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How the Non-Cognitive Skill of Myopia Affects Educational Decision-Making Among Japanese Students

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Abstract

In recent times, the number of studies on non-cognitive skills has increased. Apart from using a score for non-cognitive skills (gauged via a questionnaire), many of these investigations involve adult respondents who had already completed their educational careers at the time of the study in question. In this paper, using data on Japanese students, we explore whether the non-cognitive skill "myopia"—acquired during one's early schooling—influences educational decision-making in terms of either leaving the school system or pursuing higher education. Our sample revealed that one's sense of myopia in high school had no effect on attending junior college or university. We examined whether one's sense of myopia, when it came time to choose a high school, had already impacted educational decision-making such that it would continue to have an effect after high school graduation. We found that one's sense of myopia in junior high school had a negative, statistically significant effect on expected years of schooling. Our results suggest that high school students who did not consider their future academic careers while in junior high school are unlikely to be willing to pursue higher education.

Keywords: Educational Decision-Making, Japanese High School Students, Myopia, Non-Cognitive Skills

1. Introduction

In Japan, many previous investigations have examined the effects of parents' income, their education levels, and family background on the highest grade that their children complete (e.g., Nakamura, 1993; Yoda, 2012; Yano & Hamanaka, 2006). Using micro- and macro-scale data, prior research shows that family background and tuition have a significant impact on children's education levels.

Recently, the number of studies on how non-cognitive skills affect test scores, years of schooling, and wages have increased (Note 1). However, a great deal of these studies are based on data from adults (who have already completed their academic careers), as well as their score for non-cognitive skills (obtained through

questionnaires). Yet little research has scrutinized the influence of non-cognitive skills, measured at the time of educational decision-making, on one's trajectory after graduating high school – a very real possibility. When trying to predict whether a student will go to university, in addition to non-cognitive skills acquired in high school, we should take into account non-cognitive skills developed during junior high, which might also have an impact.

Accordingly, we considered Japanese students' ability to focus on the present – rather than the future – to be a non-cognitive skill, and determined whether this affected their educational decision-making. First, we analyzed whether the non-cognitive skill of myopia during high school influenced second-year high school students' decision to either leave the school system or to pursue higher education. Second, we established whether the non-cognitive skill of myopia, developed before entering high school, impacted decision-making after graduating from it.

This paper is organized as follows. Section 2 discusses pertinent literature. Section 3 presents the theoretical model. Section 4 covers the data and variables used in the estimations. Section 5 addresses the estimation outcomes. Finally, Section 6 summarizes the major findings.

2. Literature review

This section reviews preceding research on family background, non-cognitive skills, and educational attainment. Using Japanese data, Nakamura (1993) looked at the relationship between the father's income and children's years of schooling. He demonstrated that children tend to go to college or university if their father's income is high. Tanaka (2017) found that the probability of attending university drops by 4.3% if Japanese high school students consider their families' economic conditions. He also discovered that Japanese high school students who expect a realistic rate of return after graduating from university obtain university degrees. Using an education investment model, Kubota (2013) stressed the importance of family income in forecasting children's years of schooling. The estimation outcomes imply that children's years of schooling increase by 1.3 % if their parents' income rises by 10% (Note 2). Fujimura (2009) illustrated that Japanese high school students with poor grades and high family incomes are more likely to want to go to university than students with poor grades and low family incomes by 11.2% using the 2005 national Students' Career Survey data set. Moreover, Fujimara (2009) confirmed that students with good grades and low family incomes are more likely to attend university than students with poor grades and low family incomes by 14.8%.

In recent years, researchers have paid attention not only to how family background affects students' test scores and years of schooling, but also how a child's characteristics influence these elements. Generally speaking, IQ score, test score, word knowledge, mathematical knowledge, and suchlike are categorized as cognitive skills. On the other hand, traits such as self-control, time preferences, and sociability are called non-cognitive skills (Note 3). Heckman et al. (2006) appraised whether non-cognitive skills would affect the high school dropout rate and educational attainment. They treated the score for the locus of control and the score for self-esteem as non-cognitive skills. Regarding the high school dropout rate, they indicated that non-cognitive skills have a strong impact, although cognitive competencies are more important. Moreover, they found that non-cognitive abilities strongly determine whether one graduates from a four-year college. Using Japanese data on adults, Toda et al. (2014) showed that diligence and introversion positively influence university attendance.

Next, we will look at past studies that investigated the relationship between educational attainment and time preferences, which are closely related to economics. Breen, Werfhorst, and Jaeger (2014) proposed a theory of educational decision-making that incorporates risk aversion and time discounting preferences based on rational choice theory, and derived results from multinomial logistic regression using data from Denmark (Note 5). They found that respondents with a low time discount rate are more likely to have chosen secondary academic education. In the same way as Breen et al. (2014), Ogawa (2016) scrutinized whether risk aversion and time discounting preferences affect educational decision-making by using data on Japanese second-year high school students. His findings imply that students who focus on large future profits tend to want to pursue higher education. Lee and Ohtake (2014) also explored the link between non-cognitive skills and years of schooling.

They verified that impatient people (with a high time discount rate) assign greater significance to the present than to the future; such individuals might not appreciate the future rewards of higher education.

Lee and Ohtake (2014) pointed out that the effects of personality traits vary at different educational transition points in Japan. For example, more agreeable, conscientious Japanese males are likely to go to university; moreover, the qualities of introversion and openness to new experiences positively affect one's decision to pursue further studies (Note 6). Hirasawa (2018) argued that many educational attainment studies are based on a retrospective approach, which presents a limitation because respondents cannot report their household income when they are children. Thus, using data on Japanese high school and junior high school students, we overcame the problem of the retrospective approach, identified by Hirasawa (2018). Additionally, we employed one's sense of myopia at different stages to examine whether decision-making after graduating from high school is affected only by this sentiment during high school, or also when students choose a high school.

In the next section, we will explain the theoretical model we used to define one's sense of myopia as a proxy of non-cognitive skills; we perceive it as a psychic cost of studying.

3. Theoretical model

In this section, we will outline our theoretical model for parents' income, one's sense of myopia, and education level. First, for equation(1), we surmised that individuals (i) receive utility from consumption (C_i), which depends on income (Y_i).

$$U_i = U(C_i) = U(Y_i). \qquad (1)$$

Next, we presumed that individuals' income is determined by their human capital (I_i), which depends on age, occupation, and education level.

$$Y_i = F(I_i) = F(age_i, Occupation_i, education_i). \qquad (2)$$

Concerning education level, we posited that individuals choose whether to pursue higher education after high school by considering expected lifetime earnings $- E(Y_x) -$ and costs related to receiving education. Our model assumes three options for education level: (1) leaving the school system (high school); (2) going to school for another 2 years (junior college); or (3) going to school for another 4 years (university). Thus, we derived the following function for education:

$$education_i = F[E(Y_x), E(Cost_x)], \ x = H, JC, U. \qquad (3)$$

We reasoned that education level is an increasing function of expected lifetime earnings, but a decreasing function of cost. Hence, we can express the utilities for each option, as follows:

$$U_{H,i} = E(Y_H). \qquad (4a)$$
$$U_{JC,i} = E(Y_{JC}) - E(Cost_{JC,i}). \qquad (4b)$$
$$U_{U,i} = E(Y_U) - E(Cost_{U,i}). \qquad (4c)$$

We analyzed the situation where individuals weigh ($4a$), ($4b$), and ($4c$), and make a selection that maximizes their utilities from the three options. We inferred that individuals know the average values of lifetime earnings for each education level, and expect their lifetime earnings to be the average of their chosen level. Regarding costs, if individuals select junior college or university, they incur opportunity costs. Moreover, they must pay tuition and the psychic cost of studying, depending on what they choose. We reckoned that opportunity costs associated with junior college and university can be gauged from information about wages after graduating high school, and that individuals know each opportunity cost in advance. However, individuals might receive financial support from their parents. Therefore, the costs involved in going to school are as follows:

$$Cost_x = F(OpportunityCost_x, Tuition_x, Aid_x, PsychicCost_x). \tag{5}$$

Opportunity costs are 2 or 4 years of earnings if individuals work after high school and do not go to junior college or university. On the flip side, they must pay tuition for 2 years if they go to junior college, and for 4 years if they go to university. However, we conjectured that individuals believe their parents' financial support reduces their tuition-related burdens. Hence, it is natural to think that the higher their parents' income, the more financial support they will receive. We assumed that individuals who have poor grades, feel anxious when studying, and focus on the present (rather than the future) will face a high psychic cost in terms of continuing their studies after high school. Using these conditions, we were able to rewrite $(4a)$, $(4b)$, and $(4c)$ as $(6a)$, $(6b)$, and $(6c)$. To explain the notation, OC is opportunity costs per year, T is tuition per year, A is financial support from one's parents per year, and PC is psychic costs per year. For simplicity, we concluded that these values are not discounted, because such costs and financial support are incurred immediately after high school and for the duration of a junior college or university career.

$$U_{H,i} = E(Y_H). \tag{6a}$$
$$U_{JC,i} = E(Y_{JC}) - 2OC - 2T + 2A_i - 2PC_i. \tag{6b}$$
$$U_{U,i} = E(Y_U) - 4OC - 4T + 4A_i - 4PC_i. \tag{6c}$$

Of these elements, we surmised that expected lifetime earnings, opportunity costs, and tuition would be the same among high school students. On the other hand, psychic costs and financial support from parents vary among individuals; we added the subscript "i" to these notations.

The condition whereby individuals choose to work after high school satisfies (A) and (B).

$$E(Y_H) > E(Y_{JC}) - 2OC - 2T + 2A_i - 2PC_i. \tag{A}$$
$$E(Y_H) > E(Y_U) - 4OC - 4T + 4A_i - 4PC_i. \tag{B}$$

Similarly, the condition of choosing to attend junior college satisfies (C) and (D).

$$E(Y_H) < E(Y_{JC}) - 2OC - 2T + 2A_i - 2PC_i. \tag{C}$$
$$E(Y_U) - 4OC - 4T + 4A_i - 4PC_i < E(Y_{JC}) - 2OC - 2T + 2A_i - 2PC_i \tag{D}$$

Finally, the condition of choosing to attend university satisfies (E) and (F).

$$E(Y_H) < E(Y_U) - 4OC - 4T + 4A_i - 4PC_i. \tag{E}$$
$$E(Y_{JC}) - 2OC - 2T + 2A_i - 2PC_i < E(Y_U) - 4OC - 4T + 4A_i - 4PC_i. \tag{F}$$

Here, if we do not consider the psychic cost of continuing one's studies and receiving financial support from one's parents, then equation (7) holds. It is clear that (7) is justified by the Japanese data on lifetime earnings according to education level and tuition (Note 7).

$$E(Y_H) < E(Y_{JC}) - 2OC - 2T < E(Y_U) - 4OC - 4T. \tag{7}$$

Based on the difference between financial support and the psychic cost of continuing one's studies, we only analyzed the situation in which the values of $2A_i - 2PC_i$ and $4A_i - 4PC_i$ are negative. These differences can be positive if the parents' support is very large and the psychic cost is close to 0. However, if equation (7) holds, the positive values of $2A_i - 2PC_i$ and $4A_i - 4PC_i$ lead all students to choose to attend university. Conversely, the values of $2PC_i - 2A_i$ and $4PC_i - 4A_i$ are positive.

Using equation (7), both (A) and (B) hold when $2A_i - 2PC_i$ and $4A_i - 4PC_i$ are sufficiently negative values. Thus, individuals choose to work immediately after high school if they experience high anxiety due to formal education and receive very little financial support from their parents.

To satisfy (C), $E(Y_{JC}) - 2OC - 2T - E(Y_H)$ must be sufficiently large and/or $2PC_i - 2A_i$ must have a sufficiently small positive value. As previously mentioned, we inferred that individuals know $E(Y_H)$, $E(Y_{JC})$, OC, and T, and believe their lifetime earnings to be the average of their chosen education level. Thus, the value of $E(Y_{JC}) - 2OC - 2T - E(Y_H)$ is the same across individuals. The value of $2PC_i - 2A_i$ varies by person. This is similar when we look at a situation where (D) holds true. By arranging (D), we got $E(Y_U) - E(Y_{JC}) - 2OC - 2T < 2PC_i - 2A_i$. Using equation (7), it is apparent that the value on the left-hand side is positive, which means that all individuals know that the lifetime earnings of university graduates are greater than those of junior college graduates, even when taking opportunity costs and tuition into account. Nevertheless, why is the right-hand side larger than the left-hand side? People choose to go to junior college because they think that the stress of studying for two more years (as they would have to should they go to university) after junior college is very high, and that they cannot expect to receive financial support from their parents.

If (E) holds, this corresponds to the case where $4PC_i - 4A_i$ is a sufficiently small, positive value by using assumption (7). This means that studying is not stressful, and/or that parents provide a lot of financial support. Similarly, to satisfy (F), it must be that $2PC_i - 2A_i < E(Y_U) - E(Y_{JC}) - 2OC - 2T$. Using assumption (7), we obtained a positive value on the right-hand side. To hold the inequality of (F), the value on the right-hand side must be large, and the stress of studying negligibly small, and/or the financial support from one's parents must be large.

To summarize the above, the conditions of working after high school $2A_i - 2PC_i$ and $4A_i - 4PC_i$ have sufficiently negative values. This means that the psychic cost of studying is very large, and financial support from one's parents is very small. Regarding the condition of choosing junior college, the value of $2PC_i - 2A_i$ is significant. If this value is smaller than the difference in lifetime earnings between high school and junior college, but is larger than the difference in lifetime earnings between junior college and university, then individuals choose junior college. Finally, when selecting a university, the value of $4PC_i - 4A_i$ must be a small, positive value, and must not change the inequality in equation (E). Meanwhile, $2PC_i - 2A_i$ is smaller than $E(Y_U) - E(Y_{JC}) - 2OC - 2T$.

From these equations, we can see that the higher the psychic cost of studying and the smaller the amount of financial support from one's parents, the fewer years of additional schooling people choose to pursue. Thus, we were able to derive the estimation equations, which include years of schooling as the dependent variable, and parental income and psychic cost as the independent variables. The expected sign of the coefficient for parental income was positive. Likewise, the expected sign of the coefficient for focusing on the present (rather than the future) was negative, because these students face a high psychic cost of studying.

In the next section, we will explain the data using our estimations.

4. Data

We used two sets of survey data: "*Survey among high school students and their mothers, 2012*" (SHSSM 2012) and "*Survey on the everyday consciousness of parents and children, 2011*" (SECPC 2011). First, we looked at whether focusing on the present (rather than the future) during high school affects decision-making after graduation. Second, we explored whether the same sentiment during junior high affects one's expected years of schooling. For the analysis, we used the data from SHSSM 2012, which targets second-year high school students. To confirm whether these outcomes would hold for other samples, we performed similar examinations using the data of SECPC 2011, which targets third-year junior high school students (Note 8).

4.1 Survey among high school students and their mothers, 2012 (SHSSM 2012)

The respondents of SHSSM 2012 consisted of 1070 families with second-year high school students. The questionnaires were distributed to the students and their mothers. From the latter, we were able to obtain accurate information about family background (e.g., family income and parents' education level).

As presented by the model in Section 3, expected years of schooling is both the dependent and the ordinal variable. If the respondents wanted to work after high school, we assigned this variable a value of 1. If they chose to go to junior college or vocational school, we assigned it a value of 2. If they chose to attend university or graduate school, we assigned it a value of 3.

Concerning independent variables, we used being female as a dummy, the family's economic circumstances, parents' education levels, the grades of the second-year high school students, and high school quality; these variables have been used in previous studies. We adopted the variable of focusing on the present (rather than the future) as a proxy for non-cognitive skills. We deemed students myopic if they focused on the present more than the future. We assigned the female dummy 1 if the respondents were female and 0 if not. For the family's economic circumstances, we assigned that variable a value of 1 to 5, where 1 means "poor" and 5 signifies "very wealthy." Concerning parents' education, we used the years of the father's and mother's education separately. If their final academic background was junior high school, we assigned the variable for years of schooling a 9. If their final academic background was that of a university graduate, we assigned the same variable 18. Regarding the grades of the second-year high school students, we assigned this variable a value of 1 to 5. A higher number indicates poor grades. For high school quality, we measured this variable on five levels. If we assigned it a 1, this implied that the respondents attended a high school where most students pursue higher education. If we assigned this variable a 5, this meant that the respondents attended a high school where most students work after high school.

Concerning one's sense of myopia during high school, the respondents were told the following statement in their second year of high school: "You should live according to your genuine desires, rather than not do what you want to achieve your future goals." If the respondents focused on the present (rather than the future), we assigned the variable of myopia during high school a 5. If they tended to focus on the future, we assigned this variable a 1. We also examined one's sense of myopia when the respondents were in junior high school. They were asked whether they had considered pursuing higher education when it came time for them to choose a high school. As for students who did not desire to go to junior college or university when they were in junior high school, we believe that they focused on the present (versus the future). We deemed this variable to be a dummy and assigned it a value of 1 if the respondents selected their high school without considering what they wanted to do after graduating. We used this variable because we wanted to investigate whether an earlier sense of focusing on the present (rather than the future) would have a strong effect on decision-making after high school. Table 1 shows the descriptive statistics for SHSSM 2012.

Table 1: Descriptive statistics of SHSSM 2012

Variable	Observation	Mean	Std. Dev.	Min	Max
Expected years of schooling	899	2.549	0.727	1	3
Being female	899	0.509	0.500	0	1
The family's Economic circumstances	899	3.372	0.892	1	5
Father's education	899	14.311	2.033	9	18
Mother's education	899	13.483	1.423	9	18
Grades	899	2.924	1.177	1	5
Myopia during high school	895	3.169	1.031	1	5
Myopia during junior high school	899	0.455	0.498	0	1
High school quality	899	1.952	1.127	1	5

4.2 Survey on the everyday consciousness of parents and children, 2011 (SECPC 2011)
We also used data from a nationally representative sample of junior high school students and their parents, SECPC 2011, carried out by the Cabinet Office, and derived from 3192 students and 3197 parents. This survey has similar question items to the SHSSM 2012.

We employed these data on junior high school students to confirm the robustness of the outcomes obtained by looking at the data on high school students. The expected years of schooling is both the dependent and ordinal variable. If the respondents wanted to work after high school, we assigned this variable a value of 1. If they wanted to attend junior college or vocational school, we assigned this variable a value of 2. If they chose to attend university or graduate school, we assigned this variable a value of 3 (Note 9).

Concerning independent variables, we employed items similar to the independent variables used in the SHSSM 2012, specifically the female dummy, the family's economic circumstances, parents' education levels, the grades of third-year junior high school students, and one's sense of myopia. We gauged one's sense of myopia based on 4 levels, but for the data on high school students, we measured this variable using 5 levels. Table 2 presents the descriptive statistics on the data of the junior high school students.

Table 2: Descriptive statistics of SECPC 2011

Variable	Observation	Mean	Std. Dev.	Min	Max
Expected years of schooling	2858	2.435	0.789	1	3
Being female	2858	0.479	0.500	0	1
The family's Economic circumstances	2858	2.979	0.856	1	5
Father's education	2858	13.931	2.163	9	18
Mother's education	2858	13.373	1.545	9	18
Grades	2858	2.994	1.274	1	5
Myopia during junior high school	2858	2.664	0.915	1	4

5. Estimation results

We used expected years of schooling as a dependent variable to investigate the relationship between expected education level and one's sense of myopia. We adopted an ordered probit model as the estimation method, because the dependent variable is an ordinal one. The basic estimation equation is as follows:

$$education_i^* = \beta_0 + \beta_1 aid_i + \beta_2 Psychic\ Cost_i + \mathbf{X}'\boldsymbol{\beta} + \varepsilon_i. \qquad (8)$$

$$education_i = \begin{cases} 1 \ if\ \alpha_0 < education_i^* \le \alpha_1 \\ 2 \ if\ \alpha_1 < education_i^* \le \alpha_2 \\ 3 \ if\ \alpha_2 < education_i^* \le \alpha_3 \end{cases}$$

where (8) i denotes the respondents, β indicates the coefficients of the independent variables, and ε_i is the error term. αs are cut points ($\alpha_0 = -\infty$ and $\alpha_3 = \infty$).

Table 3 depicts the estimation outcomes. We used the data on high school students in models (1), (2), and (3). Model (4) utilizes the sample of junior high school students.

In all models, the coefficient for the female dummy is negative, but insignificant. Recently, the university entrance rate among Japanese females has risen, and the difference in university entrance rates between males and females has shrunk. This situation might lead to the female dummy becoming insignificant (Note 10).

All models illustrate that the coefficient for the family's economic circumstances is positive and statistically significant. Students' expected years of schooling is high if their parents' income is high because they can expect to receive a lot financial support from their parents, which will reduce their burden of tuition. Similarly, the coefficient for grades is statistically significant and negative in all models. These results mean that students with

poor grades are not likely to pursue higher education because they face a high psychic cost of continuing their studies. The same is true of high school quality. As stated above, if this variable is high, it implies that the respondents attended a high school where few students go to junior college or university. Such high schools might not provide a curriculum that is adequate enough to enter a junior college or university. If students who go to a high school with a low university enrollment rate want to go to university, they should make an effort to study by themselves. This situation should generate the high psychic cost associated with preparing for entrance exams.

One's sense of myopia has no effect on students' choice to pursue higher education when they are in high school (models (1) and (3)). However, in models (2) and (3), the coefficient for one's sense of myopia during junior high school is negative and statistically significant. Respondents who did not consider their post-high school career while still in junior high are likely to desire fewer years of schooling. In light of these two aspects, the impact of one's sense of myopia on one's career varies with time. If students focus on the future (rather than the present) in junior high school, they tend to choose to pursue higher education. However, this influence does not emerge among high school students. Model (4) confirms this using a junior high school sample. One's sense of myopia as a junior high school student has a negative, statistically significant effect on expected years of schooling. The more students value the present, the fewer years of schooling they desire.

Table 3: Estimation results (males and females)

Independent variables	Model (1)		Model (2)		Model (3)		Model (4)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Being female	-0.090	0.096	-0.088	0.096	-0.095	0.097	-0.058	0.050
The family's Economic circumstances	0.151 **	0.061	0.153 **	0.062	0.137 **	0.062	0.082 ***	0.030
Father's education	0.104 ***	0.025	0.096 ***	0.026	0.104 ***	0.025	0.151 ***	0.013
Mother's education	0.161 ***	0.038	0.172 ***	0.038	0.162 ***	0.038	0.136 ***	0.019
Grades	-0.146 ***	0.042	-0.133 ***	0.042	-0.140 ***	0.042	-0.445 ***	0.022
Myopia during high school	0.011	0.046	-	-	0.008	0.046	-	-
Myopia during junior high school	-	-	-0.219 **	0.100	-0.222 **	0.101	-0.066 **	0.028
High school quality	-0.670 ***	0.046	-0.637 ***	0.047	-0.647 ***	0.048	-	-
Pseudo R^2	0.277		0.276		0.280		0.200	
Observation	897		899		895		2858	
Respondent	High school						Junior High School	

Note: Standard errors are robust.
* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

We also performed the same analyses by gender because Nakamura (1993) and Shima (2008) pointed out that the determining factors of one's career path may differ by gender. Table 4 portrays the estimation findings for the male students.

In models (5), (6), and (7), the coefficients for grades and high school quality are negative and statistically significant, similar to the results of all samples. However, one's sense of myopia in both high and junior high school has no effect on expected years of schooling. To consider the possibility that one's sense of myopia in junior high school affects one's choice of high school, we omitted the variable of high school quality from the estimation equation; model (8) presents this outcome. According to model (8), one's sense of myopia during high school remains insignificant, but that of junior high school becomes negative and highly statistically significant. The finding from the junior high school sample in Model (9), regarding the coefficient for one's sense of myopia, is insignificant. How should we interpret this? When we omitted grades from the junior high school sample estimation, the coefficient for one's sense of myopia became highly statistically significant (Note 11). Thus, one's sense of myopia during junior high school indirectly affects one's choice of high school via

grades, because junior high school students who focus on the future (rather than the present) face a low psychic cost of studying; such students are likely to secure good grades (Note 12).

Next, we will refer to the estimation outcomes for the female sample. Unlike the findings of the male sample, the coefficient for grades is insignificant in models (11), (12), and (13). In contrast to models (6) and (7), the coefficient for myopia during junior high school is consistently negative and statistically significant in the other models, despite the remaining variable of high school quality in the estimation equations. When we omitted high school quality from the estimation model, the absolute value of the coefficient for myopia during junior high school became large (model (13)). This change might be the same, whereby the significance level for one's sense of myopia during junior high school becomes altered in the results for males. Comparing models (14) and (9), the coefficient for myopia in model (14) is negative and significant, despite including the variable of grades. Hence, one's sense of myopia during junior high school indirectly affects the academic career for males via high school quality and junior high school grades, but directly impacts females because it remains statistically significant, although we did not omit high school quality or grades from the estimation model.

Table 4: Estimation results (males)

Independent variables	Model (5)		Model (6)		Model (7)		Model (8)		Model (9)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
The family's Economic circumstances	0.164 *	0.096	0.169 *	0.096	0.160 *	0.097	0.164 *	0.085	0.072 *	0.043
Father's education	0.100 **	0.041	0.086 **	0.041	0.100 **	0.041	0.179 ***	0.035	0.163 ***	0.019
Mother's education	0.177 ***	0.062	0.187 ***	0.060	0.174 ***	0.061	0.227 ***	0.055	0.111 ***	0.028
Grades	-0.220 ***	0.067	-0.198 ***	0.067	-0.215 ***	0.067	-0.098 *	0.058	-0.463 ***	0.032
Myopia during high school	0.012	0.067	-	-	0.012	0.067	-0.016	0.061	-	-
Myopia during junior high school	-	-	-0.092	0.159	-0.118	0.159	-0.533 ***	0.136	-0.038	0.040
High school quality	-0.743 ***	0.071	-0.725 ***	0.074	-0.730 ***	0.076	-	-	-	-
Pseudo R^2	0.344		0.338		0.344		0.159		0.208	
Observation	439		441		439		444		1490	
Respondent	High school								Junior High School	

Note: Standard errors are robust.
* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table 5: Estimation results (females)

Independent variables	Model (10)		Model (11)		Model (12)		Model (13)		Model (14)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
The family's Economic circumstances	0.157 *	0.081	0.154 *	0.083	0.133	0.081	0.211 ***	0.073	0.101 **	0.044
Father's education	0.096 ***	0.032	0.092 ***	0.032	0.095 ***	0.033	0.115 ***	0.032	0.141 ***	0.018
Mother's education	0.159 ***	0.047	0.174 ***	0.048	0.167 ***	0.048	0.201 ***	0.045	0.167 ***	0.028
Grades	-0.096 *	0.057	-0.090	0.057	-0.087	0.057	-0.017	0.055	-0.428 ***	0.031
Myopia during high school	-0.009	0.065	-	-	-0.012	0.066	-0.107 *	0.062	-	-
Myopia during junior high school	-	-	-0.309 **	0.133	-0.295 **	0.134	-0.532 ***	0.122	-0.098 **	0.041
High school quality	-0.599 ***	0.063	-0.560 ***	0.064	-0.571 ***	0.066	-	-	-	-
Pseudo R^2	0.225		0.229		0.230		0.116		0.202	
Observation	458		458		456		460		1368	
Respondent	High school								Junior High School	

Note: Standard errors are robust.
* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

In this section, we have covered the effects of the family's economic circumstances and one's sense of myopia, treated as a non-cognitive skill regarding one's choice of career, based on the theoretical model outlined in Section 3. As expected, affluent students tend to want to pursue higher education because they can expect sufficient financial support from their parents. Students with poor grades are likely to work immediately after high school due to the high psychic cost of continuing their studies. If students go to a high school with a low number of students who pursue higher education, they might experience a high psychic cost if they want to go to university, because studying by themselves is difficult to associate with preparing for entrance exams. In terms of one's sense of myopia, focusing on the present (rather than the future) when students are in high school does

not seem to affect their choice of academic career after high school. On the other hand, this sentiment in junior high has a strong effect on their academic career. Thus, it is important to not only focus on the future (versus the present) in one's later years, but also once students acquire the capacity to think like this.

6. Conclusion

In this paper, using data on Japanese students, we investigated whether the non-cognitive skill of myopia during high school influences decision-making in terms of either leaving the school system or pursuing higher education. In the high school student sample, we found that students' expected years of schooling is high if their parents' income is high, because they can expect to receive financial support from their parents, which can reduce their tuition-related burden. On the other hand, students with poor grades are not likely to continue their education due to the high psychic cost of studying.

The effect of one's sense of myopia varies at different educational transition points. One's sense of myopia in high school had no effect on going to junior college or university, but the same sentiment in junior high school had a negative, statistically significant effect. High school students who did not consider their academic career after high school when they were in junior high are likely to desire fewer years of schooling. For robustness checks, we used a junior high school sample, and verified that one's sense of myopia during junior high had a negative, statistically significant effect on expected years of schooling across all samples.

When we performed an analysis by gender, the outcomes differed slightly. For males, one's sense of myopia in junior high indirect affected their choice of high school via grades. Yet for females, one's sense of myopia seemed to have a direct effect because this variable remained statistically significant, although we controlled for the influence of high school quality and grades.

These findings demonstrate that the discrepancy in the opportunity to pursue higher education could be mitigated by encouraging students to focus on the future (rather than the present) during the early stages of their education, although there may be income differentials among their parents. However, if families with high incomes tend to focus on the future (versus the present), and families with low incomes tend to focus on the present (versus the future), and if parents' thinking affects that of their children through home interactions, then the discrepancy in the opportunity to pursue higher education may widen. If this occurs, it might become difficult for the government to intervene.

Our contributions to the literature comprise a theoretical model based on data on Japanese students that integrates family income, tuition, and psychic cost, and illustrates the effects of the non-cognitive skill of myopia. However, our study has several limitations. We used a sample of high school students, but their reasons for choosing their high school are based on retrospective information, although they had only selected it two years prior. Additionally, preceding investigations have explored many types of non-cognitive skills; we could not include these items due to data restrictions. Future research should cover these topics.

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Notes

Note 1. For examples, see Toda, Tsuru, and Kume (2014), Heckman, Stixrud, and Urzua (2006), and Heckman and Kautz (2013). Heckman and Kautz (2013) showed the relationship between policy and non-cognitive skills throughout childhood and adolescence.

Note 2. Kubota (2013) also examined the effect of the number of siblings on children's years of schooling. If children have many siblings, they tend to have fewer years of schooling. However, if they are the firstborn, they tend to have many years of schooling.

Note 3. Lee (2014) reviewed studies on non-cognitive skills and social success. For detailed types of non-cognitive skills, see Gutman and Schoon (2013).

Note 4. Heckman et al. (2006) and Toda et al. (2014) also explored the relationship between non-cognitive skills and labor market outcomes such as wages, length of service, and type of employment.

Note 5. Breen et al. (2014) assumed three options beyond the elementary level of education: (1) an academically-oriented program; (2) a vocational-oriented one; and (3) leaving the school system.

Note 6. Among Japanese females, Lee and Ohtake (2014) found no statistically significant effects of non-cognitive skills on the choice to transition from high school to college.

Note 7. According to the Japan Institute for Labor Policy and Training (2019), lifetime earnings by education level are as follows: Males who finish high school earn 192.4 million yen, those who finish junior college or vocational school earn 203.7 million yen, and those who graduate from university earn 254.4 million yen. Females who finish high school earn 125.5 million yen, those who finish junior college or vocational school earn 158.0 million yen, and those who graduate from university earn 197.5 million yen. The results of calculations, using data from the Ministry of Education, Culture, Sports, Science and Technology (2014), show that private university annual tuition is 1.1 million yen, and private junior college annual tuition is 1.0 million. The difference in annual tuition between a private university and a private junior college is very small. We treated both schools' annual tuition cost in the same way, and we used T in the theoretical model, whether individuals went to junior college or university. Concerning opportunity costs, we performed a calculation using the Basic Survey on Wage Structure, carried out by the Ministry of Health, Labour and Welfare (2019). Males who finish junior college or vocational school earn 4.4 million yen, while those who finish university earn 9.9 million yen. Females who finish junior college or vocational school earn 4.1 million yen, while those who finish university earn 8.9 million yen. When we calculated equation (7), we found that (7) holds for males and females.

Note 8. Both sets of data for the secondary analyses, "*Survey among high school students and their mothers, 2012*" and "*Survey on the everyday consciousness of parents and children, 2011*" were provided by the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, and The University of Tokyo.

Note 9. This survey included 26 students whose expected education level was junior high school, but we eliminated these respondents from the analysis in order to ensure that the dependent variable would correspond with the survey administered to high school students.

Note 10. Data from the Ministry of Education, Culture, Sports, Science and Technology (2019) reveal that the university entrance rate of males in 2014 was 55.9% while that of females was 47.0% respectively. Concerning the junior college entrance rate, that of male students was 1.1% and that of female students was 9.5%.

Note 11. The coefficient for the sense of myopia is -0.12, and the standard error is 0.04.

Note 12. Takeshita and Imai (2019) demonstrated that students who focus on the future (rather than the present) study longer than students with the opposite tendency, and that the non-cognitive skill of time preference indirectly affects grades via study time.