

Essays on Gender, Competition, and Educational Outcomes

By

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Abstract

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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. The second chapter of this dissertation 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 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 prior test scores. Contrary to results from studies in adult populations, no gender differences were found in competitive inclination. Likewise, no gender difference was found in exam taking behavior, controlling for prior test scores.

The underrepresentation of women in leadership roles could also reinforce gender differences in competitive inclination in a “low” equilibrium. The third chapter of this dissertation studies adult competitive inclination in China, a country which has deliberately sought to move to a “high” equilibrium through massive coordinated government action. Competitive inclination is elicited from three ethnic groups in a “cultural laboratory”: the majority Han Chinese, a matrilineal minority group, and a patrilineal minority group. The Han Chinese exhibited no statistically significant gender differences in competitive inclination. Women in the patrilineal minority, where clan leaders arrange marriages, are less competitively inclined than the men, and the men are as competitively inclined than the Han Chinese. Women in the matrilineal minority are as competitively inclined as the Han Chinese but the men are more competitively inclined. This non-intuitive result may be explained by the special non-exclusive nature of “marriages” in the matrilineal group. These findings suggest that coordinated government action can shape competitive preferences, which have the potential to lead to organic increases in gender diversity in leadership roles. More broadly, they support the case for quotas for women in parliament and corporate boardrooms.

Acknowledgments

In working on my dissertation I have come to realize that no scholarly work is ever a solo achievement. The completion of this dissertation would not have been possible without my advisors and other faculty at Berkeley, my fellow graduate students, the friends I made in the field, my family, my husband and many others that I will not be able to individually acknowledge here as they deserve to be acknowledged.

Along every pivotal step of my graduate career, my advisor Ted Miguel was there to give me practical guidance and to push me toward excellence. When I went to Ted in my third year of graduate school with several ideas for my dissertation, he immediately honed in on the idea that eventually developed into this dissertation and offered to fund my field work. Before presenting my preliminary results in seminars, Ted went through every table and chart that I brought to him, offering detailed suggestions for improvement. He was always ready with a pep talk, reminding me why I should be proud of my research and motivating me to work even harder. Just when I thought I had exhausted every option for analyzing my data, Ted saw that I could estimate individual parameters structurally. This resulted in a huge improvement to the second chapter of my dissertation and gave me an opportunity to showcase technical savvy in my research that I otherwise would not have had. Ted's enthusiasm and drive for excellence has inspired me to achieve more than I thought I could.

Ted's best suggestion for me was to talk to Shachar Kariv, who also became my advisor. Shachar has been a champion of my dissertation project from our first conversation. As a graduate student, my research at moments seems promising and at other moments seems completely irrelevant, and having the constant support that I had in Shachar was invaluable to my sanity and to the timely completion of my research. He has never taken more than a day to answer my emails and whenever I went to him with a problem, he took it upon himself to solve it, whether it is through providing me with research funding, speaking with the Office of the Protection of Human Subjects on behalf of my project, or bringing together faculty in the department with differing opinions to reach a consensus on how best to structure my paper. Shachar has not only been my strongest advocate, he also took the time to explain to me the principles behind how things work in academia, so that I could learn to make the best decisions for myself. And although he always told me the approach he would take, he also gave me the freedom to make my own mistakes and supported me regardless of my choices. Shachar taught me the most important lesson that anyone can learn in graduate school – to trust my own judgment.

Ken Train does not like to take credit for his contributions to student work, but it was his course on discrete choice methods that influenced me to use structural estimation in my research. It was probably the best course I took in graduate school. The assignments were carefully crafted, the material was clearly presented, but most importantly, I saw the expan-

sive potential of structural estimation and how it could be applied to my own research. Ken also took the time to understand my research and to give specific suggestions for simulations methods, without which I would not have been able to implement some of the main pieces of analyses in my dissertation.

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Ulrike Malmendier has been a part of my dissertation project ever since serving on my orals committee. She has encouraged me to become engaged in academic discourse by inviting to meet with seminar speakers and inviting me to conferences. She also helped me communicate my research to others by having me give a five-minute summary of my work in front of her and other students. This exercise proved tremendously helpful on the academic job market.

Betty Sadoulet taught me how to read my first regression table and to write my first STATA file in my second year of graduate school. Throughout the years, she has patiently listened to my half-baked ideas and has lent me her critical eye for the tables and charts that I brought to her office hours. She has continually showed her support by keeping me apprised of new research related to mine.

I wish that I had met Peter Lorentzen earlier in my graduate career so that we could have had more discussions about our mutual interest in the Chinese economy. But I am grateful that we did meet, not only because he was gracious enough to serve on my dissertation committee, but also because he has welcomed me into the community of China scholars.

I am grateful to Liu Xin for pointing me to the literature on the Chinese Communist Party's gender policies, and consequently shaping the overarching argument for my dissertation. I have also enjoyed our discussions on the history of economic thought and his view of the difference between economists and anthropologists. I have learned from him to resist an economist's instinct to oversimplify and to welcome the richness of reality.

I am also grateful to my fellow students at Berkeley who have been an incredibly valuable resource: Wang Gewei for helping me through the painstaking task of translating my experimental instructions, Anne Moore for always being there to listen, Kenny Ajayi for being the voice of reason, Sarath Sanga for his refreshingly unique viewpoints, Vinci Chow for being an excellent sounding board, and Song Changcheng for all the timely help with programming.

My field work would not have been possible without the help of the following people. I thank Zhang Xinde for finding a way for me to do research in Yunnan and Zhang Xinhua for teaching me how to get what I need. I thank Zhao Xinghan for giving me access to the schools where I conducted my research, and Niu Xin and Li Hongbi for introducing me to him. I also want to thank the good friends I have made in the field: Hai Luru, his wife, his daughter, and his mother for welcoming me into their home in Yongning and making me a part of the community; Yang Haitao for his humor, which made the experience of conducting my experiment enjoyable; Mao Falin for being consistently helpful and supportive; and Yang Xiaosong for inspiring me with his vision for his community. I also want to acknowledge Eric Mo Welin for his sacrifice in the interest of my research – I hope he has recovered from that

meal.

Speaking of meals, my mother and father brought me countless meals from their home in San Francisco throughout my graduate studies, which nourished both my body and spirit. I thank my father for his love for China's history and language which instilled in me the same love from an early age. I thank my mother for her determination and fighting spirit that has helped me to persevere through all obstacles, whether in research or in life.

And finally, I would like to thank Lamont Tang. He inspired me to pursue graduate studies and his constant love and support helped me survive them. I am so happy that we are now on the same coast.

Chapter 1

Conducting Economic Experiments in China's Rural Schools*

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1 Bureaucratic hoops

Doing research in schools or anywhere else in China as an American requires a sponsoring organization, usually a university. Through the help of Professor Qian Yingyi, who is both a professor of economics at UC Berkeley and the dean of the School of Economics and Management at Tsinghua University, I was able to obtain a letter saying that I was working on a collaborative project with a professor of Economics at Tsinghua requiring me to conduct fieldwork in Yunnan Province. This professor made known to me, however, that I would need to find my own connections to gain access to the schools for my experiment. The letter was merely a certificate of authentication so that should there be any political fallout resulting from my research, Tsinghua would take responsibility.

I identified the Mosuo as the matrilineal ethnic group I wanted for my sample, both because they are well documented in the anthropology literature and because they live amongst the Yi, a patrilineal ethnic minority, and the Han Chinese, the majority ethnicity in China. The proximity in which the three ethnic groups live constitutes a cultural laboratory in which comparisons can be meaningfully made across groups. I also wanted to work in a middle school for two reasons. First, I wanted my subjects to be able to do the experimental task, which consisted of computational problems. Second, I wanted my subjects to all have to face a consequential real world competitive decision. For middle school students, schooling is compulsory, but to go on to high school, they have to take and pass a competitive high school entrance exam. For my research, I planned to use taking the exam as a real world counterpart to the laboratory decision of entering a competition. This made the choice of

*I am deeply grateful to Shachar Kariv and Edward Miguel for their guidance and support throughout this research project. I thank Zhao Xinghan, Yang Haitao and Mao Falin for their invaluable support and assistance in the field. I also thank Professor Qian Yingyi and Professor Yang Zhishu, without whom this project may never have gotten off the ground.

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experimental site fairly easy. In Yunnan Province, the Mosuo are concentrated in Yongning Township which has one middle school – Yongning Middle School.

Before embarking on my trip, I bought gifts for all the officials I expected to meet with. I was advised to bring chocolates and cosmetics for their wives. These items from abroad are welcome because tariffs on them are high and counterfeits are ubiquitous. It also suited me that they take up little of the precious room in my suitcase. In so far as I can tell, as a Chinese social custom, gifts are a gesture of gratitude and acknowledgment that one is asking for a favor. It does not absolve one of the social debt incurred.

It turned out that I would find a connection to Yongning Middle School through an official in the provincial education bureau. My meeting with him was brief. After asking to see my letter from Tsinghua and inquiring briefly about my project, he agreed to give me access to Yongning Middle School, with an admonishment not to let the local officials pay for my meals or lodgings even though they will offer. With one phone call to the prefectural level education bureau in Lijiang, he arranged for my transportation from Lijiang to the county seat of Ninglang to Yongning. I was on site within two days of meeting with him.

2 Settling in

I had arrived in Yongning in the middle of August 2008, hoping that I could conduct experimental sessions before school began on September 1st so as not to interfere with classes. But it soon became abundantly clear that the sessions could not begin until school started. The middle school was located in the township of Yongning, but students can be from any of the surrounding villages, which could be hours if not days away, depending on distance, elevation, and available means of transportation. During the school year, those who live in remote villages would either board at school or stay with relatives in the township. So it was only when school started that I would have access to subjects.

That gave me two weeks to get to know the school teachers and to plan the logistics of the experiment. In hindsight, it was time well spent. When I first arrived, few people spoke to me outside of an official context. When there had been more time to interact, the teachers began to joke that I might be an American spy. It was something that came up in conversation often enough to make me think that it was not entirely in jest. When I showed them my experimental instructions and survey, however, they became more relaxed, so much so that they questioned whether I can actually find anything meaningful with such a simple experiment. Eventually they warmed up enough to argue with me about American foreign policy and in the end some teachers asked me how they might get to America and what they could do there for a living.

On my part, I too viewed the teachers with distrust at first. I worried that, like the handlers of Margery Wolf¹, the teachers had a secret communist agenda that somehow involved biasing or otherwise sabotaging my research. I would come to realize that a teacher's most important agenda was his or her career ambitions, which in China's pay-for-performance education system depended on improving student test scores. It also became apparent that financial incentives far outweighed any political sentiment, despite the numerous propaganda slogans painted along the sides of the roads. Most of the teachers I came across in Yongning

¹Margery Wolf, *Revolution Postponed: Women in Contemporary China* (Stanford University Press, 1985).

owned their own businesses, some of which I patronized unwittingly. For example, I would later learn that the hotel I was shown to when I first arrived belonged to the family of a teacher.

I found that as long as I can demonstrate that I understand the principal of reciprocity and that I actually have something of value with which to reciprocate, whether it be through patronage or helping fix a computer, everything is negotiable and can be done at short notice, provided that there is no perceived conflict with anyone's career advancement. If someone can be persuaded that by cooperating with me they will be doing their superiors a favor, they will help me to their utmost ability, including corraling resources available to them in the form of friends and family.

3 Experiment logistics

The remoteness of Yongning meant that there was no ATM in the township seat. In the haste of getting there, I had not planned out how much cash I might need for subject payments, assuming that I would have access to a bank once in Yongning. The closest ATM was 45 minutes away in the village of Luoshui on Lugu Lake, which had become a tourist hub. However, it did not accept foreign bank cards. Neither did any ATMs in the county seat of Ninglang. The closest such ATM would be in Lijiang prefecture, six hours away by bus. I was saved from such a trip by the vice principal of Yongning Middle School, who offered to receive a transfer of money from my aunt in Shanghai to his Postal Savings Account for me.

Another difficulty with subject payments was the need for small denomination bills. This turned out to be tricky not only when in Yongning, but even in the banks of Lijiang or Shanghai. It was a process of knocking on every door – sometimes a place would have change, sometimes it would not, regardless of how large or small the institution. And sometimes you have to know someone, although not necessarily well. In the process of conducting experiments in the field I have gotten change at the local Rural Credit Cooperative, the local temple (donations are usually in small bills), the school convenience store (where the subject payments ended up anyway), the bus depot, and various national banks. I was successful as often as I was not. On my second trip to the field, I accumulated bagfuls of small denomination bills as I made my way from Shanghai to Yongning, stopping at each bank that I came across along the way to ask them to make change.

Printing and photocopying of consent forms, instructions, and experimental test problems was not cheap. The price was close to US prices for photocopying and more expensive for printing, at over 40 cents a page. However, printing and photocopying shops were one of the more reliable businesses in rural China and I was able to negotiate bulk discounts. On my second trip I saved myself some trouble by bringing my own portable printer.

On the other hand, there were many pleasant surprises as well in the logistical planning of the experiments. I had expected to find it difficult to access student information such as school rosters and grades. On the contrary, these were not considered especially sensitive information. They were given to me, along with individual gender and ethnicity information, in convenient excel spreadsheets. On one occasion when only a handwritten roster was available, I was able to access data entry services quickly and inexpensively.

I also expected that recruitment would involve announcing a time after school where

students would come and be screened according to their gender and ethnicity, with many students inevitably turned away and some sessions postponed until enough students could be gathered. Instead, administrators insisted that students would all show up if selected and they were right. I did have to select a few backups for each session due to absenteeism, but less than 5% of selected subjects ever needed to be substituted. This meant that sessions could be run every day, even multiple sessions per day, as long as the administrators were willing to approve a time during which the session could take place. Lunch time was usually the time given, as there was no “after-school.” Students were in class from 6 or 7 in the morning to 9 or 10 in the evening with Sundays and every other Saturday afternoon off.² The school at night is quite a sight to behold, with the classrooms lit up and students sitting attentively at their desks against a night sky lit only by the moon and the stars.

Another pleasant surprise for me was how well-behaved the student subjects were. I was warned by their own teachers that they could be very disrespectful, especially in the older grades, but I experienced nothing of the sort. Students did not talk during the session, did not interrupt when I read the experimental instructions, and answered when asked about their comprehension of the game rules. If I were to venture a guess as to the reason behind the discrepancy between expectation and reality I would say that the experiment was something new and exciting compared to the student’s normal routine, and the chance to win money probably contributed to the good behavior. Several back-up students who were turned away from sessions that checked in full asked me to include them in future sessions.

4 Different sites

4.1 Hongqiao

Before arriving in Yongning, I expected there to be enough subjects of all three ethnic groups, Mosuo, Han Chinese, and Yi in Yongning middle school to conduct all my sessions there. However, the Yi made up a smaller percentage of the student body than their census population would indicate. In addition, I chose to exclude the honors classes from my sample due to the possibility that honors status could be an overwhelming factor in determining the competition entry decision in the experiment. That left me with only a handful of Yi subjects which made it necessary to find an additional middle school site. I decided upon Hongqiao middle school based on the recommendation of an anthropology PhD student I met in Yongning named Siobhan Mattison. She suggested Hongqiao as a comparison site due to its high Yi concentration, its proximity to Yongning, and its similarity to Yongning in topography, both high altitude plains.

The principal of Hongqiao Middle School assured me that they had a computer lab. Given the tight time schedule that I found myself on, I decided to have students enter their answers into computers for scoring, rather than wait for graders to hand grade. Upon arriving in Hongqiao Middle School, however, it was clear that the computer lab was out of use. The machines were running Windows NT, if they turned on at all, and there did not appear to be any working keyboards or mice. Through an acquaintance I met in Yongning, I found an

²This included recess and study hall, but classes were often taught during study hall to make up for lost class time due to the many holidays that were observed by the school district.

internet café owner in the county seat who was willing to rent computers to me by the day based on the standard hourly fee. The computers could not be reliably networked, however, due to the ancient infrastructure of the computer lab. Data had to be collected separately on each computer after each session and manually formatted into excel spreadsheets. Another major disadvantage of using computers was that a blackout meant loss of data and subjects. One of the frequent and unpredictable blackouts occurred in the middle of a session and the data could not be salvaged. It apparently impressed the teachers when I paid the subjects anyway, based on the expected average payout, as is standard experimental procedure in cases of technical difficulty. I was told by one of the teachers that I must be a good person to do such a thing. It appeared that the monetary incentive in the experiments may have earned me not only the cooperation of the subjects, but of some teachers as well.

At Hongqiao, unlike Yongning, teachers did not own hotels or restaurants, so I did not have the same opportunities to reciprocate their kindness through my patronage. Instead, they asked me to teach an English class, as that was the students' worst subject in high school entrance exams and I was probably one of the only native speakers of English to have ever visited the school. I taught the class on the last day of my stay, to a roomful of attentive yet mostly uncomprehending students and teachers. Afterward, the teachers and I were treated to a banquet organized by the principal where we were given the honor of having a pig was slaughtered in front of us and having a Yi priest called a "bimo" read our fortunes.

4.2 Ninglang

In the second round of my fieldwork, which began November 2009, I returned to Ninglang county to expand my sample, particularly to high school students. This time around, I realized the true meaning of a "handler" a la Margery Wolf. I was introduced to a man from the county education bureau who would ostensibly speak on my behalf to the high school administrators and help me with whatever else I needed. In reality, he came along to every meeting I had with school administrators but did nothing more than observe. For everything I needed I had to ask myself, as I did at the other sites, except now there was an extra person in the room. What he did do was repeatedly try to steer me to stay in a hotel across from the education bureau even though I had chosen one closer to the school. He also insisted he would find me an assistant when I already had one referred to me by the assistant to Siobhan Mattison. He expressed what I felt was undue interest in how I came to find her and suggested that her credentials were suspect. Mysteriously, shortly after I observed him asking her for her phone number, my assistant told me quite suddenly that she had fallen ill and would no longer be able to work for me. I never got to the bottom of that and probably never will. In the end I asked for another referral and retrained my new assistant.

The school administrators were no easier to work with. Pre-agreed upon session times and session lengths constantly need to be renegotiated. The reason for the lack of cooperation, I was told, was that one of the vice principals responsible for the senior students feared that participating in the experiment would lead to a lower score on the students' college entrance exams. At the time I was not sure if this was the real reason, because it seemed ludicrous to me that an experiment that took place during the lunch hour would affect performance on an exam at least six months away. In addition, there were other teachers and administrators

who expressed no such concerns and were much more cooperative. Later I was to learn that indeed test scores were taken very seriously. However, there were two factions with opposing viewpoints on how best to achieve high scores. One faction believed that each additional hour spent studying lead to higher scores. The other faction believed that students were already spending too much time in classes and that the key to high scores lied in teaching ability. Many of those in the second faction were volunteer teachers from urban areas where school days are shorter and, in all fairness, their careers were probably less directly affected by student test scores. I had not realized that there were such divisions until I attended a banquet for the teachers. There, various teachers from the second faction who I never met before came up to tell me that they supported my research, which they thought was on liberal educational methods.

5 Conclusion

It is hard to draw any lessons from one researcher's experience in a country as large and regionally diverse as China that could be of use to other researchers. I would especially caution against forming any expectations of research interactions in urban China based on my experiences in rural China. The section above contains examples how much the reception of the same research project could vary from school to school, even in the same county.

With that said, China today is not the closed community it was thirty years ago and that applies to the research process as well. Initial access to study populations may depend on having personal or institutional connections, but financial exchange and reciprocity are key to maintaining on-going cooperation. A scholar's credentials may also go some ways toward opening doors, as educational achievement is highly esteemed, especially in schools. However, the legacy of the cold war remains in the mostly unspoken suspicion that both researcher and subject population have toward one another.

The experimental economics method proves itself exceptionally well adapted to conducting primary research in this environment. It operates on a principle of revealed preference which ensures that, when incentives are designed properly, subjects will be motivated by their self interest to tell the truth, while protecting the gatekeepers from any real or perceived risk of political persecution since subjects are not asked their opinions directly. For these reasons, I would urge any modern China scholar interested in conducting primary research to consider including experimental economics in his or her arsenal of research methods.

Chapter 2

What Can A Competition Experiment Tell Us About Real World Competitive Behavior?*

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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 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 prior test scores. Contrary to results from studies in adult populations, no gender differences were found in competitive inclination. Likewise, no gender difference was found in exam taking behavior, controlling for prior test scores.

*I am deeply grateful to Shachar Kariv and Edward Miguel for their guidance and support throughout this research project. I thank David Card, Vinci Chow, Fred Finan, Jeremy Magruder, Ulrike Malmendier, Betty Sadoulet, Changcheng Song, Ken Train, as well as UC Berkeley Development Seminar, Development Lunch, Pysch and Econ Non-Lunch, and IGERT seminar participants for their useful comments and discussions. I also thank Zhao Xinghan, Yang Haitao and Mao Falin for their invaluable support and assistance in the field.

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1 Introduction

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 underrepresentation 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

Given the seriousness of these implications, 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. To do this, 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.

Adapting the Niederle and Vesterlund (2007) experimental design, I conducted experiments with 248 middle school students in rural Yunnan Province in September 2008 and January 2010. A post-experiment survey was administered to all subjects and academic performance data was collected from the school administration to capture demographic and socioeconomic background characteristics. Individual risk aversion data was collected separately using the Binswanger (1980) instrument in January and March 2010. The subjects' real world competitive behavior is observed in a rich set of administrative data that I collected and assembled following each entrance exam cycle.

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

¹Niederle 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.

²Bertrand 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%.

and highly consequential high school entrance exam.³ The data on exam-taking comes from administrative records rather than potentially unreliable 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 at an individual level.

The location of this study was chosen for its ethnic diversity, which allows me to explore how gender differences in competitive inclination and real world competitive behavior may vary with ethnic gender norms, in a naturally controlled environment. A previous study on competitive inclination in unilineal societies in India and Tanzania found matrilineal women to be relatively more competitively inclined than patrilineal women (Gneezy et al., 2009). In this setting, the cross-cultural comparisons can be made within the same county. The Han Chinese, along with a matrilineal minority group (Mosuo) and a patrilineal minority group (Yi), live together in an area one-third the geographical size of the San Francisco Bay Area and, moreover, attend schools under the same national public school system.

Using the school rosters, I randomly selected my experimental subjects, who are on average 15.7 years old, from each of the three ethnic groups in roughly equal numbers, balanced across gender. I find no statistically significant gender difference in competitive inclination or in exam-taking behavior, controlling for prior test scores, among any of the three ethnic groups. The lack of gender difference in competitive inclination contrast with the findings from Zhang (2011b), which finds that among high school students in this region, both matrilineal and patrilineal students have significant gender differences in competitive inclination, although the Han Chinese did not. The age differences between high school and middle school suggest that the differences in the findings of the two studies could be due to maturation. However, due to the fact that high school students are a selected group whereas middle school falls under compulsory schooling, to fully investigate the effect of maturation, further research is needed to recruit subjects who do not continue on to high school.

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 on external validity, and findings on gender differences in competitive inclination across ethnic groups. Section 7 concludes with a discussion of the results and their potential implications.

³Admissions 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).

⁴In 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.

2 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 female ones do during critical points of the match, relative to performance during less critical points. Gerdes and Gransmark (2010) find that male professional chess players adopt 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.⁵ 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.⁶ 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.

3 Experimental Setting

All subjects are recruited from two middle schools in Ninglang county. 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.⁷ Ninglang itself 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

⁵In prior experimental studies of competition, mathematical or maze-solving tasks were used.

⁶See 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.

⁷The 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.

Statistics, 2008).⁸

With a population of 230,000, Ninglang's three main ethnic groups are the Yi, the Han Chinese, and the Mosuo, comprising 62%, 20%, and 9% of the population, respectively (China Census, 2000). Ethnicity in modern China is rigidly defined. In the 1950s, the Chinese government sponsored a massive ethnic identification project, which officially categorized each citizen into one of 56 ethnic groups. The majority ethnic group, both then and now, is the Han Chinese, who make up 90% of the population according to the 2000 Census. Today, ethnicity can only pass from parent to child and is required information on official identification documents.⁹

Historical records show that the Han Chinese, the Yi, and the Mosuo have coexisted as separate ethnic groups in Ninglang for at least two hundred years.¹⁰ Each ethnic group has a distinct language, although the language of instruction in schools is a dialect of Han Chinese.

3.1 Ethnic minorities in Ninglang County

The Yi (and the Han Chinese traditionally) are patrilineal (see, for example, articles in Harrell (2001)). Patriline and matriline refers to “the gender direction of the transmission of associations, rights, and duties from one generation to the next (Harrell, 2002).”¹¹ An important adjunct of patriline 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 (Harrell, 2002), making investing in daughters akin to “watering your neighbor's garden,” as the common Indian saying goes. 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 (Bamo, 2001).”

The Mosuo are a matrilineal people (see, for example, Cai (2001); Shih (1993); Walsh (2001)). In each household, there are generally two household heads, one male and one female. The female head's role is essentially managerial; the male head's role is essentially social (Cai, 2001: 122-123). A unique feature of the Mosuo matrilineal society is their sexual visitation system called the “walking marriage,” where the man travels to visit the woman in the evenings. It normally does not involve cohabitation and is “nonexclusive, noncontractual, and nonobligatory (e.g. Shih, 1993).” When cohabitation does take place, 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).

In the last 60 years of Communist Party rule in China, radical policies have promoted women's participation in the paid labor force for both ideological and economic reasons (Croll, 1983: 2; Wolf, 1985: 81; Yang, 1965).¹² Today, 67.4% of Chinese women over the age

⁸At the exchange rate of \$1 = RMB 6.8.

⁹To borrow a phrase from Stevan Harrell, a Yi scholar, 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

¹⁰For a more detailed discussion of the origins of the ethnicities in Ninglang see Zhang 2011b.

¹¹In 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).

¹²Other formerly planned economies shared in the same objectives (Therborn, 2004), which have resulted

of 15 are in the labor force, a higher percentage than that in all the OECD countries, with the exception of Iceland (ILO, 2009).¹³ Accompanying and supporting the labor policies is a national Marriage Law which weakened the traditional Han Chinese patrilineal family (Hershatter, 2004: 999). Minority ethnic groups, however, were granted exemptions from the legislation (Dreyer, 1976: 119), which allowed traditional cultural gender norms to be preserved, to some degree.

A short written survey was administered to my experimental subjects after the experimental session, with the purpose of understanding what key socioeconomic or demographic factors may vary across ethnic groups, and also as a check on the anthropological evidence. The questions were written to correspond to the Chinese Census whenever possible to maximize clarity. Nonetheless, verbal clarifications were required for some of the questions, such as the definition of brother and sister in a household, since often cousins lived together under the same roof. Table 1 shows selected background characteristics for my subjects. As expected, 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 educational levels are low, with the subjects on average having more education than their heads of households. The Yi and Mosuo heads of households have lower educational attainment than their Han Chinese counterparts, possibly in part due to the language barrier. In the subsequent analysis, I will control for both demographic and socioeconomic covariates.

3.2 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 depends almost exclusively on an entrance exam.¹⁴ 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.¹⁵

in high female labor force participation in these countries as well (ILO, 2009).

¹³In comparison, US female labor force participation is 58.4% (ILO, 2009).

¹⁴Admissions may be extended to those who just missed the cutoff and could pay an extra fee, but I did not find written guidelines for this process.

¹⁵Although 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

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 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).”

4 Data collection

4.1 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.

4.2 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 from both middle schools. In 2009, additional middle school subjects in grade 9 were recruited from one of the middle schools. The middle schools are located in townships approximately 50 kilometers apart.

go on to high school directly passed the exam on the subsequent try.

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. 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. Experimental responses were either captured electronically using the Z-tree program, or 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	
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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.¹⁶

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.

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.

¹⁶In the case of a tie all those tied for highest score are paid 2 RMB per problem.

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 RMB 2. For the experimental instructions and the survey instrument (translated into English), see the web appendix.

4.3 Tournament entry results

Raw rates of tournament entry from this study are shown in context with select experimental results from other studies in Table 2. Middle school students exhibit very little gender difference, with point estimates between 2 - 6 percent. In contrast, the smallest gender difference from the other studies is 15 percent. These raw rates of tournament entry will be used in the subsequent analysis to derive individual competitive inclination.

4.4 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.¹⁷ 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 constant relative risk aversion utility over income, each choice implies a range of values for the CRRA coefficient. 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.¹⁸ Although there is a mass at risk neutrality, there is a non-trivial distribution in the risk averse range. The top row of Figure 3 shows the distribution of risk aversion across ethnicity, by gender. A Mann-Whitney test of the overall sample shows no statistically significant difference in the distributions of risk aversion by gender (p-values=0.19), in contrast to the literature, where men are typically found to be less risk averse than women (see, for example, Croson and Gneezy (2009)).

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. 40% of risk aversion data is missing for this reason. I employ a standard multiple imputation method

¹⁷Holt 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.

¹⁸The distribution corresponds remarkably well to the distribution of comparable choices from the small stakes game in Binswanger (1980).

described in Cameron and Trivedi (2005) to impute the missing data.¹⁹ The validity of this method relies on the assumption 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. The bottom row in Figure 3 displays the imputed risk aversion distributions.

4.5 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. The subjects in my sample are on average correct about their rank, despite the fact the guesses were not incentivized monetarily (see Figure 4). 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. Figure 5 breaks the sample up by ethnicity and gender. The average value of the proxy for overconfidence for each ethnic group is statistically indistinguishable from zero. This is contrary to studies conducted in the US and the UK. The fact that my subjects are in the same schools and grades are public knowledge in China likely contributes to the accuracy of their guessed ranks, which naturally reduces overconfidence as a factor in the tournament entry decision. The differences in distribution by gender, however, is statistically significant (Mann-Whitney p-value = 0.002), with boys more overconfident than girls.

5 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

¹⁹I impute once using an ordered logit regression of choice in the instrument on gender-ethnicity main and interactions effects, age, and academic performance.

utility and the unobserved portion of utility characterized by $b(\cdot)$:

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

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.²⁰

As in Holt and Laury (2002), preferences are characterized by constant relative risk aversion: $V = I^{1-\gamma}/(1-\gamma)$, where I is payout²¹ 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.²² Let U_{it} and U_{ipr} be individual i 's utility from choosing the tournament and piece rate option, respectively:²³

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

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

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.²⁴ γ_i is the individual coefficient of constant relative risk aversion collected using the Binswanger

²⁰The behavioral portion of utility enters multiplicatively instead of additively for reasons of modeling convenience, as will become evident in the following discussion.

²¹In 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 students, their wealth is approximately zero, so that the expected utility over income model approximates the expected utility over wealth model.

²²Binswanger (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 roughly corresponds to the range of the changes in stakes in the present study.

²³When $\gamma = 1$, the utility function is defined to be $\ln I$. However, actual values of γ in the present study sample obviates this consideration.

²⁴What 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.

instrument.²⁵ $\bar{\alpha}$ 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_β^2 .

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 chooses to enter the tournament is given by:

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

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} :

$$s_{pi} = s_{ri} + k\xi_i \quad (5)$$

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 :

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

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.²⁶ Note that my subjects are students in the same middle schools, where grades (as is common practice in

²⁵Following Binswanger (1980) and Binswanger (1981), I use the geometric mean of the endpoints of each range for the point estimate of γ .

²⁶Even so, the possibility that a local rather than a global maximum has been found cannot be completely ruled out.

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_{ri} .

Figure 6 shows the empirical cdfs of performance in the compulsory tournament stage by gender for each ethnic group. Visual inspection shows no gender differences in performance and Mann-Whitney tests reveal no significant gender differences, at the 10% level or greater, across any of the ethnic groups. The lack of significant gender differences in the performance in the compulsory tournament is consistent with the literature (e.g. Niederle and Vesterlund, 2007). Figure 7 shows distributions of the probabilities of winning by gender for each ethnic group. The overlap by gender is substantial, and, again, Mann-Whitney tests reveal no significant gender differences, at the 10% level or greater, across any of the ethnic groups.

6 Results

6.1 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 mixed logit parameter estimates are reported in Table 3. All estimates take the expected sign. Estimates of $\bar{\alpha}$ are positive and significant, indicating that middle school students on average have a preference for competition above and beyond what can be accounted for through their objective probability of winning and their risk aversion.

6.2 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.²⁷ 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 were 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

²⁷The 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.

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_i s. The distribution 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.²⁸

6.3 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_i s to the subject's subsequent propensity to take a competitive high school entrance exam.

6.3.1 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.

²⁸Although 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.

6.3.2 Alternative explanations

Notice that the magnitude of the coefficient decreased from the first column to the second column in Table 4, indicating that α_i is positively correlated with ability. A concern is that there remains unobserved ability as it relates to performance on the entrance exam that has not been fully controlled for, and that it may be picked up by α_i . Table 5 is an attempt to address that concern by regressing the entrance exam score on α_i , using the same set of controls as that in Table 4. Clearly, α_i is not a significant predictor of performance on the entrance exam, at least for the 80% of subjects who took the exam. Unfortunately I cannot observe how those who did not take the exam would have performed, but this analysis may go some way to allay concerns that competitive inclination is purely a proxy for unobserved ability.

6.3.3 Robustness checks - non-structural approach

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:

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

\hat{r}_i measures the residual taste for competition, after accounting for the full set of explanatory variables in x_i .²⁹

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.

²⁹Both 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.

Table 6 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 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.

6.4 Group differences in competitive inclination

6.4.1 Structural parameters

Figure 9 plots histograms of individual α_i s by gender, for each ethnic group. Casual observation reveals substantial overlap by gender across male and female distributions in competitive inclination. 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 at the 10% level or higher.

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 avoiding 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 6 gender-ethnicity groups, all have positive average α_i s. There is no evidence that any of the groups are avoiding competition on average.

6.4.2 Regression analysis

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

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

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 7 reports the results from this estimation. The specifications in Columns 2 and 3 add demographic and socioeconomic status controls, respectively. There are no significant

gender differences in tournament entry across the three specifications, consistent with the Mann-Whitney test results of the structural parameters.

7 Conclusion

Leavitt and List (2007) assert that the generalizability of findings from the lab to the world outside is perhaps the most fundamental question in experimental economics. 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. These findings, therefore, support the continued use of the Niederle and Vesterlund (2007) pioneering experimental design in studying competitive inclination and it is my hope that our knowledge of competitive inclination may be expanded through further testing of the external validity of the experimental designs in this literature.

No gender differences in competitive inclination were found in the three ethnic groups studied, consistent with the fact that no gender differences exist in exam taking, controlling for prior test scores. Where large gender differences in competitive inclination do exist, however, as they do in the United States, the findings from this study suggest that the competition experiment may be a useful instrument for educators to identify students that may need extra encouragement in taking advantage of opportunities that involve completion. Some of these opportunities, as we have seen, may have lifelong consequences.

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

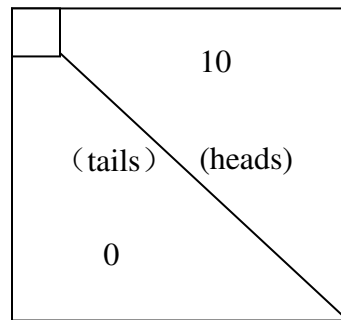
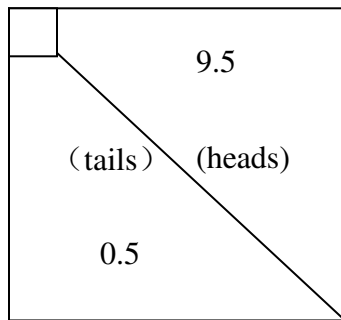
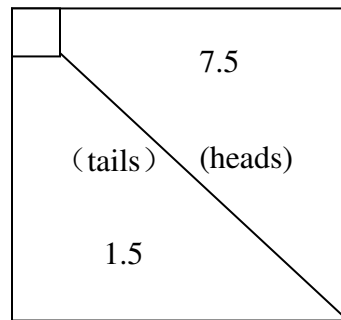
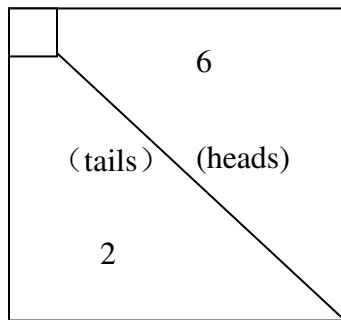
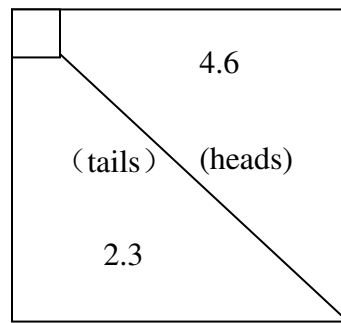
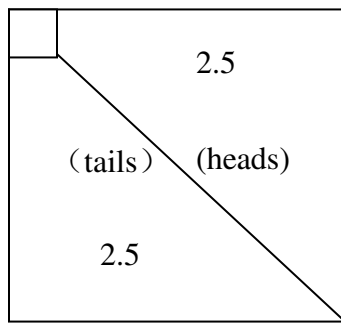
	Han Chinese	Yi Patrilineal	Mosuo Matrilineal	F-stat	p-value
Ethnicity correlates					
sex of h.h. (1 = male)	0.94 (0.25)	0.91 (0.29)	0.53 (0.50)	31.829	0.000
head of household is male but related maternally	0.00 (0.00)	0.03 (0.17)	0.09 (0.29)	23.198	0.000
parents participating in walking marriage	0.06 (0.24)	0.08 (0.28)	0.46 (0.50)	31.620	0.000
Demographics					
age	15.67 (0.98)	15.50 (1.17)	15.84 (1.08)	1.986	0.139
# brothers	0.91 (0.88)	1.54 (0.98)	0.94 (1.19)	8.656	0.000
# sisters	1.01 (0.97)	1.43 (1.10)	0.98 (1.26)	3.615	0.028
Socioeconomic Status					
h.h. engaged in agriculture	0.99 (0.11)	0.97 (0.17)	0.87 (0.34)	5.950	0.003
h.h. educational attainment (years)	6.97 (3.04)	4.46 (3.83)	5.10 (4.00)	9.647	0.000
Observations	80	72	96		

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

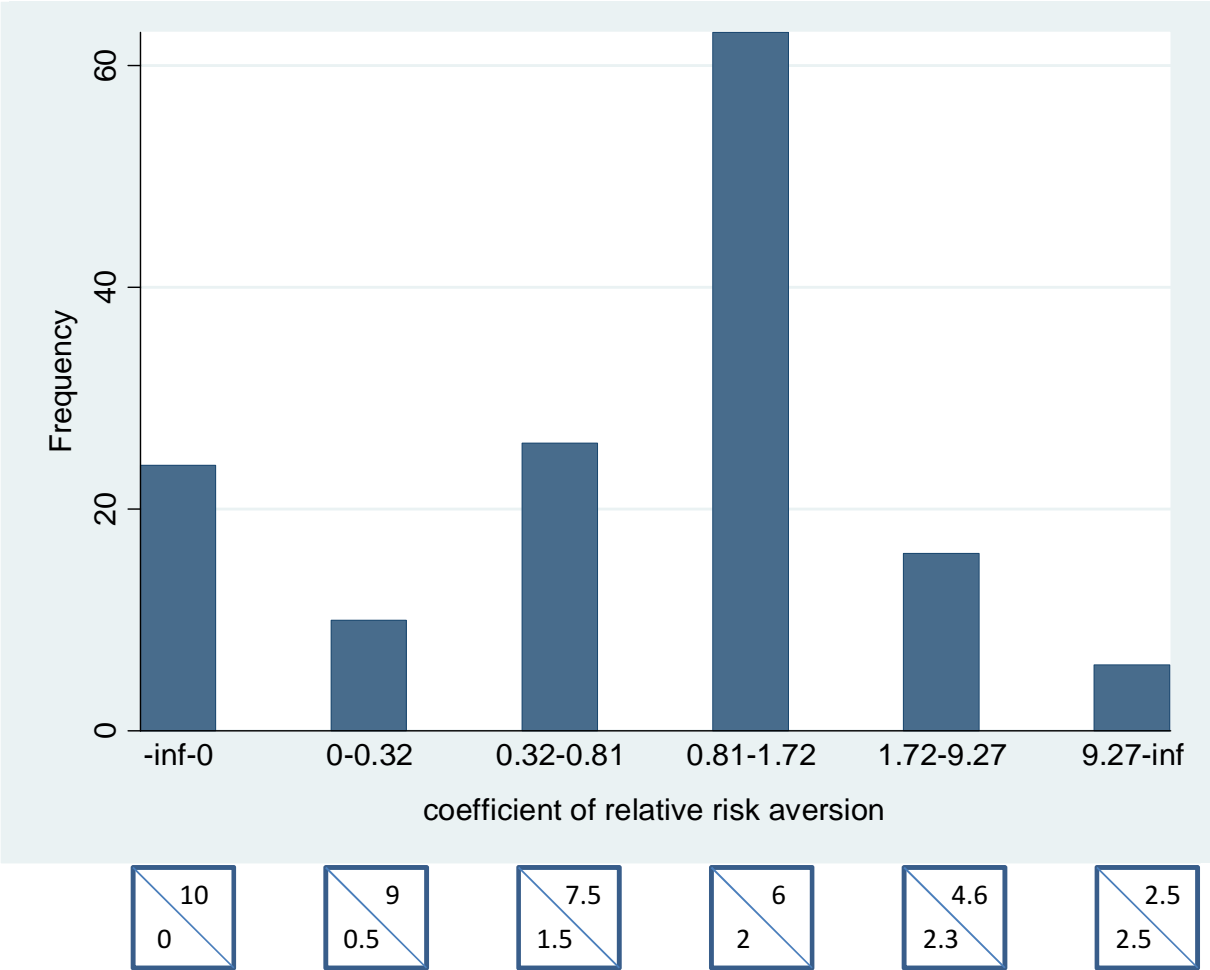


Figure 3: Distribution of Actual and Imputed CRRA Coefficients across Ethnicity, by Gender

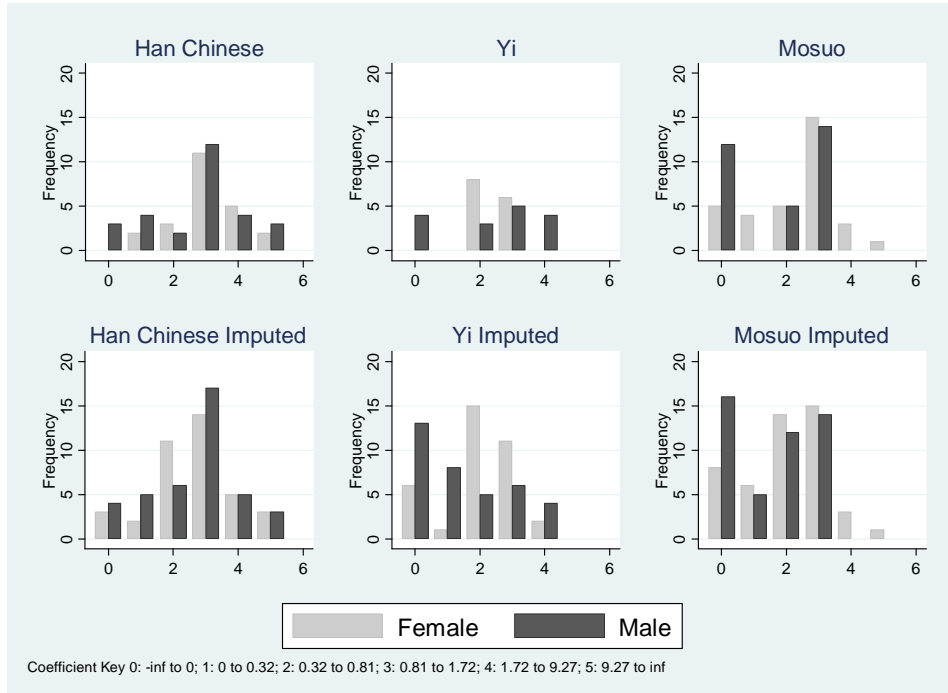


Figure 4: Distribution of the Proxy for Overconfidence

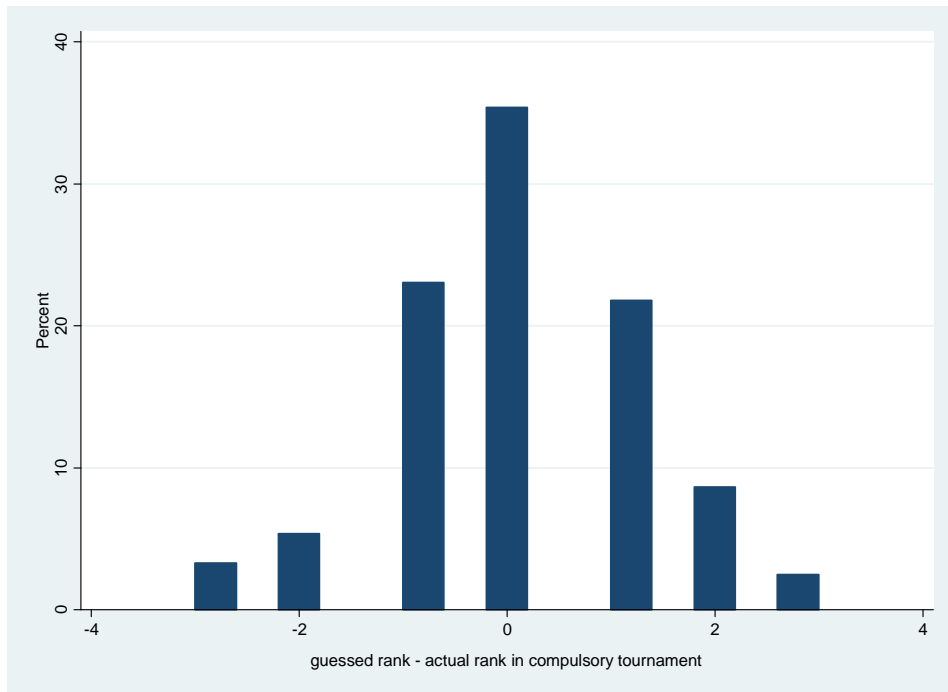


Figure 5: Distribution of the Proxy for Overconfidence across Ethnicity, by Gender

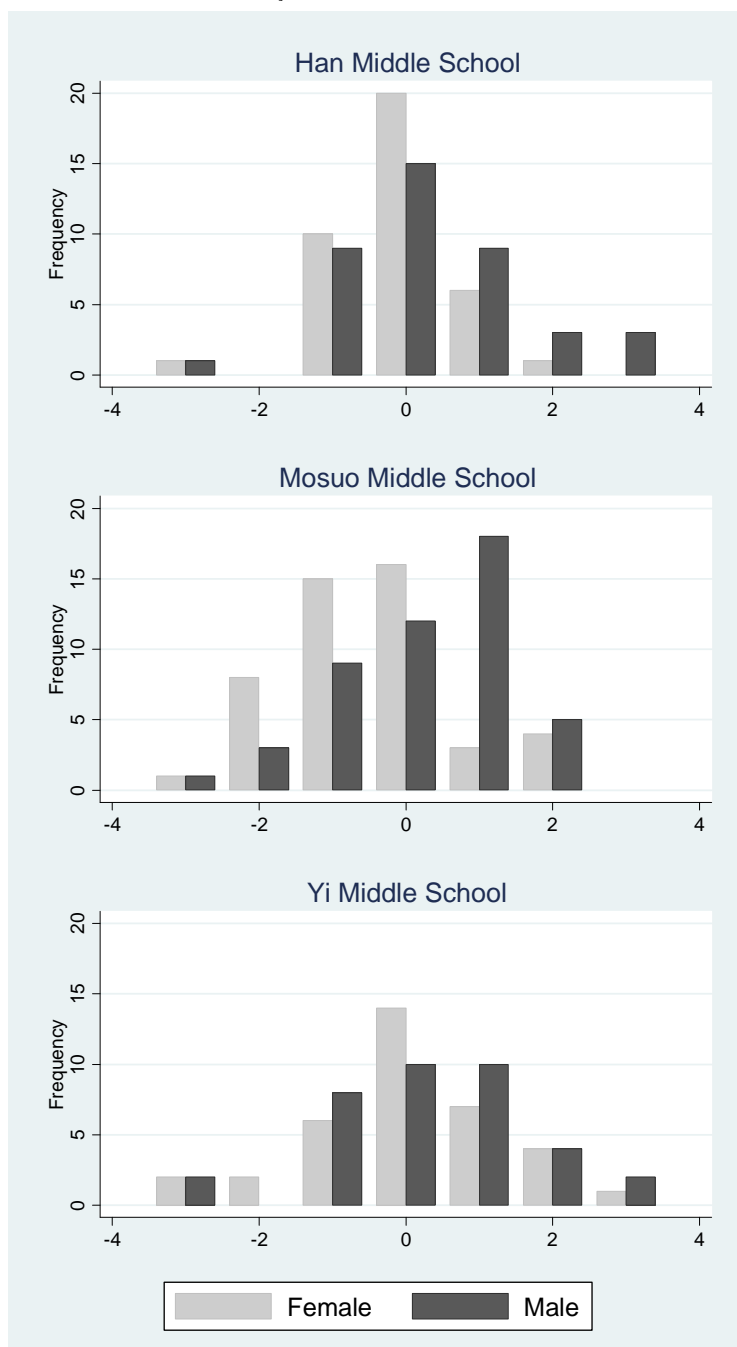


Figure 6: Distribution of the Probability of Winning the Discretionary Tournament across Ethnicity in Middle school and High school, by Gender

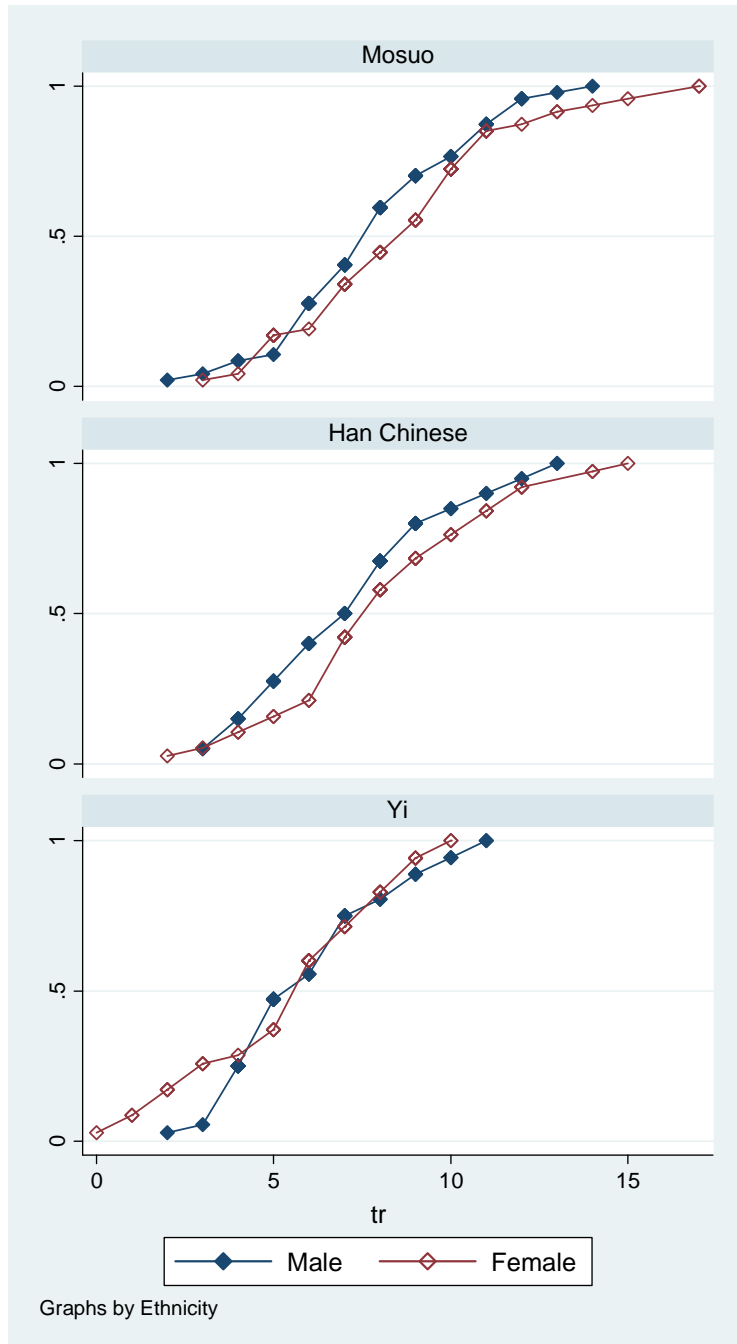


Figure 7: Distribution of the Probability of Winning the Discretionary Tournament across Ethnicity, by Gender

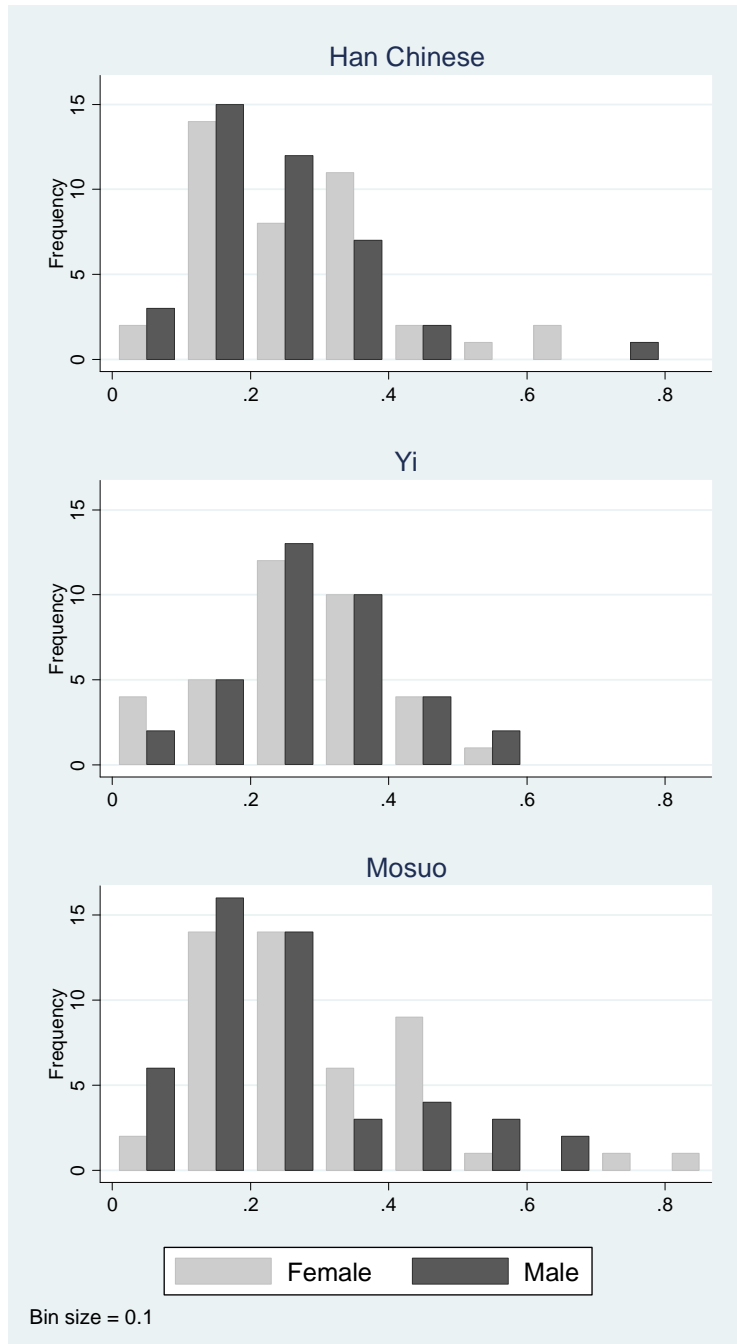


Figure 8: Distribution of Alpha

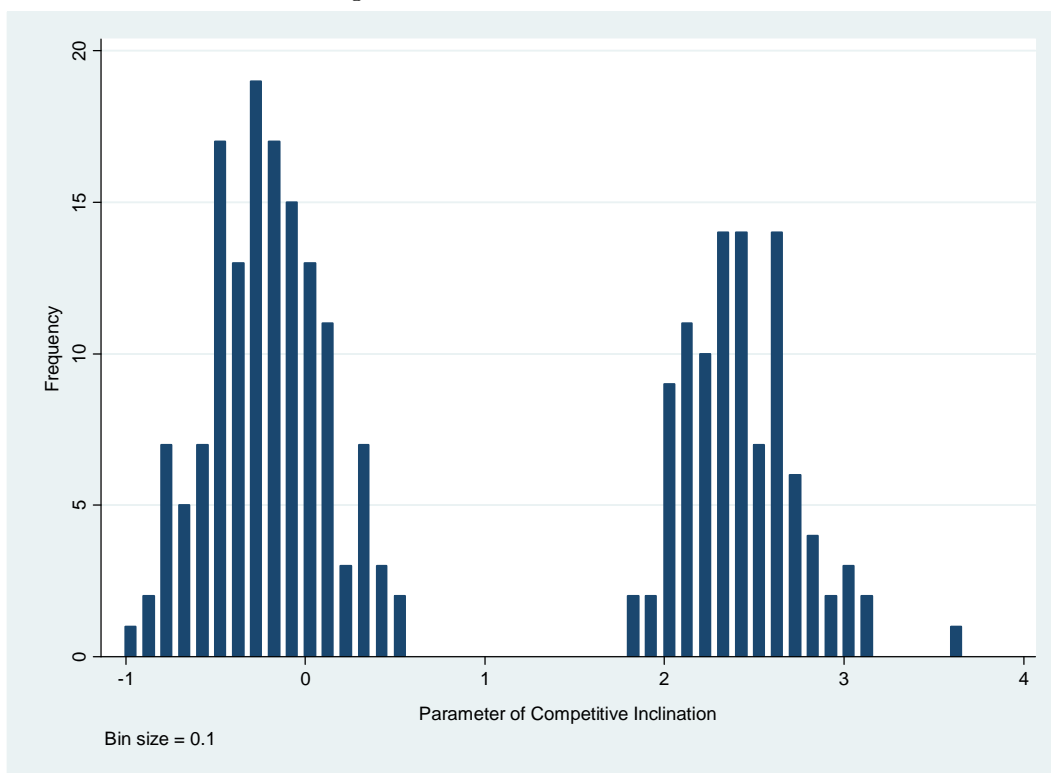


Figure 9: Distribution of Alpha across Ethnicity, by Gender

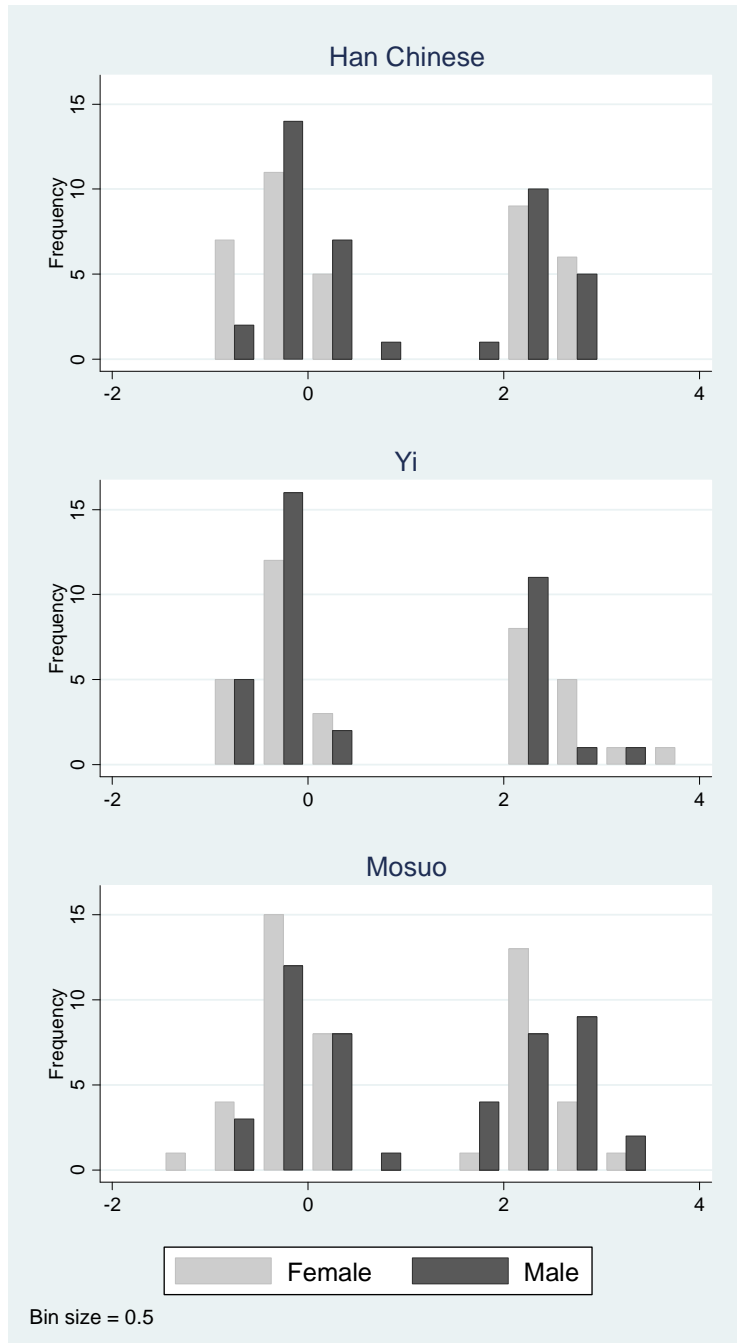


Table 2: Raw Tournament Entry Statistics

	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)						
Zhang (2011b)						
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 33.9)						
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

Variable	
α : parameter of competitive inclination	
mean	0.885** (0.418)
log prob of winning tournament	
mean	0.859*** (0.249)
std dev	0.013 (0.017)
1-risk aversion	
mean	0.097 (0.197)
std dev	0.241 (0.373)
Choice situations	243
Log likelihood	-158.4

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*** (0.034)	0.072** (0.029)	0.074** (0.029)	0.063** (0.027)	0.066** (0.028)	
$\alpha_i > 0^1$						0.079** (0.036)
regular grades (percentile)		1.154*** (0.436)	1.092*** (0.399)	1.100*** (0.374)	1.073*** (0.386)	1.071*** (0.399)
regular grades ² (percentile)		-0.726 (0.532)	-0.625 (0.473)	-0.655 (0.452)	-0.611 (0.468)	-0.596 (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
Loglikelihood	-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: Regression of Entrance Exam Score on Alpha

Dependent Variable: Score on high school entrance exam						
	(1)	(2)	(3)	(4)	(5)	(6)
α_i^1	16.766 (9.839)	6.255 (5.276)	4.626 (4.659)	4.770 (5.378)	3.496 (5.256)	
$\alpha_i > 0^1$						-2.541 (7.550)
regular grades (percentile)		304.473*** (61.978)	296.170*** (54.954)	284.407*** (53.807)	291.107*** (57.087)	292.821*** (57.707)
regular grades ² (percentile)		-61.048 (62.154)	-43.727 (52.688)	-25.891 (51.585)	-39.565 (55.515)	-39.691 (55.269)
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	181	181	181	177	172	172
Log likelihood	-1035	-948.9	-943.7	-921.1	-894.2	-894.4

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

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

Linear regression.

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 6: 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*** (0.054)	0.193*** (0.054)	0.218*** (0.060)
1-riskaversion		0.008 (0.018)	0.008 (0.018)
overconfidence			0.032 (0.028)
regular grades (percentile)	0.189 (0.457)	0.203 (0.458)	0.167 (0.466)
regular grades ² (percentile)	0.244 (0.530)	0.233 (0.527)	0.263 (0.527)
Observations	224	224	224
Panel B			
Dependent Variable: Take Entrance Exam			
Generalized residual (from Panel A)	0.045** (0.022)	0.045** (0.022)	0.044** (0.022)
log prob of winning tourn.	-0.150** (0.059)	-0.137** (0.055)	-0.122* (0.063)
1-riskaversion		-0.031** (0.015)	-0.031** (0.015)
overconfidence			0.022 (0.022)
regular grades (percentile)	1.338*** (0.426)	1.275*** (0.411)	1.240*** (0.424)
regular grades ² (percentile)	-0.790* (0.472)	-0.750* (0.447)	-0.718 (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 7: Regressions of Tournament Entry, Pooled across Ethnicity

	Middle School		
	(1)	(2)	(3)
male	0.025 (0.154)	0.019 (0.150)	-0.001 (0.143)
male*Mosuo	0.090 (0.183)	0.046 (0.176)	0.059 (0.171)
Mosuo	-0.038 (0.134)	-0.016 (0.132)	0.039 (0.142)
male*Yi	-0.137 (0.214)	-0.190 (0.191)	-0.152 (0.203)
Yi	0.100 (0.118)	0.079 (0.123)	0.086 (0.118)
log prob of winning tourn.	0.239*** (0.062)	0.264*** (0.060)	0.242*** (0.055)
1-risk aversion	0.009 (0.017)	0.007 (0.017)	0.005 (0.017)
overconfidence	0.029 (0.024)	0.035 (0.024)	0.030 (0.023)
age		0.001 (0.484)	0.006 (0.486)
age ²		0.002 (0.015)	0.002 (0.015)
# sisters		-0.028 (0.019)	-0.027 (0.018)
# brothers		0.043 (0.034)	0.040 (0.036)
Household head agricultural			0.212** (0.092)
Education of household head			0.006 (0.009)
School fixed effect	-0.102 (0.125)	-0.074 (0.125)	-0.070 (0.130)
Observations	243	238	232
Log likelihood	-155.9	-148.0	-144.1
Mean dep var	0.416	0.412	0.418

*** 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.

Chapter 3

Do Girls in China Compete Just As Much As Boys? Experimental Evidence from a Cultural Laboratory*

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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. The underrepresentation of women in leadership roles could also reinforce gender differences in competitive inclination in a “low” equilibrium. This paper studies competitive inclination in China, a country which has deliberately sought to move to a “high” equilibrium through massive coordinated government action. Competitive inclination is elicited from three ethnic groups in a “cultural laboratory”: the majority Han Chinese, a matrilineal minority group, and a patrilineal minority group. The Han Chinese exhibited no statistically significant gender differences in competitive inclination. Women in the patrilineal minority, where clan leaders arrange marriages, are less competitively inclined than the men, and the men are as competitively inclined as the Han Chinese. Women in the matrilineal minority are as competitively inclined as the Han Chinese but the men are more competitively inclined. This non-intuitive result may be explained by the special non-exclusive nature of “marriages” in the matrilineal group. These findings suggest that coordinated government action can shape competitive preferences, which have the potential to lead to organic increases in gender diversity in leadership roles. More broadly, they support the case for quotas for women in parliament and corporate boardrooms.

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1 Introduction

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 have attracted considerable attention (see, for example, Tierney (2005) and Varian (2006)) because they 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

The preponderance of the evidence could support the view that the gender difference in competitive inclination is inherent in human biology. However, a competition study conducted in two traditional unilineal societies, one patrilineal and the other matrilineal found that while men were more competitively inclined than women in the patrilineal society, women were marginally more competitively inclined than men in the matrilineal society (Gneezy et al. (2009)). The finding from the matrilineal society tells us that it is not universally true that men are more competitively inclined than women and that culture may play a large role in forming competitive preferences.

Nonetheless, it remains true that in the overwhelming majority of studies, men were found to be substantially more competitively inclined than women. Additionally, from the anthropology literature, we know of no matriarchal society, where political power is generally held by women, to exist or to ever have existed (e.g. Goldberg 1973). If it is possible for women to be as competitively inclined as men, why are there not more societies in which political power is shared equally between men and women? One explanation is that the underrepresentation of women in competitive arenas reinforces gender differences in competitive inclination (because young women see that women are underrepresented in competitive fields, they do not expect to have to be competitive and therefore do not develop a drive for competition), thus creating a “low” equilibrium from which individual deviation is costly and therefore rare.

The experiments in this literature have almost exclusively been conducted in OECD countries, where men are expected to be breadwinners but women can choose whether to

¹Niederle 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.

²Bertrand 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%.

work in or outside of the home, i.e. in the competitive or non-competitive labor force.³ This paper is the first to study competitive inclination in a society that has deliberately sought to move to a “high” equilibrium. In China, massive coordinated government action between 1949 and 1978 has pushed women in unprecedented numbers into the paid labor force. Women in China, like women in other formerly planned economies, were *expected* to work outside the home. In 1980, at the height of communism, prime age female labor force participation in China was 81%.⁴ Even today, high female labor force participation remains a legacy of communism in China, where, in the 30 years since market reforms, female labor force participation of the population 15 and over has been higher than that in every OECD country, with the exception of Iceland (ILO).

To examine the impact of coordinated government action on gender differences in competitive inclination, three ethnic groups in China were selected for comparison: the majority Han Chinese ethnic group, a patrilineal minority group, and a matrilineal minority group. While the Han Chinese have been exposed to the full force of the communist labor and gender egalitarian policies, minorities in China have been afforded a degree of cultural autonomy that have exempted them from the most radical of these policies, which I will discuss in detail below. It is the differences in the gender patterns of competitive inclination across these ethnic groups that will illuminate the mechanisms of competitive preference formation.

In order to make as clean a comparison as possible, subjects were drawn randomly from the high school student population in a county seat in southwest China’s Yunnan Province. This unique setting essentially provides a cultural laboratory that naturally imposes tight controls on other plausible confounds with culture. While cross-cultural evidence in experimental economics has yielded important insights with respect to economic correlates with social preferences (e.g., Henrich et al. 2001, 2005), cultural comparisons are almost always conducted in different countries, which raises at least four methodological difficulties (Camerer 2003). The advantage of finding a cultural laboratory is that it addresses all of these concerns. First, experimental payouts do not require adjustment for purchasing power as they would across different countries. Second, the same set of instructions can be used because both schools participating in this study use same the language of instruction – Mandarin Chinese. Third, because the entire study was held in one county seat, I was able to conduct all experiments so experimenter variation is minimal. Fourth, confounds with culture that vary across countries are held constant, such as the employment rate, growth rate, inflation, etc., and any background characteristics that differ across individuals can be directly controlled for, without having to worry about, say, what one year of parental education in one country equates to in another country.

Additionally, comparison of the two minority ethnic groups in this cultural laboratory sheds new light on competitive inclination in unilineal societies.⁵ Gneezy et al. (2009) found that men in the patrilineal society are relatively more competitively inclined than the women when compared with the men and women in the matrilineal society chosen for their study.

³Akerlof and Kranton (2010) rely on this observation to formulate their identify model on gender and work.

⁴ILO, ages 25-54.

⁵Most societies in developed countries, and increasingly the Han Chinese society, are characterized as bilateral, where kinship is traced through both mothers and fathers (Stone 1997: 235; Levy 1949; Fong 2002).

The geographical concentration of the present study allows me to make meaningful comparisons of not only gender differences in competitive inclination across cultures, but also comparisons of absolute levels in competitive inclination across the men and women of each culture. In other words, instead of only looking at a difference-in-difference, I can look at simple differences. This gives me insight into how matrilineal women compare with the patrilineal women, or with patrilineal men, for example. Furthermore, comparisons with the Han Chinese men and women will allow me to examine how cultural norms interact with government action to shape competitive preferences.

Borrowing the Niederle and Vesterlund (2007) experimental design, I conducted experiments with 296 high school students in November and December 2009. A post-experiment survey was administered to all subjects and academic performance data was collected from the school administration to capture demographic and socioeconomic background characteristics. Individual risk aversion data was collected separately using the Binswanger (1980) instrument in February and March 2010.

I find no statistically significant gender difference in competitive inclination among the Han Chinese subjects. These findings are especially surprising given the long history of female subordination and seclusion in Han Chinese culture, and given that culturally western countries document 36 to 53 percentage point gender gaps from almost identical experiments. The Yi, the patrilineal minority, have a statistically significant gender difference of 24 percentage points, with the women being less competitively inclined than the men and the men equally competitively inclined as the Han Chinese men and women. The Mosuo, the matrilineal minority, also have a gender difference of 24 percentage points, although the women are equally competitively inclined as the Han Chinese men and women and the men are more competitively inclined than everyone else. This non-intuitive result can be explained by the special non-exclusive nature of Mosuo relationships.

The paper proceeds in Section 2 to discuss the experimental setting. Section 3 gives an overview of each culture. Section 4 describes the data collection procedures. Section 5 presents results for individual ethnic groups. Section 6 pools data from the three ethnic groups. Section 7 checks the interpretation given for the patterns seen in the data. Section 8 examines some alternative explanations. Section 9 concludes.

2 Experimental Setting

All subjects are recruited from the two high schools of Ninglang county, both located in the county seat, about a mile apart.⁶ 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.⁷ Ninglang itself has been

⁶Schools in this county, as elsewhere in China, follow a uniform standard for textbooks, curriculum, and exams. The two high schools are boarding schools, although students whose homes are nearby may choose to commute.

⁷The 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.

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).⁸

With a population of 230,000, Ninglang's three main ethnic groups are the Yi, the Han Chinese, and the Mosuo, comprising 62%, 20%, and 9% of the population, respectively (China Census, 2000). Ethnicity in modern China is rigidly defined. In the 1950s, the Chinese government sponsored a massive ethnic identification project, which officially categorized each citizen into one of 56 ethnic groups. The majority ethnic group, both then and now is the Han Chinese, who make up 90% of the population according to the 2000 Census. Today, ethnicity can only pass from parent to child and is required information on official identification documents.⁹

Although the Han Chinese presence in the minority regions such as Tibet and Xinjiang has increased in recent years, contributing to ethnic tensions, in Ninglang County, the ethnic composition has remained stable for at least the last 50 years. The Han Chinese actually make up a somewhat lower percentage of the county population than they did in 1956.¹⁰ Of the three ethnic groups, the Mosuo have the longest recorded history in Ninglang. Their activities in the region were recorded in the Writings of the Later Han (Hou Han Shu) which covers the history of the Eastern Han dynasty, from 25 to 220 AD (Shih 2010: 36). The earliest Han Chinese in Ninglang were miners and craftsmen recruited to work on the silver mine during the reign of Emperor Qianlong (1736-1796 AD), as tombstone inscriptions indicate (NLYZZZXGKBXZ, 1985: 12). Most also came from Sichuan province. When the mine ceased operations in the early 1900s, the Han Chinese settled into the basin lands occupied by the Mosuo, renting land from the Mosuo chieftains (NLYZZZXGKBXZ, 1985: 12). Most of the Yi in Ninglang, according to their genealogies, are descendents of five clans of Yi from the Greater Cool Mountains (Sichuan Province) who migrated to Ninglang during the reign of Emperor Daoguang (1820-1850 AD) (NLYZZZXGKBXZ, 1985: 10). The early Yi in Ninglang were probably driven out of Sichuan due to clan warfare but many also have been recruited by the silver mine to provide security (MZWTWZCSYNSBJWYH, 2009: 1-2). The three ethnic groups, therefore, have a history of coexistence in the region for at least 200 years.

Prior to the 1950s, there were very few schools in Ninglang, all locally administered (NLYZZZXJYJ, 1997). When the Communist government came into power, local schools were either closed or absorbed into a centralized public schooling system. These schools are open to all students, regardless of ethnicity and the language of instruction is Mandarin, a dialect of Han Chinese. Today, the only two high schools in Ninglang are in the county seat, where students of all ethnic backgrounds attend the same classes and live in the same dormitories.

⁸At the exchange rate of \$1 = RMB 6.8.

⁹To borrow a phrase from Stevan Harrell, a Yi scholar, 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

¹⁰The ethnic composition in Ninglang County in 1956 was as follows: 50% Yi, 25% Han, and 8% Mosuo (NLYZZZXZBJWYH: 259).

3 Cultural distinctions

3.1 Han Chinese

Traditional Han Chinese society was structured around the patrilineal family according to Confucian principles (e.g. Stacey 1983), which most simply stated that parents were superior to children and men were superior to women (e.g., Fairbank and Goldman 1998: 51). The family was the most important unit of organization in both agricultural production and business operations (Yang 1965: 5, 138). The head of the household, almost always male, had authority over “who worked where, when and at what; who spent what and how; and when and whom [family] members would marry (Stacey 1983: 32).” The purpose of marriage was to produce male heirs and to acquire a daughter-in-law “for the service and comfort of the parents,” rather than to fulfill any desires of the individuals joined in matrimony (Yang 1965: 23). Marriage, arranged by and for the groom’s family, was essentially “an exchange of women (Stacey 1983: 34).” Once married, a woman belonged to her husband’s family and had no grounds for divorce (Stacey 1983: 34; Yang 1965: 64). To the extent possible, she was confined to the domestic sphere and excluded from all forms of public life (Stacey 1983: 39). Any income she may generate, mostly through domestic sidelines although in the South women also worked in agriculture, was controlled by the head of the household (Yang 1965: 140).

When the Communist Party assumed power in China, one of the first orders of business was to bring women into the paid labor force. Elisabeth Croll writes that the participation of women in the work force was “identified as the precondition of women’s emancipation and the crucial factor in winning equality for women (Croll 1983: 2).” Other scholars point out that, aside from rhetoric, the state found it economically necessary to mobilize all labor, including women’s, to achieve its goals of rapid industrialization and infrastructure development (Wolf 1985: 81; Yang 1965).

The Marriage Law of 1950 was promulgated to achieve these policy objectives. It abolished arranged marriage, established minimum ages for marriage, and granted both men and women the right to divorce, which weakened the claims of the household head on women’s labor, thus freeing women to work for pay outside of the home (Hershatter 2004: 999). The right for a wife to keep her maiden name after marriage was another provision introduced in the Marriage Law, a custom which differentiates the Han Chinese of the People’s Republic of China today from those Han Chinese in Hong Kong and Taiwan. The radical legislation was accompanied by the establishment of local courts to which women could turn to defy the authority of the household head and mass education campaigns to make the new legal provisions known throughout the country (Croll 1983: 1-2).

Across China, women joined the paid labor force in unprecedented numbers. In urban areas, they worked in state enterprises and neighborhood workers’ cooperatives. In rural areas, they worked in agricultural collectives, in which they, like the men, were paid individually in workpoints that translated into grains and cash (e.g. Croll 1983). While there is debate around just how much more valuable was women’s work in the collectives compared with their contribution to their households pre-1949 (Benjamin and Brandt 1995; Kung and Lee 2010), undisputed, collectivization transformed agricultural work into paid work outside of the home, giving unprecedented visibility to women’s contribution to household income

and presumably control over that income (Croll 1983; Judd 1990).¹¹ In 1980, at the dawn of the reform era, women's labor force participation for the population aged 15 and over was 71%, which was higher than that in every single OECD country, and higher than even male labor force participation in some OECD countries, e.g. Italy and the Netherlands (ILO).

3.2 Yi

Like the traditional Han Chinese, the Yi are a patrilineal and patrilocal people (see, for example, articles in Harrell 2001b).¹² The highly stratified Yi society is organized around the patrilineal clan. Clans belonged to distinct castes, depending on the the number of generations in the clan's genealogy and the number of male members it claims (Lu 2001: 70). The lowest caste is composed of slaves, often captured from other ethnic groups who by definition have no clan affiliation. Members of a clan band together in cases of feuds and to settle disputes, and may mete out punishment to members that break customary laws (Hill and Diehl 2001).

One such law is that one must marry within one's caste but cannot marry someone from one's own clan. Anecdotes abound on the horrific consequences of defying these rules (Wu 1997: 223, 343). Marriages are arranged by the clan leaders, and serve primarily to make alliances between clans (Harrell 2001a: 91). Almost every girl's marriage is arranged shortly after she is born (Wu 1997: 207). If a girl is not married by age seventeen, the normal age at which girls marry, her natal family performs a ritual to indicate that the girl is no longer a member of the family (Bamo 2001). Daughters are never considered full members of a family anyway, as illustrated in the following Yi proverb: "An egg is both meat and not meat; a daughter is both family member and not (Bamo 2001)."

Agricultural collectivization and with it, the implementation of the workpoint system, was carried out in Ninglang just as it was in the rest of China, although Ninglang had a later start. However, in an effort to win over minorities and avoid upsetting their existing power structures, the Chinese government exempted minorities from provisions in the national Marriage Law of 1950 such as the minimum marriage age and the right to divorce (Dreyer 1976: 119). For the Yi it meant a majority continued to follow customary clan laws regarding marriage despite the existence of local courts. Piecemeal efforts to reform Yi marriage customs came to Ninglang county in the late fifties and early sixties and was met with little success (Wu 1997: Ch 4). It was not until the economic reform era, in 1981, that a marriage law for Ninglang was passed. It was less strict than the national Marriage Law, categorizing practices such as child betrothal and early marriage as "backward customs (Wu 1997: 209)" rather using the stronger term "forbidden" as used by the national Marriage Law (Wu 1997:206). It also lowered the minimum marriage age for both men and women by 2 years (Wu 1997: 204). An education campaign for the Ninglang marriage law did not

¹¹This is not to say that women and men were compensated equally for their work. On average women received 6.5 to 7 workpoints per day to a man's 10 (Wolf 1985: 88), which, incidentally, was similar to the wage gap in the United States at the time (Goldin 1990). However, given the relative transparency of the workpoint system, women were sometimes able to successfully contest blatantly unfair cases by demanding a direct comparison of their productivity against the men's (Wolf 1985: 97).

¹²Patriliney and matriliney refers to "the gender direction of the transmission of associations, rights, and duties from one generation to the next (Harrell, 2002)."

begin until 1986, and was hampered by high illiteracy rates and low levels of Han Chinese comprehension (Wu 1997: 202). As of 1992, arranged marriage in many Yi villages still accounted for over 70% of all marriages (Wu 1997: 202) and a survey in the neighboring Greater Cool Mountains Prefecture, where a provision in their marriage law specifically forbade clan influence over marriage decisions (Wu 1997: 206), found that 57% of Yi girls were either married or engaged by the time they are seventeen (Wu 1997: 203). Where Yi marriage reform met with any success was among the urban cadre population (Wu 1997: 202).

Interestingly, the Yi scholar Stevan Harrell notes that pre-1949, ethnologists always compared the position of Yi women favorably to that of their “foot- and house- bound Han counterparts.” However, by his estimation, contemporary women’s status in Yi society is relatively lower than that of women in Han Chinese society. For example, Yi males are better educated on average than Han Chinese males, but Yi females had the least schooling. Yi women did not become cadres or teachers as Han Chinese women and women of other ethnic minority groups did. And in everyday interaction, women serve men, eat after them, and do most of the housework while men sit, talk and drink (Harrell 2001a: 99).

3.3 Mosuo

The Mosuo belong to a minority of societies in the world that are categorized as matrilineal (see, for example, Cai (2001); Shih (1993); Walsh (2001)). At birth, a Mosuo child is automatically a member of his or her mother’s family. Brothers and sisters generally work, eat and raise the children born to the sisters together, for their entire lives (Cai 2001: 121). In each household, there are generally two household heads, one male and one female. The female head’s role is essentially managerial: she organizes work in the home and in the fields, manages the finances, and serves the meals. The male head’s role is essentially social: he is in charge of dealing with the land, the livestock, helping other villagers, and presiding over meals when there are guests (Cai 2001: 122-123). Successors are usually the oldest daughter and the oldest son, but authority stems from the personal merits of competence and impartiality (Cai 2001: 124). The household heads do not control the household income as did the household head in traditional Han Chinese society. Each member of the household has the right to enjoy the fruits of his or her own labor. For all important decisions such “what and how much to grow, the purchase or sale of land and livestock, the pawning and renting of land, the construction of a house...” all members of the household would be included in the discussions (Cai 2001: 125).

A unique feature of the Mosuo matrilineal society is their sexual visitation system called the “walking marriage,” where the man travels to visit the woman in the evenings but returns to his own matrilineal home by the next morning. It normally does not involve cohabitation and is “nonexclusive, noncontractual, and nonobligatory (e.g. Shih 1993).” A Mosuo man or woman is free to engage in a “walking marriage” with no explicit limitation related to “age, generation, rank, or ethnic identity (Shih 2010: 77).” There was also no “moral, legal, economic, or other conditions” that prevented either partner from being involved in multiple “walking marriages” at the same time (Shih 2010: 81) or to terminate a relationship for whatever reason (Shih 2010: 79). Both men and women can have a number of “walking marriage” relationships, whether over a course of a lifetime or of one evening (Cai 2001:

202). If cohabitation take places between partners in longer relationships, it does not signify greater commitment or obligations; the moved-in partner can leave at his or her free will (Shih 2000). Children resulting from “walking marriages” 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).

While there was no legislation formally trying to reform the traditional Mosuo marriage institution, during the Cultural Revolution, with pressure from a Communist party work team, the local commune leaders tried to impose marriage on those involved in open relationships. However, once the work team left, with the exception of marriages involving cadres, most marriages dissolved shortly thereafter (Cai 2001: 389). In 1974, a more forceful campaign was brought into the Mosuo areas, where peasants were made to understand that sexual relations outside of a marriage formalized with a marriage license was illegal. Men and women were forced to live together in the same nuclear household rather than continue their walking marriage from their matrilineal homes (Cai 2001: 394). This created great turmoil in the Mosuo society and was met with resistance. With the end of the Cultural Revolution and the onset of the market reforms, the policy was reversed and Ninglang County officially recognized the Mosuo visiting relationship as a protected class of relationship in 1981 (Shih 1993). However, the state continued to enforce official marriage on cadres and salaried employee of the state (Cai 2001: 403).

3.4 Survey data

A short written survey was administered to my experimental subjects after the experimental session, with the purpose of understanding what key socioeconomic or demographic factors may vary across ethnic groups, and also as a check on the anthropological evidence. The questions were written to correspond to the Chinese Census whenever possible to maximize clarity. Nonetheless, verbal clarifications were required for some of the questions, such as the definition of brother and sister in a household, since often cousins lived together under the same roof. Selected survey results are presented in Table 1. It appears that in this uniquely controlled setting, there were no statistically significant differences in socioeconomic or demographic variables across the three ethnic groups. All three groups had similar levels of household income, educational attainment of household heads, propensity to have a head of household working in the non-agricultural setting, and number of siblings. They even scored similarly on math exams. By design, the subjects were drawn from the same grades and, as expected, there was no differences in age across the three ethnic groups. On the other hand, the ethnic correlates corresponded to the anthropological evidence, with the Mosuo most likely to have a female head of household and to have parents participating in a walking marriage. Given the lack of obligations surrounding the Mosuo union, it is not surprising to find that the Mosuo have the highest propensity for mixed ethnicity relationships.

4 Data collection

4.1 Experimental procedures

The experiment was borrowed from Niederle and Vesterlund (2007). All sessions were conducted in the fall semester of 2009. Session size ranged from 8 to 24 subjects, with a total of 14 sessions. Subjects were high school students in grades 11 and 12, recruited randomly from the schools' rosters within ethnicity and gender such that each session consisted of one ethnic group and was evenly divided across gender. Selected students were informed during class of the time and place to meet for the experiment. Absentees were replaced by the first students on the randomized roster that matched on ethnicity and gender, and consisted of no more than 5% of the total subjects present.

Vacant classrooms, generally rooms designated for taking exams, were used as the experimental lab. All sessions took place during the school day, either during normal breaks, or during times that administrators deemed appropriate. Each sessions lasted around an hour and half.

I read all experimental instructions out loud in Mandarin, which is the national language as well as the official language of instruction. Copies of the instructions were also distributed to everyone to read. Subjects recorded their responses on paper and graders assessed these responses during each session. Scratch paper was provided for everyone.

4.2 Experimental design

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	
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The experiment consists of three main rounds, 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.

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

Round 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.¹³

Round 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 round. 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.

Following Niederle and Vesterlund (2007), if the subject chooses tournament in round 3, their score is compared to the scores of the other three group members in round 2 (the

¹³In the case of a tie all those tied for highest score are paid 2 RMB per problem.

compulsory tournament round), rather than their score in round 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 round before they begin the next round. However, they do not know their relative ranking within their group. After the third round, 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.

The order in which the piece-rate round and the compulsory tournament round was conducted was randomized across sessions of each ethnicity such that half of the sessions for each ethnic group were conducted with the piece-rate round occurring first and half of the sessions with the compulsory tournament round occurring first. The discretionary tournament round always occurred last.

Following standard experimental practice, one unpaid practice round was administered before the first round to familiarize subjects with the task. At the end of the experiment, one of the rounds was randomly chosen for payout, to minimize wealth effects across the rounds. A written survey was distributed as students waited for their payment. For the experimental instructions and the survey instrument (translated into English), see the web appendix. The show up fee is RMB 2 and average payout not including the show up fee was RMB 7.5.

5 Tournament entry and Experimental Factors Determining Tournament Entry

Raw rates of tournament entry from this study are shown in context with select experimental results from other studies in Table 2. Substantial gender differences in tournament entry exist among the Yi and the Mosuo, with the men more likely to choose the tournament. The Han Chinese have a smaller gender difference, which is not statistically significant at conventional levels. 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.¹⁴

In column 1 of each panel of Table 3, the raw rates of tournament entry are regressed on gender using a probit regression, clustered by session. As expected, the coefficient on gender is large and significant for both the Yi and the Mosuo. The Han Chinese in this analysis also have significant gender differences in tournament entry, although the coefficient is smaller in size than that of either the Yi or the Mosuo. Note, however, that tournament entry is not equivalent to competitive inclination.

¹⁴Although the female Masai have the lowest tournament entry rate in this table, it cannot be directly compared with the rest of the results because the Gneezy et. al (2009) study used a different task and a different experimental design.

In order to tease apart gender differences in competitive inclination from other factors within the experimental context that can influence a subject’s tournament entry decision, I follow the literature in successively controlling for each individual subject’s probability of winning the tournament, risk aversion, and overconfidence using the following regression equation:

$$y_i = \alpha_0 + \alpha_1 male_i + \delta p_i + \lambda q_i + \tau \gamma_i + \varepsilon_i \quad (1)$$

where $y_i = 1$ if the subject chooses tournament and 0 if the subject chooses piece-rate. $male_i$, of course, equals one if the subject is male and zero if the subject is female. p_i is the probability of winning the tournament, γ_i is the coefficient of constant relative risk aversion, and q_i is the proxy for overconfidence.

5.1 Probability of winning the tournament

Anyone faced with the decision of entering a tournament must weigh their probability of winning against the risk of losing. In this section I describe how I obtain the objective probability of winning for my subjects. The gap between their objective probability of winning and their subjective probability of winning will be addressed in the section on overconfidence.

In the literature, subjects are usually drawn from large universities and are virtually anonymous to each other. Assuming no expected increases in computational ability from the compulsory tournament round to the discretionary tournament round, the objective probability of winning p_i can be fully proxied by one’s own realized score on the compulsory tournament s_{ri} . In this setting, subjects are known to each other, and, moreover, their ability in math is known to each other, given that grades are public knowledge in China. Therefore, a more precise proxy for the objective probability of winning would taken into account not only one’s own scores, but the scores of one’s competitors as well. To summarize the four scores into one measure, I employ a standard logit probability equation. Assume that the potential score s_{pi} is known up to some noise around the realized score s_{ri} :

$$s_{pi} = s_{ri} + k\xi_i \quad (2)$$

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 the closed-form expression for p_i , the true probability of winning in a group g is:

$$p_i = \Pr(s_{pi} > s_{pj}, j \neq i) = \frac{\exp(ks_{ri})}{\sum_{j \in g} \exp(ks_{rj})} \quad (3)$$

Since winning in the discretionary tournament is defined by scoring higher than the other three group members did in the compulsory tournament round, s_{ri} denotes the score in the discretionary tournament round and s_{rj} , $j \neq i$, denotes the scores in the compulsory tournament round. k , the non-linear scale parameter was estimated separately in Zhang (2011a).

Figure 1 shows the empirical cdfs of performance in the compulsory tournament round by gender for each ethnic group. Visual inspection shows that the Mosuo and the Yi have

no gender differences in performance. Mann-Whitney tests confirm this observation (p-value=0.78 for the Mosuo and 0.73 for the Yi). The Han Chinese men appear to have done better than the women, although the difference is insignificant at conventional levels in a Mann-Whitney test (p-value=0.12). The lack of significant gender differences in the performance in the compulsory tournament is consistent with the literature (e.g. Niederle and Vesterlund 2007).

Since the tournament entry decision depends not only on the probability of winning the tournament, but also on the payout in the case of choosing the piece-rate, another piece of information that will be relevant for subjects is the effect that the incentive scheme has on their performance itself. This is the improvement in scores between the piece-rate and compulsory tournament rounds, which in the literature has been interpreted as one's competitive ability (Gneezy et al. 2003). Experiments following the Niederle and Vesterlund (2007) design has elements of the Gneezy et al. (2003) experiment but because the compulsory tournament round always comes after the piece-rate round, the competitive ability effect is confounded with any learning effect. An innovation in this study was to randomize the order of round 1 and round 2, so the improvement between the piece-rate round and the tournament round indicates the degree to which performances respond to tournament incentives, net of any learning effects. In essence the first two rounds replicate the Gneezy et al. (2003) experiment. Comparisons across gender and ethnic group show no gender or ethnic differences in competitive ability and is to my knowledge the first study to document no increases in performance as a result of tournament incentives (see Figure 2). This could be due to the fact that the students were primed by the environment of test-taking and perform to their true ability each time.

Figure 3 shows distributions of the probabilities of winning the tournament, calculated using Equation 3, by gender across ethnic group. 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 ethnic groups. This finding is not surprising given the above analysis of performance on the tasks.

The coefficient on male in Column 2 of each of the three panels in Table 3 shows the gender difference in each ethnic group in tournament entry, controlling for the probability of winning. The inclusion of this control variable does not reduce the gender differences in the Yi and Mosuo, although the male coefficient is now slightly smaller for the Han Chinese.

5.2 Overconfidence

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. The distribution of this proxy variable is symmetric about zero, implying that subjects in my sample are on average correct about their rank, despite the fact the guesses were not incentivized monetarily (see Figure 7). 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. Figure 8 breaks the sample up by ethnicity and gender. The average value of the proxy

for overconfidence for each ethnic group is statistically indistinguishable from zero, with no differences in distribution by gender detected in Mann-Whitney tests (p -values >0.10). Both results are contrary to studies conducted in the US and the UK. The fact that my subjects are in the same schools and grades are public knowledge in China likely contributes to the accuracy of their guessed ranks, which naturally reduces overconfidence as a factor in the tournament entry decision.

Controlling for overconfidence in addition to the probability of winning the tournament in Column 3 of Table 3 does not reduce gender differences in tournament entry among the Yi or the Mosuo, but the coefficient on male for the Han Chinese is now smaller and insignificant.

5.3 Risk aversion

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.¹⁵ 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 constant relative risk aversion utility over income, each choice implies a range of values for the CRRA coefficient. Figure 4 shows the actual instrument used, translated. A histogram of the lottery choices appears in Figure 5, along with the associated lotteries.¹⁶ Although there is a mass at risk neutrality, there is a non-trivial distribution in the risk averse range. Figure 6 breaks the sample up by ethnicity 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)). Mann-Whitney tests confirm that the gender differences are significant for all three ethnic groups (p -values <0.05).

Because the risk aversion instrument was administered several months after the main competition experiment, not all subjects were present for risk aversion measurement. In order to explicitly address any selection effects this may cause, column 4 of Table 3 shows the gender differences across ethnic groups in tournament entry, controlling for the probability of winning the tournament and overconfidence for only those subjects for whom I observe risk aversion. It appears that some selection effects are present, although none of the results are substantively affected. Next, in column 5, I add controls for risk aversion. Following Niederle and Vesterlund (2007) and other studies in this literature, having included all three

¹⁵Holt 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.

¹⁶The distribution corresponds remarkably well to the distribution of comparable choices from the small stakes game in Binswanger (1980).

controls, I interpret any residual gender differences in tournament entry as gender differences in competitive inclination.

Given the high labor force participation of Han Chinese females post-1949, and the forces in Yi society such as arranged and early marriage and strong clan control over women that impede on the ability and perhaps incentive for Yi women to participate in the labor force, it is not surprising to find that the results indicate no statistically significant gender differences in competitive inclination among the Han Chinese, while Yi women are 23 percentage points less competitively inclined than Yi men, significant at the 1% level. What is unexpected, however, is that despite the lack of impediments in Mosuo society for women to participate in the labor force, Mosuo men are significantly more competitively inclined than Mosuo women.

6 Group differences in competitive inclination

To better understand the patterns of competitive inclination across both ethnicity and gender, I estimate a regression equation that interacts gender with ethnicity which allows me to statistically compare the gender differences in competitive inclination across ethnic groups, and also to compare the levels of competitive inclination across ethnicity-gender groups:

$$y_i = \beta_0 + \beta_1 male_i + \sum_{j=2}^3 \beta_j ethn_{ji} \times male_i + \sum_{j=1}^3 \beta_{j+3} ethn_{ji} + \tau \gamma_i + \delta p_i + \lambda q_i + X_i' B + v_i \quad (4)$$

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 represents a vector of background characteristics that include age, age squared, number of brothers, number of sisters, education of the household head, and family income. 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 4 reports the results from this estimation. Consistent with the results in Table 3, the Han Chinese 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.

Interestingly, the Yi men, the Han Chinese men, the Han Chinese women, and the Mosuo women all have about equal levels of competitive inclination. The gender difference in the Yi results from the Yi females being less competitively inclined than the males, whereas the gender differences in the Mosuo is driven by Mosuo men being more competitively inclined than the Mosuo women. It appears that the matrilineal group is more competitively inclined than the the patrilineal group, which, incidentally, also coincides with the findings from Gneezy et al. (2009).

But what can explain the gender differences that we see among the Mosuo? As discussed above, the Mosuo union is characterized by non-exclusivity. A presumption of evolutionary

biology is that polygamous mating systems exert more competitive pressure on the males than do monogamous mating systems. For example, variation in mating system is routinely used as a proxy for the degree of sexual competition (e.g. Lande 1980). Although the literature mainly focuses on non-human animals, there is evidence that early polygamous human males had more testosterone than their counterparts in early monogamous societies (Nelson et al. 2011). Females, provided that they make the greater parental investment, are the choosy sex rather than the one competing for mating opportunities (Trivers 1972). Therefore, evolutionary biology predicts no effect of mating system on female competitive behavior. For our setting, these factors translate into two predictions: 1) because the Han Chinese and Yi societies are both monogamous, Mosuo men will be more competitively inclined than either the Han Chinese or the Yi men, and 2) Mosuo men will be more competitively inclined than Mosuo women. Both predictions are borne out by the data.

7 Robustness checks

To check the interpretation that government policies are responsible for the gender difference among the Yi, I exploit the fact that exemptions from the marriage reform policies did not apply uniformly to everyone in minority ethnic groups. In particular, for those who are salaried employees of the state, non-compliance with the national marriage laws could result in the loss of an enviable job. The question in the survey I will use as a proxy for state sector employment asks whether the head of the household works in an agricultural or non-agricultural occupation. Since the private sector is negligible in Ninglang, for all intents and purposes, the non-agricultural sector in Ninglang represents the state sector.

Given that the marriage reforms discouraging child engagement practices were successful among the Yi cadres whereas they made little headway with the rest of the Yi, those Yi women whose head of household works for the state are presumably less likely to be engaged at a young age and will therefore on average marry at a later age than those Yi women whose head of household works in agriculture. In so far as the ability to pursue work outside of the home is hindered by marriage and all the responsibilities that come with it, such as childbearing and childcare, the Yi women with household heads in the agricultural sector are expected to be less competitively inclined than Yi women whose household heads work for the state. The competitive inclination of Yi men is not expected to differ across the sectors.

The Han Chinese, being the majority ethnic group in China, were not given exemptions from the national Marriage Law and therefore no differences in gender patterns are expected across the two sectors.

To test these predictions, I interact gender with sector of work for each ethnic group in the following probit regression:

$$y_i = \alpha_0 + \alpha_1 male_i + \alpha_2 sector_i + \alpha_3 sector_i \times male_i + \delta p_i + \lambda q_i + \tau \gamma_i + \varepsilon_i \quad (5)$$

where, as before, $y_i = 1$ if the subject chooses tournament and 0 if the subject chooses piece-rate. $male_i$ is an indicator variable taking the value of 1 for males and 0 for females. $sector_i$ is an indicator taking the value of 1 if the household head works in the non-agricultural sector and 0 if the household head work in the agricultural sector. p_i , q_i and γ_i are the controls for the probability of winning, overconfidence, and risk aversion, respectively. α_1 , α_2 , and α_3

are the coefficients of interest. α_1 indicates the gender difference in competitive inclination for those whose families are in the agricultural sector; α_2 indicates the difference in competitive inclination for females who come from non-agricultural families compared to those females from agricultural families; α_3 indicates the difference in the gender difference in competitive inclination between the two sectors.

The results from this estimation are displayed in Table 5 in three panels, one for each ethnic group. Columns 1, 2, and 3 in each panel explicitly highlight any changes to the coefficients of interest that result from a reduced and potentially selected sample of subjects who were observed for risk aversion. For all three panels, it appears that the inclusion of risk aversion in column 3 has a negligible effect on the gender, sector, and gender-sector interaction terms. In comparison, excluding the observations that could not be measured for risk aversion has a larger effect on these coefficients, as seen in the difference in the coefficients of interest between column 1 and column 2. For this reason, I will refer to the first columns of each panel when evaluating the model predictions.

For the Yi, the entire gender difference in competitive inclination is driven by those from agricultural families, where women are 40.5 percentage points less likely to choose tournament, conditional on the probability of winning and on overconfidence. There is no difference in male competitive inclination across the two sectors, as predicted. For the Han Chinese, very little gender difference is observed for those from agricultural families, and an insignificant increase in gender difference is observed when moving from the agricultural to the non-agricultural sector. Again, the data bear out the predictions.

For the Mosuo, recall that the cadres and state employees are explicitly required to practice monogamy. At first glance this should predict less competitive inclination for the Mosuo males in the state sector compared with the Mosuo males in agriculture. However, the legislation only limits the number of spouses to one, but does not guarantee a wife for every man. In other words, the Mosuo men in the state sector still need to compete for a wife with those Mosuo men in the agricultural sector, and moreover, needs to convince her to move out of her matrilineal household to live with him. Combine this with the fact that non-exclusive relationships continue to be tolerated among the cadres (Cai 2001: 403) and the prediction become much less obvious. The results in Table 5 show that while Mosuo men from both agricultural and non-agricultural families are more competitive than the women, those from the non-agricultural families exhibit more gender difference than those from agricultural families. Although it is hard to draw conclusions from this peculiar pattern, it is probably safe to say that government legislated monogamy for a subsector of society does not appear to decrease male competitive inclination in that sector.

Of course, the explanation provided above is not the only one which could have given rise to these patterns in the data. I contend, however, that it is the most parsimonious explanation fitting the data and I will consider and reject several alternative explanations below.

8 Alternative explanations

In this section I explore the implications of some alternative explanations for gender and ethnic differences in competitive inclination, and take these explanations individually to the

data.

8.1 Matriliney versus patriliney

Establishing property rights for women is considered by many to be instrumental to women's empowerment. In the Mosuo tradition, property is collectively owned and inherited by all members of the family, whereas in Han Chinese tradition, property is only inherited by the sons, and in the Yi tradition, property is only inherited by the youngest son. These differences in inheritance norms across the cultures, however, are unlikely to produce the patterns in competitive inclination observed for two reasons. First, the collectivization of land under communist rule has decreased the importance of property inheritance in rural China, as compared with, say, India and countries in Africa. Second, if we believe that those who stand to inherit the family wealth are more competitively inclined, perhaps because competitive inclination is related to a sense of entitlement, then we should see that men are more competitively inclined than women in the Han Chinese and Yi cultures, while gender differences in competitive inclination would be smallest among the Mosuo. On the other hand, if we believe that those who stand to inherit are the least competitively inclined because they are already provided for, then we would expect to see women more competitively inclined than men in the Han Chinese and Yi cultures, and gender differences in competitive inclination among the Mosuo would again be the smallest. Neither of these sets of predictions are borne out by the data.

Post-marital residence norms are another cultural factor widely acknowledged to impact parental investment in girls. A common saying in India, where patrilocality is prevalent, is that investing in your daughter is akin to "watering you neighbor's garden." While the Yi and Han women generally leave their natal household to live with her husband's family or clan, the Mosuo woman can expect to remain in her natal household her whole life. If we believe that those who have to break with their kinship network upon marriage are less likely to be competitively inclined, because competitive inclination is predicated upon a sense of security, then we would expect to see women being less competitively inclined than men in the Han Chinese and Yi cultures and that the smallest gender difference would be found among the Mosuo. On the other hand, if we think that those who are the least secure are those who find it most necessary to be competitive, then we would expect to see the opposite pattern. Again, neither of these sets of predictions are corroborated by the data.

Although one cannot definitively conclude that matriliney plays no role in explaining the larger competitive inclination of the Mosuo women compared with the Yi women, given that both Mosuo women and Han Chinese women were subject to the same labor policies, it stands to reason that if matriliney impacts competitive inclination through a different mechanism from the way government policies impact competitive inclination, then there would be an appreciable difference in competitive inclination between the Mosuo women and the Han Chinese women. In fact, they have the same competitive inclination.

8.2 Discrimination

Under the main mechanism proposed in this paper, labor market discrimination against minorities and women could easily lead to differences in competitive inclination across ethnicity-

gender groups. If discrimination discourages competitive inclination, we would expect to see Han Chinese males to be the most competitive and Mosuo and Yi females to be the least competitive, being both minority and female. However, these predictions are clearly inconsistent with the data.

8.3 Migration

An alternative explanation for high female competitive inclination in rural China is that it is not about communist gender egalitarian policy, but about migration opportunity. For example, women's competitive inclination in an educational setting may be determined by the opportunity to find a spouse in an urban area rather than by the higher earnings potential resulting from higher educational attainment. However, if this is the dominant mechanism, one would expect that those women who have family members working in the state sector would have greater access to migration opportunities than those from agricultural families, and therefore have greater competitive inclination. But Table 5 shows that the Han Chinese women and the Mosuo women have the same competitive inclination, regardless of the sector that their household head works in. There is a large difference for the Yi women, who are much less competitively inclined when they come from agricultural families. However, of the three ethnic groups, the Yi are the least likely to be affected by this mechanism due to their strict rules against marrying outside of the caste, let alone the ethnic group.

9 Discussion

In the last 60 years, radical communist reforms and policies have changed Chinese society from one where rarely any women worked outside of the household to one where both men and women are expected to participate in the competitive labor force. This study finds that for the Han Chinese, there are no gender differences in competitive inclination, in contrast to the large gender differentials in competitive inclination found in the western world. This phenomenon has recently been observed outside the lab as well. Of the world's female self-made billionaires, Chinese women account for half of them ((Kroll and Miller, Forbes, 2010) and of the world's largest banks, Chinese banks have a higher average female board representation than American banks (CWDI, 2010). Some in the popular media has even asserted that Chinese women are ambitious than American women (Schneiderman and Seno, Newsweek, 2010). On the other hand, in Chinese cultures where policies have allowed traditional practices that hinder women's ability to participate in the labor force to continue, such as child betrothals for young girls, women are 40.5 percentage points less likely to choose to enter an experimental competition than men, controlling for the probability of winning and overconfidence.

However, as the case of the Mosuo reveals, coordinated government effort elevating women's position in society may not be sufficient for achieving gender equality in competitive inclination. Despite the respect and autonomy that Mosuo women have traditionally enjoyed in their society, men are more competitively inclined than women, although Mosuo women are no less competitively inclined than Han Chinese women. I have offered an explanation for this special case based on the non-exclusive nature of Mosuo relationships, but in so far

as non-monogamous relationships are prevalent in other societies in the world, the impact of any coordinated government action on reducing gender differences in competitive inclination in these societies may be limited. This may be especially relevant for the culturally western societies.

A harder question is whether such government action is necessary for reaching the “high” equilibrium where women are equally represented in leadership positions. On the one hand, economic models dating back to Gary Becker’s work argues that only competitive market forces are required to wipe out any taste-based discrimination against women (e.g. Becker (1957), Becker (1971)). Indeed, substantial changes in women’s role in society have taken place. For example, according to the Bureau of Labor Statistics, labor force participation of women aged 16 and older has increased from 34% in 1950 to 60% in 1998 (BLS, 2000). The median tenure of American women over twenty-five was 3.3 years lower than that of men in 1968 and only 0.4 years in 1998 (Akerlof and Kranton 2010: 90). In 1970 only 24.6% of auditors and accountants and 4.5% of lawyers were women. Twenty years later, 52.7% of auditors and accountants and 24.5% of lawyers were women (Akerlof and Kranton 2010: 90). On the other hand, some argue that legislative action combined with the Women’s Movement was needed for these social change to occur (e.g., Akerlof and Kranton 2010: Ch 7). Whether it is only a matter of time before women, building on these achievements, are equally represented in leadership roles, remains to be seen.

The findings of this study identifies a channel through which government intervention can trigger a virtuous cycle where women respond to being put into competitive positions by adjusting their internal drive to compete, which could organically increase the number of women who enter themselves in competitions for leadership roles and improve women’s representation in these roles. Furthermore, the incredibly short time scale in which government action in China has elevated women’s position in society, especially in the face of centuries of female subordination and seclusion, gives more reason for us to be optimistic about policies legislating increased female representation in leadership roles such as quotas for women in parliament and corporate boardrooms.

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Figure 1: Empirical CDF of Compulsory Tournament Score by Ethnicity and Gender

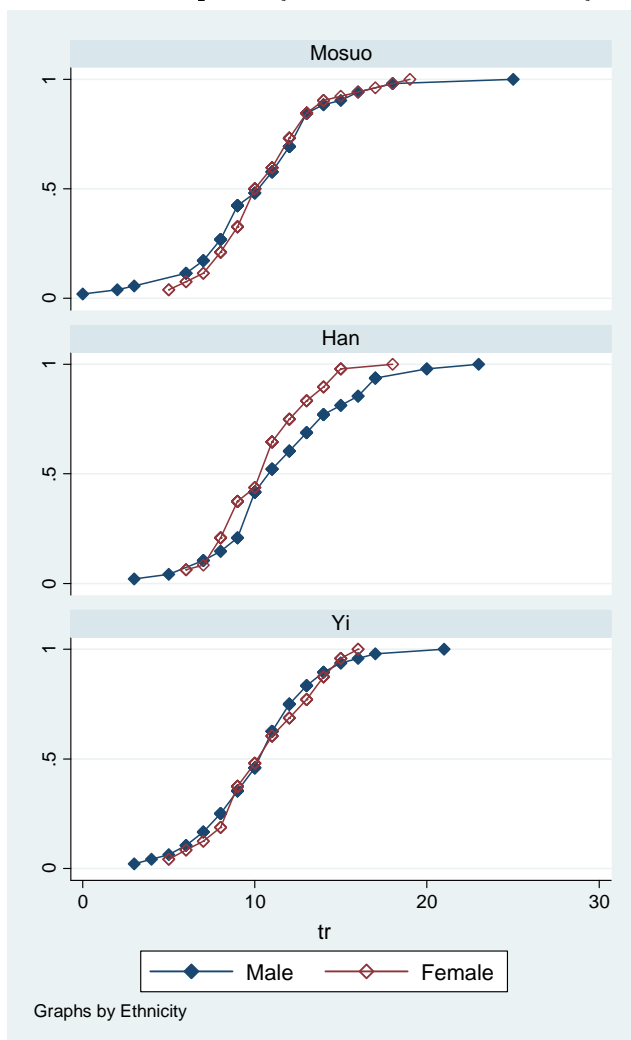


Figure 2: Improvement in Score from Piece-Rate to Tournament Round across Ethnicity, by Gender

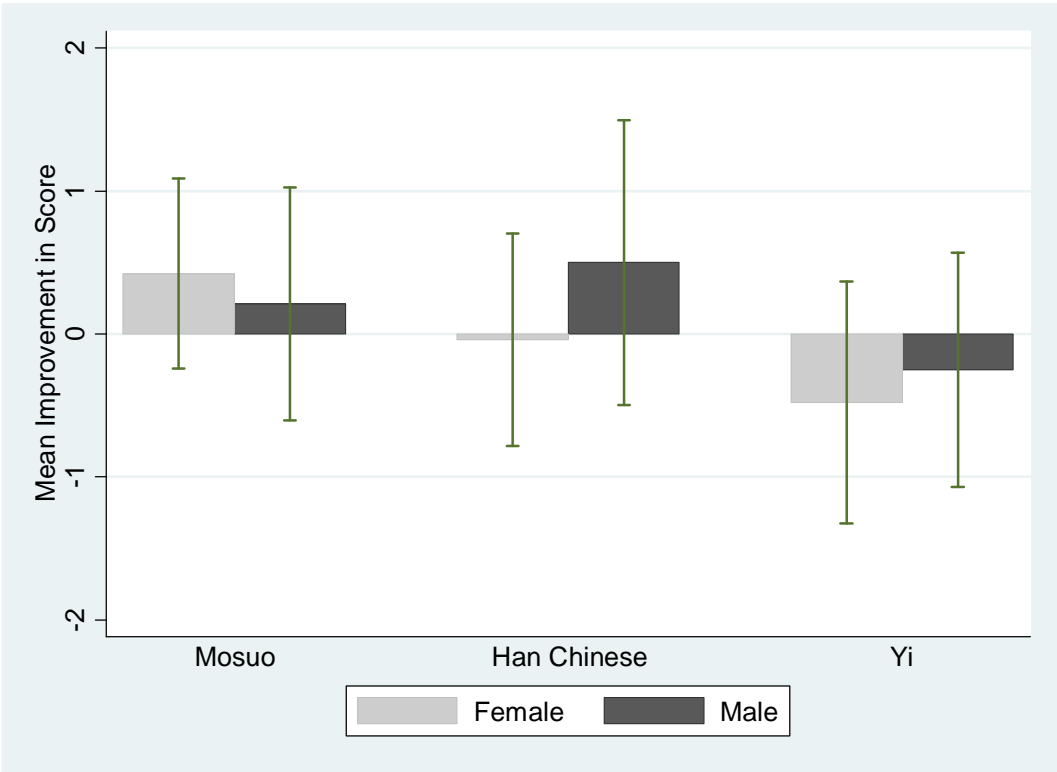


Figure 3: Distribution of the Probability of Winning the Discretionary Tournament across Ethnicity, by Gender

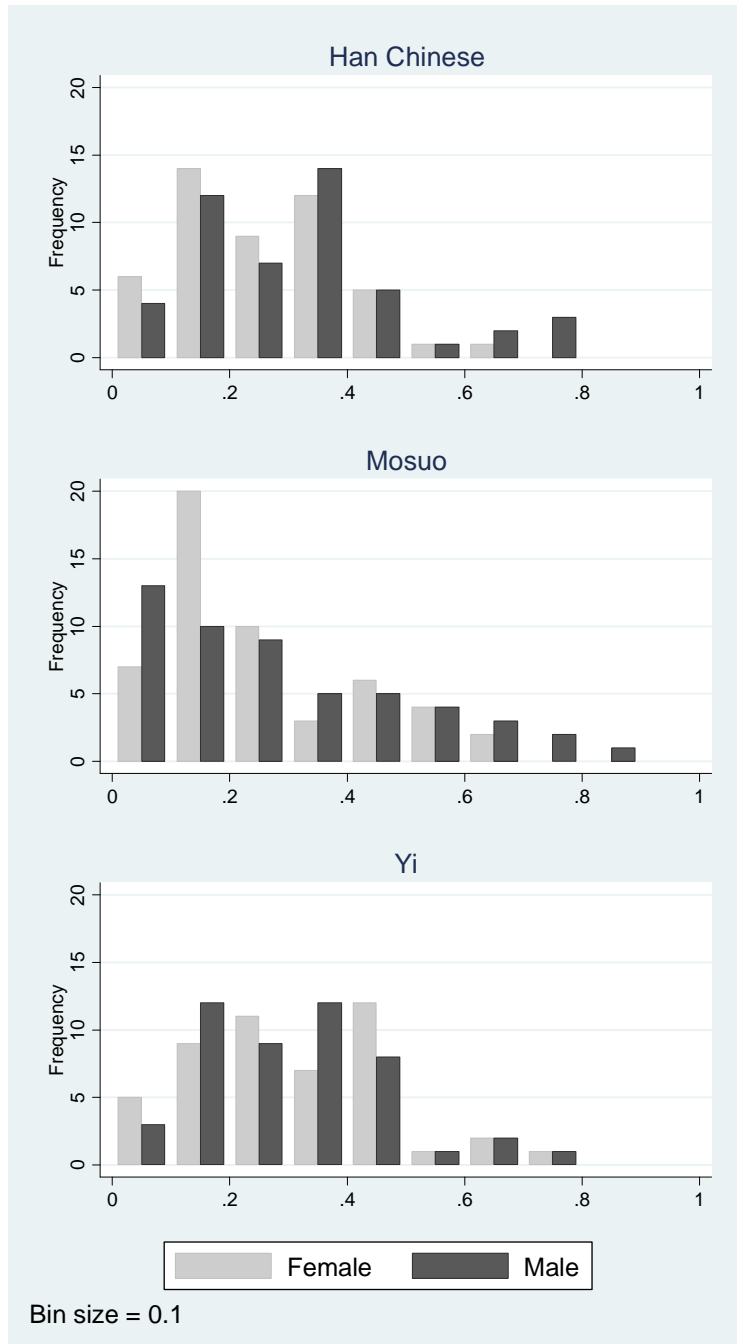
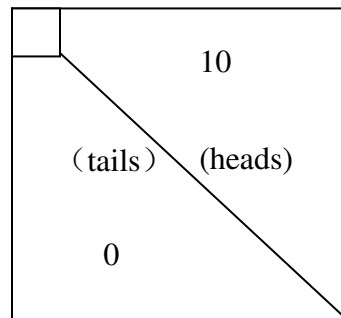
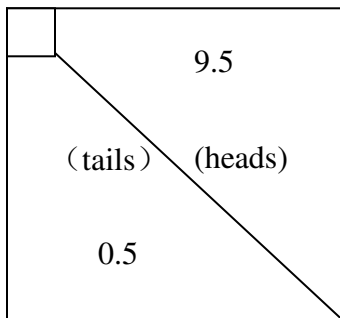
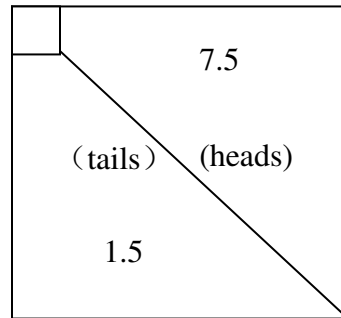
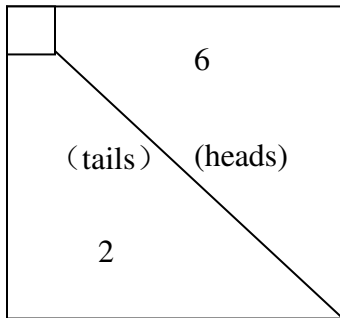
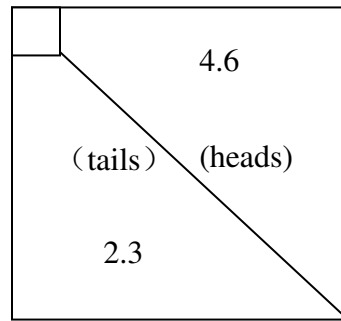
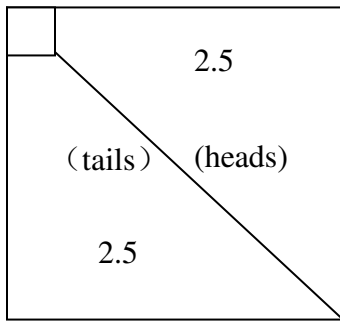


Figure 4: Binswanger Risk Instrument

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)

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

	Han Chinese	Yi (Patrilineal)	Mosuo (Matrilineal)	F-stat	p-value
Ethnicity correlates					
head of household is female	0.16 (0.37)	0.15 (0.36)	0.34 (0.48)	7.04	0.00
parents participating in walking marriage					
mixed ethnicity	0.08 (0.28)	0.07 (0.26)	0.34 (0.47)	17.84	0.00
Demographics					
age	18.43 (1.19)	18.68 (1.18)	18.38 (0.94)	2.16	0.12
brothers	0.90 (1.01)	1.17 (0.94)	0.91 (1.13)	2.09	0.13
sisters	1.04 (1.08)	1.04 (1.06)	0.87 (1.79)	0.56	0.57
siblings	1.94 (1.55)	2.21 (1.34)	1.78 (2.57)	1.27	0.28
Socioeconomic Status					
h.h. engaged in agriculture	0.78 (0.41)	0.75 (0.44)	0.79 (0.41)	0.25	0.78
h.h. educational attainment (years)	7.98 (3.10)	7.67 (4.78)	6.89 (4.30)	1.79	0.17
annual household income (100 rmb)	125.22 (94.20)	127.33 (107.77)	140.71 (113.11)	0.55	0.58
Academic Performance					
Math Grades (Score out of 100)	46.03 (17.26)	44.40 (16.98)	46.66 (16.89)	0.47	0.63
male - female	2.77	1.21	2.10		
p-value of gender difference (Mann-Whitney U test)	0.44	0.62	0.45		
Observations	96	96	104		

Figure 5: Distribution of CRRA Coefficients with Associated Lottery

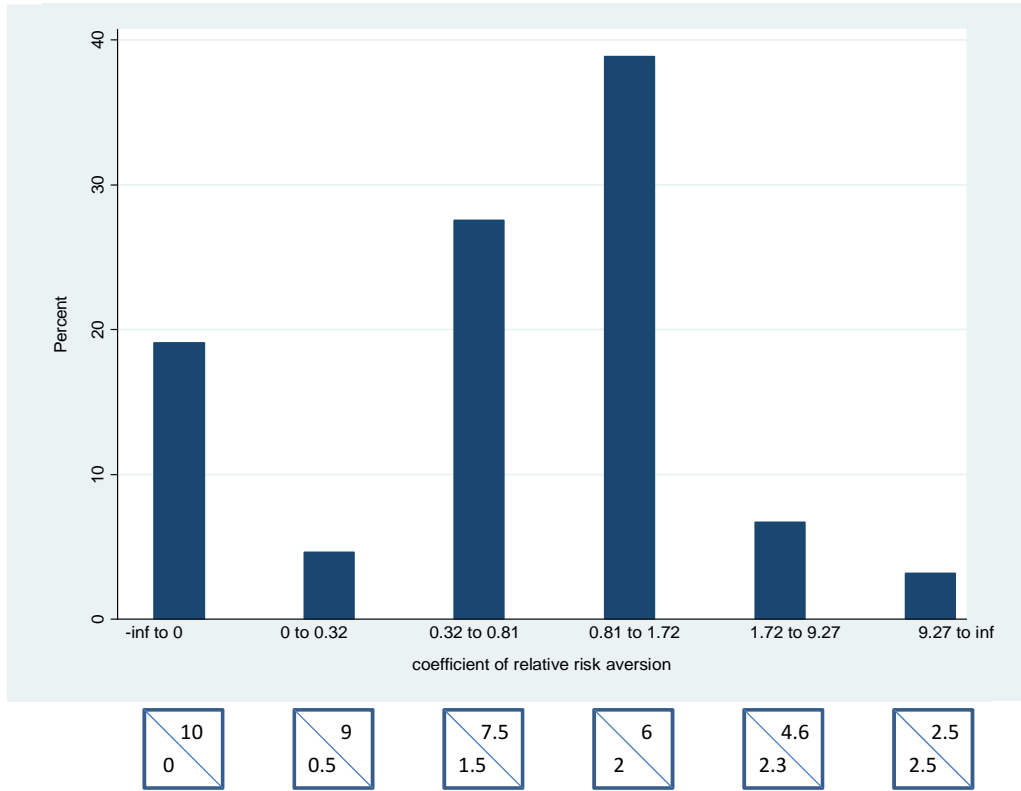


Table 2: Raw Tournament Entry Statistics

	Female	Male	Sex Difference	p-value	obs (Female)	obs (Male)
Tournament Entry						
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 33.9)						
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

Figure 6: Distribution of CRRA Coefficients across Ethnicity, by Gender

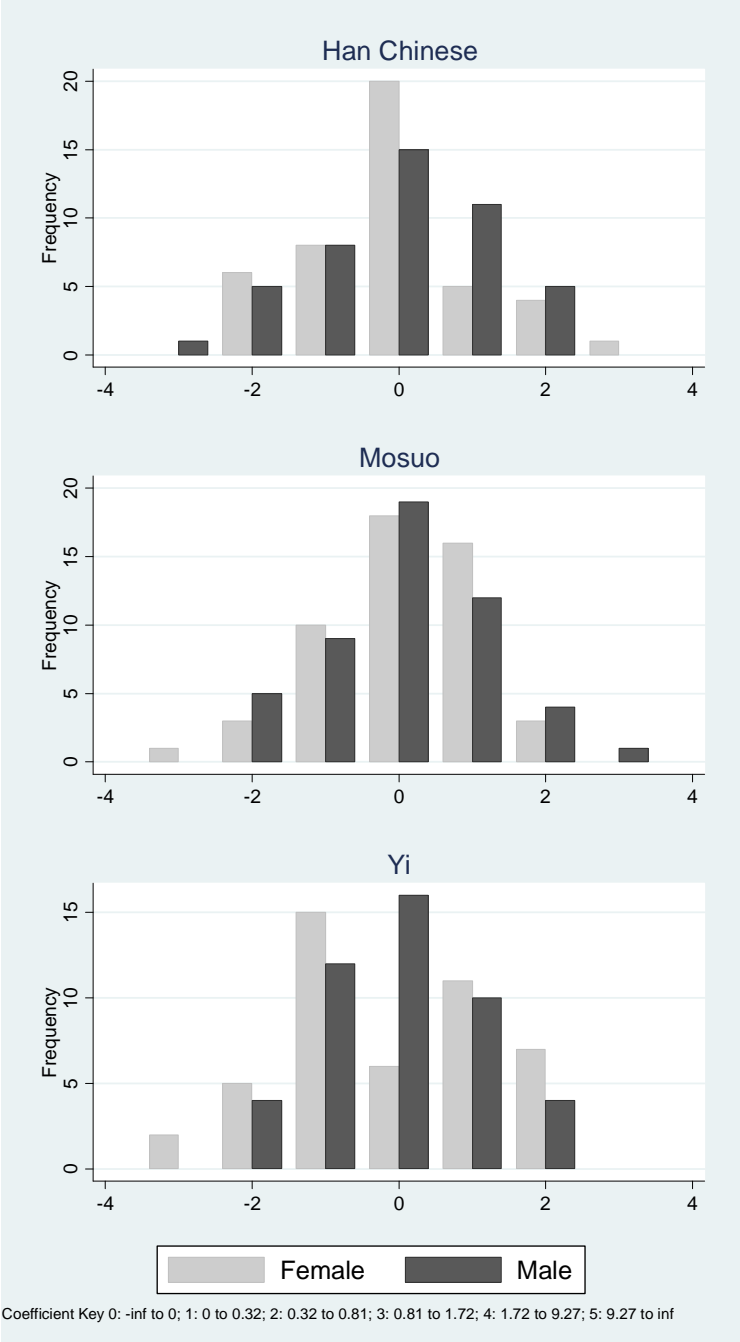


Table 3: Regressions of Tournament Entry on Gender and Controls, Separated by Ethnicity

Dependent Variable: Choose Tournament					
	(1)	(2)	(3)	(4)	(5)
Han Chinese					
male	0.146*** (0.052)	0.117* (0.067)	0.085 (0.080)	0.047 (0.080)	0.037 (0.087)
prob of winning		0.557 (0.516)	1.113** (0.554)	1.052* (0.620)	1.028* (0.600)
overconfidence			0.144*** (0.037)	0.132*** (0.035)	0.133*** (0.031)
risk aversion					-0.018 (0.018)
Observations	96	96	96	89	89
Mean dep var	0.552	0.552	0.552	0.551	0.551
Yi (patrilineal)					
male	0.229** (0.092)	0.245*** (0.090)	0.269** (0.107)	0.242** (0.097)	0.237*** (0.085)
prob of winning		0.517 (0.469)	0.777* (0.417)	0.836** (0.387)	0.853** (0.381)
overconfidence			0.082** (0.037)	0.093** (0.037)	0.084** (0.039)
risk aversion					-0.066* (0.037)
Observations	96	96	95	92	92
Mean dep var	0.490	0.490	0.484	0.478	0.478
Mosuo (matrilineal)					
male	0.231*** (0.057)	0.218*** (0.045)	0.218*** (0.043)	0.242*** (0.049)	0.241*** (0.052)
prob of winning		0.500 (0.320)	0.496 (0.355)	0.499 (0.379)	0.506 (0.389)
overconfidence			-0.002 (0.028)	0.000 (0.030)	0.002 (0.031)
risk aversion					-0.012 (0.020)
school fixed effect	0.010 (0.054)	0.008 (0.067)	0.008 (0.066)	0.006 (0.068)	0.010 (0.069)
Observations	104	104	104	101	101
Mean dep var	0.615	0.615	0.615	0.614	0.614

*** 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.

Column (4) includes only observations for which risk aversion data is not missing.

The school fixed effect only applies to the Mosuo because the Han Chinese and the Yi were all drawn from the same high school.

Table 4: Regressions of Tournament Entry on Gender, Ethnicity and Interactions, Pooled across Ethnicity

Dependent Variable: Choose Tournament			
	(1)	(2)	(3)
male	0.047 (0.060)	0.043 (0.061)	0.039 (0.061)
male*Mosuo	0.196** (0.082)	0.218** (0.087)	0.239*** (0.071)
Mosuo	-0.025 (0.109)	-0.052 (0.102)	-0.080 (0.094)
male*Yi	0.185* (0.097)	0.195** (0.093)	0.201* (0.112)
Yi	-0.187* (0.113)	-0.196** (0.099)	-0.197* (0.109)
prob of winning tourn.	0.768*** (0.241)	0.798*** (0.258)	0.730*** (0.222)
overconfidence	0.076*** (0.024)	0.080*** (0.026)	0.081*** (0.021)
risk aversion	-0.024 (0.015)	-0.017 (0.014)	-0.029* (0.015)
School Fixed Effect	Yes	Yes	Yes
Demographic controls	No	Yes	Yes
SES controls	No	No	Yes
Observations	282	282	247
Log likelihood	-177.9	-175.2	-150.6
Mean dep var	0.550	0.550	0.551

*** 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.

Han Chinese is omitted

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

SES controls include education of household head and household income.

Figure 7: Distribution of the Proxy for Overconfidence

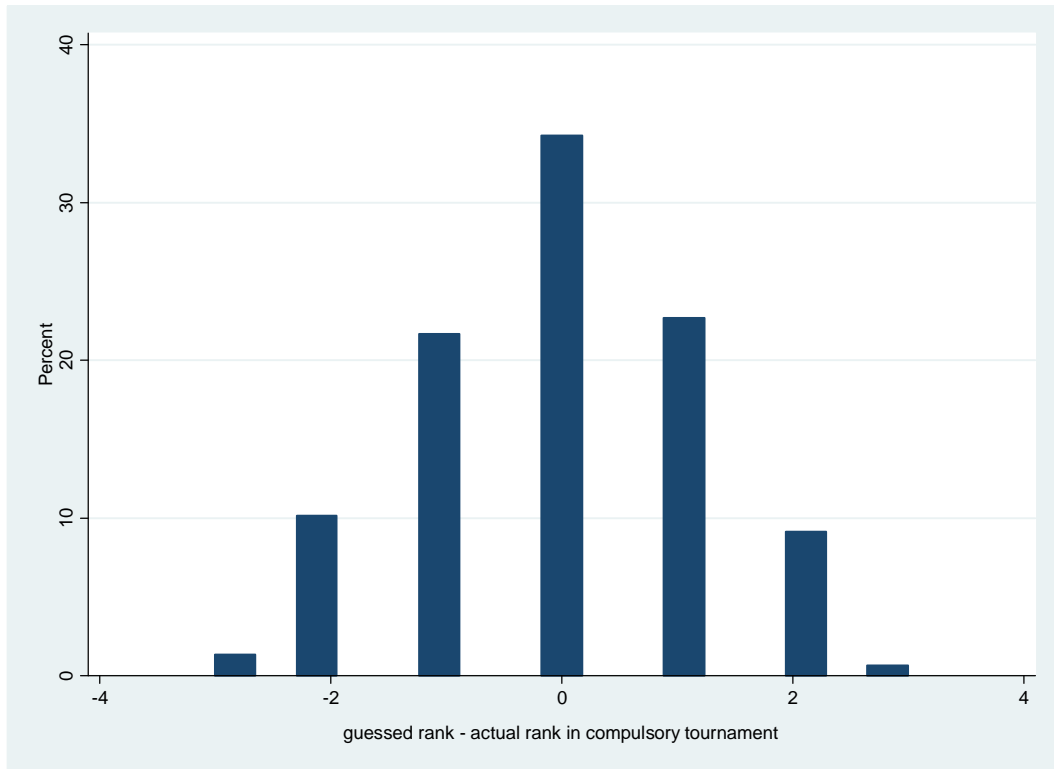


Figure 8: Distribution of the Proxy for Overconfidence across Ethnicity, by Gender

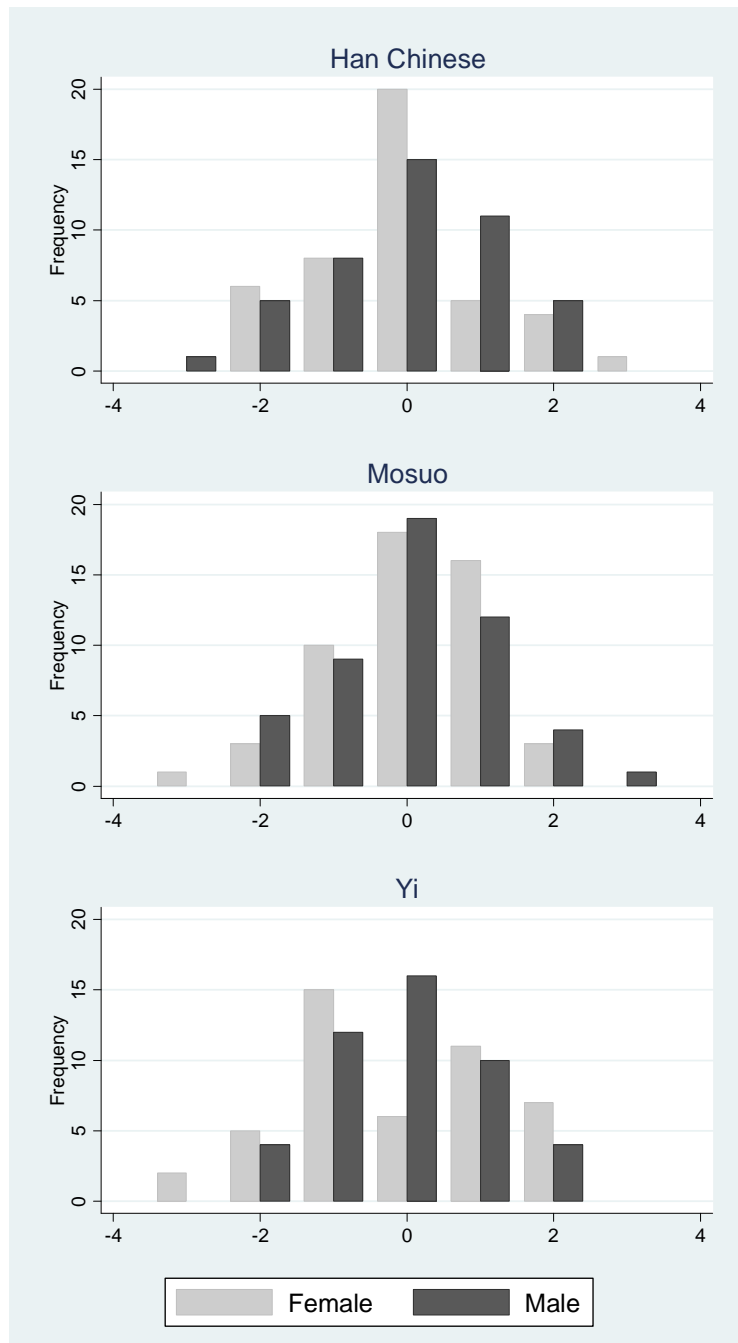


Table 5: Regressions of Tournament Entry on Gender, Sector, and Interaction, Separated by Ethnicity

Dependent Variable: Choose Tournament	Han Chinese			Yi			Mosuo		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
male	0.045 (0.130)	-0.024 (0.148)	-0.037 (0.157)	0.405*** (0.130)	0.388*** (0.120)	0.398*** (0.102)	0.135*** (0.027)	0.134*** (0.027)	0.134*** (0.031)
non-agricultural	-0.012 (0.071)	-0.094 (0.133)	-0.107 (0.143)	0.419*** (0.139)	0.418*** (0.136)	0.428*** (0.148)	-0.030 (0.154)	-0.125 (0.145)	-0.110 (0.155)
male*non-agricultural	0.119 (0.250)	0.215 (0.282)	0.221 (0.283)	-0.435*** (0.131)	-0.443*** (0.104)	-0.480*** (0.086)	0.265** (0.124)	0.378*** (0.080)	0.373*** (0.085)
prob of winning	1.079** (0.548)	1.053* (0.625)	1.027* (0.601)	0.846** (0.388)	0.917** (0.379)	0.946** (0.384)	0.525 (0.335)	0.545 (0.359)	0.559 (0.372)
overconfidence	0.137*** (0.036)	0.120*** (0.032)	0.120*** (0.027)	0.088*** (0.031)	0.102*** (0.032)	0.090*** (0.034)	0.000 (0.025)	-0.000 (0.025)	0.002 (0.028)
risk aversion			-0.021 (0.022)			-0.086* (0.046)			-0.012 (0.021)
school fixed effect							0.023 (0.069)	0.021 (0.073)	0.026 (0.071)
Observations	92	85	85	94	91	91	103	100	100
Log likelihood	-57.62	-54.35	-54.15	-56.49	-54.63	-53.11	-62.60	-59.22	-59.10
Mean dep var	0.554	0.553	0.553	0.489	0.484	0.484	0.621	0.620	0.620

*** 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.

Column (2) includes only observations for which risk aversion data is not missing.

The school fixed effect only applies to the Mosuo because the Han Chinese and the Yi were all drawn from the same high school.