Competition and Gender in the Lab vs Field: Experiments from off-grid Renewable Energy Entrepreneurs in Rural Rwanda

Rebecca A. Klege and Martine Visser

ERSA working paper 806

January 2020

Competition and Gender in the Lab vs Field: Experiments from off-grid Renewable Energy Entrepreneurs in Rural Rwanda

Rebecca A. Klege*and Martine Visser†

January 6, 2020

Abstract

Applications of lab experiments to real-world phenomenon are limited. We fill the gap by examining how gender attitudes and performance under competitive situations in the lab, reflects microenterprise outcomes in the renewable energy sector of Rwanda. – a country with progressive gender policies despite its traditional patriarchal set-up. We use the standard Niederle and Vesterlund (2007) experimental design in addition to a unique dataset from off-grid microenterprises, managed by entrepreneurs who have been working in mixed and single-sex teams since 2016. Our findings show that the gender composition of teams does not affect decisions to compete in the lab. Instead returns to education and risk-taking are more valuable to single-sex teams than for mixed gender teams. We also show that under competitive situations, women perform as well as men. Findings from the field strongly support findings in the lab that female-owned enterprises do not underperform in competitive settings, which corroborates the external validity of our lab results. Given that lab and field findings suggest no significant differentials in terms of competitiveness or performance of females, there exist ample scope to increase women involvement in the renewable energy sector of Rwanda.

JEL codes: C91, C92, J16, Q49

Keywords: Competition, Gender differences, Entrepreneurs, Performance, Renewable energy

1 Introduction

Traditional job markets are mostly male dominated despite recent efforts by developmental organisations in closing the gender gap. Women often face various

*Environmental Economic Policy Research Unit (EPRU), School of Economics, University of Cape Town - South Africa. Email: rebeccaklege@gmail.com/klbreb001@myuct.ac.za

†Environmental Economic Policy Research Unit (EPRU), School of Economics, University of Cape Town - South Africa. Email: martine.visser@uct.ac.za

social restrictions (including overseeing most household chores, receiving less schooling and lower returns to their labour) in both developed and developing countries (World Bank, 2015). This problem is more severe in rural areas where social barriers such as culture and social norms play a significant role.

Despite the well-established advantages associated with the provision of modern energy sources to rural communities, studies in the renewable energy literature have shown that provision of energy sources alone are not enough to achieve the desired empowerment levels and economic freedom for women. Women's journeys towards better welfare opportunities and livelihoods could be fast-tracked if they are well represented at all levels of the energy supply chain (Baruah, 2017; 2015). Entrepreneurship has since been used as a breakthrough point for women in this sector (Clancy et al., 2012; Clancy, Oparaocha & Roehr, 2004). This has resulted in several initiatives and projects targeted at female entrepreneurship. Typical examples are the Solar Sisters initiative, Women's Integration into Renewable Energy (WIRE) and Women's Entrepreneurship in Renewables (wPOWER) under the Energy4Impact initiative.

Though entrepreneurship is a vital tool for promoting women's empowerment, it is essential to note that a predominant characteristic associated with successful entrepreneurship is the ability to compete (Shane, Locke & Collins, 2003). Women have been shown to be less willing to compete and are usually outperformed by men under competitive conditions (Dato & Nieken, 2014; Niederle, & Vesterlund, 2011; Ergun, Rivas & García-Muñoz, 2010; Croson & Gneezy, 2009; Niederle & Vesterlund, 2008; 2007; Datta Gupta, Poulsen & Villeval, 2005). This suggests that, apart from the well-established social barriers affecting women's participation in the labour market, females' unwillingness to compete can also influence their performance levels even after taking up entrepreneurial roles. A deliberate attempt to empower women in the renewable energy industry through entrepreneurship initiatives may have limited potential if due consideration to women's competitiveness and performance abilities are ignored.

To date, very little is known about the competitive and performance abilities of women working as sales point entrepreneurs in the renewable energy sector. Our study contributes to the global discussion on women's competitive decisions and performance levels by using lab-in-the-field experiments[1] to first examine how gender attitudes towards competition differ amongst village level entrepreneurs (VLEs) in Rwanda. The study then demonstrates how performance under competitive situations in the lab reflects microenterprise operations in the field by using a unique dataset from off-grid microenterprises managed by entrepreneurs already working in mixed and single-sex teams since 2016.

Rwanda provides a unique study context for the following reasons. Rwanda though a traditional patriarchal society is today frequently cited for its commitment towards women participation and gender equality policies (Burnet, 2011).

[1] Lab- in -the- field experiments are studies "conducted in a naturalistic environment targeting theoretically relevant population but using a standardized, validated lab paradigm" Gneezy & Imas (2017: pp 441). For detail explanation about the technique see Gneezy & Imas (2017).

This comes after the 1994 genocide which saw the death of at least 500,000 people, majority of whom were men (Dubsscher & Ansoms, 2013). Many women became widows and took over traditional male dominated social and economic activities. The government of Rwanda have since implemented several gender policies such as; the integration of gender as a fundamental right in the constitution, enforcing a gender quota system for local and national government and the creation of its first Ministry of Gender Equality. These top-down approaches brought about improved economic and career opportunities as well as higher levels of women participation in government. Although such policies have substantially improved the postcolonial patriarchal gender roles, rural women are yet to harness the full benefits of the government women-friendly policies (Burnet, 2011).

Furthermore, the renewable sector of Rwanda is booming as the government of Rwanda is determined to promote private sector involvement, in their quest to accelerate rural electrification to off-grid communities in order to provide a 100% energy access to its citizenry. However, women's participation in the private energy sector of Rwanda is low as there are no gender policies governing the private energy sector (Parshotam & van der Westhuizen, 2018). Examining women's competitiveness in this context does not only enrich the economic literature on competitiveness but also provide key insights into women's abilities in the private energy sector of Rwanda.

To implement our objective, the study first partners with Nuru Energy – a for-profit social enterprise. Nuru energy provides low-cost solar mobile phone and light recharging centres to off-grid poor communities in rural Rwanda. They operate by delivering power in the form of rechargeable light emitting diodes (LEDs) via local village enterprises. LEDs are recharged by a centralised pedal-and-solar-powered-recharge-station, which is operated by community-run microenterprises. As part of a more extensive study to understand the role of a gender quota business model in empowering women, 272 new microenterprises in Rwanda are established. These enterprises are randomized into three gender treatments such that each enterprise is owned by either an all-male team, an all-female team or a mixed gender[2] team consisting of four members. While such a gender quota-based business model provides an enabling environment for entrepreneurship and self-employment for women, it is essential to further investigate attitudes towards competition in such a context and examine if performance in the lab reflects microenterprise activities in the field.

The study measures willingness to compete and performance under competition using the standard experimental design of Niederle and Vesturland (2007) for a sample of 374 entrepreneurs from off-grid microenterprises in rural Rwanda. Subsequently, field outcomes: sales and self-reported incomes from microenterprise operations, are used to measure the field performances of gender teams. Our study shows that women operating off-grid microenterprises in Rwanda do not shy away from competition and perform as well as men in the lab. Com-

[2] The mixed gender team consist of equal representation of mem and women: two men, two women per team.

paring the performance of mixed gender and female-owned microenterprises to male-owned enterprises in the field, we find similar results of no performance differences between gender teams. Findings from the field strongly support findings in the lab that female-owned enterprises do not underperform when given the opportunity, which further corroborates the external validity of lab results. Our findings provide insights into the ability and performance of women, which is of relevance to microenterprise development in the renewable energy sector.

The rest of the paper proceeds as follows. Section 2 presents a review of related literature. The experimental design and data used for the study are detailed in Section 3. This is followed by the empirical strategy of the study in Section 4. Results and discussion of findings are reported in Section 5. Section 6 concludes.

2 Related Literature

A growing experimental literature has explored gender differences in attitudes towards competition with a focus on three broad areas: competition entry decisions, performance levels and gender composition of competing groups[3]. Results show that women are less willing to compete (Zhong et al., 2018; Apicella et al., 2017; Sutter & Glaetzle-Ruetzler, 2015; Booth & Nolen, 2012; Niederle & Vesterlund, 2007) and women have lower performance levels than men when they do compete (eg., Dariel et al., 2017; Dato & Nieken, 2014; Niederle et al. 2013). This may explain why women are less represented in the labour market and why at the subsistence level, female-operated firms are less profitable than those operated by their male counterparts (Buvinic & Furst-Nichols, 2016).

The literature on competition have however been skewed towards students based experiments in Western societies (*See Appendix 1 for a summarised review of studies on students and non-students' samples including their respective study area to date).* Developments in the literature show that culture or the context in which these experiments are conducted can influence competitive outcomes. Gneezy et al. (2009) explain this by comparing patriarchal and matrilineal societies. Whereas their observed gender gap in the patriarchal society of Masai emulates most findings in Western countries, the matrilineal society of Khasi shows a reversed gender gap. A follow-up study by Andersen et al. (2013) shows that although no gender gap exists between these two societies at age 7, by age 15, these two communities start exhibiting very different characteristics towards competition. These studies have since paved the way for more society specific studies (Booth et al., 2018; Bonte et al., 2017; Dariel et al., 2017; Cassar et al., 2016; Apicella & Dreber, 2015).

Despite the progressive nature of the competition literature, to date, applications of such experimental studies are limited. Little is known about the extent to which competition measures in the lab relate to real outcomes. Studies have attempted examining competition in real-world situations or by using natural

[3]For a detailed review on these key areas see Niederle and Vesturlund (2011) and Croson and Gneezy (2009).

field experiments (Ors et al., 2013; Paserman, 2010; Lavy, 2008) however, the direct link of competition measures to real-world outcomes is still scarce. Zhang (2012) and Buser et al. (2014) directly examine how competition predicts educational choices of students. Both studies show that choices in the lab under competitive incentives correspond to choices of study but were unable to study students' performance outcomes under exam conditions. Berge et al. (2015) argue that an individual's decision to compete does not necessarily imply success in the real world. To test this, they use small scale entrepreneurs in Tanzania. Findings from Berge et al. (2015) show a positive association between competitiveness in the lab and field choices. Their study, however, was unable to explicitly examine the gender differences associated with their results due to limited data.

Our study fills the gap in the competition literature by using a unique dataset from entrepreneurs operating in specific gender groups (all-male, all-female and mixed-gender teams) in rural Rwanda to examine the relationship between lab and field outcomes. The study, therefore, does not only contribute to the competition literature but will also provide insights into the ability and performance of women, which is of relevance to microenterprise development in the renewable energy sector.

3 Experimental Design and Data

Our sample subjects are entrepreneurs operating off-grid microenterprises in the Rulindo and Ruhango districts of Rwanda, as part of a larger randomised control trial (RCT) focused on the use of a gender quota business model to empower women in the renewable energy sector. These entrepreneurs have been operating in randomly assigned gender groups since 2016, with each group consisting of four members. Their core role is to recharge lights for customers at a fee. As at March 2017 before conducting the experiments, there were 129 actively working microenterprises (one per village). This provided the study with a total population size of 516[4] entrepreneurs. Out of the 516 actively working entrepreneurs, 374 of them agreed to participate and completed the experiment[5]. A response rate (72.5%) representative of the established microenterprises.

3.1 *The Experiment*

Series of experiments focused on entrepreneurs' attitudes towards competition, risk aversion and prosocial measures were conducted. Below, we fully describe the experimental design and procedures of the two behavioural measures utilised in this study, namely the competition and risk experiment. Detailed instructions used for the experiment can be found in the supplementary material in *Appendix 3*.

[4] 129 X 4 = 516

[5] Most entrepreneurs who could not make it were not either available during the information stage or had other engagements on the day the experiment was conducted.

The competition games follow the standard experimental design of Niederle and Vesterlund (2007) in which VLEs solve real problems under piece rate and tournament incentivised schemes. A total of 25 experimental sessions were conducted between March and June 2017. In each session, VLEs were presented with a set of 20 simple addition problems to be solved under five minutes with no performance feedback between tasks. The addition problems were handed to VLEs in a booklet form such that each page had only one problem as presented below:

75	85	60	15	ANSWER

Participants performed these tasks (consisting of 20 problems each) under three different treatments, namely: piece rate, tournament and preferred incentive treatments.

In the first task (Piece rate treatment), participants earned an amount of 50 Rwandan francs (RWF) approximately 0.055 United States Dollars (USD) for each correct answer provided. In the second task (Tournament treatment), participants competed in randomly assigned gender groups (mixed and single-sex) of between two to six[6] members *(Table I Appendix 2 shows the full distribution)*. Here, the designated groups are different from VLEs' actual microenterprise gender groups in the real world. This guaranteed the anonymity of group members and limited any potential informed decisions that could arise when the identity of team members is known to participants. Subjects were however informed about the demographic distribution of their respective groups (specifically: age, marital status and gender distributions)[7] given that each session had a representation of the three gender assignment groups. All participants were made to solve the addition problems again. Thereafter, VLEs with the highest score in each group receives an amount of 150 RWF approximately 0.17 USD (three times more than the piece rate amount) for each correct answer provided. Other members of the group received nothing for their effort. In the situation of a tie, earnings were split equally among the top performers of the group.

The third round (Preferred incentive treatment) offered VLEs the opportunity to choose a preferred payment incentive (choosing either the piece rate or tournament payment schemes). Subjects then solve the addition problems for the third time. VLEs who choose the tournament compensation scheme now have their scores from the third round compared to those of their group's opponents scores from task 2[8]. VLEs were not allowed to use calculators. However, the booklets in which the problems were solved had enough space for scratch work. Instructions and incentives were read out loud to VLEs in Kinyarwanda (the official local language of Rwanda) before the start of each task.

[6] We tried to assign groups of four which is consistent with VLEs' group sizes in the field. Since we did not have control of the numbers and gender of participants showing up, we also allocate groups other than the preferred 4 member groups.

[7] This enabled the study to inform participants about the gender distribution of groups in a more subtle way by also including age and marital status.

[8] Thus, if a VLE chooses to compete in Task 3, he / she receives RWF150 if his/her score in Task 3 is greater than group members' score in previous task (Task 2), if not the VLE receives nothing. This is to ensure that a decision by a group member to choose the piece rate payment incentive does not affect comparison of scores in the third task (Niederle & Vesterlund, 2011).

We continued with the risk experiment after VLEs completed the competition games. The risk experiments closely follow Brick and Visser (2015), which was based on the earlier design of Gneezy and Potters (1997) as well as Moore and Eckel (2006). This proceeds as follows: VLEs were asked to make twenty-two choices with each choice providing VLEs with two options. The first option provides VLEs with a sure payoff (increasing from 160 RWF (˜0.18 USD) in the first choice to 580 RWF (˜0.64 USD) in the twenty-second choice). The second option offers a lottery with a 30% probability of receiving 1200 RWF (˜1.33 USD) and a 70% probability of receiving nothing. A risk-averse VLE will prefer the first option (the certain pay-off) while a more risk loving VLE will prefer the lottery. A spinning wheel is used to determine the payoffs for VLEs who preferred the gamble. The choices of subjects enabled the study to calculate risk measures using VLEs' switching points between the sure payoffs and the lottery (Booth et al., 2018; Vieider et al., 2015; Brick & Visser 2015).

3.2 *Descriptive Statistics*

Table 1 provides details of entrepreneurs' backgrounds and an overview of field outcomes used in the analysis. VLEs' background information is obtained from survey data conducted as part of the larger RCT study detailed in Barron et al., 2019. The average village level entrepreneur is married, 42 years of age, risk-averse, has at least primary education (7 years of schooling) and household size of 11 people.

For field outcomes, we focus on recharge frequency data as a proxy for sales and self-reported incomes of VLEs, which measures the performance levels of microenterprises. Nuru energy has a centralised server that regularly receives recharge frequency data from the various enterprises. The centralised data station provides the study with the sales information for each microenterprise. Self-reported incomes from business operations are obtained from the survey data. Specifically, we consider the total recharge frequency of lights for three months and the average income per month. A Nuru microenterprise on the average has a total of 209 recharges in three months with the average VLE reporting an income of 946 RwF per month.

4 Empirical Strategy

The study aims at examining entrepreneurs' attitudes towards competition and comparing entrepreneurs' performance levels in the lab to performance in business. For entrepreneurs' attitudes towards competition, we estimate a standard probit model depicted in equation 1:

$$Competition\_entry_i = \gamma_0 + \gamma_1 Female_i + \gamma_3 X_i + \gamma_4 V_i + E_i \quad (1)$$

Where the dependent variable is a dummy variable measuring the willingness of entrepreneurs to participate in a competition such that $Competition\_entry_i = 1$ if the VLE chooses the tournament and 0 if the VLE chooses piece rate in

the third round of the experiment. $Female_i = 1$ indicate that a participant is female. Other explanatory variables X_i are indicators from the experiment (e.g. scores from round 2, susceptibility to time pressure and response to competition against peers (Tournament – Piece rate), risk preferences, number of VLEs per session) and are standard explanatory variables included in willingness to compete estimations (Booth et al., 2018, Dariel et al., 2017, Niederle & Vesterlund, 2007). We also control for VLEs background indicators V_i (age, education, marital status, household size, household head, geographical districts of operation).

To examine how entrepreneurs' performance levels in the lab are associated with field outcomes, we estimate equation 2 using an Ordinary Least Squares (OLS) estimation approach:

$$Perfomance_i = \gamma_0 + \gamma_1 Gender\_Teams_i + \gamma_3 X_i + E_i \quad (2)$$

Equation 2 is estimated for lab and field outcomes. For lab outcomes, the dependent variable $Perfomance_i$ is VLEs scores under competition. *Gender_ Team* is the real-world gender teams in which entrepreneurs are working in; all-male, all-female and the mixed gender teams. Each team consist of four members such that the all-male and all-female teams have four males and four females respectively per gender group while the mixed gender teams have two males and two females working together in a group. Individual background characteristics remains the same as in equation 1. For field outcomes, we use the recharge frequency of lights (sales) and the inverse hyperbolic sine transformation[9] of self-reported incomes from VLEs to measure performance. We face the problem of some VLEs reporting zero income when considering the self-reported incomes. The inverse hyperbolic sine transformation enables us to deal with the zero's associated with VLEs' self-reported incomes. Standard errors for the field estimation are clustered at the village level, since only one microenterprise exist per village.

5 Results and Discussion

5.1 *Performance in the lab under piece rate, tournament and preferred incentive treatments*

Table 2 shows the performance levels of VLEs in the lab for all treatments. In the first two treatments (Piece rate and Tournament), VLEs scored an average of 7.73 and 9.83 respectively. This performance varies from 7.54 to 8.16 for single and mixed gender groups under the piece rate incentive. Men significantly perform better in the all-male groups with an average score of 8.23 than females in the all-female groups who scored 6.85 on the average (P-value = 0.003). In the mixed-gender groups, both men and women show no performance differences under the piece rate incentive (P-value = 0.262)

[9] A more improved way of dealing with zeros in a variable

For the tournament incentive, performance ranges from 9.49 to 10.64 for single and mixed gender groups with the all-male groups performing better than the all-female groups (P-value = 0.023). Performance under tournament also improved significantly despite a high correlation between piece rate and tournament scores of approximately 0.73 and 0.72 for men and women respectively. On average, all gender groups solved two more problems under the tournament compensation scheme compared to the piece rate treatment with no significant difference (P-value = 0.488). This suggests no gender difference associated with improvement in performance after moving from the piece rate (task 1) to the tournament treatment (task 2). Improvement in performance from task 1 to task 2 may be due to the initial learning effect, as explained by Niederle and Vesterlund (2007).

We also present average scores for the third task under the preferred incentive treatment. VLEs who chose to compete solved an average of 11.7 problems with performance varying from 11.18 to 13 for single and mixed gender teams respectively. There is no significant difference in performance for all-male and all-female teams (11.69 for men and 10.67 for women) with a corresponding P-value of 0.204. Similarly, men and women in mixed gender groups have identical performance levels (13.35 and 12.6, respectively, P-value = 0.872). Comparing performance in task 2 (tournament) to task 3, Table 2 show a slight increase in performance for both VLEs who chose to compete and those who did not. Both men and women solved an average of one more problem in Task 3, but this difference is insignificant (P-value = 0.730). The improvement in performance under the preferred incentive treatment cut across all gender groups, with no gender group performing better than the other.

In Figure 1, we show the cumulative distributions for piece rate and tournament treatments by gender. This shows the cumulative probability of correctly solving a given number of problems. The figure clearly emphasizes the existing gender gap reported in Table 2 under the first two task (Piece rate and Tournament). In both treatments, women show a higher chance of solving a lower number of problems than men. This indicates higher performance levels for men than women.

Figure 2 shows the cumulative distributions of VLEs who chose to enter the competition under the preferred incentive treatment (task 3). In the first graph, we show the cumulative probability of solving a given number of problems for VLEs assigned to mixed gender teams during the competition games. The cumulative distributions for single-sex teams are shown in the second graph in the right panel. The third graph in Figure 2 shows the distribution for all VLEs (combined) irrespective of their gender group assignment.

We find no substantial difference in the cumulative distributions for men and women. Mixed and single-sex teams show similar performance trends for both men and women. However, in the single-sex teams, women show a slightly higher cumulative probability distribution for lower scores than men. The probability of correctly solving a given number of problems under tournament in task 3 overall is similar for both men and women.

5.2 *Entrepreneurs' willingness to compete*

This section first analyses competition entry decisions of VLEs. Out of the 374 VLEs who participated in the experiment 172 (46%) preferred to compete. Comparing the 46% of participants who chose to compete in our sample to other tournament entry rates (29.6% to 54%) from previous studies (Dariel et al., 2017; Apicella et al., 2017; John, 2017; Khachatryan et al., 2015; Gneezy et.al., 2009; Niederle & Vesterlund, 2007)[10], we see that while our reported competition entry rate generally falls within the topmost percentile it does not deviate from previously reported rates as such. Female entrepreneurs select into competition 43% of the time while men, on the other hand, select into competition 49% of the time. The Fischer exact test (P=0.299) indicate that this marginal difference between women and men's competition entry is insignificant. While there is a possibility that high ability participants may self-select into the competition, subjects in our study did not receive any form of performance feedback between experimental rounds enabling the study to hedge against such potential selection bias. We, however, acknowledge that participants are still likely to have beliefs about their ability.

Table 3 shows the results for tournament entry decisions of entrepreneurs based on VLEs' gender composition of groups in the experiment. Column 1 – 3 show that being male or female does not affect entrepreneurs' decisions to compete. Instead, education and risk-taking are more important drivers of competition entry decisions in the single-sex teams than in the mixed gender teams. Risk preferences (being risk-loving) is an important driver for competition entry in the all-female groups, whereas it does not play a significant role in mixed gender teams. Married women have a higher likelihood to choose into competition in the all-female groups than in the mixed-gender groups, as shown in column 4. Results suggest no gender gap in competition entry amongst entrepreneurs operating off-grid microenterprises in rural Rwanda.

Although our finding contradicts a large body of literature which shows that women are reluctant to make competition entry decisions (Croson & Gneezy, 2009), it is perhaps not surprising in the context of Rwanda given its history and progressive gender mainstreaming policies implemented subsequently. Following the 1994 genocide which mainly targeted men and boys, 70% of Rwanda's population were women.

This forced the country to involve women in the rebuilding of the nation. As a result, traditionally male-dominated positions were offered to women. These national gender policies have gradually permeated the perception of the younger generation, which is evident in the baseline survey data collected as part of the larger RCT study. In the survey, children of VLEs were asked questions about their general gender perceptions. Their beliefs suggest that wives should be equally educated as husbands, boys should not get more resources for education and daughters should have similar rights in terms of inheriting property as sons (*as reported in Appendix 2, Table 2*).

In line with these beliefs, Burnet (2011) also identifies that the deliberate

[10] We detail many more studies in Appendix 1

gender policies implemented by the government have translated into notable successes at the local level. These successes include increased levels of respect from village members and family, improved decision making at the household level, women access to education and enhanced capacity for women to freely speak and be heard at village meetings. This is an indication that the gender equality agenda in Rwanda is gradually changing perceptions and empowering women to take on challenging roles irrespective of the entrenched cultural barriers still existing in the country. The progressive women's empowerment policies in Rwanda could be a contributing factor why we see no significant gender difference in VLEs' decision to perform tasks under competitive situations.

Further, the original business model of Nuru before the current gender quota system under study also demonstrates how women expressed great interest in the entrepreneurship prospect of the Nuru program. Thus, the willingness of women to take on entrepreneurship roles despite its associated competitive characteristics is an additional explanatory factor why no gender differences exist in the tournament entry decisions of VLEs. A more recent study by Dariel et al. (2017) supports our finding by showing that women in the United Arab Emirates are willing to participate in competition. Their results were also obtained in the context of a very entrenched patriarchal society after several policies towards women's empowerment and women's participation in the labour market were put in place.

Risk-taking and competitiveness, though different concepts, can be related in nature. Niederle and Vesterlund (2007) explain that competition involves uncertainty in earnings such that any gender gap associated with risk preferences can influence decisions to compete. Our results show that VLEs with more risk-taking orientations are more likely to choose into competition in single-sex teams, particularly in the all-female teams, but this is not the case for the mixed and all-male teams.

The relationship between risk attitudes and competition entry decisions is well established in the literature. For instance, van Veldhuizen (2017) and Bartling (2009) show that less risk-averse individuals self- select into competition. As a result, the gender gap observed in competition entry decisions is significantly driven by differences in risk attitudes. Similarly, Cardenas et al. (2012) explore this concept by comparing results from two countries: Sweden and Columbia. They find a positive relationship between risk loving individuals and competitiveness in Sweden but find no relationship amongst Columbian boys and girls. In line with Niederle and Vesterlund (2007), they conclude that whereas risk-taking is a key driver of competition entry decisions, other factors such as overconfidence could also influence decisions to compete. Our results that risk-loving VLEs are more likely to choose competition is widely supported by these previous studies.

5.3 *Performance in the lab vs field*

Table 4 reports regression results on whether performance levels of women and men differ significantly under competition and further compares performance

levels of gender teams in the lab to performance during field operations. Results from column 1 show no gender difference in performance when VLEs compete. Column 2 shows that the gender of teams in which VLEs compete does not also affect performance: all-female and mixed gender teams perform as well as male teams in the lab.

A large body of literature finds that opponents' gender influence performance under competition such that, women tend to perform better in single-sex environments than in co-gender environments (Delfgaauw et al., 2013; Booth & Nolen 2012; Niederle & Vesterlund, 2008; Gneezy et al., 2003). These studies suggest that the gender gap increases when women compete with men – the basis for the continuous debate of single-sex schools relative to mixed gender schools. Lee, Niederle and Kang (2014) test the gender composition of teams by examining whether single-sex schooling reduces the gender gap in performance. Contrary to existing studies, their study reveals that single-sex schools do not necessarily reduce the gender gap in competitiveness. Therefore, performance of women does not improve under single-sex tournaments. A subsequent study by De Paola et al. (2015) also demonstrates that the gender of one's opponent does not affect competitiveness.

Consistent with Lee et al. (2014) and De Paola et al. (2015), we find that competing in single-sex teams does not improve performance in the lab. While the gender of VLEs and the gender composition of teams does not affect performance under competition, education and household size are significant factors driving VLEs' competition performance.

Previous studies demonstrate the importance of education as a key driver of performance when evaluating outcomes such as labour productivity and economic competitiveness (Canbrera & Le Renard, 2015; Sahlberg, 2006). In Rwanda, significant progress has been made by the government to ensure universal education access. For instance, the National Gender Policy (2010) and Girls' Education Policy (2008) addresses gender gap issues through affirmative quota systems. More women after the genocide now have access to education with several rural families convinced about the importance of educating the girl child (Burnet, 2011). The world bank indicators show that between 1990 to 1992 (before the genocide) 14000 fewer girls accessed primary education; however, by 2008, approximately 16000 more girls than boys were in primary schools. The increase in access to education for women could be a contributing factor for the high competitiveness levels of Rwandan women.

Our results pertaining to household size is likely to originate from competition within the household for limited resources. Downey (1995) explains that household heads and parents have finite resources such as time, energy and money. They are forced to share these limited resources with children and other members as households increases in size, which can result in the dilution of resources. The fact that VLEs from larger households perform better compared to smaller households may be due to the urgent need to provide for households' members, therefore, increasing their urge to perform well in return for higher experimental payoffs.

In the second panel of Table 3 (column 3-4), we report results related to

performance in the field. Two field indicators: sales (column 3) and business income (column 4) at the group level are used as measures for microenterprise performance. As with the experimental results, our field results indicate no significant differences in performance among gender teams.

Married men and women also tend to have lower sales performance levels, although in the experiment married women are more likely to choose into competition. This finding contradicts studies in the entrepreneurship literature (Failie & Robb, 2009; Wickramasinghe & De Zoyza 2008) which suggest a positive relationship between marriage and business performance. These studies also explain that married women tend to have lower business performance levels than men. We show in *Table 3, Appendix 2* that there is no significant difference between married men and women teams in our case. Our finding that married people do not perform well in business might be explained by the additional time married people invest in maintaining their families, which may reduce hours of work and in effect lower business performance.

Results also show that mixed teams perform slightly better than all-male teams. Business performance of women has been constantly underestimated (Brush and Cooper 2012; Minniti and Naude 2010; de Bruin et al. 2007; Ahl 2006) based on broader characteristics and context related factors such as industry type, field experience and business size (Yousafzai et al., 2018; Baker and Welter, 2017). Sappletton (2018) shows that the underestimation of women and the observed differences between female and male-owned businesses are due to the unequal comparison of business models in a given industry. For instance, women often engage in retail businesses focused on serving local markets. Such businesses are smaller in size, have lower growth rates and yield lower profits despite their high competition levels. Emerging management literature demonstrates how measures of business performance such as business sizes and growth rates of an industry tend to favour men whereas no performance differences are associated with more specific indicators such as profitability, number of employees, number of orders and closure rates (Zolin 2013; Robb & Waston 2012). Our finding that male-owned enterprises do not outperform female-owned enterprises resonate with these emerging studies, given that, we compare the performance of entrepreneurs working in the same industry under the same business model with similar terms and conditions.

Comparing performance in the lab to performance of microenterprises in the real world, we find similar results that female and mixed gender microenterprises perform as well as male-owned enterprises. The external validity of experiments is often low and continuously criticised by empirical researchers. The artificiality under which lab experiments are conducted makes it difficult for real-world generalizability (Schram, 2005). Roe and Just (2009) argue that the best way to overcome the limitations associated with a single research method is to apply multiple approaches to the same phenomenon. Showing that similar results can be achieved when experimental results are compared to real-world operations of microenterprises corroborates the external validity of our findings.

Recent years have also seen the government of Rwanda depend heavily on the private sector's participation in implementing off-grid solutions due to the fast

pace at which the state wishes to attain a 100% electricity access for all. As a result, national policies have contributed substantially to the rapid growth of the private sector, especially for solar companies. The government has also taken steps towards engendering energy policies in the country, yet private companies are still not required to include gender mainstreaming in their operations (Parshotam & van der Westhuizen, 2018). Despite the support from government, women's participation in the private sector is limited as some companies potentially see the inclusion of women as a limitation for the maximization of revenue (Parshotam & van der Westhuizen, 2018). Our results, showing that women are as competitive and perform as well as male-owned enterprises over various outcome measures, demonstrate the capacity for Rwandan women to participate successfully in a profit-oriented enterprise, an indication for the private energy sector to reconsider the inclusion of more women.

6 Conclusion

A large body of literature investigates gender differences in competition among student subjects in the lab. Yet, the application of such studies to a real-world phenomenon is scarce. This study examines competitiveness from the perspective of gender inclusivity in the renewable energy value chain in a context where the government of Rwanda is determined to promote private sector involvement, in their quest to accelerate rural electrification to off-grid communities.

Our study adds to the existing literature on competitiveness and gender by being the first to test these concepts in the renewable energy sector using a unique subject pool of entrepreneurs operating off-grid gender-focused microenterprises in rural Rwanda – a country globally known for its progressive gender policies. Further, the extent to which competition results in the lab reflects real-world situations has not received much attention in previous studies. This study provides new evidence to support the extent to which experimental results are consistent with profitability in the field to corroborate the external validity of our findings.

Our findings show that under competitive situations in the lab: women operating off-grid microenterprises in Rwanda are not less willing to enter competition, female VLEs perform as well as men when they work in both all-female or mixed gender groups, and that gender of opponents does not affect their performance. Results also show that education and risk-taking are key drivers of decision to compete in single-sex groups. Risk-loving women are more likely to compete in the all-female teams than risk-averse women. Consistent with experimental results, field findings also show that female and mixed gender owned microenterprises perform as well as male run enterprises. Therefore the assertion that women underperform in business does not hold for the rural Rwanda woman working as sales agents in the energy sector.

While the study unleashes the applicability of experimental results by adding to the competition literature, findings from our research are also insightful for the private energy sector. Currently, women's participation in the private en-

ergy sector of Rwanda is low, as some companies potentially see the inclusion of women as a limitation for revenue maximization (Parshotam & van der Westhuizen, 2018). By showing that women are equally competitive and are also likely to perform as well as men when given the opportunity, our study provides an impetus for private energy companies in Rwanda to reconsider the involvement of more women in this sector. It further provides support for the notion of gender quotas within this sector to even out disparities in access to labour markets for women especially in recent times where pro-gender national policies are gradually permeating the perceptions and sense of agency among the people of Rwanda.

References

[1] Ahl, H., 2006. Why Research on Women Entrepreneurs Needs New Directions. *Entrepreneurship Theory and Practice*, 28.

[2] Andersen, S., Ertac, S., Gneezy, U., List, J.A. & Maximiano, S., 2013. Gender, competitiveness, and socialization at a young age: Evidence from a matrilineal and a patriarchal society. *Review of Economics and Statistics.* 95(4): 1438-1443.

[3] Apicella, C.L. and Dreber, A., 2015. Sex differences in competitiveness: Hunter-gatherer women and girls compete less in gender-neutral and male-centric tasks. *Adaptive Human Behavior and Physiology*, *1*(3), pp. 247-269.

[4] Apicella, C.L., Demiral, E.E. & Mollerstrom, J., 2017. No Gender Difference in Willingness to Compete When Competing against Self. *American Economic Review.* 107(5): 136-140.

[5] Barron, M., Clarke R. P., & Visser M., 2019. The effect of microenterprise gender composition business performance, prosocial expenditure and girls' aspirations: Experimental evidence from rural Rwanda. UCT Draft Working Paper.

[6] Bartling, B., Fehr, E., Maréchal, M.A. & Schunk, D., 2009. Egalitarianism and competitiveness. *American Economic Review*, *99*(2), pp. 93-98.

[7] Baruah, B., 2015. Creating opportunities for women in the renewable energy sector: Findings from India. *Feminist Economics.* 21(2): 53-76.

[8] Baruah, B., 2017. Renewable inequity? Women's employment in clean energy in industrialized, emerging and developing economies. *Natural Resources Forum.* Wiley Online Library. 18.

[9] Booth, A., Fan, E., Meng, X. & Zhang, D., 2018. Gender Differences in Willingness to Compete: The Role of Culture and Institutions. *Economic Journal.*10.12583.

[10] Brush, C. G., & Cooper, S. Y., 2012. Female entrepreneurship and economic development: An international perspective. *Entrepreneurship & Regional Development.* 24(1–2), 1–6. https://doi.org/10.1080/08985626.2012.637340

[11] Buvinic, M. & Furst-Nichols R., 2016. "Promoting women's economic empowerment: what works?" The World Bank Research Observer.

[12] Cabrera, A. & Le Renard, C., 2015. Internationalization, higher education, and competitiveness. *In New perspectives on internationalization and competitiveness* (pp. 11-16). Springer, Cham.

[13] Cárdenas, J.C., Dreber, A., Von Essen, E. & Ranehill, E., 2012. Gender differences in competitiveness and risk taking: Comparing children in Colombia and Sweden. *Journal of Economic Behavior & Organization*, *83*(1), pp. 11-23.

[14] Cassar, A., Wordofa, F. & Zhang, Y.J., 2016. Competing for the benefit of offspring eliminates the gender gap in competitiveness. *Proceedings of the National Academy of Sciences.* 113(19): 5201-5205.

[15] Clancy, J., Oparaocha, S. & Roehr, U. 2004. Gender equity and renewable energies.

[16] Clancy, J., Winther, T., Matinga, M. & Oparaocha, S. 2012. Gender equity in access to and benefits from modern energy and improved energy technologies: *World Development Report background paper.*

[17] Croson, R. & Gneezy, U., 2009. Gender Differences in Preferences. *Journal of Economic Literature.* 47(2): 448-474.

[18] Dariel, A., Kephart, C., Nikiforakis, N. & Zenker, C. 2017. Emirati women do not shy away from competition: evidence from a patriarchal society in transition. *Journal of the Economic Science Association.* 3(2): 121-136.

[19] Dato S. & Nieken, P., 2014. Gender differences in competition and sabotage. *Journal of Economic Behavior & Organization.* 100(2): 64-80.

[20] Datta Gupta, N., Poulsen, A. & Villeval, M.C. 2005. Male and female competitive behavior-experimental evidence. IZA Discussion paper no 1833.

[21] Downey, D.B., 1995. When bigger is not better: Family size, parental resources, and children's educational performance. *American Sociological Review*, pp. 746-761.

[22] Debusscher, P. & Ansoms, A., 2013. Gender equality policies in Rwanda: public relations or real transformations? *Development and Change*, *44*(5), pp. 1111-1134.

[23] De Paola, M., Gioia, F. & Scoppa, V. 2015. Are females scared of competing with males? Results from a field experiment. *Economics of Education Review.* 48: 117-128. [April 18, 2018].

[24] de Bruin, A., Brush, C. G., & Welter, F. 2007. Advancing a Framework for Coherent Research on Women's Entrepreneurship. *Entrepreneurship Theory and Practice*. 31(3), 323–339.

[25] Ergun, S.J., Rivas, M.F. & García-Muñoz, T.M. 2010. *Gender Differences in Economic Experiments.* Universidad de Granada. Departamento de Teoría e Historia Económica.

[26] Fairlie, R.W. and Robb, A.M., 2009. Gender differences in business performance: evidence from the Characteristics of Business Owners survey. *Small Business Economics*, 33(4), p. 375.

[27] Gneezy, U. and Imas, A., 2017. Lab in the field: Measuring preferences in the wild. In *Handbook of economic field experiments* (Vol. 1, pp. 439-464). North-Holland.

[28] Gneezy, U., Leonard, K.L. & List, J.A. 2009. Gender Differences in Competition: Evidence from a Matrilineal and a Patriarchal Society. *Econometrica.* 77(5): 1637-1664.

[29] Lavy, V., 2012. Gender differences in market competitiveness in a real workplace: Evidence from performance-based pay tournaments among teachers. *The Economic Journal*, *123*(569), pp. 540-573.

[30] Lee, S., Niederle, M. & Kang, N., 2014. Do single-sex schools make girls more competitive?. *Economics Letters*, 124(3), pp. 474-477.

[31] Minniti, M., & Naudé, W. (2010). Introduction: What Do We Know About the Patterns and Determinants of Female Entrepreneurship Across Countries? *The European Journal of Development Research.* 22(3), 277–293.

[32] Niederle, M. & Vesterlund, L. 2007. Do women shy away from competition? Do men compete too much? *Quarterly Journal of Economics.* 122(3): 1067-1101.

[33] Niederle, M. & Vesterlund, L. 2008. Gender differences in competition. *Negotiation Journal.* 24(4): 447-463.

[34] Niederle, M. & Vesterlund, L. 2011. Gender and competition. *Annual Review of Economics.* 3: 601-630.

[35] Niederle, M., Segal, C. & Vesterlund, L. 2013. How costly is diversity? *Management Science.* 59(1): 1-16.

[36] Ors, E., Palomino, F. & Peyrache, E., 2013. Performance gender gap: does competition matter? *Journal of Labor Economics*, *31*(3), pp. 443-499.

[37] Paserman, M.D., 2007. Gender differences in performance in competitive environments: evidence from professional tennis players. NBER working paper, 07.

[38] Robb, A. M., & Watson, J. (2012). Gender differences in firm performance: Evidence from new ventures in the united states. *Journal of Business Venturing*. 27(5), 544-558.

[39] Sahlberg, P., 2006. Education reform for raising economic competitiveness. *Journal of Educational Change*, *7*(4), pp. 259-287.

[40] Sappleton, N., 2018. Gender and business performance: the role of entrepreneurial segregation. Women Entrepreneurs and the Myth of 'Underperformance.' Chapter 13 in Yousafzai, S. Y., Fayolle, A., Lindgreen, A., Henry, C., Saeed, S., & Sheikh, S. (2018). Women entrepreneurs and the myth of 'underperformance': A new look at women's entrepreneurship research. Cheltenham, UK; Northampton, MA, USA; Edward Elgar Publishing.

[41] Schram, A., 2005. Artificiality: The tension between internal and external validity in economic experiments. *Journal of Economic Methodology*, *12*(2), pp. 225-237.

[42] Shane, S., Locke, E.A. and Collins, C.J., 2003. Entrepreneurial motivation. *Human resource management review*, *13*(2), pp. 257-279.

[43] Sutter, M. & Glaetzle-Ruetzler, D., 2015. Gender Differences in the Willingness to Compete Emerge Early in Life and Persist. *Management Science.* 61(10): 2339-2354.

[44] van Veldhuizen, R., 2017. *Gender differences in tournament choices: Risk preferences, overconfidence or competitiveness?* (No. 14). Discussion Paper.

[45] Vieider, F.M., Lefebvre, M., Bouchouicha, R., Chmura, T., Hakimov, R., Krawczyk, M. and Martinsson, P., 2015. Common components of risk and uncertainty attitudes across contexts and domains: Evidence from 30 countries. *Journal of the European Economic Association*, *13*(3), pp. 421-452.

[46] Wickramasinghe, V. and De Zoyza, N., 2008. Gender, age and marital status as predictors of managerial competency needs: Empirical evidence from a Sri Lankan telecommunication service provider. *Gender in Management: An International Journal*, *23*(5), pp.337-354.

[47] World Bank Group 2015. Women, Business and the Law 2016. Getting to Equal. Washington, DC: The World Bank.

[48] World Bank 2011. "World data Bank." http://databank.worldbank.org/ddp/home.do

[49] Zhong, S., Shalev, I., Koh, D., Ebstein, R.P. & Chew, S.H. 2018. Competitiveness and stress. *International Economic Review.* 59(3): 1263-1281.

[50] Zhang, Y. Jane, Can Experimental Economics Explain Competitive Behavior Outside the Lab? (July 1, 2013). Available at http://dx.doi.org/10.2139/ssrn.2292929

[51] Zolin, R., Stuetzer, M., & Watson, J. 2013. Challenging the female underperformance hypothesis. *International Journal of Gender and Entrepreneurship*, 5(2), 116-129.

Table 1: Background and field variables

Variable	Observation	Mean	Min	Max
Background				
Age	374	42.19	18	76
Education	374	6.9	1	16
Female	374	0.49	0	1
Marital Status	374	0.90	0	1
VLE Group	374	1.97	1	3
Household size	343	11	1	12
Household Head	336	0.59	0	1
District	374	1.35	1	2
Risk measure (Switching Point)	374	6.33	1	22
Business Outcomes				
Recharge frequency (Sales)	374	209.12	1	576
Income from Business	335	946.62	0	9000

Note: Age is the age of the VLE in years, Education is in years of schooling, Female is a dummy showing whether the VLE is male or female, Marital status indicates if VLE is married or not. Household size is the number of people living in VLE's household. Household head shows if VLE is a household head or not. For the microenterprise outcomes, Risk measure shows the level of VLEs' attitudes towards risk-taking ranging from 1 (highly risk-averse) to 22 (risk seeking). Recharge frequency, which is used as a proxy for sales is the number of times VLEs recharge lights for customers. Income is VLEs self-reported incomes (in RWF) from operating the microenterprise.

Table 2: Performance levels of VLEs in the Lab

Variable		**Obs**	**Combined**	**Male**	**Female**	**Diff**	**P-value**
Piece rate *(Task 1)*	Overall	374	7.73	8.38	7.06	1.32	0.002***
	Single- sex	261	7.54	8.23	6.85	1.39	0.003***
	Mixed	113	8.16	8.69	7.57	1.12	0.262
Tournament *(Task 2)*	Overall	374	9.83	10.56	9.09	1.47	0.004***
	Single- sex	261	9.49	10.12	8.85	1.28	0.023**
	Mixed	113	10.64	11.52	9.66	1.86	0.062*
Task 2–Task 1	Overall	374	2.10	2.17	2.03	0.15	0.488
	Single- sex	261	2.0	1.89	2.0	-0.11	0.793
	Mixed	113	2.48	2.83	2.09	0.74	0.292
Preferred incentive (Task 3):							
Tournament	Overall	172	11.7	12.19	11.22	0.98	0.256
	Single- sex	119	11.18	11.69	10.57	1.11	0.204
	Mixed	53	13	13.35	12.6	0.75	0.872
Piece rate	Overall	201	10.39	11.06	9.78	1.28	0.015**
	Single-sex	141	10.34	11.07	9.72	1.35	0.021**
	Mixed	60	10.5	11.03	9.93	1.10	0.353
Task3 – Task 2	Overall	172	1.02	1.03	1.02	0.01	0.730
(Tournament	Single -sex	119	1.03	1.07	0.98	0.09	0.788
Choosers)	Mixed	53	1.02	0.92	1.12	-0.19	0.899

Note: P-values are from the Mann Whitney U tests. All presented values are averages

Table 3: VLE's competition entry decisions

VARIABLES	(1) Combined	(2) Mixed	(3) Single-sex	(4) All -Female	(5) All- Males
Dummy for Females	0.0322	0.120	0.0257	-	-
	(0.0814)	(0.143)	(0.0933)		
Scores from round 2	0.0183**	0.0397***	0.0067	0.0063	0.00614
	(0.0078)	(0.0114)	(0.010)	(0.0151)	(0.0135)
Tournament - Piece rate	-0.0190*	-0.0376**	-0.0085	0.0074	-0.0162
	(0.0104)	(0.0157)	(0.0140)	(0.0207)	(0.0180)
Number of participants per session	-0.0036	-0.0213**	8.00e-05	-0.0039	0.0074
	(0.0049)	(0.0099)	(0.0059)	(0.0078)	(0.0081)
Risk taking (Switching Point)	0.0088**	0.0082	0.0108***	0.0126**	0.0081
	(0.0036)	(0.0072)	(0.0042)	(0.0060)	(0.0059)
Education	0.0247**	0.0197	0.0315**	0.0301	0.0274
	(0.0110)	(0.0182)	(0.0140)	(0.0211)	(0.0193)
Household head	0.0237	-0.0580	0.0723	0.182	-0.185
	(0.0808)	(0.147)	(0.0922)	(0.115)	(0.193)
Household size	-0.0213	-0.0303	-0.0170	-0.0203	-0.0118
	(0.0151)	(0.0282)	(0.0180)	(0.0259)	(0.0253)
Age	-0.0017	0.0069	-0.0037	-0.0013	-0.0047
	(0.0027)	(0.0049)	(0.0030)	(0.0045)	(0.0041)
Rulindo District	0.0285	-0.0033	0.0374	-0.133	0.125
	(0.0780)	(0.102)	(0.122)	(0.137)	(0.147)
Married	0.0545	0.187	0.0070	0.228*	-0.215
	(0.0920)	(0.140)	(0.114)	(0.130)	(0.232)
Dummy for single-sex teams	0.0265	-	-	-	-
	(0.0708)				
Observations	335	102	233	118	115
Log pseudolikelihood	-213.09	-58.82	-147.89	-68.55	-70.56

Results are marginal effects from a Probit estimation. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

Table 4: Performance in the lab vs field

VARIABLES	1 Competition	2 Competition	3 Sales	4 Income
Female	-1.127			
	(1.120)			
Female Teams		-0.820	43.771	0.550
		(1.088)	(31.786)	(1.191)
Mixed Teams		1.054	65.857*	-0.128
		(1.162)	(34.256)	(0.911)
Age	-0.027	-0.031	1.200	-0.038
	(0.038)	(0.038)	(1.074)	(0.038)
Education	0.781***	0.772***	-2.308	-0.138
	(0.097)	(0.094)	(3.040)	(0.105)
Rulindo District	0.914	0.250	-13.532	-0.540
	(0.779)	(0.990)	(29.804)	(0.857)
Hhead	-0.370	0.153	7.738	0.914
	(1.164)	(0.971)	(19.430)	(0.902)
Hhsize	0.343*	0.365*	9.188	-0.166
	(0.206)	(0.214)	(7.795)	(0.214)
Married	1.519	1.532	-67.62**	-0.319
	(1.429)	(1.430)	(33.199)	(1.332)
Risk -taking (SwitchingPoint)	-0.036	-0.021	2.536*	0.061
	(0.052)	(0.052)	(1.283)	(0.044)
Observations	154	154	154	149
R-Squared	0.295	0.303	0.111	0.051

*** p<0.01, ** p<0.05, * p<0.1. Village clustered standard errors for all field estimations.

Figure 1: CDF of correctly solved problems (Task 1: Piece rate & Task 2: Tournament)

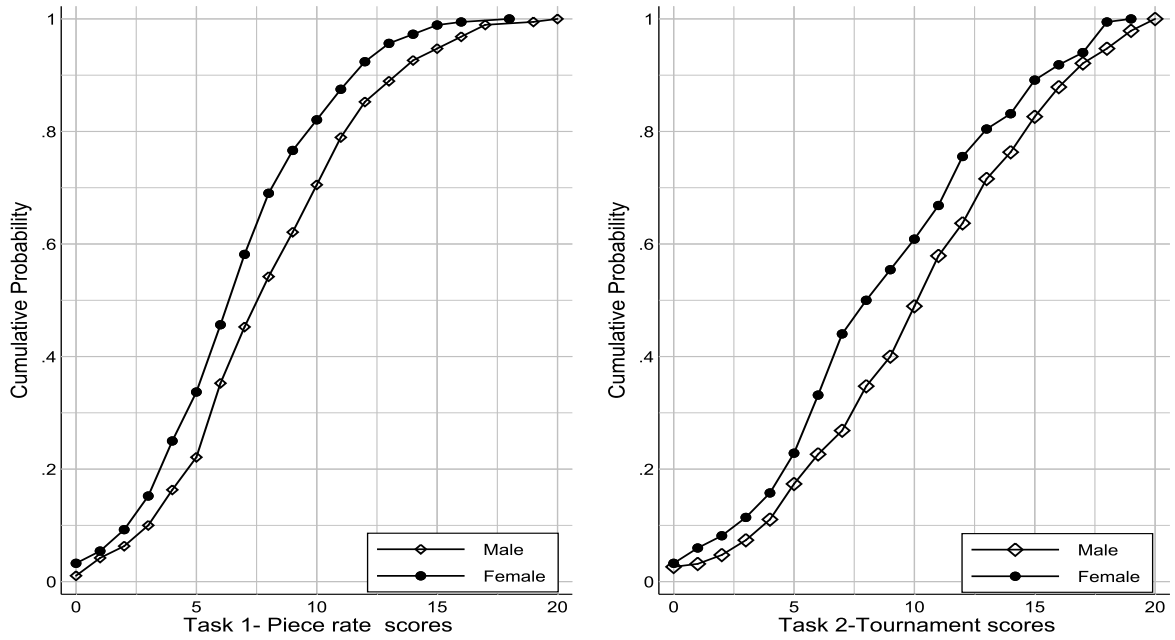
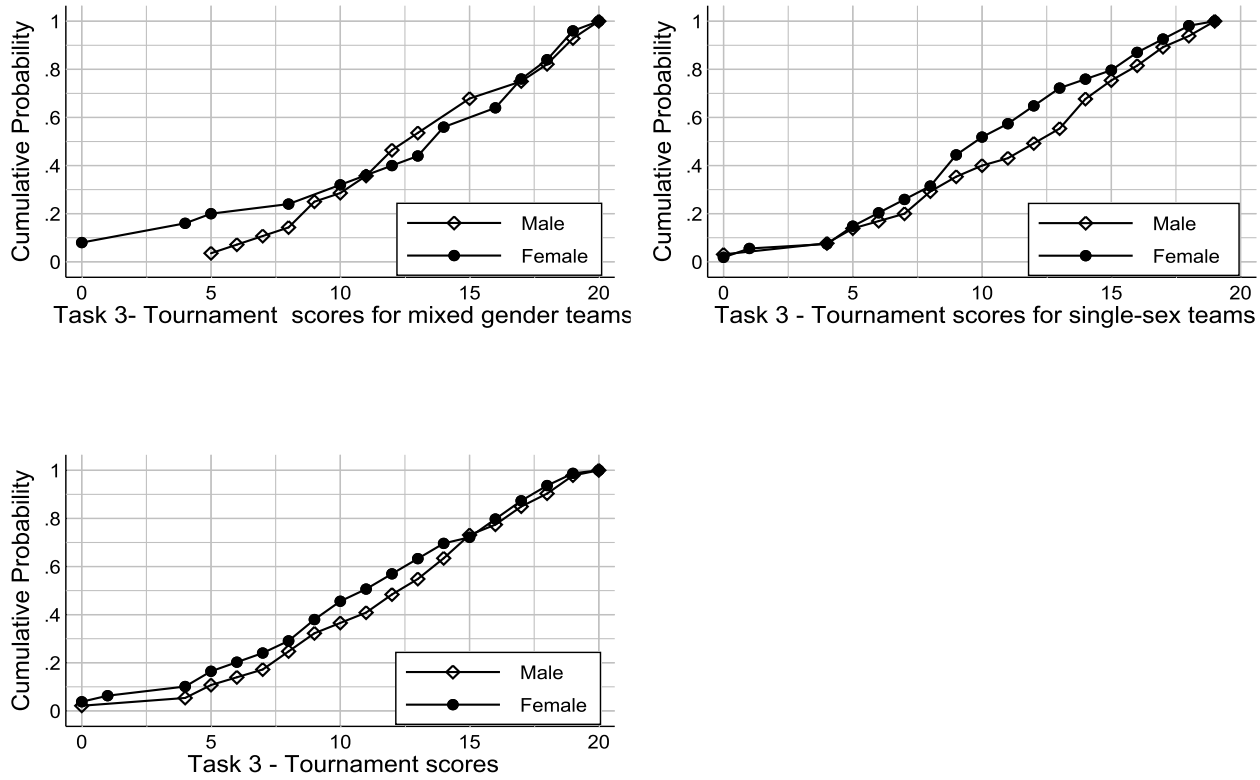


Figure 2: CDF of correctly solved problems (Task 3: Tournament)



Appendix 1

Table I: List of studies based on Niederle–Vesterlund (2007) experimental design

Students Subjects

Studies	Country	Task	Sample Size	Tournament Entry	
				Male	Female
Addition tasks					
Zhong et al. (2018)	Singapore	Addition	197	49%	25%
Dariel et al (2017)	UAE	Addition	147	50%	54%
Apicella et al. (2017)	USA	Addition	100	58%	38%
Halko & Saaksvuori (2017)	Finland	Addition	80	74%	54%
Reuben, Wiswall & Zafar, (2017)	USA	Addition	257	54%	27%
Buser, Dreber & Mollerstrom, (2017)	USA	Addition	104	52%	28%
Berlin & Dargnies (2016)	France	Addition	228	63%	35%
Brandts, Groenert & Rott, 2014)	Spain	Addition	112	59%	30%
Wozniak et al. (2014)	USA	Addition	128	54%	31%
Niederle et al. (2013)	USA	Addition	84	74%	31%
Cadsby et al. (2013)	Canada	Addition	132	36%	9%
Price, (2012)	USA	Addition	310	66%	49%
Mueller & Schwieren (2012)	Germany	Addition	127	42%	26%
Kamas & Preston (2012)	USA	Addition	310	41%	23%
Dargnies (2012)	France	Addition	76	85%	51%
Balafoutas, Kerschbamer & Sutter (2012)	Austria	Addition	134	59%	31%
Balafoutas & Sutter (2012)	Austria	Addition	72	64%	30%
Healy & Pate (2011)	USA	Addition	192	81%	28%
Niederle & Vesterlund (2007)	USA	Addition	80	73%	35%
Other tasks					
Buser, Gerhards & van der Weele, (2018)	Denmark	Mix	297	42%	26%
Banerjee, Gupta & Villeval (2018)	India	Memory task	168	22%	16%
Wozniak et al. (2014)	USA	Verbal	128	54%	31%
Gupta, Poulsen & Villeval, (2013)	France	Mazes	100	60%	34%
Shurchkov (2012)	USA	Verbal	128	39%	30%
Buser et al. (2017b)	Denmark	Mix	297	42%	26%
Banerjee et al. (2017)	India	Memory task	168	22%	16%

Non-students Subjects

Studies	Country	Task	Sample Size	Tournament Entry	
				Male	Female
Adults					
Bo¨nte et al. (2017)	Germany	Math	225	56%	45%
Cassar, Wordofa & Zhang (2016)	China	Addition	358	36%	26%
Apicella and Dreber (2015)	Tanzania	Skipping rope Bead collection Handgrip strength	191 88 70	45% 52% 67%	30% 37% 29%
Gneezy et al. (2009)	Tanzania (patriarchal) India (matrilineal)	Bucket toss Bucket toss	172 146	50% 39%	26% 54%
Children					
(Zhang, 2015)	China (Han) China (Yi) China (Mosuo)	Addition Addition Addition	96 96 80	63% 60% 75%	48% 38% 48%
Buser, Peter & Wolter (2017)	Switzerland	Addition	249	68%	51%
Alma°s et al. (2016)	Norway	Addition	483	52%	32%
Sutter et al. (2016)	Austria	Addition	246	44%	21%
Khachatryan et al. (2015)	Armenia	Addition Word search	824	54% 57%	52% 56%
Sutter & Glaetzle-Ruetzler, (2015)	Austria	Addition	717	40%	19%
Lee, Niederle & Kang (2014)	South Korea	South Korea	640	30%	22%
Dreber, von Essen & Ranehill (2014)	Sweden	Addition Word search	216 216	36% 33%	17% 28%

Appendix 2
Additional Tables

Table I: Distribution of groups and number of people per group

Number of people per group	Female Group	Male Group	Mixed-gender Group	Total Number of Groups
2	---	2	---	2
3	3	4	3	10
4	14	16	26	56
5	13	8	---	21
6	---	2	---	2

Table II: Differences in expected gender behaviours by children

Variable	Male	Female	Difference	P-value
Wives should be less educated than their husbands	3.44	3.6	-0.3.6	0.34
Boys should get more resources/opportunities for education than girls	3.92	3.98	-0.05	0.64
Girls should be allowed to study for as long as they like - as high as they want	1.57	1.57	0.00	0.99
Daughters should have a similar right in terms of inheriting property as sons	1.72	1.82	-0.10	0.48

Table III: Joint effect of gender teams and being married on sale

VARIABLES	Sales
Female Teams	29.412
	(46.999)
Mixed Teams	51.136
	(76.835)
Age	1.222
	(1.087)
Education	-2.263
	(3.074)
Rulindo district	-13.543
	(30.166)
Hhead	9.453
	(20.281)
Hhsize	9.285
	(7.907)
Married	-76.616*
	(45.088)
Risk-taking	2.513*
	(1.298)
Female X married	**17.674**
	(55.889)
Mixed X married	**17.190**
	(85.268)
Observations	154
R-Squared	0.111

Appendix 3

Experimental Instructions

Introduction

Welcome!

Thank you for coming. My name is [NAME], I am a doctoral fellow at the University of Cape Town, South Africa. These are my colleagues [NAMES]. We have invited you here to play simple economic games.

You will earn money for participating in today's experiment. For your participation, you will be paid F1000. This means you are starting the day with F1000.

You will play today's games in 3 parts

You can make additional money based on your decisions.

How much money you make **solely** depends on the decisions you make during the games. This means it is very important you pay attention and understand the rules of the games, which I am going to explain at the beginning of every game.

At the end of the day, the amount you earned will be paid to you **IN CASH**.

Please do not talk to anyone when we start playing the games. If at any stage of the game, you have ANY question just raise your hand and someone will come to you in private to answer your question.

Participating in the games is voluntary. If you decide not to continue with the games, you may leave at any stage even after we have started playing the games but note that you will not earn any money for participating.

At this point if you wish to continue with the experiment you may sign the consent form that my assistants are bringing around right now. [HAND OUT THE CONSENT FORMS AND READ TO THEIR UNDERSTANDING]

Do we have anyone who needs assistance? [IF YES, WE ASSIST WHERE NECESSARY]

Has everyone finished signing? Alright, one of us is coming around to collect the forms from you.

[COLLECT FORMS]

We are going to share a second form to capture some demographic details before we continue with the various games. Under no circumstance will this information be used to identify the decisions you make in the games. [HANDOUT IDENTIFICATION FORMS]

Your experiment number are written on the topmost part of your tables. Is everyone done with filling out the forms? [GIVE ASSISTANCE WHERE REQUESTED] Okay, someone is coming around to collect the forms. [COLLECT FORMS WHILES CHECKING THAT ALL FIELDS HAVE BEEN PROPERLY FILLED]

Part 1: Game 1

You will play three games in this part. In the first game, you are asked to add simple numbers together. All you must do is to write down the answers to as many problems as possible in 5 minutes.

Example: [POINT TO THE POSTER AND DO AN EXAMPLE]

We will time you throughout the tasks. After 5 minutes, I will ask you to stop. Each correct answer to the problem will earn you RWF 50. This means if you solve 3 problems correctly you earn 3X RWF 50 = F150, if you solve 4 problems correctly you will earn 4X RWF 50= RWF 200 and so forth. There are 20 questions in total to be solved. That means if you get all 20 problems correct you will earn a maximum of 20 X RWF 50 = F1000 for this game.

Now, your decision sheets for this game comes in a form of a booklet: one problem on each page. So, after solving a question you turn to the next page and continue solving till the 5 minutes is up.

The use mobile phones/calculators are not allowed in this session.

Once again do not talk to anyone during the games.

After you finish with all the games, your results for this part will be given to you individually at the end of the day.

Any questions?

[DISTRIBUTE BOOKLETS] Do not open your booklets until asked to do so.

[AFTER EVERYBODY HAS GOTTEN THEIR BOOKLETS] Now, write down your experimental number which was given to you at the start of the day in the blank space on your booklets. [POINT TO POSTER]

Okay! Let's continue, Solve as many problems as you can in 5 minutes. You can now open your booklets and start!
After 5 minutes, stop solving! Pencils Down! [COLLECT BOOKLETS]

Game 2

Again, in this game, you are asked to add as many numbers as you can in 5 minutes. The difference now is that for this game, you will be part of a group. The people in your group will be randomly picked from this room. We will hand over to you some basic information about your group members. However, you will never know the names of the other people in your group, and they will never know your name.
Your performance in this round will be compared to the other members of your group. Only the person with the highest score in each group will be paid for this round. The amount paid to the person who solved the highest number of problems for each group is now RWF 150 for each problem solved correctly. That is the winner of this game for each group earns RWF 150 for each correct problem.
This means if the highest score in the group is 10, the person who had the 10 will earn RWF 150 X 10 = RWF 1500
Once again there are 20 problems in total to be solved so the highest amount, the winner for each group can make is 20 X RWF 150 = RWF 3000
If two or more people have the same score in a group, the earnings will be split among the top performers of the group equally.
For example: If in a group, 2 people have the same score which is also the highest score of the group let's say their score was 5. Then it means the earnings become 5 X RWF150=RWF750. In this case the F750 will be shared equally between these two winners. This means they will receive F375 each.
Remember if you are not the winner of your group you earn **NOTHING for this game**.
Any question? Great! Now let's start with the game.
[DISTRIBUTE BOOKLETS WITH THE BASIC INFORMATION OF GROUP MEMBERS] Do not open your booklets until asked to do so.

[AFTER EVERYBODY HAS GOTTEN THEIR BOOKLETS] Now, write down your experimental number which was given to you at the start of the day and your group numbers [SHOW THEM WHERE THEY ARE] in the blank space on your booklets. [POINT TO POSTER]. ASSISTANTS GO ROUND TO EXPLAIN THE BASIC INFORMATION OF GROUP MEMBERS TO PARTICIPANTS

Okay! Let's continue, Solve as many problems as you can in 5 minutes. Remember, you are now in groups. You can now open your booklets and start!

After 5 minutes, stop solving! Pencils Down! [COLLECT BOOKLETS]

Game 3

In this game, you will go through the additions again in 5 minutes as done in previous games. But now you can choose which way you want to be paid. Do you want to be paid by your individual performance like in **GAME 1** or do you choose to be compared to your group performance as done in **GAME 2**?

As I said in Game 1, you are paid RWF **50** for each correctly solved problem. In Game 2, if you are the winner of your group you get 3 times higher the amount paid for each correct problem. That is, you earn RWF **150** for each correct problem.

Since we have a total of 20 problems, it means if you choose to be paid by your own performance as done in Game 1 the maximum amount you can make is RWF **1000** but if you choose to play in a group as done in Game 2 the maximum amount you can earn is RWF **3000 if you are the winner.** If you choose to play in a group and **you are not the winner, you earn nothing for this game.**

So, if you choose to play the individual performance task you will be paid RWF **50** for each problem solved correctly. However, if you choose to compare your performance to your group, you will earn RWF **150** for each correct problem **if you are the winner of your group**.

Any questions?

Now, write your experimental number and choose how you want to be paid for this round on sheets in front of you [POINT TO POSTER]

Experiment Number _____

[TICK]

[ ] – **Individual task payment**

[ ] – **Group task Payment**

[ASSIST PARTICIPANTS]
[DISTRIBUTE DECISION BOOKLETS WHILES COLLECTING PREVIOUS SHEETS GIVEN OUT]
[AFTER EVERYBODY HAS GOTTEN THEIR BOOKLETS]

Now, write down your experimental number (given at the start of the day) and group numbers [IN THE CASE OF THOSE WHO CHOSE TO PLAY IN GROUPS] in the blank space on your booklets

Okay! Let's continue, Solve as many problems as you can. You can start!

After 5 minutes, stop solving! Pencils Down! [COLLECT BOOKLETS]

Risk Experiment – Decision sheet

Experiment number: _____

	Option 1	✓		Option 2	✓
[1]	F160 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[2]	F180 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[3]	F200 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[4]	F220 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[5]	F240 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[6]	F260 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[7]	F280 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[8]	F300 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[9]	F320 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[10]	F340 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[11]	F360 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[12]	F380 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[13]	F400 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[14]	F420 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[15]	F440 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[16]	F460 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[17]	F480 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[18]	F500 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[19]	F520 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[20]	F540 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[21]	F560 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	
[22]	F580 for sure		**OR**	Spin the wheel: ○F0 / ●F1200	