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Abstract

Attending college is a significant human capital investment but only about 60% of those who start college will have a completed degree six years later. This makes identifying the skills associated with college success an important policy concern. We surveyed over 1,100 entering college freshmen, majoring in business and engineering at a public university in the US, and combined this information with administrative data to create a comprehensive data set that, in addition to the usual academic performance data, cognitive ability measures, and demographics, also included measures of non-cognitive skills, personality traits, student expectations about college success and performance at graduation. With this information, we analyzed if students' subjective expectations about their future success in college are related to non-cognitive skills and whether they are realistic, compared to student's performance at graduation. We identify students performing below and above objective expectations, both at the end of their freshmen year and at graduation, and study non-cognitive skills related to their objective performance. We find that non-cognitive skills are associated with academic subjective expectations of college success and objective performance in college, even after controlling for cognitive ability. However, many students enter college with unrealistic subjective expectations about their future performance and this could influence their on-time graduation.

Keywords: Higher Education; Non-cognitive Skills; Expectations; Business; Engineering

JEL codes: I23, D91, D90

1. Introduction

Since Becker's ground-breaking work (1962), human capital investments have been evaluated for the return on investment. In the U.S. the returns to higher education have consistently grown over time (Goldin and Katz, 2007; Oreopoulos and Petronijevic, 2013) even as college costs have grown and the percentage of high school graduates enrolling in college has increased. However, a significant proportion of students who enroll in college do not achieve graduation.

Since the 1996 cohort, the 6-year graduation rate for beginning college students has fluctuated between 53.8% and 61.2% for the most recent cohort of 2016 (NCES n.d.). Shapiro et al. (2012) estimated the U.S. population includes over 31 million adults who enrolled in college in the past 20 years but left before completing a degree. It could be that something changed between the time the student enrolled in college and when he/she dropped out that caused another alternative to have a higher rate of return, such as a full-time employment offer at a higher wage or a change in family obligations that increased the opportunity cost of attendance. But it is also possible that the initial enrollment decision was later revealed to be sub-optimal once the student had more complete information regarding the costs and/or benefits of a college degree, such as coursework that is more challenging than anticipated or unexpected education expenses.

The growing population of non-completers is not necessarily problematic as previous studies have found positive returns to attending college even for students who do not graduate (Greenstone and Looney, 2013). However, there is public concern about high levels of student loan debt and the perception that it is particularly burdensome for

students who do not complete a degree (Tompor, 2017) and are thus more likely to default on student loans (Delisle, 2014).

Recognizing the value of a college degree, policymakers have encouraged practices to increase graduation rates and the development of tools designed to inform students of their likelihood of success. Thus far, most of the interventions intended to help graduation rates-- including tutoring, remediation, online information, and counseling-- have proven to be mostly ineffective (Page and Scott-Clayton, 2016), although interventions that provide a more holistic approach or those using data to better target academic and non-academic supports show more promise (Dynarsky et al., 2023). This suggests that traditional characteristics used to predict college success might be imperfect and highlights the need for better tools to identify and support students at risk of leaving college before graduation.

In this paper, we explore the survey results of over 1,100 undergraduate students majoring in business and engineering at a public university in the US linked with their administrative records. In addition to the usual academic performance data, cognitive ability measures, and demographics, our survey includes measures of non-cognitive skills and personality traits as well as student expectations about college success. This allows us to identify students' subjective expectations about their future success in college, whether these expectations are realistic, and to what extent non-cognitive skills are associated with these expectations. Moreover, we identify students performing below and above objective expectations, based on their level of preparation and background at college entrance, both at the end of freshmen year and at graduation, and the non-cognitive skills related to their performance. We find that non-cognitive skills are

associated with subjective expectations and performance in freshmen year and at graduation, even after controlling for cognitive ability, but that the relationship between specific non-cognitive skills, academic expectations, and academic performance varies by discipline. Finally, our results also show that many students enter college with unrealistic expectations about their performance and that these could influence their on-time graduation.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature on non-cognitive skills, subjective expectations, and college success. Section 3 discusses the data collection process and the resulting analytical dataset. Section 4 lays out our research questions and the empirical strategy for each. In Section 5 we discuss our results about how students form their subjective expectations of college success, what determines their actual performance both at the end of their freshmen year and at graduation, and identify characteristics associated with the level of unrealistic expectations and how they relate to college success. Finally, Section 6 discusses the implications of our results and presents our conclusions.

2. Literature Review

This paper contributes to the prolific literature on cognitive and non-cognitive factors related to college success and the emerging literature on the relationship between academic subjective expectations and subsequent performance. In this section, we describe this literature and our contributions.

2.1 Cognitive Skills, Non-Cognitive Skills, and College Outcomes

Considerable research suggests that factors such as socioeconomic status, gender, family background, and cognitive ability predict college success (Richardson et al., 2012; Poropat, 2009; Cheng et al., 2013; Stephan et al., 2015; Kuh et al., 2008). Cognitive ability is one of the most widely used metrics in predicting college achievement, often measured through high school grade point average (HSGPA), ACT, and SAT scores[1] (Frey and Determan, 2004; Bettinger et al., 2013). However, increasing college enrollment rates with low persistence has spurred interest in identifying other factors associated with college success (Turner, 2004). In this study, we explore some of those related factors.

Non-cognitive skills such as conscientiousness, neuroticism, and grit are associated with economic, academic, and health outcomes (Lleras, 2008; Heckman et al., 2006; Almlund et al., 2011, Hitt et al., 2016). These associations have been measured at various stages of life including children (Heckman et al., 2013), adolescents (Duckworth and Quinn, 2009), adults (Borghans et al., 2008), and senior citizens (Jackson et al., 2015). However, less attention has been paid, in the literature, on the potential relevance of non-cognitive skills in a higher education setting.

The Big Five Personality traits--agreeableness, neuroticism, openness, extraversion, and conscientiousness-- have become the most used taxonomy of non-cognitive traits used to study their relationship with relevant life outcomes (Kyllonen et al., 2014; Conard, 2006). Conscientiousness, defined as how organized, efficient, and dutiful a person is, is found to be an important determinant of success among the college

[1] Recent literature, see Borghans et al. (2016) has recognized the fact that grades and scores in these tests might be also influenced by diverse non-cognitive skills and aspects of personality. Therefore, they cannot be considered measures of cognitive ability exclusively.

population. In a sample of undergraduates, Wagnerman and Funder (2007) discovered that self-reported conscientiousness accounted for 18% of the variation in freshman GPA and 37% of the variation in senior year GPA. Conard (2006) found conscientiousness to be predictive of college GPA, course performance, and class attendance even after controlling for SAT scores in a sample of undergraduate students.

On the other hand, neuroticism and extraversion also often show consistently negative relationships with college outcomes, inside and outside of the US, while the results for agreeableness are less clear (Poropat, 2009; Burks et al., 2015; Komarraju et al., 2009; Chamorro-Premuzic and Furnham, 2003; O'Connor and Paunonen, 2007). Finally, although the literature on openness is relatively small, it also suggests possible positive associations with measures of college performance (Lounsbury et al., 2003).

Similarly, other measures of non-cognitive skills and attitudes, such as grit, growth mindset, or locus of control, also appear to be associated with academic outcomes in higher education (e.g Akos et al., 2022; Faust and Rosendale, 2023; Saltiel, 2020). In a sample of undergraduates attending an Ivy League college, Duckworth et al. (2007) found grit, defined as persistence in accomplishing long-term goals, to be associated with college GPA (r=0.34), even after controlling for SAT performance. Similar results were obtained by Akos et al. (2022) and Faust and Rosendale (2023) who showed the relevance of grit for college performance, especially in the context of underrepresented students. However, recent critiques point out grit's strong relationship to conscientiousness putting in doubt the ability to capture a separate skill from the conscientiousness trait (Crede et al., 2017).

Within a sample of freshmen attending Columbia University, a growth mindset, the perception that one's ability is malleable and not fixed, was associated with higher intrinsic motivation, predicted a higher final course grade, and more importantly, predicted grade improvement from the first exam to the final exam in a Chemistry course (Grant and Dweck, 2003). Most recently, Akos et al. (2022) also showed the relevance of a growth mindset to predict college GPA and credit hours in the context of underrepresented students attending minority-serving institutions.

However, it is not entirely clear how personality traits or non-cognitive skills and academic performance are related. It could be that some disciplines have curricula that require students to interact with classmates and personality influences performance through peer interaction. Work by Sorić et al. (2017) suggests personality may be related to academic motivation which is reflected in observed academic performance. This is consistent with Komarraju et al.'s (2013) assertion that cognitive measures show what a student is capable of but non-cognitive skills allow for a better prediction of what the student will achieve.

Overall, this research highlights the potential relevance of non-cognitive skills for college outcomes. The literature to date, however, has not examined how the relationships with non-cognitive skills may vary across sub-groups of the college student population. This is something we pay particular attention to in this paper.

2.2 Motivation, Subjective Expectations, and College Success

Previous research looks at students' college goals, expectations, and motivation (Hall and Sverdlik, 2016; Beattie et al., 2018; Komarraju et al., 2009; Clark and Schroth, 2010; Beattie et al. 2019) and explores how well students perform in college based on

past performance and how their own goals or subjective expectations set them up for success or failure. In this respect, a recent meta-analysis by Pinquart and Ebeling (2020) shows that on average there are moderate positive associations between students' subjective expectations and their academic achievement but with considerable heterogeneity by age, ethnicity, socioeconomic status, and types of assessed expectations. The authors also document how students' expectations reflect both past and future performance but appear more optimistic on average than actual performance.

Given discrepancies between students' subjective expectations and performance, Hall and Sverdlik (2016) look at the effects of a motivational intervention on subjective expectations for students in science, technology, engineering, or mathematics (STEM) majors. Intervention participants were given tools to help calibrate their subjective expectations, which were measured by students' reports of how well they expected to do at the university, as well as their expected GPA at the end of the current semester and coming Fall semester (i.e. cumulative GPA). The results were somewhat paradoxical. Participants showed higher subjective expectations and optimism but lower actual GPAs than control group students. This result suggests that participants failed to match their higher subjective expectations after treatment with the requirements of their field of study.

Our study is most closely related to the work of Beattie et al. (2018) and the complementing work of Beattie et al. (2019). These authors study the relationship between past performance, objective expected performance based on students' background, student experiences, mental health, and non-cognitive skills in a sample of about 6,000 first-year college students studying economics in Canada. Their dataset, like

ours, includes information on high school academic performance, college performance, and non-cognitive skills, which the authors use to study the characteristics of "divers" and "thrivers." Divers are defined as students who, given their background, are expected to perform academically well but do not meet those objective expectations. In contrast, thrivers are those students who perform beyond their academic objective expectations, given their background and preparation. Beattie et al. (2018) find that divers are more likely to procrastinate and rate themselves as less conscientious. Thrivers report spending, on average, more hours studying and have higher subjective expectations for their GPA at the end of their freshmen year. Beattie et al. (2019) find that thrivers are more likely to use university resources while divers appear to often face more personal problems beyond the university.

Given the literature described above and related research linking student's subjective expectations of their future earnings to their college enrollment decision (Attanasio and Kauftmann, 2017; Attanasio and Kauftmann, 2014) and high school persistence (Jensen, 2012), it is apparent that subjective expectations can actively influence behavior. Because a student's subjective expectations about their ability and the difficulty of their degree can play an essential role in preventing and rebounding from failure (Stinebrickner and Stinebrickner, 2012), we believe the pertinent issue of understanding how students create their subjective expectations of college success and how these connect with actual performance deserves more study.

Our paper contributes to the field in three significant ways which correspond with our three research questions. First, we study how freshmen students form their subjective expectations of college success and to what extent non-cognitive skills are associated

with such subjective expectations. Second, we follow the work by Beattie et al. (2018) and Beattie et al. (2019) and explore the determinants of college academic performance and the degree to which non-cognitive skills are associated with under- and over-achievement relative to objective expectations. We complement this work by studying performance not only during the first year of college but also at graduation, and by studying its external validity in the context of US students majoring in two different fields of study; business and engineering. Work by Fonteyne et al. (2017) demonstrates that the predictive power of some student characteristics is not consistent across all disciplines so, exploring data from different disciplines and contexts is important. Finally, we analyze the extent to which students' subjective expectations are realistic or unrealistic given students' academic performance at graduation, and how the level of unrealistic expectations relate to students' non-cognitive skills and on-time graduation.

All three of these research questions are important contributions, given the heterogeneity of the student body across different fields of study and countries, and the importance of better understanding how students' subjective expectations relate to actual performance and non-cognitive skills. A better understanding of these relationships could inform the development of targeted interventions and early warning indicator systems to promote college persistence and success at graduation.

3. Data

For this project, we collected data from students majoring in business and engineering in the fall semester of 2016 at a public American university. To get a large and representative sample, as is also the case in Beatie et al. (2018), our online survey

was part of a class assignment for extra credit[2] in the freshman business course (FBC) or the freshman engineering course (FEC)[3]. This generated a sample of 1,172 business or engineering students[4] whose responses were combined with administrative records up to the Spring semester of the 2022-23 school year (i.e., 7 years later) to get the outcomes of interest including students' final GPA[5], college graduation, and other relevant control variables.

3.1 Survey

Our survey, deployed during the 2016-2017 academic year, contained questions about students' non-cognitive skills, their subjective expectations for their college careers, and general background characteristics. Item-response rates to the survey were high, with students answering 96% of the questions on average. The non-cognitive measures include questions for measuring the aforementioned Big Five personality traits (John et al., 1991), grit[6], growth mindset[7], and locus of control[8] (Duckworth and Quinn, 2009; Wellborn et al., 1989). These survey questions ask students to rate how well various statements describe themselves using variations of a five-point Likert-type scale (i.e., *Strongly Disagree, Disagree, Neither Agree or Disagree, Agree, Strongly Agree*). Each response is then averaged to develop a total score for a given trait ranging from 1 to

[2] Students had to go through all questions and get a completion code to get credit for the assignment, although they were not required to answer any of the questions for class credit.
[3] Previous attempts to get freshmen to complete a survey voluntarily generated a sample that was too small and likely too biased to be used for inference.
[4] Our sample represents 23.8% for all first time degree-seeking freshmen, with a take-up rate of 47% among all freshmen enrolled in the college of business and college of engineering.
[5] For students graduating with multiple majors, we build the cumulative final GPA as the average final GPA for the different majors.
[6] The grit scale used is the eight-item Grit-S scale modeled from Duckworth and Quinn (2009).
[7] The growth mindset scale used in a two-item scale modeled from the Education Longitudinal Study of 2002.
[8] The locus of control scale used is a six-item scale developed from the Students' Perception of Control Questionnaire (SPOCQ) (Wellborn et al., 1989).

5, with higher scores representing higher levels of that particular trait. We evaluate the reliability of each measure using Cronbach's alpha coefficients shown in Appendix Table A.1 alongside more detailed information on all non-cognitive skills survey questions. The reliability of the measures in our sample resulted in acceptable ranging from 0.64 – 0.83 in business and 0.63 – 0.88 in engineering.

Included in the survey were also students' subjective expectations of their expected GPA at graduation, which is a key outcome of interest for our research questions. This measure is the response to the following question: "What overall GPA do you predict to have by the time you finish your undergraduate education?" Responses are measured on a 0-to-4 scale.

In addition, the survey also collected direct measures of cognitive ability through a Numeracy Ability Test (NAT) on a 0-to-8 scale (Lipkus et al., 2001) and the Cognitive Reflection Test (CRT) on a 0-to-5 scale (Toplak et al., 2014). The CRT is designed to measure a participant's ability to reflect on decisions before making them, i.e., critical thinking, while the NAT measures the ability to solve problems involving basic probability and mathematical concepts. Finally, the survey includes questions covering student demographics such as gender, ethnicity, and mother's and father's education.

3.2 Administrative Data

We linked our survey data to administrative student records to gather information on our outcomes of interest and additional control variables, including the student's end-of-freshman-year cumulative grade point average (May 2017) and final cumulative grade point average at graduation, both measured on a 0-to-4 scale. Our dataset also includes

graduation status (May 2023). These are key outcomes needed for our second and third research questions. As an additional control for student's cognitive ability, in some models, we use information on ACT scores and High School GPA (HSGPA), measured on a 0-to-36 scale and a 0-to-4 scale, respectively. We also collected information about student's high school location which allowed us to create regional-state dummies to control for the variation in high school quality that could affect college performance. We also create dummy variables indicating if the survey was completed before early progress grades. Early progress grades are designed to give students feedback on their academic performance while the semester is in progress and grades can still be improved, which could influence their reported subjective expectations on final college GPA.

3.3 Summary Statistics

Table 1 shows summary statistics for our sample of 1,172 college freshmen broken down by degree program. Unsurprisingly, there are some statistically significant differences in student characteristics for the two groups. Business students are less likely to be male but more likely to be white. Students majoring in engineering have significantly higher highschool academic performance and cognitive ability, as seen by their higher HSGPAs, ACT, CRT, and NAT scores.

Most students, over 88%, completed the survey before early progress grades were released, which reduces the potential bias in reported subjective expectations. In terms of college academics, business students have significantly lower end-of-freshmen-year cumulative GPA and reported lower subjective expected GPA at graduation. This trend persisted until the end of their bachelor's degree program, where engineering students in our sample have significantly higher cumulative GPAs at graduation than their business

students counterparts. In contrast, both business and engineering students present ever graduation rates within 7 years that are equivalent, 73% for business students and 76% for engineering. Finally, among those who ever graduate, on-time graduation rates are also similar across these two fields of study, 79% for business and 76% for engineering.

Table 2 shows summary statistics for students' self-reported non-cognitive skills. We do not observe significant differences in average reported levels of conscientiousness, agreeableness, neuroticism, or growth mindset between business and engineering students. Engineering students do report significantly higher levels of openness and grit, while business students report significantly higher levels of extraversion and locus of control[9].

4. Research Questions and Empirical Strategy

4.1 Research Question 1: What are the determinants of students' subjective expectations of GPA at graduation?

Through this initial analysis, our goal is to describe how students form their subjective expectations about college success in their freshmen year. Students' subjective expectations could be influenced by past academic experiences in high school and non-cognitive skills they possess and perceive to be relevant to college success. Because business and engineering students are shown to be significantly different on the summary statistics presented above and will be taking different degree programs that may not be

[9] Pairwise correlations between the non-cognitive skills and the outcomes of interest are shown in Table A.2 in the appendix.

equally rigorous, we estimate separate models for each major[10] using the following linear regression models:

$$SubjGPA_i = \beta_0 + \beta_1 HSGPA_i + \beta_2 ACT_i + \beta_3 Big5_i + \beta_4 GM_i + \beta_5 LOC_i + \beta_6 Num_i + \beta_7 CRT_i + \beta_8 X_i + \beta_9 RegionDummies_i + \varepsilon_i$$

$$SubjGPA_i = \beta_0 + \beta_1 HSGPA_i + \beta_2 ACT_i + \beta_3 Grit_i + \beta_4 GM_i + \beta_5 LOC_i + \beta_6 Num_i + \beta_7 CRT_i + \beta_8 X_i + \beta_9 RegionDummies_i + \varepsilon_i \quad (1)$$

Where $SubjGPA_i$ is the freshmen year reported expected subjective GPA at graduation for student i, $HSPGA_i$ is their actual high school GPA, ACT_i is the ACT composite score, $Big5_i$ represents self-reported Big 5 personality traits, $Grit_i$ represents self-reported grit, GM_i represents self-reported growth-mindset, LOC_i represents self-reported locus of control, Num_i is the student's score on the numeracy ability test, CRT_i is the student's score on the cognitive reflection test, and X_i is a vector of student-level characteristics including gender, race, taking the survey before early progress reports and two dummies indicating if the student's mother and father completed college. $RegionDummies_i$ is a vector of 26 region-state level dummies indicating different areas of the multiple states of high school attendance of students in our sample including Arkansas but also neighboring states, and ε_i is an idiosyncratic error.

[10] To test if we needed to run separate models for these two majors, we run a Chow test of structural change and fail to reject the null that the coefficients for business and engineering are the same. However, given the difference of results observed across majors in separate models and differences we know across the programs (e.g. the engineering program has a mandatory mentoring program and a mandatory 3 hr intro to engineering course compared to business students who meet with an academic advisor once a semester), we believe that separate model specifications are still more appropriate in analyzing our variables of interest.

Given concerns in the literature about the strong correlation between conscientiousness and grit (Credé et al., 2017), we run separate models including either Big 5 personality traits or grit using equations (1) above[11]. In each equation the non-cognitive and cognitive skill measures are standardized, to have mean zero and standard deviation one, for ease of interpretation.

4.2 Research Question 2: What are the determinants of student performance at the end of the first year of college and graduation?

Our second research question investigates the determinants of students' performance at the end of their freshmen year and graduation. We first follow the methodology of Beattie et al. (2018) and classify students' performance both at the end of freshmen year and at graduation relative to their objective expected level, based on highschool academic performance and various student-level characteristics. This allows us to identify students who are meeting or not meeting their objective expected levels of performance. To do so, we regress their end of the freshmen year (May 2017) and final graduation cumulative GPA, respectively, on the set of high school academic variables (i.e., ACT and HSGPA), demographic variables, regional dummies and background characteristics that are predictive of college GPA (Beattie et al., 2018; Cheng et al., 2013; Geiser and Santelices, 2007; Kuh, et al., 2008), separately for each major using the following equation:

$$GPA_i = \beta_0 + \beta_1 HSGPA_i + \beta_2 ACT_i + \beta_3 Z_i + \beta_4 RegionDummies_i + \varepsilon_i \quad (2)$$

[11] We also estimated models that included Big 5 and grit scales together. Results were similar to those presented in the paper.

Where GPA_i is the May 2017 cumulative GPA and cumulative GPA at graduation for student *i*, respectively, and Z_i is a vector of student-level characteristics including gender, race, and two dummies indicating if the student's mother and father completed college. The variables in equation (2) that overlap with those in equation (1) are defined the same as described above.

Using the estimated coefficients from equation (2), student-level residuals are computed and standardized respectively for an analysis of freshmen (May 2017) GPA and final cumulative GPA among those who graduate. The estimated residual values then represent the amount of current academic performance not explained by past performance and student-level characteristics. Standardized residuals are then grouped into quartiles. As is shown in the results sections below, students in the bottom quartile of the standardized residuals performed under objective academic expectations and are labeled as "Below Objective Academic Expectations" (i.e. Divers in Beattie et al., 2018), students in the top quartile performed above their objective academic expectations and are labeled as "Above Academic Expectations" (i.e. Thrivers in Beattie et al., 2018), and students in between are labeled as "At Objective Academic Expectations".

Characteristics of Students Below, Above, and At Objective Academic Expectations

After identifying which students performed above or below objective academic expectations, at the end of their freshmen year and graduation, we study what characterizes these groups. To measure the association between various non-cognitive and cognitive skills and student performance (below, at, or above objective academic expectations) we use multinomial logistic regression models shown below. In each

equation, the non-cognitive and cognitive measures are standardized to ease interpretation.

$$Pr\left(Y = j_{1,2,3} \middle| Noncogs + Cogs\right)$$

$$= \Lambda(\beta_0 + \beta_1 Big5_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i + \beta_6 HW_i)$$

$$P\left(Y = j_{1,2,3} \middle| Noncogs + Cogs\right) =$$

$$= \Lambda(\beta_0 + \beta_1 Grit_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i) \quad (3)$$

$$\text{where } j = \begin{cases} 1 & Below\ objective\ academic\ expectations \\ 2 & At\ objective\ academic\ expectations \\ 3 & Above\ objective\ academic\ expectations \end{cases}$$

Where *Y* takes value 1 if a student *i* is classified as performing below objective academic expectations at the end of the freshmen year or graduation, given his/her high school performance and background, value 2 if the student is performing at objective academic expectations, and 3 if performing above objective academic expectations. $Big5_i$ represents self-reported Big 5 personality traits, $Grit_i$ represents self-reported grit scale, GM_i represents self-reported growth mindsets, LOC_i represents self-reported locus of control, Num_i is the individual's score to the numeracy ability test, and CRT_i is the individual's score to the cognitive reflection test.

We present estimated results as relative odds ratios. These odds ratios represent the estimated proportionate change in the probability of performing either above or below objective expectations, relative to performing at objective expectations, when the explanatory variable changes by one unit.

Finally, we estimate linear probability models[12] for the following graduation outcomes: ever graduation (within up to 7 years after freshmen year), and, among those who ever graduate, on-time 4-year graduation (in 4 years or less). For these additional analyses, we follow specifications similar to (2) with ever-graduating and on-time graduation, among those who graduate, as our outcomes.

4.3 Research Question 3: What are the determinants of unrealistic subjective expectations? Our third research question aims to better understand the relationship between subjective expectations studied in section 4.1 and student college performance studied in 4.2. In particular, we want to gain a better understanding of to what extent a student's subjective expectations could be considered realistic by comparing their subjective expectations with their actual academic performance at graduation.

Comparing their performance to their self-reported subjective expectations early in their academic career allows us to determine to what degree students come to college with unrealistic subjective expectations. Essentially, unrealistic subjective expectations are measured as the distance between what students report they are expecting as their final GPA and what they earn at graduation. Positive numbers represent greater levels of unrealistic subjective expectations in final GPA at graduation and negative numbers capture an underconfidence in their subjective expectations. For example, a student who has a subjective expectation of a 4.0 GPA upon graduation and a cumulative GPA of 3.0 at graduation is considered to have one unit of unrealistic subjective expectation. A

[12] We also estimated models using a binary choice logit instead of a linear probability model. These models lead to similar conclusions in our explanatory variables but dropped multiple observations due to perfect collinearities. For this reason, we report results of linear probability models instead.

student who has a subjective expectation of 2.0 final GPA but has a cumulative GPA at graduation of 3.0 would have -1.0 units of unrealistic subjective expectations. Meaning that student is on track to meet (or surpass) their personal goal or subjective expectations.

Unrealistic Subjective Expectations and Non-cognitive Skills

Thus, we explore what skills or traits are associated with students' levels of unrealistic subjective expectations in their final GPA by estimating linear regression models as follows, separately for business and engineering students:

$$UnrealisticExp_i = \beta_0 + \beta_1 Big5_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i + \varepsilon_i$$

$$UnrealisticExp_i = \beta_0 + \beta_1 Grit_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i + \varepsilon_i \quad (4)$$

Where $UnrealisticExp_i$ represents the measure of unrealistic subjective expectations described above and the remainder of variables are as previously defined in equation (1) above.

Unrealistic Subjective Expectations and Graduation Outcomes

Finally, we estimate a linear probability model for on-time 4-year graduation (in 4 years or less) among those who graduate. For this analysis, we follow the specification similar to (2) but add the amount of unrealistic expectations as an additional explanatory variable.

5. Results

5.1 Research Question 1: Subjective Expectations on GPA at Graduation

Table 3 shows the estimated relationship between a student's freshmen subjective expected GPA at graduation, past high school academic performance, and self-reported non-cognitive skills, for business and engineering students separately, following the

analysis described in section 4.1 above. The first thing to consider is that, as reported in Table 1 above, students both in business and engineering are coming into college with high expectations of success as indicated by their high levels of initial subjective expected final GPA. Across both business and engineering, the average student reports they expect a 3.5 and a 3.6 GPA at graduation, respectively.

Looking at the results presented in Table 3, we see that these high subjective expectations are found to increase among those who performed well in high school, as measured by high school GPA (HSGPA) and ACT scores. For instance, across columns 1 through 5, for business students, a one standard deviation increase in HSGPA and ACT score is associated with 0.040 to 0.043 points and a 0.062 to 0.066 points increase in subjective GPA at graduation, respectively. The estimates are even larger in engineering with effects for HSGPA and ACT scores ranging from 0.078 to 0.088 points and 0.075 to 0.085 points, respectively.

Further, reported non-cognitive skills are also statistically significantly associated with subjective final GPA in their freshmen year. Among business students, subjective final GPA was positively associated with conscientiousness, extraversion, and grit. In column 3, a one standard deviation increase in conscientiousness is associated with a 0.04-point increase in freshmen year reported subjective GPA at graduation. Similar patterns are seen in engineering. Conscientiousness and grit are all positively related to subjective expectations, in this case. For example, in column 10, a one standard deviation increase in grit is associated with a 0.025-point increase in reported subjective GPA at graduation. Interestingly, openness also appears marginally significantly associated with subjective GPA for Engineering students.

These results suggest students are forming their freshmen year subjective expectations of GPA at graduation based on their academic experiences in high school and perceived non-cognitive skills. Students seem to recognize the non-cognitive skills they possess and believe that these non-cognitive skills contribute to their academic success at graduation.

5.2 Research Question 2: Student Performance in the First Year of College and at Graduation

Following our approach described in section 4.2 above, we identify students who are performing above and below objective academic expectations at the end of their freshmen year and graduation. Then, we study the student characteristics associated with this range in performance. Tables 4a and 4b show the relative odds ratios of performing below ("Divers") or above ("Thrivers") objective expectations, in a student's freshmen year, relative to meeting expectations for business and engineering majors, respectively. As can be seen in these tables, conscientiousness is an important skill for freshmen year performance across both business and engineering majors. In column 1 of Table 4a, a one-standard-deviation increase in conscientiousness is associated with lower relative odds of performing below expectations compared to meeting expectations by about 0.78 times for business students at the end of their freshmen year. Conversely, for engineering students, in Table 4b, a one-standard-deviation increase in conscientiousness is associated with higher relative odds of performing above objective expectations compared to meeting expectations by about 1.3 times, see column 2. These results for business students are in line with those reported by Beattie et al. (2018) for their sample of Economics students in Canada.

Table 4b also shows that, apart from conscientiousness, engineering students with higher levels of grit are also more likely to perform above objective expectations. Similarly, engineering students with higher levels of critical thinking through the cognitive reflection test are less likely to perform below expectations. Looking at Table 4b, column 8, a one-standard-deviation increase in reported grit is associated with a higher relative odds of performing above expectations by about 1.2 times while one standard deviation increase in critical thinking performance is associated with a reduction in the probability of performing below expectations by about 0.7 times. Numeracy also has a marginally significant association with performing above objective expectations for engineering students. Interestingly, for business students, none of our cognitive measures (i.e., numeracy and cognitive reflection test scores) were statistically significantly associated with freshmen year performance above or below expectations.

Tables 5a and 5b, show the equivalent results on performance above or below objective expectations but at graduation, among those who are observed ever graduating, respectively for business and engineering students. Looking at these results, we observe that conscientiousness remains a significant predictor of performance at graduation for both business and engineering students, reducing the odds of performing below objective expectations at graduation by about 0.7 times for business students and increasing the odds of performing above objective expectations for engineering students by about 1.5 times. However, neither numerical cognitive ability nor critical thinking appears related to performance at graduation for either business or engineering students. On the other hand, other personality traits appear to be relevant for performance at graduation. Both higher levels of agreeableness and neuroticism appear related to higher odds of

performing above objective expectations for business students at graduation while grit and growth mindset appear related to better performance at graduation for engineering students. On the other hand, higher levels of locus of control appear negatively associated with the odds of performing above objective expectations for engineering students at graduation, once we condition on a set of other non-cognitive skills.

Finally, we also study the relationship between high school preparation, non-cognitive skills and the following graduation outcomes: ever graduating within 7 years, and, among those who graduate, on-time graduation in 4 years. Results for these regressions can be found in Tables 6 and 7. Overall, we find that high-school GPA appears to be the only significant predictor of graduation within 7 years for both business and engineering students while for business students, both high school grades and ACT scores appear significantly associated with ever graduating. In contrast, to results presented in Saltiel (2020) using national U.S. data from different cohorts of high school students, we do not find non-cognitive skills to be significant predictors of Bachelor's degree completion for business students, above high school preparation information. Conscientiousness appeared significant for graduation only for engineering students for one of our specifications.

Table 7 presents the results for on-time graduation, among those who graduate. As we found it was the case for ever graduating, high school grades remain the only statistically significant predictor for on-time graduation for both business and engineering students. However, in this case, ACT scores significantly predict on-time graduation for engineering students but not for business students. As was the case for ever graduating, we do not find that overall non-cognitive skills help predict on-time graduation. Only

agreeableness appears marginally significantly related to on-time graduation for engineering students.

5.3 Research Question 3: Unrealistic Subjective Expectations on College GPA at Graduation

In this final section of results, we explore the relationship between students' subjective expectations of final college GPA reported in their freshmen year and their actual cumulative GPA at graduation. This allows us to get a better understanding of the degree to which students enter college with realistic (or unrealistic) expectations of their performance. To do so, for those who graduate, we compute the difference between a student's subjective GPA at graduation as reported in freshmen year and the observed cumulative GPA at graduation, to capture the degree of unrealistic expectations. We then study the distribution of unrealistic expectations for students in both majors and all three objective graduation performance categories identified above (i.e., students performing below objective expectations (Divers), at expectations, or above objective expectations (Thrivers)), measured both at the end of freshmen year and at graduation, and the characteristics that predict these unrealistic expectations. This analysis is important as students with more unrealistic subjective expectations might not recognize they may lack the skills needed to obtain their expected academic performance and will probably struggle more to succeed in college.

Figures 1 and 2 show the distribution of unrealistic subjective expectations for business and engineering students who graduate, depending on their objective levels of performance in their freshmen year. Similarly, Figures 3 and 4 show the distribution of unrealistic subjective expectations based on objective levels of performance at

graduation. Even though all groups have some amount of unrealistic subjective expectations, students performing below objective expectations at graduation seem to have the highest levels of unrealistic subjective expectations in their freshmen year and students above expectations seem to have the lowest levels. The differences become even starker when we look at the distribution by objective performance at graduation in Figures 3 and 4. This suggests incoming freshmen, in general, may have overly optimistic subjective expectations about college performance. It is then important to study the characteristics and non-cognitive skills possessed by these students, whose performance does not meet their subjective expectations.

Unrealistic Subjective Expectations and Non-cognitive Skills

Table 8 shows the relationship between the amount of unrealistic subjective expectations reported in freshmen year, cognitive measures, and non-cognitive skills for business and engineering students who graduate. Evident within the table are the heterogeneous effects of non-cognitive skills across majors. For business students, as presented in column 2, a one standard deviation increase in conscientiousness is associated with a 0.04-point decrease in the amount of unrealistic subjective expectations. Similar results are observed for a one standard deviation increase in neuroticism among business students. Alternatively, increases in openness are positively related to unrealistic subjective expectations. Lastly, among business students, scores on the numeracy ability test consistently show a negative relationship with unrealistic subjective expectations across all models.

For engineering students, neither conscientiousness nor numeracy levels are statistically related to unrealistic subjective expectations. In contrast, those engineering freshmen who report higher levels of extraversion or openness appear to demonstrate higher levels of unrealistic expectations at graduation while engineering students who present higher levels of neuroticism present lower levels of unrealistic expectations, but these relationships are only marginally significant in this case.

Unrealistic Subjective Expectations and Graduation Outcomes

Finally, we explore the relationship between unrealistic subjective expectations and on-time 4-year graduation (in 4 years or less). Our results are presented in Table 9. These regressions follow the models presented in Table 7 but add the amount of unrealistic expectations as an additional explanatory variable. Here we standardize the amount of unrealistic expectations for ease of interpretation of our results. As we can see in Table 9, across all specifications, we observe a significant relationship between on-time graduation and the amount of unrealistic subjective expectations of performance students report during their freshmen year. A one standard deviation increase in the level of unrealistic expectations is associated with between 7.2 and 7.8 percentage points reduction in the probability of graduating on time within 4-years for business students, and between 6.7 and 7.5 percentage points for engineering students, controlling for students' level of preparation at the entrance in their freshmen year and different reported non-cognitive skills.

6. Conclusion

This paper contributes to the literature on college success in three ways. First, we study what factors are related to students' subjective expectations of college success and whether non-cognitive skills influence those subjective expectations. Second, we explore the determinants of academic performance in the first year of college and at graduation, and how well students perform relative to what would be expected based on their background and preparation at college entrance. In this respect, we complement the work of Beattie (2018) by analyzing the relationship between student performance and non-cognitive skills, within the US and for both students majoring in business and engineering. Finally, we study the degree to which students enter college with unrealistic expectations of their performance, the cognitive and non-cognitive skills characteristics associated with it, and how they might influence on-time graduation.

Among the factors related to students' expected subjective GPA at graduation, we find that, across both majors, high school academic performance plays a big role in influencing the subjective expectations of freshmen students. In addition, non-cognitive skills, such as conscientiousness and grit, are also significantly associated with students' reported subjective GPA at graduation. Overall, our results suggest that students recognize the value of high-school preparation and non-cognitive skills in their potential for academic success in college.

Next, we study students' success through their end of freshmen year and at graduation GPA performance compared to what would be predicted based on their demographic background and levels of preparation at entrance. Our results show that conscientiousness is significantly associated with business students' performance at the end of their freshmen year. These results go in line with those of Beattie et al. (2018) for

a sample of Economics students in Canada. We also find that these results remain for engineering students' performance at the end of freshmen year and also for both business and engineering students at graduation, contributing to our understanding of the relationship between conscientiousness and related skills and students' performance above objective expectations.

Our results studying graduation outcomes, however, tell a different story. In contrast with results presented by Saltiel (2020), we do not find non-cognitive skills to be statistically significant predictors of Bachelor's degree completion for both business and engineering students. This could be due to the relatively high graduation rates observed in our sample, compared with national averages. More work is needed to understand the role of non-cognitive skills in graduation outcomes.

Finally, we study students' levels of unrealistic expectations at college entrance by comparing their reported subjective GPA in freshmen year with their performance at graduation. Our results show that incoming freshmen, in general, are overly optimistic about their college performance, especially those who perform below what was expected of them based on their demographic characteristics and level of preparation at college entrance. Our results also suggest there is no single pattern of non-cognitive skills that characterize students with large amounts of unrealistic subjective expectations. We corroborate results by Beattie et al. (2018) among business students. In this case, being more organized and reliable or conscientious is found to be significantly associated with lower amounts of unrealistic subjective expectations a student has and higher odds of performing above objective expectations. However, results are different among

engineering students as we do not find conscientiousness to be associated with engineering students' levels of unrealistic expectations.

This lack of a consistent pattern across majors may reflect the self-selection of students into engineering and business or it could be due to the differing requirements by major. The engineering college at the university requires all students to meet weekly with a peer mentor to cover the behaviors required (i.e. high school college transition, academic success strategies, and personal wellness) to achieve success in their respective engineering programs. Mentoring could mask the influence of non-cognitive skills or be effective in performing the same role for students who do not already have those skills when they arrive on campus. More research is needed to determine the source of the observed differences across majors. For university administrators, this finding suggests groups of students should be analyzed separately to better identify the skills needed within their respective degree fields. Finally, however, for both engineering and business students higher levels of unrealistic expectations appear related to lower chances of on-time graduation, among those who graduate.

Given our results, How can we better help students achieve their ambitious goals? One possible intervention is to partner with students in promoting their effort and non-cognitive skills necessary for reaching their subjective expectations and succeeding in their respective fields (Hall and Sverdik, 2016). On the other hand, our findings also reveal many students come to campus as freshmen with unrealistic expectations regarding their likely academic performance in college. On-time information about their performance and mentoring to help students understand how to achieve their ambitious goals could be beneficial.

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Appendix

Table A.1: Survey Questions of all Non-cognitive Skills

Construct	Introduction to Construct	Question		Alpha		Authors
				Business	Engineering	
Conscientiousness		1. I am someone who does a thorough job 2. I am someone who can be somewhat careless 3. I am someone who is a reliable worker 4. I am someone who tends to be disorganized 5. I am someone who tends to be lazy	6. I am someone who perseveres until the task is finished 7. I am someone who does things efficiently 8. I am someone who makes plans and follows through with them 9. I am someone who is easily distracted	0.77	0.78	
Agreeableness		1. I am someone who tends to find fault with others 2. I am someone who is helpful and unselfish with others 3. I am someone who starts quarrels with others 4. I am someone who has a forgiving nature 5. I am someone who is generally trusting	6. I am someone who can be cold and aloof 7. I am someone who is considerate and kind to almost everyone 8. I am someone who is sometimes rude to others 9. I am someone who likes to cooperate with others	0.73	0.75	
Neuroticism	Here are a number of questions about yourself; there are no right or wrong answers. Please answer to the best of your ability. Indicate your level of agreement with the following statements:	1. I am someone who is depressed, blue 2. I am someone who is relaxed, handles stress well 3. I am someone who can be tense 4. I am someone who worries a lot 5. I am someone who is emotionally stable, not easily upset	6. I am someone who can be moody 7. I am someone who prefers work that is routine 8. I am someone who gets nervous easily	0.77	0.78	John, Donahue and Kentile (1991)
Openness		1. I am someone who is original, comes up with new ideas 2. I am someone who is curious about many different things 3. I am someone who is ingenious, a deep thinker 4. I am someone who has an active imagination 5. I am someone who is inventive	6. I am someone who values artistic, aesthetic experiences 7. I am someone who remains calm in tense situations 8. I am someone who likes to reflect, play with ideas 9. I am someone who has few artistic interests 10. I am someone who is sophisticated in art, music,	0.77	0.74	
Extraversion		1. I am someone who is talkative 2. I am someone who is reserved 3. I am someone who is full of energy 4. I am someone who generates a lot of enthusiasm 5. I am someone who tends to be quiet	6. I am someone who has an assertive personality 7. I am someone who is sometimes shy, inhibited 8. I am someone who is outgoing, sociable	0.83	0.88	
Grit	On the following pages you will see a number of statements that may or may not apply to you. When responding, think of how you compare to most people -- not just the people you know well, but most people in the world. There are no right or wrong answers, so just answer honestly!	1. New Ideas and projects sometimes distract me from previous ones 2. Setbacks don't discourage me 3. I have been obsessed with a certain idea or project for a short time but later lost interest 4. I am a hard worker 5. I often set a goal but later choose to pursue a different one	6. I have difficulty maintaining my focus on projects that take more than a few months to complete 7. I finish whatever I begin 8. I am diligent	0.65	0.74	(Duckworth and Quinn, 2009)
Growth Mindset	Whether a person does well or poorly in college may depend on a lot of different things. In the questions that follow, you may feel that some of these things are easier for you to change than others. In college, how possible is it for you to change:	1. Being talented 2. Liking a subject 3. Your level of intelligence 4. Putting forth a lot of effort 5. Being attentive in class	6. How easily you give up	0.69	0.63	Developed from from the Classroom Mindset from the Panorama Student Survey.
Locus of Control	How much do you agree or disagree with each of the following statements about yourself? Remember, this is not a test and there are no right or wrong answers:	1. Good luck is more important than hard work for success 2. Every time I try to get ahead, something or somebody stops me 3. Planning only makes a person unhappy since plans hardly ever work out anyway 4. People who accept their condition in life are happier than those who try to change things 5. I often feel like I don't have control over my life	6. When I make plans, I am almost certain I can make them work	0.64	0.66	Developed from the Students' Perception of Control Questionnaire (SPOCQ). Wellborn et al., (1989)

Table A.2: Pairwise Correlations between GPA, Subjective Final GPA, and Non-Cognitive Measures for Business and Engineering Students

1. GPA - May 2017	0.306*	0.246*	0.078*	-0.001	-0.137*	-0.082*	0.131*	0.034	-0.120*	0.121*	0.398***	0.682***	**Business**
2. Subjective Final GPA	1.000	0.195*	0.086*	-0.013	0.101*	0.115*	0.105*	0.086*	-0.039	0.126*	0.087**	0.220**	
3. Conscientiousness		1.000	0.353*	-0.236*	0.145*	0.106*	0.605*	0.169*	-0.345*	0.181*	0.093**	0.197**	
4. Agreeableness			1.000	-0.285*	0.195*	0.189*	0.252*	0.236*	-0.193*	0.068	0.053	0.051	
5. Neuroticism				1.000	0.074	-0.178*	-0.329*	-0.043	0.299*	-0.042	-0.057	0.064	
6. Openness					1.000	0.246*	0.058	0.127*	-0.030	0.106*	-0.060	-0.085*	
7. Extraversion						1.000	0.129*	0.043	-0.128*	0.084*	0.039	-0.051	
8. Grit								0.119*	-0.321*	0.152*	0.047	0.062	
9. Growth Mindset								1.000	-0.117*	0.016	0.035	0.001	
10. Locus of Control									1.000	-0.027	-0.053	-0.117***	
11. Study Hours Per Week										1.000	0.086**	0.106	
12. Graduated											1.000	-	
13. Cum GPA at Graduation												1.000	

1. GPA - May 2017	0.463*	0.125*	0.060	-0.044	0.016	-0.034	0.077	0.032	-0.100*	-0.020	0.533***	0.717***	
2. Subjective Final GPA	1.000	0.157*	0.086	-0.073	0.095*	0.041	0.078	0.066	-0.124*	-0.043	0.300**	0.378**	
3. Conscientiousness		1.000	0.333*	-0.237*	0.067	0.143*	0.647*	0.120*	-0.341*	0.171*	0.132***	0.096*	
4. Agreeableness			1.000	-0.272*	0.136*	0.218*	0.288*	0.173*	-0.218*	0.039	0.031	0.000	
5. Neuroticism				1.000	0.153*	-0.360*	-0.268*	-0.071	0.211*	0.019	-0.046	0.028	**Engineering**
6. Openness					1.000	0.105*	0.046	0.149*	0.013	-0.006	-0.036	0.000	
7. Extraversion						1.000	0.149*	0.097*	-0.037	0.172*	0.092	-0.119**	
8. Grit								0.042	-0.264*	0.226*	0.101**	0.063	
9. Growth Mindset								1.000	-0.166*	-0.024	0.001	0.175***	
10. Locus of Control									1.000	-0.006	-0.021	-0.165***	
11. Study Hours Per Week										1.000	0.067	-0.062	
12. Graduated											1.000	-	
13. Cum GPA at Graduation												1.000	

Figures

Figure 1: Business Students- Distribution of Unrealistic Expectations by Levels of Objective Performance at the end of Freshmen Year

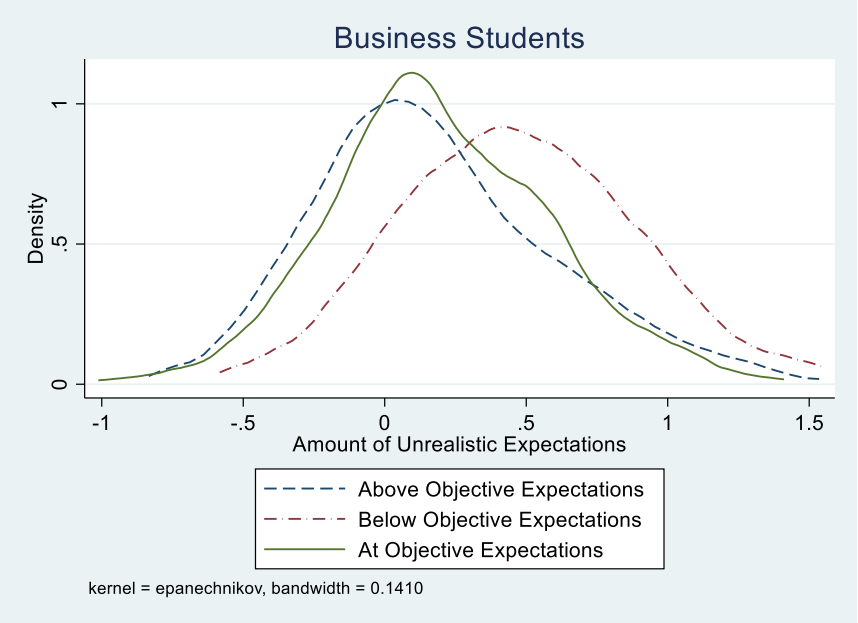


Figure 2: Engineering Students-Distribution of Unrealistic Expectations by Levels of Objective Performance at the end of Freshmen Year

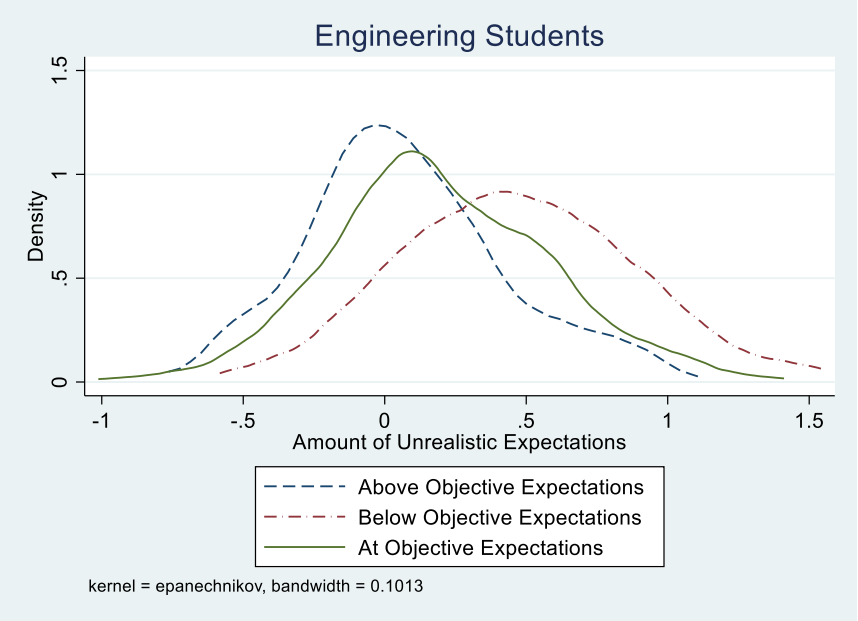


Figure 3: Business Students- Distribution of Unrealistic Expectations by Levels of Objective Performance at Graduation

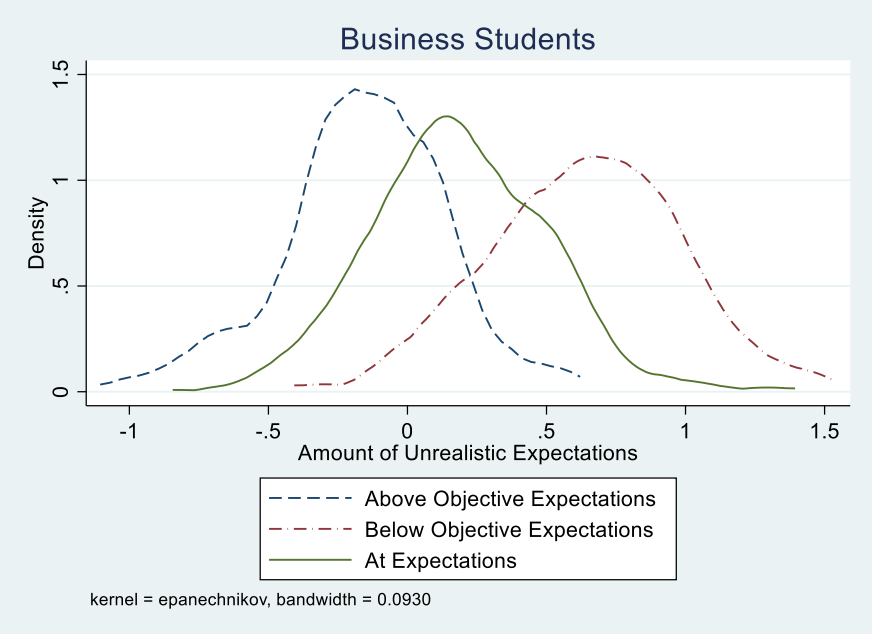
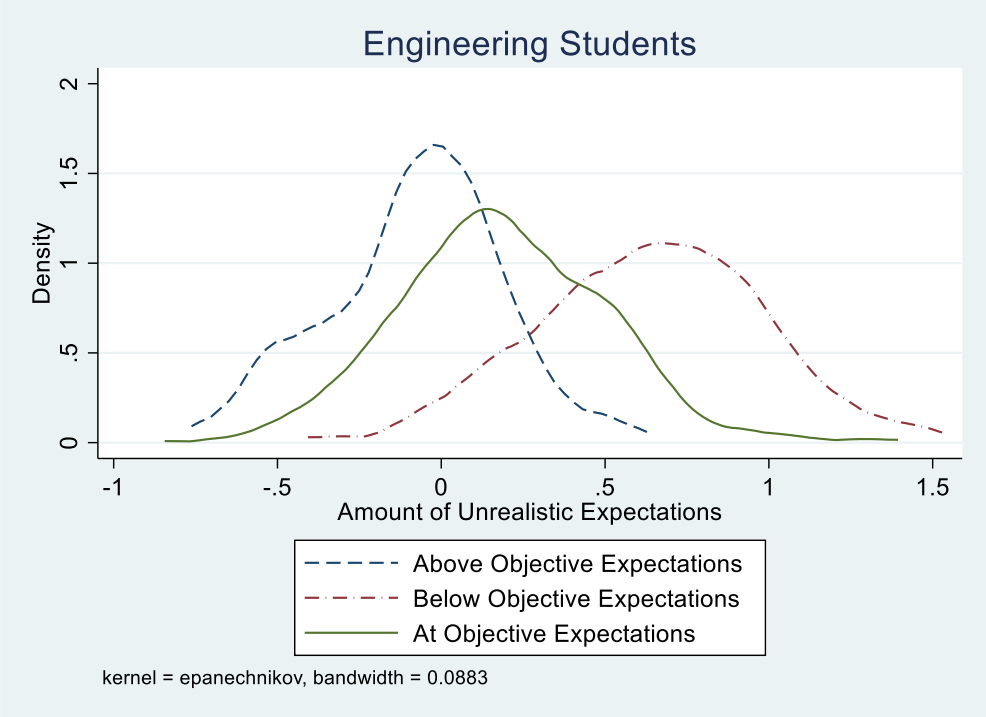


Figure 4: Engineering Students-Distribution of Unrealistic Expectations by Levels of Objective Performance at the end of Freshmen Year



Tables

Table 1. Summary Statistics of Student Characteristics and College Performance

	Business Students			Engineering Students			
Variable	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Diff. in Means**
Demographics							
Male	0.59	0.49	666	0.71	0.46	467	-0.12***
White	0.78	0.41	660	0.73	0.44	462	0.05**
Black	0.05	0.21	660	0.03	0.16	462	0.02*
Hispanic	0.05	0.22	660	0.07	0.26	462	-0.02
Asian	0.03	0.16	660	0.06	0.25	462	-0.04***
Native American	0.01	0.09	660	0.00	0.05	462	0.01
Two or More	0.09	0.28	660	0.10	0.31	462	-0.02
HSGPA	3.54	0.35	684	3.87	0.37	478	-0.33***
ACT	24.60	2.71	678	28.65	4.01	479	-4.04***
Cognitive Reflection Test	0.81	0.99	684	1.86	1.52	488	-1.05***
Numeracy Ability Test	3.93	1.68	684	5.15	1.86	488	-1.23***
Coll. Deg. Highest Edu – Mother	0.71	0.46	658	0.64	0.48	461	0.06**
Coll. Deg. Highest Edu – Father	0.70	0.46	654	0.63	0.48	458	0.07**
First Generation College Student	0.11	0.31	658	0.18	0.38	462	-0.07***
Survey Taken							
Before Early Progress Grades	0.80	0.40	684	1.00	0.00	488	-0.20***
College Academics							
GPA - May 2017	3.07	0.68	647	3.25	0.76	478	-0.19***
Accumulated Credit Hours freshmen year	26.21	6.51	684	27.40	5.88	488	-1.19***
Subjective Expected GPA	3.50	0.27	683	3.59	0.29	484	-0.09***
Ever Graduated (≤ 7 years)	0.73	0.45	684	0.76	0.43	488	-0.04
On time graduation (≤ 4 years)	0.79	0.41	496	0.76	0.43	371	0.03
Cumulative GPA at Graduation	3.27	0.39	496	3.46	0.39	371	-0.19***

Table 2. Summary Statistics of Student Non-Cognitive Skills

	Business Students				Engineering Students				
Variable	**Mean**	**Std. Dev.**	**Alpha**	**Obs**	**Mean**	**Std. Dev.**	**Alpha**	**Obs**	**Difference**
Conscientiousness	3.52	0.51	0.77	674	3.51	0.53	0.78	478	0.00
Agreeableness	3.77	0.47	0.73	674	3.72	0.51	0.75	478	0.04
Neuroticism	2.83	0.59	0.77	674	2.81	0.63	0.78	478	0.02
Openness	3.42	0.48	0.77	674	3.48	0.46	0.74	478	-0.06**
Extraversion	3.47	0.64	0.83	674	3.16	0.76	0.88	479	0.31***
Grit	3.19	0.46	0.65	669	3.24	0.52	0.74	474	-0.05*
Growth Mindset	3.97	0.59	0.69	668	3.91	0.57	0.63	469	0.06
Locus of Control	2.72	0.51	0.64	670	2.66	0.51	0.66	476	0.06*

Notes: *** p<0.01, ** p<0.05, * p <0.1

Table 3: Relationship between Subjective Expectations, Cognitive Ability and Non-cognitive Skills

	Business Students					Engineering Students				
	Subjective Expected GPA									
z-scores	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
HSGPA	0.043***	0.041***	0.042***	0.040***	0.041***	0.088***	0.082***	0.081***	0.079***	0.078***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
ACT	0.062***	0.064***	0.065***	0.064***	0.066***	0.075***	0.082***	0.082***	0.085***	0.085***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.018)	(0.020)	(0.020)	(0.020)	(0.020)
Conscientiousness		0.037***	0.040***				0.030**	0.029**		
		(0.011)	(0.011)				(0.012)	(0.013)		
Agreeableness		-0.003	-0.005				0.007	0.007		
		(0.011)	(0.011)				(0.013)	(0.013)		
Neuroticism		-0.005	-0.009				-0.020	-0.019		
		(0.011)	(0.011)				(0.014)	(0.014)		
Openness		0.014	0.013				0.022*	0.023*		
		(0.010)	(0.010)				(0.013)	(0.012)		
Extraversion		0.018*	0.019*				0.008	0.009		
		(0.010)	(0.010)				(0.012)	(0.012)		
Grit				0.029***	0.029**				0.029**	0.025**
				(0.011)	(0.011)				(0.013)	(0.013)
Growth Mindset			0.018		0.021*			-0.006		0.001
			(0.011)		(0.011)			(0.013)		(0.013)
Locus of Control			0.018		0.010			-0.007		-0.014
			(0.012)		(0.012)			(0.013)		(0.012)
Numeracy Ability Test		-0.015	-0.016	-0.012	-0.014		-0.018	-0.018	-0.018	-0.021
		(0.013)	(0.013)	(0.013)	(0.014)		(0.020)	(0.020)	(0.020)	(0.020)
Cognitive Reflection Test		0.013	0.014	0.014	0.015		0.011	0.010	0.015	0.016
		(0.012)	(0.012)	(0.012)	(0.012)		(0.016)	(0.017)	(0.017)	(0.017)
Constant	3.687***	3.596***	3.625***	3.641***	3.665***	3.829***	3.839***	3.837***	3.838***	3.833***
	(0.082)	(0.087)	(0.084)	(0.088)	(0.086)	(0.058)	(0.064)	(0.065)	(0.057)	(0.058)
Controls			Yes					Yes		
Observations	641	641	641	641	641	441	441	441	441	441
R-squared	0.196	0.229	0.235	0.209	0.215	0.312	0.344	0.345	0.323	0.325

Notes: Robust standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1. Controls include gender dummies, ethnicity dummies, parental education levels, region dummies, and a before early progress grade dummy.

Table 4a: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Academic Expectations: Business (Freshmen Year)

	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations
z-scores	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Conscientiousness	0.781**	1.302**	0.768**	1.267*				
	(0.0805)	(0.152)	(0.0825)	(0.155)				
Agreeableness	1.045	1.057	1.014	1.021				
	(0.109)	(0.126)	(0.108)	(0.124)				
Neuroticism	0.947	1.071	0.942	1.072				
	(0.0962)	(0.121)	(0.0981)	(0.124)				
Openness	1.158	0.953	1.155	0.946				
	(0.115)	(0.108)	(0.116)	(0.108)				
Extraversion	1.073	0.989	1.077	0.993				
	(0.107)	(0.109)	(0.108)	(0.109)				
Grit					0.865	1.208*	0.864	1.179
					(0.0821)	(0.127)	(0.0865)	(0.132)
Growth Mindset			1.134	1.170		1.208*	1.134	1.178
			(0.110)	(0.133)			(0.107)	(0.130)
Locus of Control			1.030	0.998			1.039	0.996
			(0.105)	(0.120)			(0.103)	(0.115)
Numeracy Ability Test	0.946	0.902	0.930	0.884	0.913	0.914	0.909	0.903
	(0.105)	(0.115)	(0.105)	(0.114)	(0.101)	(0.116)	(0.102)	(0.116)
Cognitive Reflection Test	0.923	1.006	0.936	1.019	0.936	1.008	0.940	1.014
	(0.103)	(0.123)	(0.105)	(0.125)	(0.103)	(0.124)	(0.104)	(0.125)
Constant	0.433***	0.299***	0.441***	0.304***	0.447***	0.309***	0.449***	0.310***
	(0.0407)	(0.0323)	(0.0417)	(0.0331)	(0.0416)	(0.0330)	(0.0419)	(0.0332)
Observations	674	674	667	667	669	669	667	667

Notes: Coefficients are relative odds ratios, standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1

Table 4b: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Academic Expectations: Engineering (Freshmen Year)

	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations
z-scores	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conscientiousness	1.065	1.271**	1.064	1.240*				
	(0.149)	(0.151)	(0.153)	(0.153)				
Agreeableness	0.749**	0.895	0.758**	0.906				
	(0.104)	(0.107)	(0.106)	(0.110)				
Neuroticism	0.945	0.943	0.930	0.943				
	(0.137)	(0.116)	(0.135)	(0.118)				
Openness	0.915	1.036	0.921	1.063				
	(0.121)	(0.116)	(0.124)	(0.121)				
Extraversion	1.109	0.941	1.101	0.952				
	(0.153)	(0.110)	(0.154)	(0.112)				
Grit					0.987	1.239**	1.013	1.226*
					(0.126)	(0.133)	(0.135)	(0.137)
Growth Mindset			1.030	0.895			0.988	0.901
			(0.138)	(0.0993)			(0.127)	(0.0983)
Locus of Control			1.053	0.926			1.076	0.922
			(0.144)	(0.114)			(0.141)	(0.109)
Numeracy Ability Test	1.332	1.301*	1.243	1.246	1.279	1.299*	1.244	1.260
	(0.233)	(0.200)	(0.229)	(0.200)	(0.226)	(0.201)	(0.228)	(0.201)
Cognitive Reflection Test	0.703**	0.971	0.714*	0.964	0.702**	0.973	0.710**	0.972
	(0.123)	(0.140)	(0.126)	(0.141)	(0.121)	(0.140)	(0.123)	(0.140)
Constant	0.344***	0.555***	0.355***	0.571***	0.357***	0.562***	0.363***	0.572***
	(0.0441)	(0.0599)	(0.0459)	(0.0623)	(0.0450)	(0.0607)	(0.0461)	(0.0621)
Observations	478	478	469	469	474	474	469	469

Notes: Coefficients are relative odds ratios, standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1

Table 5a: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Academic Expectations: Business (At Graduation)

	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations
z-scores	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conscientiousness	0.725***	1.125	0.680***	1.051				
	(0.0857)	(0.154)	(0.0849)	(0.151)				
Agreeableness	1.169	1.415**	1.135	1.404**				
	(0.141)	(0.205)	(0.139)	(0.205)				
Neuroticism	0.948	1.495***	0.964	1.542***				
	(0.113)	(0.205)	(0.116)	(0.216)				
Openness	1.163	0.986	1.169	0.989				
	(0.130)	(0.130)	(0.132)	(0.130)				
Extraversion	0.993	0.921	0.987	0.912				
	(0.114)	(0.121)	(0.114)	(0.120)				
Grit					0.935	1.144	0.908	1.100
					(0.102)	(0.144)	(0.104)	(0.148)
Growth Mindset			1.107	1.008			1.097	1.057
			(0.120)	(0.135)			(0.116)	(0.135)
Locus of Control			0.883	0.827			0.948	0.908
			(0.0993)	(0.119)			(0.103)	(0.122)
Numeracy Ability Test	0.983	1.100	0.930	1.051	0.966	1.096	0.943	1.065
	(0.125)	(0.171)	(0.121)	(0.167)	(0.122)	(0.170)	(0.122)	(0.169)
Cognitive Reflection Test	0.992	1.088	1.018	1.100	0.993	1.060	0.999	1.065
	(0.126)	(0.157)	(0.130)	(0.160)	(0.125)	(0.152)	(0.126)	(0.153)
Constant	0.527***	0.298***	0.535***	0.302***	0.539***	0.323***	0.537***	0.322***
	(0.0562)	(0.0399)	(0.0574)	(0.0408)	(0.0565)	(0.0409)	(0.0565)	(0.0409)
Observations	490	490	486	486	486	486	486	486

Table 5b: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Academic Expectations: Engineering (At Graduation)

	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations	Below Expectations	Above Expectations
z-scores	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Conscientiousness	1.245	1.550***	1.235	1.419**				
	(0.213)	(0.218)	(0.219)	(0.204)				
Agreeableness	1.103	1.116	1.182	1.084				
	(0.182)	(0.152)	(0.204)	(0.152)				
Neuroticism	1.183	0.972	1.156	1.015				
	(0.205)	(0.140)	(0.205)	(0.150)				
Openness	0.933	1.101	0.985	1.131				
	(0.148)	(0.144)	(0.164)	(0.152)				
Extraversion	1.062	0.791*	1.099	0.808				
	(0.174)	(0.108)	(0.186)	(0.112)				
Grit					1.226	1.479***	1.248	1.381**
					(0.190)	(0.186)	(0.204)	(0.178)
Growth Mindset			0.695**	0.997			0.720**	1.021
			(0.106)	(0.132)			(0.107)	(0.131)
Locus of Control			0.972	0.667***			0.951	0.655***
			(0.169)	(0.0996)			(0.160)	(0.0943)
Numeracy Ability Test	0.861	0.986	0.861	0.913	0.872	1.024	0.864	0.937
	(0.173)	(0.171)	(0.181)	(0.167)	(0.177)	(0.176)	(0.182)	(0.170)
Cognitive Reflection Test	1.124	1.262	1.093	1.262	1.098	1.255	1.090	1.274
	(0.227)	(0.207)	(0.223)	(0.211)	(0.220)	(0.204)	(0.220)	(0.211)
Constant	0.325***	0.575***	0.322***	0.587***	0.333***	0.588***	0.329***	0.589***
	(0.049)	(0.072)	(0.051)	(0.075)	(0.049)	(0.072)	(0.051)	(0.075)
Observations	366	366	360	360	364	364	360	360

Table 6: Relationship between EVER graduated, Cognitive Ability and Non-cognitive Skills

	Business Students					Engineering Students				
	Ever Graduated									
z-scores	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HSGPA	0.071***	0.068***	0.068***	0.070***	0.069***	0.174***	0.162***	0.163***	0.168***	0.170***
	(0.022)	(0.023)	(0.022)	(0.022)	(0.022)	(0.0250)	(0.026)	(0.026)	(0.026)	(0.026)
ACT	0.044**	0.045**	0.045**	0.045**	0.045**	0.0132	0.031	0.031	0.027	0.027
	(0.020)	(0.022)	(0.022)	(0.022)	(0.022)	(0.0271)	(0.031)	(0.031)	(0.029)	(0.030)
Conscientiousness		0.021	0.019				0.033	0.042**		
		(0.019)	(0.020)				(0.020)	(0.021)		
Agreeableness		0.008	0.005				-0.002	0.002		
		(0.020)	(0.020)				(0.021)	(0.021)		
Neuroticism		-0.011	-0.001				0.001	-0.005		
		(0.021)	(0.021)				(0.024)	(0.024)		
Openness		-0.025	-0.026				-0.025	-0.026		
		(0.019)	(0.019)				(0.020)	(0.020)		
Extraversion		0.030	0.030				0.028	0.025		
		(0.019)	(0.019)				(0.019)	(0.019)		
Grit				0.016	0.010				0.019	0.026
				(0.018)	(0.019)				(0.019)	(0.020)
Growth Mindset			0.017		0.018			-0.000		0.001
			(0.018)		(0.019)			(0.021)		(0.021)
Locus of Control			-0.0027		-0.012			0.036		0.027
			(0.019)		(0.019)			(0.022)		(0.021)
Numeracy Ability Test		-0.010	-0.012	-0.004	-0.008		-0.007	-0.000	-0.006	-0.002
		(0.023)	(0.023)	(0.023)	(0.023)		(0.028)	(0.028)	(0.028)	(0.028)
Cognitive Reflection Test		0.009	0.010	0.0063	0.007		-0.008	-0.009	-0.011	-0.012
		(0.020)	(0.021)	(0.021)	(0.021)		(0.025)	(0.025)	(0.025)	(0.025)
Constant	0.453	0.382	0.392	0.427	0.423	0.857***	0.901***	0.920***	0.867***	0.877***
	(0.317)	(0.309)	(0.307)	(0.322)	(0.323)	(0.173)	(0.182)	(0.180)	(0.182)	(0.181)
Observations	642	642	642	642	642	442	442	442	442	442
R-squared	0.090	0.100	0.101	0.091	0.093	0.274	0.288	0.293	0.277	0.281

Notes: Robust standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1. Controls include gender dummies, ethnicity dummies, parental education levels, region dummies, and a before early progress grade dummy.

Table 7: Relationship between On-time graduation (≤ 4 years), Cognitive Ability and Non-cognitive Skills

	Business Students					Engineering Students				
	On-time graduation (≤ 4 years)									
z-scores	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
HSGPA	0.106***	0.092***	0.091***	0.104***	0.103***	0.119***	0.108***	0.106***	0.109***	0.107***
	(0.024)	(0.026)	(0.026)	(0.025)	(0.025)	(0.039)	(0.040)	(0.040)	(0.039)	(0.039)
ACT	0.009	0.004	0.0053	-0.0004	-0.001	0.070*	0.098**	0.097**	0.087**	0.085**
	(0.025)	(0.025)	(0.026)	(0.025)	(0.025)	(0.036)	(0.042)	(0.042)	(0.039)	(0.039)
Conscientiousness		0.029	0.028				0.029	0.030		
		(0.020)	(0.021)				(0.029)	(0.029)		
Agreeableness		0.010	0.013				0.048*	0.046*		
		(0.021)	(0.022)				(0.025)	(0.026)		
Neuroticism		0.019	0.020				0.017	0.018		
		(0.022)	(0.022)				(0.031)	(0.032)		
Openness		-0.024	-0.023				-0.004	-0.007		
		(0.018)	(0.018)				(0.029)	(0.029)		
Extraversion		0.0023	0.0017				0.025	0.024		
		(0.021)	(0.021)				(0.026)	(0.027)		
Grit				-0.005	-0.008				0.042	0.040
				(0.021)	(0.021)				(0.026)	(0.027)
Growth Mindset			-0.017		-0.013			0.021		0.030
			(0.019)		(0.018)			(0.024)		(0.023)
Locus of Control			-0.0093		-0.016			0.006		-0.003
			(0.020)		(0.019)			(0.030)		(0.028)
Numeracy Ability Test		0.037	0.038	0.040*	0.040		0.019	0.017	0.022	0.019
		(0.024)	(0.025)	(0.024)	(0.024)		(0.034)	(0.034)	(0.034)	(0.034)
Cognitive Reflection Test		-0.023	-0.024	-0.022	-0.023		-0.042	-0.041	-0.040	-0.038
		(0.022)	(0.022)	(0.022)	(0.022)		(0.031)	(0.031)	(0.032)	(0.031)
Constant	0.959***	0.903***	0.886***	0.955***	0.930***	1.017***	1.082***	1.079***	1.068***	1.061***
	(0.082)	(0.090)	(0.093)	(0.0841)	(0.087)	(0.151)	(0.179)	(0.181)	(0.158)	(0.161)
Observations	469	469	469	469	469	339	339	339	339	339
R-squared	0.147	0.160	0.162	0.153	0.155	0.196	0.224	0.226	0.209	0.213

Notes: Robust standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1. Controls include gender dummies, ethnicity dummies, parental education levels, region dummies, and a before early progress grade dummy.

Table 8: Relationship between Unrealistic Subjective Expectations, Cognitive Measures, and Non-Cognitive Skills

	Business Students				Engineering Students			
				Unrealistic Expectations				
z-scores	(1)	(2)	(3)	(4)	(5)	(6)	7)	(8)
Conscientiousness	-0.048**	-0.041*			-0.017	-0.012		
	(0.020)	(0.022)			(0.022)	(0.023)		
Agreeableness	0.009	0.002			0.004	0.008		
	(0.020)	(0.021)			(0.020)	(0.021)		
Neuroticism	-0.045**	-0.053**			-0.026	-0.038*		
	(0.021)	(0.021)			(0.022)	(0.022)		
Openness	0.071***	0.066***			0.037*	0.038*		
	(0.020)	(0.020)			(0.021)	(0.021)		
Extraversion	0.026	0.028			0.040*	0.038*		
	(0.019)	(0.019)			(0.021)	(0.021)		
Grit			-0.008	-0.002			-0.009	-0.005
			(0.019)	(0.020)			(0.019)	(0.019)
Growth Mindset		0.033*		0.037**		-0.040*		-0.028
		(0.018)		(0.018)		(0.022)		(0.022)
Locus of Control		0.038*		0.036*		0.023		0.016
		(0.020)		(0.020)		(0.023)		(0.022)
Numeracy Ability Test	-0.065***	-0.064***	-0.066***	-0.063***	-0.016	-0.024	-0.028	-0.030
	(0.022)	(0.022)	(0.024)	(0.024)	(0.031)	(0.032)	(0.031)	(0.033)
Cognitive Reflection	0.023	0.027	0.027	0.030	-0.050*	-0.045	-0.041	-0.38
	(0.022)	(0.022)	(0.022)	(0.022)	(0.027)	(0.027)	(0.028)	(0.028)
Constant	0.250***	0.250***	0.248***	0.248***	0.190***	0.190***	0.191***	0.191***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)
Observations	489	485	485	485	365	359	363	359
R-squared	0.066	0.078	0.017	0.030	0.053	0.071	0.027	0.038

Notes: Robust standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Relationship between On-time graduation (≤ 4 years), Unrealistic Subjective Expectations, Cognitive Ability and Non-cognitive Skills

	Business Students					Engineering Students				
	On-time graduation (≤ 4 years)									
z-scores	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Unrealistic Expectations	-0.077***	-0.073***	-0.072***	-0.075***	-0.074***	-0.069**	-0.075***	-0.074***	-0.070**	-0.067**
	(0.021)	(0.021)	(0.021)	(0.020)	(0.021)	(0.029)	(0.028)	(0.028)	(0.029)	(0.028)
HSGPA	0.080***	0.071***	0.071***	0.079***	0.079***	0.096**	0.084**	0.084**	0.086**	0.085**
	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)	(0.039)	(0.040)	(0.040)	(0.039)	(0.039)
ACT	0.001	0.007	0.007	0.002	0.002	0.067*	0.099**	0.099**	0.088**	0.087**
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.035)	(0.042)	(0.042)	(0.039)	(0.039)
Conscientiousness		0.025	0.025				0.030	0.032		
		(0.019)	(0.020)				(0.029)	(0.030)		
Agreeableness		0.011	0.013				0.047*	0.046*		
		(0.021)	(0.021)				(0.025)	(0.026)		
Neuroticism		0.010	0.011				0.013	0.013		
		(0.022)	(0.022)				(0.031)	(0.032)		
Openness		-0.015	-0.015				-0.002	-0.004		
		(0.018)	(0.018)				(0.028)	(0.029)		
Extraversion		0.006	0.006				0.032	0.032		
		(0.020)	(0.020)				(0.027)	(0.027)		
Grit				-0.004	-0.006				0.042	0.041
				(0.020)	(0.021)				(0.027)	(0.027)
Growth Mindset			-0.011		-0.007			0.014		0.023
			(0.019)		(0.018)			(0.024)		(0.023)
Locus of Control			-0.004		-0.012			0.010		-0.0008
			(0.019)		(0.018)			(0.030)		(0.028)
Numeracy Ability		0.0295	0.030	0.033	0.032		0.011	0.010	0.016	0.012
		(0.0242)	(0.024)	(0.024)	(0.024)		(0.034)	(0.035)	(0.035)	(0.035)
Cognitive Reflection Test		-0.0203	-0.021	-0.019	-0.020		-0.043	-0.043	-0.040	-0.039
		(0.0213)	(0.022)	(0.022)	(0.022)		(0.031)	(0.031)	(0.031)	(0.031)
Constant	0.919***	0.868***	0.858***	0.917***	0.901***	1.070***	1.137***	1.138***	1.117***	1.110***
	(0.080)	(0.0867)	(0.089)	(0.081)	(0.092)	(0.134)	(0.163)	(0.164)	(0.141)	(0.145)
Observations	468	468	468	468	468	338	338	338	338	338
R-squared	0.181	0.189	0.190	0.185	0.185	0.214	0.244	0.245	0.227	0.229

Notes: Robust standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1. Controls include gender dummies, ethnicity dummies, parental education levels, region dummies, and a before early progress grade dummy.