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: Evidences from Lab-Experiments

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I. INTRODUCTION

An increasing number of enterprises or organizations is introducing performance-based pay[1] in recent decades for the sake of increasing productivity. According to a survey based on data of EWCS (2000-2005) and GSS (2002-2006), almost a half of private enterprises in the U.S. and more than 15 percent in EU countries introduced a performance related pay to their employees (Boeri et al. 2013). Performance-based pay is usually introduced in an expectation to increase worker's efforts and labor productivity by linking their outputs and wages and giving extrinsic incentives to workers. Some empirical studies corroborate the assumptions. Shearer (2004)'s field experiment in a tree-planting firm in Canada shows that piece rate raises at least 20 % productivity of workers more than fixed wage. Dowling and Richardson's questionnaire survey (1997) reports that an introduction of performance-related pay to National Health Service managers in the U.K. for succeeds in improving their motivations. Recent empirical study on Brazilian retail banks by Barbosa et al (2014) concludes that agents with guaranteed variable salary contracts has less productivity than those of performance-based salary because of their moral hazard.

However, it should be noted that performance-based pay does not always function as it is attempted or even triggers adverse effects (Perry et al 2009), especially when organizational factors matter in a workplace where the payment system is implemented. In most cases organizational performances are not a mere aggregation of individual worker's performances, but results of their interactions and cooperation among workers. Theoretical study by Lazear (1989) shows egalitarian wage system is better for that performance-based pay may reduce incentives for cooperation. Drago and Garvey (1998) empirically collaborate that a piece rate reduces other helping behaviors among colleagues. A field experiment with bicycle messengers by Burks et al (2009) reports that workers with performance-based pay behave less cooperative than those hourly paid. Actually, few organizations implement performance pay in a fundamental form; in most cases performance pay was introduced in a mixed form of incentive pay and a certain range of a fixed wage (Boeri et al. 2013).

One of other possible factors that make performance pay imperfect may be attributed to a difficulty of performance measurement under collaborative working style. In recent days most works are not performed independently from others, but in a form of collaboration, in which each worker's outcome more or less depends on that of other colleagues and each

[1] In this paper we exclusively mean an individual performance-based pay or piece rate, which links worker's performance and his wage by a term of a performance pay or performance-based pay. Group performance pay or other forms of financial participation by employees are out of a scope in this paper.

working process is connected with each other. In such a collaborative working condition it is hard to figure out which outcome belongs to which worker's efforts or performance (Cf. Milgrom & Roberts 1992). A case study by Freeman and Kleiner (2005) shows that a shift from piece rate to fixed pay in a shoe company in the early 90s in the U.S. increases profitability even though worker's productivities are higher in the former, because monitoring costs of worker' performance required in piece rate offset its raised productivity. If managers fail to measure each worker's performance correctly, it may result in losing their incentives. A recent empirical study by Brenčič and Norris (2010) discusses that employer less likely offer performance-based pay in multi-tasking, quality control or in teamwork because those works entails difficulty to appropriately evaluate employee's performance. Because of a difficulty in measuring performance under collaboration, performance pay may contradict worker's fairness ideals that may trigger them being unsatisfied with their payments or demotivated on their jobs.

By performing lab-experiments consisting of a production stage and a distribution stage, we examined which fairness ideals out of selfish, performance-based and egalitarian individuals tend to commit according to different production modes of independent/collaborative working style and different conditions on performance information in this paper. In our experiment subjects were required to distribute a total team earning with their pairs, after having earned some amount of money in production stage. We performed four treatments, each of which has different production process: i) An independent production style with information of each team member's performance; ii) An independent production style without the performance information; iii) A collaborative production style with each team member's performance information; vi) A collaborative production style without the information. We classified subjects' distribution proposals into three possible fairness ideals: selfish, performance-based and egalitarian and examined coefficient between four different treatments and occurrence rate of those fairness ideals.

It should be noted that this study is not directed to clarify a link between a certain payment system and its positive/negative consequences such as productivity, but to inquire individuals' fairness ideals, which are triggered by certain production processes. Taking norms that individuals spontaneously have into consideration is important since not only financial aspect, but also fairness ideals matter for motivations. Bregn (2013) points out norms employees have matter in payment system: if workers believe that they are not appropriately compensated to their work according to their fairness ideals and feel 'unfair' with given payments, they may be demotivated. According to Kessler (1994), performance pay improves employees' commitments to their jobs when they believe the payment scheme is more 'fair' than fixed pay. Thus fairness ideals workers may have in a specific working condition should be a key to success of a payment system.

We also attempted to contribute on experimental studies on individual's distribution behavior by introducing a set of new experimental design in a production stage, that is, collaborative working style between participants. A great number of previous experimental studies have contributed to clarify subjects' distribution justice or selfish behavior changes under different experimental conditions, such as social context, anonymity, or production style (Kahneman et al 1986; Forsythe et al 1994; Hoffman 1985; Cherry et al 2002; Cappelen et al. 2007). In those experiments subjects were asked to distribute some amount

of money, which is given as endowment or produced independently from other members. In order to examine how collaborative working style affects on individuals' fairness ideals, we designed a production stage as such that subjects can communicate and collaborate with their team members through chatting function of a computer program.

Our experimental results were quite intriguing and implicative. A significant number of participants under collaboration committed egalitarian distribution, whereas subjects engaged in an independent working style significantly prefer a performance-based distribution. Those who were notified team member's performance information committed performance-based pay, whereas a significant number of participants without the information preferred egalitarian distribution. Further, it is quite interesting to note that increment of labor dependency on another team member as well as transparency of performance information significantly refrains selfish distribution by subjects. Our experimental results show individuals rather prefer to commit egalitarian distribution justice under collaboration with insufficient performance information, and thus may partly explain some failures of performance-based pay under collaboration, where each individual's output is closely connected with others' and it is hard to measure individual performance.

The organization of this paper is following. In the next section II we describe our experimental design, game rules, details of treatments. Then we propose our models and hypothesis in section III. After that we describe experimental results in section IV, and discuss the experimental result in section V and conclude in final section VI.

II. EXPERIMENTAL DESIGN

By modifying previous distribution experiments with production (Hoffman 1985; Cappelen et al. 2007), our experiment are designed in order to examine individuals' commitment tendency to a certain fairness ideals in different modes of production and different conditions on performance information. Every participant is randomly pair-matched with another participant by a computer, but all participants as well as experimenters could not know concrete information on whose pair is whom during and after an experiment. Each experiment consists of two stages: a production stage and a following distribution stage. In a production stage, participants are required to earn some amount of points by engaging in numerical calculation. All answers of each subject are scored and become an individual income. Individual incomes of both team members are summed up and become a total team earning. After finishing a production stage, each subject is required to make a distribution proposal, which separate a team income into his share and his pair's. A computer selects randomly one proposal and a total team earning is distributed according to the selected proposal. Summing up with 800 show-up fee points, distributed team earnings constitute final profit points of each participant.

Following four treatments that differ by conditions of production modes and performance information are performed for comparisons.

- IW *with*-PI Treatment: An independent working style with each team member's performance information.

In this treatment, each subject is required to work with 100 numerical calculations, independent from his [her] team member during a production stage. Random double digits are displayed in odd numbered questions (ex. Q1.12, Q3.34, Q5.56…) and subjects can get a correct answer of the question by multiplying 8 to the double digits. In even numbered questions (Q2, Q4, Q6…), characters like AQX (AQ1, AQ3, AQ5…), which means a correct answer of QX, are displayed: subjects can get a correct answer by multiplying 8 to AQX. Subjects get 4 points by giving a correct answer to an odd numbered question and 16 points for an even numbered question. The time for answering questions is 15 minutes. Maximum earnings should be 1000 points by perfectly answering questions.

After the production stage, individual's performance information, that is, a subject's earning points, his [her] pair's earning points, and a total team earnings given by aggregating of each team member's earnings are shown on a screen of the subject.

- IW *without*-PI Treatment: An independent working style *without* each team member's performance information.

  In this treatment, a working style subjects are engaged in is the same as IW *with*-PI Treatment. However, each individual's performance information is not informed of subjects in this treatment, but only a total team earnings is shown in their screen after a production stage.

- CW *with*-PI Treatment: A collaborative working style *with* each team member's performance information.

  In this treatment, a subject is required to work with 100 numerical calculations similar to those in the independent working style. However, in a process of production, subjects need to collaborate with his [her] pair. A half of given questions is designed not to be able to answer without knowing one's pair's answer to a certain question. As is shown in Table 1, random double digits are displayed in odd numbered questions (Q1, Q3…) for a team member A, whereas random double digits are displayed in even numbered questions (Q2, Q4…) for another team member B. Like independent working style treatment, subjects can get a correct answer of the question by multiplying 8 to the double digits. In even numbered questions of team member A, that is, characters like AX (A2, A4, A6…), which means an answer of QX for team member B, is displayed. Team member A have to answer by multiplying 8 to AX in even numbered questions, and vice versa team member B have to answer in odd numbered questions. In order to get information of AX from one's pair, a chat box is displayed in the left side of a screen of each participant. Each participant can communicate with his [her] team member via the chat during a production stage. Subjects get 4 points by giving a correct answer to a question of double digits and 16 points to a question of AX. The time for answering questions is 20 minutes.

  After the production stage, individual's performance information, that is, a subject's earning points, his [her] pair's earning points, and a total team earnings given by aggregating of each team member's earnings are shown on a screen of the subject.

Table 1: An example of collaborative work

Questions of team member A	Correct answers of team member A	Questions of team member A	Correct answers of team member A
Q1. 12	Q1. 96 (=12×8)	Q1. A1	Q1. 768 (=96×8)
Q2. A2	Q2. 2176 (=272×8)	Q2. 34	Q2. 272 (=34×8)
Q3. 56	Q3. 448 (=56×8)	Q3. A3	Q3. 3586 (=448×8)
Q4. A4	Q4. 4992 (=624×8)	Q4. 78	Q4. 624 (=78×8)

- CW *without*-PI Treatment: A Collaborative working style *without* each team member's performance information.
  In this treatment, a working style subjects are engaged in is the same as CW *with*-PI Treatment. However, each individual's performance information is not informed of subjects in this treatment, but only a total team earnings is shown in their screen after a production stage.

Final profit points each subjects earned in an experiment is counted into Japanese yen and paid by cash. After experiments are over, we performed short anonymous questionnaire survey, which ask participants about their feelings in the experiments they have experienced.

III. MODELS, HYPOTHESES AND PREDICTIONS

Three possible fairness ideals that subjects may commit in distribution stage are assumed: i) *Selfish*; ii) *Performance-based*; iii) *Egalitarian*. A strict selfish ideal is a proposal, which distributes all team earning to a proposer himself and leaves nothing to his pair. A strict performance-based distribution is a proposal, which distributes a team earning according to individual earnings each member earned in a production stage. A strict egalitarian proposal distributes a team earning half-to-half to each member. Naturally, not all subjects follow those fairness ideals strictly. About classifications of those slightly deviated from strict fairness ideals we will explain in the next section.

Now let us consider a value function V_i of an individual i, whose self-earning at a production stage is π; a total earning of his team is Π; a distribution amount to himself is y ($0 \leq y \leq \Pi$). We assume that a person i has a given endowment vector $\lambda_i = (\lambda_i^S,\ \lambda_i^P,\ \lambda_i^E)$, $(0 \leq \lambda_i^S,\ \lambda_i^P,\ \lambda_i^E \leq 1,\ \lambda_i^S + \lambda_i^P + \lambda_i^E = 1)$, which designates loading factor for each fairness ideal: λ_i^S is for *Selfish*, λ_i^P is for *Performance-based* and λ_i^E is for *Egalitarian*. A person i maximizes his value function by deciding self-distribution y as follows.

$$\max_y V_i = V_S + V_P + V_E = \lambda_i^S\left(\frac{y}{\Pi}\right)^2 - \lambda_i^P\left(\frac{\pi - y}{\Pi}\right)^2 - \lambda_i^E\left(\frac{\Pi/2 - y}{\Pi}\right)^2$$

Where $V_s = \lambda_i^S\left(\frac{y}{\Pi}\right)^2$ is a material utility that a person i can get from self-distribution; $V_P = -\lambda_i^P((\pi - y)/\Pi)^2$ designates negative utility triggered by a deviation from ideal performance-based distribution π; and $V_E = -\lambda_i^E\left((\Pi/2 - y)/\Pi\right)^2$ designates negative

utility triggered by a deviation from ideal egalitarian distribution $\Pi/2$. Let us suppose that we have three extreme types of individual S, P, E, who exclusively commit one of fairness ideals: strictly selfish; strictly performance-based; strictly egalitarian. The value function and optimum distribution of each extreme type can be expressed as follows.

(Strictly Selfish)	$\lambda_S = (1,0,0)$	$V_i = V_S = (y/\Pi)^2$	$y^* = \Pi$
(Strictly Performance-Based)	$\lambda_P = (0,1,0)$	$V_i = V_P = -((\pi - y)/\Pi)^2$	$y^* = \pi$
(Strictly Egalitarian)	$\lambda_E = (0,0,1)$	$V_i = V_E = -\left((\Pi/2 - y)/\Pi\right)^2$	$y^* = \Pi/2$

With respect to production conditions, let us define a degree of performance information disclosure as θ $(0 \leq \theta)$ and a degree of labor dependency with another team member in production process as δ $(0 \leq \delta)$. A degree of performance information disclosure means intensity to disclose performance information of each individual earned in production process. It becomes maximum in '*with*-PI' (Performance Information) treatment and minimum in '*without*-PI' treatment in our experimental design explained in section II. A degree of labor dependency means intensity, by which a labor depends on that of another team member. It becomes maximum in 'CW' (Collaborative Working style) treatment and minimum in 'IW' (Independent Working style) treatment.

Regarding a degree of performance information disclosure θ and individuals' fairness ideals or distribution incentives, we set up the following three hypotheses.

- *HYPOTHESIS 1A*: If a degree of performance information disclosure increases, individuals' incentives to commit to selfish distribution decrease: $\frac{\partial V_S}{\partial \theta} < 0$.
- *HYPOTHESIS 1B*: If a degree of performance information disclosure increases, individuals' incentives to commit to performance-based distribution increase: $\frac{\partial V_P}{\partial \theta} > 0$.
- *HYPOTHESIS 1C*: If a degree of performance information disclosure increases, individuals' incentives to commit to egalitarian distribution decrease: $\frac{\partial V_E}{\partial \theta} < 0$.

Hypothesis 1B is clear since individuals commit more easily to performance-based distribution under transparency of performance information than in a condition without the performance information. Because performance information is disclosed, individuals less likely commit egalitarian distribution as Hypothesis 1C designates. Incentives to leave nothing to others should decrease if individuals could know another team member's output or contributions to team earnings, as Hypothesis 1A expresses.

Regarding a degree of labor dependency with another team member in production process δ, we set up these following three hypotheses.

- *HYPOTHESIS 2A*: If a degree of labor dependency with another team member increases, individuals' incentives to commit to selfish distribution decrease: $\frac{\partial V_S}{\partial \delta} < 0$.
- *HYPOTHESIS 2B*: If a degree of labor dependency with another team member

increases, individuals' incentives to commit to performance-based distribution decrease: $\frac{\partial V_P}{\partial \delta} < 0$.

- *HYPOTHESIS 2C*: If a degree of labor dependency with another team member increases, individuals' incentives to commit to egalitarian distribution increase: $\frac{\partial V_E}{\partial \delta} > 0$.

If labor dependency increases, individuals' output in production largely depends on another team member's cooperation. In such cases it should be hard to identify one's own performance being separately from others'. Thus individuals would avert performance-based distribution as Hypothesis 2B designates and commit egalitarian distribution as is designated in Hypothesis 2C. If most amounts of team earnings owe to member's collaboration, selfish distribution should decrease as Hypothesis 2A designates.

Now taking above six hypotheses on production conditions proposed above into consideration, for simplicity, we assume that individuals have compound fairness ideals expressed by the following vector of loading factors: $\lambda = \left(\frac{1}{a\delta\theta}, \frac{\theta}{b\delta}, \frac{\delta}{c\theta}\right)$, where a, b and c are positive constants. Then, individuals' value function V can be expressed as follows:

$$V = \frac{1}{\mathrm{a}\delta\theta}\left(\frac{y}{\Pi}\right)^2 - \frac{\theta}{\mathrm{b}\delta}\left(\frac{\pi - y}{\Pi}\right)^2 - \frac{\delta}{\mathrm{c}\theta}\left(\frac{\Pi/_2 - y}{\Pi}\right)^2$$

Information disclosure intensity approaches maximum ($\theta \to \infty$) in '*with*-PI' (Performance Information) treatment whereas it approaches minimum ($\theta \to 0$) in '*without*-PI' treatment vice versa. Similarly, labor dependency intensity approaches maximum in 'CW' (Collaborative Working style) treatment and it approaches minimum in 'IW' (Independent Working style). Taking those relationships into consideration, one can infer maximum and minimum load factors by treatments as shown in Table 2.

Table 2. Predictions on maximum and minimum load factors

	Load factor of Fairness Ideal			
Type of Treatment	Selfish $(1/a\delta\theta)$	Performance-based $(\theta/b\delta)$	Egalitarian $(\delta/c\theta)$	Prediction
IW *with*-PI		Max	Min	2A, 3B
IW *without*-PI	Max			1A
CW *with*-PI	Min			1B
CW *without*-PI		Min	Max	2B, 3A

From these considerations, above six hypotheses can be converted into following six predictions in experiments (see also Table 2):

- *PREDICTION 1A*: From hypotheses 1A and 2A, selfish distribution will be maximized in IW *without*-PI treatment.

- *PREDICTION 1B*: From hypotheses 1A and 2A, selfish distribution will be minimized in CW *with*-PI treatment.
- *PREDICTION 2A*: From hypotheses 1B and 2B, performance-based distribution will be maximized in IW *with*-PI treatment.
- *PREDICTION 2B*: From hypotheses 1B and 2B, performance-based distribution will be minimized in CW *without*-PI treatment.
- *PREDICTION 3A*: From hypotheses 1C and 2C, egalitarian distribution will be maximized in CW *without*-PI treatment.
- *PREDICTION 3B*: From hypotheses 1C and 2C, egalitarian distribution will be minimized in IW *with*-PI treatment.

Hypotheses and predictions here proposed are examined in the next section.

VI. EXPERIMENTAL RESULTS

4-1. Overview

Experiments were performed at a laboratory of Kyoto University in July 2014. A hundred and thirty participants were gathered from undergraduate students of all faculties at Kyoto University. Around 20 per cent of all subjects were female. This is almost compatible with average female ratio in undergraduate students at Kyoto University. Experiments were performed 9 times and around 14.4 subjects in average participated in one experiment. In the beginning of an experiment an instruction, in which rules of a game is explained, was read aloud by an experimenter. Participants could raise their hands to ask questions if there was anything unclear. Every experiment was started after all participants understood the rules sufficiently. Experiments took around 45 minutes in average including an instruction period and a paying period. All experiments were performed, by using an experimental software z-tree (Fishbacher 2007).

Table 3 describes average figure or each parameter by type of treatments. Apparently, an average of self-production in Independent Working style treatment (844.581) was clearly higher than that of Collaborative Working style (486.294). This indicate that tasks in IW was easier than those of CW, which require subjects to calculate given questions and communicate with their pairs in the same time. Actually, in the anonymous questionnaire survey after experiments, 57 % of subjects with CW treatments answered that they were tired (‘very tired’ or ‘tired’ in a question with five degrees options) with the calculation tasks, in contrast with that 47 % of subjects engaged in IW treatments answered similarly[2]. It is interesting to note that, despite an average size of pie that should be distributed (i.e. team production) was quite smaller in CW (972.5882) compared with that of IW (1689.161), an average of self-distribution rate in CW (62.4%) was almost 10 % smaller than that of IW (72.0%).

[2] This inference is partly based on free descriptions by subjects contained in the questionnaire. Some of CW treatment participants had written that they felt pressures with tasks in production stage because of communications with their pairs. Almost no such description was observed in IW treatment participants.

Participants in CW treatment were paid 1286.29 yen in average and 1644.5805 yen in IW treatment, as a result of converting final profit points including show-up fee to yen (100 yen is almost the same with 1 dollar). In 2014 an average payment in Japanese city area was 956 yen per hour according to a survey by Recruit Jobs Research Center, thus payment of our experiment, which takes 45 minutes in average sufficiently satisfied participants' opportunity cost. Almost 70 % of participants of all treatments answered that they were satisfied ("very satisfied" or "satisfied" in a question with five degrees options) with their final payments in five degree of satisfaction intensity in our questionnaire survey.

Table 3 Averages of parameter by type of treatment

Type of Treatment	Averages of parameters			
	Individual Production (π)	Team Production (Π)	Self-Distribution (y)	Self-Distribution Rate (y/Π)
IW *with*-PI (N=32)	850.4	1700.8	1147.5	0.679
IW *without*-PI (N=30)	838.4	1676.8	1265.2	0.763
CW *with*-PI (N=30)	500.0	1000.0	570.5	0.585
CW *without*-PI (N=38)	475.5	950.9	613.6	0.655
CW total (N=68)	486.3	972.6	594.6	0.624
IW total (N=62)	844.6	1689.2	1204.5	0.720
with-PI total (N=62)	680.8	1361.7	868.3	0.633
without-PI total (N=68)	635.6	1271.2	901.1	0.703

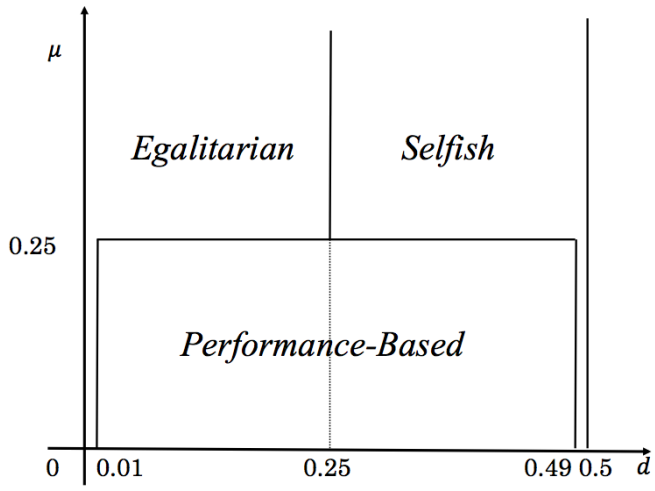
4-2. Classification of Fairness Ideals

As is discussed in the previous section, we assumed three possible fairness ideals (selfish, performance-based and egalitarian) and judged which fairness ideals each subject had committed according to two classification criteria: i) divergence rate of self-distribution from own individual production (μ); defined as $\mu = \frac{|y-\pi|}{\pi}$, ($\mu \geq 0$) and ii) distance from egalitarian distribution (d), defined as an absolute value of difference between 0.5 and a self-distribution rate (y/Π: a proportion of self-distribution in the total team earning). It can be expressed as $d = |0.5 - \text{y}/\Pi|$, $(0 \leq d \leq 0.5)$. This criterion is the same with Gini coefficient, which is generally used for measureing income inequality. Using these two criteria, we classify fairness ideal of each subject as follows:

- *Selfish*: $(\mu > 0.25 \; and \; d \geq 0.25)$ *or* $(\mu \leq 0.25 \; and \; d > 0.49)$
- *Performance-Based*: $\mu \leq 0.25 \; and \; 0.01 \leq d \leq 0.49$
- *Egalitarian*: $(\mu > 0.25 \; and \; d < 0.25)$ *or* $(\mu \leq 0.25 \; and \; d < 0.01)$

If we put divergence rate μ on vertical axis and distance from egalitarian distribution d on horizontal axis, three different fairness ideals can be mapped as figure 1.

Figure 1. Classification of Fairness Ideals



4-3. Fairness Ideals by treatment

Following classification criteria above, component ratios of three fairness ideals in each type of treatment each subjects committed. Table 4 shows numbers and occurrence rates of subjects who committed to each fairness ideals by treatments. Our main findings here were threefold as is below described.

Firstly and interestingly enough, our experimental results showed that 50 % of subjects with IW *without*-PI treatment committed selfish distribution, in contrast with that only 13.33 per cent of subjects with CW *with*-PI distributed selfishly, as is predicted in our prediction 1A and 1B. These figures are statistically significant and also well collaborate our hypothesis 1A and 2A. As we can see figures of selfish commitments in CW total (23. 53 %) in comparison with IW total (41.9 %), labor dependency on other workers significantly contribute to decrease selfish distribution. Similarly, performance information disclosure significantly seem to affect on decreasing selfish distribution, as is shown in numbers of *with*-PI total (24.19 %) and *without*-PI total (39.71 %).

Secondly, we found that giving performance information significantly increase numbers of performance-based distribution while labor dependency does not affect on increment of performance-based fairness ideal. More than a half of subjects *with*-PI total committed performance-based fairness ideal (51.61%), whereas only one forth subjects of *without*-PI

distributed in performance-based way (25.00 %). This result is in line with our hypothesis 1B, which assumes that information disclosure increase performance-based fairness ideal. However, it is interesting to note that labor dependency does not decrease performance-based fairness ideals, as will be clear if we can see rate of performance-based in CW total (38.24 %) comparing with IW total (37.10 %), against our hypothesis 2B.

Thirdly, we found that labor dependency significantly contributes to increase egalitarian distribution and obscure performance information also have significant tendency to increase commitment to egalitarian fairness ideal. As is predicted in prediction 3B and 3A, small number of subjects with IW *with*-PI treatment committed egalitarian distribution (18.75%), whereas commitment rate to egalitarian in subjects with CW *without*-PI treatment reached almost a half of them (44.74%). These results are compatible with our hypothesis 1C and 2C, which we can also confirm in a significant numerical difference on egalitarian between IW total (20.97%) and CW total (38.24%) and a difference between *with*-PI total (24.19%) and *without*-PI total (35.29 %).

Table 4 Component ratio of fairness ideals in each type of treatment

	Component Ratio of Fairness Ideals					
	Selfish		*Performance-based*		*Egalitarian*	
Type of Treatment	%[a]	p-value[b]	%	p-value	%	p-value
IW *with*-PI (N=32)	34.38(11)	0.7741	46.88(15)	0.2208	18.75(6)	0.0987†
IW *without*-PI (N=30)	50.00(15)	0.0208*	26.67(8)	0.1480	23.33(7)	0.3553
CW *with*-PI (N=30)	13.33(4)	0.0072**	56.67(17)	0.0157*	30.00(9)	1.00
CW *without*-PI (N=38)	31.58(12)	0.9090	23.68(9)	0.0304*	44.74(17)	0.0207*
IW total (N=62)	41.9(26)	0.0246*	37.10(23)	0.8936	20.97(13)	0.0305*
CW total(N=68)	23.53(16)		38.24(26)		38.24(26)	
With-PI total (N=62)	24.19(15)	0.0575†	51.61(32)	0.0017**	24.19(15)	0.1661
Without-PI total(N=68)	39.71(27)		25.00(17)		35.29(24)	

a. Figures in parentheses are number of subject. b. Estimated in likelihood ratio test. p†<.10, p*< .05, p**<.01.

Our experimental results were consistent with predictions we proposed in section III, except for prediction 1B, based on hypothesis 1B and 2B as we can see in Table 5. As already explained above, hypothesis 1B was well confirmed by coefficient data between with and without performance information treatment and performance-based fairness. Thus we could state that only hypothesis 2B, which assume that labor dependency increase performance-based distribution, was falsified and other five hypothesis were confirmed in our experiments. Obtained results were discussed in detail in the next section.

Table 5. Results on maximum and minimum in component ratios of each fairness ideal

Type of Treatment	Fairness Ideal			Prediction
	Selfish	Performance-based	Egalitarian	
IW *with*-PI			Min*	2A, 3B
IW *without*-PI	Max*			1A
CW *with*-PI	Min*	Max		1B
CW *without*-PI		Min*	Max*	2B, 3A

Note: Asterisk (*) shows confirmed prediction.

V. DISCUSSION

As we have seen experimental results in the previous section, our primary findings were that both of labor dependency and disclosure of performance information have significant effects to decrease selfish behavior. In CW *with*-PI treatment, selfish subjects who distributed whole team earnings to themselve remained only less than 13.3 % whereas a half of subjects in IW *without*-PI treatment was selfish. These figures significantly deviate from the results of previous distribution experiments without productions, of which selfish distribution rate range from 20% to 30 % (Cf. Forsythe et al 1994).

This result of selfish decrement may be a consequence that individual's other-consciousness was more enhanced in collaborative working style than independent working style and also in the situation under given individual's performance information than without information. In independent working style, a subject has no opportunity to directly recognize with her pair during a production stage, although she is informed of a total figure of a team earning after the stage. On the contrary, a subject under collaborative working style always recognizes his pair during production stage through communication via chat. We could also confirm this assumption in our questionnaire survey, in which some subjects with independent working style describe 'I distributed all to myself', 'because I don't know who is my pair'. Similarly, a subject who was informed of individual performance information was more conscious with her pair, since it designate that her pair as well as herself contributed to total team earnings, than those who were not informed of the information.

Our second finding was that whether subjects are informed of individual's performance before making decisions on distribution proposals has crucial importance on their commitments to performance-based fairness ideal. In both of independent and collaborative working style, significant rate of subjects with individual's performance information tend to commit performance-based distribution compared with those without this information. This result implies that, in the case of performance-based pay system, transparency and appropriate measurements of each individual performance is necessary requirements in order to be in line with workers' fairness ideals. Even in a treatment of collaborative working style, incentives to commit performance-based fairness was not muted in subjects those who were informed of individual performance as our hypothesis 2B was falsified. From this one may say that individuals tend to prefer performance-based payment under

condition that their and their colleagues' outputs were clear. This explains that piece rate succeed in increasing worker's productivity when their outputs are easily measurable.

However, conditions of performance transparency could be realized in our artificially constructed laboratory and may be possible in some of the simplest production systems as well, however, would be hard in most of modern workplace as is already discussed in previous studies. If individual's performance cannot be measured and informed appropriately in workplace, it would be quite natural that workers are unsatisfied with performance-based pay, being felt 'unfair' and demotivated as a result. This difficulty in measurement of individual's performance explains some unsuccessful results of performance-based pay as is explained in introduction.

Our experiment also shows that labor independency as well as opaqueness of performance information has significantly enhanced commitments to egalitarian fairness ideal. Almost a half of subjects under collaboration without performance information distributed their team earning half-to-half with their pairs, whereas only less than one fifth of subjects with independent working style with information was egalitarian. As we have referred in introduction, most of works in recent days are done by collaboration with others where it is hard to measure each worker's output correctly. In that sense, one may say that CW *without*-PI treatment is the best approximation to conditions of common workplaces out of other treatments, and it is quit interesting to note that egalitarian distribution was mostly supported in the treatment. Thus an introduction of performance-based pay in a workplace, where works are done under collaboration and have a difficulty of performance measurement, may be at risk to contradict worker's fairness ideal and to demotivate them accordingly.

From discussions on our obtained experimental results above we conclude that egalitarian distribution would be more in line with a fairness ideal of workers under collaboration. Correctly measured performance information is required as a basis that performance-based pay is supported, that may be hard in a collaborative working style. Additionally, workers working with others have significant tendency to distribute half-to-half with others. These results may partly explain recent failures of performance-based pay.

VI. CONCLUTION

Collaboration with other colleagues is most frequently observed working style in recent days. Under collaboration, goods or services are produced as a result of cooperation of workers, thus correct measuring individual contribution to a production would be hard. Our experimental results showed that a disclosure of correctly measured performance information is a key basis that performance-based distribution is supported by workers, that may be hard to achieve in actual workplace under collaboration. Our experiments also showed that individuals under collaboration were less selfish and preferred to commit egalitarian distribution. These experimental results partly explain a success of piece rate in a simple independent working style, where performance measurement is easier, and also a failure of an introduction of performance-based pay in a collaborative working style.

REFERENCE

Barbosa, Klenio, Bucione, André and Souza, André Portela (2014) "Performance-based Compensation vs. Guaranteed Compensation: Contractual Incentives and Performance in the Brzilian Banking Industry", *Economia Aplicada*, 18(1), 5-34.

Boeri, Tito, Lucifora, Claudio and Murphy, Kevin. J (ed.) (2013) *Executive Remuneration and Employee Performance-Related Pay: A Transatlantic Perspective,* Oxford: Oxford University Press.

Brenčič, Vera and Norris, John, Brian (2010) "On-the-job Tasks and Performance Pay: a Vacancy-Level Analysis", *Industrial and Labor Relations Review*, 63(3), 511-544.

Burks, Stephen, Carpenter, Jeffrey, and Goetthe, Lorenz (2009) "Performance pay and worker cooperation: Evidence from an artefactual field experiment", *Journal of Economic Behavior & Organization,* 70, 458-469.

Cappelen, A. W., Hole, A. D., Sorensen. E. O., and Tungodden, B. (2007), "The Pluralism of Fairness Ideals: An Experimental Approach," *The American Economic Review*, 97(3), 818–827.

Cherry, T. L., Frykblom, P., and Shogren, J. F. (2002), "Hardnose the Dictator," *The American Economic Review*, 92(4), 1218–1221.

Dowling, Bernard and Richardson, Ray (1997) "Evaluating performance-related pay for managers in the National Health Service", *The International Journal of Human Resource Management* 8(3), 348-366.

Drago, Robert. and Garvey, Gerald T. (1998) "Incentives for Helping on the Job: Theory and Evidence", *Journal of Labor Economics*, 16(1), 1-25.

Fischbacher, U. (2007), "z-Tree: Zurich Toolbox for Ready-made Economic Experiments," *Experimental Economics*, 10(2), 171–178.

Forsythe, R., Horowitz, J.L., Savin, N.E., and Sefton, M. (1994), "Fairness in Simple Bargaining Experiments," *Games and Economic Behavior*, 6(3), 347–69.

Hoffman, Elizabeth, Kevin McCabe, and Vernon L. Smith (1996) "Social distance and other-regarding behavior to dictator games", *American Economic Review* 86(3), 653-60.

Horowitz, J.L., Savin, N.E., and Sefton, M. (1994), "Fairness in Simple Bargaining Experiments," *Games and Economic Behavior*, 6(3), 347–69.

Freeman Richard B. an Kleiner, Morris M. (2005) "The Last American Shoe Manufacturers: Decreasing Productivity and Increasing Profits in the Shift from Piece Rates to Continuous Flow Production", *Industrial Relations*, 44(2), 307-330.

Hoffman, E., and Spitzer, M. L. (1985), "Entitlements, Rights, and Fairness: An Experimental Examination of Subjects' Concepts of Distributive Justice," *Journal of Legal Studies*, 14, 259–297.

Kahneman, D., Knetsch, J. L., and Thaler, R. H. (1986), "Fairness and the Assumptions of Economics," *Journal of Business*, 59(4). S285–S300.

Kessler, I. 1994. Performance Pay, in Sisson, K. (ed.), *Personnel Management*, Oxford: Blackwell.

Kirsten Bregn, (2013) "Detrimental Effects of Performance-Related Pay in the Public Sector? On the Need for a Broader Theoretical Perspective", *Public Organization Review* 13, 21–35

Koch, Alexander, and Hans-Theo Normann (2008) "Giving in dictator games: Regard for others or regard by others?", *Southern Economic Journal* 75(l), 223-3l.

Lazear, Edward P. (1989) "Pay Equality and Industrial Politics, Journal of Political Economy" 87, 1261-84.

Lemieux, T., Macleod, W.W. and Parent, D.(2009) "Performance Pay and Wage Inequality", *Quarterly Journal of Economics*, 124, 1-49.

Milgrom, Paul & Holmstrom, Bengt (1991) "Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design, Journal of Law", *Economics, & Organization*, vol. 7, Special Issue, 24-52.

Milgrom, Paul & Roberts, John (1992) *Economics, Organization & Management*, P Prentice Hall.

OECD (2005) *Performance-related pay policies for government employees*. Paris: OECD Publishing.

Perry, J. L., Engbers, T. A., & Jun, S. Y. (2009) "Back to the future? performance-related pay, empirical research, and the perils of persistence", *Public Administration Review*, 69(1), 39–51.

Recruit Jobs Research Center (2014) 「2014年7月度アルバイト・パート募集時平均時給調査」 (An average hourly payment survey for part-time job workers in 2014 July). jbrc. Recruitejobs.co.jp, accessed in September 8, 2014.

Shearer, Bruce (2004) "Piece Rates, Fixed Wages and Incentives: Evidence from a Field Experiment", *Review of Economic Studies*, 71, 513-534.