)	(10.09)	(-0.57)	(0.65)	(8.88)	(0.41)	(0.38)
N	470	423	423	470	423	423	423
Adj. R-sq	0.208	0.119	0.245	0.234	0.130	0.254	0.290
Demographic Controls	No	No	No	No	No	No	Yes

Notes: Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The β_1 coefficient in sequential game is 0.0708 which is also statistically significant with p-value<0.01 and found at Table 6. By looking these result, one can say that 15 unit increase in wage might lead to increase in effort by 1 unit.

In order to understand the individual's behavior on effort choice, we also focus on the change in wage offer. By taking the first lag of wage offer, we created new variable as wage differences.If wage offer in Period t is higher relative to previous period, then wage difference is positive. The regression for difference in wage on effort is below

$$effort_{it} = \beta_0 + \beta_1(wage_{it} - wage_{it-1}) + u_{it} \tag{2}$$

where $wage_{it} - wage_{it-1}$ is wage differences at Period t and $t = 2, 3, ...10$.

Results can be shown in third column on Table 5 and 6 (R2) and the coefficients of wage differences are statistically significant at 99% confidence interval in both games.(N=423 for sim. and N=450 for seq. game).The coefficient for simultaneous game is slightly higher than sequential game which are 0.051 and 0.0417,respectively. Increase in wage offer might be thought as more gift from principal and thus effort level might be increased by agent that are consistent with earlier studies like Fehr et al.(1993), Fehr et al.(1998), Gachter and Falk(2002) and Brown et al.(2004).

However, when we run multiple regression(R3) with independent variables used in R1 and R2, wage coefficients decrease slightly and keep rejection power as p-value<0.01 while beta coefficients of wage difference lose its power in both games. Regression coefficient for wage difference loses its power to 10% significance level in simultaneous game. Contrary, null hypothesis is true for sequential game in R3.

In this experimental setting, the effect of period might be substantial because rational agent breaks the bond in Period 10 and selects zero or one effort level if he

Table 6. Regression Results for Sequential Game-Dependent Variable:Effort

	(R1) Effort	(R2) Effort	(R3) Effort	(R4) Effort	(R5) Effort	(R6) Effort	(R7) Effort
Wage	0.0708***		0.0703***	0.0702***		0.0698***	0.0705***
	(7.10)		(5.62)	(6.86)		(5.50)	(6.09)
Change in Wage		0.0417***	0.00564		0.0414***	0.00568	0.00582
		(6.64)	(0.70)		(6.71)	(0.70)	(0.73)
Period				-0.0429	-0.0631	-0.0430	-0.0428
				(-1.54)	(-1.84)	(-1.33)	(-1.31)
Constant	-0.708*	1.707***	-0.710	-0.451	2.086***	-0.435	-3.733*
	(-2.48)	(10.08)	(-1.97)	(-1.22)	(8.21)	(-0.96)	(-2.42)
N	500	450	450	500	450	450	450
Adj. R-sq	0.271	0.065	0.275	0.273	0.070	0.277	0.316
Demographic Controls	No	No	No	No	No	No	Yes

Notes: Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

realizes that there is no more wage offer. We add period as an independent variable to R1 and R2; and effort choice cannot be explained by period in sequential game. The beta coefficient for simultaneous game is significant in multiple regression (R4 and R5 in Table 5) and R4 shows that almost 1 unit decrease in effort choice between Period 1 and Period 10. When we compare wage difference coefficients on R2 and R5 in simultaneous game, there is almost no change in wage difference coefficient but beta for period has power at 10% significance level. In R6, we regress effort on all independent variables and observe that beta for wage is statistically different from zero on both games;however, wage difference and Period is meaningful only in simultaneous game. In R7, we add our control variables such as age in years, indicator for male, number of siblings, number of economics class taken, self-evaluation for how trustful they are(trust) and how risky they are(risk) ranking from 1 to 10. The null hypothesis for all control variables is true at 5% significance level in both games and therefore we can say that these demographic control variables has no effect on effort level choice. Rejection power of beta coefficients for independent variables stays the same in simultaneous game and beta coefficients for wage differences and Period are still zero for sequential game. By looking these results, one might claim that decisions based on retrospect behavior and the effect of time(Period) are mostly seen in simultaneous game. The connection between agent and employer might be distorted by random outcomes and therefore effort level at Period t can be explained only by wage offer at Period t in sequential game.

Wage offer is fundamental variable in gift-exchange experiments. After wage offer is realized, effort level is determined by agent. In order to investigate the fact that wage offer in Period t, one can take wage offer as dependent variable and effort level in Period $t-1$ (previous effort) as independent variable.

$$wage_{it} = \beta_0 + \beta_1(effort_{it-1}) + u_{it} \tag{3}$$

where $t = 2, 3, ..., 10$. According to test results, previous effort level is statistically different from zero and equals 2.611 (p-value<0.01 and N=423) for simultaneous game and 3.6 (p-value<0.01 and N=450) for sequential game. Results are shown in second column in Table 7 and 8.

The rational principal might think herself as self-sufficient if she experiences that the maximum value found by employee is less than the value on box selected by herself. Note that if principal chooses a box among agent's choice(s), principal cannot know the rest of the box values. Therefore, principal does not observe value differences. However, if principal does not admire the maximum value found by matched agent and selects a box with the value higher than employee, then principal

Table 7. Regression Results for Simultaneous Game-Dependent Variable:Wage

	(R8) Wage	(R9) Wage	(R10) Wage	(R11) Wage	(R12) Wage	(R13) Wage	(R14) Wage	(R15) Wage	(R16) Wage
Previous Effort	2.611***		2.558***	3.480***		3.427***	3.528***	3.461***	3.478***
	(4.82)		(3.92)	(5.37)		(4.45)	(5.46)	(4.55)	(4.60)
Value Difference		-8.095**	-0.613		-8.322**	-0.572		-0.745	0.0383
		(-3.44)	(-0.23)		(-3.29)	(-0.21)		(-0.27)	(0.02)
Change in Effort				-1.189**	0.318	-1.184**	-1.235**	-1.230**	-1.240**
				(-3.25)	(1.07)	(-3.16)	(-3.33)	(-3.26)	(-3.25)
Period							0.233	0.243	0.230
							(0.85)	(0.90)	(0.83)
Constant	27.60***	33.82***	27.81***	26.17***	34.00***	26.38***	24.56***	24.77***	45.17**
	(20.41)	(20.12)	(14.48)	(18.38)	(19.55)	(12.79)	(9.35)	(8.24)	(3.44)
N	423	423	423	376	376	376	376	376	376
Adj. R-sq	0.131	0.036	0.129	0.166	0.042	0.164	0.165	0.163	0.192
Demographic Controls	No	No	No	No	No	No	No	No	Yes

Notes: Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

might make lower wage offer to employee in the next period. On the contrary, if principal selects lower value than employee, she might increase wage offer to learn the more box values in the next period. To observe the relationship between wage and value differences, we regress value differences on wage is as follows:

$$wage_{it} = \beta_0 + \beta_1(Y_{it-1} - Z_{it-1}) + u_{it} \tag{4}$$

where Y_{it-1} is box value selected by principal "i" in Period $t-1$ and Z_{it-1} is the maximum value found by agent. The difference equals to zero if principal chooses one of boxes selected by agent. Otherwise it can be taken the values $\in$[-0.9,0.9] with 0.1 decimal. The coefficient of value differences is negative and statistically significant in all games. The coefficient is -8.095 in simultaneous game and -11.84 in sequential one. By looking these results, we can say that if box selected by principal has higher value than the agent's box on previous period, then wage offer at Period t is almost 46% less in sequential game. However, when we run multiple regression with these two independent variables, the null hypothesis that beta of value differences is true for both games while keeping beta for previous effort is significant.

If principal observes the decline in effort in consecutive periods, she might decrease wage offer.For example, if employee extracts 3 effort in Period 1 and 2 effort in Period 2 in response for the same wage offer, employer might tend to reduce wage offer in Period 3. To test this effect, we take first and second lag differences of effort and construct multiple regression including change in effort as new variable.

$$wage_{it} = \beta_0 + \beta_1(effort_{it-1}) + \beta_2(effort_{it-1} - effort_{it-2}) + u_{it} \tag{5}$$

$$wage_{it} = \beta_0 + \beta_1(Y_{it-1} - Z_{it-1}) + \beta_2(effort_{it-1} - effort_{it-2}) + u_{it} \tag{6}$$

where $t = 3, 4.., 10$. The fifth and sixth columns in Table 7 and 8 (R11 and R12) shows the multiple regression results. Change in effort coefficient is negative and statistically significant in R11 on both games. This negative sign implies that marginal decrease in effort on previous period effort1 $effort_{it-1} - effort_{it-2} < 0$ leads to increase in wage offer and wage increase almost equals in two games. On the contrary, when we regress wage on effort decrease and value difference, beta for value difference is roughly the same but beta for decrease in effort is zero. R13 stands for multiple regression with three independent variable above. Null hypothesis that beta coefficient of value difference is zero cannot be rejected in both games, thus we can say that value difference has no effect on both games while previous effect and decrease in effort are statistically significant. To test the effect of Period on wage offer, we add Period variable into the regressions R11 and R13. Period variable has negative and statistically significant coefficient in simultaneous game while keeping other independent variables as significant. On the other hand, Period effect cannot be seen in sequential game due to the fact that all beta coefficients for Period variable is zero. On the last column of Table 7 and 8 (R16), we add our control variables which is also used for effort regressions and we observed that demographic variables has no effect on wage offer in both games.

Table 8. Regression Results for Sequential Game-Dependent Variable:Wage

	(R8) Wage	(R9) Wage	(R10) Wage	(R11) Wage	(R12) Wage	(R13) Wage	(R14) Wage	(R15) Wage	(R16) Wage
Previous Effort	3.599***		3.415***	4.391***		4.163***	4.384***	4.156***	4.147***
	(8.44)		(7.04)	(7.66)		(6.39)	(7.63)	(6.36)	(6.64)
Value Difference		-11.84***	-2.314		-11.82***	-2,690		-2.686	-2.986
		(-5.25)	(-1.21)		(-4.74)	(-1.32)		(-1.31)	(-1.45)
Change in Effort				-1.512***	0.310	-1.494***	-1.506***	-1.488***	-1.518***
				(-4.00)	(1.28)	(-3.88)	(-3.98)	(-3.86)	(-3.91)
Period							-0.0778	-0.0752	-0.0735
							(-0.31)	(-0.30)	(-0.29)
Constant	27.61***	35.81***	28.28***	26.01***	35.71***	26.85***	26.52***	27.34***	14.44
	(20.96)	(21.22)	(17.93)	(18.64)	(20.24)	(15.24)	(12.14)	(11.27)	(0.76)
N	450	450	450	400	400	400	400	400	400
Adj. R-sq	0.236	0.072	0.237	0.261	0.079	0.262	0.259	0.260	0.290
Demographic Controls	No	No	No	No	No	No	No	No	Yes

Notes: Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To check the robustness of effort and wage regressions, we have used Wooldridge test for autocorrelation in panel data. We first tested serial correlation in effort regressions and we reject the null hypothesis that there is no first-order autocorrelation between wage and change in wage variables with p-value <0.01 in both games. When we look at serial correlation in wage regression, we observe that there exist autocorrelation between previous effort and change in effort in two games(p-value<0.01). We fail to reject null hypothesis that there is no autocorrelation between previous effort and value difference in both games with p-value= 0.08 in simultaneous game and p-value=0.1 in sequential game. We also observe serial correlation between change in effort and value differences in sequential game (p-value$<$0.01) but not in simultaneous game. Thus, in order to solve serial correlation problem, we added individual fixed effect to regressions and also included period as dummy variable.

New effort regression coefficients can be found at Table 9 for two games. Wage coefficients in two game are still positive and statistically significant but the coefficient decreases in sequential game while staying almost the same in simultaneous game. The coefficient for last period is significant in both games and negative sign of coefficient might be the evidence for the fact that decrease in effort is more observable in simultaneous game. Also, one can observe that the coefficient of the change in wage gains significance in sequential game. We do not add demographic variables into regression analysis because of the fact that they cause multicollinearity with the fixed effects.

On the other hand, one can notice that previous effort coefficients decrease nearly by 1 unit in simultaneous game and more than 2 unit in sequential game while coefficients are still positive and significant excepting last regression on Table 10 and 11. Contrary, beta coefficient of value differences increases in both games and the change in coefficient is larger in sequential game. Last period is insignificant on both games on 95% confidence interval. Change in effort variable has lost its significance level in two games and becomes significant on 90% confidence interval in simultaneous game but insignificant in sequential game. The negative beta coefficient of change in effort in simultaneous game may imply that if agents decreases effort in previous periods, then principal increases wage offer to lessen the effects of random values.

In overall, we have seen that there is a positive relationship between wage and effort and the regression coefficients of two games are close to each other. We observe that effort level is explained by wage offer while change in wage offer has less power on agent's decisions in two games. In line with the earlier studies, agents rewards his employer by serving effort higher than minimum one. On the other hand, wage is explained by previous effort and the higher effort level in Period $t-1$ lead to higher wage offer in Period t. If effort is lowered in comparison to previous period, then employer may be worried about decrease in effort and increases wage offer in simultaneous game but not in sequential one. Namely, even if under uncertain outcomes, people respond wage offer and effort level based on reciprocity. However, one can conclude that timing of outcome realization has almost no effect on subjects choice.

Table 9. Effort Regressions with Fixed Effect for Two Games

	Simultaneous			Sequential		
Wage	0.0687***		0.0534***	0.0497***		0.0357*
	(7.07)		(5.41)	(5.08)		(2.67)
10.Period	-1.586***	-1.120***	-1.114***	-0.714*	-1.030*	-0.888*
	(-5.22)	(-3.45)	(-3.57)	(-2.28)	(-2.52)	(-2.19)
Change in Wage		0.0458***	0.0186*		0.0376***	0.0204*
		(7.98)	(2.48)		(5.81)	(2.55)
Constant	0.491	2.271***	0.521	0.238	2.198***	0.902
	(1.25)	(9.90)	(1.33)	(0.54)	(7.36)	(1.51)
N	470	423	423	500	450	450
Adj. R-sq	0.227	0.052	0.120	0.114	0.106	0.129
Period Dummy	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10. Wage Regressions with Fixed Effect for Sim. Game

	(1) Wage	(2) Wage	(3) Wage	(4) Wage	(5) Wage	(6) Wage
Previous Effort	1.602**		1.345*	2.150**		1.844*
	(3.02)		(2.31)	(2.99)		(2.36)
10.Period	1.381	0.912	1.774	1.991	1.161	2.458
	(0.58)	(0.38)	(0.74)	(0.69)	(0.41)	(0.85)
Value Difference		-6.834**	-3.488		-7.109**	-4.190
		(-3.13)	(-1.61)		(-3.03)	(-1.85)
Change in Effort				-0.727*	0.0907	-0.735*
				(-2.02)	(0.37)	(-2.03)
Constant	28.72***	33.10***	29.43***	27.34***	32.89***	28.20***
	(14.95)	(26.00)	(13.89)	(10.31)	(18.90)	(9.76)
N	423	423	423	376	376	376
Adj. R-sq	0.054	0.022	0.059	0.056	0.023	0.064
Period Dummy	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11. Wage Regressions with Fixed Effect for Seq. Game

	(1) Wage	(2) Wage	(3) Wage	(4) Wage	(5) Wage	(6) Wage
Previous Effort	1.352***		1.159**	1.008*		0.771
	(4.09)		(3.26)	(2.21)		(1.53)
10.Period	-5.103*	-4.493	-4.706*	-3.923	-3.867	-3.687
	(-2.32)	(-1.94)	(-2.11)	(-2.00)	(-1.98)	(-1.88)
Value Difference		-5.097**	-2.467		-3.852*	-2.774
		(-3.33)	(-1.49)		(-2.37)	(-1.51)
Change in Effort				0.160	0.528*	0.180
				(0.51)	(2.61)	(0.57)
Constant	33.54***	36.45***	34.01***	32.96***	35.46***	33.73***
	(21.65)	(24.42)	(22.19)	(21.09)	(29.78)	(20.06)
N	450	450	450	400	400	400
Adj. R-sq	0.060	0.032	0.063	0.044	0.042	0.049
Period Dummy	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.4 Employer Payoff and Effort

When we focus on the relationship between employer payoff and effort, we observe that employer payoff rises from effort level 2 to 4; however, the value of employer payoff fluctuates after effort level 4 in simultaneous game. When we look at the Table 12 on below, we say that the magnitude of the positive and negative deviation from mean of employer payoff is almost equal and therefore fitted line is almost horizontal. Namely, we observe that there is a slight decrease in employer payoff as effort level rises. This is likely to be due to low number of observations.

Table 12. Mean of Employer Payoff by Effort

Effort	Simultaneous Game Mean of Employer Payoff	Sequential Game Mean of Employer Payoff
0	51.93	51.42
1	61.53	63.96
2	60.45	60.02
3	64.17	61.65
4	68.16	57.72
5	57.28	54
6	72.36	56.96
7	49.5	45.25
8	51.42	54
9	35	44.2
10	68	59.75
Mean	**60.89**	**56.46**

In sequential game, employer payoff almost linearly decreases from effort level 3 to effort level 7 in sequential game. From effort level 0 to 2 and 7 to 10, we see that employer payoff does not follow any path in line with the effort level. By looking Figure 5 and 6 below, the fitted line is downward sloping and therefore we can say that employer payoff decreases as effort level increases in sequential game. One reason to explain negative slope is probably due to the fact that high effort is only observed for high wage, and the return for that wage is not enough to compensate the employer.

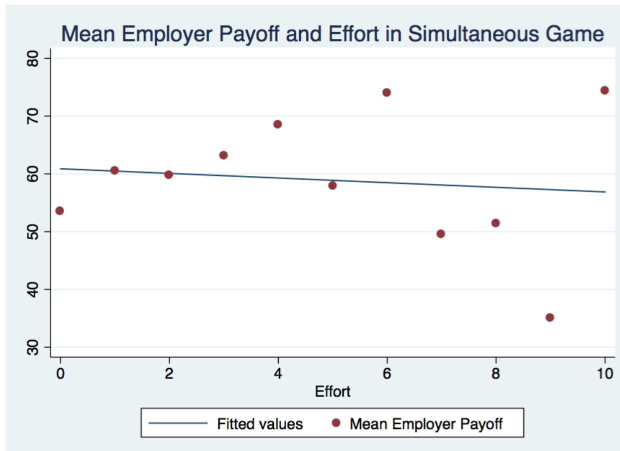

Figure 5. Mean employer payoff and effort in simultaneous game

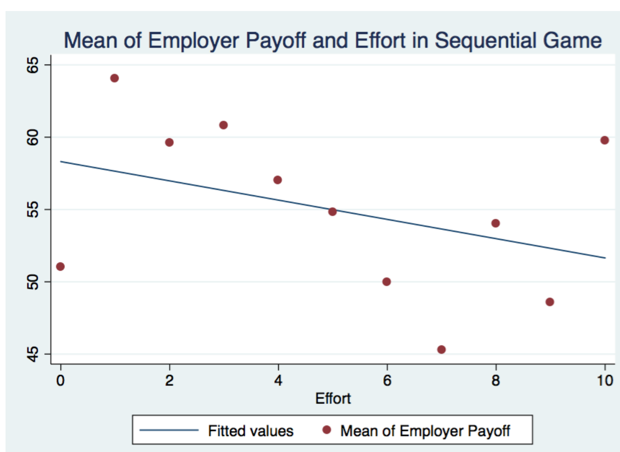

Figure 6. Mean employer payoff and effort in sequential game

4.5 Expected Maximum Value

Because of the fact that the box values are hidden and the learning the value of boxes is costly for agent, calculation of the expected maximum box value for each effort level takes important place for subjects in order to maximize their payoffs. Wage offer gives a signal to the agent and agent effort choice directly affects the payoff of both parties. All subjects are informed about the distribution of box values that each box takes uniformly distributed random value among 0.1 and 1 with 0.1 decimals. The probability density function(PDF) of expected value equals given box value under selected effort level among n boxes calculated as follows:

$$P(max\{V_1, V_2, V_3, ..., V_l = v\}) = \frac{(10v)^l - (10v-1)^l}{n^l}$$

where l is number of opened boxes (effort level) and v is the value of box takes value between 0.1,0.2,...,1, V_l is the value of box given effort level l and n number of all boxes,e.g 10 in our experiment. We multiply v by 10 and it gives the value that how many different value takes one box. For example, if v equals 0.3, then there are 3 different number that box takes such as 0.1, 0.2 and 0.3. $(10v)^l$ gives the number of observations that value of boxes takes values from 0.1 to v for a given effort level. And we subtract $(10v-1)^l$ observations that do not include the value of v namely do not give maximum value as v with l effort. Then, we divide it to total number of observations for a given effort level. The probabilities of each box values for a given effort level can be seen at Table 13. Suppose we want to calculate the joint probability of finding box value equals 0.9 with 5 effort level:

$$P(max\{V_1, V_2, V_3, V_4, V_5 = 0.9\}) = \frac{(10*(0.9))^5 - (10*(0.9)-1)^5}{10^5} = 0.2628$$

Table 13. Probability of Box Values for a Given Effort Level

Effort	1	2	3	4	5	6	7	8	9	10
Box Value										
0.1	0.1	0.01	0.001	0.0001	0.00001	0.000001	0.0000001	0.00000001	0.000000001	0.0000000001
0.2	0.1	0.03	0.007	0.0015	0.00031	0.000063	0.0000127	0.00000255	0.000000511	0.0000001023
0.3	0.1	0.05	0.019	0.0065	0.00211	0.000665	0.0002059	0.00006305	0.000019171	0.0000058025
0.4	0.1	0.07	0.037	0.0175	0.00781	0.003367	0.0014197	0.00058975	0.000242461	0.0000989527
0.5	0.1	0.09	0.061	0.0369	0.02101	0.011529	0.0061741	0.00325089	0.001690981	0.0008717049
0.6	0.1	0.11	0.091	0.0671	0.04651	0.031031	0.0201811	0.01288991	0.008124571	0.0050700551
0.7	0.1	0.13	0.127	0.1105	0.09031	0.070993	0.0543607	0.04085185	0.030275911	0.0222009073
0.8	0.1	0.15	0.169	0.1695	0.15961	0.144495	0.1273609	0.11012415	0.093864121	0.0791266575
0.9	0.1	0.17	0.217	0.2465	0.26281	0.269297	0.2685817	0.26269505	0.253202761	0.2413042577
1	0.1	0.19	0.271	0.3439	0.40951	0.468559	0.5217031	0.56953279	0.612579511	0.6513215599
Cumulative	1	1	1	1	1	1	1	1	1	1

In order to calculate expected maximum value of box given effort level, we need to multiply each box values probability for a given effort level with box values and add them up. Then we get,

$$E[V|l] = \sum_{v=0.1}^{1} \frac{(10v)^l - (10v-1)^l}{n^l} * v$$

Using formula above, we can calculate expected maximum value of boxes for 5 effort level as:

$$E[V|l] = \sum_{v=0.1}^{1} \frac{(10*(0.9))^5 - (10*(0.9)-1)^5}{10^5} * v = 0.879$$

By using these probabilities in Table 13, we have calculated expected maximum value for each effort level on Table 14. Besides, the mean of maximum box value found by agent for each effort level in two games stated in third and forth columns at Table 14. Figure 12 and 13 in Appendix A show the relationship between box value and effort for each game. Furthermore, Figure 14 and 15 in Appendix A illustrate the relationship between employer payoff and box value in two games. Taking into account the expected maximum value of each effort level and figures in Appendix A, we can state that there is a potential Pareto improvement in this game.

In this experiment, the mean wage is 33.33 and mean effort is 1.728. Note that, mean of agent payoff is 31.91 and employer payoff is 58.63. By looking Table 14 expected maximum values in second column, we can find better payoff solutions for both parties. For example, employer offers 34 ECU and agent decides 3 boxes to open. The expected payoff for agent would be

$$U_A(w, c(b)) = 34 - c(3) = 32$$

and employers expected payoff would be

$$U_P(v, w) = (120 - 34) * 0.797 = 68.58$$

Employer can increase own payoff by considerable amount while increasing agent payoff slightly. We can construct 80 more equilibrium which dominate the mean of experimental results. However, 7 of them is dominated by the equilibrium which is stated above. For instance, employer offers 35 ECU as wage and labor decides 3 boxes to open. With these values,labor payoff is

$$U_A(w, c(b)) = 35 - c(3) = 33$$

$$U_P(v, w) = (120 - 35) * 0.797 = 67.78$$

Even if these outcomes make agent better off, due to the fact that in this game first employer offers a wage and then agent choose the effort level, offering 35 ECU is dominated by offering 34 ECU for employer.

Table 15 shows different Pareto Efficient outcomes for different wage and effort level. 8 of these Pareto efficient outcome give employer payoff at least 10 ECU higher than the mean employer payoff in experiment. It can be seen that the equilibrium that offering 40 ECU as a wage and choosing effort level 6 maximizes subjects expected payoffs is Pareto Dominant.

Table 14. The Mean of Box Values in Each Effort Level

Effort	Exp. Max. Value	Sim. Game	Seq. Game
0	0	0	0
1	0.55	0.585	0.627
2	0.715	0.688	0.758
3	0.797	0.792	0.814
4	0.846	0.858	0.811
5	0.879	0.865	0.826
6	0.902	0.95	0.79
7	0.919	0.9	0.883
8	0.932	0.925	0.833
9	0.942	0.7	0.84
10	0.95	0.94	0.875

Table 15. Pareto Efficient Outcomes for Different Wage and Effort Level

Effort Level(l)	Wage	c(l)	Agent Expected Payoff	Employer Expected Payoff
2	33	1	32	62.2
3	34	2	32	68.58
4	36	4	32	71.12
5	38	6	32	72.09
6	**40**	**8**	**32**	**72.16**
7	42	10	32	71.69
8	44	12	32	70.85
9	47	15	32	68.8
10	50	18	32	66.55

In our experiment, 42 out of 470 and 45 of 500 observations are recorded as wage offer equals 40. The mean of box value given wage offer=40 ECU is 0.7.By focusing on giving sample sizes, offering socially efficient wage can be seen almost 10% of our observations. However, the rest of observations cannot be explained by converging competitive outcomes. In this setup, agents are indifferent to choose zero and one effort level but if they care about efficiency, selecting one effort increases productivity as well as employer's payoff. Mean wage and effort are higher than the competitive outcome where wage offer equals 20 and effort level equals 0 or 1. Thus, our findings are consistent with earlier studies that people make their wage and effort decision not solely based on material payoff maximization but based on reciprocity.

CHAPTER 5

CONCLUSION

In this paper, we examine the effect of random outcomes and timing of outcome realization on labor market outcomes. To test these effects, we modified gift-exchange game studied by Charness and Haruvy(2002) and construct two games which are called as simultaneous and sequential game. Many of gift-exchange game, employer makes a wage offer and the agent, upon observing this offer, decided how much effort to extract.In our simultaneous game, after deciding and committing effort level on computer screen, agent learns the random outcomes of each effort level at the same time. On the other hand, in sequential game, agent learns random value of selected effort level immediately after increasing effort decision by one unit.

We mainly focused on wage and effort decision of principal and agents. Principals offers 61% more in simultaneous game and 71% more in sequential game even if they are faced with random labor productivity. In exchange for these, agents supply approximately 73% higher effort in both games. By means of regression analyses, we observed that there exist positive relationship between wage and effort. We observe that mean wage offer differs to each other in two games. The mean wage offer in simultaneous game fluctuates less in simultaneous game while change in wage offer in sequential game is observable. Effort level selection can be explained by wage offer in two games but change in wage offer in comparison to earlier periods has only power on effort level in simultaneous game. Also, effort level may fluctuate more with period in simultaneous game.

Wage decision in Period t can be explained by effort level in Period $t-1$ in both games. Value differences, which is difference between maximum value found by agent and the box value selected by principal, has no significant effect on wage when we run multiple regression. Change in effort is an signal for principal and the regression coefficient is negative and significant at 90% confidence interval in simultaneous game but not in sequential game. This negative slope implies that if agents decreases effort in previous periods, then principal increases wage offer to lessen the effects of random values on her business. Aggregating all of our findings, we can say that random outcomes has effect on labor market but timing of outcome realization might not have significant effect on labor effort choice as well as wage offer of principal.

APPENDIX A

FIGURES

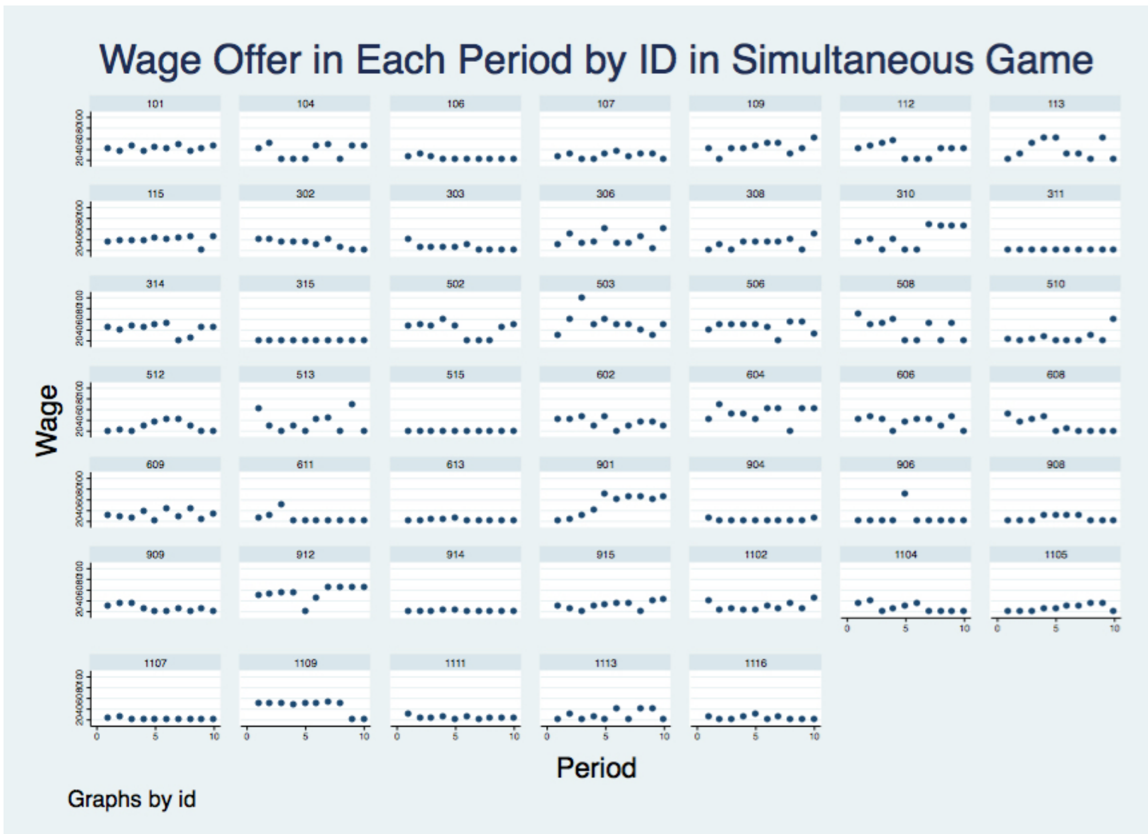

Figure 7. Wage offer in each period by ID in sim. game

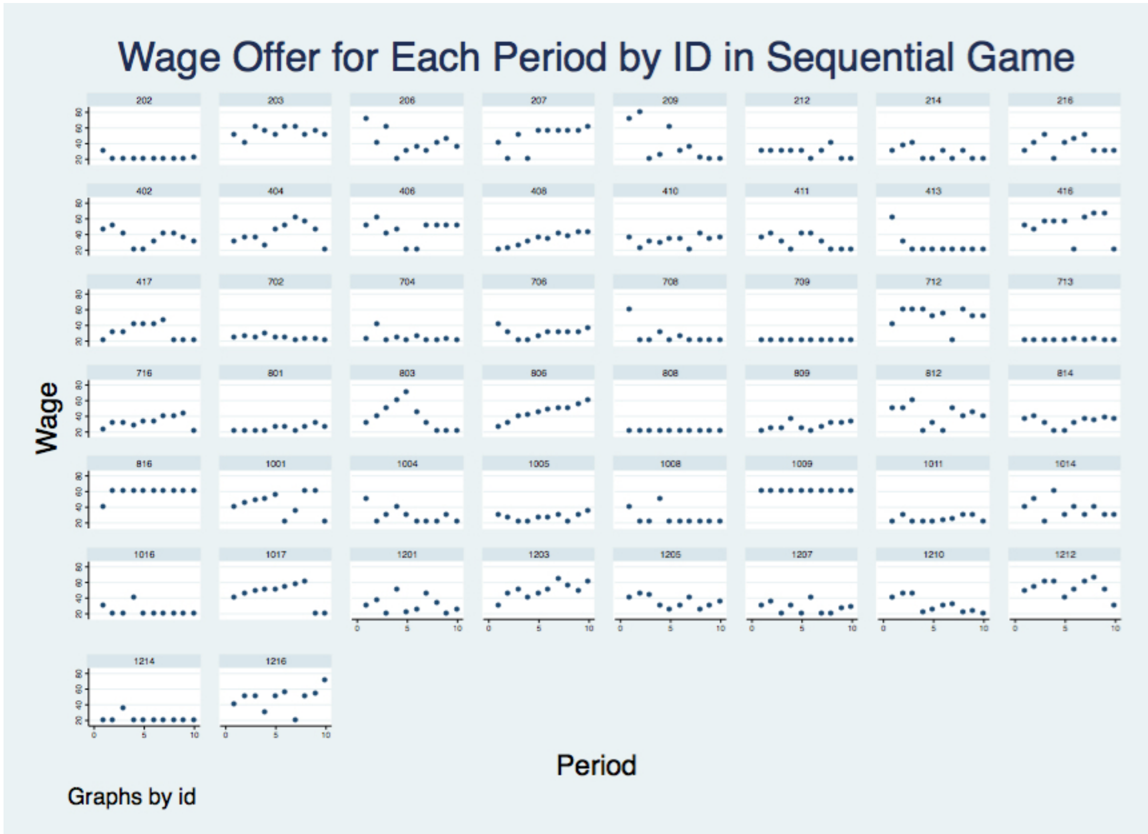

Figure 8. Wage offer in each period by ID in seq. game

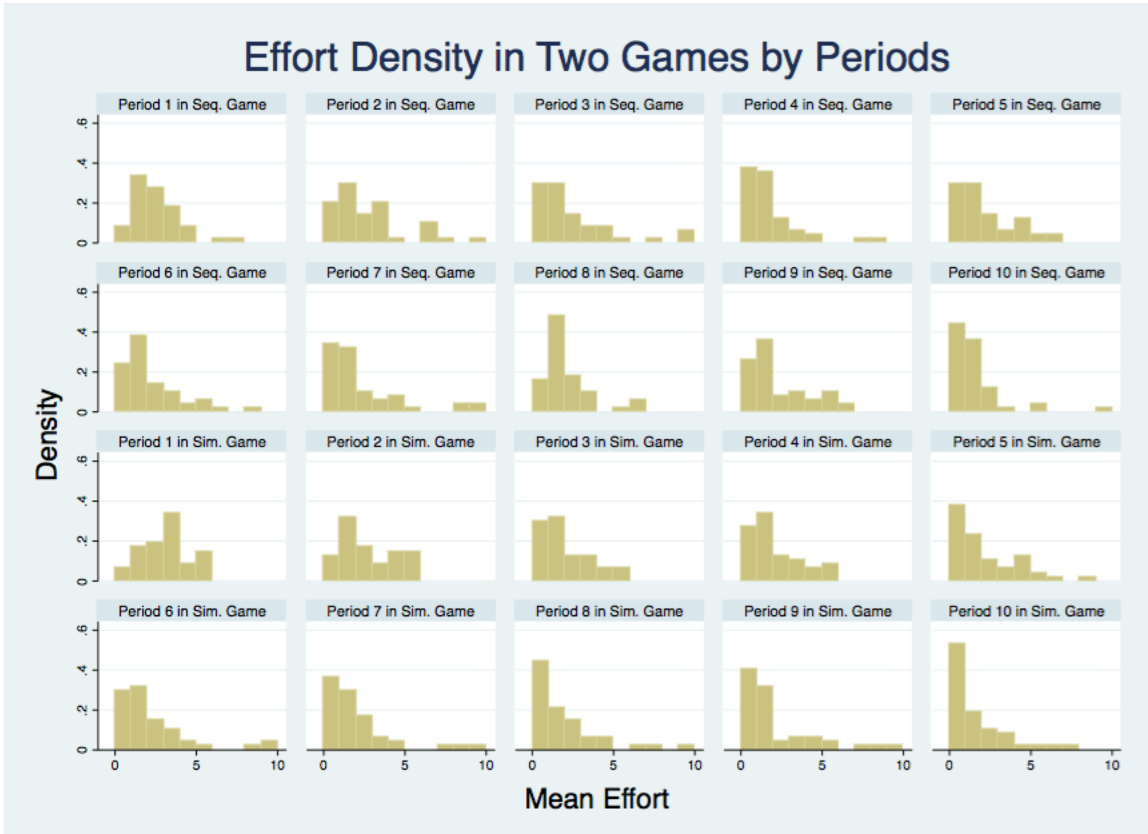

Figure 9. Effort density in two games by periods

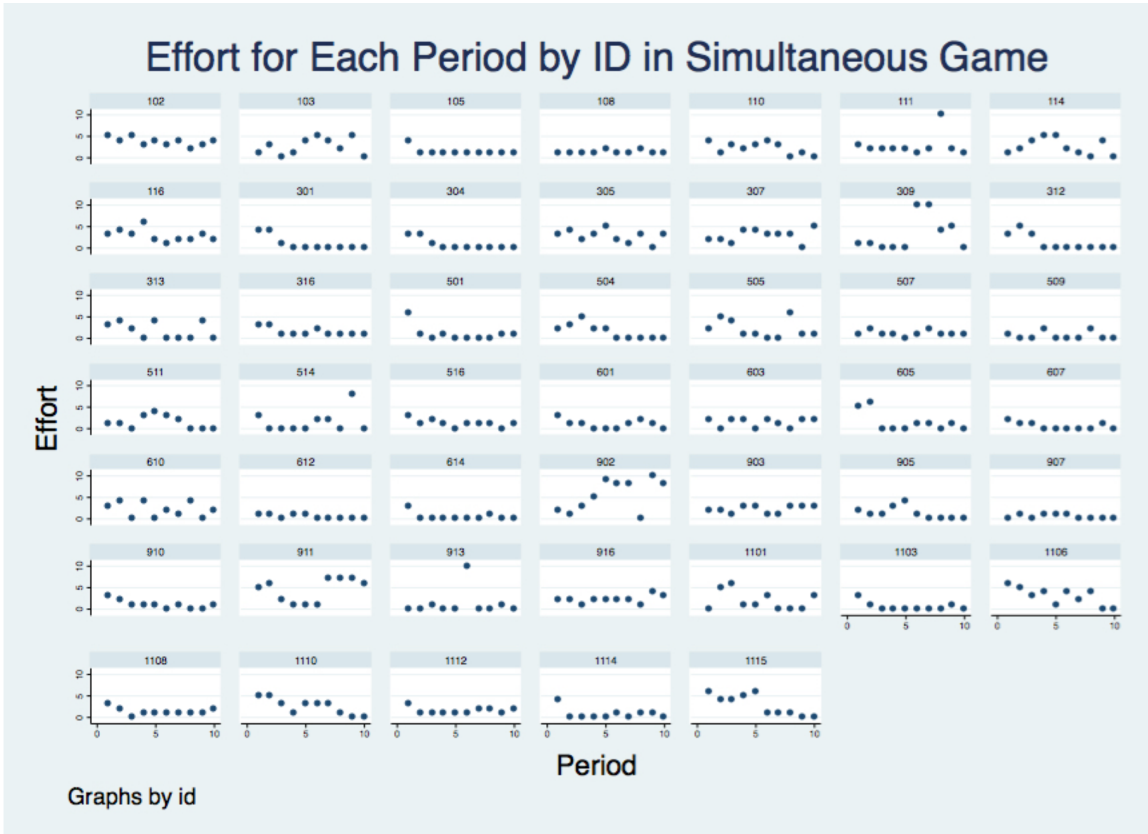

Figure 10. Effort in each period by ID in sim. game

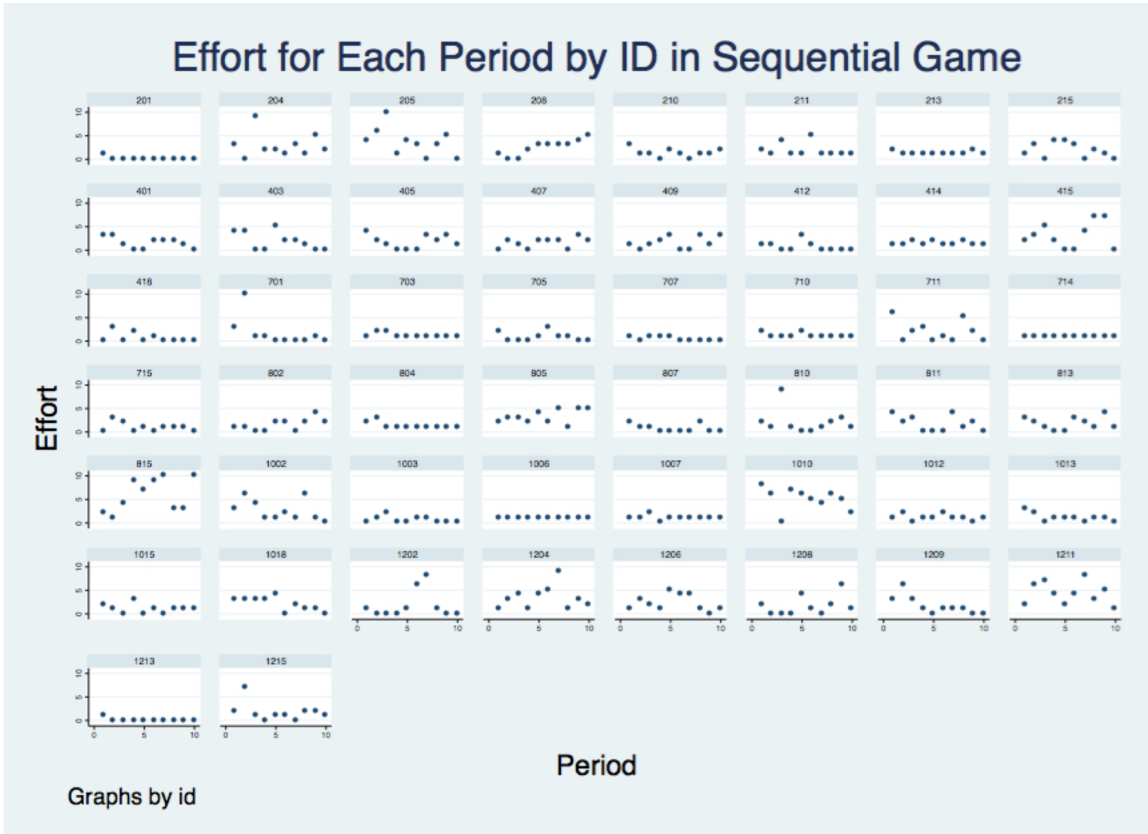

Figure 11. Effort in each period by ID in seq. game

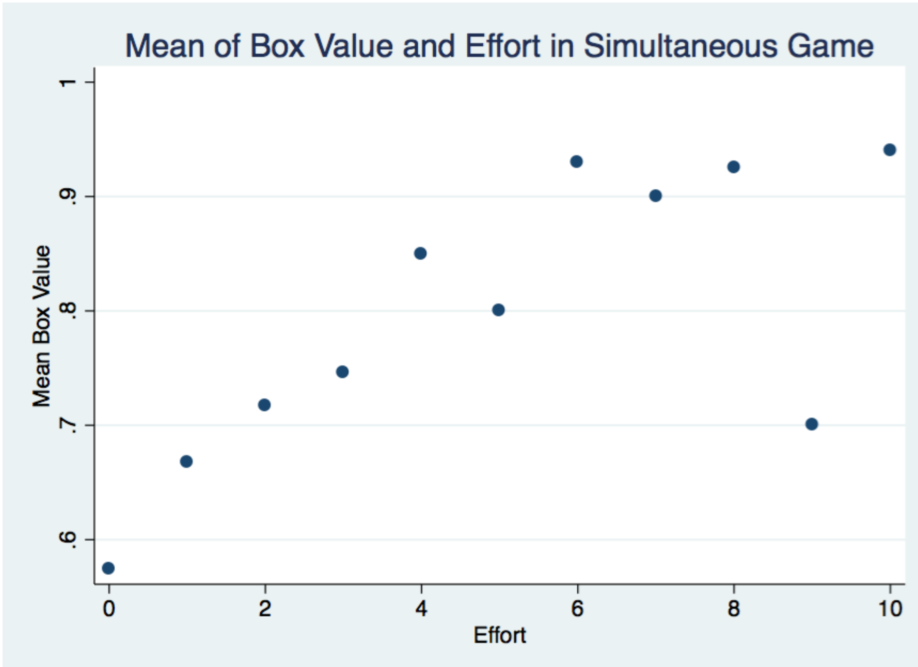

Figure 12. Mean of box value for a given effort level in simultaneous game

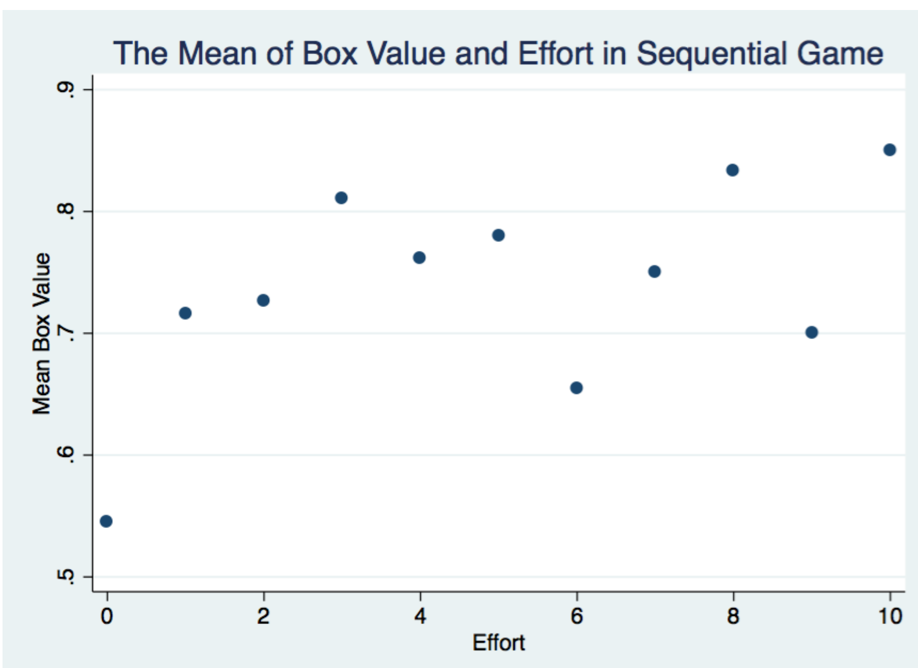

Figure 13. Mean of box value for a given effort level in sequential game

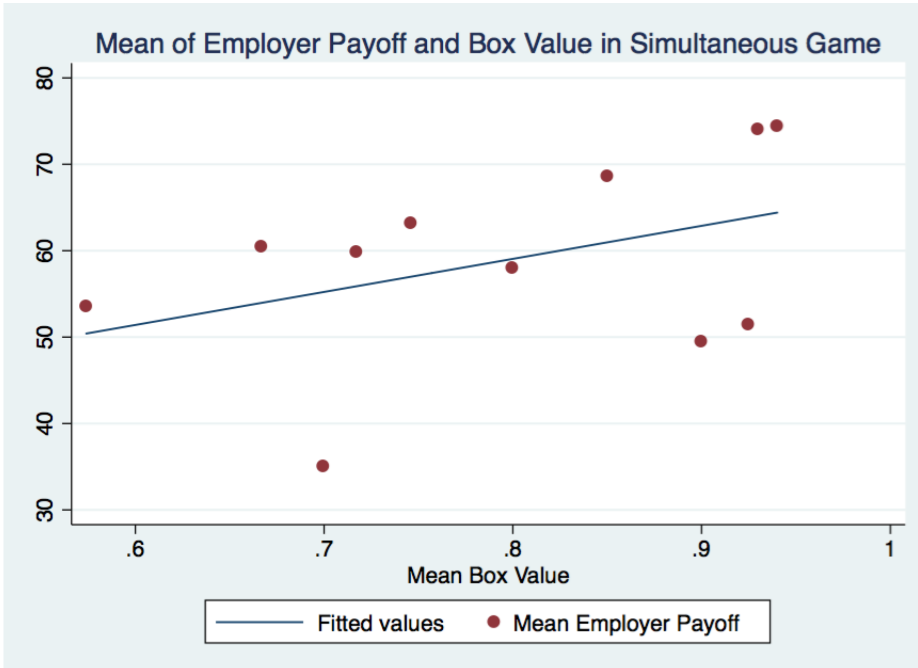

Figure 14. Mean of employer payoff for a given box value in simultaneous game

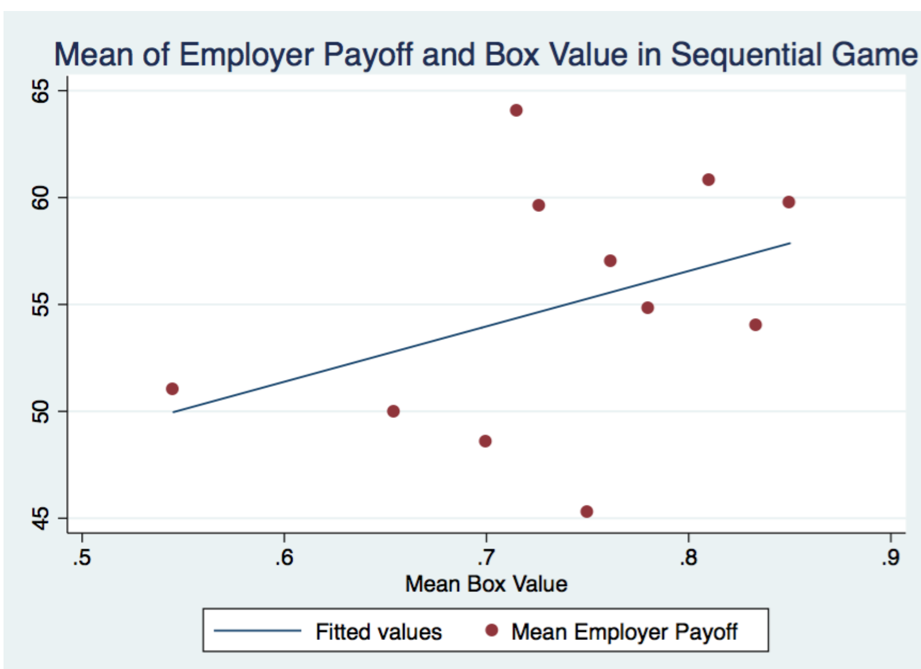

Figure 15. Mean of employer payoff for a given box value in sequential game

APPENDIX B

INSTRUCTIONS OF SIMULTANEOUS GAME

Welcome!

Thank you for your participation. The purpose of this study is to understand how people make decisions in certain situations. From now on, participants are not allowed to talk to each other. Violation of this rule requires us to terminate the experiment. If you have any question, please raise your hand and ask your question. By means of that, everybody can hear your question and its answer.

The experiment will be played in computer and you will send all of your decisions via computer. You will earn a cash prize at the end of the experiment. Your earnings depend on your and other players decision. These earnings and experiment participation fee will be paid in the end of the experiment by cash.

Now, we begin to explain the game that you will play.

Game:

The game will last 10 rounds and you will be matched with any participant (rather than you) in the beginning of the game. These matching will be the same participant for all 10 rounds; namely, you will play this game with same person. One of you will play the game as the player A and the other as the player B and the roles will remain constant for 10 rounds.

In this game, the task of player A is to choose a box for own business. There are 10 different boxes and the value of these boxes varies randomly between 0.1 and 1 (0.1 and 1, included). The task of the player B is to learn the value of these boxes for the player A.

The game begins with Player A's wage offer to Player B. Initial endowment of Player A is **120** gold and minimum wage in this economy is **20** gold. Therefore, Player A can make wage offer between **20** and **120** gold. Learning the value of boxes is costly for Player B. The cost schedule as follows:

Table 16. The Cost of Box Selection for Player B

box	1	2	3	4	5	6	7	8	9	10
cost	0	1	2	4	6	8	10	12	15	18

After Player A makes wage offer, Player B decides how many boxes that s/he will choose to learn value and determines which boxes that s/he will select.

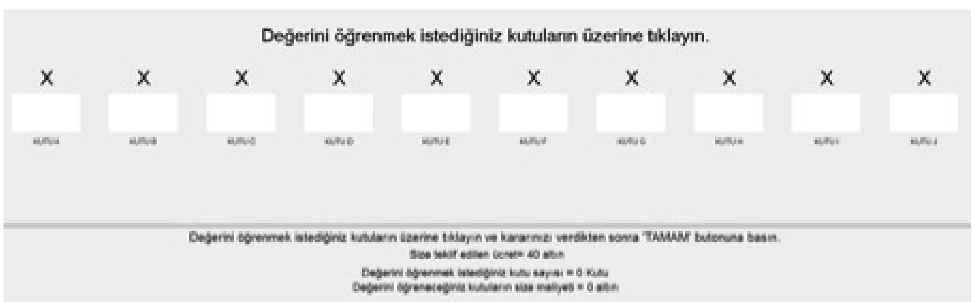

Figure 16. Screenshot 1 for illustrated simultaneous game

During the game, Player B marks the boxes on computer screen that s/he wants to learn the values. When Player B marks the box, the white color of box turns into black. Player B can see the given wage offer, how many boxes s/he selects and the cost of value learning on the bottom of the computer screen. If Player B wants to undo any of his/her box selection, then s/he should click the black portion of box. This action takes back his/her selection. After Player B decides and selects the box(es), then s/he should click OK button.

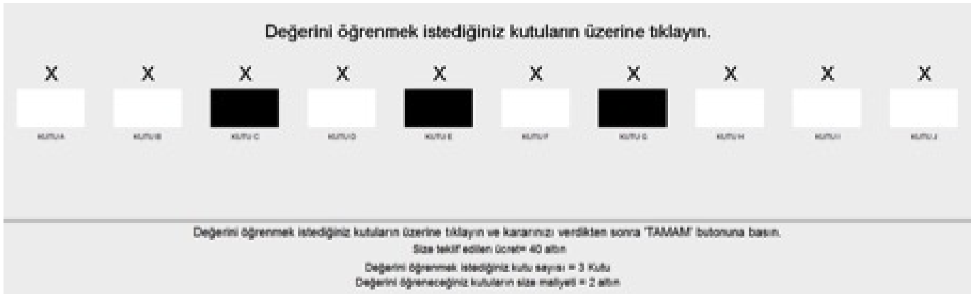

Figure 17. Screenshot 2 for illustrated simultaneous game

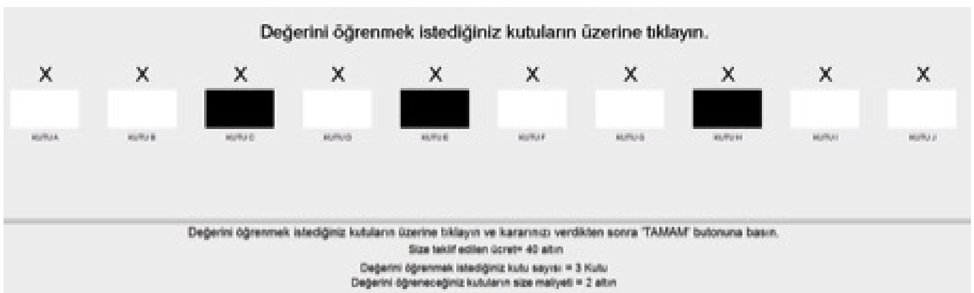

Figure 18. Screenshot 3 for illustrated simultaneous game

On the next screen, the value(s) of selected box(es) will be learned by both Player A and B . When Player B reaches this screen, s/he should click OK button to continue.

At the same time, Player A should select **ONE** box for his/her business. Player A can make his/her one box selection among all 10 boxes (included both value-learned box(es) and unlearned box(es)).

Figure 19. Screenshot 4 for illustrated simultaneous game

After Player A makes his/her box selection, the payoff of players will be determined.

- The payoff for **Player A** in the end of the round is calculated as:
  (120-Wage offer)*(Box Value Selected by Player A)
- The payoff for **Player B** in the end of the round is calculated as:
  (Wage Offer)-(The Cost of Box Value Learning)

The money to be paid to you at the end of the game will be selected randomly among 10 rounds you have played. Therefore, it is expected to see that you should pay equal attention in all rounds. In this experiment, **1 Gold** equals to **30 Kuruş** (10 Gold= 3 Turkish Lira). In addition to your earnings, you will get 10 Turkish Lira as experiment participation fee.

APPENDIX C

INSTRUCTIONS OF SEQUENTIAL GAME

Welcome!

Thank you for your participation. The purpose of this study is to understand how people make decisions in certain situations. From now on, participants are not allowed to talk to each other. Violation of this rule requires us to terminate the experiment. If you have any question, please raise your hand and ask your question. By means of that, everybody can hear your question and its answer.

The experiment will be played in computer and you will send all of your decisions via computer. You will earn a cash prize at the end of the experiment. Your earnings depend on your and other players decision. These earnings and experiment participation fee will be paid in the end of the experiment by cash.

Now, we begin to explain the game that you will play.

Game:

The game will last 10 rounds and you will be matched with any participant (rather than you) in the beginning of the game. These matching will be the same participant for all 10 rounds; namely, you will play this game with same person. One of you will play the game as the player A and the other as the player B and the roles will remain constant for 10 rounds.

In this game, the task of player A is to choose a box for own business. There are 10 different boxes and the value of these boxes varies randomly between 0.1 and 1 (0.1 and 1, included). The task of the player B is to learn the value of these boxes for the player A.

The game begins with Player As wage offer to Player B. Initial endowment of Player A is **120** gold and minimum wage in this economy is **20** gold. Therefore, Player A can make wage offer between **20** and **120** gold. Learning the value of boxes is costly for Player B. The cost schedule as follows:

Table 17. The Cost of Box Selection for Player B

box	1	2	3	4	5	6	7	8	9	10
cost	0	1	2	4	6	8	10	12	15	18

After Player A makes wage offer, Player B decides how many boxes that s/he will choose to learn value and determines which boxes that s/he will select.

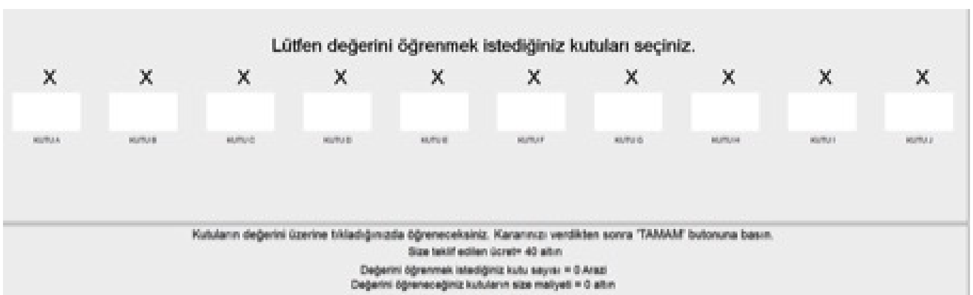

Figure 20. Screenshot 1 for illustrated sequential game

During the game, Player B marks the boxes on computer screen that s/he wants to learn the values. Player B learns the value of boxes immediately after s/he marks the box. Therefore, the box selection cannot be retaken. Player B can see the given wage offer, how many boxes he selects and the cost of value learning on the bottom of the computer screen.After Player B decides and selects the box(es), then s/he should click OK button.

On the next screen, the value(s) of selected box(es) will be learned by both Player A and B . When Player B reaches this screen, s/he should click OK button to continue.

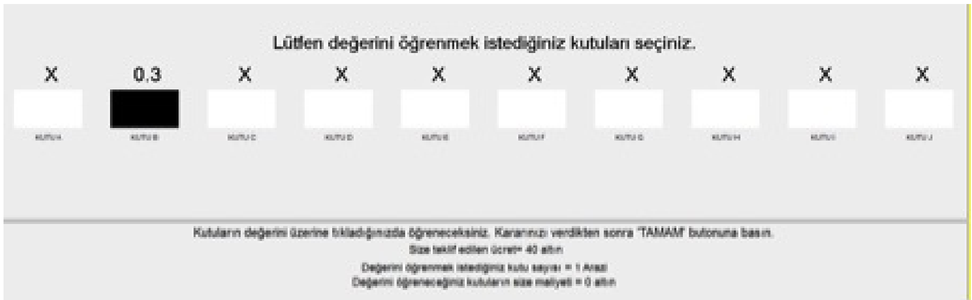

Figure 21. Screenshot 2 for illustrated sequential game

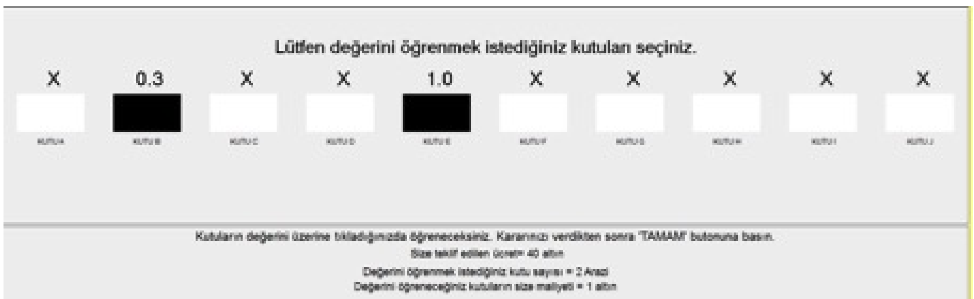

Figure 22. Screenshot 3 for illustrated sequential game

At the same time, Player A should select **ONE** box for his/her business. Player A can make his/her one box selection among all 10 boxes (included both value-learned box(es) and unlearned box(es)).

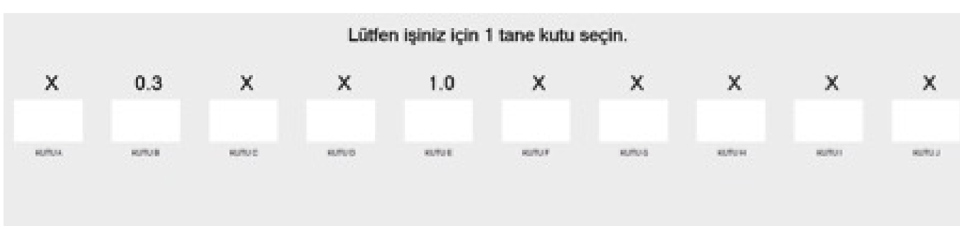

Figure 23. Screenshot 4 for illustrated sequential game

After Player A makes his/her box selection, the payoff of players will be determined.

- The payoff for **Player A** in the end of the round is calculated as:
  (120-Wage offer)*(Box Value Selected by Player A)

- The payoff for **Player B** in the end of the round is calculated as:
  (Wage Offer)-(The Cost of Box Value Learning)

The money to be paid to you at the end of the game will be selected randomly among 10 rounds you have played. Therefore, it is expected to see that you should pay equal attention in all rounds. In this experiment, **1 Gold** equals to **30 Kuruş** (10 Gold= 3 Turkish Lira). In addition to your earnings, you will get 10 Turkish Lira as experiment participation fee.

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