The effect of wage proposals on efficiency and income distribution

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Abstract:

Pre-play non-binding communication in organizations is prevalent. We study the implications of pre-play wage proposals and information revelation in a labour relationship in a laboratory experiment. In the baseline, that depicts a typical labour market interaction, the employer makes a wage offer to the worker who may then accept or reject it. In a subsequent treatment, workers, moving first, make private, non-binding, wage proposals to the employer. Our findings suggest that wage proposals promote higher wages, efficiency, and income equality. We run an additional experiment as a robustness check where we make the wage proposals public. We find that most of the results hold. Similar wage proposals are observed in the Public and Private information treatments, while accepted wages in the public treatment are higher than the baseline and significantly lower than under private information. It seems that workers conform to the available information on the wage of their co-worker from the last period when proposals are public. Interestingly, while both benefit over the baseline, public information on wage proposals benefits firms more than workers. We also develop a theoretical model to rationalize our results. The experimental results provide broad support for our hypotheses.

Keywords: wage negotiations, pre-play communication, laboratory experiments, ultimatum game, wage proposals.

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1. Introduction

Employers frequently ask workers for their expected wages in negotiations or, workers may instead make wage proposals to their employers. The practice is common in professional sports, senior level management, academic hiring and many other highly skilled jobs. Proposals can take many forms with one-to-one negotiations to centralized mechanisms such as unions (at the firm, industry or national level) making wage proposals to employers. Despite their widespread use, these forms of wage institutions are poorly understood and little studied.[2]

While there is a large literature dealing with pre-play communication when "talk is cheap" (see Crawford 1998 for an early review and Blume et al. 2020 for a more recent one), these models have been rarely applied to labour market settings. Thus, our main contribution is to analyse the effect that different wage proposals have on the outcomes of the employment relationship. In this paper, we study pre-play wage proposals (cheap talk) in a laboratory experiment of employment relationships where workers can make a non-binding wage proposal to their employer. Our *baseline* looks at the traditional ex-ante wage posting structure (ultimatum game) where the employer makes wage offers to two workers. Each worker can either accept or reject. On acceptance, full surplus is realised, while zero surplus is obtained in the case of a rejection. We then modify this to allow workers to first make *private* wage proposals that are non-binding for the firm. Firms observe the proposals and can then choose to make an offer that the worker may accept or reject.[3] We also run an additional treatment to check for the robustness of private proposals by allowing for *public* observability of the proposal, at the end of each period.[4]

Our focus is to analyse the effect that different wage proposals have on the outcomes of the employment relationship. By comparing the effects of proposals with the baseline, we can study how pre-play communication affects wages, income distribution and overall efficiency. Our setting allows us to answer the following novel research questions: Are wage offers higher when workers are allowed to make ex-ante proposals? Do proposals increase the probability of accepting wage offers (and hence efficiency)? Who benefits from making wage proposals public information to other workers?

[2] See, Caju et al. (2008) for details on different forms of wage bargaining institutions.
[3] This is the ultimatum game version of the labour market institution where rejection of an offer results in zero surplus to both workers and the firm. In fact, most traditional markets are of this nature, where a rejection of an offer from one side results in zero surplus for both. A structure with counter proposals would be akin to a double auction or a bargaining framework.
[4] Our private and public proposals treatments resemble the design in Rigdon (2012) (demand side) ultimatum game experiment. Rigdon's research goal is to analyse the gender wage gap under private proposals and whether it can be mitigated with public information. Our focus is quite different from hers.

Our theoretical model is developed to rationalise our results and provide us with testable hypotheses. It relies on the idea that workers' wage proposals are pre-play cheap talk (see Farrell and Rabin 1996 for a review). Non-binding proposals may convey information about the worker's minimum acceptable wage with workers misreporting their private information with a certain positive probability. As a result, the optimal wage offer by the firm is a function of the workers' wage proposals (which may be "partially" or "fully" revealing to the employer). We show that if we have a mix of "revealing" and "partially revealing" workers then the final wage offer will be increasing in the proposals as the firm faces a trade-off between the possibility of rejection of low offers and acceptance of higher ones. This simple intuition also sets the stage for our hypotheses. We expect firm's wage offers to be increasing in proposals. This implies that average wage offers under proposals should be greater than in the baseline (with no proposals). We also expect wage proposals to increase acceptance rates, and consequently, efficiency relative to the baseline.

The experimental results are broadly consistent with the hypotheses. Introducing proposals prior to firm wage-setting decisions has important efficiency and distributional consequences. The additional treatment with public proposals, which serves as a robustness check and gives us some insight into making wage proposals public, also provides some interesting results. In the main treatment, i.e., private proposals, we find that wage proposals always increase efficiency and workers benefit more relative to baseline.[5] It also shows efficiency gains with the main difference being that public information of proposals work to the firms' advantage increasing their profits.

Though not a direct test, our experimental results have interesting implications for policy makers as we find the potential efficiency and distributional consequences of proposals that are a widely used instrument in wage negotiations. Importantly, we find that pre-play communication benefits workers unequivocally over the baseline. With a caveat that proposals, when public, benefit the firm more as they earn higher profits. Importantly, and relative to the baseline, both type of wage proposals increase income equality amongst workers. The baseline (without proposals) is the most inefficient setting, with lower average wages, while also resulting in the highest level of income inequality. While this finding runs counter to popular opinion on the effects of wage transparency, it is very much in line with recent field evidence showing that making the outcomes of wage negotiations public reduces individual workers'

[5] While not our main focus, we also look at gender effects in our experiment (see Section 5.3). Wage proposals could be another avenue for gender wage discrimination if females have lower willingness to accept/propose. We find that making proposals privately (publicly), tend to increase male (female) wage proposals and hence overall income. Even though these differences are not statistically significant, this pattern of behavior resembles the "catch up" result in Rigdon (2012).

bargaining power and hence wages (Cullen and Pakzad-Hurson, 2021). We suggest that a possible explanation for this is that, under public information, workers are more willing to conform to the proposals of others and less likely to reject wage offers.

The remainder of the paper is organized as follows. We review the literature in Section 2. We describe the experimental design and procedures in Section 3. We present our theoretical model in Section 4. The main results are reported in Section 5, and we conclude in Section 6.

2. Literature Review

To our knowledge, the only paper that analyses (average) wage proposals, in a relationship between firms and workers is Bottino et al. (2016). They studied the effect of worker entitlement to a wage in a gift exchange game. Their structure resembled that of a workers' union making a non-binding single wage proposal to firms on behalf of a worker's collective. An average non-binding wage proposal is presented to employers from the workers, who then independently respond by making wage offers in a double auction format (a la Fehr et al.1993). While average wages slightly increase, they find a negative relation between effort and wage expectations. The main difference with our study is that we present worker proposals to firms at an individual level. Additionally, we don´t consider effort levels to control for reciprocity effects. Also, while Bottino et al. (2016) use a double auction set-up that has been used in gift exchange experiments, we model a firm-worker relationship where offers are posted and can only be accepted or rejected.

Rigdon (2012) uses proposals in a (demand-side) Ultimatum game to study the gender wage gap. She finds that females ask for less and earn smaller amounts than their male counterparts. In her framework workers make proposals that are made public in a subsequent treatment. Making proposals public, i.e., proposals being made by others in a similar negotiating situation, directly influences the beliefs women have about proposals in the ultimatum game. Consequently, they ask for more, thus eliminating the negotiation gap and eliminating the gender gap in wages. In contrast to our study, Rigdon (2012) does not study a labour market interaction and uses a Demand Side Ultimatum Game. Additionally, the experiment does not consider a baseline treatment without proposals (since her research goal

is quite different to ours) and her framework cannot be used to assess the overall effects of wage proposals.[6]

Our paper also relates to the experimental literature on negotiations. Their focus, however, is mostly on the gender gap. Some of them consider the Ultimatum Game (Eckel and Grossman, 2001 and García-Gallego et al. 2012), while others use different versions of negotiation games with several stages (Hernandez-Arenaz and Iriberri, 2018 and Exley et al. 2020). We will provide further details of these studies in the results section where we report our findings on gender.

Cheap talk can be interpreted as the weakest form of worker participation where firms consider workers' communication credible with a certain probability. Our research also adds to the literature on worker involvement in the wage participation process (Charness, et al. 2012, Charness et al. 2016, Jeworrek and Mertins, 2014, Franke et al. 2016, among others).[7] Worker participation in the wage determination process occurs in many forms at the workplace. It can be through wage bargaining, centralised or decentralised, or direct participation of workers in the wage process. The latter has been studied in the lab (Charness et al. 2012) and the field (Jeworrek and Mertins, 2014). Other factors that have been studied are social comparison (Charness et al. 2016) or choosing from a menu of options (Franke et al. 2016). The majority of this research, experimental or field, broadly confirms that worker participation increases worker productivity.

A comment is due regarding the experimental methodology and as to whether the behavioural traits identified in the experiment are present or applicable in markets outside the laboratory. While external validity is always an issue in any laboratory (or field) experiment, what is important is that qualitative results guide us in the right direction (see Kessler and Vesterlund, 2015 and Camerer, 2015). There is evidence that many of the behavioural traits observed in the laboratory are observed with high stakes (Cameron, 1999; Slonim and Roth, 1998; Fehr, Fischbacher, and Tougareva, 2002: Jeworrek and Mertins, 2014) or extend to real world situations. Jeworrek and Mertins (2014) find that a managerial policy of allowing employees to self-determine their wages, as had been suggested by laboratory evidence,

[6] Yamamori et al. (2008) conducted a dictator game experiment in which the recipient states a request for the minimum offer that they are willing to receive before the dictator dictates their offer, finding that the latter increases as the recipient's request increases to half of the share. Albeit in a quite different setting, their finding is in line with our own result that wage offers tend to increase with workers' proposals.

[7] Charness et al. (2016) argue that social comparison is important in labour markets and may affect one's attitude towards an employer or intrinsic motivation. This is similar to our idea of conformity (Cialdini and Goldstein, 2004), when rival proposals are public, where workers observe proposals of a worker from an earlier period. The only channel through which conformity works in our setup is through adjustment of wage proposals. Our idea of conformity assumes that a worker's proposal will mimic the co-worker's previous proposal (Charness et al. 2016).

extends to the field. They find that this policy indeed enhances performance. Güth et al. (2007) compare an Ultimatum Game (UG hereafter) where participants were students and another UG where participants were newspaper's readers and they found that results are similar. Dyer, Kagel and Levin (1989) find that professionals also are subject to the winner's curse. Fairness concerns also play a prominent role in firm's wage policies (Bewley and Bewley,2009; Agell and Bennmarker, 2003) while recent papers indicate that laboratory measures of social preferences can be good predictors of behaviour in field settings. Karlan (2005) shows that reciprocity (i.e., trustworthiness) in trust games predicts subjects' loan repayments one year after a laboratory experiment, and Carpenter and Seki's work (2005) suggests that laboratory measures of conditional cooperation forecast productivity in the workplace. Finally, laboratory experiments have long been used by policy makers as a guide, i.e., to provide qualitative insights. The Arizona Corporation Commission (ACC) used laboratory experiments to gain insights into incentive regulation (see Cox and Isaac, 1986 and Rassenti and Smith, 1986). Laboratory experiments were then further used as a guide to inform electric decentralization/privatization in US, Australia and New Zealand (Rassenti et al. 2002). Therefore, while we do not wish to downplay the importance of field evidence on salary negotiations, we also believe that laboratory experiment can be seen as a promising first step to shed light on real world issues.

3. Experimental design

The experiment was conducted at a major university using z-Tree software (Fischbacher, 2007). It consisted of 8 sessions (four per treatment) with 147 participants in total, who were recruited online using ORSEE (Greiner, 2015). No participant could participate in more than one session. The average length of a session was around 70 minutes and average earnings were 10.85€.

Our design is a slightly modified version of the game in Falk, Fehr and Zehnder (2006). Participants were randomly assigned a role as either a firm or a worker and the role was fixed for the entire duration of the experiment. In each period, a firm was randomly matched with two workers. Subjects read the instructions once roles were assigned.[8] Participants had to answer some questions after finishing the instructions (see Appendix A2 for further details) to

[8] The instructions were first read individually and then aloud, by the experimenter.

make sure they understood them. They could only participate in the experiment on successfully answering all the questions. The experiment lasted 15 periods.

The structure is as follows: in the first stage, the firm decided whether to make a wage offer to each worker or not,[9,10] while in the second stage, workers receiving an offer decided whether to accept it or reject it. The surplus is only realized when a wage offer was accepted by a worker. A rejected offer implied that neither the firm nor the worker realized any gains. To avoid potential confounds regarding reciprocity concerns, workers were homogenous and did not differ in their productivity levels. We considered two different experimental treatments:

Baseline (BASE): A firm makes a wage offer, or not, to one or both workers. A worker receiving an offer decides whether to accept or reject. Worker information was private, and they only knew if they received an offer or not.

Wage proposals (PRO): Prior to Stage 1 of the BASE, workers first made a "wage proposal". The proposal remained private information and was not disclosed to the co-worker.[11] Firms knew that the proposals were not binding, and they could make an alternate (or no) wage offer.

Table 1: Experimental design

Treatment	Description	Timeline
Baseline (BASE)	Firms could make 0/1/2 private wage offers in Stage-1. Workers accepted or rejected the offers. They own past offers. Firms saw own past actions and worker decisions.	Stage 1 → Stage 2 ***Firm*: Wage offer** *Worker*: Accepts/Rejects
Wage Proposals (PRO)	Workers made non-binding "wage proposals" to the firms before the wage offer + BASE	Stage 1 → Stage 2 → Stage 3 *Worker*: Wage proposal ***Firm*: Wage offer** *Worker*: Accepts/Rejects

Note: There were 4 sessions per treatment, 25 firms and 50 workers in BASE, 24 firms and 48 workers in PRO.

[9] Following Falk et al. (2006), we frame the instructions as employer, employee and wages (see instructions in Appendix A1).
[10] The firm-worker framing is also used in García-Gallego et al. (2012).
[11] In Section 5.3, we discuss an additional treatment where the wage proposal is disclosed to the co-worker (i.e., it is made public). We describe this treatment as well as how it relates to our main experiment in an online appendix.

The payoff for workers and firms are summarized in Table 2 where w_i denotes the wage offer for the worker, $i = \{1, 2\}$. If an offer was accepted, the worker received the agreed wage and the firm earned 390 points (see exchange rates below) minus the wage offer. At the end of the experiment, participants answered a questionnaire that included age, gender, zip code, studies, self-reported fair wage, reasons for wage discrimination (only for firms), Cognitive Reflection Test (Toplak, West and Stanovich, 2014), risk aversion (Bomb Risk Elicitation Task by Crosetto and Filippin, 2013) and the difficulty to recognize own mistakes (for further details on these questions see Appendix A3).The answers to the questionnaire allow us to control for subject heterogeneity.

Table 2: Payoffs

Total offers	Total surplus	Worker decision	Firm Profits	Worker earnings
0	0	-	0	0
1	390	Accept	390-w_i, i=1,2	w_i, i=1,2
		Reject	0	0
2	780	Accept	780-(w_1+w_2)	w_i, i=1,2
		Reject	0	0

The payoff functions, the number of rounds and the matching protocol were common information for participants in all treatments. Everyone was informed that they will be paid for one of the (15) rounds which was randomly chosen. They only knew their own exchange rate.[12] Exchange rates were set to have comparable payoffs across participants. The exchange rate for firms was 1 euro = 17.73 points and 1 euro = 21.67 points for workers.

In all treatments, firms could only see their own wage offers and payoffs for current and previous periods at the end of each period. Additionally, under PRO firms were also informed about wage proposals in the current and all previous periods, while workers were also informed about their own wage proposals after period one.

[12] By informing subjects of their exchange rate at the start of the experiment, we are more likely to prevent feelings of disappointment and increase their willingness to participate in future experiments (Blount and Bazerman, 1996).

4. The theoretical model

In this section, we describe a theoretical framework that formalizes the key elements of our experiment. Our purpose is not to make pinpoint predictions but rather providing a simple theoretical framework that provides us with testable hypotheses regarding overall treatment differences. Below we describe the basic model and discuss the experimental hypotheses.

We consider an ultimatum game between a "worker" (*he*) and a "firm" (*she*). Let $M \in \mathbb{R}_+$ be the endowment to be divided between the two parties. In our basic framework, the firm offers a wage to the worker, $w_o \leq M$, which in turn decides whether to accept or reject. If the firm's offer is accepted, the worker receives w_o and the firm collects $M - w_o$. If the offer is rejected, both parties end up with 0. For simplicity, we assume risk neutrality which involves linear utility functions over wealth (i.e., $M - w_o$ for the firm and w_o for the worker).[13]

Consistent with results in ultimatum games (see Camerer, 2011, pp. 48-63 for a review) we assume that the worker has a *minimum acceptable wage* $w_m \leq M$.[14] Thus, the worker will accept (reject) a firm's offer if $w_o \geq w_m$ ($w_o < w_m$). The worker's minimum acceptable wage can be of two types, low and high, indexed by $i \in \{L, H\}$ where $M \geq w_{m,H} > w_{m,L} \geq 0$. We denote by q the proportion of workers with a low minimum acceptable wage ($w_{m,L}$) in the population.[15]

4.1. Baseline (BASE)

We begin by solving the model where the firm does not have any more information about the worker's type other than the commonly known prior (q). This corresponds to our Baseline (BASE) treatment. In this case, the firm decides whether to offer a high wage ($w_o = w_{m,H}$) that both worker types would accept or, offer a low wage $\left(w_o = w_{m,L}\right)$ that will be accepted only with probability p. We denote by $T = \frac{M - w_{m,H}}{M - w_{m,L}}$ the firm's profits from a high offer relative to the firm's profits from a low offer that was accepted. Therefore, $T < 1$ is a measure of the relative profitability of making a high wage offer. In the proposition below we provide the optimal wage (w_0^{BASE}) and the corresponding expected firm's profits (Π_F^{BASE}), expected

[13] None of the main predictions that we test in the experiment would change if we assumed risk aversion. Only the quantitative results might be different. It is easy to check that the wage offer should increase with the firm's level of risk aversion.

[14] Note that the existence of a minimum acceptable wage is also consistent with previous papers on rules of fairness in the workplace (e.g., Akerlof, 1982; Kahneman et al. 1986; Bottino et al. 2016). According to this interpretation w_m represents the worker's 'reference wage', that is, his idiosyncratic idea of a fair compensation.

[15] In a previous version we proposed a general version of this model where the minimum acceptable wage follows a uniform continuous distribution (the document is available upon request). Our main qualitative results and predictions were not affected by this assumption. We thus focus on the two-type model for the sake of simplicity and clarity of exposition.

worker's income (Π_W^{BASE}) and the acceptance rate (r^{BASE}). All proofs are relegated to Appendix B.

Proposition 1*: The optimal wage offered by the firm, and the corresponding expected firm's profits, expected worker's income and the acceptance rate are given by:*

$$w_o^{BASE} = \begin{cases} w_{m,L} & if \quad q \geq T \\ w_{m,H} & if \quad q < T \end{cases}; \quad \Pi_F^{BASE} = \begin{cases} q(M - w_{m,L}) & if \quad q \geq T \\ M - w_{m,H} & if \quad q < T \end{cases}$$

$$\Pi_W^{BASE} = \begin{cases} qw_{m,L} & if \quad q \geq T \\ w_{m,H} & if \quad q < T \end{cases}; \; r^{BASE} = \begin{cases} q & if \quad q \geq T \\ 1 & if \quad q < T \end{cases}$$

where $T = \frac{M - w_{m,H}}{M - w_{m,L}}$.

Thus, the firm makes a low offer when the proportion of low types in the population is high enough (q is high) and/or when making a high offer is relatively unprofitable (T is low), otherwise the firm makes a high offer. The low offer would be accepted only with probability q, while a high offer would be accepted by all workers.

4.2. Wage Proposals (PRO)

We now consider a modified version of the ultimatum game in which the worker moves first by sending a non-binding wage proposal to the firm, $w_p \leq M$. After receiving the wage proposal, the firm decides the wage offer. The worker can then accept or reject the firm's offer.

Following insights from the cheap talk literature (see Farrell and Rabin 1996 for a review) we study a situation where the wage proposal conveys information about the worker's minimum acceptable wage ($w_{m,i}$), with the possibility that the workers might be misreporting their private information. In particular, we assume that the low type worker's proposal is their minimum acceptable wage (i.e., reports truthfully) with probability $\lambda \in (0,1)$.[16] However, with probability $1 - \lambda$ the low type misreport, i.e. proposes $w_p = w_{m,H}$.[17] Therefore, when observing a high wage proposal the firm does not know whether the worker is truly a high type, or a low type who is misreporting. The assumption that the worker, when proposing a wage to

[16] According to Farrell and Rabin (1996): "[P]eople typically say what they want to have been believed even when the incentives clearly imply that cheap talk should not be believed, [that is] some people tell the truth despite incentives to lie" (p.104). However, that some people always propose their minimum acceptable wage is not key assumption in our model. Our main results would remain unchanged if we assume that everybody misreports, as long as some misreport more than others.

[17] In the continuous version of this model (available upon request) workers can misreport by a factor $b > 0$. The two-type model is essentially a particular case of the continuous model where $b = w_{m,H} - w_{m,L}$. The assumption, that only the low type misreports is also captured in the continuous version because, given that the maximum report is M, those with a high minimum acceptable wage ($w_m > M - b$) cannot fully misreport; and those with $w_m = M$ will not misreport at all. Therefore, a high proposal in the continuous case is more indicative that the worker is not misreporting. Finally, note that in the discrete model, results would not be different if we allow the high type to misreport as well; this is because such a misreport will always be detected, and hence ignored, by the firm.

the firm, does not always misreport their minimum acceptable wage is consistent with the "aversion to lying" literature (e.g., Gneezy, 2005; Lundquist et al. 2009). Moreover, for simplicity, we do not formalize whether it is optimal for the low-type worker to misreport or not and simply assume that this occurs with a commonly known probability $(1 - \lambda)$.

Note that, in our model, low proposals $w_p = w_{m,L}$ (which arise with probability λq) are "fully revealing" for the firm, because only a low type who is truthfully reporting would make such a low proposal. However, observing $w_p = w_{m,H}$ is only "partially revealing" because such a proposal might have come from a high type (with probability $(1 - q)$) or from a low type who is misreporting (with probability $q(1 - \lambda)$). It is easy to see that the firm would always meet the worker's proposal when it is "fully revealing." If, however, the wage proposal is "partially revealing" then the firm needs to consider the trade-off between the benefit of offering $w_{m,L}$ if the worker is misreporting, and the loss that comes from a rejection if the worker's proposal was his minimum acceptable wage, $w_{m,H}$. In other words, the firm decides whether it pays off to believe the worker or not. In the following proposition we summarize the results of the wage proposals case.

Proposition 2*: The optimal wage policy and the corresponding expected firm profits, expected worker income, and the acceptance rate are:*

$$w_o^{PRO} = \begin{cases} w_{m,L} & if \quad w_p = w_{m,L} \\ \widetilde{w}_o^{PRO} & if \quad w_p = w_{m,H} \end{cases} \quad where \quad \widetilde{w}_o^{PRO} = \begin{cases} w_{m,L} & if \quad \hat{q}^{PRO} \geq T \\ w_{m,H} & if \quad \hat{q}^{PRO} < T \end{cases};$$

$$\Pi_F^{PRO} = \begin{cases} q\left(M - w_{m,L}\right) & if \quad \hat{q}^{PRO} \geq T \\ M - w_{m,H} + q\lambda\left(w_{m,H} - w_{m,L}\right) & if \quad \hat{q}^{PRO} < T \end{cases}$$

$$\Pi_W^{PRO} = \begin{cases} qw_{m,L} & if \quad \hat{q}^{PRO} \geq T \\ w_{m,H} - q\lambda\left(w_{m,H} - w_{m,L}\right) & if \quad \hat{q}^{PRO} < T \end{cases}; \quad r^{PRO} = \begin{cases} q & if \quad \hat{q}^{PRO} \geq T \\ 1 & if \quad \hat{q}^{PRO} < T \end{cases}$$

where $T = \frac{M - w_{m,H}}{M - w_{m,L}}$, $\hat{q}^{PRO} = P\left(w_{m,L} \middle| w_p = w_{m,H}\right) = \frac{(1-\lambda)q}{1-q\lambda} < q$, *and* $\widetilde{w}_o^{PRO}$ *is the optimal wage offer conditional on the wage proposal being high.*

When a worker first makes a proposal, he is sending a signal to the firm about his minimum acceptable wage. While proposing w_m^H is only partially revealing, it decreases the firm's belief that the worker is low type (i.e., $\hat{q}^{PRO} < q$). As a result, when the proposal is high, the firm is less likely to offer a low wage offer in PRO than in BASE. Consequently, expected worker's income should increase with proposals. However, as we show in the corollary below because acceptance rates will be higher, firms' might also be strictly better off under proposals.

Corollary 1 (PRO vs. BASE)*: Comparing the results when wage proposals are available (PRO) with the results without proposals (BASE), we find that:*

$$w_o^{PRO} \geq w_o^{BASE};\ \Pi_F^{PRO} \geq \Pi_F^{BASE};\ \Pi_W^{PRO} \geq \Pi_W^{BASE} \text{ and } r^{PRO} \geq r^{BASE}$$

Therefore, our theory shows that workers' proposals can promote higher wages, firm's profits, and overall efficiency (i.e., higher acceptance rates) when they provide information about the worker's type.

Corollary 2 (Income inequality across treatments). If $T \in (\hat{q}^{PRO}, q]$ then$r^{PRO} = 1 > q = r^{BASE}$ and hence:

(i) Conditional on the wage offer being accepted, income inequality among workers is higher in PRO than BASE.

(ii) Worker's income, as a share of the total surplus, is higher in PRO than BASE.

Under the condition of Corollary 2 ($T \in (\hat{q}^{PRO}, q]$) the firm would offer higher wages to those who ask for it in PRO, but she would always offer a low wage, which would be rejected with probability $1 - q$, in BASE. It follows then than under proposals, the percentege of accepted high wages should be higher (Corollary 2.i) and workers should be able to get a higher share of the total surplus (Corollary 3.ii) than in the baseline.

4.3. Testable Predictions

In this section, we provide testable predictions for our experiments. In our theory, wage proposals convey (imperfect) information about the worker's minimum acceptable wage; firm, therefore, would on average offer higher wages to those making higher proposals. Our theoretical results also indicate that, because workers can misreport, the firm's optimal policy is sometimes to ignore high proposals and offer a low wage instead.

Hypothesis 1: **(wage offers and proposals)**

(i) We expect firms' wage-offers to increase in the workers' proposals.

(ii) We expect average wage proposals to be higher than average wage-offers.

(iii) We expect average wage-offers to be higher under proposals.

Moreover, our model makes important predictions about welfare effects. Corollary 1 shows how proposals affect firm's profits, worker's income, and acceptance rates (and hence overall efficiency).

Hypothesis 2: **(Welfare effects)**

(i) We expect workers' income to be higher under proposals.
(ii) We expect firms' profits to be higher under proposals.
(iii) We expect acceptance rates (and hence overall efficiency) to be higher under proposals.

Finally, under the condition of Corollary 2, we can predict the following results about income equality.

Hypothesis 3: (Income inequality)

(i) Conditional on the wage offer being accepted, income equality among workers is higher under proposals.
(ii) We expect the share of worker's income in total surplus to be higher under proposals.

5. Results

We use both nonparametric statistics and econometric analysis to test our hypotheses. Nonparametric tests (Mann-Whitney one-tailed tests, unless otherwise stated) are considered at an individual level to ensure independence. Observations are averaged for the 15 experimental rounds by individual. To be conservative with the independence hypothesis non-parametric tests are also conducted at the session level. The econometric analysis (while controlling for additional effects) uses both Random Effects (RE hereafter) Logit and Generalized Least Squared (GLS hereafter) models. We first study wages and proposals with their acceptance rates. This is followed by welfare effects and income equality. Finally, even though we have a limited number of observations for firms, we also explore gender differences.

5.1. Wages and proposals

Figure 2 shows firms' wage offers and workers' wage proposals over time for PRO. The relationship of those two variables is positive with a correlation coefficient of 0.544 ($p < 0.01$). This confirms Hypothesis 1(i), i.e., that the wage offers increase with the wage proposals. Proposals and wage offers have a positive trend over time. Interestingly, the gap between workers' proposals and firms' wage offers is increasing as the experiment progresses. A possible explanation for this is that firms learn over time that, and as predicted by our theory, workers are less likely to reject low wage offers as rounds advance.

Figure 2: Average wage proposals and firms' wage offers over time

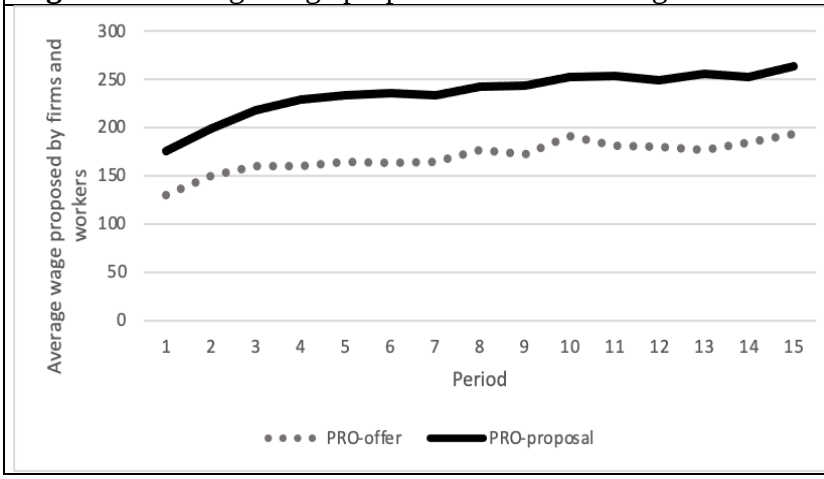


Table 3 contains the descriptive statistics for wage offers and proposals. Differences between proposals and wage offers are positive on average (65.39). We cannot, however, consider that wage proposals and wage offers are independent. Thus, we conduct a Wilcoxon matched-pairs signed-ranks test and find that proposals are statistically higher than wage offers in each period (maximum $p < 0.001$). This supports Hypothesis 1 (ii). In Figure 2 above, we can see that this result holds in all 15 periods for both treatments. Consistent with Hypothesis 1 (iii), we see that wage offers by firms are higher (see Table 3) when workers can submit wage proposals compared to the baseline (PRO-BASE: $z = -3.001$, $p < 0.001$).

Table 3: Descriptive statistics for wage offers and wage proposals

	BASE	**PRO**
Wage proposals by workers	-	235.43
Wage offers by firms	144.79	170.04
Accepted wages by workers	160.42	177.17
Proposals – accepted wages	-	55.38
% Accepted offers	75%	86%
N(firms/workers)	25/50	24/48

Table 4 presents two RE Generalized Least Squares regressions where the dependent variable is the average wage offer made by firms.[18] The first explanatory variable, given the strong relationship observed in Figure 2 above, is workers' *wage proposal*, computed as the average of the two proposals for the workers-firm pair in any given period. To control for heterogeneity, as it is usual in laboratory experiments, we use some of the variables extracted from our post-questionnaire (see experimental section): *female*, a dummy with value 1 if the firm is female and 0 otherwise; *risk lover*, a categorical variable that is 0 if the firm is risk averse, 1 if risk neutral and 2 if risk lover; *self-reported fair wage*, that is, firms' subjective opinion about what they considered to be a fair wage in a post-questionnaire; *high income*, a dummy with value 1 if the subject is among the 25% of the subjects living in areas with higher per capita income and 0 otherwise. We also consider the *period* to control for time trends and the dummies for the BASE and the PRO treatments.

[18] Results qualitatively hold if the dependent variable is the wage offer made by firms to each worker.

Table 4: RE GLS regressions on wage offers

	PRO	BASE vs PRO
	(1)	(2)
Wage proposal	0.412***	-9.678
	(0.055)	(10.440)
Female	-1.844	-4.273
	(12.384)	(4.361)
Risk lover	-3.472	0.151
	(6.308)	(0.105)
Self-reported fair wage	-0.044	11.270
	(0.071)	(9.700)
High income	17.059*	1.691***
	(9.314)	(0.579)
Period	1.392**	-21.540**
	(0.624)	(10.29)
BASE		-21.642**
		(10.289)
Constant	66.686***	129.500***
	(19.73)	(20.64)
R-squared	0.188	0.225
Observations	358	732

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

We test Hypothesis 1(i) in specification (1). The coefficient associated with *workers' wage proposals* is positive and significant (0.412, $p < 0.01$). Thus, higher proposals result in higher wage offers. Next, we make pairwise comparisons between treatments. Specification (2) confirms that wage offers were significantly higher in PRO than in BASE (Hypothesis 1(iii)).

We state Result 1 below, which goes in line with Hypothesis 1:

Result 1.

i) Firms' wage-offers increase with workers' wage-proposals.

ii) On average, wage-proposals are higher than wage offers.

iii) Compared to BASE, wage-offers are higher in PRO.

5.2. Profits, Efficiency, and Income Inequality

In Table 5, we report descriptive statistics for firm and worker earnings, and income inequality. Relative to the baseline, worker earnings are higher under proposals (PRO-BASE: z = -4.864,

p < 0.001). This supports Hypothesis 2 (i). Interestingly, relative to the baseline, firm profits are higher when proposals are present. The difference, however, is not significant (z = -0.160, p = 0.873, two-tails). Thus, Hypothesis 2 (ii) is not supported.

Efficiency is only impacted in our framework if a contract between a worker and firm is not realized. This can occur if a worker rejects a wage offer or if a firm makes no wage offer to a worker. In both cases, workers and firms would get zero earnings, resulting in a deadweight loss and lower total surplus (efficiency). We find that acceptance rates are higher (by approximately 10%) under proposals (PRO-BASE: z = -2.566, p = 0.005). This result is consistent with our theoretical framework (Hypothesis 2(iii)) where proposals lead to higher wage offers (Hypothesis 1(iii)).

Table 5: Descriptive statistics for profits, efficiency and income inequality

	BASE	**PRO**
Firms' earnings	334.90	347.63
Workers' earnings	116.14	144.69
Total earnings	568.88	635.69
Acceptance rates	75%	86%
Workers' surplus share	20%	22%
Gini Index: Overall	0.450	0.318
Gini Index: workers	0.172	0.157
N(firms/workers)	25/50	24/48

We next test Hypothesis 3 where we look at the impact of proposals on income inequality. First, we observe that efficiency and worker share in total surplus (*p = 0.024*) is higher when proposals are present. These results support Hypothesis 3 (ii). Next, we consider two additional measures of inequality for all our treatments: overall inequality in the system (i.e., Gini index-overall), which measures how unequal are overall outcomes for both workers

and firms, and inequality across workers (Gini index-workers).[19] Thus, the first measure captures inequality between firms and workers, while the second measure focuses on inequality only across workers. Moreover, to be consistent with our Hypothesis 3(i), we will compute the Gini index only for accepted offers.

We obtain higher (overall) income inequality in BASE (0.450) relative to PRO (0.318) (see Gini index-overall variable on Table 4). This result is even more striking given that our workers are homogenous, and labor is the only input. We expect these results to be stronger if we include heterogeneity in skill or productivity levels of workers. Our first take from this is that allowing for proposals decreases overall inequality while increasing income inequality among workers. This is confirmed by the Gini index-worker which is lower in PRO (0.157) than in BASE (0.172). Thus, making proposals decreases income inequality among workers. These results are not consistent with Hypothesis 3(i). One possible explanation for this is that, since in PRO treatment wage offers are higher than in BASE, there is greater variance in the accepted offers and hence in inequality.

Below, we further conduct some econometric regressions to check the robustness of the previous results on profits, efficiency, and income inequality. Table 6 contains three RE GLS regressions where the dependent variables are workers' earnings (specification 1), firms' profits (specification 2) and efficiency defined as 1 if two contracts are accepted, 0.5 if only one worker accepted the offer and, 0 when no contract is accepted (specification 3). The set of independent variables are the same as in Table 5. Notice that in specification 1 all the covariates will refer to workers' characteristics. We confirm that workers' profits are higher under proposals. Looking at Table 6, we find that the coefficient associated with BASE is negative and significant (-25.536). Thus, we find the same results as before (Hypothesis 2(i) supported).

[19] Note that there are several ways to compute the Gini index since we have 15 observations per subject. We compute the Gini index as the average of the 15 periods. We believe this is the best way to capture income inequality since profits and inequality evolve over time and the reference point should be considered within each period.

Table 6: RE GLS regressions on workers' and firms' profits, efficiency

	BASE and PRO	BASE and PRO	BASE and PRO
	(1) workers	(2) firms	(3) efficiency
Female	0.309	-24.826	-0.066
	(5.545)	(17.839)	(0.049)
Risk lover	-	9.307	0.003
		(7.354)	(0.020)
Self-reported	0.126***	-0.193	0.00004
Fair-wage	(0.044)	(0.163)	(0.0004)
High income	-13.478**	7.653	0.044
	(6.543)	(14.583)	(0.040)
Period	2.605***	1.641	0.009***
	(0.451)	(1.267)	(0.002)
BASE	-25.536***	-20.432	-0.096**
	(5.178)	(16.427)	(0.044)
Constant	95.608***	380.453***	0.763***
	(10.717)	(34.916)	(0.092)
R-squared	0.317	0.149	0.137
Observations	1470	735	735

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Looking at firm earnings (2) (where all covariates refer to firms' characteristics), we find that, although they are higher under proposals, the effect is not significant. This is similar to what we found with the non-parametric statistical tests. Hypothesis 2(ii) is thus not supported. Clearly, efficiency in BASE is significantly lower than in PRO (see coefficient of BASE dummy). Thus, Hypothesis 2(iii) is also supported.

Next, we turn our attention to income inequality. In Table 7, we analyse it for workers using a RE-GLS model where we consider two dependent variables. For specification (1), the dependent variable is the distance between each worker's income in a period minus the average incomes of all the workers in that period, and treatment, in absolute value but, restricted to those cases where there was an accepted offer. For specification (2), the dependent variable is the distance between each workers income in a period minus the average profits of all the workers and firms in that treatment in absolute value.

Table 7: RE-GLS on the distance between workers' earnings and average earnings of all workers; and the distance between average earnings of all workers and firms in a treatment.

	Only workers	**Workers and firms**
	(1) BASE and PRO	(2) BASE and PRO
Female	-8.172**	-0.309
	(3.837)	(5.546)
High income	-1.036	13.480**
	(3.810)	(6.543)
Self-reported fair wage	0.063**	-0.126***
	(0.031)	(0.044)
Period	-1.254***	-2.605***
	(0.288)	(0.451)
BASE	8.226**	-43.470***
	(3.573)	(5.178)
Constant	45.200***	540.50***
	(7.884)	(10.72)
R-squared	0.125	0.086
Observations	1,135	1470

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

If we look at income inequality amongst workers, we find that it is significantly higher in BASE than in PRO (see coefficient of the dummy BASE in (1)). Thus, the econometric analysis contradicts Hypothesis 3 (i) earlier. When we analyze inequality in overall terms in (2), we observe that income inequality is significantly lower in BASE than in PRO. This result clearly contradicts what we found in Table 5 according to the Gini index (overall). The most plausible explanation is that even though workers earn higher wages with proposals, this effect is dominated by the increase in firms' earnings due to higher acceptance rates in the presence of proposals. We summarize our findings in Result 2 (Hypothesis 2) and Result 3 (Hypothesis 3) below:

Result 2.

i) Workers earn more under proposals (PRO) relative to BASE.

ii) Relative to BASE, proposals increase firm profits under PRO.

iii) Acceptance rates (and therefore efficiency) are higher under proposals.

Result 3:

i) Income inequality among workers, conditional on the wage-offer being accepted, is higher in BASE than in PRO. Income inequality measured through the Gini index is also higher in BASE.

ii) Workers' share of total surplus is higher in PRO than in BASE.

5.3. Robustness check-Public wage proposals

Previously we looked at the case where wage proposals were private information between the worker and the firm. We now discuss the implications of making proposals public, i.e., co-workers are now informed about co-workers' wage proposals at the end of each period. Our interest was to see whether changing the informational conditions in pre-play communication, i.e., public vs private, alters our results. Secondly, making wage proposals public (weakly) captures an issue that has been raised in several policy debates regarding wage disclosure policies (see discussion in Section 6). Disclosing proposals, which is nothing but non-binding pre-play communication, is a weaker implementation than disclosing actual wages from past periods. Any insights thus obtained, regarding any effect on worker wages, relative to PRO, would be expected to be stronger if true wages were to be revealed.

From a theoretical standpoint, making wage proposals public might affect workers' decisions if, for example, their behavior is influenced by a desire to conform to what co-workers do. Social psychologists refer to conformity as "the act of changing one's behavior to match the responses of others" (Cialdini and Goldstein, 2004, p. 606).[20] Thus, a straightforward way to expand our theoretical framework described in Section 3 to capture conformity is by assuming that a worker's proposal will mimic the co-worker's previous proposal. This means that, instead of being purely random, a low type's decision to misreport in PUB is influenced by the co-worker's previous proposal. We describe the details of this model's extension and

[20] Conformity is not only widespread, but also at the root of important findings in the economic literature (see, e.g., Bernheim, 1994; Clark and Oswald, 1998; Sliwka, 2007; Thöni and Gächter, 2015). Moreover, we can consider conformity as a type of "social influence": the fact that a person's emotions, opinions or behavior is affected by others. There are two types of conformity emphasized in the literature: "normative influence" and "informational influence". The former is often used to refer to situations in which individuals are susceptible to social influence in order to conform to or identify with others (Festinger et al. 1950; Asch, 1953; Cai et al. 2009; and Fatas at al. 2018). Alternatively, informational influence (also known as "social proof") is used to describe social influence in a context in which the behavior of others is useful in order to infer inaccessible information about an objective state of the world (Banerjee 1992; Anderson and Holt, 1997; Goeree and Yariv, 2015; and Muchnik et al. 2013). In this paper, we are agnostic about what type of conformism is more likely to affect subjects' behaviour (but believe they are not mutually exclusive). Thus, our assumption is that people conform but we do not enter into the reasons why people conform.

prove our main results in Appendix-B. We summarize the main theoretical conjectures in the following hypothesis:

Hypothesis P: Public (PUB) vs. Private (PRO) Proposals

(i) Compared to PRO, in PUB we expect similar wage proposals, but lower accepted wages and wage offers.

(ii) Compared to PRO, in PUB we expect lower workers' income but higher firm profits.

(iii) Compared to PRO, in PUB we expect higher income equality (conditional on the wage offer being accepted).

We begin by replicating the analysis we performed earlier with PRO by comparing its results those of BASE. Table 3' contains the descriptive statistics for wage offers and proposals in BASE and PUB. As expected, proposals are statistically higher than wage offers in each period (maximum $p < 0.001$, Wilcoxon matched-pairs signed-ranks test). This supports Hypothesis 1(ii). Also, Hypothesis 1(iii) is supported since wage offers by firms are significantly higher when workers can submit public wage proposals compared to the baseline (PUB-BASE: $z = -0.917$, $p = 0.017$).

Table 3': Descriptive statistics for wage offers and wage proposals

	BASE	**PUB**
Wage proposals by workers	-	234.66
Wage offers by firms	144.79	152.77
Accepted wages by workers	160.42	158.96
Proposals – accepted wages	-	74.92
% Accepted offers	75%	87%
N(firms/workers)	25/50	24/48

Table 4' presents two RE GLS regressions on the wage offer to test Hypothesis 1. First, we observe that workers proposals have a significant positive effect in wage offers in PUB (Hypothesis 1(i)). However, Hypothesis 1(iii) is not supported although the coefficient of the dummy BASE is negative but not significant.

Table 4':RE GLS regressions on wage offers

	PUB	BASE vs PUB
	(1)	(2)
Wage proposals	0.272***	-7.688
	(0.044)	(9.398)
Female	12.076	-3.508
	(10.996)	(4.172)
Risk lover	-10.004*	0.209**
	(5.298)	(0.089)
Self-reported fair wage	0.198***	6.187
	(0.076)	(10.460)
High income	-2.883	0.715
	(9.851)	(0.489)
Period	-0.336	-8.270
	(0.711)	(9.070)
BASE		-8.27
		(9.07)
Constant	62.467**	112.400***
	(17.223)	(17.50)
R-squared	0.314	0.221
Observations	359	733

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Next, Table 5' reports the descriptive statistics for profits, efficiency and income inequality in BASE and PUB. As before, workers' earnings are higher when proposals are present (PUB-BASE: z = -2.615, p = 0.004). Although firm's profits were higher in PRO than in BASE, with the difference not being significant, however, this is not the case for PUB where firms' profits are significantly higher than in BASE (z = -2.680, p = 0.004). Interestingly, firms earn more when proposals are public than when they are not (PRO-PUB: z = -3.103; p = 0.001). Finally, as in PRO, acceptance rates in PUB are higher than in BASE (z = -3.186, p < 0.001). In sum, Hypothesis 2(i), (ii) and (ii) are all supported.

Regarding income inequality, workers' share is the same for PRO and BASE (in PRO it was higher by 2 percentage points). Thus, Hypothesis 3(ii) is not supported. As in PRO income inequality among workers (see Gini workers in Table 5') is lower for PUB than in BASE. Therefore, again, Hypothesis 3(i) is not supported.

Table 5': Descriptive statistics for profits, efficiency and income inequality

	BASE	**PUB**
Firms' earnings	334.90	390.12
Workers' earnings	116.14	134.45
Total earnings	568.88	658.67
Acceptance rates	75%	87%
Workers' surplus share	20%	20%
Gini Index: Overall	0.450	0.364
Gini Index: workers	0.172	0.164
N(firms/workers)	25/50	24/48

All previous results hold when running the corresponding regressions (see Table C1 and C2 in Appendix C). To summarize, with a few exceptions (Hypothesis 2(ii) which is quantitatively the same and Hypothesis 3(i)), we obtain the same results in PUB as in PRO.

To conclude the section, we analyse the effect that making wage proposals public has on wages, profits, efficiency, and distribution. For this purpose, we compare PRO, our main treatment, with PUB, where workers also know the co-worker's previous wage proposals (as described earlier). First, although we observe similar wage proposals in PUB and PRO (235.43 vs. 234.66), accepted wages in PUB (158.96) are significantly lower than in PRO (177.17). As a result, workers' earnings are higher when proposals are private (144.69 vs. 134.45). A possible explanation for this result is that, when proposals are public, workers tend to conform to the wage of the co-worker. We find supporting evidence for this from the fact that wage proposals are more similar in PUB than in PRO. Further support for the conformity hypothesis comes from the observation that acceptance rates are no different in PUB and PRO (86% vs. 87%) which suggests that some workers change their minimum acceptable wages when wages are made public. Because acceptance rates are similar but, wages are lower, firms make higher profits when wages are public (390.12 vs. 347.63). Therefore, our results are consistent with recent evidence that making wage information public can favour firms and lower the wages that workers receive (Cullen and Pakzad-Hurson, 2021).

5.4. Gender Analysis

Our experiment also provides some interesting results regarding gender effects that we discuss in this section. We begin by summarizing the key papers in this literature and discuss how they relate to our experiments. We then use these findings to provide an empirical hypothesis regarding gender effects in our experiment. We finish by testing this hypothesis with our experimental results.

The experimental literature on gender differences in negotiation presents mixed results. Eckel and Grossman (2001) used the ultimatum game to study the gender gap in an environment where participants know their partner's gender (as opposed to our setting). They found that compared to men, women's wage offers are higher, while, as second movers, they are also more likely to accept wages. Solnick (2001) performs an ultimatum game experiment with two treatments, one where the partner's gender is known and another when it is unknown. Similar to Eckel and Grossman's results, he found that when gender is salient, males receive higher offers. By contrast, there are no gender differences in wage offers when the gender of the partner is unknown. However, in contrast to Eckel and Grossman's findings, females were more likely to reject offers. A possible explanation for these different results is that Solnick's experiment followed the strategy method and hence the impact of rejection decisions on the overall outcome is less obvious.

García-Gallego et al. (2012) also study gender differences in an ultimatum game. However, in their setup participants don't know their partner's gender. They have three treatments. In two of them workers perform a real effort task. We focus on the treatment where there is no real effort task. Though not significant, and contrary to Eckel and Grossman (2001), they find that women offer less and reject more. As we did not inform subjects about their partner's gender or use the strategy method, our work is more closely related to García-Gallego et al. (2012). Finally, Rigdon (2012) uses a Demand Ultimatum Game where partner's gender was unknown. She finds that, when proposals are made privately, females make significantly lower wage proposals than males, similar wage offer and accept offers more frequently. However, when proposals were made public females make similar proposals and higher wage offers. Note that, Rigdon's baseline treatment is related to our PRO treatment, while her public

treatment is related to our PUB one.[21] Based on the findings of this literature, we state the following empirical hypothesis:

Empirical hypothesis G: Gender

(i) Compared to males, female workers will make lower wage proposals in PRO but similar in PUB (Rigdon, 2012).

(ii) Compared to males, female firms will make lower wage offers in BASE (García-Gallego et al. 2012) but similar in PRO and PUB.

(iii) Female workers' acceptance rates will be lower than those of males in BASE (García-Gallego et al. 2012) but similar in PRO and PUB (Rigdon 2012).

Table 8 reports the descriptive statistics by gender in BASE, PRO and PUB. We do not find any gender difference for average wage proposals (PRO: *p = 0.353*, PUB: *p = 0.347*), a result that partly contradicts Hypothesis G (i).[22]Although not statistically significant, it seems that, compared to men, women make lower proposals in PRO, a result consistent with Rigdon's (2012) finding that women are more assertive in wage negotiations when they have access to public information. Indeed, if we explore the evolution over time of these variables (Figure 3), we observe that average wage proposals by women are below those of men in every period under private (PRO) proposals but, the opposite occurs with PUB with a few exceptions.

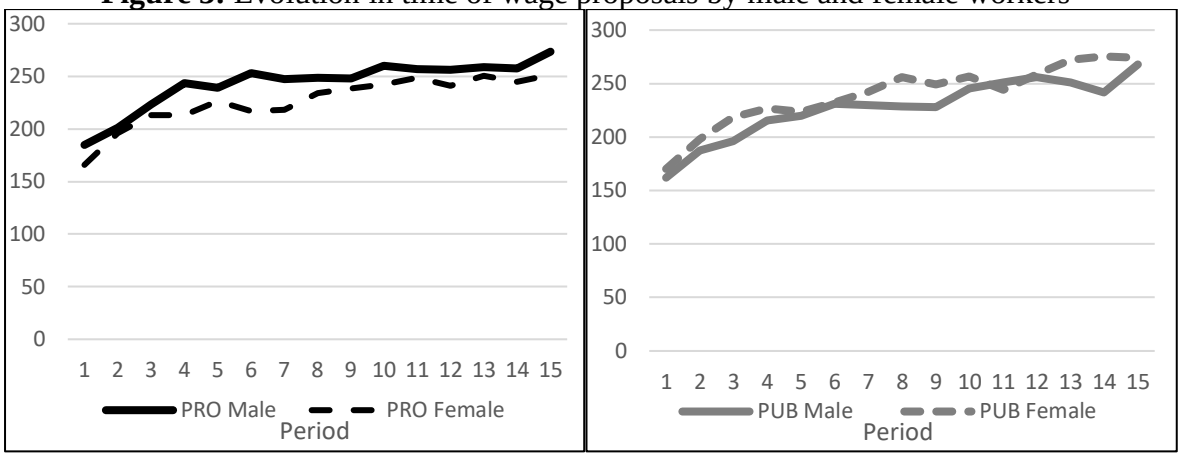
Table 8: Descriptive statistics by gender

	BASE		**PRO**		**PUB**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Proposals	-	-	243.45	226.71	227.41	239.85
Wage offers	152.39	136.33	172.27	169.15	152.62	152.89
Accepted wages	167.17	155.60	183.63	169.96	161.10	157.58
% Accepted offers	64%	84%	86%	85%	81%	91%
Firms' profits	353.17	315.11	357.56	343.53	388.54	392.76
Workers' income	105.41	127.68	151.8	136.95	128.34	138.82
N(firms/workers)	13/24	12/26	7/25	17/23	15/20	9/28

[21]There is also an extensive literature on gender and negotiation which is not so close to our setting either because the partner's gender is known or because the game is not an Ultimatum Game: Dittrich, Knabe and Leipold (2014) use a face-to-face alternating-offers wage bargaining environment and they find that male workers receive on average higher wage offers. Also, male workers ask higher salaries than females when they make a counteroffer to firms. Hernandez-Arenaz and Iriberri (2018), in a real word TV negotiation game, find that when the strong bargaining position is held by men, and they bargain against women responders, men are more likely to take a larger share of the pie. Meanwhile, women demand less from men than from women.

[22] This result also holds if we consider data just from the first 5 periods (PRO: *p=0.279*, two-tails; PUB: *p=0.490*, two-tails).

Figure 3: Evolution in time of wage proposals by male and female workers



Although, not statistically significant (*p = 0.415, two-tails*), we observe that in line with Hypothesis G (ii), wage offers made by females are 12% lower than those made by males in BASE. Additionally, in line with this hypothesis, we do not find gender differences in wage offers with proposals (PRO: 172.27 vs 169.15; PUB: 152.62 vs 152.89) (PRO: *p = 0.634* and PUB: *p = 0.655*, two-tails).

Regarding acceptance rates, female workers accept significantly more offers than males in BASE (*p < 0.001*), a result that does not support Hypothesis G (iii).[23] Compared to males, females have similar acceptance rates in PRO (*p = 0.902*, two-tails). This is consistent with the Hypothesis G (iii). Notice, however, that in PUB females have higher acceptance rates (*p = 0.018*), which does not support Hypothesis G (iii). Therefore, we do not find support for Hypothesis G (iii). Finally, there are no significant gender differences in firm profits or worker incomes except in BASE, where female workers receive higher income than males, a result that follows from females having higher acceptance rates.[24]

We summarize our findings on gender below:

[23] Note that García-Gallego et al. (2012) find that women reject more although not significantly. We get the opposite, women reject (quantitatively) less but not significantly. A possible explanation is that García-Gallego et al. (2012) consider a fixed matching while we consider a random one.

[24] For firms' profits: *p = 0.889* in BASE, *p =0.427* in PRIV, *p =0.612* in PUB, all tests two-tails. For workers' profits: *p = 0.038* in BASE, *p =0.252* in PRIV, *p =0.369* in PUB, all tests two-tails.

Result 5

When proposals are present there are no gender differences in wage offers, wage proposals, firms' profits or workers' income. Moreover, when proposals are private there are no gender differences in acceptance rates. Thus, the gender gap on acceptance rates and workers' profits vanishes under proposals.

6. Conclusion

In this paper, we have experimentally studied the impact of pre-play communication and information in a labour relationship. Pre-play communication is a common feature of many job negotiations but their impact in wage formation is little understood. Additionally, providing information on salaries has recently been explored in many countries, including the European Union, in an attempt to increase transparency in the labour markets.[25] In our main treatment, with private pre-play communication, workers made wage proposals that were private. We ran an additional robustness check, by making wage proposals public (only for co-workers). Despite wage proposals being non-binding, we still find that wage proposal can have important implications for workers and firms.

Our results indicate that pre-play wage proposals matter and promote higher average wage offers relative to the baseline without proposals both under private, and public, treatments. We also find that making proposals public increases firm profits while, worker wage are similar under both private and public proposals. Both private and public proposals lower rejection rates and hence increase efficiency relative to the baseline. This is an important result, as it shows that non-binding pre-play communication can have important welfare implications. We also explore the effects on income distribution. While workers earn more under proposals, wage proposals decrease income inequality. In fact, the workers' income is the most unequal in the baseline which is the traditional worker-employer setting studied in economics (without proposals). Finally, we also provide some evidence that making a private proposal, eliminates gender bias in acceptance rates and workers' income.

[25]https://www.eleconomista.es/legislacion/noticias/11242527/05/21/La-ley-obligara-a-informar-del-sueldo-antes-de-la-entrevista.html?fbclid=IwAR1ps57ZgHdETU8Wc146ngBAKPkfoZeEL5AkdvexzPTbJAblp1HbEyHMv4c.

Our experiment also reveals another element of making wage proposals public. Even though average wages increase under proposals, they increase by a greater amount when proposals are private. Thus, we find that making wage proposals public mainly benefits the firm. This might be because publicly available proposals generate a conformity effect where workers are less likely to reject, which decreases wages relative to the case where proposals are made privately.

The previous result is contrary to popular belief, as indicated by the motivation behind some policy measures that have recently gained increased attraction. These relate to wage disclosure policies in organizations to address income inequality with emphasis on fair remuneration or wage disclosure for the sake of transparency (a la California, Switzerland, Norway or Denmark).[26,27] For example, the UK (since January 1, 2019) has a disclosure policy where its biggest companies have to disclose and explain every year their top bosses pay and the gap between that and their average worker. Similar measures have also been adopted in several countries such as Norway, Sweden, Finland and states in US.[28] Furthermore, recently the EU commission has presented a proposal as regards wage transparency that aims to guarantee the same wages for the same work and to address gender discrimination. We find that while the use of public proposals eliminates some gender differences, making information public for proposals works to the benefit of the firms.

Our paper is a first step in trying to understand the complicated interaction between public and private information in labour markets and its subsequent impact on worker' wages, firm profits and overall efficiency. While inequality in salaries in the workplace is a growing policy concern, its wider implications towards work performance and well-being are not yet clear. Moreover, it remains as an open question what the effect of wage proposals in the labour market will be when effort levels are considered.

[26] https://www.cipd.co.uk/knowledge/strategy/reward/pay-fairness-reporting-factsheet
[27] See for example, https://www.gov.uk/government/news/new-executive-pay-transparency-measures-come-into-force, https://www.forbes.com/sites/jackkelly/2019/11/21/the-growing-movement-to-make-employees-salaries-public-for-all-to-see/?sh=68cb40a97bb8,https://time.com/5353848/salary-pay-transparency-work/and https://www.nytimes.com/interactive/2020/02/19/magazine/salary-sharing.html.
[28] Eleven US states have a legislation which makes non-disclosure clauses illegal.

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APPENDIX

Appendix A1: Instructions for PRO treatment[29]

General instructions

You are taking part in an economic experiment. Please read the following instructions carefully. Depending upon the decisions you make you can earn additional money in addition to the 3 Euros fee for your participation. It is extremely important that you read the instructions carefully.

Absolutely no communication whatsoever is allowed in the course of the experiment. Please address questions you might have to us directly. Any violation of this will lead to the exclusion from both the experiment and all payments.

This experiment consists of companies and employees. Each individual will be assigned randomly the role of a company, or employee, and will maintain the same role during the entire experiment**.**

The entire experiment comprises of 15 periods. In each period, each company will be randomly matched with two employees.

The identity of the employees will not be disclosed to any company before or after the experiment. Likewise, employees will not know with which firm they have been paired or the identity of other employees who are assigned to the same company as them.

Decisions in each period

At the beginning of each period, the company will receive a salary proposal from her two potential employees. The salary proposal is not binding, that is, companies can decide whether to make the proposed offer, another offer or no offer. The proposals will be private, that is, each employee will only know his proposal (not the one of the other employee).

After learning the salary proposals, the company can submit a salary offer separately to **one,** or **both,** employees, or submit **no offer at all**. Each offer received by an employee is known only to them.

Once an employee learns the salary offer and its amount, they will have to decide whether to **accept** or **reject** it. **Employees will never know whether the company they are paired with has submitted an offer to the other employee.**

Employees learn only the amount of their own salary offer. They don't know if the company submitted any other salary offers. If, for instance, a company submits a salary offer to one employee and a different one to the other employee, none of the employees will learn the other employee's offer.

[29]Instructions for other treatments are available upon request.

The company's income in each period

When an offer is accepted, the employee and the company close a contract. This will generate the following income for the company:

- If the company concludes a contract with **the two** employees, she will achieve an income of **780 points - salary offered to employee 1 - salary offered to employee 2.**

- If the company concludes a contract with **one** employee, she will achieve an income of **390 points - the salary offered to the employee who accepted the offer**.

- If the company concludes **no contract at** all (because she has not made an offer or because her offers has not been accepted)**,** she will achieve an income of **zero points.**

The employee's income in each period

- If **no** offer of salary is submitted to you, **your income amounts to zero**.

- If you **accept the salary offer,** your income will be the **amount of the salary offered**.

- If you **reject the salary offer,** your **income will be zero**.

EXAMPLES of how income is calculated in a period

1. The employee 1 makes a salary proposal of 70 points and employee 2 of 150 points. The company submits two salary offers, 120 points to employee 1 and 120 points to employee 2. Both reject the offer:

-Income for the company: 0
-Income for the employees: 0

2. The employee 1 makes a salary proposal of 250 points and employee 2 of 100 points. The company submits two salary offers to the two employees, 80 points to employee 1 and 200 to employee 2. If both accept the offer:

-Income for the company: 780-80-200 = 500
-Income for employee 1: 80
-Income for employee 2: 200

3. The employee 1 makes a salary proposal of 65 points and employee 2 of 220 points. The company submits a salary offer to employee 1 of 180 points. If employee 1 accepts the offer:

-Income for the company: 390-180 = 210
-Income for employee 1: 180

-Income for employee 2: 0

Please note:

- The **salary** you offer to be paid to the employee only if the offer is actually accepted.

- The above mentioned rules apply to all companies and all employees. They are known to each company and to each employee.

How to make your decision

All decisions will be made on the screen. At the beginning of each period, you will be shown the following screen for companies:

On this screen, the company will have to decide whether to submit a salary offer to each employee. To do so, the company must click either "Yes" or "No" in the respective input fields.

If the company clicks "Yes" for a particular employee, then she will be asked to enter the amount of the salary offer she wants to make to that particular employee.

If the company clicks "No", that particular employee will not get a salary offer.

The permitted numbers for salary offers are between 0 and 390:

$$0 \leq \textit{salary offer} \leq 390$$

Once the company has made her decision(s) and entered the input, she must click the OK button. **Important, the company can revise her decisions as long as the OK button is not activated.**

To finish this stage, the company must click on the “NEXT” button (on the right bottom corner).

The following screen shows the decision that the employee will have to make in the event that they have received a salary offer:

On this screen, the employee will be informed of the exact amount of the offer. Afterwards, the employee must decide whether to accept or reject the offer by clicking on "accept" or "reject".

If the employee has not received an offer, the message "The company has decided not to make any offer to you in this period" will appear.

The income for that period will then appear on the screen.

This concludes the period. **In the following period, each company will be randomly assigned two new employees**. At the end of each period, the company will be able to see the salary offers of each employee and the income of the previous periods. Employees will see the offers received (only their own) and their income from previous periods.

Before starting the experiment, we will tell you on the computer screen the equivalence between points and Euros.

You will only be paid the points corresponding to a randomly chosen round by rolling a die.

Appendix A2: Control Questions for PRO and PUB treatments[30]

It is mandatory to answer every question. Wrong answers have no consequences. Address any questions to us!

1. Employee 1 makes a wage proposal of 100 points and employee 2 of 120. The company does not make wage offers to any of the employees. What is the income in points for,

- The company: 0
- Each of the employees: 0

---

2. Employee 1 makes a wage proposal of 80 points and employee 2 of 120. The company sends wage offers to employee 1 and 2 for a value of 250 points. What is the income in points for,

(a) Both employees accept the offer. What is the income in points for,

- The company: 280
- Each of the employees: 250

(b) Employee 1 accepts the offer and 2 rejects it. What is the income in points for,

- The company:140
- Employee 2: 0

---

3. Employee 1 makes a wage proposal of 30 points and employee 2 of 70. The company sends a wage offer for a value of 30 pints to employee 1 and a wage offer of 60 points to employee 2. What is the income in points if,

(a) Both employees accept the offer. What is the income in points for,

- The company: 690
- Each of the employees: 60

(b) Employee 1 accepts the offer and 2 rejects it. What is the income in points for,

[30]Control questions for Baseline are available upon request.

- The company:360
- Employee 1: 30

(c) Both employees reject the offer. What is the income in points for,

- The company: 0
- Each of the employees: 0

Appendix A3: Post-questionnaire

In this questionnaire we ask you to give us some general information about yourself. After carefully reading each section, we ask you to answer by writing an "x" in the appropriate box. Please, answer all the questions.

Thank you for participating!

General information:

1. Date of birth:

2. Gender: a) Male: ☐ b) Female: ☐

3. School and Degree that you study at the university:

School:……

Degree:……

4. What is the zip code of your parents' house?

5 . If Juan can drink a barrel of water in 6 days and Maria can drink a barrel in 12 days, how long do they need to drink a barrel between the two of them?

6. Juan receives the fifteenth highest grade in his class and at the same time the fifteenth lowest grade in his class. How many students are there in class?

7. A man buys a pig for € 60, sells it for € 70, buys it again for € 80, and finally sells it for € 90. How much money has he made?

8. Simon decides to invest € 8,000 in shares one day at the beginning of 2018. Six months after investing, on July 17, the shares he bought decrease in value by 50%. Fortunately, from July

17 to October 17, the shares you have purchased increase in value by 75%. At this moment, Simon

a. did not win or lose anything in the stocks market,

b. his shares have a higher value tan when he started,

c. he lost money (his shares lost value)

9. Imagine that you are participating in a program in which you have to decide how many boxes to open out of a total of 100 numbered boxes. All boxes contain € 10 except one that has € 0. You do not know where the box with no money is, only that it can be in any of the 100 boxes with the same probability. The boxes are opened in numerical order. If, for example, you decide to open 20 boxes, the boxes ranging from 1 to 20 will be opened; If, for example, you decide to open 57, all the boxes between 1 and 57 will be collected.

How many boxes would you decide to open in this situation?

10.- What do you think is the appropriate salary for a worker? (Remind that it must be a number between 0 and 390):

11.- If you have participated in the experiment as a company and you have chosen different salaries for your two workers in the same period, why have you done it? (If you have not been a company, please write "I am a worker").

12.- If you have participated in the experiment as a worker, what is the minimum wage you would be willing to accept? (If you have not been a worker, please write “I am a company”).

13.- Do you think it is difficult for you to recognize your mistakes?

Yes

No

Appendix B: Theory Proofs

Proof of Proposition 1: The firm's optimal decision is to offer the low wage if $(M - w_m^L)q \geq M - w_m^H$; otherwise, she will offer the high wage. Thus, $w_o^{BASE} = \begin{cases} w_{m,L} & if \quad q \geq T \\ w_{m,H} & if \quad q < T \end{cases}$. The rest of the Proposition follows immediately from this.

■

Proof of Proposition 2: Applying Bayes rule we can compute the firm's belief that the worker is low type given the prior (q) and the observation that his proposal was high:

$$\hat{q}^{PRO} \coloneqq P\left(w_{m,L} \middle| w_p = w_{m,H}\right) = \frac{P\left(w_p = w_{m,H} \middle| w_{m,L}\right)}{P(w_p = w_{m,H})} q$$

where $P\left(w_p = w_{m,H} \middle| w_{m,L}\right) = (1 - \lambda)$ and $P\left(w_p = w_{m,H}\right) = 1 - q\lambda$

Therefore, when observing a high proposal, the firm's optimal decision is to offer a low wage if $(M - w_m^L)\hat{q}^{PRO} \geq M - w_m^H$; otherwise, she will offer a high wage. Thus, if we denote by $\widetilde{w}_o^{PRO}$ to be the optimal wage when observing a high proposal, we get $\widetilde{w}_o^{PRO} = \begin{cases} w_{m,L} & if \quad \hat{q}^{PRO} \geq T \\ w_{m,H} & if \ \hat{q}^{PRO} < T \end{cases}$

And because the firm always matches the proposal of the low type (which is fully revealing), the optimal firm's policy is:

$$w_o^{PRO} = \begin{cases} w_{m,L} & if \quad w_p = w_{m,L} \\ \widetilde{w}_o^{PRO} & if \quad w_p = w_{m,H} \end{cases}$$

The rest of the proposition follows immediately from this.

■

Proof of Corollary 1: First note that $\hat{q}^{PRO} < q$ and hence, when comparing PRO and BASE there are three possible cases:

(i) $T \leq \hat{q}^{PRO}$

In this case, $\widetilde{w}_o^{PRO} = w_o^{BASE} = w_{m,L}$ which means that, regardless of proposals, wage offers are the same in both cases, $w_o^{PRO} = w_o^{PRO} = w_{m,L}$, and this leads to the same firms profits $\Pi_F^{PRO} = \Pi_F^{BASE}$; workers income $\Pi_W^{PRO} = \Pi_W^{BASE}$ and acceptance rates $r^{PRO} = r^{BASE} = q$.

(ii) $T > q$

In this case, $\widetilde{w}_o^{PRO} = w_o^{BASE} = w_{m,H}$. Therefore, expected firm's profits are:

$$\Pi_F^{PRO} = q\lambda\big(M - w_{m,L}\big) + (1 - q\lambda)\big(M - w_{m,H}\big) = M - w_{m,H} + q\lambda\big(w_{m,H} - w_{m,L}\big) > \Pi_F^{BASE} = M - w_{m,H}$$

Expected worker's incomes are:

$$\Pi_W^{PRO} = q\lambda w_{m,L} + (1 - q\lambda)w_{m,H} = w_{m,H} - q\lambda\big(w_{m,H} - w_{m,L}\big) > \Pi_W^{BASE} = w_{m,H}$$

And acceptance rates are: $r^{PRO} = r^{BASE} = 1$

(iii) $T \in (\hat{q}^{PRO}, q]$

In this case, $\widetilde{w}_o^{PRO} = w_{m,H} > w_o^{BASE} = w_{m,L}$. Therefore, firm's profits in PRO are (see case ii): $\Pi_F^{PRO} = M - w_{m,H} + q\lambda\big(w_{m,H} - w_{m,L}\big)$ while expected firm's profits in BASE are: $\Pi_F^{BASE} = q(M - w_{m,L})$ where $\Pi_F^{PRO} > \Pi_F^{BASE}$ iff $M(1-q) > w_{m,H}(1 - q\lambda) - qw_{m,L}(1 - \lambda)$. Note that for this condition not to hold $w_{m,H}$ should be relatively close to M (i.e., M sufficiently low) in which case $T > q$ and hence condition (iii) would not hold.

Expected worker's incomes are: $\Pi_W^{PRO} = w_{m,H} - q\lambda\big(w_{m,H} - w_{m,L}\big) > \Pi_W^{BASE} = qw_{m,L}$

And acceptance rate are: $r^{PRO} = 1 > q = r^{BASE}$

■

Proof of Corollary 2: It follows immediately from Corollary 1 and the arguments in the text.

■

Appendix C: Robustness check for PUB

Table C1: RE GLS regressions on workers' and firms' profits, efficiency

	BASE and PUB	BASE and PUB	BASE and PUB
	(1) workers	(2) firms	(3) efficiency
Female	13.277**	-18.938	-0.049
	(6.039)	(16.646)	(0.040)
Risk lover	-	4.453	-0.003
		(8.073)	(0.020)
Self-reported	0.106**	-0.204	0.0002
Fair-wage	(0.045)	(0.142)	(0.0003)
High income	6.426	15.630	0.040
	(6.183)	(15.738)	(0.040)
Period	1.371***	2.156*	0.006**
	(0.399)	(1.245)	(0.003)
BASE	-17.435***	-50.638***	-0.111***
	(5.687)	(15.711)	(0.04)
Constant	90.947***	08.203***	0.766***
	(10.126)	(29.833)	(0.072)
R-squared	0.211	0.285	0.192
Observations	1470	735	735

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table C2: RE GLS on the distance between workers' earnings and average earnings of all workers; and the distance between average earnings of all workers and firms in a treatment.

	Only workers	**Workers and firms**
	(1) BASE and PUB	(2) BASE and PUB
Female	-7.117**	-13.280**
	(3.494)	(6.039)
High income	0.874	-6.426
	(3.414)	(6.183)
Self-reported fair wage	0.070** (0.029)	0.106** (0.045)
Period	-1.172***	-1.371***
	(0.269)	(0.399)
BASE	11.68***	-74.110***
	(3.222)	(5.687)
Constant	38.39***	567.70***
	(7.065)	(10.13)
R-squared	0.278	0.200
Observations	1,156	1,470

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1