

## THE RELATIONSHIP BETWEEN GRIT AND ACADEMIC PERFORMANCE IN THE CLASSROOM

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### Abstract

A student's perseverance and dedication to successfully completing their goals for academic success are studied to determine if grit may be a measurable qualifying factor used to predict a positive student outcome. This analysis examines how student grit in undergraduate economics courses, along with other control variables, contributes to student success, as measured by their average grade earned in the course. Our results indicate that grit has a statistically significant positive impact on student performance in the classroom.

Key Words: grit, financial stress, and academic performance

JEL Classification: A22

### Introduction

In numerous research papers since 2007 and in her best-selling book, *Grit: The Power of Passion and Perseverance* (2016), Angela Duckworth explains how grit, defined as the "perseverance and passion needed to accomplish long-term goals in the face of challenges and obstacles," may be as essential as intelligence in achieving success in most endeavors. Duckworth hypothesizes that skills and traits other than intelligence are important factors for successfully achieving goals under difficult circumstances. She claims that grit is an important trait possessed by successful people in many fields including business, art, athletics, education, medicine, and law. In addition to Duckworth, many studies in education, including Chang (2014), Cross (2013), and Mason (2018, and Strayhorn (2014) have shown a positive correlation between grit and long-term academic success, measured as the students' grade point averages (GPA) over their high school or college careers. Although grit is usually linked to the achievement of long-term goals, this accomplishment is the result of a series of short-term successes. Our research seeks to establish the relationship between grit and short-term success by examining end of semester course grades rather than long term GPA. We also analyze whether grit varies according to students' gender and ethnicity.

### Literature Review

Duckworth et al. (2007) hypothesizes that the traits of perseverance and passion, grit, played a very important role in explaining the achievements of very successful people. They

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developed a seventeen-item questionnaire to measure grit, consistency of interest, and perseverance of effort, which they validated across six studies. The samples in the first two studies were composed of people aged twenty-five and older who volunteered to answer the grit survey online. In both studies, there was a positive association between grit and the level of education of the participant. The third study found that among 139 undergraduate students, those with a higher grit score had significantly higher GPAs. In the fourth and fifth studies, which were conducted in 2004 and 2006 on more than one thousand freshman cadets entering the United States Military Academy at West Point, Duckworth et al. (2007) found that grit was the best predictor of whether a cadet would complete the rigorous summer training program. Finalists in the Scripps National Spelling Bee were the subject of the sixth study which found that the children with higher grit scores outperformed those with lower scores.

Many studies have confirmed the importance of grit as an important factor leading to success in the pursuit of long-term goals. Maddi et al. (2012) found that grit accurately predicted retention among freshman cadets at the United States Military Academy in 2008. Strayhorn (2014) found that grit was positively related to college grades for African American men attending predominantly white colleges. Using a sample of over 2000 freshmen at a large private institution, Chang (2014) found that gender, SAT scores, ethnicity and the perseverance subscale score of grit were significant in predicting the students' GPAs. Cross (2013) found significant relationships between grit and GPA, number of hours studied, and age among doctoral students. Examining a sample of 121 South African university students, Mason (2018) found that students with high grit scores obtained higher semester grades than those with lower grit scores.

In an interview with Lee Duckworth, Perkins-Gough (2013) points out that college admissions decisions include considerations for character traits like grit that are important in determining student success. She recommends that schools be involved in character building of personality traits such as grit, self-control, gratitude, honesty, and skills to deal with setbacks. Agarwal (2019) also recommends helping college students to develop grit, so that they can "think outside the box," and develop confidence that promotes success.

Some recent research has contradicted Duckworth's findings. Bazalais et al. (2016) found that grit was not a significant predictor of grades for first-year community college students in a physics course, but high school GPA was found to have a significant positive effect in their study. In a sample of 66,807 individuals, Crede et al. (2017) found that grit was only moderately correlated with academic performance and retention, and that the personality trait of conscientiousness was a better predictor of academic success. They conclude that improving grit is not as important as teaching study skills and ensuring class attendance. They cautioned that grit may make individuals persist in unproductive pursuits and fail to ask for help when it is needed. Studying a sample of 4,642 sixteen year-olds in the United Kingdom, Rimfeld et al. (2016) came to the same conclusion, that grit adds very little to the personality trait, conscientiousness, as a predictor of academic performance.

Kohn (2014) makes the point that not everything is worth doing; that is, the person may be working hard, but not in the pursuit of something worthwhile. Kohn questions persistence and says that it may be counter-productive in some cases. He quotes the Law of Holes, which states, "when you're in a hole, stop digging." He suggests that the single-minded pursuit that grit proposes is often counterproductive. Kohn suggests that grit masks the assertion that education needs to be more democratic and collaborative in favor of teaching skills that many students need in order to maintain the status quo.

Rose (2012) and Denby (2016) are both critical of grit because they feel that gritty people may lack flexibility and have difficulty learning from mistakes. They also point out that, in order to have grit, a person needs financial resources to give them the opportunity to pursue goals. They worry that prioritizing grit development will divert resources from policies that better the financial and social welfare of students from low-income homes.

### **Methodology and Empirical Results**

Data for this study come from a survey administered at Jacksonville State University, a regional public university in northeast Alabama. The survey included 304 undergraduate students in the School of Business and Industry who were enrolled in undergraduate economics courses during the Fall semester of 2015. At the beginning of the semester, the students answered the seventeen-item Grit Scale in addition to completing a survey that collected the expected hours worked per week for those who were employed, the expected study hours per week for their enrolled economics course, and the level of financial stress (See Appendix A for an explanation of the Grit Scale, and Appendix B for the questions used to measure financial stress). The students' gender, ethnicity, ACT score, and GPA in JSU courses were obtained from JSU student records. The three instructors provided the students' final averages in their courses, which were used as a measure of academic performance.

Table 1 summarizes the characteristics of the students included in the sample. Approximately 56% of the students were male, and 44% were female. Almost 18% were African American, while 82% were Caucasian. The composite average grade across all courses was 75.6%. The average grades for Instructors A and B, 79.4 and 75.4, respectively, were not significantly different. However, the average grade for Instructor C, 71.6, was significantly different ( $p < 0.000$ ) from those for both Instructors A and B. The average grade for microeconomics courses, 72.1, was significantly lower ( $p < 0.000$ ) than the average grade for macroeconomics courses, 79.4. The average ACT score was 22.6, and the average GPA in JSU courses was 3.14 on a 4.0 scale. The average score on the Grit Scale (GRIT) was 3.65 on a scale from 1 to 5, with 5 indicating the highest level of grit. Perseverance of Effort (PE) and Consistency of Interests (CI) are two components of grit. PE was measured using a scale of 1 to 5, with 5 indicating the strongest level of agreement, to statements such as "I finish whatever I begin." CI was reverse scored on a scale of 1 to 5 based on responses to six items, such as "I become interested in new pursuits every few months." The average CI was 3.14, while the average PE was 4.15. The average financial stress level, measured on a scale of 1 (no stress) to 4 (considerable stress) in response to questions such as, "In the last year, how often have you worried about not having enough money to pay for regular expenses?," was 2.14 (see Appendix B for more details on the financial stress survey). Students planned to study for their economics course an average of 4.28 hours per week. Students in upper level courses planned to study 4.46 hours per week, while students in the principles courses planned to study 4.21 hours per week, but these were not significantly different. Forty-two percent were not employed, sixteen percent worked less than 20 hours per week, and forty-two percent worked 20 hours or more per week. The fifty-eight percent of students who were employed averaged 24.2 hours of work per week.

**Table 1: Student Characteristics**

<b>Gender</b>		
<b>Female</b>		43.75%
<b>Male</b>		56.25%
<b>Ethnicity</b>		
<b>African American</b>		17.8%
<b>Caucasian</b>		82.2%
<b>Averages</b>		
<b>Grade</b>		75.6 (3.56)
<b>Instructor A</b>	<b>n=21</b>	75.4 (10.50)
<b>Instructor B</b>	<b>n=145</b>	79.4 (11.57)
<b>Instructor C</b>	<b>n=138</b>	71.6 (13.78)
<b>Micro</b>	<b>n=159</b>	72.1 (13.43)
<b>Macro</b>	<b>n=145</b>	79.4 (10.67)
<b>ACT</b>		22.6 (3.93)
<b>GPA</b>		3.14 (0.58)
<b>GRIT</b>		3.65 (0.53)
<b>CI</b>		3.14 (0.68)
<b>PE</b>		4.15 (0.53)
<b>Financial Stress Level</b>		2.14 (0.81)
<b>Planned weekly study hours</b>		4.28 (3.61)
<b>Principles</b>	<b>n=201</b>	4.21 (3.15)
<b>Upper level</b>	<b>n=102</b>	4.46 (4.41)
<b>Student Employment</b>		
<b>Not employed</b>		42.1%
<b>Work &lt; 20 hours per week</b>		15.5%
<b>Work ≥20 hours per week</b>		42.4%
<b>Average weekly work hours</b>		24.2 (9.57) n=176

Values in parentheses are standard deviations.

Table 2 summarizes student characteristics by gender. The men had slightly higher final grades, ACT, GRIT, CI, and PE scores, but were not significantly different compared to women in the sample. Women had slightly higher GPAs, planned study hours, and longer weekly work hours, but were not significantly different compared to men in the sample. A significantly higher proportion of women were employed, 66% compared to 51.5% of men. Women reported a significantly higher level of financial stress than men.

**Table 2: Student Characteristics by Gender**

	<b>Men n=171</b>	<b>Women n=133</b>	<b>Significance (p-value)</b>
<b>Grade</b>	76 (12.51)	75.1 (12.98)	0.54
<b>ACT</b>	22.65 (3.93)	22.45 (3.94)	0.66
<b>GPA</b>	3.11 (.592)	3.17 (.566)	0.45
<b>GRIT</b>	3.67 (.570)	3.62 (.481)	0.44
<b>CI</b>	3.16 (0.70)	3.11 (0.67)	0.49
<b>PE</b>	4.16 (0.56)	4.14 (0.50)	0.72
<b>Financial stress level</b>	2.04 (.797)	2.27 (.802)	0.012
<b>Planned weekly study hours</b>	4 (3.54)	4.68 (3.68)	0.104
<b>Employed</b>	51.5%	66.9%	0.006
<b>Weekly work hours</b>	23.77 (8.83)	24.67 (10.28)	0.529

Values in parentheses are standard deviations.

As can be seen in Table 3, there are large and significant differences in student characteristics between African American and Caucasian students. The average grade for African American students was 66.8, 10.6 points lower ( $p=0.000$ ) than the average of 77.4 for Caucasian students. African Americans also had significantly lower GPAs and ACT scores. Their GRIT and PE scores, however, were significantly higher than those of Caucasians, which may indicate that the African American students worked harder to compensate for their lower GPAs and ACT scores. The African Americans' CI scores were higher than the Caucasians' scores, but the differences were not statistically significant ( $p=0.12$ ). African American students also worked significantly more hours per week ( $p=0.029$ ), had significantly higher financial stress levels ( $p=0.001$ ), and planned to study significantly longer ( $p=0.0014$ ) than the Caucasian students.

**Table 3: Student Characteristics by Ethnicity**

	<b>Caucasian n=250</b>	<b>African American n=54</b>	<b>Significance (p-value)</b>
<b>Grade</b>	77.4 (12.25)	66.8 (12.03)	0.000
<b>ACT</b>	23.3 (3.77)	19.4 (2.99)	0.000
<b>GPA</b>	3.25 (.534)	2.61 (.491)	0.000
<b>GRIT</b>	3.62 (.539)	3.78 (.51)	0.05
<b>CI</b>	3.11 (0.68)	3.27 (0.68)	0.12
<b>PE</b>	4.12 (0.52)	4.27 (0.59)	0.083
<b>Financial Stress Level</b>	2.06 (.794)	2.48 (.782)	0.001
<b>Planned Study Hours</b>	3.92 (3.31)	6.04 (4.42)	0.0014
<b>Employed</b>	57.6%	61.1%	0.632
<b>Weekly Work Hours</b>	23.4 (9.31)	27.7 (10.03)	0.029

Values in parentheses are standard deviations.

We utilized regression analysis to determine the impact of GRIT and various other factors on the grade earned in the economics courses surveyed. We included GRIT, gender, ethnicity,

GPA, ACT, level of financial stress, hours worked, planned study hours, course level, and instructor as the explanatory and control variables. The overall course grade was used as the dependent variable. Gender, ethnicity, and course level, were dummy variables 0= male and 1 = female, 0 = Caucasian and 1=African American, 0=upper level course and 1 = principles level. Dummy variables, INS B and INS C, for the instructors are as follows:

If Instructor A, INS B=0 and INS C=0

If Instructor B, INS B=1 and INS C=0

If Instructor C, INS B=0 and INS C=1

**Table 4: Regression Results for All Variables on Grades**

	<b>Entire Sample (n=304)</b>	<b>Caucasian (n=250)</b>	<b>African American (n=54)</b>
<b>Gender</b>	-1.386 (0.111)	-1.697 (0.069)	-0.41 (0.876)
<b>Ethnicity</b>	-0.56 (0.655)		
<b>GRIT</b>	1.921 (0.015)	1.20 (0.155)	5.48 (.018)
<b>GPA</b>	15.432 (0.000)	15.59 (0.000)	11.36 (0.001)
<b>ACT</b>	0.355 (0.015)	0.337 (0.017)	0.478 (0.332)
<b>Work Hours</b>	-0.025 (0.426)	0.017 (0.629)	-0.224 (0.020)
<b>Financial Stress</b>	-0.026 (0.963)	-0.189 (0.754)	-0.20 (0.905)
<b>Study Hours</b>	-0,063 (0.731)	-0.028 (0.893)	-0.060 (0.897)
<b>Course Level</b>	-0.903 (0.312)	-1.164 (0.212)	-1.99 (0.496)
<b>Ins B</b>	2.46 (0.154)	4.01 (0.049)	-2.14 (0.598)
<b>Ins C</b>	-6.28 (0.000)	-4.88 (0.017)	-11.26 (0.013)
<b>Adjusted R<sup>2</sup></b>	0.680	0.673	0.519

Values in parentheses are p-values.

As shown in Table 4, when the entire sample of 304 students was analyzed, the level of financial stress, hours worked, gender, planned study hours, course level, Instructor B, and ethnicity were not significant predictors of the course grade. Interestingly, GRIT was a significant predictor of overall performance when analyzing the full sample ( $p=0.015$ ) or only African American students ( $p=0.018$ ), but GRIT became statistically insignificant when only analyzing the Caucasian students. In contrast, gender was significant only when analyzing the Caucasian students. ACT was significant for the entire sample and for Caucasian students, but it was not significant for African American students. Hours worked had a significant negative impact only for the African American students. GPA consistently had significant positive impacts on course grades, while Instructor C consistently had significant negative impacts on grades. Instructor B had a significant positive effect on the grades of the Caucasian students. Financial stress, planned study hours, and course level were never significant.

Stepwise regressions, displayed in Tables 5a, 5b, and 5c, were performed to determine the variables that explained the most variation in the average grades. GRIT was positive and significant for the entire sample and for African American students, but not for the sample of Caucasian students. For the entire sample and the samples of Caucasian students and African American students, GPA had highly significant positive effects, while Instructor C had a highly significant negative effect. Instructor B had a significant impact for the Caucasian students only.

ACT had a significant positive impact for the entire sample and for the Caucasian students, but it was not significant for the African American students. Being female had a significant negative effect for the entire sample and for the Caucasian students, but it was not significant for the African American students. Hours worked had a significant negative impact for the African American students only.

**Table 5a: Stepwise Regressions for Entire Sample (n=304)**

Variable	Step 1	Step 2	Step 3	Step 4	Step 5
<b>GRIT</b>	0.61 (0.646)	1.023 (0.239)	1.262 (0.095)	1.652 (0.031)	1.597 (0.036)
<b>GPA</b>		16.511 (0.000)	17.033 (0.000)	15.657 (0.000)	15.794 (0.000)
<b>INS C</b>			-8.396 (0.000)	-8.277 (0.000)	-8.303 (0.000)
<b>ACT</b>				0.349 (0.009)	0.331 (0.013)
<b>Gender</b>					-1.673 (0.046)
<b>Adjusted R<sup>2</sup></b>	0.07	0.565	0.672	0.679	0.682

Values in parentheses are p-values.

**Table 5b: Stepwise Regressions for Caucasian Students (n=250)**

Variable	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
<b>GRIT</b>	1.33 (0.349)	0.478 (0.622)	0.851 (0.303)	1.126 (0.174)	1.351 (0.105)	1.231 (0.138)
<b>GPA</b>		16.533 (0.000)	16.912 (0.000)	15.732 (0.000)	15.431 (0.000)	15.559 (0.000)
<b>INS C</b>			-8.637 (0.000)	-8.501 (0.000)	-5.08 (0.011)	-5.05 (0.011)
<b>ACT</b>				0.322 (0.020)	0.343 (0.013)	0.333 (0.016)
<b>INS B</b>					3.82 (0.056)	3.86 (0.053)
<b>Gender</b>						-1.701 (0.056)
<b>Adjusted R<sup>2</sup></b>	0.036	0.539	0.663	0.669	0.673	0.676

Values in parentheses are p-values.

**Table 5c: Stepwise Regressions for African American Students (n=54)**

Variable	Step 1	Step 2	Step 3	Step 4
<b>GRIT</b>	2.96 (0.294)	3.10 (0.149)	3.28 (0.087)	4.27 (0.028)
<b>GPA</b>		16.35 (0.000)	15.30 (0.000)	12.95 (0.000)
<b>INS C</b>			-8.08 (0.002)	-9.85 (0.000)
<b>Work Hours</b>				-0.1980 (0.017)
<b>Adjusted R<sup>2</sup></b>	0.023	0.478	0.515	0.560

Values in parentheses are p-values.

### Summary and Conclusions

Our regression results indicate that GRIT has a statistically significant positive impact on performance as measured by the average grade earned by a student in principles and intermediate economics courses for the entire sample of 304 students and for the sub-sample of 54 African American students. GRIT was not significant when the sub-sample of 250 Caucasian students was analyzed separately, which suggests that the African American students were driving the significant grit results for the entire sample, as only African American students had a significant negative impact on hours worked. The fact that the African American students had higher grit scores but lower course grades coupled with a higher proportion of the sample that worked, higher levels of financial stress, and longer work hours may imply that the African American students' passion and focus had to be spent on earning money for both college costs and everyday living expenses. Although they planned to study significantly longer than the Caucasian students, the hours required for work could have disrupted their study plans.

Interestingly, being female had a significant negative impact in the regressions for the entire sample and for the sample of Caucasian students when it was analyzed separately. However, gender was not significant for the sample of African American students. This suggests that the results for the gender variable for the Caucasian students were driving the results for the entire sample. Although in the descriptive statistics for the sample shown in Table 2, male students had slightly higher grades and grit scores than female students, the differences were not significant. We did find that a significantly higher proportion of women were employed, that women planned to study significantly longer than men and women reported significantly higher levels of financial stress. These factors may explain the significant negative effect of gender among the Caucasian students in the regressions.

The impact of Instructor C was significant in the regressions for the entire sample as well as the individual samples for Caucasian and African American students. Instructor C's classes were all microeconomics, both principles and intermediate, while Instructor B had all principles and intermediate macroeconomics. Instructor A had relatively few students in the sample, 14 students in principles of microeconomics and 7 in managerial. The lower grades for Instructor C may be due to the quantitative nature of microeconomics which makes it more difficult for many students. (The results of regressions with dummy variables for micro vs macro as explanatory variables were very similar to the results using dummy variables for the instructors and are found in Appendix C.) However, the results for Instructor C are difficult to explain and warrant further investigation. Topics for future research can explore the influence of grit in micro versus macro



courses that would look deeper into the impact of the increased quantitative rigor of microeconomics, student preparedness as measured by the ACT math sub-score, the course times (morning, afternoon), the number of students who drop the course (which grit could impact), and the course format (on-line, hybrid or traditional), among other factors.

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## Appendix A

### *Grit Scale*

*Please respond to the following statements by marking the one that best describes you. Be honest – there are no right or wrong answers!*

1. I aim to be the best in the world at what I do.  
 Very much like me  
 Mostly like me  
 Somewhat like me  
 Not much like me  
 Not like me at all
  
2. I have overcome setbacks to conquer an important challenge.  
 Very much like me  
 Mostly like me  
 Somewhat like me  
 Not much like me  
 Not like me at all
  
3. New ideas and projects sometimes distract me from previous ones.  
 Very much like me  
 Mostly like me  
 Somewhat like me  
 Not much like me  
 Not like me at all
  
4. I am ambitious.  
 Very much like me  
 Mostly like me  
 Somewhat like me  
 Not much like me  
 Not like me at all
  
5. My interests change from year to year.  
 Very much like me  
 Mostly like me  
 Somewhat like me  
 Not much like me  
 Not like me at all
  
6. Setbacks don't discourage me.  
 Very much like me  
 Mostly like me  
 Somewhat like me

\_\_\_\_\_ Not much like me  
\_\_\_\_\_ Not like me at all

7. I have been obsessed with a certain idea or project for a short time but later lost interest.

\_\_\_\_\_ Very much like me  
\_\_\_\_\_ Mostly like me  
\_\_\_\_\_ Somewhat like me  
\_\_\_\_\_ Not much like me  
\_\_\_\_\_ Not like me at all

8. I am a hard worker.

\_\_\_\_\_ Very much like me  
\_\_\_\_\_ Mostly like me  
\_\_\_\_\_ Somewhat like me  
\_\_\_\_\_ Not much like me  
\_\_\_\_\_ Not like me at all

9. I often set a goal but later choose to pursue a different one.

\_\_\_\_\_ Very much like me  
\_\_\_\_\_ Mostly like me  
\_\_\_\_\_ Somewhat like me  
\_\_\_\_\_ Not much like me  
\_\_\_\_\_ Not like me at all

10. I have difficulty maintaining my focus on projects that take more than a few months to complete.

\_\_\_\_\_ Very much like me  
\_\_\_\_\_ Mostly like me  
\_\_\_\_\_ Somewhat like me  
\_\_\_\_\_ Not much like me  
\_\_\_\_\_ Not like me at all

11. I finish whatever I begin.

\_\_\_\_\_ Very much like me  
\_\_\_\_\_ Mostly like me  
\_\_\_\_\_ Somewhat like me  
\_\_\_\_\_ Not much like me  
\_\_\_\_\_ Not like me at all

12. Achieving something of lasting importance is the highest goal in life.

\_\_\_\_\_ Very much like me  
\_\_\_\_\_ Mostly like me  
\_\_\_\_\_ Somewhat like me  
\_\_\_\_\_ Not much like me  
\_\_\_\_\_ Not like me at all

13. I think achievement is overrated.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

14. I have achieved a goal that took years of work.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

15. I am driven to succeed.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

16. I become interested in new pursuits every few months.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

17. I am diligent.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

*Directions for scoring the Grit Scale*

For questions 1, 2, 4, 6, 8, 11, 12, 14, 15, and 17, assign the following points:

- 5 = Very much like me
- 4 = Mostly like me
- 3 = Somewhat like me
- 2 = Not much at all like me
- 1 = Not like me at all

For questions 3, 5, 7, 9, 10, 13, and 16, assign the following points:

- 1 = Very much like me
- 2 = Mostly like me
- 3 = Somewhat like me
- 4 = Not much at all like me
- 5 = Not like me at all

Grit is calculated as the average score for items 1, 4, 12, 13, and 15  
Consistency of interest is calculated as the average score for items 3, 5, 7, 9, 10, and 16.  
Perseverance of Effort is calculated as the average score for items 2, 6, 8, 11, 14, and 17.

*Grit Scale citation*

Duckworth, A.L. and Quinn, P.D. 2009. "Development and Validation of the Short Grit Scale." *Journal of Personality Assessment*, 91. 166-174.  
Duckworth, Angela, Peterson, Christopher, Matthews, Michael, and Dennis Kelly. "Grit: Perseverance and Passion for Long-Term Goals." *Journal of Personality and Social Psychology* 92.6. 2007. 1087-1101.

**Appendix B**

*Financial Stress Questions*

- 1. In the last year, how often have you worried about having enough money to pay for regular expenses?  
\_\_\_\_\_ Very often    \_\_\_\_\_ Often    \_\_\_\_\_ Sometimes    \_\_\_\_\_ Never
- 2. In the last year how often have you worried about paying for college?  
\_\_\_\_\_ Very often    \_\_\_\_\_ Often    \_\_\_\_\_ Sometimes    \_\_\_\_\_ Never
- 3. In the last year how often have you chosen not to participate in an educational activity (clubs, field trips) due to lack of money?  
\_\_\_\_\_ Very often    \_\_\_\_\_ Often    \_\_\_\_\_ Sometimes    \_\_\_\_\_ Never
- 4. In the last year how often have you chosen not to purchase required academic materials due to their cost?  
\_\_\_\_\_ Very often    \_\_\_\_\_ Often    \_\_\_\_\_ Sometimes    \_\_\_\_\_ Never
- 5. Financial concerns have interfered with my academic performance.  
\_\_\_\_\_ Strongly agree    \_\_\_\_\_ Agree    \_\_\_\_\_ Disagree    \_\_\_\_\_ Strongly Disagree

- 4 = Very often and Strongly Agree
- 3 = Often and Agree
- 2 = Sometimes and Disagree
- 1 = Never and Strongly Disagree

The financial stress level is calculated as the average response on the five questions.

### Appendix C

Although grades for Instructor C were significantly lower than those for Instructors A and B, Instructor C taught only microeconomics, so it is possible that the differences in instructor grades might be explained by the subject matter, rather than the instructor. Also, Instructor A had relatively very few students, 21 out of the sample of 304. When dummy variables for both the instructor and the subject were included in the model, Minitab automatically removed one of them, since they were the same variable except for 21 observations, Instructor A's students. The estimations in tables C1-C4 use the same explanatory variables as those in table 4 and tables 5a-5c, except the dummy variables for instructor are replaced by dummy variables for micro vs. macro, where micro=1 and macro=0. In all cases, micro had a significant negative impact on the average grade, and the significance of the other explanatory variables was almost identical to the results using dummy variables for the instructors.

**Table C1: Regression Results for All Variables on Grades with Dummy Variable for Micro**

	<b>Entire Sample n=304</b>	<b>Caucasian n=250</b>	<b>African American n=54</b>
<b>Gender</b>	-1.377 (0.121)	-1.859 (0.048)	0.25 (0.928)
<b>Ethnicity</b>	-0.14 (0.911)		
<b>GRIT</b>	2.035 (0.011)	1.365 (0.112)	5.23 (0.032)
<b>GPA</b>	15.167 (0.000)	15.25 (0.000)	12.67 (0.001)
<b>ACT</b>	0.398 (0.004)	0.379 (0.007)	0.741 (0.151)
<b>Work Hours</b>	-0.0063 (0.843)	0.0308 (0.373)	-0.1561 (0.107)
<b>Financial Stress</b>	-0.026 (0.963)	-0.117 (0.847)	-0.55 (0.753)
<b>Study Hours</b>	0.011 (0.953)	0.038 (0.855)	0.059 (0.903)
<b>Course Level</b>	-0.879 (0.335)	-1.216 (0.196)	-1.15 (0.708)
<b>Micro</b>	-7.863 (0.000)	-8.376 (0.000)	-6.06 (0.029)
<b>Adjusted R<sup>2</sup></b>	0.668	0.667	0.460

**Table C2: Stepwise Regressions for Entire Sample (n=304) with Dummy Variable for Micro**

<b>Variable</b>	<b>Step 1</b>	<b>Step 2</b>	<b>Step 3</b>	<b>Step 4</b>	<b>Step 5</b>
<b>GRIT</b>	0.61 (0.646)	1.023 (0.239)	1.566 (0.042)	2.026 (0.009)	1.978 (0.011)
<b>GPA</b>		16.511 (0.000)	16.671 (0.000)	15.063 (0.000)	15.178 (0.000)
<b>Micro</b>			-7.899 (0.000)	-7.878 (0.000)	-7.857 (0.000)
<b>ACT</b>				0.410 (0.002)	0.395 (0.003)
<b>Gender</b>					-1.425 (0.093)
<b>Adjusted R<sup>2</sup></b>	0.007	0.565	0.661	0.670	0.672

**Table C3: Stepwise Regressions for Caucasian Students (n=250) with Dummy Variable for Micro**

Variable	Step 1	Step 2	Step 3	Step 4	Step 5
<b>GRIT</b>	1.33 (0.349)	0.478 (0.622)	1.261 (0.133)	1.586 (0.058)	1.463 (0.080)
<b>GPA</b>		16.533 (0.000)	16.371 (0.000)	14.990 (0.000)	15.123 (0.000)
<b>Micro</b>			-8.445 (0.000)	-8.388 (0.000)	-8.392 (0.000)
<b>ACT</b>				0.378 (0.006)	0.366 (0.008)
<b>Gender</b>					-1.724 (0.055)
<b>Adjusted R<sup>2</sup></b>	0.004	0.539	0.656	0.665	0.669

**Table C4: Stepwise Regressions for African American Students (n=54) with Dummy Variable for Micro**

Variable	Step 1	Step 2	Step 3
<b>GRIT</b>	2.96 (0.294)	3.10 (0.149)	3.27 (0.115)
<b>GPA</b>		16.35 (0.000)	16.50 (0.000)
<b>Micro</b>			-5.55 (0.028)
<b>Adjusted R<sup>2</sup></b>	0.023	0.423	0.470