Competitiveness, Abilities, and Institutions: Evidence with Three Korean Groups

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Introduction

- Competition is an essential way of allocating scare resources in a society.
- It requires individuals to be equipped with proper levels of human capital.
  - cognitive abilities;
  - non-cognitive skills (in particular, competitiveness)
- Institutions have significant influences on the formation of human capital.
- We explore the association between competitiveness, cognitive ability, and institutions, using three Korean groups.

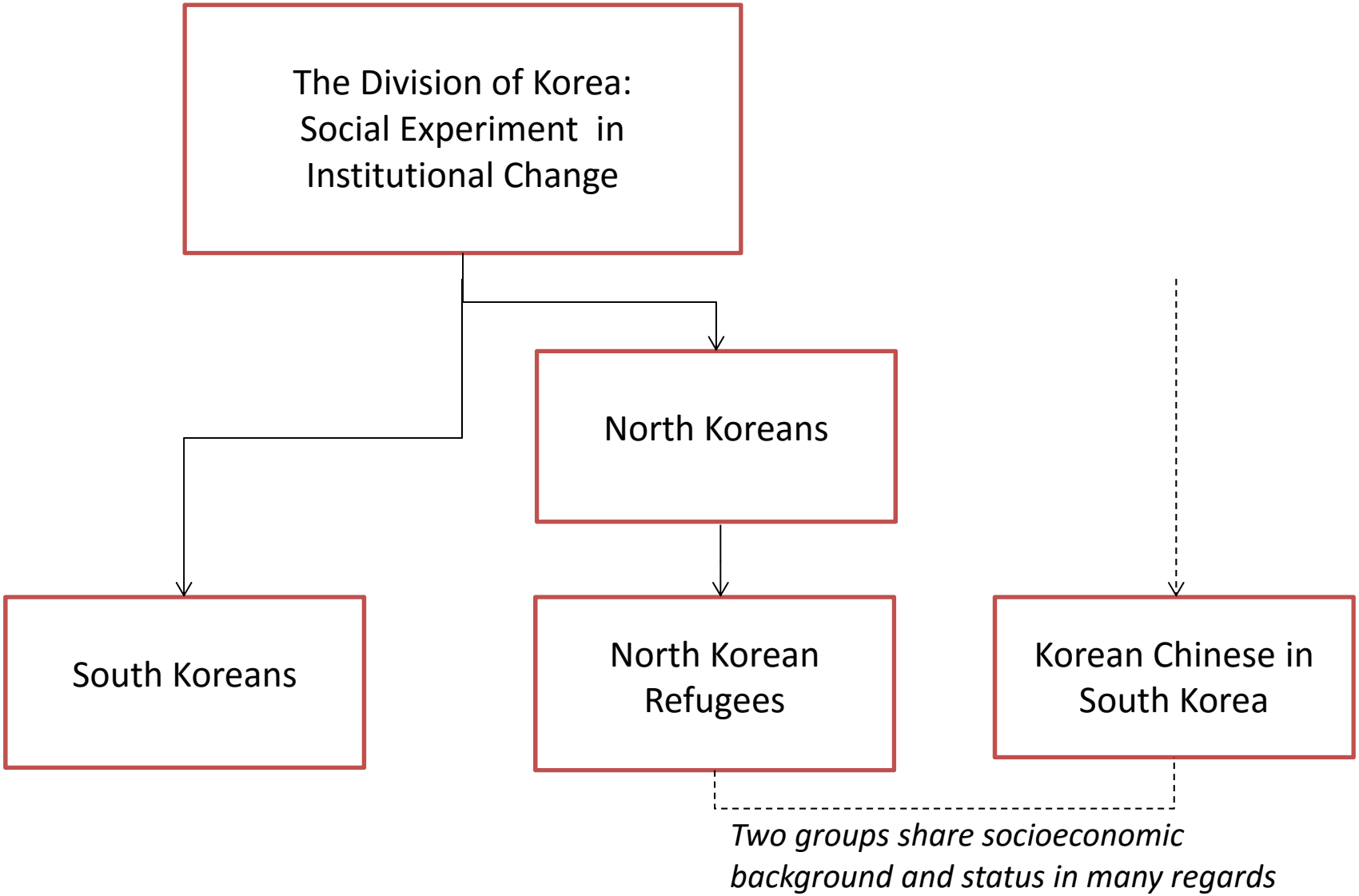
Introduction

- The division of Korea into North and South is a natural experiment in institutional change (Acemoglu et al. 2005) that turns:
  - South Korea into being prosperous with private ownership and market-based competition;
  - North Korea into a failing country with state ownership, central planning, and non-market competition;
- Three Korean groups–NK refugees, SK-born citizens, Korean Chinese–have had life experiences of survival and competition under different institutions.
- Despite concerns of selection, it is worth exploring their preferences for competition and cognitive abilities.

What We Do

- We use a lab experimental approach to measure preferences for competition (e.g., Nierderle and Vesterlund, 2007)
  - A simple task requiring less ability of cognition
  - Choice between payment scheme based solely on individual performance and that based on competition
- We measure cognitive ability by using Raven Progressive Matrices Test.
- We recruit a representative sample of North Korean refugees over age 20 living in South Korea (191 subjects), and comparable groups of South Korea-born citizens (193 subjects) and Korean Chinese (72 subjects).

Subjects


The Division of Korea: Social Experiment in Institutional Change
North Koreans
South Koreans
North Korean Refugees
Korean Chinese in South Korea
Two groups share socioeconomic background and status in many regards

Sampling

North Korea Census and North Korean Refugees

	Census: 2008	Refugees: 2011	Our sample: 2015
Sample size	24,052,231	20,358	191
Female (%)	51.2	68.6	66.0
Age composition (%)			
0-19	21.8	15.5	0.0
20-29	14.9	27.4	33.6
30-39	16.2	32.1	35.1
40-49	14.9	15.6	19.3
50 and above	21.8	9.4	12.1
Birth or residential province in North Korea			
China border provinces (%)	30.3	78.2	79.1
Highest educational attainment obtained in North Korea			
Primary (including no education)	7.5	8.8	10.0
Secondary (complete & incomplete)	71.9	66.0	63.9
Post-secondary (up to 3 additional years)	9.9	13.5	15.7
Tertiary or higher	10.7	9.4	10.5
No response	0.0	2.2	0.0

Characteristics of Subjects

	NK	CK	SK
Female	0.660	0.708	0.710
Age	37.45	33.60	34.76
Married	0.298	0.306	0.425
Secondary education	0.524	0.145	0.319
Post-secondary education	0.262	0.850	0.597
Health status: bad	0.304	0.125	0.140
Religious	0.597	0.417	0.585
Number of household members	2.382	2.903	3.150
Employed	0.639	0.792	0.798
Unemployed	0.136	0.111	0.078
Out of labor force	0.225	0.097	0.124
Monthly household income	1.500	2.117	4.425
Monthly household expenditure	1.050	1.542	3.340
Household wealth	132.677	185.321	351.812
Number of subjects	191	72	193

Characteristics of NK Subjects

	NK
Years in SK	7.121
	(3.776)
Military in NK	0.147
Communist party member	0.131
Education in NK	
Primary or below	0.100
Some secondary	0.115
Secondary	0.524
Some post-secondary	0.157
Tertiary	0.105
China border provinces	0.791
Observations	191

Related Literature: Competitiveness

- Previous studies show that competitiveness varies by
  - Gender (e.g., Gneezy, Nierderle, and Rustichini, 2003; Nierderle and Vesterlund, 2007)
  - Working environments / experiences (Leibbrant, Gneezy, and List, 2013)
- We contribute to this literature by exploring potential association between competitiveness, cognitive abilities, and institutions.

Experiments and Survey

In an experimental session with three Koreans, we conduct the following

Experiments

1. Real-effort experiments

2. Elicitations of subjective winning probabilities and risk preferences

Raven test for cognitive abilities

Surveys

Real-effort Experiments

- The individual real-effort task consists of 3 stages with a simple, tedious task.
  - requiring less ability of cognition and thus (expected) little difference in performance among three groups
- In each stage, subjects count 0s in 20 of 7×7 tables within 5 minutes:

0	1	0	1	0	0	0
1	1	1	0	0	1	0
0	1	0	1	1	0	0
1	0	1	0	1	0	1
0	0	1	1	1	0	0
0	1	0	0	0	1	0
1	1	0	1	1	0	0

Real-effort Experiment

Stage 1 & 2: Piece-rate scheme or tournament scheme (order is randomly allocated)

- Under piece-rate:
  - 1,000 KRW (about $1)×(# of correct answers)
- Under tournament:
  - Matched with an anonymous participant.
  - 2,000 KRW (about $2)×(# of correct answers) if win and 0 otherwise.

Real-effort Experiment: Willingness to Compete

Stage 3: Choice of payment scheme

- Randomly assigned with a bonus point in the range {0,1,…,10}
- Choose either piece-rate or tournament scheme.
- If piece-rate is selected,

1,000 KRW (about $1)×(# of correct answers + bonus)

- If tournament is selected, the individual competes with an opponent in Stage 2 who did not have a bonus;

2,000 KRW (about $2)×(# of correct answers + bonus) if win
and 0 otherwise

Elicitation of Beliefs and Risk Preferences

- After the individual task (and before knowing the outcome of Stage 3), subjects were asked about their beliefs of winning if the tournament had been selected.

- This belief elicitation is incentivized (Hossain and Okui, 2013).

  - Prediction error is computed from a subject's report and a true event.

  - If this prediction error is smaller than a randomly generated number, the subject receives a fixed amount (2,000 KRW).

- We use a multiple price list design to elicit risk preferences (Holt and Laury, 2002).

Raven Progressive Matrices Test (Raven, 1962)

- 24 Raven Matrices Test in paper within 10 minutes.

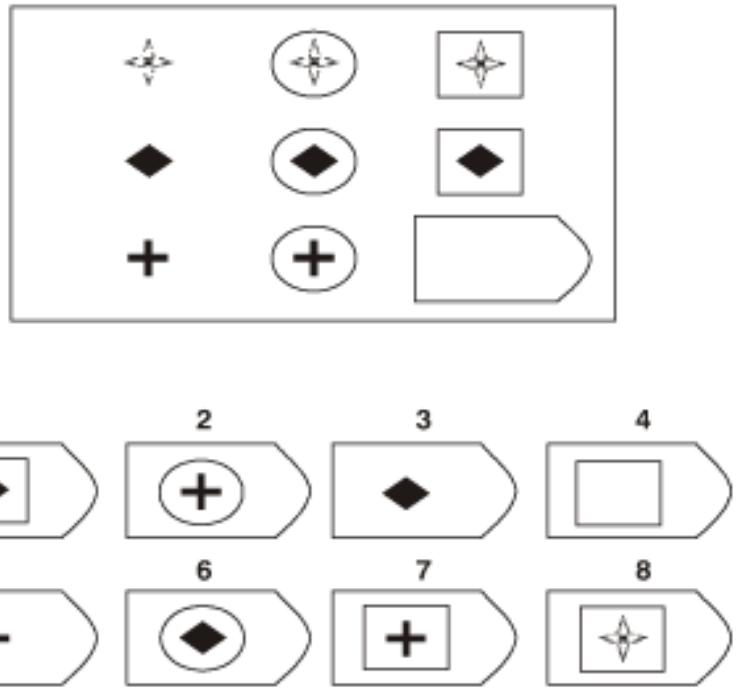
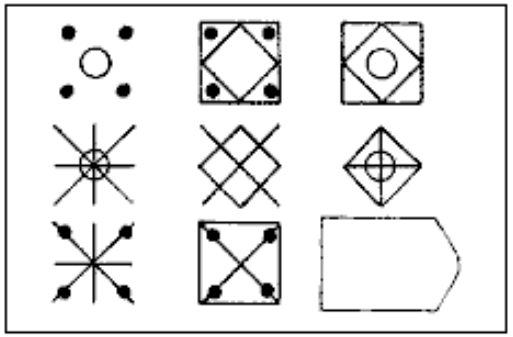
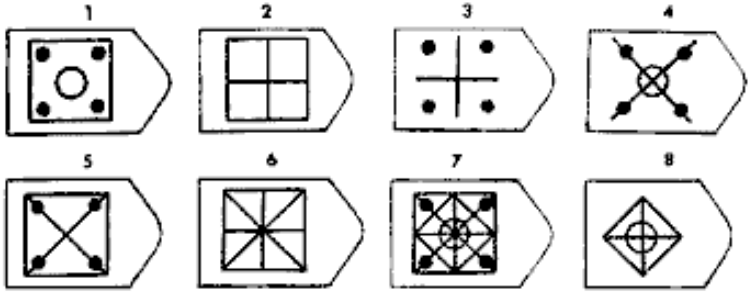
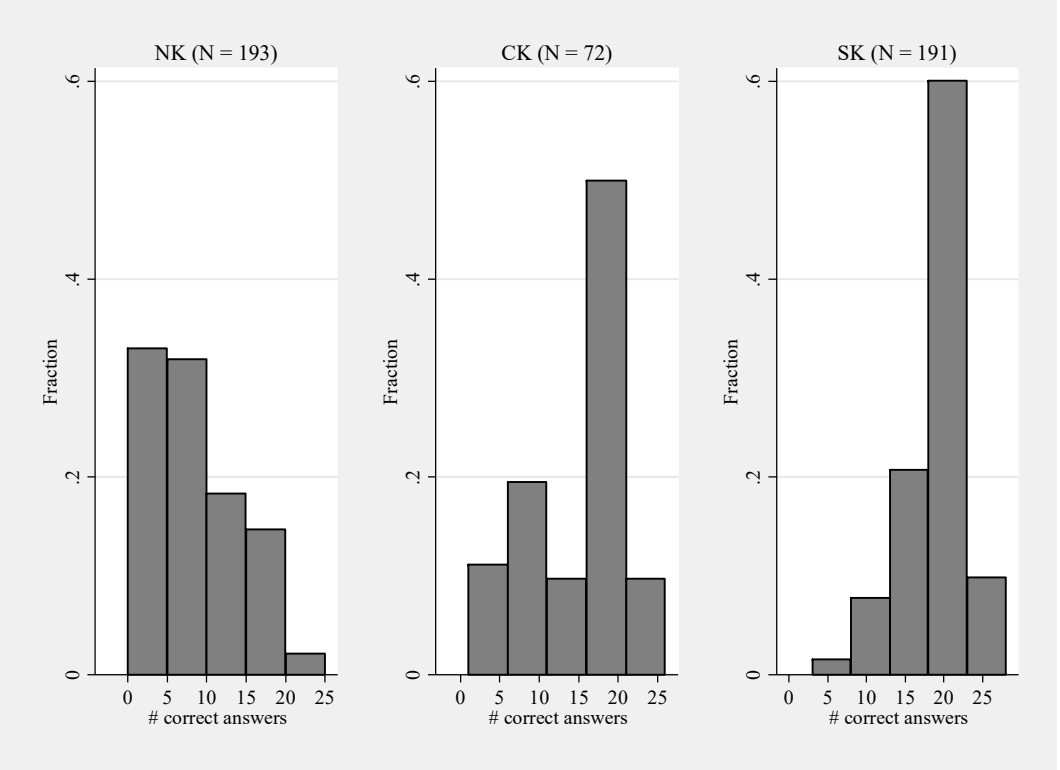


Figure 2 - Raven's progressive matrices



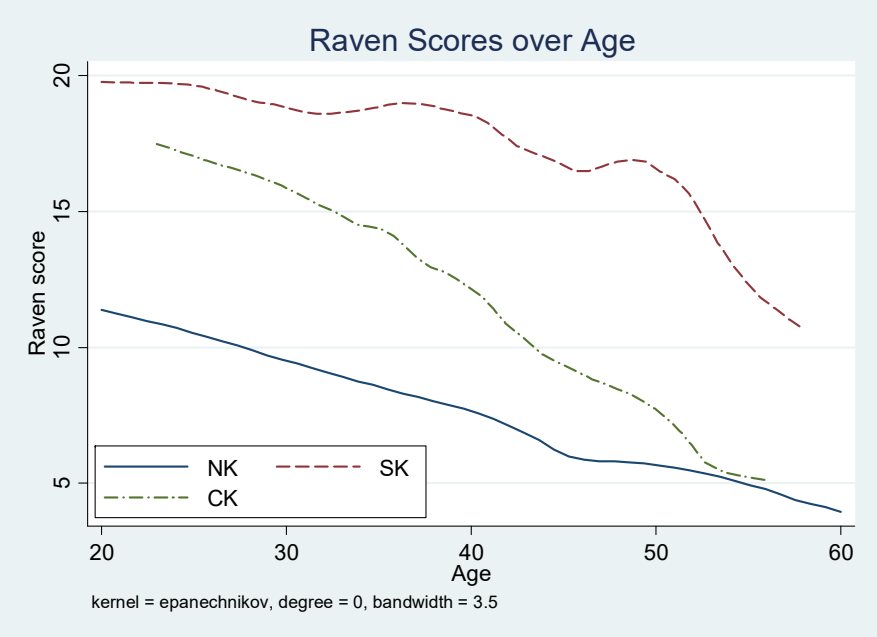


Result 1: Raven Scores



	NK	CK	SK
Raven score	8.089	14.028	18.233
	(5.357)	(6.132)	(3.881)

Raven Scores over Age



- The gap in Raven test scores between NK and SK subjects appears stable over age.

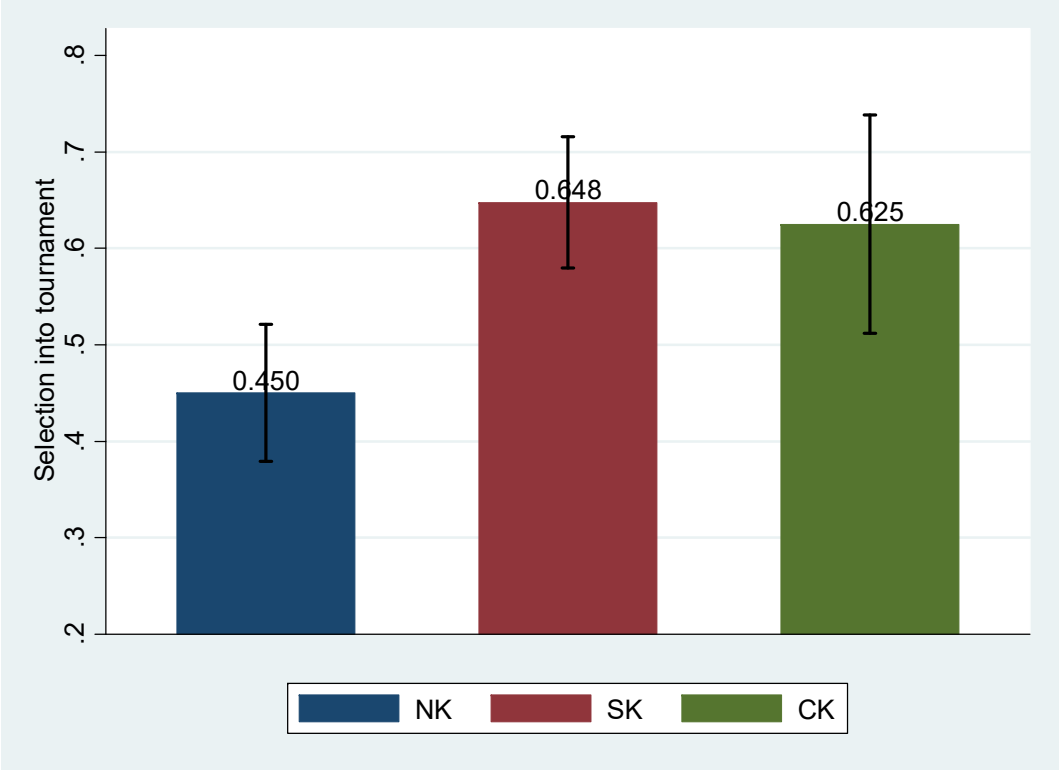
- These gaps remain significant, after controlling basic characteristics.

Real-effort experiment: Performances at Stage 1 & 2

	NK	CK	SK
Stage 1 & 2			
Piece rate first	0.539	0.500	0.487
Piece rate	10.791	12.861	12.922
	(3.755)	(3.762)	(3.565)
Tournament	11.351	12.667	13.617
	(3.640)	(3.544)	(3.453)

- Under each of the two schemes, SK subjects performed best: they solved two more problems than NK subjects.
- There is less difference between SK and CK (Korean Chinese) subjects.

Real-effort experiment: Willingness to compete



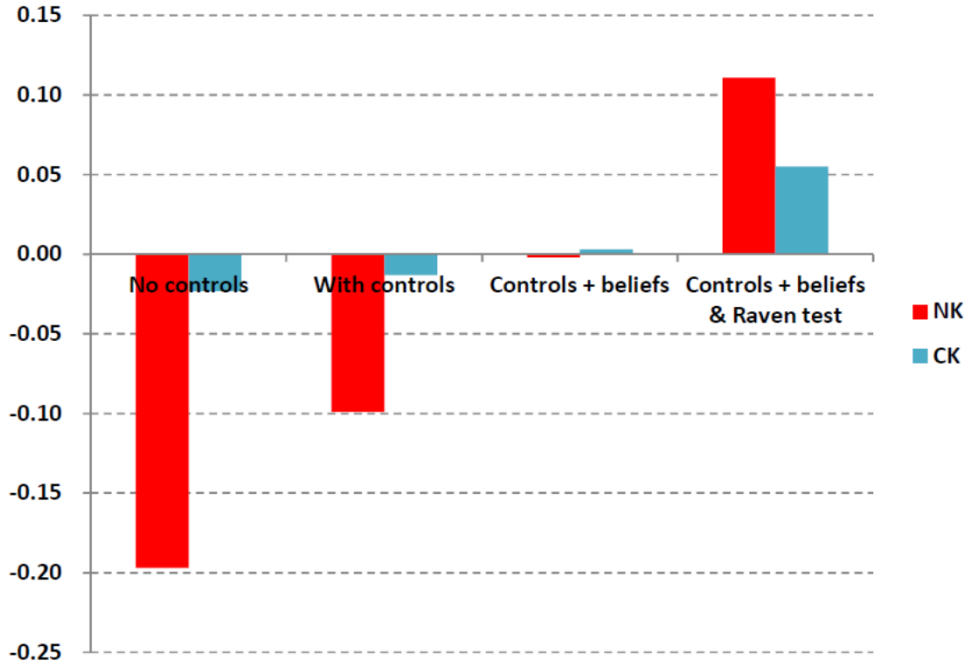
- NK subjects are about 20 percentage points less likely to choose the tournament scheme than SK subjects.

Regression Analysis: Willingness to Compete

- Beliefs of winning, bonus, and task-specific ability matter.
- General cognitive ability captured by Raven test plays a significant role.
- Gender matters a bit (e.g., Nierderle and Versterlund 2007).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NK	-0.197***	-0.125**	-0.136**	-0.099*	-0.008	-0.009	0.103*
	(0.041)	(0.050)	(0.049)	(0.055)	(0.050)	(0.041)	(0.056)
CK	-0.023	-0.012	-0.031	-0.013	0.008	0.000	0.052
	(0.109)	(0.095)	(0.093)	(0.089)	(0.088)	(0.083)	(0.078)
Age		-0.014***	-0.014***	-0.012***	-0.008**	-0.007**	-0.005
		(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Female		-0.115*	-0.105*	-0.112*	-0.058	-0.042	-0.035
		(0.058)	(0.054)	(0.053)	(0.054)	(0.055)	(0.053)
Household income		0.010	0.007	0.005	0.005	0.004	0.002
		(0.008)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
Number of HH members		0.012	0.016	0.014	0.010	0.010	0.007
		(0.010)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)
Bonus			0.032***	0.032***	0.012**	0.011**	0.014***
			(0.005)	(0.005)	(0.004)	(0.005)	(0.004)
Task-specific ability				0.023***	0.004	0.004	0.001
				(0.006)	(0.005)	(0.005)	(0.005)
Prob of winning					0.781***	0.766***	0.711***
					(0.088)	(0.087)	(0.086)
H&L inconsistent choices						-0.071	-0.041
						(0.040)	(0.044)
Number of safe choices						-0.019*	-0.019**
						(0.009)	(0.008)
General cognitive ability							0.015***
							(0.004)
Constant	0.648***	1.138***	0.979***	0.622***	0.182	0.287*	-0.007
	(0.041)	(0.147)	(0.150)	(0.166)	(0.147)	(0.134)	(0.162)
Observations	456	456	456	456	456	456	456
R-squared	0.036	0.127	0.169	0.194	0.330	0.343	0.358

Channels: Differences in Competitiveness



- The NK-SK gap reduces by half, after controlling sociodemographic information and task-specific performances.
- Subjective probability of winning can account for the remaining gap.
- NK subjects turn out to be more willing to compete, once we control for Raven scores as well as other factors.

Subjective Beliefs of Winning

	NK	CK	SK
C. Belief elicitation			
Prob of winning	0.601	0.749	0.781
	(0.282)	(0.250)	(0.276)
Subjective - empirical prob.	-0.119	-0.084	-0.045
	(0.318)	(0.258)	(0.253)
Overconfidence	0.173	0.139	0.155
Underconfidence	0.424	0.347	0.269

- NK subjects hold 18 percentage point lower expectation about winning the tournament than SK subjects.
- Define under-(over-)confidence when subjective beliefs of winning deviates a half standard deviation down (above) from empirical winning probabilities.
- NK subjects hold systematically under-confidence over their winning chances.

Regression Analysis: Beliefs of Winning

- Older people and female hold lower beliefs of winning.
- Task-specific ability and random bonus shock affect beliefs of winning.
- General cognitive ability explains the remaining NK-SK gap in subjective winning probability.

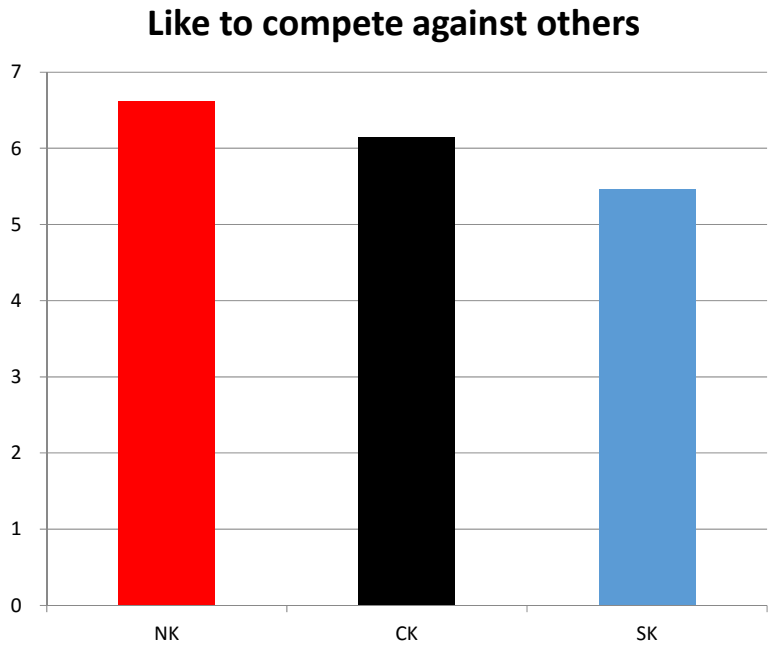
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NK	-0.180***	-0.147***	-0.156***	-0.148***	-0.109**	-0.095**	-0.009
	(0.019)	(0.031)	(0.034)	(0.043)	(0.039)	(0.042)	(0.041)
CK	-0.033	-0.031	-0.045**	-0.043*	-0.024	-0.019	0.019
	(0.034)	(0.023)	(0.016)	(0.020)	(0.023)	(0.022)	(0.027)
Age		-0.008***	-0.008***	-0.008***	-0.006***	-0.005***	-0.003**
		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Female		-0.070***	-0.062***	-0.070***	-0.076***	-0.069***	-0.061***
		(0.020)	(0.018)	(0.016)	(0.016)	(0.016)	(0.015)
Household income		0.004	0.002	0.002	-0.001	-0.000	-0.002
		(0.008)	(0.007)	(0.008)	(0.007)	(0.007)	(0.006)
Number of HH members		0.004	0.007	0.006	0.004	0.004	0.002
		(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)
Bonus			0.026***	0.026***	0.025***	0.025***	0.026***
			(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Own group strongest				-0.012	-0.008	-0.005	-0.006
				(0.030)	(0.031)	(0.033)	(0.032)
Own group weakest				-0.089***	-0.078***	-0.084***	-0.075***
				(0.021)	(0.020)	(0.021)	(0.020)
Task-specific ability					0.024***	0.024***	0.021***
					(0.003)	(0.003)	(0.003)
H&L inconsistent choices						-0.049	-0.025
						(0.037)	(0.036)
Number of safe choices						-0.004	-0.003
						(0.004)	(0.004)
General cognitive ability							0.011***
							(0.003)
Constant	0.781***	1.070***	0.944***	0.973***	0.594***	0.605***	0.361***
	(0.020)	(0.082)	(0.080)	(0.084)	(0.107)	(0.112)	(0.092)
Observations	456	456	456	456	456	456	456
R-squared	0.088	0.171	0.250	0.264	0.346	0.352	0.378

Discussion

- The quantity and quality of education in NK is lower than that of SK? Probably.
- Are refugees low-ability North Korean? (selection) Maybe.
- Traumatic experiences in NK or in transit to SK have adverse impacts on cognitive abilities? Partly.
- The North Korean famine during the late-1990s has severe impacts on the formation of cognitive abilities? Not in this sample.

Robustness Check: Subjective Attitudes toward Competition

	(1)	(2)	(3)
NK	1.141***	1.048***	1.328***
	(0.240)	(0.272)	(0.344)
CK	0.681**	0.696**	0.822**
	(0.300)	(0.318)	(0.339)
Age		0.018	0.026**
		(0.011)	(0.013)
Female		-0.928***	-0.904***
		(0.232)	(0.233)
Monthly HH income		-0.005	-0.010
		(0.038)	(0.038)
# of HH		0.020	0.013
		(0.061)	(0.061)
Raven score			0.032
			(0.025)
Constant	5.472***	5.454***	4.650***
	(0.139)	(0.522)	(0.826)
Observations	456	456	456
R-squared	0.048	0.086	0.089



Sample Selection Issue I:
Selection into Competition by NK Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Prob of winning	0.578***	0.598***	0.596***	0.607***	0.592***	0.580***
	(0.135)	(0.134)	(0.135)	(0.128)	(0.128)	(0.129)
H&L inconsistent choices	-0.012	-0.006	-0.011	-0.004	-0.026	-0.035
	(0.048)	(0.044)	(0.044)	(0.042)	(0.049)	(0.052)
Number of safe choices	-0.021**	-0.021**	-0.021*	-0.020*	-0.019*	-0.020**
	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)
General cognitive ability	0.007	0.006	0.005	0.007	0.005	0.003
	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Secondary education in NK		-0.143	-0.145	-0.109	-0.047	0.005
		(0.129)	(0.130)	(0.135)	(0.144)	(0.156)
Post-secondary education in NK		-0.149	-0.142	-0.131	-0.087	0.035
		(0.132)	(0.129)	(0.129)	(0.133)	(0.139)
Border provinces			0.083	0.083	0.081	0.094
			(0.061)	(0.063)	(0.058)	(0.064)
Military service in NK				-0.153	-0.157	-0.134
				(0.150)	(0.153)	(0.148)
Communist party member				0.157	0.174	0.144
				(0.142)	(0.139)	(0.148)
Any education in SK					0.140*	0.079
					(0.071)	(0.081)
Years in SK						0.023**
						(0.009)
Years in a third country						0.019
						(0.013)

Sample Selection Issue II: Winning Probability

No variables related to N. Korea are significant.

	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.003*	-0.004**	-0.004**	-0.004	-0.004	-0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Female	-0.102***	-0.111***	-0.111***	-0.104***	-0.102***	-0.097***
	(0.019)	(0.020)	(0.020)	(0.030)	(0.029)	(0.027)
Household income	-0.000	0.002	0.002	0.002	0.002	0.001
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Number of HH members	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003
	(0.010)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)
Bonus	0.023***	0.023***	0.023***	0.023***	0.023***	0.023***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
Own group strongest	-0.017	-0.020	-0.020	-0.021	-0.020	-0.021
	(0.030)	(0.031)	(0.031)	(0.032)	(0.033)	(0.034)
Own group weakest	-0.064**	-0.060**	-0.060**	-0.061*	-0.059**	-0.059**
	(0.025)	(0.026)	(0.026)	(0.028)	(0.026)	(0.023)
Task-specific ability	0.018***	0.018***	0.018***	0.018***	0.017***	0.017***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)
H&L inconsistent choices	-0.005	-0.006	-0.006	-0.008	-0.012	-0.010
	(0.057)	(0.056)	(0.057)	(0.061)	(0.061)	(0.061)
Number of safe choices	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
General cognitive ability	0.015***	0.016***	0.016***	0.015***	0.015***	0.015**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Secondary education in NK		0.066	0.065	0.054	0.065	0.073
		(0.048)	(0.049)	(0.043)	(0.059)	(0.061)
Post-secondary education in NK		0.049	0.049	0.044	0.052	0.062
		(0.035)	(0.033)	(0.038)	(0.044)	(0.059)
Border provinces			0.005	0.005	0.004	0.006
			(0.033)	(0.032)	(0.031)	(0.031)
Military service in NK				0.047	0.046	0.045
				(0.084)	(0.081)	(0.084)
Communist party member				-0.037	-0.034	-0.033
				(0.111)	(0.108)	(0.111)
Any education in SK					0.024	0.020
					(0.050)	(0.053)
Years in SK						0.003
						(0.008)
Years in a third country						-0.001
						(0.005)

Raven Score

	(1) SK	(2) CK	(3) NK	(4) NK
Age	-0.020***	-0.043***	-0.024***	-0.025***
	(0.004)	(0.006)	(0.004)	(0.005)
Female	-0.132**	-0.018	-0.043	-0.048
	(0.066)	(0.141)	(0.089)	(0.106)
Household income	0.010	0.019	0.028	0.025
	(0.010)	(0.047)	(0.023)	(0.025)
Number of HH members	0.012	0.032	0.044	0.036
	(0.016)	(0.035)	(0.030)	(0.030)
Secondary education	1.135***	-0.179	-0.224	-0.196
	(0.124)	(0.237)	(0.138)	(0.157)
Post-secondary education	1.156***	0.274	0.054	0.139
	(0.104)	(0.226)	(0.150)	(0.182)
Border provinces				0.055
				(0.101)
Military service in NK				0.179
				(0.155)
Communist party member				-0.275*
				(0.143)
Years in SK				0.026**
				(0.013)
Years in a third country				0.009
				(0.013)
Reasons for defection: political				0.064
				(0.101)
Reasons for defection: recommendation				-0.075
				(0.137)
Reasons for defection: family				-0.062
				(0.129)
Family members left in NK				0.010
				(0.103)

Concluding Remarks

- We recruit three Koreans (NK refugees, SK, CK) to explore potential links between institutions, abilities, and competitiveness.
- There is a substantial gap in cognitive ability between NK and SK subjects.
- NK refugees are unconditionally less competitive than SK subjects in the simple task requiring little cognition.
- However, conditioning on general cognitive abilities and others, they are more competitive.