Do Girls in China Compete Just As Much As Boys? Evidence from an Experiment that Predicts Educational Choice*

JANE ZHANG†

University of California at Berkeley

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Abstract

Recent experimental economics research documents substantial gender differences in the willingness to compete in a tournament, suggesting that women may be underrepresented in positions of power because they lack competitive drive. This study examines whether competitive inclination measured in the lab is predictive of the subsequent propensity to take a competitive and highly consequential high school entrance exam in rural China. Using a discrete choice mixed logit model, I estimate individual parameters of competitive inclination from lab data for my sample of ethnically diverse middle and high school students. I find that a middle school student with a taste for competition one standard deviation above the mean is 7.2 percentage points more likely to take the exam, controlling for academic performance. Contrary to results from previous studies in the United States, the Han Chinese exhibited no gender differences in competitive inclination. However, high school boys from ethnic minority groups were 20 percentage points more likely to compete in a tournament than the girls, controlling for the probability of winning, risk aversion, and overconfidence. More speculatively, the findings suggest that radical Communist policies promoting gender equality among the Han Chinese may have helped shape taste for competition.

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†jzhang@econ.berkeley.edu

A recent experimental literature on competition has found that men are much more willing than women to choose to compete in a tournament rather than take a piece-rate payment, even after controlling for performance in the experimental task (Niederle and Vesterlund, 2007; Niederle et al., 2008; Booth and Nolen, 2009; Healy and Pate, 2010).[1] A related strand of the literature finds that males also perform better than females under competitive situations relative to non-competitive situations (Gneezy et al. (2003); Gneezy and Rustichini (2004); Paserman (2007)). These results resonate with the conventional wisdom that men enjoy competitive environments more than women do (see, for example, Tierney (2005) and Varian (2006)), and have the potential to explain the under-representation of women in areas where competition is intense, such as in upper-level corporate management (Bertrand and Hallock, 2001; Wolfers, 2006) and parliamentary-level politics (United Nations, 2010).[2]

This study aims to provide a better understanding of how competitive inclination in the lab relates to the world outside of the lab, especially in the context of a developing country. I do this in two ways. First, I test whether experimentally derived measures of competitive inclination can predict a subsequent real world decision to take a competitive and highly consequential high school entrance exam in rural China. Second, I investigate whether gender differences in competitive inclination vary with cultural norms regarding gender in a unique setting that imposes tight controls on other plausible confounds.

Adapting the Niederle and Vesterlund (2007) experimental design, I conduct experiments with 544 middle school and high school students in a region of rural China where three ethnic groups with vastly different gender norms live in close proximity. Individual risk aversion data was collected separately using the Binswanger (1980) instrument. The subjects' real world competitive behavior and academic performance is observed in a rich set of administrative data that I collect and assemble. I also administer a post-experiment survey to capture demographic and socioeconomic

[1] Niederle and Vesterlund find a 38 percentage point gender gap in the propensity to enter the tournament among University of Pittsburgh students, controlling for performance; Niederle, Segal, and Vesterlund find a 36 percentage point gender gap in tournament entry among Harvard Business School students, controlling for the probability of winning the tournament; Booth and Nolen find a 39 percentage point gender gap in tournament entry among grade 10 and 11 students in Essex and Suffolk counties in the UK, controlling for performance. Healy and Pate find a 53 percentage point gender gap in tournament entry among Loyola Marymount University students, controlling for performance.

[2] Bertrand and Hallack find that between 1992 and 1997, of the top 5 highest paid executives in a large set of US public corporations, 2.5% were women; Wolfers finds that between 1992 and 2004, women occupied the position of CEO of the S&P 1500 companies 1.3% of the time. The UN reports that in 2010, 18% of parliamentarians worldwide are women, including seats reserved specifically for female politicians. In developing regions, this figure is 15%.

characteristics.

I use the lab data on competitive inclination and risk aversion to estimate a structural discrete choice mixed logit model of the decision to compete in the tournament, from which I obtain individual-specific parameters of taste for competition using a method similar to the one proposed in Revelt and Train (2000). Previous studies have largely relied on regression analysis and have not attempted to generate individual estimates of competitive preference. Having the individual measures allows me to test whether laboratory measures of competitive inclination can predict a subject's subsequent decision to take a competitive and highly consequential high school entrance exam.[3] This decision is observable in the administrative data so I do not have to rely on self-reports. In addition, regular middle school tests are standardized across the county and designed to mimic high school entrance exams,[4] so performance on these tests, which I also have access to, serves as a good proxy for academic ability as it applies to high school entry.

I find that even after accounting for academic performance, the lab measure of competitive inclination is a statistically significant predictor of the propensity to take the exam, with an economically meaningful magnitude. Subjects with a taste for competition one standard deviation above the mean are 7.2 percentage points more likely to take the entrance exam, controlling for prior academic performance. Taken from the baseline, this represents a reduction of 36% in the exam truancy rate. To my knowledge, this finding is the first direct evidence linking lab measures of competitive inclination with competitive behavior outside the lab.

The location of this study was chosen for its ethnic diversity, which allows me to explore how gender differences in competitive inclination may vary with ethnic gender norms, in a naturally controlled environment. In this part of Yunnan Province, the Han Chinese, along with a matrilineal minority group (Mosuo) and a patrilineal minority group (Yi), both extensively studied by anthropologists, live together in an area one-third the geographical size of the San Francisco Bay Area. They also attend the same schools under the national public school system.

The advantage of the geographic concentration is that it addresses all four methodological difficulties inherent in cultural comparisons cited by Camerer (2003). First, experimental payouts

[3] Admissions to secondary schooling, where returns to education are 11.5% per year (De Brauw and Rozelle, 2008), is based on performance in this exam. Competition is especially fierce in rural China, where the continuation rate from middle school to high school is 33% (Ministry of Education, 2007; 2008).

[4] In contrast, preparation for the SAT in the United States, which is a standardized exam used in college admissions, is generally not a part of the standard high school curriculum.

do not require adjustment for purchasing power across these ethnic groups. Second, the same set of instructions can be used because the language of instruction is Mandarin Chinese in all the schools participating in this study. Third, I was able to conduct all experiments so experimenter variation is minimal. Fourth, difficult-to-measure confounds that cultural analyses tend to struggle with are largely held constant since the ethnic groups share in the same macroeconomic environment and many of the same formal institutions (Fernandez and Fogli, 2009).

Using the school rosters, I randomly selected my experimental subjects from each of the three ethnic groups in roughly equal numbers, balanced across gender. I find no statistically significant gender difference in competitive inclination among the Han Chinese in both my middle school and high school samples, where subjects are on average 15.7 and 18.4 years old, respectively. In each case, the effects are precisely estimated zeros.

Findings of no gender differences in competitive inclination among the Han Chinese is interesting because it is a society that has experienced enormous changes in its gender relations in the past few decades. Under the traditional Confucian value system, women are subordinate to men in all spheres of life. The high male to female sex ratios in China, from which Amartya Sen has calculated 50 million "missing women," testifies to the traditional biases against women (Sen, 1990). However, Communist policies aggressively promoting female labor force participation and gender equality in general have had a crippling effect on the traditional value system in recent decades (Therborn, 2004, p. 121). Today, female labor force participation in China is higher than that in almost all the OECD countries, and a recent tally of the world's female self-made billionaires reveal that half are Chinese (Kroll and Miller, Forbes, 2010). This has led some in the popular media to assert that Chinese women are more ambitious than American women (Schneiderman and Seno, Newsweek, 2010). Indeed, the 36 to 53 percentage point gender gaps from almost identical experiments conducted in culturally western countries do not contradict this assertion (Niederle and Vesterlund, 2007; Niederle et al., 2008; Booth and Nolen, 2009; Healy and Pate, 2010).

For the matrilineal Mosuo and the patrilineal Yi, there were no gender differences in middle school, similar to the finding among the Han Chinese. In high school, there *were* gender differences in competitive inclination, but both minority ethnicities had *equally* large differences, with males being about 20 percentage points more willing to enter the competition than females. The fact that the Han Chinese exhibit smaller gender differences in competitive inclination than either of the minority groups is potentially due to differential government policy. While both the Mosuo and the Yi are governed by the same central authority as the Han Chinese, as members of ethnic minority groups, they have been given many exemptions from official policy. For example, while policy toward the Han Chinese was designed to dismantle the traditional Confucian value system, the main principle behind minority policy since the Communist Party assumed power in 1949 has been to maintain national unity. As part of that goal, the government has afforded minorities a degree of autonomy in how they organize their societies (Mackerras, 1994, p. 145). One manifestation of this autonomy is that the Marriage Law of 1950 promoting gender equality in marriage and divorce did not apply to them (Dreyer, 1976, p. 119). In this context, an intriguing albeit speculative interpretation is that egalitarian policies have the potential to affect gender equality in preferences.

These findings also add to the existing evidence on competitive inclination in matrilineal and patrilineal groups. Gneezy et al. (2009) find that women in a matrilineal Indian society were more competitive when compared with the men, and men in a patrilineal Tanzanian society were more competitive when compared with the women. A leading interpretation that reconciles these findings with the current study is that once confounds with culture have been adequately controlled for, matriliny and patriliny per se does not strongly influence gender differences in competitive inclination.[5] This interpretation is consistent with observations from anthropology – in all unilineal descent groups, whether patrilineal or matrilineal, authority resides with men (Schneider and Gough, 1961).[6] Of course, other interpretations cannot be definitively ruled out. For example, because the Gneezy et al. (2009) study used a slightly different experimental procedure, differences in experimental design could have caused the difference in the results. Nonetheless, the results in the current study do call into question the robustness of the effect of matriliny versus patriliny on gender patterns in competitive inclination.

The remainder of the paper proceeds in Section 2 to discuss the background literature. Section 3 describes the experimental setting in detail. Section 4 describes the data collection procedures. Section 5 develops a structural discrete choice mixed logit model. Section 6 presents results from the structural estimation, findings from linking lab to real world behavior, and findings on gender differences in competitive inclination across ethnic groups in both middle school and high school.

[5] The Indian and Tanzanian societies differ in their means of subsistence, for example.

[6] Most modern Euro-American societies, in contrast, are bilateral, where kinship is traced through both mothers and fathers (Stone, 1997, p. 235).

Section 7 concludes with a discussion of the results and their potential implications.

1 Related Literature

This study builds on a literature exploring the generalizability of findings from competition experiments to real world competitive behavior. One approach in this literature analyzes data from competitions that take place outside of the lab. For example, Paserman (2007) finds that male professional tennis players perform better than females ones do during critical points of the match, as compared with performance during less critical points. Gerdes and Gransmark (2010) find that male professional chess players take more aggressive strategies than female ones do, controlling for ability. Another approach varies the design of the competition experiments, thereby adding to our understanding of how men and women may behave under a broader range of real world competitive contexts. For example Shurchkov (2010) finds that when the task used was verbal in nature, gender differences in the willingness to enter a tournament disappeared.[7] Cotton et al. (2010) conduct repeated rounds of a competition experiment and find that the male advantage in performance disappears after the initial round. Healy and Pate (2010) find that when the subjects competed in teams, the gender gap in tournament entry was reduced by two-thirds.

The approach taken in the current study is to directly link individual-level competitive inclination elicited in the lab to individual decisions involving a real world competition of consequence. As such, this study contributes to a nascent literature on validating experimental economics results in the broader world.[8] Most of this literature involves social preference experiments. Karlan (2005) finds that those Peruvian microfinance borrowers who were more trustworthy in a trust game (i.e. returned more money to their partners) are more likely to repay their microloans. Benz and Meier (2008) find that Swiss students who donated more money to charities in a classroom experiment also donate more money to charities in a natural setting. Finan and Schechter (2010) find that Paraguayans who exhibited more reciprocity in an experimental setting are more likely to vote for the party from whom they accepted a gift. To my knowledge, the current study is the first to test the relationship between lab and non-lab behavior involving competition experiments.

[7] In prior experimental studies of competition, mathematical or maze-solving tasks were used.

[8] See Falk and Fehr (2003) for a discussion on the generalizability of lab experiments and Leavitt and List (2007) for a discussion on external validity as it applies to social preference experiments.

2 Experimental Setting

The experiment takes place in Ninglang County in southwest China. Ninglang is a mountainous county located in the border province of Yunnan, which contains the highest number of nationally designated "poor" counties and the most number of ethnic minority groups.[9] Ninglang has been on the register of poor counties since 1986, the year the criteria for the designation were first established. In 2008, GDP per capita was $630 (China County Statistics, 2008).[10]

With a population of 230,000, Ninglang's three main ethnic groups are the Yi, Han Chinese, and Mosuo, comprising 62%, 20%, and 9% of the population, respectively (China Census, 2000). Historical records show that the Yi and Mosuo have coexisted as separate ethnic groups in Ninglang for at least several hundred years.[11] The Han Chinese began migrating into the Mosuo dominated areas of Ninglang in the 1920s,[12] and have the lowest economic status of all the ethnic groups in the region (Shih, 2010, p. 72). Each ethnic group has a distinct language, although the Mosuo do not have a written script.

2.1 Ethnicity in China

Modern ethnic identity in China is a relatively rigid concept. In the 1950s, the Communist government sponsored a massive ethnicity identification project, which officially categorized each citizen into one of 56 ethnic groups.[13] Today, ethnicity is required information on official identification documents and ethnic identification can only pass from parent to child.[14] [15] Although ethnic consciousness is undoubtedly more fluid than official categories would suggest, official categories have created at least another identity with which groups differentiate themselves from one another.[16]

[9]The basic standard for qualifying as a "poor" county was rural net income per capita below RMB 150 in 1985 (˜$50 using 1985 exchange rates). Currently 28% of counties (the term "county" is reserved for rural regions in China) are designated poor. See (Park et al., 2002) for details on determinants of poor county designation.

[10]At the exchange rate of $1 = RMB 6.8.

[11]The Mosuo have been recorded to inhabit Ninglang since the Tang dynasty (618-907 AD); the Yi began migrating into Ninglang from nearby Sichuan Province in the middle of the Qing Dynasty (1644 - 1911 AD) (Harrell, 2001b).

[12]Although there have been small numbers of Han Chinese living among the Mosuo since the Yuan Dynasty (1271 - 1368 AD), these early arrivers have completely assimilated and retain no ethnic markers distinct from the Mosuo (Shih, 2010, p. 72).

[13]The last state-recognized ethnic group gained its status in 1979 (Heberer, 1989, p. 37-38).

[14]This is done at the time of "hukou" registration for the child, which typically happens shortly after birth. Parents from mixed ethnic backgrounds must pick one ethnic designation for their child.

[15]The Mosuo in Ninglang are not an official ethnicity, but have been given state recognition as a "people," (Harrell, 2001b, p. 70) and have been issued official documentation identifying them as such.

[16]As Stevan Harrell, a Yi scholar, puts it, "the question of whether the categories correspond to the previous reality of ethnic consciousness is unimportant in most areas, because for at least forty years, the Yi have been the Yi ..."

90% of China's population is ethnically Han, whose traditional culture was centered around the Confucian value system. Under the system, a woman is subject to her father in her youth, to her husband in her marriage, and to her son in her widowhood. To the extent possible, women are confined to the home and excluded from education, and consequently, all forms of public life (Stacey, 1983, p. 39). When the Communist Party assumed power in 1949, policies were put forth to aggressively promote female labor force participation (Yang, 1965, p. 145; Croll, 1983, p. 2).[17] A large part of the success of this policy comes from assigning such low salaries to men as to compel their wives to work, as made possible through labor collectivization (Yang, 1965, p. 167). Additional support came from propaganda campaigns that highlighted women in traditionally male occupations, such as tractor drivers and locomotive engineers (Yang, 1965, p. 165). In addition, men were re-educated in widespread campaigns exhorting them to undertake their share of domestic chores (Croll, 1983, p. 7). Today, 67.4% of Chinese women over the age of 15 are in the labor force, a higher percentage than that in all the OECD countries, with the exception of Iceland (ILO, 2009).[18]

While a large part of Communist social policies toward the Han were aimed at dismantling the Confucian value system, Communist policies in relation to the ethnic minorities have long been chiefly concerned with national unity. Minority territories make up 60% of China's land mass and are generally found along the borders (Mackerras, 1995, p. 4). Recognizing the strategic importance of good relations with the minority groups, early Communist policies toward minorities allowed for considerable autonomy (Mackerras, 1994, p. 145).[19] The Communist government "tacitly approved" of existing social structures among minority groups and even encouraged the development of their 'special characterisitics' (Dreyer, 1976, p. 94). Indigenous power structures were left intact as "minorities were specifically exempted from numerous reforms imposed or bestowed upon the Han (Dreyer, 1976, p. 119)." For example, they were exempted from the Marriage Law of 1950 (Dreyer, 1976, p. 119) which proclaimed the equality of the sexes, established minimum ages for marriage, and most notably granted men and women equal rights to property and children upon

(Harrell, 2001a, p. 8)

[17]Other communist and former communist states shared in the same objectives (Therborn, 2004), which have resulted in relatively high female labor force participation in these countries as well (Chase, 1995).

[18]In comparison, US female labor force participation is 58.4% (ILO, 2009).

[19]The exception is where national unity is threatened. For example, intrusive policies toward the Tibetans and the Uygurs of Xinjiang are in part responses to their secessionist tendencies, which date back to pre-Communist China (Mackerras, 1994).

divorce, which lead to a doubling of divorce cases immediately after its passage (Yang, 1965, p. 69). Minorities were also exempt from both early policies encouraging fertility control and the more radical one-child policy introduced in 1978 (Mackerras, 1995; Mackerras, 2003), although many rural Han Chinese were also exempted.

Although the special treatment of minorities was suspended during the Great Leap Forward, this created a backlash that ironically slowed the integration process and the minority policy soon reverted to one that encouraged national unity through diversity. During the Cultural Revolution, minorities were again denied special treatment but minority regions were spared the most radical manifestations of the revolution, potentially for national security reasons (Dreyer, 1976, p. 231). In addition, the propaganda campaigns characterizing periods of political upheaval were potentially not as effective among the minorities due to language barriers. Han Chinese cadres were loathe to learn minority languages (Dreyer, 1976, p. 150), and the minorities were at various times encouraged by official policy to use and develop their own languages (Dreyer, 1976, p. 117).

Although the minority groups in the current study, the Mosuo and the Yi, no doubt did experience changes to their lifestyle under Communist rule, anthropologists note no major changes to their kinship systems in the last sixty years. On the other hand, the contemporary Han Chinese kinship system has been described as "transitional," and as moving away from a patrilineal system toward a bilateral system (Levy, 1949; Fong, 2002).

2.2 Ethnic minorities in Ninglang County

The Yi (and the Han Chinese traditionally) are patrilineal (see, for example, articles in Harrell (2001a)). Patriliny and matriliny refers to "the gender direction of the transmission of associations, rights, and duties from one generation to the next (Harrell, 2002)."[20] An important adjunct of patriliny is patrilocal residence, in which a woman moves to her husband's home and becomes a member of that household at the time of marriage, making investing in daughters akin to "watering your neighbor's garden (Harrell, 2002)." A Yi proverb gives quick insight into the tenuous position of daughters in the family: "An egg is both meat and not meat; a daughter is both family member and not (Ayi, 2001)."

[20] In contrast, patriarchy and matriarchy refers to the gender who typically holds political power. Anthropologists have yet to find a single matriarchal society (Stone, 1997, p. 110-111).

The Mosuo are a matrilineal people (see, for example, Shih (1993) and Walsh (2001)). As such, the head of a Mosuo household is typically a woman (Mackerras, 1995). A unique feature of the Mosuo matrilineal society is their sexual visitation system called the "walking marriage," with the man traveling to visit the woman in the evenings. It normally does not involve cohabitation – the partners work and eat with their own respective families (Shih and Jenike, 2002). When cohabitation does take places, it does not signify greater commitment or obligations; the moved-in partner can leave at his or her free will (Shih, 2000). Children usually grow up in their mother's household, with the maternal uncle playing the closest role to a father figure in a child's life (Shih, 1993).

Although women in a Mosuo society may have more autonomy on some matters than do women in a Yi society, I observed in both Yi and Mosuo households a strongly gendered division of labor, with females performing the bulk of the housework as well as their share of agricultural labor.[21] Interactions with the outside world are generally the man's responsibility. In my experience, in both Mosuo and Yi households, male members are responsible for entertaining the guests. Females prepared the meals but were usually silent and sometimes ate separately. I did not notice this behavior among Han Chinese women. In addition, village leaders in both Mosuo and Yi villages are almost always male.[22] This is consistent with anthropologists' observations on traditional societies that in both patrilineal and matrilineal kinship systems, authority always rests with men (Schneider and Gough, 1961).

Table 1 shows selected background characteristics for my subjects. Importantly, the ethnic correlates correspond to the anthropological evidence, with the majority of the Mosuo having either a female head of household or one that is related to the subject maternally. The Mosuo are also the most likely to have parents participating in a walking marriage. The subjects are slightly older compared with students in the same grades in the United States, as is common in rural China, and for the most part are past the age of puberty. The Yi have the most children, although both the Mosuo and the Han Chinese have not restricted themselves to only one child, indicating that fertility policies are less restrictive in this area. All three ethnic groups are predominantly agricultural and

[21]The Han Chinese males, in contrast, are known for sharing in the housework, which I was able to observe on several occasions.

[22]I did not have the chance to visit a predominantly Han Chinese village, although the only female cadre at the county-level that I encountered was Han Chinese.

educational levels are low, with the subjects on average having more education than their heads of households. The Han Chinese heads of households have one more year of education than either their Mosuo or Yi counterparts, possibly in part due to the language of instruction being a dialect of Chinese, rather than the Mosuo or Yi language. In the subsequent analysis, I will control for both demographic and socioeconomic covariates.

2.3 Education in Ninglang County

In 1986, China passed the Law on Compulsory Education, mandating six years of primary and three years of middle school education as compulsory for all children (Ministry of Education, 1986).

Schools in Ninglang County, as elsewhere in China, follow a uniform standard for textbooks, curriculum, and exams. Middle schools and high schools are boarding schools, although students whose homes are nearby may choose to commute. Admission to high school is competitive and almost exclusively depends on an entrance exam.[23] At the very least, one must take the entrance exam in order to gain admission – I found no case of someone not taking the exam and continuing on to high school. In my sample, about 80% of middle school students take the entrance exam, and less than 30% go on to high school without repeating.[24]

As is common in rural China, the two high schools in Ninglang are both located in the county seat. The few who score sufficiently high for a prefecture level high school may apply to it once exam scores are made public, but by default everyone who passes the exam is enrolled in one of the two schools in Ninglang county. The process for assigning the admitted pool of students into one of the two schools is essentially random.

The fees for the entrance exam is around $70 and mainly covers three days of food and lodgings in the county seat, where the exam is administered. Although this is not a small sum for this population, school administrators insist that the fee is not what prevents students from taking the exam. Among the administrators and students I spoke with, the consensus was that families almost invariably want the student to take the entrance exam – if the student does not take the exam, it was his or her own choice. For a more systematic understanding of the issue, I consulted a study

[23] Admissions may be extended to those who just missed the cutoff and could pay an extra fee, but I did not find clear rules for this process.

[24] Although some students repeat grade 9, it is rare for someone who does not continue directly to high school to pass the exam in a later year. In my sample of grade 9 students in 2008, 5 out of 75 who did not go on to high school directly passed the exam on the subsequent try.

on the barriers to education in rural Gansu province that surveyed over 2,000 students and families (Hannum and Adams, 2009). For children aged 13-16 who drop out of school, the survey found that the top two reasons given were consistent across responses given by the child, their mother, and their village leader: poor academic performance and simply not wanting to go to school. The comments from in-depth interviews conducted in Gansu echo the sentiments I heard in Ninglang. One student said: "[My parents tell me:] ' If you pass entrance exams, even if we have to sell our house and vehicle, we will, in order to support your schooling.' " One of the mothers explained her perspective: "In this village, if you do not study, you are in for a hard life...but if your child refuses to learn, we, as parents, really cannot do anything (Hannum and Adams, 2009)."

3 Data collection

3.1 Administrative and school outcome data

Scores from the most recent comprehensive exams relative to when the experiment was conducted were collected from each school and matched to subjects by name. High school entrance exam records came from the county bureau of education. For all names of students who did not have an exam record, I confirmed with middle school teachers that they either had not taken the exam or that there had been a typographical error or name change. In the latter cases, I obtained from teachers the "matchable" name on an individual basis. In less than 5% of the cases, the student transferred out of the province and teachers did not know whether they took the entrance exam in their new province.

3.2 Experimental procedures

The experiment was adapted from Niederle and Vesterlund (2007). Experiments were conducted in two rounds – fall semester of 2008 and fall semester of 2009. In 2008, middle school subjects in grades 8 and 9 were recruited. In 2009, middle school subjects in grade 9 and high school subjects in grades 11 and 12 were recruited. Experiments were conducted in two middle schools and two high schools in Ninglang. The middle schools are located in townships approximately 50 kilometers apart. The high schools are both situated in the county seat.

Subjects were randomly recruited from the schools' rosters within ethnicity and gender such that each session consisted of one ethnic group and was evenly divided across gender. Session size ranged from 8 to 24 subjects. There were a total of 16 sessions in middle school and 14 sessions in high school. Selected students were informed of the time and place to meet for the experiment in class. All sessions took place during the school day, either during normal breaks, or during times that administrators deemed appropriate. Laboratories were set up in vacant classrooms, which were generally rooms designated for taking exams. Absentees were replaced by the first students on the randomized roster that matched on ethnicity and gender. I read all experimental instructions out loud in Mandarin, which is the national language as well as the official language of instruction. Hard copies of the instructions were also distributed to everyone. Sessions lasted around an hour and half. Where computer labs were available for use, experimental responses were captured electronically using the Z-tree program, but where it was not available, subjects recorded their responses on paper and graders assessed these responses during each session. Scratch paper was provided in all sessions.

The task used throughout the experiment was to add sets of five two-digit numbers and to do as many as possible in five minutes. The number of problems correctly solved is the subject's "score" in the subsequent discussion. See below for a sample problem.

12	34	41	87	64	

The experiment consists of three main stages, throughout which subjects were randomly seated in groups of four (two males and two females) and were not allowed communication although they could see one another.

Stage 1: Piece-rate - subjects are compensated 0.5 RMB for each problem solved.

Stage 2: Compulsory tournament - The subject who solves the most problems in his or her group of 4 receives 2 RMB for each correctly solved problem, while the others receive no payment.[25]

Stage 3: Discretionary tournament - subjects first choose which of the two types of compensation scheme (piece-rate or tournament) they would like to apply to their performance in this stage. If they choose piece-rate, they are paid 0.5 RMB per problem solved. If they choose to enter their performance in a tournament, they receive 2 RMB per problem if they score highest in their group of four, and nothing if there is someone in their group who scores higher than they do.

[25] In the case of a tie all those tied for highest score are paid 2 RMB per problem.

Following Niederle and Vesterlund (2007), if the subject chooses tournament in stage 3, their score is compared to the scores of the other three group members in stage 2 (the compulsory tournament stage), rather than their score in stage 3. This ensures that participants choosing the tournament option are competing against the scores of others also performing under the tournament payout conditions, and rules out reasons for choosing the piece-rate scheme such as not wanting to impose negative externality on others or strategic response to beliefs about other participants' choices.

Subjects receive their scores from the previous stage before they begin the next stage. However, they do not know their relative ranking within their group. After the third stage, subjects are asked to guess their rank in the compulsory tournament. This information will be used in the analysis to assess the accuracy of their beliefs toward their relative performance.

Following standard experimental practice, one unpaid practice stage was administered before stage 1 to familiarize subjects with the task. At the end of the experiment, one of the stages was randomly chosen for payout, to minimize wealth effects across the stages. A written survey was distributed as students waited for their payment. The show up fee is 2 RMB. For the experimental instructions and the survey instrument (translated into English), see the web appendix.

3.3 Tournament entry results

Raw rates of tournament entry from this study are shown in context with select previous experimental results in Table 2. Middle school students in my sample exhibit very little gender difference, with point estimates between 2 - 6 percent. In contrast, substantial gender differences appear in high school among the Yi and the Mosuo. These gender differences are smaller than that found in Niederle and Vesterlund (2007), and are similar in size to the gender differences in the Gneezy et al (2009) study, also conducted in developing regions. When the data from China and the data from the United States are viewed together, the absolute tournament entry rates for men and women in the United States represent the two extremes.[26]

These raw rates of tournament entry will be used in the subsequent analysis to derive competitive taste.

[26] Although the female Masai have the lowest entry rate in this table, the Gneezy et. al (2009) study used a different intensity of incentives for choosing the tournament compared with the piece-rate, and therefore cannot be directly compared.

3.4 Risk aversion data

A simplifying assumption that experimental researchers often make is that under the scale of payouts in an experiment, subjects are approximately risk neutral so that risk preferences can be ignored. However, experiments designed specifically to test for risk preferences have found non-trivial levels of risk aversion (see, for example, Holt and Laury (2002)). I adopt the classic Binswanger (1980) instrument widely used in development economics research to elicit risk preferences. The risk instrument was presented at least one month after the competition experiment, the purpose being to minimize wealth effects from earnings in the experiment, although such wealth effects have not been found to be important in prior research.[27] The formatting of the instrument comes from Barr and Genicot (2008), with the size of the stakes designed to be roughly comparable to the stakes in the competition experiment. Subjects are presented with six lottery choices over pairs of payouts, each with 50% probability of occurring. Assuming CRRA utility over income, each choice implies a range of values for the coefficient of constant relative risk aversion. Figure 1 shows the actual instrument used, translated into English. A histogram of the lottery choices appears in Figure 2, along with the associated lotteries.[28] Although there is a mass at risk neutrality, there is a non-trivial distribution in the risk averse range. Figure 3 breaks the sample up by ethnicity, school type, and gender. Casual observation shows that for the most part, the female distributions are right-skewed, whereas the male distributions are left-skewed, implying that females are more risk averse than males, as is consistent with the literature on risk preferences (see, for example, Croson and Gneezy (2009)). A Mann-Whitney test of the overall male and female risk preference distributions confirms that the distributions are different (p-value = 0.000).

Risk aversion data were collected in the second round of data collection, during the fall semester of 2009. Unfortunately, data could not be obtained for those who were no longer in school, mainly those in grade 9 in 2008 who did not continue on to high school. About 18% of risk aversion data is missing for this reason. I employ a standard multiple imputation method described in Cameron and Trivedi (2005) to impute the missing data.[29] The validity of this method relies on the assumption

[27] Holt and Laury (2002) found no such wealth effects between the 3rd and 4th rounds within the same session, even though the 3rd round had 50 times or 90 times the stakes of the 4th round.

[28] The distribution corresponds remarkably well to the distribution of comparable choices from the small stakes game in Binswanger (1980).

[29] I impute once using an ordered logit regression of choice in the instrument on gender-ethnicity main and interactions effects, age, and academic performance.

that the data are missing at random, meaning that the value of the missing variable is not correlated with the fact that it is missing. In this case, because we know that the missingness is due to being out of school, I can test the missing at random assumption. Limiting the sample to middle school subjects recruited in round 2, the difference in the distribution of risk aversion between those who eventually enroll in high school and those who do not are insignificant (a two-sided Fisher's exact test yields a p-value of 0.934). The subsequent analyses involving middle school data will utilize the imputed measures of risk aversion, and the substantive results are robust to assuming risk neutrality for everyone. Figure 4 reproduces Figure 3, using the imputed values.

3.5 Overconfidence data

Using the guesses on the compulsory tournament rank, I construct a proxy for overconfidence by subtracting the guessed rank from the actual rank, with the best rank being 4 and the worst 1. This proxy takes on integer values between -3 and 3, with positive values signifying overconfidence, negative values signifying underconfidence, and zero representing a correct guess. Figure 5 shows the distribution of this proxy variable for the entire sample. The symmetry about zero implies that subjects in my sample are on average correct about their rank, despite the fact the guesses were not incentivized monetarily. In contrast, subjects in Niederle and Vesterlund (2007) were on average overconfident by more than one full rank, with men more overconfident compared with women, although women were also overconfident. The fact that my subjects know each other probably contributes to the accuracy of their guesses, although this is not the full story. Figure 6 breaks the sample up by ethnicity, school type, and gender. Subjects in high school appear no less accurate compared with subjects in middle school, despite high schools being ten times as large as middle schools. The average values of the proxy for overconfidence for each of the six groups are statistically indistinguishable from zero.

Casual observation also reveals no systematic overestimation of one's rank or gender differences in overestimation, with the exception of the Mosuo in middle school. Mann-Whitney tests confirm the casual observation: the only group where gender differences are significant at the 10% level or higher is the Mosuo in middle school (p-value = 0.003).[30] The ability of my subjects to guess their

[30]The full sample test by gender is significant (p-value = 0.02) but these differences are driven the Mosuo in middle school. Excluding them, the p-value is 0.24.

ranks with accuracy suggests that the nature of the competition may be different in this setting compared to competitions in experiments conducted with anonymous subjects. Since competitions in life often involve settings in which participants have some idea of their chances of success, I would argue that the current setting is no less realistic than previous experimental settings.

4 Structural Model

This section presents a binary mixed logit discrete choice model of the tournament entry choice in the lab. Introducing individual heterogeneity in taste for competition allows me to estimate individual parameters of competitive inclination, which will then be related to the subsequent real world decision to take the high school entrance exam for the middle school subjects.

In the spirit of de Palma et al. (2008), the optimal tournament entry decision is modeled in a random utility framework with the observed portion of utility characterized by expected utility and the unobserved portion of utility characterized by $b(\cdot)$:

$$U_i = \sum_{j=1}^{J} p_{ij} V_i(I_{ij}) \cdot b(\alpha_j + \epsilon_{ij}) \tag{1}$$

where discrete alternatives are indexed by j, and preferences may vary across individuals, indexed by i. α_j is an alternative specific constant summarizing the effect on utility of all unobserved factors and ϵ_{ij} is an error term reflecting individual unobserved heterogeneity. In this formulation, $b(\cdot)$ can be interpreted as the behavioral portion of utility.[31]

As in Holt and Laury (2002), preferences are characterized by constant relative risk aversion: $V = I^{1-\gamma}/(1-\gamma)$, where I is payout[32] and γ is the coefficient of constant relative risk aversion. I make the additional assumption that $V(0) = 0$. The CRRA functional form for utility is used for its tractability within the structural model.[33] Let U_{it} and U_{ipr} be individual i's utility from

[31] The behavioral portion of utility enters multiplicatively instead of additively for reasons of modeling convenience, as will become evident in the following discussion.

[32] In justifying their choice of an expected utility over income rather than an expected utility over wealth model, Holt and Laury (2002) appeal to the body of literature in auction theory, where an expected utility over income model is used to develop Nash equilibrium bidding theory for risk averse agents. In addition, Holt and Laury (2002) point out that studies testing the asset integration hypothesis have found no evidence in support of it. Binswanger (1980) find that risk aversion coefficients estimated using an experimental game in rural India did not vary with the wealth of the subjects, despite large variations in wealth. Alternatively, one can appeal to the fact that since the subjects are rural middle school and high school students, their wealth is approximately zero, so that the expected utility over income model approximates the expected utility over wealth model.

[33] Binswanger (1981) finds that although risk aversion increased with the size of the game stakes, estimation was not

choosing the tournament and piece rate option, respectively:[34]

$$U_{it} = \frac{(p_i q_i)(2\hat{s}_i)^{(1-\gamma_i)}}{1-\gamma_i} \cdot \exp(\bar{\alpha} + \epsilon_{it}) \tag{2}$$

$$U_{ipr} = \frac{(0.5\hat{s}_i)^{(1-\gamma_i)}}{1-\gamma_i} \cdot \exp(\epsilon_{ipr}) \tag{3}$$

where the tournament option is chosen iff $U_{it} > U_{ipr}$.

$p_i q_i \in (0,1)$ represents the subjective probability of winning the discretionary tournament, with p_i denoting the true probability of winning and q_i denoting the ratio of the subjective probability of winning to the objective probability of winning. $\hat{s}_i$, the scale of the stakes, is assumed to be anchored on the known compulsory tournament score.[35] γ_i is the individual coefficient of constant relative risk aversion collected using the Binswanger instrument.[36] $\bar{\alpha}$ represents the population average taste or distaste for competition over and above what can be accounted for by risk preferences and the subjective probability of winning. When q_i is assumed to be 1, $\bar{\alpha}$ represents the degree to which individuals deviate on average from expected utility maximizing behavior given the objective probability of winning, and captures all reasons for that deviation, including, for example, overconfidence.

The unobserved portion of utility, ϵ_t and ϵ_{pr}, are assumed to be distributed i.i.d. extreme value I, and represent the heterogeneity in individual taste for the tournament and piece-rate options, respectively. All other parameters of the model are also allowed to vary across individuals such that $\beta \sim f(\beta|\mu_\beta, \sigma_\beta)$, where $f(\cdot)$ is a mixing distribution with mean μ_β and variance σ^2_β.

In the specifications that are reported below, I assume that $q_i = 1$ and that $f(\cdot)$ is a normal mixing distribution. I also work with log utility which preserves utility ordering and has the advantage of being linear in parameters. Given the assumptions above, the probability that individual i

significantly changed from using an increasing relative risk aversion utility function rather than the more convenient constant relative risk aversion utility function (in his paper, these are referred to as the increasing partial risk aversion utility function and the constant partial risk aversion utility functions, respectively). Holt and Laury (2002) also find that relative risk aversion increased with the size of the stakes, but the changes were small from 1x to 20x, which roughly corresponds to the range of the changes in stakes in the present study.

[34]When $\gamma = 1$, the utility function is defined to be $\ln I$. However, actual values of γ in the present study sample obviates this consideration.

[35]What the value of this number is will not matter, as we will see shortly; the assumption that will have bite is that the scale of the stakes is known at the time of decision making.

[36]Following Binswanger (1980) and Binswanger (1981), I use the geometric mean of the endpoints of each range for the point estimate of γ.

chooses to enter the tournament is given by:

$$\Pr(\ln U_{it} > \ln U_{ipr}) = \int \frac{\exp(\bar{\alpha} + \beta_1 \ln p_i + \beta_2(1-\gamma_i))}{1+\exp(\bar{\alpha} + \beta_1 \ln p_i + \beta_2(1-\gamma_i))} f(\beta_1, \beta_2|\mu_\beta, \sigma_\beta) d\beta \tag{4}$$

where $\bar{\alpha}$, the average taste for competition, is the alternative specific constant for choosing tournament. The individual heterogeneity in taste for competition is implicitly captured by $\epsilon = \epsilon_t - \epsilon_{pr}$, which is distributed i.i.d. standard logistic. In the subsequent discussion I will refer to the individual taste for competition as $\alpha = \bar{\alpha} + \epsilon$.

Realized scores in the experiment were used to obtain the objective probability of winning p_i. I assume that the potential score s_{pi} is known up to some noise around the realized score s_{ri}:

$$s_{pi} = s_{ri} + k\xi_i \tag{5}$$

where ξ_i is an i.i.d. extreme value type I noise term, and k is inversely proportional to the standard deviation of the noise. Then we arrive at the following closed-form expression for p_i, the true probability of winning in a group g:

$$p_i = \Pr(s_{pi} > s_{pj},\, j \neq i) = \frac{\exp(ks_{ri})}{\sum_{j \in g} \exp(ks_{rj})} \tag{6}$$

Since winning in the discretionary tournament is defined by scoring higher than the other three group members did in the compulsory tournament stage, s_{ri} denotes the score in the discretionary tournament stage and s_{rj}, $j \neq i$, denotes the scores in the compulsory tournament stage. k, the non-linear scale parameter was estimated separately using a standard logit counterpart of Equation 4. Ten starting values of k corresponding to standard deviations of ξ_i ranging from 1 to 5.5 in increments of 0.5 were utilized, and all converged to the same maximum likelihood estimate of k, accurate to the thousandth place.[37] Note that my subjects are students in the same middle school and high school, where grades (as is common practice in China) are public knowledge and often posted along with student names in the classroom. If instead subjects were drawn from a large university and are virtually anonymous to each other, one could make the alternative assumption that subjects know the overall distribution and knowing their realized score would tell them their

[37] Even so, the possibility that a local rather than a global maximum has been found cannot be completely ruled out.

relative standing. p_i can then be fully proxied by one's own realized score s_{ri}.

Figure 7 shows distributions of the probabilities of winning by gender for each ethnic group in both middle school and high school. The overlap by gender is substantial, and Mann-Whitney tests reveal no significant gender differences, at the 10% level or greater, across any of the six groups. This finding is consistent with the literature. For example, Niederle and Vesterlund (2007) found no significant gender differences in performance on the compulsory tournament task.

5 Results

5.1 Results from structural estimation

Estimation of Equation 4 was by the method of maximum simulated likelihood, using 500 draws of β from $f(\cdot)$ for each individual. The middle school and high school samples were estimated separately and the mixed logit parameter estimates are reported in Table 3. All estimates take the expected sign but the standard errors are large, particularly in high school, so the interpretation of the estimates are merely suggestive. Estimates of $\bar{\alpha}$ are positive and significant in middle school, indicating that middle school students on average have a preference for competitive above and beyond what can be accounted for through their objective probability of winning and their risk aversion. The estimate of $\bar{\alpha}$ is also positive in high school, however, it is not statistically significant.

Comparisons of the magnitudes of coefficients across samples must be made with caution in discrete choice models, where the estimated parameters are estimates of the ratios of the "true" coefficients divided by a normalization factor that is proportional to the standard deviation of the unobserved portion of utility. Since this normalization factor is unidentified, the fact that the estimate of $\bar{\alpha}$ is larger in high school than middle school could be indicative of either higher mean competitive inclination in high school, or that the variation in competitive inclination in high school is lower than that in middle school.

5.2 Individual parameter of competitive inclination

The real benefit of the structural estimation approach in this study is that it allows for estimates of the individual taste for competition, α. Taking an approach conceptually similar to Revelt and Train (2000), the conditional distribution of preference parameters for an individual who made the tournament entry choice y_i while facing independent variables x_i, $h(\alpha, \beta | y_i, x_i, \hat{\mu}_\beta, \hat{\sigma}_\beta)$, can be simulated using an accept-reject procedure.[38] Specifically, 10,000 draws were simultaneously drawn from the distribution of ϵ and from $f(\beta | \hat{\mu}_\beta, \hat{\sigma}_\beta)$ for each individual. The draws that are consistent with the actual tournament entry choice as well as the values of the independent variables were retained ("accepted") while the rest where discarded. The first 1,000 retained draws for each individual comprise the simulated dataset of conditional distributions $h(\alpha, \beta | y_i, x_i, \hat{\mu}_\beta, \hat{\sigma}_\beta)$. Various statistics can be derived from these simulated distributions. In particular, I follow Revelt and Train (2000) to base the measure of individual competitive inclination on the conditional mean, which is simply the averages from the individual simulated conditional distributions. Although this measure would be more correctly notated by $\bar{\alpha}_i$, in the subsequent discussion I will drop the bar and simply refer to this measure as α_i in the interest of notational simplicity.

Figure 8 plots a histogram of the individual α_is for the middle school sample and the high school sample. The distribution in middle school is clearly bimodal. The left cluster represents those who chose piece-rate and the right cluster represents those who chose tournament. The shape of the distribution implies that competitive inclination is largely driven by the choice of tournament versus piece-rate.[39]

The distribution of the α_is in high school exhibits substantially less variation than that in middle school, which, combined with the fact that both underlying population distributions are assumed to be standard logistic, implies that relatively little information was gained by conditioning on the observed choices and choice situations for the high school sample. To see this, suppose that there is no information to condition upon. Then the individual conditional distributions would be identical and equal to the population distribution, in which case there would be no variation in the means of the conditional distributions. The lack of statistical significance in the mixed logit estimates from the high school sample in Table 3 is consistent with this interpretation.

[38] The Revelt and Train (2000) method uses Bayes' rule to derive the conditional distribution of the slope coefficients, but it does not describe how to derive the conditional distribution of the alternative specific constant, which requires knowledge of the conditional distribution of the utility errors. The accept-reject procedure described here is more general: it is asymptotically equivalent to Revelt and Train (2000) for the random slope coefficients and yet also simulates the utility error terms. See Train (2003) for a discussion on accept-reject procedures.

[39] Although the population distribution of competitive inclination was assumed to be logistically distributed, there is no theoretical reason to expect the distribution of the conditional means to take any particular shape.

5.3 Linking lab and real world behavior

If we believe that the competition experiment widely used in the literature and replicated in this study reveals a stable preference for competition, and that the choice model has been correctly specified, then α_i should be able to predict future competitive behavior outside the lab. I test this hypothesis by linking the individual α_is to the subject's subsequent propensity to take a competitive high school entrance exam.

5.3.1 Results

Table 4 reports results from probit regressions of the decision to take the entrance exam on α_i. To facilitate interpretation, the α_i have been normalized by its population standard deviation of $\sqrt{\frac{\pi^2}{3}}$. The first column is a simple probit regression of taking the entrance exam on α_i. Column 2 controls for prior academic performance and its quadratic. As expected, prior academic performance is significantly predictive of the propensity to take the entrance exam, although its quadratic is not. Even so, competitive inclination remains significant at the 5% level. A one standard deviation increase in the taste for competition is associated with a 7.2 percentage point increase the propensity to take the entrance exam. Given that around 20% of the population do not take the exam, a 7.2 percentage point increase in the exam participation rate implies a reduction of the non-participating population by 36%.

Columns 3-5 add controls for the observable background characteristics that are conventionally thought to be associated with educational continuation, namely ethnicity-gender main effects and interactions, demographics, and socioeconomic status (Hannum and Adams, 2009). By adding the covariates, I am able to examine whether competitive inclination measured experimentally remains predictive of taking the entrance exam after controlling for the more traditional explanatory variables. Results from columns 3-5 confirm that it is.

Column 6 enters α_i as an indicator variable that takes the value of 1 if the individual has a preference for competition ($\alpha_i > 0$) and 0 if the individual has a dispreference for competition ($\alpha_i < 0$). The results indicate that, controlling for the full set of covariates, on average people who have a preference for competition are 8 percentage points more likely to take the entrance exam than people who have a dispreference for competition.

5.3.2 Robustness checks - alternative explanations for the correlation between experimental competitive inclination and taking the entrance exam

The structural approach assumes that tournament entry decisions are based on the objective probability of winning. However, if people are overconfident about their abilities, they may appear to be more competitively inclined in the experiment and also be more likely to take the entrance exam, even conditional on their prior academic performance. This would lead to spurious correlation between α_i and taking the entrance exam. In this section I test the robustness of the results linking lab and real world behavior by taking a generalized residual approach to estimating individual measures of competitive inclination. Robustness is tested both in the sense that this is a different approach from the structural mixed logit model developed above, and also in the sense that I will be able to weigh the importance of alternative explanations for the association between the tournament entry decision and taking the high school entrance exam.

The generalized residual approach proceeds in two stages. In the first stage, I estimate a standard probit model of the tournament entry decision y_i^1: $\Pr(y_i^1 = 1|x_i) = E(y_i^1|x_i) = \Phi(x_i'\beta)$ where Φ is the standard normal cdf and x_i is a full set of regressors including both predictors of the experimental choice and predictors of the propensity to take the entrance exam. From this regression I obtain the generalized residual, corrected for heteroskedasticity:

$$\hat{r_i} = \frac{y_i^1 - \hat{E}[y_i^1|x_i]}{\sqrt{(1-\hat{p}(y_i^1=1|x_i)) \cdot (\hat{p}(y_i^1=1|x_i)}} = \frac{y_i^1 - \Phi(x_i'\hat{\beta})}{\sqrt{(1-\Phi(x_i'\hat{\beta})) \cdot \Phi(x_i'\hat{\beta})}} \tag{7}$$

$\hat{r_i}$ measures the residual taste for competition, after accounting for the full set of explanatory variables in x_i.[40]

In the second stage, I estimate a probit model of the decision to take the entrance exam y_i^2, adding $\hat{r_i}$ to the set of regressors in x_i: $\Pr(y_i^2 = 1|x_i, \hat{r_i}) = \Phi(x_i'\beta + \hat{r_i}\pi)$. Thus, π is a measure of the correlation between the unobserved factors contributing to entry into the tournament with the unobserved factors contributing to taking the high school entrance exam.

Table 5 reports the results from the generalized residual approach. Panel A reports the first stage results and Panel B reports the second stage results. All specifications include the traditional

[40]Both α_i and $\hat{r_i}$ capture variation across individuals in the propensity to enter the tournament. But because $\hat{r_i}$, unlike α_i, is not a structural parameter, its sign does not indicate whether the subject has a preference or dispreference for competition.

explanatory variables for taking the entrance exam discussed above. In all three specifications, the estimates of π is statistically significant at at least the 5% level, consistent with the results using the structural estimate of competitive inclination. In column 1 the only experimental control is the probability of winning the tournament. The specifications in columns 2 and 3 progressively add risk aversion and overconfidence but the change in the point estimate and the standard error of π from column 1 to column 3 is minimal. This is not surprising given that controlling for the probability of winning the tournament, neither risk aversion nor overconfidence are significant predictors of laboratory competitive behavior. Further, this result is consistent with the interpretation that the correlation between competitive behavior in the lab and competitive behavior in the real world is not due to risk preferences or overconfidence.

5.4 Group differences in competitive inclination

The study presents the first opportunity to investigate potential gender differences in competitive inclination among the Han Chinese, a group that is traditionally patrilineal and still exhibits strong son preference, but through radical communist egalitarian policies have achieved female labor force participation higher than that in most OECD countries. In addition, the ethnic diversity in the experimental site provides a unique opportunity to observe potential gender differences in competitive inclination across a matrilineal and a patrilineal group holding fixed many of the environmental confounds that can complicate cultural analyses. In this setting these groups with vastly different gender norms and traditions share in the same macroeconomic environment and many of the same formal institutions – in fact their children attend the same schools.

I explore these questions first using the structurally estimated individual parameters of competitive inclination, and then through regression analysis.

5.4.1 Structural parameters

Figure 9 plots histograms of individual α_is by gender, for each ethnic group in middle school and in high school. Casual observation reveals substantial overlap by gender across male and female distributions in competitive inclination, although gender differences may be larger in high school than in middle school. Mann-Whitney tests were performed on each of the six sub-samples. There were no significant gender differences in any of the three ethnic groups in middle school at the 10%

level or higher. The Han Chinese in high school also exhibited no significant gender differences (p-value = 0.72). The groups that do have significant gender differences, with males being more competitive, are the high school Mosuo (p-value = 0.04) and the high school Yi (p-value = 0.01).

Another advantage of modeling the tournament entry decision structurally is that it defines a threshold for preference and dispreference for competition. This allows me to test whether people on average are competing too much or if they are shying away from competition. This is an open question in the literature on competitive inclination, which thus far has relied on reduced form methods. I find that of the 12 gender-ethnicity-school type sub-samples, all have positive average α_is. There is no evidence that any of the groups are shying away from competition on average.

5.4.2 Regression analysis

The reduced form estimation equation for testing gender differences across ethnic groups adapted from Equation 4 is as follows:

$$y_i = \beta_0 + \beta_1 male_i + \sum_{j=2}^{3} \beta_j ethn_{ji} \times male_i + \sum_{j=1}^{3} \beta_{j+3} ethn_{ji} + \delta \ln p_i + \tau(1-\gamma_i) + \lambda q_i + X_i' B + \upsilon_i \quad (8)$$

where $y_i = 1$ if the subject chooses tournament and 0 if the subject chooses piece-rate. p_i and γ_i are measured as above. q_i is the proxy for overconfidence. $ethn_{1i}$, $ethn_{2i}$, and $ethn_{3i}$ are indicator variables for Han Chinese, Mosuo and Yi, respectively. $male_i$ is an indicator variable taking the value of 1 for males and 0 for females. X_i is a vector of other controls. The coefficients of interest are $\beta_2(\beta_3)$ which indicates the gender difference in the Mosuo (Yi), as compared with the Han Chinese, the omitted group.

Table 6 reports the results from this estimation. The middle school and high school samples are estimated separately. The specifications in Columns 2 and 3 in both panels add demographic and socioeconomic status controls, respectively. In middle school, there are no significant gender differences in tournament entry across the three specifications. Although the standard errors are large, the point estimates are sufficiently small that even if we borrow from the standard errors in the much more precisely estimated high school sample, gender differences would still be insignificant. This is consistent with the Mann-Whitney test results of the structural parameters.

In high school, the Han Chinese again exhibit no statistical gender difference, but the matrilineal Mosuo and patrilineal Yi each have about a 20 percentage point gender gap the willingness to compete in the tournament. Controlling for demographics and socioeconomic status does not change this result qualitatively. This is also consistent with the Mann-Whitney test results of the structural parameters. These results contrast, however, with the Gneezy et al. (2009) study, which found that women in a matrilineal Indian society were more competitive compared with the men and men in a patrilineal Tanzanian society were more competitive compared with the women. One leading interpretation is that once confounds with culture, such as differences in the means of subsistence or educational institutions, have been adequately controlled for, such as by holding the environment fixed in the current study, matriliny and patriliny per se does not strongly influence gender differences in competitive inclination.

Interestingly, the Yi males and Han Chinese males are about equally likely to enter the tournament – the gender difference in the Yi results from the Yi females being less competitively inclined than the Han Chinese females. On the other hand, the Mosuo females have similar tournament entry rates as the Han Chinese females, but the Mosuo males are much more competitively inclined than the Mosuo females. It appears, then, that there is a level shift in the competitive inclination of the matrilineal group compared with the patrilineal group.

The coefficient estimates on probability of winning, risk aversion, and overconfidence take on the expected signs, consistent with the findings from the mixed logit estimation in Table 3. One puzzling finding is that having a head of the household engaged in agriculture makes someone more competitive in middle school, and less competitive in high school.

Next, I allow for more flexibility in the regression functions by estimating Equation 8 separately for each ethnic group in high school. Table 7 reports these results. In each of the nine specifications, I control for the probability of winning, risk aversion, and overconfidence. Columns 2 and 3 add demographic and socioeconomic status controls. The coefficients reported are the gender differences in tournament entry. Substantively consistent with the results in Table 6, the coefficients on gender are between 0.2 and 0.3, significant at the 1% level, for both the Mosuo and the Yi, and are precisely estimated zeros for the Han.

Finally, I explore how the probability of winning, risk aversion, and overconfidence may affect the tournament entry decisions of males and females differently. Table 8 reports gender interactions with each of these variables for the three ethnic groups in high school. All specifications also control for demographic and socioeconomic status variables. The males in the three ethnic groups appear not to base their tournament entry decision on the behavioral parameters of risk aversion and overconfidence, with the exception of the Han Chinese males, who are marginally affected by overconfidence. The females are more likely to be affected by the behavioral factors, with the Han Chinese affected by both risk aversion and overconfidence and the Yi affected by overconfidence only. The probability of winning seems to factor into the competition decision for males and females alike, with the exception of the Han Chinese, whose coefficients on this variable is imprecisely estimated.

Table 8 suggests that indeed there are gender differences in how tournament entry decisions are made, and that we understand the behavioral components of female competitive inclination better than we understand the behavior components underlying male competitive inclination.

6 Conclusion

This study, to my knowledge, provides the first direct evidence showing that experimental measures of competitive inclination are predictive of competitive behavior outside the lab. While gender differences in the willingness to enter a tournament have been shown to be sensitive to experimental design, the findings in this study indicate that competitive inclination measured from the widely used experimental design developed in Niederle and Vesterlund (2007) is meaningful for understanding real world competitive behavior, at least in the context of a competitive exam taking decision facing tens of millions of middle school students each year in China.

Results from this externally validated experimental procedure show that the Han Chinese girls in both middle school and high school were no less competitively inclined than the boys. This is the first finding to my knowledge of no gender differences in competitive inclination using this experiment in any population studied. Meanwhile, in the same high schools, minority girls were about 20 percentage points less likely to choose tournament than minority boys, controlling for the probability of winning, risk aversion, and overconfidence. These differences in the gender patterns across ethnic groups strongly suggest that gender differences in competitive inclination is not a biologically determined certainty. Combined with the fact that the gender difference in competitive inclination among the minorities is still smaller than that found in previous studies from culturally western countries, these facts are consistent with the interpretation that radical gender egalitarian policies aimed at the Han Chinese, and to a lesser extent the minorities, have had an impact in reducing gender differences in competitive inclination for the Chinese.

Of course, this is not the only possible interpretation. Although the three ethnic groups in this study face an environment that is tightly controlled in many respects, unobserved differences between the ethnic groups still remain, and may in fact be driving the observed gender differences in competitive inclination. For example, Han Chinese females and minority females may have different assortative mating incentives in that the Han Chinese potentially have access to the pool of marriage partners in the broader Chinese population that the minorities do not have access to.

If, however, we are willing to entertain the possibility that it was Communist social engineering that has overcome traditional Han Chinese gender norms in shaping competitive inclination, then the fact that the most radical of the gender egalitarian policies were enacted in the past, before the market reforms of the late 1970s, suggests that early changes to competitive inclination have been retained through the generations. In addition, the fact that the minorities and the Han Chinese today attend the same schools suggests that the development of competitive inclination occurs outside of the formal educational system, perhaps in the home environment. Taken together, these two observations suggest that competitive inclination may be transmitted intergenerationally, much like cultural norms are transmitted. While we know from previous research that the intergenerational transmission of norms are important for fertility choices and female labor force participation, the current findings suggest that it may be also important for competitive inclination, which can impact highly consequential educational choices.

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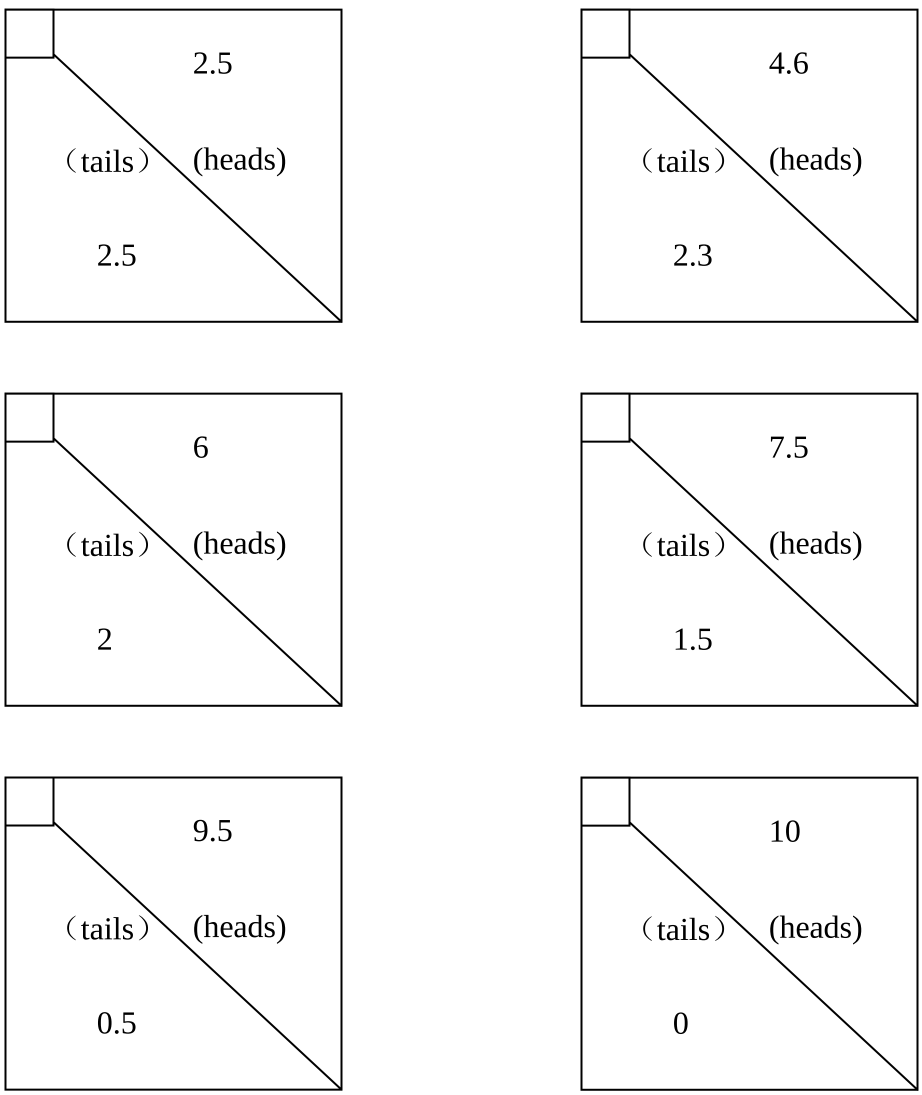
Figure 1: Binswanger Risk Instrument

Student ID ________________

In this game there are six ways to win money, represented by the 6 pictures below. In each picture, there are two amounts. You may choose one of the six pictures. When you've made your choice, we will determine your payout by a coin toss. If the coin lands on heads, you will receive the amount in the upper right half of your chosen picture; if the coin lands on tails, you will receive the amount in the lower left. As we know, the probability of a coin landing on heads and the probability of it landing on tails is each 50%.

Please make your choice by marking the upper left corner of the picture with a "✓". Please let us know if you have any questions.



(All amounts are in Chinese RMB)

Figure 2: Distribution of Actual CRRA Coefficients with Associated Lottery

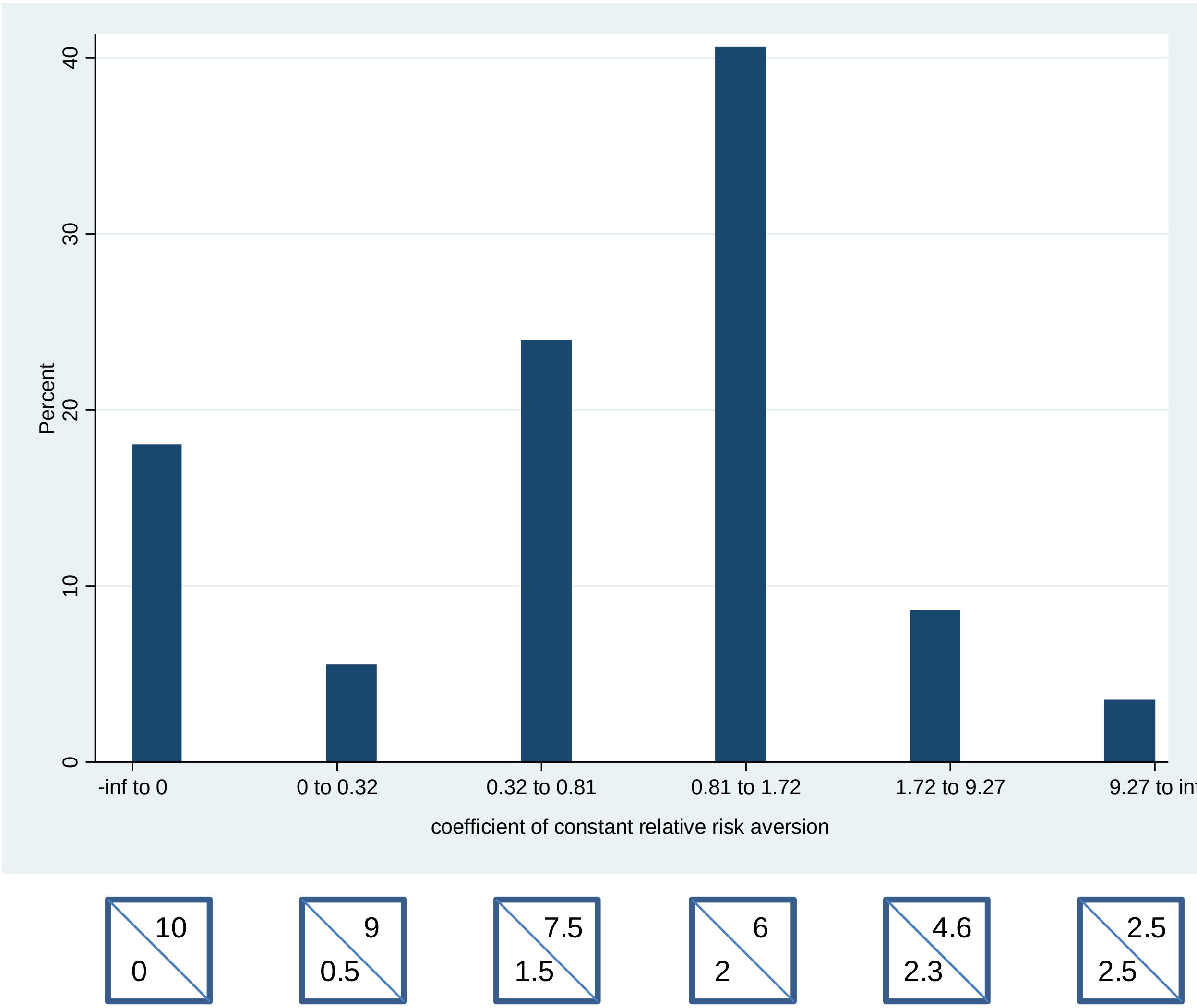


Figure 3: Distribution of Actual CRRA Coefficients across Ethnicity in Middle school and High school, by Gender

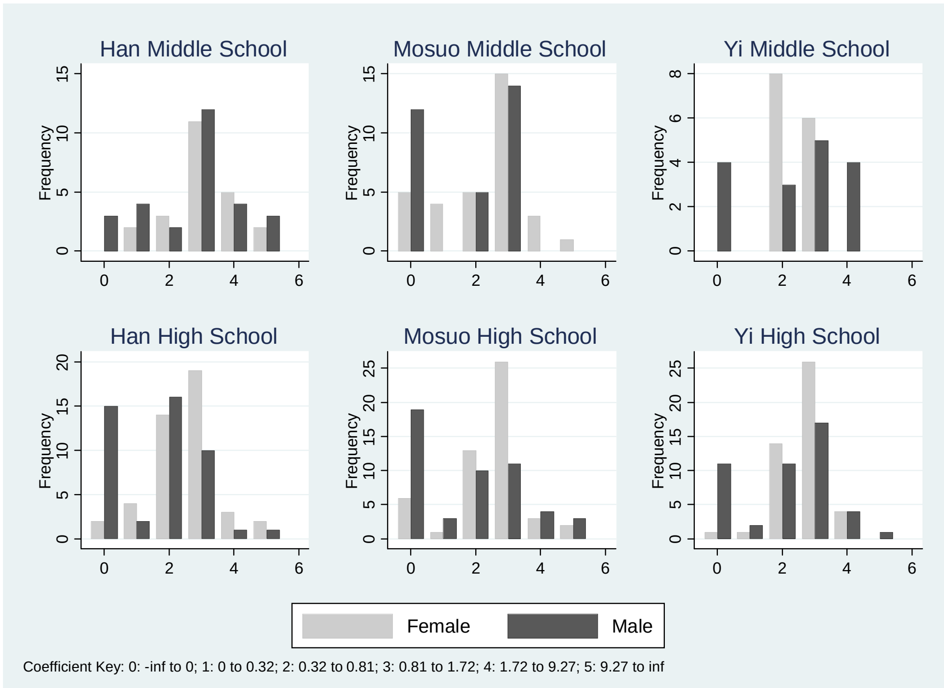


Figure 4: Distribution of Imputed CRRA Coefficients across Ethnicity in Middle school and High school, by Gender

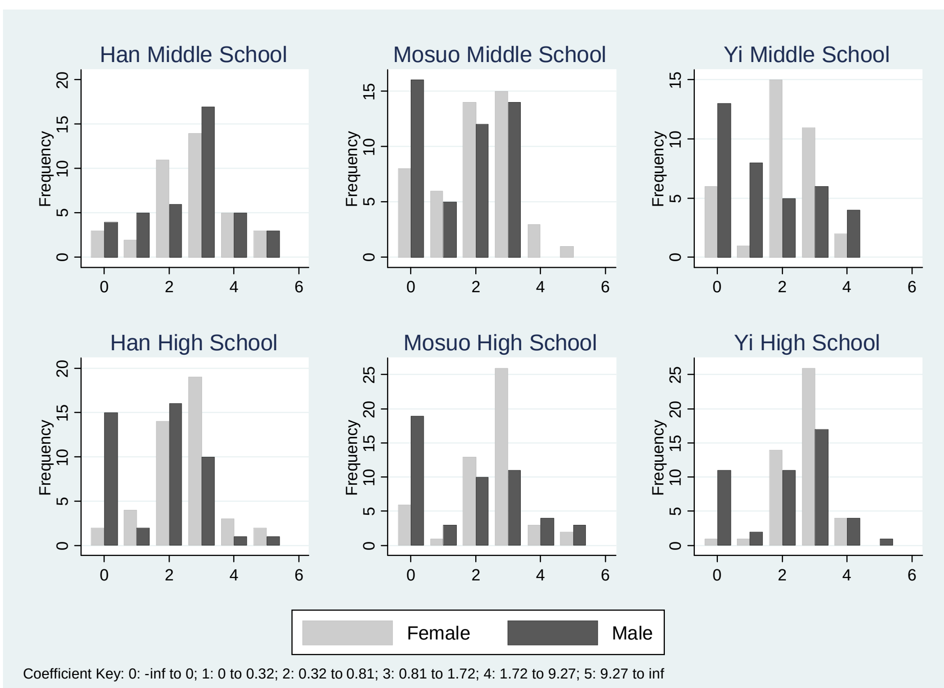


Figure 5: Distribution of the Proxy for Overconfidence

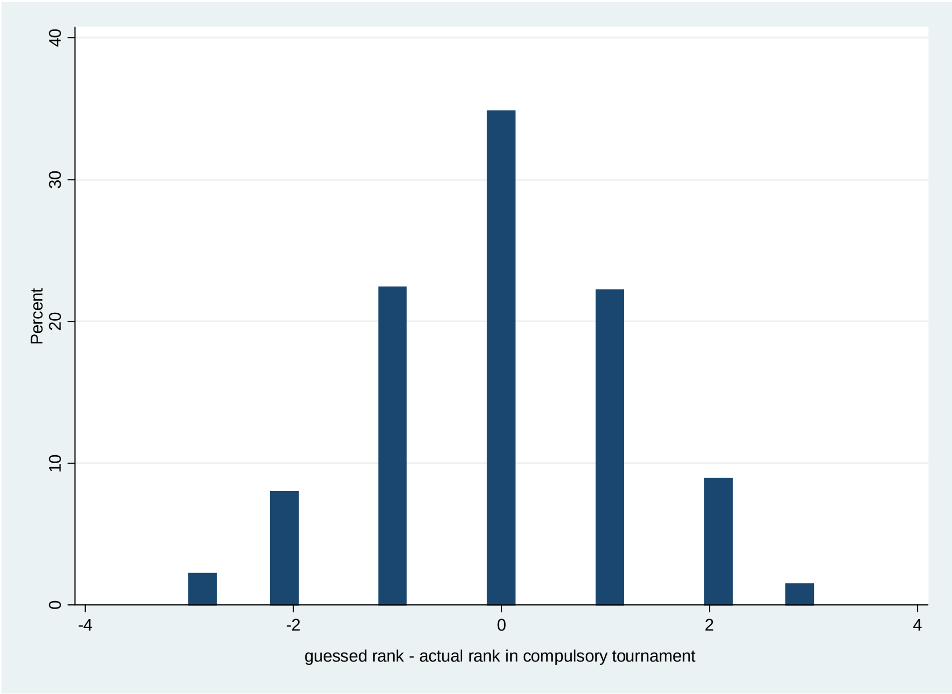


Figure 6: Distribution of the Proxy for Overconfidence across Ethnicity in Middle school and High school, by Gender

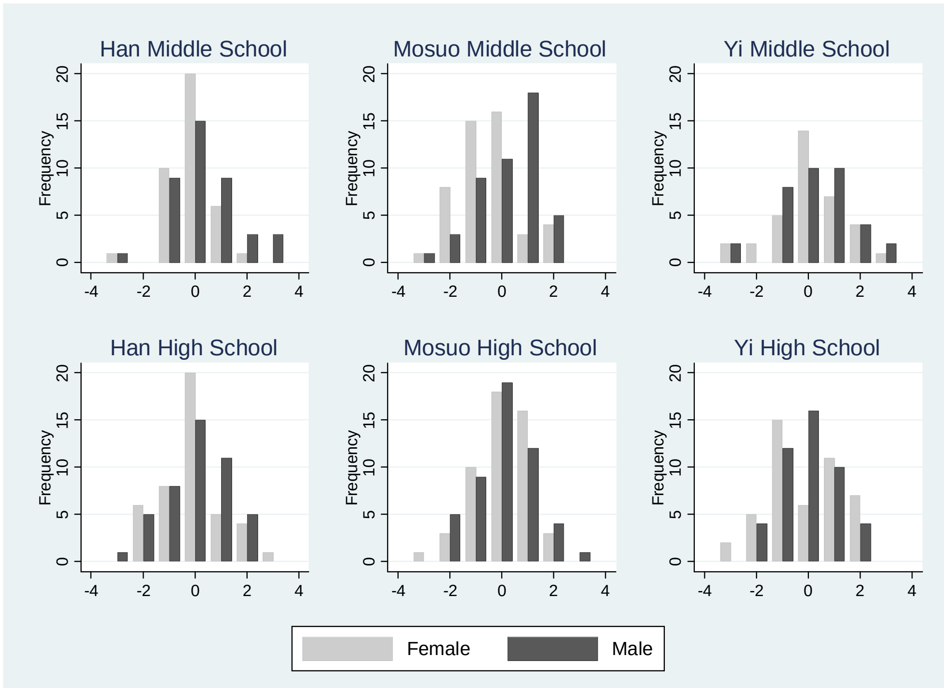


Figure 7: Distribution of the Probability of Winning the Discretionary Tournament across Ethnicity in Middle school and High school, by Gender

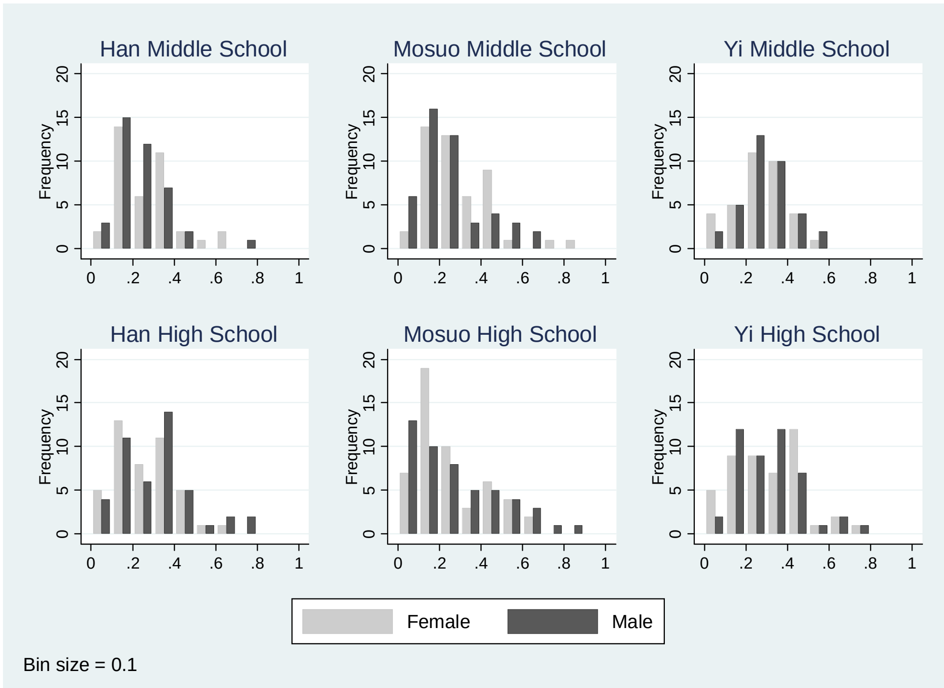


Figure 8: Distribution of Alpha in Middle School and High School

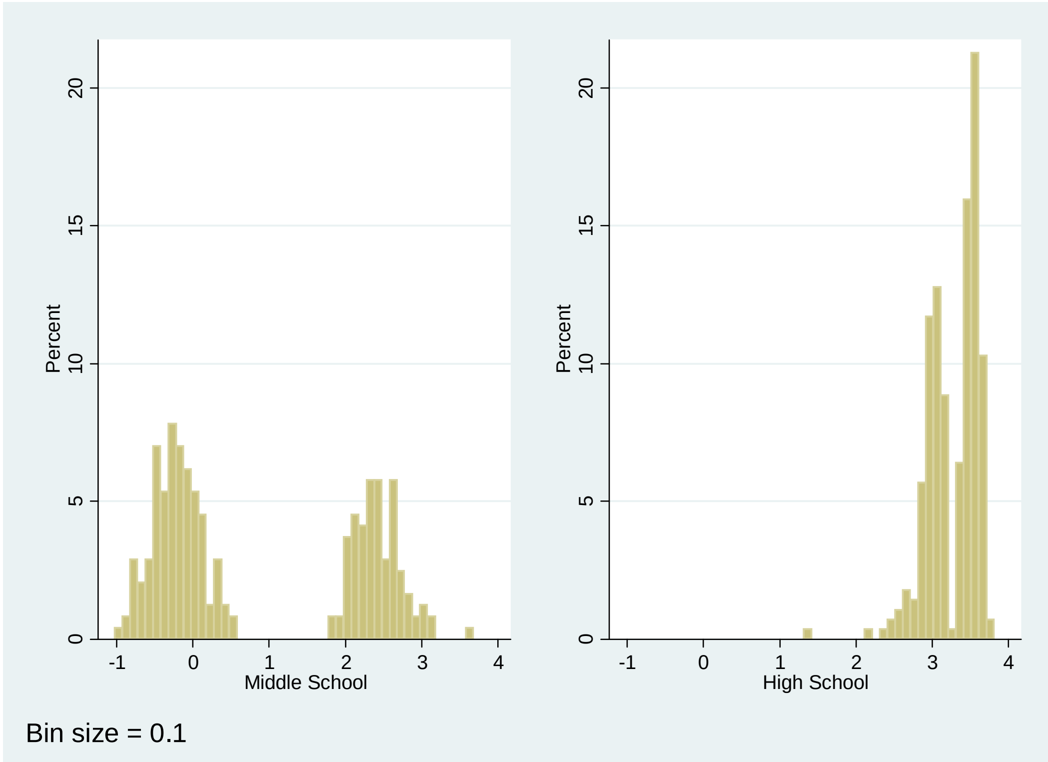


Figure 9: Distribution of Alpha across Ethnicity in Middle school and High school, by Gender

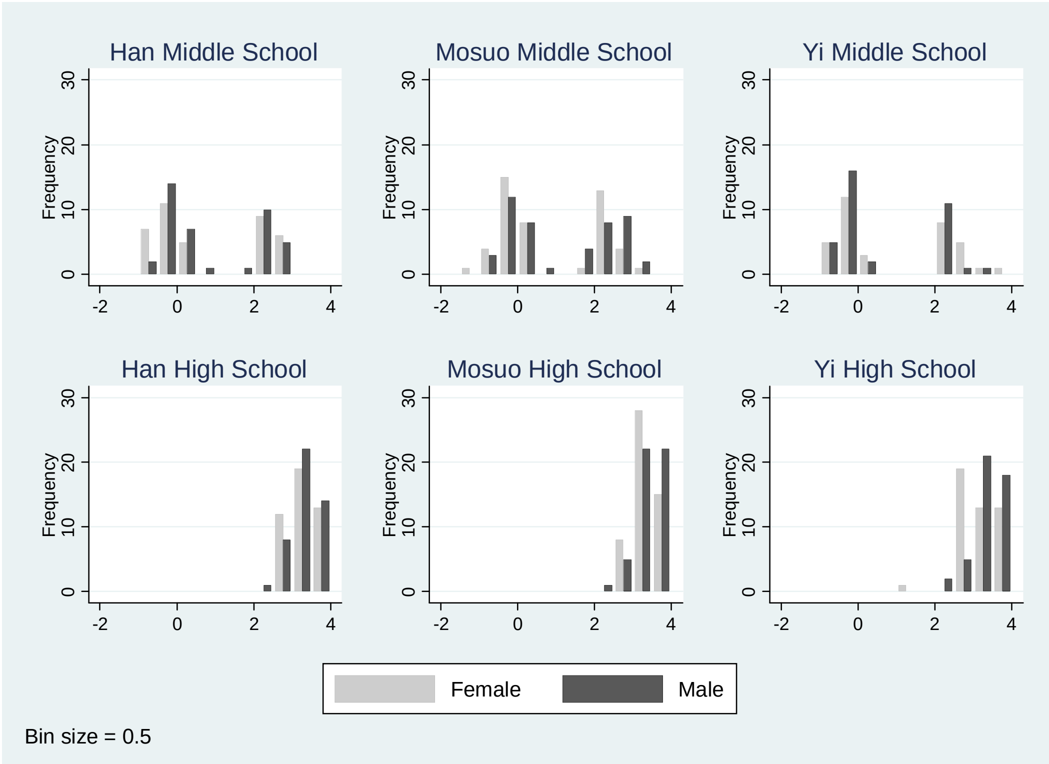


Table 1: Selected Descriptive Statistics (Means; Standard Deviation in Parentheses)

	Han	Mosuo Matrilineal	Yi Patrilineal	F-stat	p-value
Ethnicity correlates					
head of household is female	0.12	0.40	0.12	32.06	0.00
	(0.32)	(0.49)	(0.33)		
head of household is male but related maternally	0.02	0.16	0.01	20.60	0.00
	(0.15)	(0.37)	(0.11)		
parents participating in walking marriage	0.04	0.38	0.10	46.1	0.00
	(0.19)	(0.49)	(0.30)		
Demographics					
age - middle school	15.67	15.84	15.50	1.99	0.14
	(0.98)	(1.08)	(1.17)		
age - high school	18.43	18.38	18.68	2.16	0.12
	(1.19)	(0.94)	(1.18)		
siblings	1.93	1.84	2.52	8.01	0.00
	(1.31)	(2.22)	(1.36)		
SES					
h.h. engaged in agriculture	0.88	0.83	0.84	0.92	0.40
	(0.33)	(0.38)	(0.37)		
h.h. educational attainment (years)	7.52	6.03	6.32	6.70	0.00
	(3.10)	(4.25)	(4.67)		
Observations	176	200	168		

Table 2: Raw Tournament Entry Statistics

	Female	Male	Sex Difference	p-value	obs (Female)	obs (Male)
Competition Entry						
Middle school (avg age 15.7)						
Han (Chinese)	38%	40%	2%	0.890	39	40
Mosuo (Chinese Matrilineal)	42%	48%	6%	0.543	48	48
Yi (Chinese Patrilineal)	42%	36%	-6%	0.635	36	36
Total					123	124
High school (avg age 18.4)						
Han (Chinese)	48%	63%	15%	0.154	48	48
Mosuo (Chinese Matrilineal)	50%	73%	23%	0.015	52	52
Yi (Chinese Patrilineal)	38%	60%	22%	0.025	48	48
Total					148	148
University undergraduates						
Niederle & Vesterlund (2007)						
United States	35%	73%	38%	0.002	40	40
Adults (avg age 30.9; 37.8)						
Gneezy, Leonard, and List (2009)						
Maasai (Tanzanian Patrilineal)	26%	50%	24%	0.040	34	40
Khasi (Indian Matrilineal)	54%	39%	-15%	0.201	52	28
Total					86	68

Table 3: Mixed Logit Estimates

	Middle School	High School
Variable		
α: paramenter of competitive inclination		
mean	0.885**	3.269
	(0.418)	(3.794)
log prob of winning tournament		
mean	0.859***	1.831
	(0.249)	(2.044)
std dev	0.013	6.76
	(0.017)	(9.751)
1-risk aversion		
mean	0.097	0.750
	(0.197)	(1.041)
std dev	0.241	2.092
	(0.373)	(2.836)
Choice situations	243	282
Log likelihood	-158.4	-188.8

Robust standard errors in parentheses, clustered by session
*** p<0.01, ** p<0.05, * p<0.10

Table 4: Structural Approach to Linking Lab and Real World Behavior

Dependent Variable: Take Entrance Exam

	(1)	(2)	(3)	(4)	(5)	(6)
α_i[1]	0.104***	0.072**	0.074**	0.063**	0.066**	
	(0.034)	(0.029)	(0.029)	(0.027)	(0.028)	
$\alpha_i > 0$[1]						0.079**
						(0.036)
regular grades (percentile)		1.154***	1.092***	1.100***	1.073***	1.071***
		(0.436)	(0.399)	(0.374)	(0.386)	(0.399)
regular grades ^{2} (percentile)		-0.726	-0.625	-0.655	-0.611	-0.596
		(0.532)	(0.473)	(0.452)	(0.468)	(0.483)
ethnicity*gender controls	No	No	Yes	Yes	Yes	Yes
Demographic controls	No	No	No	Yes	Yes	Yes
SES controls	No	No	No	No	Yes	Yes
Observations	231	231	231	226	221	221
Log likelihood	-114.1	-98.97	-96.66	-91.55	-88.70	-89.15
Mean dep var	0.792	0.792	0.792	0.792	0.787	0.787

*** p<0.01, ** p<0.05, * p<0.10

Marginal effects; robust standard errors in parentheses, clustered by session.

Probit regression. Dependent variable = 1 if subject has record of taking the high school entrance exam, 0 if subject was known to have not taken the high school entrance exam.

Demographic controls include age, age squared, # brothers, # sisters

SES controls include household engaged in agriculture, education of household head.

[1] α_i is normalized by the estimated population standard deviation.

Table 5: Generalized Residual Approach to Linking Lab and Real World Behavior

	(1)	(2)	(3)
Panel A			
Dependent Variable: Choose the Tournament			
log prob of winning tourn.	0.193***	0.193***	0.218***
	(0.054)	(0.054)	(0.060)
1-risk aversion		0.008	0.008
		(0.018)	(0.018)
overconfidence			0.032
			(0.028)
regular grades (percentile)	0.189	0.203	0.167
	(0.457)	(0.458)	(0.466)
regular grades ^{2} (percentile)	0.244	0.233	0.263
	(0.530)	(0.527)	(0.527)
Observations	224	224	224
Panel B			
Dependent Variable: Take Entrance Exam			
Generalized residual (from Panel A)	0.045**	0.045**	0.044**
	(0.022)	(0.022)	(0.022)
log prob of winning tourn.	-0.150**	-0.137**	-0.122*
	(0.059)	(0.055)	(0.063)
1-risk aversion		-0.031**	-0.031**
		(0.015)	(0.015)
overconfidence			0.022
			(0.022)
regular grades (percentile)	1.338***	1.275***	1.240***
	(0.426)	(0.411)	(0.424)
regular grades ^{2} (percentile)	-0.790*	-0.750*	-0.718
	(0.472)	(0.447)	(0.459)
Observations	221	221	221

*** p<0.01, ** p<0.05, * p<0.10

Marginal effects; robust standard errors in parentheses, clustered by session.
Probit regressions. All specifications include controls for ethnicity-gender main effects and interaction effects; demographic controls for age, age squared, # brothers, # sisters; SES controls for whether the household is engaged in agriculture, education of household head.

Table 6: Regressions of Tournament Entry, Pooled across Ethnicity for Middle School and High School

Dependent Variable: Choose the Tournament

	Middle School			High School		
	(1)	(2)	(3)	(1)	(2)	(3)
male	0.025	0.019	-0.001	0.055	0.052	0.045
	(0.154)	(0.150)	(0.143)	(0.058)	(0.057)	(0.052)
male*Mosuo	0.090	0.046	0.059	0.206**	0.228***	0.191**
	(0.183)	(0.176)	(0.171)	(0.082)	(0.086)	(0.080)
Mosuo	-0.038	-0.016	0.039	-0.020	-0.048	-0.037
	(0.134)	(0.132)	(0.142)	(0.106)	(0.100)	(0.100)
male*Yi	-0.137	-0.190	-0.152	0.163*	0.173**	0.205**
	(0.214)	(0.191)	(0.203)	(0.092)	(0.087)	(0.096)
Yi	0.100	0.079	0.086	-0.169	-0.178*	-0.206*
	(0.118)	(0.123)	(0.118)	(0.115)	(0.103)	(0.108)
log prob of winning tourn.	0.239***	0.264***	0.242***	0.129**	0.138**	0.122**
	(0.062)	(0.060)	(0.055)	(0.059)	(0.061)	(0.059)
1-risk aversion	0.009	0.007	0.005	0.023	0.017	0.020
	(0.017)	(0.017)	(0.017)	(0.015)	(0.014)	(0.014)
overconfidence	0.029	0.035	0.030	0.065***	0.069**	0.057**
	(0.024)	(0.024)	(0.023)	(0.025)	(0.027)	(0.028)
age		0.001	0.006		0.812	0.769
		(0.484)	(0.486)		(0.521)	(0.578)
age^2		0.002	0.002		-0.021	-0.020
		(0.015)	(0.015)		(0.014)	(0.015)
# sisters		-0.028	-0.027		-0.042	-0.037
		(0.019)	(0.018)		(0.031)	(0.037)
# brothers		0.043	0.040		-0.010	-0.015
		(0.034)	(0.036)		(0.019)	(0.020)
Household head agricultural			0.212**			-0.202***
			(0.092)			(0.066)
Education of household head			0.006			-0.017
			(0.009)			(0.012)
School fixed effect	-0.102	-0.074	-0.070	0.024	0.025	0.030
	(0.125)	(0.125)	(0.130)	(0.064)	(0.080)	(0.081)
Observations	243	238	232	282	282	269
Log likelihood	-155.9	-148.0	-144.1	-180.9	-178.3	-167.9
Mean dep var	0.416	0.412	0.418	0.550	0.550	0.550

*** p<0.01, ** p<0.05, * p<0.10
Marginal effects; robust standard errors in parentheses, clustered by session.
Probit regression: dependent variable = 1 if subject chooses to enter competition, 0 otherwise.
Demographic controls include age, age squared, # brothers, # sisters
SES controls include household engaged in agriculture, education of household head.

Table 7: Regressions of Tournament Entry, Separate by Ethnicity

Dependent Variable: Choose Tournament (High School Sample)

	(1)	(2)	(3)
Gender coefficient			
Han	0.061	0.041	-0.025
	(0.088)	(0.080)	(0.078)
Observations	89	89	84
Mosuo (matrilineal)	0.252***	0.265***	0.216***
	(0.050)	(0.065)	(0.073)
Observations	101	101	96
Yi (patrilineal)	0.246***	0.241***	0.308***
	(0.073)	(0.055)	(0.080)
Observations	92	92	89
Experimental controls	Yes	Yes	Yes
Demographic controls	No	Yes	Yes
SES controls	No	No	Yes

*** p<0.01, ** p<0.05, * p<0.10

Marginal effects; robust standard errors in parentheses, clustered by session.

Probit regression: dependent variable = 1 if subject chooses to enter the tournament, 0 otherwise.
Experimental controls include likelihood of winning, risk aversion, and confidence.
Demographic controls include age, age squared, # brothers, # sisters
SES controls include household engaged in agriculture, education of household head.

Table 8: Regressions of Tournament Entry, Separate by Ethnicity with Gender Interactions

Dependent Variable: Choose the Tournament (High School Sample)

	Han	Mosuo Matrilineal	Yi Patrilineal
log prob winning tourn.	0.087	0.106**	0.161*
	(0.117)	(0.049)	(0.092)
male*log prob winning tourn.	0.170	-0.046	0.165*
	(0.207)	(0.102)	(0.094)
1-risk aversion	0.078***	0.009	0.174
	(0.022)	(0.043)	(0.125)
male*(1-risk aversion)	-0.100	-0.014	-0.122
	(0.078)	(0.052)	(0.110)
overconfidence	0.136***	-0.056	0.139**
	(0.032)	(0.043)	(0.062)
male*overconfidence	-0.055	0.034	-0.145
	(0.071)	(0.117)	(0.118)
Main gender effect	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes
SES controls	Yes	Yes	Yes
Observations	84	96	89

*** p<0.01, ** p<0.05, * p<0.10

Marginal effects; robust standard errors in parentheses, clustered by session.

Probit regression: dependent variable = 1 if subject chooses to enter competition, 0 otherwise.

Demographic controls include age, age squared, # brothers, # sisters

SES controls include household engaged in agriculture, education of household head.