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Personality Traits and Academic Performance: Evidence from college students in Brazil[1]

Abstract: *Drawing from a sample of 534 college students from a small private college and a large public university in Rio de Janeiro, Brazil, this study investigates the effects of personality traits, measured by the Big Five (neuroticism, extroversion, openness to experience, agreeableness, and conscientiousness), Core Self-evaluation (locus of control, neuroticism, self-efficacy, and self-esteem), and Grit (loosely defined as enthusiasm and resilience), on academic performance. Controlling for socio-economic status, we find that a one-standard deviation increase in conscientiousness is associated with a 2.8% increase in Graduate-Point Average (GPA). Additionally, a one-standard deviation increase in Grit is associated with an increase of 1.8% in GPA. Moreover, we also find that extroversion and agreeableness are negatively related to academic performance. These results suggest that investing in some specific personality traits, such as Grit and conscientiousness can have significant payoffs in terms of academic performance.*

Keywords: *Personality Traits; Big Five; Academic Performance; non-cognitive skills.*

Classificação JEL: A2; A22; I2; I21; I23.

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1. Introduction

As forcefully argued by Heckman (2013) and Almlund et alli (2011), successful life outcomes, understood as having a fulfilling professional life, good personal and social relations, depends on cognitive skills, as well as on non-cognitive skills. Non-cognitive skills include physical health and personality traits, such as perseverance, self-discipline, intrinsic motivation, emotional stability, among others.

There is a large and well-established literature in economics assessing the impact of cognitive skills on earnings and educational achievement (see, for instance, Cunha et alli (2006)). In fact, since the beginning of the literature on human capital with the work of Becker (1964), the main research question was about the relationship between the accumulation of cognitive skills and its effect on the job placement and wage earnings. On the other hand, the literature studying the effects of non-cognitive skills on earnings is relatively recent, and it is largely put forward by James Heckman and his many co-authors. For instance, Heckman and Kautz (2014) study the role of character skills in predicting educational attainment and job market success. In fact, Heckman is stressing the importance of non-cognitive skills in building a "successful in life" since the early 1990s, based on his work on the impact of the General Educational Development (GED) testing program in the U.S. (see Heckman and Rubinstein, 2001, and the references therein). Heckman's work builds a bridge between economics and psychology, amplifying the scope and depth of the research effort to understand the effects of cognitive and non-cognitive skills on educational attainment and life outcomes in general. The policy implications of this research agenda go from rethinking educational evaluation systems based solely on cognitive skills, to the way parents raise their children.

Non-cognitive skills include a number of characteristics that enables an individual to fully develop his/her potential in life and be a productive member of society. These characteristics include personality traits such as self-control, perseverance, emotional stability, self-esteem, having a collaborative attitude, openness to new ideas and experiences, among others.

An important dimension of individual characteristics is his/her personality, and a central measure of personality traits is the so-called Big Five factor. According to the Big Five, there are five main global characteristics that describe efficiently an individual's personality, namely: neuroticism, extraversion, openness to new experiences, agreeableness, and conscientiousness.

There is ample evidence that certain personality traits measured by the Big Five are positively associated with increased educational attainment. For instance, Almlund et alli (2011) present evidence that conscientiousness is a strong predictor of overall educational attainment and achievement, and job performance. Goldberg et alli (1998) find evidence that conscientiousness and openness to new experiences are the two traits most strongly associated with years of study. The evidence suggests that a one-standard deviation increase in the measure of conscientiousness or openness to new experiences is associated with an increase of up to 0.2 years of study. Komarraju et alli (2008) find that conscientiousness and openness to new experiences were significantly related to intrinsic motivation, for a sample of 308 college students. Additionally, they find that four of the Big Five personality traits could account for 14% of the variance in academic performance, as measured by the graduate-point average (GPA).

Two other measures of individual traits considered to be important in the literature are the so-called Core Self-Evaluation and Grit. The Core Self-Evaluation is a personality trait that includes four dimensions, namely: Locus of control, Neuroticism, Self-efficacy and Self-esteem. The Core Self-Evaluation measure is related with the Big Five factors, in fact, it has some overlap with the Big Five, since the trait neuroticism appears in

both measures. A high score on the Core Self-Evaluation correlates positively with job satisfaction and good mental health.

The concept of Grit is a combination of passion and perseverance. It was popularized by Angela Duckworth's best-selling 2016 book, where she describes her research investigating the key predictors of success at challenging admission processes, professions, and competitions in general. For instance, some of her research was based on the "Beast Barracks", which is a seven-week training program at the West Point Academy in the U.S, an elite military school. According to Duckworth's research, the individual's level of Grit is the best predictor of who makes it through the "Beast".

One aspect of the research effort assessing the impact of individual characteristics on educational achievement is that it is primarily focused on developed countries, particularly, in the U.S, where data and researchers are abundant. Recently, however, we observe an increasing research effort in developing countries as well, particularly in Brazil. For instance, Santos and Ricci (2014) put forth a report with a proposal to measure socioemotional status and to use this information as an instrument in empirical studies assessing the effect of individual characteristics on educational achievement. Their report also contains implications for public policy.

In this paper, we study the relationship between personality traits, as measured by the Big Five factors, Core Self-Evaluation and Grit, and academic performance among college students. We address this relationship based on a sample consisting of 534 students from a small private college and a large public university in Rio de Janeiro, Brazil. Our dataset includes measures of academic performance, measures of individual traits (i.e., Big Five factors, Core Self-Evaluation and Grit), and socio-economic control variables. We analyze the data descriptively and estimate an econometric model relating individual traits and academic performance.

Based on our best econometric specification, we find that: (i) Conscientiousness and Grit are strongly associated with cumulative GPA; (ii) a one-standard deviation increase in conscientiousness is associated with an average increase in cumulative GPA of 0.21 points, which represents 2.8% of the average GPA; (iii) a one-standard deviation increase in the measure of Grit is associated with an average increase in cumulative GPA of 0.13 points, which represents 1.8% of the average GPA; (iv) Extroversion and Agreeableness are negatively associated with cumulative GPA; (v) Openness to new experiences is weakly associated with cumulative GPA.

Our paper contributes to the growing empirical literature on the effects of non-cognitive skills and individual traits on educational attainment. The evidence we find here suggests that one way of boosting academic performance is by developing students' non-cognitive abilities, such as conscientiousness and Grit. These individual characteristics are malleable, especially at younger ages. This suggests a clear avenue for an investment strategy for schools and universities in general. Instead of focusing only on hard skills, schools and universities should also promote awareness and develop individual traits such as Grit, the Big Five, and CSE.

2. Personality Traits: Big Five, Core Self-Evaluation and Grit

In this section, we define and characterize the individual traits we use in the descriptive analysis and the econometric model. An exhaustive survey on personality psychology and economics, with almost 600 references, can be found in Almlund et alli (2011). As mentioned in the introductory section, our measure of personality traits is captured by the so-called Big Five factors, the Core Self-Evaluation, and Grit.

The Big Five is a taxonomy of individual characteristics which characterizes personality traits as emanating from five big categories, which we list in Table 1 below,

together with their respective refinement.

Table 1 - Big Five Personality Traits

Dimension and its definition	High End	Low End
Neuroticism (N)/Emotional Stability (ES): N - "a chronic level of emotional instability and proneness to psychological distress"; ES - "predictability and consistency in emotional reactions, with absence of rapid mood changes."	Anxious, Angry, Depressed, Self-conscious, Impulsive, Vulnerable	Calm, Placid, Not depressed, Not self-conscious, Controlled, Secure
Extroversion: "an orientation of one´s interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability"	Warm, Gregarious, Assertive, Active, Excitement-seeking, Positive emotions	Detached, Withdrawn, Unassertive, Contemplative, Tranquility-seeking, Modulated emotions
Openness to Experience: "the tendency to be open to new aesthetic, cultural, or intellectual experiences"	Seek out new experiences, Fluid style of thought	Traditional, Conservative, Prefer familiarity to novelty
Agreeableness: "the tendency to act in a cooperative, unselfish manner"	Trusting, Straightforward, Altruistic, Compliant, Modest, Tender-minded	Suspicious, Conniving, Selfish, Noncompliant, Self-aggrandizing, Hard-headed
Conscientiousness: "the tendency to be organized, responsible, and hardworking"	Competent, Ordered, Dutiful, Achievement-striving, Self-disciplined, Deliberative	Incompetent, Disordered, Neglectful, Not achievement- striving, Not self-disciplined, Careless

Note: This table is adapted from Gray (2011), Table 15.3, p. 554, and from Almlund et alli (2011), Table 3, p. 71.

According to the definition in Table 1, neuroticism is defined as "a chronic level of emotional instability and proneness to psychological distress", whereas emotional stability is defined as "predictability and consistency in emotional reactions, with absence of rapid mood changes." An individual who scores high on the neuroticism dimension is characterized as someone who is anxious, feels angry most of the time, is depressed, impulsive, among others. On the other hand, an individual who scores low on neuroticism is calm, controlled, secured, and not depressed. Conscientiousness is defined as "the tendency to be organized, responsible and hardworking". A high score on this dimension is associated with individuals who are competent, ordered, self-disciplined and achievement-striving, whereas a low score is associated with individuals who are incompetent, disordered, neglectful, and not achievement-striving.

As discussed in the introduction, the Core Self-Evaluation (CSE) is a personality trait which involves four dimensions: locus of control, neuroticism, self-efficacy, and self-esteem. The locus of control gives a measure of the extent to which an individual feels in control of the events in his/her life. The idea is that an individual who feels in control of his/her life is more likely to feel good about his/her job and life. Neuroticism, as it appears in the CSE measure, is the same concept as in the Big Five we discussed above. Self-efficacy can be understood as the individual's own assessment of his/her ability to perform and react to a variety of situations. Individuals with a high assessment of their self-efficacy are more likely to try out new activities and feel more confident about completing new tasks successfully. Self-esteem is probably the most important domain in the CSE, and it is defined as an individual's own assessment of his/her own worth; how he/she values himself/herself as a person.

As mentioned above, the concept of Grit was popularized by Angela Duckworth 2016 best-selling book by the same name. Grit is a combination of passion and perseverance.

More specifically, it is having a passion to achieve a specific goal, presumably a top-level one, and act perseveringly to reach this goal. Grit is considered by many to be an important part of the individual character sills (see, for instance, Heckman and Kautz, 2014).

Duckworth (2016) starts her book describing the so-called "Beast Barracks" seven-week initiation training at the West Point Academy, an elite military school in the U.S. This "Beast" training occurs in the first summer at the Academy and is responsible for a substantial portion of the dropouts. According to Duckworth's research, Grit is the single best predictor of who succeeds in the "Beast" training program.

Additionally, Duckworth (2016) describes how one can "grow" Grit, from the point of view of an individual and from parents' point of view. The fact that Grit is malleable and can be "grown" is important from a policy perspective – if in fact Grit helps predict key life outcomes and it can be grown, then we have a recipe for an investment strategy in human skills.

There is a vibrant and growing literature on the effects of cultural traits, cultural differences, and economic preferences on educational attainment and student performance, that relates to our paper. For instance, Becker et ali (2018) introduce a new dataset (Global Preference Survey, GPS), based on a representative sample of 76 countries and economic and social preferences, such as patience, risk aversion, altruism, positive and negative reciprocity, and trust. They find evidence that patient individuals have higher educational attainment.

Hanushek et ali (2020) find that patience and attitudes towards risk can account for two-thirds of the cross-country variation in student achievement. Their measures of student achievement are based on PISA test scores, and their measures of patience of and attitudes towards risk are newly available from the GPS. These two measures – patience and attitudes towards risk – are important cultural traits and relate directly to the accumulation of human capital.

The relationship between economic preferences, such as attitudes towards risk and time preferences, and personality traits has been established in the literature. For instance, Becker et ali (2012) provide evidence that personality traits such as Big Five personality factors and Locus of control are highly complementary to economic preferences such as attitudes towards risk and time preferences, in explaining life outcomes in general, such as life satisfaction, subjective health, wage earnings, years of education, among others.

Along the same line, Figlio et ali (2019) study the relationship between Long-term orientation (LTO) and educational attainment. LTO is defined as "the fostering of the virtues oriented toward future rewards, perseverance and thrift", and data on LTO is generated from surveys. LTO helps building the ability to delay gratification and exert self-control. Educational achievement data comes from immigrants enrolled in elementary and secondary school in Florida. They use immigrant subjects as a strategy to isolate cultural transmission of traits from institution and other economic factors.

Figlio et ali (2019) find that immigrants from countries with high LTO have superior performance on standardized tests when compared to immigrants from countries with low LTO. Additionally, there is evidence that this superior relative performance persists over time. This finding is important because it suggests a link between cultural traits and the persistence of educational outcomes across generations.

Another important study relating economic preferences (impatience and risk aversion) with cognitive ability and connecting them with personality traits is by Dohmen et ali (2007). More specifically, they conduct a year-long experiment measuring risk aversion and impatience with a sample of about 1.000 German subjects. The subjects also take cognitive ability tests. Their main finding suggests that individuals with high

cognitive ability are more risk lovers over year-long lottery experiments and more patient over year-long time horizon in intertemporal choice experiment.

Dohmen et ali (2007) suggest that measures of cognitive ability may partly reflect personality traits such as conscientiousness as measured by the Big Five factor, rather than IQ. If so, their results would establish a link between economic preferences, such as risk aversion and intertemporal discount rate, and personality traits. They also find that openness to new experiences is positively correlated with willingness to take risks, and that extroversion correlates negatively with patience.

3. Methodology

We initially analyze the data descriptively and then we estimate our main econometric specification relating academic performance and individual traits according to the following:

$$GPA_i = \beta_0 + \beta_1 \cdot EXT_i + \beta_2 \cdot AGR_i + \beta_3 \cdot CNS_i + \beta_4 \cdot NEU_i$$
$$+ \beta_5 \cdot OPN_i + \beta_6 \cdot CSE_i + \beta_7 \cdot GRIT_i + Controls + u_i \tag{1}$$

where GPA denotes the cumulative graduate point average, EXT, AGR, CSN, NEU, and OPN denote the Big Five personality traits, respectively, extraversion, agreeableness, conscientiousness, neuroticism, and openness to new experiences. CSE denotes the score on the Core Self-Evaluation measure, and GRIT denotes a numerical measure for the concept of Grit, which we discuss above.

Our control variables include gender, age, academic status (whether the student intends to change his/her major for the following semester), number of siblings, home ownership, number of cars in the house, and college major. For students enrolled in the private college, we also asked whether students were recipients of a government-sponsored scholarship (Prouni) and whether student participate in the Fies program (a government-sponsored student loan program with subsidized interest rates). For students from the large public university, we also asked whether the student entered the university through legal quotas, and whether the student graduated from a private or a public high school.

We estimate the above model using the ordinary least squares estimator with robust standard errors. We do not expect to face serious endogeneity problems, given that it is unlikely that personality traits (variable of interest) and unobservable variables, such as ability, are correlated, which rules out a potential source of bias.

4. Data and Descriptive Analysis

To construct a numerical measure for the Big Five personality traits we use as an instrument the 44-questions questionnaire of John, Donahue, and Kentle (1991) and John, Naumann, and Soto (2008). To construct numerical measures for the Core Self-Evaluation (henceforth, CSE) and Grit we have added two questionnaires, one with twelve questions for the CSE and the other with ten questions for Grit.

The CSE questionnaire includes three questions for each of the four personality traits included in the CSE concept, namely, self-efficacy, self-esteem, locus of control and neuroticism, with three questions each. The questions range from "I am confident that I will achieve the success I deserve in life" to "Sometimes, when I fail, I feel useless and worthless". The questionnaire is available upon request.

As mentioned above, the concept of Grit is taken from Duckworth's (2016) book. To determine the level of Grit of the students, we apply the (translated to Portuguese

version) ten-question questionnaire Angela Duckworth makes available on page 55 of her 2016 book, i.e., "Grit: The Power of Passion and Perseverance".

The questions range from "New ideas and projects sometimes distract me from previous ones", to "I finish whatever I begin". The numerical measure of Grit ranges from 1 to 5, where 1 would be not Gritty at all and five would be very Gritty. Someone in the median of the distribution would have a Grit of 3.8.

We passed the questionnaires among 534 students in a small private college and in a large public university in Rio de Janeiro, Brazil, between April 17th and October 5th of 2018. The two schools differ in several dimensions. The large public university is tuition-free, and it has about 30.000 students divided between undergraduate and graduate courses. About a third of the student body entered the university through the quota system. Additionally, a large proportion of the students come from modest economic background. On the other hand, the small private college caters to a small number of well-off undergraduate students; it has about 4.000 students, and they are mostly undergraduates. Although the two schools are physically close, in fact just six subway stations apart, one can say that they are culturally distant and separated by socio-economic status.

We applied the questionnaire as follows. First, we translated all questions to Portuguese. Then, we visited the students in their classrooms and told them we were conducting a general survey about school life that would be used for academic purposes only; we tried to be as vague as possible about the purpose of the questionnaire so as not to induce them one way or another, and thereby, create any bias in their responses. Following the introduction, we asked them to fill out the questionnaire. On average, it took them ten minutes to complete the questionnaire. Table 2 displays basic descriptive statistics of our subjects.

Table 2 shows that all five personality traits exhibit similar means and standard deviation, except neuroticism (NEU) which seems to be a notch lower than the others. Additionally, the mean and the median are numerically close, which suggests that the distribution of personality traits is symmetrical. The third quartile of the distribution is numerically close across all traits, except neuroticism, which again appears to be notch lower. For instance, the third quartile of conscientiousness is the same as that of openness to new experiences, and it so happens to be the midpoint between the third quartile of extroversion and agreeableness. The first quartile of the distribution exhibits a similar pattern.

Of all personality traits, agreeableness (AGR) presents the shortest interquartile range. In this case, half of all observations fall in the interval (3.33; 4.11). On the other hand, extroversion and neuroticism present the widest interquartile range with observations falling in the intervals (2,63; 3.88) and (2.25;3.50), respectively. Conscientiousness and Core Self-evaluation have similar interquartile ranges, falling in the interval (3.00;4.00) approximately.

As shown in Table 2, the sample median of the measure of Grit is 3.45. This estimate is lower than the median Grit estimate presented by Duckworth (2016) for a "large sample of American adults", which is 3.8. Clearly, these estimates are not directly comparable since there are cultural differences between Brazil and the U.S., and Duckworth's sample consists of adults from the general population, and not college students.

Comparing the above estimates of the Big Five personality traits and the Core Self-evaluation with an older sample we have with 386 subjects taken from the same small private college in 2015, we note that these traits seem to be stable, across time and subjects. (These estimates are no shown in Table 2; They are available upon request). For instance, the Big Five personality traits for the older sample are: EXT=3.39, AGR=3.68, CNS=3.48, NEU=2.72, and OPN=3.55. These estimates are numerically close to the ones

presented in Table 2. Similarly, the Core Self-evaluation from the older sample is 3.66, which is in line with the estimate of 3.50 in Table 2.

Table 2 - Descriptive Statistics

	EXT	AGR	CNS	NEU	OPN	CSE	GRIT
Mean	3.24	3.72	3.48	2.88	3.54	3.43	3.43
Median	3.25	3.78	3.56	2.88	3.55	3.50	3.45
3rd Quartile	3.88	4.11	4.00	3.50	4.00	3.92	3.90
1st Quartile	2.63	3.33	3.00	2.25	3.10	2.92	3.00
IQR	1.25	0.78	1.00	1.25	0.90	1.00	0.90
Std	0.84	0.53	0.63	0.86	0.62	0.70	0.63
Max	5.00	4.78	4.89	5.00	5.00	5.00	5.00
Min	1.00	2.00	1.56	1.00	1.70	1.50	1.60

	GPA	Age-Pr	Age-Pu	MoEd-Pr	FaEd-Pr	MoEd-Pu	FaEd-Pu
Mean	7.17	22.03	23.56	1.96	2.01	1.52	1.47
Std	1.20	1.90	3.50	4.00	4.00	4.00	4.00
Max	9.70	30.45	53.45	1.00	1.00	1.00	1.00
Min	2.88	18.77	18.23	0.82	0.90	0.71	0.68

	Home	Car	Sib	ProUni	Fies	Female	Male
Total#	435	1.20	1.25	21	18	235	299

	#Obs	BUS	COM	ECO	ENG	NUT	OTH
Total#	534	67	50	218	118	52	30

Note: Our sample consists of 178 students from the small private college, and 356 from the large public university, making up a total of 534 students. EXT, AGR, CNS, NEU, and OPN, denote the average score in our sample of the Big Five personality traits, respectively, Extroversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience. CSE and GRIT, denote, respectively, the average score of the Core-Self Evaluation and GRIT indexes. GPA denotes the average cumulative graduate-point average, AGE-Pr and AGE-Pu denote, respectively, the average years of age of students from the private college and the public university. MoEd-Pr and FaEd-Pr denote the average education level of students' parents in the private college, where MoEd-Pr is average education level of the mother, and FaEd-Pr of the father. MoEd-Pu and FaEd-Pu refers to the same variable for the public university. Home denotes the number of students whose family owns the property they live in. Car denotes the average number of cars in the students' family. Sib denotes the average number of siblings. ProUni denotes the number of students receiving the Prouni scholarship from the government, whereas Fies denotes the number of students under the government-sponsored student loan program. Prouni and Fies only are applicable for the private college only. Female and Male denote, respectively, the number of female and male students in our sample. #OBS denotes the total number of observations in our sample. BUS denotes the number of students in the sample that are business administration majors, whereas COM denotes the number of communication/marketing majors, ECO denotes economic majors, ENG denotes engineering majors, NUT denotes nutrition majors, and OTH denotes the number of students from other majors.

The picture that emerges from Table 2 is that the students in this sample are, on average, emotionally stable, organized, open to new experiences, somewhat extroverted and above all agreeable. Their measures of CSE and Grit appear to be consistent with this assessment.

Students' average age is 23.05 years. The mean of the age distribution differs between schools, but not by much. The average age of the student in the private college is 22.03 years, whereas in the public university is 23.56 years. On average, students from the small private college have 0.88 siblings, have 1.85 cars in the garage of a 3.21-bedroom apartment they own (83.71% of homeownership). On the other hand, students from the large public university have, on average, 1.43 siblings, live in an apartment with 2.54 bedrooms and have 0.88 cars in the garage. The proportion of homeowners in the large

public university is 79.78%. That is, on average, students from the small private college come from smaller families that live in a more spacious home with a bigger garage.

The above observations are consistent with the educational attainment of the students' parents, as shown in Table 2. Both parents of a typical student in the small private college have a bachelor's degree (MoEd-Pr and FaEd-Pr, are both close to 2, which is equivalent to 16 years of schooling), whereas a typical student in the large public university have educational attainment higher than high school but less than college (MoEd-Pu and FaEd-Pu, are both close to 1.5, which is more or less equivalent to having 12-14 years of schooling).

Among the 534 students surveyed, 18 are on Fies, a government-sponsored student loan program for college students, and 21 of them receive Prouni scholarships. The Prouni program is also government-sponsored, and it grants scholarships of up to 100% of the tuition for students originating from the public-school system or those on the private school system who were on 100% scholarship. Two hundred and ninety-nine students are male, and 235 are female. Economics majors make up 218 students, Engineering students another 118, Business Administration 67, Nutrition 52, Communication students another 50, and the remainder 29 (the category OTH on Table 2) are distributed among International Relations and undergraduate Law.

Table 3 displays personality traits by gender and school. All Big Five personality traits, Core Self-Evaluation, and Grit are numerically close between female and male students, suggesting that personality traits are independent of gender. The t-stat suggests that differences in personality traits between male and female students are statistically irrelevant. Similarly, the same holds true for personality traits by school type. The latter finding is somewhat interesting, after all, the entrance exam for the public university is considerably more competitive than the entrance exam to the small private college. Given that public universities in Brazil are tuition-free, one would expect students from the public university to be Grittier. However, empirically this is not the case, at least in this sample.

Table 3 - Personality Traits by Gender and School

	Male	Female	t-stat	Private	Public	t-stat
	(1)	(2)	(3)	(4)	(5)	(6)
EXT	3.26	3.21	0.03	3.32	3.20	0.10
AGR	3.64	3.83	-0.27	3.63	3.76	-0.18
CNS	3.43	3.55	-0.14	3.52	3.46	0.06
NEU	2.64	3.18	-0.47	2.75	2.94	-0.16
OPN	3.55	3.53	0.03	3.49	3.56	-0.08
CSE	3.52	3.30	0.22	3.50	3.40	0.17
GRIT	3.38	3.49	-0.12	3.44	3.43	0.02

Note: Our sample contains 299 males and 235 females, making a total of 534 subjects, of which 178 are from the small private college and 356 are from the large public university. Column (1) displays average scores of the Big Five personality traits (EXT, AGR, CNS, NEU, OPN), as well as the average scores of Core Self-Evaluation and Grit for male students. Column (2) displays the same measures for female students. Column (3) displays the t-statistic testing for equality of means between male and female personality traits. In all cases, we fail to reject equality of means. Column (4) displays the average scores of the personality traits listed above for students in the private college, whereas Column (5) displays the average scores for students from the public university. Finally, Column (6) displays the t-statistic for testing the equality of means for personality traits between students from the private college and the public university.

Table 4 displays personality traits, Core Self-Evaluation, Grit and control variables by major. We observe that personality traits, Core Self-Evaluation and Grit are invariable with respect to the choice of major.

Table 4 - Personality Traits and Control Variables by College Major

	EXT	AGR	CNS	NEU	OPN	CSE	GRIT
BUS	3.33	3.66	3.56	2.74	3.45	3.59	3.39
COM	3.39	3.84	3.27	2.98	3.84	3.14	3.26
ECO	3.23	3.66	3.45	2.84	3.48	3.47	3.39
ENG	3.17	3.75	3.56	2.82	3.57	3.38	3.52
NUT	2.94	3.75	3.47	3.34	3.44	3.29	3.48
	GPA	Age	Sib	Car	Bdr	MoEd	FaEd
BUS	7.55	21.73	1.28	1.69	3.12	1.82	1.88
COM	8.29	24.31	1.58	0.80	2.60	1.60	1.54
ECO	6.91	23.54	1.06	1.24	2.74	1.70	1.67
ENG	7.12	23.68	1.30	1.08	2.69	1.70	1.58
NUT	6.47	20.81	1.46	0.88	2.5	1.48	1.48
	#Obs	Home	ProUni	Fies	Male	Female	Priv
BUS	67	57	1	2	47	20	44
COM	50	37	0	0	13	37	0
ECO	218	174	11	10	144	74	90
ENG	118	101	4	0	74	44	15
NUT	52	39	0	0	12	40	0

Note: The above notation follows the same one used in Table 2, with minor differences. For instance, MoEd and FaEd refer to the average level of education of students' parents, respectively, mother and father. We also add the variable Bdr, which denotes the average number of bedrooms in students' homes, and the variable Priv, which denotes the number students from the small private college. The remainder of the notation matches the one in Table 2.

As measured by the number of cars or the number of bedrooms in the house, the wealthiest students are majoring in Business Administration, whereas Communication and Nutrition majors seem to come from more modest economic background. All Communication and Nutrition majors come from the large public university, which concentrates students from a modest economic background. Communication and Nutrition are more popular among female students, whereas Economics and Business Administration are the most popular choices for male students. Only 2% of the students take loans from the Fies program, and a little less than 3% are on Prouni scholarship program.

Table 5 displays the correlation matrix between GPA, Core Self-Evaluation, Grit, and the Big Five factors. CNS exhibits the strongest correlation with GPA at 0.19, followed by GRIT at 0.16. CSE correlates 0.02 with GPA, and is strongly negatively correlated with NEU, with a correlation coefficient of -0.54. The personality traits EXT, AGR, NEU and OPN exhibit a small degree of correlation with GPA, between -0.02 and 0.05.

The above correlations are in line with the literature on Big Five and academic performance at a university level. For instance, Trapmann et ali (2007) in a meta-analysis based on 258 correlations from 58 studies on the effect of Big Five personality traits on academic success of college students in Germany, find that CNS correlates positively with grades with an average correlation coefficient of 0,269, consistent with our estimate in Table 5. Additionally, Trapmann et ali (2007) find that EXT, OPN, and AGR do not correlate significantly with grades, which is consistent with the correlations we find in Table 5.

5. Econometric Estimates

Table 6 column (1) displays estimates of our base specification, i.e., without including any controls. As shown in column (1), only conscientiousness (CNS) is statistically significant. According to estimates in column (1), an individual who increases his/her

CNS score in one-standard deviation (ΔCNS=0.63) is predicted to have a cumulative GPA, all else equal, increased by 0.20 points, on average. This is equivalent to an increase of 2.8% on the average cumulative GPA.

Table 5 - Correlation Matrix of Personality Traits and GPA

	GPA	EXT	AGR	CNS	NEU	OPN	CSE
EXT	0.01	--	--	--	--	--	--
AGR	-0.02	0.09	--	--	--	--	--
CNS	0.19	0.16	0.16	--	--	--	--
NEU	0.05	-0.10	-0.19	-0.16	--	--	--
OPN	0.05	0.23	-0.03	0.03	0.03	--	--
CSE	0.02	0.29	0.09	0.38	-0.54	0.01	--
GRIT	0.16	0.13	0.17	0.65	-0.21	0.02	0.42

Note: The above table displays sample correlation coefficients between GPA and personality traits. For example, the sample correlation between the cumulative graduate-point average (GPA) and the score on extroversion (EXT) is 0.01.

Estimates in column (2) include gender and age as control variables. It shows that the coefficient on CNS is numerically close to the estimate in column (1) and strongly statistically significant. Moreover, column (2) shows that gender appears to be an important control, whereas age does not. The dummy variable MALE is strongly significant. According to estimates in column (2), all else equal, the cumulative GPA of a male student is 0.26 points lower than that of a female student, on average. The finding that female students have, on average, a higher GPA than male students is a common result in the literature. In our sample, an alternative explanation could be that most of the male students are economics majors, which is the major with the lowest GPAs. Judging by the estimates shown in column (5), this seems to be the case, since the coefficient of the dummy male loses its statistical significance in presence of controls for students' majors.

Estimates in column (3) include additional controls, such as DROP, Prouni, Fies, and Priv. Of the four additional controls, only Priv, a dummy that assumes 1 if the student is from the private college, is marginally statistically significant at 10%.

The specification in column (3) shows that the coefficient of CNS is numerically stable across different specifications and highly significant. The personality traits EXT, AGR, NEU, OPN and GRIT are not statistically significant.

Column (4) displays estimates from a specification with four added controls. The additional controls are the number of siblings (SIB), the number of cars in the family (CAR), homeownership (HOME), and the number of bedrooms in the home (BDR). We add the variables CAR, HOME and BDR as an attempt to control for the effects of income on academic performance. The idea is that students who come from wealthy families have more learning opportunities outside the school, and this could be a source of bias. The variable SIB, defined as the number of siblings, may capture the fact that students with many siblings may receive less attention from their parents, and this may negatively affect their academic performance. Of these variables, only BDR is statistically significant. Ultimately, estimates in column (4) shows that the coefficient of CNS is highly significant and numerically close to estimates in column (3).

Estimates in Column (5) include dummies for the choice of majors. To economize on space, we do not display their estimated coefficients. These dummies are constructed as follows: BUS assumes value 1 if the student is a Business Administration major and zero otherwise, ECO denotes Economics majors, ENG is for Engineering majors, and so on. The dummy OTH includes all other majors (in fact, only International Relations and undergraduate Law majors), and is the omitted category. The dummies for ECO,

ENG, NUT and COM are statistically significant. In the cases of ECO, ENG and NUT, the estimated coefficients are negative and large in absolute terms, while in the case of COM the estimated coefficient is positive and large. Business Administration majors have on average, all else equal, a cumulative GPA that is 0.72 points higher than that of Economics majors, whereas Communication majors enjoy 1.52 points over economics students' cumulative GPA.

Table 6 - Dependent variable: Cumulative GPA

Regressor	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EXT	-0.02	-0.02	-0.02	-0.02	-0.11*	-0.20**	-0.04
	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.09)	(0.08)
AGR	-0.09	-0.14	-0.13	-0.13	-0.17*	0.07	-0.08
	(0.10)	(0.10)	(0.10)	(0.10)	(0.1)	(0.14)	(0.13)
CNS	0.32***	0.30***	0.30***	0.30***	0.34***	0.19	0.31**
	(0.11)	(0.11)	(0.11)	(0.11)	(0.1)	(0.14)	(0.12)
NEU	0.08	0.02	0.02	0.01	0.11*	0.11	0.08
	(0.07)	(0.08)	(0.08)	(0.08)	(0.07)	(0.09)	(0.08)
OPN	0.08	0.09	0.10	0.09	-0.02	-0.03	-0.03
	(0.09)	(0.09)	(0.09)	(0.09)	(0.08)	(0.13)	(0.11)
CSE	-0.08	-0.07	-0.09	-0.11	-0.002	0.13	-0.03
	(0.10)	(0.10)	(0.10)	(0.10)	(0.1)	(0.14)	(0.13)
GRIT	0.16	0.15	0.15	0.16	0.21**	0.24	0.22*
	(0.11)	(0.12)	(0.11)	(0.12)	(0.10)	(0.15)	(0.13)
Male	--	-0.26**	-0.28**	-0.27**	-0.12	1.13	-0.12
		(0.11)	(0.12)	(0.12)	(0.11)	(1.24)	(0.11)
Age	--	-0.02	-0.02	-0.01	-0.04	-0.04	-0.04
		(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Priv	--	--	0.19*	0.14	0.01	-0.01	0.19
			(0.11)	(0.12)	(0.13)	(0.13)	(1.19)
Controls 1	No	No	Yes	Yes	Yes	Yes	Yes
Controls 2	No	No	No	Yes	Yes	Yes	Yes
Controls 3	No	No	No	No	Yes	Yes	Yes
Int. Trait*Male	No	No	No	No	No	Yes	No
Int. Trait*Priv	No	No	No	No	No	No	Yes
Intercept	5.65***	6.66***	6.48***	6.40***	7.38***	6.70***	7.36***
	(0.65)	(0.82)	(0.83)	(0.86)	(0.91)	(1.10)	(1.02)
F-test: All Traits	2.08*	1.73	1.87*	1.87*	3.68***	2.68***	3.30***
	(0.05)	(0.11)	(0.08)	(0.08)	(0.00)	(0.00)	(0.00)
F-Test: Interactions	--	--	--	--	--	1.25	1.39
	--	--	--	--	--	(0.28)	(0.22)
R^2	0.05	0.06	0.07	0.08	0.26	0.27	0.26
#obs	534	533	533	533	533	533	533

Note: Statistical significance at 1% is marked with "***", at 5% with "**", and at 10% with "*". Controls 1 include the following control variables: ProUni, Drop and FIES. Controls 2 include socio-economic indicators such as number of siblings (Sib), number of cars in the family (Car), homeownership (Home), and number of bedrooms in the house (Bdr). Controls 3 include dummy variables for the students' majors. We use robust standard errors, computed with HAC variance-covariance matrix.

We consider our best econometric specification the one that generates estimates in Column (5). Accordingly, the coefficients of CNS and GRIT are statistically significant at 1% and 5%, respectively, whereas the coefficients of EXT, AGR and NEU are significant at 10%. An increase of one standard deviation in CNS, i.e., $\Delta CNS = 0.63$, is associated with, all else equal, an average increase in GPA of 0.21 points (2.8% of the GPA sample average), which is close to estimates in column (1). An increase of one-standard deviation in GRIT, i.e., $\Delta GRIT = 0.63$, all else equal, is associated with an average increase in GPA of 0.13 points (1.8% of the GPA sample average).

As shown in Column (5), the coefficients of extroversion (EXT) and agreeableness (AGR) have a negative sign. It is not unusual to find a negative estimated coefficient for EXT and AGR, since typically individuals with a high score in these two traits are more friendly and popular and this takes time away from studying. An increase of one-standard deviation in EXT and AGR (i.e., $\Delta EXT = 0.53$, and $\Delta AGR = 0.84$), all else equal, is associated with a decrease in average GPA of 2.55%.

Estimates in Column (6) include interaction terms between the Big Five personality traits, CSE, Grit and the dummy Male. This is an attempt to evaluate whether the effects of personality traits on academic performance depend on gender. As it turns out, AGR is the only trait in which, at the same time, the F-test rejects the null that AGR and AGR*Male are jointly zero, and the t-test rejects that null of irrelevance for the interaction coefficient AGR*Male. Since for all other traits either the F-test null hypothesis is not rejected at traditional significance levels (not shown in Table 6) and/or the t-test does not reject the null of irrelevance of the interaction coefficient TRAIT*Male, we comment only on the results for AGR. In this case, the F-test testing for the joint significance of the coefficients of AGR and AGR*Male is 4.08 with a p-value of 1.75%, and the t-test for significance of the interaction term AGR*Male has a p-value of 2.3%.

The estimated coefficient for the interaction term AGR*Male is -0.43, and the estimated coefficient for AGR is 0.09 (not shown in Table 6), so that an increase of one standard deviation in AGR, i.e., $\Delta AGR = 0.52$, all else equal and on average, is associated with an increase of 0.05 in the cumulative GPA for female students, and with a decrease of 0.20 points for male students.

One possible interpretation for this finding is that agreeableness (AGR) affects men and women differently. If so, it would be interesting to further investigate the channels through which AGR affect academic performance differently between male and female students. However, this finding should be taken with caution, after all, we saw in section 4 that personality traits are unrelated to gender and the F tests for the joint statistical relevance for all interaction terms is not significant, as shown in Column (6).

Since students from the small private college and large public university come from different socio-economic and cultural backgrounds, one may conjecture that the effect of personality traits on GPA might interact with type of school. To assess whether this is the case, we estimate a specification with interaction terms between Big Five personality traits, CSE, Grit and the dummy Priv. Results are displayed in Column (7).

Based on the results of the joint significance F-test and looking at the t-test for the significance of the interaction term, we observe that EXT is the only personality trait in which we reject the null of the F-test for EXT and EXT*PRIV and find a significant interaction term (p-values of 0.54% and 4.2%, respectively). The estimated coefficient of EXT is -0.12 (not statistically significant), and the estimate coefficient of the interaction term is EXT*PRIV is -0.30. Thus, a one-standard deviation increase in EXT ($\Delta EXT = 0.84$), all else equal and on average, is associated with a reduction of 0.10 points in cumulative GPA for students from the large public university, and is associated with decrease of 0.42 points if they come from the small private college.

As in the case of estimates in Column (6), these findings must be seen as exploratory,

given the relatively low values of the F-tests and the fact that in section 4 we saw that personality traits are similar between the two types of schools.

Our results are broadly consistent with the literature. For instance, Cabus et ali (2021), based on a comprehensive meta-analysis, consistently with our results, find that CNS is positively related to higher earnings, whereas AGR is negatively related to earnings. More generally, Heckman et ali (2006) find that a measure of non-cognitive skills, which includes locus of control and self-esteem, are associated with better outcomes in schooling, employment, work experience and choice of occupation.

Interestingly, there are two important studies for Swedish subjects. Recently, Edin et ali (2022) find that returns to non-cognitive skills are increasing over time, especially since the early 1990s. These results are not directly comparable to ours, because their measure of non-cognitive skills differs from ours, as well as their outcome variable (they mainly use wage, instead of measures of academic performance), though they show the increasing relevance of non-cognitive skills in general. An older study with Swedish data including enlisted military personnel, by Lindqvist and Vestman (2011), using an interview-based measure of non-cognitive ability, present evidence that individuals who lack non-cognitive skills – rather than cognitive skills - are the ones facing adverse labor and life outcomes in the long run.

6. Conclusion

We study the effect of personality traits on the academic performance for a sample of 534 students from a small private college and a large public university in Brazil. Based on estimates from our best econometric specification, we find that a one-standard deviation increase in Conscientiousness is associated with an average increase in cumulative GPA of 0.21 points, or 2.8% of the average GPA. Furthermore, we find that a one-standard deviation increase in Grit is associated with an average increase in GPA of 1.8%. Extroversion (EXT) and agreeableness (AGR) are negatively related to academic performance. More specifically, an increase of one-standard deviation in EXT and AGR (i.e., $\Delta EXT = 0.53$ and $\Delta AGR = 0.84$), all else equal, on average, is associated with a decrease in GPA of 2.55%.

Our findings corroborate the converging wisdom in the literature that developing personality traits can be a powerful investment strategy to improve academic performance, perhaps even more important than cognitive skills. The reason being is that the evidence suggests that personality traits and non-cognitive skills are, in general, malleable, whereas cognitive skills are not. Finally, it would be an interesting extension of this research to investigate further the channels through which personality traits and Grit affect academic performance.

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