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Document de Travail n° 2019 – 21

Mai 2019

Bureau d'Économie Théorique et Appliquée BETA

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The Hidden Effect of Meritocratic Promotion Procedure: Experimental Evidence

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May 22, 2019

Abstract

The aim of this experimental paper is to show how the willingness of an employee to accept inequality of wages between him and his executive will depend on the ability on which the executive is evaluated when he is promoted. This willingness to accept inequality is captured by the minimum wage enough to incentivize to work for his executive. We show that selecting an executive on his ability to outperform his employee at his own task will be counterproductive to make employee accepting inequality of wages. We argue that the efficiency of "merit-based" promotion procedure may be challenged by this result.

Keywords: Legitimacy, leadership, tournament, contract theory, moral hazard, personnel economics

JEL-Classification: D00, J50, M50, M51, D86

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1 Introduction

This paper is using mostly the experimental methodology even though we will present also a tractable theoretical framework to explain what predictions we attempt to prove with our experiment. What we study is the willingness of an employee to accept wage inequality between him and his executive with respect to the procedure of selection of his executive. More specifically, the purpose is to study a merit-based promotion procedure that is a procedure where the best employee (i.e the one who makes the best performance) is chosen to become the executive. The stake for the organization would be to establish a procedure that makes effort of the subordinates less costly to incentivize than a regular monetary incentive as it would allow to decrease the incentive wage and favor obedience.

To tackle this issue, we design an experiment constituted of two stages. The first stage is a tournament with two opponents. Each opponent must invest an amount of money in an investment project such that the winner is the one who makes a higher income. The probability for an opponent to win depends on the quality of his project that can be profitable or unprofitable and is established exogenously. Investment projects were previously randomly allocated such that opponents ignore if they have a high quality or less quality project and we ask them before and after the tournament to declare their beliefs in owning the less profitable project. The second stage is an elicitation phase using a Becker Degroot Marschak (BDM) procedure.[1] The looser will be asked to invest again and to declare the share of the future income he would demand to invest heavily rather than lightly (only two levels of investment are possible) knowing that the rest of the income will be given to the winner. To study the relative effect of procedure of selection we use two treatments: in treatment 1 (procedure 1) the looser will have to invest again in the same project than the one he was endowed before the tournament, whereas in treatment 2 (procedure 2) he will be endowed a new project after failure before stage 2. The game intends to capture a promotion process followed by a hierarchical

[1] A Becker Degroot Marschak (BDM) procedure is a experimental procedure that aims to elicit reservation price or to elicit belief that was established by Becker et al. (1964)

relationship where the quality of the project represents an unknown competence and the investment project can be interpreted as a production.Thus the level of monetary investment can be understood as an effort. Indeed, in order to have instruction as neutral as possible and to have measurable effort we chose to use a monetary effort contrary to a real effort task.

Experimental behavior are compared to theoretical predictions which are based on a two stages sequential game. The first stage is a tournament while the second stage is a standard principal-agent framework where the principal is the winner of the previous tournament.[2] The ability of each opponent are unknown but the tournament will bring information about it like in a career concern framework. The role of the firm is to choose between a procedure where the ability required by the agent in stage 1 is revealed during the tournament (procedure 1) or a procedure that select principal on a totally different ability (procedure 2). However, this choice is not captured in the experiment as each procedure corresponds to a different treatment because the purpose of the experiment is precisely to compare the efficiency of both procedures.

We get the following main empirical results which are consistent with the theoretical predictions. First, when the loser of the tournament keeps the same investment project than the one he was endowed before the tournament (treatment 1), his belief in having the more profitable investment project before stage 2 will be less optimistic than when he was endowed a new project after his defeat (treatment 2). This is actually a purely bayesian effect. It is due to the fact that the new information about the quality of the project that could have been inferred after the tournament becomes no longer useful if a new project is given. The second result is that the incentive wage (i.e the wage the looser demands to invest heavily rather than lightly) demanded in second stage is negatively correlated with the belief in having the profitable investment. It means that a higher wage is seen, in the view of opponents, as a way to compensate the fact they are less optimistic about having the high quality project. If they have a strong belief that their investments will fail, they need to have

[2]In this work the principal would be the executive and the agent would be the employee

a strong reward to make it worthwhile. Finally, the last result is that the incentive wage is higher on average in case losers keep the same investment project (treatment 1) than in case they receive a new project after failure (treatment 2). We interpret these results this way: in treatment 1, the individuals who become employees after failure, will become more pessimistic on the expected return of their projects and will be discouraged to invest again. They will them need a higher wage to be incentivized to invest again. Whereas in treatment 2, information on investment project of the first stage are not relevant any more. Thus the changing of project will be a "fresh start".

We argue this simple game captures the issue of merit-based promotion procedure in a sense that the "best employee" becomes the executive of his peers. Indeed, we previously mentioned that the quality of the project in the experiment represents an unknown ability. As a consequence, the treatment 1 (investing in the same project during the competition and during the hierarchical relationship) represents a procedure where the ability required during the tournament is the same ability required by the employee after the tournament during the hierarchical relationship. Thus it captures a situation where the worse employee remains an employee. And so, keeping using the same employee's ability even if the failure is precisely a signal on his lack of employee's ability. Whereas, investing in a different project during the hierarchical relationship (treatment 2) captures a promotion process which is not a signal on the employee's ability that is, the specific ability required by the looser during the hierarchical relationship. Thus our result suggest that the "merit-based" promotion procedure could exacerbate rivalry where the one who is not promoted will lose confidence and will be hard to incentivize to cooperative behavior. On the contrary, selecting executives on another ability than their employee's abilities would tend to defuse this phenomenon by preserving the confidence of employees.

Generally speaking, this paper is related to the literature of non-monetary incentives (or informational incentives) such as peer effect, self-esteem and evaluation of performance (Azmat and Iriberri, 2010; Kuhnen and Tymula, 2012; Gill and Prowse, 2012; Villeval, 2016). More specifically, Kuhnen and Tymula (2012) show

in a experiment how people work harder if they are aware that they will receive information about their rank order. This is the "positive" incentive effect of peer effect. However, a "negative" incentive effect has been observed as well. Indeed, Gill and Prowse (2012) show that an opponent may be discouraged to make a high performance if he observes his opponent achieving a high performance before him. This result is based on the same intuition than ours: comparing to each other can exacerbate rivalry and finally be counterproductive. But Gill and Prowse (2012) do not focus their analysis on the consequence in terms of incentive and acceptation of wage inequality. Furthermore, besides their experimental work, they made a model to explain their empirical results based on the behavioral concept of reference points.[3]

This issue is also related to the research on procedure of justice originally studied by social psychology (Tyler and Blader, 2003) and experimental economics (Bolton et al., 2005; Ku and Salmon, 2013). These authors study how people are more willing to accept unequal distribution of revenues if the allocation rule was previously established by a procedure seen as "fair". Bolton et al. (2005) study notably an ultimatum game preceded by a procedure of allocation of incomes that can be totally random or biased. They study the rejection rate of the offer of the proposer with respect to if the proposer can choose himself a unequal distribution or if this distribution depends on a pre-established bias or a random criteria established exogenously as a parameter of the experiment. If the proposal is established randomly (a random throw of a dice) it is in general less rejected than if the proposal is chosen by the proposer. However, among random procedure, if there is a biased procedure (a throw of loaded dice) in favor of an allocation rule that is not fair, it will be more rejected that a unbiased procedure. Ku and Salmon (2013) deepen this issue and show how the willingness to accept unequal outcome may depend on institutional elements. They deliberately part participants of their experiment into two categories: one is endowed generously (or "favored") and the other one is

[3]A reference point in behavioral economic literature is an expected performance such that if an agent deviates above he will feel a psychological positive utility whereas if he deviates under he will feel a psychological negative utility.

less endowed (or "unfavored"). Unfavored participants will be asked to accept or reject to transfer a part of their endowments to the favored participants being told that this transfer is actually an investment that will eventually increase their own incomes but in a smaller proportion than the income of favored people. To select favored and unfavored participants they used four kinds of procedures: a random procedure, a merit-based procedure where the one with the highest performance at an exante test will be selected to be in the favored category, a procedure where non cooperative behaviors (free riding at a public good game) are rewarded and finally a procedure that discriminates with respect to a social group identity (people are asked whether they prefer painting of Klee or Kandinsky). The first result is that disadvantaged people are more tolerant to inequality when the advantaged people share the same group identity. Furthermore it is showed that the merit based procedure does not favor acceptation of transfer to the advantaged people relatively to the random procedure. Our contribution is to deepen this last idea by proposing a theoretical explanation and by testing it.

In terms of methodology and design our work is related to the literature on elicitation of beliefs (Buser et al., 2018; Schlag et al., 2015; Becker et al., 1964). Buser et al. (2018) study how people do not perfectly update their beliefs after receiving a signal on their abilities relatively to a bayesian benchmark. The signal is a rating after passing some intelligence tests (the signal is noisy as it is an imperfect evaluation) and the belief is the belief in their own abilities to succeed at these tests. To elicit belief they use a Becker Degroot Marschak (BDM) procedure (Becker et al., 1964) that incentivizes participants to report sincere belief on their competences. They show that indeed people update their beliefs but not as strongly as the bayesian benchmark would suggest, especially when they receive "bad" signal. Besides Buser et al. (2018) add a final task where they measure the competitiveness of participants with respect to their abilities to update their beliefs. The first difference in our work is that we do not design real task but investment with a monetary effort. The second difference is that we use BDM procedure not to elicit belief but to elicit the incentive wage required to invest after the competition.

Our work is also related to some theoretical papers. It is notably related to

works that deals with social mobility (i.e the fact individuals enjoy a standard of living superior or different than their parents) and the preferences for redistributive tax policies (Piketty, 1995; Benabou and Tirole, 2006). Piketty (1995) argues that the sequence of success and failure determining social mobility implies a subjective learning in term of statistical inference on the role of effort and pre-established allocation of resources. Indeed, they assume that success (such as being efficient at work, academic success ...) can be related to effort of individuals but also some external and exogenous circumstances (such as being born in a wealthy family for instance). But individual do not know to what extent external circumstances or effort will count such that they only have a belief inherited from their parents and based on bayesian learning. As a consequence, people that will prefer a less redistributive tax are people that are from high wealthy and successful families origin and people who prefer a more redistributive tax are from low revenue families origin. In our work, we use the same idea that the learning on competence will establish the allocation of incomes preferences. Our contribution is to focus on the hierarchical relationship and moral hazard issue. Thus, we study incentive wage and there is no redistributive consideration like in tax. Furthermore, the bayesian learning will depend on relative performance. Mostly our contribution is to elicit a procedure that can neutralize the "negative" consequence of failure on incentive wage. Indeed, a failure at the tournament will tend to make individuals think that do not own the high quality project (or the high competence) which will imply that they will demand a higher wage to choose a high level of investment (or effort) in order to maintain his investment worthwhile. The negative consequence is that it will imply an extra cost for the principal. Besides, it sheds light on the issue of acceptation of hierarchy and moral hazard as the accepted wage in our work is an incentive wage and not only a simple transfer.

The rest of the paper is organized as follows. Section 1 deals with the theoretical framework and the theoretical predictions. Section 2 deals with empirical analysis comprised of the experimental design, the econometrical models and the empirical results. Section 3 concludes.

2 Theoretical predictions

In this section, we will briefly expose our theoretical framework in order to explain and justify the econometrical model we intend to test further. For the sake of clarity, we deliberately use a different notation for the theoretical and econometrical models because the econometrical model does not shape exactly the theoretical ones.

2.1 Framework

A standard result in contract theory is that the wage sufficiently high to incentivize high effort from the employee will be negatively correlated with the marginal return of the effort of the employee that is the supplement of probability of producing high production generated by high effort relatively to low effort. We will study how this marginal return of the effort may change with respect to the procedure of selection of the executive. As a consequence the theoretical framework is a two stages model: a promotion contest (stage 1) followed by a regular hierarchical relationship (stage 2).

Let us describe the stage 1 which represents a promotion contest. The promotion procedure is captured by a contest between agent i and j who have an *a priori* belief about their relative abilities. They both produce an output that can take two values $q_i \in \{\underline{q}, \overline{q}\}$ and the winner is the one who outperforms his opponent. The production is assumed to be stochastic such that we denote Π_1 the probability of producing a high level of production. We will assume the opponents do not know for sure if they have a higher or a lower ability but they have a belief about it captured by a probability which is common knowledge. Thus for i we define $\Pi_1 = \lambda_{i,1}\pi_1 + (1 - \lambda_{i,1})\underline{\pi}_1$ where $\lambda_{i,1}$ is the belief of having the high ability in stage 1, π_1 and $\underline{\pi}_1$are the probabilities of producing the high output respectively with a high and low ability with $\pi_1 > \underline{\pi}_1$.

The firm can choose two kinds of procedures of promotion. In the first procedure opponents are evaluated on the same ability that the one they will require if they become employee in stage 2. In the second procedure they are evaluated on another

ability different that the one they will require in second stage.[4]

During the first stage, the effort/investment is not formalized because we assume agents don't choose the level of their investments and exert an exogenous effort such that only the information that reveals defeat or success will matter. The purpose of this assumption is to match with the future experimental design that is mostly focused on the behavior of opponent in stage 2 with respect of their defeats in stage 1. It allows us to avoid strategic behavior to occur during stage 1 in the experiment as no backward induction is feasible. Besides, during the experiment it allows us to have a complete control of the likelihood of the signal during the promotion process as it will not depends on participants behavior.

Let us now describe the second stage of the model which captures a hierarchical relationship. The standard model assumes that an executive denoted principal j offers a wage to his employee denoted agent i who can exert only two levels of effort $e_i \in \{0, 1\}$ (either a high level of effort, or investment, or a low level of effort). Besides the output S can only take two values as well, (i.e $S \in \{\underline{S}, \overline{S}\}$). As effort of the employee is not observable by the executive and himself does not perform any task, the objective of the executive is to incentivize the agent to exert high effort by proposing a wage $\bar{t}$ in case the production is high and another wage $\underline{t}$ in case the output is low. The production is assumed stockastic and similar to the stage 1 except that now two levels of effort can be implemented. Namely: $\Pi_1 = \lambda_{i,2}\pi_1 + (1 - \lambda_{i,2})\underline{\pi}_1$ where $\lambda_{i,2}$ is the belief in having the high ability in stage 2 and π_1 and $\underline{\pi}_1$ are the probabilities of producing the high output respectively with a high and low ability in case of high effort. Similarly, we can define for a low effort $\Pi_0 = \lambda_{j,1}\pi_0 + (1 - \lambda_{i,1})\underline{\pi}_0$ where π_0 and $\underline{\pi}_0$ are the probabilities of producing the high output respectively with a high and low ability. We assume without loss of generality that $\underline{t} = 0$ (i.e the

[4]In the experiment, procedure 2 is captured by treatment 2 as we consider that to be given a new project in the hierarchical relationship is a reasonable approximation of being evaluated on another ability than during the promotion contest.

principal can only reward in case of high production). We get the following program:

$$\begin{aligned} \max_{\bar{t}} \quad & \Pi_1(\lambda_{i,2})(\bar{S} - \bar{t}) + [1 - \Pi_1(\lambda_{i,2})]\underline{S} \\ s.c. \quad & \Pi_1(\lambda_{i,2})\bar{t} - \psi_1 \geq \Pi_0(\lambda_{i,2})\bar{t} - \psi_0 \quad (1) \\ & \Pi_1(\lambda_{i,2})\bar{t} - \psi_1 \geq 0 \quad (2) \end{aligned}$$

The parameters ψ_1 and ψ_0 are the cost of exerting high an low effort respectively (or the cost of choosing a high or low level of investment). Equation (2) is the participation constraint, it means that the condition must be guaranteed if the principal wants the agent to exert effort. Equation (1) is the incentive constraint and this condition guarantees that the effort chosen by the agent will be the high level of effort. The solution of the principal's program is completely standard by saturating the incentive constraint (equation 1). We get the standard result obtained in the literature (Laffont and Martimort, 2009):

$$\bar{t}^* = \frac{\psi_1 - \psi_0}{\Delta\Pi(\lambda_{i,2})} \quad (3)$$

With $\Delta\Pi(\lambda_{i,2}) = \Pi_1(\lambda_{i,2}) - \Pi_0(\lambda_{i,2})$ the marginal return of high effort with respect to $\lambda_{i,2}$.

2.2 Theoretical findings

Let's now establish the several theoretical results that we intend to test in this experiment.

Prediction 1: *In procedure 1, where opponents are evaluated on the same ability required in stage 2, the belief in having a high ability will be inferior in stage 2 than in stage 1, that is:* $\lambda_{i,2} < \lambda_{i,1}$. *Whereas in procedure 2, when the ability required in stage 2 is different than the one required in stage 1, the belief in having a high ability will be identical in stage 1 and stage 2, that is:* $\lambda_{i,2} = \lambda_{i,1}$.

Prediction 1 is a straightforward effect of bayesian learning. The intuition is that defeat at the contest will send a negative signal on ability. This negative signal will

not matter in procedure 2 because information on ability will be not useful in stage 2, as another ability will be required for the agent to produce.

Prediction 2: *The equilibrium wage in stage 2 decreases with respect to the belief in having a high ability.*

The second prediction is about the variation of the equilibrium wage with respect to the belief in having a good competence. Indeed, by denoting $\Delta\pi$ as $\Delta\Pi$ in case $\lambda_j = 1$, that is the marginal return of high effort with high ability, and $\Delta\underline{\pi}$ as $\Delta\Pi$ in case $\lambda_j = 0$, that is the marginal return of high effort with low ability, we can finally write using equation (3):

$$\bar{t}^* = \frac{\psi_1 - \psi_0}{\lambda_{i,2}(\Delta\pi - \Delta\underline{\pi}) + \Delta\underline{\pi}} \tag{4}$$

It is straightforward with equation (4) that $\bar{t}^*$ increases when $\lambda_{i,2}$ decreases. One of the main purpose of this experiment is to test equation (4) by showing that the incentive wage will be negatively correlated with the belief in having a high ability.

Prediction 3: *In procedure 1, where opponents are evaluated on the same ability required in stage 2, the equilibrium wage will be higher that in procedure 2 where the ability required in stage 2 is different than the one required in stage 1.*

The third theoretical finding is about the consequence of the bayesian inference on the demanded wage and is a straightforward consequence of equation (4) and prediction 1. We find that the wage requested in procedure 2, where different abilities are required in stage 1 and stage 2, will be lower than in procedure 1, where the same ability is required in both stages. That will give us a highlight on the importance of procedure of promotion to shape the willingness to accept wage inequality.

We will explain in the next section the empirical analysis to test this theoretical work.

3 Empirical analysis

3.1 Experimental design

The experiment has been run at the Laboratoire d'Economie Experimentale de Strasbourg and subjects were students from the university of Strasbourg.[5]

The experiment has been run in 6 sessions with 24 subjects per session and 3 sessions per treatment. The 24 subjects were separated in groups of 6. In the first stage, each individual in each group was matched one by one with the 5 other members of the group in 5 successive promotion tournaments following a stranger protocol. During a tournament they had to make an investment in an investment project that was randomly allocated and whose they did not know if it was high or low quality (the project could be profitable or on the contrary unprofitable). The winner was the one who made the best return. As mentioned previously, this investment in the first stage was not a choice for participant because they was forced to invest only one amount (it explains why in the theoretical framework, this choice of investment is not formalized). The purpose was to allow us to have a complete control of the likelihood of the signal that defeat sent on owning the high quality or low quality project. Otherwise, this signal would have depended on participants choices of investment. Besides it avoided to observe strategic behaviors during stage 1 and allowed us to focus our analysis on the behaviors in following stage with respect to failure at the promotion. Each tournament were then followed by a second and last stage where only the loser was asked to invest again. In that stage 2, we used a BDM procedure to elicit the incentive wage that he would demand to invest heavily rather than lightly (only two levels of investment were possible). In treatment 1, it was asked to the loser to invest a second time in the same project that the one he was endowed before the tournament whereas in treatment 2 he was endowed randomly a new project after his defeat and was asked to invest in that last project.

Stage 1 (the tournament) and stage 2 (the elicitation) constitute what we denote a "game". This game is designed to fit schematically with a hierarchical relationship when the effort is non contractible and with the promotion process that precedes it.

[5] lees.u-strasbg.fr

The level of monetary investment can be understood as an effort and the investment project as a production. Besides, the quality of the project can be interpreted as a high or low ability to succeed at producing the production. Thus, being endowed a new project before stage 2 in treatment 2 can be understood as producing a production that requires a different ability than in stage 1 whereas in treatment 1, keeping the same project can be interpreted as producing in stage 2 a production that requires the same ability than in stage 1. In order to avoid strategic interactions in stage 2 we did not ask the winner to propose an incentive wage himself like the theoretical framework would suggest. This means that our design does not shape perfectly the theoretical framework. But we argue the philosophy remains the same as the core of the theoretical reasoning is based on the incentive wage and the bayesian learning mechanism and those will operates in this design anyway. Besides, this allowed to avoid that agent interpret the wage proposal of his former opponent as filled with "good intention" or "bad intention". Indeed, this behavioral bias is very common in the ultimatum game (Bolton et al., 2005) and could have occur in the experiment.

We also note that, before the tournament and before the second stage, we asked subjects to declare their beliefs in owning a low quality investment project. As we repeated a game 4 times per subject we obtained 5 observations of prior belief and posterior beliefs per subject and 5 incentive wages declared. As a consequence we had 60 observations per session on the loser side.

Stage 1: the promotion tournament and the declaration of beliefs

Let us explain extensively the design of the promotion tournament and the declaration of beliefs. Before each tournament each subject were allocated an amount of money which is the same for every subject: 100 EC (Experimental Currency). The computer assigned randomly an investment project at each subject. Project A had a average return higher than project B but the two competitors did not know in advance which project they were allocated. Each project could make an income of either 140 EC or 0 EC (any other income is impossible): each subject had 90% of chances to get 140 EC if he had the project A and only 50% if he had the project

B. Then we asked subjects the following question: "What are your chances, in your point of view, that you have been endowed with the project B"? Neither remuneration during this phase was given and the gain during the following phases was not impacted by the reply.

During the tournament, subjects faced each other one by one and was forced to invest 80 EC in their investment projects allocated previously. We measured at the end the income of the investment and ranked opponents with respect to this and informed them of the ranking. The winner was the one who make a higher income (namely the one who get 140 EC whereas the other get 0). In case of a tie (namely when both opponents get simultaneously 140 or 0) the winner was drawn by lot. But this signal was noisy. Indeed, the incomes from investment projects were still random variables depending on the quality of the project (A or B) such that it was still feasible to wins with project B for instance even though it was less likely. We did not inform subjects on their chances of winning. The first reason is because we wanted to keep instructions as simple as possible. The second reason is because subjects could infer those probabilities of winning and loosing from the return of projects A and B (information that they have received previously). As a consequence they could infer that theoretically, if they have the high quality project their chances of winning would be 70% and if they have the low quality project 30%.[6] The gain of each subject did not correspond to the income of the investment because the latter was only used to select the winner. The winner received 300 EC and the looser 100 EC. We made then a second elicitation of belief and asked subjects the following question: "Now, knowing whether you have won or lost the tournament, what is your opinion on the percentage of chances that the computer allocated you the project B?".

Then in treatment 1, before the next phase of the game, the looser kept the same project whereas in treatment 2, he was endowed with a new project also drawn by lot between a project C and D. Project C was similar to project A and Project D was similar to B. As a consequence in treatment 2 we also asked them to declare

[6]Indeed, with high quality project we have $0,9*(1-0,5)+\frac{1}{2}(0,9*0,5)+\frac{1}{2}(1-0,9)(1-0,5)=0,7$ and with low quality project we have $0,5*(1-0,9)+\frac{1}{2}(0,5*0,9)+\frac{1}{2}(1-0,5)(1-0,9)=0,3$.

their beliefs in owning project D.

Stage 2: the elicitation of incentive wage

Let us explain now in more details the next stage of the game where we wanted to elicit the incentive wage with a BDM procedure. In treatment 1, the looser was still in possession of the investment project allocated previously and still ignoring if it was project A or B. And in treatment 2, he was in possession of the investment project C or D allocated after the tournament also ignoring which one he actually owned. First, he was allocated 100 EC for this phase and then he was asked to answer the following question: "What is the minimum wage that you would demand for investing 80 EC, rather than 40 EC in the project that you have been endowed? You need to know that this wage will be received only if your investment has an income of 140 EC". We also informed that the winner of the tournament would receive $\left[140 - \text{this wage}\right]$ and that the winner was not asked to make any decision or any declaration. We also specified that the wage declared should be between 80 and 140 EC. Finally, we informed subjects on the return of the 2 investment projects with respect to the level of investment. On the one hand, the project A has 90% of chances of making an income of 140 EC, rather than 0, if the investment is 80 EC and only 40 % of chances of making an income of 140 EC, rather than 0, if the investment is 40 EC. On the other hand, the project B has 50% of chances of making an income of 140 EC, rather than 0, if the investment is 80 EC and only 30 % of chances of making an income of 140 EC, rather than 0, if the investment is 40 EC.

We used a BDM procedure to elicit the incentive wage that the looser of the tournament would demand to invest 80 EC instead of 40 EC. As a consequence, subjects did not actually receive the wage they declared, but this procedure incentivized them to answer sincerely to the question anyway.

Indeed, before answering to the question asked, we informed them that 2 different situations could occur. In the situation 1, subjects would be forced to invest 40 EC and receive a wage w EC if the income of their projects was 140 EC (the wage would be null in case the income is null). The wage w was drawn by lot between 80 and 140 EC (included) and each possible value of w had the same probability to

occur (it followed an uniform distribution). The situation 2 is similar but subjects would be forced to invest 80 EC instead of 40 EC. The occurrence of one situation rather than the other depended on the value of w drawn and of the wage declared. Indeed, if w was inferior or equal to the wage demanded, the situation 1 occurred and subjects were forced to invest 40. However, if w was superior to the wage declared, the situation 2 occurred and subjects were forced to invest 80. This procedure guaranteed that the declaration of the incentive wage was truthful.

For the one who lost the tournament, the total gain for this phase was 100 (his allocation)+w EC (if the income was 140 EC) or 0 (if not) - 80 or 40 EC (depending on if situation 1 or 2 occurs). For the one who won the tournament the total gain of this phase was 140 EC − w EC if the income is 140 or 0 otherwise.

3.2 Econometric models

The econometrical analysis will consist in testing equation (4). Nevertheless, we will adapt the notation to the experimental design notably because experimental variables have double index due to the number of successive games and the number of participants. Thus, we will test the correlation between the belief in owning the high quality project after defeat and the wage participants are willing to accept to invest 80 EC instead of 40 EC in the elicitation phase. Relying on equation (4) in the theoretical model we have:

$$w^*_{i,j} = \frac{\psi}{\hat{\mu}_{j,j}(\Delta\pi - \Delta\underline{\pi}) + \Delta\underline{\pi}}$$

We denote $w^*_{i,j}$ the wage participant i declares he is willing to accept to invest 80 EC instead of 40 EC once he lost the tournament against participant j. It is a transposition of the variable $\bar{t}^*$ in the theoretical framework. We also denote $\hat{\mu}_{i,j}$ the belief for participant i of having the high quality project given he just lost the competition facing agent j. It corresponds to the variable $\lambda_{i,2}$ in the theoretical framework which is the belief in having a high competence in second stage. Furthermore, we note that in treatment 1 the high quality project is project A and the low quality project is project B whereas in treatment 2, project C is the high quality project and the less profitable project is project D.

Besides, ψ is the marginal cost of investment that is to say $80 - 40 = 40$. It corresponds to $\psi_1 - \psi_0$, the marginal cost of effort, in the theoretical framework. The variable $\Delta\pi = 90\% - 40\% = 50\%$ is the increase of the likelihood of getting a high output (140 instead of 0), by investing 80 instead of 40 when having the high quality project (A in treatment 1 or C in treatment 2). And the variable $\Delta\underline{\pi} = 50\% - 30\% = 20\%$ is the increase of the likelihood of getting a high output (140 instead of 0), by investing 80 instead of 40 when having this time the less profitable project (project B or D in treatment 2). For the sake of clarity, we name $\Delta\pi$ the marginal return of the high quality project and $\Delta\underline{\pi}$ the marginal return of the low quality project.

Player i will repeat the whole game 5 times (tournament and elicitation phase) but the number of defeats is actually random such that the number of observations will vary for each i. As a consequence we will have 24 observations for each session and 3 sessions by treatment but the number of periods observed for each i will changed with respect to the number of his defeats.

We will first study an econometrical model straightforward derivative from the theoretical model. We finally obtain the following econometrical model to test denoted Model 1:

$$\text{Model 1: } ln(w^*_{i,j}) = \alpha ln[\hat{\mu}_{i,j}(\Delta\pi - \Delta\underline{\pi}) + \Delta\underline{\pi}] + \beta ln(\psi) + \epsilon_{i,j} \tag{5}$$

The purpose will be to tested hypothesis $\alpha < 0$. It is important to understand that theoretically $\alpha = -1$ but the purpose of this paper is to test qualitatively equation (4) and not quantitatively. As a consequence, the more α will be closed to zero the more the effect of the belief in having the high quality project on the wage will be interpreted as small and the more α will be negative and low the more the effect will be interpreted as strong.

For the sake of exhaustivity we will also study another econometrical model that we denote Model 2:

$$\text{Model 2: } ln(w^*_{i,j}) = \alpha ln[\frac{\hat{\mu}_{i,j}}{\mu_{i,j}}(\Delta\pi - \Delta\underline{\pi}) + \Delta\underline{\pi}] + \beta ln(\psi) + \epsilon_{i,j} \tag{6}$$

In equation (6), $\mu_{i,j}$ is the belief in having the high quality project (project A) before the tournament. Thus $\frac{\hat{\mu}_{i,j}}{\mu_{i,j}}$ is a variable that captures the *deception* after failure. Equation (6) would imply that without any bayesian inference (that is $\frac{\hat{\mu}_{i,j}}{\mu_{i,j}} = 1$), the choice of the wage would become independent of the belief. Indeed if $\frac{\hat{\mu}_{i,j}}{\mu_{i,j}} = 1$ is verified then equation (6) becomes:

$$ln(w^*_{i,j}) = \alpha ln(\Delta\pi) + \beta ln(\psi) + \epsilon_{i,j}$$

As a consequence, without any bayesian inference, the choice of the wage would only depend on the marginal return of the profitable project $\Delta\pi$.[7] Hence, we can interpret Model 2 such that, if there is no *deception*, the participant will "simplify" his cognitive approach of the issue only considering the case he has the high quality project and not taking into account the other potential case. In other word he will not think in term of expected return. As a consequence, it allows us to interpret equation (6) as a two-step reasoning for participants when he declares his wage. In a first step, he considers only the best scenario and the marginal cost of investment ψ, and appraises the wage he will demand. In a second step, he takes into account his *deception* and appraises a supplement to the wage.

3.3 Empirical results

3.3.1 Bayesian belief and descriptive statistics

Table 1 shows the proportion of individuals who did not revise their beliefs or who revised upwards by round, session and treatment. If we consider treatment 1, 25 % falls into this category for session 1. It is evaluated at 30 % and 35 % respectively for session 2 and 3.

Result 1: *In line with prediction 1, in treatment 2, when participants are endowed a new project after failure at the tournament, the belief in owning a high quality project in the elicitation stage is higher than in treatment 1, when participants keep the same project.*

[7] Indeed, it would imply $[\frac{\hat{\mu}_{i,j}}{\mu_{i,j}}(\Delta\pi - \Delta\underline{\pi}) + \Delta\underline{\pi}] = [(\Delta\pi - \Delta\underline{\pi}) + \Delta\underline{\pi}] = \Delta\pi$.

Table 1: Descriptive statistics

Round	Treatment 1			Treatment 2		
	$S1$	$S2$	$S3$	$S1$	$S2$	$S3$
1	25.00 [a]	33.33	33.33	91.67	100.00	83.33
2	25.00	16.67	41.67	75.00	83.33	100.00
3	25.00	33.33	50.00	83.33	91.67	75.00
4	33.33	25.00	16.67	83.33	83.33	75.00
5	16.67	41.67	33.33	75.00	75.00	75.00
Sessions	25.00	30.00	35.00	81.67	86.67	81.67
Treatment		30.00			83.34	

[a] 25% of subjects in session 1 (S1) didn't downgrade their beliefs in treatment 1 (T1)

The failure led most people to downgrade their beliefs, 70% in treatment 1. However, we found that for treatment 2, the number of individuals who revised their beliefs is very low.

The distribution of beliefs reveals an heterogeneity in the individuals' behavior (Fig.1). Indeed, for the expost belief, about 50% of individuals have a belief revolves around the average in the treatments 1 & 2. For lower values (around 20 %), we find also a small concentration of individuals indicating a part of the person who downgraded their beliefs. If we consider the two treatments separately, we find that the greatest number of people having revised their beliefs are obtained in treatment 1 (Fig.2).

3.3.2 Econometric analysis

Since each individual is observed 5 times during the experiment, we use the fixed effect panel data model. However, as only the losers are retained in each round, we end up with an unbalanced panel sample. An individual may be a loser in one round and win in another. Thus, the individual fixed effect is not relevant to analyze our data for which we do not have enough variation within cluster. So, we used a

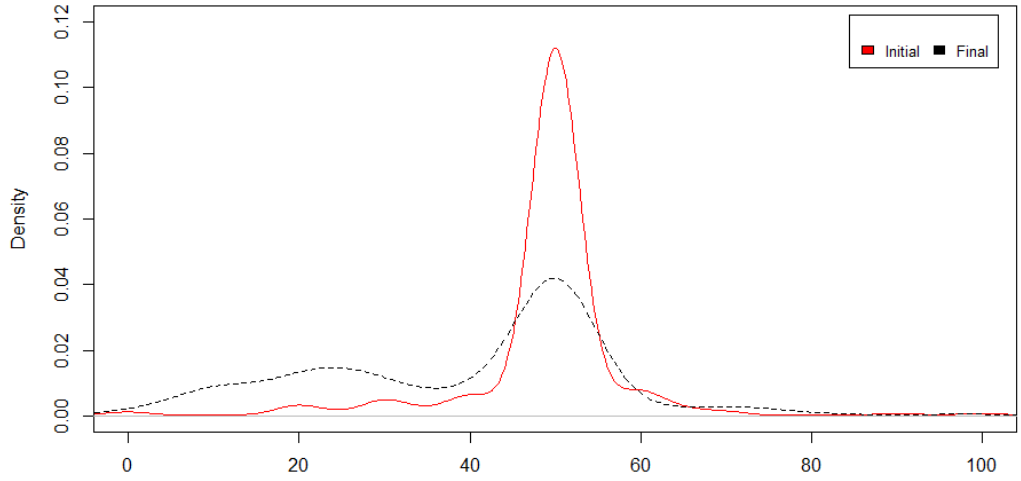

Figure 1: Initial and final belief for all of the sample

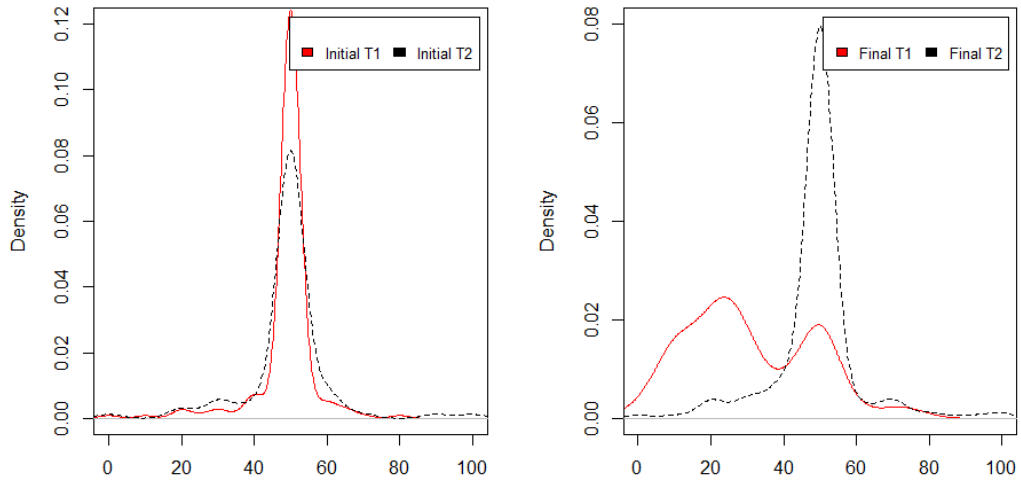

Figure 2: Initial and final belief for Treatments 1&2

time fixed effect model and we introduce some control variables such as sex, age, or degree of risk aversion.

Result 2: *In line with prediction 2, the wage demanded in the elicitation stage is negatively correlated with the marginal return of effort.*

The estimated results of the econometrical Model 1 in table 2, correspond to equation (5). They show that the marginal return on investment impacts negatively and significantly the income requested by the individual. The elasticity value is between -0.03312^{***} to -0.026629^{**} depending on the different specifications.

Table 2: Estimation results for Model 1

Variables	(1)	(2)	(3)	(4)
Marginal return	-0.03312^{***}	-0.02593^{**}	-0.02657^{**}	-0.02629^{**}
	(0.01069)	(0.01196)	(0.01191)	(0.01191)
Female			-0.02579^{*}	-0.02280
			(0.01484)	(0.01511)
Age			-0.10429	-0.10174
			(0.07934)	(0.07934)
Risk aversion				0.01980
				(0.01902)
Treatment		✓	✓	✓
N	360	360	360	360

The standard deviations are in parentheses.*** Significant at 1%, ** Significant at 5%, * Significant at 10%.

For the specification (1) we note that a decrease of 1% in the marginal return on investment leads to an increase of about 0.033% of the incentive wage. The belief update (BU) reflecting a low probability for an individual to see the return of his project increased, is negatively correlated with income. Indeed, the BU incites individuals to expect a low rate of return on their investments. So, faced with this situation, individuals will be more likely to ask for a higher income to limit their "losses" and make their investments worthwhile. Other control variables such as gender, age (specifications 2 & 3) and risk variable (specification 4) that describes whether the individual likes risk or not have been added to the model.[8] Estimates

[8]We ask individuals, if they consider to be a person who likes to take risks rather cautious.

show that female dummy variable and age have a negative but not significant effect (specification 2 & 3). The risk variable has a positive but not significant effect on the income. Since our data come from two different procedures (treatments), their effects is controlled using a dummy variable.[9]

Table 3: Estimation results for Model 2

Variables	(1)	(2)	(3)	(4)
Relative marginal return	-0.14579^{***}	-0.14591^{***}	-0.14597^{***}	-0.15017^{***}
	(0.04170)	(0.04192)	(0.04234)	(0.04292)
Female			−0.01193	−0.00854
			(0.02239)	(0.02305)
Age			-0.03630	-0.02965
			(0.11720)	(0.11787)
Risk aversion				0.01942
				(0.03020)
Session		✓	✓	✓
N	179	179	179	179

The standard deviations are in parenthese.*** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 3 gives the estimates results of the econometrical Model 2 that corresponds to equation (6). As a reminder, the main difference between Model 2 and Model 1 is that it explicitly considers the final belief relatively to the initial belief. As in Treatment 2 most individuals have not revised their beliefs, this model is only estimated for Treatment 1. The results are in line with those obtained with Model 1 but the relative marginal return impact in Model 2 is higher than the impact of marginal return in Model 1. Indeed, the relative marginal return on investment

Indicate on a scale of 1 to 10 where you think you are, 1 representing a person who is extremely careful and 10 representing a person who loves to take risks

[9]For all the considered specifications, the effect of the treatment is not statistically significant.

has a negative and significant effect on the negotiated income by individuals for all specifications. The elasticity value is between -0.14579^{***} to -0.15017^{***}. As for Model 1, the variables ages, sex, risk and session do not affect individuals income.

3.3.3 Non-parametric test

Descriptive statistics reveal that individuals revise more in treatment 1 than in treatment 2 (Result 1). This difference in individual behavior could impact their expected incomes. Thus, the nonparametric Wilcoxon-Mann-Whitney test is used to test whether incomes are statistically different from one treatment to another. This test is commonly used by experimental economists for difference detection in central tendency between two samples (Feltovich, 2003). We test the hypothesis H0: income in treatment 1 and income in treatment 2 come from the same population. This test is based on equality of mean/median/mode of distributions.

Result 3: *In line with prediction 3, in treatment 2 when participants are endowed a new project after failure, the wage demanded is on average significantly inferior to the wage demanded in treatment 1, when participants keep the same project.*

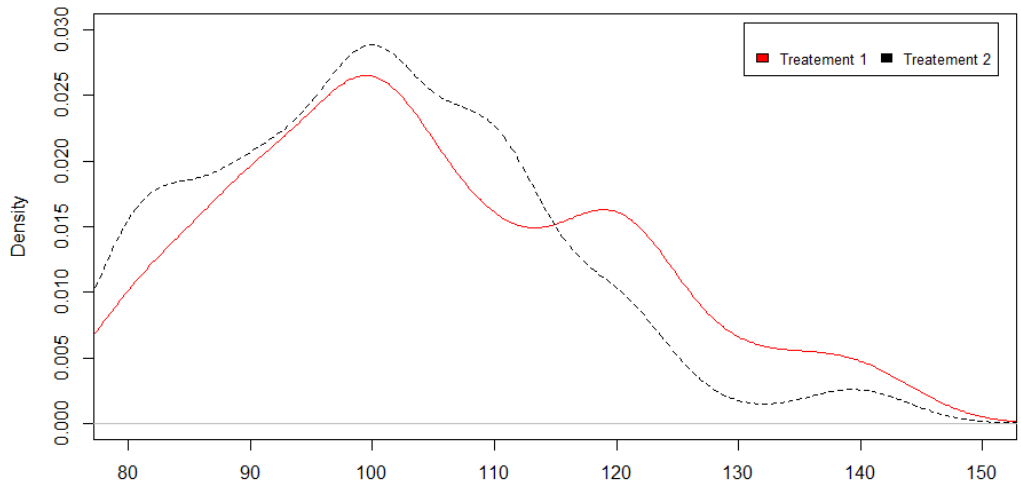

Figure 3: Distribution of wages in Treatments 1 & 2

The results of test allow to reject the null hypothesis (P-value = 0.02466) at the 5% threshold. The average of income in treatment 1 is estimated at 104.77 EC (Sd = 15.75) and 100.59 EC (Sd = 13.73) for treatment 2. As observed in figure 3, for income level less than 115 EC, the frequency is higher in treatment 2 while it is higher in treatment 1 when income is higher than 115 EC. This high frequency for treatment 1 in extreme value of income (between 115 and 130) could be explained by the lower expectation of return on investment as it is suggested by Result 2. We interpret that individuals that are pessimist about their chances of owning a high quality project will require a strong reward to make their investments worthwhile. It is then straightforward that this behavior occurred much more frequently in treatment 1 as the beliefs of owning the high quality project are smaller than in treatment 2 (Result 1). However, this is not the case in treatment 2 because the change of project was considered as a fresh start for individuals.

4 Conclusion

The aim of this experimental analysis was to investigate the issue of competition between peers and how it could be a major stake to explain how people accept inequality of wages . Most of the literature that deals with acceptation of inequality of revenue assumes some *inequity aversion* (Falk et al., 2008). Furthermore Ku and Salmon (2013) and Bolton et al. (2005) focus on the *procedural fairness* and highlight notably how people do not take merit (i.e a performance at a test) into account as a "fair" criteria of allocation of revenues but they rather prefer to take into the belonging to a social group. Our work wants to focus on how people are willing to accept a lower wage compared with their executive's incomes with respect to the procedure of selection of their executives. We particularly study how the choice of the nature of the task assessed to select executive might be crucial. Thus, we design an experiment that comprises a first phase that selects the higher performer among of two individuals to become the executive of the lower performer during the

second phase of the experiment. The performance evaluated is the outcome they are able to make by investing in a investment project with a random return. None of them is aware in advance if they had received the most profitable project. After this competition only the employees has to invest again. We study two procedures. In the first procedure (treatment 1), the looser is asked to invest in the same project that the he one has been endowed before the competition, whereas in the second procedure (treatment 2) he receives a new investment project after his defeat, again without knowing if it is profitable or not. He is required to invest in that project in the second phase. We use a BDM procedure to elicit the wage he would request to invest heavily rather then lightly.

The main result observed in the experiment is that the wage demanded in the treatment 1 is *on average* significantly higher than the wage demanded in treatment 2. We also observed that the wage demanded is negatively correlated with the belief in owning a profitable investment project and that this belief is inferior in treatment 1 than in treatment 2. These last two results obtained using econometrics methods allow us to interpret this difference in wages between the two treatments. Our interpretation is that the one who has failed as being promoted in treatment 1 will be more pessimist about his chances of owning the profitable project. He will then demand a higher wage to be incentivized to make a heavy investment in the next stage to make his investment worthwhile. Whereas in treatment 2, information received through the tournament about the return of the investment project they have endowed will be not relevant in the next phase anymore because the looser receives a new project after his defeat. This changing of investment project will be lived as a "fresh start". Those results fit with the theoretical findings. They study the limits of a procedure of selection where the best employees are promoted as executives. We argue these results question the efficiency of this kind of "merit based" promotion procedure to bolster the legitimacy of executive, in a sense that it would make inequality of wage more acceptable in the view of the employee.

Some interesting further research could be to add new treatments in the experiment. For example, what would be the consequences on bayesian inference if the opponents choose a different level of investment during the tournament? Indeed, for

instance one participant could prefer invest a lot of his resources (effort or money) in the project and the other one few of his resources. This could shed new light on the role of effort during the competition as a way to bolster or undermine acceptation of inequality of income between a executive and his employee. Indeed, effort of the winner might exacerbate the discouragement of the looser during the second phase by exacerbating the spread between the two performances. Some others interesting further research would be to define more precisely what could be the ability that should be chosen to actually make employee accept more inequality. The idea would be to design real effort task. One specific ability for one specific task, like mathematical skills at an intelligence test for instance like Buser et al. (2018), could be required for the promotion and for the hierarchical relationship thereafter in a first treatment. Whereas in a second treatment we could change the required ability and the corresponding task, like verbal abilities for instance, and observe if the wage demanded is different between the two treatments.

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