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Abstract

Attending college is a significant human capital investment but only about 56% of those who start college will have a completed degree 6 years later. This makes identifying which skills are 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, and student expectations about college success. With this information we analyzed if students' subjective expectations about their future success in college were related to non-cognitive skills and whether they are realistic, as compared to student's performance trajectory at the end of their first year in college. Moreover, we compared student's academic progress at the end of the first year with what would be objectively expected for them, given their background and preparation at entrance. We identify students performing below and above objective expectations 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 and time spent studying, but the relationship between specific non-cognitive skills, academic subjective expectations and academic objective performance varies across disciplines.

Keywords: Higher Education; College; 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, the rate at which students graduate from college is relatively flat. For two decades the 6-year graduate rate for beginning college students has fluctuated between 52.0% - 56.4%. Shapiro et al. (2012) estimate the current 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). Although there is some 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, policy makers have encouraged students and institutions to consider graduation rates with policies designed to incentivize schools to increase graduation rates and 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). This would suggest the traditional characteristics used to predict college success are lacking and administrators need 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. 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 compare student's subjective expectations with their academic progress, given their background and preparation at entrance. We identify students performing below and above objective expectations and the non-cognitive skills related to their objective performance. We find that non-cognitive skills are associated with subjective expectations and objective performance in college, even after controlling for cognitive ability and time spent studying, but the relationship between specific non-cognitive skills, academic expectations and academic performance varies by discipline.

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 resulting dataset. Section 4 lays out the empirical strategy for understanding the determinants of students' subjective expectations and predicting expected academic performance based on background and preparation at entrance, which we refer to as objective expectations or objective academic expectations. In Section 5, we discuss student subjective expectations relative to actual performance at the end of the first year, and identify characteristics associated with having unrealistic subjective expectations and actually performing above (or below) what is objectively expected, based on their background and preparation at entrance. Finally, Section 6 discusses the implications of our results and presents our conclusions.

2. Literature Review

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

A body of research is underway to discover the factors relevant in predicting college success, including socio-economic status, gender, family background, and cognitive ability (Richardson, Abraham and Bond, 2012; Poropat, 2009; Cheng, Hitt and Mills, 2013; Stephan et al., 2015; Kuh, Cruce, Shoup and Kinzie, 2008). In particular, 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 (Frey and Determan, 2004; Bettinger, Evans and Pope, 2013). The increasing college enrollment rates with consistently low persistence has spurred interests

in identifying other potential factors associated with college success (Turner, 2004). This study seeks to understand those related factors.

Similarly, another strand of research studies the importance of non-cognitive or character skills and their predictive power of desirable later life outcomes, beyond that of cognitive measures. Non-cognitive skills such as conscientiousness, neuroticism and grit have been found to be associated with economic, academic and health outcomes (Lleras, 2008; Heckman, Stixrud and Urzua, 2006; Almlund et al., 2011). These effects have been measured at various stages of life including childhood (Heckman et al., 2013), adolescence (Duckworth and Quinn, 2009), adulthood (Borghans et al., 2008) and the elderly (Jackson et al., 2015). Because of their inherent relevance to a variety of desirable outcomes and populations, our paper joins those considering non-cognitive skills in a higher education setting.

The Big Five Personality traits: agreeableness, neuroticism, openness, extraversion, and conscientiousness, have become some of the most pertinent non-cognitive traits in predicting relevant life outcomes (Kyllonen et al., 2014; Conard, 2006). Conscientiousness, defined as how organized, efficient, and dutiful a person is, has been found to be an important determinant of success among the college 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, Karau and Schmeck, 2009; Chamorro-Premuzic and Furnham, 2003; O'Connor and Paunonen, 2007). Finally, the literature on openness is relatively small but suggests possible positive associations (Lounsbury et al., 2003).

Additional non-cognitive skills and mindsets, including grit and growth mindset, have also been shown to be salient in predicting higher education academic outcomes. 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. Within a sample of freshmen attending Columbia University, 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). Overall, the research highlights the relevance of non-cognitive skills in important college outcomes, but to our knowledge the literature to date has not examined how these skills may vary in their effect across various sub-groups of the college student population.

2.2 Motivation, Subjective Expectations and College Success

Additional research looks at students' college goals, expectations, and motivation (Hall and Sverdlik, 2016; Beattie, Laliberte and Oreopoulos, 2018; Komarraju, Karau and Schmeck, 2009; Clark and Schroth, 2010; Beattie, Laliberté, Michaud- Leclerc and

Oreopoulos, 2017) 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. Only three of these studies, to our knowledge, look at the relationship between academic subjective expectations and subsequent 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 developed from life-span theory of motivation to help calibrate their subjective expectations, which were measured by student's reports of how well they expected to do at the university on a 1 to 10 Likert scale, as well as their expected GPA at the end of the current semester[1]. The results are somewhat paradoxical. Participants showed higher subjective expectations and optimism but lower actual GPAs than the control group. This 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, Laliberte, and Oreopoulos (2018) and the complementing work of Beattie, Laliberté, Michaud- Leclerc and Oreopoulos (2017) who studied the relationship between past performance, objective expected performance based on student's 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, included information on high school academic performance, college performance, and non-cognitive skills, which the authors used to study the characteristics of "divers" and "thrivers." Divers were defined as

[1] Hall and Syerdlik (2016) collected an additional measure of subjective expectations measured by their expected GPA by the coming Fall semester (i.e. cumulative GPA).

students that, given their background, are expected to perform academically well but do not meet those objective expectations and thrivers are those that perform beyond their academic objective expectations, given their background and preparation. Beattie and coauthors (2018) find that divers are more likely to procrastinate and rate themselves as less conscientious. Thrivers spend more hours studying and have higher expectations for their GPA at the end of the current school year. While Beattie and coauthors (2017) find that thrivers are more likely to use university resources and divers often face personal issues beyond the university. Overall, the literature is not well developed on the relationship between subjective expectations and actual performance, and because a student's subjective expectations about their own ability and the difficulty of their degree can play an important role in preventing failure and rebounding from failure, we believe this is a non-trivial issue that deserves more study.

Our paper contributes to the field in three ways. 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 expand the work of Hall and Sverdlik (2016) and Beattie, Laliberte and Oreopoulos (2018) to analyze the extent to which student subjective expectations are realistic or unrealistic given their current academic trajectory. Lastly, we complement the work of Beattie, Laliberte, and Oreopoulos (2018) by analyzing the relationship between non-cognitive skills and the variation of college performance above and below objective expectations, given student background and high school performance, in the context of US students majoring in two different fields of study, business and engineering. These are all important contributions, given the heterogeneity of the student body, across different

fields of study and countries, and the importance of better understanding how student's subjective expectations relate to actual performance and non-cognitive skills. Once the relationship is better understood, targeted interventions can be developed with the aim of promoting college persistence and graduation.

3. Data

Data for this project was collected from students majoring in business and engineering in the fall semester of 2016 at a public American university. Previous attempts to get freshmen to complete survey voluntarily were disappointing. To get a larger and more representative sample for this project the online survey was part of a voluntary assignment[2] in the freshman business course (FBC) or the freshman engineering course (FEC), respectively. A total of 1,183 surveys were collected. Survey results were combined with administrative records to get the outcomes of interest and relevant control variables. Eleven students were subsequently dropped from the sample for having a major other than business or engineering, giving us an analytic sample of 1,172 students.

3.1 Survey

Our survey was deployed during the 2016-2017 academic year and contains questions pertaining to the student's non-cognitive skills, their subjective expectations for their college career, and general background characteristics. Out of 217 total questions, on average 96% of questions received a response. The non-cognitive measures include

[2] Students had to go through all of the 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.

conscientiousness, agreeableness, neuroticism, openness, and extraversion, which come from the Big Five Inventory of personality traits (John, Donahue and Kentile, 1991). Other collected non-cognitive measures include grit[3], growth mindset[4], and locus of control[5] (Duckworth and Quinn, 2009; Wellborn et al., 1989). These non-cognitive 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 was averaged to develop a total score for a given trait ranging from 1 to 5, with higher scores representing higher levels of that particular trait. Items were reverse coded when the statements are phrased to indicate a lack of that trait. We evaluate the reliability of each measure using Cronbach's alpha as can be seen in Appendix Table A.1 alongside more detailed information on all non-cognitive skills survey questions.

Included in the survey are student's subjective expectations of their expected GPA at the completion of their college career, which is a key outcome of interest. This measure is the response to the following question from the survey, "What overall GPA do you predict to have by the time you finish your undergraduate education?" It is 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, Samsa and Rimer, 2001) and a Cognitive Reflection Test (CRT) on a 0 to 5 scale (Toplak, West and Stanovich, 2014). The CRT is designed to measure a participant's ability to reflect on decisions before

[3] The grit scale used in the eight-item Grit-S scale modeled from (Duckworth and Quinn, 2009)
[4] The growth mindset scale used in a two-item scale modeled from the Education Longitudinal Study of 2002.
[5] The locus of control scale used is a six-item scale developed from the Students' Perception of Control Questionnaire (SPOCQ) (Wellborn et al., 1989).

making them, i.e. critical thinking, while the Numeracy scale measures the ability to solve problems involving basic probability and mathematical concepts. We also incorporate a measure of study habits, assessed as the number of hours spent studying per week, ranging from 0 to 12+ hours[6]. Finally, the survey includes questions covering student demographics such as gender, ethnicity, private school attendance, homeschool attendance, mother's education, and father's education.

3.2 Administrative Data

We link our survey data to administrative student records to gather information on our outcome variables of interest and additional controls, including student's end of freshman year cumulative grade point average or their May 2017 cumulative GPA (measured on a 0 to 4 scale). As a 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 collect information about student's high school location, allowing us to create regional state dummies to control for variation in high school quality that could affect HSGPA. We also created dummy variables signifying if the student completed the survey 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. Lastly, we include a measure of total credit hours accumulated at the end of the first spring semester after starting school, which was May 2017.

[6] Hours spent studying is measured on a 1 to 5 point scale, where 1-5 represent 0-2 hours, 3-5 hours, 6-8 hours, 9-11 hours, and 12+ hours, respectively.

3.3 Summary Statistics

Table 1 shows summary statistics for our sample of 1,172 college freshman; comparing the 684 students majoring in business and 488 students majoring in engineering. Business students are less likely to be male but more likely to be white. Students majoring in engineering have significantly higher 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 GPAs, accumulated credit hours, and subjective expected GPAs at graduation. Both majors report the same average amount of time spent studying per week.

<<Insert Table 1 Here>>

Table 2 shows summary statistics for students' self-reported non-cognitive skills. There are no significant differences in reported levels of conscientiousness, agreeableness, neuroticism, or growth mindset between business and engineering students. Business students do report significantly lower levels of openness and grit than engineering students, while engineering students report significantly lower levels of extraversion and locus of control.

<<Insert Table 2 Here>>

To gain insight on the relationship between our non-cognitive skill measures and outcomes of interests, pairwise correlations are shown in Table 3. The top portion of

Table 3 shows pairwise correlations for business students and as expected conscientiousness, grit, and reported study hours are each positively correlated with May 2017 cumulative GPA. Smaller but significant positive and negative correlations are observed with agreeableness and extraversion, respectively. Surprisingly, locus of control has a small but negative correlation. Similar patterns are not seen for engineers. Conscientiousness is the only measure that shows a positive and significant correlation with May 2017 cumulative GPA among engineers. Again, locus of control also shows a negative correlation. Overall, these findings show the potential heterogeneous effects of non-cognitive skills across majors, which is a possibility we explore in our analysis.

<<Insert Table 3 Here>>

4. Empirical Strategy

4.1 Subjective Expectations of college GPA at graduation

Through this initial analysis our goal is to identify how students form their subjective expectations about college success as they enter college. 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 reach those expectations. Because of the concerns of high correlation between grit and conscientiousness, as the literature has argued grit could be a sub-factor of conscientiousness (Credé, Tynan and Harms, 2017), we run separate models including either Big 5 personality traits or grit using equations 1 and 2 shown below, respectively. In each equation the non-cognitive and cognitive skills measures are standardized, to have mean zero and standard deviation one, to ease interpretation. Because business and engineering students are shown to be

different on the summary statistics presented above, we estimate separate models for each major; both following these linear regression models:

$$SubjGPA_i = \beta_0 + \beta_1 HSGPA_i + \beta_2 ACT_i + \beta_3 Big5_i + \beta_4 GM_i + \beta_5 LOC_i + \beta_6 Num_i + \beta_7 CRT_i + \beta_8 X_i + \beta_9 RegionDummies_i + \varepsilon_i \quad (1)$$

$$SubjGPA_i = \beta_0 + \beta_1 HSGPA_i + \beta_2 ACT_i + \beta_3 Grit_i + \beta_4 GM_i + \beta_5 LOC_i + \beta_6 Num_i + \beta_7 CRT_i + \beta_8 X_i + \beta_9 RegionDummies_i + \varepsilon_i \quad (2)$$

Where $SubjGPA_i$ is the reported subjective expected final 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 students'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 grades and two dummies indicating if the student's mother and father completed college. $RegionDummies_i$ is a vector of region level dummies indicating the state of high school attendance, and ε_i is an idiosyncratic error.

4.2 Expected Performance Based on Background Characteristics

We follow the methodology of Beattie, Laliberte, and Oreopoulos (2018) and classify students as meeting or not meeting their objective expected level of performance based on past academic performance and various student level characteristics.

To identify students that are meeting or not meeting their objective expected level of performance we regress their May 2017 cumulative GPA on the set of high school academic variables (i.e. ACT and HSGPA), demographic variables, regional dummies and background characteristics that have been found to be predictive of college GPA (Beattie, Laliberte and Oreopoulos, 2018; Cheng, Hitt and Mills, 2013; Geiser and Santelices, 2007; Kuh, et al., 2008), separately for each major using the following equation:

$$GPA_i = \beta_0 + \beta_1 HSGPA_i + \beta_2 ACT_i + \beta_3 Z_i + \beta_4 RegionDummies_i + \varepsilon_i \quad (3)$$

Where GPA_i is the May 2017 cumulative GPA for student i 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 (3) that overlap with those in equations (1) and (2) are defined similarly.

Using the estimated coefficients from equation (3), student level residuals are computed and standardized to have mean zero and a standard deviation of one. 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. Students in the bottom quartile of the standardized

residuals are labeled as "Below Objective Academic Expectations", students in the top quartile are labeled as "Above Objective Academic Expectations" and students in the middle 50% of the distribution represent "Meeting Objective Academic Expectations".

4.3 Unrealistic Subjective Expectations

As a supplementary analysis to the investigation on student's subjective expectations described above in section 4.1, we study to what extent a student's subjective expectations could be considered realistic by comparing their reported subjective expectations with their actual academic trajectory at the end of the freshmen year. Because enough time has not elapsed since data collection during the 2016-2017 academic year, GPA at graduation is still unavailable. To overcome this limitation, we compare their subjective expectations of GPA at graduation to a projected final GPA that is a function of current performance and course load to determine to what extent their reported subjective expectations can be considered unrealistic.

To estimate projected final GPA at graduation given end of freshmen year performance, we use data from 9 cohorts of about 15,000 freshmen from 2004 to 2012[7] at the same institution from which our data was collected. Using this data, we then run the following regression for business and engineering students separately:

$$FinalGPA_i = \beta_0 + \beta_1 GPA_i + \beta_2 Hours_i + \varepsilon_i \quad (4)$$

Where $FinalGPA_i$ is the cumulative GPA at graduation for student *i, GPA* is the cumulative GPA at the end of freshman year for student *i* and $Hours_i$ is the total hours

[7] The cohorts includes the use of 4 and 6-year graduation rates and was the source of analysis for Cheng, Hitt and Mills (2013).

accumulated by the end of the freshmen year. The estimated coefficients ($\widehat{\beta_0}, \widehat{\beta_1}$ and $\widehat{\beta_2}$) from equation (4) allow us to predict cumulative GPA at graduation for business and engineering students within our analytic sample. This predicted cumulative GPA at graduation would represent the final GPA for each student in our sample if they continue on the academic trajectory shown during freshman year. We then subtract this predicted cumulative GPA at graduation from the student's reported subjective GPA at graduation to result in a measure of unrealistic subjective expectations. Essentially, unrealistic subjective expectations are measured as the distance between what students report they are expecting as final GPA and what trajectory their current academic achievement predicts them to be on. Positive numbers represent greater levels of unrealistic subjective expectations in final GPA at graduation and negative numbers capture an under confidence in their subjective expectations. For example, a student who has a subjective expectation of a 4.0 GPA upon graduation and a predicted GPA of 3.0 at graduation, given their freshman year performance, is considered to have a one-unit of unrealistic subjective expectation. A student who has a subjective expectation of 2.0 but has a predicted 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.

4.4 Unrealistic Subjective Expectations and Non-cognitive Skills

Additionally, we explore what skills, traits, or actions are associated with the amount of unrealistic subjective expectations a student possesses. To do this we estimate the following two equations separately for business and engineering students:

$$UnrealisticExp_i = \beta_0 + \beta_1 Big5_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i + \beta_6 HW_i + \varepsilon_i \quad (5)$$

$$UnrealisticExp_i = \beta_0 + \beta_1 Grit_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i + \beta_6 HW_i + \varepsilon_i \quad (6)$$

Where *UnrealisticExp*$_i$ represents the amount of unrealistic subjective expectations produced in Section 4.3 and HW_i is the student's reported number of study hours per week. The variables in equations (5) and (6) that overlap with those in equations (1) and (2) are defined similarly.

4.5 Characteristics of Students Below and Above Objective Academic Expectations

Finally, we also study what non-cognitive skills characterize students performing below and above objective academic expectations, as estimated following the description in section 4.2 above. To measure the association between various non-cognitive and cognitive skills and student performance (above, below or at objective academic expectations) we use a set of multinomial logistic regression models shown below. In each equation the non-cognitive and cognitive measures are standardized to ease interpretation (i.e. presented in terms of standard deviation changes).

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

$$= \beta_0 + \beta_1 Big5_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i + \beta_6 HW_i + \varepsilon_i \quad (7)$$

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

$$= \beta_0 + \beta_1 Grit_i + \beta_2 GM_i + \beta_3 LOC_i + \beta_4 Num_i + \beta_5 CRT_i + \beta_6 HW_i + \varepsilon_i \quad (8)$$

Where Y takes value 1 if a student i is classified as performing below objective academic expectations at the end of the freshmen year, 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, CRT_i is the individual's score to the cognitive reflection test, HW_i is the student's reported number of study hours per week and ε_i is the idiosyncratic error assumed to follow a logistic distribution.

We present estimated coefficients as relative odds ratios. Which provide us with an estimate of the proportionate change in the probability of performing either above or below objective expectations relative to meeting objective expectations when the explanatory variable changes by one unit.

5. Results

5.1 Subjective Expectations on GPA at Graduation

Table 4 shows the relationship between a student's reported subjective expected GPA at graduation, past high school academic performance, and self-reported non-cognitive skills for business and engineering students separately. Overall, we observe that

students both in business and engineering are coming into college with high initial reported subjective expectations. Across both business and engineering the average student is reporting to expect a 3.6 and a 3.8 GPA at graduation, respectively. These high subjective expectations are found to increase with past high school academic performance as measured by HSGPA and ACT. For instance, across columns 1 through 5, in business, a one standard deviation increase in HSGPA and ACT score are associated with 0.041 to 0.043 point and a 0.062 to 0.066 point increases 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 significant in predicting reported subjective GPA at graduation. In business, reported conscientiousness, extraversion, grit and growth mindset, show significant positive associations. In column 3, a one standard deviation increase in conscientiousness is associated with a 0.04-point increase in reported subjective GPA at graduation. Similar patterns are seen in engineering. Conscientiousness, openness, and grit are all positively related to subjective expectations. For example, in column 10, a one standard deviation increase in grit is associated with a 0.03-point increase in reported subjective GPA at graduation. These results suggest students are forming their subjective expectations of GPA at graduation based on their academic experiences in high school and perceived non-cognitive skills. Students seem to recognize the importance of non-cognitive skills to succeed.

<<Insert Table 4>>

5.2 Objective Expected Performance Based on Background at College Entrance

Table 5 shows the regression results for the model presented in equation (3) of the relationship between end of the freshmen year cumulative GPA, past high school academic performance, and background characteristics, for business and engineering students separately. This analysis is to study student's actual GPA performance at the end of the freshmen year and differentiate students performing below and above objective expectations. We then study the relationship between student reported non-cognitive skills and the probability of student's performing at each of these levels.

High school GPA and ACT scores are significant predictors of May 2017 cumulative GPA across both samples. For instance, a one standard deviation increase in HSGPA is associated with a statistically significant 0.26-point increase in May 2017 cumulative GPA for students majoring in business and a 0.43-point increase for students majoring in engineering. Overall, student demographics and preparation at college entrance allow us to explain about 27% and 45% of the variation in May 2017 cumulative GPA for business and engineering students, respectively. This result is consistent with those found in previous literature (Kuh et al., 2008; Stephan et al., 2015).

<<Insert Table 5>>

5.3 Unrealistic Subjective Expectations on College GPA at Graduation

In this section, we study the relation between student's reported subjective expectations of final college GPA at graduation and their expected actual GPA based on their observed May 2017 cumulative GPA. This allows us to get a better understanding of the degree to which students enter college with realistic (or unrealistic) expectations of

their performance. This is important as students with larger amounts of unrealistic subjective expectations would need to overcome the challenge of performing at their desired reported GPA at graduation.

We first estimate an equation for the relationship between objective cumulative GPA at the end of freshmen year and final college GPA, based on data from 9 cohorts of students observed from freshmen year to graduation during the years 2004 and 2012, as described in equation (4) in section 4.3 above. Table 6 shows estimated coefficients from this regression equation presented in (4). Both business and engineering majors revealed that cumulative GPA at the end of the freshmen year and the number of credit hours completed by then are significant predictors of actual college GPA at graduation, explaining almost 80% of the variation.

<<Insert Table 6 Here>>

Using these regression coefficients, we predict expected objective GPA at graduation, given May 2017 cumulative GPA for students in our sample. Table 7 shows descriptive statistics for these projected college GPAs at graduation based on the estimated coefficients of model (4) presented earlier. We use these estimates to compare freshmen student's subjective college GPA at graduation with their objective predicted GPA, based on the actual performance at the end of the freshmen year. This allows us to study whether students hold realistic or unrealistic subjective expectations of their college success. To do so, we compute the difference of a student's reported subjective GPA at graduation and the projected expected actual GPA at graduation as the amount of unrealistic expectations and study the results for students in both majors and for all three objective freshmen year performance categories identified above (i.e. students

performing below objective expectations, meeting expectations or above objective expectations). In column 1 of Table 7, we observe business students performing below objective expectations are averaging over one point lower in projected objective college GPA compared to students performing above expectations. In column 3, those same students are found to have significantly larger amounts of unrealistic subjective expectations on their college GPA at graduation, averaging around one point of unrealistic expectations. Meaning that students whom are performing below expectations are reporting they expect to perform almost a full grade point better than their current performance would predict.

The second half of table 7 shows a similar pattern for students majoring in engineering. Engineering students performing below objective expectations are projected to have a college GPA over a point lower at graduation and present higher amounts of unrealistic subjective expectations, compared to students performing above objective expectations.

<<Insert Table 7 Here>>

Figures 1 and 2 show the distribution of unrealistic subjective expectations for business and engineering students, respectively. Even though all groups have some amount of unrealistic subjective expectations, students performing below objective expectations seem to have the highest levels of unrealistic subjective expectations and students above expectations seem to have the smallest levels. This suggests incoming freshman, 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 freshmen year performance does not meet their

subjective expectations. If this level of optimism among students performing under objective expectations is not supplemented with the characteristics and non-cognitive skills displayed by students meeting or exceeding objective expectations, these students are likely to have a difficult time meeting their high subjective expectations in college.

<<Insert Figure 1 and 2 Here>>

5.4 Unrealistic Subjective Expectations and Non-cognitive Skills

Table 8 shows the relationship between unrealistic subjective expectations, cognitive measures, non-cognitive skills, and study hours for business and engineering students. Evident within the table are the heterogeneous effects of non-cognitive skills across majors. For business students, ass presented in column 3, a one standard deviation increase in conscientiousness and neuroticism are associated with a 0.09 and a 0.05 point decrease in the amount of unrealistic subjective expectations, respectively. Alternatively, increases in openness, extraversion, and locus of control are positively related to unrealistic subjective expectations. Turning to grit, a one standard deviation increase is associated with a 0.05-point decrease in the amount of unrealistic subjective expectation, as seen in column 4. The grit effect loses statistical significance, however, when we control for reported study hours per week. Lastly, scores on the numeracy ability test consistently show a negative relationship with unrealistic subjective expectations across all models. In contrast, for engineering students, not a single non-cognitive skill is statistically related to unrealistic subjective expectations. But increases in the cognitive reflection test performance showed a consistent negative relationship with the amount of unrealistic subjective expectations.

<<Insert Table 8 Here>>

5.5 Characteristics of Students Below and Above Objective Academic Expectations

As a complementary analysis we also study the characteristics of students who perform below and above objective expectations in their freshmen year based on their background at college entrance. Tables 9 and 10 show the relative odds ratios of performing below or above objective expectations relative to meeting expectations for business and engineering majors, respectively. As can been seen in the tables, non-cognitive skills vary on their effect within major and across major. In column 5 of Table 9, a one-standard deviation increase in conscientiousness decreases the relative odds of performing below expectations compared to meeting expectations by about 0.77 times for business students. Conversely, a one-standard deviation increase in conscientiousness increases the relative odds of performing above expectations compared to meeting expectations by about 1.4 times, seen in column 6. Higher openness also increases the relative odds of performing below expectations, suggesting that students who are more imaginative and open to new ideas are more likely to underperform academically at the end of their freshmen year in business. Similar patterns can be found for grit. In Table 9, column 12, a one-standard deviation increase in grit increases the relative odds of performing above rather than meeting expectations by about 1.2 times. Neither the cognitive measures nor study hours per week show relevance in predicting performance placement for business majors.

For engineering students, a different story emerges, as seen in Table 10. Only one non-cognitive measure shows relevance in characterizing student performance in

engineering: extraversion. Being more outgoing or extraverted increases the relative odds of performing below expectations by about 1.2 times, seen in column 5. The only other consistent finding is the positive influence of the cognitive reflection test on meeting expectations versus performing below expectations. This is an important result because of the negative relationship the cognitive reflection test has on the amount of unrealistic expectations seen in Table 8. These results imply that engineering students who critically think about their decisions have a greater ability in navigating college.

<<Insert Table 9 Here>>

<<Insert Table 10 Here>>

5.6 Robustness Checks

As a robustness check to the analysis performed in sections 5.2, 5.3 and 5.5, we estimated two additional specifications. In the first alternative specification we define performing above objective expectations as being in the top 15% and performing below objective expectations as being in the bottom 15% of the residual distribution produced from equation (3), instead of considering the top and bottom quartiles as we did previously. In the second specification we define performing above and below objective expectations as being in the top 5% and bottom 5% of the distribution, respectively.

For business students we find little evidence of change in the interpretation of the results in sections 5.3 or 5.5 using the first alternative specification. Students performing below expectations have the greatest amount of unrealistic expectations and the possession of conscientiousness and grit both increase the likelihood of performing above

expectations. But study hours per week gained significance in increasing the likelihood of performing above expectations. In the second alternative specification, the direction of the results discussed in sections 5.3 and 5.5 remained unchanged, but do lose statistical significance. This lack of statistical significance found by the second specification could possibly be explained by the small sample size located in the top and bottom 5% of the distribution.

For engineers, under both alternatives specifications the results from sections 5.3 and 5.5 remain qualitatively the same; however, various non-cognitive skills become statistically significant in both specifications. In the first alternative specification agreeableness decreases your likelihood of performing below expectations, while students who are open to new experiences are more likely to perform above expectations. Similar to the findings for business students, an increase in study hours increases the chances of performing above expectations. In the second specification openness remains a significant predictor of performing above expectations while neuroticism decreases those chances. Results for both specifications using the full models of equations (7) and (8) in business and engineering can be found in the Appendix Tables A.2 and A.3.

6. Conclusion

This paper contributes to the literature on non-cognitive skills and college success in three ways. First, we try to understand what factors are related to students' subjective expectations of college success, whether those subjective expectations are realistic given performance at the end of freshmen year and whether non-cognitive skills are associated with these subjective expectations. Second, we study the extent to which students

performing above or below objective expectations, based on previous performance and background, have realistic or unrealistic subjective expectations about their own future performance. Lastly, we complement the work of Beattie, Laliberte, and Oreopoulos (2018) by analyzing the relationship between non-cognitive skills and a wide distribution of first year college outcomes, but within the US and for both students majoring in business and engineering.

Among the factors related to students' reported subjective GPA at graduation, we find that, across both majors students' high school academic performance play a big role in influencing the subjective expectations among freshmen students. In addition, through heterogeneous in their effects across majors, non-cognitive skills, such as conscientiousness and grit, are also found to be significantly associated with students' reported subjective GPA at graduation.

We then compare, students' reported subjective GPA at graduation with their predicted objective GPA, given actual performance at the end of the freshmen year, and build measures of unrealistic subjective expectations. Students performing below objective expectations have the greatest amounts of unrealistic subjective expectations on their GPA at graduation as compared to students meeting objective expectations and performing above objective expectations. These students average about a full grade point of idealistic expectations about their GPA. It appears that students on the cusp of being unsuccessful in college are the students with the greatest levels of unrealistic subjective expectations. To put this in perspective let's take a student at the end of their freshman year who has a 2.0 GPA, 30 completed credit hours, projected to have a 2.0 GPA at the end of their college career, but expects to have a 3.0 GPA when he graduates. To

overcome a grade point of unrealistic subjective expectations and to reach a 3.0 GPA at graduation, it will require this student to take at least 16 credit hours for each of the next two semesters while making 4.0 GPAs for both semesters. Once the 3.0 is achieved, the student will have to maintain their performance for the rest of their college career to meet their desired subjective expectations. Which can be a daunting task for students without the necessary non-cognitive skills.

How can we better help students achieve their ambitious goals? One possible intervention would be to partner with students in promoting the effort and non-cognitive skills necessary to reaching their subjective expectations and succeeding in their respective fields (Hall and Sverdik, 2016). Thus it is imperative to identify and understand what skills are required to succeed in college.

Our results suggest there is no single pattern of non-cognitive skills that characterizes students with large amounts of unrealistic subjective expectations or students performing below or above objective expectations in both fields of study. In business, 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. Similar patterns are observed for grit, not giving up so easily, reduces the amount of unrealistic subjective expectations while increasing the odds of performing above objective expectations.

For our main specification in engineering, only a single non-cognitive skill identified students in either tail. Students that self-report higher levels of extraversion, have higher relative odds of performing below objective expectations. But with a more restrictive definition of performing below and above objective expectations, greater

levels of openness increased the odds of performing above expectations while increased neuroticism decreased those odds.

This lack of a consistent pattern may reflect self-selection of students into engineering and business or they 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 program. Mentoring could mask the influence of non-cognitive skills behind the influence of peer advice on how to be successful in engineering. For university administrators, this finding alludes to the need of analyzing groups of students separately to better identify the skills needed to help students achieve success within their respective degree fields. Therefore, the results we saw from previous work on economics students in Canada, by Beattie, Laliberte, and Oreopoulos (2018) and Beattie, Laliberté, Michaud-Leclerc, and Oreopoulos, (2017) might not fit all students in all fields.

Our proposal is to not judge whether a student's subjective expectations are too high, but to determine if their performance, attitudes, and non-cognitive skills can be developed to prepare them to reach those optimistic subjective expectations. Because if this level of optimism among students performing under expectations is not combined with the levels of effort and non-cognitive skills required to meet or exceed expectations, these students may have a difficult time satisfying their high expectations in college.

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Figure 1: Distribution of Unrealistic Subjective Expectations: Business Students

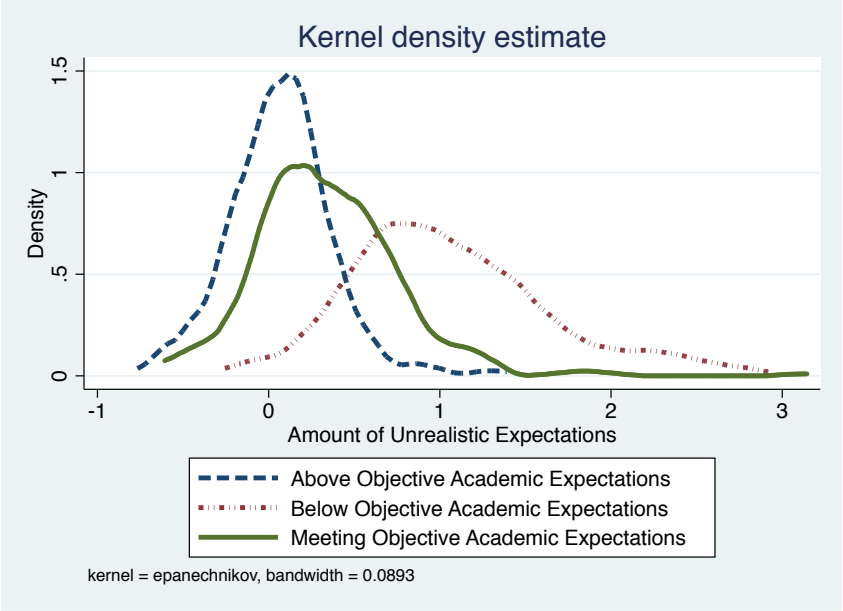

Figure 2: Distribution of Unrealistic Subjective Expectations: Engineering Students

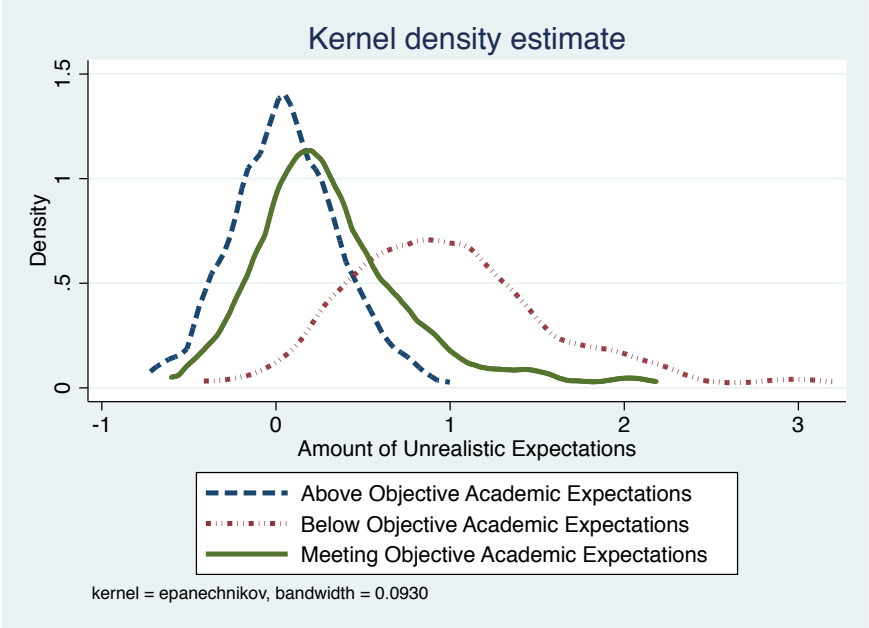

Table 1. Summary Statistics of Student Characteristics and College Performance

	Business Students		Engineering Students		
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Diff.**
Demographics					
Male	0.59	0.49	0.71	0.46	-0.12***
White	0.78	0.41	0.73	0.44	0.05**
Black	0.05	0.21	0.03	0.16	0.02*
Hispanic	0.05	0.22	0.07	0.26	-0.02
Asian	0.03	0.16	0.06	0.25	-0.04***
Native American	0.01	0.09	0.00	0.05	0.01
Two or More	0.09	0.28	0.10	0.31	-0.02
HSGPA	3.54	0.35	3.87	0.37	-0.33***
ACT	24.60	2.71	28.65	4.01	-4.04***
Private School Attendance	0.35	0.48	0.32	0.47	0.04
Homeschool Attendance	0.03	0.17	0.05	0.23	-0.02**
Cognitive Reflection Test	0.81	0.99	1.86	1.52	-1.05***
Numeracy Ability Test	3.93	1.68	5.15	1.86	-1.23***
Coll. Deg. Highest Edu - Mother	0.71	0.46	0.64	0.48	0.06**
Coll. Deg. Highest Edu - Father	0.70	0.46	0.63	0.48	0.07**
First Generation College Student	0.11	0.31	0.18	0.38	-0.07***
Survey Taken					
Before Early Progress Grades	0.80	0.40	1.00	0.00	-0.20***
College Academics					
Total Semesters	1.97	0.29	2.01	0.25	-0.04**
GPA - May 2017	3.07	0.68	3.25	0.76	-0.19***
Accumulated Credit Hours	26.21	6.51	27.40	5.88	-1.19***
Subjective Expected GPA	3.50	0.27	3.59	0.29	-0.09***
Study Hours Per Week	3.03	1.07	3.03	1.06	0.00

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

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

	2	3	4	5	6	7	8	9	10	11	
1. GPA - May 2017	0.306*	0.246*	0.078*	-0.001	-0.137*	-0.082*	0.131*	0.034	-0.120*	0.121*	
2. Subjective Final GPA	1.000	0.195*	0.086*	-0.013	0.101*	0.115*	0.105*	0.086*	-0.039	0.126*	
3. Conscientiousness		1.000	0.353*	-0.236*	0.145*	0.106*	0.605*	0.169*	-0.345*	0.181*	
4. Agreeableness			1.000	-0.285*	0.195*	0.189*	0.252*	0.236*	-0.193*	0.068	
5. Neuroticism				1.000	0.074	-0.178*	-0.329*	-0.043	0.299*	-0.042	**Business**
6. Openness					1.000	0.246*	0.058	0.127*	-0.030	0.106*	
7. Extraversion						1.000	0.129*	0.043	-0.128*	0.084*	
8. Grit								0.119*	-0.321*	0.152*	
9. Growth Mindset								1.000	-0.117*	0.016	
10. Locus of Control									1.000	-0.027	
11. Study Hours Per Week										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	
2. Subjective Final GPA	1.000	0.157*	0.086	-0.073	0.095*	0.041	0.078	0.066	-0.124*	-0.043	
3. Conscientiousness		1.000	0.333*	-0.237*	0.067	0.143*	0.647*	0.120*	-0.341*	0.171*	
4. Agreeableness			1.000	-0.272*	0.136*	0.218*	0.288*	0.173*	-0.218*	0.039	
5. Neuroticism				1.000	0.153*	-0.360*	-0.268*	-0.071	0.211*	0.019	**Engineering**
6. Openness					1.000	0.105*	0.046	0.149*	0.013	-0.006	
7. Extraversion						1.000	0.149*	0.097*	-0.037	0.172*	
8. Grit								0.042	-0.264*	0.226*	
9. Growth Mindset								1.000	-0.166*	-0.024	
10. Locus of Control									1.000	-0.006	
11. Study Hours Per Week										1.000	

Notes: * $p<0.05$ or better

Table 4: 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 5. Objective Expected Performance Based on Background Characteristics

	Business Students	Engineering Students
	GPA - May 2017	
z-scores	(1)	(2)
HSGPA	0.264***	0.434***
	(0.034)	(0.050)
ACT	0.110***	0.086**
	(0.030)	(0.049)
Constant	3.124***	2.689***
	(0.304)	(0.252)
Controls	Yes	Yes
Observations	608	432
R-squared	0.268	0.453

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, and region dummies.

Table 6: Regression Analysis on Projected Final GPA

	Business Students	Engineering Students
	Final GPA	
z-scores	(1)	(2)
2nd Sem. Cumulative GPA	0.819***	0.841***
	(0.0122)	(0.0142)
Accumulated Credit Hours	0.0104***	0.00462**
	(0.00167)	(0.00195)
Constant	0.264***	0.306***
	(0.0342)	(0.0372)
Observations	2,593	2,193
R-squared	0.790	0.789

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

Table 7: Projected Final GPA and Unrealistic Expectations

	Business Students			
	Projected GPA at Grad.		**Unrealistic Expectation**	
	(1)	(2)	(3)	(4)
	Mean	Std. Dev.	Mean	Std. Dev.
All	3.05	0.59	0.45	0.57
Meeting	3.16	0.42	0.34	0.42
Below	2.37	0.41	1.06	0.58
Above	3.50	0.26	0.07	0.30
Difference between Below and Above	-1.13***		0.99***	
	Engineering Students			
	Projected GPA at Grad.		**Unrealistic Expectation**	
	Mean	Std. Dev.	Mean	Std. Dev.
All	3.17	0.66	0.42	0.59
Meeting	3.28	0.55	0.33	0.47
Below	2.52	0.69	1.00	0.63
Above	3.57	0.32	0.06	0.30
Difference between Below and Above	-1.06***		0.95***	

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

Table 8: Relationship Between Unrealistic Subjective Expectations, Cognitive Measures, Study Hours, and Non-Cognitive Skills

	Business Students						Engineering Students					
						Unrealistic Expectations						
z-scores	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Conscientiousness	-0.109***	-0.098***	-0.093***				-0.045	-0.044	-0.042			
	(0.022)	(0.023)	(0.023)				(0.030)	(0.029)	(0.030)			
Agreeableness	-0.018	-0.017	-0.016				-0.007	-0.005	-0.005			
	(0.022)	(0.022)	(0.022)				(0.030)	(0.030)	(0.030)			
Neuroticism	-0.040*	-0.052**	-0.051**				0.000	0.004	0.006			
	(0.022)	(0.022)	(0.023)				(0.032)	(0.032)	(0.032)			
Openness	0.113***	0.106***	0.112***				0.027	0.019	0.019			
	(0.022)	(0.022)	(0.022)				(0.030)	(0.030)	(0.030)			
Extraversion	0.055**	0.057***	0.058***				0.032	0.029	0.032			
	(0.022)	(0.022)	(0.022)				(0.026)	(0.025)	(0.028)			
Grit				-0.052**	-0.043*	-0.039				-0.036	-0.034	-0.033
				(0.022)	(0.024)	(0.024)				(0.030)	(0.030)	(0.031)
Growth Mindset		0.018	0.015		0.023	0.023		0.001	0.000		0.003	0.003
		(0.021)	(0.021)		(0.022)	(0.022)		(0.026)	(0.026)		(0.027)	(0.027)
Locus of Control		0.040*	0.042*		0.040*	0.042*		-0.007	-0.006		0.001	0.001
		(0.022)	(0.022)		(0.022)	(0.022)		(0.030)	(0.030)		(0.028)	(0.028)
Numeracy Ability Test	-0.085***	-0.091***	-0.090***	-0.104***	-0.100***	-0.098***	-0.040	-0.031	-0.032	-0.034	-0.038	-0.038
	(0.025)	(0.026)	(0.026)	(0.026)	(0.027)	(0.027)	(0.042)	(0.042)	(0.042)	(0.041)	(0.042)	(0.041)
Cognitive Reflection Test	0.017	0.028	0.025	0.029	0.031	0.028	-0.106***	-0.106***	-0.108***	-0.106***	-0.103***	-0.103***
	(0.025)	(0.024)	(0.024)	(0.026)	(0.026)	(0.026)	(0.037)	(0.038)	(0.038)	(0.037)	(0.037)	(0.038)
Study Hours Per Week			-0.036			-0.028			-0.012			-0.006
			(0.022)			(0.022)			(0.031)			(0.029)
Constant	0.444***	0.441***	0.443***	0.443***	0.442***	0.444***	0.424***	0.419***	0.419***	0.419***	0.419***	0.419***
	(0.021)	(0.021)	(0.021)	(0.022)	(0.022)	(0.022)	(0.027)	(0.027)	(0.027)	(0.026)	(0.027)	(0.027)
Observations	637	630	626	632	630	626	467	458	458	463	458	458
R-squared	0.103	0.109	0.114	0.033	0.039	0.042	0.063	0.055	0.055	0.051	0.051	0.051

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

Table 9: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Academic Expectations: Business

	Below Expectations	Above Expectations	Below Expectations	Above Expectations	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)	(9)	(10)	(11)	(12)
Conscientiousness	0.770**	1.509***	0.761**	1.492***	0.773**	1.447***						
	(0.085)	(0.166)	(0.087)	(0.172)	(0.089)	(0.169)						
Agreeableness	0.966	1.028	0.953	1.006	0.960	1.013						
	(0.106)	(0.114)	(0.106)	(0.114)	(0.108)	(0.115)						
Neuroticism	0.886	1.063	0.891	1.059	0.899	1.072						
	(0.096)	(0.111)	(0.098)	(0.114)	(0.100)	(0.116)						
Openness	1.177	0.873	1.184	0.870	1.199*	0.857						
	(0.123)	(0.092)	(0.125)	(0.092)	(0.128)	(0.092)						
Extraversion	1.149	1.081	1.151	1.086	1.165	1.081						
	(0.122)	(0.110)	(0.122)	(0.111)	(0.125)	(0.111)						
Grit							0.901	1.302***	0.905	1.281**	0.920	1.247**
							(0.090)	(0.126)	(0.096)	(0.133)	(0.098)	(0.131)
Growth Mindset			1.018	1.102	1.002	1.103			1.007	1.107	0.998	1.104
			(0.101)	(0.116)	(0.102)	(0.117)			(0.097)	(0.112)	(0.098)	(0.113)
Locus of Control			1.001	1.032	1.004	1.023			1.012	0.993	1.016	0.990
			(0.106)	(0.115)	(0.107)	(0.114)			(0.104)	(0.106)	(0.105)	(0.106)
Numeracy Ability Test	0.844	0.918	0.830	0.907	0.835	0.903	0.811*	0.940	0.815*	0.934	0.822*	0.926
	(0.097)	(0.111)	(0.0967)	(0.111)	(0.098)	(0.110)	(0.093)	(0.112)	(0.094)	(0.112)	(0.096)	(0.112)
Cognitive Reflection Test	0.989	1.092	1.001	1.106	0.989	1.115	1.002	1.089	1.002	1.093	0.989	1.102
	(0.117)	(0.122)	(0.119)	(0.124)	(0.118)	(0.125)	(0.117)	(0.121)	(0.117)	(0.122)	(0.116)	(0.123)
Study Hours Per Week					0.867	1.140					0.877	1.158
					(0.090)	(0.115)					(0.088)	(0.115)
Constant	0.390***	0.385***	0.397***	0.391***	0.397***	0.392***	0.412***	0.406***	0.414***	0.408***	0.414***	0.408***
	(0.039)	(0.039)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.041)	(0.040)	(0.041)	(0.041)
Observations	674	674	667	667	663	663	669	669	667	667	663	663

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

Table 10: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Academic Expectations: Engineering

	Below Expectations	Above Expectations	Below Expectations	Above Expectations	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)**	**(9)**	**(10)**	**(11)**	**(12)**
Conscientiousness	1.051	1.164	1.015	1.123	1.017	1.101						
	(0.134)	(0.146)	(0.134)	(0.147)	(0.136)	(0.146)						
Agreeableness	0.872	0.901	0.870	0.903	0.869	0.902						
	(0.112)	(0.115)	(0.113)	(0.117)	(0.113)	(0.117)						
Neuroticism	0.988	0.848	0.986	0.849	0.988	0.836						
	(0.132)	(0.113)	(0.133)	(0.114)	(0.134)	(0.114)						
Openness	0.920	1.082	0.928	1.098	0.927	1.101						
	(0.111)	(0.131)	(0.114)	(0.135)	(0.114)	(0.136)						
Extraversion	1.235*	1.012	1.242*	1.023	1.246*	0.996						
	(0.158)	(0.128)	(0.160)	(0.131)	(0.164)	(0.130)						
Grit							1.031	1.200	1.021	1.178	1.016	1.154
							(0.121)	(0.138)	(0.125)	(0.142)	(0.127)	(0.142)
Growth Mindset			1.050	0.983	1.050	0.989			1.040	0.999	1.040	1.002
			(0.129)	(0.118)	(0.129)	(0.119)			(0.124)	(0.117)	(0.124)	(0.118)
Locus of Control			0.934	0.917	0.934	0.917			0.954	0.911	0.953	0.909
			(0.120)	(0.120)	(0.120)	(0.120)			(0.118)	(0.115)	(0.118)	(0.115)
Numeracy Ability Test	1.340*	1.194	1.232	1.113	1.233	1.121	1.293	1.168	1.221	1.109	1.223	1.115
	(0.219)	(0.197)	(0.211)	(0.192)	(0.212)	(0.193)	(0.214)	(0.194)	(0.209)	(0.189)	(0.209)	(0.191)
Cognitive Reflection Test	0.726**	1.003	0.738*	1.010	0.737*	1.026	0.723**	1.025	0.736*	1.036	0.739*	1.050
	(0.117)	(0.157)	(0.119)	(0.159)	(0.120)	(0.162)	(0.115)	(0.159)	(0.117)	(0.161)	(0.118)	(0.165)
Study Hours Per Week					0.990	1.127					1.024	1.103
					(0.122)	(0.138)					(0.124)	(0.133)
Constant	0.400***	0.403***	0.415***	0.418***	0.414***	0.415***	0.411***	0.410***	0.420***	0.419***	0.420***	0.417***
	(0.047)	(0.047)	(0.049)	(0.049)	(0.049)	(0.049)	(0.048)	(0.048)	(0.049)	(0.049)	(0.049)	(0.049)
Observations	478	478	469	469	469	469	474	474	469	469	469	469

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

Appendix

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

Construct	Introduction to Construct	Question		Likert-Scale	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	(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree	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	(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree	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	(1) Not at all possible to change (2) A little possible to change (3) Somewhat possible to change (4) Quite possible to change (5) Completely possible to change	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	(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree	0.64	0.66	Developed from the Students' Perception of Control Questionnaire (SPOCQ). Wellborn et al., (1989)

Table A.2: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Academic Expectations: Business

	15%				5%			
	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	0.651***	1.302*			0.598**	1.139		
	(0.089)	(0.176)			(0.131)	(0.245)		
Agreeableness	0.863	1.066			0.866	1.139		
	(0.114)	(0.143)			(0.182)	(0.244)		
Neuroticism	0.896	1.133			0.777	1.247		
	(0.118)	(0.143)			(0.168)	(0.261)		
Openness	1.410***	0.934			1.362	0.865		
	(0.179)	(0.118)			(0.274)	(0.175)		
Extraversion	1.127	0.897			1.111	1.121		
	(0.145)	(0.107)			(0.229)	(0.221)		
Grit			0.823	1.260*			0.804	1.064
			(0.105)	(0.157)			(0.165)	(0.214)
Growth Mindset	1.045	1.161	0.877	0.942	0.963	1.071	0.923	1.093
	(0.125)	(0.149)	(0.119)	(0.133)	(0.182)	(0.215)	(0.167)	(0.213)
Locus of Control	1.046	0.935	0.976	0.948	1.078	0.824	1.132	0.843
	(0.127)	(0.124)	(0.134)	(0.131)	(0.211)	(0.179)	(0.214)	(0.176)
Numeracy Ability Test	0.916	0.906	1.025	1.163	0.852	0.806	0.841	0.819
	(0.126)	(0.128)	(0.118)	(0.144)	(0.188)	(0.176)	(0.184)	(0.178)
Cognitive Reflection Test	0.960	0.960	1.103	0.972	1.283	0.825	1.273	0.828
	(0.135)	(0.133)	(0.130)	(0.123)	(0.268)	(0.208)	(0.260)	(0.207)
Study Hours Per Week	0.944	1.298**	0.953	1.295**	0.751	0.963	0.760	0.971
	(0.115)	(0.154)	(0.113)	(0.152)	(0.151)	(0.187)	(0.148)	(0.188)
Constant	0.168***	0.172***	0.185***	0.176***	0.0408***	0.0453***	0.0464***	0.0471***
	(0.021)	(0.021)	(0.022)	(0.021)	(0.009)	(0.009)	(0.009)	(0.009)
Observations	663	663	663	663	663	663	663	663

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

Table A.3: Non-Cognitive and Cognitive Skills Associated with Students Performing Below and Above Objective Expectations: Engineering

	15%				5%			
	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	0.871	0.914			0.851	0.747		
	(0.139)	(0.141)			(0.226)	(0.179)		
Agreeableness	0.705**	0.981			0.701	0.996		
	(0.108)	(0.152)			(0.178)	(0.248)		
Neuroticism	0.901	0.838			1.120	0.627*		
	(0.145)	(0.135)			(0.294)	(0.163)		
Openness	1.043	1.347**			0.970	1.797**		
	(0.153)	(0.201)			(0.232)	(0.469)		
Extraversion	1.250	1.008			1.264	0.769		
	(0.194)	(0.158)			(0.311)	(0.207)		
Grit			0.911	1.226			1.008	1.038
			(0.135)	(0.183)			(0.239)	(0.258)
Growth Mindset	1.145	0.878	1.110	0.926	1.250	0.989	1.189	1.138
	(0.171)	(0.123)	(0.159)	(0.126)	(0.314)	(0.244)	(0.284)	(0.265)
Locus of Control	0.924	1.071	0.993	1.143	0.668	1.090	0.762	1.210
	(0.137)	(0.163)	(0.145)	(0.168)	(0.165)	(0.268)	(0.190)	(0.275)
Numeracy Ability Test	1.272	1.243	1.236	1.198	1.134	1.431	1.105	1.312
	(0.261)	(0.256)	(0.252)	(0.241)	(0.376)	(0.494)	(0.358)	(0.441)
Cognitive Reflection Test	0.671**	0.836	0.692*	0.900	0.538*	0.518*	0.555*	0.606
	(0.132)	(0.160)	(0.132)	(0.169)	(0.178)	(0.174)	(0.178)	(0.197)
Study Hours Per Week	1.172	1.282*	1.192	1.218	0.675	1.076	0.670	0.978
	(0.171)	(0.185)	(0.169)	(0.173)	(0.170)	(0.263)	(0.167)	(0.231)
Constant	0.174***	0.177***	0.183***	0.180***	0.040***	0.038***	0.043***	0.046***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.012)	(0.011)	(0.011)	(0.011)
Observations	469	469	469	469	469	469	469	469

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