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Gender Differences in Willingness to Compete: Experimental Evidence from Bosnia

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Abstract: This research examines gender differences in willingness to compete with differing incentives . The results of previous experiments show that women are significantly less competitive, even when they perform equally well as men. However, in these experiments cash was the only incentive provided. Therefore, we investigate what happens to gender differences in willingness to compete when we switch the incentive from cash to non-cash prize. Similar to Cassar, Whordofa, and Zhang (2016) who found that women become equally competitive as men when incentive is related to wellbeing of their children, we find that the gender gap in competitiveness still exists when a gender neutral incentive is offered, but women are significantly more willing to compete at significantly higher rates for a gender-specific cosmetic store voucher relative to cash.

1. Introduction

Gender inequality has become an important issue in the context of development economics.Development and gender issues have a proven circular benefit. That is, development has been shown to lead to more gender equality and this equality in turn leads to a country's further development through channels such as increased women's labor force participation and education outcomes (Duflo 2012). Empowering women to participate fully in economic life across all sectors is essential in building stronger economies. Doing so will help in achieving internationally agreed upon goals for development and sustainability, and improving the quality of life for women, men, families and communities (Women's empowerment principles, UN Women). Unfortunately, we observe gender inequality in our everyday lives, as well as in global data, especially in poor countries. Women spend almost twice as much time on housework, almost five times as much time on child care, and about half as much time in the labor market as men do (Berniell and Sánchez-Páramo 2011). In political representation, women constitute less than one fifth of the members of lower and upper levels of political institutions. In terms of legal rights, women in many countries still lack independent rights to own land, manage property, and conduct business. (Duflo 2012). In some regions of the world, gender inequality is so extreme that it leads to the phenomenon of "missing women" (Sen 1990). The term "missing women" refers to a smaller number of women in reality relative to the expected number of women. It is measured through male-to-female sex ratios. This phenomenon is usually caused by sex-selective abortions, female infanticide, and inadequate healthcare and nutrition for female children.

Even though gender inequality is an important issue in the developing world, its importance in the developed world remains a worthwhile cause. Indications of gender inequality in the developed world are not as extreme as those in lesser developed nations but still include inequalities in wages, job opportunities, presence of women on high-level positions in companies or public and political institutions. This implies that gender inequality is not only a consequence of poverty; but that the problem is much deeper and more complex. For example, even in cases where women are more educated and/or performing better than men, such as the United States and England, women are still less represented in high-level positions and have lower wages. This means that genetics, education and skills are not the key causes of gender inequality.

There is increasing empirical evidence showing gender differences in willingness to compete. This might mislead us to the conclusion that gender discrimination is not an issue that causes gender inequality, but rather a natural biological byproduct. The problem is that the competition setting is discriminatory in itself: it is a setting that has historically evolved from patriarchal formal and informal institutions, where

women were omitted from any participation. Such a setting is more natural and beneficial for men. That is why we observe more confidence and more willingness to compete in men relative to women. For example, cash is believed to be a universal incentive for competition and in such a setting women are significantly less willing to compete. But women are much more competitive when competing for the wellbeing of their children compared to competing for their own wellbeing. Gender gaps have been proven to disappear when we introduce a new incentive for competition; such as vouchers for children *(Cassar, Whordofa, and Zhang 2016).* This is why we further investigate different incentives in competitions in order to better understand gender differences in the willingness to compete and eventually to come up with policy recommendations that will encourage female competitiveness and reduce gender inequality. This is why we are introducing different types of incentives to investigate whether female competitiveness changes as we change incentives thereby reducing the gender gap in competitiveness. As expected, our results confirm that incentive does matter – when offered an alternative incentive; women compete significantly more compared to when the incentive is cash.

2. Literature review

This section is organized in two sub-sections. Subsection 1.1. is focused on the earliest attempts to explain gender differences in competitiveness, but also gender differences in general, using theories from evolutionary biology: Darwin's Theory of sexual selection and critiques of this theory. Subsection 1.2. is focused on theoretical and empirical work on gender differences in competitiveness, utilizing the game theory and economics perspective.

2.1. Gender differences in competitiveness from the perspective of evolutionary biology

2.1.1. Darwin's Theory of sexual selection *(Darwin, 1871)*

Darwin distinguishes between primary and secondary sexual characteristics of males and females. Primary sexual characteristics are physiological characteristics of primarily their organs of reproduction. What this study is more focused on are the secondary sexual characteristics, which include characteristics related to sexual selection (any advantages that certain individuals have over other individuals of same species and sex, in exclusive relation to reproduction – height, strength, masculinity, etc).

Darwin claims that some characteristics of males and females of all species have changed over time relative to their use. This applies even for physiological characteristics. For example, size of a human jaw has reduced through disuse; as humans started to use their hands and arms for fighting with sticks and stones, as well as for other purposes of life. Physiological differences, like greater size, strength and masculinity of men compared to women, are acquired through the inherited effects of different roles of men and women in society, where men's work required more strength, but even more through the effect of more violent and competitive nature of men in sense of competing for access to females.

By Darwin's theory of sexual selection (applied to all species, not only humans), males compete amongst themselves for sexual access to females, in order to increase the number of their offspring. As a result, either females choose one of these rivals as the best suitable male or one of the rivals excludes other rivals which leaves a female with no choice but to mate with him or not to mate at all. The strongest and most vigorous males; those who could best defend and hunt for their families, those who were provided with the best weapons and who possessed the most property; would have better chances of accessing a desired female compared to weaker ones. Consider, for example, a species of which females provide most of the time and energy needed to raise young. In such creatures, a male's reproductive posterity depends directly on the number of his mates, but a female has less to gain from polygamy because she can only have a limited number of offspring. Thus, sexual selection tends to equip males with competitive traits that help them have as many sexual contacts as possible and tends to equip females with discriminatory traits that help to assure that especially healthy or otherwise superior males sire their young.

Sexual selection, in the sense of men's competition for females, made men not only physically stronger compared to women, but also intellectually. At the early stages, in order to get access to a female, men primarily had to defeat their rivals in physical combat, which required predominantly physical abilities. Later however, intellectual abilities became more important, as humans started to build weapons and improve their shelters. For example, no matter how strong a man is, even he would not have the ability to defeat a weaker opponent who is equipped with spear and/or bow and arrow. In addition, the ability to build a safe shelter and being more productive in hunting, which is equivalent to providing for their family, became a more significant secondary sexual characteristic in the sexual selection process. Since men were more involved in hunting, building shelters and weapons, their intellectual abilities were challenged more and as a consequence, men's intellectual abilities developed at a faster rate. Darwin argues this by comparing the absolute number of significant males vs female scientists, artists, poets, writers…

2.1.2. Critique of Darwin's Theory of sexual selection *(Hrdy, 1981)*

One of the best critiques of Darwin's Theory of sexual selection and theories that follow the same or similar ideas was done by Sarah Hrdy in her book "The Woman that Never Evolved".

Bio-behaviorists claim that hunting as a main human activity for providing food, led to the most significant gap between men and women, as hunting permitted men to "monopolize" the provision and distribution of meat. Not only were men the decision makers about food provision and distribution, but hunting also allowed them more interactions with others in sense of cooperation with other men in order to increase the efficiency of the hunting. Those interactions led to general cooperation between the men and general cooperative behavior that led to building social institutions and societies as we know them today. Women were not only uninvolved in those interactions, but they were also viewed as objects of exchange and given in marriage by brothers or fathers who received wives for themselves in return. That resulted in one of the earliest forms of behavioral aspects of gender inequality.

Socio-Darwinists claim that competition was the main factor of greater evolution of a men compared to women. They believe that competition among men left only the "winners" alive and allowed them to extend their stronger genes to next generation. That is what led to improvement of men's characteristics from generation to generation. They believe that women were passive, both sexually and in terms of competitiveness, since they spent most of their time taking care of children. As a result, the evolution of women was not as fast and intensive as that of men.

The main problem of all of theories of evolution of men vs women is that they are all focused on the life of men, his characteristics, interactions, and activities, while they didn't pay attention to what was going on in lives of women, what kind of interactions and roles did they have. All of these theories assume a constant role of women as mothers and nothing else, without deeper analysis of actual facts about women through history and ignoring the fact that a child gets part of its genes from the mother; not only from the father. These theories also ignore the fact that females were the ones who were less mobile, yet still managed to build relations and interactions with others within society that had more long term effects on their children in terms of adopting future customs and traditions.

Competitive behavior and inequality between males and females in many different species also depends on whether these species are monogamous or polygamous. So far, larger competitiveness and aggression of males is assumed, but that assumption was too general because it only applies to polygamous

species, where males mate with different females in order increase number of their offspring. Such a polygamous environment leads to a great deal of aggression and competition between males for access to females. In contrast, monogamous species act in completely different way: since males mate with only one female, there is no such intense competitive behavior between males, at least not for access to females. Source of aggression and competition in these cases is fighting over territory, food, safety of offspring, but not only males fight for territory, females equally competitive for same causes. In these cases, males and females actually show cooperative behavior in defending their territory, food or offspring. Even more interestingly, females show non-submissive behavior when they enter the conflict with their male and especially other males – they fight back.

Another criticism of Darwin's standpoints about gender and competition is that Darwin and his followers studied the obvious, physically expressed, male-like type of competitive and/or aggressive behavior. The fact is that females of many species, including human, are much more subtle in expressing their aggression and competitive behavior. Therefore, female competitive behavior is much more discrete, but that doesn't diminish its significance. Additionally, female sexuality was perceived as restricted, since early theories assume that sexual activity has no other function than reproduction. In that sense, male sexuality and sexual activity were assumed to be unlimited, since male reproduction potential has no limits, in sense that males can inseminate countless number of females, while females have limited capacity to conceive (females simply cannot have as many offspring, their reproductive health and potential are limited). But, the assumption of only reproductive function of sex is too strong. This assumption might be true for many species, but definitely not for humans, both male and female. Sex has functions beyond reproduction in humans, including expressing love, intimacy or just pure pleasure. Since love and intimacy are abstract concepts, they prove difficult to study from a purely scientific perspective. However, a central role in research about functions of sexual activity belongs to sexual pleasure. There is increasing evidence of female primates experiencing orgasms and looking for sexual partners not only for reproduction, but for sexual pleasure. One example of this is homosexual activities among female primates. So, even following primate to human evolutionary theory, observed evidence still works in favor of rejecting the hypothesis that female sexuality is determined by their limited capacities of conception and that females are sexually passive.

Male sexuality and sexual activity were assumed to be unlimited, since male reproduction potential has no limits in the sense that males can inseminate countless number of females, while females have limited capacity to conceive. But, assuming that sex only has a reproductive function is too strong. This

assumption might be true for many species, but definitely not true for humans, both male and female. Sex has many more functions in humans, including love, intimacy or just pure pleasure. In that, like every other sense, humans are not just highly sophisticated monkeys (most of the research of Darwin's time was done on primates and directly generalized to humans). Since love and intimacy are very abstract things that are really hard to study from pure scientific perspective, central role in research about functions of sexual activity belongs to female orgasm. There is an increasing evidence of female primates experiencing orgasms and looking for sexual partners not only for reproduction, but for sexual pleasure. One of the examples of such evidence are homosexual activities among female primates. So, even if we humans were just highly sophisticated monkeys, observed evidence still works in favor of rejecting the hypothesis that female sexuality is determined by their limited capacities of conception and that females are sexually passive.

The point and goal of this book is that gender differences are not just given by nature.

2.2. Gender differences in competitiveness from the perspective of game theory and economics

Theories have also developed from biology, anthropology, and the theory of evolution and their critiques are no longer sufficient to prove or disprove gender differences in willingness to compete, or gender differences in general. They are howeveruseful in building assumptions in theoretical models that we are going to use. Such assumptions are based on gender differences in abilities, confidence and risk aversion. These assumptions might or might not hold from one case to another, and that is why replication of empirical studies are very important.

In order to understand gender differences in willingness to compete, we must also look at economic theories and include monetary incentives for competition. Most of the economic models of competition are developed from game theory literature on contests. *Tullock (1980)* and *Baik (1994)* developed a framework for modeling contests between asymmetric players. But these models are more general and they don't account for gender differences and how gender affects important parameters of the model like preferences, abilities, confidence and risk aversion. These models assume differences only on the individual level, but they do not consider gender as one of the very important sources of those differences. Therefore, these models needed an adaptation that will account for gender as a source of differences in preferences, abilities, confidence, aside from differences on the individual level. Such an adapted model

was developed by *Cotton, Li, McIntyre, Price (2015).* In terms of quantitative theoretical framework, this is the most recent and most advanced model of behavior in a competitive setting. In the model, players simultaneously choose effort; where their performance is a function of invested effort and their abilities, with the probability of winning the contest increasing in own performance and decreasing in opponent's performance. Further, in this model, players are competing with each other, so the probability of winning the contest doesn't depend only on player's own performance, but also on their performance relative to their opponent. Performance is a function of effort and abilities. Effort depends of a player's cost-benefit ratio of putting the extra effort. In that sense, if a player values benefit (winning the competition) more than the cost of putting the effort, a player will put more effort and increase their probability of winning, while holding their abilities fixed.

Empirical evidence is relatively consistent with previously mentioned theoretical framework, but there are some results that are not consistent with all of the assumptions of the theoretical model. Even with the same performance as men, women choose to compete significantly less *(Nierderle &Vesterlund 2007).* Additionally, many empirical studies have revealed some factors that should be incorporated in the theoretical model, like the impact of different types of incentives and mixed sex versus same sex competitions.

Why are women less likely to compete? This it could be due to their beliefs about their relative performance. Evidence from empirical studies prove this assumption: when they are asked to guess their relative performance, most of the subjects over-rate themselves, with men doing that significantly more; which essentially means that men are more confident about their relative performance, which is one of the main factors of their decision about whether to compete or not. Similarly, there is a significant difference in performance of women in same sex competitions compared to mixed sex competition. Women are much more competitive when they are competing with other women than when they are competing with men or when they do not know who they are competing with *(Nierderle &Vesterlund 2008).*

Risk aversion plays an important role in decision making in general, thus economists and psychologists have developed a variety of experimental methodologies to estimate risk aversion. Which methodology to use depends on the characteristics of the sample and which question we want to answer *(Charness, Gneezy, Imas 2012).* Because it is so difficult to distinguish whether the decision to compete or not is based on competitiveness or risk tolerance/aversion, some of these methodologies are used to control for the risk aversion of players in competitive games.

Most of the authors use the same or similar methodologies to compare male and female competitiveness. Authors compare male and female willingness to compete by comparing their performance in doing experimental tasks under two main payment schemes: a piece rate scheme and a tournament scheme.. In the piece rate scheme, subjects receive a payment that depends only on their own performance. For example, they get paid $1 per solved problem, regardless of how other subjects perform. In the tournament scheme, subjects get paid more, but only if they outperform their opponent. If they don't outperform their opponent, they get nothing. Results of most of these experiments show that the performance of males and females is statistically insignificantly different in most of the cases. However, males choose the tournament scheme significantly more than females. In most of the experiments, experimenters used only cash incentives, which could be one of the reasons for these results. If we use alternative incentives, that could change the results. For example, if we use non-monetary incentives that women might value more than cash, but that had the same monetary value, gender differences in willingness to compete completely disappear. An experiment on this topic has been done in China, and the results show that when offered cash incentives, women are less competitive than men, but when offered non-cash incentives (bookstore voucher for their kids), women and men compete at equal rates *(Cassar, Whordofa, and Zhang 2016)*. This proves that women are more competitive when competing for the wellbeing of their children compared to competing for their own wellbeing *(Nierderle &Vesterlund 2008).* These findings are consistent with biological theories, but they have not yet been incorporated into the economic framework. This paper will be based on the methodology used in *Cassar, Whordofa, and Zhang (2016),* as the most recent and advanced methodology that takes into account all previously mentioned factors that affect the decision about whether to compete or not: such as performance, risk aversion, confidence and different types of incentives.

This paper is replication to the extent of using same methodology as *Cassar, Whordofa, and Zhang (2016),* but uses a different sample – primarily different country and different age category.

3. Model and hypothesis

$$Choice_{it} = \beta_0 + \beta_1 Gender_i + \beta_2 Treatment_{it} + \beta_3 Gender_i * Treatment_{it} + \beta_4 Performance_i + \beta_5 Risk\ Tolerance_i + \beta_6 WTP_i + \beta_7 Confidence_i + \beta_8 Controls_i$$

Where:

- Choice is a binary variable – 0 if subject chooses not to compete, 1 if subject chooses to compete,
- Treatment is a binary variable that takes value of 0 for cash incentive and value of 1 for alternative incentive. This way we are measuring how different treatments (incentives) affect willingness to compete,
- Performance is number of correct answers,
- WTP is willingness to pay for voucher. In other words, how much subject value different incentives, relative to cash,
- Control variables include age, education, education of head of household, income, household level income and dummy variables for missing values of all variables in the model.

H0: difference in female willingness to compete is zero across different payment schemes (treatment has no effect on female willingness to compete)

H1: female subjects are significantly more willing to compete for at least one of the non-cash prizes (treatment has significant effect on female willingness to compete).

4. Experimental Protocol

The experiment was conducted in 4 sessions. Each session lasted approximately 60 minutes. Written instructions were distributed to the subjects to ensure consistency between sessions. Participants recorded their responses on paper and assistants graded the answers during each session. Everyone was provided with scratch paper.

The experiment consisted of 8 rounds: 5 rounds of solving addition problems with time limit where each round represents different payment scheme, plus 3 additional rounds for measuring risk aversion and willingness to pay for different payment types. At the end of each round, subjects were informed of their own score, but not of score of other participants or their performance relative to others. No communication between subjects was allowed for the entire duration of the experiment. Similarly, the use of cell phones, calculators or any other devices that could affect the results was not allowed.

The first 5 rounds consisted of 30 addition problems with time limit of 3 minutes. Problems had 5 two-digit addends, horizontally aligned. Example:

32 + 16 + 22 + 46 + 12 = _____

The goal was to provide as many correct answers as possible within the time limit of 3 minutes. Only correct answers were taken into account as a measure of performance, so both speed and correctness were vital.

This is an incentivized experiment, so subjects are getting paid 10 BAM as show-up payment in addition to a variable payment based on their performance and 10 BAM for dictator game that can be considered as a fixed payment, since most of the subjects keep either 9 BAM or 10 BAM. The variable part of the payment depends on their performance and preferences. For the variable payment, subjects get paid according to only one randomly drawn round. We have 8 rounds, so if we randomly draw number 3, that means they are going to be paid according to their performance in round 3. Since subjects don't know which round is going to be drawn, they have to give their best in each round. Also, this way, we are forcing subjects to reveal their true preferences in risk aversion and willingness to pay. Because what they choose might be exactly what they are going to be paid, any false answers will negatively affect them.

Round 1 – Piece rate

In this round, participants are doing addition tasks with time limit of 3 minutes. If this round gets drawn as round according to which subjects are going to be paid, they get paid 1 BAM per correct answer, no matter how well they performed relative to others. This is a non-competitive round, where only a subject's own performance matters.

Round 2 – Tournament

In this round, participants are doing the same type of addition tasks with time limit of 3 minutes. If this round gets drawn as round according to which subjects are going to be paid, then they get paid 2 BAM per correct answer, but only if they have more correct answers than a randomly assigned, anonymous opponent (they know nothing about their opponent). If they have fewer correct answers than opponent, they get 0 for the variable part of the payment. This is a competitive round and participants don't have a choice of whether to compete or not. If we have a tie, both participants get paid 1 BAM per

correct answer. If we have an odd number of participants in the session, two of the participants will be matched with same opponent.

Round 3 – Choice cash

In this round, participants are doing the same kind of addition tasks with time limit of 3 minutes. This time, at the end of the round, participants can choose whether they want to compete or not. If they choose to compete, they will be paid 2 BAM per correct answer, but only if they have more correct answers than randomly assigned, anonymous opponent. If they have fewer answers than the opponent, they get 0 for the variable part of the payment. In case they choose to compete, their score in this round will be compared to score of their opponent in round 2 (tournament) so that everybody has a match and this way we are also making sure that they are competing against the score of the other participant under competitive payout conditions. During the whole experiment, they are assigned the same opponent they were assigned to in round 2 (tournament). If they choose not to compete, they get paid 1 BAM per correct answer, regardless of their relative score to others. In this round, they are competing for cash.

Round 4 – Choice gender-neutral voucher

This round is the same as previous round, except that if this round gets drawn, subjects are going to be paid in gender-neutral voucher of same value, instead of cash. Again, they get paid 1 BAM value of voucher per correct answer and similarly if they choose not to compete and they get paid 2 BAM value of voucher per correct answer, if they choose to compete and win. If they have fewer answers than opponent, they get 0 for variable part of payment. The gender-neutral voucher is a restaurant voucher. Some might argue that some people like going to restaurants more or less than others, but we are controlling for how much they value this voucher.

Round 5 – Choice gender specific voucher

Again, this round is the same as the previous round, except the that, if this round gets drawn, subjects are going to be paid in gender-specific voucher of the same value, instead of cash. Male subjects get a voucher for a male good (voucher for sport goods, equipment, accessories, clothes etc.) and female subjects get a voucher for a female good (voucher for makeup and cosmetics store). Again, they get paid 1 BAM value of voucher per correct answer if they choose not to compete and they get paid 2 BAM value of voucher per correct answer, if they choose to compete and win. If they have fewer answers than the

opponent, they get 0 for the variable part of payment. Again, we are controlling for how much they valuate this voucher.

Round 6 – Risk tolerance/aversion game

Risk tolerance is measured with a series of choices between a certain amount of cash and an uncertain, gambling option with a higher payment, but with a 50% chance of winning, determined by coin flip. If they get heads, they win 20 BAM and if they get tails, they get 0. In first row of this game, subjects choose between a guaranteed win of 2 BAM and a coin toss for 20 BAM. In next row, they choose between a guaranteed win of 4 BAM or a coin toss for 20 BAM. We keep increasing the amount of the guaranteed win until they finally have to choose between a guaranteed win of 20 BAM or the coin toss for 20 BAM. Then, we record at which point they switch from the coin toss to a guaranteed win as their risk tolerance. The sooner they switch, the less risk tolerant (or more risk averse) they are. A very important part of this game is consistency of answers: subjects can switch only once from risky to non-risky option, because it wouldn't make sense, for example, to take a guaranteed win when offered 8 BAM vs gambling for 20 BAM but gamble when offered 14 BAM vs gambling for 20 BAM. Thus, once a subject switches from the gambling option to the guaranteed option, they have to stick to the guaranteed win option. Otherwise, we wouldn't have meaningful data with more than one switching point. If this round does get drawn, then we randomly draw a number from 1 to 10, since they have 10 choice questions and they are going to be paid according to their choice in a randomly drawn number of question. For example, if we randomly draw number 2, it means that they are going to be paid according to their choice of a guaranteed win of 4 BAM, and a coin toss for 20 BAM. If they choose the coin toss, we are really going to toss the coin for 20 BAM and if they choose a guaranteed win; they are going to be paid that amount. This way, we are ensuring that subjects reveal their true preferences, because if they give false answers, they might be paid according to those false answers and they will be the ones that will not be happy with that outcome.

Round 7 - Willingness to pay for gender-neutral voucher

Willingness to pay is measured similarly to risk tolerance where subjects choose between an option of 20 BAM value of gender-neutral voucher and option of certain amount of cash, with increasing increments, like in the risk game. In the first row of this game, subjects choose between 2 BAM in cash and 20 BAM value of voucher. In next row, they choose between 4 BAM in cash or 20 BAM voucher.

We keep increasing the amount of cash until they finally have to choose between 20 BAM of cash or 20 BAM voucher. Then we record their switching point from voucher to cash as their willingness to pay for voucher. The sooner they switch, less they value the voucher. Again, a very important part of this game is the consistency of the answers: subjects can only switch once. As in risk game, subjects might be paid according to their preferences in this round if this round is randomly drawn. If this round does get drawn, then we randomly draw number from 1 to 10, since they have 10 choice questions and they are going to be paid according to their choice in the randomly drawn number of question. For example, if we randomly draw number 2; it means that they are going to be paid according to their choice between 4 BAM in cash and 20 BAM voucher. They really get what they choose. This way, we are making sure that subjects reveal their true preferences, because if they give false answers, they might be paid according to those false answers and will be the ones that will not be happy with that outcome.

Round 8 – Willingness to pay for gender specific voucher

In this round, we apply the same rules as in previous round (WTP for gender neutral voucher), only this time they are choosing between cash and gender specific voucher.

While rounds 3, 4 and 5 always followed rounds 1 and 2, the treatment order within the two blocks was randomly assigned to sessions (rounds 1 and 2 are one block and rounds 3, 4 and 5 are other block).

After the first five rounds, subjects were asked to guess their opponent's score in the round 2 (tournament). The difference between their own score and their guess of their opponent's score is used to proxy for their confidence in winning the tournament.

5. Data

Our sample consists of 119 subjects, 62 male and 57 female. Original sample had 141 observations, but we had to eliminate first 22 observations as a result of no variation in behavior due to protocol issues. Subjects are young people from 19 to 30 years, mainly college students from Banjaluka, Republic of Srpska, Bosnia and Herzegovina. Average age of subjects is 23.5 years.

Potential subjects were required to send an application via email. After collecting base of 300 potential subjects, 160 of them were randomly drawn for participation, 80 males and 80 females. Randomization had to be done on the gender level, since the gender structure of the sample is a crucial issue for this experiment. The initial plan was to have 160 subjects, 80 male and 80 female, but in each session there were subjects that didn't show up. The experiment was organized in 4 sessions and sessions were organized approximately every two weeks.

There are no significant differences between male and female subjects in terms of age, education and income. Also, experimental data shows that there is no significant difference between male and female subjects in terms of abilities, since they have equally good performance in experimental games – in every round of the experiment male and female subjects have an insignificantly different number of correct answers. Likewise, male and female subjects have insignificantly different preferences in valuation of different payment schemes. The only statistically significant difference between male and female subjects in terms of results of experimental games is risk tolerance/aversion. Male subjects in the sample are significantly more risk tolerant. These results are consistent with existing literature, so they were expected. More formally, these results are shown on Table 1.

Table 1 – Summary statistics by gender

Variable	Overall	Male	Female	H0: difference = 0
	N = 119	N = 62	N = 57	p value
Score - Piece rate	7.50	7.50	7.51	0.9898
	(3.73)	(3.81)	(3.67)	
Score - Tournament	7.34	7.27	7.40	0.8565
	(3.87)	(4.11)	(3.64)	
Score - Choice cash	7.69	7.73	7.65	0.9208
	(4.18)	(4.42)	(3.93)	
Score - Choice gender neutral voucher	7.97	7.95	8.00	0.9517
	(4.32)	(4.43)	(4.25)	
Score - Choice gender specific voucher	8.29	8.50	8.07	0.5890
	(4.31)	(4.44)	(4.19)	
Risk tolerance	9.85	10.71	8.91	0.0133
	(3.98)	(3.82)	(3.98)	
WTP for gender neutral voucher	9.95	10.39	9.47	0.3689
	(5.51)	(5.39)	(5.65)	
WTP for gender specific voucher	10.24	9.71	10.81	0.2632
	(5.32)	(5.32)	(5.32)	
Confidence	-0.34	-0.52	-0.15	0.4660
	(2.75)	(2.88)	(2.61)	
Age	23.54	23.28	23.83	0.2616
	(2.66)	(2.67)	(2.64)	
Household income	1904.91	2022.71	1776.77	0.1777
	(991.89)	(1066.27)	(895.87)	
Own income (censored at 0)	310.11	362.94	252.64	0.0664
	(327.75)	(357.17)	(284.49)	
Years of education	13.57	13.44	13.72	0.4448
	(2.00)	(1.95)	(2.05)	
Years of education of head of household	13.43	13.74	13.09	0.2091
	(2.83)	(2.95)	(2.67)	

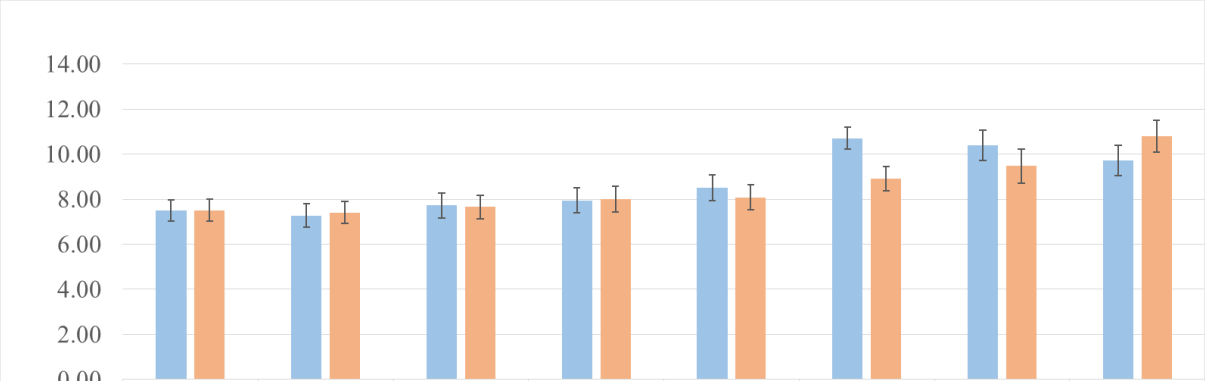
Standard deviation in parentheses

As previously stated, there are no significant differences between male and female subjects, except in risk tolerance.

Explanation of variables:

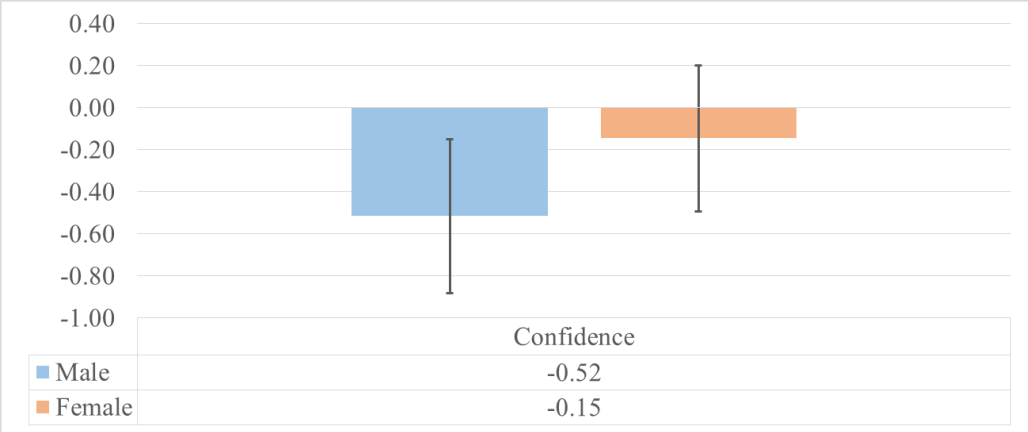
- First 5 rows of Table 1 (Piece rate, Tournament, Choice cash, Choice gender neutral voucher, Choice gender specific voucher) represent different rounds of experimental game under different payment schemes. Reported values are average number of correct answers (out of 30 tasks per round) and their standard deviation.
- Risk Tolerance (6th row of Table 1) is measured by recording the switching point from certain, safe option to uncertain, gambling option where higher value represents higher risk tolerance.
- Willingness to pay (7th and 8th row of Table 1) are measured by recording switching point from cash prize to voucher, where higher value represents higher willingness to pay for voucher. Since we have two types of vouchers, we measure WTP for each.
- Confidence is measured by comparing subject's performance in tournament round and their belief about performance of their randomly assigned, anonymous opponent. Negative values mean they have reported that they believe that opponent had more answers. More negative this measure is, lower the confidence is, and opposite.
- Income is measured on monthly basis in local currency – Bosnian marks (BAM).
- Years of education is derived from whether they finished elementary school (8 years), high school (12 years), college (16 years) etc.
- Last column reports p values for difference between male and female subjects.

Figure 1 – Performance, risk tolerance and WTP



	Piece rate	Tournament	Choice cash	Choice gender neutral voucher	Choice gender specific voucher	Risk tolerance	WTP for gender neutral voucher	WTP for gender specific voucher
Male	7.50	7.27	7.73	7.95	8.50	10.71	10.39	9.71
Female	7.51	7.40	7.65	8.00	8.07	8.91	9.47	10.81

Figure 2 – Confidence



As we can see from Figure 2, we get surprising results that show us that female subjects are more confident compared to male subjects. But this difference is not statistically significant. Also, minimal difference between subject's number of answers and guessed number of opponent's answers can be 1 and here we see that their confidence is between 0 and 1 on average which means that they are pretty much on zero level of confidence.

Since the experiment was organized in multiple sessions, we have to check if there is any significant difference between sessions, in terms of subject's abilities, preferences, education, age, and income. We find that sessions are mostly insignificantly different, but there are some significant differences between sessions. Subjects from session 1 performed significantly better than subjects from session in round 2 –Tournament (p=0.03). Similarly, subjects from session 1 are significantly more risk tolerant than subjects from session 3 (p=0.03) and subjects from session 4 (p=0.04). Subject's from session 4 have significantly higher household level income than subjects from session 1 (p=0.03), as well as higher own (personal) income (p=0.03). But subjects from session 1 have significantly higher own income than subjects from session 2 (p=0.03). These are all statistically significant differences between sessions, but they are not a concern, since we are controlling for these differences in our regressions and it will be shown that they don't have significant impact on main outcome.

Formally, these differences between sessions are shown in Table 2 and Table 3. Table 2 consists of information about mean and standard deviations of main variables of interest, while Table 3 consists of formal results of comparison of main variables of interest across sessions using t test (p value reported).

Table 2 – Summary statistics across sessions

Variable	Overall	Session 1	Session 2	Session 3	Session 4
	N = 119	N = 34	N = 32	N = 33	N = 20
Piece rate	7.50	8.12	7.69	7.06	6.90
	(3.73)	(3.88)	(3.99)	(3.31)	(3.78)
Tournament	7.34	8.35	7.44	6.33	7.10
	(3.87)	(3.96)	(3.78)	(3.30)	(4.53)
Choice cash	7.69	8.41	7.75	6.91	7.65
	(4.18)	(3.85)	(3.72)	(4.05)	(5.52)
Choice gender neutral voucher	7.97	8.59	8.13	7.45	7.55
	(4.32)	(4.56)	(3.98)	(3.99)	(5.09)
Choice gender specific voucher	8.29	8.88	8.41	7.64	8.20
	(4.31)	(4.49)	(3.68)	(3.90)	(5.59)
Risk tolerance	9.85	11.18	9.56	9.09	9.30
	(3.98)	(3.23)	(4.59)	(4.42)	(2.92)
WTP for gender neutral voucher	9.95	10.29	10.63	9.21	9.50
	(5.51)	(5.33)	(6.04)	(5.27)	(5.58)
WTP for gender specific voucher	10.24	10.71	10.19	9.45	10.80
	(5.32)	(4.92)	(6.39)	(4.67)	(5.37)
Confidence	-0.34	-0.24	-0.78	-0.19	-0.05
	(2.75)	(2.61)	(2.77)	(2.60)	(3.28)
Age	23.54	23.93	23.80	22.97	23.40
	(2.66)	(2.58)	(2.81)	(2.34)	(3.07)
Household income	1904.91	1662.36	2060.25	1829.03	2193.90
	(991.89)	(791.26)	(1109.99)	(1034.04)	(983.84)
Own income (censored at 0)	310.11	207.71	387.66	287.43	397.51
	(327.75)	(242.81)	(408.43)	(254.84)	(381.24)
	29	29	13	7	3
Years of education	13.57	13.76	13.31	13.14	14.38
	(2.00)	(2.02)	(2.01)	(1.80)	(2.12)
Years of education of head of household	13.43	13.29	13.00	13.64	14.00
	(2.83)	(3.44)	(3.09)	(2.09)	(2.34)

Standard deviation in parentheses

Table 3 – t test results in comparison across sessions

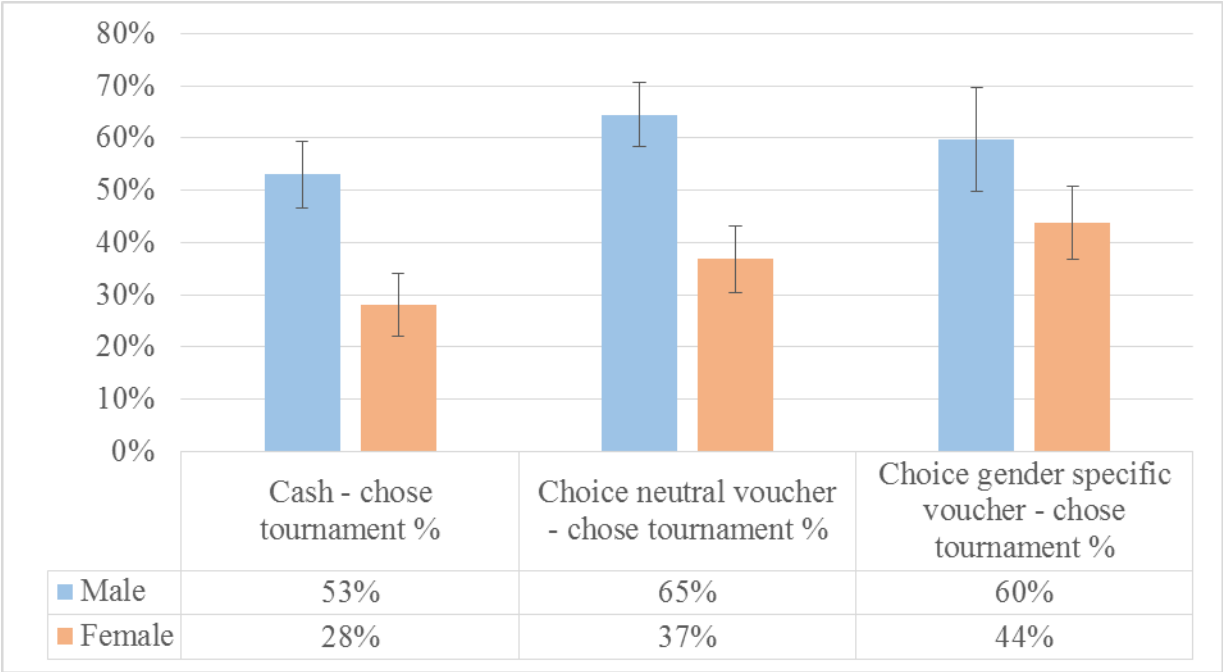
Variable	H0: difference = 0					
	p value					
	1 vs 2	1 vs 3	1 vs 4	2 vs 3	2 vs 4	3 vs 4
Piece rate	0.66	0.24	0.27	0.49	0.48	0.87
Tournament	0.34	**0.03**	0.29	0.21	0.77	0.48
Choice cash	0.48	0.12	0.55	0.39	0.94	0.58
Choice gender neutral voucher	0.66	0.28	0.44	0.50	0.65	0.94
Choice gender specific voucher	0.64	0.23	0.62	0.42	0.87	0.67
Risk tolerance	0.10	**0.03**	**0.04**	0.67	0.82	0.85
WTP for gender neutral voucher	0.81	0.41	0.61	0.32	0.50	0.85
WTP for gender specific voucher	0.71	0.29	0.95	0.60	0.72	0.34
Confidence	0.41	0.95	0.82	0.38	0.39	0.86
Age	0.85	0.12	0.50	0.20	0.63	0.57
Household income	0.10	0.46	**0.03**	0.39	0.66	0.21
Own income (censored at 0)	**0.03**	0.19	**0.03**	0.24	0.93	0.21
Number of zero income	0.08	0.13	0.07	0.81	0.73	0.58
Years of education	0.36	0.19	0.29	0.71	0.07	**0.03**
Years of education of head of household	0.72	0.63	0.42	0.33	0.22	0.56

1 vs 2 - session 1 compared to session 2
1 vs 3 - session 1 compared to session 3
etc.

6. Results

Figure 3 shows results of a comparison between male and female competitiveness in each round where they had a choice between competing or not. Competitiveness is measured by whether subjects choose to compete in order to get paid double amount if they win or they choose a safe option – piece rate, where they will be paid only according to their own performance, not relative to others. Each of these rounds also represents different payment schemes. Results show that male subjects are significantly more competitive when the payment is cash (53% of male subjects choose to compete vs 28% of female subjects, p=0.0051). Also, male subjects are significantly more competitive when the payment is gender-neutral voucher (65% of male subjects choose to compete vs 37% of female subjects, p=0.0023). Finally, results show that there is no statistically significant difference between competitiveness of male and female subjects at 1% or 5% level when payment is gender specific voucher (60% of male subjects choose to compete vs 44% of female subjects, p=0.0858). These results are just a first look at the comparison between male and female subjects in terms of competitiveness. Here we don't control for any of variables that could explain these differences, except gender itself.

Figure 3 – Gender differences in willingness to compete



	Cash - chose tournament %	Choice neutral voucher - chose tournament %	Choice gender specific voucher - chose tournament %
Male	53%	65%	60%
Female	28%	37%	44%

Not only do we want to investigate male vs female competitiveness under different payment schemes, we also want to investigate the change in female competitiveness under different payment schemes and determine if that change is statistically significant. First, we drop all male observations in order to take only female competitiveness into account. Then, we compare female competitiveness under different payment schemes. We follow the same procedure for male subjects. Results are presented in Table 4, where we report p values of comparison of female competitiveness under different payment schemes in first row and p values of comparison of male competitiveness under different payment schemes.

Table 4 – Comparison of competitiveness of each gender separately under different payment schemes

		Cash vs Gender neutral voucher	Cash vs Gender specific voucher	Gender neutral vs Gender specific voucher
p value	Female	0.32	0.08	0.45
	Male	0.21	0.47	0.58

As we can see from Table 4, there is no significant change in female competitiveness when we switch incentive from cash to gender neutral voucher (p=0.32). Also, when we compare female competitiveness when competing for gender-neutral voucher vs gender specific voucher, there is no significant difference (p=0.45). However, when we compare female competitiveness for cash vs gender specific voucher, difference is significant at 10% level (p=0.08). We follow the same procedure to investigate what happens with male competitiveness under different incentives and we find no significant difference in male competitiveness under different payment schemes.

Besides analysis in terms of significance levels, we also analyzed the size of the difference – effect size by using Cohen's d and odds ratio. Cohen's d has value of 0.52 when incentive is cash, 0.57 when incentive is gender neutral voucher and it drops to 0.32 when we introduce gender specific voucher as an incentive, which simply means that not only does the significance of difference between male and female subjects drop when we introduce gender specific voucher as an incentive, but also magnitude (size) of the difference between male and female subjects drops. Odds ratio has value of 1.89 when incentive is cash, 1.76 when incentive is gender-neutral voucher and it drops to 1.36 when we introduce gender specific voucher as an incentive. Odds ratio of 1 would mean that there is no difference between male and female

willingness to compete. Hence, as we introduce gender specific voucher as an incentive, we can see that odds ratio approaches to value of 1.

Power analysis

Considering the small sample size, we did a power analysis in order to check the probability of rejecting the null hypothesis with a given sample size and to check for minimum sample size that would be necessary for rejecting the null hypothesis. Results are presented in Table 5.

Table 5 – Power analysis

	Cash	Gender neutral voucher	Gender specific voucher
Power with a given sample size	99%	99%	93%
Minimum sample size for rejecting the null with 95% confidence and power of 80%	31	26	79

With a given sample size (n=119), power is 99% for cash and gender-neutral voucher rounds and 93% for gender specific voucher round/treatment. This simply means that the likelihood of correctly rejecting the null (not making type I error) is 99% in case of cash and gender-neutral voucher and 93% in the case of gender specific voucher. On the other hand, by using a default statistical power of 80%, we calculate minimum sample size that is necessary for correctly rejecting the null: in the case of the cash incentive, the minimum sample size is 31, in the case of gender neutral voucher 26 and in the case of gender specific voucher 79. Since our sample size is 119, we can conclude that statistical power is not an issue.

Regression results

As fore mentioned, we don't control for any other factors that could affect the subject's choice whether to compete or not in previous analysis, those were just simple t tests. The next step is including other variables that could affect their choice to compete or not. We include the number of correct answers, risk tolerance, willingness to compete for the voucher, confidence and a set of control variables: age; education; education of the head of household; income; and household level income. We also control for missing observations for all of the variables in model.

Since our dependent variable is binomial, 0 or 1 outcome, where choice = 1 if subject chooses to compete and choice = 0 if subjects chooses not to compete, we use probit estimation to estimate differences between male and female subjects in probability to choose to compete. Since we have 3 different payment schemes, we use 3 separate cross-sectional probit estimations, first for gender differences under cash payment scheme, second for gender differences under neutral voucher payment scheme and third for gender differences under gender specific payment scheme.

Results are consistent with results presented on Figure 3 – when competing for cash and a gender-neutral voucher, female subjects are significantly less competitive than male subjects. But, when competing for gender specific voucher, female subjects are insignificantly different from male subjects in their willingness to compete.

The difference between male and female subjects in the willingness to compete when competing for cash is significant at 1% level, when competing for gender-neutral voucher at 1% level too, but when competing for gender specific voucher, the difference between male and female subjects is insignificant both at the 1% and 5% level.

These results are presented in Regression table 1. The table is split into 3 parts (3 major columns) where part (1) represents probit regression in the cash payment scheme; part (2) represents probit regression in a gender-neutral voucher payment scheme and part (3) represents probit regression in a gender specific voucher payment scheme. Each of these regressions is split into part (a) and part (b), where part (a) represents the basic model without control variables and part (b) represents the model with control variables included. We are going to focus on interpretation of coefficients from part (b) of each regression, meaning that we are going to interpret only the coefficients from full models with all control variables.

When competing for cash, female subjects are 25.8 percentage points less likely to choose to compete. Also, confidence is significant – a one unit increase in confidence leads to 7.73 percentage points increase in probability to choose to compete. Both coefficients are significant at 1% level.

When competing for a gender-neutral voucher, female subjects are 30.9 percentage points less likely to choose to compete, significant at 1% level.

When competing for a gender specific voucher, the difference between male and female subjects in their willingness to compete is insignificant at both 1% and 5% level. Confidence is significant at 1% level and the coefficient on confidence is telling us that one unit increase in confidence leads to 6.88 percentage points increase in probability to choose to compete.

Our analysis doesn't end here, since we also have to capture within individual random effects. Our main independent variable as well as some other important explanatory variables, are time/treatment invariant, therefore we can't use fixed effects. We are starting by reshaping our dataset in panel dataset where we treat different treatment (different payment schemes) as "time" variable. Basically, we are taking into account behavior with no treatment (cash payment scheme) and with treatment (voucher payment scheme). So different payment schemes are treated as different time points (before and after treatment). This way, we are going to be able to capture within individual effects. We are also including an interaction term of variable treatment and gender, because we want to differentiate the effect of treatment in general and effect of treatment on females only.

Results, after applying this approach, are presented in Regression table 2. Gender is still significant, implying there are still differences between male and female subjects, but we can also see that the effect of treatment on females is significant at 5% level. The coefficient on "Treatment on females" means that female subjects are 15.8 percentage points more likely to compete, when we introduce the treatment – a gender specific voucher as an incentive, relative to cash incentive. Also, confidence remains a significant factor on decision on whether to compete or not. Generally, one unit increase in confidence level means 7.42 percentage points increase in probability that the subject is going to choose to compete.

Coefficient on "Treatment on females" is a coefficient that we got by joining the coefficients of variable "Treatment" and interaction term of "Treatment" and "Gender". Basically, that is a first derivative with respect to "Treatment" when gender is female. We can get the same results in a different setting: by running a regression for females only, by excluding male subjects. This way, the coefficient on "Treatment" is 0.158, which confirms our results and the logic of it.

Regression table 1 – Probit cross-sectional regressions

	(1)		(2)		(3)	
	COMPETING FOR CASH		COMPETING FOR GENDER NEUTRAL VOUCHER		COMPETING FOR GENDER SPECIFIC VOUCHER	
	(a)	(b)	(a)	(b)	(a)	(b)
Gender	-0.247***	-0.258***	-0.248***	-0.309***	-0.176**	-0.159*
	(0.0772)	(0.0855)	(0.0791)	(0.0802)	(0.0861)	(0.0871)
Number of correct answers	-0.0109	-0.0215	0.0139	-0.00425	-0.00659	-0.0112
	(0.0144)	(0.0150)	(0.0155)	(0.0166)	(0.0163)	(0.0169)
Risk tolerance	0.00959	0.00795	0.0110	0.0101	0.00802	0.00993
	(0.0116)	(0.0118)	(0.0120)	(0.0116)	(0.0117)	(0.0114)
WTP gender neutral voucher			0.00160	-0.00362		
			(0.00824)	(0.00807)		
WTP gender specific voucher					0.0113	0.00973
					(0.00851)	(0.00836)
Confidence	0.0667***	0.0773***	0.0107	0.0171	0.0624***	0.0688***
	(0.0184)	(0.0184)	(0.0213)	(0.0213)	(0.0214)	(0.0215)
Control variables included	NO	YES	NO	YES	NO	YES
Log pseudo likelihood	-69.64	-65.91	-75.65	-70.61	-73.97	-71.10
Pseudo R squared	0.14	0.18	0.08	0.14	0.10	0.14
Observations	119	119	119	119	119	119

Regression table 2 – Panel regression, random effects

	(1)	(2)	(3)	(4)	(5)	(6)
Gender	-0.252***	-0.255***	-0.238***	-0.251***	-0.271***	-0.254***
	(0.0879)	(0.0865)	(0.0891)	(0.0909)	(0.0859)	(0.0952)
Treatment on females	0.158**	0.158**	0.158**	0.158**	0.158**	0.158**
	(0.0743)	(0.0745)	(0.0747)	(0.0748)	(0.0750)	(0.0765)
Number of correct answers		0.0244***	0.0239***	0.0246***	-0.00774	-0.0147
		(0.00830)	(0.00830)	(0.00854)	(0.0113)	(0.0133)
Risk tolerance			0.00924	0.00704	0.00833	0.00952
			(0.0104)	(0.0110)	(0.0112)	(0.0109)
WTP gender specific voucher				0.00826	0.0108	0.00916
				(0.00788)	(0.00737)	(0.00729)
Confidence					0.0649***	0.0742***
					(0.0147)	(0.0156)
Control variables included	NO	NO	NO	NO	NO	YES
Observations	238	238	238	238	238	238
Number of subjects	119	119	119	119	119	119

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

Controls: age, education, education of head of household, income, household level income and missing values of all variables in the model

7. Conclusion

From the results, we can conclude that incentive matters for female competitiveness. Even though women are less competitive for cash, their competitiveness significantly increases when offered an alternative incentive that they potentially care more about, relative to cash. Mothers are more competitive when competing for incentives related to wellbeing of their children and young women are also more competitive when competing for incentive related to something they care about more than cash. The gender gap is still present, but we see a significant increase in female competitiveness.

These results are consistent with previous literature, mainly with Alessandra Cassar, Feven Wordofa, and Y. Jane Zhang (2016) "Competing for the Benefit of Offspring Eliminates the Gender Gap in Competitiveness" that we are replicating in terms of methodology and main idea. Such results could have important policy implications. One of the recommendations would be to raise awareness about equal performance and unequal competitiveness of females in universally applied, cash incentivized setting in order to encourage women to compete more. Even though women compete less for cash, equal performance of women and men should be a well known fact. Beliefs about relative performance are one of the most important factors, if not the most important factor in process of making the decision about whether to compete or not. Even when we achieve gender equality in terms of education, skills and performance, gender gap in terms of confidence still persists. That is why we need to work on raising awareness about women's false beliefs of weaker relative performance in order to boost their confidence to the level of realistic beliefs about their relative performance. This way, women would compete more, in general, regardless of incentive. Our results imply that confidence is statistically significant factor of choice about whether to compete or not, so increase in confidence leads to increase of likelihood to compete. Even though we didn't find significant difference in confidence between male and female subjects in this study, previous literature firmly confirms that women are less confident in competitions. Another recommendation would be to redistribute incentives in favor of non-monetary benefits for women. Those benefits would depend on age group, marital status and whether they have children or not. For example, redistributing salaries of mothers towards benefits for their children (daycare or school benefits, health insurance and similar). This way, even if women are less confident and competitive in traditional, cash incentivized setting, we would increase their willingness to compete as a result of new incentive - we already proved that incentive matters.

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