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Gender differences in willingness to compete: A survey of the literature

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Gender differences in willingness to compete: A survey of the literature

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Abstract

A large experimental literature shows that when given the choice between individual performance incentives and competitive incentives, men are typically more likely than women to choose competition. This finding of a robust gender difference in willingness to compete has sparked much follow-up research into the causes and consequences of individual and gender differences in willingness to compete. The aim of this chapter is to summarize these different strands of research and draw conclusions on what we can learn from them. I conclude that there is strong evidence that – underlying individual differences in willingness to compete – there is a “competitiveness” trait that is not well-captured by other traits and preferences, and somewhat less conclusive evidence that there is a gender difference in this trait. Willingness to compete – and the gender gap therein – varies strongly across countries, cultures and social contexts, suggesting that it can be influenced by them. Nevertheless, while the magnitude of the gender gap varies across contexts, men are more competitive than women in most countries and settings, suggesting that biology might play a role as well. Finally, there are strong indications that individual differences in preferences for competition are economically relevant: competitiveness predicts important life choices and labor market outcomes and can statistically explain gender differences in career outcomes.

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1 Introduction

The experimental literature on willingness to compete (WTC) was sparked by a single empirical observation: when given the choice between individual performance incentives and competitive incentives, men are typically more likely than women to choose competition. Most experimental studies use a variant of the game of Niederle and Vesterlund (2007).¹ Student participants in the lab perform a simple arithmetic task over three rounds under varying incentives. In the first round, they are paid according to a piece-rate of 0.5\$ per correct answer. In the second round, they participate in a winner-takes-all tournament in groups of four, where the winner earns 2\$ per correct answer and the others earn nothing. In the third round, participants choose between the two incentives schemes.

Niederle and Vesterlund’s main result is that 73% of men and 35% of women enter the tournament – despite there being no significant gender difference in performance. This gender gap in WTC is partly due to differences in beliefs – men are more (over)confident than women – but even among participants who think they rank first in their group, 80% of men enter the tournament compared with 50% of women.² This gender difference in WTC in quantitative tasks in the lab turned out to be remarkably robust, although in most replications the magnitude tends to be somewhat smaller than the massive gender gap documented by Niederle and Vesterlund (see Markowsky and Beblo, 2022 for a meta-analysis, and Croson and Gneezy 2009; Niederle and Vesterlund 2011; Niederle 2016; Dariel et al. 2017 for overviews of the earlier experimental literature).

This initial finding of a robust gender difference in WTC has raised new questions and spurred follow-up research in several directions. The aim of this chapter is to summarize these different strands of research. From the start, there has been a discussion of whether individual and gender differences in competition entry choices are due to a “new” underlying preference or personality trait – “taste for competition” or “competitiveness” – or due to a combination of other, related traits

¹Before that, several studies had already investigated gender differences in the reaction to competitive incentives, finding that they increase men’s performance relative to women’s performance, both in the lab and the field (Gneezy, Niederle, and Rustichini, 2003; Gneezy and Rustichini, 2004; Günther et al., 2010; Shurchkov, 2012; Ors, Palomino, and Peyrache, 2013; Gill and Prowse, 2014; Schram, Brandts, and Gërxhani, 2019). In this chapter, I will focus on gender differences in the willingness to enter competitions rather than in performance under competitive incentives.

²As of now, the literature on gender differences in WTC has overwhelmingly focused on a binary definition of gender. This has very recently started to change and studies have started to appear that either use a continuous measure of gender or focus on gender minorities or sexual minorities. Brenøe et al. (2022) collect a single-item measure of continuous gender identity and correlate it with measures of several economic preferences. While they replicate the gender gap in WTC, they find that continuous gender identity does not predict WTC above biological sex. Fornwagner et al. (2022) find no difference in WTC between cis and transgender individuals (in their data there is also no gender difference in WTC between cisgender men and women, although cisgender men become more competitive than all the other groups when a masculine gender identity is primed). Buser, Plug, and Geijtenbeek (2018) and Aksoy and Chadd (2025) correlate WTC with sexual orientation. Buser, Plug, and Geijtenbeek (2018) find that gay men compete less than straight men and that lesbians compete as much as straight women. Aksoy and Chadd (2025) find that both gay and lesbian individuals compete less than their heterosexual counterparts. See also Aksoy, Exley, and Kessler (2024) on related work documenting that gender minorities are less confident and have less favorable self-evaluations.

such as confidence, risk preferences, or other-regarding preferences. This question is addressed in Section 2. For the rest of this chapter, I will refer to the choice of entering a competition as “willingness to compete” (WTC) and to the underlying trait as “competitiveness”.

Another follow-up literature seeks to uncover the – cultural, biological, or socioeconomic – origins of individual and gender differences in WTC. Some of these studies tackle the question of external validity: is the gender gap in WTC limited to Western student populations or does it replicate across diverse cultural contexts and in more representative samples? This is addressed in Section 3.

Other researchers investigated the robustness of the gender gap in WTC to changes in the choice environment. Some of these studies are aimed at exploring policies that could mitigate gender gaps in labor market settings. This research is summarized in Section 4.

Being willing to face competition is an essential part of career success, which makes the gender gap in WTC an intuitive explanation for some of the remaining gender differences in labor market outcomes. Section 5 summarizes research that asks whether WTC predicts career choices and whether gender differences in WTC can partially explain the over-representation of men in top positions as well as gender differences in career choices.

In the final section, I summarize what are in my view the main conclusions we can draw from each of these literatures.

2 Is competitiveness a “new” trait?

Right from the start, the authors of experimental studies on gender difference in tournament entry were aware that the gender gap in WTC could be due to a range of psychological differences other than a gender difference in competitiveness, including differences in risk preferences and confidence. Niederle and Vesterlund (2007) elicited an incentivized measure of confidence that consists of retroactively asking participants whether they thought they ranked first, second, third or fourth in their group of four. They also elicited an additional compensation scheme choice that keeps the riskiness of competing constant but eliminates the need to perform under competitive pressure: participants were asked whether they wanted to retrospectively submit their first-round performance to a tournament. The gender gap in WTC shrinks by about 26% when controlling for believed rank and by 57% when the retrospective choice is also controlled for.

There is an ongoing debate about whether the remaining gender gap in WTC should be attributed to a gender difference in a “new” preference or personality trait – typically referred to as “taste for competition” or “competitiveness”. Gillen, Snowberg, and Yariv (2019) argue that the controls typically used in experimental WTC studies – and in particular the control for confidence – are rather crude and therefore suffer from significant measurement error.³ As a consequence,

³The measure of Niederle and Vesterlund (2007) – which is also used by many follow-up studies – elicits the

the estimated effect of these controls might be biased downward, leading to an overestimate of the residual gender gap which is then interpreted as a gender difference in competitiveness. Using a sample that is larger than in typical experimental papers, Gillen, Snowberg, and Yariv (2019) show that a more extensive set of controls for performance, risk preferences and confidence reduces the gender coefficient to zero.

Van Veldhuizen (2022) uses a different approach – controlling for risk and beliefs through design – to come to the same conclusion. His treatment-based approach compares choices in treatments that hold the riskiness of the decision and the participants’ beliefs constant but vary the presence of competition. He finds that the gender gap is almost identical when the competitive aspect of the decision is removed, which he interprets as evidence that the gender gap in WTC is not due to a gender difference in competitiveness. Lozano and Reuben (2025) also use a design-based approach to investigate whether there is a separate preference for competition. They hold the riskiness of the decision constant across competitive and non-competitive payment schemes and elicit beliefs in a thorough way. Moreover, participants make many competition entry decisions in different settings. They conclude that a majority of participants have true preferences for competition in that they are consistently competition-loving or competition-averse across different settings. They find no gender difference in these preferences.

The debate about the determinants of the gender gap in WTC relates to the more general question of what else is picked up by the binary tournament entry decision and whether it is a good measure of individual competitiveness – if such an independent trait exists – in the first place. The binary competition choice adopted by most of the literature on WTC has the advantage of being incentive-compatible. But it only elicits a single choice and therefore provides limited information about the WTC of each individual. This is especially true for high (low) performers who – financially speaking – should (not) compete whatever their preferences for competition.

Some studies have used price lists instead of a single choice (Petrie and Segal, 2024; Ifcher and Zarghamee, 2016; Van Veldhuizen, 2022; Lozano and Reuben, 2025) or allowed participants to decide on a percentage to invest in a competitive incentive scheme (Saccardo, Pietrasz, and Gneezy, 2018). But this still leaves the question of which traits apart from competitiveness the competition decision might pick up. On top of risk preferences and confidence, which economists have focused on, one can also ask whether personality traits as defined by personality psychology can adequately capture WTC and the gender gap therein.⁴

A further disadvantage of the tournament-entry decision as a measure of individual WTC is that it is expensive and cumbersome to elicit in large samples, in particular in survey panels where

mode of the probability distribution across the four possible ranks, which does not fully capture the relevant belief information. Moreover, most studies elicit beliefs about a past performance rather than beliefs about the performance that follows the competition decision.

⁴Another interesting observation is that competition involves both rivalry for resources and social status ranking (Schram, Brandts, and Gërkhani, 2019). Brandts, Gërkhani, and Schram (2020) exclude the first dimension and show that there might be a gender difference in aversion to status ranking even when no resources are at stake.

answers can be linked to other survey data or government registry data. The work of Dohmen et al. (2011) and Falk et al. (2023) suggests a way forward. They show that for other economic preferences – including risk preferences, time preferences, and social preferences – it is possible to find simple survey items that correlate with incentivized experimental choices. These items typically consist of generally worded statements (“Are you a person who is generally willing to take risks, or do you try to avoid taking risks?”) or hypothetical versions of experimental tasks.

Buser, Niederle, and Oosterbeek (2024) develop and validate such a questionnaire item for competitiveness. They show that in a large and representative sample of the Dutch population, the answer to the question “How competitive do you consider yourself to be?” not only predicts an incentivized competition choice elicited one year apart, but also predicts a range of education and labor market outcomes that are predicted by the incentivized choice. The test-retest correlation of this single-item measure of competitiveness across a four-year period is 0.578.⁵

A few other studies have linked non-incentivized measures of WTC or competitiveness with incentivized competition choices. Bönnte, Lombardo, and Urbig (2017) elicit both an incentivized measure of WTC and several unincentivized questions taken from different competitiveness scales from the psychology literature in a sample of students, finding a significant correlation between incentivized and self-reported competitiveness. Fallucchi, Nosenzo, and Reuben (2020) correlate eight survey questions on competitiveness with an incentivized competition choice that was elicited two weeks later in a student sample. They find the strongest correlation for the statement “Competition brings the best out of me”.

The questionnaire approach to measuring competitiveness raises the question of what it exactly means to be “competitive”. In the psychology literature, competitiveness refers both to enjoyment of competition and to a need to win or outperform others. Moreover, people may enter competitions for personal development motivations – to improve themselves – or out of a general drive to seek new challenges, whether competitive or not. Buser and Oosterbeek (2023) elicit these separate aspects of competitiveness in the same survey panel used by Buser, Niederle, and Oosterbeek (2024).⁶ They find that the different dimensions of competitiveness are heavily correlated with each other – the same people who enjoy competition tend to exhibit a strong need to win and a tendency to seek challenges in general – but not perfectly so. The incentivized tournament entry choice and the single questionnaire item of Buser, Niederle, and Oosterbeek (2024) pick up a mix of enjoyment of competition and need to win, as well as a general willingness to seek challenges.

Classic personality traits – such as the Big 5 personality inventory (Goldberg et al., 2006) or grit (Duckworth and Quinn, 2009) – have generally been found to be complementary with es-

⁵Buser, Niederle, and Oosterbeek (2024) replicate the gender gap in tournament entry in their representative sample: 34 percent of working-age men and 22 percent of working-age women choose to compete. Men also rate their own competitiveness significantly higher on the survey item.

⁶Their questionnaire is an augmented version of Urbig et al. (2021) whose questionnaire items are in turn taken from the psychology literature (Spence and Helmreich, 1983; Smither and Houston, 1992; Newby and Klein, 2014; Bönnte, Lombardo, and Urbig, 2017).

tablished economic preferences (Borghans et al., 2008; Almlund et al., 2011; Becker et al., 2012). Buser, Niederle, and Oosterbeek (2024) find that while their general measure of competitiveness is positively correlated with the Big Five traits extraversion, openness, mental stability, and conscientiousness – as well as risk tolerance and confidence – controlling for these traits barely changes the correlations between competitiveness and life outcomes, suggesting that competitiveness is an important trait in its own right.⁷

Urbig et al. (2021) relate survey measures of three dimensions of competitiveness to the six personality traits defined by the HEXACO framework.⁸ They find that desire to win is negatively correlated with agreeableness; competing for personal development is positively correlated with emotionality (a trait that is negatively related to mental stability); and enjoyment of competition is positively correlated with extraversion and negatively with emotionality. Buser and Oosterbeek (2023) relate different dimensions of competitiveness to a wider range of personality and preference measures. Enjoyment of competition is most strongly associated with extraversion, mental stability, confidence, and risk seeking, while desire to win is most strongly associated with negative reciprocity, narcissism, Machiavellianism (a tendency to manipulate others for personal gain), and lower mental stability. All dimensions of competitiveness are positively correlated with negative reciprocity. Buser and Oosterbeek also show that general challenge seeking is well-captured by established personality traits and economic preferences, but competitiveness is not, again indicating that it is a separate trait.⁹

In summary, the literature suggests that competitiveness is a “new” trait in its own right that is not adequately captured by existing measures of preferences and personality traits. Another piece of evidence for this, which I will tackle later on in this chapter, is that measures of competitiveness predict life outcomes above and beyond other trait measures. However, competitiveness being a separate trait does not automatically mean that the gender gap in WTC is due to a gender differ-

⁷Some studies have linked incentivized measures of WTC to social preferences. Bartling et al. (2009) find a negative relationship between egalitarianism – as measured by experimental choices that reduce payoff inequality – and self-selection into competition. Balafoutas, Kerschbamer, and Sutter (2012) also experimentally investigate the link between WTC and distributional preferences and find that efficiency-minded participants choose competition more often, while spiteful and inequality averse participants avoid it. Müller and Schwieren (2012) link an incentivized measure of WTC to the Big 5 traits and find a negative correlation with neuroticism (the inverse of mental stability). Neuroticism is also negatively correlated with performance in competition and partially mediates the gender difference in tournament entry.

⁸The HEXACO model adds a sixth trait, honesty-humility, to the Big 5 traits (Lee and Ashton, 2004).

⁹A final methodological point is that in the design of Niederle and Vesterlund (2007) – which most follow-up studies use – the choice task is deliberately designed to exclude as many potential determinants of a gender gap in competition entry apart from a gender difference in taste for competition as possible, including any influence of social preferences. Specifically, WTC is measured as the willingness to compare one’s own performance in a real-effort task against the past performances of the randomly selected group of opponents. Contrary to most competitions in the field, the choice of competing is therefore purely individual and does not affect anyone else’s payoff. Moreover, competition occurs against randomly selected opponents rather than opponents who themselves selected into competition. Buser, Cappelen, and Tungodden (2021) experimentally test the impact of changing these two dimensions – whether winning the competition creates a loser and whether potential opponents self-select into competition – and find no impact on the WTC of men or women, which is good news for the external validity of the experimental literature on gender differences in WTC.

ence in competitiveness. Lab experiments have shown that it is possible to obtain similar gender gaps in non-competitive decisions that involve similar odds and tradeoffs about risk. On the other hand, women on average score themselves lower on questionnaire items such as “I enjoy competing against others”, “I often try to outperform others”, or simply “How competitive do you consider yourself to be?”. The gender differences in these questionnaire measures of competitiveness are of similar magnitude to well-documented gender differences in personality traits such as agreeableness or mental stability (Buser, Niederle, and Oosterbeek, 2024; Buser and Oosterbeek, 2023).

3 The origins of individual and gender differences in competitiveness

A large follow-up literature has focused on the related questions of where individual and gender differences in WTC come from and whether the gender gap in WTC replicates across different cultural settings. Most of the early experimental studies on gender differences in WTC were conducted on student samples from WEIRD (western, educated, industrialized, rich, and democratic) countries.¹⁰ People from WEIRD societies tend to be psychological outliers (Henrich, Heine, and Norenzayan, 2010) and we should not simply assume that results carry over to the rest of the world.

Gneezy, Leonard, and List (2009) find a gender gap in WTC in a patriarchal society in Kenya but not in a matrilineal society in India. Andersen et al. (2013) also compare WTC in a matrilineal and a patriarchal society (within India) and find that girls become less competitive around puberty in the patriarchal society while there is no difference at any age in the matrilineal society. On the other hand, Lowes (2021) compares the gender gap in WTC between matrilineal and patrilineal societies from the same region in Central Africa and finds a similarly sized gender gap in both.

Several studies indicate that China might be different from the West. Zhang (2012) does not find a gender difference in WTC there. Zhang (2019) replicates this, arguing that it is due to communist institutional reforms making women more willing to compete and showing that a gender gap does exist in an ethnic group that was less affected by the reforms. Booth et al. (2019) similarly find that women in Beijing who grew up during the communist regime are more competitively inclined than Beijing women who grew up during the market regime, Beijing men, and women in Taipei.¹¹

¹⁰See Daryl et al. (2017) for a list of experimental studies by country.

¹¹Other examples of experiments aimed at measuring a gender gap in WTC in non-Western countries include Cardenas et al. (2012) who find a significant gender difference in children aged 9-12 in Sweden but not in Colombia; Khachatryan et al. (2015) who find no gender difference in WTC for Armenian children; Apicella and Dreber (2015) who run experiments with children and adults from a population of hunter-gatherers in Tanzania; Daryl et al. (2017) who do not find a gender difference in WTC in the United Arab Emirates; Buser et al. (2021) who find a significant gender gap in India, Norway, and Tanzania; and Khadjavi, Sipangule, and Thiele (2024) who find that exposure to large-scale farms increases the WTC of farmers in Zambia and closes the gender gap. In a non-gender

Recently, true global evidence on competitiveness levels and gender differences has become available. Buser et al. (2025) use the Gallup World Poll to collect questionnaire measures of WTC and the importance people attach to boys’ and girls’ WTC in representative samples from 62 countries spanning all continents. Their main finding is that people in more unequal countries are more competitive and attach greater importance to children’s WTC. Men are more competitive than women in all but one country, China again being the outlier.¹² Greater gender equality is associated with placing more importance on girls’ WTC relative to boys’ but not with a smaller gender gap in WTC itself. Napp and Breda (2022) and Klinowski and Niederle (2025) use questionnaire measures in the PISA (Programme for International Student Assessment) data to compare the competitiveness of high-school students across 79 countries. Boys are significantly more competitive than girls in the majority of countries. Strikingly, girls are less competitive – and the gender gap is bigger – in more gender-equal societies. Markowsky and Beblo (2022) conduct a meta-study of experimental papers on the gender gap in WTC and also find evidence for such a “gender-equality paradox”.¹³

Other studies have compared WTC across different groups within the same society. Dariel and Nikiforakis (2022) show that mothers in the United Arab Emirates and the US are less willing to compete than non-mothers. They then use panel data from the Netherlands to show that this is due to selection into motherhood rather than a causal effect. Hauge, Kotsadam, and Riege (2023) compare the WTC of Norwegians who have parents born in different countries and find a smaller gap among people with ancestries from more gender-equal countries. Klinowski and Niederle (2025), using their international PISA sample, find the opposite result: among second-generation immigrant students, girls with parents from more gender-equal countries are less competitive, confirming the finding of a gender-equality paradox from their cross-country regressions. Dariel et al. (2024) compare a self-reported measure of competitiveness across ethnic groups in the US. They find that black and hispanic people are on average more competitive than white people, but that the gender difference in competitiveness is similar across all three ethnic groups.¹⁴

related study, Leibbrandt, Gneezy, and List (2013) find that in Brazil, fishermen from individualistic societies are more competitive than fishermen from collectivistic societies.

¹²Bönte (2015), using the 2009 Eurobarometer Survey on Entrepreneurship that elicits a questionnaire measure of WTC for more than 25,000 individuals from 36 mostly European countries, also finds that men rate themselves as more competitive everywhere.

¹³Other studies have documented a similar gender-equality paradox for other traits and outcomes. Schmitt et al. (2008) document a gender-equality paradox for personality traits, Falk and Hermle (2018) for economic preferences, and Stoet and Geary (2018) for career choices.

¹⁴Some studies have documented how the WTC or competitiveness of men and women changes with age. Mayr et al. (2012), in a sample of people recruited in a shopping mall; Bönte (2015), using the 2009 Eurobarometer Survey on Entrepreneurship that elicits competitiveness for more than 25,000 individuals from 36 countries; Buser, Niederle, and Oosterbeek (2024), who elicit both incentivized WTC and a survey measure of competitiveness in a Dutch survey panel; and Buser et al. (2025) in their global sample covering 62 countries all find a significant gender gap in competitiveness at any age. Flory et al. (2018), in a sample of rural villagers from Malawi and a smaller sample from the US, find that the gender gap in WTC disappears above age 50 due to a large increase in the WTC of women.

On top of differences across countries, regions and groups, competitiveness (and gender differences therein) could also be shaped by differences in upbringing and the home environment. Almås et al. (2015) correlate WTC with socioeconomic background in Norway. Girls from well-off families are less willing to compete than boys from well-off families, but there is no statistically significant gender difference in WTC among children from very low-SES families. Boneva et al. (2022), on the other hand, find that in a sample of families from the German cities of Bonn and Cologne, the gender gap in competitiveness is more pronounced among adolescents from low-SES families.¹⁵ They also analyze the causal impact of a randomized mentoring intervention on the competitiveness of low-SES children. They find that the intervention – which exposes the children to predominantly female role models for the course of a year – causally affects girls’ competitiveness and narrows the gender gap in competitiveness (as well as the gender gap in future earnings expectations).

There is also evidence for a significant correlation between children’s competitiveness and the preferences of their parents. Tungodden and Willen (2023) show that parents who choose to compete in an incentivized experiment have children who are themselves significantly more willing to compete. They also find that parents are less likely to choose competition for their daughters than for their sons. Boneva et al. (2022) find a strong correlation between the competitiveness of mothers and daughters. In their global sample, Buser et al. (2025) show that people who see themselves as more competitive attach greater importance to the WTC of children.¹⁶

Other studies have analyzed the impact of different aspects of the school environment. Booth and Nolen (2012) find that English girls from single-sex schools are more competitive, but Lee, Niederle, and Kang (2014) – taking advantage of randomized assignment to single-sex schooling in South Korea – find no effect. Alan and Ertac (2019) study the impact of a randomized classroom intervention aimed at fostering grit, finding that the gender gap in WTC is significantly reduced as a result of the treatment. Jørgensen, Piovesan, and Willadsen (2022) show experimentally that girls compete more often for each extra school friend they have who is willing to compete.

The competitiveness of adults has also been shown to be susceptible to educational or work environments. Shan and Zölitz (2025) find that university students who are randomly assigned to study groups with more competitive peers become more competitive themselves, and Delavande et al. (2024) find that over a period of year, male students who live with a higher proportion of female flatmates experience a decrease in WTC. Johnsen et al. (2023) show that among people who join the Norwegian army, competitiveness increases for both women and men over an initial

¹⁵The definitions of low SES in these two studies are quite different and they therefore document differences at different margins of SES. Almås et al. (2015) include the bottom 8 percent of families based on income and parents’ education in their low-SES category. Low-SES in the categorization of Boneva et al. (2022) means fulfilling at least one of three criteria: low income (below the 30th percentile of the income distribution), low education (neither the mother nor father of the child has an “Abitur”), or growing up with a single parent.

¹⁶Khadjavi and Nicklisch (2018) document that parents’ ambitions concerning their children’s success in professional life predict their children’s WTC.

training period.

The studies surveyed in this section so far indicate that culture and the childhood environment shape individual and gender differences in competitiveness. Still, competitiveness – and gender differences in competitiveness – could be influenced by biology too. Cassar and Zhang (2022) propose a theoretical framework based on evolutionary psychology whereby – during our evolutionary past – women had to trade off acquiring resources through competitive means for other considerations to a greater extent than men – including investing directly into offspring, attracting and retaining mates, and cultivating female allies to help in child rearing. Relatedly, social status was likely correlated with mating opportunities to a greater extent for men than for women (Cassar and Rigdon, 2021). While these evolutionary origins seem plausible, they are difficult to prove. Indirect evidence comes from experiments that show that women are more willing to compete when the benefits go to their children instead of to themselves or when there is an option to share the winnings (Cassar, Wordofa, and Zhang, 2016; Cassar and Rigdon, 2021; Cassar and Zhang, 2022).¹⁷ Several studies have attempted to establish correlations between WTC and markers for biological sex differences, generally finding null or contradictory results.¹⁸ Other studies have investigated the link between stress reactions and WTC, often finding significant correlations but little evidence that differential stress reactions to competition are a major explanation for the gender gap in WTC.¹⁹

¹⁷While women are more likely to compete when the prize benefits their children, they are less likely than men to choose to enter their child into a competition (Tungodden and Willen, 2023). In their global data with samples from 62 countries, Buser et al. (2025) find that women attach less importance to the WTC of children than men in the vast majority of countries. Shurchkov and van Geen (2019) find that women are also less likely to choose competitive incentives for workers in a lab experiment.

¹⁸Apicella et al. (2011) find no correlation between WTC and markers for current and past testosterone exposure. Buser (2012) and Wozniak, Harbaugh, and Mayr (2014) find that the WTC of women varies over the menstrual cycle and with the intake of hormonal contraceptives. However, the two studies are based on small samples and find contradictory results. Ranehill et al. (2018), using a randomized control trial, find no impact of hormonal contraceptives on WTC. Parslow et al. (2019) find no correlation between a putative marker for pre-natal testosterone exposure and WTC and Van Leeuwen et al. (2020) find no correlation between sex hormone levels measured at birth and WTC later in life. Buser et al. (2021) correlate WTC with handedness (which in turn has been hypothesized to correlate with prenatal sex hormone exposure). They run three experiments in three different countries and find contradictory results. Balafoutas, Fornwagner, and Grosskopf (2023) find that objective facial characteristics and subjective attractiveness cannot predict WTC but that people are significantly better than chance at predicting the WTC of experimental participants by looking at pictures of their faces alone.

¹⁹Buser, Dreber, and Mollerstrom (2017) show that competing increases stress levels (measured as salivary cortisol). This stress response is positively correlated with WTC for women but not for men. In a second experiment, they exogenously induce physiological stress and find a positive causal effect of stress on WTC for women but no effect for men. Zhong et al. (2018) report on two very similar experiments. They also find that competing increases cortisol levels and that cortisol increases positively predict WTC. They do not find a significant effect of exogenously induced stress on WTC. Buckert et al. (2017) correlate WTC with heart rate variability and blood pressure, as well as cortisol and testosterone levels. Only the heart rate measure reacts to performing under competitive incentives and greater increases in testosterone and heart rate predict WTC in a subsequent round. Halko and Sääksvuori (2017) find that men’s heart rate variability reacts more to competing than women’s and that the reaction in heart rate variability to competing predicts WTC. Cahlíková, Cingl, and Lively (2020) randomly subject participants to a stress treatment and find that it lowers WTC for both men and women. Despite finding gender differences in stress reactions to competition (and showing that stress reactions predict WTC), all of these studies conclude that differences in stress responses cannot explain a meaningful part of gender differences in WTC. Esopo et al.

In summary, the gender gap in WTC is a near-global phenomenon that is not limited to Western student samples. Nevertheless, the magnitude of the gender difference varies systematically across economic and cultural contexts both across and within countries and can be influenced by targeted interventions. This does not rule out that biology plays a role as well. Like any other behavioral trait, WTC is surely influenced by genetic differences (Turkheimer, 2000). But while there are plausible evolutionary explanations for the gender gap in WTC, finding conclusive proof for them is challenging.

4 The impact of the choice environment on gender differences in willingness to compete

The initial finding that men are more willing to compete in the lab quickly motivated research into how gender differences in WTC could be mitigated by changing the decision environment, ideally without sacrificing efficiency (that is, without lowering the expected performance of competition winners). Balafoutas and Sutter (2012) and Niederle, Segal, and Vesterlund (2013) investigate the effect of affirmative action treatments. They both find that a quota whereby one of two winners must be a woman substantially increases the WTC of women without lowering the quality of winners (Niederle, Segal, and Vesterlund, 2013 also find that it lowers the WTC of men).²⁰ Czibor and Dominguez Martinez (2019) introduce a gender quota in the last round of a multistage elimination contest and find that this increases women’s participation in the first round as well as their representation in the last round without reducing the participation of men. Maggian, Montinari, and Nicolò (2020) also find that a gender quota at the second stage of a two-stage contest increases the participation of women. Leibbrandt, Wang, and Foo (2018), however, show that the possibility of peer sabotage can render a gender quota ineffective.

The confidence gap between men and women motivated research into the effect of feedback on the gender gap in WTC. Ertac and Szentes (2011) and Wozniak, Harbaugh, and Mayr (2014) both find that relative performance feedback substantially reduces the gender difference in WTC, and Kessel, Mollerstrom, and Van Veldhuizen (2021) find that merely informing participants of the existence of the gender difference in WTC (and its earnings consequences for women and men) reduces the gender gap in tournament entry.²¹ Brandts, Groenert, and Rott (2015) study the

(2019), using a comparatively large all-male sample, find that exogenously induced stress reduces men’s WTC by 8 percentage points. They conclude that the stress of competing is therefore unlikely to be able to account for men’s higher WTC. They also conduct a meta-analysis of the papers mentioned above and conclude that these previous studies found similar effects, but were not powered enough to detect them. Finally, Lowes (2021) finds that stress reactions to competition – as measured by skin conductance – are positively correlated with men’s WTC and negatively with women’s WTC.

²⁰Balafoutas and Sutter (2012) also find that exogenously boosting women’s performance increases the WTC of women. Sutter et al. (2016) show that similar interventions are effective for reducing the gender gap in WTC in children.

²¹Jeworrek (2019) shows that providing information on the average performance of men and women has a sim-

impact of advice by better-informed individuals. The intervention eliminates the gender gap among high performers but the overall gender gap remains.²² Baldiga and Coffman (2018) analyze the effects of a sponsorship intervention in the lab (where being sponsored means a vote of confidence and/or creates a link between the payoffs of the decision maker and the sponsor). The intervention increases the WTC of men but not of women.

Another institutional change that has been explored by several studies is changing the competition from individual to team-based. Healy and Pate (2011) find that the gender gap in WTC is reduced by two-thirds in a team competition, both because women enter more and because men enter less. Dargnies (2012) also finds that the gender difference in WTC is smaller in group competitions, mainly because men are less likely to enter due to high-performing men fearing being paired with low-performing teammates. In the field, Flory, Leibbrandt, and List (2015) similarly find that women are more likely to apply for a position with relative performance pay if the competition is team-based. Kuhn and Villeval (2015) show that women are more attracted to team-based incentives than men in general.²³

The math-related real-effort task in Niederle and Vesterlund (2007) and the tasks used in many subsequent experiments are (deliberately) stereotypically male. Some studies have used more gender-neutral tasks or have varied the task between a stereotypically male and a stereotypically female task. A number of studies found that the gender gap is present in a numbers-based task but not in a letters or words-based task, suggesting that the gap is influenced by task stereotypes (Kamas and Preston, 2009; Shurchkov, 2012; Grosse, Riener, and Dertwinkel-Kalt, 2014; Dreber, von Essen, and Ranehill, 2014; Boschini et al., 2019). However, others found that the gap is similar in such tasks (Cardenas et al., 2012; Wozniak, Harbaugh, and Mayr, 2014). Buser, Peter, and Wolter (2022), in a sample of Swiss high-school students, divide participants between a math task and a letters task and confirm that the students themselves expect the math task to favor boys and the letters task to favor girls. Nevertheless, they find a similar gender difference in WTC

ilar effect. See Berlin and Dargnies (2016) for the effects of performance feedback in a more complex decision environment.

²²Moreover, the results of Coutts, Koh, and Murad (2023) indicate that people may be less willing to give relevant negative feedback to women than to men in a competitive context.

²³Experimental studies have tested a variety of other institutional changes. Shurchkov (2012) compares the gender difference in WTC across different levels of time pressure and finds that women are more likely to compete when time pressure is low, leading to a smaller gender gap. Buser, Van Veldhuizen, and Zhong (2024) also find that women, more than men, prefer to compete under less strict time limits. Balafoutas and Sutter (2019) investigate the effect of uncertainty and ambiguity (regarding the number of competitors), finding that ambiguity increases the gender gap in WTC. Buser, Ranehill, and Van Veldhuizen (2021) manipulate the public observability of the tournament entry decision (and the competition outcome), finding no economically or statistically significant effects on the gender gap. A related question is whether women who act competitively face a costly backlash from others. Haeckl, Moeller, and Zednik (2025) find that spectators in the lab show significantly less concern toward participants who voluntarily entered a competition, but women are not treated harsher than men. Buser, Cappelen, and Tungodden (2021) vary the fairness of the competition setting. They find that while women are much less likely than men to enter even competitions or compete when at a disadvantage, they are just as likely as men to compete when they know the opponent is weaker.

in both tasks.²⁴ It is also worth pointing out again that there is a robust gender difference in how people score themselves on neutrally formulated survey measures (Bönte, Lombardo, and Urbig, 2017; Buser, Niederle, and Oosterbeek, 2024; Fallucchi, Nosenzo, and Reuben, 2020; Boneva et al., 2022; Buser and Oosterbeek, 2023).

Some studies have investigated whether the WTC of men and women depends on the gender composition of the competitor pool. Booth and Nolen (2012) find that British girls just under 15 years of age are significantly more likely to compete when the competitor pool is all-female. Geraldès (2020) finds that women are just as likely to compete as men if the competitor pool is all-female or if they can choose the gender of the opponent (in which case most women choose a female competitor), despite being substantially less likely than men to compete in the standard condition. Using data from a Dutch game show with very high stakes, Buser, van den Assem, and van Dolder (2023) find that women are much more likely than men to accept a relatively small opt-out prize rather than compete against other candidates when the competitor pool is majority male, but not when it is majority female. Moreover, at a later stage of the competition in a head-to-head contest with strategic interaction – where contestants should factor in their opponents’ WTC – women tend to avoid competing against men whereas men are less likely to opt out against women.

Apicella, Demiral, and Mollerstrom (2017) and Carpenter, Frank, and Huet-Vaughn (2018) explore WTC against oneself rather than others. They both replicate the gender gap in WTC against others but find no gender difference in the propensity to self-compete (see also Apicella, Demiral, and Mollerstrom, 2020). Klinowski (2019) finds that the gender gap re-emerges in a self-competition task with higher earnings volatility. Bönte, Procher, and Urbig (2018) also find a gender difference in self-competition.

In summary, some changes to the choice environment close the gender gap in tournament entry in the lab. Among these, affirmative action and team competition (albeit at the cost of lower entry by men) have support from several studies. There is still limited evidence on the feasibility and efficacy of these interventions in the field.

5 Can gender differences in competitiveness explain gender differences in the labor market?

Ultimately, for individual differences in WTC to be economically relevant, they need to be related to consequential life decisions and outcomes. If people feel strongly enough about their preference for competition relative to other considerations, we should expect people who are more competitive

²⁴The evidence is mixed for non-cognitive tasks as well. Apicella and Dreber (2015) find gender gaps for a male task (strength) and a neutral task (skipping rope), but not a female task (collecting beads). However, Sutter and Glätzle-Rützler (2014) find a gender gap in both a stereotypically male task (running) and a stereotypically female task (picking items from a basket).

to be relatively more attracted to competitive environments – e.g. to become investment bankers rather than teachers – to be more attracted to careers that allow them to out-earn others – e.g. to pick a STEM major rather than a humanities major – and to be better at climbing the corporate hierarchy. If this is the case, gender differences in WTC as documented in experiments could offer a (partial) explanation for some of the remaining gender differences in the labor market, for example the relatively low number of women in certain STEM careers or in management positions (Bertrand, 2011; Azmat and Petrongolo, 2014).

A growing number of studies indeed show that competitiveness correlates with educational attainment, occupation, and income. People who are more competitive choose more challenging study majors, are more successful in their professional careers, and are more likely to hold leadership positions. Buser, Niederle, and Oosterbeek (2014) and Buser, Peter, and Wolter (2017) show that WTC predicts the decision of specializing in more prestigious and math-heavy subjects for Dutch and Swiss students from the pre-university track of secondary school. Reuben, Sapienza, and Zingales (2024) show the same for the starting salaries and initial industry choices of MBA graduates. Other studies find that experimental or survey measures of WTC predict taking a competitive high-school entrance exam (Zhang, 2012); interest in entrepreneurship (Bönte and Piegeler, 2013) and actual entrepreneurship (Urbig et al., 2019); the investment choices of entrepreneurs (Berge et al., 2015); choosing an ambitious college track in high-school (Almås et al., 2016); future salary expectations of undergraduate students (Reuben, Wiswall, and Zafar, 2017); and career choices in vocational education (Buser, Peter, and Wolter, 2022).

Buser and Oosterbeek (2023) find that apart from career outcomes, competitiveness is also positively correlated with measures of happiness and life satisfaction.²⁵ And Buser (2024) shows that competitiveness is correlated with political preferences: people who are more competitive see themselves as more right-wing and are more likely to vote for economically conservative, free-market parties (but not for socially conservative or populist parties).

A number of recent studies provide evidence on the correlation between competitiveness and life outcomes in larger and more representative samples. Buser, Niederle, and Oosterbeek (2024) show that, in a representative sample of the Dutch population, both incentivized and survey measures of WTC predict income, level of occupation, level of education, and college major choice. Buser and Sangi (2025), using the same survey panel, show that conditional on general WTC, an experimentally validated survey measure of willingness to engage in “dirty” competition²⁶ predicts holding a management or supervisory position and of working in the private – versus the public – sector, but also worse social and psychological outcomes. Women score significantly lower on

²⁵Differentiating between four different motivations for entering competitions – enjoyment of competition, desire to win, competition for personal development, and general challenge seeking – Buser and Oosterbeek (2023) find that all of them predict income and career success, but only enjoyment of competition and challenge seeking positively predict wellbeing. Conditional on enjoyment of competition, desire to win is a negative predictor of wellbeing.

²⁶Competitions in which competitors can sabotage their opponent’s performance, lie about their own performance, or retaliate against the winner ex-post.

this measure. Buser et al. (2025) find that people’s competitiveness positively correlates with their income and level of education in virtually all of the 62 countries in their global sample. Klinowski and Niederle (2025) find that competitiveness predicts interest in high-paying occupations and math achievement in virtually all countries in their large international sample of high-school students who took the PISA test.

In summary, competitiveness predicts a number of career outcomes for which we commonly observe gender gaps. Because women’s competitiveness is on average lower than men’s, gender differences in competitiveness can mechanically account for gender gaps in these outcomes, including the underrepresentation of women in STEM and gender differences in income and occupational choices. The question of how much of these differences it can explain is trickier to answer. Indicators of labor market outcomes and competitiveness are each affected by measurement error – which could lead to underestimating the explanatory power – but so are measures of factors one might want to control for, including other psychological traits – which could lead to overestimating the contribution of competitiveness (Gillen, Snowberg, and Yariv, 2019).

Buser, Niederle, and Oosterbeek (2014) conclude that gender differences in WTC can account for around 20 percent of the gender differences in subject choices in their sample of Dutch secondary-school students (Buser, Peter, and Wolter, 2017, estimate a roughly 15 percent reduction in Switzerland). Buser, Niederle, and Oosterbeek (2024) estimate that in their Dutch survey data, controlling for two questionnaire measures of competitiveness reduces the gender difference in income conditional on education level by 4.9 percent (9.6 percent for college-educated individuals), 9.9 percent of the gender gap in holding a high-level position conditional on education, and 8.4 percent of the gender difference in major choice for college graduates. Compared to a range of other preferences and traits – the Big 5 personality traits, risk preferences, confidence, and need for cognition – competitiveness is consistently among the traits with the highest explanatory power. Using the same survey panel and differentiating between four different motivations for competing – enjoyment of competition, desire to win, competition for personal development, and general challenge seeking – Buser and Oosterbeek (2023) find that enjoyment of competition differs the most between women and men and has the highest explanatory power for gender differences in income and occupation. Reuben, Sapienza, and Zingales (2024) find that preferences for competition explain around 10 percent of the gender gap in initial salaries among MBA graduates but cannot explain the gender gap in mid-career salaries. Shurchkov and Eckel (2018) and Lozano, Ranehill, and Reuben (2022) provide overviews of the literature on gender differences in economic preferences as an explanation for gender differences in the labor market.

Another way of tackling the question of external relevance is to run field experiments in relevant settings. Flory, Leibbrandt, and List (2015) post employment advertisements for real administrative assistant positions and randomize interested individuals into different compensation regimes that rely to a lesser or greater extent on performance relative to other workers. Although both

women and men are on average repulsed by the competitive incentives, this effect is stronger among women, leading to a slightly larger gender gap in the likelihood of following through with the job application when compensation is competitive. Samek (2019) runs a similar field experiment with university students who apply for a short-term job, again finding that competitive incentives disproportionately deter women from applying. Yet another approach is to look for data from naturally occurring high-stakes settings that are similar to the lab experiments. Buser, van den Assem, and van Dolder (2023) use game show data to show that gender differences in WTC persist when hundreds of thousands of euros are at stake.

More recently, experimental studies have also looked into gender differences in the dynamics of WTC, asking whether among those who compete, men and women might react differently to winning and losing. Buser and Yuan (2019) find that even among experimental participants who initially choose to enter the competition, women are much more likely to not compete in following rounds if they lose the first competition relative to men.²⁷ This result replicates in field data from the Dutch Math Olympiad: using a regression discontinuity design, there is no effect of not making the second round on future participation for male students but a significant effect for female students. This gender difference in the effect of losing has in the meantime been documented in a range of field settings including elections (Brown et al., 2019; Baskaran and Hessami, 2022; Wasserman, 2023)²⁸, high school mathematics (Ellison and Swanson, 2023), college entrance exams (Kang et al., 2024), submissions to economics conferences (Pereda et al., 2023), submissions to academic journals (Shastry and Shurchkov, 2024), and Rubik’s cube contests (Fang, Zhang, and Zhang, 2021).

6 Conclusion

Incentivized lab experiments starting with Niederle and Vesterlund (2007) have established that there is a sizable gender difference in the propensity to compete in winner-takes-all tournaments, which is especially robust in stereotypically male tasks. Many men choose to compete even if they have little chance of winning, whereas many high-performing women prefer to opt out. Since then, an ever-growing literature has explored the causes and consequences of individual and gender differences in willingness to compete (WTC), and how to mitigate them. More recently, large-scale studies have started to appear that use the type of questionnaire items common in personality

²⁷Alnamlah and Gravert (2020) find that the gender difference in persistence depends on whether losing is attributed to ability or bad luck, and Piasenti et al. (2023) find that it depends on the fairness of the competition setting. Relatedly, Shastry, Shurchkov, and Xia (2020) find that high-performing men are more likely to attribute negative feedback to luck and continue to compete, while high-performing women are more likely to attribute negative feedback to lack of ability and reduce competition entry. Kogelnik (2022) finds a gender gap in persistence in a non-competitive setting.

²⁸But also see Bernhard and de Benedictis-Kessner (2021) who find no gender difference in persistence after losing in local and state elections in the US.

psychology to elicit people’s general competitiveness as a personality trait rather than as an economic preference elicited through an incentivized choice. The gender gap in WTC carries over to such measures of general competitiveness when they are elicited in representative samples (Buser, Niederle, and Oosterbeek, 2024; Buser and Oosterbeek, 2023; Buser et al., 2025)

This chapter provides a survey of what we have learned about four important follow-up questions. 1) What do we measure when we measure competitiveness? 2) Where do individual and gender differences in competitiveness come from? 3) Can we mitigate the gender gap in WTC by changing the choice environment? And 4) can gender differences in WTC explain gender differences in the labor market? In this section, I will summarize the conclusions we can draw on each of these questions based on the surveyed literature.

We have accumulated strong evidence from survey-based studies that competitiveness is a personality trait in its own right: it predicts important life choices, shows strong heterogeneity across individuals and groups, and has high test-retest stability (Buser, Niederle, and Oosterbeek, 2024). Moreover, it is adequately captured neither by risk preferences or confidence, nor by classic personality taxonomies such as the Big 5 or the Dark Triad (Buser and Oosterbeek, 2023). It predicts many life outcomes above and beyond these other traits, and sometimes predicts outcomes that are not predicted by other traits. Less clear is how distinct competitiveness is from a general willingness to seek and confront challenges, whether they involve competition or not. It is quite possible that related traits such as competitiveness, confidence, optimism about future competition outcomes, and general challenge seeking are manifestations of a common underlying personality trait.

The existence of a separate competitiveness trait does not automatically mean that gender gaps in WTC in the lab and field are due to gender differences in competitiveness. Lab experiments have shown that it is possible to obtain similar gender gaps in non-competitive decisions that involve similar odds and tradeoffs about risk (Van Veldhuizen, 2022). On the other hand, women on average not only tend to avoid competition in incentivized experiments, but also score themselves lower on questionnaire items such as “I enjoy competing against others”, “I often try to outperform others”, or simply “How competitive do you consider yourself to be?” (Buser, Niederle, and Oosterbeek, 2024; Buser and Oosterbeek, 2023). The gender difference in such questionnaire measures of competitiveness is of similar magnitude to well-documented gender differences in personality traits such as agreeableness or mental stability.

We also have accumulated extensive evidence that competitiveness varies across cultures, countries, and childhood environments. Differences in the gender gap across countries, however, evade the most obvious explanations. If anything, gender differences in competitiveness are largest in the most gender-equal countries, mirroring the so-called “gender-equality paradox” previously documented for other traits and preferences (Markowsky and Beblo, 2022; Napp and Breda, 2022; Klinowski and Niederle, 2025). Moreover, while the magnitude of the gender gap varies signifi-

cantly across environments, recent evidence from global samples suggests that men rate themselves as more competitive than women in the vast majority of countries (Buser et al., 2025). This literature does not, therefore, provide clear ideas on how we could tackle the gender gap in WTC through social policy, if such a thing is even desirable.

The robustness of the gender difference in competitiveness across countries raises the possibility that it is partially biologically determined. Despite the fact that we do not have heritability estimates for competitiveness from twin studies or genome-wide association studies, it is reasonable to assume that competitiveness is genetically heritable in the same way that virtually all behavioral traits are heritable (Turkheimer, 2000). That does not mean, however, that the *gender gap* has biological origins. Researchers have come up with plausible narratives based on evolutionary psychology but proving them is more difficult. Studies that have directly linked WTC to biological markers mostly find null effects (Apicella et al., 2011; Ranehill et al., 2018; Van Leeuwen et al., 2020). Indirect evidence comes from the fact that women are more willing to compete when the benefits go to their children or when the winnings can be shared with others (Cassar, Wordofa, and Zhang, 2016; Cassar and Rigdon, 2021; Cassar and Zhang, 2022). It is important to point out that biological and cultural influences do not rule each other out. It is quite possible that men are on average biologically predisposed to be more competitive but that the magnitude of this gender difference is susceptible to cultural norms or differences in upbringing.

Two related – and heavily researched – questions are whether the gender difference in WTC is externally valid and whether it can explain gender differences in career choices and labor market outcomes. We have accumulated convincing evidence that WTC and competitiveness are significant predictors of study choices, earnings, occupations, and even political preferences (Buser, Niederle, and Oosterbeek, 2014, 2024; Reuben, Sapienza, and Zingales, 2024; Buser, 2024). This does not automatically mean, however, that gender differences in competitiveness can explain a meaningful part of gender differences in these outcomes. Correlational studies typically estimate by how much the gender gap in a given outcome shrinks when competitiveness is added as a control. The estimated impacts could be an underestimate – due to measurement error in both traits and outcomes – or an overestimate – due to residual confounding between competitiveness and other, unobserved traits (Gillen, Snowberg, and Yariv, 2019). That said, many studies find that competitiveness can explain a meaningful proportion of gender differences in outcomes, but is far from the only explanation. Further evidence for the external relevance of the gender gap in WTC comes studies looking at high-stakes decisions in field settings, such as job applications or game shows with very high prizes (Flory, Leibbrandt, and List, 2015; Buser, van den Assem, and van Dolder, 2023).

Either way, a perhaps more interesting question is how much of gender gaps in education and the labor market – both those “favoring” men and those “favoring” women – can be explained by differences in personality *overall*. While it is debatable whether there is a gender gap in

competitiveness, the overall evidence for meaningful gender differences in average personality traits, preferences and beliefs between men and women is overwhelming. On top of being more willing to compete, men are also typically found to be more risk seeking, more confident, less agreeable, more mentally stable, less conscientious, less honest, more psychopathic, and more reciprocal (Schmitt et al., 2008; Falk and Hermle, 2018; Buser, 2024). Many of these traits are correlated with each other and therefore difficult to separate, but it is probably anyway more interesting to ask how much of individual and gender differences in behavior all traits can *jointly* explain. Buser, Niederle, and Oosterbeek (2024) find that competitiveness, the Big 5 personality traits, risk tolerance, confidence, and need for cognition can jointly explain 13 percent of the gender gap in income (19 percent for college-educated individuals) and 27 percent of the gender gap in holding a high-level occupation. And Buser (2024) finds that controlling for a comprehensive range of personality traits reduces gender differences in voting and political ideology by more than half. More research in this direction would be a great complement to studies looking at competitiveness – or other traits and preferences – in isolation.

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