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Bidding for the Better Jobs:
An Experiment on Gender Differences in Competitiveness without a Real-Effort Task

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Abstract

We model the competitive striving for high-level positions in firms by letting experimental participants compete in bidding for prizes of different sizes in a hierarchy. Our set-up includes both a flat hierarchy and a steep hierarchy. We mainly focus on whether men and women behave differently with respect to bidding for higher and lower positions, but also consider other possible sources of heterogeneity in behavior. On average, women bid higher than men, but not significantly so, except for the top position of the flat hierarchy. For lower positions, bids are generally close to optimal bidding whereas they are relatively lower for higher positions. Women do win the top positions significantly more often, but there are no significant gender differences in earnings, the difference between prizes and bids. Our results suggest that the strong gender differences in attitudes towards competition that were found in numerous previous studies based on competition in tournaments with real-effort tasks may not carry over to other environments. A broader implication of our results thus is that a particular phenomenon should be studied using various experimental designs.

Keywords: Experiments, Gender differences, Competition

JEL Classifications: C91, J16

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1. Introduction

Starting with Gneezy et al. (2003) and Niederle and Vesterlund (2007) gender differences in competitive behavior have been extensively studied using real-effort tasks and tournament incentives as a representation of competition in society suggesting that women perform worse under tournament incentives and shy away from entering such competitions (see Niederle, 2017 for a recent survey of the experimental literature). These results have been replicated numerous times and have provided important insights.[1] They are based, however, on one particular way of representing competition. In this paper we present an experimental study of gender differences in behavior in a competitive environment using a completely new design. In our setting there are stylized hierarchies with ranked positions meant to represent jobs in firms. Our experimental participants, men and women, obtain positions in these hierarchies through a competitive bidding process and our focus is on gender differences in bidding for the positions. In our context behaving more competitively corresponds to higher bidding for positions.

Competing for jobs in a market economy involves many aspects of behavior which cannot all be captured by the head-to-head simultaneous competition in one particular real-effort task in a tournament environment. Here we directly represent competition for different positions in hierarchies. Competition is typically multi-faceted. It involves spending resources in many different ways such as investing in costly training, exhibiting initiative and leadership, and working long hours. In our representation of job competition via a competitive bidding process, bids sum up monetarily various aspects of how one competes for higher positions in organizations. Our representation captures the following features: i) in society, as in individual organizations, different positions yield different salaries, ii) to obtain better positions individuals need to spend resources, which depend on the position, and iii) positions are allocated through a competitive process. We believe that these are crucial characteristics on competitive processes.

[1] See Shurchkov (2013) and Cassar et al. (2016) for suggestive evidence that gender differences in this environment can greatly vary.

Whereas field situations offer many ways to compete for the better positions, including questionable ones, laboratory research can focus on specific aspects of stylized but better controlled job assignment contests. In the hierarchies we study there is one top position which pays a higher prize if obtained, two intermediate positions which pay the same lower prize, as well as default payoff. The amount of the prizes is independent of who ends up at that position, i.e. they are interpersonally and objectively comparable and the positions do not differ in anything but in the prize they pay.

We study competition for positions in two parts. In part 1, two groups of participants bid in two separate hierarchies, as in intra-firm competition. In a second part we open competition so that the separate groups can now bid for positions in both hierarchies, as in broader inter-firm market competition. One of the hierarchies is relatively flat, in the sense that the difference in prizes between the top and intermediate positions is small, whereas the other hierarchy is steep.

Compared to most auction experiments (see Kagel and Levin, 2008, for a review) our contests are more complex since participants have to submit more than one bid. In within-firm competition they have to submit two bids, one for the top and one for the intermediate positions, and in inter-firm bidding competition they have to submit four bids, namely for the top positions and intermediate positions in both firms. Due to incentive compatibility of the auction rules that we use the more global bidding competition is not necessarily cognitively more demanding but if perceived as more competitive could possibly strengthen or weaken gender differences in bidding.[2] In our view, letting individuals strive for various positions at the same time makes sense, since their various bids for the different positions may reflect how much more they are interested in one position versus another. Also, assigning hierarchically ranked and usually better paid positions in organizations like commercial firms, private or public bureaucracies via bidding is easily understood by student participants.[3]

[2] Güth et al. (1983) as well as Güth and Tietz (1986) rely on competitive bidding to infer aspirations for playing games in a specific player role and provide entitlement (see Hoffman and Spitzer, 1985) when actually playing in that role.
[3] There exist few field situations where better-rewarded jobs are awarded using auction-like procedures. Brand products, when marketed via assigning regional monopolies to applicants for local markets, usually differ considerably

Even when job competition is firm specific, information about auction prices is not restricted to firms. In the field, internal promotion contests are mostly informationally linked, a circumstance which we capture by providing participants with end-of-round feedback information about auction prices in both firms. Additionally, bidders learn only privately which position they have acquired and what they have earned after each round.[4]

Our experiment involves multiple rounds and we refer to eight successive rounds as a phase. Participants play four such phases, i.e. in total thirty-two rounds, sixteen each with intra-, respectively inter-firm competition. Each group is composed of eight participants, who compete for six (two top, four intermediate) potentially better paid positions, and remain constant across rounds and phases, i.e. we employ a within-partners design for comparing intra- and inter-firm competition and learning how to bid in both conditions. It seemed obvious to begin with intra-firm competition, which is simpler, and to introduce the more global inter-firm job competition only when participants have already experienced job assignment by competitive bidding. Reversing the order would seem not in line with the dynamics of globalization in the field.

In contrast to the research based on real-effort tournaments we do not find women to behave less competitively. Women bid higher than men, but not significantly so, except for the top position of the firm with the flat hierarchy. For the lower prizes, average bids are nearly optimal but relatively lower for the higher prizes. Women do win the top positions significantly more often, but there are no significant gender differences in earnings. Our results show that using a different stylized representation of the competitive process leads to different results and suggests different conclusions than those of previous studies based on

in demand and profitability. Bidding in such instances may concern license fees, investments in the sales infrastructure, e.g. for technical service and display of products like premium cars. Similarly, restaurants with rooms or tables offering more and less scenic views may auction off the better and more frequently demanded ones e.g. to waiters and waitresses who earn their tips minus what they pay for their rooms or tables. Our bidding setup would qualify as one with complete information.

[4] Regarding the debate whether the earnings of managers should be public we have implemented the case where, via public information about auction prices, the remuneration of managers becomes public.

tournaments with real-effort tasks[5]. Although our representation of competition for jobs captures some interesting key aspects of the process we are interested in, we do not view our setting as a necessarily superior representation of competition in society than those of other studies. However, our results suggest that when studying gender differences with respect to competition, one needs to look at the issue from more than one angle.

Section 2 introduces the bidding setup, presents the experimental protocol and states the main hypotheses. After describing the data in section 3, statistical (regression) analysis establishes the significance of the main findings in section 4. We discuss our conclusions, also by relating them to the literature, in section 5.

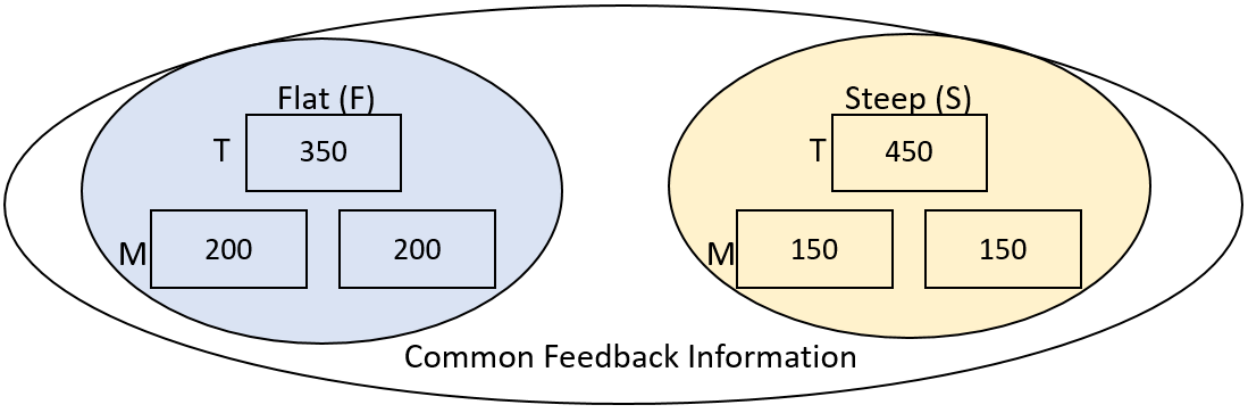
2. Experimental Protocol and Hypotheses

We use the same notation as in the (translated) instructions which can be found in the Appendix A. An experimental group is composed of eight participants, who bid in two separate groups of four before they become one group of eight interacting bidders. In groups of four, participants bid for one position $\boldsymbol{t}$ and two positions $\boldsymbol{m}$ yielding salary $\boldsymbol{T}$ or $\boldsymbol{M}$ to winners and $\boldsymbol{U}$ to non-winners in the $\boldsymbol{F}$ firm (for relatively flat salaries), whereas the other group of four participants bids for one $\boldsymbol{t}$ and two $\boldsymbol{m}$ positions in the $\boldsymbol{S}$ firm (for relatively steep ones). The two firms differ in their salary amounts. Firm $\boldsymbol{F}$ pays (in ECU): $\boldsymbol{T} = 350$; $\boldsymbol{M} = 200$, and firm $\boldsymbol{S}$ pays (in ECU): $\boldsymbol{T} = 450$; $\boldsymbol{M} = 150$. When not obtaining any of these superior salaries the default payoff is $\boldsymbol{U} = 50$, irrespective whether one belongs to firm F or S.[6] Figure 1 illustrates the setting when the bidding interaction involves two groups of four which are joined in the second part (see Figure 2). It also indicates that all participants in a group obtain feedback information about behavior

[5] There is evidence that the type of real-effort task also matters when it comes to gender differences in competition (see Dreber at al., 2014).
[6] Only when employing even more bidder participants, i.e. when allowing for unemployment, would bidding also for U-positions make sense.

in both firms in both parts. Both, the first and second part of bidding interaction extends over four rounds of bidding. Both parts together are described as a phase, and each group played four such phases.

Figure 1: The first four rounds (Phase 1) of intrafirm bidding but common end-of-period- feedback across firms



During the first four rounds of a phase candidates $i(k)$ for firm $k = F, S$ submit bids $b_{i(k)}(t_k)$ and $b_{i(k)}(m_k)$ with $b_{i(k)}(t_k) \geq b_{i(k)}(m_k) \geq 0$ where $i(k)$ varies from 1 to 4. The rules in case of intra-firm competition assign for $k = F, S$ positions as follows:

- the top position and salary t_k to the highest bidder $i^*(k)$ with $b_{i^*(k)}(t_k) \geq b_{i(k)}(t_k)$ for all $i(k) = 1, \dots, 4$ at the price of the second-highest bid $b_{i(k)}(t_k)$:
  $p(t_k) = \max\{b_{i(k)} \mid i(k) \neq i^*(k)\}$, i.e. the highest non-winning bid $b_{i(k)}(t_k)$;
- the two intermediate position and salaries m_k are then allocated among the remaining three bidders to those two whose bids $b(m_k)$ are (first or second) highest (among the three remaining bidders) at the price $p(m_k)$ of the minimal bid $b_{i(k)}(m_k)$:
  $p(m_k) = \min\{ b_{l(k)}(m_k) \mid l(k) \neq i^*(k)$
- The remaining bidder $l(k)$, who has not acquired t_k or m_k, earns the default pay of $U = 50$.[7]

Payoffs of bidders in firms $k = F, S$ are:

- $t_k - p(t_k)$ at the top position,
- $m_k - p(m_k)$ at the intermediate positions, and
- U at the bottom level

[7] We think that this order of allocating positions makes economic sense. The positions are allocated in top-down order of the size of the salary.

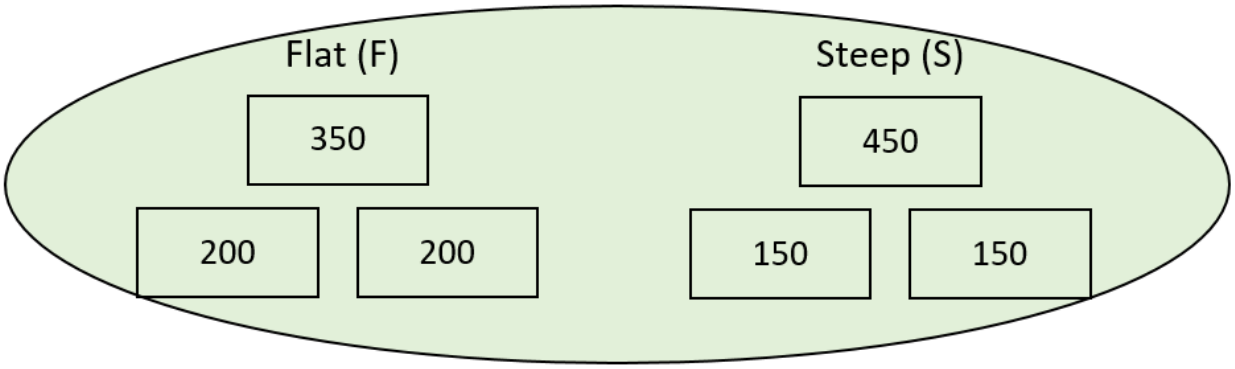
In the later four rounds of a phase the rules require four bids, namely individual bids

$$b_i = (b_i(t_s),\ b_i(t_f),\ b_i(m_f),\ b_i(m_s))$$

by all eight members $i = 1, \ldots, 8$ before belonging either to firm F or S, for which monotonicity requires

$$b_i(t_s) \geq b_i(t_f) \geq b_i(m_f) \geq b_i(m_s) \geq 0$$

Figure 2: The last four rounds (Phase 2) of intrafirm bidding with common feedback information



Job assignment follows similar rules as before from highest to lowest salary by determining

- first the highest bid for $b(t_S)$ for the highest top salary of *S*, and the price $p(t_S)$ via the second highest-bid $b(t_S)$,
- then among the seven remaining bidders the highest bid $b(t_F)$ for the top salary in *F* and the price $p(t_F)$ via the second highest-bid $b(t_F)$ of the remaining bidders,
- then among the remaining six participants the two highest $b(m_F)$ bidders at the price $p(m_F)$ via the third highest $b(m_F)$-bid,
- finally among the four remaining bidders the two highest $b(m_S)$ bidders at the price $p(m_S)$ of the third highest $b(m_S)$ bid , whereas
- the two remaining bidders earn U=50 each.

Payoffs are $t_k - p(t_k)$, $m_k - p(m_k)$, or U in firm $k = F, S$ and U otherwise.

Each session included two or three groups of eight participants and lasted about one hour and twenty minutes. In total, 168 participants (45% female and 55% male) self-registered for participation through ORSEE (Greiner, 2015) at CESARE lab (LUISS Guido Carli University). No subject participated in more than one session. Earnings (including a show-up fee of 5 euros) range from 0 euros to 25 euros, with an average of 12.3 euros. The experiment was programmed and conducted using z-Tree (Fischbacher, 2007).

Before the start of the experiment we asked a number of control questions about the design. Most participants did not have any problems with the questions. The few that did typically had difficulties understanding the monotonicity rule, i.e. the fact that it was not possible to bid more for a lower-paying position than for a higher-paying position.

After completing all 32 rounds of the experiment, participants filled out an unincentivized questionnaire which included demographics, a cognitive reflection test, a 10-item big-5 personality test, as well as a risk aversion test. Participants were paid once the questionnaire had been concluded, and they left the lab. Payments were based on one randomly selected run for which they received the payoff of one randomly selected round of the first four rounds (Phase 1) and one randomly selected round of the second four rounds (Phase 2), i.e. payments were based on two random rounds of a random run.

Due to the incentive compatible rules the obvious benchmark prediction[8] in view of common opportunism, i.e. based on own payoff maximization, is the

Hypothesis 0:

$$b^*_{i(k)}(t_k) = t_k - U, \text{and} \quad b^*_{(k)}(m_k) = m_k - U$$

for either $k = F, S$ and, of course,

$$b^*_{i(k)}(t_k) = t_k - U, \text{and} \quad b^*_{i(k)}(m_k) = m_k - U$$

for both $k = F$ and $k = S$ in all rounds which implies the auction prices

$$p(m_k) = m_k - U, \text{and} \quad p(t_k) = t_k - U$$

for $k = F, S$ and the same payoff U for all eight bidders.

This hypothesis applies, of course, to both women and men.

One reason to believe that opportunism will not prevail is that it may be difficult for participants to grasp the logic behind Hypothesis 0 and deviate from it in various ways. Some participants may (be

[8] In the sense of dominance solvability, i.e. the benchmark bids are weakly undominated meaning that their optimality requires no common knowledge of (opportunistic) rationality.

anticipated to) misperceive the situation and this may influence their (others') bidding. In particular, they may fail to understand that *U* has to be subtracted when determining the opportunistic bids.

To take into account that participants may, for different reason, misinterpret their monetary incentives we will analyze whether bidding behavior is influenced by the score of the cognitive reflection test. Note, however, the paragraph in the instructions alerting participants about the incentive compatibility of the auctions. This could at least discourage overbidding and should help participants to understand that, except for intrinsic competitiveness concerns, there exist no strategic incentives nor image concerns (other than self-image ones) to deviate from benchmark bidding.

A different issue is that the incentive compatible 2nd or 3rd price rule may trigger ring formation, i.e. collusion of bidders.[9] In our setup all positions could be obtained for essentially nothing when all bids, except those of the designated winners, are close to zero implying that the designated winners pay essentially nothing. Although without preceding communication bidder collusion is, difficult to establish collusion incentives nevertheless exist. Collusion seems easier when fewer bidders are involved, i.e. in the first four rounds of a phase. We will pay attention to whether collusion incentives as well repeated bidding of constant groups partly trigger significant underbidding, i.e. lower bids than predicted by Hypothesis 0. If so, there should be less systematic underbidding in the later of the four rounds and with more bidders (for end game effects see Selten and Stoecker, 1978).

Our main focus is not on deviations from optimality, but whether men bid higher than women. Males' eagerness to engage in competitive tournaments, contests etc., e.g. for promotion or better jobs in other firms, can be analyzed in our data by comparing women's and men's bids. This differential competitiveness could, for instance, only show up in the bids for the top position, $b(t_k)$ for $k = F, S$, before and after merging the two firms. The idea of individuals bidding more agressively only for the top positions would be in line with the alleged statement of Julius Caesar when crossing the Alps and looking down to

[9] One's bid only separates the regions of too high prices, which one does not want to pay, and low enough prices which one is willing to pay but not directly the price which one pays.

an Alpine village: "I would rather be the first man in this village than the second in Rome, (see also Avrahami et al. 2019, who discuss such views and study them experimentally).

It could also extend to the bids in the lower position in the hierarchy, $b(m_k)$ for $k = F, S$, what would mean that male bidders mainly want to avoid not winning due to some perceived stigma of being unemployed (i.e. not winning a positions). We therefore distinguish two cases in our gender hypothesis:

Gender Hypothesis G:[10]

(a) Male bidders bid, on average, higher than female bidders for the top positions

(b) Male bidders bid, on average, higher than female bidders for all positions.

An additional hypothesis related to gender differences is that men will win the top positions more frequently. This does not follow directly from (a) or (b). Although our main focus is on gender differences we also look at how other sources of heterogeneity could affect bidding behavior. To this end we post-experimentally ask participants to complete a demographics survey, a cognitive reflection test, as well as a personlaity questionaire (see Gosling et al., 2003).

A separate is whether winners earn more or less than non-winners. Overbidding winners in the sense of $b(t_k) > t_k - U$ and $b(m_k) > m_k - U$ for $k = F, S$ may not necessarily suffer in terms of payoffs as the highest non-winning bids and thus the prices to be paid may not be exceeding $t_k - U$, respectively $m_k - U$. But they may not always be so lucky which allows those at the bottom level of the hierarchies to potentially earn more than those above them. Since competitive auctions render those who are excessively overoptimistic as winners, we will investigate whether winners earn on average less than non-winners and whether bidding optimally, on average, is correlated with better earnings and whether overbidding is worse than underbidding.

[10] Chen et al. (2013) and Pearson and Schipper (2013) investigate how women' behavior in auctions is affected by the menstrual cycle.

3. Results

In this section we first look at bidding, then at gender differences in obtaining the top positions, and finally at earnings.

3.1. Bidding results

To get a first impression Figure 3 shows the evolution of average deviations from optimal bids across all 32 rounds separately for the four salary levels. Except possibly for m_s underbidding dominates what already questions Hypothesis 0. The only strong dynamic feature of the data is the very low bidding for the lower positions in the hierarchies in periods 1-3. Whereas for m_s initial minor overbidding changes to minor underbidding, the averages for the other three salaries first increase during the first four rounds, which would be inconsistent with maintaining successful collusion, and are then displaying rather unstable under bidding ratios, The first remarkable feature of the data is the strong underbidding for the top positions. Instead, bidding for the middle positions is about the level of the prediction, with some overbidding for m_s and slight underbidding for m_f. An explanation of this overall pattern could be satisficing behavior: bidders aspire the middle positions more than to the top positions. From the information in Figure 3 we can already conclude that our data reject Hypothesis 0 for the top positions but not for the middle ones. Also, we do not see much evidence for a successful ring formation in the form of massive and stable underbidding.

Figure 4 shows individual bids for the four positions separated by gender. Starting with the two top positions one can see that there is strong underbidding (many more bids below the benchmark than above it) both in the flat and in the steep firm, with bunching at bids of 300 and 400 respectively. For the middle positions it is less clear whether overall there is over or under bidding; observe, however, that the high bids appear to come from women.

Figure 3: Dynamics of average bids across rounds.

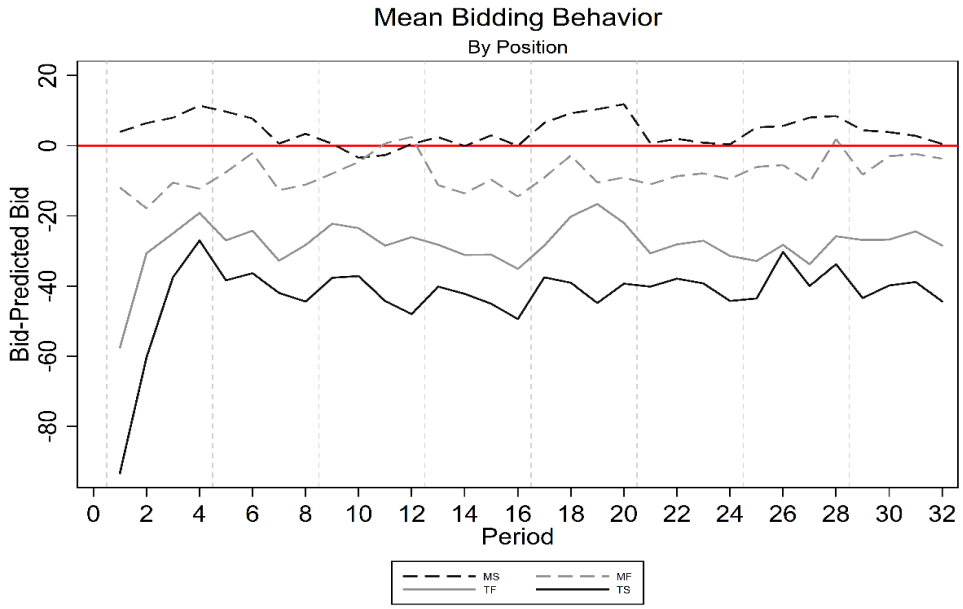


Figure 4: Distribution of bids by gender and position

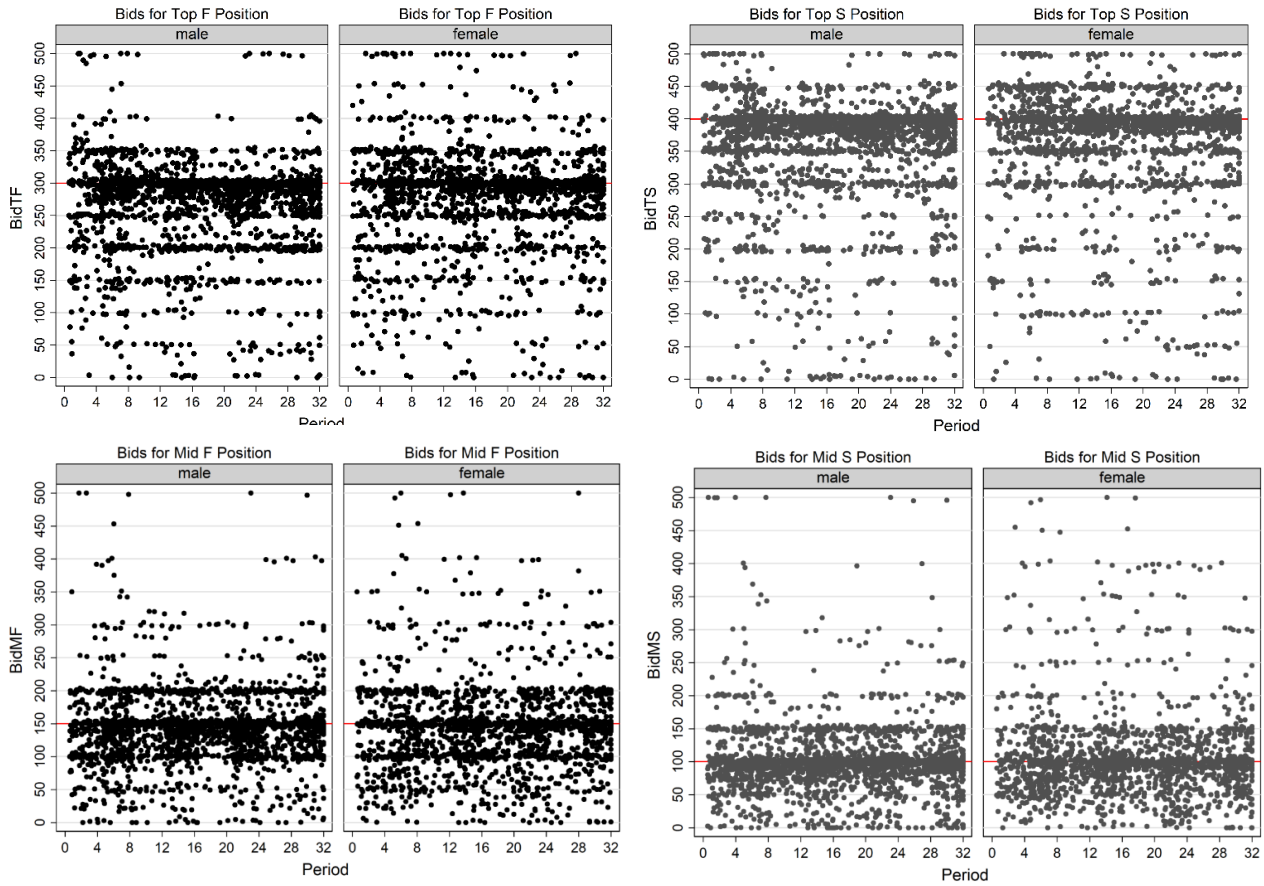
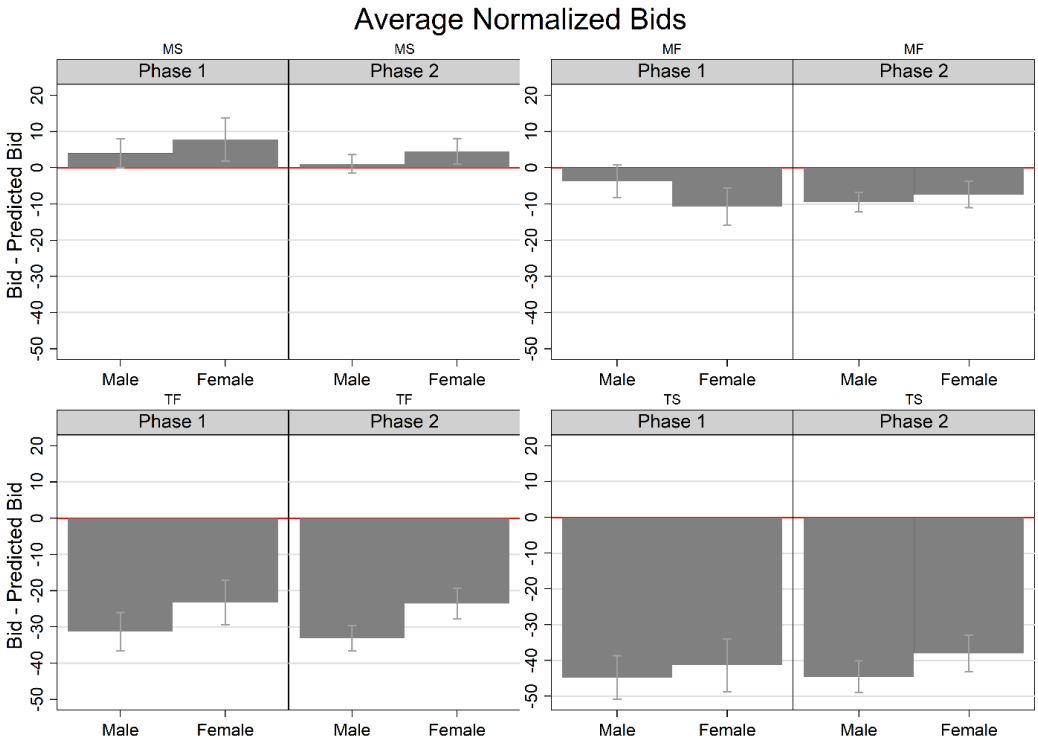


Figure 5 shows average bid deviations from predicted bids (Hypothesis 0), separated by gender for each of the four position and the two phases. The first feature that we want to highlight is that average male bids do not appear to be higher than average female bids. Indeed, the significantly lower underbidding of female participants for t_f in both phases is our first evidence that, if women bid at all differently than men, they bid somewhat more aggressively. However, none of the differences for the other three cases are significant. Figure 3 confirms this also when only considering the later four rounds with global job competition via bidding. A possible explanation of this feature of the data is that participants aim at satisficing aspiration levels. Women (in relative terms) somehow settle for being at the top in the flat firm.

Figure 5: Average (across participants, and rounds) deviations from benchmark bidding, separately for each salary, gender and phase.



In the first four models of Table 1 we regress the normalized bids on the basic variables. One can see that gender has a significant effect at the 10% level on bids only for the top position in the flat firm, and that women bid higher than men. This is consistent with the results shown in Figure 5. For each of the

regressions of Table 1 we have added variables for the big-five personality traits and some other individual motivations We include them because, although our focus is on gender, bidding can also be affected by other sources of heterogeneity. We can see that none of the motivational variables have a significant effect, except for risk aversion, albeit only in one of the regressions and at the 10% level.

Table 1: Mixed-Effects Panel Regression on bids clustered at individual and group levels

	Mixed Effects Panel Regression on Bids							
	MS Bids		MF Bids		TF Bids		TS Bids	
Period	**-0.020**	**-0.281**	**0.157****	**0.49**	**0.163**	**0.299**	**0.052**	**-0.309**
	(-0.25)	(-0.40)	(2.00)	(0.70)	(1.60)	(0.33)	-0.45	(-0.30)
Phase	**-3.967*****	**-4.178**	**-1.093**	**-2.010**	**-3.580***	**-5.454**	**3.705**	**4.898**
	(-2.60)	(-1.27)	(-0.71)	(-0.61)	(-1.80)	(-1.29)	-1.61	-1.02
Female	**1.677**	**2.936**	**1.477**	**2.213**	**12.200***	**14.880***	**6.849**	**11.49**
	(0.28)	(0.43)	(0.24)	(0.30)	(1.88)	(1.90)	(0.77)	(1.08)
Age	**-0.959**	**-0.788**	**-0.971**	**-0.754**	**-4.038*****	**-4.191*****	**-4.224****	**-4.403****
	(-0.76)	(-0.58)	(-0.73)	(-0.52)	(-2.88)	(-2.70)	(-2.23)	(-2.11)
Run		**1.478**		**-3.54**		**-2.359**		**1.751**
		(0.26)		(-0.63)		(-0.33)		-0.21
Cognitive R. Score		**-4.342**		**-2.303**		**0.187**		**0.0537**
		(-1.35)		(-0.67)		(0.05)		(0.01)
Extraversion		**-2.359**		**-2.741**		**-0.662**		**-1.519**
		(-1.15)		(-1.26)		(-0.28)		(-0.48)
Agreeableness		**-3.12**		**-2.758**		**-0.683**		**0.646**
		(-1.34)		(-1.11)		(-0.26)		(0.18)
Conscientiousness		**-1.873**		**-0.528**		**-2.161**		**-3.224**
		(-0.87)		(-0.23)		(-0.89)		(-0.98)
Neuroticism		**1.158**		**1.791**		**1.018**		**-0.198**
		(0.62)		(0.90)		(0.48)		(-0.07)
Openness		**0.865**		**0.636**		**1.26**		**3.323**
		(0.43)		(0.30)		(0.55)		(1.07)
Risk Aversion		**-3.795***		**-2.918**		**-1.204**		**2.206**
		(-1.72)		(-1.24)		(-0.48)		(0.65)
_cons	**32.10**	**84.23***	**12.33**	**49.23**	**64.20***	**88.10***	**45.85**	**51.58**
	(1.08)	(1.93)	(0.39)	(1.06)	(1.93)	(1.77)	(1.02)	(0.77)
N	3456	3456	3456	3456	3456	3456	3456	3456

We use *, ** and *** for significance at the 10%, 5% and 1% level.

On the basis of the regressions in Table 1 and the average data in Figure 5 we reject both parts (a) and (b) of the Gender Hypothesis.

3.2. Gender differences in obtaining the top positions

We find few gender differences in bidding, but is it gender dependent who ends up in one of the two top positions? Figure 6 shows the average frequency of female participants winning any of the positions by phase, compared to the expected frequencies based on the proportion of women in the participant pool. One can see that women are more likely to obtain the two top positions, particularly the one in the flat firm and in phase 2. For the middle positions, the differences between actual and expected frequencies are smaller than for the top positions, with the actual frequency being lower than the expected one in three of four cases. Women also obtain the benchmark positions somewhat more often than expected.

Figure 6: Actual vs. expected frequency of women in each position.

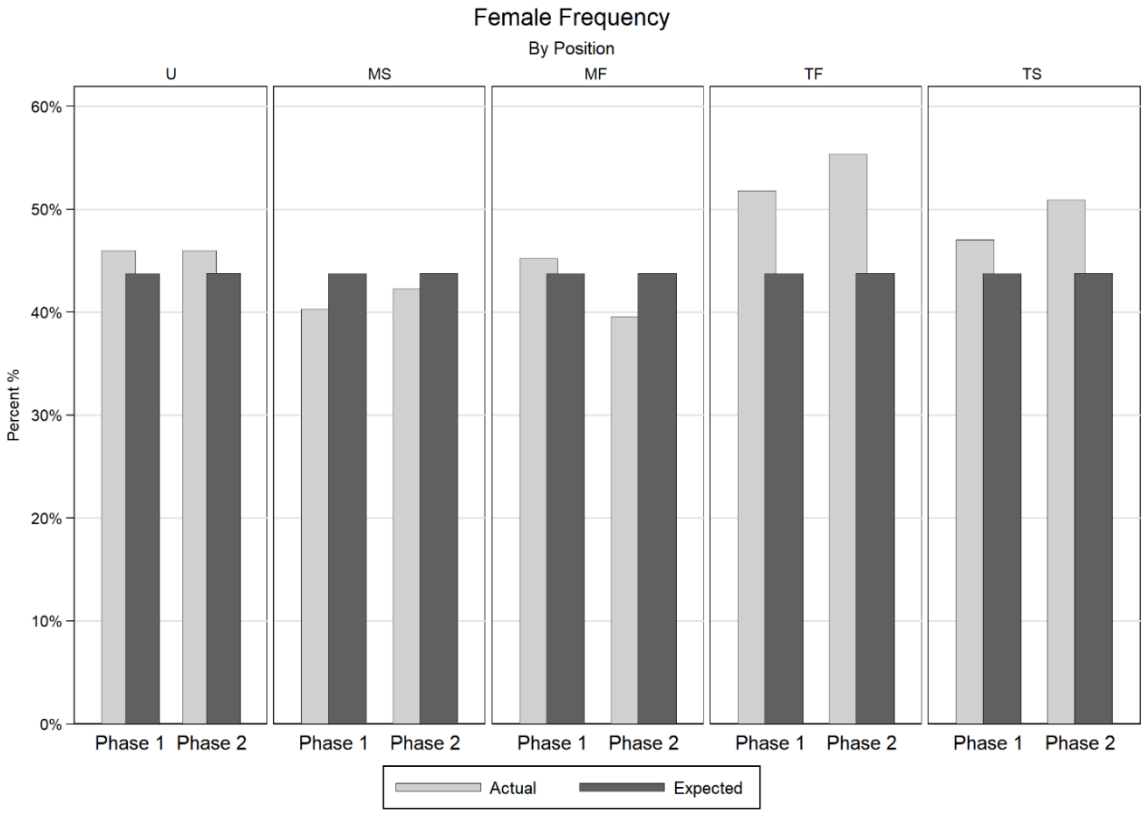


Table 2 shows the results of regressions to study the access to the top positions in more detail. In first three regressions we use only the basic variables, whereas in the last three regressions we again include personality traits. According to these regressions making it to the top is significantly more likely for female

participants, mostly due to the more competitive bidding in Phase 2. Our data, hence, reject the additional hypothesis mentioned in the introduction that men win the top position more often. With respect to other sources of heterogeneity, we find that individuals with high score in Extraversion and Agreeableness are less likely to end up in a top position, but only in one of the phases.

Table 2: Mixed-Effects Logit Regression on winning a T position[11]

	All Data		Phase 1		Phase 2	
Female	**0.434****	**0.435****	**0.298**	**0.311**	**0.589****	**0.557****
	(2.40)	(2.200)	(1.61)	(1.500)	(2.55)	(2.200)
Age	**-0.0605**	**(0.048)**	**-0.051**	**(0.035)**	**-0.063**	**(0.050)**
	(-1.59)	(-1.26)	(-1.31)	(-0.88)	(-1.31)	(-1.04)
Cognitive R. Score		**(0.131)**		**(0.142)**		**(0.113)**
		(-1.44)		(-1.49)		(-0.97)
Extraversion		**-0.114***		**(0.078)**		**-0.155****
		(-1.95)		(-1.28)		(-2.07)
Agreeableness		**-0.135****		**-0.173****		**(0.093)**
		(-2.05)		(-2.52)		(-1.11)
Conscientiousness		**(0.006)**		**(0.011)**		**0.039**
		(-0.10)		(-0.17)		(0.490)
Neuroticism		**(0.036)**		**(0.008)**		**(0.068)**
		(-0.69)		(-0.15)		(-1.02)
Openness		**(0.054)**		**(0.080)**		**(0.044)**
		(-0.97)		(-1.35)		(-0.61)
Risk Aversion		**(0.012)**		**(0.013)**		**(0.031)**
		(-0.19)		(-0.19)		(-0.38)
Constant		**1.820**		**1.624**		**1.558**
		(1.500)		(1.280)		(1.000)
_cons	**-0.126**	**1.036*****	**-0.256**	**0.938*****	**-0.248**	**1.546*****
	(-0.14)	(-6.27)	(-0.28)	(-5.06)	(-0.22)	(-5.39)
N	4608	4608	2304	2304	2304	2304

We use *, ** and *** for significance at the 10%, 5% and 1% level.

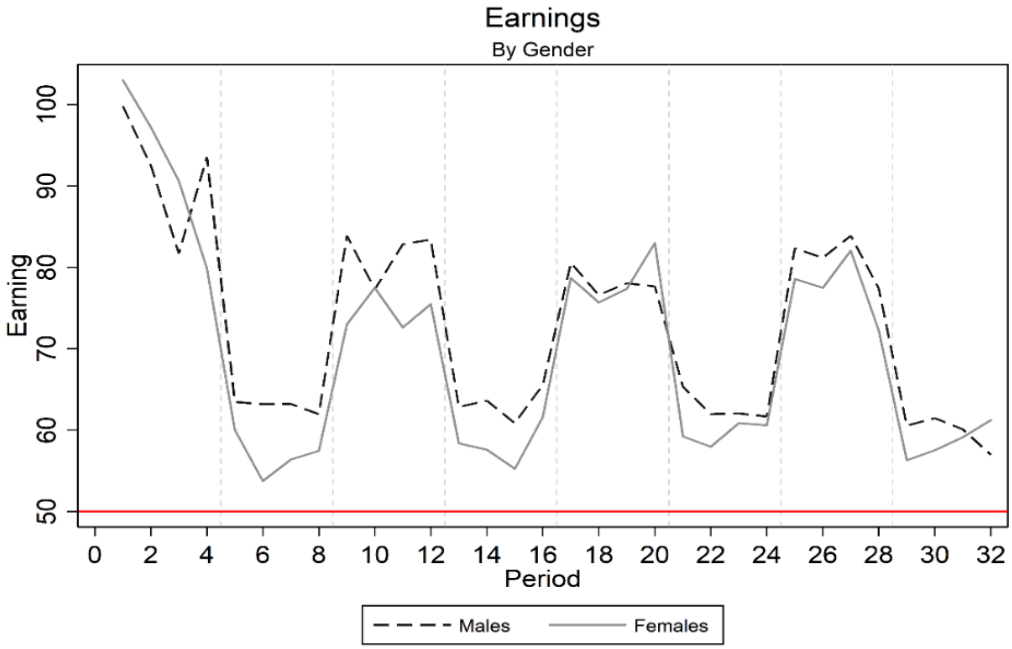
3.3 Earnings

We complete our analysis by studying earnings and whether winners overbid more than losers, as mentioned in Section 2. Figure 7 displays the average earnings over time for all four positions, relative to the benchmark payoff of 50, corresponding to U earnings. Earnings are higher in the middle positions than

[11] We also tested for a gender difference in ending up in the flat firm, but using a Mann-Whitney Rank-Sum test don't find a significant difference (p=0145), two-sided.

Figure 7: Dynamics of earnings across rounds.

Figure 8: Gender differences in dynamics of earnings across rounds.

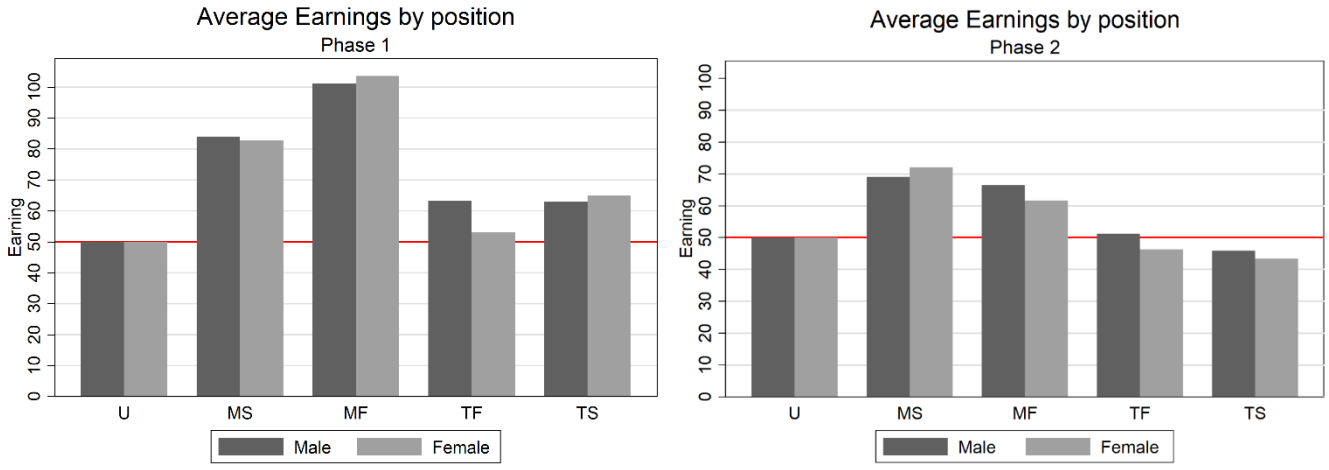


in the top in the positions, consistent with what the differences in bids suggested by Figure 3. The figure also shows that average earnings are lower in phase 2 than in phase 1, due to the fiercer competition. The figure also

suggests that in phase 1 earnings in the middle position in the flat firm are higher than in the steep firm. Figure 8 shows that earnings dynamics of all positions are not gender dependent.

Figure 9 shows average earnings by position and gender separately by phase, again relative to the benchmark of 50. In phase 1 earnings appear to be much higher in the middle than in the top positions. The explanation for this is not only the higher bidding for the middle positions noted above, but also the fact that participants can bid for all positions and that they are allocated top-down according to their prizes. This leads to individuals who tend to bid high on both middle and top positions to win the top positions and exit the competition for the middle positions. As a consequence bidders who remain in the competition bid relatively low and earn more in the middle positions. From Figure 9 one can also see that earnings are higher for MF than for MS, whereas the difference between the two top positions appear to be minor. Altogether, gender differences are very minor, except perhaps for TF, where women earn less than men, consistent with the fact seen in Figure 6 that women obtain the top position more frequently than expected.

Figure 9: Average (across participants and rounds) earnings in Phases 1 and 2, separately for each salary and gender.



In phase 2 we see the same pattern of higher earnings for the middle than for top positions, but with earnings now being lower overall, due to the stronger competition: earnings are above 50 in the middle positions but below it in the top positions. With respect to gender differences there are somewhat higher female earnings in MS and somewhat higher male earnings in all other positions.

Table 3 shows the results of regressions on earnings per period. According to model 1 the variable for female is not significant. Phase is negative and strongly significant, as already suggested by what we saw in Figures 7 and 9. The coefficient for the steep firm is negative and significant at the 10% level.

Table 3: Mixed-Effects Panel Regression on earnings clustered at individual, group and session levels

	Period 1		Period 2	
Period	**-0.194**	**-0.136**	**-0.194**	**-0.136**
	(-1.59)	(-1.02)	(-1.59)	(-1.02)
Phase	-	-	-	-
	(-11.31)	(-11.05)	(-11.31)	(-11.05)
Female	**-2.689**	**-1.995**	**-0.806**	**-0.224**
	(-1.02)	(-0.60)	(-0.31)	(-0.07)
Steep Firm	**-2.370***	**-2.207**	**-0.736**	**-0.323**
	(-1.80)	(-1.48)	(-0.58)	(-0.23)
Age	**0.369**	**0.377**	**0.368**	**0.364**
	(0.65)	(0.66)	(0.75)	(0.70)
Cognitive R.		**1.702***		**0.879**
		(1.67)		(0.94)
Extraversion		**1.492****		**1.459****
		(2.21)		(2.23)
Agreeableness		**-0.026**		**-0.434**
		(-0.03)		(-0.51)
Conscientiousness		**-0.231**		**0.027**
		(-0.23)		(0.03)
Neuroticism		**-0.131**		**-0.567**
		(-0.26)		(-1.21)
Openness		**-0.061**		**-0.399**
		(-0.06)		(-0.52)
Risk Aversion		**0.796**		**0.762**
		(0.72)		(0.75)
Reference Cat - U				
MS			**27.07*****	**28.47*****
			(7.40)	(6.93)
MF			**33.20*****	**35.36*****
			(7.11)	(6.68)
TF			**3.243**	**3.535**
			(0.68)	(0.63)
TS			**4.504**	**5.167**
			(1.16)	(1.13)
_cons	**86.24*****	**75.90*****	**68.56*****	**63.33*****
	(6.66)	(3.76)	(5.94)	(3.54)
N	4608	4608	4608	4608

We use *, ** and *** for significance at the 10%, 5% and 1% level.

Inspection of Figure 9 suggests that this effect may be due the lower earnings in the top position of the steep firm. In model 2 of Table 3 we have added variables for the two middle and the two top positions, relative to earnings level of 50 (as for ***U***). The results show that in both middle positions earnings are higher than in benchmark, whereas they are not different from it in the top positions.

Models 2 and 4, like in Table 1, include variables for the different personality traits to explore other dimensions of heterogeneity besides gender. In model 2 the coefficient of cognitive reflection score has a positive effect, significant at the 10% level, whereas in model 4 its effect is not significant. There is, hence, only very weak evidence that cognitive capability matters. By contrast, in models 2 and 4 extroversion is positive and significant at the 5% level. As mentioned above we did not have any ex ante hypothesis about the effects of this variable, but the result may inspire some future work. So our answer to the question in the introduction whether losers earn more than winners, is that winners of the middle positions earn more than U, whereas winners of the top positions earn similar to U, and in phase 2 amounts somewhat lower than U.

4. Conclusions

The novelty of our approach is to capture competition for better paid jobs in one's firm or industry via competitive bidding. In our setting, we directly model the bidding for positions in hierarchies. We assume incentive compatible bidding rules to avoid confounding effects of strategic (under) bidding (as, for instance, in case of the first price rule). We, furthermore, have ruled out income effects in case of common optimality (truthful bidding) as well as of authority, autonomy, and responsibility effects related to the various hierarchy levels in the firms. Because of these controls our claim to analyze whether pure competitive behavior varies across genders seems well justified. Our main finding is rather surprising: unlike in many (but not all) previous experimental studies women do not behave less competitively; if anything they bid, on average, more aggressively, although this effect is very small.

Previous experimental results reporting gender differences in competitiveness where obtained using settings with real-effort tasks. This is, however just one interesting but rather specific way of capturing the environment in which our variable of interest, namely competition for better paid jobs by females and males, can be experimentally explored. These settings have been very useful in generating interesting results, but they are not the only possible ones.[12]

One unique feature of our design is that there is no social status per se to be gained by winning the top position (for gender differences when social-status is present see Schram et al. 2019): winning bidders remain anonymous, and positions/auctions are neutrally worded. Our bidding competition also does not really allocate a single winner like classical "winner takes it all" auctions. In our experiment 3 out of the 4, respectively 6 out of 8, participants "win" in an auction, and the non-winners receive a guaranteed prize. Thus, all what should matter is the monetary payoff. Still, we find that many participants are willing to pay more to get to the top, and women seem to do this slightly more often than men.

The fact that we find what we find does, of course, not mean that there is no difficulty in women's access to high positions in organizations and in society in general. Our results should be interpreted as taking some weight away from intra-personal factors as mainly responsible, e.g. in the sense of decisions made by women themselves that lead to gender imbalances instead of putting more weight on inter-personal factors, such as the way how women are perceived and treated by others (see Gino et al., 2015).

Before describing how our stylized job competition via bidding can be enriched let us just mention that bidding may not only be used for job assignment in commercial enterprises but also in corporate? governance. Usually the necessary information, competence and skills which let a firm succeed in market competition are not concentrated at the top hierarchical level but distributed across the various layers of the hierarchy. So when considering at least major structural changes it is crucial to elicit the perceived

[12] See also Gillen et al. (2016) and Van der Heldhuizen (2016) for in-depth analysis of the motives behind observed behavior.

profitability effects at all hierarchy levels. For such elicitation bidding seems the institutional choice.[13] So bidding might not only be practiced in job assignment but could also be used to collect what is only privately known and has to be aggregated in organizations, e.g. for the purpose of corporate governance (see Alberti et al.,2020, for an experimental analysis).

One may want to enrich our bidding setup by letting bidder participants, who end up at different hierarchy levels, perform managerial tasks which could depend on their hierarchy level. If one could assess the individual suitability for a specific hierarchy dependent management task, this would allow to analyze whether self-selection in job assignment via competitive bidding leads to a suitable match of individual suitability and job requirements[14]. In our view, our bidding setup would allow to include such additional aspects without necessarily rendering decision making too complex.

[13] Similar to voting which mostly does not allow to continuously state one's appreciation.
[14] It would also potentially introduce effects such as competition-related stress (see Buser et al., 2017), which may be less present in our current design.

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APPENDIX

Translation of Experimental Instructions

Welcome to our experiment! During this experiment you will be asked to make several decisions and so will the other participants.

Please read the instructions carefully. Your decisions as well as the decisions of the other participants will determine your earnings according to rules, which will be explained below. For participating in this experiment you will receive a participation fee of 5 euros. You can earn more money but also lose some money, depending on the decisions by you and others during the experiment. However, you will not lose money for participating in the experiment, as losses cannot exceed your participation fee (5 euros). The final amount you earn during the experiment will be paid individually immediately after the experiment. No other participant will learn from us how much you have earned.

All monetary amounts in the experiment are computed in ECU (Experimental Currency Units). At the end of the experiment, earned ECUs will be converted into euro using the following exchange rate:

10 ECU= 1 euro

This experiment is fully computerized. You will submit your decisions by clicking buttons on the screen. All participants are reading the same instructions and participate in this experiment for the first time.

Please note that from now on any communication between participants is strictly prohibited. If you violate this rule, you will be excluded from the experiment with no payment. If you have any questions, please raise your hand. The experimenter will come to you and answer your questions privately.

Description of the Experiment

In the experiment, you will first interact in a group of four participants but also learn what happens in another group with four interacting participants. We refer to these two informationally connected groups by *S* and *F*. At the beginning of the experiment you will be randomly assigned and told whether you belong to group *S* or *F*.

After 4 rounds of interaction within your own group the two groups will be merged and the experiment will continue with all eight participants interacting repeatedly for another 4 rounds.

What you and the other three, respectively seven participants with whom you are interacting have to decide is how much you are willing to bid for acquiring the top position, *t*, as well as for one of the two lower positions, *m*, in a hierarchical organisation. Thus, all of you will submit bids, $b(t)$, for the top position *t*, as well as bids, $b(m)$, for one of the two lower positions m. In the following, we refer to stating the bids, $b(t)$and $b(m)$, as bidding and to your individual choices $b(t)$and $b(m)$ as your bids. Let us now explain how your and the others' bids determine what you earn.

If you acquire the top position you will receive the salary of T (in ECU=Experimental Currency Units) whereas one of the lower positions will only grant you a salary of M, with $T > M$. If you do not obtain a position (t or m), you will earn *U*, where $M > U > 0$.

The two groups differ in that the salary amounts for the two positions are:

In group F (in ECU): $T = 350; M = 200; U = 50$
In group S (in ECU): $T = 450; M = 150; U = 50$

However, you also would have to pay the price for your respective position, *t* or *m*, which in the first four rounds is decided according to the following rules:

- To acquire the top position your bid $b(t)$ has to be highest and the price $p(t)$ which you would pay for position t is the second highest bid $b(t)$, submitted by another participant in your group of four participants. Thus, if you achieve the top position you will earn what the top position yields minus its price i.e. $T - p(t)$.
- Only those who do not obtain the top position compete for one of the lower positions m. These two *m*-positions are granted to those whose two bids $b(m)$ are highest among the three remaining bidders and the price $p(m)$ they have to pay for position m is the third highest bid. Thus, what those who obtain the *m*-positions earn is what the top position yields minus its price i.e. $M - p(m)$.
- The remaining bidder in your groups earns *U* for which they do not have to pay a (positive) price.

Note that you could lose money when your bid for position *t* is higher than *T* or when your bid for position *m* is higher than *M*.

What each of the eight bidders learns after each round are the prices for the top positions, $p(t_F)$ and $p(t_S)$, as well as for the m positions, $p(m_F)$ and $p(m_S)$, in groups F and S where:

- $p(t_F)$ and $p(t_S)$ denote the prices for the top position $\boldsymbol{t}$ in groups *F* and *S*
- $p(m_F)$ and $p(m_S)$ denote the prices for the $\boldsymbol{m}$ positions in groups *F* and *S*

You will also be informed about your own payoff $T - p(t)$ or $M - p(t)$ due to the position t or m you acquire or, respectively, the payoff of *U*, if you fail to acquire a position.

As stated above, after the first 4 rounds groups *F* and *S* merge and all 8 interacting participants can bid for positions *F* and *S*. So in the later for rounds you will submit four bids namely for top position t_F and t_S as well as for the lower positions m_F and m_S. These bids must satisfy:

$$0 \leq b(m_S) \leq b(m_F) \leq b(t_F) \leq b(t_S) \leq 500$$

Positions after the merge are assigned according to the following rules:

- first determining the highest bid for the top position in *S*, i.e. $b(t_S)$, and its price $p(t_S)$ via the second highest-bid $b(t_S)$, i.e. the highest bidder would earn $450 - p(t_S)$,
- Then determining among the seven remaining bidders the highest bid for the top position in *F*, $b(t_F)$, and the price $p(t_F)$ via the second highest-bid $b(t_F)$ of the remaining bidders, i.e. the highest bidder would earn $350 - p(t_F)$
- Followed by determining among the remaining six participants the two highest bids $b(m_F)$ and the price $p(m_F)$ via the third highest-bid $b(m_F)$i.e. the two highest bidders would earn $200 - p(m_F)$ each,
- Finally determining among the four remaining participants the two highest bids $b(m_S)$ and the price $p(m_S)$ via the third highest bid $b(m_S)$i.e. the two highest bidders would earn $150 - p(m_S)$ each.

- The two remaining participants obtain no position and each earns U=50 each since they do not have to pay a positive price.

In the first 4 rounds bids must satisfy:

$$0 \leq b(m) \leq b(t) \leq 500$$

i.e. the minimal bid is 0 while the maximal bid is 500. Similarly, in the last 4 rounds bids must satisfy:

$$0 \leq b(m_S) \leq b(m_F) \leq b(t_F) \leq b(t_S) \leq 500$$

We refer to the first four rounds before merging F and S and the successive four rounds after merging as one run which will been repeated three more times, i.e. this experiment will have four runs with altogether 32 rounds. You and the other 7 participants are randomly assigned to F and S at the beginning of each run. Therefore, you will be randomly reassigned to F and S three more times after the initial run.

Payments are based on one randomly selected run for which you will earn the payoff of one randomly selected round of the first four rounds (before the merge) and one randomly selected round of the second four rounds (after the merge), i.e. payments of this experiment are based on two random rounds of a random run.