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Efficiency and Sustainability in Teamwork: The Role of Entry Costs

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Abstract: This research studies how incentives to cooperation and sustainability through up-front pay mechanisms can impact teamwork. For this purpose, we carry out certain laboratory experiments on the two-player Minimum Effort Game. First, we compare two treatments: one with "free play teams", against teams forced to make a non-refundable up-front payment that covers the total output in case of maximum contribution, which we call "optimal entry cost teams". In the second comparison, experimental results are focused on different amounts in the up-front pay in order to test the theoretical prediction that higher entry costs might improve efficiency (optimal entry cost treatment vs. medium entry cost treatment). We find that the up-front pay mechanism induces higher effort levels compared to the "free play teams", which converge to the efficient and sustainable solution. The increase in the up-front pay, however, does not seem to accelerate such a convergence. These findings provide evidence for a new mechanism to encourage efficiency and sustainability in firms.

Keywords: teamwork; up-front pay; minimum effort coordination game; efficiency

1. Introduction

Over the last few decades, economic growth and globalization have made a significant impact on natural resources. Resources held in common, such as oceans, rivers, air, and parklands, are subject to massive degradation [1]. These "open access" or "common pool resources" phenomena are explained by the tragedy of the commons [2]. From an economic perspective, the internalization of external costs through market mechanisms and incentive systems is viewed as a solution to this problem [3]. Take, for example, the Kyoto Protocol, which was devised as an attempt to have industrialized countries commit to stabilizing greenhouse emissions by punishing parties that exceed the assigned amount of emissions [4]. Environmental taxes can help to manage environmental problems by internalizing environmental costs and creating economic incentives for the public and businesses to promote ecologically sustainable activities [5].

Decision makers concerned by the use and management of open access resources are commonly organized as a team, defined as a collection of specialized agents whose efficiency as a group is greater than as individuals [6]. Understanding and developing effective teams is a challenging issue [7], because teamwork contributes substantially to organizational success [7], especially when firms are also concerned about sustainability. However, team production commonly faces the problem of measuring individual productivity as a condition to implement incentives to achieve an efficient allocation of individual resources. In fact, when individual productivities cannot be observed or measured, compensation rules based on the output value lead to inefficient outcomes owing to "free rider" and moral hazard problems [8].

From an economic viewpoint, the attempt to minimize this inefficiency leads agents to search for and implement different types of organizations [9] or to implement incentive systems and optimal contracts [8]. In this paper, we focus on the implementation of an "up-front pay" framework as an additional mechanism to improve efficiency and even sustainability if team production is linked to environmental or common pool resources issues.

In this context, studies in behavioral economics provide support for up-front pay as a solution that can overcome the inefficiencies in teamwork. In general, subjects have a higher tendency to continue an endeavor once an investment in money, effort, or time has been made [10], because subjects feel that "they have invested too much to quit" [11], and they have a greater aversion to losses than to incentives from gains [12]. There is some relevant research in the public goods and environmental economics fields related to the impact of up-front pay and team efficiency. For example, a hierarchical solution was proposed, by which team members commit to the public good by paying a deposit to an authority prior to the contribution [13]. These parameters suggest that an up-front pay solution might improve efficiency and sustainability in team production.

The effect of up-front pay has received attention from psychologists and behavioral researchers. When players are forced to make an initial payment they expect others to avoid strategies that always result in losses, even when such strategies are more profitable [14]. This selection principle makes sense under the assumption that subjects are more concerned about losing a given amount of wealth than gaining it [15]. Team members are prone to taking decisions to recoup sunk costs rather than ignoring them [10,16,17]. Given that teams are the basic unit of performance for most organizations [18], we conclude that organizations formed by inefficient teams are not sustainable. In other words, team efficiency is a sufficient condition for an organization to be sustainable [19], that is capable of surviving and creating wealth [20,21].

Experimental economics provides a new perspective and avenues for policy makers and scholars [22,23] in the sustainability area. The effects of non-cooperative behavior have been studied in the laboratory in different contexts such as public goods [24,25], natural resources [26,27], and team production [28]. This paper adds new evidence and theoretical insights to the role of entry costs in teamwork. In this vein, previous experimental studies have proposed different research designs with some interesting findings, such as that charging an entry fee to team members creates higher payoff equilibria [14], and that the price of the right to play does indeed communicate information about the strategy coordination problem [29].

Our research proposes an experimental design that includes an up-front pay mechanism in team production and allows us to test its ability to induce cooperation and efficiency in resource allocation. In particular, we compared contributions of teams with no up-front pay, called "free play teams" (control treatment) to those teams with an "optimal entry cost" before deciding on their effort or contribution levels. With a simple design of a two-player minimum effort game, we tested the theoretical prediction that teams made up by members who make an up-front payment equal to the efficient total output achieve a more efficient equilibrium than those formed by "free play teams", namely, those with no up-front pay. In addition, we tested the hypothesis that a higher up-front pay entails better performance. Finally, we looked into the determinants of the subjects' exerted efforts by studying the effects of different variables such as own and partner's past decisions, beliefs, gender, self- belief about the up-front pay effect, nationality or time spent on making decisions.

2. Theoretical Model and Predictions

According to Holmstrom's [8] definition a "team" is characterized as follows: (1) members' capabilities in the team are subject to technological constraints represented by a production function, $y = F(\boldsymbol{a})$, where y is the output value and $\boldsymbol{a} = (a_1, a_2, ..., a_N)$ the vector comprising each member's contribution; (2) the production function F is featured as a "team technology", which implies that individuals, given the same level of input, can obtain a higher level of output if they participate in the team than if they do not; (3) each member owns one and only one input and hence, a_i is the contribution of member i; (4) each member bears the total cost of allocating her resource to the productive activity of the team; the cost of each individual's resource is $V_{\mathrm{i}}(a_i)$ where V_{i} is an increasing and convex function in a_i for all i. Therefore, the team's net profit or surplus will be given by $U(a) = F(\boldsymbol{a}) - \sum_{i=1}^{N} V_{\mathrm{i}}(a_i)$; (5) the utility function of member i of the team is $U_i = S_i(y) - V_i(a_i)$ for i = 1, 2, ... , N, where S_i is the function that determines the output sharing. This sharing rule depends exclusively on the output value of the team (y); and (6) any member can obtain an alternative utility of zero if she leaves the team.

2.1. Efficient Solution and the Nash Equilibrium with "Free Play Teams"

The Pareto-efficient solution to the team problem is given by:

$$\max_{a_i} \sum\nolimits_{\mathrm{i}=1}^{\mathrm{N}} U_i = \sum_{i=1}^{N} S_i[F(\boldsymbol{a})] - \sum\nolimits_{\mathrm{i}=1}^{\mathrm{N}} V_{\mathrm{i}}(a_{\mathrm{i}}) \tag{1}$$

$$\textit{such that } a_i \geq 0, \textit{ and } S_i[F(\boldsymbol{a})] \geq V_i(a_i) \text{ for } i = 1, 2, \ldots, N.$$

Thus, the efficient solution to the team problem, $\boldsymbol{a}^* = \left(a_1^*, a_2^*, \cdots, a_N^*\right)$ and $y^* = F(\boldsymbol{a}^*)$, is achieved when the marginal revenue of the team equals its marginal cost.

$$\frac{\partial F}{\partial a_i} = \frac{\partial V_i}{\partial a_i} \text{ for } i = 1, 2, \ldots, N. \tag{2}$$

But team members are assumed to behave rationally, and therefore they maximize their own utility, given the contributions of the remaining team members, i.e.,

$$Max_{a_i}\ U_i = S_i[F(\boldsymbol{a})] - V_{\mathrm{i}}(a_{\mathrm{i}}) \tag{3}$$

$$\text{such that } a_i \geq 0,\ \sum\nolimits_{i=1}^{N} S_i[F(\boldsymbol{a})] = F(\boldsymbol{a}), \text{ and } S_i[F(\boldsymbol{a})] \geq V_i(a_i)\ for\ i = 1, 2, \ldots, N.$$

The solution to the above problem is actually the Nash equilibrium and its first order conditions are:

$$\frac{dS_i}{dy}\frac{\partial F}{\partial a_i} = \frac{\partial V_i}{\partial a_i} \text{ for } i = 1, 2, \ldots, N. \tag{4}$$

The above expression differs from (2) because $0 < dS_i/dy < 1$ when the number of members of a team is equal or greater than two ($N \geq 2$). Thus, the above equilibrium is not efficient.

2.2. Up-Front Pay as Guarantee for Team Members

Assuming now that members can afford an "up-front pay" equal to the total efficient output minus each member's part of the output, i.e., $K_i = F(\boldsymbol{a}^*) - S_i[F(\boldsymbol{a}^*)]$, the payoff function is:

$$F(\boldsymbol{a}) - K_i \text{ for } i = 1, 2, \ldots, N, \tag{5}$$

where $S_i[F(\boldsymbol{a}^*)] \geq V_i(\boldsymbol{a}_i^*)$ for $i = 1, 2, \ldots, N$ and $\sum_{i=1}^{N} S_i[F(\boldsymbol{a}^*)] = F(\boldsymbol{a}^*)$.

Then individual utility can be represented as

$$U_i = F(\boldsymbol{a}) - K_i - V_i(a_i) \text{ for } i = 1, 2, \ldots, N. \tag{6}$$

Thus, the Nash equilibrium is the solution to the following maximization problem:

$$Max_{a_i}\ U_i = F(\boldsymbol{a}) - K_i - V_i(a_i) \tag{7}$$

$$\text{such that}: \sum_{i=1}^{N} S_i[F(\boldsymbol{a})] = F(\boldsymbol{a}),$$
$$S_i[F(\boldsymbol{a}^*)] \geq V_i(a_i^*) \; for \; i = 1, 2, \ldots, N,$$
$$\sum_{i=1}^{N} K_i = F(\boldsymbol{a}^*) \; for \; i = 1, 2, \ldots, N,$$
$$a_i \geq 0 \; for \; i = 1, 2, \ldots, N.$$

As K_i is a constant, first order conditions of the above problem are,

$$\frac{\partial F}{\partial a_i} - \frac{\partial V_i}{\partial a_i} = 0 \text{ for } i = 1, 2, \ldots.., N. \tag{8}$$

It becomes clear that conditions (2) and (8) are equivalent, and hence the Nash equilibrium represented by (8) is efficient.

Notice that the efficient solution is only achieved when the sum of the fees paid as "up-front pay" by all members equals the value of the output at the efficiency level, that is, $\sum_{i=1}^{N} K_i + F(\boldsymbol{a}^*) = NF(\boldsymbol{a})$. Otherwise, if the aggregate up-front pay is less than N-1 times the efficient output, i.e., $\sum_{i=1}^{N} K_i < (N-1)F(\boldsymbol{a}^*)$ the payoff function cannot guarantee that each member will receive the total value of the team output. For instance, let us assume that "up-front pay" and the payoff are the same for all members, $K_i = K$ and $F(\boldsymbol{a})$, respectively. In this case the value of K that makes it possible to share N times the value of the total output at the efficient level is $K^* = (N-1)F(\boldsymbol{a}^*)/N$. However, if the effective up-front pay is lower than K^*, namely, $K = \alpha K^*$ with $0 < \alpha < 1$, the individual payoff cannot be greater than $\alpha F(\boldsymbol{a})$. Therefore, we can conclude that the efficiency of the "up-front pay" should become lower as the up-front pay decreases.

3. Methods

3.1. The Minimum Effort Coordination Game

Coordination games have been widely used in real problems observed in companies and industries [28]. Several studies using minimum effort coordination games (MECGs) have analyzed the impact on experimental outcomes of parameters such as group size [30–32], cost of effort [33], money back guarantees [31] or entry fees [14].

In our study, the MECG framework is used to make two types of comparisons within three treatments. In the first comparison, we study the effect of up-front pay on the contributions of team members compared to the control "free play teams" treatment (between subjects treatment). In the second comparison, with a within subject treatment we examine the impact of changing the fee amount ("optimal entry" cost vs. "medium entry" cost treatments). The above experiments consider teams formed by two members who simultaneously and privately exert an effort level or contribution. Contributions are natural numbers between zero and fifty that team members wish to devote to the collective task, namely, $C_i \in [0, 50]$, $i \in \{1, 2\}$. The production process is represented by Leontief technology, which implies that the inputs should be used in fixed (technologically pre-determined) proportions, as there is no substitutability between factors. In other terms, inputs are considered "pure complements" as deviations from the fixed proportion between inputs imply an obvious loss. The proportion of the two inputs is 1:1 to produce 2 units of output. Hence, the output is determined by the minimum effort of the two participants, and any effort higher than the minimum is assumed to be a loss.

We make two comparisons: the first analyzes "free play teams" versus "optimal entry cost teams". In the first treatment (free play teams), the payment function (π_{it}) is determined by the double of the minimum contribution of the couple (C_{1t}, C_{2t}) minus C_{it} , the contribution of subject i in round/period t.

$$\pi_{it}^{\text{Free Play}} = 2\text{Min}\{C_{1t}, C_{2t}\} - C_{1t} \tag{9}$$

The dilemma of player i in this treatment is to predict and choose the minimum effort of the group taking into account that any deviation from this value implies a net utility loss.

In the second and third treatments the utility functions include the up-front pay as a constant in the payoff function. For the second treatment, a fee of $K_2 = 100$ units is required to be paid before taking every decision. In this case, the payoff function turns out to be 4 times the minimum effort:

$$\pi_{it}^{\text{Optimal Entry Cost}} = 4\text{Min}\{C_{1\text{t}}, C_{2\text{t}}\} - K_2 - C_{2\text{t}} \tag{10}$$

As presented, the games corresponding to all treatments have multiple Nash equilibria in pure strategies, namely, $C_{1\text{t}} = C_{2\text{t}}$, but only the maximum contribution for both subjects is Pareto-efficient, i.e., $C_{1\text{t}} = C_{2\text{t}} = 50$.

Finally, in the third treatment in order to quantify the effect of the amount of the up-front pay, members now pay a lower amount ($K_3 = 75$) as a mandatory fee before deciding their contribution in each period. In this treatment, called "medium entry cost teams", the output is computed as three times the minimum effort that guarantees the fact that the maximum contribution leads to the efficient output level.

$$\pi_{it}^{\text{Medium Entry Cost}} = 3\text{Min}\{C_{1\text{t}}, C_{2\text{t}}\} - K_3 - C_{2\text{t}} \tag{11}$$

To sum up, $C_{1t} = C_{2t} = 50$ corresponds to the (Pareto-optimal) equilibrium in all treatments [34]. However, any situation in which $C_{1t} = C_{2t}$ is a Nash equilibrium in pure strategies in all treatments [35]. The only difference between the experimental treatments is in the amount of the up-front pay. The logic for the comparison between the "no up-front pay" ($K_1 = 0$) and that with an optimal entry cost ($K_2 = 100$) is that the latter is expected to push higher contributions and create an environment of concern for sustainability from team members, knowing that there is a sunk cost to pay, and that if any member tries to free ride on the other, then the minimum effort is lower for both. In the second comparison, it might be thought that a higher up-front payment ($K_2 = 100$ vs. $K_3 = 75$) would push contributions upwards more strongly.

3.2. Procedures

The experiment was programmed in the Ztree toolbox [36] and performed in the computer room of the Faculty of Economics and Management at the University of Salamanca. The experiment involved two groups of subjects: the first, which was called "free play teams", had 152 participants, all of them just playing one treatment of 20 consecutive rounds. The second group ("up-front pay" teams) had 184 subjects who participated in two treatments performed consecutively and in the same order: first, the "optimal entry cost treatment" and then, the "medium entry cost treatment". Subjects of these two treatments also played 20 rounds per treatment and they received an initial endowment of 100 when playing the "optimal entry cost" treatment and 80 when playing the "medium entry cost" treatment. All subjects were students of undergraduate programs (Economics and Business Administration) of the aforementioned University.

Subjects were considered unexperienced as they had never participated in a similar activity before and were incentivized according to their performance during the experiment and in terms of their payoffs. Before the experiment started, we carried out the following tasks: (1) participants read the instructions (see Appendix A) and any doubts were privately answered; (2) to verify that they had correctly understood the information provided, we asked the participants to fill in a form with some questions that we reviewed before starting the experiment; In this questionnaire we also collected data about the participants (gender, degree of studies and nationality) for control purposes and we also elicited their previous belief about the effect of paying an initial fee on contributions; (3) subjects were required to complete a round test consisting of three consecutive decisions that allowed participants to familiarize themselves with the software. Teams were formed by randomly selecting pairs of subjects in each session. Information exchange between team members was not allowed and hence, subjects remained unaware of her/his team mate's identity. All treatments consisted of 20 consecutive decisions or rounds. In each round, the subject had to choose her own contribution to the teamwork and register her guess about the partner's contribution. Response time was unrestricted and registered by the software. After every round, the software reported: (1) contributions and profits and payoffs of both team members after their last choice and (2) the accumulated profits of all past rounds. Subjects of the "free play" treatment were gathered into 8 groups organized according to the availability of the participants' schedules and limited to a maximum of 20 participants per group. Unlike the "free play" treatment, subjects of the "up-front pay" scenario successively performed two treatments, namely, "optimal entry cost" and "medium entry cost". Therefore, the comparison of data between the "optimal" and "medium" entry cost treatments was performed through a within-subject approach (i.e., subjects of both treatments remained unchanged). Alternatively, the comparison of data of the above treatments versus the "free play" treatment involved a between-subjects design (subjects were different). The composition of the team remained unchanged in both treatments. After concluding the first treatment, we reminded participants that decisions for the next treatment were independent from past decisions, as indicated in the instruction sheet. Thus, the start of a new treatment involved the restart of a new game. For the "medium entry cost treatment" participants proceeded directly to perform the experiment as previous pilot tests were omitted. In the "up-front pay" treatments, 6 groups of a maximum of 32 participants were made.

3.3. Hypothesis

As commented in Section 3.1, the MECG has multiple and symmetrical equilibria, which are characterized by the fact that all players choose the same contribution, although only the maximum is optimal for both subjects ($C_{1t} = C_{2t} = 50$). Nevertheless, findings from previous experiments on the repeated MECG reveal that subjects rarely tend to coordinate at maximum effort [28]. The introduction of an "up-front pay" scheme in this game led us to formulate the following propositions:

P1: The efficient and more sustainable equilibrium in "up-front pay" requires maximum contribution (i.e., $C_{it} = 50$, $i = 1, 2$) of team members.
P2: The loss avoidance principle improves coordination in more efficient equilibria.
P3: The efficiency of the Nash equilibrium in a team increases with the up-front pay.

Consistently with our proposition P1, the solution proposed in our work to overcome inefficiency and encourage sustainability is the consideration of an efficient level of up-front pay for participating in a team production related to, for instance, natural resources exploitation. To be efficient, the sum of the up-front pay should equal the efficient level of outcome, and also "signaling and incentives system to coordinate individuals" have been proposed in production systems [37]. A payment in advance can be viewed as an investment which leads to efficient outcomes in different contexts [29]. Open access culture in the management of natural resources must be replaced with more appropriate property rights regimes and governance structures [38]. For instance, in the Tasmanian abalone fishery case [39], a quota system is established, based on division of a total allowable catch (TAC) into quotas, with shares that can be traded. Along this line, empirical work in marine natural resources challenges researchers to come up with the development of appropriate economic policy and management measures relating to property (e.g., tourism, coastal urban and property development, agricultural activities impacting on the marine ecosystem and general marine activities). Cooperatives are increasingly proposed as solutions for sustainable fisheries management [40]. Other related examples are the cases of the Ningaloo Marine Park, Western Australia, Queensland Hervey Bay, and Great Barrier Reef Park [41].

Therefore, the main hypothesis of this work posits that up-front pay schemes, represented by payoff functions such as those in Equations (10) and (11), increase cooperation in teamwork and encourage far more concern for sustainability. Our first hypothesis (H1) can be expressed as follows:

Hypothesis 1 (H1). *The contribution of team members facing an "up-front pay" rewarding framework is higher than those facing a "zero entry cost" framework.*

Another variable that might determine contributions are beliefs, specially a subject's expectations about others' willingness to contribute in the first rounds (P2). From this perspective, the "loss avoidance" principle is likely to apply. Under this principle, subjects tend to reject strategies that result in certain losses for themselves as they only consider strategies that might result in a gain. Charging a fee to play creates coordination on more efficient equilibria [14]. Beliefs prior to playing a coordination game can influence which equilibrium they eventually coordinate upon [42]. We tested in our first comparison the effect of the eventual relevance of the "loss avoidance" principle.

Hypothesis 2 (H2). *Subjects' contributions improve coordination when there is a prior belief about up-front pay; as a result, selection is done through the loss avoidance principle.*

For the second and third treatment, the teams were kept the same, the difference between treatments being the amount of the up-front pay. Indeed, increasing up-front franchise fees encourages efficiency and profitability [43]. There is also evidence that coordination does improve when the fee rises and is publicly announced (i.e., public costs) [14,31]. Consistent with these findings:

Hypothesis 3 (H3). *The contribution of team members facing an optimal "up-front pay" rewarding framework is higher than that of a suboptimal "up-front pay" framework.*

4. Results

This section describes the results of the experiment. First, we analyze the main descriptive statistics on the effort levels of the different groups and the three treatments. Then, we test hypotheses H1 and H3 with non-parametric statistics (U Mann Whitney test and Wilcoxon test, respectively) and also perform estimations of panel data models to explain the dynamic behavior of the contributions.

4.1. Free Play Teams Treatment vs. Optimal Entry Cost Teams Treatment

4.1.1. Descriptive Statistic

Measures of central tendency (mean, median, and mode) and dispersion (standard deviation) from "free play" and "optimal entry cost" treatments are shown in Table 1. Panels A and B show contributions/efforts of individuals for both treatments and each group session in the experiment.

Table 1. The table reports main descriptive statistics for every group session and the maximum (Max) and minimum (Min) contribution at the beginning and end of the experiment for (**a**) free play teams and (**b**) optimal entry cost treatments.

Groups	*N*	Mean	Median	SD	Mode	Initial Cont. Max/Min	Final Cont. Max/Min
1	14	26.01	25.00	9.19	30	50/10	30/10
2	18	29.55	30.00	8.68	30	50/3	50/15
3	20	20.90	20.00	14.66	5	50/0	50/1
4	20	20.84	22.00	13.68	20	50/0	50/0
5	20	29.16	30.00	13.66	40	50/0	50/14
6	20	25.64	25.00	15.03	50	50/7	50/4
7	20	34.30	40.00	13.67	50	50/20	50/0
8	20	30.09	30.00	15.31	50	50/5	50/0

(**a**) Free Play Teams treatment

Table 1. *Cont.*

Groups	N	Mean	Median	S.D.	Mode	Initial Cont. Max/Min	Final Cont. Max/Min
1	26	33.29	40.00	18.41	50	50/0	50/0
2	32	39.85	50.00	15.34	50	50/0	50/10
3	32	35.13	40.00	16.78	50	50/0	50/3
4	32	40.23	50.00	14.69	50	50/0	50/1
5	32	38.74	45.00	14.53	50	50/0	50/0
6	30	40.90	50.00	15.06	50	50/0	50/0
(**b**) Optimal Entry Cost treatment							

Central tendency measures (mean, median, and mode) in all groups are higher in the “optimal entry cost treatment” than in the “free play treatment”. However, the “optimal entry cost treatment” also shows a higher dispersion (SD) compared to the “free play treatment”. In the latter, minimum initial contributions are higher in most (62.5%) of the groups. The maximum contribution is reached in both treatments. The final contributions in the “optimal entry cost” treatment achieve the maximum in all groups and this is also true for seven of eight groups for the “free play treatment”. Minimum contributions are higher in most of the “free play” groups as compared to the “optimal entry cost” treatment.

Also analyzed was the concentration or contingency of the contribution in three rounds: 1, 10, and 20 in both treatments (Appendix B). In all these rounds, the relative frequency of the choice of the maximum contribution (50) is greater in the “optimal entry cost treatment” than in the “free play treatment”. Team members in the “optimal entry cost treatment” tend to increase contributions throughout the experiment.

4.1.2. Non-Parametric Analysis (Mann-Whitney U Test)

In this section, we formally test the evidence discussed in the previous section concerning the higher contributions when subjects are forced to pay a fee. Since teams differed between “free play” and “up-front pay” treatments, their corresponding samples are independent and thus the Mann-Whitney is valid to test H1.

Table 2 displays the mean contribution, frequency of subjects and teams with maximum contribution for each treatment and the result of Mann-Whitney U test for every round and for the whole sample (168 teams). Mean contribution and the frequency reveal higher values in the “optimal entry cost treatment” than in the “free play treatment”. The Mann-Whitney test confirms that teams contribute significantly more when they incur in entry costs and this is confirmed for every round in the experiment. Hence, nonparametric analysis supports our hypothesis H1: the implementation of an up-front pay scheme significantly increases teams’ effort levels and leads to more efficient/sustainable solutions.

Table 2. The table shows the mean contribution averaged for every round of the experiment and the number of subjects and teams exerting maximum contribution, and the Mann-Whitney test in every round for both the “free play” teams and optimal entry cost treatments.

	Free Play Teams			Optimal Entry Cost Teams			U MANN -WHITNEY	
Round	Mean Contribution	Frequency of Maximum Contribution		Mean Contribution	Frequency of Maximum Contribution		Z	*p*-Value
		Subjects	Teams		Subjects	Teams		
1	28.24	14	1	35.61	84	25	−5.06	0.00
2	26.51	13	2	35.03	77	23	−5.65	0.00
3	27.01	12	2	32.99	65	19	−4.00	0.00
4	28.86	18	2	33.97	81	24	−3.72	0.00
5	27.97	17	1	35.39	88	29	−5.17	0.00

Table 2. *Cont.*

Round	Free Play Teams			Optimal Entry Cost Teams			U MANN -WHITNEY	
	Mean Contribution	Frequency of Maximum Contribution		Mean Contribution	Frequency of Maximum Contribution		Z	*p*-Value
		Subjects	Teams		Subjects	Teams		
6	29.13	25	7	35.59	80	25	−4.27	0.00
7	27.64	15	2	37.39	92	32	−6.37	0.00
8	27.73	21	4	39.01	90	31	−7.13	0.00
9	27.88	17	2	37.78	92	26	−6.60	0.00
10	26.86	14	1	37.91	88	25	−7.18	0.00
11	27.32	15	2	38.42	93	26	−7.43	0.00
12	26.42	11	2	40.35	101	27	−9.05	0.00
13	25.63	12	1	39.66	97	35	−8.78	0.00
14	25.64	10	1	39.77	103	39	−8.99	0.00
15	26.18	15	1	41.18	108	41	−9.37	0.00
16	26.95	13	2	40.21	96	36	−8.64	0.00
17	26.32	11	1	39.91	99	38	−8.77	0.00
18	26.39	12	4	40.45	100	40	−9.07	0.00
19	26.01	18	4	41.29	108	43	−9.36	0.00
20	26.72	16	2	41.03	101	39	−9.17	0.00

4.1.3. Econometric Analysis

In this section we describe the tests of hypothesis H1 for the first scenario through panel data models using the individual contributions as explanatory variable. The treatment effect is captured by a dummy variable that takes value 0 in the "free play treatment" and 1 in "optimal entry cost treatment". Also, to test the selection principle in subjects (i.e., the effect of the past on future decisions), the treatment variable is introduced in a multiplicative way with the lagged dependent variable. This variable make test if decisions are driven by learning effects or other principles selection (H2). Note that as we expect that the decisions of subjects that are forced to pay an entry cost should be driven by loss avoidance and thus learning effects should be less important for them. Consistently, we expect a negative value of the interaction between the treatment dummy and the lagged contributions. As subjects decide on their own contributions knowing both their own and their partner's past contributions we consider dynamic models including the first lag of the dependent variable and the partner's contribution. In addition, we include a variable that captures the belief about the partner's contribution, which is elicited during the experiment. Finally, different control variables are considered, including gender, university degree (economics or management), and the time spent to make a decision. Consequently, we propose the following basic model for subject 1:

$$C_{1it} = \beta_0 + \beta_1 T_t + \beta_2 C_{1it-1} + \beta_3 T_t \times C_{1it-1} + \beta_4 C_{2it-1} + \beta_5 \widetilde{C}_{2it} + \boldsymbol{\alpha}'\boldsymbol{X_{1it}} + \eta_{1i} + \varepsilon_{1it}, \quad for\ i = 1, 2, \ldots, 168\ and\ for\ t = 1, 2, \ldots, 40. \tag{12}$$

where independent variables are C_{1it-1} i.e. the lagged contribution of member one of team i in period t; the lagged contribution of her/his team mate (C_{2it-1}); the belief of team member two about the future contribution of his partner ($\widetilde{C}_{2it}$); a dummy variable capturing the treatment (T_t); a vector of control variables including gender, type of degree and time of response; individual unmeasured effects (η_{1i}); and the error term (ε_{1it}).

Consistent estimation was performed using the generalized method of moments (GMM). Lagged endogenous variables were used as instruments to control for endogeneity [44]. In addition, we employ Sargan-Hansen test to check the validity of the instruments.

Table 3 presents three alternative models for the individual contribution. Model 1 reproduces the structure in Equation (10), Model 2 is similar but omitting variables in order to improve the model (gender and degree are significant but negative), and Model 3 omits the lagged endogenous variable. All the variables are highly significant in the three models and the validity of the instruments is confirmed by Sargan and Hansen's tests. The treatment variable (T_t) is positive, reflecting the fact that subjects increase their contributions when an up-front pay policy is implemented (hypothesis H1).

Contributions are positively correlated to past contributions; however, the dynamic learning effects seem to have a higher impact on the "free play" than in the "optimal entry cost" treatment. This means that "free play teams" give more importance to their past contributions than those that have to pay a fee, whereas the latter decide in terms of other considerations such as loss avoidance [14], supporting the fact that the introduction of an initial fee in the MECG leads to higher contributions. A member's belief in her partner's future contribution ($\widetilde{C}_{2it}$) and her partner's past contribution also has a positive effect.

Regarding the effects of the control variables, "response time" has a positive effect on contribution, suggesting that the efficiency of team outcomes is favoured by more thoughtful decisions on the part of its members. Finally, "university degree" and gender have a negative effect on contribution, which means that students from Economics and women seem to contribute less than those from management studies and men. These findings are not consistent with a strand of the literature on gender and cooperation, which points toward women being more cooperative than men from a social dilemma perspective [45–47]. However, this effect seems to vanish with repetitions [48].

Overall, the econometric analysis seems to support hypotheses H1 and H2. Teams that are forced to provide an initial up-front pay make higher contributions, which leads to more efficient and more sustainable contributions. Teams that have an initial fee improve coordination, leading to more efficient equilibria.

Table 3. This table displays results of the econometric models for the contribution of subject 1 as dependent variable. C_{1it} and C_{2it} represent the contributions of subjects 1 and 2 of the same team, respectively; T_{it} is the dummy variable treatment it takes a value of 0 for $t \leq 20$ and 1 for $t > 20$; *Time* is the time consumed to make a decision; and *Gender* is a dummy variable that takes 0 for men and 1 for women. The Arellano-Bond estimators for testing autocorrelation of order 1 and 2 are labelled as AR1 and AR2, respectively; "Sargan" and "Hansen" denote the tests for the validity of instruments and N is the number of observations.

	Model 1		**Model 2**		**Model 3**	
	Coef.	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**
C_{1it-1}	0.16	0.00	0.17	0.00	0.149	0.00
$T_{it} x C_{1it-1}$	−0.02	0.00	−0.03	0.00		
C_{2it-1}	0.19	0.00	0.19	0.00	0.19	0.00
T_{it}	5.48	0.00	7.09	0.00	4.48	0.00
$\widetilde{C}_{2it}$	0.33	0.00	0.33	0.00	0.33	0.00
Response Time	0.04	0.00	0.04	0.00	0.03	0.00
Degree	−2.13	0.00			−2.19	0.00
Gender	−0.70	0.00			−0.766	0.00
Intercept	10.72	0.00	7.35	0.00	11.23	0.00
AR1	−9.46	0.00	−9.46	0.00	−9.46	0.00
AR2	−0.70	0.48	−0.65	0.51	−0.71	0.47
Sargan	1167.75	0.00	1110.47	0.00	1169.26	0.00
Hansen	333.32	1.00	332.39	1.00	331.32	1.00
N	336		336		336	

4.2. Optimal Entry Cost Teams Treatment vs. Medium Entry Cost Teams Treatment

In the second comparison, we focus the analysis on the consequences of reducing the up-front pay from 100 to 75 units. We perform the same analysis as in the previous case: first, we compare the central tendency measures (mean, median and mode) for every group and round in each treatment; second, we test the second main hypothesis (H3) in our study using non-parametric tests (Wilcoxon) and panel data models (H2).

4.2.1. Descriptive Statistics

Main descriptive statistics (mean, median and mode) of subjects' contributions/efforts for both "Optimal Entry Cost" and "Medium Entry Cost" treatments are presented in Table 4, Panels A and B, respectively. In particular, measures of central tendency (mean, median and mode) and dispersion (standard deviation) are shown, as well as the maximum and minimum values in the first and last period of the experiment.

Table 4. The table reports the main descriptive statistics for every group session and the maximum (Max) and minimum (Min) contribution at the beginning and end of the experiment for (a) optimal entry cost teams and (b) medium entry cost treatments.

N	Mean	Median	SD	Mode	Initial Cont. Max/Min	Final Cont. Max/Min
26	33.29	40.00	18.41	50	50/0	50/0
32	39.85	50.00	15.34	50	50/0	50/10
32	35.13	40.00	16.78	50	50/0	50/3
32	40.23	50.00	14.69	50	50/0	50/1
32	38.74	45.00	14.53	50	50/0	50/0
30	40.90	50.00	15.06	50	50/0	50/0

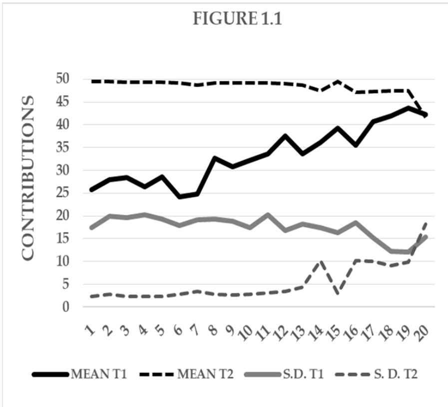
(**a**) Optimal Entry Cost treatment

N	Mean	Median	S.D.	Mode	Initial Cont. Max/Min	Final Cont. Max/Min
26	48.36	50.00	6.96	50	50/38	50/0
32	42.54	50.00	13.79	50	50/2	50/0
32	40.72	50.00	13.48	50	50/0	50/0
32	44.61	50.00	11.56	50	50/5	50/0
32	41.41	47.00	13.31	50	50/0	50/0
30	42.41	50.00	13.75	50	50/0	50/5

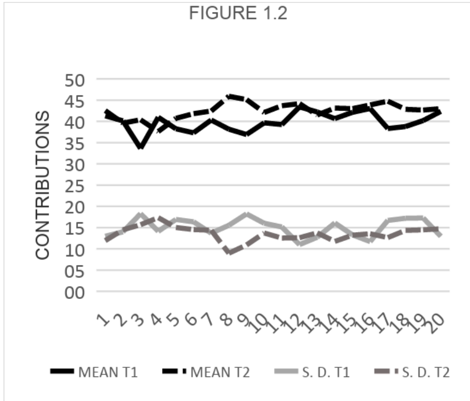
(**b**) Medium Entry Cost treatment

The central tendency (dispersion) measures for all six groups are higher (lower) in the "medium entry cost" than in the "optimal entry cost" treatment (6 groups). In the results for minimum and maximum initial contributions between treatments, it is noteworthy that in the "medium entry cost" treatment (3 groups), subjects show higher minimum contributions than in the "optimal entry cost treatment". The statistics of maximum contributions does not offer substantial differences between treatments. Viewing the minimum and maximum final contributions, we find that minimum contributions in the "medium entry cost" treatment (3 groups) are higher than in the "optimal entry cost" treatment. Regarding the maximum contribution, values are similar in both treatments.

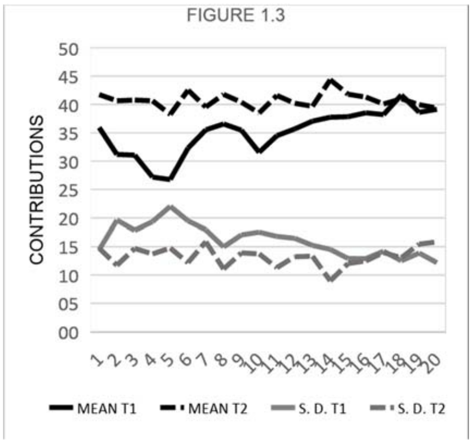
The above findings support the idea that past contributions and beliefs would improve contributions. Furthermore, the descriptive statistics seem to indicate strong learning effects throughout the experiment. Figure 1 illustrates the evolution of these descriptive statistics over the 20 periods of each treatment and for every group. Particularly, this figure depicts the mean and standard deviation (SD) for the "optimal" and "medium entry cost" treatment, denoted by T1 and T2, respectively. These plots clearly illustrate the fact that in all groups the mean contribution is higher in the "optimal" than in "medium entry cost" treatment. Standard deviation, however, fluctuates without a clear trend and reflects a higher dispersion for the "optimal entry cost treatment".



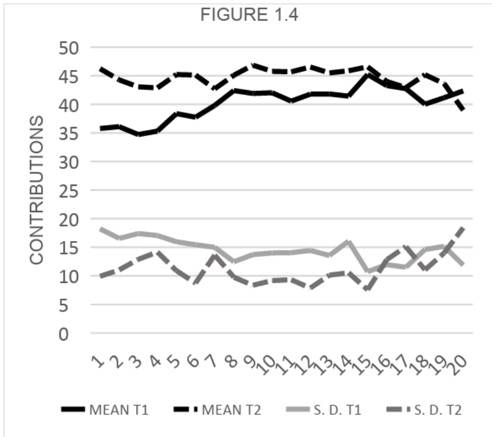
Contribution Group 1
Mean–Standard Deviation
(**a**)



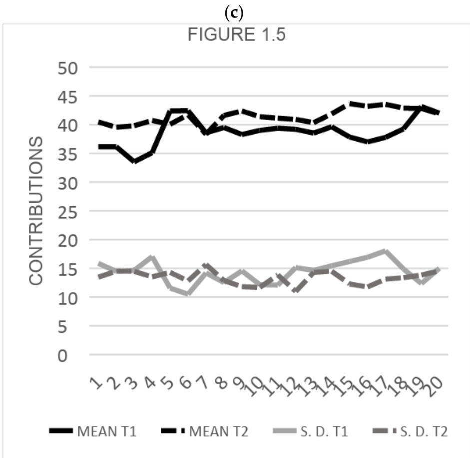
Contribution Group 2
Mean–Standard Deviation
(**b**)



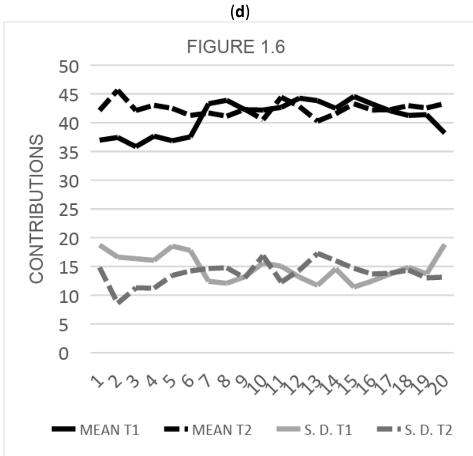
Contribution Group 3
Mean–Standard Deviation
(**c**)



Contribution Group 4
Mean–Standard Deviation
(**d**)



Contribution Group 5
Mean–Standard Deviation
(**e**)



Contribution Group 6
Mean–Standard Deviation
(**f**)

Figure 1. These figures illustrate the evolution of the mean and standard deviation (SD) of contributions for the 6 group sessions in both the optimal entry cost (T1) and medium entry cost (T2) treatment.

So far, we have analyzed the descriptive statistics by groups. Table 5 analyzes the contribution by round, including the average contribution for all teams throughout the experiment and the frequencies of subjects and teams that exerted the maximum effort (50) in every round. Subjects and teams achieve the maximum contribution in the "medium entry cost treatment" more frequently. Another interesting feature in the Wilcoxon test is the fact that there is no difference in contribution for the last three periods as a result of the convergence obtained regardless of the up-front pay amount.

Table 5. The table shows the mean contribution averaged for every round of the experiment and the number of subjects and teams exerting maximum contribution, and the Wilcoxon test in every round for both "optimal entry cost" and "medium entry cost" treatments.

	Optimal Entry Cost Teams (100)			Medium Entry Cost Teams (75)			Wilcoxon Test	
Round	Mean Contribution	Frequency of Maximum Contribution		Mean Contribution	Frequency of Maximum Contribution		Z	*p*-Value
		Subjects	Teams		Subjects	Teams		
1	35.61	84	25	43.61	124	52	−5.51	0.00
2	35.03	77	23	42.97	116	48	−5.18	0.00
3	32.99	65	19	42.36	109	47	−6.18	0.00
4	33.97	81	24	42.14	108	44	−4.79	0.00
5	35.39	88	29	42.47	114	47	−4.27	0.00
6	35.59	80	25	43.45	122	53	−5.41	0.00
7	37.39	92	32	42.05	117	47	−3.03	0.00
8	39.01	90	31	43.98	123	55	−3.58	0.00
9	37.78	92	26	44.24	124	53	−5.06	0.00
10	37.91	88	25	42.73	120	51	−3.93	0.00
11	38.42	93	26	44.11	126	56	−4.23	0.00
12	40.35	101	27	43.79	123	54	−2.72	0.00
13	39.66	97	35	42.51	117	50	−2.23	0.02
14	39.77	103	39	43.97	129	55	−3.15	0.00
15	41.18	108	41	44.48	128	57	−2.84	0.00
16	40.21	96	36	43.53	123	53	−3.11	0.00
17	39.91	99	38	43.36	125	53	−3.12	0.00
18	40.45	100	40	43.60	126	55	−2.55	0.01
19	41.29	108	43	43.04	123	51	−1.56	0.11
20	41.03	101	39	41.33	118	47	−0.36	0.71

4.2.2. Non-Parametric Analysis (Wilcoxon Test)

For the second scenario, and given the "within-subjects" nature of our experimental design, the last hypothesis of our study (H3) can be tested using the Wilcoxon signed-rank statistic.

Table 6 displays the results considering a sample of the 92 teams, divided into 6 groups. The Wilcoxon test confirms that teams contributed significantly more in the "medium entry cost treatment" than in the "optimal entry cost treatment". The mean contribution is significantly higher in the "medium entry cost treatment" and thus the nonparametric analysis rejects our hypothesis H3. This counterintuitive finding might be a result induced by the higher leaning effects along both treatments overall.

Table 6. Results of the Wilcoxon test. The test shows that for every group, the medium entry cost treatment (T2) shows significantly higher contributions.

	Group 1		Group 2		Group 3		Group 4		Group 5		Group 6	
Mean Contribution	T 1 33.29	T 2 48.36	T 1 39.85	T 2 42.54	T 1 35.13	T 2 40.72	T 1 40.23	T 2 44.61	T 1 38.74	T 2 41.41	T 1 40.90	T 2 42.41
Z	−13.20 [a]		−3.73 [a]		−6.72 [a]		−7.45 [a]		−4.42 [a]		−2.06 [a]	
p-value	0.00		0.00		0.00		0.00		0.00		0.03	

[a] Based on negative ranks.

4.2.3. Econometric Analysis

Finally, for the second comparison we test our last two hypotheses (H2 & H3) through panel data methods according to the model in Equation (10). In this case, the treatment dummy variable takes value 0 for the "optimal entry cost treatment" and 1 for the "medium entry cost treatment". For these analyses, we add in our study two new variables called "nationality" and "self belief in up-front pay". As control variables, the analysis of the effect of these variables exceeds the scope of this research but we can find some tentative explanations. Nationality, tests if the subjects' origin have some impact in decisions (although this variable might be capturing differences due to the fact that foreign students might be more extroverted, open-minded and cooperative). Self belief in up front pay studies if a previous belief about pay an initial fee might lead to the loss avoidance principle. The first one takes value of 0 for people born in Spain and 1 for the rest of the world, the second variable was elicited at the beginning of the game by asking subjects' beliefs about whether an initial fee would generate more commitment in the team.

The model was also estimated by GMM and lagged endogenous variables were used as valid instruments (as shown by the Sargan and Hansen tests). Table 7 presents the results for three alternative models. The first model is a complete version that includes all the variables, the second model omits those variables that are significant but negative (gender and degree) and, finally, the third model is very similar to the second but excluding the treatment effect on the dynamics of the model. The best model is the second one, in which the treatment variable is positive, reflecting that subjects increase their contributions in the "medium entry cost" treatment, which seems to reject our hypothesis H3. Own and partner delayed contribution are significant and positive. The interaction between the treatment variable and the delayed own contribution is also positive, corroborating the idea that contributions are higher and the dynamics of the adjustments are faster in the "medium entry cost" treatment. This result could be due to the fact that subjects were informed that teams would be the same for both treatments, and thus they learned how to play with their partner during the 40 rounds. The variable nationality seems to indicate that people outside of Spain tend to have higher contributions. Finally, one interesting result is that the "Self belief in up-front pay" points to more cooperative behavior when there is an initial fee, thus supporting our H2.

Meanwhile, Model 1 found that control variables like gender and career indicate that women and Business management students contribute less than men and Economics students. Model 3, disregards the effect of treatment variable on past contributions, as well as control variables like career and gender.

Table 7. Results on models for subject 1 contribution when there is a variation in the up-front pay. C_{1it-1} and C_{2it-1} represent the contributions of subjects 1 and 2 on the same team, respectively; T_{it} is the dummy variable treatment that is 0 for $t \leq 20$ and 1 for $t > 20$; $\widetilde{C}_{2it}$ is the belief of subject 1 about the contribution of subject 2; *Time* is the time consumed to make a decision; *Self Belief Up-front pay* is the self-reported degree of an initial fee, *Nationality* captures the subjects" area of origin: 0 for Spain and 1 for Rest of the world; *Degree* is the university profile, 0 for economics and 1 for business; and finally *Gender* is a dummy variable that takes 0 for men and 1 for women. The Arellano-Bond estimator for testing autocorrelation of orders 1 and 2 are labelled as AR1 and AR2, respectively; "Sargan" and "Hansen" denote the tests for the validity of instruments and *N* is the number of observations.

	Model 1		**Model 2**		**Model 3**	
	Coef.	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**
C_{1it-1}	0.11	0.00	0.11	0.00	0.11	0.00
$T_{it}XC_{1it-1}$	0.01	0.00	0.01	0.00		
C_{2it-1}	0.15	0.00	0.15	0.00	0.15	0.00
T_{it}	1.47	0.00	1.57	0.00	2.18	0.00
$\widetilde{C}_{2it}$	0.43	0.00	0.42	0.00	0.42	0.00
Response Time	0.07	0.00	0.06	0.00	0.06	0.00
Degree	−1.13	0.00				
Gender	−1.48	0.00				
Self Belief Up-front pay	0.01	0.81	0.33	0.00	0.42	0.00
Nationality	4.67	0.00	4.83	0.00	5.02	0.00
Intercept	11.70	0.00	9.17	0.00	8.66	0.00
AR1	−8.36	0.00	−8.34	0.00	−8.34	0.00
AR2	1.08	0.28	1.06	0.28	1.07	0.28
Sargan	1187.83	0.00	1115.99	0.00	1116.06	0.00
Hansen	170.72	1.00	175.71	1.00	177.59	1.00
N	184		184		184	

5. Discussion

This research analyses the effect of up-front pay schemes on the efficiency and sustainability of team production systems. For this purpose, we adopt an experimental approach and examine contributions of teams with and without an up-front payment and for different up-front pay amounts. With a simple MECG design, our study considers two scenarios: the first compares up-front pay teams with the standard case of teams that do not have to deposit a fee, whereas the second compares higher to lower up-front payments.

In this framework we find that: (1) Up-front pay teams indeed contribute significantly more and thus are more concerned about sustainability than teams that do not face the up-front pay requirement; (2) subjects exhibit different selection principles: when the entry cost is zero ("free play treatment"), partner's past contribution shows a lower impact on current subject's contribution as the entry cost increases. Given the sign and significance of the interaction term ("Treatment" X "Partner's lagged contribution"), we can conclude that the loss avoidance principle is a plausible explanation for this outcome. In addition, the positive impact of the variable "Self believe Up front" on subject's contribution also adds support to the loss avoidance hypothesis; and (3) decreases in the amount of the up-front pay do not seem to slow down convergence to efficient and sustainable solution.

Our research represents a relevant contribution for the implementation of techniques leading to efficient production and economic sustainability. We propose a mechanism based on up-front pay guarantees that encourages not only efficiency, but also sustainability when collective production is linked to natural resources exploitation. Such a mechanism is similar to different policies created to diminish environmental damage by internalizing its effects; the main difference is that it promotes subjects for cooperation when different natural resources or interrelated activities (team technology) are being handled. Previous works about the effects of sunk costs or selling the right to play [8–28] are mainly concerned with the individual behavior rather than with collective or team behavior. Our work adds new insights in two main aspects: First, we focus on team production by considering entry cost as a mechanism to improve efficiency in teams; and second, our experimental outcomes are based on theoretical models capable to offer prescriptions on optimal entry costs.

On the other hand, this study has certain limitations that should be addressed in future research. In particular, subjects facing entry costs played the treatments in the same order. Under this experimental design, we cannot control for potential learning effects. It would be interesting to randomize the order of pay up front treatments to control for such effects and to check to what extend our rejection of hypothesis 3 might be induced by learning effects.

All in all, and although our result is directly oriented to solving the free riding problems in teamwork within the firm, it has applications in many economic situations. As a result, future work should be devoted to study of the other pillars of sustainability, where similar proposals are demanded by policy makers.

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Appendix A

INSTRUCTIONS

First of all, thank you for participating in this experiment. The purpose of this experiment is to study how individuals make decisions in this context. The instructions are simple and if you follow them carefully you will receive credit that will be taken into account (always positively) in your grade. In this experiment there are no right or wrong answers. Hence, do not think that we expect any specific behavior on your part. On the other hand, keep in mind that your decisions will affect your score. You can ask us at any time the doubts you have by raising your hand first. Outside of these questions, any type of communication between you is forbidden

(1) In this experiment you will be randomly matched with another student. This matching will be the same during all the experiment and you will never know who your partner is.
(2) The experiment has 40 rounds divided into two treatments each of 20 rounds. Once you finish the first 20 rounds (first treatment) you will receive instructions for the second treatment.
(3) In each period t every team (two people) will decide independently the level of contribution, c_{it} with i = 1, 2, that they wish contribute to a common work. These contributions can be any natural number between 0 and 50 (both included).
(4) The requirement to participate in the game is to pay an initial contribution of 100 units in each period.
(5) In every round you will receive a payoff (π_{it}) that depends on the contributions of both team members according to the function:

$$\pi_{it} = 4\min\{C_{1t}, C_{2t}\} - K_2 - C_{2t}$$

where C_{it} is the contribution of subject i in period t.
(6) In every round you will have to answer two simple questions about the amount you want to contribute and about how much you think your teammate is going to contribute (note that the first of the questions affects your payoff, but the second is just information).
(7) Payoffs in each round will accumulate and will be displayed on your computer screen, as well as your decisions and the payoff received throughout the whole experiment.
(8) Next, you will be asked some simple questions to check that you have understood these instructions and you will have 3 trial periods to make sure you understand how it works.

QUESTIONS

(1) If both subjects contribute 50: What is going to be the payoff for both?
(2) If both subjects contribute 0: What is going to be the payoff for both?
(3) If the first subject contributes 50 and the second contributes 0

    a. Payoff for the first subject will be . . .
    b. Payoff for the second subject will be . . .

Appendix B

Concentration of the contribution in three rounds (1, 10 and 20) in "free play" and "optimal entry cost" treatments.

Contribution	Round 1				Round 10				Round 20			
	Free Play		Optimal Entry Cost		Free Play		Optimal Entry Cost		Free Play		Optimal Entry Cost	
	N°	%	N°	%	N°	%	N°	%	N°	%	N°	%
0	3	2.0%	12	6.5%	4	2.6%	12	6.5%	6	3.9%	8	4.3%
1	1	0.7%	0	0.0%	3	2.0%	0	0.0%	3	2.0%	1	0.5%
2					2	1.3%	0	0.0%	1	0.7%	1	0.5%
3	1	0.7%	0	0.0%					0	0.0%	1	0.5%
4	1	0.7%	0	0.0%					1	0.7%	0	0.0%
5	3	2.0%	5	2.7%	1	0.7%	1	0.5%	4	2.6%	1	0.5%
6					2	1.3%	0	0.0%				
7	1	0.7%	0	0.0%	0	0.0%	1	0.5%	2	1.3%	0	0.0%
8					3	2.0%	1	0.5%	1	0.7%	0	0.0%
9					3	2.0%	0	0.0%				
10	11	7.2%	10	5.4%	9	5.9%	8	4.3%	6	3.9%	4	2.2%
11					1	0.7%	0	0.0%				
12	0	0.0%	1	0.5%	2	1.3%	0	0.0%	1	0.7%	1	0.5%
13									1	0.7%	0	0.0%
14									1	0.7%	0	0.0%
15	6	3.9%	1	0.5%	9	5.9%	3	1.6%	8	5.3%	1	0.5%
16												
17									2	1.3%	0	0.0%
18									2	1.3%	0	0.0%
19					1	0.7%	1	0.5%				
20	14	9.2%	16	8.7%	12	7.9%	9	4.9%	18	11.8%	6	3.3%
21					1	0.7%	0	0.0%	2	1.3%	0	0.0%
22	1	0.7%	0	0.0%								
23					2	1.3%	0	0.0%	1	0.7%	0	0.0%
24	1	0.7%	0	0.0%	1	0.7%	0	0.0%	2	1.3%	0	0.0%
25	22	14.5%	12	6.5%	14	9.2%	3	1.6%	10	6.6%	4	2.2%
26	2	1.3%	0	0.0%	1	0.7%	0	0.0%	1	0.7%	0	0.0%
27	1	0.7%	0	0.0%	2	1.3%	1	0.5%	3	2.0%	1	0.5%
28	1	0.7%	0	0.0%	2	1.3%	0	0.0%	5	3.3%	0	0.0%
29	1	0.7%	0	0.0%	1	0.7%	0	0.0%	1	0.7%	0	0.0%
30	32	21.1%	15	8.2%	21	13.8%	15	8.2%	19	12.5%	5	2.7%
31					1	0.7%	0	0.0%	1	0.7%	0	0.0%
32					5	3.3%	0	0.0%	2	1.3%	0	0.0%
33					4	2.6%	0	0.0%				
34	1	0.7%	1	0.5%					5	3.3%	0	0.0%
35	12	7.9%	3	1.6%	8	5.3%	9	4.9%	7	4.6%	7	3.8%
36	2	1.3%	0	0.0%	1	0.7%	1	0.5%	0	0.0%	2	1.1%
37					1	0.7%	0	0.0%	0	0.0%	1	0.5%
38					2	1.3%	0	0.0%	1	0.7%	1	0.5%
39	0	0.0%	1	0.5%					0	0.0%	1	0.5%
40	16	10.5%	18	9.8%	11	7.2%	15	8.2%	10	6.6%	16	8.7%
41					2	1.3%	0	0.0%	1	0.7%	1	0.5%
42	1	0.7%	0	0.0%	1	0.7%	1	0.5%	1	0.7%	0	0.0%
43					0	0.0%	2	1.1%				
44									0	0.0%	1	0.5%
45	3	2.0%	3	1.6%	2	1.3%	8	4.3%	5	3.3%	14	7.6%
46									0	0.0%	1	0.5%
47	1	0.7%	0	0.0%	0	0.0%	1	0.5%	0	0.0%	1	0.5%
48	0	0.0%	1	0.5%	1	0.7%	2	1.1%	2	1.3%	1	0.5%
49	0	0.0%	1	0.5%	2	1.3%	2	1.1%	0	0.0%	2	1.1%
50	14	9.2%	84	45.7%	14	9.2%	88	47.8%	16	10.5%	101	54.9%
N	152		184		152		184		152		184	

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