Gender Differences in Competitive Inclination and Educational Outcomes: Evidence from Three Ethnic Groups

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Abstract

Recent experimental techniques that isolate the preference for competition has found men to be much more competitively inclined than women (Niederle and Vesterlund, 2007). This evidence leads to an intriguing hypothesis: gender differences in competitive inclination can explain gender inequality in economic outcomes, such as those in a developing countries context. This paper first tests whether experimentally derived measures of competitive inclination can explain a real world choice to compete. I find that competitive inclination has significant explanatory power for the decision to take a competitive high school entrance exam, a decision with serious consequences for my subject pool of rural Chinese middle school students. Second, this paper explores cultural determinants of gender differences in competitive inclination. The subjects come from neighboring matrilineal and patrilineal societies that exhibit gender bias in child preference. Surprisingly, gender differences in competitive inclination are small compared to evidence from the US, and if anything, the largest differences are found in the matrilineal group.

1 Introduction

For the last 50 years, there has been a concerted push for gender equality across the spectrum of activists and academics, with policymakers emphasizing the elimination of institutional barriers to equal rights for women and development economists emphasizing potential efficiency gains from investing in women, for example in women's education or health. More recently, gender equality has gained new attention as part of the UN Millennium Development Project's strategy to eliminate global poverty by 2015. In 2008, 45% of all loans made by the World Bank and 59% of all rural projects funded by the World Bank included gender issues in their designs.[1]

Strides toward gender equality has been made in enrollment in primary education, which has almost reached gender parity worldwide.[2] However, gains have been slow in women's labor force participation, which has essentially remained unchanged at 40% for the last ten years (ILO, 2009), and women's political participation remains low, with women accounting for 16.5% of parliamentarians in developing regions, including seats that are reserved for female politicians (MDG Report, 2008).

Even where legislation has been passed specifically to guarantee women equal rights, equality in outcomes does not always follow. Arable land is one of the most valued possessions in an agrarian economy, and in India it is mainly transferred through inheritance(Agarwal, 2003). Customarily, property is passed down from father to son but women were granted equal inheritance rights by the Hindu Succession Act of 1956(Agarwal, 1994). In reality, however, studies around India show that only 8 – 18% of women with land-owning fathers inherit any land(Agarwal, 2003).

One commonality in the areas of slow progress in gender equality is that access to the "goods" in question, whether it is a salaried job, a political seat, or scarce land, is inherently competitive. For example, land rights experts believe that one reason legal reforms have not translated into land ownership for women in India is that women in a patriarchal Hindu culture are unwilling to compete against their brothers for the parental land(Patel, 2007).

[1] http://web.worldbank.org/

[2] According to the 2008 UN Millennium Development Goals Report, girl to boy enrollment ratios increased from 87% in 1991 to 94% in 2006, for developing regions.

In contrast, primary education, where gender gaps have all but closed, has been made more widely available to through a simultaneous push for universal primary education (see, for example, (MDG Report, 2008), so that at least from the perspective of the student, access is essentially non-competitive.

Because gender inequality is so pervasive, many theories have been put forth to account for its existence. Taste-based discrimination theory was formalized as early as the seventies(Becker, 1971), but empirically it has often been difficult to reject the alternative hypothesis that men and women have different capabilities,[3] or that men and women have different occupational preferences – for example, women may prefer housework over employment outside the home, or they may not want to hold positions of power. On the issue of land rights, some policymakers believe that the reason women do not exercise their rights is because they do not view it as a priority (Agarwal, 2003). A third explanation, one which I will be focusing on, is the possibility that men and women have different preferences for competition.

Generally, with self-reported data, it is hard if not impossible to disentangle these theories of gender inequality from one another. But a recent experiment designed by Niederle and Vesterlund has the potential to isolate the preference for competition. Subjects are divided into groups of four and asked to add up sets of numbers for five minutes. They are paid once on a piece-rate scale (50 cents per correct problem) and once on a tournament scale (the high scorer in the group receives 2 dollars per correct problem and other receive nothing). Subjects are then asked to reveal their competitive inclination by choosing their preferred payment scheme (piece-rate or tournament). Since the incentive is monetary, taste for the prize can be assumed not to differ across subjects. In addition, any ability differences are observable and thus can be controlled for. In Niederle and Vesterlund's sample of University of Pittsburgh students, men chose the tournament almost twice as often as women, even though their performances on the task were not statistically different. Subsequent experiments have largely confirmed this result, although there are is at least one exception [add notes].

An intriguing hypothesis arising from this experimental literature is that gender differences in economic outcomes in developing countries can be explained by differences in

[3] A notable exception is Goldin and Rouse (2000)

competitive inclination. If true, this implies that even if development agencies succeed in giving men and women a level playing field to compete for resources, equal outcomes may not follow. I explore this hypothesis in two parts. First, I test whether the experimental measure of competitive inclination can explain a real world choice involving competition in rural China. Using the experiment developed by Niederle and Vesterlund along with a classic instrument for measuring risk aversion, I elicit competitive preferences from a population of rural Chinese middle school students. I then correlate individual competitive inclination to the decision to take a competitive high school entrance exam, which is arguably one of the most important economic choices facing this population. I find that the experimentally elicited competitive inclination has significant predicative power for the propensity to take the entrance exam, controlling for regular grades.

Second, my paper explores the cultural determinants of gender differences in preference for competition. Cultural norms such as female seclusion or the tradition in patrilineal societies for a bride to move into her husband's family and leave behind her own kinship ties has long been recognized as impediments to gender equality. In addition, the phenomenon of large sex ratios in India and China which Amartya Sen has calculated to result in 100 million "missing women" is generally thought to result from cultural preferences for boys(Sen, 1990). However, to quote Fernandez and Fogli (2009), "The main challenge that any analysis of culture faces is how to separate the effects of culture from those due to strictly economic factors and institutions." To address these concerns, I conduct my study in one county in China where three ethnic groups live in close proximity and attend the same schools.[4] The Mosuo are matrilineal, the Yi are patrilineal, and the Han are traditionally patrilineal but as the majority ethnicity in China, they have been subject to communist policies aimed as disintegrating kinship systems, which minorities tend to be exempt from. Matriliny and patriliny are generally associated with residence structures that are believed to give rise to gender differentiated investment in children. In my study population, evidence of differential investment is found in the lower male-female sex ratios of children under 5 in the matrilineal

[4]In similar research, Gneezy et al. (2008) conduct competition experiments in a matrilineal society in India and a patrilineal society in Tanzania and found that gender differences in experimentally measured competitive inclination run in opposite directions. However, the two societies differ in other ways than in their kinship system, which complicates the interpretation of the results.

society compared to the patrilineal societies. The close proximity of the subjects limits the variation in the macroeconomic climate across ethnic groups. And since the schools in this county share a common curriculum, the problem of disentangling culture from variation in educational institution is avoided. Results show that in middle school, no significant gender differences in competitive inclination exist in any of the cultures. In high school, gender differences are statistically significant, although surprisingly, they are largest in the matrilineal culture and smallest among the the Han.

2 Background

2.1 Experimental subjects

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.[5] 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.[6][7]

With a population of 230,000, Ninglang's three main ethnic groups are the Yi, Han, and Mosuo, comprising 62%, 20%, and 9% of the population, respectively.[8] As a point of comparison, the Han make up 90% of China's population as a whole. Historical records show that the Yi, Han, and Mosuo have coexisted as separate ethnic groups in Ninglang for at least several hundred years.[9]

Modern ethnic identity in China is a relatively rigid concept. In the 1950s, in a reversal of the policies of the Nationalist government, which claimed all ethnic groups in China were off-shoots of the Han, the Communist government issued a call for ethnic registration. Over

[5] The basic standard for qualifying as a nationally designated poor county was rural net income per capita below RMB 150 in 1985 (~$50 using 1985 exchange rates). The standard was changed in 1994 to include more counties, and currently 28% of counties (in China, the term county is reserved for rural regions) are designated poor. See (Park et al., 2002) for details on determinants of poor county designation.

[6] County Statistical Yearbook 2008, accessed from China Data Online

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

[8] China Census 2000 at China Data Online.

[9] The Mosuo have been recorded to inhabit Ninglang since the Tang dynasty (618-907 AD); the Han since the Yuan Dynasty (1271 - 1368 AD); and the Yi began migrating into Ninglang from nearby Sichuan Province in the middle of the Qing Dynasty (1644 - 1911 AD) (Harrell, 2001a).

400 groups responded but detailed field research whittled the officially recognized number of ethnicities down to 55 groups, chiefly relying on Stalin's definition of an ethnicity as a community of people sharing common language, common territory, common economic life, and common culture, although political considerations no doubt also played a factor (Heberer, 1989, p. 31-34). Since the identification of the 56th ethnicity in 1979, many more groups have applied for ethnic status but no new ethnicities have been officially recognized (Heberer, 1989, p. 37-38). Today, ethnicity is required information on official identification documents and ethnic identification is passed from parent to child [10]. The Mosuo in Ninglang are officially categorized as belonging to a different ethnic group, but after repeated petitioning, the government has consented to the Mosuo calling themselves the Mosuo "people," (Harrell, 2001a, p. 70) and have issued official documentation identifying them as such. 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. 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..." (Harell, 2001, p. 8)

Both the Yi and the Han are patrilineal ethnic groups. Patriliny and matriliny refers to "the gender direction of the transmission of associations, rights, and duties from one generation to the next(Harell, 2002)."[11] Most Euro-American societies, for example, are bilateral, in which kinship is traced through both mothers and fathers (Stone, 1997, p. 235). In Yi and Han societies, both lineage and property pass from father to son, and patrilines are important to the establishment of social status. However the Yi place more emphasize than the Han do on the patriline in everyday life. In Han society, only those of high social status possess records of lineage, which may only see use in establishing connections to another high status family. In contrast, all Yi men over the age of 25 are expected to know their patrilines for seven generations back (Hill and Diehl, 2001).

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 (Harell,

[10]This is done at the time of "hukou" registration, which typically happens shortly after birth.

[11]In contrast, patriarchy and matriarchy refers to the gender who typically holds political power. Anthropologists have yet to find a single matriarchal society.

2002). Both the Han and the Yi practice patrilocality, although to differing degrees. If a Han family has no male heirs, the daughter may take a husband into the family. However, even if a Yi girl is not married, at the age of 17 she undergoes a symbolic wedding ceremony in which her membership in her natal family expires (Ayi, 2001). A Yi proverb gives quick insight into the position of daughters in the family: "An egg is both meat and not meat; a daughter is both family member and not (Ayi, 2001)."

The Mosuo are a matrlineal people.[12] 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 "walking marriage." It differs from conventional marriage in that it normally does not involve cohabitation. Instead, "the two partners... work and eat in their own matrilineal homes (Shih and Jenike, 2002)," although it is common practice for the partners to help out in each other's households during agricultural busy season (Shih, 2000). When cohabitation takes places, it is usually due to the need for gender balance in the households of the two partners, and does not signify greater commitment or obligations; the moved-in partner can leave at his or her free will (Shih, 2000). Children are usually reared in their mother's household. While the father will contribute labor or money to the child, the bulk of the responsibility for child rearing rests with the mother and her siblings, with the maternal uncle playing the closest role to a father figure in a child's life.

Although gender relations within a society cannot be adequately summarized using any one measure, the sex ratio of children under five can reflect sex differentiated investment in children. According to the 2000 Census, the boy to girl sex ratio of children under five in Ninglang county is 1.23 for the Yi, 1.14 for the Han, and 1.05 for the Mosuo, which is equal to the US sex ratio for this age group[13] .

[More on communist policies toward the Han]

Table 1 and Table 2 show summary statistics for the students in my sample. Notice that the ethnic correlates correspond to the ethnographic evidence, with the Mosuo more likely to have a female head of household, to be related to the head of the household maternally, and to have parents who are participating in a walking marriage.

[12] See, for example, Shih (1993)and Walsh (2001)

[13] Data accessed from China Data Online

2.2 Education in Ninglang

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. Admission to high school is competitive and is almost exclusively based on an entrance exam.[14] At the very least, one must take the entrance exam in order to be admitted - I found not a single case of someone who did not take the exam but went to high school. In my sample, about 80% of middle schoolers take the entrance exam, and less than 30% go on to high school without repeating. 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.

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. An administrator described the enrollment process thusly: all students are sorted by their scores on the entrance exam. Students with odd-numbered rankings are designated for one school and those with even-numbered rankings are designated for the other school.

The fees for the entrance exam is around $70 and mainly covers three days 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 always want the student to take the entrance exam, therefore 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 on the barriers to education in rural Gansu province that surveyed over 2000 students and families(Hannum and Adams, 2009). Of the children aged 13-16 who drop out of school, the survey found that the top two reasons were

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

poor performance and unwillingness to attend. The comments from in-depth interviews conducted in Gansu echo the sentiments I heard in Ninglang. One student says: "[My parents] want me to study well; [they say] '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 explains her position: "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 regular term exam were collected from each school and matched to the roster by name. High school entrance exam scores were obtained from the county bureau of education. All names of students who did not have an exam record were double checked with middle school teachers to confirm that they had not taken the exam. In some cases, a typo or name change was found and students were matched to their exam record. 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.

High school enrollment data was obtained from high school students who just graduated from either of the two middle schools in my study. For subjects in grade 9 in 2008, 4 students in each high school, two from each middle school, were interviewed about the students on the experimental roster. They were asked whether the student attended attended high school, and if so, which one. In each high school, students from the same middle school were encouraged to confirm their answer between themselves. 74% of the time students from the two high schools agreed about where the subject went to high school. The rest of the time I relied on students' information about their own school.

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 10, 11, and 12 were recruited. Subjects were randomly recruited from the schools' rosters within ethnicity and balanced by gender so that each session consisted of one ethnic group and was evenly divided across gender. Session size ranged from 8 to 24. 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, generally ones that were designated for taking exams. No shows were replaced by the first students on the randomized roster that matched on ethnicity and gender. All experimental instructions were read out loud by me in Mandarin, which is the national luggage as well as the official language of instruction. Hard copies were also passed out to everyone. Sessions lasted around an hour and half. Where computer labs were available for use, experimental responses were captured on computers using the Z-tree program, but where it was not available, responses were written on paper and graders were utilized to grade during the sessions. 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 will be referred to as 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.[15]

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

Stage 3: Discretionary tournament - subjects first choose which of the two types of compensation scheme (piece-rate or tournament) they'd 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 are paid 2 RMB per problem if they score highest their group of four, and nothing if there is someone in their group who scores higher than they do.

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 externally on others or strategic response to beliefs about other participants' choices.

Subjects are told 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 were asked to guess their rank in the compulsory tournament. 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 given out 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 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 developing research to elicit risk preferences. The formatting of the instrument is taken 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 6 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 is displayed in Figure 2. Although there is a mass at risk neturality, there is non-trivial distribution in the risk averse range. 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 weath effects have not been found to be important.[16]

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. The validity of this method relies on the assumption that data are missing at random, or that the value of the missing variable is not correlated with the fact that it is missing. In this case, since we know that 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 results are robust to assuming risk neutrality for everyone.

3.4 Summary statistics

Raw summary statistics on rate of tournament entry from this study is put in context with previous experimental results in Table 3.

[16]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.

4 Structural Model

Following de Palma et al. (2008), the optimal tournament entry decision is modeled in a random utility model framework under expected utility:

$$\sum_{j=1}^{J} p_j U_i(I_j) + \epsilon_{ij} \tag{1}$$

where discrete alternatives are indexed by j, and preferences may vary across individuals, indexed by i. ϵ_{ij} is a residual reflecting unobserved heterogeneity. As in Holt and Laury (2002), preferences are characterized by constant relative risk aversion: $u = I^{1-\gamma}/(1-\gamma)$, where I is payout[17] and γ is the coefficient of constant relative risk aversion. I make the additional assumption that $u(0) = 0$. The CRRA functional form for utility is used for its tractability within the structural model[18]. Let U_{it} and U_{ipr} be person i's utility from choosing the tournament and piece rate option, respectively:[19]

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

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

where the tournament option is chosen iff $U_{it} > U_{ipr}$. p_i represents the true probability of winning the tournament; q_i is a measure of over- or underconfidence such that $p_i q_i \in (0, 1)$ represents the subjective probability of winning; s_i represents the number of correctly solved

[17]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 variation 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, which would make the expected utility of income and the expected utility of wealth models roughly equal.

[18]Binswanger (1981)finds that although risk aversion increased with the size of the game stakes, estimation was not 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 is roughly the range of the change in stakes in the present research.

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

problems in the compulsory tournament stage; and γ_i represents the individual coefficient of constant relative risk aversion. α, the parameter of interest, represents the taste or distaste for competition over and above what can be accounted for by risk preferences and the subjective probability of winning. If we assume $q_i = 1$, then α represents the degree to which people deviate from optimal behavior based on objective probabilities, and captures all reasons for that deviation, including, for example, cultural factors, or overconfidence. $\epsilon_{it}$and ϵ_{ipr} are iid mean zero normal error terms.

I assume that ability is known up to some noise around the actual score:

$$a_i = s_i + k\xi_i \tag{4}$$

where s_i are the realized scores in the compulsory tournament stage; $\xi_i$is an extreme value type I noise term, and k represents the scale of 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:

$$p_i = pr(a_i > a_j,\, j \neq i) = \frac{\exp(ks_i)}{\sum_{j \in g} \exp(ks_j)} \tag{5}$$

As a first pass, I set σ_s, the standard deviation of ξ_i, to be the standard error of the mean of the scores in the full sample, and calculate k accordingly. A more thorough approach would be to grid over plausible values of k and choose the value that maximizes the likelihood function. 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 relative standing. p_i can then be fully proxied by one's own realized score s_i.

5 High school entrance exam

5.1 Index of Competitive Inclination

In order to correlate competitive inclination elicited in the experiment to the real-life decision of taking an entrance exam, following the structural model, I develop an individual index of competitive inclination. Using the objective probability of winning and the risk aversion bands implied by subject choice in the Binswanger risk instrument, I identify thresholds of optimal tournament entry. I assign +1 to subjects who should not enter but do; -1 to subjects who should enter but do not; and 0 to subjects who either behave optimally, or fall into a gray area in which either entry choice could be consistent with expected utility maximization behavior. Essentially, I manually created individual αs. Figure 3 provides an illustration. The backdrop is a kernel density of the objective probability of winning. The illustration uses CRRA coefficients ranging from 0.32 to 0.81 (or the third choice in the risk instrument) such that the vertical lines represent the probabilities at which the expected utility maximizing choice switches from entering the tournament to not entering. Those above the right line who do not enter are deemed under-competitive (-1), those below the left line who do enter are deemed over-competitive (+1), and those who are in the area between the lines, or those who enter optimally are deemed neutral (0).

5.2 Estimation Results

Table 4 and Table 5 show results from probit regressions of the propensity to take the high school entrance exam on the index of competitive inclination, controlling for regular term grades and other controls.

Note that the index of competitive inclination includes the effects of overconfidence in one's ability. In that light, the results can be more precisely stated as: competitive inclination as defined by more or less competition than actual abilities and risk preferences would warrant is predictive of the propensity to take the entrance exam, conditional on grades and other demographic and SES controls.

Table 6 and Table 7 show results from probit regressions of the propensity to attend high school on the index of competitive inclination, controlling for whether someone has passed the entrance exam and other controls.

5.3 Value of the Index of Competitive Inclination

An open question in the literature on competitive preferences is whether women are under-competing. Findings of large gender differences in tournament entry rate does not necessarily mean that women are not competing enough, or that men are competing too much. One contribution of the structural model is that it provides a standard for comparing actual behavior against optimal behavior. Figure 4 shows the value of the competitive inclination index by gender, and across ethnic groups. In no group do females have negative competitive inclination.

6 Culture

6.1 Estimation

While an individual measure of competitive inclination is necessary for correlating experimental results to real world choices, the index method does not take into account magnitude differences in preference or dispreference for competition. For example, someone who has no chance of winning the tournament is treated the same way as someone who just missed the threshold for entry by the index method. Since testing for ethnic group differences does not require individual measures, I employ a regression approach to take advantage of its ability to capture magnitudinal differences in preference for competition.

Following the structural model above, taking logs of U_{it} and U_{ipr} and differencing reduces to the following structural equation:

$$y_i = \alpha + \ln p_i + \ln q_i + \ln 4(1-\gamma_i) + \epsilon_i \tag{6}$$

where $y_i = \mathbf{1}(\ln U_{it} > \ln U_{ipr})$ and $\epsilon_i = \epsilon_{it} - \epsilon_{ipr}$ is distributed iid probit with variance σ_ϵ^2. The way that α enters the equation implies that only proportional differences between U_{it} and U_{ipr} in utility matter, not absolute differences. $\ln 4$ represents the designed incentive from winning the tournament compared with the piece-rate payout. As expected with CRRA preferences, the scale of the payout, s_i, drops out.

The reduced form estimation equation for testing gender differences across cultures is as follow:

$$y_i = \beta_0 + \beta_1 male_i + \sum_{j=2}^{3} \beta_j ethn_{ji} \times male_i + \sum_{j=1}^{3} \beta_{j+3} ethn_{ji} + \delta p_i + \lambda q_i + \tau \gamma_i + \epsilon_i \qquad (7)$$

where $y = 1$ if the subject chooses tournament and 0 if the subject chooses piece-rate. p_i is measured in the same way as above. q_i, the measure of over or under confidence, is proxied by subtracing the actual rank in the compulsory tournament from the guessed rank, and takes on integer values between -3 and 3. γ_i, the coefficient of relative risk aversion, differs from above in that it is treated as a continuous variable here. Following Binswanger (1980) and Binswanger (1981), I use the geometric mean of the endpoints of each range for the point estimate of γ. $ethn_{1i}$, $ethn_{2i}$, and $ethn_{3i}$ are indicator variables for Mosuo, Han, and Yi, respectively. $male_i$is an indicator variable taking the value of 1 for males and 0 for females.

6.2 Estimation Results

The results for middle school subjects are reported in Table 8 and results for high school subjects are reported in Table 9.

7 Discussion

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Table 1: Descriptive Statistics for Middle School Subjects

Middle School	Mosuo Matrilineal	Han Patrilineal1	Yi Patrilineal2	F-stat	p-value
Demographics					
age	15.84	15.67	15.50	1.986	0.139
	(1.08)	(0.98)	(1.17)		
# brothers	0.94	0.91	1.54	8.656	0.000
	(1.19)	(0.88)	(0.98)		
# sisters	0.98	1.01	1.43	3.615	0.028
	(1.26)	(0.97)	(1.10)		
Ethnicity correlates					
sex of h.h. (1 = male)	0.53	0.94	0.91	31.829	0.000
	(0.50)	(0.25)	(0.29)		
h.h. related to subject through mother	0.43	0.04	0.09	29.363	0.000
	(0.50)	(0.19)	(0.29)		
parents participating in walking marriage	0.52	0.06	0.09	38.266	0.000
	(0.50)	(0.25)	(0.29)		
parents of different ethnicities	0.20	0.13	0.12	1.258	0.286
	(0.40)	(0.34)	(0.32)		
SES					
h.h. engaged in agriculture	0.87	0.99	0.97	5.950	0.003
	(0.34)	(0.11)	(0.17)		
h.h. educational attainment (years)	5.10	6.97	4.46	9.647	0.000
	(4.00)	(3.04)	(3.83)		
yearly household income (100 RMB)	161.95	99.32	73.96	8.609	0.000
	(191.26)	(91.45)	(63.85)		
Beliefs					
I can do anything that I put my mind to (1 = Agree)	0.87	0.88	0.94	1.086	0.339
	(0.34)	(0.32)	(0.24)		
School administrative data					
most recent scores on math exam	66.71	60.53	53.16	5.865	0.003
	(26.28)	(27.11)	(19.80)		
Observations	96	80	72		

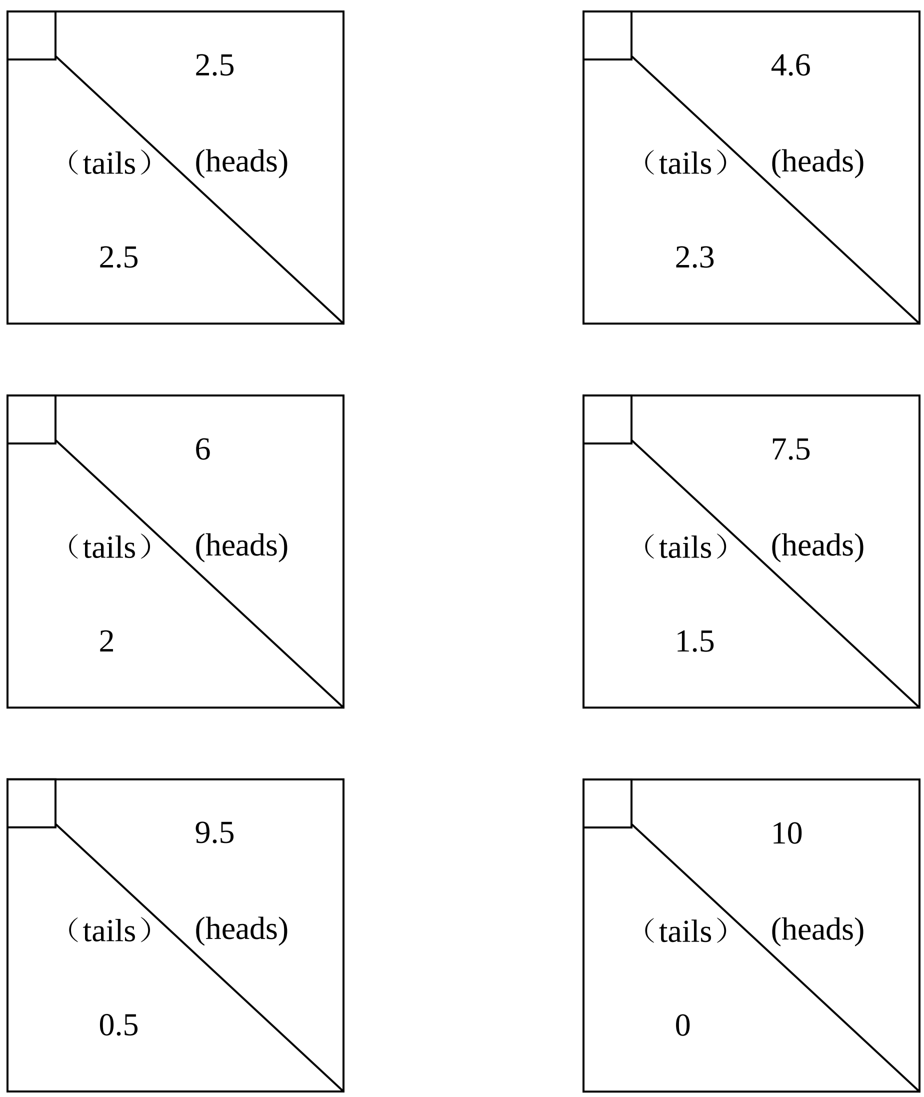
standard deviation in parentheses

Figure 1: Risk aversion 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: Histogram of CRRA Coefficients

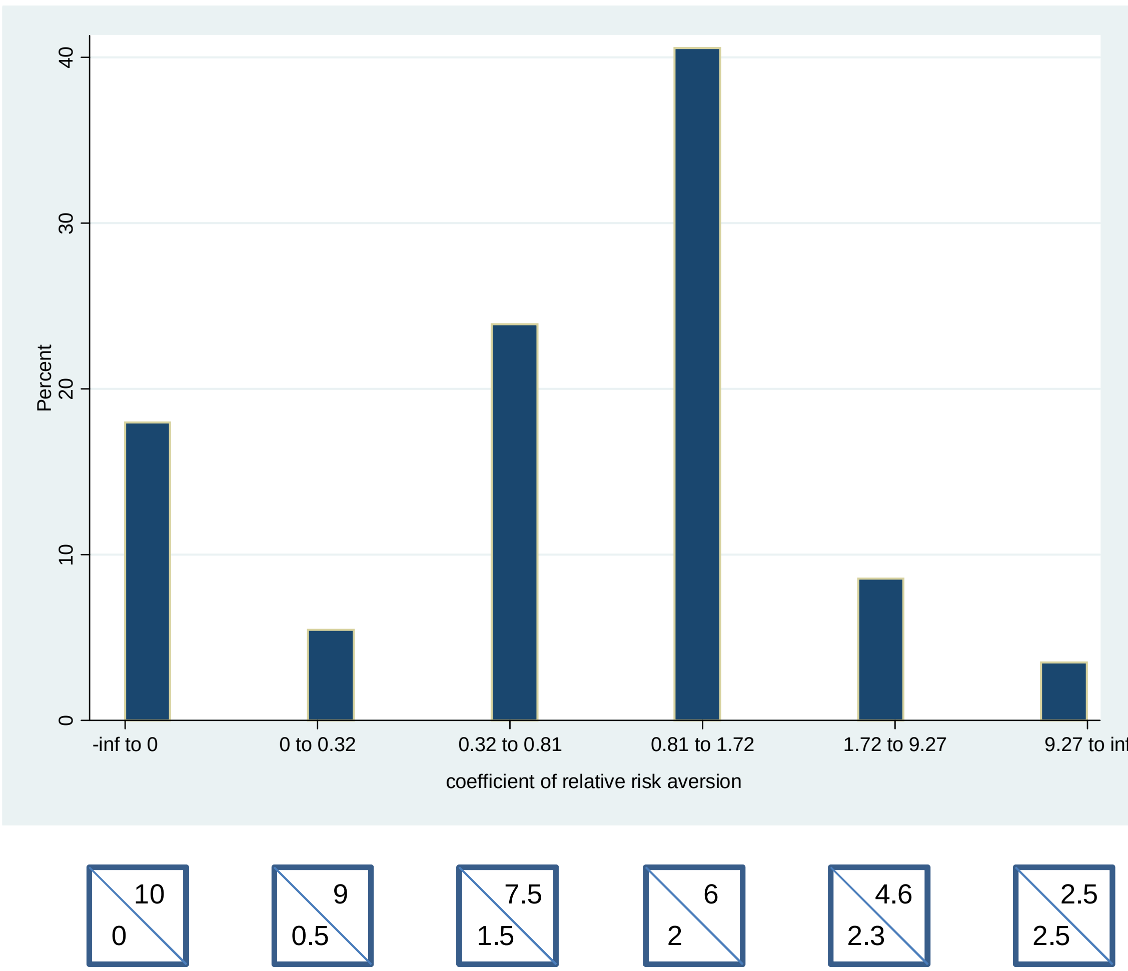


Figure 3: Construction of Index of Competitive Inclination

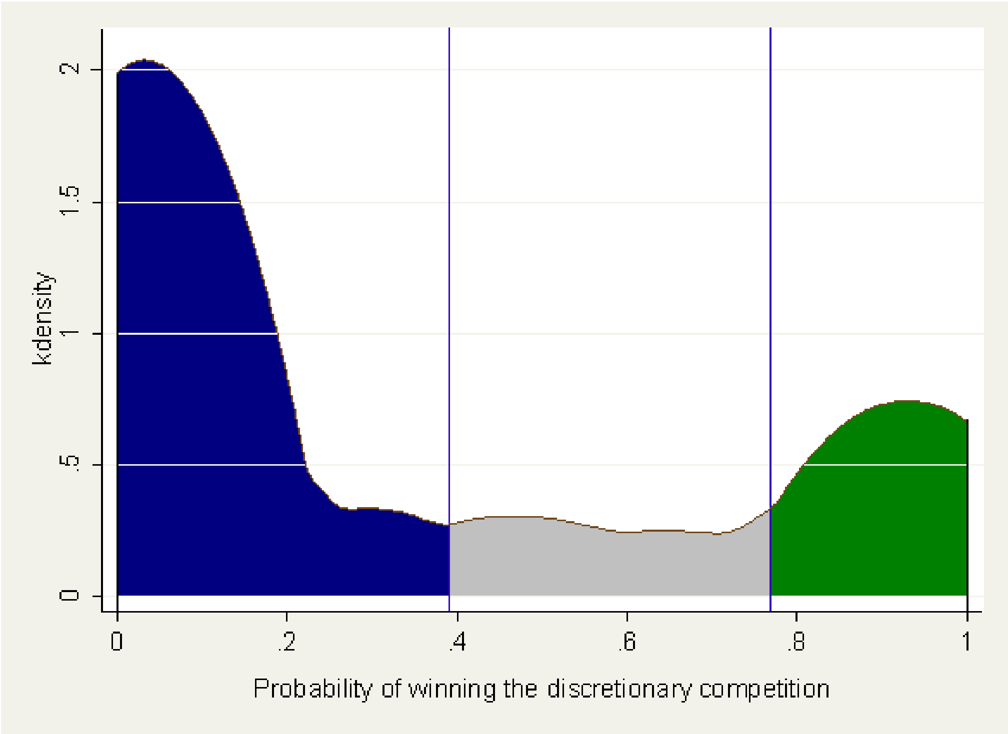


Illustration using coefficient of constant relative risk aversion ranging from 0.32 to 0.81, or the third choice in the risk instrument.

Figure 4: Competitive Inclination Index: Group Means

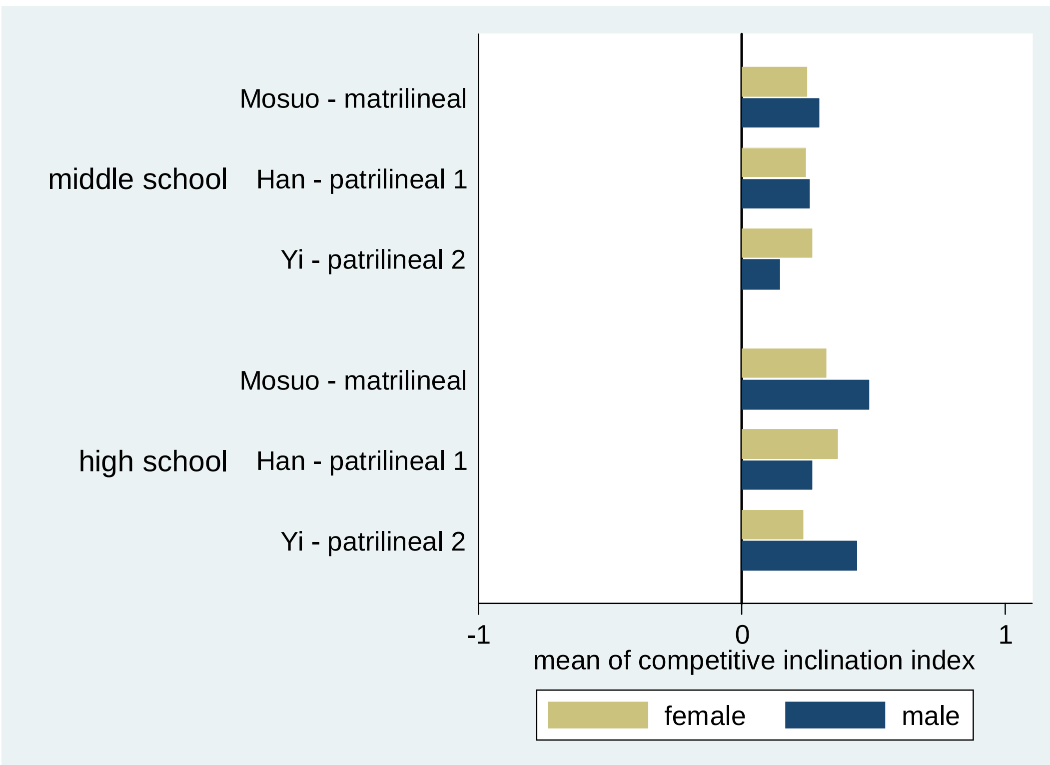


Table 2: Descriptive Statistics for High School Subjects

High School

	Mosuo Matrilineal	Han Patrilineal1	Yi Patrilineal2	F-stat	p-value
Demographics					
age	18.08	18.43	18.68	8.216	0.000
	(1.15)	(1.19)	(1.18)		
# brothers	0.90	0.90	1.17	2.314	0.101
	(1.10)	(1.01)	(0.94)		
# sisters	0.87	1.04	1.04	0.652	0.522
	(1.66)	(1.08)	(1.06)		
Ethnicity correlates					
sex of h.h. (1 = male)	0.70	0.84	0.85	4.958	0.008
	(0.46)	(0.37)	(0.36)		
h.h. related to subject through mother	0.33	0.16	0.14	7.693	0.001
	(0.47)	(0.37)	(0.35)		
parents participating in walking marriage	0.25	0.01	0.11	12.462	0.000
	(0.43)	(0.11)	(0.31)		
parents of different ethnicities	0.38	0.08	0.07	24.500	0.000
	(0.49)	(0.28)	(0.26)		
SES					
h.h. engaged in agriculture	0.74	0.78	0.75	0.278	0.758
	(0.44)	(0.41)	(0.44)		
h.h. educational attainment (years)	7.47	7.98	7.67	0.395	0.674
	(4.34)	(3.10)	(4.78)		
yearly household income (100 RMB)	153.17	125.22	127.33	1.756	0.175
	(140.65)	(94.20)	(107.77)		
Beliefs					
I can do anything that I put my mind to (1 = Agree)	0.96	0.89	0.88	2.653	0.072
	(0.20)	(0.31)	(0.32)		
School administrative data					
most recent scores on math exam	46.09	46.03	44.40	0.334	0.717
	(16.26)	(17.26)	(16.98)		
Observations	128	96	96		

standard deviation in parentheses

Table 3: Raw Tournament Entry Statistics

	Female	Male	p-value of sex difference	obs (Female)	obs (Male)
Competition Entry					
Middle school (avg age 15.7)					
Mosuo (Chinese Matrilineal)	42%	48%	0.543	48	48
Han (Chinese Patrilineal)	38%	40%	0.890	39	40
Yi (Chinese Patrilineal)	42%	36%	0.635	36	36
Total				123	124
High school (avg age 18.4)					
Mosuo (Chinese Matrilineal)	48%	72%	0.007	64	64
Han (Chinese Patrilineal)	48%	63%	0.154	48	48
Yi (Chinese Patrilineal)	38%	60%	0.025	48	48
Total				160	160
University undergraduates					
Niederle & Vesterlund (2007)					
University of Pittsburgh Students	35%	73%	0.002	40	40
Adults (avg age 30.9; 37.8)					
Gneezy, Leonard, and List (2008)					
Maasai (Tanzanian Patrilineal)	26%	50%	0.040	34	40
Khasi (Indian Matrilineal)	54%	39%	0.201	52	28
Total				86	68

Table 4:

Dependent Variable	Take Entrance Exam					
	(1)	(2)	(3)	(4)	(5)	(6)
competitive inclination index	0.125***	0.096***	0.094***	0.088***	0.113***	
	(0.038)	(0.033)	(0.034)	(0.034)	(0.031)	
ci index = 0						0.157*
						(0.094)
ci index = 1						0.190***
						(0.040)
regular grades (percentile)		0.640***	0.650***	0.640***	0.651***	0.653***
		(0.105)	(0.101)	(0.102)	(0.101)	(0.103)
Ethnicity*gender interactions	No	No	Yes	Yes	Yes	Yes
Demographic controls	No	No	No	Yes	Yes	Yes
SES controls	No	No	No	No	Yes	Yes
Observations	230	230	230	225	192	192
Log likelihood	-112.7	-96.04	-93.86	-88.41	-73.39	-73.31
Mean dep var	0.796	0.796	0.796	0.796	0.786	0.786

*** 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 income, household engaged in agriculture, education of household head.
Main effects of ethnicity are suppressed.

Table 5:

Dependent Variable	Take Entrance Exam					
	(1)	(2)	(3)	(4)	(5)	(6)
male	-0.139**	-0.148*	-0.153*	-0.168*	-0.133	-0.138
	(0.065)	(0.077)	(0.080)	(0.090)	(0.116)	(0.113)
male*Han (patrilineal 1)	0.153	0.143*	0.140*	0.135*	0.156**	0.159**
	(0.115)	(0.085)	(0.079)	(0.074)	(0.070)	(0.069)
male*Yi (patrilineal 2)	0.121	0.095	0.106	0.095	0.071	0.075
	(0.077)	(0.080)	(0.069)	(0.063)	(0.090)	(0.086)
regular grades (percentile)		0.676***	0.650***	0.640***	0.651***	0.653***
		(0.098)	(0.101)	(0.102)	(0.101)	(0.103)
competitive inclination index			0.094***	0.088***	0.113***	
			(0.034)	(0.034)	(0.031)	
ci index = 0						0.157*
						(0.094)
ci index = 1						0.190***
						(0.040)
Demographic controls	No	No	No	Yes	Yes	Yes
SES controls	No	No	No	No	Yes	Yes
Observations	230	230	230	225	192	192
Log likelihood	-113.4	-96.37	-93.86	-88.41	-73.39	-73.31
Mean dep var	0.796	0.796	0.796	0.796	0.786	0.786

*** 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 income, household engaged in agriculture, education of household head.
Main effects of ethnicity are suppressed.

Table 6:

Dependent Variable	Attend High School					
	(1)	(2)	(3)	(4)	(5)	(6)
competitive inclination index	0.153***	0.095**	0.090**	0.075*	0.090**	
	(0.053)	(0.044)	(0.045)	(0.039)	(0.043)	
ci index = 0						0.030
						(0.067)
ci index = 1						0.157*
						(0.091)
pass entrance exam (binary)		0.779***	0.793***	0.784***	0.824***	0.824***
		(0.047)	(0.054)	(0.058)	(0.037)	(0.037)
Ethnicity*gender interactions	No	No	Yes	Yes	Yes	Yes
Demographic controls	No	No	No	Yes	Yes	Yes
SES controls	No	No	No	No	Yes	Yes
Observations	233	233	233	220	194	194
Log likelihood	-130.4	-56.00	-53.59	-48.45	-39.69	-39.61
Mean dep var	0.266	0.266	0.266	0.255	0.263	0.263

*** 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 income, household engaged in agriculture, education of household head.

Table 7:

Dependent Variable	Attend High School					
	(1)	(2)	(3)	(4)	(5)	(6)
male	0.085	0.066	0.065	0.044	0.147	0.150
	(0.119)	(0.143)	(0.141)	(0.131)	(0.152)	(0.152)
male*Han (patrilineal 1)	-0.058	-0.080	-0.093	-0.069	-0.133*	-0.134*
	(0.145)	(0.118)	(0.110)	(0.103)	(0.078)	(0.079)
male*Yi (patrilineal 2)	-0.093	-0.164**	-0.158**	-0.124**	-0.165**	-0.167**
	(0.130)	(0.067)	(0.066)	(0.061)	(0.073)	(0.073)
pass entrance exam (binary)		0.800***	0.793***	0.784***	0.824***	0.824***
		(0.050)	(0.054)	(0.058)	(0.037)	(0.037)
competitive inclination index			0.090**	0.075*	0.090**	
			(0.045)	(0.039)	(0.043)	
ci index = 0						0.030
						(0.067)
ci index = 1						0.157*
						(0.091)
Demographic controls	No	No	No	Yes	Yes	Yes
SES controls	No	No	No	No	Yes	Yes
Observations	233	233	233	220	194	194
Log likelihood	-132.1	-54.95	-53.59	-48.45	-39.69	-39.61
Mean dep var	0.266	0.266	0.266	0.255	0.263	0.263

*** 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 income, household engaged in agriculture, education of household head.
Main effects of ethnicity are suppressed.

Table 8:

Middle School

Dependent Variable	Choose Tournament				
	(1)	(2)	(3)	(4)	(5)
male	0.088	0.087	0.038	-0.068	-0.134**
	(0.099)	(0.101)	(0.095)	(0.044)	(0.057)
male * Han (patrilineal 1)	-0.014	-0.028	0.024	0.024	0.112
	(0.140)	(0.144)	(0.153)	(0.159)	(0.162)
male * Yi (patrilineal 2)	-0.145	-0.149	-0.148	-0.009	-0.005
	(0.196)	(0.199)	(0.194)	(0.213)	(0.218)
liklihood of winning	0.142*	0.188**	0.221**	0.333***	0.315***
	(0.076)	(0.092)	(0.093)	(0.106)	(0.090)
risk aversion	0.007	0.007	0.009	0.017	0.021
	(0.013)	(0.013)	(0.014)	(0.014)	(0.015)
confidence		0.027	0.034	0.072**	0.082**
		(0.029)	(0.030)	(0.032)	(0.032)
Demographic controls	No	No	Yes	Yes	Yes
SES controls	No	No	No	Yes	Yes
Ethnicity correlates	No	No	No	No	Yes
School Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	242	240	235	199	194
Log likelihood	-161.5	-159.7	-151.8	-121.1	-111.5
Mean dep var	0.417	0.417	0.413	0.422	0.428

*** 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 income, household engaged in agriculture, education of household head.
Ethnicity correlates include sex of household head, maternal relation to household head, and parents participating in walking marriage.
Main effects of ethnicity are suppressed.

Table 9:

High School

Dependent Variable	Choose Tournament				
	(1)	(2)	(3)	(4)	(5)
male	0.248***	0.247***	0.242***	0.256***	0.309***
	(0.045)	(0.045)	(0.052)	(0.045)	(0.065)
male * Han (patrilineal 1)	-0.186**	-0.206***	-0.193**	-0.211***	-0.270***
	(0.080)	(0.072)	(0.079)	(0.064)	(0.071)
male * Yi (patrilineal 2)	-0.041	-0.022	0.005	0.005	-0.018
	(0.096)	(0.115)	(0.121)	(0.158)	(0.186)
liklihood of winning	0.189**	0.324***	0.312***	0.330***	0.427***
	(0.095)	(0.103)	(0.104)	(0.098)	(0.109)
risk aversion	-0.026*	-0.027*	-0.022	-0.035***	-0.036***
	(0.015)	(0.014)	(0.015)	(0.014)	(0.012)
confidence		0.077***	0.076***	0.082***	0.099***
		(0.029)	(0.029)	(0.027)	(0.033)
Demographic controls	No	No	Yes	Yes	Yes
SES controls	No	No	No	Yes	Yes
Ethnicity correlates	No	No	No	No	Yes
School Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	304	303	303	262	222
Log likelihood	-198.0	-193.3	-190.0	-157.4	-127.8
Mean dep var	0.546	0.545	0.545	0.538	0.559

*** 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 income, household engaged in agriculture, education of household head.
Ethnicity correlates include sex of household head, maternal relation to household head, and parents participating in walking marriage.
Main effects of ethnicity are suppressed.