Sustaining the potential for cooperation as female competitive strategy

Alessandra Cassar[1] and Mary Rigdon[2]

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The lower female competitiveness often found in economic experiments presents a puzzle. If accumulating wealth and reaching high status affords women essential benefits for themselves and their children, why do women appear less competitive? By looking at behavioral strategies from a cooperative breeding perspective, we propose that women may have evolved an adaptation to strategically suppress competitiveness to elicit cooperation for the benefit of raising offspring. To support this idea, we review the literature that shows that female behavior is, in general, more reactive than males to the social conditions of the different games. In particular, we focus on our experimental work where we show that women are not less competitive than men once the games evoke a parenting frame (by substituting cash with rewards that could benefit the participants' offspring), a gender-typical one (by using vouchers for prizes acceptable as domain of female interests), or include a prosocial option (by allowing winners to share some of the gains with losers). We conclude that, for women, nurturing the potential for cooperation intertwines with competitiveness to produce a complex, adaptive female social strategy.

[1]Alessandra Cassar: University of San Francisco, Department of Economics, San Francisco, CA 94117; acassar@usfca.edu; ORCID: 0000-0001-9944-0396.

[2]Rigdon: University of Arizona, Center for the Philosophy of Freedom, Tucson, AZ 85721; mrigdon@arizona.edu; ORCID: 0000-0002-4516-9999.

1. Introduction

Labor and experimental economists have been increasingly interested in investigating the hypothesis that the gender gaps found in labor markets may be due, at least in part, to sex differences in non-cognitive skills such as psychological attributes, preferences, personality, and behavior (Bertrand, 2011; Croson and Gneezy, 2009; Blau and Kahn, 2017). Initial explanations of why women have not reached economic and political equality with men focused on gender differences in human capital accumulation, years of education, choice of major in college, accumulated labor market experience, and discrimination (Altonji and Blank, 1999; Blau and Kahn, 2006; Goldin and Rouse, 2000). Yet, despite the narrowing of many disparities, notably in education, where the trend has even reversed, many inequalities persist (Goldin, 2014).

To explain the remainder of such gaps, economists have advanced the idea that women are less competitively inclined than men (Niederle and Vesterlund, 2007; 2011). In both the lab and the field, experimental data suggests that women are less competitive, more averse to risk, and less ambitious than men in laboratory games and field settings (Croson and Gneezy, 2009; Charness and Gneezy, 2012). By shying away from competitive environments, women might self-select into activities that have lower but more predictable returns with significant implications for their economic wellbeing, including career choice, performance in competitive workplaces, and negotiations of salaries and promotions (Buser, Niederle, and Oosterbeek, 2014; Flory, Leibbrandt, and List, 2015). In fact, some recent evidence shows that competitiveness is associated with positive economic gains for the individual (Buser, Niederle, and Oosterbeek, 2021). Yet, other disciplines are turning up increasing evidence of the crucial benefits that women would gain for themselves and their offspring by securing resources and reaching high status, giving rise to the puzzle of why women do not show competitiveness (Geary 2000; Borgerhoof-Mulder 2007; Hrdy 2009; Rucas et al. 2012; Rucas 2017; Alami et al. 2020).

Here, we propose that such a puzzle could be explained by focusing on the social features that a contest possesses and the costs, not just the benefits, that winning may bring to the individual. If one important way to understand behavior is to understand its function, we hypothesize that the standard competitiveness protocol, based on winner-take-all tournaments that create extreme inequalities, is fine-tuned to record and amplify competitiveness as expressed in males but not necessarily in females. While men have been found to enjoy many benefits by achieving high status in terms of reproductive opportunities and coalition partners (Hill, Kaplan and Hawkes 1993; von Rueden, Guerven, and Kaplan, 2008), women, despite the many advantages that gaining resources

can afford, may face significant costs from winning and being perceived as competitive: personal costs on the household front with partners (Fisher 2013; Folke and Rickne 2016; Bertrand et al. 2015) and the potential loss of allies (Benenson 2013; Benenson and Markovitz 2014). Both losses would impose severe consequences for the survival and thriving of their offspring. Specifically, we hypothesize that women may avoid competitions not per se but for fear of appearing overly interested in pursuing individual gains and, as a consequence, of damaging cooperative relationships. If a behavioral legacy of our cooperative breeding nature is a sensitivity to elicit cooperation from fathers, kin, and others to help raise energetically expensive offspring, women could be expected to be particularly responsive to those elements that could hinder sustained cooperation. Preferences for fair resource distributions and more egalitarian outcomes have long been recognized as essential for cooperation based on reciprocity. While both males and females would have benefited from cooperation, the trade-offs of mating vs. parenting may have placed a lower tolerance for inequity in women than in men.

In this paper, we discuss the evidence related to competitiveness and our work designed to test the hypothesis that women are not less competitive than men, but react to different incentives. Our experiments show that women can be as competitive as men when provided with prosocial incentives that could help mitigate competition's costs: having the option to share some of the winnings with losers or making the incentives explicitly about their children or spheres of acceptable female interests. The implications of our findings suggest types of rewards and policies that could promote gender equality and induce more women to thrive in competitive workplaces: less skewed incentive structures (e.g., team bonuses rather than individual ones or strong social mission) and contracts that explicitly include benefits for children (e.g., paid parental leave, school vouchers, and flexible schedules).

2. Competitiveness in winner-take-all experiments

Laboratory experiments and field studies have documented that women tend to respond less favorably to competition than men across several ways of measuring competitiveness: women tend to perform worse than men in competitive settings even when they perform equally well in non-competitive environments (competitiveness as *performance*) and, even conditional on equal performance, women appear less eager to enter competitive environments (competitiveness as *choice*) (Croson and Gneezy, 2009; Niederle and Vesterlund 2011).

A typical protocol for measuring competitiveness has individuals doing a task---like adding numbers, solving a maze, running, throwing balls into a bucket—either under a non-competitive

environment where they get paid a certain amount for correct answer (*piece-rate* treatment) or in a competitive environment in which subjects are matched with other subjects, and only the top scorer is the winner (*tournament* treatment). To measure competitiveness, one calculates the average number of correct answers (time to finish the race, number of balls in the bucket, etc.) by sex in the tournament treatment and compares it to the piece-rate average. One of the first studies to find a gender gap in competitiveness as performance, Gneezy et al. (2003) examines differences in the rate at which men and women solve computerized mazes and report that men and women solve the same number of mazes under a piece-rate payment, but then men outperform women in a competitive, winner-take-all, mixed-gender group tournament. Gneezy and Rustichini (2004) observe a similar difference in performance in Israeli children running against each other.

Interestingly, these gender gaps in performance are mitigated or vanish entirely when the experiment manipulates the gender of the subjects they compete against (with women performing worse than men mainly when they compete in mixed-gender groups) and the specific task (with women performing worse mostly in stereotypical male tasks). Gneezy et al. (2003) reports that when all competitors are women, the gender gap in performance closes. Backus et al. (2016) studies performance by expert chess players and reports that gender composition matters for women's underperformance: women obtain worse outcomes than men of the same ability mainly in mixed-gender games. Price (2008), examining the results of a competitive fellowship program for graduate students, reports that men increase their performance in response to incentives, while women's outcomes improve only when their cohort is primarily composed of other women. Finally, Antonovics et al. (2009) examines data from a high-stakes game show and finds that men answer more questions correctly only when competing against a woman, while no similar effect can be observed for women.

More recent findings suggest that the effort-task also matters. For example, Gunther et al. (2010) replicates that women perform worse than men when the task is male-oriented (solving mazes), while in a gender-neutral task (a word generating task) and in a female-oriented task (memory task), women respond to competitive incentives as much as men. Similar findings of no gaps have been reported when: the task is perceived as being feminine (symbol-digit substitution task) instead of being masculine (mental rotation task) (Iriberri and Biel, 2013); with a perceived female task (verbal task) under low-time pressure (Shurchkov, 2012); in induced-value effort tasks rather than math-based (Lezzi et al., 2015). Finally, it is worth noting that not all studies report sex differences under competitive pressures, e.g., Dreber et al. (2014) on adolescents in Sweden.

The second characterization of competitiveness (as *choice*) focuses on the sexes' different preferences for entering competitions. Consistent empirical evidence shows that women display a lower desire to enter environments characterized by winner-take-all tournaments, preferring to self-select into activities that have lower returns but independent of relative ranking (Niederle and Vesterlund, 2007). Here, the typical protocol has participants complete a task both under the piece-rate payment (where the rewards are a guaranteed fixed rate based on a player's performance) and under the winner-take-all tournament payment (where the rewards are typically twice as high but based on the players' relative performance, i.e., only for those who score higher than the opponents while the losers earn nothing). Then the players are asked to choose their preferred compensation scheme, between the two previously experienced, to be applied in a subsequent round. Niederle and Vesterlund (2007) reports that 73 percent of men choose competition as their preferred compensation scheme versus only 35 percent of women. The experiment includes modules to elicit a player's confidence, risk, and feedback aversion. While these elements can explain part of the gender differences, the kernel of the gap in competitiveness usually remains unexplained. This gender gap in choice to compete has been replicated numerous times (e.g. by Gupta et al., 2013; Dohmen and Falk, 2011; Sutter and Glätzle-Rützler, 2015). Several field experiments have reported findings similar to the laboratory ones using job seekers' decisions in natural settings. Flory et al. (2015) finds that men apply significantly more often than women when the compensation schemes involve payments based on relative performance. Buser et al. (2014) study actual academic choices by secondary school students and reports that boys choose "prestigious" tracks significantly more often than girls. Buser, Niederle, and Oosterbeek (2021) finds that both incentivized and unincentivized measures of competitiveness are strong predictors of income, occupation, level of education, and field of study among a representative panel of the Duch population.

As with competitiveness measured as performance, several factors mitigate the gender gap in competitiveness measured as choice to enter a competitive environment. Cultural factors that have been found to close the gender gap include: attending a single-sex school rather than a co-ed one (Booth and Nolen, 2012); family background, with girls much less willing to compete than boys among children from better-off families, but no gender difference among children from low socioeconomic status families (Almas et al., 2016); matrilocality and matrilineality vs. patrilocality and patrilineality (Gneezy et al., 2009). Incentives and institutional elements affecting female competitiveness contain: team-based competitions rather than individual ones (Dargnies, 2012); providing feedback about relative performance prior to choosing the payment scheme rather than

giving information only about individual performance (Wozniak et al., 2014). Furthermore, individual traits such as confidence (Kamas and Preston, 2012) and social preferences (Balafoutas et al., 2012) have been found to explain away a significant portion of the gender gap, while age (Flory et al., 2018) and hormonal factors (Apicella et al. 2008; Buser, 2012; Wozniak et al. 2014) appear to be important determinants of women's willingness to compete. Cassar and Zhang (2022) reports an extensive review of this literature.

3. Competitiveness from an evolutionary perspective

The evidence reviewed in the previous section suggests that the robustness of the results of women's competitiveness being lower than men's critically depends on the set of conditions in which such gap is found: winner-take-all distributions, stereotyped male tasks, mixed-gender competitions, and patriarchal cultures. In light of these findings, we propose a theoretical framework that could explain why competitiveness, so open among men, may be more concealed among women, whose preferred strategy of shying away from overtly competitive situations may have offered evolutionary fitness gains. Although the logic is evolutionary, rooted in a time when competitiveness costs may have had life and death consequences, the traces of such tolls and gains are still detectable today. Our argument hinges on the consequences that power, status, and resources bring to the relationships between winners and losers. In addition to determining outcomes, individual behavior may signal personal value to potential mates and allies, who may react accordingly. Consciously or not, such anticipated effects may have repercussions on whether one finds it advantageous to openly display competitiveness and on the type of strategy chosen to be deployed. We hypothesize that these subsequent considerations are actually "central" for a sex that evolution has groomed for competence in negotiating cooperative relations with mates and allies. If one way to elicit cooperation is through reciprocity, then avoiding inequalities, appearing less aggressive, and less interested in getting ahead are all strategies to maintain its potential. Our experiments show that the sex gap in competitiveness can be closed by including in the games incentives that matter to women---whether adding a prosocial option to a competition or reframing the winning of the tournament as something beneficial to children. These results signify that men and women do not differ in competitiveness but rather how they express it. Women would underplay competitiveness to avoid signaling overt non-cooperative intentions (for example, when the gains are highly unequal). Still, they would get motivated to increase it when winning would not necessarily preclude prosocial actions or be viewed as seeking gains for others.

3.1 Nature & nurture

After decades of research on the psychological differences between men and women, the topic is still intensely debated across disciplines. Overinflating or under-appreciating sex differences in the workplace costs both the individual (discrimination) and society (loss of welfare). The "consensus" depends on whether one wants to focus on the overall vast similarities (Hyde, 2005) or the few areas of dissimilarities (Del Giudice, 2015). Differences in cognition, preferences, and behavior between the sexes are not expected, except for those domains relevant to the sexes' differential roles in reproduction. Furthermore, social norms and institutions exert a powerful influence on beliefs and preferences. Hence it is essential to highlight that any behavioral result we observe derives from the interplay of biological and cultural factors, although the literature has initially focused on the two spheres separately.

Evolutionary framework. According to a first set of theories, evolutionary forces caused not only physical sex differences but also operated on the mind. Given the sexes' different biological contributions to reproduction, evolutionary pressures would have honed each sex to adopt those traits especially suited to its own role in procreation. From Darwin (1871) to Bateman's experiments on fruit flies (Bateman, 1948), and parental investment theory (Trivers, 1972), higher variance in male reproductive success and higher maternal investment have been theorized as the key elements to understand behavior. Centered on the higher risks and rewards of the mating game for males than for females, this argument gave rise to a set of predictions about gendered behavior: males would have evolved greater aggressiveness, indiscriminate sexual desires and, relevant for our topic, higher competitiveness, appetite for risk, and behavior conducive to dominance and status seeking (Buss, 1989; Browne, 2006; Campbell, 2013). Departing from this initial model, a less passive interpretation has emerged about the role of females in sexual selection. Rather than a merely inert object of male competition, females across species have been found to be active actors competing for the wellbeing of their offspring and the best suitable mates, depending on male genetic endowments, abilities, and anticipated willingness to invest in them and their offspring (Hrdy 1981; 1999; Campbell, 1999; Stockley and Bro-Jørgensen, 2011; Gowaty, 2013). Aside from mates, women have also been found to compete for social resources, such as friends and social status (Reynolds 2021).

Socio-cultural framework/social role theory. A second set of theories claim that evolution would have affected mainly the physical differences between the sexes, such as body strength, size, and reproductive activities. These factors would then interact with economic and social needs, some

universal some specific to each culture, giving rise to a range of psychological and behavioral differences between the genders (Wood and Eagly, 2012). Early human societies, having to adjust to local socio-economic and ecological environments, adopted a division of labor in which women specialized in activities compatible with infant caretaking (such as gathering) while men specialized in activities requiring greater physical strength, uninterrupted periods of time, and long-distance travel (such as hunting). Settled agriculture further differentiated such division of labor and gendered activities, giving rise to the social construction of gender: children, needing to fulfill their adult roles eventually, would be socialized by parents and society through the instilling, expecting, punishing, and rewarding of behaviors consistent with the cultural beliefs about each sexes attributes. Such cultural beliefs would "construct" masculine traits based on agency (involving assertiveness and competitiveness) and feminine traits centered on communion (warmth and concern for others). As individuals internalize these beliefs, "culture gets inside the person" and creates observable sex differences in behavior. Evidence for this argument is provided by recent studies tracing contemporary differences in outcomes, preferences, and belief systems to the legacies of the pre-industrial characteristics of a culture. For example, economies whose agriculture had a tradition of plow use still display recognizable gaps in female participation in entrepreneurship, labor market outcomes, and politics (Alesina et al., 2013; Giuliano, 2015). Other economic and cultural characteristics capable of explaining some of the persistence of differences in gender norms include fishing economies, socialism, dowry, and family structure ((BenYishay et al., 2017; Giuliano, 2020). Evidence that sociocultural factors contribute to gendered behavior---through social norms adherence and gender stereotypes conformance---is gaining momentum, although it remains unclear whether such effects can explain the existence of a difference between feminine and masculine traits or, rather, how strongly these traits get to be expressed. Surprisingly, recent studies comparing WEIRD societies to developing economies reveal that behavioral gaps are actually more significant in those countries characterized by a higher level of economic development and gender egalitarianism. The hypothesis is that when survival is less at stake, like in richer countries, and women can aspire to positions and incomes similar to men, the expression of individual differences would be less costly (Falk and Hermle, 2018). Differences are also reported among countries sharing similar levels of development but with different institutions and cultural practices. For example, Gneezy, Leonard, and List (2009) find that women compete more than men among the matrilineal and matrilocal Khasi in India (where men take on a large role in childcare), while men are more competitively inclined than women among the patriarchal Maasai in Tanzania. Similar results were found by Flory et al. (2018) who compare women

and men in one matrilocal and one patrilocal culture in rural Malawi and replicate the finding that a gender gap in competitiveness can be found only in the patrilocal culture. Looking at different institutions, Booth et al. (2019) find that mainland Chinese women exposed to communist ideology are more competitive than both Taiwanese women of similar age and younger mainland Chinese women who were less exposed to such ideology.

3.2 Benefits and costs of competing

Analyzing traits as the product of evolutionary forces requires looking at their costs and benefits from a fitness perspective. Competing and winning can bring many benefits that could enhance reproductive success. Some are common to both males and females: access to the best resources, deference from others, and freedom from harassment (hence less stress). Others are specific to each sex: males gain access to reproductive opportunities with females, while females gain access to resources, whose reliable availability is crucial for offspring survival. Competitions, almost by definition, tend to be zero-sum games that produce winners and losers. The costs associated with losing could mean different things to males and females: different repercussions on offspring survival if a mother vs. a father dies (Campbell, 1999) or threats to cooperative relationships when contests create inequalities (Bartling et al., 2009; Rucas, 2017).

3.2.1 For males

The main benefit of achieving high status to males is an increased chance of reproductive success, even if it does not translate into an automatic increase in the number of offspring (Hill and Kaplan, 1993; von Rueden, Gurven, and Kaplan, 2011; Campbell, 2013). First, especially in non-humans, winners of male-male competitions can dominate rivals in acquiring females. Second, winners get preferential access to contested resources that, in addition to providing nourishment, allow the opportunity for increased reproductive success since, in most species, females have shown a preference for highly ranked males. Even when paternal investment is limited, females may still prefer high-status males to select for good genes such as strength and competitiveness.

In humans, in addition to good genetic material, a woman's preference may be based on a man's resource-holding potential, which indicates his ability to provide for the woman and her offspring (Buss, 1989; Fisher, 2013; Walter et al., 2000). Securing resource-holding and committed partners offers crucial benefits for a woman's life outcomes and her children's (Geary, 2000). Men's social status is sometimes based on dominance, i.e., a superior ability to inflict costs on others and

withhold benefits critical to others' fitness largely dependent on physical strength and capacity to instill fear (Cheng et al., 2013). Male warriors and gang members would be an example of this type of strategy, and, in fact, they have been found to have a higher number of sexual partners (Chagnon, 1988; Palmer & Tilley, 1995). More often, though, power is obtained through prestige (Henrich and Gil-White, 2001; von Rueden et al., 2011), i.e., through natural and culturally acquired abilities (e.g., social intelligence or determination) that permit the accumulation of wealth, achievement of status over others in economic enterprises and public organizations, or the possession of valuable knowledge and specialized competence (e.g., artists, doctors, athletes, etc.). History abounds with examples of the extraordinary reproductive success of men of wealth and power like Julius Caesar, who kept hundreds of wives for reproduction purposes, or Chinese emperors who kept royal harems of 1,000 women (Betzig, 1992). Marked social dominance hierarchies with authoritative leadership are a widespread characteristic of most human societies in both chiefdoms, kingdoms, and states. Even among humans living in traditional small-scale societies characterized by much smaller wealth and power inequalities (Boehm et al., 1993), a correlation between status and reproductive success still exists to a certain extent (Hill and Kaplan, 1993; von Rueden, Gurven, and Kaplan, 2011), and even here, females subordinance to males has been seen as the norm (Boehm, 1999). In conclusion, across societies varying in size, complexity, and economic development, women have been shown to be attracted to high-status men, whether it comes from strength, skills, bravery, intelligence, or prowess. Consequently, men ubiquitously display a powerful desire to outrank other men and attract women. Whether it would be optimal for men to take advantage of their position or to stay committed and invest in their offspring is currently being debated (Alger et al., 2020).

3.2.2 For females

Traditionally, competitiveness has been associated with dominance, violence, and those behavioral traits clearly visible to an observer. Primatologists used to think that females were just less interested in competing, showing no clear dominance rankings and no displays to show off high positions (de Waal, 1989). Instead, they seemed to prefer to form female bonds that gave them the power to contest male control and coercion, exhibiting a different leadership style when in power (Kano, 1992; Tokuyama and Furuichi, 2017). More recently, high status has been shown to bring females many benefits that could translate into greater reproductive success (Hrdy, 1981). Among primates, first and foremost, high status confers priority and continuous access to food (Stockley and Bro-Jorgensen, 2011; Campbell, 2013), which females value not just for themselves but for provisioning their

offspring (de Waal, 1989; Silk et al., 2013). Second, high-status females are not subject to harassment; they rather inflict it on others and even induce reproductive suppression (Young et al. 2006). Third, dominant females are more likely to have allies who will support them in disputes; their infants are less likely to be handled, kidnapped, or killed by other adults (Campbell, 2013). Fourth, when rank is heritable, their young grow up to experience these same rewards. Despite these clear benefits to high status, the use of physical force is rarely seen used by females (Kahlenberg et al. 2008). Instead, females enjoy the benefits of dominance without incurring its costs through ranks that are not physically fought but inherited and, when food conditions permit, instead of dispersing at sexual maturity to neighboring troops (e.g., in female-bonded species such as baboons, lemurs, and macaques), by remaining with their kin who make the best allies because of their shared genes (Hrdy, 1981).

Also in the case of humans, establishing rank has been more difficult for women than for men as women's preferred forms of aggressiveness (indirect, covert, through exclusion, gossiping) are less visible than men's more direct forms (physical and direct verbal) (Del Giudice, 2015; Vaillancourt and Krems, 2018). Eventually, Staying Alive theory was proposed to explain many of the puzzling traits of women: if the costs of direct aggression (in terms of likelihood of offspring survival) are greater for females than for males, females would have a greater need to avoid serious physical harm, preferring more muted tendencies to compete using physical aggression and (a disinclination) to form dominance hierarchies (Campbell, 1999; Moucheraud et al. 2015; Benenson et al., 2022). Nevertheless, recent empirical evidence confirms that high status does increase women reproductive success (Ellis, 1995; Hrdy, 1999; Borgerhoof-Mulder, 2007; Rucas et al., 2012; Alami et al., 2020), suggesting that there are no reasons to expect that females' motivations for wanting power should be any lower than males' and that this lack of ouvert competitiveness should be interpreted as a lower interest in securing resources. The main difference across the sexes would then be one of the strategies evolved to achieve those goals (Archer, 2004): being more attuned to the needs to avoid physical harm through the development of more *couvert* strategies ranging from slander to exclusion (Hess and Hagen, 2006; Reynolds et al. 2018; Benenson 2013; Benenson and Marcovitz 2014; Vaillancourt and Krems, 2018).

In this paper, we propose another strategy: the suppression of competitiveness to maintain the potential for cooperation. The type of competitiveness we discuss in this paper, the one found in laboratory experiments and relevant for labor markets (e.g., seeking job promotions, choice of profession, entry into politics) is not typically associated with threats to life, rather its main feature is that it produces stark resource inequalities---and also comes with the cost of being perceived of as highly competitive. Inequalities have been hypothesized as an obstacle for sustained cooperation based

on reciprocity. Insofar as one sex more than the other resorts to reciprocity-based cooperation (Croson and Buchan, 1999; Ben-Ner et al., 2004; Buchan et al., 2008; Croson and Gneezy, 2009), women may shy away from situations producing unequal outcomes to avoid alienating potential partners and allies. See Kramer (2022) in this volume for an overview of relevant theoretical, cross-cultural, and cross-lifespan research on female cooperation. By forgoing short-term gains in favor of greater egalitarianism, women would invest in social resources such as alliances with men, friendships, groups of kin, and affines, that increase fitness by bringing benefits to offspring (Rucas, 2017). By being more sensitive to strategies conducive to social capital, women may be more motivated to enter competitions when they come with prosocial features or are framed as beneficial to others. By not appearing competitive, these situations afford women the opportunity to win resources and to maintain allies by not alienating losers and signaling good mate value. A different set of strategies does not mean that female competitiveness is less important or less intense; instead, we would need to use different instruments to measure it.

Evidence outside of economics helps support this idea. In laboratory studies and surveys, even talking about rank and selecting group leaders seem a tabu' for many women, suggesting a relative aversion to conditions that produce status discrepancies (Benenson et al., 2002). Across 36 countries and 25,000 individuals, women report enjoying competition less than men (Bonte, 2015). Already in childhood, boys display a love for competitive games with clear winners and losers, for rough and tumble fighting, and games that indicate a desire to strive for dominance (Strube, 1981; Fabes, R.A., Martin, C.L. and Hanish, L.D., 2003.). Girls prefer games based more on cooperation than competition (Benenson et al. 2002; Sutter and Glatzle-Rutzler, 2015; Ahlgren, 1983). Since childhood, girls are concerned with developing shared norms and cohesion within the group (Eder and Sandford 1988) and prefer to resolve conflicts through discussion, collaborative interchanges, and suggestions (Eder, 1990), while domineering exchanges and giving orders are more common in boy groups (Leaper, 1991).

With respect to social networks, girls have been found to form small groups and cliques, usually dyads or triads whose hierarchical lines are hard to detect and dominant behaviors are neither desired nor discernible (Benenson et al., 1997; Savin-Williams, 1980; David-Barrett et al., 2015; Vigil 2007). Adolescent girls declare to seriously dislike other girls who see themselves as superior, while boys seem to openly encourage statements about relative ranking (Schneider et al., 2005). Girls find explicit comparisons offensive, monitor each other's behavior for displays that one is trying to differentiate herself from her friends, and criticize and reject those whose behavior implies that they

feel superior to others in their group (Benenson and Markovitz, 2014). Girls who 'stick out' attract a kind of negative halo; they are seen as egotistical and likely to betray friendships (Goodwin, 2002; Simmons, 2002). Eder (1985) shows that for girls 'popular' is very different than 'likable,' whereas no such dualism is evident among boys. Women, especially those more attractive, strategically select more modest clothing when interacting with other women (vs. both men and women), suggesting they anticipate the costs to same-sex peers of displaying sexually (Krems et al., 2020).

Girls have been found to want strong egalitarianism within their cliques, and those thought to think of themselves as superior to others (especially in attractiveness) are disliked as friends. Inequalities are disliked because women fear they impede cooperation based on reciprocity. Girls have been found very careful about not flaunting their successes with their social groups or striving for individual prominence, downplaying their own achievement in order not to alienate the other girls and risk exclusion. Empirical evidence supports that minimizing status discrepancies may help women ingratiate themselves with same-sex peers (Vigil, 2007). In adulthood, women show a similar reluctance to appear superior to their female friends: they avoid bragging about their accomplishments, successes, and gains (Tannenbaum, 2011). Doing so would arouse jealousy, hostility, criticism, and possibly losing friends (Rose, Swenson, and Waller, 2004; Campbell, 2013). All this evidence suggests that suppressing competitiveness, rather than an indication of a lower female trait, could be the manifestation of different essential interests: keeping a close group of allies for the many crucial benefits that they provide. Social support is strongly linked to better health and increased longevity (Liu and Newschaffer, 2011; Tilvis et al., 2012; Holt-Lundstad, Smith and Layton, 2010). Bedrov and Gable (2022) in this volume offers an overview of the relationship between social support and physical and psychological wellbeing specifically for women. Those who secure cooperative social relationships receive aid, resources, support, childcare, information---strong incentives for women to cooperate with peers (Taylor et al., 2000). Caregiving provided by female friends and kin have been shown to allow women to increase their fertility and promote child survivorship (Hrdy, 2009). Among the Tsimane, women well-liked by their female peers have more surviving children than those less liked (Rucas, 2017). Female social status and support to lessen the workload could translate into child survival (Crittenden and Marlowe, 2008; Meehan, Quinlan, Malcon, 2013).

Furthermore, there are costs to winning for women that are not found for men: women who pursue careers get punished on the family front. Studies of men mating choices show that women that acquire power and status do not necessarily see these gains directly translated into better quality males (Buss, 1989; Fisher, 2013; Brown and Lewis, 2004; Fisman et al. 2006). Political victories and high-

level promotions significantly increase the divorce rate for females but not for males (Folke and Rickne, 2016). Men seem to react negatively to their spouses' relative success (Bertrand et al., 2015). When high-quality bachelors can observe preferences, highly competitive female Harvard MBAs downplay their economic aspirations (Bursztyn et al., 2017). Cross-cultural regularities in data reveal that the investment of male partners critically improves the survival and wellbeing of children (Geary, 2000), so the costs of alienating men are not to be taken lightly. Competing to obtain the resources of men willing to invest remains the most critical domain of female intrasexual competition across human history (Campbell, 2013).

In conclusion, once this evidence is considered, a behavior that may be adaptive in males—competing overtly for resources and dominant positions—may not be as beneficial for females given the costs both to losing *and* winning. Choosing to compete in environments that create highly unequal distributions reveals an overt trait that would impede further cooperation. Such a trait may not be valued in women given the importance of being capable of eliciting cooperation from others for the need of raising children. Having internalized such costs (Eagly and Karau, 2002), women may appear less attracted to leadership roles and less likely to strive for promotions if doing so risks them being disliked (van Vianen and Fischer, 2002). Unsurprisingly, women report favoring public and non-profit institutions and jobs with meaning, possibly explaining why women are less represented in the highest positions in corporate, political, military, and other levels of society. Under this perspective, the finding that women display lower competitiveness than men would not indicate that females do not battle for the critical benefits of high status, rather that they may have developed other strategies, more attuned to their needs not to alienate potential mates and allies, i.e., less ostentatious forms of competitiveness.

4. Competing for the benefit of offspring

To find empirical evidence for the idea that women are not less competitively inclined than men, we tested the hypothesis that a strategically suppressed female competitive trait could be expressed more openly if the contests were framed as something beneficial to the offspring or gender-typical (Cassar, Wordofa and Zhang, 2016; Cassar and Zhang, 2022). When the prize of a competition conforms to gender norms, a female inhibition to compete may get relaxed as the anticipated backlash from both males (potential romantic partners) and females (potential allies and allomaternal helpers) should decrease. Rather than being interpreted as having a strong desire to outcompete others, women entering such contests could signal good maternal qualities or align with more acceptable spheres of female-female competition.

We conducted a first experiment in China among parents (N=358) of school-age children (Cassar, Wordofa & Zhang, 2016). We introduced a treatment to the traditional protocol that measures competitiveness as choice to enter a winner-take-all tournament. For this new round, the game's monetary rewards are substituted by an equal value prize intended to benefit the participants' children (a bookstore voucher valid for test preparation books). The complete protocol consists of a within-subject design in which participants play four rounds of a task involving the addition of five two-digit numbers for three minutes. Each round is remunerated according to a different payment scheme. In round one (piece-rate treatment), players receive a fixed rate per correct answer. In round two (tournament treatment), players are anonymously matched in pairs and made to compete: only the person who correctly answers more questions would win and earn a rate per correct answer twice as high as in the previous non-competitive round, while the loser would receive nothing. After experiencing both treatments, the participants have to choose which payment scheme they would prefer for playing next. We had two of these final rounds, administered in random order between subjects: one in which the prize is in cash (exactly like in round two) and one in which the prize is a bookstore voucher of equal value. Our results show that, using cash, we replicate the literature's gender gap in competitiveness and find a significant 10 percentage point gender difference in choosing to compete (men: 0.36, women: 0.26, p=0.043). Confirming the hypothesis, that gap vanishes when using vouchers for children, bringing the level of mothers' competitiveness to the level of fathers' (men: 0.31, women: 0.31, p=0.978).

Next, we conducted a set of experiments to delve deeper into three elements: i) the nature of frames that could close the gender gap in competitiveness; ii) the importance of life stage (whether being parent matters); iii) and the influence of culture (Cassar and Zhang, 2022). To do this, we implemented treatments that utilize three types of prizes: in-kind payments dedicated to children's needs (vouchers for school supplies or children's clothes), gender-specific interests (beauty products or scarfs for women, soccer gear or rain slippers for men), or gender-neutral interests for placebo tests (restaurant meal or electricity credits). We recruited subjects at different life stages (parents and non-parents). We sampled from countries at varying levels of economic development and profoundly different cultures, resulting in a dataset containing N=871 individual observations from Togo, Sierra Leone, Bosnia, Colombia in addition to the previously sampled N=358 in China. The hypothesis is that different types of incentives—cash or prize—-may induce specific frames capable of motivating individuals to compete according to the different domains of interest with behavioral predictions depending on an individual's gender and life stage. Consistent with that prediction, the results on

parents from China, Togo, and Sierra Leone and non-parents from Bosnia show that, once the incentives are switched from cash to child-benefitting or gender-stereotypical goods, the gender gap in competitiveness is largely eliminated, shrinking by more than 10 percentage points, whereas placebo prizes have no impact. Importantly, economic and cultural elements matter, as not all societies exhibited a gender gap to start with (Colombia and Nana Benz of Togo). For these subject pools, in which men and women resulted similarly competitive using cash, we found no difference using prizes either.

These results indicate that competitiveness in females is a facultative trait that may depend on how such preference is elicited. Importantly, it can be just as intense as in males once we include in the games what matters to women. The implication is that a behavioral gender gap in competitiveness is more a reflection of a difference in the expression of a trait rather than a difference of intensity. This knowledge would suggest that including benefits for children (e.g., school vouchers, flexible working hours, onsite childcare) has the potential to attract more women into competitive fields and help promote gender equality in labor markets.

5. Competing with a prosocial option

Additionally, we tested the idea that women would express competitiveness more openly if less extreme payoff inequalities were at least an option in the contests. By seeking ventures that could benefit both oneself and others at least potentially, women would worry less about the consequences of being disliked by others. More egalitarian distributions may appeal to women for their reduced threat to reciprocity-based cooperation. Men too would gain from sustaining cooperation---we do not expect them to be any less interested in competing when a prosocial option is added to a contest---but their strategies may be more tolerant of inequalities as they have adapted to reap the benefits of situations with clear winners and losers and where signaling competitiveness would increase one's appeal to both romantic partners and coalition allies. Not so for women, who always had to tread a thin line between competition and cooperation with close partners, whose continuous help was necessary for raising children (Hrdy, 1981; 1999; 2009). Given the difficulties with monitoring childcare and obtaining it by coercion---as it may result in substandard care at best and harm of one's child at worse---one strategy to facilitate cooperation, minimize aggressiveness, create the basis for risk-sharing, and consumption smoothing, is to use reciprocity. Reciprocity thrives on egalitarianism, while asymmetries in status and resources can destabilize exchange relationships and hurt especially female same-sex cooperation (Johnstone, Bshary, 2002; Benenson and Markovitz, 2014). Inequality

aversion, reciprocal altruism, and mutualism may have all helped women sustain cooperative relationships with both other women and male partners. On the contrary, competitiveness or status-striving behavior may have been perceived as an undesirable female trait by signaling a reduced likelihood of reciprocation. Hence, a strategy that would allow the individual to enjoy the benefits of winning without alienating others would be optimal, especially for women. One way to achieve this dual goal of competing and not being disliked would be for the winners to have the option to share some of their gains with the losers so that one could potentially maintain allies and enjoy the crucial help they provide.

We test this hypothesis through a series of experiments in which a prosocial option is added to a standard winner-take-all tournament. In a first study, focused on competitiveness as *performance*, we designed a treatment in which the winners of the tournament could send some of their gains to the losers (*dictator* treatment), and we compared that performance to the one of participants under the standard winner-take-all tournament (*baseline* treatment) (Cassar and Rigdon 2021a). We ran the experiment among adults (N = 438) recruited from the online subject pool Amazon Mechanical Turk. Our data support the hypothesis: women compete as much as men in tournaments when the rules of the competition give the winners the option to share part of the rewards with one of the losers following competition. In particular, we observe a significant 26 percentage point gender gap in performance when the subjects compete in a standard winner-take-all tournament (men: 3.32, women: 2.63, t-test p=0.017). However, in the new treatment that includes the winners the option to divide the prize, female performance increases to levels indistinguishable from males, whose performance remains unchanged (men: 3.30, women: 3.41, t-test p=0.704).

As for the winners' behavior, women shared their gains with losers only marginally more than men, despite competing more when the prosocial option was present. Aggregating across rank (1st and 2nd top scorers), the results indicate that women give more than men, but the difference is only marginally statistically significant (men: \$1.03, women: \$1.38; two-tailed t-test p = 0.122; one-tailed t-test p = 0.061). In the analysis by rank, we can significantly reject the hypothesis that men give as much as women in favor of women giving more only for players who ranked first (men: \$0.70, women: \$1.28, two-tailed t-test p = 0.080; one-tailed t-test p = 0.040). It appears that just the presence of the prosocial option was sufficient to shield the women from appearing competitive to others and, more likely, to themselves.

In a subsequent experiment, we extended the previous test (that a cooperative option increases women's competitiveness) to the case where competitiveness is measured as *choice* to enter a

tournament (Cassar and Rigdon, 2021b). In this design, subjects experience a piece-rate scheme in round one, a tournament scheme in round two, before being asked to choose their preferred compensation scheme for an upcoming round three. Again, we implemented two separate tournament treatments: the classic winner-take-all contest and one in which top performers can divide their winnings with the losers. We run this test among N=238 subjects from three laboratories (University of California Santa Cruz, Chapman University, and Simon Fraser University). Our results indicate that an initial 16.2% gender gap in choice to enter a competitive environment is eliminated when the incentives include the prosocial option. In the classic tournament, we replicate the standard result that women choose to compete at significantly lower rates than men (men: 51%, women: 34.8%, t-test p=0.076). In the new treatment with a prosocial option as the incentive for winning the tournament, we find that women choose to compete at rates not significantly different than men (men: 52.5%, women: 60.3%, t-test p=0.424). While men's choice to compete remained unchanged, about 52% in both conditions (t-test p=0.887), women nearly doubled their entry rate from 34.8% to 60.3% with the prosocial option (t-test p=0.002). Once again, these findings indicate that competitiveness in women can be much more intense than observed once we include incentives that matter to them.

6. Conclusion

When read in light of the recent literature on women's behavior, our work suggests that cooperation intertwines with competitiveness to produce a complex, adaptive female social strategy. Displaying a prosocial nature, avoiding overt conflicts, preferring the possibility of a more egalitarian distribution of gains and rewards that could benefit others, allow women to compete and cooperate simultaneously. Whether these traits are indicative of a truly more cooperative nature or indicative of just caring about appearances by hiding more competitive intentions is beyond the scope of this paper. Self-deception about one's ultimate goals would surely help women achieve such a balancing act convincingly. Indeed, some evidence seems to indicate that women are more prone to self-deception than men (Von Hippel and Trivers, 2011). Grounding our argument in a vast body of work in economics, evolutionary psychology, and anthropology, we propose that women are not less competitive than men but express it differently, through strategies more attuned to the needs to nourish supportive relationships with others (fathers and other allomaternal helpers) in order to raise energetically expensive offspring.

Our experimental evidence shows that women are as competitive as men once the incentives include benefits explicitly benefiting children or options that could reduce outcome inequalities among

contenders. One caveat from our results is that closing the gap in competitiveness does not mean that, given the chance, women are necessarily going to be more generous or altruistic than men, rather that they will be more sensitive to an environment's distributional rules: reacting more negatively to inequalities among exchange partners and displaying a stronger desire not to be seen as more successful than their potential allies. For over a century, female fitness variance has been overshadowed by studies about males, delaying scientific progress on gendered behavior and advancing ideas on a supposedly passive nature of women, all to the detriment of finding effective ways to achieve gender equality in the economic and political arena. Lean in, and other programs that induce women to change behavior have not delivered the promised results (Exley et al., 2020). By showing that incentives can be manipulated (e.g., the potential for less unequal distributions and contracts inclusive of benefits for the children) to strengthen women's desire to compete, our research suggests that policies designed in alignment with women's goals and respectful of the differential constraints that nature and societies put on the individual have the potential to close labor market gaps. In practice, our treatments could be implemented as team bonuses rather than individual ones, strong social missions, less hierarchical structures, flexible working hours, school vouchers, onsite childcare, quality afterschool programs.

Growth and economic development have been shown to alleviate some of the worse inequalities between men and women. Still, economic growth, by itself, has proven not enough to guarantee women equal access to health, education, earning opportunities, rights, and political participation (Duflo, 2012). Beyond the constraints of external nature (educational opportunities, access to financial services, asset ownership, etc.), internal constraints (different preferences and motivations) have been shown to matter. Hence, policies need to address gender-specific constraints of either nature to promote inclusiveness and egalitarian outcomes. Continuing to reinforce a gender stereotype of women as lacking in competitivity or political aspirations has real economic costs to women, who get penalized in hiring, remuneration, and performance evaluations when we violate these stereotypes (Eagly et al., 1992; Rudman and Glick, 1999), and it is detrimental to men when their nurturing role and provisioning and protective contributions are not adequately recognized (Hyde, 2005).

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