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Higher Gaokao Scores, Better Academic Performance in College?

-- A Comparative Study to Cognitive and Non-Cognitive Abilities

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Abstract: For a long time, much research has focused on the overall impact of candidates' family background to college admission opportunities, as well as the analysis to mediating mechanisms such as educational expectations, cognitive abilities, and academic performance. However, it has overlooked the influence of individuals' non-cognitive abilities on college academic performance. This study proposes a theoretical hypothesis that non-cognitive abilities play a decisive role in undergraduates' academic performance under a loose management model. Using the baseline data from Beijing College Student Panel Survey and applying a fixed-effects model, the paper analyzes the respective impacts of undergraduates' cognitive and non-cognitive abilities on their academic performance, as well as the relative magnitude of the impacts. The results show that while cognitive abilities can significantly improve undergraduates' comprehensive academic performance, they have no effect on specialized course performance. In contrast, non-cognitive abilities have a significant impact on both undergraduates' comprehensive academic performance e and specialized course performance, and their role is far more significant than that of cognitive abilities.

Keywords: Undergraduates; Cognitive Abilities; Non-Cognitive Abilities; Academic Performance.

1. Introduction

For a long time, the two topics that about how family socioeconomic background influences people's college admission opportunities and occupational status have been classic issues in the field of social stratification. In order to explore the topics, scholars have conducted deep analyses from diverse perspectives such as the Effective Maintenance of Inequality Theory, Maximally Maintained Inequality Theory, Social Selection Theory, and Rational Choice Theory. It can be said that such studies account for nearly half of the classic papers in the field of social stratification. Recently, with the availability of more representative survey data, some scholars have begun to focus on the causal effects of family socioeconomic background on students' non-cognitive abilities, college academic performance, and postgraduate's admission opportunities [1][3][4][5]. This has advanced research on the impact of family background on higher education to a more deep and refined level. The logic of the aforementioned research can be illustrated in Figure 1.

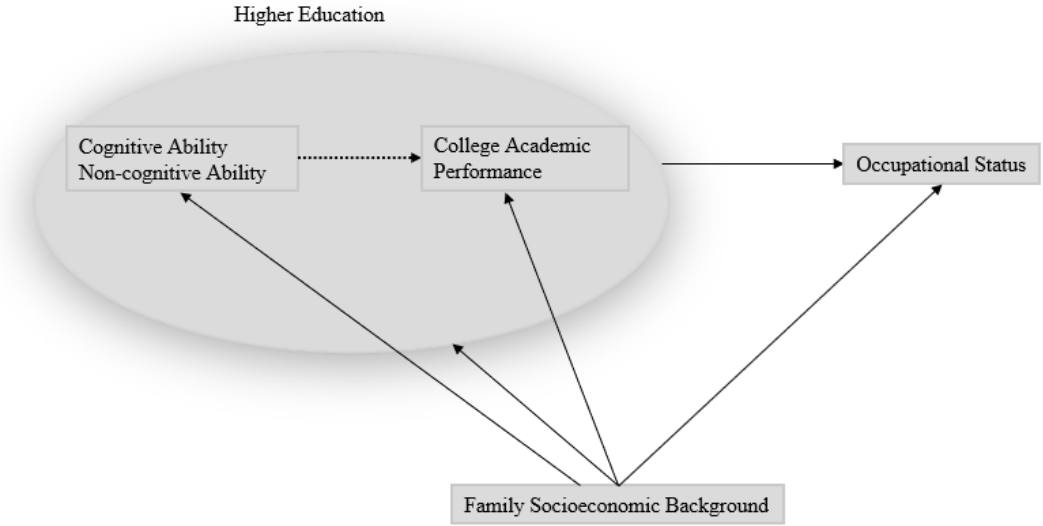

Figure 1. Traditional Research Path

However, as shown in Figure 1, the mechanism about how cognitive and non-cognitive abilities influence academic performance in higher education level remains a 'black box'. Uncovering this black box will help people understand the unique educational mechanisms or characteristics of the higher education stage better compared with the secondary education stage, and highlight the positive value of individuals themselves to academic performance. This has great differences with existing studies, which pay much attention on the impact of family socioeconomic background on educational outcomes and their economic consequences with a deterministic tone. In fact, existing studies have shown that as individuals advance along with education hierarchy, the influence of family socioeconomic background gradually

diminishes, while the impact of individuals themselves on educational achievements becomes increasingly significant [6][7]. This provides us with encouragement based on free will rather than determinism. Therefore, the focus shifting from an individual's family background back to the individual themselves is more practically meaningful and more humanistic.

Basing on the reasons mentioned above, the study attempts to uncover the black box in Figure 1, and focus on researching the impact of individuals' cognitive and non-cognitive abilities on college academic performance. Specifically, this paper will answer the following questions: How cognitive and non-cognitive abilities influence college academic performance respectively, and which of the two impacts is more important? Is it true that higher Gaokao scores mean better academic performance in college just as people say?

2. Literature Review

Just as Thomas Edison said, success requires one percent talent and ninety-nine percent effort. Therefore, personal qualities such as an individual's motivation, perseverance, and integrity are crucial factors determining their educational and economic achievements. However, for a long time, scholars from education and economics under the influence of traditional human capital theory and screening theory have often equated 'ability' directly with cognitive ability when analyzing how ability affects educational achievement or labor market returns. Alternatively, they have used educational attainment as a direct substitute for an individual's cognitive ability.

Nevertheless, a series of empirical studies on educational return rate have shown that while education plays a vital role in income, the explanatory power of cognitive ability traditionally measured by test scores is relatively low. Even after controlling for cognitive ability, family background, and some demographic variables, nearly two-thirds to four-fifths of the variance remains unexplained [8][9][10][11]. This is particularly evident in studies on intergenerational income mobility: though there is a strong intergenerational transmission of income between parents and children, but cognitive ability, demographic factors, and some school education variables can only explain one-third to three-fifths of this transmission. Furthermore, the impact of school education on income is independent of cognitive ability. This indicates that there are other factors beyond cognitive ability that significantly influence an individual's future. In fact, school education fosters more than just cognitive ability [12][13].

Bowles and Gintis argue that the shortage arises traditional human capital theory overlooking the role of non-cognitive ability [14]. Traditional human capital theory relies entirely on two assumptions: economic equilibrium and complete contracts. In reality, however, economies often operate in a state of disequilibrium, and the quantity and quality of work are often difficult to stipulate through contracts. Therefore, to enhance the explanatory power of human capital theory, it is necessary to expand these two assumptions. Once these assumptions are expanded, the economic value of non-cognitive ability becomes prominent.

After Bowles and Gintis' found, an increasing number of scholars recognize the important role of non-cognitive ability in individuals' educational choices and career achievements, and conduct numerous empirical studies [15][16]. However, most of these studies rely on respondents' self-reports of traits such as perseverance, self-esteem, optimism, or preferences. Due to the difficulty of eliminating the 'subject effect' (respondents adjusting their answers to meet perceived expectations), the reliabilities of the results are widely questioned by other scholars.

It is not until Hackman and Rubinstein's paper that the role of non-cognitive ability in people's educational and economic achievements has been recognized widely by people [17]. In the paper, Heckman and Rubinstein ingeniously utilize the quasi-natural experiment provided by the General Educational Development (GED) testing program in the United States. The program aims to provide a second opportunity for individuals who dropped out of high school—yet possessing cognitive ability equivalent to that of high school graduates who successfully obtained their diplomas—to prove their academic competence [17]. Through this program, the adolescents are divided into three groups: high school dropouts without a GED, high school dropouts obtaining a GED, and high school graduates. The cognitive ability of the first group was lower than that of the latter two groups, while the cognitive ability of the second group is roughly equivalent to that of the third group. However, tracking research to these adolescents reveals that although the second group generally earns higher hourly wages than the first group, after controlling for cognitive ability, the former's hourly wages are actually lower than the latter. This indicates that there are unmeasured factors contributing to the lower hourly wages of the second group, among which non-cognitive factors are the most critical. Heckman and Rubinstein argue that it is the personal qualities of the second group such as lack of perseverance, poor future planning, and weak adaptability to the environment that have led them to drop out of high school earlier, and these qualities ultimately result in their lower income [17].

With the growing emphasis on non-cognitive ability, scholars have also investigated its role in education. Almlund et al. find that non-cognitive ability represented by openness to experience plays a positive effect on education [18]. Through intervention experiments on students' non-cognitive ability, Perry discovers that students receiving the intervention achieve far higher educational outcomes than those in the control group. Moreover, non-cognitive ability can enhance cognitive ability by fostering students' spirit of exploration and open attitude toward learning: the more positive the non-cognitive ability, the more conducive to the active and rapid acquisition of cognitive ability [19][20].

However, despite the studies mentioned above conduct rigorous analysis to the role of non-cognitive ability, none of them focus on the impact of non-cognitive ability on the academic performance of undergraduate students, nor do they include a comparative analysis of the roles of cognitive and non-cognitive ability. This is partly due to the lack of representative survey data, which has hindered scholars from conducting such research. More importantly, perhaps because people naturally assume that cognitive ability plays a decisive role in undergraduates' academic performance, thus neglecting the need to explore this topic. Basing on this, this study focuses on the roles of non-cognitive and cognitive ability in undergraduates' academic performance and the relative magnitude of these roles.

3. Research Hypotheses

Basing on the above literature review, we know that non-cognitive abilities such as an individual's self-evaluation,

self-esteem, future orientation, and perseverance have a significant impact on both people's career achievements and educational outcomes. Referring to the paper of Bowles et al., who argued that non-cognitive abilities play a crucial role in determining occupational income under conditions of an unbalanced labor market or within the frameworks of the 'Schumpeterian Model of Income Determination' and 'Coasean Model of Income Determination', the study proposes the theoretical hypothesis that non-cognitive abilities play a decisive role in undergraduates' academic performance under a loose management model.

Our theoretical basics are as follows: Compared with secondary education, a key difference in undergraduate education in China is that the management of schools and teachers are both looser. This is first reflected in the fact that students are no longer required to attend classes or study in classrooms from approximately 6:00 a.m. to around 10:00 p.m. As a result, students have more time to dominate independently. Consequently, individuals with stronger self-management abilities and better future planning are more likely to arrange their leisure time effectively.

Second, unlike the relatively fixed curriculum arrangement in high school, undergraduates enjoy significant freedom in selecting elective courses, general education courses, and public electives aside from mandatory specialized courses and mandatory public courses. These elective courses account for at least 30% of the total class hours. The choice of elective courses primarily depends on students' interests. Thus, unlike the coercive learning model in high school where teachers drive students' studying regardless of their interests, during undergraduate education stage, enthusiasm for courses becomes the primary factor determining students' selecting courses and, in turn, subsequent academic performance.

Third, while undergraduate academic evaluation still relies on teachers' grading, in most universities, the weight of final exam scores is only approximately 50%. Therefore, the pressure of academic examinations faced by undergraduates is far less than that faced by high school students. Outstanding performance in non-exam components such as book reports or class participation depends more on students' personality traits, such as self-discipline or passion for their major, rather than their cognitive ability. Even for mandatory specialized courses and mandatory public courses, final academic performance is largely determined by non-cognitive abilities such as enthusiasm for the subject and self-esteem.

Finally, the majority of undergraduates admitted to Chinese universities are selected through a national unified entrance examination (Gaokao). Although admission scores vary across institutions (and provinces), the paper argues that the average differences in cognitive ability among students accepted by different universities are far smaller than the average differences between students admitted to and not admitted to universities, which actually weakens the impact of cognitive ability on undergraduates' academic performance. Thus, we contend that the differences in cognitive ability among undergraduates are more likely to be continuous rather than categorical. Therefore, the impact of individual cognitive ability measured by Gaokao scores on undergraduate academic performance may be limited.

Basing on this, the theoretical hypothesis that non-cognitive abilities play a decisive role in undergraduates' academic performance under a loose management model is operationalized into the following specific hypotheses:

Hypothesis 1: cognitive ability contributes to improving undergraduates' academic performance.

Hypothesis 1a: cognitive ability contributes to improving undergraduates' comprehensive academic performance.

Hypothesis 1b: cognitive ability contributes to improving undergraduates' specialized course performance.

Hypothesis 2: non-cognitive ability contributes to improving undergraduates' academic performance.

Hypothesis 2a: non-cognitive ability contributes to improving undergraduates' comprehensive academic performance.

Hypothesis 2b: non-cognitive ability contributes to improving undergraduates' specialized course performance.

Hypothesis 3: the effect of non-cognitive ability on improving undergraduates' academic performance is greater than that of cognitive ability.

Hypothesis 3a: The effect of non-cognitive ability on improving undergraduates' comprehensive academic performance is greater than that of cognitive ability.

Hypothesis 3b: The effect of non-cognitive ability on improving undergraduates' specialized course performance is greater than that of cognitive ability.

4. Research Design

4.1. Data

The data used in this study derives from the base part of Beijing College Student Panel Survey (BCSPS). The target population of this survey includes full-time undergraduates enrolled in non-private universities in Beijing. However, in order to control costs under the precondition of not destroying representativeness of sample, the BCSPS defined the undergraduates admitted by colleges in 2006 and 2008 as its survey population. The BCSPS adopted a stratified, multi-stage sampling method with probability proportional to size (PPS). In the first stage, universities were selected as primary sampling units; in the second stage, academic majors served as secondary sampling units; and in the third stage, individual students were the final sampling units. Finally, the sample size was calculated to ensure a sampling absolute error of no more than 3% at a 95% confidence level, and was set 5,100. After excluding missing values and outliers across all variables, the effective sample size for this study is 4,213.

4.2. Variables

4.2.1. Dependent Variable

College academic performance. The paper uses two indicators to measure academic performance. One is comprehensive academic performance. For the 2006 and 2008 undergraduates, this is measured by their rank within their class. The original data include each respondent's class rank and total class size; however, due to varying class sizes, direct comparisons are impossible. Thus, ranks are standardized to a 100-point scale, where a smaller value indicates a higher rank. The other one is specialized course performance. It is measured by respondents' satisfaction with their specialized course grades, using a 5-point scale (a higher score indicates greater satisfaction with specialized course performance).

4.2.2. Independent Variables

Cognitive Ability. The paper defines it as the ability of the human brain to process, store, and retrieve information, which collectively reflects an individual's inherent capabilities [2]. Some scholars have used math test scores and vocabulary test scores to measure cognitive ability [2][21][22], but these

indicators only capture a small portion of an individual's overall cognitive ability. In contrast, Gaokao (National College Entrance Examination) scores are a more comprehensive and reliable indicator for measuring the cognitive ability of college students [1]. The BCSPS provides respondents' original Gaokao scores, which are used to measure cognitive ability in the paper.

Non-cognitive ability. It refers to abilities measured through personality traits [2][3], which is distinct from cognitive skills (such as calculation, reading, or memorization). Following the measuring method proposed by Heckman, Stixrud and Urzua [23], this study uses self-efficacy and self-esteem scales to assess non-cognitive ability.

The General Self-Efficacy Scale (GSES) developed by German psychologist Ralf Schwarzer and his colleagues is adopted to measure self-efficacy in BCSPS. The scale consists of 10 items, each scored on a 4-point scale (1 = 'completely inconsistent' to 4 = 'completely consistent'). The total self-efficacy score is calculated by summing the scores of the 10 items.

BCSPS uses the Rosenberg Self-Esteem Scale (RSES) to measure self-esteem, which includes 10 items (5 positively worded and 5 negatively worded). In this paper, the 5 negatively worded items are first reverse-coded, and the total self-esteem score is then obtained by summing the scores of all 10 items. A higher total score indicates a more positive self-evaluation.

4.2.3. Control Variables

Family socioeconomic background. The study measures it using parental education level and parental occupation. The original questionnaire provides a categorical variable ranging from 'no education' to 'postgraduate education or above' to measure parental education. In this paper, it is recoded into a binary variable (1 = 'college degree or above', 0 = 'below college degree').

In addition, the original questionnaire includes a categorical variable covering occupations from farmers, industrial workers to private entrepreneurs. The paper defines professional and technical personnel, university teachers, journalists (artists/athletes), managers of enterprises and public institutions, government officials, and private entrepreneurs as 'white-collar occupations'. A binary variable is created (1 = 'at least one parent holds a white-collar occupation', 0 = 'neither parent holds a white-collar occupation').

Besides, other confounding variables that affect both respondents' abilities and academic achievement are controlled, including gender, ethnicity, household registration type, number of siblings, and family residence.

Table 1. Descriptive Statistics of Variables (N=4213)

Variable	Mean	Standard Deviation	Minimum	Maximum
Class Rank (Standardized)	44.131	24.049	1.250	100.000
Satisfaction with Specialized Courses	3.132	1.000	1.000	5.000
Ethnic Minority (1=Yes)	0.123	0.328	0.000	1.000
Rural Household Registration (1=Yes)	0.303	0.460	0.000	1.000
Residence -Village	0.243	0.429	0.000	1.000
Residence -Market Town	0.072	0.259	0.000	1.000
Residence -County Town	0.139	0.346	0.000	1.000
Residence -County-level City	0.086	0.280	0.000	1.000
Residence -Prefecture-Level city	0.159	0.366	0.000	1.000
Residence -Provincial Capital	0.301	0.459	0.000	1.000
Parent with College Degree(1=Yes)	0.493	0.500	0.000	1.000
White-Collar Parent (1=Yes)	0.388	0.487	0.000	1.000
Number of Siblings	0.517	0.788	0.000	11.000
Junior Year(1=Yes)	1.975	0.998	1.000	3.000
GaoKao Score	564.305	72.007	35.000	886.000
Self-Efficacy Score	29.275	5.039	10.000	40.000
Self-Esteem Score	38.328	5.998	12.000	50.000

4.3. Methodology

Since 2002, the Ministry of Education has generally adopted province-specific proposition for the Gaokao, meaning different provinces use different exam papers. This results in Gaokao scores from the BCSPS being incomparable directly across provinces. Furthermore, provinces differ significantly in terms of economic development level, public education resources, and private tutoring institutions. These differences are important factors that simultaneously influence the development of respondents' cognitive ability, non-cognitive ability, and ultimately their academic achievement. Failure to control for these factors may seriously violate the orthogonality assumption of Ordinary Least Squares (OLS) estimation. A fixed-effects model can effectively address the aforementioned issues. Therefore, this paper would take a provincial fixed-effects regression model as the primary analytical method.

5. Research Results

5.1. Impact of Cognitive and Non-Cognitive Abilities on Undergraduates' Comprehensive Academic Performance

Table 2 presents the impact of cognitive and non-cognitive abilities on undergraduates' academic performance basing on fixed-effects model. Among the models, Model 1 (Baseline Model) measures the influence of respondents' demographic variables and family background variables on academic performance. From the model results, female students show significantly better comprehensive academic performance than male students, with their class rank in academic performance being 10.75% higher (i.e., a more advanced position) than that of males. In contrast, ethnic minority students (compared to Han students) and students residing in a county town (compared to those residing in rural areas)

show a relatively poorer comprehensive academic performance, with their class ranks lagging behind the latter groups by 3.28% and 3.34%, respectively.

Model 2 adds the variable of Gaokao scores (measuring individual cognitive ability) to Model 1. The results indicate that higher Gaokao scores significantly improve undergraduates' class rank in academic performance (Hypothesis 1a is supported). However, this effect is extremely small, after controlling for other variables, a 100-point increase in Gaokao scores only leads to an average 1.4% improvement in undergraduates' class rank. This is further corroborated by the fact that the increase in R-squared is merely 0.1%. Model 3 further incorporates self-efficacy and self-esteem into Model 2 in order to measure individual non-cognitive ability. The results reveal that a higher subjective evaluation of one's own value is associated with better comprehensive academic performance. For each 1-point increase in self-esteem (on a 1–5 scale), undergraduates' class rank in academic performance advances by 51% (Hypothesis 2a is supported). It is evident that non-cognitive ability is a far more important factor influencing undergraduates' academic performance than cognitive ability (Hypothesis 3a is supported). This conclusion is more precisely validated by the 1.5% increase in R-squared (in contrast to the 0.1% increase in Model 2).

Table 2. Estimation Results of the Impact of Cognitive and Non-Cognitive Abilities on College Class Rank

	Model 1	Model 2	Model 3
Female (1=Yes)	-10.750***	-10.832***	-10.684***
	(0.808)	(0.810)	(0.814)
Ethnic Minority (1=Yes)	3.280*	3.132*	3.145*
	(1.298)	(1.299)	(1.284)
Rural Household Registration (1=Yes)	1.019	1.076	1.029
	(1.329)	(1.331)	(1.338)
Residence (Rural = 0)			
Market Town	3.042	3.061	3.149
	(1.631)	(1.633)	(1.624)
County Town	3.335*	3.358*	3.299*
	(1.646)	(1.649)	(1.639)
County-Level City	2.247	2.220	2.256
	(1.806)	(1.807)	(1.808)
Prefecture-Level City	0.897	0.902	1.104
	(1.772)	(1.774)	(1.783)
Provincial Capital	0.804	0.953	1.037
	(1.667)	(1.667)	(1.680)
Parent with College Degree (1=Yes)	0.049	0.168	0.297
	(0.973)	(0.973)	(0.971)
White-Collar Parent (1=Yes)	0.587	0.657	1.072
	(0.935)	(0.933)	(0.931)
Number of Siblings	-0.178	-0.220	-0.306
	(0.552)	(0.552)	(0.551)
Junior Year (1=Yes)	-1.474***	-1.376***	-1.374***
	(0.383)	(0.387)	(0.384)
Gaokao Score		-0.014*	-0.012*
		(0.006)	(0.006)
Self-Efficacy Score			0.022
			(0.093)
Self-Esteem Score			-0.510***
			(0.081)
Constant	50.453***	57.858***	75.527***
	(1.810)	(3.795)	(4.607)
Provincial Fixed Effects	Controlled	Controlled	Controlled
Arts/Science Fixed Effects	Controlled	Controlled	Controlled
Observations	4,213	4,213	4,213
R-Squared	0.124	0.125	0.140

Note: Data were weighted by sampling probability. *** P<0.001, ** P<0.01, *P <0.05

5.2. Impact of Cognitive and Non-Cognitive Abilities on Undergraduates' Specialized Course Performance

Compared with senior high school students, most undergraduates enjoy more freedom to allocate different amounts of time and effort to specialized courses following their own will. Therefore, to fully capture the impact of cognitive and non-cognitive abilities on undergraduates' academic performance, this study also estimates the factors influencing respondents' specialized course performance. Among the models, Model 4 (Baseline Model) incorporates individuals' demographic variables and family background variables. As shown in the table, female students demonstrate better performance in specialized courses than male students. Specifically, the former's satisfaction with their specialized course performance is approximately 0.13 points higher than the latter's (on a 1–5 scale). Model 5 incorporates Gaokao scores into Model 4. The results reveal that higher Gaokao scores do not increase undergraduates' satisfaction with specialized courses. Instead, they decrease it (Hypothesis 1b is rejected). This study argues that this phenomenon is most

likely due to the fact that students with high Gaokao scores initially hold high expectations for their specialized course grades, but their actual exam results fail to meet these expectations. Model 6 incorporates self-efficacy and self-esteem into Model 5. The results show that both indicators significantly increase undergraduates' satisfaction with specialized course performance (Hypothesis 2b is rejected). Specifically, for each 1-point increase in self-efficacy (on a 1–4 scale), undergraduates' satisfaction with specialized course performance rise by 0.04 points; for each 1-point increase in self-esteem (on a 1–5 scale), their satisfaction with specialized course performance increase by 0.01 points. Additionally, by comparing a 6.1% increase of R-square in Model 6 with a 0.1% increase of R-square in Model 5, the paper can conclude that it is individuals' non-cognitive ability, rather than cognitive ability, that plays a dominant role in undergraduates' specialized course performance (Hypothesis 3b is rejected).

Table 3. Impact of Cognitive and Non-Cognitive Abilities on Undergraduates' Specialized Course Performance

	Model 4	**Model 5**	**Model 6**
Female (1=Yes)	0.132***	0.128***	0.132***
	(0.036)	(0.036)	(0.035)
Ethnic Minority (1=Yes)	-0.063	-0.070	-0.070
	(0.055)	(0.055)	(0.053)
Rural Household Registration (1=Yes)	0.006	0.009	0.007
	(0.056)	(0.056)	(0.053)
Residence (Rural = 0)			
Market Town	-0.095	-0.095	-0.105
	(0.071)	(0.071)	(0.068)
County Town	-0.119	-0.118	-0.120
	(0.069)	(0.069)	(0.065)
County-Level City	0.025	0.024	0.016
	(0.079)	(0.079)	(0.075)
Prefecture-Level City	-0.007	-0.007	-0.037
	(0.075)	(0.075)	(0.072)
Provincial Capital	-0.038	-0.031	-0.051
	(0.072)	(0.072)	(0.069)
Parent with College Degree (1=Yes)	0.029	0.034	0.019
	(0.043)	(0.043)	(0.042)
White-Collar Parent (1=Yes)	-0.056	-0.053	-0.090*
	(0.040)	(0.040)	(0.039)
Number of Siblings	-0.026	-0.028	-0.021
	(0.024)	(0.024)	(0.023)
Junior Year (1=Yes)	0.053**	0.057***	0.053**
	(0.017)	(0.017)	(0.016)
Gaokao Score		-0.001*	-0.001**
		(0.000)	(0.000)
Self-Efficacy Score			0.036***
			(0.003)
Self-Esteem Score			0.011**
			(0.004)
Constant	3.137***	3.474***	1.870***
	(0.080)	(0.162)	(0.194)
Provincial Fixed Effects	Controlled	Controlled	Controlled
Arts/Science Fixed Effects	Controlled	Controlled	Controlled
Observations	4,213	4,213	4,213
R-Squared	0.036	0.037	0.098

Note: Data were weighted by sampling probability. *** P<0.001, ** P<0.01, *P <0.05

6. Conclusion and Discussion

It can be argued that the transition from senior high school to undergraduate education represents the most significant transformation in educational content, teaching methods, and students' learning styles throughout the entire educational journey—from primary school to postgraduate studies. Unlike primary and secondary education, where most courses consist of foundational knowledge with no room for students to select, and students have to follow a uniformly scheduled timeline in China, undergraduate students enjoy relatively more freedom whether course selection or the arrangement of leisure time. Therefore, during this stage, the impact of non-cognitive ability on academic performance may be more significant, even surpassing that of cognitive ability. Basing on the reasonings, this study proposes three sets of hypotheses.

After controlling for provincial-level effects using a fixed-effects model, this study analyzes the impacts of cognitive ability and non-cognitive ability on undergraduates' academic performance respectively. The results reveal that while cognitive abilities measured by Gaokao scores contribute to improving undergraduates' comprehensive academic performance, it reduces their satisfaction with specialized course performance. Although this outcome supports Hypothesis 1a, it rejects Hypothesis 2a and Hypothesis 2. This study argues that this phenomenon may be attributed to the fact that students with higher Gaokao scores hold higher expectations for their specialized course grades, but their actual exam results fail to meet these expectations.

As presented in Table 1 and Table 2, for undergraduates, non-cognitive abilities measured by individual self-esteem levels and self-efficacy exert a more significant influence on

their academic performance than Gaokao scores. In contrast, the prominent impact of cognitive ability on academic performance, which is evident in the senior high school stage, no longer holds the same effect during the undergraduate stage. This finding differs from the conventional empirical assumption that 'individuals with higher Gaokao scores tend to achieve better academic performance in college'.

The findings of this study support the initial theoretical proposition that non-cognitive abilities play a decisive role in college academic performance under the loose education model. Although this theory is originally proposed for undergraduates, there is reason to believe that it is also applicable to postgraduate students given the similarities between the postgraduate training process and that of undergraduates. The limitation of this study lies in the fact that, although a fixed-effects model is used to control for provincial-level factors, constraints related to data availability prevent the analysis of two key relationships: the potential interaction effect between cognitive ability and non-cognitive ability, and the reverse causality between college academic performance and non-cognitive ability. However, the study has sufficient grounds to conclude that its findings are reliable by referring to existing literature [1][5] which explores the impacts of cognitive and non-cognitive abilities on postgraduates' admission opportunities and initial job income.

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