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ABSTRACT

Gender Differences in Interpersonal and Intrapersonal Competitive Behavior

Gender differences in competitive behavior have been well documented by economists and other social scientists; however, the bulk of the research addresses competition with others and excludes other economically relevant competition that may contribute to the gender pay gap. In this paper, we ask: How does gender affect how individuals react to competition against themselves? In a laboratory experiment in which some subjects compete against others and some compete against themselves, we find women select into intrapersonal competition at significantly higher rates than interpersonal competition, the first such findings. We find perseverance or “grit” to be a poor predictor of interpersonal competition selection, but find familial effects such as parent’s education and number of brothers to be correlated with competition selection.

JEL Classification: C92, J16, M52

Keywords: gender, competition, tournament, real effort, labor

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Introduction

Women “make 77 cents for every dollar a man earns” is an oft-cited statistic in the conversation about sex equality in the United States (The White House 2014). The implication of such a statement, in this case made by the President of the United States, is that women earn less for equal work and that discrimination is primarily to blame. However, research suggests that the explanation is not so simple. As the effects of discrimination are very hard to measure, economists account for the gender pay gap with other explanatory factors first, and then term the residual differences “wage discrimination” (Blau 2006). A number of explanatory factors exist, though their relative weights are contested.

The first is human capital differences between men and women. Are women being paid less because they have less education and less experience? Not anymore. Claudia Goldin, at Harvard University, calls this “the grand gender convergence” (2006). More years of education, increasingly similar content learned in college and more time in the labor force for women has narrowed the gap between human capital measurements of men and women (Goldin 2006). According to Altnozi and Blank (1999), human capital factors explained 24.6 percent of the raw gender pay gap in 1979 but just 7.9 percent of the gap in 1998. From the 1980s to 2011, the difference in men’s and women’s full-time labor market experience decreased from 7 years to 1.4 years (Blau 2016). Women now also have higher college attendance and college graduation rates than men and are nearing 50% of those earning JD, MBA and MD degrees, further evidence of converging human capital factors (“Women’s Participation”). Though this factor may have explained a large portion of the gender pay gap in the past, it is less relevant today.

A second explanation is that the gender pay gap results from career choices, particularly choices within fields. Approximately three-quarters of the gender pay gap arises from pay differences within occupations (Goldin 2014). Goldin considers that women pursue different “amenities” from their jobs, particularly workplace flexibility. Women are more likely to hold jobs that are part-time or have high flexibility in terms of hours, have less travel, and do not require being “on call”. But, “in many occupations [hours] are worth more when given at particular [times] and when the hours are more continuous” (Goldin 2014). These more flexible jobs tend to have lower salaries. Anne-Marie Slaughter, President of the New America think tank, believes women choose these lower-paying jobs to accommodate the caregiving functions they often provide for their children or aging parents (2015). Goldin provides data to support this assessment, using a cohort of graduates of 34 selective colleges. Within the first fifteen years of employment, women with children had non-educational out-of-work spells of 2.08 years, compared to 0.41 years for women without children and 0.24 years for men (2006). Regardless of cause, “opting out” appears to be a major factor in the pay gap.

A third explanation is behavioral: men and women have different attitudes toward bargaining and competition. Babcock and Laschever (2013) document the reticence of women to ask for promotions; they cite socialization, women’s overconfidence that they will be recognized for their work without asking, as well as penalties for asking. A large body of research, to be explored in depth below, also supports the notion that women tend to opt out of competition, both in laboratory and field settings (Gneezy, Niederle, and Rustichini 2003 and Niederle and Vesterlund 2007). But Goldin (2014) critiques, “These experiments do not consider the types of jobs that reward competition the most. Often those are winner-take-all positions, such as partner in a firm, tenured professor at a university, or top manager. These are also positions for which considerable work hours leads [sic] to a higher chance of obtaining the reward, and it is often the case that hours alone get rewarded. Persistence in these positions and continuous time on the job

probably matters far more to one's success than a desire and ability to compete.”

From this perspective, competitive inclinations matter little if much work is solitary. However, competition may exert its effects even when workers are not in direct competition. This paper analyzes gender differences in intrapersonal competitive behavior—how we compete with ourselves. From this angle, the decision to persist or opt out is intrinsically entangled with an individual's competitive preferences. Thus, the second and third factors contributing to the gender pay gap may be inherently linked.

As Goldin points out, much time spent in pursuit of career advancements is solitary.¹ Though no employee advances in a vacuum, much of a person's ability to advance depends on their willingness to persist on their own and compete with themselves. Thus, it matters how we compete with ourselves in addition to how we compete with others. While there is abundant literature on gender differences in interpersonal competition, intrapersonal competition is less well understood. If women differ from men not just in how they compete with others but also how they compete with themselves, those differences matter in terms of understanding the pay gap. If women are more inclined to compete against themselves than against others, which we show to be the case, and Goldin is correct that much of career advancement is based on solitary time and self-motivation, then the other factors holding women back from such advancement may be stronger than previously believed. However, there may be ways to utilize this gender difference to minimize the pay gap, by restructuring promotions to depend more on self-improvement. We show that this modification may be viable in terms of overall productivity.

We use a laboratory experiment to study individual choices in a controlled manner that allows objective observance of competitive behavior differences. Participants, without their knowledge, are split into interpersonal and intrapersonal treatment groups to perform a real-effort task, summing five two-digit numbers over a period of five minutes, three times. First, subjects are paid a piece-rate for each correct answer. Second, subjects are paid via a winner-take-all tournament, either against their previous score or three other participants' previous scores. Third, subjects are given a choice for how their last task would be paid—as a piece rate or in a tournament.

We find that women are twice as likely to opt into intrapersonal competitions than interpersonal ones. We also find a number of predictors of willingness to compete, notably one's parent's education, one's number of brothers and one's reported level of happiness.

We also test the hypothesis that interpersonal competition is correlated with persistence, which has been studied extensively by Angela Duckworth. She terms trait-level perseverance and passion for long-term goals as “grit,” and has found that it accounts for 4% of variance in success outcomes such as educational attainment, GPA of Ivy League undergraduates, retention at West Point Military Academy and National Spelling Bee ranking (Duckworth 2007). Grit is not positively related to IQ, though it is positively correlated with higher educational attainment. Duckworth also cites a 1985 study of talented individuals in which “Bloom noted that ‘only a few of [the 120 talented individuals in the sample] were regarded as prodigies by teachers, parents, or experts’. Rather, accomplished individuals worked day after day, for at least 10 or 15

¹ Data on how time is spent at work, and with whom that time is spent, is not readily accessible for a cross-section of occupations. A working paper on how academics spend their time shows that they are alone 57% of the time. Only 17% of work time is spent with colleagues (Ziker 2014). CEOs, on the other hand, spent 15% of time alone (Bandiera 2011), though “advancement” at that stage in an individual's career is different in kind than for almost any other worker. Of course, it is important to keep in mind that one can be in competition with others while being physically alone. Thus, not only does solitary time matter, but so does the structuring of promotion mechanisms—on whose work does an individual's advancement depend?

years, to reach the top of their fields. Bloom observed that in every studied field, the general qualities possessed by high achievers included a strong interest in the particular field, a desire to reach ‘a high level of attainment’ in that field, and a ‘willingness to put in great amounts of time and effort’.” (Duckworth 2007 quoting Bloom 1985)

In a 2006 study, Duckworth examined why females earn higher grades in elementary, middle and high school despite lower standardized test scores. In college, women’s SAT or ACT scores under-predict their GPAs, while the opposite is true for men. Studying eighth-grade students, Duckworth found girls to be more self-disciplined than their male classmates according to delay of gratification measures and self-report, teacher, and parent ratings (2006). “Whereas girls earned higher grades in all courses, they did only marginally better on an achievement test and worse on an IQ test. Mediation analyses suggested girls earned higher GPAs at least in part because they were more self-disciplined.” This difference in grit informed our hypothesis that women will favor intrapersonal competition. If women are “grittier,” as Duckworth’s research suggests, at least in adolescence, then they will likely opt into competition with themselves, even if they disfavor competing against others. We find, in our experiment, however, that grit is not correlated with tournament entry.

Lastly, we take account of productivity. We note that women are better at the task overall and that tournaments tend to be more productive for everyone. We observe that the most productive participants are also the least common—women who are willing to compete with others. By forming “firms” made up of randomly selected participants, we test the hypothesis that intrapersonal pay structures are more productive than interpersonal pay structures overall, and find that they are not, but that the difference is within a standard deviation. In other words, firms in our experiment that utilize intrapersonal tournaments actually do slightly better than those that use traditional (interpersonal) tournaments but the difference is not large enough to be significant. However, considering the negative side effects of real world interpersonal competition, sabotage in particular, we think intrapersonal competition may ultimately be preferable in various occupational settings.

Literature Review

The existing literature on competitive behavior differences between the genders focuses on how individuals decide to compete against others and their performance when they do. Women are found to be less likely to opt into competition in lab settings (Gneezy et al. 2003, Kamas 2012, Niederle & Vesterlund 2007, Niederle 2011), as well as in field experiments (Bosquet 2013, Flory 2014, DePaola 2015). Niederle and Oosterbeek (2012) have also been able to document that measures of competitiveness translate to choosing more prestigious schools, explaining 23% of the difference in choices between male and female Dutch students.

Niederle and Vesterlund (2007) show that, in the task of summing five two-digit numbers, 73% of men and 35% of women will choose to compete in a winner-take-all tournament, rather than be paid a piece-rate, when the tournament offers four times the per-point pay than the piece-rate scheme. Compared to a payment-maximizing scheme, low-ability men select the tournament too often and high-ability women do not select tournament payment enough, making the outcome inefficient. By having subjects choose their payment scheme for both future and past performances and by having subjects rank themselves on how well they think they performed, the authors could measure the relative importance of confidence, feedback aversion and risk. They found that after controlling for these factors, women are still competition-averse, suggesting different preferences toward competition alone.

This may be driven by social environment, as the trend does not persist in a matrilineal society (Andersen 2013), is less strong for men with low socioeconomic status fathers (Almas 2014) and is less evident in single-sex environments (Booth 2009). Datta Gupta et al. (2013) show men increase their entrance into competition when competing against women and Buser (2014) shows that after a previous loss, men become more challenge seeking. Men also apply at higher rates to jobs with competitive compensation mechanisms (Flory 2014). Buser (2012) finds competitiveness can explain 23% of gender differences in career choice. Kamas (2012) indicates that confidence as well as choice of study of STEM, social sciences, humanities or business can explain much of the gap in tournament entry. Feedback about relative performance in a previous round reduces gender differences (Wozniak 2009). Time pressure and whether a task is considered to favor men or women (math versus verbal-based, respectively) also affects outcomes, with low-pressure verbal tasks equalizing competitive entry across the genders (Grosse 2010, Shurchkov 2012).

With regards to actual performance in competitions, Gneezy and Rustichini find that competition improves the performance of males but not females (2004). Buser (2014) finds that losing a previous round worsens the performance of females, but not males. Reward systems also impact results divergently: men increase their exam scores under rank-order grading systems and women do not (Czibor 2014).

Gender differences in entry and performance are minimized by proportional payment or revenue-sharing schemes (Cason et al. 2010, Dohmen & Falk 2011) as well as larger prizes (Petrie 2014, Ifcher 2014). An affirmative action guarantee that women will be equally represented among winners also increases entry (Niederle, Segal, Vesterlund 2008). Balafoutas and Sutter confirm the finding on quotas, adding that quotas and preferential treatment in the form of gender-specific bonuses increase female entry without sacrificing efficiency (2010). They show repetition of the competition to not be a significant way to increase female entry.

At the time of our experiment, there were, to our knowledge, no other experiments that examined the relationship between gender and one's willingness to compete with one's self. Since the first draft of our results in the Spring of 2016², however, we have learned of an experiment by Apicella et al. (2017) that is very similar. This subsequent study, run during the Fall of 2016, finds similar, if slightly weaker, results to those that we find. Men in their study are more likely to enter both inter- and intrapersonal competitions but the participation gap shrinks by a third in the intrapersonal setting and is no longer significant.

Grit research on adults rarely discusses gender, leading us to suspect that differences have not been found to continue through adulthood. In studies of related traits, conclusions about gender differences are mixed. Some scholars have reported that gender-differences in self-control arise in only a few self-reported areas, with eating being a good example (Tnagney, Baumeister and Boone 2004). Results of a field study, however, show that controlling for self-control makes the gender gap in crime insignificant (Burton et. al 1998). In lab settings, women seem to be slightly better at delaying gratification than men (Kirby 1996). Of course, the abilities to control oneself and delay rewards are only components of long-term perseverance, and there is not yet good evidence that the gender gap in grit persists into adulthood.

Experimental Design

Our experiment, which took place during the Fall of 2015, follows the design used by Niederle and Vesterlund (2007) and focuses on the choice to either be paid a piece-rate for the

² <http://middarchive.middlebury.edu/cdm/ref/collection/scholarship/id/757>

real-effort task, or to compete in a winner-take-all tournament. The experiment proceeded in three parts, followed by a questionnaire. In each of the three parts, subjects summed five two-digit numbers over periods of five minutes. Participants could not use a calculator, but were provided with scratch paper and a pen or pencil. As participants worked next to each other, headphones were also provided to reduce the influence of hearing other participants' paces as they typed their answers. Running tallies of correct and incorrect answers were provided on the screen throughout the task. This math task was used because previous literature consistently shows that despite not yielding gender differences in performance, it evokes different choices among men and women during interpersonal competitions Almas (2014), Balafoutas (2010), Buser (2014), Cason (2010), Grosse, (2010), Ifcher (2014), Kamas (2012), Niederle & Vesterlund (2007), Niederle & Vesterlund (2008), Petrie (2014), Wozniak (2009).

There were 112 participants, 53 women and 59 men. Participants were Middlebury College students and were paid a \$5 show up fee and a \$5 participation fee in addition to their earnings.

The three tasks were either paid a piece-rate or as a winner-take-all tournament. Participants were randomly divided into Interpersonal and Intrapersonal groups for the treatments. Inter- participants were placed into groups of two men and two women, following Niederle and Vesterlund, and were seated in rows with their group. Participants could see the group's gender composition, though gender was not specifically mentioned. Intra- participants were not assigned groups. At the end of the experiment, participants were asked what they believed the purpose of the study to be and none mentioned gender or sex.

The computer program Z-tree was used to administer the experiment (Fischbacher 2007). Participants were informed prior to the first part that they would only be paid for one of the three parts, which was to be selected randomly. Participants were given verbal instructions at the beginning of the experiment, and then instructed on their computer screens about the payment mechanism of each task before it began. By only informing the participants of the payment scheme just prior to each task, Intra- participants could not try to maximize their expected pay by giving less than a complete effort in the first and second rounds.

In Part One, participants performed the task and were paid a piece-rate of \$0.50 per correct answer if Part One was selected for payment.

In Part Two, participants performed the task and were paid in a winner-take all tournament in which the winner earned \$2.00 for each correct answer and the losers earned nothing if Part Two was selected for payment. Winning was defined as having the most correct answers in your group for Inter- participants and as beating your Part One score for Intra- participants.

In Part Three, participants were given the choice of how they wanted to be paid for the next five-minute task, if it was selected for payment. They could be paid a piece-rate or tournament-style, with the same payment schemes as in Parts One and Two, respectively. If Inter- participants chose tournament-style payment, they competed against the Part Two scores of their group members. If Intra- participants chose tournament-style payment, they competed against their own Part Two score. Participants were shown running tallies of the number of correct and incorrect answers they had given during each part, so Intra- participants who remembered their Part Two score knew what number they needed to solve correctly in order to win. Inter- participants did not know the scores of their competitors, so had to make their decisions based on judgment of their group's ability.

The last part of the experiment was a questionnaire that asked a number of demographic

questions, including information about prior enrollment in a single-sex school, participation in sports and employment. Participants also ranked their risk preferences, confidence, feelings of freedom and happiness on a ten-point scale. Finally, participants answered the eight questions from Duckworth & Quinn’s Short Grit Scale (2009), which aims to measure persistence.

The experiment took place over nine sessions, which lasted approximately 30 minutes each. Most sessions had both Inter- groups and Intra- individuals, though it varied based on the gender composition of each session. Participants earned approximately \$20, though payment ranged from \$10-\$48, depending both on ability and which task was selected for payment.

Participant Characteristics

Participants were 112 Middlebury College students, divided into the Inter- group (to compete interpersonally) and the Intra- group (to compete intrapersonally). There were 52 Inter-subjects and 60 Intra- subjects. Table 1 below shows that the participants were successfully randomized to treatment based on their observables, with the exceptions of the asterisked variables (controlled for in the regressions discussed below).

Table 1: Treatment Balance

Variable	Inter- (mean)	Intra- (mean)	T-stat	P-value
Female (I)	.5	.45	.52	.60
Sport Played at Middlebury (I)	.40	.37	.40	.69
Asian (I)	.25	.25	.00	1.00
Black (I)	.02	.05	-.88	.38
Hispanic (I)	.12	.03	1.68	.09
Conservative (I)	.12	.12	-.02	.98
Progressive (I)	.65	.5	1.64	.10
Sophomore (I)	.21	.23	-.28	.78
Junior (I)	.12	.17	-.18	.85
*Senior (I)	.33	.13	2.45	.01
Age	19.8	19.5	1.36	.18
Employed (I)	.5	.45	.53	.60
Single-Sex Education pre-Middlebury (I)	.10	.15	-.86	.39
GPA	3.52	3.62	-1.67	.10
Happy (10-point likert)	7.04	7.1	-.15	.88
Freedom (10-point likert)	4.02	4.73	-1.63	.11
Confident (10-point likert)	7.17	6.62	1.50	.14
Risk (10-point likert)	6.21	6	.51	.61
Brothers (#)	.63	.85	-1.10	.27
Sisters (#)	.77	.7	.41	.68
*Income \$50-\$100k per year (I)	.15	.32	-2.01	.04
Income \$101-\$300k per year (I)	.48	.35	1.4	.16
Income over \$300k per year (I)	.13	.17	-.47	.64
Father High School as highest degree (I)	.15	.18	-.41	.68
Father College as highest degree (I)	.21	.28	-.88	.38
Father Grad. School as highest degree (I)	.58	.52	.64	.52
Science Major (I)	.25	.22	.42	.68
Arts Major (I)	.04	.05	-.29	.77
*Social Science Major (I)	.40	.18	2.57	.01
Humanities Major (I)	.10	.18	-1.31	.19
Mother High School as highest degree (I)	.13	.20	-.92	.36
Mother College as highest degree (I)	.29	.42	-1.41	.16
Mother Grad. School as highest degree (I)	.52	.35	1.80	.07

Experimental Results

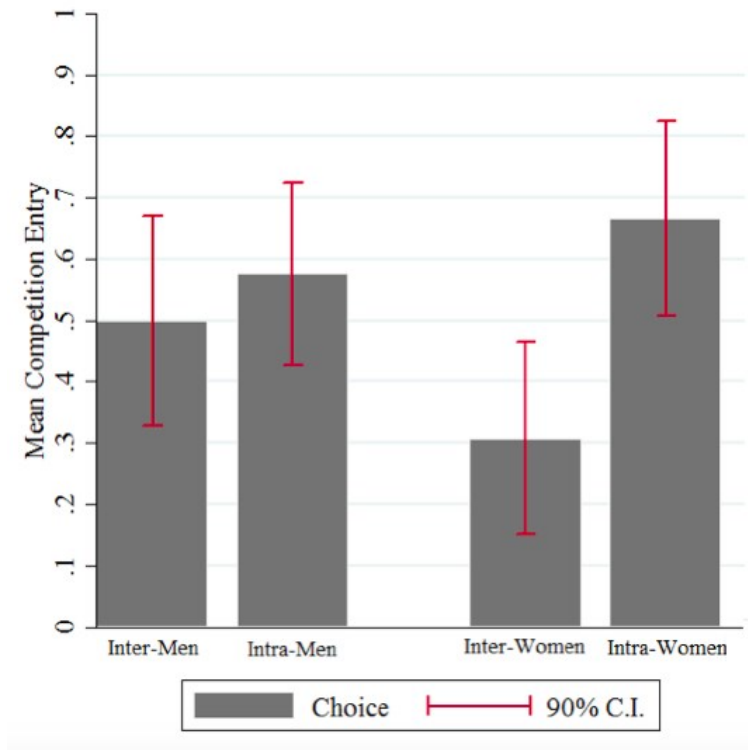
Tournament Entry

We find, as illustrated in Figure 1, that women are more than twice as likely to compete against themselves than against others. In the Part Three choice, women selected to compete against themselves 66% percent of the time, while only selecting to compete against others 31% of the time. This difference is highly significant (p-value of 0.009). Men did not exhibit such disparate preferences, with rates of interpersonal competition of 50% and intrapersonal competition of 58%, an insignificant difference. Like Niederle and Vesterlund (2007), we find, in Table 2, that women are less likely to opt into competition with others as compared to men, though the difference was not significant in our study. Comparing men and women in intrapersonal competition also does not yield a statistically significant difference. What's important, however, is that the difference in these differences is large 28 percentage points but only significant at the 0.13 level.

Table 2: Tournament Entry

Treatment	Male	Female	<i>T-test p-value by sex</i>
Inter-	0.5	0.308	0.158
Intra-	0.576	0.667	0.471
<i>T-test p-value by choice</i>	0.562	0.009	

Figure 1: Tournament Entry Bar Graph



Controlling for Unbalanced Factors

To ensure that the above differences arose from different choices by the participants and were not the result of incomplete randomization to treatment, regression analysis was performed. As Table 3 below shows, the linear combination of the coefficient of the treatment and the coefficient of the interaction of treatment with being female changes very little when the imbalanced variables are included. The coefficient of the linear combination decreases by approximately 2% (from 0.359 to 0.338), and, it is significant near the 1% level (p value of 0.017). The three imbalanced variables are, thus, not influencing the main results, and, results indicate that competing against one's self rather than against others increases female willingness to compete dramatically.

Table 3: Controlling for Observables

	$Y = \alpha + \beta_1 \text{ Intra}$	$Y = \alpha + \beta_1 \text{ Intra} + \beta_2 \text{ Female}$	$Y = \alpha + \beta_1 \text{ Intra} + \beta_2 \text{ Female} + \beta_3 \text{ Intra*Female}$	$Y = \alpha + \beta_1 \text{ Intra} + \beta_2 \text{ Female} + \beta_3 \text{ Intra*Female} + \beta_4 \text{ Senior} + \beta_5 \text{ Income50_100} + \beta_6 \text{ SocialScience}$
β_1 =Intrapersonal Competition	0.213** (0.093)	0.211** (0.093)	0.076 (0.133)	0.071 (0.134)
β_2 =Female		-0.041 (0.093)	-0.192 (0.136)	-0.185 (0.137)
β_3 =Intra * Female			0.283 (0.186)	0.267 (0.186)
β_4 =Senior				-0.189 (0.116)
β_5 =Income \$50-\$100k per year				0.054 (0.099)
β_6 =Social Science Major				0.151 (0.116)
Linear Combination of Intra & Intra*Female			0.359*** (0.131)	0.338*** (0.139)

*p<0.10 **p<0.05 ***p<0.01 Robust standard errors in parenthesis.

Considering the Mechanism: Competing Against Oneself as a Form of Same Gendered Competition

One possible explanation of the findings is that intrapersonal comparison is in some sense by default a form of same-gendered competition. Previous work (e.g. Gneezy et al., 2003) has found that the poorer performance of women in interpersonal tournament comparisons is attenuated when the tournaments are held against fellow women. While in our design we do not have same sex tournaments, we can exploit the seating in the experimental lab to compare the results of women in the intrapersonal tournament treatment to interpersonal tournament treatment women who are seated next to a woman in their tournament group (excluding from the analysis the women in the latter group seated next to only men in their tournament group). The findings of Kuhnen and Tymula (2012) suggest that the more women (and fewer men) in the comparison group, the better a woman's performance, suggesting we might see a closing of the

gap between these two groups. However, the difference in willingness to compete remains statistically significant with a p-value of 0.02 even when comparing the intrapersonal tournament treatment women to only the interpersonal tournament treatment women seated next to a woman (though this seems to be because there is no difference in willingness to compete for the women in the latter group and the other women in the interpersonal tournament treatment who are seated only next to men).

Replicating “Do Women Shy Away”

Niederle and Vesterlund’s experiment yielded tournament selection rates of 73% and 35% for men and women, respectively, in the Part Three choice. They reported a p-value on the difference of 0.002. As noted, we were not able to replicate these results with the same statistical significance, but, our results are qualitatively similar, with only 50% of men and 31% of women in our sample entering into the interpersonal tournament in Part Three (p-value of 0.158). This may be due to differences between University of Pittsburgh students and Middlebury College students.

Grit

To test our hypothesis that women would be “grittier” and thus select intrapersonal competition at high rates than men, subjects complete the Short Grit Scale, an eight-question measure of grit developed by Duckworth and Quinn (2009). Factor analysis of the eight grit questions centered the scale on zero, with a minimum of -2.18 and a maximum of 1.96. Men had a mean grit score of 0.014 and women had a mean score of -0.015, which was not statistically significant. The first part of our hypothesis, that women would be “grittier,” is thus not supported.

Does grit nevertheless influence the choice to compete? Regression analysis provided very small grit coefficients that were statistically insignificant for both the Intra- and Inter-treatments. It may be that Middlebury College students are all quite “gritty,” due to the highly selective admissions process that only admits high-achieving students, and thus differences are minimized.

Auxiliary Regressions

Using the data collected in the questionnaire, we were able to test, in Table 4, a number of demographic characteristics for their ability to predict choice in Part Three. Race and age proved to be non-predictive, as did participation in sports at Middlebury, employment, political orientation, GPA and Middlebury graduation year. Attendance of a single-sex school prior to Middlebury also did not have a significant impact on competitive preference.

The following regression model includes the variables found to be predictive of choice, as well as their interactions with treatment, if found to be significant.

$$Y = \alpha + \beta_1 \text{Intra} + \beta_2 \text{Happy} + \beta_3 \text{Intra} * \text{Happy} + \beta_4 \text{Risk} + \beta_5 \text{Father High School} \\ + \beta_6 \text{Father College} + \beta_7 \text{Father Graduate School} + \beta_8 \text{Mother No High School} \\ + \beta_9 \text{Humanities} + \beta_{10} \text{Brothers}$$

The significance of the first independent variable, intrapersonal competition, reiterates our main finding: women are more responsive to change in tournament type than men. This remains true when controlling for other variables.

Greater risk tolerance was positively correlated with opting into the tournament for both men and women. Confidence and freedom were not correlated, and happiness was only significantly correlated for those in the intrapersonal competition. The correlation of choice and happiness was only significant for women in the intrapersonal competition, and negatively so. For every one point lower a woman in the intrapersonal group ranked her happiness, she was 12% more likely to select the tournament, *ceteris paribus*.

Table 4: Auxiliary Choice Regression Results

Predictor	Coefficient (Overall)	Coefficient (Men)	Coefficient (Women)
<i>Constant</i>	-0.9597971***	-1.206414***	-0.6485053**
<i>Intrapersonal</i>	.7973913 ***	0.6698749	1.148502***
<i>Happy</i>	-0.0230677	-0.0443545	0.0050841
<i>Intra*Happy</i>	-0.0808071**	-0.0732064	-0.115037**
<i>Risk Seeking</i>	0.0787755***	0.0742711**	0.1021153***
<i>Father HS</i>	1.060529***	1.389062***	0.6045951***
<i>Father College</i>	0.9528434***	1.463245***	0.2281595
<i>Father GS</i>	1.101425***	1.477586***	0.5891521***
<i>Mother no HS</i>	0.5104148 ***	0.5690544**	0 (omitted) ³
<i>Humanities Major</i>	-0.294074***	0-.2957683	-0.1398806
<i>Brothers</i>	0.10557147	0.131899***	-0.1309241*
R²	0.3122	0.3030	0.38964
*p<0.10 **p<0.05 ***p<0.01			

Parent’s education was correlated with choice across genders, though the direction of the correlation varied. Compared to participants whose fathers had less than a high school education, a father’s completion of high school, college and graduate school increased the likelihood of the participant of opting into competition. The positive correlation of father’s education and tournament entry was substantially stronger for men. Mother’s education, however, had the opposite effect. As compared to participants whose mothers had a high school degree or greater, participants whose mothers did not complete high school were 51% more likely to compete.

While the number of sisters a participant had was not correlated with tournament entry, each additional brother increased the likelihood of competing 13% for males, but decreased the likelihood of competing by 13% for women. Humanities majors were 29% less likely to compete than those with other majors. This finding is similar to that from Kamas (2012) on the different competitive preferences of students of various majors. As the R-squared values indicate, the above variables accounted for between 30-39% of tournament entry.

Productivity Maximization

Beyond measurements of the number of participants selecting into interpersonal and intrapersonal competition are comparisons of how they actually performed in the tasks, or their productivity. Summed over the three rounds, women had a mean of 31.38 correct answers, while men had a mean of 27.51 correct answers, a statistically significant difference (p-value=0.016).

³ Omitted due to collinearity. This was a problem due to the sample size and prevented further regressions breaking down the impact of the variables across treatments. The impact of treatment on happiness was included via an interaction term. Interaction terms between female and brothers and female and mother’s education were also tested, but did not yield coefficients significant at the 10% level.

This is not out of line with the literature. In an analysis of 100 studies of mathematical ability, Hyde et al. (1990) found that women have slightly higher performances on computational math tasks, though more selective groups, perhaps such as at Middlebury, favor males.

As Table 5 shows, there was substantial variation not just between the sexes but also depending on treatment type and Part Three choice. For both sexes, the Part One piece-rate was the least productive setting, the Part Two tournament slightly more productive, and the Part Three chosen scheme most productive. This progressive improvement may be a result of participants “warming up” and improving through subsequent rounds simply due to more practice, but there was also considerable variation within Parts Two and Three.

In Part Two, intrapersonal tournaments are more productive than interpersonal tournaments with respective correct answers of 10.25 and 10.06 but the difference is not significant. In Part Three, however, interpersonal tournaments were more productive than intrapersonal tournaments. Of those who selected tournament payment in Part Three, interpersonal competitors had on average 1.18 more correct answers than intrapersonal competitors, though, again, the difference is not significant.

Overall, men were less productive in each round and in both conditions; however, the most interesting comparison is between Inter- and Intra- women because, though women are more likely to compete against themselves, they work harder when competing against others. The same, however, can be said of men. Though, given the small sample in each individual cell of the data, these productivity comparisons are under-powered (all p-values are close to 0.2).

Table 5: Productivity Means Across Rounds, Treatment & Sex

	Round 1	Round 2	Round 3	Round 3 Piece-rate	Round 3 Tournament
Inter- Men	7.80	9.23	10.35	10.23	10.46
Inter-Women	9.11	10.88	11.46	10.61	13.38
Inter- Overall	8.46	10.06	10.91	10.45	11.57
Intra- Men	7.73	9.88	10	11.14	9.16
Intra- Women	9.44	10.71	11.15	10.11	11.67
Intra- Overall	8.50	10.25	10.52	10.74	10.38

Our finding that the most productive subgroup was also the smallest (women selecting into interpersonal competition) is not ideal in terms of labor market implications. If firms would like to maximize their output and hire the most productive workers, in terms of summing numbers, they would have to draw from a small pool. However, women who selected to compete against themselves also performed quite well, solving 11.67 problems correctly in Part Three, and were more numerous. Given the scarcity of women willing to compete interpersonally, could a firm using intrapersonal competition do just as well? We simulated firms made up of four randomly selected participants to find out. The output of each firm was the average number of the four participants’ Part Three correct answers.

Table 6: Simulated Firm Gender Composition & Output

	Interpersonal Firms	Intrapersonal Firms	Standard Deviation of Sex
Percent Female	49%	48%	0.50
Mean Output	10.79	10.85	0.50
Standard Deviation of Output	3.36	3.40	

As Table 6 shows, Intra- firms are slightly more productive and slightly more male than Inter-firms. The standard deviations indicate that the two schemes are not statistically very different from one another in either dimension. However, prior research indicates that interpersonal competitions can suffer productivity losses due to sabotage (Carpenter 2010). If workers expect that other competitors will sabotage their work, they produce less—a problem that intrapersonal competition avoids. This suggests that even though the two competition types appear to be equally productive in the above table, intrapersonal competition may be more productive in real-world environments.

Discussion & Conclusion

Our finding that women are more willing to compete against themselves than others has important policy implications, especially when considering the gender pay gap. If women in a laboratory setting are indeed willing to compete against themselves, this suggests that women would act similarly in the “real world.” However, “real world” women often decide to pursue less intensive careers with fewer opportunities for advancement. Our findings suggest that women should be outcompeting men in jobs for which advancement depends heavily on work done while alone and that are not directly interpersonally competitive, such as academic research or law. That women occupy relatively few high-level positions in those fields suggests that either women’s intrapersonal competitive preferences differ in the real world or other competing forces are actively keeping women from competing against themselves in these jobs. The results of this study suggest that those forces are stronger than previously believed.

Joan Williams, director of the Center for Work Life Law and expert on women in the workforce, has written, “Many women never get near” the glass ceiling, because “they are stopped long before by the maternal wall” (2005). Both Goldin and Slaughter advocate for a public policy that reduces the caretaking responsibilities of women, thereby freeing them to pursue the more intensive careers that this paper suggests they may be inclined toward.

Our findings on the influence of familial factors in competitiveness suggest that family composition and family member’s achievements are quite important, though not equally so in magnitude or direction for men and women. Why women tend to be more competitive if their mothers are less educated and both men and women are more competitive if their fathers are more educated is curious. The same can be said for the diametric impacts of having brothers on men and women.

The finding that the less happy a woman is the more likely she will opt into competition with herself is also hard to explain intuitively. Is her unhappiness causing her to compete with herself or the reverse? One could posit that happy people engage with others generally, while unhappy people turn inwards to seek self-improvement. But our finding only holds true for women—happiness was not correlated with competition entry for men. The picture is further complicated by the fact that women have been reporting lower levels of happiness since the 1970s, when liberation supposedly occurred and they entered the workforce in large numbers (Stevenson 2009). Stevenson’s finding is not based on longitudinal data so does not help resolve the chicken-or-the-egg problem of causality, but suggests that our finding may be part of a much larger picture, much of which is still obscured.

Another implication of our findings is that firm productivity does not change significantly based on pay structure, but that women prefer intrapersonal competition. Thus, firms may consider altering promotion and pay mechanisms such that they emphasize self-improvement

rather than direct competition with others. Our findings suggest that men will not be as sensitive to this change, but that women would respond positively. This, in combination with a public policy that reduces outside pressures on women to “opt out” may help further diminish the gender wage gap.

Appendices

Appendix A: Experimental Instructions

This is an experiment in economics. The instructions are simple. If you follow them closely and make careful decisions, you can earn an appreciable amount of money. The experiment will proceed in four parts. Some parts require you to follow the directions on the screen, and other parts will contain decision problems that require you to make a series of choices which determine your total earnings, and the final part is a questionnaire. Everyone also receives a \$5.00 show-up fee and a \$5.00 participation fee, regardless of his or her decisions in the experiment. At the end of today's experiment, you will be paid for one of the three tasks, which will be determined randomly. Payment will be in private and in cash.

It is very important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

In this experiment you will be presented with math problems in which you have to add numbers. You will be paid only for correct answers to these problems. For your calculations you are not allowed to use a calculator, but you can use the scratch paper on your desk. In each round, you will see five two-digit numbers on your screen. Add these numbers, then enter the sum in the box and click "Submit." The next set of numbers will then appear and you will see if your previous answer was correct. You will answer as many of the problems correctly as you can in five minutes.

This experiment is divided into three tasks, one of which you will be paid for, and then a questionnaire. For each task you will see directions on your monitor. Please read the directions carefully and raise your hand before pressing "OK" if you have any questions.

There are headphones provided on your desk. Please put them on.

Go through 3 sections. Treatment-specific instructions are provided on the computer screens.

The fourth and final part of the experiment consists of a questionnaire. Please answer the questions on your screen. Raise your hand if you have any questions and an experimenter will come to you.

Appendix B: Questionnaire

- 1) Have you been on a sports team while at Middlebury College:
Yes
No
- 2) Ethnicity:
Asian
Black
Caucasian
Hispanic
Other
- 3) Sex:
- 4) Age:
- 5) Are you currently an:
Freshman or Sophomore Feb
Sophomore or Junior Feb
Junior or Senior Feb
Senior or Super Senior Feb
- 6) How would you characterize your political views:
Conservative
Moderate
Progressive
- 7) Major:
Arts
Natural/Physical Sciences or Math
Humanities
Social Sciences
Not Declared
Other
- 8) What is your best estimate of your family's annual income:
Under \$50,000
\$50,000 - \$100,000
\$100,000 - \$300,000
Over 300,000
- 9) What is your father's highest level of education:
No high school
High school

College
Graduate/professional school

10) What is your mother's highest level of education:

No high school
High school
College
Graduate/professional school

11) How many brothers do you have? Please write how many.

12) How many sisters do you have? Please write how many.

13) Are you currently working for pay:

Yes
No

14) Have you ever attended a single-sex educational institution?

15) What is your GPA?

16) New ideas and projects sometimes distract me from previous ones.*

Very much like me
Mostly like me
Somewhat like me
Not much like me
Not like me at all

17) Setbacks don't discourage me.

Very much like me
Mostly like me
Somewhat like me
Not much like me
Not like me at all

18) I have been obsessed with a certain idea or project for a short time but later lost interest.*

Very much like me
Mostly like me
Somewhat like me
Not much like me
Not like me at all

19) I am a hard worker.

Very much like me
Mostly like me

Somewhat like me
Not much like me
Not like me at all

20) I often set a goal but later choose to pursue a different one.*

Very much like me
Mostly like me
Somewhat like me
Not much like me
Not like me at all

21) I have difficulty maintaining my focus on projects that take more than a few months to complete.*

Very much like me
Mostly like me
Somewhat like me
Not much like me
Not like me at all

22) I finish whatever I begin.

Very much like me
Mostly like me
Somewhat like me
Not much like me
Not like me at all

23) I am diligent.

Very much like me
Mostly like me
Somewhat like me
Not much like me
Not like me at all

24) Please rank from 1-10 how you would say things are going these days: are you not at all happy or very happy? 1 is not at all happy and 10 is very happy.

25) Please rank from 1-10 how you see yourself: are you generally a person who is not at all confident or are you very confident? 1 is not at all confident and 10 is very confident.

26) Please rank from 1-10 how much freedom of choice and control you feel you have over the way your life turns out. 1 is complete freedom of choice and 10 is none.

27) Please rank from 1-10 how you see yourself: are you generally a person who avoids taking risks or are you fully prepared to take risks? 1 is unwilling to take risks and 10 is fully prepared to take risks.

28) Please describe what you believe to be the purpose of the study:

29) Please describe how you made your choice in Part Three (piece-rate or tournament)

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