Who gains from competition? The ultimatum game in a labour market setting in Ghana

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Abstract

Who benefits from introducing competition in the setting of an ultimatum game? We introduce a multiplayer version of the ultimatum game to subjects in Accra, Ghana, framed in a labour market setting. In this version three Proposers (employers) can make offers to three Responders (workers) at the same time. Subjects also participate in a treatment without competition. In this treatment one Proposer faces one Responder, just as in the classical ultimatum game. Even though in the competition treatment the number of Responders and Proposers is equal, we find some evidence that the amounts proposed increase in the treatment with competition. A potential explanation for this are bidding effects, where Proposers bid offensively for the Responders with lower reservation payoffs, to increase their chances of having this Responder accept their offer. This bidding increases the amounts that Proposers propose to give to the Responders. This is in particular beneficial to the Responders, who now capture a larger share of the surplus.

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1 Introduction

Understanding how labour market institutions function is crucial for economic development. Developing countries have traditionally relied on other forms of employment than wage employment, such as being an own account worker or a contributing to the family firm. In these types of work, the profits from labour are not divided, because the worker is either self-employed or part of the family. Wage employment is different, as this requires an explicit transfer to the worker, who is often outside the household. Furthermore, competition plays a role in the recruitment and contracting of labour: there is competition between workers for a job, but also competition between employers for a specific worker. In this paper we use experimental methods to assess how the profits from labour are shared by the worker and the employer, in a developing country setting. Furthermore, we look at how competition affects how the profits from labour are shared.

The process of contracting a worker is often close to ultimatum bargaining: the employer specifies a job description and proposes a wage and the worker accepts or rejects.[2] To examine ultimatum bargaining behaviour, we invited students from colleges and universities in Ghana to play a labour-market version of the ultimatum game. In the ultimatum game, proposed by Güth et al. (1983), there are two players: the Proposer and the Responder. To receive a sum of money, they need to agree on the division of this. The Proposer proposes a division, which the Responder can accept or reject. If the Responder accepts the proposed division, the players receive their share according to the proposed split. If the Responder rejects the division, both players earn nothing.

Under the assumption that participants are rational and maximize their own payoffs, subgame perfect equilibrium predicts that a Proposer offers the smallest amount possible to the Responder and that the Responder accepts any amount that is larger than zero. However, a wide range of studies, conducted both in developed and developing countries, have shown

[2]Depending on the profession and the labour market situation, some bargaining over the wage or the job description might take place. The ultimatum game does not allow for this type of negotiation. Often, the resulting bargain is not drastically different from the initial wage offer made by the employer.

that a large share of the Proposers propose a payment that is significantly larger than zero and that a large share of Responders reject small but positive payments (see e.g. Güth & Tietz, 1990; Roth et al., 1991; Cardenas & Carpenter, 2008; Henrich et al., 2006).

Our labour market version of the ultimatum game uses different wording, but is in payoffs equivalent to the ultimatum game: the Proposer is framed as the employer and the Responder as the worker. The purpose of framing is to trigger heuristics associated with labour market behaviour in the studied country. Instead of making a proposal for the division of the money received, the employer makes a wage offer to the worker, specifying a wage and a level of effort from the worker. The wage and effort level in the offer determine the payoffs of both parties, if it is accepted: the employer's payoff is equal to a profit that is increasing with worker effort minus the wage, and the worker's payoff is equal to the wage minus a cost that is increasing with effort. It is common knowledge how the wage and the level of effort translate into the final payoffs of both parties in that period.

The participants of our study are students from universities and colleges in Accra, the capital of Ghana. Like in many developing countries, the Ghanaian labour market is characterized by a large presence of the informal sector and the share of wage employment in total employment is low: in 2012-13 20.2 percent of the working population throughout the country and 32.5 percent of the working population in urban areas was wage employed (Ghana Statistical Service, 2014). The rest of the working population is mostly either an own account worker (46.4 percent), a contributing family worker (22.3 percent) or an employer (6.2 percent). Even though the share is still low, the share of wage employment in total employment has been growing: in 2005-06 only 16.4 percent of the working population in Ghana was wage employed (Ghana Statistical Service, 2008). Urbanization, the growth of the economy and the growth of the service sector play a role over here: the number of jobs in agriculture has declined, while the service sector has become more important. The service sector now accounts for 40.9 percent of employment, while this was only 26.4 percent in 2005-06.

Next, we introduce competition in our ultimatum game. Instead of one employer facing one worker, three employers face three workers at the same time. The workers take turns in accepting or rejecting their offer. Workers can only accept one offer and employers can only have one offer of them accepted. We predict that this form of competition increases the offer made by the employers above the bare minimum of what the worker would except, even if employers do not have any fairness considerations. We find empirical evidence for this: the employers make offers that lead to higher workers' payoffs in the treatment with competition and the workers capture a larger share of surplus. This shows that even though the number of employers and workers is equal, this competition structure affects the final outcomes.

This paper is organized as follows: Section 2 presents the experimental design and introduces the competition treatment. Section 3 discusses the actual implementation in Accra. Section 4 formulates predictions on the basis of economic theories. Section 5 presents the results and relates this to the predictions. Finally, Section 6 concludes and provides a discussion of the main results.

2 Experimental design

Each participant was randomly assigned the role of a Proposer (employer) or of a Responder (worker) for the entire duration of the experiment. Each period consisted of three stages: an offering stage, in which the Proposers made offers to the Responders, an acceptance stage, in which the Responders could choose to accept or reject their offer, and a recontracting stage, in which the Proposer could make an offer for the next period and the Responder could indicate the minimum payment required for acceptance of this offer.

As mentioned earlier, the experiment is framed in labour market language. In each period, the Proposers, as the employers, are given the opportunity to offer a contract to the Responders, specifying a wage w and a level of effort e. There are three levels of effort: high, medium or low. The combination of the wage and the effort level determines the payoff of the Proposer and the Responder if the contract is expected. For the Proposer (employer), the payoff from

Table 1: The payoff parameters used in the experiment.

Effort level e	low (e_L)	medium (e_M)	high (e_H)
Benefit to Proposer (employer) $\Pi(e)$	5	20	40
Cost to Responder (worker) $c(e)$	0	2	6
Surplus $S(e) = \Pi(e) - c(e)$	5	18	34

Note. The payoff of the Proposer (employer) is equal to $x_P = \Pi(e) - w$ and the payoff of the Responder (worker) is equal to $x_R = w - c(e)$. The surplus is equal to the sum of the payoffs of both parties. One point is equal to 0.05 Ghana cedis (which equals approximately USD $0.02 at the time of the experiment).

contracting is given by

$$x_P = \pi(e) - w, \tag{1}$$

where $\pi(e)$ is the benefit that the employer gets from the worker exerting an effort level e and w the wage. For the Responder (worker), the payoff from contracting is given by

$$x_R = w - c(e), \tag{2}$$

where $c(e)$ is the worker's cost of effort. Table 1 shows the values of $\pi(e)$ and $c(e)$ for the three effort levels. Both $\pi(e)$ and $c(e)$ are increasing in the level of effort: a higher level of effort is more costly to the worker, but also more beneficial to the employer.

The payoff structure is similar to the payoff structures in gift-exchange games (Brown et al., 2004, 2012; Charness & Haruvy, 2002; Charness et al., 2004; Davies & Fafchamps, 2015b,a), but with the main difference that the workers cannot choose the level of effort: after accepting they have to exert the effort level demanded by the employer.[3] By specifying the wage and the effort level, the employer exactly determines the payoffs of both parties, provided that the worker accepts the offer. In this way, the experiment is monetarily equivalent to the traditional ultimatum game, with the level of effort e determining the total size of the "pie" and the wage w representing its division.

We have two treatments: treatment (1-1) without competition and treatment (3-3) with

[3]Some of these papers include a treatment where workers or responders have no effort choice, such as the (C) treatment in Brown et al. (2004) and Brown et al. (2012) and the (1C) treatment in Davies & Fafchamps (2015b) and Davies & Fafchamps (2015a).

competition. In the (1-1) treatment the market consists of one Proposer and one Responder. They face the same contracting partner for five periods. In the (3-3) treatment the market consists of three Proposers and three Responders, who remain in the same market for five periods. Each Proposer can simultaneously make offers to the three Responders in her market. Similarly, each Responder can receive offers from three Proposers, but only can accept one. The Responders take turns to either select an offer or reject all available offers. The Responders' choosing order is randomized every period. Each participant can only contract once every period, so if one Responder has accepted an offer from one Proposer, the offers from this Proposer are no longer available to the Responders choosing after this Responder.

In the (3-3) treatment, we show the Proposers what offers were made by the other two Proposers in their market. Next, we offer them a chance to revise their offers before they are sent to the Responders. These revised offers are not shown to the other Proposers.[4] In the (1-1) treatment, no additional information is shown, but Proposers are still allowed to make a revision.

Furthermore, we introduce a rehiring mechanism, to elicit the minimum wage that the Responder requires in order to accept the offer. This mechanism works as follows: after the Responder accepts the offer and the payoffs are realized, the Responder is asked which minimum wage he or she requires in the next round from the Proposer. Similarly, the Proposer is asked to make an offer to this particular Responder. If the offer of the Proposer is higher than the minimum required payment, the Responder automatically accepts the offer of the Proposer in the next period.[5]

3 Implementation

The experimental sessions took place in Accra, the capital of Ghana, in September 2015. The participants were recruited from local universities and colleges. Most of the participants were

[4]Note that if Proposers do not want to share their offers with the other Proposers, they can wait with making their offers until they are offered to revise their offers.

[5]This provides a way for Proposers and Responders to develop a bilateral relationship, even in the (3-3) treatment. In the (1-1) treatment, this rehiring mechanism leads to a contract in 13.6% of the Proposer-Responder pairs. In the (3-3) treatment, this leads to a contract for 11.7% of Proposers.

Table 2: Participant's characteristics.

	Frequency	Percentage
Gender		
Female	44	29.73
Male	104	70.27
Type of school		
Polytechnic	19	12.84
University	95	64.19
Teacher education	3	2.03
Other	9	6.09
Not enrolled	14	9.46
Not specified	8	5.41
Area of studies		
Economics, business & accounting	44	29.73
Political science	7	4.73
Other social sciences	36	24.32
Computer sciences	12	8.11
Science, engineering and technical degrees	12	8.11
Arts & languages	9	6.09
Other	7	4.73
No subject area	11	7.43
Not given	10	6.76
At least one parent is entrepreneur		
Yes	87	58.78
No	54	36.49
Not specified	7	4.73
Total	148	100.00
Average age (years)	22.2	

Table 3: The treatment sequencing and the number of participants.

Treatment sequence	Game 1 (5 periods)	Game 2 (5 periods)	Number of participants
I	(1-1)	(1-1)	28
II	(1-1)	(3-3)	120
Total			148

social science students and more than half of the participants had at least one parent who was an entrepreneur. Table 2 shows some summary statistics on the participants of the project. The experiment was conducted in English, which is the main language of instruction at Ghanaian universities and colleges. The subjects were paid in cash at the end of the experiment, based on the number of points they accumulated over the periods in the game, excluding the practice periods. As an incentive, we handed out a 10 Ghana cedis bonus to participants who showed up on time. Besides this, we gave the participants an initial allocation of points at the beginning of each game. The average earnings in each session was around 25-30 Ghana cedis (including the on time bonus), which is equivalent to about 15 US dollars.

Each participant played two games of five periods. The participants played the games in two different sequences of treatments: 28 participants played the (1-1) treatment for two games of five periods, while the other 120 played the (1-1) treatment in the first game and then the (3-3) treatment in the second game (see also Table 3). Between the games, Proposers and Responders were randomly rematched.

Both oral as well as on-screen instructions were given to explain the game. All participants played the game for two practice periods to increase familiarity of the game. No points could be earned or lost during these practice periods. Making offers was made as easy as possible: Proposers had to use a slider to select a wage. Furthermore, we facilitated the calculations of the payoffs by showing the participants bar charts of what they and their contracting partner would earn. These bar charts were updated interactively when the participants changed their choices.

4 Predictions

In the one-to-one classical ultimatum game, under the assumption that players only care about their own monetary payoffs, subgame perfect equilbirium predicts that the Proposer offers the smallest nonnegative amount possible, and that the Proposer accepts any offer where he or she receives a nonnegative amount. However, in practice, many studies of the ultimatum game have shown that a substantial share of Responders reject low positive offers and that a substantial share of Proposers proposes an offer that is significantly higher than zero.

Fehr & Schmidt (1999) suggest players do not only have preferences over their own payoffs, but also over how their own payoffs compare to the payoff of the other players. They introduce an utility function in which there is a disutility from having a higher or lower payoff than another agent. In the case of our ultimatum game, the Fehr-Schmidt utility function for the Responder can be expressed as follows:

$$U_R(x_R, x_P) = x_R - \alpha_R \max\{x_P - x_R, 0\} - \beta_R \max\{x_R - x_P, 0\}. \tag{3}$$

In this equation x_R is the (monetary) payoff of the Responder, x_P the (monetary) payoff of the Proposer. The coefficients α_R and β_R represent the degree of inequality aversion: α_R represents the disutility from having a lower payoff than the other player (disadvantageous inequality) and β_R represents the disutility of having a higher payoff than the other player (advantageous inequality).

When α_R is positive, Responders will reject positive low offers if the disutility from receiving less than the other player is larger than the utility from the payoff. Suppose that $x_R < x_P$, i.e. the Responder's payoff is less than the Proposer's payoff, so the inequality is disadvantageous for the Responder. In the subgame perfect equilibrium, the Responder will accept if and only if the utility of accepting is higher or just as high as the utility of rejecting:

$$x_R - \alpha_R (x_P - x_R) \geq 0. \tag{4}$$

This implies that in order for the Responder to accept we need that

$$\frac{x_R}{x_P - x_R} \geq \alpha_R. \tag{5}$$

The higher the value of α_R, the higher the threshold $\frac{x_R}{x_P - x_R}$ is for the Responder to accept the offer.[6] Only when $\alpha_R = 0$, the Responder will accept all positive relatively disadvantageous offers, because the fraction $\frac{x_R}{x_P - x_R}$ on the left hand side of the equation is always larger than zero, so the condition for acceptance is always satisfied. Unless β_R is very large, it is unlikely that a Responder will reject relatively advantageous offers (i.e., when $x_P > x_R$).[7]

In our setup, $x_R = w - c(e)$ and $x_P = \pi(e) - w$, which implies that a disadvantageous offer will be accepted if

$$\frac{w - c(e)}{\pi(e) - 2w + c(e)} \geq \alpha_R$$

The left hand side is an increasing function in w as long as $\pi(e) > c(e)$, which is the case with our set of parameters (see Table 1). This implies that for the Responder there is a threshold level $\bar{w}_R(e)$ above which the Responder will accept the offer and below which the Responder will reject the offer. Proposers will always demand the highest level of effort, as such offers Pareto dominate offers asking for lower levels of effort: for each low effort offer that is accepted, the Proposer could come up with a high effort offer that gives both parties a higher utility, even when taking inequity aversion preferences into account.[8]

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[6] Note that if $x_R < x_P$ and $x_P > 0$ this function is increasing in x_R, since

$$\frac{d}{dx}\frac{x_R}{x_P - x_R} = \frac{x_P}{(x_R - x_P)^2} > 0.$$

[7] If the Responder rejects the offer, this means that the Responder cares so much about the inequality that is to the disadvantage of the Proposer that they are willing to reject the division proposed by the Proposer, such that both of them receive a payoff of zero and achieve full equality. For example, for a sufficient high value of $beta_R$, the Responder would reject a division of 39 points to the Responder and 1 to the Proposer, because of the inequality in payoffs. This is not very likely. Rejection of offers like these is not widely documented in studies like these. Charness & Haruvy (2002) notes that therefore in the ultimatum game only a meaningful estimation of α can be achieved. In the Fehr-Schmidt model β is bounded at 1, which rules out rejection of such offers as long as both payoffs are positive.

[8] Suppose that a Responder accepts an offer asking for medium effort, with payoffs $\tilde{x}_P$ and $\tilde{x}_R$. This means that $\frac{\tilde{x}_R}{\tilde{x}_P - \tilde{x}_R} \geq \alpha_R$ in order for the Responder to have accepted this offer (see equation (5)). The total surplus of this transaction was $\tilde{x}_P + \tilde{x}_R = 18$ points. If the Proposer demanded high effort (with a surplus of 34 points) instead of medium effort, and divided the difference in surplus of 16 points equally between the Responder and Proposer

The optimal contract for a purely self-interested Proposer is a contract asking for high effort and offering the threshold wage of the Responder. The wage offered could be higher in case the Proposer has strong preferences against inequality (e.g., a high β in the Fehr-Schmidt model). The value of α_R can vary between the various Responders, and therefore threshold wages will vary as well. Uncertainty about threshold wages could also increase the offers, depending on the Proposer's level of risk aversion.

Competition can increase the threshold wages as well, as Proposers will want to compete for the Responders with a low threshold wage. Assume that the threshold levels $\bar{w}_i(e)$ are public knowledge. In our treatment with competition the Proposer can make offers to three Responders, who then in a randomly determined sequence can choose to accept or reject the offer. Without competition from other Proposers, a Proposer would offer each Responder their threshold wage. The Proposer achieves the maximum payoff x_{max} if the worker with the lowest threshold wage accepts and the minimum payoff x_{min} if the worker with the highest threshold wage accepts.

The number of offers available to a Responder depends on their position in the choosing sequence: assuming all Proposers made offers to all Responders, the first Responder in the sequence will have three offers available, while the last Responder might only have one offer available. As long as the first two Responders in the choosing sequence accepted their offers, the third Responder will face only one offer, and will accept this offer if it is above his threshold wage. In this case, a Proposer can ensure a minimum payoff of x_{min} by offering all workers their threshold wages. The minimum payoff of x_{min} will be achieved if the third Responder is the Responder with the highest threshold wage. Offering a higher wage than the threshold wage to the Responder with the highest threshold wage does not make sense: if this Responder is the third one choosing, he would have accepted a lower offer, and if this Responder is the first or second one choosing, the Proposer is actually better off if the Responder does not accept

(such that $x_P = \tilde{x}_P + 8$ and $x_R = \tilde{x}_R + 8$, the Responder would have accepted this offer as well, since

$$\frac{\tilde{x}_R + 8}{(\tilde{x}_P + 8) - (\tilde{x}_R + 8)} = \frac{\tilde{x}_R + 8}{\tilde{x}_P - \tilde{x}_R} > \frac{\tilde{x}_R}{\tilde{x}_P - \tilde{x}_R} \geq \alpha_R.$$

This high effort offer Pareto dominates the corresponding medium offer.

Table 4: Average offered wages, corresponding payoffs and surplus, the share of offers accepted and the realized payoffs and surplus

	Average wage offered	Average corresponding payoffs (share of surplus)		Average corresponding surplus	Share of offers accepted	Average realized payoffs (share of surplus)		Average realized surplus
		Responder	Proposer			Responder	Proposer	
(1-1) Game 1	20.5	15.9 (69%)	12.5 (31%)	28.4	81.3%	13.4 (77%)	8.7 (23%)	22.1
(1-1) Game 2	20.0	14.4 (46%)	17.8 (54%)	32.2	75.7%	10.7 (46%)	13.9 (54%)	24.6
(3-3) Game 2	20.4	15.6 (64%)	13.1 (36%)	28.8	35.9%* (90.3%)**	15.6 (57%)	11.5 (43%)	27.1

Note. Surplus is equal to the sum of the Responder's payoff (x_R) and the Proposer's payoff (x_P), and depends on the effort level demanded (see Table 1). The percentages in the parentheses show the share of the payoffs as a share of the surplus. The share of offers accepted is reported as a share of all offers made, and does not include cases where the Proposer did not make an offer to a particular worker.[9] The realized payoffs and surplus figures are averaged over all Proposers and Responders and includes Proposers and Responders without a contract (and therefore a zero payoff). The amounts are reported in "points". One point is equal to 0.05 Ghana cedis (which equals approximately USD $0.02 at the time of the experiment). * This figure represent the acceptance rate of an offer, given that the offer was presented to the Responder. By construction, when Proposers make multiple offers, this figure cannot be 100%, as Responders that receive multiple offers automatically reject the offers they do not accept. ** This figure represents the share of Responders accepting one of the offers presented to them, or equivalently, the share of Proposers who have one of their offers accepted.

her offer, but that of another Proposer, so that your offer to the next Responder, with a lower threshold wage, is still available.

However, for the Responders with lower threshold wages the Proposers have an incentive to increase the wage: in this way it is more likely that this Responder accepts their offer, and not the offer of another Proposer. This bidding for these Responders by the Proposers will increase the wage levels up to the threshold wage level of the Responder with the highest threshold wage. In this way, the strategic interaction between Proposers will lead to both a higher wages (at least if there was heterogeneity in threshold wages) and wage convergence.

5 Results

This section focuses on the proposed division of surplus by the Proposer, the acceptance behaviour of the Responder and finally the final distribution of the surplus.

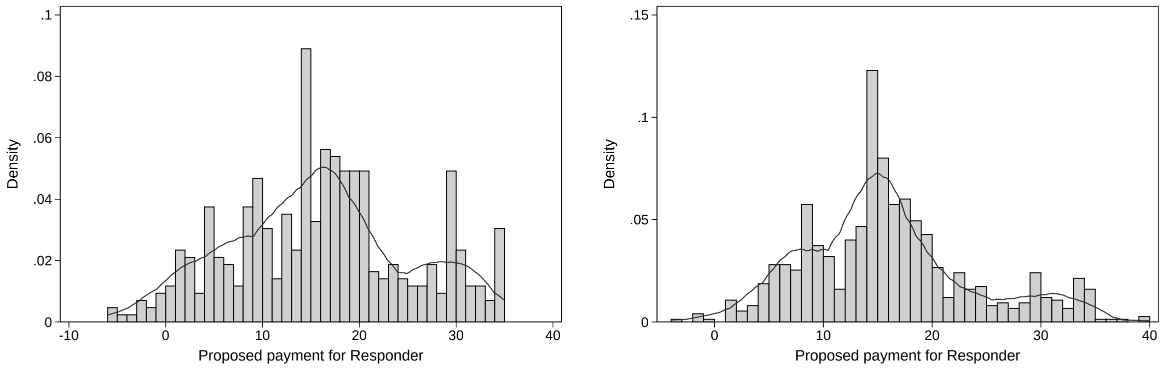

Figure 1: The Responder's payoffs corresponding to the proposed offers in the (1-1) treatment (left) and the (3-3) treatment (right). The figure on the left includes data from all periods in both game 1 and 2 (both games of five periods), while the figure on the right only includes data from all periods in game 2 (the (3-3) treatment was only conducted in game 2). The solid line represents a kernel density estimate using an Epanechnikov kernel function.

5.1 Proposals

The first three columns in Table 4 show the average wage offers and the payoffs for the Responder and the Proposer corresponding to the offered contracts. To facilitate comparisons with results from other ultimatum games, instead of focusing on the wage, we will mainly focus on the Responder's payoff corresponding to the wage and effort level of the proposed contract, x_R, as this parallels the "proposed amount" in the traditional ultimatum game. As mentioned earlier, the payoffs of the Responders and Proposers depend directly on the wage and effort level specified in the contract (see Equations (1) and (2)), and both the Responders and the Proposers are made aware of the corresponding payoffs while making an offer or accepting an offer.

In the (1-1) treatment, the average Responder's payoff corresponding to the proposed wage is 15.9 in game 1 and 14.4 in game 2. In the (3-3) treatment, which is only played as game 2, the average corresponding Responder's payoff is 15.6. Figure 1 shows the distribution of the Responder's corresponding payoff in the two treatments. It is clear that in both treatments, most Proposers offer a wage that corresponds to a Responder's payoff that is strictly higher than the bare minimum amount predicted by the "classical" subgame perfect equilibrium. In fact, for game 1 of treatment (1-1) and for game 2 of treatment (3-3) the offered contracts correspond to a division of surplus in which the Responder receives more than half of the surplus: the offers correspond to the Responder receiving respectively 69% and 64% of surplus. In game 2 of treatment (1-1) this share is lower, at 46%.

A t-test shows that the average Responder's payoffs corresponding to the offered contracts are not significantly different from each other.[10] Furthermore, the non-parametric Kolmogorov-Smirnov equality-of-distributions test shows that there is no significant difference in the distribution of proposed payoffs for the Responders between the (1-1) treatment in game 1 and the (3-3) treatment in game 2 (p-value: 0.116). However, the difference between the (1-1) treatment in game 2 and the (3-3) treatment in game 2 is significant at a 10% level (p-value: 0.054).

Proposers can refrain from making offers, but rarely do so in the (1-1) treatment: this only happens in 3.0% of the cases in game 1 and never in game 2. In game 1 the number of non-offers decreases over time: in periods 2 to 5, there are only one or two Proposers each period not making an offer. In the (3-3) treatment, where Proposers can make separate offers to three Responders, the number of non-offers is considerably higher, at 10.8%.[11] However, in practice, it is rare for a Responder to not receive a single offer at all during a trading period: this happened in 1.33 % of the cases.

Table 5 shows fixed effects reduced-form regression estimates of the treatment effect on the proposed payment. Regression (1) shows the treatment effect, without accounting for the sequencing of the treatments (the (3-3) treatment is only played as the second game, see Table 3). The estimate is positive but not significantly different from zero (p-value: 0.664).

Regression (2) includes an indicator variable to control for the sequencing of the treatments. The coefficient for the treatment effect is positive and significant at a 5% significance level. The coefficient for being in the second game is negative and significant as well. This indicates that, without competition, proposed payments in the second game tend to be lower. However, introducing competition cancels this decrease and is associated with higher proposed payments by the Proposer: on average the proposed contribution is 3.0 points higher. Including indica-

[10] The p-value of the difference between (1-1) in game 1 and (3-3) in game 2 is 0.603 and the p-value of the difference between (1-1) in game 2 and (3-3) in game 2 is 0.209.

[11] Every instance when a Proposer could have made an offer to a particular Responder, but did not do so, is counted as a non-offer.

Table 5: Reduced-form estimates of the proposed Responder's Payoff.

Dependent variable: Proposed Responder's payoff (x_R)	(1)	(2)	(3)
Competition (3-3)	0.241	2.979**	2.977**
	(0.544)	(1.057)	(1.056)
Second game		-2.738**	-2.721**
		(0.944)	(0.938)
Period 2			0.752
			(0.502)
Period 3			0.620
			(0.496)
Period 4			0.574
			(0.495)
Period 5			-0.178
			(0.640)
Constant	15.48*	15.64*	15.28*
	(0.476)	(0.458)	(0.683)
Observations	1176	1176	1176
R-squared	0.642	0.645	0.647
Adj. R-squared	0.617	0.621	0.621
Proposer fixed effects	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, * $p < 0.01$

Note. The dependent variable is the Responder's payoff corresponding to the proposed wage and effort level. "Competition (3-3)" is an indicator variable indicating whether the observation was in the competition treatment (3-3). "Second game" indicates that this observation was from the second game (i.e. the second set of five periods), see also Table 3. "Period 2-5" indicates the period within the game. The robust standard errors are clustered at the session-game level.

Table 6: Linear probability model of acceptance.

Dependent variable: Acceptance of offer by Proposer	**Panel A:** All offers in treatment (1-1)		**Panel B:** All offers in treatment (1-1) and sole remaining offers in (3-3)	
	(1)	(2)	(3)	(4)
Proposed payoff	0.0161***	0.0192***	0.0146***	0.0160***
	(0.00247)	(0.00207)	(0.00241)	(0.00303)
Proposed payoff × Game 2		-0.0142*		-0.0117
		(0.00653)		(0.00715)
Proposed payoff × Competition (3-3)				0.0128
				(0.00951)
Competition (3-3)			0.0152	-0.172
			(0.0476)	(0.130)
Game 2	0.0285	0.246***	0.0215	0.196**
	(0.0591)	(0.0622)	(0.0547)	(0.0823)
Constant	0.549***	0.498***	0.581***	0.559***
	(0.0495)	(0.0393)	(0.0461)	(0.0535)
Fixed effects	Yes	Yes	Yes	Yes
Observations	427	427	551	551
R-squared	0.323	0.333	0.301	0.307
Adj. R-squared	0.178	0.188	0.189	0.193

Standard errors in parentheses
$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Note. The dependent variable is a binary variable whether the offer is accepted (1 = accepted, 0 = rejected). Panel A includes observations from treatment (1-1) only, while panel B also includes acceptance decisions from treatment (3-3) where only one offer was available to the Responder ("sole remaining offers"). The "proposed payoff" is the Responder's payoff corresponding to the wage and effort level offered in the proposed contract. "Competition" is an indicator variable indicating the (3-3) treatment. "Game 2" is an indicator variable indicating the second set of five periods. The robust standard errors are clustered at the session-game level.

tors for the period of the game, as is done in Regression (3), does not change these coefficients. These indicators are not significantly different from zero, which suggests that there are no strong time trends within the game periods.

5.2 Acceptances

The fifth column in Table 4 shows the share of offers that were accepted in each treatment and game. The acceptance rate in the (1-1) treatments in game 1 and game 2 are respectively 79% and 76%, which means that 21% and 24% of the offers are rejected. In the (3-3) treatment, Responders could choose offers from multiple Proposers, which means that the acceptance rate for a particular offer is lower, at 36%, as they automatically rejected the offers from Proposers they did not choose. However, the share of Responders that accepted any offer in a given period is higher, at 90%, and this figure is significantly higher than in the (1-1) treatments (the p-values of the t-test of the difference of the means are 0.0001 and 0.0008 for treatment (1-1) in respectively game 1 and 2). Competition therefore leads to a higher number of contracts.

There is a positive and significant correlation between the Responder's payoff corresponding to the proposed offer and acceptance of the offer. Table 6 shows a linear probability model regression of acceptance on the proposed Responder's payoff. From regression (1) we can see that in the (1-1) treatment an increase in the proposed payoff is, on average, associated with an increase in probability of 1.61 % of accepting the offer. In regression (2) we control for the sequencing of the treatments, by including an indicator variable for game 2 as well as the interaction between the proposed payoff and whether the observation is from game 2. In regressions (3) and (4) we also include observations from the (3-3) treatment, but we exclude observations where Responders had to choose from more than one offer.[12] Again, we find a positive correlation between the proposed Responder's payoff and the acceptance of the offer.

5.3 Surplus

The next question is: who captures the benefits from competition? In principle, both employers and workers could benefit from competition, at least if competition leads to more workers accepting offers, which is beneficial to the employers as well.

The last columns in Table 4 show the actual realized payoffs and total surplus. We see that the game 2 (3-3) treatment is associated with the highest realized surplus.[13] This is primarily due to a higher rate of offer acceptance by Responders. In game 2, responders fare better in the treatment with competition: in the game 2 (3-3) treatment they receive a higher share of the surplus than in the game 2 (1-1) treatment (57% against 46%) and a higher absolute payoff

[12] In the case that the Responder has more than one offer, the offer(s) that the Responder did not choose are rejected automatically, as the Responder can only choose one offer. To ensure comparability with treatment (1-1) we excluded these cases.

[13] Note that even though 90.3% of the Proposers have one of their offers accepted, the total surplus does not equal $0.903 \times 34 \approx 30.7$, with 34 the surplus associated with high effort. The main reason for this is that not all Proposers demand the highest level of effort.

Table 7: Reduced-form estimates of the treatment effects on the actual payoff of the Responder and the Proposer, and the total surplus (the sum of both payoffs).

	(1)	(2)	(3)
Dependent variable:	Payoff Responder	Payoff Proposer	Total surplus
Competition (3-3)	8.237*	-1.330	2.970
	(4.155)	(2.241)	(4.653)
Game 2	-5.457	4.357**	1.343
	(3.923)	(2.001)	(4.539)
Constant	13.43***	8.697***	22.13***
	(0.578)	(0.267)	(0.681)
Observations	740	740	740
R-squared	0.355	0.391	0.264
Adj. R-squared	0.282	0.322	0.181
Fixed effects	Responder	Proposer	Proposer

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note. "Competition (3-3)" is an indicator variable indicating whether the observation was in the competition treatment (3-3). "Game 2" indicates that this observation was from the second game (i.e. the second set of five periods), see also Table 3. Standard errors are clustered on the session-game level.

(15.6 against 10.7).

The absolute and relative earnings of the Proposers are higher in the two game 2 treatments than in game 1 (1-1). The process by which this is achieved differs, however. In the game 2 (1-1) treatment, Proposers lower their offers and demand higher levels of effort relative to game 1 (1-1). It appears that, in the no-competition case, Proposers learn to be more demanding, even though this tends to reduce the proportion of accepted offers. In contrast, in game 2 (3-3), offers are kept at the same level as in game 1 (1-1), but we observe an increase in the share of Responders that accept an offer. It therefore appears that Responders respond to increased competition by becoming more accommodating.

Table 7 shows the reduced-form estimates of the impact of the treatment on the payoff of the Responder, the payoff of the Proposer and the total surplus. Responder and Proposer fixed effects are included. The coefficient of the impact of the competition treatment (3-3) on the payoff of the Responder is positive, but only significant at the 10% level (p-value: 0.066). For the payoff of the Proposer, this coefficient is negative, but not significant at the 10% level (p-value: 0.562). For the total surplus, this coefficient is positive, but not significant at the 10% level (p-value: 0.533).

6 Conclusion and discussion

The institution of wage employment is less prevalent in Ghana than it is in developed countries: less than a quarter of the working population in Ghana is wage employed. We therefore expect differences in people's perceptions of wage employment. By framing our experiment explicitly in labour market terms, we encouraged our subjects to think of the ultimatum game in a wage employment context and to use the heuristics they considered as applicable in such a context.

We confirm the main earlier findings of the ultimatum game: Proposers make offers that are strictly higher than what rational utility maximizing theory would tell us. Earlier findings typically find that Proposer's propose a share of surplus between 40% to 50% to the Responders (Cardenas & Carpenter, 2008). An earlier ultimatum game experiment in Accra conducted by Henrich et al. (2006) with urban workers found a proposed Responder's share of 44%. In our experiment, the offers made by the Proposers correspond on average to a Responder's share of 69% in treatment (1-1) in game 1, of 46% in treatment (1-1) in game 2 and of 64% in treatment (3-3) in game 2. Apart from the value in treatment (1-1) in game 2, these values are higher than the values found by Henrich et al.

The theory tells us that introducing competition in the ultimatum game increases offers, as Proposes compete for the Responders with lower reservation wages. Besides this, winner's curse can increase offers: just feeling the pressure of competition might lead to overbidding, as participants care more about making sure they edge out their competitors than whether this is rationally the best bid. Auction studies have noted the prevalence of such winner's curses, in particular when competition is increased (Kagel & Levin, 1986).

We find some evidence that competition increases offers. This increase tilts the balance even more in favour of the Responders, who are now receiving a larger share of the surplus. However, at the same time, competition leads to a higher number of contracts being accepted, which increases total surplus. This means that on an aggregate level, competition is beneficial.[14]

It is a separate question what happens when there are competition effects resulting from excess demand or supply, for example when the number of Proposers or Responders are not equal to each other. In labour markets an excess or a shortage of labour supply, depending on the type of position and the required qualifications, is very well possible. Gift-exchange game experiments have shown that the market power resulting from excess demand or supply influences the division of surplus in favour of the side of the market with market power, but does not necessarily affect the size of the surplus and the principle of gift exchange (Brown et al., 2012; Brandts & Charness, 2004). In this paper we focus on the competition effects that arise due to moving away from bilateral one-to-one interactions to multilateral many-to-many interactions. To rule out market power considerations we have set the number of Proposers and Responders equal to each other.

We conjecture that the high offers by the employers in our experiment are influenced by our participant's perception of labour relations: for example, employers could feel that they have a responsibility towards the worker, while workers could see employers as in general better-off and are therefore less concerned about the employers' payoffs.

We find a similar result in a companion experiment to this experiment, where we let students in Accra play a gift-exchange game instead of an ultimatum game (Davies & Fafchamps, 2015b). The gift-exchange game is in its setup similar to our version of the ultimatum game, but it introduces contractual incompleteness on the side of the worker: the worker can now exert a lower effort than what the employer asked for and the employer cannot enforce this. Just like in other gift-exchange games (see e.g. Fehr et al., 1993, 1998b,a; Brown et al., 2004; Charness & Kuhn, 2011), the employers make offers that are above the bare minimum. We find a pattern of conditional reciprocity for a large share of the workers, who reciprocate a

[14] Competition should not be confused with market imbalance, which is a common occurrence in labour markets, e.g., too many or too few qualified applicants for the available positions. Our experiment is not designed to investigate the effect of market imbalance because gift-exchange experiments have already examined this issue. Excess demand or excess supply have indeed been shown to affect the division of surplus in favour of the short side of the market(Brown et al., 2012; Brandts & Charness, 2004). Existing experiments, however, have not sought to disentangle the effect of competition from that of market imbalance. In this paper we focus on the competition effects that arise as a result of moving from a bilateral to a multilateral interaction. To isolate this effect from that of market imbalance, we have deliberately set the number of Proposers and Responders equal to each other.

high offer with high effort, but there is substantial minority of workers who do not reciprocate. However, we do not see a pattern of conditional reciprocity for the employers: contrary to earlier gift-exchange games, low effort workers are not punished by the employers in the next periods. Only a few employers lower the wage in response to low effort. As a result, employers tend to make losses or very small earnings, while workers capture most of the surplus. A follow-up experiment confirms this behaviour (Davies & Fafchamps, 2015a). This difference in conditional reciprocity between workers and employers is surprising, given that assignment was random.

The results from our experiments seem to suggest that identity and framing matters, and lead to more generous and forgiving behaviour on behalf of the employer. In our ultimatum game we find that a substantial share of employers offer the Responder a share of surplus of more than fifty percent. Furthermore, we find some evidence that competition increases this generosity further. Follow-up experiments are needed to ascertain the respective roles of identify and framing in driving our findings.

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