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Height and Labor Market Outcome: Evidence from Panel Data

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Previous studies show that tall people have better labor market outcomes, but controlling for their abilities reduces the size of height effects. This implies that a failure to properly control for one's ability could overestimate the OLS estimate. This paper contributes to the literature by being the first to control for individual fixed effects (FE) and to examine height effects on the probability of one's attaining a leadership position. The data used are panel data of a cohort obtained during the cohort's middle and high school years. In OLS estimation, this paper finds positive height effects for boys. However, when controlling for individual fixed effects, the estimate is not statistically significant. For girls, the height effects are found on neither OLS nor FE model.

Keywords: height, height premium, leadership, discrimination, student council

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Ⅰ. Introduction

Previous studies show that tall people have better labor market outcomes. For example, Lindqvist (2012) analyzes Swedish male data to find that a 1 cm increase in height is associated with 0.2 percentage point or 2.7% increase in the probability of obtaining a managerial position. Case and Paxson (2008) analyzes U.S. and U.K. data to find that increasing height by one inch raises weekly wage by 1.4~2.6% for males and 1.4~2.9% for females. In addition, Park and Lee (2010) shows that a 1 cm increase in height increases hourly wage of Korean males by 1.5%.[1)]

Why do tall people have better labor market outcomes? There are several hypotheses that explain this phenomenon. One hypothesis is that tall people are likely to be healthy and their healthiness makes them successful in labor markets. Unhealthy people are more likely to be absent at work for illness, and thus they are not likely to be promoted or have high wages. Another is that tall people sort into high-paying occupations and short people sort into low-paying occupations. This hypothesis holds true for jobs that include tasks that tall people are better at than short people. Basketball players or policemen could be included in these jobs. A third hypothesis is that tall people have better cognitive abilities because nutrition in childhood is used for both height growth and cognitive ability development, creating a correlation between the two.

Regarding the third hypothesis, the studies described above show that controlling for cognitive abilities reduces the sizes of height effects. Lindqvist (2012) shows that controlling for cognitive and non-cognitive abilities measured in a military enlistment test reduces the effects of height on the probability of obtaining a managerial position by half. Case and Paxson (2008) finds that if one's cognitive test score measured at the age of 5~11 years

1) Studies also analyze the effects of one's appearance on labor market outcomes to find that (labor) market discriminates for people with good appearance. See Hamermesh and Biddle (1994), Biddle and Hamermesh (1998), Mobius and Rosenblat (2006), Price (2008), Berggren et al. (2010), Johnston (2010), and Belot et al. (2012).

old is controlled for, the height premium reduces by 50%. Park and Lee (2010) also shows that controlling for one's education level reduces the height effects by 34%. These studies imply that the better labor market outcomes of tall people are partly due to their better abilities, and a failure to properly control for one's abilities could produce upward-biased estimates of the height effects.[2)]

Some studies use siblings' or twins' data to control for one's ability (e.g., Lundborg et al., 2014; Böckerman and Vainiomäki, 2013), but using siblings' data cannot fully eliminate the genetic influence because siblings do not share the entire of their genes: variations in height within siblings may reflect differences in their abilities. While using twins' data can control for ability, heights do not vary very much within each couple of twins. For example, in Böckerman and Vainiomäki (2013), the average height variation for male monozygotic twins is 1.7~2.0 cm, while the number for women are 1.6~1.7 cm.[3)]

Employing an individual fixed effects (FE) method is a common way to control for unobserved heterogeneity such as ability. Controlling for FE allows one to compare within each individual and to eliminate the bias arising from ability differences between people of different heights. However, one cannot use adults' data since they do not increase in height, while using teens' data enables the method to estimate the effects of height.

This paper contributes to the literature by being the first to control for one's ability by including individual fixed effects (FE) in the regression and to estimate the effects of height on one's attaining a leadership position: the leadership position is the opportunity to become a student council member in the school.[4)] Because height grows during school ages, it is possible to control for the fixed effects. In addition, studies show that becoming a leader in the school is a significant predictor of labor market outcomes. For example, Kuhn and

2) Besides these studies, Judge and Cable (2004), Case et al. (2009), Kanazawa and Reyniers (2009), and Heineck (2009), Cinnirella et al. (2011) find a positive correlation between height and intelligence.

3) Lundborg et al. (2014) analyzes Swedish male data to find positive height effects, while Böckerman and Vainiomäki (2013) analyzes Finnish data to find positive height effects for women but no effects for men.

4) There are studies that use an individual fixed effects method to estimate the effects of height on other outcomes. For example, Rees et al. (2009) uses the method to estimate the effect of height on mental health.

Weinberger (2005) finds that high school leaders, acting as a team captain or club president, earn more by 4~33% and are more likely to hold managerial occupations as adults.

To control for an individual fixed effect, this paper uses panel data of a cohort that were obtained in the cohort's 9^{th} and 12^{th} grade years. In OLS estimation, this paper finds positive height effects for boys: taller boys have higher probabilities of becoming student council members in the school, while the probability increases at a decreasing rate. However, when controlling for individual fixed effects, this paper finds no height effects for boys. While these results imply that tall boys may have better abilities than short boys, this paper shows that the former have better academic performances and leadership skills than the latter. For girls, the height effects are found on neither OLS nor FE model.

This paper is organized as follows. The next section describes the data used in this paper. Section III presents the empirical strategy, followed by the estimation results in Section IV. Finally, Section V concludes this paper.

Ⅱ. Data

The data used in this paper come from Korean Education & Employment Panel (KEEP) that the Korean Research Institute for Vocational Education and Training (KRIVET) has obtained since 2004. KEEP has the purpose of examining the educational and labor market experiences of youths in Korea. In 2004, the first year of the survey, KRIVET surveyed two cohorts of students, composed of 2,000 9^{th} graders enrolled in 100 schools and 4,000 12^{th} graders enrolled in 200 schools.[5] Since 2004, the institute has interviewed the students and their families annually. In 2004 and 2007, it also surveyed students' homeroom teachers.[6]

5) In each school, four classes were randomly chosen, and in each class, five students were randomly chosen - 20 students total in one school. In any school featuring fewer than four classes, all of the classes were chosen.

6) Korean middle schools and high schools have homerooms, while in each homeroom one homeroom teacher is assigned. Homeroom teachers discipline students, record attendance, and take care of other administrative duties. In most cases, students take classes in their homerooms and do not move from

This paper uses the 9^{th} grade cohort data that were obtained in the students' 9^{th} and 12^{th} grade years. The 9^{th} grade year data of the cohort have 996 boys and 1,004 girls (2,000 students in total), while some of them did not respond in the 12^{th} grade year survey, and the 12^{th} grade year data have 839 boys and 859 girls (1,698 students in total). Out of 1,698 students who responded in the 12^{th} grade year survey, KRIVET was able to survey the homeroom teachers of 1,130 students, while the institute was able to survey all 2,000 9^{th} graders' homeroom teachers in the 9^{th} grade year survey.

The data include a variety of information on students, which includes information on whether a student had become a student council member in the school as well as information on their height. In the 9^{th} grade year survey, a question was asked to determine whether the student had become a member of the student council during his or her middle school years (7^{th}~9^{th} grade years), and in the 12^{th} grade year survey, a question was asked to determine whether the student had become a member during his or her high school years (10^{th}~12^{th} grade years).[7] In order to obtain information on students' height, they were asked to write down their height in centimeters (self-reported measure). A problem with self-reported measure is that it can be contaminated with measurement error. Yet, previous studies document that people correctly report their height. For example, Persico et al. (2004) analyzed Britain's National Child Development Survey to find that using a self-reported measure of height does not produce biased results (see p.1027). This paper also shows that the self-reported measure used in this paper is quite similar to a national height survey below.

In addition, the data provided information on students' gender, academic performances, health status, and leadership skills. The information on students' academic performances was obtained from students' homeroom teachers, and the measurement indicates their rank in the school. For 9^{th} graders, the rank measurements range from 0 to 100, and the number indicates the proportion of students that is better than the student measured. For example, if a student's rank is 20, it means that 20% of students are better than that particular student.

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classroom to classroom.

7) Each homeroom has a student council that consists of two or three members of students in the homeroom. Students usually vote to determine the council members.

For 12th graders, it is a tier rank that consists of nine ranks. Students of rank 1 perform the best in the school, and those of rank 9 perform the worst.[8] To measure students' health status, a five-point Likert scale was used, and this paper considers one's health in a good state if the score is 4 or 5. Students' leadership skills were evaluated by both students themselves and their homeroom teachers. Students were asked to evaluate themselves in this category only in the 9th grade year survey, while the teachers were asked to make this evaluation in both grade year surveys. This paper considers one's leadership skills good if the score is 4 or 5 in the five-point Likert scale. The data also provide information on the students' families, including parental education levels.

Table 1 provides descriptive statistics. The proportion of boys who had become a student council member during their middle school years is 22.7%, and the proportion for high school is 20.5%. The numbers for girls are 26.3% and 21.3%, respectively. The average heights of boys are 168.7 cm for 9th graders and 174.8 cm for 12th graders, while the numbers for girls are 159.5 cm and 161.3 cm, respectively. As described above, these numbers are self-reported measures, and a problem with it is that it can be contaminated with measurement error, causing attenuation bias in the estimated height effects. To check this possibility, this paper compares these numbers with a national height survey that the Korean Center for Disease Control and Prevention (KCDC) conducted in 2007. KCDC (2007) shows that the median height of 15-year-old boys or 9th grade boys is 169.7 cm, while the median height of 18-year-old boys or 12th grade boys is 173.4 cm. The numbers for girls are 159.4 cm and 160.7 cm, respectively.[9] These numbers appear to be quite similar to students' self-reported heights, and this paper concludes that the self-reported heights are not contaminated with measurement error.

In addition, boys grew, on average, by 6.2 cm between 9th grade year and 12th grade year, while girls grew by 2.1 cm. As shown in Appendix Figure 1, which presents density estimates of the entire distribution of change in height, the ranges are 25 cm for both boys and girls. For leadership skills, about 19.7% of 9th grade boys say that their leadership skills are good, while 24.1% of 9th grade girls say so. Students' homeroom teachers say

8) See Appendix Table 1 for cutoff points which divide 12th graders into nine ranks.
9) See pp.125~130 in KCDC(2007).

〈Table 1〉 Descriptive Statistics

	Boys		Girls	
	9th grader	12th grader	9th grader	12th grader
Student council member (%)	22.7 (41.9)	20.5 (40.4)	26.3 (44.0)	21.3 (41.0)
Height (cm)	168.7 (6.6)	174.8 (5.4)	159.5 (4.8)	161.3 (4.8)
Change in height (cm)	6.2 (4.3)		2.1 (2.0)	
Health status - good (%)	60.8 (48.8)	71.4 (45.2)	58.5 (49.3)	64.3 (48.0)
Academic performance	50.9 (28.2)	4.8 (1.9)	46.8 (27.6)	4.6 (1.8)
Leadership skills - good (%) (self-evaluation)	19.7 (39.8)	--	24.1 (42.8)	--
Leadership skills - good (%) (teachers' evaluation)	17.8 (38.3)	22.8 (42.0)	20.8 (40.6)	25.0 (43.4)
Father - some college or more (%)	33.5 (47.2)	32.5 (46.9)	29.6 (45.7)	27.3 (44.6)
Father - high school graduates (%)	48.8 (50.0)	50.3 (50.0)	49.1 (50.0)	50.7 (50.0)
Mother - some college or more (%)	15.8 (36.5)	13.6 (34.2)	17.0 (37.6)	15.5 (36.2)
Mother - high school graduates (%)	60.6 (48.9)	62.9 (48.3)	55.8 (49.7)	57.1 (49.5)
Maximum number of observations	996	839	1,004	859

Standard deviations are in parenthesis. Change in height is restricted to the analysis sample. Academic performance measurement is rank in the school. For 9th graders, the measurement ranges from 1 to 99, and the number indicates the proportion of students that is better than the student measured. For 12th graders, it is a tier rank that consists of nine ranks. Students of rank 1 perform the best in the school, and those of rank 9 perform the worst. Leadership skills and health status are considered to be good if the score is 4 or 5 in a five-point Likert scale.

that 17.8% of 9th grade boys and 22.8% of 12th grade boys demonstrate good leadership skills, while the numbers for girls are 20.8% and 25.0%, respectively.

Not all students in the survey are included in the analysis. As described above, about 300 out of 2,000 students who responded to the survey in their 9th grade year did not respond in their 12th grade year, while some students did not have information on their parents' education levels. In addition, 6 boys and 47 girls said that their height was taller in 9th grade year than in 12th grade year. Excluding these students leaves 1,562 students in the sample, 792 boys and 770 girls. To check whether dropping some students produces biased results, this paper makes comparisons of data obtained in 9th grade year between original sample and analysis sample. The variables used for comparison are restricted to those used in the regression analysis. Appendix Table 2 shows the results. The first three columns are for boys, and the last three columns are for girls. In each gender, the first column is for the original sample and the second one is for the analysis sample. As shown in the table, there are no significant differences between the two groups. For example, for boys, 22.7% of the original sample became a student council member during middle school, while the number for the analysis sample is 23.0%. The p-value is 0.88. For girls, the proportions are 26.3% and 28.2%, respectively, and the p-value is 0.37. These results imply that students in the analysis sample are not significantly different from students in the original sample. Therefore, this paper concludes that dropping some samples does not produce biased results.

Ⅲ. Empirical Strategy

Consider the following linear probability model of a students i's attaining a leader position in grade g.

$$L_{ig}=\beta_0+\beta_1 H_{ig} + \mathbf{X_{ig}B} + \alpha_i+T_g+\varepsilon_{ig} \qquad (1)$$ [10]

10) A referee suggested to add one's height change in the regression equation because students whose height grows faster during high school can become more confident and this can have significant effects on becoming a student council member in the school. When including the variable in the equation to estimate the height effects using data from 12th grade year, this paper finds a negative coefficient on the variable, which implies that students whose height grows fast during high school are less likely to become student council members. This may be because, as shown in Table 3, tall students, especially tall boys, are already tall in 9th grade year, and they grow the slowest during high school. If this is the case, not including height change in the regression equation would not underestimate the true height effects.

where L is a dummy variable indicating whether one is a student council member, and H is a student's height in centimeters. The regression for boys also includes height squared variable. A vector **X** includes a dummy variable for students' health status, which is 1 if the score is 4 or 5 on the five-point Likert scale and 0 otherwise. The vector also includes two dummy variables for students' parental education level, one of which indicates whether their education level is some college or more, and the other of which indicates whether they have a high school diploma. The regression for boys includes the father's education level, and the regression for girls includes the mother's education level. The variable α is an individual fixed effect that can affect the probability of one's attaining a leadership position. One's cognitive and non-cognitive skills that do not change over time may be included in this variable. This paper includes individual dummy variables in the regression equation to control for the effects. The variable T is grade fixed effects, which are controlled for by including a grade dummy variable in the regression. Finally, ε is an idiosyncratic term.

This paper does not include students' leadership skills in the equation, since the skills could be positively affected by students' height, and thus including the variable could underestimate the effects of height.[11] This paper does not include the students' academic performances in the equation, either, for data deficiency reasons. About 220 9^{th} graders have the information missing, since their teachers did not report the information, and about 570 12^{th} graders are so, since their teachers did not respond in the survey. In addition, body weight does not have significant explanatory powers, and thus it is not included in the equation.

The parameter of interest in equation (1) is β_1. The parameter shows how the probability of one's attaining a leadership position changes with respect to one's height. Positive β_1 means discrimination for taller students. This paper estimates the parameter separately for each gender using both OLS and individual fixed effects estimations. A failure to adequately control for the variable α in OLS estimation could produce biased

11) Persico et al. (2004) finds that tall boys are more likely to participate in high school sports and clubs and to develop productive skills and attributes that include the skills of interpersonal negotiation, social adaptability, and motivation.

results. For example, if tall students have better cognitive abilities, which are considered to increase the probability of becoming a student council member, the OLS estimates could be upward-biased. Individual fixed effects estimation can address this by comparing the probability within each student (within-estimates). In addition, this paper reports the standard errors clustered at the individual level.

Ⅳ. Results

To begin the analysis of the relationship between height and the probability of becoming a student council member, this paper examines the students' abilities - namely, their academic performances and leadership skills by height. Table 2 shows the results. The upper panel is for boys, and the lower panel is for girls. The tall group of each grade is those whose height is greater than the median height, and the short group comprises those whose height is less than the median. Looking at 9^{th} grade boys first, one can see that tall ones perform better academically and have better leadership ability than shorter ones. For example, the average rank of the former is 49.1, while the average rank of the latter is 52.6. The p-value of 0.07 implies that the difference is statistically significant. Turning to 12^{th} grade boys, tall ones still have better leadership skills than short boys. According to their teachers, about 26.5% of the former have good leadership ability, while about 18.7% of the latter have good leadership ability (p-value=0.03).

The results for girls show that the ability difference between the two groups is not as large as it is for the boys. The only significantly different ability is their leadership skills measured in 9^{th} grade year. When students evaluate themselves, 29.9% of tall ones say that they have good leadership skills, while the number for short ones is 20.2%. When teachers evaluate, the numbers are 24.4% and 18.2%, respectively. The p-values are 0.00 and 0.07, respectively. In summary, tall students have better abilities than short ones, while the difference is larger for boys than for girls.[12)]

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12) A referee suggested to run a regression of students' leadership skills on height. In OLS estimation,

〈Table 2〉 Students' Abilities by Height

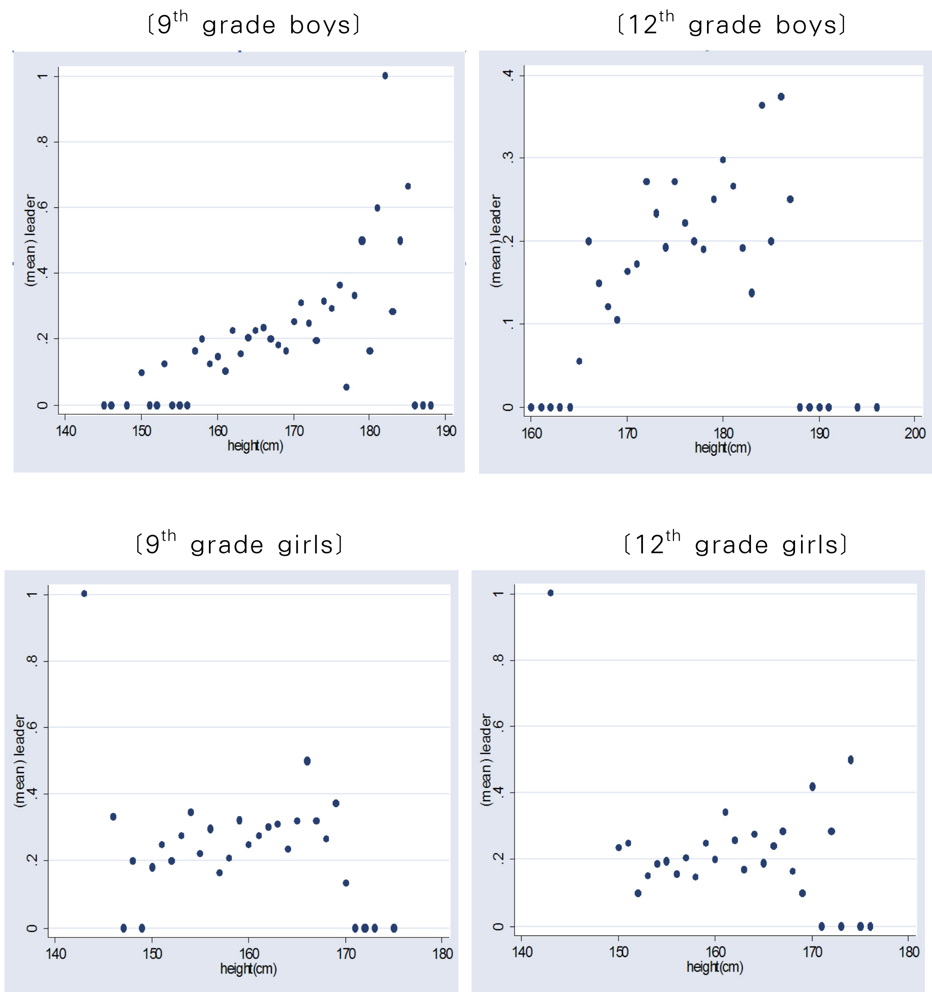
	9th grader			12th grader		
	Tall group (1)	Short group (2)	p-value (3)	Tall group (4)	Short group (5)	p-value (6)
Boys						
Academic performance	49.1 (27.6)	52.6 (28.6)	0.07	4.7 (1.9)	4.9 (1.7)	0.21
Leadership skills - good (%) (self-evaluation)	24.4 (43.0)	15.0 (35.7)	0.00	--	--	--
Leadership skills - good (%) (teachers' evaluation)	22.4 (41.7)	13.4 (34.1)	0.00	26.5 (44.2)	18.7 (39.0)	0.03
Maximum number of observations	496	500		287	252	
Girls						
Academic performance	45.4 (27.9)	47.7 (27.3)	0.21	4.5 (1.9)	4.7 (1.8)	0.13
Leadership skills - good (%) (self-evaluation)	29.9 (45.8)	20.2 (40.2)	0.00	--	--	--
Leadership skills - good (%) (teachers' evaluation)	24.4 (43.0)	18.2 (38.7)	0.07	27.3 (44.6)	22.8 (42.1)	0.47
Maximum number of observations	409	595		289	302	

Standard deviations are in parenthesis. The tall group of each grade is those whose height is greater than the median height, while the short group comprises those whose height is less than the median. The median heights are 169 cm for 9th grade boys and 175 cm for 12th grade boys, while the numbers for girls are 159 cm for 9th grade girls and 161 cm for 12th grade girls. Academic performance measurement is rank in the school. For 9th graders, the measurement ranges from 0 to 100, and the number indicates the proportion of students that is better than the student measured. For 12th graders, it is a tier rank that consists of nine ranks. Students of rank 1 perform the best in the school, and those of rank 9 perform the worst. Leadership skills are considered to be good if the score is 4 or 5 in a five-point Likert scale.

Before turning to the regression results, this paper presents plots of the proportion of those who had become student council members by height. In Figure 1, the upper two graphs are for boys, and the bottom two are for girls. In addition, the left two are for 9th graders, and the right two are for 12th graders. In each graph, the horizontal axis is

this paper finds that a 1cm increase in height increases the probability of having a good leadership skill by 0.9% points for boys and 0.6% points for girls. The results are available upon request.

〔Figure 1〕 Proportions of a Student Council Member by Height



In each graph, the horizontal axis is students' height in centimeters, and the vertical one is the proportion of those who had become a student council member.

〈Table 3〉 Height and Change in Height by Group

	Boys				Girls			
	Group A	Group B	Group C	Group D	Group A	Group B	Group C	Group D
Height in 9th grade year(cm)	171.3 (5.4)	167.7 (6.8)	169.7 (6.4)	169.8 (6.5)	159.6 (5.0)	159.1 (4.9)	159.7 (4.6)	159.8 (5.3)
Height in 12th grade year(cm)	175.7 (4.7)	174.4 (5.5)	175.1 (5.6)	175.7 (4.9)	161.4 (4.7)	161.3 (4.8)	161.8 (4.6)	161.8 (5.1)
Change in height (cm)	4.3 (3.2)	6.7 (4.4)	5.4 (3.9)	5.9 (4.1)	1.7 (1.4)	2.1 (2.2)	2.1 (1.8)	2.1 (1.7)
Council member during middle school years?	Yes	No	Yes	No	Yes	No	Yes	No
Council member during high school years?	Yes	No	No	Yes	Yes	No	No	Yes
Number of observations	63	508	119	102	75	460	142	93

Standard deviations are in parenthesis. Group A composes those who had become a student council member during both middle and high school. Group B is those who had never become a member during middle and high school. Group C is those who were a member during middle school, but not during high school, and Group D composes those who were a member during high school, but not during middle school.

students' height in centimeters, and the vertical one is the proportion of those who had attained the leadership position. One can see that as height increases, the probability of becoming a leader also increases: the dots are more likely to be located on the upper side of the graphs as height increases, while the relationship appears to be much stronger for boys than for girls.

Table 3 shows the average height of student council members and non-members. The first four columns are for boys, and the last four columns are for girls. For boys, as expected, student council members are, on average, taller than non-members. Boys who never became a council member during middle school and high school were the shortest group in both grade years, while boys who became a member during both middle school and high school were the tallest group: the former was 167.7 cm in 9th grade and 174.4 cm

〈Table 4〉 Regression Results for Boys

	Dependent variable = whether one is a student council member			
	Pooled OLS			FE
	(1)	(2)	(3)	(4)
Height (cm)	0.082** (0.041)	0.082** (0.041)	0.079** (0.040)	-0.004 (0.078)
Height squared	-0.0002* (0.0001)	-0.0002* (0.0001)	-0.0002* (0.0001)	0.00003 (0.0002)
Health status - good	--	0.011 (0.024)	0.013 (0.023)	-0.013 (0.051)
Father - some college or more	--	--	0.131*** (0.033)	--
Father - high school graduates	--	--	0.037 (0.028)	--
Adjusted R^2	0.03	0.03	0.03	0.18
Number of observations	1,584	1,584	1,584	1,584

Standard errors are in parenthesis and are corrected for within-student correlation. Dependent variable is either whether one is a student council member during middle school years or whether one is a student council member during high school years. Health status is considered to be good if the score is 4 or 5 in a five-point Likert scale. These regressions also include a constant and a dummy variable indicating a student's grade. Column (4) includes individual dummy variables.
***: p<0.01, **: p<0.05, *: p<0.1

in 12th grade, while the latter was 171.3 cm in 9th grade and 175.7 cm in 12th grade.

Of note is that the former grew the fastest among the four groups, by 6.7 cm over the two grade years, and the latter grew the slowest, by 4.3 cm. The other two groups grew by 5.4 cm and 5.9 cm, respectively.[13)] For girls, height differences between council members and non-members are not very large, and changes in heights do not vary by group. Girls who never became a council member during middle school and high school were 159.6 cm in 9th grade and 161.4 cm in 12th grade, while girls who became a council member during

13) Studies find that tall adults are likely to have been born tall and short adults are likely to have been born short. In addition, the former grow slowly to be tall, and the latter grow fast to be short. For example, Sørense et al. (1999) finds that Danish men whose length at birth is 55-56 cm are, on average, 182.4 cm tall at age 18-20 while those whose length at birth is 47-48 cm are, on average, 176.7 cm tall at the same age: the former grow by 127.4-128.4 cm after birth, and the latter by 129.7-130.7 cm after birth.

both middle school and high school were 159.1 cm and 161.3 cm, respectively.

One can conduct a regression analysis to examine whether the relationships shown in Figure 1 are causal. Table 4 and Table 5 show the results for boys and girls, respectively. Columns (1), (2), and (3) in each table present pooled OLS estimation results, while column (4) presents individual fixed effects estimation results. Column (1) includes only height variables, column (2) adds a student's health status, and column (3) adds parental education level.14) The OLS estimations for boys in Table 4 shows that the coefficient on height variable is positive, and the coefficient on height squared variable is negative, which indicates that as height increases, the probability of becoming a student council member increases at a decreasing rate. Looking at column (3) of the table, a 1 cm increase in height is associated with an increase in the probability by 7.9 percentage points minus 0.04 (=2×0.02) percentage points multiplied by height. If a student is 160 cm tall, a 1 cm increase in height increases the probability by 1.5 percentage points, and if a student is 170 cm tall, the probability is increased by 1.1 percentage points. Because a boy's likelihood of becoming a council member in either 9^{th} or 12^{th} grade is 21.7%, the OLS estimate is equivalent to 6.9% (=1.5/21.7) and 5.1% (=1.1/21/7), respectively. Column (3) of Table 4 also indicates that one's health status does not have significant effects on the probability, and boys whose fathers attended college are more likely to become council members than boys whose fathers did not graduate from high schools.15)

Whether the OLS estimates for boys are subject to ability bias can be explored by controlling for individual fixed effects. If abilities make a difference in the probability, the FE estimate of the height effects will be statistically insignificant. Column (4) of Table 4 controls for individual fixed effects by including individual dummy variables. Parental education levels do not change over time, and thus the effects cannot be estimated in this

14) Although this paper does not control for students' academic performances and leadership skills in Table 4 and Table 5 for the reasons described in section II, Appendix Table 3 and Appendix Table 4 present results that include both variables in the regression equation. One can see that including the two variables reduces the size of height effects.

15) Previous studies find that one's health status has either no effects or positive effects on labor market outcomes while including the variable does not change the estimated height effects (e.g., Persico et al., 2004; Park and Lee, 2010; Lindqvist, 2012).

〈Table 5〉 Regression Results for Girls

	Dependent variable = whether one is a student council member			
	Pooled OLS			FE
	(1)	(2)	(3)	(4)
Height (cm)	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)	-0.0004 (0.012)
Health status - good	--	0.036 (0.023)	0.035 (0.023)	0.008 (0.048)
Mother - some college or more	--	--	0.116*** (0.038)	--
Mother - high school graduates	--	--	0.043* (0.027)	--
Adjusted R^2	0.007	0.008	0.02	0.19
Number of observations	1,540	1,540	1,540	1,540

Standard errors are in parenthesis and are corrected for within-student correlation. Dependent variable is either whether one is a student council member during middle school years or whether one is a student council member during high school years. Health status is considered to be good if the score is 4 or 5 in a five-point Likert scale. These regressions also include a constant and a dummy variable indicating a student's grade. Column (4) includes individual dummy variables.
***: p<0.01, *: p<0.1

model. When individual fixed effects are controlled for, both height and height squared variables become much smaller in magnitude and statistically insignificant. The coefficient on height variable is -0.004, and the coefficient on height squared variable is 0.00003. These results imply that one's height is positively correlated with one's ability and the better abilities of tall boys make them become leaders, not height per se.

Table 5 shows the regression results for girls. These regressions do not include height squared variable because the variable does not have an explanatory power. Looking at column (3) of the table, the coefficient on height is 0.003 with standard error of 0.002 and is not statistically significant, which implies that girls' height is not associated with becoming a leader in the school. One's health status is not associated with the probability of becoming council members, either, while the mother's education level increases the probability. Girls whose mother attended college were 11.6 percentage points more likely to become council members than girls whose mother did not graduate from high schools. Because a girl's likelihood of becoming a council member in either 9^{th} or 12^{th} grade is 24.0%, the former are 48.3% (=11.6/24.0) more likely to become council members than the latter. Controlling for individual fixed effects in column (4) reduces the coefficient on height to -0.0004, and the coefficient is still insignificant.

V. Conclusion

This paper contributes to the literature by being the first to control for an individual fixed effect and to estimate the effects of height on one's attaining a leadership position. In OLS estimation, this paper finds positive height effects for boys but no effects in FE estimation. For girls, no effects are found on neither OLS nor FE model. This paper finds that tall students have better abilities than short students, while ability difference between tall students and short students are larger for boys than for girls.

Why is ability difference over height pronounced for boys, but not for girls? One explanation is that height difference is larger among boys than among girls, and thus height could be a critical factor in determining a male leader but not a female leader. As shown in Table 1, standard deviations of height are 6.6 cm for 9^{th} grade boys and 5.4 cm for 12^{th} grade boys, while the numbers are 4.8 cm for girls of both grades. Another explanation is that people have different impressions for tallness depending on gender. According to Blaker et al. (2013), people think that tall men are intelligent, healthy, and dominant, but they believe that tall women are just intelligent. If this is the case, it is likely that tall men have more opportunities to lead their peers from an early age and thus to develop leadership and social skills, while tall girls do not have such opportunities.

Acknowledgment

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Appendix

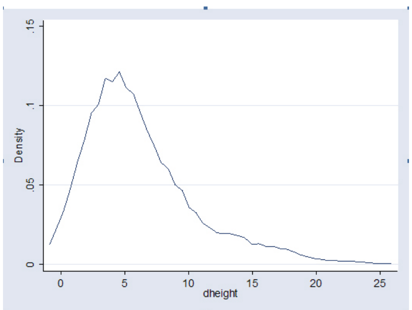
Appendix Table 1: Cutoff Points for Nine Ranks of 12th Graders

	Cutoff points	
	Upper	Lower
Rank 1	0.00	4.00
Rank 2	4.01	11.00
Rank 3	11.01	23.00
Rank 4	23.01	40.00
Rank 5	40.01	60.00
Rank 6	60.01	77.00
Rank 7	77.01	89.00
Rank 8	89.01	96.00
Rank 9	96.01	100.00

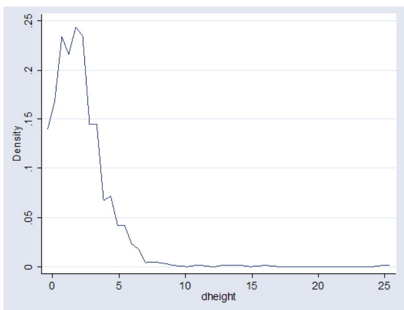
Rank 1 is assigned to those who rank between top 0.00% and top 4.00% in the school, rank 2 is assigned to those who rank between top 4.01% and top 11.00% in the school, etc.

Appendix Figure 1: Densities of Change in Height by Gender

〔Boys〕



〔Girls〕



These graphs are restricted to the analysis sample. The horizontal axis is change in height between 9th grade year and 12th grade year.

Appendix Table 2: Comparison between Original Sample and Analysis Sample

	9^{th} grade boys			9^{th} grade girls		
	Original sample	Analysis sample	p-value	Original sample	Analysis sample	p-value
Student council member (%)	22.7 (41.9)	23.0 (42.1)	0.88	26.3 (44.0)	28.2 (45.0)	0.37
Height (cm)	168.7 (6.6)	168.5 (6.7)	0.53	159.5 (4.8)	159.4 (4.9)	0.67
Health status - good (%)	60.8 (48.8)	61.1 (48.8)	0.89	58.5 (49.3)	57.0 (49.5)	0.53
Father - some college or more(%)	33.5 (47.2)	32.4 (46.8)	0.62	--	--	--
Father - high school graduates(%)	48.8 (50.0)	50.3 (50.0)	0.53	--	--	--
Mother - some college or more(%)	--	--	--	17.0 (37.6)	15.6 (36.3)	0.43
Mother - high school graduates (%)	--	--	--	55.8 (49.7)	57.2 (49.5)	0.56
Maximum number of observations	996	792		1,004	770	

Standard deviations are in parenthesis. Health status is considered to be good if the score is 4 or 5 in a five-point Likert scale.

Appendix Table 3: Regression Results for Boys Including Leadership Skills and Academic Performances

	Dependent variable = whether one is a student council member			
	Pooled OLS			FE
	(1)	(2)	(3)	(4)
Height (cm)	0.105** (0.052)	0.102** (0.047)	0.073 (0.045)	0.024 (0.103)
Height squared	-0.0003* (0.0002)	-0.0003** (0.0001)	-0.0002 (0.0001)	-0.00007 (0.0003)
Health status - good and father's education level	O	O	O	O
Leadership skills - good		O	O	O
Academic performances			O	O
Adjusted R^2	0.04	0.13	0.16	0.18
Number of observations	874	874	874	874

Standard errors are in parenthesis and are corrected for within-student correlation. Dependent variable is either whether one is a student council member during middle school years or whether one is a student council member during high school years. Health status and leadership skills are considered to be good if the score is 4 or 5 in a five-point Likert scale. Leadership skills used in this table are evaluated by teachers. The academic performances of 9^{th} graders are transformed into a scale of nine ranks based on the rule in Appendix Table 1. Dummy variables indicating each rank are included in the regression equation. These regressions also include a constant and a dummy variable indicating a student's grade. Column (4) includes individual dummy variables.

**: p<0.05, *: p<0.1

Appendix Table 4: Regression Results for Girls Including Leadership Skills and Academic Performances

	Dependent variable = whether one is a student council member			
	Pooled OLS			FE
	(1)	(2)	(3)	(4)
Height (cm)	0.0003 (0.003)	-0.001 (0.003)	-0.003 (0.003)	-0.004 (0.017)
Health status - good and mother's education level	O	O	O	O
Leadership skills - good		O	O	O
Academic performances			O	O
Adjusted R^2	0.02	0.08	0.15	0.23
Number of observations	990	990	990	990

Standard errors are in parenthesis and are corrected for within-student correlation. Dependent variable is either whether one is a student council member during middle school years or whether one is a student council member during high school years. Health status and leadership skills are considered to be good if the score is 4 or 5 in a five-point Likert scale. Leadership skills used in this table are evaluated by teachers. The academic performances of 9^{th} graders are transformed into a scale of nine ranks based on the rule in Appendix Table 1. Dummy variables indicating each rank are included in the regression equation. These regressions also include a constant and a dummy variable indicating a student's grade. Column (4) includes individual dummy variables.

요 약

신장과 노동시장 성과 관계 : 패널 데이터를 이용한 분석

조 현 국

신장이 노동시장 성과에 미치는 영향을 분석한 문헌은 신장 프리미엄이 존재함을 보이면서도 능력을 통제하면 신장 프리미엄이 줄어든다고 하였다. 이는 신장 효과 추정 시 능력 변수를 적절히 통제하지 않으면 신장 효과가 과대 추정될 수 있음을 의미한다. 본고는 문헌 최초로 개인고정효과(FE) 모델을 사용하여 신장 효과를 추정한다. 최소자승법(OLS)으로 분석 시 키가 큰 남학생이 리더 포지션을 획득할 확률이 유의적으로 높으나, 개인고정효과를 통제하면 둘의 관계는 유의하지 않다. 여학생은 OLS, FE 모두 신장 프리미엄이 나타나지 않는다.

주제어: 신장, 신장 프리미엄, 리더십, 학급 임원