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The Role of Social Capital in Competition and Gender-matching Environments ' Evidence from East Asian Countries

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2017

Abstract: This paper investigates the role of social capital in determining oneôs competitiveness. The analysis exploits the data of the PISA test in math because competitive occupational choices often require high quantitative skills. The empirical results highlight that a higher level of trust in school promotes oneôs competition, participation, and motivation in math. However, this positive effect of trust maintains mainly in mixed-sex environments but not in single-sex competitions. The trust effect is exhausted in gender-matching environments, probably because single-sex matches reduce unfairness caused by gender discrimination. In addition to that, the effects of social capital are heterogeneous across countries. This country-asymmetric effect implies that the role of social capital is culturally defined and mediated.

Keywords: gender; competitiveness; math studies; social capital; trust; trustworthiness; gender-matching environments; institutions; survey; and East Asia.
JEL-codes: I24; J16; O17; O53

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1. Introduction

As competitiveness is an important non-cognitive ability in the labor market, gender differences in competition can explain gender gaps in economic and professional outcomes. Literature documents evidence on a glass-ceiling where women are disadvantaged in obtaining promotions because of non-cognitive gender differences in competitiveness despite their equivalent qualifications in observable factors (Niederle and Vesterlund 2010, 2011; de la Rica et al. 2008). Recent studies attribute the gender-asymmetric levels of competitiveness to institutional settings of competition ï namely, gender-matching effects. Girls are more reluctant to enter a competition than boys when they have to compete in mixed-sex matches, but they are more competitive in single-sex settings (Booth and Nolen 2012a, b; Booth 2009; Boschini and Sjögren 2007; Datta Gupta et al. 2013; Niederle and Vesterlund 2007). The positive effect of single-sex environments on girlsô competitiveness can be explained through several channels. Gender-matching effects of competitors increase girlsô confidence in their own abilities; girls can trust the fairness of the rules more when competing with other girls instead of boys; and/or single-sex environments for girls reinforce positive gender role models taken from peers and teachers of the same sex under the absence of boys.

Literature has so far addressed the impact of gender-matching environments on self-confidence (Niederle and Vesterlund 2007; Gneezy et al. 2003) and gender role models (Booth and Nolen 2012a, b; Booth 2009). However, the literature has not yet spoken much about a linkage between trust (beliefs about fairness) and competitiveness. To fill the gap in the literature, my paper is aimed at providing empirical evidence on the role of social trust in determining oneôs competitiveness. Through this analysis, gender gaps in competition can be explained by gender variations in social capital ï individual levels of trust and trustworthiness.

In disentangling gender gaps in competitiveness, this study focuses on competition in math because competitive occupational choices that offer higher payment and promotion often require high quantitative and mathematical skills (Friedman-Sokuler and Justman 2016). Thus, gender differences in competition in math studies can provide a lens to elicit evidence on gender gaps in competitiveness in labor markets later in oneôs life.

The empirical analysis of this paper utilizes the 2012 PISA (Programme for International Student Assessments, OECD 2012) data that includes survey and test outcomes of students of 15 years old. So far, the majority of studies that investigate gender gaps in competition have employed behavioral experiments, which reveal observed behavioral preferences towards competitiveness (for instance, Booth and Nolen 2012a, b; Buser et al. 2014; Gneezy et al. 2003; Niederle and Vesterlund 2007). Application of survey data, on the other hand, examines another mode of preferences for competition ï stated behavioral choices. This implicates that the findings of a survey can be used to identify whether observed preferences can be replicated in stated preferences. While survey data has potential risks of over-/understatements in answers, stated preferences provide advantages in revealing preferences in non-experimental (not controlled) settings.

Furthermore, the PISA survey incorporates a wide range of countries worldwide that can overcome Western biases which are likely present in the experimental studies, most of which were conducted in North America and Europe. In my study, East Asia is selected as a regional focus to cross-check whether the findings of the studies on the West correspond with the findings of the study on the East. Accordingly, seven East Asian countries/economies whose data are available in the PISA 2012 are selected in the sample ï Hong Kong, Japan, (South) Korea, Macao, Shanghai, Singapore, and Taiwan. These countries share several characteristics ï high-performing economies, high performance in studies evident in the PISA tests, and cultural similarities of Buddhist and/or Confucianist heritages. These shared characteristics minimize the risks of biased results due to unobserved cultural differences between the countries.

The empirical results highlight the important role of social capital ï particularly trust level ï in competition. A higher level of trust in school environments promotes oneôs competition and participation in math and motivation in pursuing a competitive, quantitative career. However, this positive effect of trust maintains mainly in mixed-sex schools, but not in single-sex schools, when competition takes place inside a school. On the other hand, trust increases oneôs competitiveness in both single- and mixed-sex schools when competition involves outside school surroundings (i.e. instrumental motivation in career choices after graduation). These findings suggest that the trust effect is exhausted in gender-matching environments, probably because single-sex matches reduce unfairness caused by gender discrimination. On the other hand, trust is

an important determinant of competition when one competes with others of the opposite sex ï either in mixed-sex schools or outside school environments. Furthermore, the effects of social capital vary across the countries, particularly regarding inside school competitions. But, for external competitions, the positive effect of trust remains consistent in all countries in question. This (somewhat) heterogeneous effect of social capital across countries signals that the role of social capital is culturally defined and mediated.

In addition to social capital and gender-matching environments, cultural and resource-based capital, confidence, and cognitive abilities accounts for variations in oneôs competitiveness to a great extent. Controlling for these effects reduces the negative gender effect on girlsô competitiveness. However, the net gender effect still remains negative and substantial after the inclusion of these variables. This result exhibits unexplained gender differences in preferences towards competition. The considerable negative effect of gender on stated preferences highlighted in this paper corroborates the evidence of behavioral experiments on revealed preferences in the literature.

2. Descriptive Findings: Gender Gaps in Competitiveness, Social Capital, Confidence, and Performance

To illustrate how male and female students are different in their competitiveness, trust, confidence and performance levels, descriptive evidences are first presented in this section followed by systematic analyses in the next sections. For the analysis, the data of 6,215 male and 5,908 female high school students of age 15 who took part in the PISA in 2012 in the seven East Asian countries/economies is used.

First, competitiveness is measured by three indicators available in the PISA data that capture different dimensions of competition: the frequency of competing in a math contest (*competition*); the frequency of participating in a school math club (*participation*); and the degree of instrumental motivation in pursuing math-related careers (*motivation*). Both *competition* and *participation* are measured on a scale of 1 (never)ï 4 (always). *Motivation* is a composite index that combines four questions on oneôs study and career plan related to math and is measured on a

continuous scale from ï 2.3 to +1.59. Appendix A provides detailed survey questions used to construct these three indicators. Table 1.2 shows descriptive differences in competitiveness between male and female students.

In all of the three indicators, male students demonstrate a higher level of competitiveness. The mean value of male competition in a contest is 1.39 and that of femalesô is 1.21. In addition to comparing the mean values, I further examined whether boys and girls are different in all levels of competitiveness by applying the Mannï Whitney test of equal distributions. The test result shows that the difference in the distributions between the genders is significant (MW z-statistics = 14.39, p-value = 0.00). The level of male participation in a math club is also significantly higher than the female level (the mean value of 1.22 and 1.10, respectively, MW z-statistics = 13.75, p-value = 0.00). Boysô instrumental motivation in math-related careers is 0.20 higher than girlsô on average (the mean value of ï 0.16 and ï 0.35, respectively), and the gender difference in the distributions of motivation levels is also significant (MW z-statistics = 11.11, p-value = 0.00).

Second, in this paper, social capital is conceptualized as trusting other people and the trustworthiness of others (environments), following Fukuyama (1995) and Putnam (1993). In my sample, male students show a higher level of trust than female students. Here, the index of student-teacher relationship is used to capture an individual level of trust. This index comprises of five questions on teachersô fairness and interpersonal attitudes towards students that are evaluated by an individual student. The student-teacher relationship measurement reveals how much a student trusts his/her teachers who play an important role in evaluating a success in competition and in advising for career choices. This relationship is measured on a scale from ï 3.11 to +2.16. Male students exhibit a higher level of trust with the mean value of 0.10 compared to that of females, 0.06. The gender difference in the distribution of trust levels is significant at the 5-percent level (MW z-statistics = 1.97, p-value = 0.049).

The level of social capital a student possesses is measured by an additional indicator of trustworthiness. The teachersô morale index, which utilizes school principalsô assessments on teachers, is employed to measure the trustworthiness of the school environments. The teachersô morale index was constructed by using four questions on teachersô moral and professional attitudes evaluated by the head of each school (on a scale from ï 2.79 to +1.45). While the index

of student-teacher relationship relies on studentsô self-evaluation on how much they trust teachers, the teachersô morale index employs a third-personôs evaluation on the trustworthiness of the teachers. In contrast to the trust level, the trustworthiness level of environments is higher for girls (the mean value is ï 0.22 for girls and ï 0.26 for boys. MW z-statistics = ï 2.35, p-value = 0.019).

Third, a gender gap in confidence in math studies against girls is evident in the descriptive statistics. Confidence level is measured by using the index of self-concept in math that assembles five questions regarding how confident one is in studying math. This index is based on studentsô self-evaluation and is measured on a scale of ï 2.18 to +2.26. The mean confidence level of male students is ï 0.03, while that of female students is ï 0.40 ï i.e. boys are significantly more confident than girls (MW z-statistics = 21.59, p-value = 0.00).

On the other hand, female students are more anxious about math evaluations (evaluation aversion). Evaluation aversion is measured by the level of anxiety on receiving poor grades in math exams on a scale of 1 (not at all worried) ï 4 (very worried). Female students demonstrate a significantly higher level of evaluation aversion than male students (the mean value of 3.11 and 2.85, respectively, MW z-statistics = ï 14.90, p-value = 0.00).

Fourth, how boys and girls are different in terms of abilities is captured by the math score each student attained in the PISA test. Male students received about 15 points higher than female students on average and the gender gap in this performance-based measurement of cognitive abilities is significant at the 1-percent level (MW z-statistics = 6.46, p-value = 0.00).

The descriptive findings show that boys are more competitive, participatory, and instrumentally motivated than girls. Also, they are more trusting and confident and perform better in math. On the other hand, girls have more trustworthy school environments, while they are more evaluation averse. Detailed descriptive statistics and survey questions used for these variables can be found in Table 1 and Appendices A and B.

3. **Research Design**

3.1. Testable Hypotheses

This paper focuses on the role of social capital in explaining why women are less competitive than men. The literature widely attributes gender differences in confidence and gender-specific role models to gender gaps in competitiveness (Booth and Nolen 2012a, b; Booth 2009; Datta Gupta et al. 2013; Gneezy et al. 2003, 2009; Niederle and Vesterlund 2007, 2011). However, the literature has provided little empirical evidence about the influences of social trust on oneôs competitiveness level, although a crucial factor in making a decision to enter a competition is whether one trusts the fairness of the rules of the game. Without trust, individuals would be reluctant to participate in competition because their performance may not be fairly evaluated.

The literature shows that women trust less than men (Buchan et al. 2008; Dohmen and Falk 2011; Glaeser et al. 2000). This is because social minorities who are discriminated against are less likely to believe that ómost people can be trustedô (Buchan et al. 2008). With a lower level of trust, women tend to perceive the rules of the game as unfair to them when they compete, especially against men who, arguably, belong to the socially dominant group. Niederle and Vesterlund (2007) suggest that women trust the fairness of the game less, and therefore shy away from competition. However, Niederle and Vesterlund do not substantiate empirical evidence on the relationship between trust and competitiveness, and instead emphasize the role of confidence in explaining gender gaps in competition.

Instead of directly connecting gender gaps in trust and competitiveness, the findings of the literature insinuate the importance of trust through eliciting effects of gender-matching environments. For instance, Gneezy et al. (2003) and Niederle and Vesterlund (2007) show that single-sex tournaments increase female competitiveness. Also, girls in single-sex schools are more competitive and risk-taking than girls in mixed-sex schools (Booth and Nolen 2012a, b; Booth 2009).[1] There are several possible channels that can explain the positive gender-matching effects. First is the above-discussed nexus between trust and competition. In single-sex environments, women may trust the fairness of the game more because they only compete with other women (or not competing with men). Second, gender-specific competition may reduce gender gaps in confidence because women may more positively evaluate their abilities when competing with others of the same sex. Third, the gender-matching environments can provide

[1] On the other hand, Lee et al. (2014) provide counter-evidence through a country-case study of Korea, in that girls in single-sex schools are less competitive than girls in co-educational schools.

positive role models for women through interacting with other female counterparts ï e.g. teachers, mentors, and peers. Thus, the assumed positive effect of single-sex environments for women (girls) is presumably an outcome of the combination of increasing trust, confidence, and positive role models. Naturally, it is necessary to isolate the influence of increasing trust in gender-matching environments from confidence and gender-role effects.

With this in mind, the following hypotheses that elicit the effects of social capital on competition are proposed and empirically tested. Accordingly, empirical evidence of these hypotheses will invoke explanations on gender gaps in competition.

H1. A higher level of trust increases oneôs competitiveness (competition, participation, and instrumental motivation in math, respectively).
H2. A higher level of the trustworthiness of environments increases oneôs competitiveness.

Furthermore, a gender-matching effect of environments should be examined in establishing a linkage between trust and competition. Trust and trustworthiness are arguably more important for women when they have to compete with men rather than women, as discussed above. This is because women are historically discriminated against and therefore, trust is a more crucial factor for women to enter a competition in cross-gender matches. Thus, the effects of trust and trustworthiness are expected to be stronger for girls in mixed-sex schools than others in all-girlsô schools.

H3. The positive effect of social capital is greater for girls in mixed-sex schools than girls in single-sex schools.

Lastly, the effect of social capital may not be identical across countries. This is presumably because of two reasons. First, cultural influences affect an individualôs competitiveness and the size and direction of gender gaps in competitiveness (Farre and Vella 2013; Gneezy et al. 2009; Nollenberger et al. 2016). For instance, trust may have a greater impact on female competition in a patriarchal society than in a matriarchal (or more gender-equal) society. Furthermore, there is a complementary relationship between social capital as an informal institution and formal institutions. When formal institutions are not well-functioning, informal institutions may

supersede (part of) formal institutions and take the role of ensuring fair transactions among players (Greif 1989). That being said, in countries with weaker formal institutions, the effect of social capital can be more significant than in other countries with better-developed institutions.

H4. The effect of social capital is heterogeneous across different countries.

3.2.Empirical Model

To test for the hypotheses discussed in section 3.1, the following econometric model is formulated.

$$DV_{isc} = \breve{U}_{sc} + \beta_1 Female_{isc} + \beta_2 Trust_{isc} + \beta_3 Trustworthiness_{isc} + \beta_4 Math\ Score_{isc} + \beta_5 Confidence_{isc} + \beta_6 Evaluation\ Aversion_{isc} + \beta_7 Single\text{-}sex\ School_{isc} + \beta_8\ Female_{isc} * Single\text{-}sex\ School_{isc} + C_{isc}\acute{}\Upsilon + W_{isc}\acute{}\varsigma + u_{isc} \quad (1)$$

The data used for the analysis is the PISA survey and test scores of individual students (i = 1,,,,, 12,123) in 1,029 schools (s = 1,,,,, 1,029) in the seven East Asian countries/economies (c = 1,,,, 7) in 2012. PISA used the double stratification of the sampling that ensures the random selection of schools and students (OECD 2014). With the sample of 12,123 students, the analysis exploits individual variations at the micro-level.

The vector of the three dependent variables that enter the regression model separately, one by one, consists of:

DV = {Competition in Math, a scale of 1 to 4,
Participation in Math Club, a scale of 1 to 4,
Instrumental Motivation in Math-related Career, a scale of ï 2.3 to +1.59}

The independent variables of main interest are *female*, *trust*, and *trustworthiness*. The *female* variable is a dummy that takes a value of 1 if the student is a girl, and 0, otherwise. *Trust* measures a studentôs self-assessed level of trusting teachersô fairness and the teacher-student relationship. The measurement is taken by the PISA Index of Teacher-Student Relations (STUREL, a scale of ï 3.11 to +2.16), as described in section 2. *Trustworthiness* is the level of

teachersô morale and teaching attitudes, assessed by school principals. Different from *trust* ï subjective self-assessments of students on how much they trust school environments, *trustworthiness* captures the quality of school environments evaluated by a third-person, the school management (the PISA Index of TeachersôMorale, a scale of ï 2.79 to +1.45).

The other explanatory variables are *confidence*, *evaluation aversion*, (log)*math score*, *single-sex school*, and the vectors of cultural and resource-based capital variables (C and W, respectively). *Confidence* measures an individual level of confidence in math studies on a scale from ï 2.18 to +2.26. This variable is used to estimate how much oneôs confidence level accounts for his/her competitiveness, as proposed by Gneezy et al. (2003) and Niederle and Vesterlund (2011). A question, *how much do you agree that you worry about getting poor grades in math*?, is used to measure the level of evaluation aversion on a scale of 1 (strongly disagree) to 4 (strongly agree). This variable reflects possibilities that students may not participate in competition or competitive career paths because of anxiety against negative feedback (Niederle and Yestrumskas 2008).

As differences in performance also likely attribute to differences in decisions to enter competitions, the PISA math score of a student is used as a measurement of performance-based cognitive abilities. The PISA score ranges from 0 to 1,000 and scores are adjusted to have a mean of 500 test-score points and a standard deviation of 100 test-score points across the OECD countries (OECD 2014). In this paper, the sample mean score is 564 ï that is 64 points higher than the OECD-average, while the standard deviation (101) remains almost unchanged. This higher mean score indicates a relatively high level of math abilities of East Asian students.

The *single-sex school* variable addresses gender-matching effects. Literature suggests that women are more likely to participate in competition if matched with other women (Datta Gupta et al. 2013; Boschini and Sjögren 2007). As discussed in section 3.2, single-sex environments may affect girlsôcompetitiveness through three channels: by boosting confidence, increasing trust, and providing positive gender role models. In this paper, confidence and trust levels are exclusively controlled by inserting the respective variables in the model. Therefore, the variable of single-sex schooling in this context specifically represents gender-matching environments that provide positive gender role models. Such a gender role effect in school basically arises from teachers and peers. The absence of the opposite sex among peers can play a role in establishing

unconventional gender identities (Booth 2009). Also, all-girlsô schools tend to hire a higher proportion of female teachers (also for all-boysôschools, vice versa). Thus, students in single-sex schools are more likely to be taught by teachers of the same sex who often provide role models for adolescent students. Particularly for girls, female teachers can create a role model of professional women that can influence girlsô choices of careers and competitions (Booth and Nolen 2012a, b). In this model, an interaction term between the female and the *single-sex school* variables is additionally included so that any augmented effect of single-sex schooling for girls can be identified.

Literature also underscores cultural influences on oneôs choices of competitive studies and careers (Guiso et al. 2008; González de San Román and de la Rica Goiricelaya 2012). In this respect, oneôs country of origin is an important cultural background. Furthermore, a motherôs employment status can be a crucial determinant of childrenôs attitudes, particularly girlsô career ambitions because working mothers can provide a positive role model for their daughters (Farre and Vella 2013; Nollenberger et al. 2016). In this paper, two cultural variables are considered in this respect and included in vector C of cultural capital.

C = {Motherôs Job, a scale of 1 to 4,
Ethnic Backgrounds, dummy}

The motherôs job variable measures the employment status of a mother on a four-point scale (out of labor force, in job markets, part-time, and full-time, respectively). The effect of a migrant status (*ethnic backgrounds*) identifies if and how oneôs cultural background at the country level affects individual competitiveness. For those who reside in their country of origin, this variable reflects their national cultural influences, whereas for others with migrant backgrounds, it refers to the effect of being an ethnic minority in the respective country.

In addition to cultural capital, resource-based capital is included in the model as vector W because socio-economic conditions of students can be a decisive factor of their competitiveness. In W, three variables are incorporated: a general wealth level, and the availability of cultural and educational resources, respectively. The indices of wealth, cultural possessions, and home-based educational resources, taken from the PISA 2012 survey, are used as the measurements.

W= {Wealth, a scale of ï 5.08 to +3.13,
Cultural Possessions, a scale of ï 1.51 to +1.27,
Educational Resources, a scale of ï 3.93 to +1.12}

The model is constructed as a multilevel model in which observations are nested within schools which are nested within countries. This three-level nested model approach addresses heterogeneous patterns of studentsô behaviors and performance across schools and countries. The overall error distributions of the linear multilevel model are assumed to be Gaussian and heteroskedasticity and correlations within the lowest-level group are modeled by employing robust standard errors.

The model is first estimated with the full sample of all participant students in the seven countries/economies. Then, the sample is sub-grouped by the two following ways. First, the data is sub-sampled by school type and gender of students. Accordingly, the sub-samples include four groups: girls in single-sex schools; boys in single-sex schools; girls in mixed-sex schools; and boys in mixed-sex schools. This sub-grouping is implemented in order to identify whether single-sex schools can provide fair school environments for girls (testing for Hypothesis 3). Second, the sample is grouped by country. Sub-sampling by country enables the determinants of competitiveness to interact with cultures so that Hypothesis 4 can be tested.

4. Results

4.1. What Determines Competitiveness? ï Gender and Social Capital

Table 2 presents the baseline results of the nested model analysis with the full sample, when the dependent variable is *competition*, *participation*, and *motivation*, respectively. First, columns 1ï 2 show the determinants of competition in math. Marginal effects are estimated through a linear estimation technic. Column 1 estimates the gross gender effect without taking into account other factors. Being a female reduces oneôs competitiveness level by 0.162 points (4.1 percentage-points). Conditional on the other covariates, the negative gender effect remains substantial but

decreases by 40 percent (i.e. ï 0.098-points, see column 2). This result indicates that the net gender effect accounts for 2.5 pp. of gender gaps in competitiveness against girls.

In column 2, both factors of social capital have significant, positive effects on competitiveness. A one-standard deviation increase in trust increases competition in math by 0.018 points (0.45 pp.). The same increase in trustworthiness boosts oneôs competitiveness level by 0.01 points (0.24 pp.). Among other factors, confidence is important to oneôs competitiveness. Increasing oneôs confidence level by one-standard deviation increases oneôs competitiveness level by 0.224 points (5.6 pp.). This finding corroborates the evidence provided in the literature that emphasizes the importance of confidence in competition (Gneezy et al. 2003; Niederle and Vesterlund 2007). However, cognitive abilities, single-sex schooling environments, and cultural capital do not have a significant effect on the frequency of one competing in a math contest. On the other hand, resource-based capital strengthens competition. Increasing cultural possessions of a student by one-standard deviation increases oneôs competitiveness level by almost one percentage-point. Increasing educational resources at home by the same extent adds 0.55 pp. to the level of a studentôs competition.

Columns 3ï 4 provide estimations for participation in a math club. The gross gender effect (see column 3) is ï 0.114 points (2.85 pp.). By incorporating other covariates, the net gender effect is mitigated to ï 0.082 points (column 4). This shows that more than 2 pp. of gender gaps in competitiveness, measured by the frequency of participation in a math club, are unexplained. In line with the results above, the effect of trust is positive. Increasing the trust level by one-standard deviation results in the frequency of participation in a math club to be 0.53 pp. greater. However, trustworthiness does not affect oneôs participation level, contrary to its positive effect on competition in a math contest.

Interestingly, having a lower math score encourages (rather than discourages) oneôs participation. Lowering oneôs math score by one-standard deviation increases his/her participation level by 5.63 pp. This is possibly because underperforming students use math club participation to improve their math scores. On the other hand, the positive effect of confidence remains consistent for participation ï with a smaller margin than that of competition. With an increase in confidence level by one-standard deviation, one participates in a math club 2.83 pp. more frequently.

Resource-based capital also positively affects the frequency of one participating in a math club. The effects of cultural possessions and educational resources together are 0.04 points, in that, with a one-standard deviation increase in resource-based capital, one increases his/her participation level by about 1 pp.

When oneôs competiveness level is measured by his/her instrumental motivation in competitive, math-related careers (columns 5ï6), the findings further verify the positive impacts of social capital. Both trust and trustworthiness reinforce oneôs motivation level. Particularly, the effect of trust is substantially large ï a one-standard deviation increase in trust level increments oneôs motivation level by 5.56 pp. Increasing trustworthiness by the same extent results in a 0.62 pp. higher level of motivation. The gross gender effect on instrumental motivation is ï 0.187 points (4.81 pp., see column 5). After accounting for the other covariates, the net gender effect reduces by three-quarters (ï 0.046). That being said, the unexplained, net effect of gender captures 1.18 pp. of gender gaps in instrumental motivation in competitive career choices.

Also, the effect of confidence is large. Increasing one-standard deviation in confidence level adds 11.75 pp. to oneôs motivation level. Somewhat different from the prediction, higher evaluation aversion strengthens oneôs motivation level ï with a coefficient of 0.119 significant at the 1 percent level. It seems that the question of anxiety about grades reflects oneôs concerns on studies that may be positively associated with his/her instrumental motivation. Additionally, cultural backgrounds influence instrumental motivation. Being part of the ethnic majority of a respective country increases an individual motivation level by 1 pp. Two factors of resource-based capital cancel out the effect of one another. The effect of a studentôs family wealth is negative with a coefficient of ï 0.068, while that of educational resources is positive with a magnitude of +0.066.

Evidence in Table 2 substantiates the positive effects of social capital on competiveness. In particular, trust enhances oneôs competitiveness level in all three dimensions, whereas trustworthiness affects competition and motivation but not participation. Variations in oneôs confidence level explain individual variations in competitiveness to a great extent. Furthermore, gender remains to have a net effect of decreasing female competitiveness with a margin of about 2.5 pp., after accounting for the other factors. This negative net effect of gender basically supports the findings in the literature. However, the magnitude of the net gender effect estimated

in this paper by using a survey (stated preferences) is smaller than the sizes gauged through behavioral experiments (revealed preferences) ï for instance, a net effect of 16 pp. suggested in Niederle and Vesterlund (2007); and 12 pp. in Buser et al. (2014).

4.2. Are the Effects of Social Capital Greater for Girls in Mixed-sex Schools than Girls in Single-sex Schools?

One may speculate that the effects of social capital differ between school types. This speculation is based on presumed gender-matching effects of single-sex schooling. In single-sex schools, girls are only competing with other girls and do not compete with boys. Under these circumstances, female students may be less concerned about unfair treatment caused by gender discrimination. Under the hypothesis of this school channel, the importance of social capital should be less significant for girls in all girlsô schools than others in mixed-sex schools

Table 3 presents the results, of which the sample is sub-categorized by school types. When competition takes place inside a school ï i.e., competition in a math contest and participation in a math club ï the trust effect is insignificant for both boys and girls in single-sex schools. In contrast, trust increases inner-school competition for students in mixed-sex schools, as expected. Interestingly, the magnitudes of the trust effects are larger for boys than girls in mixed-sex environments ï 0.012 and 0.019 for girls and 0.023 and 0.027 for boys. This difference posits a puzzle. Possibly, boys are more sensitive to trust-based relationship with their teachers than girls in co-educational schools. It would be worthwhile examining whether the size of the effect can be altered, if other aspects of trust are measured. On the other hand, when competition concerns competitive career choices outside of school, the trust effect is consistently positive regardless of school types and a studentôs gender. The effect is larger for students in mixed-sex schools than others in single-sex schools ï that further supports a greater role of trust in mixed-sex matches. A one-standard deviation increase in trust level boosts girlsô motivation by 5 pp. in single-sex schools, while it is 5.3 pp. in mixed-sex schools. For boys, the effect is 5.4 pp. in single-sex schools and 5.8 pp. in mixed-sex schools.

The effect of trustworthiness is not as significant as that of trust. There is some evidence of positive effects in single-sex schools: increasing girlsô competition in a math contest and boysô instrumental motivation. However, no effect is found in mixed environments.

Interestingly, cognitive abilities have opposite effects on girls and boys. Math abilities increase female competition in all girlsô schools (coeff. = 0.328), but constrain boysô competition and participation in mixed-sex schools ($coeff._{competition}$= ï 0.159; $coeff._{participation}$= ï 0.397). Seemingly, underperforming boys demonstrate a higher level of competitiveness in mixed gender environments. This is possibly because boys may try to compensate a low level of performance with a high level of competitiveness when girls are present. By contrast, gender-matching environments facilitate female abilities to boost their competitiveness. Besides, similar to the findings in Table 2, oneôs confidence level has high explanatory power over oneôs competitiveness.

These results empirically verify the hypothesis that trust has a more important effect for girls in mixed-sex environments than in single-sex environments. Additionally, trust is also important for boys in mixed-sex schools. This finding implicates that mixed-gender matches, in which both genders compete against one another, necessitate a higher level of trust towards fairness.

4.3. Are the Effects of Social Capital Heterogeneous across Countries?

While cultural capital has no direct effect on competitiveness in most estimations in Table 2, culture may affect competition indirectly through the macro-level channel. To address such indirect influences of culture, I conduct a sub-group estimation of each country and examine if the determinants of competition are heterogeneous across countries. Tables 4ï 6 present the results of the country analyses.

The negative gender effect against girls holds in most countries when competitiveness is measured by *competition* and *participation*. The coefficients on *female* for *competition* are negative at the 1ï 5 percent levels in all countries (Table 4). The negative magnitudes of the gender effect are larger for Singapore (ï 0.142) and Hong Kong (ï 0.124) than the average level of the seven countries/economies (ï 0.098 that is 2.5 pp. of a gender gap against girls, see column 2

in Table 2). In Japan, Korea, and Macao, the effect is relatively small: ï 0.055, ï 0.09, and ï 0.075, respectively. Shanghai and Taiwan maintain the average level of the effect.

For *participation*, the gender effect is most negative again in Hong Kong (ï 0.131) and Singapore (ï 0.109). In Korea and Taiwan, girls are as disadvantaged as the average level that is ï 0.082 (2.1 pp. of a gender gap against girls, column 4 in Table 2). In Japan and Macao, the effect is smaller than the average: ï 0.04; and ï 0.073. Gender plays no significant role in participation in Shanghai. Different from the results for *competition* and *participation*, the gender effect on *motivation* is insignificant in Hong Kong, Japan, Korea, and Shanghai. The effect is significant only in Macao, Singapore, and Taiwan where the size of the effect is larger than the average, ï 0.046 (1.2 pp. of a gender gap against girls, column 6 in Table 2).

The estimates in these three models show that the gender gap in competitiveness against girls is largest in Singapore. Also, in Hong Kong and Taiwan, the negative gender effect is more pronounced than the other countries. The gender gap is smallest in Japan and Shanghai where the net gender effect is either insignificant or its negative magnitude is below the average of the other countries. In Korea, the gender gap is mostly below the average level, while, in Macao, the gap is larger than the average for motivation but smaller for competition and participation.

In addition to the gender effect, the effects of social capital are also heterogeneous across countries not only in terms of their magnitudes but also significance. Trust increases competition in math in Hong Kong and Korea with a magnitude of 0.041 and 0.038, respectively, but not in the other countries (Table 4). Also, trust has a positive effect on participation only in Korea (0.067, Table 5). On the other hand, trust plays an important role in instrumental motivation in all countries in question (Table 6). The coefficients range from 0.186 (Taiwan) to 0.246 (Shanghai). Specifically, a one-standard deviation increase in trust level increments oneôs instrumental motivation by 4.8ï 6.4 pp. The findings show that trust is most important to oneôs competitiveness in Korea, while the effect is least pronounced in Taiwan. As a comparison, trustworthiness has a significant effect only in a few countries. It increases *competition* in Shanghai only and *motivation* in Hong Kong and Japan. Trustworthy environments play no role in participation in all countries. These findings suggest no straightforward relationship between the effect of social capital and a countryôs wealth, institutional quality or womenôs status. For

instance, the effect of trust is opposite between Korea and Taiwan which share a similar level of economic and social development. Also, there is no linear relationship between the effect of trustworthiness and income level ï as shown in the cases of Japan and Shanghai. This puzzle requires a closer examination of channels that define country-specific roles of social capital.

Besides, there is evidence of country-heterogeneous effects of cognitive abilities (*math score*). Cognitive abilities have no effect on competition and motivation, and a constraining effect on participation on average (Table 2). In the country-analysis, the effect varies between countries ï negative to competition in Hong Kong, Japan, and Singapore; positive in Korea; and insignificant in Macao, Shanghai, and Taiwan (Table 4). The effect on participation is negative in all countries but in Korea where it is insignificant (Table 5). For instrumental motivation, cognitive abilities have a positive effect in Korea and Japan, but negative in Macao, Shanghai, and Singapore. There is no effect on motivation in Hong Kong and Taiwan (Table 6).

The estimates on evaluation aversion and single-sex schooling also demonstrate varying effects across countries. Evaluation aversion facilitates competition and participation in Japan, while constraining them in Shanghai, Singapore, and Taiwan. On the other hand, for instrumental motivation, evaluation aversion generally produces a positive effect ï in five countries (Japan, Korea, Macao, Shanghai, and Taiwan) out of seven. The effect of single-sex schooling is positive to *competition* in Macao and to *participation* in Macao and Shanghai, but the negative interaction coefficient on *female*single-sex school* cancels out the positive effect for girls in Macao. For *motivation*, the effect of single-sex schooling varies depending on countries and gender. It has a positive effect for boys in Korea and a negative effect for them in Macao. However, such effects (almost) disappear for girls in these two countries because the interaction effect offsets the effect of single-sex schools. In Shanghai, Singapore and Taiwan, single-sex schooling negatively affects the level of oneôs motivation but the effect is smaller for girls in Singapore and Taiwan.

The evidence above suggests that the determinants of competitiveness are country-specific: for instance, a positive effect of cognitive abilities in Korea; a positive effect of evaluation aversion in Japan; and a negative effect of single-sex schooling in Shanghai, Singapore and Taiwan. On the other hand, the effect of confidence remains positive in all countries for all dimensions of

competitiveness. This finding hints at the importance of confidence as a robust determinant of competitiveness across countries.

5. Conclusion

This research deepens our understanding of the role of social capital in determining oneôs competitiveness. My results are in accordance with previous findings in experimental studies that emphasize the effect of confidence on competition. What is innovative in my findings is lending support for the influences of social capital that are mediated through gender-matching environments. The conclusion of this paper is value-added to the studies of Apicella et al. (2017) and Niederle and Yestrumskas (2008) that endorse trust-ensuring institutions as a stimulator of boosting womenôs competitiveness

A remaining issue to be considered in a future study involves country-specific effects of social capital. The current findings in this paper refer to no linear relationship between the effect of social capital and the level of a countryôs economic and institutional development. In a future study, the channels that generate country-specific roles of social capital need to be more closely investigated ï for example, why is trust more important for competition in Korea, while it is trustworthiness in Japan?

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Table 1. Descriptive Statistics

1.1. Full sample (both male and female students)

Variable	Observation	Mean	Std.Dev.	Min.	Max.
Competition in Math	12,123	1.31	0.64	1	4
Participation in Math Club	12,121	1.16	0.50	1	4
Instrumental Motivation	12,107	-0.26	0.98	-2.3	1.59
Female	12,123	0.48	0.5	0	1
Trust	12,123	0.08	1.01	-3.11	2.16
Trustworthiness	12,123	-0.24	0.97	-2.79	1.45
Math Score	12,123	564	101	184	925
Confidence	12,123	-0.21	0.95	-2.18	2.26
Evaluation Aversion	12,123	2.98	0.91	1	4
Single-sex School	12,123	0.14	0.35	0	1
Motherôs Job	12,123	2.95	1.31	1	4
Ethnic Backgrounds	12,123	0.77	0.42	0	1
Wealth	12,123	-0.57	0.78	-5.08	3.13
Cultural Possessions	12,123	-0.13	1.04	-1.51	1.27
Educational Resources	12,123	-0.20	0.99	-3.93	1.12

1.2. Comparison between boys and girls

	Boys (n = 6,215)				Girls (n = 5,908)			
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Min.	Max.
Competition in Math	1.39	0.72	1.00	4.00	1.21	0.51	1.00	4.00
Participation in Math Club	1.22	0.58	1.00	4.00	1.10	0.39	1.00	4.00
Instrumental Motivation	-0.16	1.00	-2.30	1.59	-0.35	0.96	-2.30	1.59
Trust	0.10	1.04	-3.11	2.16	0.06	0.97	-3.11	2.16
Trustworthiness	-0.26	0.96	-2.79	1.45	-0.22	0.98	-2.79	1.45
Math Score	569.46	104.05	207.83	924.84	558.41	97.24	183.99	912.30
Confidence	-0.03	0.94	-2.18	2.26	-0.40	0.92	-2.18	2.26
Evaluation Aversion	2.85	0.96	1.00	4.00	3.11	0.84	1.00	4.00
Single-sex School	0.12	0.32	0.00	1.00	0.16	0.37	0.00	1.00
Motherôs Job	2.95	1.31	1.00	4.00	2.95	1.31	1.00	4.00
Ethnic Backgrounds	0.77	0.42	0.00	1.00	0.76	0.43	0.00	1.00
Wealth	-0.56	0.80	-5.08	3.13	-0.59	0.77	-5.04	3.11
Cultural Possessions	-0.23	1.04	-1.51	1.27	-0.03	1.03	-1.51	1.27
Educational Resources	-0.24	1.02	-3.93	1.12	-0.17	0.96	-3.93	1.12

Table 2. Baseline Results, full sample, nested model

DV	Competition		Participation		Motivation	
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.162	-0.098	-0.114	-0.082	-0.187	-0.046
	(0.028)***	(0.013)***	(0.018)***	(0.012)***	(0.029)***	(0.025)***
Trust		0.018		0.021		0.214
		(0.007)***		(0.008)***		(0.007)***
Trustworthiness		0.01		0.003		0.025
		(0.006)*		(0.004)		(0.009)***
Math Score		-0.03		-0.225		0.017
(log)		(0.082)		(0.041)***		(0.204)
Confidence		0.236		0.119		0.481
		(0.035)***		(0.023)***		(0.019)***
Evaluation		-0.005		-0.001		0.119
Aversion		(0.019)		(0.011)		(0.027)***
Single-sex School		0.027		0.008		0.055
		(0.034)		(0.019)		(0.086)
Female*Single		-0.016		-0.015		-0.037
-sex School		(0.034)		(0.026)		(0.066)
Mother's Job		0.002		0.001		-0.010
		(0.005)		(0.005)		(0.005)*
Ethnic		-0.033		-0.027		0.036
Backgrounds		(0.043)		(0.022)		(0.015)**
Wealth		0.005		0.008		-0.068
		(0.005)		(0.009)		(0.008)***
Cultural		0.033		0.019		-0.005
Possessions		(0.013)**		(0.005)***		(0.016)
Educational		0.022		0.021		0.066
Resources		(0.006)***		(0.009)**		(0.008)***
Countries	7	7	7	7	7	7
Schools	1,029	1,020	1,029	1,020	1,029	1,020
Observations	25,213	12,123	25,225	12,133	25,255	12,139
Log Likelihood	-23,254	-10,456	-17,414	-8,249	-33,926	-14,455

Note: Random intercepts are applied. Parentheses are robust standard errors. * $p< .10$, ** $p< .05$, *** $p< .001$.

Table 3. Results in Single- and Mixed-sex Schools, nested model

DV	Competition				Participation				Motivation			
School Types	Girls	Boys	Mixed-F	Mixed-M	Girls	Boys	Mixed-F	Mixed-M	Girls	Boys	Mixed-F	Mixed-M
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Trust	0.010	0.007	0.012	0.023	-0.010	0.005	0.019	0.027	0.192	0.209	0.205	0.224
	(0.013)	(0.023)	(0.005)**	(0.011)**	(0.022)	(0.016)	(0.010)*	(0.010)***	(0.042)***	(0.050)***	(0.014)***	(0.02)***
Trust-Worthiness	0.023	-0.010	0.005	0.016	-0.007	-0.018	-0.002	0.011	0.008	0.058	0.020	0.026
	(0.004)***	(0.033)	(0.006)	(0.010)	(0.013)	(0.018)	(0.007)	(0.007)	(0.032)	(0.011)***	(0.013)	(0.020)
Math Score (log)	0.328	0.108	0.083	-0.159	-0.032	0.089	-0.058	-0.397	0.020	0.203	0.021	0.014
	(0.146)**	(0.267)	(0.093)	(0.072)**	(0.107)	(0.255)	(0.046)	(0.045)***	(0.330)	(0.338)	(0.238)	(0.195)
Confidence	0.152	0.322	0.174	0.287	0.065	0.124	0.083	0.154	0.550	0.554	0.450	0.485
	(0.018)***	(0.068)***	(0.029)***	(0.043)***	(0.008)***	(0.022)***	(0.025)***	(0.027)***	(0.044)***	(0.030)***	(0.017)***	(0.02)***
Evaluation Aversion	-0.040	0.028	-0.025	0.005	-0.029	-0.068	-0.008	0.012	0.187	0.097	0.106	0.120
	(0.023)*	(0.035)	(0.023)	(0.024)	(0.021)	(0.020)***	(0.008)	(0.018)	(0.044)***	(0.068)	(0.030)***	(0.03)***
Motherôs Job	-0.002	-0.012	0.003	0.004	-0.006	-0.027	0.005	0.003	-0.038	-0.025	-0.007	-0.005
	(0.013)	(0.010)	(0.004)	(0.006)	(0.008)	(0.017)	(0.004)	(0.007)	(0.016)**	(0.010)**	(0.008)	(0.005)
Ethnic Backgrounds	-0.005	-0.340	-0.056	0.028	-0.024	-0.161	-0.017	-0.023	0.077	0.086	0.009	0.047
	(0.042)	(0.10)***	(0.021)***	(0.061)	(0.010)**	(0.057)***	(0.012)	(0.034)	(0.054)	(0.058)	(0.044)	(0.023)**
Wealth	-0.019	0.005	0.006	0.005	0.006	-0.023	0.015	0.002	0.029	-0.014	-0.092	-0.059
	(0.034)	(0.039)	(0.005)	(0.010)	(0.018)	(0.032)	(0.012)	(0.014)	(0.035)	(0.050)	(0.012)***	(0.02)***
Cultural Possessions	0.048	0.029	0.021	0.046	0.021	-0.010	0.013	0.031	-0.045	-0.038	0.006	-0.005
	(0.020)**	(0.035)	(0.015)	(0.011)***	(0.009)**	(0.016)	(0.007)*	(0.007)***	(0.042)	(0.036)	(0.023)	(0.014)
Educational Resources	0.020	0.039	0.017	0.025	0.012	0.071	0.014	0.023	0.101	0.033	0.080	0.055
	(0.010)**	(0.022)*	(0.011)	(0.006)***	(0.019)	(0.022)***	(0.011)	(0.011)**	(0.045)**	(0.051)	(0.013)***	(0.01)***
Countries	7	7	7	7	7	7	7	7	7	7	7	7
Schools	83	67	843	854	83	67	843	854	83	67	844	855
Observations	968	743	4,940	5,472	968	743	4,946	5,476	968	744	4,947	5,480
Log Likelih.	-666.02	-754.98	-3,281.6	-5,381.7	-358.58	-662.31	-2,222.3	-4,496.3	-1,1895	-935.31	-5,743.7	-6,564.8

Note: Random intercepts are applied. Girls: female students in all-girlsô schools; Boys: male students in all-boysô schools; Mixed-F: female students in mixed-sex schools; and Mixed-M: male students in mixed-sex schools. Parentheses are robust standard errors. * p< .10, ** p< .05, *** p< .00

Table 4. Competition in Math, country-analysis, nested model

Country	Hong Kong	Japan	Korea	Macao	Shanghai	Singapore	Taiwan
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	-0.124	-0.055	-0.090	-0.075	-0.101	-0.142	-0.103
	(0.031)***	(0.017)***	(0.039)**	(0.038)**	(0.033)***	(0.037)***	(0.025)***
Trust	0.041	0.004	0.038	0.015	0.018	0.007	0.002
	(0.017)**	(0.011)	(0.019)**	(0.016)	(0.016)	(0.018)	(0.015)
Trustworthiness	0.012	0.002	0.002	-0.033	0.031	0.018	0.020
	(0.019)	(0.008)	(0.019)	(0.025)	(0.018)*	(0.018)	(0.013)
Math Score	-0.325	-0.303	0.334	0.091	0.156	-0.190	0.055
(log)	(0.117)***	(0.066)***	(0.106)***	(0.124)	(0.126)	(0.105)*	(0.070)
Confidence	0.204	0.087	0.260	0.285	0.383	0.259	0.235
	(0.027)***	(0.017)***	(0.026)***	(0.028)***	(0.029)***	(0.023)***	(0.017)***
Evaluation	-0.012	0.047	-0.018	0.033	-0.062	-0.036	-0.031
Aversion	(0.025)	(0.012)***	(0.021)	(0.026)	(0.026)**	(0.021)*	(0.019)*
Single-sex	0.045	-0.030	0.060	0.30	0.019	-0.023	-0.054
School	(0.076)	(0.029)	(0.053)	(0.032)***	(0.032)	(0.075)	(0.10)
Female*Single	0.061	0.036	-0.036	-0.313	.	-0.045	0.105
-sex School	(0.080)	(0.036)	(0.071)	(0.09)***	.	(0.086)	(0.107)
Mother's Job	0.001	0.015	-0.008	-0.002	0.006	-0.016	0.012
	(0.011)	(0.006)**	(0.010)	(0.010)	(0.012)	(0.011)	(0.009)
Ethnic	0.006	0.026	0.421	0.013	0.050	-0.131	0.102
Backgrounds	(0.030)	(0.048)	(0.102)***	(0.04)	(0.143)	(0.036)***	(0.054)**
Wealth	-0.008	-0.004	0.041	0.005	-0.004	-0.011	0.019
	(0.034)	(0.012)	(0.026)	(0.02)	(0.022)	(0.029)	(0.018)
Cultural	0.005	0.0005	0.044	-0.008	0.054	0.079	0.039
Possessions	(0.017)	(0.008)	(0.014)***	(0.015)	(0.020)***	(0.020)***	(0.012)***
Educational	0.020	0.012	-0.003	0.046	0.022	-0.001	0.018
Resources	(0.020)	(0.011)	(0.018)	(0.013)***	(0.020)	(0.019)	(0.013)
Schools	148	189	156	45	155	164	163
Observations	1,478	2,025	1,610	1,718	1,686	1,703	1,903
Log Likelihood	-1,218.6	-687.2	-1,401.9	-1,516	-1,647	-1,688.7	-1,530.6

Note: Random intercepts are applied. Parentheses are robust standard errors. * $p< .10$, ** $p< .05$, *** $p< .001$.

Table 5. Participation in Math Club, country-analysis, nested model

Country	Hong Kong	Japan	Korea	Macao	Shanghai	Singapore	Taiwan
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	-0.131	-0.04	-0.083	-0.073	-0.047	-0.109	-0.086
	(0.029)***	(0.015)***	(0.032)**	(0.022)***	(0.034)	(0.026)***	(0.016)***
Trust	0.013	-0.001	0.067	0.019	0.024	0.013	0.012
	(0.017)	(0.009)	(0.018)***	(0.015)	(0.017)	(0.015)	(0.010)
Trustworthiness	0.001	-0.005	-0.008	-0.008	0.018	0.007	0.009
	(0.018)	(0.006)	(0.014)	(0.017)	(0.019)	(0.012)	(0.007)
Math Score	-0.189	-0.236	-0.043	-0.222	-0.304	-0.379	-0.129
(log)	(0.11)*	(0.058)***	(0.081)	(0.089)**	(0.119)**	(0.093)***	(0.052)**
Confidence	0.117	0.054	0.104	0.163	0.262	0.117	0.078
	(0.026)***	(0.015)***	(0.020)***	(0.019)***	(0.028)***	(0.017)***	(0.013)***
Evaluation	-0.005	0.022	-0.012	0.031	-0.034	0.006	-0.020
Aversion	(0.027)	(0.011)**	(0.020)	(0.018)*	(0.026)	(0.014)	(0.012)*
Single-sex	0.01	-0.019	0.039	0.096	-0.207	0.008	-0.022
School	(0.092)	(0.020)	(0.047)	(0.029)***	(0.031)***	(0.047)	(0.11)
Female*Single	0.08	0.014	-0.038	-0.123	.	0.013	0.02
-sex School	(0.108)	(0.029)	(0.053)	(0.039)***	.	(0.047)	(0.114)
Motherôs Job	0.003	0.008	-0.020	0.006	0.016	-0.006	0.003
	(0.011)	(0.004)*	(0.008)**	(0.010)	(0.012)	(0.008)	(0.006)
Ethnic	-0.056	-0.050	0.212	0.015	0.246	-0.071	0.033
Backgrounds	(0.033)*	(0.058)	(0.059)***	(0.031)	(0.080)***	(0.029)**	(0.032)
Wealth	-0.035	-0.008	0.032	0.008	0.025	-0.013	0.023
	(0.033)	(0.010)	(0.022)	(0.018)	(0.021)	(0.019)	(0.013)*
Cultural	0.033	-0.001	0.019	0.013	0.035	0.023	0.011
Possessions	(0.019)*	(0.007)	(0.013)	(0.013)	(0.018)**	(0.015)	(0.008)
Educational	0.035	0.019	-0.014	0.042	0.061	0.0004	0.004
Resources	(0.020)*	(0.009)**	(0.015)	(0.009)***	(0.019)***	(0.014)	(0.010)
Schools	148	189	156	45	155	164	163
Observations	1,482	2,028	1,611	1,719	1,686	1,703	1,904
Log Likelihood	-1,171.9	-251.6	-1,137.5	-1,203.7	-1,621.5	-1,137.4	-773.2

Note: Random intercepts are applied. Parentheses are robust standard errors. * $p< .10$, ** $p< .05$, *** $p< .001$.

Table 6. Instrumental Motivation in Math-related Career, country-analysis, nested model

Country	Hong Kong	Japan	Korea	Macao	Shanghai	Singapore	Taiwan
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	-0.054	-0.064	0.085	-0.096	0.043	-0.065	-0.082
	(0.041)	(0.042)	(0.054)	(0.047)**	(0.037)	(0.040)*	(0.037)**
Trust	0.209	0.217	0.214	0.207	0.246	0.212	0.186
	(0.025)***	(0.023)***	(0.027)***	(0.025)***	(0.022)***	(0.02)***	(0.017)***
Trustworthiness	0.049	0.048	-0.004	-0.007	0.030	0.002	0.011
	(0.022)**	(0.024)**	(0.022)	(0.021)	(0.025)	(0.021)	(0.018)
Math Score	0.068	0.705	0.703	-0.186	-0.625	-0.767	0.131
(log)	(0.125)	(0.139)***	(0.152)***	(0.106)*	(0.136)***	(0.118)***	(0.095)
Confidence	0.466	0.511	0.525	0.458	0.453	0.426	0.441
	(0.030)***	(0.029)***	(0.031)***	(0.023)***	(0.031)***	(0.026)***	(0.027)***
Evaluation	0.050	0.139	0.223	0.105	0.022	0.106	0.094
Aversion	(0.031)	(0.026)***	(0.027)***	(0.029)***	(0.030)	(0.021)***	(0.023)***
Single-sex	-0.054	0.137	0.209	-0.157	-0.234	-0.176	-0.319
School	(0.07)	(0.104)	(0.063)***	(0.043)***	(0.036)***	(0.067)***	(0.038)***
Female*Single	0.092	0.029	-0.202	0.20	.	0.159	0.289
-sex School	(0.115)	(0.125)	(0.087)**	(0.095)**	.	(0.096)*	(0.072)***
Motherôs Job	-0.00$	0.013	-0.023	-0.009	0.019	-0.015	-0.025
	(0.015)	(0.017)	(0.014)	(0.015)	(0.015)	(0.013)	(0.012)**
Ethnic	0.012	0.050	0.207	0.007	0.029	0.022	0.154
Backgrounds	(0.04)	(0.175)	(0.314)	(0.04)	(0.134)	(0.039)	(0.104)
Wealth	-0.086	-0.013	-0.06	-0.094	-0.076	-0.029	-0.058
	(0.034)**	(0.037)	(0.037)	(0.024)***	(0.027)***	(0.026)	(0.028)**
Cultural	0.019	0.028	-0.075	0.003	0.045	-0.042	-0.02
Possessions	(0.026)	(0.024)	(0.028)***	(0.02)	(0.030)	(0.021)*	(0.019)
Educational	0.036	0.067	0.09	0.097	0.053	0.05	0.065
Resources	(0.022)*	(0.031)**	(0.026)***	(0.019)***	(0.024)**	(0.017)***	(0.02)***
Schools	148	189	156	45	155	164	163
Observations	1,488	2,031	1,612	1,723	1,685	1,701	1,899
Log Likelihood	-1,681.8	-2,582.2	-1,995.2	-1,976.5	-1,947.7	-1,894.1	-2,135.1

Note: Random intercepts are applied. Parentheses are robust standard errors. * $p< .10$, ** $p< .05$, *** $p< .001$.

Appendix A. Survey Questions

A.1. Dependent Variables

- Competition in a math contest (maths behaviour)

  How often do you participate in math competition? (always, often, sometimes, or never/rarely)

- Participation in a math club (maths behaviour)

  How often do you participate in a math club? (always, often, sometimes, or never/rarely)

- The index of instrumental motivation in math-related career

  How much do you agree that math (is):

  (strongly agree, agree, disagree, or strongly disagree)

  (i) Worthwhile for work

  (ii) Worthwhile for career chances

  (iii) Important for future study

  (iv) Helps to get a job

A.2. Explanatory Variables

- The index of student-teacher relationship

  How much do you agree that:

  (strongly agree, agree, disagree, or strongly disagree)

  (i) You get along with teachers

  (ii) Teachers are interested

  (iii) Teachers listen to students

  (iv) Teachers help students

  (v) Teachers treat students fair

- The index of teachersômorale (evaluated by school heads)

  Think about the teachers in your school. How much do you agree with the following statements?

(strongly agree, agree, disagree, or strongly disagree)

(i) The moral of teachers in this school is high

(ii) Teachers work with enthusiasm

(iii) Teachers take pride in this school

(iv) Teachers value academic achievement

- The index of self-concept in math (maths self-concept)

  How much do you agree that you (are):

  (strongly agree, agree, disagree, or strongly disagree)

  (i) Not good at math

  (ii) Get a good grade at math

  (iii) Learn math quickly

  (iv) Find math as one of the best subjects

  (v) Understand difficult mathematical work

- Evaluation aversion (maths anxiety)

  How much do you agree that you worry about getting poor grades in math?

  (strongly agree, agree, disagree, or strongly disagree)

Appendix B. Country-level Descriptive Statistics

B.1. Hong Kong

	Full Sample (n = 1,478)				Boys (n = 774)		Girls (n = 704)	
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Mean	Std.Dev.
Competition in Math	1.28	0.59	1	4	1.37	0.70	1.17	0.42
Participation in Math Club	1.19	0.56	1	4	1.26	0.66	1.11	0.40
Instrumental Motivation	-0.30	0.90	-2.3	1.59	-0.20	0.90	-0.41	0.88
Trust	0.05	0.92	-3.11	2.16	0.03	0.95	0.07	0.89
Trustworthiness	-0.41	0.90	-2.15	1.45	-0.42	0.89	-0.41	0.91
Math Score	564	95.91	209	829	572	101.01	555	89.20
Confidence	-1.12	0.91	-2.18	2.26	0.09	0.88	-0.35	0.90
Evaluation Aversion	2.92	0.90	1	4	2.78	0.95	3.07	0.82
Single-sex School	0.18	0.38	0	1	0.17	0.38	0.18	0.39
Mother's Job	2.72	1.39	1	4	2.77	1.38	2.66	1.39
Ethnic Backgrounds	0.46	0.50	0	1	0.50	0.50	0.42	0.49
Wealth	-0.98	0.68	-5.08	3.13	-0.95	0.74	-1.01	0.61
Cultural Possessions	-0.15	0.98	-1.51	1.27	-0.20	0.98	-0.10	0.97
Educational Resources	-0.29	0.97	-3.93	1.12	-0.28	1.00	-0.29	0.94

B.2. Japan

	Full Sample (n = 2,025)				Boys (n = 1,038)		Girls (n = 942)	
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Mean	Std.Dev.
Competition in Math	1.08	0.35	1	4	1.11	0.42	1.04	0.24
Participation in Math Club	1.04	0.28	1	4	1.06	0.35	1.02	0.17
Instrumental Motivation	-0.54	1.05	-2.3	1.59	-0.41	1.06	-0.69	1.03
Trust	-0.16	1.03	-3.11	2.16	-0.12	1.07	-0.20	0.98
Trustworthiness	-0.50	0.95	-2.47	1.45	-0.46	0.93	-0.54	0.96
Math Score	539	92.43	222	849	552	95.74	525	86.30
Confidence	-0.49	0.95	-2.18	2.26	-0.28	0.93	-0.72	0.93
Evaluation Aversion	2.90	0.96	1	4	2.75	0.98	3.07	0.92
Single-sex School	0.11	0.31	0	1	0.08	0.28	0.14	0.35
Mother's Job	2.93	1.09	1	4	2.91	1.09	2.94	1.09
Ethnic Backgrounds	0.99	0.12	0	1	0.99	0.11	0.99	0.12
Wealth	-0.29	0.64	-2.5	1.8	-0.28	0.65	-0.30	0.63
Cultural Possessions	-0.49	0.94	-1.51	1.27	-0.55	0.92	-0.42	0.96
Educational Resources	-0.58	0.84	-3.93	1.12	-0.62	0.86	-0.53	0.81

B.3. Korea

	Full Sample (n = 1,610)				Boys (n = 843)		Girls (n = 767)	
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Mean	Std.Dev.
Competition in Math	1.32	0.66	1	4	1.41	0.74	1.21	0.53
Participation in Math Club	1.15	0.51	1	4	1.22	0.60	1.08	0.37
Instrumental Motivation	-0.41	1.06	-2.3	1.59	-0.34	1.09	-0.50	1.01
Trust	-0.10	0.89	-3.11	2.16	-0.09	0.92	-0.10	0.85
Trustworthiness	-0.28	1.05	-2.47	1.45	-0.30	1.11	-0.25	0.98
Math Score	560	95.75	184	826	570	101.36	548	87.72
Confidence	-0.36	0.90	-2.18	2.26	-0.22	0.93	-0.52	0.85
Evaluation Aversion	3.12	0.83	1	4	3.05	0.89	3.21	0.76
Single-sex School	0.43	0.49	0	1	0.41	0.49	0.44	0.50
Motherôs Job	2.69	1.39	1	4	2.63	1.42	2.76	1.35
Ethnic Backgrounds	0.99	0.07	0	1	0.998	0.05	0.99	0.10
Wealth	-0.71	0.59	-3.04	1.25	-0.69	0.60	-0.73	0.59
Cultural Possessions	0.28	0.94	-1.51	1.27	0.23	0.96	0.33	0.93
Educational Resources	-0.08	0.96	-2.92	1.12	-0.10	0.97	-0.06	0.95

B.4. Macao

	Full Sample (n = 1,718)				Boys (n = 898)		Girls (n = 820)	
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Mean	Std.Dev.
Competition in Math	1.36	0.65	1	4	1.46	0.72	1.26	0.55
Participation in Math Club	1.18	0.51	1	4	1.25	0.58	1.11	0.42
Instrumental Motivation	-0.33	0.90	-2.3	1.59	-0.21	0.91	-0.45	0.87
Trust	-0.08	0.96	-3.11	2.16	-0.02	0.99	-0.14	0.91
Trustworthiness	-0.51	0.83	-2.47	1.45	-0.52	0.78	-0.50	0.89
Math Score	544	92.61	208.14	808.78	546	93.24	543	91.93
Confidence	-0.18	0.93	-2.18	2.26	0.02	0.89	-0.40	0.92
Evaluation Aversion	2.88	0.95	1	4	2.73	0.97	3.04	0.90
Single-sex School	0.10	0.30	0	1	0.05	0.23	0.14	0.35
Motherôs Job	3.24	1.25	1	4	3.30	1.21	3.17	1.29
Ethnic Backgrounds	0.23	0.42	0	1	0.22	0.41	0.23	0.42
Wealth	-0.55	0.82	-4.96	3.11	-0.58	0.82	-0.51	0.82
Cultural Possessions	-0.42	0.98	-1.51	1.27	-0.58	0.94	-0.24	0.99
Educational Resources	-0.28	1.02	-3.93	1.12	-0.32	1.06	-0.24	0.97

B.5. Shanghai

	Full Sample (n = 1,686)				Boys (n = 838)		Girls (n = 848)	
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Mean	Std.Dev.
Competition in Math	1.47	0.76	1	4	1.61	0.84	1.33	0.64
Participation in Math Club	1.33	0.69	1	4	1.42	0.76	1.25	0.60
Instrumental Motivation	-0.05	0.91	-2.3	1.59	0.03	0.93	-0.13	0.89
Trust	0.51	1.02	-3.11	2.16	0.54	1.05	0.49	0.996
Trustworthiness	-0.007	0.95	-2.79	1.45	-0.03	0.95	0.01	0.95
Math Score	612	98.62	305	912	614	103.24	610	93.84
Confidence	-0.006	0.85	-2.18	2.26	0.22	0.85	-0.23	0.79
Evaluation Aversion	2.88	0.85	1	4	2.71	0.90	3.05	0.75
Single-sex School	0.007	0.08	0	1	0	0	0.01	0.11
Motherôs Job	3.22	1.25	1	4	3.20	1.26	3.26	1.24
Ethnic Backgrounds	0.98	0.12	0	1	0.99	0.11	0.98	0.14
Wealth	-0.78	0.89	-5.04	3.03	-0.77	0.91	-0.79	0.86
Cultural Possessions	0.45	0.88	-1.51	1.27	0.33	0.92	-0.57	0.82
Educational Resources	-0.03	0.94	-3.93	1.12	-0.07	0.95	0.005	0.93

B.6. Singapore

	Full Sample (n = 1,703)				Boys (n = 840)		Girls (n = 863)	
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Mean	Std.Dev.
Competition in Math	1.40	0.72	1	4	1.49	0.80	1.32	0.61
Participation in Math Club	1.14	0.49	1	4	1.20	0.58	1.08	0.37
Instrumental Motivation	0.32	0.86	-2.3	1.59	0.39	0.87	0.25	0.85
Trust	0.33	0.96	-3.11	2.16	0.39	0.98	0.27	0.93
Trustworthiness	0.11	0.96	-2.47	1.45	0.08	0.97	0.13	0.95
Math Score	573	99.92	210	868	572	103.44	574	96.42
Confidence	0.19	0.92	-2.18	2.26	0.26	0.94	0.12	0.89
Evaluation Aversion	3.12	0.93	1	4	3.10	0.97	3.14	0.90
Single-sex School	0.15	0.36	0	1	0.11	0.32	0.19	0.39
Motherôs Job	2.82	1.36	1	4	2.82	1.37	2.82	1.34
Ethnic Backgrounds	0.67	0.47	0	1	0.70	0.46	0.65	0.48
Wealth	-0.38	0.80	-2.85	3.03	-0.35	0.83	-0.41	0.77
Cultural Possessions	-0.41	1.03	-1.51	1.27	-0.51	1.02	-0.30	1.02
Educational Resources	0.14	0.98	-2.92	1.12	0.14	1.00	0.13	0.95

B.7. Taiwan

	Full Sample (n = 1,903)				Boys (n = 939)		Girls (n = 964)	
Variable	Mean	Std.Dev.	Min.	Max.	Mean	Std.Dev.	Mean	Std.Dev.
Competition in Math	1.28	0.61	1	4	1.38	0.71	1.19	0.47
Participation in Math Club	1.10	0.38	1	4	1.16	0.47	1.04	0.24
Instrumental Motivation	-0.42	0.90	-2.3	1.59	-0.31	0.95	-0.53	0.83
Trust	0.04	1.05	-3.11	2.16	0.04	1.11	0.04	0.99
Trustworthiness	-0.07	0.97	-2.15	1.45	-0.11	0.94	-0.02	1.00
Math Score	562	112	208	925	567	116	557	107.72
Confidence	-0.42	0.96	-2.18	2.26	-0.22	0.99	-0.62	0.88
Evaluation Aversion	3.02	0.88	1	4	2.86	0.94	3.18	0.79
Single-sex School	0.05	0.22	0	1	0.03	0.16	0.07	0.26
Mother's Job	3.00	1.36	1	4	3.00	1.36	3.00	1.36
Ethnic Backgrounds	0.97	0.18	0	1	0.96	0.19	0.97	0.18
Wealth	-0.46	0.79	-3.71	2.99	-0.44	0.80	-0.48	0.79
Cultural Possessions	-0.11	1.09	-1.51	1.27	-0.21	1.10	-0.004	1.07
Educational Resources	-0.22	1.05	-3.93	1.12	-0.28	1.10	-0.17	1.00