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The Impact of Video Gaming and Social Media on Finance Class Grades

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We analyze the impact of video game and social media usage on academic performance in an undergraduate introductory finance course. We implement a multivariate econometric model and find that certain aspects of social media and video gaming have significant relationships with student performance. Among the general sample, students who use YouTube to rewatch class lectures score higher than those who do not, whereas total hours of social media consumed by students negatively correlates with student grades. Among students who play video games, students who use Facebook and Instagram perform significantly worse in course average and in the probability of earning an A. Video game usage has no significant correlation with student grade or earning an A in the general sample. In the gaming sample, we find three significant video game variables based on when and why students play. Our results indicate a nuanced correlation of video gaming and social media aspects and help explain the contradictory findings of previous studies on how video gaming and social media impact grades.

Keywords: Finance education, Video games, Social media

Introduction

There is a plethora of speculation in the popular media about the influence of video games and social media on academic performance. The potential impact on academic success is significant since video games and social media have been ubiquitous during the formative years of today's typical college student. Using a sample of 1,257 students at a large, private university, we assess the impact of time spent playing video games and social media involvement on outcomes in an introductory finance class that covers topics such as time value of money, modeling of discounted cash flows, bond pricing, equity pricing, cost of capital, and capital budgeting techniques. Following Brau, Brau, Rowley, and Swenson (2017), this analysis includes an extensive set of control variables to allow a clearer picture of the impact of video gaming and social media involvement on academic performance in a finance course (Burgess, Stermer, and Burgess, 2012).

The literature studying the impact of video games is robust; however, insights as to whether there is an impact on finance students remains uncertain until now. Anand (2007) reports that in the United States, at least 90% of households with children have access to video games. Some researchers, including Anand (2007), Skoric, Teo, and Neo (2009), and Wright (2011), find evidence that time spent playing video games negatively impacts student performance. Interestingly, there is also evidence that video gaming can enhance academic performance. Smyth (2007) suggests that complex games may lead to academic success by engaging players in problem-solving, critical thinking, and creativity. Skoric et al. (2009) find that whereas game addiction can lead to deterioration in academic performance, moderate engagement in gaming can lead to improved performance in an academic setting.

Similarly, existing research also reports conflicting results on the impact of social media engagement. There is high variation in findings on the potential positive effects of social media on academic performance. Deng and Tavares (2013) conclude that social media usage may enhance critical thinking ability, facilitating improved academic performance. Apeanti and Danso (2014) report that students themselves perceive contacting professors through social media as a positive factor in the learning process. Yunus and Salehi (2012) show that social media usage improves students' vocabulary and writing abilities. Conversely, Junco (2011) and Kirschner and Karpinski (2010) show that increased social media involvement negatively correlates with academic performance.

A plausible explanation for the conflicting evidence on the impact of video games and social media usage is that the skillset required for academic success varies across disciplines. After all, English classes and engineering classes may demand different learning approaches and may reward different skills. In this paper, we specifically examine the impact of video gaming and social media involvement on success in an introductory to finance course to refine an understanding of student performance and to more effectively counsel students within finance departments.

We extend the methods of Brau et al. (2017), who also study factors that influence student performance in an introductory finance class, but without video game or social media questions. Our survey instrument includes all of the questions from Brau et al. (2017), along with 16 multi-part video game questions and five multi-part social media questions. When the multi-part questions are expanded, we have over 50 video game and social media variables that may provide explanatory power on student grades. Our methods also follow and extend Brau et al. (2017). We perform a series of empirical tests to analyze whether video gaming and social media usage play a statistically significant role in student outcomes. We study both implications using continuous empirical models and discrete empirical models. The extension of our research to Brau et al. (2017) explicitly tests whether the type and amount of video games and social media usage impact student performance in an undergraduate finance class.

We find a nuanced correlation of certain video game and social media variables. In the general model of student grades measured as a percentage (0-100% semester grade), whether a student plays video games or not, has no correlation with course grade. Considering social media, the hours a student uses on social media negatively impacts their course average, and those who use YouTube are correlated with a higher course average. When we consider only those students who identify as playing video games, the age at which they started gaming has a negative impact on their course grade. For social media variables, only Tumblr is significant, and it is positive.

When the grade is parsed into a binary variable equaling one for an A and zero for every other grade, again, playing video games has no correlation. Three social media variables are significant:

Facebook is negative, *Instagram* is negative, and *Other Social Media* (i.e., not Facebook, Instagram, Twitter, Reddit, Snapchat, Pinterest, Tumblr, or YouTube) is positive. When only the video gaming sample is analyzed in the binary setting, three video game and two social media variables are significant. Students who play video games during weekend afternoons have a positive correlation with earning an A. Students who would rather video game than watch TV and those who agree that playing video games make them bored (and yet they still play) both are negatively correlated with earning and A. Students who use *Facebook* negatively correlate with an A, whereas one who use *Other Social Media* correlates higher with an A.

The remainder of this paper is as follows. The next section addresses the literature review via a factor analysis. Section three covers the data and empirical methods. In section four we discuss the empirical results and in five we cover implications for practice and conclude.

Literature Review and Factor Analysis

To control for potential omitted variable bias in our empirical models, we include independent variables that are shown to be correlated with student performance, in general. Such a robust set of control variables will allow us to pinpoint with more accuracy the real relationship between student performance in the intro to finance course and video game/social media usage. We include a description of all significant variables in Table 1. For our study and analysis purposes, we have grouped many of the individual variables into factor groups using factor analysis. We construct factors to capture multiple dimensions within a single construct and test for the significance of a factor, which the individual variable may not wholly measure. We elaborate on the individual variables that compose the factor groups below.

1) Drive: The *Drive* factor includes individual variables that describe a student's belief of how much they strive toward learning, academic goals, and career goals. Researchers in many educational disciplines find that these three variables correlate positively with student's academic success (e.g., Cole, Field, and Harris, 2004; Loo & Choy, 2013; Phan, 2012). Although little research has been done regarding recreational video gaming and academic motivation, there is some evidence that using educational video games can increase motivation in students (Ebrahimzadeh, 2017). Zusho, Anthony, Hashimoto, and Robertson (2014) conversely find insufficient evidence that video games provide any motivational pull.
2) Sleep: The *Sleep* factor comprises two variables: the time the student generally goes to bed and the time the student generally wakes up. Prior research has found that appropriate sleep schedules (time) correlate with academic success (Howell, Jahrig, and Powell, 2004; Taylor, Vatthauer, Bramoweth, Ruggero, and Roane, 2013; Wolfson & Carskadon, 1998). However, Eliasson, Lettier, and Eliasson (2010) suggest that sleep efficiency is better than total sleep time when predicting sleep's effect on academic success.
3) Self-Belief: The *Self-Belief* factor comprises the student's self-assessment of the following variables: personal handling of difficult situations, personal handling of many things at once, and self-belief. This factor has been studied before (Brau, Brau, Owen, and Swenson, 2016; Brau et al. 2017), where it was found to have a slightly negative effect on course success outcome in a Tobit model. Brau et al. (2017) suggest that the negative relationship may exist as a result of the overconfidence of the student. As Brau et al. (2017) discuss, studies have found that high schools do not help students develop accurate expectations prior to beginning higher education. Nonis and Hudson (2006) document that 69% of high

school students indicate they were achieving their academic potential contrasted with faculty perceptions of students at 22%.

Table 1
Variable Definitions

Variable	Definition (All Likert Scales range from 1 (Strongly Disagree) to 7 (Strongly Agree)
AcadSchoIEver	Indicator variable = 1 if yes to "Have you received an academic scholarship?"
AcaSchoI	Indicator variable = 1 if yes to "Are you currently on academic scholarship?"
ACT	"What is the highest score you received on the ACT?"
Age	"What is your age?"
AthlSchoI	"Have you received an athletic scholarship?"
AttndClass	Likert scale for "I attend all of my classes."
BelifHar	Likert scale for "My belief in myself gets me through hard times."
BusAcadm	Likert scale for "I am determined to do well in my business courses because I want to achieve my academic goals."
BusCarr	"I am determined to do well in my business courses because I want to pursue a career in business."
BusinessMajor	"Are you a Pre-business Major, Business Minor, or neither?"
BusinessMinor	"Are you a Pre-business Major, Business Minor, or neither?"
BusLearn	Likert scale for "I am determined to do well in my business courses because I am interested in learning new subjects."
BusMinor	Indicator variable = 1 if Minor to "Are you a Pre-business Major, Business Minor, or neither?" and 0 otherwise.
Children	"Do you have children?"
ClassSkill	Likert scale for "How well do you rate your skills in this class's subject matter?"
CloseWorker	Indicator variable = 1 if yes to "Do you have a parent, sibling, or close associate who works in this field?"
CollegeGPA	"What is your [this college] GPA (4.00 maximum)?"
ConfMath	Likert scale for "I have confidence in my math ability."
CourseAcadGoals	Likert scale for "I am determined to do well in my business courses because I want to achieve my academic goals."
CourseBusCareer	Likert scale for "I am determined to do well in my business courses because I want to pursue a career in business."
CourseLearnNew	Likert scale for "I am determined to do well in my business courses because I am interested in learning new subjects."
CredHrs	"How many credit hours are you taking this semester?"
Depressed	Likert scale for "I would consider playing video games if I felt depressed."
EmHlpFam	Likert scale for "I get the emotional help and support I need from my family."
EQLar_Sm	Likert scale for "I perform equally well in large classes and small classes."
ExtraAct	"Approximately how many hours did you spend each week participating in extracurricular activities (for example, ROTC, performing arts groups, membership or leadership in campus clubs, etc.)?"
Facebook	"What social media platforms do you use? (Select all that apply)"
FamInSub	"Do you have a parent, sibling, or close associate who works in this field?"
FrndHelp	Likert scale for "My friends really try to help me."
GameInSem	"Did you attend any or all of your sport's games during this semester?"
GdNotes	Likert scale for "I take good notes in class."
Gender	"To which gender identity do you most identify?"
Grade	The percentage grade earned in the course from instructor's gradebook.
HndlMany	Likert scale for "I feel I can handle many things at a time."
HrPaidJb	"How many hours each week have you spent at a paid job this semester?"
HrRelSer	"How many hours each week do you spend serving in your religious or spiritual community?"
HrsSocialMedia	"How many hours do you use social media daily? (on average)"
HrsStudyExamWeek	"How many hours per exam week do you study outside of class for this class?"
HrsStudyNonExamWeek	"How many hours per non-exam week do you study outside of class for this class?"
HSGPA	"What is your high school unweighted GPA (4.0 maximum)?"
Instagram	"What social media platforms do you use? (Select all that apply)"
Interest	Likert scale for "What is your personal level of interest in this class topic?"
IntSub	"How interested are you in this subject?"
LearnOutClass	Likert scale for "I learn best outside of class through personal study."
LengthSession	"What is the typical length of a gaming session in hours?"
Lonely	Likert scale for "I would consider playing video games if I felt lonely."
Marital	"What is your marital status?"
MathConf	Likert scale for "I have confidence in my math ability."
MathSkill	Likert scale for "I believe I have good math skills."
NoBusiness	Indicator variable = 1 if neither to "Are you a Pre-business Major, Business Minor, or neither?" and 0 otherwise.

Table 1 (continued)
Variable Definitions

Variable	Definition (All Likert Scales range from 1 (Strongly Disagree) to 7 (Strongly Agree)
NotePer	Likert scale for "Studying my notes improves my performance in class. "
OtherMajor	Indicator variable = 1 if Minor to "Are you a Pre-business Major, Business Minor, or neither?" and 0 otherwise.
OthersWatchPlay	Likert scale for "I play video games with others watching me play or playing with me."
OutDiff	Likert scale for "When I am in a difficult situation, I can usually find my way out of it."
PaidJobHours	"How many hours each week have you spent at a paid job this semester?"
PercentReadings	"What percentage of the assigned readings do you generally have completed before attending this class?"
Pinterest	"What social media platforms do you use? (Select all that apply)"
PlayVid	Indicator variable = 1 if yes to "Do you play video games (can be on phone, laptop, console, etc.)?" and 0 otherwise.
VGBecauseBoredom	Likert scale for "I would consider playing video games if I felt bored."
VGPlayWithOthers	Likert scale for "I prefer playing video games with others than playing by myself."
PplGp	"How many people (yourself included) regularly participate in your study group? "
PreACCT	Pre Accounting Major
PreBusMajor	Indicator variable = 1 if Pre-business Major to "Are you a Pre-business Major, Business Minor, or neither?" and 0 otherwise.
PreEXDM	Pre Experiential Design Major
PreFIN	Pre Finance Major
PreMarketing	Pre Marketing Major
PreSupplyChain	Pre Supply Chain Major
PrevAcaSchol	"Have you had a previous accounting course?"
ReadingBeforeClass	"What percentage of the assigned readings do you generally have completed before attending this class?"
Reddit	"What social media platforms do you use? (Select all that apply)"
Retake	"Are you retaking this class?"
SAT	"What is the highest score you received on the SAT?"
SatAccPerf	Likert scale for "I feel satisfied with my academic performance."
SatAcEffort	Likert scale for "I feel satisfied with my academic efforts."
Section	Either Section 1 or 2.
SmallClassBetter	Likert scale for "Class size affects my overall performance -- the smaller the class the better.."
SmBetter	Indicator variable = 1 if yes to "Do you use social media during class?" and 0 otherwise.
SocialMedia	"Do you use Social Media (like Facebook, Twitter, Instagram, etc.)?"
SocialMediaDuringClass	Indicator variable = 1 if yes for "How many hours do you use social media daily? (on average)" and 0 otherwise.
SocialMediaClassTime	"How many hours do you use social media daily? (on average)"
StartSemester	"Which semester did you begin studying at [this university]?"
StGrp	"Are you in a study group for this class?"
SubjectMatterSkill	Likert scale for "How well do you rate your skills in this class's subject matter?"
TeachPrinciples	"Do you teach other people principles from the class in order to help you learn the material from class?"
TimeSleep	"What time do you typically go to sleep at night?"
Transfer	Indicator variable =1 if yes to "Did you transfer to [this university] from another university? and 0 otherwise.
Trauma	Indicator variable = 1 if yes to "Did you happen to experience a traumatic life event right before or during this semester (for example, death of a loved one, your own divorce or divorce of your parents, serious illness of self or immediate family member)?"
Tumblr	"What social media platforms do you use? (Select all that apply)"
Tutor	"How often do you use tutors (non-TAs) for this class?"
Twitter	"What social media platforms do you use? (Select all that apply)"
UAC	"Do you have a letter on file with the University Accessibility Center (UAC) that provides academic accommodations to you?"
UnderstandCourse	Likert scale for "I feel like I understand my course material."
VGAdventure	"What types of video games do you play? (check all that apply)"
VGARGames	"What types of video games do you play? (check all that apply)"
VGConsoleDesktopComputer	"What console do you play video games on? (Check all that apply)"
VGConsolePhone	"What console do you play video games on? (Check all that apply)"
VGEducation	"What types of video games do you play? (check all that apply)"
VGMassiveMultiplayerOnlineGame	"What types of video games do you play? (check all that apply)"
VGOnlineRolePlaying	"What types of video games do you play? (check all that apply)"
VGSimulations	"What types of video games do you play? (check all that apply)"
VGStrategy	"What types of video games do you play? (check all that apply)"
VGWeekendMorning	"What time(s) of day do you typically play video games on weekends? (Select all that apply)"

4) Subject Matter: The *Subject Matter* factor measures two variables: the student's interest in the class subject (introduction to finance) and their self-assessed skill in the class material. Previous studies have examined student's skills and interest in finance, and the outcome of both variables on course outcome. Several studies show that interest in a course subject is significant to student performance in that course (e.g., Brau et al., 2016; Brau et al., 2017; Kara, Bagheri, and Tolin, 2009; Loo & Choy, 2013).

5) Math: The *Math* factor is comprised of the student's confidence in math and their skill in math. Consistent with previous studies, we construct the math factor using the student's self-assessed confidence and skill in math, as measured by a seven level Likert scale. This differs from the methods of previous studies where researchers have used ACT math scores (Trine and Schellenger, 1999; Uyar and Gungormus, 2011), and previous math class outcomes (Kirk and Spector, 2006). The advantage of allowing students to self-report their math skills and math confidence is that we can overcome the measurement limitation explained by Ballard and Johnson (2004) that no single variable can exemplify math skills sufficiently. Previous research has shown that there is a significant correlation between gender and math. Hyde, Lindberg, Linn, Ellis, and Williams (2008) show that although the gap is shrinking, men tend to be better at math than women. Although women generally have lower math SAT scores than men, Odell and Schumacher (1998) report that women do not rate their math ability lower than men and find that within a business school men and women have a significant difference in math ability and recommend that colleges use different grade prediction scales for each. Motivated by such findings, we control for gender in our empirical model.
6) Intelligence: The *Intelligence* factor is comprised of three variables: (1) whether the student has previously been granted an academic scholarship, (2) the student's score on the ACT on the traditional 36-point scale, (3) and the student's SAT score on a 33-point scale. Most students have taken either the ACT or the SAT, not both. ACT/SAT scores and scholarships have long been accurate predictors that researchers use when studying class success outcomes (e.g., Betts and Morrell, 1999; Coyle and Pillow, 2008).
7) Athlete: The *Athlete* factor is made up of the three variables: (1) whether the student has received an athletic scholarship, (2) whether they are currently a collegiate athlete, and (3) whether they participated in any or all of their sport's games during the semester in question. Purdy, Eitzen, and Hufnagel (1982) studies approximately 2,000 college athletes over a ten-year window and find that college athletes are generally less prepared for college and achieved less academically than other students. In addition, Adler and Adler (1985) find that while most college athletes begin college with optimistic attitudes toward their academic goals, athletes typically become detached from their academic goals because of their athletic, social, and academic experiences.
8) Notes: The *Notes* factor includes the self-reported variable of whether the student takes good notes and their belief that notes improve their success in the class. A prior study finds that most students had unsatisfactory notes and that the notes taken in class are a significant factor in student's success in the course (Chen, 2013a). In addition, Baker and Lombardi (1985) report a "strong relation between note-taking and test performance."
9) Study Group: The *Study Group* factor includes variables of whether the student is in a study group and the number of students in the study group. Saleem (2001) finds that, "interacting with friends provides mutual circles which may enhance [student] interest in instructional and non-instructional activities." This finding suggests that students who participate in study groups with their friends and classmates tend to be more engaged with the class material. However, when Brau et al. (2016, 2017) include a factor that also contains variables relating to study groups, they state the following:

> *However, there is a nuance with this factor. It may be the case that students who grasp the material quickly or have a natural knack for the material do not need to seek outside help. If this is the case, only those students who need outside*

help will seek it, and on average, these may be weaker students. If this is the case, then ceteris peribus, we predict the Outside Help factor will have a negative correlation with grade.

It is important to note that when Brau et al. (2016, 2017) test the study group factor, the factor comes back statistically indifferent from zero in both models tested.

10) Parents Limit Video Games: Chen (2013b) concludes that limiting the screen time during adolescence can improve school performance. The research on college-aged individuals and the impact that parental limits in their youth have on their academic success is sparse in the existing literature. The *Parents Limit Video Games* factor includes whether a parent limited video games and how many ways the parent limited the student's gaming habits. Most of the students surveyed currently do not have external limits set on their gaming, so this factor measures parents' historical efforts to limit gaming time.
11) Video Game Type: The *Video Game Type* factor measures how many different genres of video games a student plays. For example, the different genres could be First Person Shooter (such as Halo or Overwatch), Sandbox (such as Minecraft), or Online Role-Playing (such as World of Warcraft). Notice that this factor does not distinguish whether playing a specific type of game significantly influences grade but whether playing various combinations of types influences grade outcome.
12) Early Morning Game Play: The *Early Morning Game Play* factor contains the variables of whether the student plays video games in the early morning (4 AM – 8 AM) on weekdays, and whether the student plays video games in the early morning on weekends. Triberti, Milani, Villani, Grumi, Peracchia, Curcio, and Riva (2018) find that there is a relationship between when individuals play video games and video game addiction. Video game addiction could potentially have an impact on course outcome, hence its inclusion as a variable of interest in this research analysis.
13) *Nighttime Game Play*: This factor contains the variables of whether the student plays video games at night (8 PM – 12 AM) during weekdays and whether the student plays video games at night during weekends. We again reference Triberti et al. (2018) as above and expect that the time of play is related to video game addiction, and that this type of media compulsion is negatively correlated with course performance.
14) Time and Type of Video Game Console: To our knowledge, we are among the first scholars to include such a variable in the type of research setting as this paper. The *Time and Type of Video Game Console* factor is comprised, in part, of when the student generally plays video games (excluding early morning play, and nighttime play as outline above), and the type of console the student uses (e.g., Xbox, PlayStation, PC, Nintendo, etc.).
15) *Emotional Factors in Playing Video Games*: Wang, Sheng, and Wang (2019) find that mobile game addiction is positively correlated with social anxiety, depression, and loneliness. Thus, the emotional state of the student while playing video games is constructed by variables related to video game habits as they relate to emotional duress (loneliness, depression, stress, boredom).
16) *Television and Video Games Interferes with Homework*: The last factor we discuss is the relates to the interference of television and video games on student homework. This factor consists of several variables where the student indicates whether their video game/television habits interfere with their at-home assignments. Such interference could be an indication of significant time spent using video games/media, which Anand (2007) find to be negatively correlated with academic performance.

Data and Methods

The sample for this study consists of 1,257 student responses to survey questions at a large, private university. The students were offered extra credit to complete the 131-item questionnaire. The response rate is 80% which is high when compared to other finance-related surveys (e.g., Graham & Harvey (2001), 8.5 percent response rate; Trahan & Gitman (1995), 12 percent response rate; Brau & Fawcett (2006), 18.8 percent response rate; Krigman, Shaw, & Womack (2001), 34 percent response rate; Brau, Ryan, & Degraw (2006) 44.5 percent response rate, Brau et al. (2017) 60.4 percent response rate). Our survey questions are derived using academic literature, recommendations from professors and students, and our ideas of what might be directly applicable to an intro to finance class. The survey is available upon request. Table 2 reports the declared major of our sample and Table 3 reports descriptive statistics of the survey responses.

Table 2: Student Declared Majors

EMPHASIS	#	**EMPHASIS**	#
UNDECIDED	169	GLOBAL SUPPLY CHAIN	31
ACCOUNTING	122	HUMAN RESOURCES	20
ANIMATION	2	INFORMATION SYSTEMS	94
ASIAN STUDIES	1	INTERNATIONAL RELATIONS	2
BIOLOGY	14	ITALIAN	1
CHEMICAL ENGINEERING	10	LANDSCAPE MANAGEMENT	6
CHINESE	3	MANUFACTURING ENGINEERING	5
CIVIL ENGINEERING	4	MARKETING	64
COMMUNICATION DISORDERS	1	MECHANICAL ENGINEERING	10
COMMUNICATIONS	11	MEDIA ARTS	3
COMPUTER SCIENCE	20	MIDDLE EASTERN STUDIES	1
CONSTRUCTION MANAGEMENT	20	MUSIC	1
DANCE	1	NEUROSCIENCE	8
DENTAL HYGEINE	1	NURSING	2
DESIGN	7	PHILOSOPHY	3
ECONOMICS	29	PHYSICS	2
ELEMENTARY EDUCATION	1	POLITICAL SCIENCE	13
ENTREPRENEURIAL MANAGEMENT	16	PORTUGUESE	1
EUROPEAN STUDIES	1	PRE-BUSINESS	261
EXDM	68	PRE-ENGINEERING	6
EXERCISE SCIENCE	2	PSYCHOLOGY	16
FAMILY STUDIES	6	PUBLIC RELATIONS	16
FINANCE	135	RUSSIAN	5
FOOD SCIENCE	7	SOCIOLOGY	8
FRENCH	1	STATISTICS	7
GENERAL STUDIES	1	STRATEGIC MANAGEMENT	12
GEOGRAPHY	3	THEATER	2

Table 3: Descriptive Statistics

Variable	N	Mean	Median	Minimum	Maximum
PrevAcaSchol	1163	0.51	1	0	1
AcaSchol	1257	0.01	0	0	1
ACT	1155	26.52	28	0	36
Age	1162	21.47	21	17	31
AthlSchol	1257	0.02	0	0	1
AttndClass	1162	5.83	6	1	6
BelifHar	1162	5.56	6	1	7
BusAcadm	1159	6.14	6	1	7
BusCarr	1162	5.91	6	1	7
BusLearn	1163	5.74	6	1	7
CollegeGPA	1114	3.57	3.67	0	4
Children	1163	0.02	0	0	1
CollAthl	1163	0.05	0	0	1
ConfMath	1162	5.57	6	1	7
CredHrs	1163	13.97	14	8	19
EmHlpFam	1163	5.90	6	1	7
EngFirst	1149	0.95	1	0	1
EQLar_Sm	1163	4.87	5	1	7
ExtraAct	1162	1.89	1	0	11
FamInSub	1161	0.36	0	0	1
FrndHelp	1161	5.53	6	1	7
GameInSem	1257	0.04	0	0	1
GdNotes	1163	5.23	5	1	7
Gender	1162	0.40	0	0	7
HlpDesk	1161	0.93	0	0	6
HndlMany	1161	5.44	6	1	7
HrsStudyExamWeek	1160	7.05	7	0.5	10
HrPaidJb	1159	2.76	3	0	8
HrRelSer	1144	2.12	2	0	6
HrsStudyNonExamWeek	1160	2.97	3	0.5	10
HSGPA	1140	3.83	3.9	0	4
IntSub	1158	5.18	5	1	7
Marital	1163	0.19	0	0	1
MathSkill	1163	5.54	6	1	7
Mission	1158	0.89	1	0	2
NotePer	1163	5.23	6	1	7
OutDiff	1162	5.87	6	1	7
PplGp	1257	0.92	0	0	7
Race	1153	5.76	6	1	8

ReadingBeforeClass	1070	73.01	82	0	100
SAT	364	24.09	25	2	33
ClassSkill	1158	5.15	5	1	7
SmBetter	1163	4.20	4	1	7
StGrp	1159	0.32	0	0	1
TeachPrinciples	1158	0.57	1	0	1
Transfer	1163	0.20	0	0	1
Trauma	1156	0.16	0	0	1
Tutor	1156	0.35	0	0	6
UAC	1162	0.06	0	0	1
WhnSleep	1162	5.31	5	1	7
WhnWake	1143	5.18	5	1	7
Gamer	1206	0.50	1	0	1
SocialMedia	1184	0.93	1	0	1
HrsSocialMedia	1088	1.93	2	0.5	11
SocialMediaClassTime	1067	0.43	0	0	1
Retake	1158	0.06	0	0	1
BusinessMajor	1257	0.65	1	0	1
BusinessMinor	1257	0.17	0	0	1
OtherMajor	1257	0.75	1	0	1
PreACCT	1257	0.10	0	0	1
PreBusM	1257	0.21	0	0	1
PreFIN	1257	0.11	0	0	1
PreIS	1257	0.07	0	0	1
PreEXDM	1257	0.05	0	0	1
PreMarketing	1257	0.05	0	0	1
PreSupplyChain	1257	0.02	0	0	1
PreStrategicM	1257	0.01	0	0	1
PreEntMan	1257	0.01	0	0	1

Applied empirical methods include factor analysis; univariate Spearman correlation tests; multivariate ordinary least squares regressions; difference in means t-tests based on whether a student earns an A or not; and binary logistic regressions, where the outcome variable of interest is whether a student surveyed earns an A or not at the semester's end. A more detailed explanation and the econometric representation of the regressions are included in Section 4.

Empirical Results

Continuous Outcome Analysis

We begin by studying the Spearman correlation coefficients between a student's outcome grade (a value between 0 and 1). Table 4 reports the significant Spearman correlation coefficients for each of the survey variables as they positively correlate with the student's course grade. Each variable reports the name of the variable, the estimated correlation coefficient (rho), the p-value, and the number of observations. Although there is a high probability that these correlations suffer

from omitted variable bias, the correlations are included as several interesting patterns can be seen from this table.

Table 4: Spearman Correlations with Positive Significant Relationship to Course Outcome

Variable Name	Rho	P-Value	N
PrevAcaSchol	0.3160	<.001	1163
AcaSchol	0.0790	0.0050	1257
ACT	0.2450	<.001	1155
AthlSchol	0.0730	0.0090	1257
AttndClass	0.1170	<.001	1162
BelifHar	0.1200	<.001	1162
BusAcadm	0.3850	<.001	1159
BusCarr	0.3100	<.001	1162
BusLearn	0.2460	<.001	1163
CollegeGPA	0.5630	<.001	1114
ConfMath	0.3340	<.001	1162
CredHrs	0.1120	<.001	1163
EmHlpFam	0.1560	<.001	1163
EQLar_Sm	0.3610	<.001	1163
ExtraAct	0.1080	<.001	1162
FamInSub	0.0990	0.0010	1161
FrndHelp	0.0890	0.0020	1161
GameInSem	0.0600	0.0330	1257
GdNotes	0.1230	<.001	1163
HndlMany	0.1990	<.001	1161
HrsStudyExamWeek	0.1010	0.0010	1160
HrsStudyNonExamWeek	0.1470	<.001	1160
HSGPA	0.2580	<.001	1140
IntSub	0.3640	<.001	1158
MathSkill	0.3140	<.001	1163
Mission	0.1590	<.001	1158
NotePer	0.1870	<.001	1163
OutDiff	0.1640	<.001	1162
PplGp	0.0710	0.0110	1257
ReadingBeforeClass	0.1550	<.001	1070
SAT	0.2450	<.001	364
ClassSkill	0.5990	<.001	1158
StGrp	0.0700	0.0170	1159
TeachPrinciples	0.1390	<.001	1158
BusinessMajor	0.1690	<.001	1257
OtherMajor	0.1100	<.001	1257
PreACCT	0.1440	<.001	1257
PreFIN	0.2280	<.001	1257

Positively correlated with course grade are many variables we expect to see in this category: whether the student has previously been on academic scholarship, whether the student is currently on academic scholarship, ACT score, the student's level of class attendance, College GPA, High School GPA, and the amount of reading the student does before class, among others. More surprising are variables such as the amount of credit hours that students are enrolled in, non-business major, and whether the student is a collegiate athlete. It is worth noting that our binary variable of whether a student plays video games is non-significant, perhaps suggesting that it does not hurt nor help the student's grade on average.

Table 5 reports the negatively correlated variables with student performance. Brau et al. (2016) suggest that the variable Children found in Table 5 could be argued, a priori, for either a negative or positive sign of the correlation. For example, relative to a grade in the class, having a child may help a student be more mature and driven with the added responsibility; or conversely, having a child may hurt a student by resulting in less sleep and energy: one of these predicts a positive correlation, while the other predicts the opposite. The correlation observed in this study is -0.074 which is consistent with the second explanation.

Many correlations in the negative category are unsurprising, but confirming in nature, such as hours at a paid job, hours spent doing religious service, and hours spent on social media. Other variables, such as whether a student is retaking finance (-0.141, p-value <0.001), are surprising. It seems counterintuitive that a student taking an introductory finance class for the second time would be negatively correlated with grade. The grade in the prerequisites is so crucial for program admission at the university where students were surveyed so some students choose to retake the class in an effort to earn an A. Regardless of the fact that these students are already familiar with the course material, and have sat through the lectures twice, these students still tend to underperform. Such a result suggests that students who do not do well enough the first time they take the class have some inherent, persistent reason that continues to challenge them the second time. Both transfer students (-0.116, p-value < 0.001) and students who report to have experienced some sort of serious trauma during the semester (-0.159, p-value < 0.001) correlate negatively with course outcome. Both correlations confirm anecdotal evidence among faculty and prior studies (e.g., Brau, et al., 2017).

Most notably, it appears that several of the video game variables have a statistically negative correlation with a student's performance in the intro to finance class. Many of the social media variables are also statistically negative in relation to course grade, the most interesting being whether a student uses any sort of social media (-0.076, p-value=0.009), the hours the student spends on social media every day (-0.078, p-value=0.01) and whether the student uses social media during class (-0.096, p-value=0.002). However, several of the video game and social media variables may be correlated with other factors that explain why a student is using those outlets. To control for this potential omitted variable bias, we implement a regression model.

Table 5: Spearman Correlations with Negative Significant Relationship to Course Outcome

Variable Name	Rho	P-Value	N
Age	-0.1080	<.001	1162
Children	-0.0740	0.0110	1163
Gender	-0.1710	<.001	1162
HrPaidJb	-0.2720	<.001	1159
HrRelSer	-0.1610	<.001	1144
Marital	-0.0670	0.0230	1163
SmBetter	-0.2850	<.001	1163
Transfer	-0.1160	<.001	1163
Trauma	-0.1590	<.001	1156
Tutor	-0.0630	0.0320	1156
UAC	-0.0790	0.0070	1162
SocialMedia	-0.0760	0.0090	1184
HrsSocialMedia	-0.0780	0.0100	1088
SocialMediaClassTime	-0.0960	0.0020	1067
Retake	-0.1410	<.001	1158
BusinessMinor	-0.1620	<.001	1257
PreEXDM	-0.0940	0.0010	1257
PreMarketing	-0.0710	0.0110	1257
PreSupplyChain	-0.0730	0.0100	1257
Section	-0.3250	<.001	1257
VGWeekendMorning	-0.0530	0.0620	1257
VGMassiveMultiplayerOnlineGame	-0.0640	0.0230	1257
VGOnlineRolePlaying	-0.0510	0.0700	1257
VGAdventure	-0.0710	0.0110	1257
VGStrategy	-0.0490	0.0840	1257
VGEducation	-0.0490	0.0790	1257
VGSimulations	-0.0710	0.0120	1257
VGARGames	-0.0620	0.0270	1257
VGConsoleDesktopComputer	-0.0610	0.0310	1257
VGConsolePhone	-0.0630	0.0260	1257
VGBecauseBoredom	-0.0860	0.0360	587
VGPlayWithOthers	-0.0900	0.0290	584
UseSocialMedia	-0.0760	0.0090	1184
Facebook	-0.0990	<.001	1257
Instagram	-0.0890	0.0020	1257
Twitter	-0.0630	0.0270	1257
Reddit	-0.0550	0.0500	1257
Pinterest	-0.1400	<.001	1257
Tumblr	-0.0550	0.0500	1257
HoursSocialMedia	-0.0780	0.0100	1088
SocialMediaDuringClass	-0.0960	0.0020	1067

We use an ordinary least squares (OLS) regression to model the relationship between our independent variables and student outcomes. Such an analysis allows us to control for endogeneity issues such as omitted variable bias. We estimate the following empirical model,

$$Grade_i = \alpha + \beta_k Vars_i + \varepsilon_i$$

where $Grade_i$ is the outcome grade between 0 and 100 for student i, α is the intercept, $Vars_i$ is the vector of survey responses for student i, β_k is the coefficient estimate for the kth survey response for student i, and ε_i is the error term. In all models we test for multicollinearity using variance inflation factors (VIFs) and use heteroskedastic consistent standard errors.

Table 6 reports the results of a specification that includes the variables grouped by our factor analysis. The most important finding of our model estimates is that the indicator variable that controls for video game usage is statistically insignificant (coeff=-0.0034, p=0.6014), implying that there was in fact some omitted variable bias in the pairwise correlation tests. For example, students who engage in video gaming may be using gaming as an outlet to cope with other factors that impact their course performance, such as experiencing a traumatic event (which is statistically significant in our multivariate model). However, according to the model, increased social media usage does, in fact, negatively correlate with academic performance (coeff=-0.0055, p=0.0072). Students who use YouTube perform better in the course (coeff=0.0178, p=0.0072). The lectures for this course have historically been posted to YouTube, which perhaps accounts for the positive significance, indicating that students who review the lectures online are correlated with higher grades. The model has an adjusted R^2 of 53.0% with an F-statistic of 8.264 and model p-value of <.0001 indicating overall model statistical significance.

For robustness, Table 7 reports multivariate results for students who reported engaging in video gaming at some point. The results reported in Table 7 give insight to the factors that affect students who do play video games and find similar overlap in significant predictor variables of student performance between the entire sample and the subsample of only those who report playing video games. Among students who play video games, the age at which they started playing (coeff=-0.0031; p=0.0205) negatively correlates with their course average. For social media variables, video gamers who use Tumblr (coeff=0.1208; p=0.0153) have a positive relationship with course grade.

Table 6

Regression Analysis of Combined Sample to Course Outcome (Significant Factors Only)

Variable	Parameter Estimate	Standard Error	T Value	P Value
(Intercept)	0.2045	0.0864	2.3666	0.0181
VGPlayVideoGames	-0.0034	0.0066	-0.5226	0.6014
YouTube	0.0178	0.0066	2.6922	0.0072
HoursSocialMedia	-0.0055	0.0023	-2.3866	0.0172
SubjectMatter	0.0160	0.0017	9.6506	<.0001
Drive	0.0034	0.0013	2.6998	0.0070
Math	0.0024	0.0013	1.9094	0.0565
Intelligence	0.0013	0.0006	2.2710	0.0233
Athlete	0.0144	0.0064	2.2470	0.0248
PrevAcaSchol	0.0264	0.0067	3.9444	<.0001
AttndClass	0.0217	0.0047	4.6639	<.0001
CollegeGPA	0.0811	0.0084	9.6227	<.0001
EQLar_Sm	0.0071	0.0024	3.0018	0.0027
HrsStudyExamWeek	0.0049	0.0014	3.4962	0.0005
HrPaidJb	-0.0028	0.0017	-1.6766	0.0939
HrRelSer	-0.0062	0.0036	-1.7077	0.0880
Mission - Served a Mission	0.0174	0.0103	1.6821	0.0928
Race - Asian	0.0322	0.0175	1.8359	0.0666
Race - Native Hawaiian or Pacific Islander	-0.0463	0.0239	-1.9398	0.0527
ReadingBeforeClass	0.0003	0.0001	2.3612	0.0184
Transfer	-0.0215	0.0085	-2.5407	0.0112
Trauma	-0.0355	0.0086	-4.1258	<.0001
BusinessMinor	-0.0191	0.0091	-2.1116	0.0349
PreIS	0.0291	0.0112	2.6097	0.0092
PreMarketing	-0.0291	0.0138	-2.1110	0.0350
PreSupplyChain	-0.0403	0.0185	-2.1758	0.0298
PreEntMan	-0.0910	0.0254	-3.5817	0.0004
Section	-0.0698	0.0083	-8.4060	<.0001
	Adjusted R^2		**F-Stat**	**P Value**
Model	53.0%		8.264	<.0001

Table 7
Regression Analysis of Video Gaming Students to Course Outcome (Significant Factors Only)

Variable	Parameter Estimate	Standard Error	T Value	P Value
VGAgeStartedPlayingVG	-0.0031	0.0013	-2.3249	0.0205
Tumblr	0.1208	0.0496	2.4341	0.0153
Math	0.0046	0.0018	2.6061	0.0095
SubjectMatter	0.0189	0.0024	7.8708	0.0000
Intelligence	0.0015	0.0008	1.7942	0.0734
Athlete	0.0195	0.0100	1.9552	0.0512
ParentLimit	-0.0098	0.0043	-2.2919	0.0224
EarlyMorningPlay	0.0369	0.0167	2.2069	0.0278
PrevAcaSchol	0.0329	0.0096	3.4095	0.0007
AttndClass	0.0234	0.0065	3.5902	0.0004
CollegeGPA	0.0653	0.0110	5.9349	0.0000
EQLar_Sm	0.0059	0.0035	1.6630	0.0970
FrndHelp	-0.0078	0.0039	-2.0017	0.0459
HlpDesk	0.0034	0.0040	0.8391	0.4019
HrsStudyExamWeek	0.0035	0.0020	1.7115	0.0877
Race - Asian	0.0504	0.0274	1.8431	0.0659
Transfer	-0.0287	0.0127	-2.2678	0.0238
BusinessMinor	-0.0262	0.0127	-2.0590	0.0400
PreIS	0.0267	0.0152	1.7563	0.0797
PreSupplyChain	-0.0499	0.0268	-1.8592	0.0636
PreEntMan	-0.1164	0.0328	-3.5495	0.0004
Section	-0.0670	0.0120	-5.5853	0.0000
	Adjusted R^2		**F-Stat**	**P Value**
Model	51.3%		19.23	<.0001

Elaborating on the controls of the multivariate model output to understand what impacts student performance, the variable *Section* indicates that the section a student enrolls in makes a difference. The section a student enrolls in affecting performance is most likely a proxy for the time of day (one section is at 8am and the other at 2pm) the class is taken. The pedagogical approach in both sections is similar, and most likely *Section* is measuring a clientele variable for preferred section time. Students in the 8am section tend to out-perform those in the 2pm section. It seems that a certain type of student who is willing to attend the first-class slot of the academic day has some correlation not captured in the other variables that positively relates to grade.

Drive, *Subject Matter*, and *Intelligence* are all consistent with theoretical predictions. However, the factor *Self-Belief* is somewhat surprising on its face, and negatively correlates with the student's grade, on average. In context, *Self-Belief* is consistent with Brau et al. (2016) who attribute the negative relationship between course outcome and self-belief to overconfidence. Another interesting variable in this model is the hours that students studied during exam week—this variable is statistically significant, while the variable that represents the number of hours that

student's study during a non-exam week is statistically indifferent from zero. Such findings may suggest that students who are more anxious about the class and who study more still tend to do worse than students who are more comfortable with the material. The model has an adjusted R^2 of 51.3% with an F-statistic of 19.23 and model p-value of <.0001, consistent with Table 6, indicating overall model statistical significance.

Discrete Outcome Analysis

For our discrete analysis, we split the sample into two groups: students who earn an A and students who did not. We begin by performing a difference in means test reported in Tables 8 and 9. For each variable, there is a column corresponding to the number of observations for the variable for students who earned an A (denoted *A Students*), and those who did not (denoted *Non-A Students*). Reported are the mean of the respective groups of students, the p-value of the corresponding difference in means, and the difference between the mean of *A Students* and the mean of *Non-A Students*.

Perhaps the most striking result of Tables 8 and 9 is that the vast majority of differences are statistically significant. (The p-values have been adjusted for sample size and variance). Much like the correlations in Tables 4 and 5, we document interesting (but expected) results. For example, *A-Students* typically have higher ACT/SAT scores, higher GPA's, spend less time at a paid job, are not transfer students, and experience less trauma. We also observe that the p-value for the t-test on the video game variable is statistically indifferent from zero further indicating that video gaming does not play a significant role in finance student performance.

Similar to our continuous outcome analysis, it is important to control for the potential existence of omitted variable biases. To that end, we implement a logit regression for robustness. The Logistic model has a binary response variable of whether the student received an A in the class—in this financial management class a 94% is considered an A,

$$Pr(Y_i = 1|Grade \geq 94\%) = \alpha + \beta_k Vars_i + \varepsilon_i$$

where $Pr(Y_i = 1|Grade \geq 94\%)$ equals 1 if a student *i* earned an A in the course (grade greater than or equal to 94%), α is the intercept, $Vars_i$ is the vector of survey responses for student *i*, β_k is the coefficient estimate for the *k*th survey response for student *i*, and ε_i is the error term.

Table 8

Difference in Means of Academic Performance between A and Non-A Students with a Positive Relationship to Earning A

Variable Name	N (A Students)	Mean (A Students)	N (Non-A Students)	Mean (Non-A Students)	P-Value	Diff.
AcaSchol	189	0.026	1068	0.003	0.047	0.023
ACT	176	28.347	979	26.187	0.001	2.16
AthlSchol	189	0.053	1068	0.013	0.018	0.04
AttndClass	177	5.932	985	5.811	0.002	0.121
BusAcadm	176	6.54	983	6.064	<.001	0.476
BusCarr	177	6.362	985	5.832	<.001	0.53
BusinessMajor	189	0.762	1068	0.625	<.001	0.137
BusLearn	177	6.079	986	5.684	<.001	0.395
ClassSkill	176	6.091	982	4.985	<.001	1.106
CollAthl	177	0.085	986	0.044	0.063	0.041
CollegeGPA	174	3.826	940	3.52	<.001	0.306
ConfMath	177	6.147	985	5.468	<.001	0.679
CredHrs	178	14.197	985	13.93	0.075	0.267
EmHlpFam	177	6.056	986	5.873	0.06	0.183
EQLar_Sm	177	5.593	986	4.737	<.001	0.856
ExtraAct	177	2.305	985	1.818	0.028	0.487
FamInSub	177	0.441	984	0.346	0.019	0.095
GameInSem	189	0.079	1068	0.035	0.03	0.044
HndlMany	176	5.665	985	5.402	0.007	0.263
HrsStudyNonExamWeek	177	3.28	983	2.91	0.016	0.37
HSGPA	177	3.899	963	3.815	<.001	0.084
IntSub	176	5.824	982	5.059	<.001	0.765
MathSkill	177	6.102	986	5.436	<.001	0.666
Mission	176	0.949	982	0.875	0.061	0.074
NotePer	177	5.554	986	5.176	0.002	0.378
Other	189	0.079	1068	0.04	0.059	0.039
OtherMajor	189	0.852	1068	0.736	<.001	0.116
OutDiff	177	5.983	985	5.854	0.086	0.129
PreACCT	189	0.169	1068	0.084	0.003	0.085
PreFIN	189	0.238	1068	0.084	<.001	0.154
PrevAcaSchol	177	0.746	986	0.465	<.001	0.281
ReadingBeforeClass	171	77.895	899	72.085	0.01	5.81
SAT	54	26.315	310	23.697	<.001	2.618
TeachPrinciples	176	0.636	982	0.562	0.062	0.074
VGPreferPlayingWithOthers	87	5.874	500	5.498	0.022	0.376
VGWeekendAfternoon	189	0.206	1068	0.147	0.06	0.059

Table 9
Difference in Means of Academic Performance between A and Non-A Students with a Negative Relationship to Earning A

Variable Name	N (A Students)	Mean (A Students)	N (Non-A Students)	Mean (Non-A Students)	P-Value	Diff.
Age	177	21.006	985	21.552	<.001	-0.546
BusinessMinor	189	0.085	1068	0.186	<.001	-0.101
Children	177	0.006	986	0.02	0.043	-0.014
Facebook	189	0.63	1068	0.732	0.007	-0.102
HrPaidJb	176	1.909	983	2.909	<.001	-1
HrRelSer	174	1.96	970	2.144	0.011	-0.184
PreEntMan	189	0	1068	0.015	<.001	-0.015
PreEXDM	189	0.032	1068	0.058	0.074	-0.026
PreMarketing	189	0.016	1068	0.057	<.001	-0.041
PreSupplyChain	189	0	1068	0.029	<.001	-0.029
Reddit	189	0.053	1068	0.086	0.073	-0.033
Retake	176	0.023	982	0.069	0.001	-0.046
Section	189	0.116	1068	0.287	<.001	-0.171
SmBetter	177	3.559	986	4.319	<.001	-0.76
SocialMedia	181	0.895	1003	0.937	0.082	-0.042
SocialMediaClassTime	157	0.363	910	0.441	0.065	-0.078
SocialMediaDuringClass	157	0.363	910	0.441	0.065	-0.078
Transfer	177	0.096	986	0.217	<.001	-0.121
Trauma	176	0.102	980	0.168	0.011	-0.066
Tumblr	189	0	1068	0.007	0.008	-0.007
UAC	178	0.022	984	0.068	0.001	-0.046
UseSocialMedia	181	0.895	1003	0.937	0.082	-0.042
VGAdventure	189	0.085	1068	0.142	0.012	-0.057
VGAvgAmountPlayWeekly	85	3.241	494	4.343	0.01	-1.102
VGConsoleDesktopComputer	189	0.021	1068	0.051	0.019	-0.03
VGConsoleiPad	189	0.011	1068	0.025	0.099	-0.014
VGEducation	189	0.011	1068	0.026	0.081	-0.015
VGHardToStopPlaying	87	4.655	499	5.032	0.05	-0.377
VGLengthGamingSession	87	1.178	500	1.41	0.015	-0.232
VGMassiveMultiplayerOnlineGame	189	0.016	1068	0.042	0.017	-0.026
VGMusic	189	0	1068	0.014	<.001	-0.014
VGPlayAlone	87	4.207	500	4.454	0.082	-0.247
VGsandbox	189	0.058	1068	0.099	0.035	-0.041
VGSimulation	189	0.005	1068	0.022	0.019	-0.017
VGSimulations	189	0	1068	0.026	<.001	-0.026
VGWeekdayEarlyMorning	189	0	1068	0.013	<.001	-0.013
VGWeekdayMorning	189	0.005	1068	0.029	0.001	-0.024

The results of the full-sample logit model are reported in Table 10. We document that the results are robust to those reported in Table 6. Most important for our study, we find that video gaming is statistically insignificant in both the OLS and Logit models. The three social media variables of Facebook, Instagram, and Other Social Media are all robust to the OLS specification in Table 6. The pseudo R^2 for Table 10 is 37.5% with a model p-value <.0001.

Table 10
Logit Regression Analysis of Combined Sample to Course Outcome (Significant Factors Only)

Variable	Parameter Estimate	Standard Error	Z Value	P Value
Intercept	-22.5880	4.6469	-4.8609	<.0001
VGPlayVideoGames	0.0491	0.2377	0.2065	0.8364
Facebook	-0.5583	0.2711	-2.0595	0.0394
Instagram	-0.4911	0.2939	-1.6707	0.0948
Other Social Media	1.0448	0.4783	2.1845	0.0289
SubjectMatter	0.5354	0.0895	5.9843	<.0001
SelfBelief	-0.0871	0.0488	-1.7847	0.0743
Athlete	0.6517	0.2052	3.1765	0.0015
CollegeGPA	2.9836	0.6226	4.7918	<.0001
EQLar_Sm	0.1826	0.0971	1.8805	0.0600
FrndHelp	-0.2543	0.1088	-2.3383	0.0194
HrPaidJb	-0.1693	0.0632	-2.6792	0.0074
Marital	0.5702	0.3250	1.7542	0.0794
Race - Other	2.0363	0.9579	2.1259	0.0335
Transfer	-1.5020	0.3847	-3.9040	<.0001
BusinessMinor	-1.0451	0.3777	-2.7673	0.0057
PreBusM	-0.5888	0.3045	-1.9336	0.0532
PreMarketing	-1.3394	0.6719	-1.9934	0.0462
Section	-1.1245	0.3593	-3.1293	0.0018
Notes: The pseudo R^2 for the model is 0.3754 with a model p-value <.0001				

As a final robustness analysis, we estimate a logit model for the subset of students who report playing video games. The results are reported in Table 11 which has a pseudo R^2 of 48.1% and a model p-value of <.0001. The same three videogame variables and the same two social media variables are robust to the OLS model in Table 7.

Table 11
Logit Regression Analysis Video Gamers to Course Outcome (Significant Factors Only)

Variable	Parameter Estimate	Standard Error	Z Value	P Value
VGWeekendAfternoon	0.9419	0.4519	2.0843	0.0371
VGRatherThanWatchTV	-0.3475	0.1699	-2.0455	0.0408
VGMakeMeBored	-0.6041	0.1994	-3.0304	0.0024
Facebook	-1.6627	0.5618	-2.9599	0.0031
Other Social Media	2.7468	1.0808	2.5415	0.0110
Intelligence	0.0993	0.0425	2.3341	0.0196
SubjectMatter	0.7513	0.1840	4.0825	<.0001
Athlete	0.8658	0.4038	2.1439	0.0320
StudyGroup	0.2647	0.1504	1.7602	0.0784
TimeandType	0.4166	0.1674	2.4888	0.0128
CollegeGPA	3.3282	0.8707	3.8226	0.0001
HrsStudyExamWeek	-0.3425	0.1081	-3.1671	0.0015
Marital	1.7306	0.6163	2.8081	0.0050
Transfer	-1.9767	0.7066	-2.7974	0.0052
BusinessMinor	-1.0718	0.6252	-1.7143	0.0865
Section	-1.8381	0.7321	-2.5108	0.0120
Notes: *The pseudo R^2 for the model is 0.4814 with a model p-value <.0001				

Implications for Practice and Conclusion

In this paper we have given examples of variables and factors that contribute to the course grades of undergraduate students in an undergraduate introduction to financial management class. Although we are not the first researchers to study this type of question, our study is the first to test the effect of video games and social media on academic success in an introductory financial management class. Along with continuing to demonstrate that several of the Harris (1940) variables are still robust today (which Brau et al. (2016) also show), we demonstrate the impact of dozens of individual factors and variables. Using both univariate and multivariate models, we show robustness for a set of variables to contribute to the discussion on how students learn in an introductory finance class. Our paper has implications for not only professors on how to help their students, but also for students who desire to succeed in their classes.

Of our primary findings, the most nuanced for our study is that of the video games and social media variable. There is some evidence that the amount daily social media use does negatively impact the academic performance in introductory finance classes, but we find no evidence that video game play has an impact on course grade in the general sample. For the video gaming sample, we find three video game variables that correlate with course grade and the binary variable of earning an A. Students who manage their time to play video games on weekend afternoons correlate positively with course grade and earning an A. Students who would rather video game than watch TV and those that persist in playing video games even when the games make them

bored are negatively related to course grade. Among the video gaming sample, those who use Facebook are negatively correlated with course grade and earning an A whereas those who use other types of social media (not Facebook, Instagram, Twitter, Reddit, Snapchat, Pinterest, Tumblr, or YouTube) have a positive relationship with course grade.

As a final caveat, our analysis is focused on the relationship between video gaming and social media with undergraduate students at a large, private university enrolled in an intro to finance class. The student's surveyed obtained admission to this competitive private institution which rejects admission to thousands each year. The average high school GPA of students admitted is 3.8/4.0 with an average ACT score of 29/36 (which increase to 3.9/4.0 and 31/36, respectively, when transfer students are removed from the sample). Hence, for students at this level of academic achievement, we can say based on this study that using video games and social media does not lower their grade in this class, with some nuance. Perhaps these students have learned to balance their usage and still complete their studies at a high level. Care must be taken not to apply our findings to the population of students in general. Whereas our findings may generalize to other high-performing college students, they may not apply to other segments of students, including primary and secondary school-aged students.

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Assessment Within a Student-Managed Investment Fund

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In this paper I outline a student-managed investment fund with embedded assessment that is used at the University of Wisconsin-La Crosse (UWL). The approach at UWL focuses on a course associated with the fund and the use of an advisory board of investment professionals that is involved with the assessment. A key aspect of the approach used is that it ties assessment to fund decisions and involves professionals in the assessment process. This paper also argues against using realized returns to assess student learning or SMIF programs in general (which is common in the SMIF literature), while providing evidence that assessment results of student work do not correlate with future returns. In addition to providing the assessment model used at UWL, I describe other aspects of the UWL SMIF and provide performance measures of the fund and the student stock selections.

Keywords: student-managed investment funds, pedagogy, financial education, stock selection, investment education

Introduction

Several studies highlight the importance and development of learning objectives in pedagogical approaches (e.g., Adams, 2015; Bonner, 1999; Torrance, 2007). Other studies stress the importance of *assessing* learning objectives. For example, Torrance (2007) discusses how assessment, and feedback related to assessment, has come to completely dominate the learning experience. It is now common for assessment to drive the learning experience, rather than assessment occurring ex-post and independent of the learning process. Clements and Cord (2013) discuss common assessment in the classroom, which falls short of measuring workplace readiness. Other studies, such as Ferns and Zegwaard (2014), Hodges (2011), and Zegwaard et al. (2003), outline the benefits of assessment in experiential learning and suggest that learning is enhanced and job readiness is increased by having practitioners involved in the process, be it providing input and feedback or participating in assessment design and measurement itself.

There has been little discussion of assessment in student-managed investment funds (SMIFs), though. Macy (2010) discusses assessing student work from a SMIF course but does not provide full details. Thus, my intent for this paper is to: 1) provide an additional example and further discussion of assessment within a SMIF while incorporating recent lessons from pedagogical research; 2) provide a fully detailed model for others who wish to embed assessment into their SMIF program; and 3) demonstrate why direct assessment of student work is more reliable than using returns to assess student work. It is common in the SMIF literature to use realized returns to assess student learning or a SMIF program, but I provide evidence that this methodology is problematic.

It should also be noted that there are several important differences between the approach I outline in this paper and that of Macy (2010). The biggest difference is that, in the approach I outline, the assessment scores also double as the "votes" for fund trades. I argue that aligning assessment of student deliverables with the fund's decisions further incentivizes the students and

makes assessment more reliable. Another difference from Macy (2010) is that, in the approach I outline, alumni/professional advisory board members are directly involved with assessment. They score the presentations in real-time, thus helping make fund decisions. This allows a balance between oversight and student control. It also allows the practitioners to offer suggestions and help improve the assessment process, rubric, and learning outcomes.

While only Macy (2010) discusses direct assessment of student work within a SMIF, other lines of SMIF research are still relevant. Some research discusses the learning outcomes of a SMIF course. For example, Tashjian (2020) highlights the importance of tying clear learning objectives to experiential learning. Other practices discussed in the SMIF literature are student reflection and surveys of alumni. As Clements and Cord (2013) discuss, student self-reflection can be vital in the assessment process. Alternatively, some studies assess student performance in terms of fund returns/performance. However, there are two issues with assessing learning via returns that this paper will discuss: 1) if markets are efficient, then future fund returns would not be indicative of student learning; 2) this paper provides evidence that assessment scores of student stock pitch presentations do not match future returns of the stocks pitched. Thus, I argue that assessing a SMIF program should involve some combination of alumni and student surveys/reflections, as well as direct assessment of the final student work.

In what follows, I discuss the approach of the University of Wisconsin-La Crosse (UWL) SMIF in assessing learning objectives while also comparing student assessment results to fund/stock pick returns. The assessment occurs at the end of the semester when the students from the associated SMIF course present their research to finance faculty members and a professional advisory board. This allows the advisory board to assess student work, provide feedback to the students, improve their mentoring, and help faculty with adjusting the expected learning outcomes. Further, the assessment is used in a continuous loop: shortcomings in assessment drive changes to the course. Also, the assessment scores determine which student recommendations are followed (i.e., which stocks are bought and sold). This process allows for a unique combination of student management and faculty/professional oversight. It also aligns the learning objectives, assessment, experiential learning outcome, and fund decisions. The benefit of this alignment can be found in the previously mentioned pedagogical research that highlights the importance of assessment and practitioner involvement as well as the importance of an outcome of significance in experiential learning programs.

Aside from assessment scoring, the advisory board is instrumental in providing feedback and mentoring to the students. In this paper I will discuss the rubric used at UWL to assess student work as well as the feedback survey given to the board. While I will detail the main lessons learned from the feedback survey, the process itself is more important than the results. These professionals provide valuable advice on the operation of the SMIF program, such as what skills the students should be learning and how they should conduct their research on a stock. Furthermore, as alumni of the university, the board members know the typical UWL students well and are happy to donate their time.

In what follows I will also describe the challenges, obstacles, and lessons learned in developing the approach used at UWL. I will also report the recent performance of the stocks the students have recommended (while comparing that performance to the assessment scores of the student presentations) as well as the overall performance of the SMIF. From 2016 to 2019, the UWL SMIF has outperformed various market indices such as the S&P 500. The stocks the students recommend (whether it was chosen to be added to the fund or not), also outperform the S&P 500. Further, the stocks from this group that are ultimately chosen to be added to the fund outperform the stocks

that are not selected. However, for the first academic year (2019-2020) where the assessment/fund decision process was in place, higher assessment scores did not result in higher returns. I find that student presentations rated on average as "exceeding expectations" had a lower one-year return than those rated on average as "not meeting expectations." I also find a negative correlation between student presentation ratings and future returns. Based on this observed negative correlation between assessment scores and future stock returns, I argue that assessment of a SMIF should be based on student work rather than fund returns.

The rest of the paper proceeds as follows. Section 2 reviews the relevant literature. Section 3 describes the UWL fund and its various pedagogical aspects as well as the feedback received from the advisory board. Section 4 details the performance of the fund and the stocks recommended by the students and compares fund returns to student assessment results. Section 5 concludes.

Literature Review

Chincarini and Le (2018), Lawrence (1994), Lawrence (2008), Neely and Cooley (2004), and Peng et al. (2009) provide overviews of the various SMIFs and their features. SMIFs have many observed benefits and offer a chance for experiential learning. Many studies discuss the role of SMIFs in offering experiential learning, such as Block and French (1991), Macy (2010), Mallett et al. (2010), and Yerkes (2017). A key feature of many SMIFs is an advisory board of practitioners and alumni, who are involved with mentoring students, providing feedback, and in some cases voting on fund decisions. Schlee (2000) and Tyran and Garcia (2005) discuss the benefits of mentoring from business professionals. Reid et al. (2020) discuss the importance of these advisory boards in terms of their membership, consistent student-alumni engagement, and mentoring.

In terms of assessment of learning, Macy (2010) discusses using a SMIF to assess a finance program. As Macy points out, SMIFs are ideal places to measure student learning. Macy discusses assessing student reports, surveying students and alumni, and using that feedback to close the loop. In the model Macy lays out, student presentations and reports are assessed to reflect finance-specific skills/knowledge as well as effective communication. The key differences between the UWL model and that of Macy (2010) are as follows. 1) Alumni (via the advisory board) are involved in assessment at UWL. All student presentations are assessed by finance faculty and advisory board members in attendance. As mentioned previously, recent research suggests many benefits to incorporating professionals in assessment. 2) At UWL, the assessment scores determine the fund trades. The highest-rated group presentations have their recommendations followed (typically two groups/stocks a semester). This ties the main course outcome, assessment, and fund trades together. It ensures that the task used for assessment is meaningful, and it allows for an alternative to student votes determining the fund trades.

Aside from Macy (2010), there are traditionally two approaches used in the SMIF literature to assess learning within a SMIF: 1) tracking fund performance and returns, with higher returns indicating higher levels of student learning; 2) surveying students and alumni. Examples of the first category include Ammermann et al. (2020), Arena and Krause (2020), Boyd et al. (2020), Daugherty and Vang (2015), Ghosh et al. (2020), and Tashjian (2020). Daugherty and Vang (2015) assess student learning by comparing investment returns in the SMIF at the start of the academic year to returns at the end of the academic year. Examples of the second category include Clinebell and Murphy, Ghosh et al. (2020), and Mullen and Salvucci (2019). Clinebell and Murphy (2016) survey alumni of a SMIF to provide evidence of learning that such a fund provides. Clinebell and Murphy also lay out the suggestions offered by their alumni, some of which are similar to what

the UWL advisory board has suggested. Mullen and Salvucci (2019) discuss the expected student outcomes of the program and report feedback from surveys given to alumni of the SMIF program at Stonehill College.

In related research, D'Souza and Johnson (2019) detail a course that manages a SMIF, and Macy (2010) details a model for regional schools. D'Souza and Johnson detail a SMIF started from a university endowment at a Catholic university where religious considerations must be applied. Other examples of SMIF programs at institutions similar to UWL (which face similar challenges due to size, funding, small student population, and lack of graduate students) include Bergquist et al. (2020), DeBoeuf (2019), and Mullen and Salvucci (2019). Examples of SMIF models which are not necessarily similar to the UWL SMIF include a model with a long-term perspective in Mallett et al. (2010), a model for metropolitan universities in Kahl (1997), and a model for religious universities in Saunders (2008). In other research related to SMIFs, Dolan and Stevens (2010) provide a top-down investment model that incorporates finance and economics students. Saunders (2015) describes experiential learning through shareholder engagement for students participating in the SMIF. Charlton et al. (2015) discuss the leadership and management aspects of a SMIF. Betker and Doellman (2019) discuss a LinkedIn group that keeps alumni of the program involved.

Fund Details and Pedagogical Aspects

Background Information on the UWL SMIF

UWL's SMIF, the Gordon Spellman Fund, was started in January 2006 via various outside donations and matching contributions from the university's foundation. The SMIF was initially funded at around $60,000. Later in 2006 an additional $33,000 was added by the university foundation. A final contribution of almost $10,000 was added by the foundation in June 2008. Overall, the contributions totaled $103,000. Krueger (2011) provides a summary of the structure of the UWL SMIF in the early years. The first trades were made in February 2006. Currently, as of June 28, 2021, the fund value stands at around $425,000.

Background on SMIF Course

The investment decisions for the SMIF are made through an elective course offered by the finance department. This course is devoted to the management of the fund, as well as related topics such as investment analysis, stock valuation, and portfolio theory. Only students who have successfully completed an introductory investment course are able to register for this course, therefore most students are seniors. In the beginning of the semester, students are asked to team up in groups of three or four and to pick a stock to analyze.

In picking a stock to analyze, the students are advised to follow the investment policy statement, which states that highly profitable firms with low valuation measures (e.g., P/E and P/B) and wide or narrow economic moats are desirable. To help students with this process, I run a Morningstar stock screener and provide students with a list of stocks to choose from (although they are free to choose any stock to analyze). Importantly, students are advised to keep in mind the existing diversification profile of the fund as well as the policy statement.

Once students have picked their stock, they spend the rest of the semester analyzing the stock and performing various valuation methods. They create a written report and prepare a presentation, in which they are asked to give their buy/sell/hold recommendation. Historically, however, students have almost always recommended a *buy*. Aside from analyzing a stock to possibly add to

the fund, students are also asked to provide suggested revisions to the investment policy statement and to give their recommendations on the *existing* holdings in the fund. Previously, the class's consensus sell recommendations were provided to the board members to vote on. Recently, though, the board members no longer vote on the sale of existing holdings but can still veto the class's recommendations (although they have not done so to this point).

Table 1 illustrates the types of stocks that were added to the fund between December 2016 and December 2019. The table shows each stock's P/E, P/B, ROE, net profit margin, and dividend yield at the time the stock was purchased, with data obtained from Morningstar's Investment Research Center. The average ratio numbers for these stocks are also reported. Overall, the recent stock purchases are mostly in line with the fund's stated investment strategy, although the price multiples could be lower.

Advisory Board

An important development of the SMIF and its associated course has been the substantial involvement of the advisory board. The advisory board is made up of a rotating group of five to eight individuals who are all UWL alumni, some of them alumni of the SMIF course as well. Most of the board members are CFA charter holders with jobs in investment analysis, portfolio management financial planning, and financial advising. The board members come to campus at the end of the semester to attend the student presentations, ask students questions, and vote on which stocks to buy and sell.

However, an important recent change, at the board's recommendation, is to have each board member paired up with a student group once the students have picked a stock to analyze. As mentors, the board members work with the students throughout the semester to answer questions, offer guidance, and help students prepare for what to expect on the day of the presentations. While this mentoring process is still being refined, it has greatly improved the student reports and the quality of the presentations (and relieved some of the burden of the instructor).

Assessment via Feedback

The board members' feedback has been crucial in the refinement of the SMIF investment process and the associated course. The board typically provides feedback informally after the presentations. Recently I have also sent out surveys to the board members to obtain a formal record of the feedback. The survey is as follows:

1. In your opinion, do you feel the student *presentations* (and their research) is lacking in any area?
2. In the *presentations*, is there any area where you feel the students already excel or have greatly improved compared to previous semesters?
3. In your communications with the assigned group you *mentored*, do you feel they were lacking knowledge or skills in any area? If so, where?
4. Do you have any general suggestions for the students or myself for future *mentoring*?
5. What are the students' weaknesses/what skills or knowledge are they lacking for a *career in finance/investments/as analysts*?

Based on the survey responses, the mentors recommended that the students focus more on describing and projecting key drivers of future growth. Another recent development is that students are advised to select stocks while taking into consideration their effect on the overall portfolio and

Table 1

SMIF Stock Pick Characteristics

Ticker	Company	Date acquired	Price/Earnings	Price/Book	Return on Equity %	Net Profit Margin %	Dividend Yield %
ADBE	Adobe Systems Inc.	1/22/2018	51.85	10.18	21.33	23.20	1.18
AMAT	Applied Materials.	12/13/2019	21.34	6.80	35.95	18.52	5.40
DIS	Disney Walt Co..	5/16/2019	13.12	3.35	27.97	21.20	3.74
EMR	Emerson Electric Co.	12/18/2018	17.27	4.11	24.94	12.66	5.98
FB	Facebook Inc.	5/16/2019	19.74	4.66	27.90	39.60	2.76
MA	Mastercard Inc.	12/19/2016	28.52	17.95	69.48	37.67	3.59
NEE	NextEra Energy Inc.	12/19/2016	22.63	2.34	12.41	18.03	2.91
SAP	SAP SE ADR.	12/13/2019	42.12	4.87	11.15	12.05	1.25
SBUX	Starbucks Corp.	5/12/2017	29.22	13.75	48.16	13.22	3.80
HEAR	Turtle Beach.	12/13/2019	6.22	3.30	35.57	7.65	1.64
UNH	UnitedHealth Group Inc.	12/23/2016	23.64	4.05	19.46	3.81	1.98
	Average:		25.06	6.85	30.39%	18.87%	3.11%

Note. This table shows the end-of-year financial data for stocks added to the UWL SMIF from 2016-2019. End-of-previous-year data is used for stocks purchased in May, and end-of-current-year data is used for stocks purchased in December. Data is obtained from Morningstar's Investment Research Center. The average of all 11 stocks is reported in the last row. Note: Energy Transfer LP (ETE) and Boeing Co (BA) were purchased during this time period but are not included due to outliers in their ROE and/or P/B.

not just as a stand-alone stock. In particular, the board members advised the students to present what and how much, if any, existing holdings should be sold to better rebalance the portfolio. The board also advised students to consider correlations and efficient frontier weights in the analysis.

The feedback collected from the advisory board helps address student shortcomings and identify ways to improve. Mostly, it helps finance faculty determine any job readiness shortcomings present in the students. The feedback allows for a continuous loop: changes are made to the course based on the advisory board feedback, and then feedback is sought to identify if the changes were positive/progress has been made (while also identifying any additional areas that could be improved). The feedback also allows for informal assessment as to whether the students are meeting the course learning outcomes and if the SMIF program is beneficial.

Embedded Assessment

While feedback from the advisory board is vital (as is student self-reflection), feedback methods such as this have been discussed extensively in the literature. However, a detailed embedded assessment model has not yet been provided in the SMIF literature. While Macy (2010) discusses assessment within a SMIF in a general sense, I provide a more detailed model (complete with a rubric and details on how assessment scores are used) which others can follow. Also, the assessment model I outline below determines fund trades, and the professional advisory board assesses the student work as well. Similar to the surveys and informal feedback collected from the advisory board, involving the board with assessment allows the finance department to partially measure job readiness of students and to determine how to improve job readiness. The advisory board is asked to provide input into the assessment process in addition to being asked to perform the assessment. Having professionals involved in the assessment process is highly beneficial, as other studies such as Ferns and Zegwaard (2014), Hodges (2011), and Zegwaard et al. (2003) point out. While assessing the learning of class material is important, job readiness, critical thinking, and effective communication is much more important when it comes to experiential learning. Further, professionals likely have a better and more current perspective (compared to academics) on what specific items should be assessed in the first place when assessing job readiness and career skills. Involving the advisory board ensures that assessment is measuring the right items. It also allows for continuous changes to not only assessment but to the course and fund as well.

Having the assessment results determine the fund trades ensures that the task being assessed (in this case, the student stock presentations to the advisory board) is meaningful. Properly aligning the course learning objectives, student work (i.e., assessment task), assessment, and SMIF decisions also allows for streamlined changes and updates to the course and SMIF. It ensures that the students who have the best presentations (and thus did the best work throughout the course) are rewarded by having their recommendation followed. We typically follow the recommendations of the top two groups, which means the fund typically buys two new stocks a semester. We also allow for a limit buy order to be placed if the group recommends buying the stock at a lower price (although this has not occurred since this new decision process was implemented). This change also moved the UWL SMIF closer to a traditional SMIF, as previously the advisory board simply voted whether to buy each stock. Their input is still used, though, as the overall score for each group presentation includes not only the assessment scores but an investment rating for the stock. At UWL, some administrators have raised concerns about allowing students to control a large sum of money. Thus, the advisory board voting process originated. With the new process, there is still professional oversight, but the students have more control and are more engaged in the process.

This decision process could be implemented by other institutions where similar concerns are raised.

The UWL SMIF course has the following expected outcomes that students should be able to perform by the end of the course:

1. Evaluate portfolio objectives that incorporate portfolio management theory and write an investment policy statement.
2. Obtain, synthesize, and report information about the investment environment and security selection.
3. Manage risk through portfolio construction.
4. Effectively communicate, both written and orally, a stock pitch to investment professionals.
5. Identify potential undervalued assets through stock valuation, economic/industry/firm outlooks, and financial ratio analysis.

The assessment process mostly focuses on outcome 4, although outcomes 2 and 3 are indirectly assessed as well, since the student presentations are the culmination of a semester of stock research, valuation, analysis, etc. The assessment rubric (and SMIF decision process) was designed with the following two components: 1) the presentation/research quality, and 2) the viability of the investment. The two components are equally weighted, with a tie going to the presentation quality. Knowing that decisions will be based on the criteria stated in this rubric, the students are more likely to feel in control and are reassured that if they present their research effectively, their stock will be added to the fund. The presentation/research quality aspect (which directly assesses learning outcome 4 above) is broken up into five components to allow for a more granular assessment process and to better identify shortcomings.

The rubric is shown in Table 2. Each item is scored 1 (not meeting expectations), 2 (meeting expectations), or 3 (exceeding expectations). The investment viability rating is also scored a 1, 2, or 3, with 3 being the best rating. Both attending faculty and board members are asked to assess the presentations using this rubric. All six components are averaged across all audience member ratings to determine the final scores. The two top-rated groups (there are typically six groups a semester) have their recommendations followed by the SMIF.

Investment Club

To this point I have discussed how UWL uses an elective finance course (which focuses on investment analysis and portfolio management) that is associated with the SMIF. The main goal of the SMIF is to provide experiential learning to as many students as possible, so that they learn to trade and monitor both individual investments and the overall market. This is one area where the UWL SMIF has recently tried to improve. To that end, UWL now has the student investment club involved with the fund.

In the Spring 2021 semester, the club's newly formed Investment Management Team (IMT) monitored the fund and presented a fund overview to the advisory board (prior to the students from the course presenting their stock analysis). The IMT also provided suggested revisions to the investment policy statement (discussed below) and sector allocation suggestions. The team will also give suggested allocation/weighting changes each semester. This allows for students to be involved with the fund for more than one semester. One challenge that we have faced at UWL prior to the IMT being formed is that, with a one-semester SMIF course, the student management team had 100% turnover each semester. That meant faculty members had to take on more of the

fund management role. Now, the IMT will take on the role of portfolio managers, while the students in the course can focus solely on security selection.

Table 2
Student Presentation Rubric for Assessment

Stock	Group's (B/S/H)	Strength of Financials	Presentation of Valuation / Earnings Estimates	Q&A: Strength of Answers	Strength of Delivery	Presentation Score (total)

Group's (B/S/H): Is the group recommending a buy, sell, or hold?

Please rate each other category as 1 (does not meet expectations of a junior analyst); 2 (meets expectations); 3 (exceeds expectations)

Strength of Research: Do the students appear to have properly researched the company?

Presentation of Financials: Are the appropriate financials presented? Do they use the numbers to make a strong case?

Valuation/Earnings: Do their projections make sense? Are they able to back up their projection? Does this strengthen their case?

Q&A: Are they able to satisfactorily answer the questions? Does their recommendation hold up to questioning?

Strength of Delivery: overall presentation quality. Do they effectively communicate and use visual aids?

Presentation score: sum of previous 5 numbers

If you are able, please also rate the pitched stock's investment viability from 1 to 3:
1 = Definitely not a good purchase, 2 = Indifferent, 3 = Recommend buying

Stock	**Investment Viability**

Note. This table shows the rubric developed at UWL that is given to both faculty and the advisory board of investment professionals. The rubric is used to assess student learning and the skills and knowledge that would be expected of a stock analyst hire. The rating system and details of each category are shown below the table. In the second panel, those attending the presentations are also asked to rate the stock in terms of its investment viability. Both panels are equally weighted to determine what stocks to add to the fund (assuming the student group is giving a buy recommendation).

Investment Policy Statement

Another important development with the UWL SMIF is the investment policy statement (IPS). UWL recently updated the statement to include a clear investment strategy and the types of stocks the fund is looking to add. The value investing approach and the stock characteristics which fit

that approach were laid out, and students are constantly made aware of this. The IPS also lays out both the learning objectives and the objectives for fund performance and stock picks/investing strategy. In the SMIF-associated course, students are provided the IPS at the beginning of each semester. At the end of the semester, students in the course and in the IMT are asked to suggest changes to the statement. Other faculty and I then decide if these changes should be implemented. For example, several students suggested that a stock's Environmental, Social, and Governance rating should be considered. Also, the IMT suggested that the sector allocation weighting stay within 5% of the benchmark S&P 500 sector weighting. Therefore, these items were added to the IPS.

SMIF Performance

Overall Performance

Below, I examine how the SMIF has performed in recent years. However, I only have access to data starting in July 2016, when I started at the university. I will, therefore, show the fund's performance from July 2016 to December 2019. Market return data is obtained from Ken French's website and all other return data is obtained from Telemet. Table 3 shows the average monthly return, the standard deviation of the monthly returns, and monthly Sharpe ratio of the fund, the S&P 500 (in the form of the ETF with ticker SPY), and the value-weighted composite market return. The SMIF outperformed all three by both return and Sharpe ratio, with a 33% improvement in Sharpe ratio over the SPY. Of course, 42 months are not enough to draw any conclusions on long-term performance.

Table 3
Performance of SMIF and Benchmarks

	SMIF	SPY	Market Return
Mean	1.38%	1.25%	1.16%
Standard Deviation	2.97%	3.30%	3.33%
Sharpe Ratio	0.43	0.34	0.31

Note. This table shows average monthly return, monthly standard deviation, and monthly Sharpe ratio of the UWL SMIF, the SPY ETF (which tracks the S&P 500 index), and the value-weighted market return (Fama-French market factor plus risk-free rate) from July 2016 to December 2019. Data is obtained from Ken French's website and Telemet.

Table 4 shows the risk-adjusted returns of the fund, using both the CAPM and Fama-French three-factor model. The time-series regression results are shown, with t-stats in parentheses and adjusted-R^2 values provided at the bottom. A positive alpha remains after both risk corrections, but the alpha is only statistically significant when using the CAPM.

Recent Stock Picks

Now I examine only the stocks which have been added to the fund from December 2016 to December 2019; therefore, returns for 2017-2019 are examined. Note that these returns only reflect stocks selected under the old decision model used at UWL where faculty and advisory board members voted on the stocks presented by students. I take an equal-weighted average of the stocks that have been selected up to that point. For example, from January 2017 to May 2017, an equal-

weighted average of the three stocks picked in December 2016 is used. Then from June 2017 to December 2017, an equal-weighted average of four stocks is used, as one stock was added in December 2017. Equal-weighted returns are used because we typically add a roughly equal amount of each stock.

Table 4
Risk-Adjusted Returns of SMIF

	CAPM		FF3	
Alpha	0.0035	1.95*	0.0025	1.47
Rm-Rf	0.7905	15.92***	0.8526	18.33***
SMB			-0.2313	-3.47***
HML			-0.0653	-1.22
Adj. R-square	0.86		0.89	

Note. This table shows the regression results of the CAPM and Fama-French three-factor model (FF3), where the monthly excess return of the UWL SMIF is the dependent variable. The sample runs from July 2016 to December 2019. The adjusted R-squared value is reported, and t-statistics are reported in parentheses. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level. Data is obtained from Ken French's website and Telemet.

Table 5 shows the average of the monthly returns, the monthly standard deviation, and the monthly Sharpe ratio of these equal-weighted returns plus the two market benchmarks used earlier. The recent stock picks have almost twice the return of the closest benchmark, the SPY ETF. The standard deviations are slightly lower than the benchmarks, resulting in a Sharpe ratio that is almost double the SPY and more than double the value-weighted composite market index.

Table 5
Performance of Recent Stocks Added to SMIF

	Student stock picks	SPY Return	Market Return
Mean	2.13%	1.24%	1.12%
Standard Deviation	3.34%	3.48%	3.49%
Sharpe Ratio	0.60	0.32	0.28

Note. This table shows average monthly return, monthly standard deviation, and monthly Sharpe ratio of the recent stocks (stocks added from December 2016 to December 2019) added to the UWL SMIF, the SPY ETF (data obtained from Telemet), and the Fama-French market return factor (with the risk-free rate added back; data obtained from Ken French's website) from January 2017 to December 2019. The return of the recent stocks is an equal-weighted average of the stocks that have been added as of that month (with the first starting in January 2017).

Table 6 shows the risk-adjusted returns of these stocks. The returns have a significantly positive alpha for both models. Thus, for this short horizon, the model previously followed by the UWL SMIF seemed to work well in terms of performance: the board and faculty picked superior stocks from the stocks that students pitched.

Table 6
Risk-Adjusted Returns of SMIF

	CAPM		FF3	
Alpha	0.0120	3.38***	0.0097	2.53***
Rm-Rf	0.7300	7.73***	0.7540	7.64***
SMB			-0.1251	-0.79
HML			-0.1930	-1.33
Adj. R-square	0.63		0.63	

Note. This table shows the regression results of the CAPM and Fama-French three-factor model (FF3), where the monthly excess return of the recent stocks (stocks added from December 2016 to December 2019) added to the UWL SMIF is the dependent variable. The return of the recent stocks is an equal-weighted average of the stocks that have been added as of that month (with the first starting in January 2017). The regression sample runs from January 2017 to December 2019. The adjusted R-squared value is reported, and t-statistics are reported in parentheses. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level. Data is obtained from Ken French's website and Telemet.

All Stocks Pitched by Students

I also examine the return of all stocks that students choose to analyze (and ended up pitching as a buy). Table 7 shows the results. Here, only the return from December 20, 2016 to February 11, 2020 is shown. The specific start date is chosen as that is when the first stock was purchased (since 2010), and the end date was selected to show performance prior to the COVID-19 market downturn. Panel A of Table 7 shows the value-weighted return of all stocks pitched, the equal-weighted return of all stocks pitched, the actual returns (based on actual shares purchased) of the stocks that were picked to be added to the fund during this time, and the SPY ETF for comparison. The returns are based on investing an equal dollar amount each semester (either in all stocks pitched, both equal- and value-weighted, the stocks actually purchased, or only in the SPY, respectively). First, investing in all stocks pitched by the students would have outperformed the S&P 500 over this time period, with a 51% cumulative return (if value weighting) or 43% cumulative return (if equal weighting) compared to the SPY's 35% cumulative return.

Panel B shows the cumulative returns from December 1, 2016 to February 13, 2020 for the entire SMIF and the SPY ETF. These returns are based on a one-time investment at the beginning, so they differ greatly from Panel A. Here, we see that the fund outperformed the S&P 500 with a cumulative return of roughly 85% compared to the SPY's 71% return. This shows that, in this time period at least, the SMIF's investment process worked effectively in terms of performance.

Comparing Assessment Scores to Stock Returns

While these previous results demonstrate that the fund and student stock picks performed well, caution should be taken. I argue that returns alone should not be used to assess a SMIF or student learning. If markets are efficient, then future returns may not reflect this student work. With the recent shift to using assessment scores to determine fund trades at UWL, it allows for comparison of assessment results and future stock returns. In essence, this allows for a simple test as to whether investment returns do indicate student learning (albeit with a short sample size). I use one-year total stock returns, from the student presentation date to twelve months ahead. To allow for a full year to pass after the assessment takes place, only the Fall 2019 (December 2019) and Spring 2020

(May 2020) assessment results/stocks presented are used. Also note that only stocks for which the students provided a *buy* rating are used.

Table 7
Cumulative Returns

Panel A: Recent Stocks				
	VW all stocks pitched	EW all stocks pitched	Actual	SPY
Return	51.19%	42.82%	62.69%	35.08%
Panel B: Total SMIF				
Total return		Student-managed fund		SPY
Average annual return		75.14%		64.63%

Note. This table shows the total cumulative returns of recent stocks pitched by students and those added to the fund (in Panel A) and the entire SMIF (Panel B). The SPY ETF (which tracks the S&P 500 index) is shown for a benchmark comparison. In Panel A, returns are based on investing an equal dollar amount each semester (splitting that total dollar amount either based on value weights, equal weights, the actual number of shares purchased, or only in the SPY). Panel B shows the total cumulative return of the SMIF and the SPY. VW all stocks pitched is a value-weighted average of all stocks pitched by the students each semester (return calculated as if all the stocks were purchased with weights based on market capitalization), EW all stocks pitched is an equal-weighted average of these stocks (return calculated as if all the stocks were purchased with equal weights), Actual is the return of stocks chosen to be added to the fund (weighted by actual market value purchased), and Student-managed fund is the true return of the entire fund. Panel A shows the returns from 12/14/2016 (when the first stocks in this group were added to the fund) to 2/11/2020. Panel B shows the returns from 12/1/2016 to 2/13/2020. Data is obtained from Telemet.

First, in Table 8, I provide a correlation matrix showing the correlation between average presentation assessment scores (the average of all audience members and all five categories of the rubric shown in Table 2), the average investment viability rating provided by all audience members, and the one-year stock returns for the stocks presented. Table 8 shows that the assessment scores and investment ratings are highly positively correlated (0.84), which could be an indication that students who present well and demonstrate superior analysis may convince audience members that the stock is a good investment. More interestingly, the investment rating is negatively correlated with the next year's stock return. This indicates, for this recent sample at least, that the audience member ratings do not predict returns. Importantly, the assessment scores are negatively correlated (-0.54 correlation coefficient) with future stock returns. Thus, higher future stock returns do not correspond to higher student learning in this case.

Table 8
Correlation Matrix for Student Assessment and Stock Returns

	One-year stock returns	Assessment scores	Investment rating
One-year stock returns	1		
Assessment scores	-0.537	1	
Investment rating	-0.406	0.844	1

Note. This table contains the correlation coefficients between the following items: the one-year stock returns for the stock pitched by the student group, the average assessment scores for each group's presentation (assessed by both faculty and alumni), and the average investment rating provided by faculty and alumni for the stock pitched. Presentations from the Fall 2019 and Spring 2020 semesters were used. Returns are total percent returns from the following year after the presentation date and are found using Telemet.

Next, I also show in Table 9 the average returns of these stocks, but first sort by assessment score and investment rating. The table shows the average one-year stock return for presentations that were on average rated as not meeting expectations or exceeding expectations. The first two columns show that stocks from student presentations that did not meet learning outcome expectations outperformed stocks from student presentations that exceeded expectations over the next year. These two extremely divergent average return numbers again point to the disconnect between student learning and stock/fund performance. While this pattern may not hold up over time and could be attributed to randomness, it still shows the danger of using returns to evaluate student learning, a SMIF program, or a simulation. This is especially true when trying to evaluate progression over time or to make comparisons across time. To truly evaluate a SMIF program (or student learning within the program), alumni surveys, advisory board surveys, student reflection, and direct assessment of learning outcomes via student work (preferably with professionals helping with the assessment) is required.

Table 9
Average Returns Sorted by Assessment Scores

	Presentations not meeting expectations	Presentations exceeding expectations	Investments with a buy rating	Investments with a hold or sell rating
Average one-year return	84.33%	46.46%	39.80%	84.75%

Note. This table provides the average one-year stock returns for the one year following student presentations during the Fall 2019 and Spring 2020 semesters. Average returns are shown for stocks whose student presentations had an average assessment rating of not meeting expectations and those that were exceeding expectations. Also shown are the average returns of stocks that had an average faculty/practitioner investment rating of above 2 (signaling a buy rating) and below 2 (signaling a hold or sell). Each audience member rates the stocks 1, 2, or 3 after viewing the presentation (in addition to assessing several items related to the student work).

Finally, the table also shows the average return for stocks with an average investment rating below two (indicating a sell or hold rating, meaning the audience members do not think it should

be added to the fund) and above two (indicating a buy rating). Here, the stocks with a sell or hold average rating have more than twice the average annual returns as those with a buy rating. The UWL SMIF has shifted towards more student control, though, and ultimately a SMIF should be judged on student learning, not fund performance.

Conclusion

In this paper, I provide an assessment model embedded within a student-managed investment fund (SMIF) that other institutions could adopt. Specifically, based on the SMIF at the University of Wisconsin-La Crosse (UWL), I provide a rubric and learning outcomes that could be assessed in student presentations or reports at the end of a SMIF course or program.

The first contribution of this paper is to provide an example of how a SMIF assessment process can be embedded into the program and how trade decisions could be based on the assessment results. This decision process, which at UWL involves finance faculty and professional audience members assessing student presentations in real time, allows for a mix of student control and faculty/professional oversight. For institutions concerned about students losing valuable foundation money, this decision process could be adopted. Aside from providing oversight, it also ensures that learning outcomes, assessment, and fund decisions are aligned. For assessment to be accurate (and for experiential learning to be beneficial), a meaningful outcome must be present. When fund decisions are tied to student performance, it makes the outcome as meaningful as possible.

I also provide details on how the professional advisory board is involved in the assessment process. Other pedagogical research shows that both student learning and job readiness are improved when practitioners are involved with assessment. The process also allows the finance faculty to make changes to the program or curriculum based on the practitioners' assessment scores and feedback. Thus, it would be beneficial for more SMIF programs to have professional advisory board members assess student work. I also provide an example of a survey given to the advisory board, along with a summary of their survey responses in the hopes that it may be of use to other SMIF programs wanting to best utilize alumni or an advisory board.

The second contribution of the paper is to present a case that student learning (or a SMIF program in general) should not be evaluated based on investment returns. If markets are efficient, and returns are unpredictable, then future returns may not match the students' skills and knowledge gained through the program. Indeed, I provide evidence (at least for the lone academic year with sufficient data) that higher assessment scores of learning outcomes do not correspond to higher stock returns over the next year. The UWL assessment data and subsequent returns of the stocks presented by the UWL students show that the higher-rated presentations resulted in stocks with lower returns over the next year. This paper argues that evaluation of student learning or a SMIF program in general should be done via assessment of student work (along with surveys and self-reflections).

Lastly, I show the performance of the UWL SMIF, albeit with data only over a three- to four-year period. The overall fund has outperformed the market, and students on average pick exceptional stocks. The new process at UWL, as described above, is based on a combination of faculty and practitioner votes as well as the assessment results (with the two being very highly correlated). While more student control should mean more engaged students and higher levels of student learning, if oversight is a concern at other programs, this approach could be adopted.

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Exploring Community-Based Learning to Improve Finance Students' Confidence in Delivering Financial Education

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At-risk youth in residential treatment facilities are separated from their families, limiting family financial socialization. School and peer groups may be a way to influence financial literacy among at-risk youth, and, at the same time, provide university finance students an opportunity to improve their skills in financial education delivery. Using a community-based learning model, this study set out to determine if: 1) basic financial literacy lessons, offered by college finance students to at-risk youth, improved financial literacy knowledge among the at-risk youth, and 2) the peer-learning model improved self-reported levels of confidence among university finance students in teaching others about financial literacy and fundamental principles of financial planning. Though the sample size was too small to report quantitative significant findings in improved financial literacy of the at-risk youth, self-efficacy of increased financial knowledge was observed. A basic analysis of pre- and post-interviews with university finance students revealed increased confidence with teaching others about the importance of financial literacy and analyzing the appropriateness of other's financial goals. In addition, qualitative responses from university personal finance students, pre- and post-intervention, strongly supports the use of community-based learning and peer-tutoring pedagogies in learning and applying financial literacy content.

Keywords: financial education, community-based learning, self-efficacy, financial literacy, at-risk youth

Introduction

The purpose of this study was two-fold. First was to increase the understanding of financial literacy topics by female youth in a residential care program using a peer-based, education model, aligning curriculum with the South Dakota Personal Finance Content Standards. Second was for college students to apply personal finance content knowledge as indicated by course objectives, through participation in a community-based learning project, using a peer-tutoring model.

The Abbott House, located in Mitchell, SD is a private charity that provides residential treatment services focused on "helping girls, ages 7 to 18, who: have little or no family support, have endured extreme trauma, experienced sexual, physical, emotional, and mental abuse, have been diagnosed with depression, anxiety, and ADHD, have had suicidal thoughts" (Abbott House, 2017).

For this study, "At-risk denotes a set of presumed cause–effect dynamics that place an individual child or adolescent in danger of future negative outcomes." (McWhirter, McWhirter, McWhirter, & McWhirter, 2017). It is important to note that at-risk does not equate to low-income. Abbott House program administrators and the researchers wondered if financial education could be a possible intervention for at-risk youth, and simultaneously serve as an application opportunity for the university finance students.

Providing financial literacy education meets the South Dakota Personal Finance Content Standards for residential settings. McWhirter, et al. (2017) suggest implementing life-skills programs and note, "The best interventions are ones that are fully integrated into other services provided by agencies and schools." It was determined that partnering with a local university's personal finance class and having college students deliver financial literacy education would be a practical intervention for the at-risk youth, meeting both time and resource constraints faced by the residential center, while providing an opportunity for college finance students to apply content in a real-world setting and enhance their learning. Using a cross-age tutoring model, matching the older college student with the younger at-risk student was supported by McWhirter, et al. in that, "Peer tutoring alters the environmental and social climate in a school and can enhance and increase learning."

Review of Literature

Family Financial Socialization

Financial socialization is defined as ''the process of acquiring and developing values, attitudes, standards, norms, knowledge, and behaviors that contribute to financial viability and individual wellbeing'' (Danes M., 1994). "Positive financial socialization contributes to positive change in young adults' thinking and behavior regarding finances. Relationships with parents, financial classes, and information from multiple sources contribute to a positive financial attitude, a higher degree of control and efficacy, and, ultimately, more responsible financial decision-making (Shim, Soyeon, & Serido, 2007-2018)."

McWhirter, et al. (2017) observed recent, longitudinal research of at-risk youth, demonstrating a multidirectional relationship between societal, family, and individual characteristics. Such breadth, though critically important, is beyond the scope of this paper, and thus, focus is given to the root of family.

At-risk youth, in residential treatment facilities, are separated from their families. As such, financial socialization at the family level may be limited. According to a 2014 study by Danes and Yang, it is not clear if family characteristics constrain or enhance financial socialization, due to the complexities and cultures in which families function. The Family Financial Socialization Conceptual Model considered both family socialization processes and financial socialization outcomes (Danes & Yang, 2014). Looking at the first dimension of family socialization processes, Danes and Yang suggested treating demographic factors as predictors of financial outcomes rather than control variables.

Though family financial problems have been identified as a risk variable for families with youth in residential facilities (Griffith, et al., 2009), little research has been done related to educating at-risk youth about financial literacy. With the root of family largely severed, this project aimed to cultivate the roots of school and peer group to increase financial knowledge and improve self-reported financial knowledge of these specific at-risk youth by providing financial literacy lessons based on the South Dakota Personal Finance Content Standards (Personal Finance Standards, 2017).

Financial socialization is also important in a university-level personal finance course. Instructors continue to seek out new pedagogies to improve student financial knowledge, attitudes, and behaviors. Of interest for this research is community-based learning and peer-tutoring.

Teaching Pedagogy

Community-based learning can be defined in many ways, depending on the source. For this study, the working definition from The University of Colorado Boulder (2021) was utilized:

> an intentional pedagogical strategy to integrate student learning in academic courses with community engagement. This work is based on reciprocal and mutually beneficial partnerships between instructors, students, and community groups. The goal is to address community-identified needs and ultimately create positive social change. Critical reflection is an essential component of community-based learning; it serves to enhance students' learning of course content, understanding of the community, and sense of civic agency. (Para. 3)

Further, Dakota Wesleyan University (2021) defines Community-Based Research and Learning (CBRL) as "the intersection of students, faculty, and community members who collaborate on the two-fold goal of fostering immersive educational experiences and addressing immediate and long-term community needs."

By identifying a community need in educating at-risk youth about financial literacy, and using purposeful, pre- and post-critical reflection on the part of the college finance students, the community-based learning model served the needs of both the agency in educating their youth and the university in enhancing the students' understanding of finance content.

In direct support of the peer-tutoring model for the benefit of the at-risk youth, Gartner and Riessman (1993) concluded that, "The critical importance of youth having the opportunity to participate in meaningful roles such as youth-helping-youth is a salient factor in preventing social problems, including substance abuse, teen pregnancy, and delinquency." In addition, this same study found that the literature on peer-tutoring reveals that the impact on the tutors usually outweighs the impact on tutees (Gartner & Riessman, 1993). Further, a study conducted by Eije (2005) found that university students perceived a Fresh Peer Group (FPG) approach to teaching a finance course assisted their learning in three ways: increased knowledge, application, and achieving course objectives.

Given the above support for improvement in perceived knowledge and confidence among both tutors and tutees, the following hypotheses were proposed:

> H1: Understanding of basic financial literacy concepts, as identified by the South Dakota Personal Finance Content Standards, and self-reported level of financial knowledge will improve when at-risk students have access to information through a peer-tutoring model.
>
> H2: University students' confidence in their ability to do the following, will increase using the peer-tutoring model:
>
> a) teaching others about the importance of financial literacy,
> b) teaching others about the fundamental principles related to financial planning,
> c) understanding the financial planning process, and
> d) analyzing the appropriateness of financial goals.

Course Setting and Methodology

The investigator met with the directors of the Abbott House, face-to-face, to discuss the project and identify specific financial literacy topics of instruction needed. The researcher organized topics and aligned the content with specific South Dakota Personal Finance Content Standards. Standards identified, student language regarding the standards, and alignment with educational sessions and topics presented are provided in Table 1. Hypothesis one reflects these content topics.

Table 1

South Dakota Personal Finance Content Standards identified by topic

Class	Topic	Standard	Student Friendly Language
1	Introduction of program, pre-test		
2	Needs vs Wants	PF 1.1 Explain controllable factors involved in personal finance.	I can understand that decisions I make affect personal finances.
3	Smart Goals, Income	PF 1.1 Explain controllable factors involved in personal finance.	I can understand that decisions I make affect personal finances.
4	Developing a Budget	PF 2.3 Generate a system to organize finances and maintain records	I can understand the need for developing a user-friendly system for keeping financial records.
5	Saving, compound interest	PF 4.1 Explain how saving contributes to financial security.	I can understand how saving money can lead to being financial stable.
6	Accounts and financial management tools – checking and savings	PF 2.2 Differentiate between various money management tools.	I can understand many tools are available to help me take care of my money.
7	Cost of Credit – types and sources, varying costs	PF 3.1 Differentiate the sources, costs, and benefits of using consumer credit.	I can decide what type of credit is best for me to use in each financial situation I encounter.
8	Purchasing Decisions	PF 2.1 Execute a rational decision-making process considering alternatives and consequences.	I can understand that if I don't put thought and time into making purchases, I may be unhappy with the results.
9	Post-Test and discussion		

At-risk Students

The Achievement level students at the Abbott House, a group of students who were at or near high-school grade level equivalency, were asked to participate in the study. Consent to Participate in a Research Study was filed and approved by the Dakota Wesleyan Institutional Review Board and signed by a legally responsible person on behalf of each of the participants.

There were twelve high-school participants in the Achievement group at the beginning of the study. Seven of the twelve participants remained in the study by the final session. An informed consent form was completed for each participant. A pre- and post-test was developed using the National Endowment for Financial Education (NEFE) Evaluation Online Toolkit. Subjects were

not allowed access to the internet in the residential treatment classroom, thus pre- and post-test data was gathered on paper, in the classroom, with the researcher present.

University Students

University students enrolled in a 300-level personal finance course developed and presented basic financial literacy lessons and activities to the Achievement students at the Abbott House. Consent to Participate in a Research Study was filed and approved by the Dakota Wesleyan Institutional Review Board and signed by each of the university student participants.

The course objective to "communicate the importance of financial literacy" directly aligned with the project. Other course objectives included: understand the financial planning process, analyze appropriateness of financial goals, and apply fundamental principles related to financial planning. Hypothesis two directly reflects the four objectives of the university course.

University students were asked to complete a pre- and post-community-based learning and peer-tutoring reflection. The reflection assignments were completed in the classroom, and responses were collected electronically. The first series of questions asked students about their feelings regarding the project, concerns, what they were excited about, what they hoped to learn, and what they hoped to accomplish. The second set of questions had them rate their confidence in the four areas identified above in H2 a-d. In addition, qualitative responses were collected regarding in what ways the students felt the project would help them achieve these outcomes.

In groups of two or three, the university students developed and implemented financial literacy lessons on specific topics, as assigned. Students were provided with a lesson plan form and given detailed instructions in class. Eleven university students participated in creating and delivering the lessons.

Results & Analysis

At-risk Students

Because of the small sample size, quantitative data regarding the increase in financial content knowledge among at-risk youth could not be reported. Thus, H1 could not be supported nor refuted by the study. Of interest, however, is that an increase in self-reported financial knowledge from a mean of fair to good was observed.

Final questions on the post-test asked at-risk participants what they liked the least about this program and the most about this program. Comments regarding what was liked the least included the following.

"That we did do much things"
"That it was only once a week."
"Could have covered more topics such as retirement."
"When they didn't have all their information present, but other than that it was great."
"Really nothing"
"The text parts"

Comments regarding what the at-risk students like the most included the following.

"Everything"
"It gave us a college perspective."
"The activities and examples!"
"Real people came not just the teacher, it was a cool experience"

"It was great"
"Money parts"

University Students

Of the eleven, university student peer-tutors, eight identified as male and three as female. Two students were in the fifth year of university education, three in the fourth year, five in the third year, and one in the first year. Ten, open-ended, qualitative questions were asked of the students before the start of the project, as well as four Likert-scale questions asking students to rate their subject confidence on each of the four course outcomes. The first five questions asked students about their feelings, anticipations, and concerns before starting the project. Appendix A provides a full summary of questions and responses. In general, many students were excited about the project and the opportunities it would provide. Students were looking forward to helping others in the community, using skills they have learned, and applying financial skills in the real word setting. Some students were concerned about not having the "right" answers and talking in front of others. Students hoped to learn more about the population they would be serving, how to improve communication skills, financial planning, and human behavior. They hoped to make a difference for the students they would be teaching, learn how to better help others, improve financial literacy, and instill confidence.

For the four questions regarding confidence:

6. How confident do you feel in teaching others about the importance of financial literacy?
7. How confident are you in teaching someone about the fundamental principles related to financial planning?
8. How confident do you feel about understanding the financial planning process?
9. How well do you think you could currently analyze the appropriateness of someone's financial goals?

the following Likert-scale was used: 1= Not Confident, 2= Slightly Confident, 3=Moderately Confident, 4=Very Confident, and 5=Completely Confident. Basic results of the Likert-scale questions may be found in Table 2.

Table 2

Self-Reported Confidence in Learning Outcomes Pre and Post-Test, Paired T-Test (n=11)

	Pre-Test		Post-Test		t-test	*p*
	Mean	S.D.	Mean	S.D.		
Question 6	3.2	0.47	4.1	0.30	5.01	<.001
Question 7	3.4	0.52	3.9	0.53	1.86	.096
Question 8	3.6	0.52	4.1	0.54	1.96	.081
Question 9	3.5	0.67	4.2	0.60	3.28	.010
P < .05						

The last four questions were open-ended qualitative questions that asked students to expand on the Liker-scale outcome questions. Students felt the project would help them better communicate the importance of financial literacy in many ways, including getting real-time feedback, gaining experience with people instead of learning from a computer, developing lessons, becoming more involved with the content, and learning how to teach. Student responses indicated that the project would help students understand the financial planning process by allowing them to break it down

at a basic level, commit the process to memory, and learn through teaching. Students felt the project would help them apply fundamental financial planning principles and help them analyze goals by being able to empathize with others.

The post-test contained eleven, open-ended, qualitative, questions, as well as four Likert-scale questions, asking students to rate their subject confidence on each of the four course outcomes. The first five questions asked students about their feelings, learning, accomplishments, usefulness to the community, and suggestions for improvement. Appendix B provides a full summary of responses.

Student responses were incredibly positive with many commenting that it was a valuable experience. All university students responded that the project was worth their time and effort. Students learned more about finance concepts, how to improve public speaking, teach, and how to explain concepts differently. Students felt that many accomplishments came out of the project and that it would help the community partner in ways such as helping the at-risk students begin to think about their financial future, making wise financial decisions, and considering financial scenarios that could happen in real life. Some improvements the students suggested for future classes included limit the amount the community partner instructor spoke, use more case studies, limit the number of peer-mentors in the classroom for each lesson, create a separate course for the community-based learning component, allow more time to teach the students, limit the project to one half of the semester, and have more than one group of students present at each meeting.

The same four, Likert-scale questions regarding confidence were asked post-intervention, and results are reported in Table 2, above. An increase in confidence did occur in all four course objectives, with a t-test showing a statistically significant increase in confidence in outcomes one and four, H2a and H2d (see Table 2).

The next, four open-ended questions asked students to again expand on the Likert-scale outcome questions. Students felt the project helped them communicate the importance of financial literacy by allowing them to understand and present concepts in a simplified way and allowed them freedom in how to present each topic. It helped students with understanding the financial planning process by seeing each of the steps, mastering before teaching, understanding difficulty in planning with a limited budget, appreciating that each plan is different and some priorities may need to remain a focus, and understanding the comprehensive nature of financial planning. Students were able to apply fundamental principles of financial planning through the project by taking a step back and focusing on the simple aspects first, creating basic lesson plans, reflecting on the at-risk students' questions, relating content knowledge to the real world, and creating real-life examples. Finally, the project helped students analyze financial goals by applying concepts learned to at-risk students' goals, realizing the goals need to be realistic, evaluating the time needed to reach the goals, and improving personal financial goals.

The final, two open-ended questions asked students to provide a basic definition of community-based learning and offered an opportunity for students add any other comments or questions. Students did not have any additional questions or comments, but their definitions conveyed a personal understanding of what community-based learning is, using descriptive words such as: reciprocal, reflection, course-based, serving others, and give back to the community.

Implications

Significant improvement in perceived financial knowledge should be explored further in relation to financial self-efficacy for female, at-risk youth, specifically when utilizing a peer-

tutoring model. As supported by Shim, Soyeon, and Serido (2007-2018) financial classes and information from multiple sources contribute to a higher degree of efficacy, "and, ultimately, more responsible financial decision making".

The at-risk participants wanted to learn more about budgeting, savings and investments, homeownership, consumer protection, and identity theft. However, the specific financial literacy topics selected by the directors of the Abbott House for instruction did not include homeownership, consumer protection, and identity theft. Instructors may find benefit in including additional topics based on student interest, if in alignment with personal finance content standards.

Overall, the at-risk student participants had a positive experience, as demonstrated by the comments regarding what they liked best about the program, and this would support continued use and improvement of similar projects in similar settings. Considering these comments and the findings by Shim, et al. (2015) that positive financial socialization may contribute to positive change in financial attitude and behavior, it is imperative that the at-risk youth continue to have a source of positive financial socialization through similar programming.

University students all felt the project was worth their time and that it was a positive learning experience. They too had numerous comments to support the continued use of peer-tutoring and community-based learning as a pedagogy in the personal finance course. An increase in university students' confidence with teaching others about the importance of financial literacy, teaching others about the fundamental principles related to financial planning, understanding the financial planning process, and analyzing the appropriateness of financial goals, did occur, with a statistically significant increase in confidence observed with teaching others about the importance of financial literacy and analyzing the appropriateness of financial goals. However, a sample size of eleven is too small to make generalized conclusions from this data. Similar projects with larger class sizes would need to replicate these methods to truly measure the statistical difference in pre- and post-intervention.

Limitations are apparent in this study. The sample size for the study was small, with both the at-risk student population and university student population. However, that is, in-part, what made this project feasible and successful. In addition, due to the nature of the residential facility program, students move in and out of the Achievement group. Of the twelve participants in the study, only seven completed the entire financial literacy program. Though this project shows mush promise to be repeated in similar settings, and the small number of participants provided rich qualitative insight, gathering reliable data on the at-risk, youth population would require greater resources and would be encouraged. In addition, though measuring an increase in student outcomes would require larger class sizes and repetitive implementation over time, continuing similar projects using community-based learning and peer-tutoring models with university personal finance students is supported by the strong and consistent qualitative responses received.

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Appendix A
University Student Pre-Reflection Qualitative Questions and Answers

1. How do you feel about this project?
   "Not sure at the moment"
   "It provides a unique opportunity"
   "I feel torn, because I know it to a point. Just not sure if I know it enough to teach it."
   "I am excited, I think it is a great way to learn about the community not being from Mitchell, it is a way to get immersed in the community and share my knowledge."
   "I am excited to use financial skills in a real world setting."
   "Should be interesting"
   "I feel like this project can be extremely beneficial for both parties"
   "Seems like a good way to serve others"
   "I feel like this project will help the girls with their finances, but will also help us in some ways we can improve how we take care of our money."
   "I think it will be a great learning experience for us all."
   "Its a great way to be able to help the community while keeping my memory sharp of what I have already learned."

2. What are you looking forward to?
   "Helping out others"
   "Helping and interacting with others"
   "Being able to help someone else learn finance."
   "I am looking forward to sharing my knowledge and developing material to teach."
   "Helping individuals who need the financial advice."
   "Helping people using both my major and minor"
   "Helping people and discussing about financial literacy"
   "Serving the community"
   "I look forward to sharing with them our experiences of how we started out with managing our money and some of things we learned when we were their age."
   "I am looking forward to working with the girls at the Abbott house."
   "I like to help others achieve their goals so I hope my teaching helps them be able to learn and retain the information."

3. What are you concerned about?
   "Being able to not always have the best answer"
   "Not being able to answer a student's question"
   "Doing it wrong"
   "I am most concerned about presenting material, I need to work on my confidence in the information that I know."
   "Not having the right answer"
   "Teaching for the first time"
   "Nothing"
   "Not sure what to expect"
   "I am concerned about not knowing too much about budgeting a check book and that I do not have that information on my financial goals."

"I have no concerns."
"I'm not the best at standing in front of a group of people so I hope that I don't get too nervous."

4. What do you hope to learn through this project?
   "Learn a little more about how the Abbott house works and who is there"
   "I hope to gain an insight into how other "non-finance" individuals view the financial world"
   "How to communicate effectively while talking about finance"
   "I hope to learn a way to share and explain the topics that we learn in this course."
   "More about financial planning."
   "How to relate to other people and teach in a way they understand"
   "I hope to teach and give them an understanding about the topics discussed."
   "Learn about people and people's behavior"
   "I hope to learn better ways to manage my money and how I need to start making smarter decisions because I will not alway be living at my parent's house."
   "I hope to learn more about our course material and how to effectively communicate with the girls of the Abbott House."
   "I hope to learn how to better communicate what I am try to get across in my lessons."

5. What do you hope to accomplish through this project?
   "Being able to help and make a difference in as many kids as I can"
   "Provide others with basic knowledge of financial importance"
   "The basic knowledge of financial planning"
   "I hope to be able to accomplish a better knowledge of the material that is presented in this course, while teaching and explaining to the girls."
   "Gain knowledge while helping others."
   "Give them information that they can use every day"
   "Make my background with Financial literacy stronger."
   "Get a better understanding of why people are troubled or abused"
   "I want to give them the confidence they need to manage their money and make smart decisions to impact their lives."
   "I hope to accomplish a better understanding of the course material."
   "I hope to be a good enough teacher to have the students do well."

10. In what ways do you think this project will help you communicate the importance of financial literacy?
    "It gives you feedback from an actual person to see if what your saying is actually helping"
    "It should provide us with an opportunity to provide information to individuals with a desire and need for this specific knowledge"
    "It will give me experience talking about finance, instead of learning from a computer."
    "I think that by coming up with lesson plans and a way to teach others about financial planning on the most basic level, I would be able and more confident to teaching others."
    "By teaching them how important financial literacy is and in what ways it will help them now and in the future."
    "It will help me to become more involved with the course and the processes involved"
    "Give a basic understanding and foundation."

"By teaching someone else who doesn't have a grasp on the concept, it will allow me to learn how to teach"
"I think think this will help me understand how a lot of people do not know how to budget their money and that learning the right way will help later on."
"By teaching the material to someone else, this will help me gain a better understanding of the importance of financial literacy."
"in life they will come across these term in maybe a loan or when investing so they will need to have an idea of what the financial advisors are saying."

11. In what ways do you think this project will help you understand the financial planning process?
"Help me be able to slim down the process to a point where they can understand it"
"They say the best way to learn is to teach - you don't truly understand something until you can effectively communicate it to someone else"
"It'll give me a better understanding as I will have to speak to others about financial planning and then teach it."
"By breaking it down to the most basic level, gives me a chance to understand financial planning more in depth."
"Helping others with their financial plans will help me get a better understanding of the process and how to use it."
"Teaching will help me to better understand the concepts and give quality information"
"Review and give me a better understanding of the financial planning process"
"It will allow me to learn by teaching someone else vocally"
"This will help me to make smarter decisions and what things I can cut out of my budgets and things I need to bring into my budget that are necessary."
"By teaching this to others, it will help me understand the process better."
"Maybe a student will have a better way of remembering the process or understanding it."

12. In what ways do you think this project will help you apply basic, fundamental principles related to financial planning?
"While planning for this project it will help me dig deeper into the basic principles"
"They say the best way to learn is to teach - you don't truly understand something until you can effectively communicate it to someone else"
"it'll give me a better understanding of it."
"By helping others come up with a financial plan of their own, will help me understand and from another point of view."
"Having to teach them about the fundamentals will help me apply the basic principles."
"Using basic real world examples to teach"
"Review and give me a better understanding of the basic principles"
"If people do not have any concept of financial planning, then it will be easy to teach the rudiments of financial planning which I could apply to my own finances"
"I will start to use these principle sin my everyday life. Right now I kinda spend my money how I want, but I know after college I will have to start saving my money and accumulate more into my saving account."
"This project will help me apply basic, fundamental principles related to financial planning because we are dealing with high-school aged girls, making"

"It will help me reiterate the principles and refresh my mind of what we have previously went over."

13. In what ways do you think this project will help you understand & analyze appropriate financial goals?
    "The more you talk about it and teach it the more familiar you are with the information"
    "They say the best way to learn is to teach - you don't truly understand something until you can effectively communicate it to someone else
    "How to set them and then prepare for them"
    "This project will help me analyze others financial goals by seeing others goals, I can learn about my own."
    "By helping them with their financial goals I will be able to see what is and what isn't appropriate."
    "There are different financial goals for everyone and recognizing individualized goals will be important while keeping them realistic"
    "Review and give me a better understanding of analyzing appropriate financial goals."
    "By dissecting a financial plan, it will allow me to see a broader picture of the concept of financial planning"
    "I think this will help me relax my values and what is really important in my life. It will make me think twice before getting an expensive coffee or buying a brand new car."
    "By working with the girls at the Abbott House, I think this will help us use our basic knowledge of the course material and help solidify that knowledge."
    "it will maybe allow me to go more into depth and think about being in another person's shoes."

14. Do you have any other major questions or comments about the project you'd like us to know about?
    "Is there a rubric for preparing a lesson plan(s)?"
    "How in depth will we be getting into financial planning? Will the concepts be fairly basic or complex?"

Appendix B
University Student Post-Reflection Qualitative Questions and Answers

1. How do you feel about this project? Why?
   "Educational. Our class learned and so did the girls at the Abbott House."
   "It was pretty basic knowledge, but helped with public speaking. Felt good to know we were making a difference in other's lives."
   "It was a create chance to learn how to teach other students"
   "I liked the project because we were outside of a classroom setting and had to learn a variety of ablilties"
   "I liked being able to help the community."
   "It was a good learning experience because I improved my public speaking skills"
   "It was a fun and interesting project."
   "I feel like the girls learned a lot about how to handle their future finances and is a great project for our class to engage in."
   "I liked this project, it was neat to help others and see the girls develop and interact with us through the course of the profect."
   "I thought it helpful to talk in front of a class and make an impact on some people and give them something they can use for the rest of their lives"
   "I enjoyed doing this project, it taught me many things"

2. Did you feel the project was worth your time and effort? Why or why not?
   "Yes, it helped both groups learn and understand more about finances."
   "Yes, it was not overly strenuous, and helped to raise awareness about financial literacy for the girls. They seemed to enjoy it as well."
   "Yes, I believe we made an impact in those kids life"
   "I do it was worth time and effort"
   "Yes, it was easy to teach them basic finance principles."
   "Yes, it helped me learn by teaching others"
   "Yes, it was helpful for me to do for me to understand the info a little better."
   "Yes, because the girls had a fun and learned a lot at the same time."
   "I felt like this project was worth my time and effort. I feel like I learned alot."
   "Yes. (Above^)"
   "I felt it was worth my time because I didn't just learn more about finance, I learned about the Abbott House and the girls there"

3. What are some things you learned through this project?
   "How to clearly teach and understand comprehension of others."
   "Improved public speaking skills"
   "That every kid has a different story"
   "Had to organize a lesson plan and how to pass on the information that I know to people who have not learned the information."
   "I learned how to teach."
   "Different concepts in finance and how to teach a class"
   "I learned that being a teacher is difficult in the aspect to fill time with relative information."

"It was a good project for us as students because it went over the basics of how to handle our money because I think we forget sometimes."
"How to communicate basic financial needs, where other people come from, and how to think on your toes."
"That the concepts taught are not always easy to understand for everyone and some things will need to be explained differently"
"I learned more about finance"

4. What do you feel this project accomplished? How do you think this project was helpful to the community partner? (The Abbott House)
"I feel I helped the girls understand more about finance and help them in tier future."
"Although the knowledge was relatively basic I think it at least prompted the girls to begin thinking about their financial future"
"I think they learned a lot and really seemed excited and wanted to be involved"
"I feel it was helpful to the Abbott house to see different faces and different people and learn things that they may not have known."
"I think that they learned a lot through this class and gave good input during lessons."
"This project accomplished teaching the kids about money and wise choices to make with money."
"I think we were able to give a good understanding of financial essentials to the Abbot House attendants."
"The girls learned some life lessons and real scenarios on what could happen in the real world. This helped to get them ready for life after high school. It was helpful because we were teaching or helping out girls who needed guidance on the best ways to handle their finances."
"It was helpful, helped the girls see the future."
"I feel like we gave them some base knowledge to use in their everyday lives after they leave high school, which they otherwise, would not have had"
"I feel it solidified my knowledge of the finance industry. I felt that it taught the girls who knew very little about finance, some very good lessons about basic financial subjects"

5. How could this project be improved for next year's class?
"Not have the Abbott House teacher talk so much."
"Make it clear that the group's presenting should show up with case studies - those seemed to be the most beneficial "
"Not take all the students everyday"
"Make a separate class for it"
"Make the lessons shorter and give the class more freedom to ask us questions about anything that they need."
"Take a longer period to teach to the students"
"Less people in the room at one time."
"It could only be for half the semester because it drug on."
"smaller groups"
"Just not having the whole class go every time, which was already changed"
"staying on track; only having two groups present each time"

10. In what ways did this project help you communicate the importance of financial literacy?
    "Give me the ability to understand it simply."
    "Gave us a platform to say what we wanted on each topic without much restriction"
    "Helped me learn that sometimes you have to make it more simple for them to understand"
    "Helped me gain a better understanding"
    "I don't think they knew much about the basic financial principles until we taught them."
    "By teaching the kids verbally and giving them work to do to learn"
    "I had to break the terms into more simple terms which was also good for me to understand the terms better"
    "It helped me with how they view their finances at this point and where they want to be in the future."
    "it helped me communicate it on a simpler level."
    "It made me realize how imperative it is to understand finance and talk about subjects I otherwise wouldn't."
    "I believe this project helped me communicate the importance of financial literacy by having to teach it to a classroom of students"

11. In what ways did this project help you understand the financial planning process?
    "Allowed me to see each step of the process."
    "The best way to understand something is to teach it - we had to master the material before we could teach it to others"
    "That everyone will have a different plan."
    "Helped me gain a better understanding"
    "It showed that sometimes it is hard to plan with a limited budget."
    "teaching is the best learning tool"
    "That everyone has different priorities, but some things need to stay at the top."
    "It helped to fresh my memory on some of things that are most important when it comes to handling my future finances."
    "It helped me see where others come from."
    "You need to know some things in finance before you can learn some more complex things"
    "It helped me understand all of the different aspects that go into financial planning"

12. In what ways did this project help you apply basic, fundamental principles related to financial planning?
    "It helped me teach those principles to others and in turn understand them more myself."
    "Most of the girls' financial knowledge was relatively low, which required us to take a step back and touch on things we take for granted"
    "That you have to find the simple aspects first so that the topic isn't to broad to teach."
    "Helped me a gain a better understanding"
    "Most of them didn't know the basic principles so we applied it to them."
    "By creating basic learning plans to follow"
    "The girls questions enabled me to think more in depth on what is needed in one's life."
    "It helped me to go through the steps of planning that I may have forgot and apply them to my life today. I had goals in the past, but I they have changed since then."
    "it helped me relate what was learned in school to real world."
    "It caused me to think of real life situations to give examples to the girls so they can relate"

"By teaching these principles, it made me more aware of what I need to be planning for in my life, for my and my family's future."

13. In what ways did this project help you understand & analyze appropriate financial goals?
"It helped my analyzing my own goals and understanding how to get where I want to be financially."
"Applying appropriateness to the girls' goals"
"That sometimes you must have realistic goals"
"Helped me gain a better understanding"
"Not everyone can have the same goals."
"by diving deeper into information in order to teach someone else"
"The girls asked some questions on how long it would take to pay some of high value, and we calculated the time and it puts the amount of time into perspective."
"It helped me to make goals for myself because this will come in handy when I am out of college."
"it helped me understand it more by simplifying it."
"I have not learned much about most of the topics covered in this class, but I have learned a good amount about them in the past semester. Going to the Abbott House and teaching them, and hearing others teach about them, helped me understand financial goals much more than I even had before."

14. Can you give a basic definition of "community-based learning" or "service learning"?
"One part of the community teaches, other learns while both get an educational gain from the experience."
"course based, reciprocal, reflection"
"Going out in the community and putting your knowledge to the test. In hope of making someone else more knowledgeable"
"Learning based in the community"
"Teaching a part of the community about what we know."
"serving others to give back to the community"
"We help the community out while we are able to learn from it also."
"A learning that helps people in the community better understand something in a specific area."
"a program that is course based and reciprocal and the ends with reflection."
"Trying to teach what is being taught in schools in some other area of the community"
"Service learning is teaching the community or other entities about a certain topic, while solidifying your knowledge about that topic, and hopefully learning something in the process."

A Simple Alternative Method of Teaching Option Price Boundaries

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Most derivatives textbooks teach option pricing using arbitrage proofs, whereby they present the answer first and the proof itself subsequently. This method often prevents students from logically deducing the answer on their own and may thus decrease their understanding and retention of the material. Using the concepts of certainty and the risk-free rate, I introduce a very simple way for the instructor to establish lower bounds on option prices that encourages the students to reason through the process simultaneously. The simplicity and brevity of this example allows instructors to incorporate it into investments courses, which usually do not have the time available to delve into the issue of option pricing, as well as derivatives courses. I then test the students on two exams and find that they prefer the alternative proof, although they still find proofs to be difficult. Last, I expand this example to include arbitrage by viewing the right-hand side of the lower bound equation as an investment alternative to the call option itself.

Introduction

Many derivatives textbooks teach option pricing in different ways, from using the Black-Scholes model (see Black and Scholes, 1973 as well as Merton, 1973) to the binomial trees laid out in Cox, Ross and Rubinstein (1979), to demonstrations of put-call parity (see Stoll, 1969). Before introducing these concepts, however, the textbook will likely present to its readers some basic ideas regarding what the value of an option should be. This includes developing upper and lower bounds based on the option's and the underlying asset's characteristics. This method of presentation extends back many years. Managing Financial Risk, by Smithson (1998) and Derivative Securities, by Jarrow and Turnbull (1996) both present proofs of lower bounds before offering exact-price models such as binomial trees and the Black-Scholes formula. More recently, textbooks by Hull (2017) and Chance and Brooks (2016) also begin their discussions of pricing with arbitrage proofs before introducing more complex valuation models.

Although these arbitrage proofs have their advantages, they can also hamper the students' learning of the material, primarily because they present the answer first rather than encourage the students to reason their way to that answer. Several papers have addressed this issue from many different angles. Hobbs (2012) presents an alternative discussion of put-call parity to the one given in many textbooks. Brous (2017) advocates letting students identify real options of their choosing and then attempting to value them. Saunders (2014) discusses the results of allowing students to employ covered calls and protective puts in a student-run investment fund. Smolira and Travis (2011) presents option valuation in an exercise where finance students may buy call or put options on their own grades. Both Cooper and Grinder (1997) and Pavlik and Nienhaus (2004) suggest teaching options in the form of a game. Cooper and Grinder (1997) focuses on put-call parity and the Black-Scholes formula to price options, whereas Pavlik and Nienhaus (2004) use sequential rounds of trading from which the students can learn concepts like order fulfillment, arbitrage, and time value (along with time value decay).

This paper presents a simple alternative to the traditional textbook method that more directly involves the students but also follows the textbook approach of pricing options analytically through a lower-bound proof. Thus, this paper differs from previous research in that it establishes some basic rules that the student can then generalize to derive the minimum value for any call or put. By starting with the concepts of outcome certainty and the risk-free rate, the students can quickly reason their way to the minimum value. This method has the additional advantage of making the students consider the importance of the standard deviation of the underlying asset – a concept that is crucial to gaining a deep understanding of options. Finally, the analytical method presented herein will test and should help sharpen the students' ratiocination, an issue to which Brous (2017) attaches primary importance. Tularam (2013) specifically recommends using proofs in order to better prepare students for graduate-level work or the business world.

The paper proceeds as follows. Next, I discuss the traditional derivatives textbook method of presenting lower bounds on option prices. After that, I propose and discuss an alternative method that more directly involves the students while retaining the use of analytical reasoning to develop proofs of call and put options' minimum values. Following that, I extend the alternative method to include arbitrage proofs (or arbitrage-related discussion) that the instructor can use in the classroom as he or she sees fit. Last, I test the students on the proofs of minimum call option values twice, letting each select either the traditional or the alternative method, and report the results. I conclude with a summary of the results and some advice for finance instructors regarding this topic.

Option Price Boundaries: The Traditional Method

There are some advantages to using arbitrage proofs. First, the idea of an arbitrage proof (if not always the proof itself) is easy for students to understand. Second, an arbitrage proof is a strong statement – if real-life circumstances violate the proof, then traders can make free money. Regarding the minimum value of an option, many texts including Chance and Brooks (2016, pp. 81-84) begin by presenting the reader with two investment portfolios. One portfolio consists of a long position in the call option (or, alternatively, a short position in the put option) plus a long position in risk-free bonds with a total face value equivalent to the option's strike price, while the other portfolio consists of a long position in one unit of the underlying asset. A simple comparison of the two portfolios' possible values on the option's expiration date shows that regardless of whether the option holder exercises, the underlying asset cannot be worth more than the combination of the option position plus risk-free bonds. Derivatives notation varies significantly across textbooks, but if we denote the current values of the stock and call with the terms S and C, respectively, the strike price with X, the amount of time remaining until the option expires with T, and the risk-free rate of interest with r, then we can write the portfolio relation as: $C + X/(1+r)^T \geq S$. A simple rearrangement of the terms yields a minimum value for the call: $C \geq S - X/(1+r)^T$. Finally, given that exercise is a choice and not an obligation for the option holder, an option's value can never be negative. Thus we must slightly modify the above formula to arrive at the final answer for the minimum value of a call: $C \geq \text{Max}(0, S - X/(1+r)^T)$.

Option Price Boundaries: The Proposed Method

My primary critique of the traditional textbook method of teaching option price boundaries is that it begins with the answer rather than allowing the students to deduce the answer for

themselves. Moreover, the proof that they are given makes little intuitive sense; it seems unlikely that one would have the idea to buy a call (or sell a put), buy risk-free bonds, and then compare that combination to the underlying asset itself. I propose an alternative proof. First, I should point out that in order for the students to understand this proof, they must know one thing in addition to the basic workings of call and put options. They must know that the relationship between an option's value and the volatility of the underlying asset is direct rather than inverse. In my experience this understanding requires no more than a five minute discussion of the "heads-I-win, tails-I-tie" nature of an option holder's payoff at expiration, which derives from the notion that the holder will simply not exercise an out-of-the-money option. Thus, a more volatile underlying asset increases the potential gains to the option while maintaining a minimum expiration-day payoff of zero. This combination increases the option's value.

The proposed alternative method of teaching the minimum value of an option focuses on the underlying asset's volatility (represented by its standard deviation of returns) as the key variable. I provide the proof below:

> Step 1: For any given stock price (S), strike price (X), risk-free rate (r), and time to expiration (T), the cheapest call option will be one for which the underlying asset has a volatility (σ) of zero. This result, again, is implied by the fact that larger standard deviations increase the upside to options while the choice of non-exercise keeps the downside at zero. It may be helpful for the instructor to explain for a minute or two the meaning of zero-volatility. Zero volatility does not mean (as students might at first surmise), that the price of the underlying asset does not move. It simply means that there is no uncertainty about that future price; we know it in advance.
>
> Step 2: If the underlying asset is valued fairly, then its price must grow at the risk-free rate in the economy (r). Therefore, when the call option expires, the underlying asset's price will equal $S(1+r)^T$ and the value of the call will equal $Max(0, S(1+r)^T - X)$.
>
> Step 3: Discount the call's future value to the present to get $C = Max(0, S - X/(1+r)^T)$.
>
> Step 4: Recall from Step 1 that this particular call option (where $\sigma = 0$) is the cheapest possible given S, X, T, and r. Therefore, the minimum value of *any* call option with the same S, X, T and r is written $C \geq Max(0, S - X/(1+r)^T)$. This completes the proof.

This proposed method of teaching the lower bound has several advantages. One major advantage is that the students receive less guidance and thus must reason their way to the answer. There is, of course, some prodding, but my custom is to give the students only the necessary information and see if they can then deduce the answer to each step. For example, I begin by saying something like, "Take S, X, r, and T as given and focus on volatility instead. The absolute cheapest option will be one where the underlying asset has what level of volatility?" The correct answer typically comes quickly. I then follow with, "As long as this zero-volatility underlying asset is not mispriced, what *must* be its rate of return?" This method helps the students get through the proof but also forces them to participate in the reasoning process each step of the way.

Another advantage to the alternative method is its simplicity. While the traditional method is also quite simple, the primary reason for its simplicity is that the traditional method gives the

answer (apart from some rearranging of terms) first. Once the student sees the two given portfolios, it is easy to compare the values of those portfolios under two possible future states of the world, but the student likely does not know how one would develop that proof in the first place. The simplicity of the alternative method is important because it allows the students, many of whom will be uncomfortable with proofs, to reason their way through four very simple steps to arrive at the answer.

A third advantage of the proposed method is that it gets the students thinking in terms of volatility. This is a key concept in the understanding of derivatives in general, and it is obviously central to such fundamental ideas as implied volatility, vega, and option trading strategies that act as bets on or against the volatility of the underlying asset.

A fourth advantage to the proposed method is that the instructor has the option of extending it in many ways - to include more direct proofs of arbitrage, to discuss arbitrage and relative pricing, to compare options to futures contracts in pricing and valuation, or to lead into a deeper discussion of issues like volatility, time decay, and speculative value. In the following sections of this paper, I discuss these possible extensions.

Arbitrage

In step 2 of the proof in the previous section, we assume that the underlying asset (which is risk-free) is priced correctly, which implies that its rate of return will be the risk-free rate in the economy. To give the students more practice with examples of arbitrage, the instructor may want to expound upon this concept further. This is especially helpful for more advanced situations such as may be introduced in a second investments course or a course specializing in derivatives.

One possibility is that the underlying asset is mispriced. If that asset is truly risk-free, then we know not only its current price, S, but also its price at future time T, S_T. The mispricing implies that the rate of return on the underlying asset will differ from the risk-free rate in the economy. If that rate of return is higher than the risk-free rate, an investor can earn a risk-free profit above the risk-free rate by simply purchasing the underlying asset and holding it until T. If that rate of return is lower than the risk-free rate, then an investor can short the underlying and thus borrow at less than the risk-free rate.

A second possibility is that the option itself is undervalued. In keeping with the examples I have used so far in this paper, let us assume that the option in question is a call. Let S = \$100, r = 5%, T = 1 year, X = \$100, and assume that the underlying asset is valued fairly. If it is risk-free, then its price at the call option's expiration will be \$105 and the call itself will have a future value, C_T, of Max(0, 105-100) = \$5. The present value of the call must therefore be \$5/(1.05) = \$4.76. Reversing the mathematics shows that \$4.76 invested today for a value of \$5 one year later represents a return of 5%. If the call is currently valued at less (more) than \$4.76, then the investor could go long (short) the call option and thus perform arbitrage.

Additionally, the instructor may now introduce the idea of the right-hand side of the equation: $C \geq Max(0, S - X/(1+r)^T)$ as a portfolio. After the students have applied the concept of a zero-volatility underlying asset to obtain the above equation, the instructor can urge them to examine the meaning of that equation. Since X is a certain rather than risky dollar amount, one finds its present value by discounting at the risk-free rate and thus X itself can be represented by treasuries having a total face value of X and maturing at T. Thus, the equation states that the current cost of the call must be at least that of the underlying asset less that of the treasuries, else a savvy trader will short the right-hand side of the equation (i.e., short the underlying and purchase the treasuries)

and simultaneously buy the undervalued call. The instructor can then compare the two portfolios' possible values at time T, noting that if $S_T < X$, the call is worth zero whereas the right-hand side portfolio has a negative value and thus the trader makes money. However, if $S_T \geq X$, the two portfolios have equivalent time T values and the trader's net payoff is zero. The instructor may also want to explain how both the "Max(0," and "≥" parts of the equation derive from this difference between $S_T < X$ and $S_T \geq X$, with "Max(0," capturing the possibility of non-exercise and "≥" showing how it creates a beneficial asymmetry in the possible future payoffs to the buyer. Last, the instructor may want to expand this example into a discussion of put-call parity by introducing a put option to capture the underlying asset's downside and thus create a true equivalent or "replicating portfolio" for the call option.

One caveat is in order here. The instructor may wish to distinguish between the concepts of zero-volatility and the repo rate (or implied repo rate) within the context of the two portfolios having equivalent ending values for all cases where $S_T \geq X$. This is a fundamental feature of cash-and-carry arbitrage and may be useful particularly in advanced classes where the students will encounter different types of arbitrage (including cash-and-carry) multiple times.

Assurance of Learning

In order to test the students' preferences and learning, I put the following question on their first undergraduate derivatives exam as well as on their cumulative final exam:

Prove the minimum value of a European call. Show your assumptions and how they lead to the answer.

Before each exam, I mentioned to the students that I would likely ask this type of question and told them that they could use whichever method they preferred. On the first exam, 11 students selected the alternative method while only three selected the traditional textbook method. Of the 11 who selected the alternative method, four received full credit, which required all of the following: mentioning that the zero-volatility underlying asset would result in the cheapest option, other factors equal; establishing that the price of any zero-volatility asset must grow at the risk-free rate; calculating the future value of the call based on S_T being equal to $S^*(1+r)^T$; and discounting that future value back to the present. The other seven received most of the credit. Of the three who selected the traditional textbook method, one received full credit and the other two received partial credit. Unfortunately, another 12 students attempted a shortcut to the answer that failed to meet the requirements of a proof or simply did not know how to get started.

On the final exam, eight students attempted the alternative method whereas only one attempted the traditional method. Six of the eight who attempted the alternative method received full credit and the other two received most of the credit. The one student who attempted the traditional method received most but not all of the credit. Sixteen students either did not know how to begin the problem or attempted a shortcut. This illustrates the difficulty of proofs for undergraduate students. The majority of students who attempted some type of shortcut were pretty clearly trying to use the alternative method but were skipping one or both of the first two steps. The following is a representative example:

> "You would first find the F.V. of the underlying and then you would the F.V. of the call by subtracting what the strike price would be from it and then discounting everything to get the P.V. of the call.
>
> FV of underlying = $S(1+r)^T$
> FV of C_e = Max [0, $S(1+r)^T - X$]
> PV of C_e = Max [0, $S(1+r)^T/(1+r)^T - X/(1+r)^T$]
> Final answer: $C_e \geq$ Max [0, $S - X/(1+r)^T$]"

Note that the only step of the proof that this student skipped is the first – the concept of the cheapest option (all other factors equal) being one written on a primary asset that has zero volatility. However, the statement: "FV of underlying = $S(1+r)^T$" derives from that first step, but that fact is not stated. Many students begin by writing the future value of the call as Max [0, $S_T - X$] and then take the present value of each term to arrive at a present value of Max [0, $S - X/(1+r)^T$]. They then jump to $C_e \geq$ Max [0, $S - X/(1+r)^T$]. Of course, this final step substitutes a greater-than-or-equal sign for an equal sign without explaining why.

While it is clear that the students preferred the alternative method to the traditional textbook method, their willingness to skip the crucial first step of the alternative proof surprised me. Many of my students simply treated the problem as a future value that they could then discount to a present value. In future semesters I will emphasize more that first step in the proof, and I strongly recommend that other instructors do the same.

Conclusion

Most derivatives textbooks present to their readers lower bounds for option prices prior to delving into more complicated models like binomial trees and the Black-Scholes formula. They usually reveal these lower bounds through "arbitrage proofs", which begin most of the way to the answer. There are potential problems with this approach. First, the students do not have the chance to reason their way from the very first step to the answer. Second, the answer, as typically presented, is not intuitively appealing and thus may be difficult for the students to retain.

In this paper, I present a very simple alternative proof that allows the students to reason their way to the answer almost entirely on their own. The only major prodding is at the beginning, where the instructor encourages students to think in terms of the volatility of the underlying asset while treating all of the other key option-pricing factors as given. In four brief steps, the students will have arrived at the answer, easing them into the world of proofs and revealing the intuition behind that answer. This method differs from those suggested in prior pedagogical research in that it still requires the use of analytical, proof-based thinking, which the student can then apply to all standard option contracts. I anticipate that the proof will take only about 15-20 minutes of class time, thus adding a deeper element to the treatment of derivatives in introductory investments courses where the time available for any one topic is restricted. I also present possible extensions, recommended for use only in more advanced courses, of this proof.

I tested the students on a midterm as well as on a final exam, allowing them to prove the lower bound of a call option in any way they wanted. The students preferred the method proposed in this paper by a large margin, but there are caveats that I must mention. First, proofs are difficult for undergraduate students, and the instructor must discourage any shortcuts that invalidate the proof itself. In particular, many of my students started with the future value of the option and discounted it to the present, but did not explain how an option's value could be greater than the maximum of

zero or the current price of the underlying less the present value of the strike price. Thus, they may still fail to discuss volatility, a key component of extrinsic value. Thus, I recommend that instructors strongly emphasize the importance of volatility not only at the beginning but throughout the entire discussion of options valuation.

I believe that this alternative method of allowing the students to develop the proof on their own with only minimal guidance will help them in many ways. First, the alternative method provides them with a simple, fast and intuitive way of learning proofs, which is a large part of derivatives courses as well as master's and Ph.D. level finance courses. Second, it allows for increased retention of the fundamental concepts of options, both because it allows the students to deduce the answer through a series of simple steps and because it encourages them to think in terms of the volatility of the underlying asset, which is a necessary condition for understanding options. From this discussion can follow the teaching and reinforcement of crucial, related concepts like vega, time-value decay, and how volatility affects both the buyer and seller of the option. Third, it retains the possibility of detailed arbitrage discussions as an "add-on" to the proposed proof or as part of the discussion of the proof itself. Because of these advantages, the proposed alternative method should leave students with a better grasp of options and option valuation.

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Use of Technology in Teaching Capital Structure: A Smart Design to Enhance Students' Performance

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This paper develops a smart spreadsheet design that makes the complex capital structure coverage more accessible for finance students. The smart design uses the synthetic rating method showing the required spread over the benchmark risk-free rate for alternative D/E ratios. The design also uses a case-based approach enabling students to work with actual data from real firms. This work uses the Disney corporation to demonstrate an application of the smart design. The design is nearly instructions-free, compact, and self-contained and provides users with an instant visual presentation of the weighted average cost of capital (WACC) when inputs are entered and modified. Once the required data are entered, the smart design shows the optimal capital structure that minimizes the WACC, together with a confirmation graph providing a visual presentation. When inputs are modified to observe the impact of alternative scenarios, the smart design provides instant answers together with the sensitivities involved in the process. In addition to being an effective teaching tool, it can also be used in conducting research related to the capital structure.

Keywords: Capital Structure, Smart Design, Synthetic Rating Method, Cost of Capital, WACC

Introduction

Teaching is an act with alternative approaches, functional with the nature and complexity of the subject. The effectiveness of teaching is a complicated matter that makes many of us invest a significant amount of time in assessing it. Finance is a discipline sitting at the crossroads of economics, mathematics, probability, statistics, data analysis, and accounting. Any undergraduate Finance major will quickly confirm the difficulty of finance topics. The underlying reasons for this difficulty relate to the common characteristics of the finance curriculum:

- Required familiarity with multidisciplinary terminology (finance, statistics, mathematics, economics, accounting, regulations, legal.)
- Use of methods with multifaceted structure (time value, asset pricing models, valuation models, capital structure, dividend models, bond ratings, portfolios, integrated models feeding each other)
- Use of strategic moves based on results obtained from integrated models.

Expectedly, financial subjects with different difficulty levels may require significantly different teaching methodologies. Introductory finance courses such as principals of financial management

or introductory corporate finance may emphasize terminology and simple time value used in valuation and capital budgeting. A typical investment course with more quantitative material such as portfolios and more sophisticated modeling such as the Capital Asset Pricing Model (CAPM) or other multifactor valuation models may suggest finance lab use and spreadsheet integration. A course dealing with derivatives will require special software and coding.

Regardless of an instructor's capabilities, covering financial subjects usually require the use of technology: a financial calculator to compute the yield-to-maturity or internal rate of return or a spreadsheet showing the impact of an input on a particular variable, such as changes in the market interest rate on bonds' prices. Lecturing about bond price sensitivities is not a simple matter. Making students see it through the spreadsheet is much more valuable as they can instantly observe the changes in bond price once the discount rate is modified. Moreover, one can include other parameters entering the bond valuation, such as time to maturity, coupon payment, and their relative impact on the bond's market price. Including an applied component always make lectures more accessible. Instantly observing the relative impacts of different inputs will immediately make the audience aware of the material's dynamics and more likely to generate well-engaged discussions.

When a lecturer using a spreadsheet shows that bond prices are more sensitive to interest rate declines compared to identical interest rate increases, students will simultaneously observe the price sensitivity of a bond as interest rate changes. If they are familiar with the theoretical material, they will be able to confirm it. Students with poor study habits also benefit from the interactive presentation since interactive designs encourage student participation and discussions. In such a presentation, students will also see the impact of other variables such as time to maturity: What happens if the term changes from 5-year to 20-year? What if the bond has a 5% annual coupon versus a 12% annual coupon? Getting an instant answer to several essential questions is a great benefit in interactive teaching as it makes students participate in an application to verify the theoretical material and observe the impact immediately. The use of technology, when properly integrated, becomes a powerful tool in covering complex and multiple-step designs.

This paper aims to initiate a smart design that will make a highly advanced finance topic, the capital structure, accessible for undergraduate students. The capital structure is a complex and bulky finance topic that is not typically covered at the undergraduate level. The implemented design will make the ***capital structure*** accessible and easy to understand. It will also use a case-based approach that enables students to work with actual data obtained from real firms.

The next section defines and details the concept of capital structure, including its theoretical and applied dimensions. Section 3 underlines why capital structure is not a popular undergraduate topic and suggests integrating this important topic into the undergraduate finance curriculum. The components of the smart design are introduced in section 4, along with their theoretical ties. An application using The Walt Disney Corporation's (Disney) actual data is explained in section 5. Section 6 shows the effectiveness of the proposed design. Section 7 concludes.

Capital Structure

Capital structure is an important corporate finance concept describing a firm's finances in terms of its debt and equity. Capital structure and its impact on a firm’s cost of capital and firm value have always been widely debated and well analyzed. Historically, the weighted average cost of capital approach introduced by Modigliani and Miller (1958, 1963) highlights that a levered firm’s

value may be expressed as a sum of two present values representing investment and financing decisions.

Usually, a company will come to life as a private, sole proprietorship and decide to go public to obtain the expansion funds to finance its growth. Before issuing any debt, a firm will be called an all-equity company with the simplest capital structure: Its cost of capital is equal to its cost of equity. We may write the cost of equity using the discounted cash flow approach shown in many corporate finance textbooks (see, for example, Brigham & Ehrhardt, 2017, p. 389).

$$r_E = \frac{D_1}{P_0} + g \tag{1}$$

where r_E is the cost of equity, D_1 is the next period's dividends, P_0 is the stock price now, and g is the growth rate.

One may interpret the first component on the right-hand side as the dividend yield and the second component as the capital gain. Therefore, a stockholder expects to gain dividend yield plus capital gain making the cost of equity equal to the sum of the two components.

Alternatively, we may use the CAPM to compute the cost of equity:

$$r_E = r_{rf} + (r_m - r_{rf})\beta_i \tag{2}$$

where r_e is the cost of equity, r_{rf} is the risk-free return, r_m is the market return, and β_i is the company i's beta coefficient.

The complication starts when a company decides to finance itself with debt and equity. With the new debt, its capital is no longer *all equity* but has two components, *debt* (D) and *equity* (E), with the corresponding weights, W_D and W_E, where $W_D+W_E = 1$. Naturally, we need to compute the cost of debt, r_D, so that we can compute the weighted average cost of capital (WACC) for the firm. Cost of debt computation is straightforward under highly unrealistic assumptions: If a firm has only one recently issued debt, then the cost of debt is equal to the yield-to-maturity of this debt. Since the interest on the debt is paid before the firm pays its taxes, we can write the composite or weighted average cost of capital, following Clayman et al. (2012, p. 133):

$$WACC_i = w_D.r_D(1 - T) + w_E.r_E \tag{3}$$

For simplicity, we ignore the preferred stock component of the WACC. As noted by Ross et al. (1996), the WACC approach to valuation has been a favorite for both practitioners and theorists since the 1990s.

Complexities in Capital Structure

Theoretically, the capital structure is considered optimal if it minimizes the WACC. When the WACC of a firm is minimized, the firm's stock price and value are maximized. The capital structure evaluation starts with checking if a firm's current capital structure is the optimal one.

To obtain the current weighted average cost of capital of a firm, one needs to compute the firm's current cost of debt and equity. The market value of equity or the market cap is easy to compute since the number of shares outstanding and the stock price are always available. If we intend to use the discounted cash-flow approach, we may use the last dividends paid, or D_0, to compute the firm's implied growth rate, and using equation (1), we can compute the current r_E. Alternatively, we may use the CAPM approach: For that, the risk-free rate, usually proxied by the 10-year Treasuries, the market risk premium, and the firm's beta will be needed. There are several alternative proxies for the risk-free rate, such as 10-Year T-bonds or other maturities. As for the

market risk premium, historical market-risk-premium or the implied one may be used. The beta may be computed using monthly data for 5 years or directly obtained from any financial information provider. Using equation (2), we can compute the current cost of equity, r_E.

However, there are some potential issues with the current component cost of debt. The first hurdle is to compute the market value of outstanding debt. Naturally, many firms have a portfolio of bonds with various coupon rates and different issues and expiration dates. As a result, one may compute the cost of outstanding debt for those firms using either an approximate or an exact approach. The exact approach is complicated and requires computing the internal rate of return of the exact bond portfolio. The approximate approach is acceptably accurate and simply the weighted average of the cost of the outstanding issues using the size of the issues as weights. However, both of those approaches include bonds issued in the past when the firm possibly had a different risk structure, and the economy might have had different benchmarks. We need a cost of debt reflecting the present position of the firm.

One possible way to obtain the current cost of debt for a firm is to use the firm's bond rating. After all, the bond rating takes into account the current total risk of the firm. However, many firms may have bonds that are not rated or traded for several reasons. One such reason is private placements since only the publicly traded bonds have ratings. These hurdles move us towards using synthetic rating method based on developing a link between a firm's interest coverage ratios and its rating by looking at all rated companies in the United States. The method obtains the default spread that goes with that rating from traded bonds.

In summary, the synthetic rating table shows quite accurately the required spread over the benchmark risk-free rate for alternative "interest coverage ratios." This method is intuitive and compact once the table is created.

Table 1 is prepared by Professor A. Damodaran and updated every January. The link between the TIE (times interest earned ratio) and the ratings is developed by looking at all rated U.S. companies, and the corresponding spreads obtained from traded bonds. The table provides us with the pretax cost of debts for alternative capital structures. Adding the obtained spread to the risk-free rate yields the pretax cost of debt for the evaluated debt-to-equity ratio. If we move to an alternative D/E ratio, the new TIE will be computed using the new estimated "interest paid," assuming EBIT (earnings before interest and taxes) will not be affected by the leverage. With the synthetic rating table, one can compute all cost of debt values corresponding to the alternative capital structures.

One may obtain the corporate spreads from Bloomberg's Fixed Income Worksheets (FIW). This option gives one the control of including the desired type of bonds. Spreads obtained from Bloomberg FIW using S&P rankings and maturities may be incorporated into Table 1 at any time to make the process updated to the present time. However, this is not necessary if the smart design is intended to explain the process rather than having a process that works in real-time. If the design is used for research purposes, it is important to update the table using current spreads.

Table 1
Synthetic Rating Table for non-financial firms

Emerging Markets with Market Cap < $5 billion	**Developed Markets with Market Cap > $5 billion**	**Date of Analysis: January 2020**	
TIE	TIE	Rating	Spread
(12.50 - 1000)	(8.50 - 1000)	Aaa/AAA	0.63%
(9.50 - 12.49)	(6.50 - 8.45)	Aa2/AA	0.78%
(7.50 - 9.49)	(5.50 - 6.49)	A1/A+	0.98%
(6.00 - 7.49)	(4.25 - 5.49)	A2/A	1.08%
(4.50 - 5.99)	(3.00 - 4.24)	A1/A-	1.22%
(4.00 - 4.49)	(2.50 - 2.99)	Baa2/BBB	1.56%
(4.00 - 4.49)	(2.25 - 2.49)	Ba1/BB+	2.00%
(3.00 - 3.49)	(2.00 - 2.24)	Ba2/BB	2.40%
(2.50 - 2.99)	(1.75 - 1.99)	B1/B+	3.51%
(2.00 - 2.49)	(1.50 - 1.74)	B2/B	4.21%
(1.50 - 1.99)	(1.25 - 1.49)	B3/B-	5.15%
(1.25 - 1.49)	(0.80 - 1.24)	Caa/CCC	8.20%
(0.80 - 1.24)	(0.65 - 0.79)	Ca2/CC	8.64%
(0.50 - 0.79)	(0.20 - 0.64)	C2/C	11.34%
(-1000 - 0.49)	(-1000 - 0.19)	D2/D	15.12%

From: Damodaran (2020).
http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ratings.htm

Cost of Equity Component

For each composite cost of capital specific to an alternative capital structure, one needs to compute a new cost of equity. Theory tells us that when the leverage is modified, its risk structure is modified, requiring a new cost of equity computation matching the new risk structure. This can be done using the Hamada equation (Brigham & Ehrhardt, 2017, p. 630) that provides us with the levered beta values for the alternative leverage levels.

$$\beta_L = \beta_U \left(1 + (1 - T)\frac{D}{E}\right) \quad (4)$$

β_L in equation (4) is the current published or computed beta reflecting the firm's current capital structure and therefore known. D/E, the current debt-to-equity ratio, is also known. Solving equation (4) for the only unknown yields the unlevered beta. Once we have the unique value of unlevered or debt-free beta, we can start computing the alternative cost of equity values for alternative leverage ratios using CAPM.

$$r_E = r_{rf} + (r_M - r_{rf})\beta_L \quad (5)$$

where β_L is the levered beta.

Inserting the alternative D/E ratio into equation (4) that now has the unlevered beta value will provide us with the corresponding levered beta value, β_L, for the investigated D/E ratio.

Consequently, inserting the levered beta value into equation (5) yields the desired cost of equity. Now that we have both the cost of debt and the cost of equity for the alternative D/E ratio, we can compute WACC's value for the underlined D/E ratio.

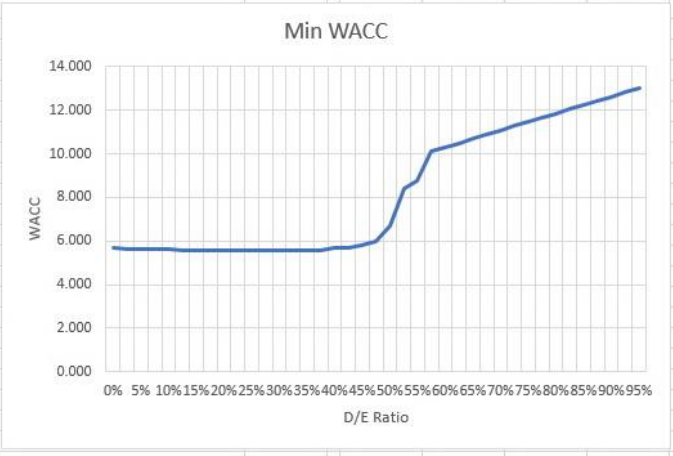
The process explained in detail above will be repeated using a spreadsheet for D/E ratios starting with "no debt" and systematically increasing the leverage ratio so that we can observe the values of WACC as the debt ratio increases. This process will produce the lowest WACC value labeled as the *optimal capital structure*. Figure 1 below shows the smart design layout with four panels: Inputs, Synthetic Rating Table, Results, and the Graph. Modification in any input will instantly change the results and graph panels. Synthetic rating table spreads are also adjustable, and the impact is observable instantly.

Figure 1
The Smart Design

D(%)	D/E	Debt($)	Interest Paid	TIE	Spread	R(D)	Beta	R(E)	WACC
0.000	0.000	0.00	0.001	11850	0.63	0.0251	0.922	0.0568	5.678
0.025	0.026	8.00	0.201	59.05	0.63	0.0251	0.940	0.0575	5.659
0.050	0.053	15.99	0.401	29.52	0.63	0.0251	0.960	0.0583	5.641
0.075	0.081	23.99	0.602	19.68	0.63	0.0251	0.980	0.0592	5.623
0.100	0.111	31.98	0.803	14.76	0.63	0.0251	1.002	0.0601	5.604
0.125	0.143	39.98	1.003	11.81	0.63	0.0251	1.024	0.0610	5.586
0.150	0.176	47.97	1.204	9.84	0.63	0.0251	1.049	0.0620	5.568
0.175	0.212	55.97	1.405	8.44	0.78	0.0266	1.074	0.0631	5.570
0.200	0.250	63.96	1.701	6.96	0.78	0.0266	1.102	0.0642	5.555
0.225	0.290	71.96	1.914	6.19	0.98	0.0286	1.130	0.0654	5.575
0.250	0.333	79.95	2.287	5.18	1.08	0.0296	1.161	0.0667	5.583
0.275	0.379	87.95	2.603	4.55	1.08	0.0296	1.194	0.0680	5.574
0.300	0.429	95.94	2.840	4.17	1.22	0.0310	1.230	0.0695	5.598
0.325	0.481	103.94	3.222	3.68	1.22	0.0310	1.268	0.0710	5.591
0.350	0.538	111.93	3.470	3.42	1.22	0.0310	1.309	0.0727	5.584
0.375	0.600	119.93	3.718	3.19	1.22	0.0310	1.353	0.0745	5.578
0.400	0.667	127.92	3.966	2.99	1.56	0.0344	1.401	0.0765	5.678
0.425	0.739	135.92	4.676	2.53	1.56	0.0344	1.453	0.0787	5.679
0.450	0.818	143.91	4.951	2.39	2	0.0388	1.510	0.0810	5.835
0.475	0.905	151.91	5.894	2.01	2.4	0.0428	1.572	0.0836	5.994
0.500	1.000	159.91	6.844	1.73	4.21	0.0609	1.641	0.0864	6.725
0.525	1.105	167.90	10.225	1.16	8.2	0.1008	1.716	0.0895	8.433
0.550	1.222	175.90	17.730	0.67	8.64	0.1052	1.801	0.0930	8.755
0.575	1.353	183.89	19.345	0.61	11.34	0.1322	1.894	0.0969	10.121
0.600	1.500	191.89	25.367	0.47	11.34	0.1322	2.000	0.1012	10.315
0.625	1.667	199.88	26.424	0.45	11.34	0.1322	2.120	0.1061	10.508
0.650	1.857	207.88	27.481	0.43	11.34	0.1322	2.257	0.1118	10.701
0.675	2.077	215.87	28.538	0.42	11.34	0.1322	2.415	0.1183	10.894
0.700	2.333	223.87	29.595	0.40	11.34	0.1322	2.599	0.1259	11.087
0.725	2.636	231.86	30.652	0.39	11.34	0.1322	2.817	0.1349	11.281
0.750	3.000	239.86	31.709	0.37	11.34	0.1322	3.079	0.1456	11.474
0.775	3.444	247.85	32.766	0.36	11.34	0.1322	3.398	0.1588	11.667
0.800	4.000	255.85	33.823	0.35	11.34	0.1322	3.798	0.1753	11.860
0.825	4.714	263.84	34.880	0.34	11.34	0.1322	4.311	0.1964	12.054
0.850	5.667	271.84	35.937	0.33	11.34	0.1322	4.996	0.2246	12.247
0.875	7.000	279.83	36.994	0.32	11.34	0.1322	5.955	0.2641	12.440
0.900	9.000	287.83	38.051	0.31	11.34	0.1322	7.393	0.3234	12.633
0.925	12.333	295.82	39.108	0.30	11.34	0.1322	9.789	0.4221	12.826
0.950	19.000	303.82	40.165	0.30	11.34	0.1322	14.582	0.6196	13.020

INPUTS	
Share price(published)	148
Shares outstanding(published)	1.81
Total Debt(published)	51.93
Capital	319.81
R(M)(assumed)	6
(10-Y T-Bond)(published) R(rf)	1.88
B(computed or published)	1.04
EBIT(published)	11.85
Interst paid (published)	1.25
Interest percentage cost	0.0240709
TIE (initial)	9.4800
B(unlevered)	0.9218
Tax Rate(21% across the board)	0.21

Synthetic Rating Table			
Lower Bound	Upper Bound	Rating	Spread over 10Y
8.500	100.000	AAA	0.63
6.500	8.499	AA	0.78
5.500	6.499	A+	0.98
4.250	5.499	A	1.08
3.000	4.249	A-	1.22
2.500	2.999	BBB	1.56
2.250	2.499	BB+	2.00
2.000	2.249	BB	2.40
1.750	1.999	B+	3.51
1.500	1.749	B	4.21
1.250	1.499	B-	5.15
0.800	1.249	CCC	8.20
0.650	0.799	CC	8.64
0.200	0.649	C	11.34
-100.000	0.199	D	15.12



From: Topyan, K (2020)
https://drive.google.com/file/d/1IbrfZwzMFp_b7ZFRY8Lc1LYXdIqQ3ByK/view?usp=sharing

Application: Case Study - *The Walt Disney Corporation*

This section uses the actual Disney data obtained from Yahoo! Finance, a free financial information source. The data is used to show how one set of WACC values are computed.

1. Using any financial information provider, we can obtain the number of shares outstanding and the share price. The product of the two will yield the market value of equity, which is always available and published as the "Market Capitalization" or "Market Cap." Using Yahoo! Finance, we can obtain the Walt Disney Corporation's market cap: $268.24 B (January 2, 2020).
2. Since it is difficult to obtain the market value of outstanding bonds for the corporations, the book value of bonds is used. Using the book value in place of market value is a common practice and considered a good proxy since firms will refinance the debt if the rates go down and keep the current debt when the rates go up. As a result, the book value of bonds is usually close to the market value. Using Yahoo! Finance, we can see that the Walt Disney Corporation's total debt is $51.93 billion. The D/TA ratio is equal to $51.93/($268.24+$51.93) = 0.0.162, or 16.2 percent showing Disney's current capital structure, approximately 16% debt, and 84% equity. Using Yahoo. Finance, we also make a note of the following: β_{DISNEY} = 1.04, EBIT = 11.85 billion, Interest paid = 1.25 b.
3. Using the synthetic rating table and TIE ratio, 11.85/1.25 = 9.5X, we can conclude that Disney's rating is AAA, and the corresponding spread is 0.63%. Adding this to a 10-year Treasury rate of 1.88 (Jan 2, 2020) yields 2.51% as the cost of debt, r_D.
4. Using equation (4) and inserting the beta (1.04), risk-tree rate (1.88%) and the market risk premium MRP (6%), we can compute the initial r_E as 1.88% + (6%)1.04 = 8.12%
5. Using equation (3) with the marginal tax rate of 21% yields

$$WACC_0 = (0.16)2.51\%(1 - .21) + (0.84)8.12 = 7.13\%$$

It implies that for every $1 Disney raises, 16 cents come from debt financing and costs 2.51%, whereas 84 cents come from equity financing and costs 8.12%. Overall, the cost of raising $1 capital is, therefore, will be 7.13 cents.

The ultimate question here is to check if Disney's current capital structure is the optimal one. If it is the optimal one, no other capital structure must yield a lower WACC value. On the other hand, computing WACC value is a tedious process, and students may not be able to follow it efficiently.

To illustrate how our design addresses the steps, we produced the steps of the first alternative WACC value of 20% debt and 80% equity. In other words, we increase the leverage from 16% to 20%.

i) New debt is 20% of TA, or $64 billion. (.2 x $320b=$64)
ii) Interest on this debt, using 2.51% cost of debt is 0.0251 x $64 billion is $1.70 billion.
iii) The interest coverage ratio is now $11.85b / $1.70 = 6.97x.
iv) Spread over risk-free using the synthetic rating table is 0.78%.
v) New interest rate or r_D is 1.88 + 0.78 = 2.66%.
vi) Debt-to-equity ratio, D/E, is 0.20/0.80 = 0.25
vii) Unlevered beta, using equation (4), can be estimated as 0.902. The unlevered beta shows the cost of equity when the firm is all equity.
viii) Levered beta, reflecting the risk of the new capital structure of 20/80, using the equation (4), can be estimated as 1.08.
ix) The cost of equity, r_E, using the equation (5), can be estimated as 8.36%.
x) The new WACC value with a 20/80 capital structure is 7.11%.

Using the 10-step procedure shows that moving from 16% debt to 20% debt lowered the Disney Corporation's cost of capital from 7.13% to 7.11%. Until the lowest WACC value that

maximizes the firm's market value is obtained, the 10-step procedure must be repeated for all alternative debt-to-equity ratios. The smart instructional design will make this tedious work instantly available; it will also graph the WACC values, showing the minimum WACC. Moreover, one may use the design to explain WACC's sensitivities to changing inputs as students may question the WACC's response to certain input variables such as risk-free rate, corporate tax rate, or beta. The design developed here will address those issues instantly.

Smart Design and Assurance of Learning

The process explained above and the case study showing its application using a real firm is included in the ***Fin 340 Corporate Structure and Financing*** course offered at the O'Malley School of Business in Manhattan College. The course is offered regularly, every Spring semester, in multiple sections and is taught by one of the authors. The smart design was part of the efforts to meet the capital structure course's learning goals and was designed accordingly. As part of the course, students will have a semester-long, three-stage project requiring them to evaluate a real company's capital structure and recommend restructuring if it is not optimal. This project is intended to help students understand complex theories using real firms and meet the capital structure course's learning goals in line with the department's learning goals.

Table 2 shows the smart design's effectiveness by comparing students' answers to five basic capital structure questions designed in line with the Capital Structure course's learning outcomes. The table's top part shows the Spring 2018 semester when the smart design was not developed and integrated into teaching. The section under it shows the responses to the same questions when students use the developed design as the aid. Five questions used to evaluate the students' comprehension are listed at the bottom of the table. Those questions are included as an assignment posted on Moodle and made available to students during the last week of classes. Students can log in any time to answer those questions, in 30 minutes. Students will have to answer those questions using their company evaluation in their project. All six sections are taught by the same professor using an identical course outline. Spring 2019 sections made the smart design available to students to use during the semester.

The table shows the design's effectiveness with the correct answer percentage increases of 28 to 56 percent for the question included in the assignment. It is worth noting that the design's contribution is higher with more difficult questions such as questions 3, 4, or 5.

Table 2

Assessment of Learning Table

The table shows the comprehension of students on five learning objectives related to capital structure questions. Numbers in the questions columns show the number of students who answered the questions correctly. The percentage of correct answers is next to the number.

Semester	Course	Section	Enrollment	Question 1	Question 2	Question 3	Question 4	Question 5
Spr 2018	Fin 340	1	32	15 (47%)	21 (66%)	9 (28%)	11 (35%)	7 (22%)
		2	15	7 (47%)	10 (66%)	4 (27%)	7 (46%)	4 (27%)
		3	23	12 (52%)	15 (65%)	10 (44%)	11 (48%)	6 (26%)
			Average:	49%	66%	33%	41%	24%
Spr 2019	Fin 340	1	23	20 (87%)	23 (100%)	19 (83%)	21 (91%)	19 (83%)
		2	10	9 (90%)	9 (90%)	8 (80%)	8 (80%)	8 (80%)
		3	21	18 (86%)	19 (91%)	17 (81%)	17 (81%)	16 (76%)
			Average:	87%	94%	81%	85%	80%
Increase attributable to smart design				38%	28%	48%	44%	56%

Q1	If your company's beta increases 50%, what would be the impact of this change on current capital structure?
Q2	If the corporate tax rate goes down 10 %, what would be the impact of this on current capital structure?
Q3	If the risk-free rate increases 80 basis points, would the minimum WACC value change? By how much?
Q4	If we use an equity risk premium that is 60 percent higher, would that change the min WACC value? By how much?
Q5	If the firms debt is doubled, what would be the new optimal debt-to-equity ratio and min WACC?

Conclusion

The previous section presented the complexities of capital structure computations. Capital structure and financing require data gathering, heavy computations integrated into alternative scenarios, and a good understanding of the theoretical frame. With proper instructions and support, students usually are able to compute the current capital structure for the firms using actual data. However, they usually fail to be able to visualize the impact of alternative capital structure scenarios on the cost of debt and equity. They also usually fail to visualize the total impact on WACC when inputs change. This is mostly because the capital structure and financing issues have long multiple steps requiring recursive computations.

Similarly, understanding the input sensitivities is important and requires tedious steps, and not instantly observable. For example, a professor may like to show the impact of a higher marginal tax rate or increase in the firm's beta or a change in risk-free rate on the weighted average cost of capital. However, each of those will require lengthy computations and cannot be easily integrated into lectures. Those elasticities or sensitivities are crucially important in the capital structure and provide us with instant answers and help us determine the strategies related to leverage, financing, and risks.

The smart design integrated into lectures should, therefore, efficiently address a number of practical problems: It must be compact, preferably a single page that students will see everything at once; easy to use requiring to enter only a few firm-specific inputs; easy to explain, so that the professor will be able to show the results instantly.

It should be easy to interpret so that the impacts of changing inputs will be instantly observable and visually appealing. The inputs, outputs, reference tables, and the explanatory graph should be nicely integrated into a single page design.

With the issues highlighted above, a single page Excel sheet with four distinct sections is developed: 1) the inputs section where students will enter the required information; 2) the synthetic rating table that shows the ratings connecting the required spread; 3) the main table that displays all capital structures for alternative debt ratios; 4) the graphical representation displaying the optimal capital structure percentages and showing WACC's minimum point using a graph.

The design is not only a teaching tool but can be used to do research related to capital structure. It can be used to answer potential study questions, and it is a tool to check if students' case studies are computed correctly. It is a tool to show the impact of the assumptions on the outcome, and it enables the professor to compare different theoretical approaches and their impacts. It is easily adaptable to play with the numbers in the synthetic rating table, may assume different equity risk premium and risk-free rates. The single-page design in Figure 1 is stored in the authors' Google drive, and readers are welcome to download and use it by clicking on the link under Figure 1.

The smart design has seven firm-specific input cells marked in yellow: The **stock price**, **shares outstanding**, **total debt**, **beta**, **EBIT**, **total interest paid**, and **the tax rate**. Any student will be able to quickly obtain the inputs as they are available in several financial data outlets for free. The table also needs the model-specific **current risk-free rate** that can be copied from the Federal Reserve's website and an assumed ERP, or **equity risk premium**, marked in blue. Alternative equity risk premium estimations are easy to plug in, and this experiment itself is a valuable learning tool showing the impact of the ERP assumptions.

The design's effectiveness for the AACSB assurance of learning criteria has been evaluated using six sections of the same course with the same instructor and the course outline. Three of those sections were offered in Spring 2018 without the smart design, and the other three were offered in Spring 2019, using smart design. Utilizing five questions designed in line with the course learning objectives, students' comprehension has been evaluated. As shown in Table 2, the complex design's effectiveness was confirmed with a 28% to 56% increase in correctly answered questions.

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Let's Teach CAPM Correctly

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The capital asset pricing model is one of the cornerstones of modern financial economics. In the early CAPM literature, celebrated theorists including Lintner and Fama provided a depth of interpretation which has been largely lost. My paper uses simple CAPM calculations to show how we have over-simplified the logical implications of CAPM. I show an unusual but helpful CAPM equation for beta that reveals how the CAPM expected return on a risky asset is determined not by its payoff risk per se, but by its payoff risk per unit of payoff mean. This result is fully reconciled with the usual returns form of CAPM which we teach to all finance students. To assist students, I illustrate my CAPM analysis with a simple numerical example. Lastly, I add some sample exam questions that highlight how we have previously gone wrong.

Keywords: logic of CAPM, risk premium, payoffs CAPM, risk per unit of mean, Fama ratio

Introduction

This teaching note shows something about the CAPM that originated most clearly with Fama (1977), and which is known to a few finance theorists, but is virtually unknown in textbooks and apparently not taught to students.

This omission is first explained, and then illustrated using example calculations. Later in the paper, I offer some "sociological" explanation for how it occurred.

CAPM Analysis

Let the cash payoff from a risky asset be a random amount V, and let the rate of return on the market be r_M. Writing the CAPM in its less usual yet well known pricing form, as shown in Brealey, Myers and Allen (2017), Fama and Miller (1972), Grinblatt and Titman (1998), and Luenberger (1998), the equilibrium price of a risky asset is:

$$P = \frac{E[V] - k\,\mathrm{cov}(V, r_m)}{1 + r_f} \tag{1}$$

where r_f is the risk-free interest rate, r_m is the expected return on the market portfolio, and $k > 0$ captures the market's exogenous risk aversion, or, more specifically, the market's aversion to aggregate payoff variance.

By definition the expected return on the asset is:

$$E[r] = \frac{E[V]}{P} - 1 \tag{2}$$

Substituting for P in $E[r]$ gives:

$$E[1+r] = \frac{E[V]}{P} = \frac{E[V]\left(1+r_f\right)}{E[V] - k\,\mathrm{cov}(r, r_m)} = \left(1+r_f\right)\left[1 - k\frac{\mathrm{cov}(V, r_m)}{E[V]}\right]^{-1} \tag{3}$$

It follows therefore that the characteristic of the risky cash flow that drives its CAPM expected return is the ratio of the variability or covariance of the cash flow with its expected amount or mean. Risk is therefore best understood as risk or covariance *per unit of mean*.

Throughout finance discourse, the addendum "per unit of mean" is typically overlooked, and hence the embedded CAPM effect of the mean on its own "discount rate" is overlooked. Exceptions to this rule include Peasnell (1977), Lambert et al. (2007) and Johnstone (2016, 2017).

Part of why the effect of the mean is not widely recognized is that common textbook CAPM expositions stress how the expected return is a function of just the cash flow's "beta", and beta is a measure of risk. But a deeper understanding of CAPM shows that beta is a function of both the first and second moments (i.e., the mean and covariance) of the cash flow.

The underlying asset characteristic that determines its beta is its "Fama ratio" of payoff covariance to mean. It is easy to show this result by writing beta as follows:

$$\begin{aligned} \beta &= \frac{\mathrm{cov}(r, r_m)}{\mathrm{var}(r_m)} = \frac{\mathrm{cov}\left(\frac{V}{P}, r_m\right)}{\mathrm{var}(r_m)} = \frac{1}{P}\frac{\mathrm{cov}(V, r_m)}{\mathrm{var}(r_m)} \\ &= \frac{\left(1+r_f\right)}{E[V] - k\mathrm{cov}(V, r_m)}\left(\frac{\mathrm{cov}(V, r_m)}{\mathrm{var}(r_m)}\right) \\ &= \frac{\left(1+r_f\right)}{\mathrm{var}(r_m)}\left[\left(\frac{E[V]}{\mathrm{cov}(V, r_m)}\right) - k\right]^{-1} \end{aligned} \tag{4}$$

To my knowledge, this simple algebraic expansion of beta is virtually unknown. It is written only in Johnstone (2017). Interestingly, it was Fama (1977, p.7), one of the originators of the finance theory surrounding CAPM, who first noted the ratio:

$$\frac{\mathrm{cov}(V, r_m)}{E[V]} \tag{5}$$

as the driver of CAPM beta. Fama stated explicitly that the underlying driver of the expected return on a risky asset under the CAPM can be found in just the simple ratio of the payoff's covariance to its mean. This ratio of covariance to expected value [payoff] is the source of differences in the values of E[R] for different firms. (Fama 1977, p.7).

Fama did not however write down the associated algebraic proof, and his point seems to have been virtually ignored and completely lost, at least by textbook writers and hence by generations of finance students. Re-proof was provided by Lambert et al. (2007).

Numerical Example

Consider this simple but highly insightful example. The market has two states, "up" and "down". When the market is up, it pays a return of $r_m = 0.3$, and when it is down it pays a return of $r_m = -0.1$. The two states are equally probable, so the expected return on the market is:

$$E[r_m] = 0.5(0.3) + 0.5(-0.1) = 0.1,$$

and the variance of the market return is:

$$\text{var}(r_m) = 0.5(0.3 - 0.1)^2 + 0.5(-0.1 - 0.1)^2 = 0.04.$$

Using these values we can find the market's implied risk aversion constant, k. That is done by applying the CAPM pricing equation to the market as a whole; i.e., to the aggregate price P_M of all assets in the market. Thus,

$$P_m = \frac{E[V_m] - k\,\text{cov}(V_m, r_m)}{1 + r_f},$$

where V_m is the cash payoff in aggregate from all assets in the market.

Using this equation for P_m and noting that $\text{cov}(V_m, r_m) \equiv P_m \text{cov}(r_m, r_m) \equiv P_m \text{var}(r_m)$, it follows from the definition $E[r] \equiv \frac{E[V]}{P} - 1$, and the given values of r_m and $\text{var}(r_m)$, that:

$$k = \frac{\left(E[r_m] - r_f\right)}{\text{var}(r_m)} = \frac{(0.1 - 0.05)}{0.04} = 1.25.$$

Hence, the market's aversion to risk is $k = 1.25$.

Now within that market there is a risky asset or cash flow that pays $V = \$150$ when the market is up and $V = \$50$ when the market is down.

Hence, its expected payoff is $E[V] = 100$ and the covariance of that payoff with the market return is, by the usual statistical rule for covariance:

$$\text{cov}(V, r_m) = 0.5(150 - 100)(0.3 - 0.1) + 0.5(50 - 100)(-0.1 - 0.1) = 10.$$

Now, using the algebraic form (1) of the CAPM pricing equation, we can write:

$$P = \frac{E[V] - k\,\text{cov}(V, r_m)}{1 + r_f} = \frac{100 - 1.25(10)}{1.05} = 83.33.$$

The price implied expected return is therefore:

$$E[r] = \frac{E[V]}{P} - 1 = \frac{100}{83.33} - 1 = 20\%.$$

Now to tie all the equations together, we re-find this result using the asset's beta and the more common form of CAPM. The asset's beta is by definition:

$$\beta = \frac{\left(1 + r_f\right)}{\text{var}(r_m)}\left[\left(\frac{E[V]}{\text{cov}(V, r_m)}\right) - k\right]^{-1} = \frac{1.05}{0.04}\left[\left(\frac{100}{10}\right) - 1.25\right]^{-1} = 3.$$

Hence, we can now find the expected return on the asset from the much more conventional CAPM returns equation:

$$E[r] = r_f + \beta\big(E[r_m] - r_f\big) = 0.05 + 3(0.1 - 0.05) = 20\%,$$

which corroborates what was already found above and completes the CAPM equilibrium. So, the analysis is internally consistent.

Now let us repeat these calculations for an asset with the same risk or payoff variability but with a different mean. Suppose that the asset pays \$250 when the market is up and \$150 when it is down. In that case it has an unchanged payoff covariance with the market, but its mean is higher (all that has happened is that its distribution has shifted to the right). Its new mean is $E[V] = \$200$.

Using the same calculations as above, the new asset price is:

$$P = \frac{E[V] - k\,\mathrm{cov}(V, r_m)}{1 + r_f} = \frac{200 - 1.25(10)}{1.05} = 178.5714.$$

and the price implied expected return for the asset is:

$$E[r] = \frac{E[V]}{P} - 1 = \frac{200}{178.5714} - 1 = 12\%.$$

To corroborate these results, we find the asset's revised beta,

$$\beta = \frac{(1 + r_f)}{\mathrm{var}(r_m)}\left[\left(\frac{E[V]}{\mathrm{cov}(V, r_m)}\right) - k\right]^{-1} = \frac{1.05}{0.04}\left[\left(\frac{200}{10}\right) - 1.25\right]^{-1} = 1.4,$$

and hence from the usual CAPM returns equation:

$$E[r] = r_f + \beta\big(E[r_m] - r_f\big) = 0.05 + 1.4(0.1 - 0.05) = 12\%,$$

So again, the results are all internally consistent, which is of course as expected under a coherent logically correct application of CAPM.

Strikingly, note how an increase in the expected cash flow is sufficient of itself to reduce its beta. No change in cash flow risk or statistical variability is required. That is an unappreciated corollary of CAPM and is vitally important throughout finance yet is widely unknown and contradicted.

I first saw this result in Lambert et al. (2007) (LLV) and was immediately taken with how simple yet fundamentally important it is. I asked one of the co-authors of that paper why it was so unknown, being so fundamental, and his explanation was as follows:

> In the course of writing LLV, Rick Lambert and I had extensive discussions about 'myths and conceptions' that seem to surround the CAPM, and why this was the case (suffice to say that our conversations were more interesting than the actual paper that we wrote). Rick comes from a traditional 'finance' background, and believes that over time, as finance has come to embrace and disseminate the chief implications of the CAPM, it has unintentionally incorporated/superimposed assumptions or implications that were never intended – or are simply false (such as the assertion that a firm's expected cash flow is unrelated to its cost of capital). …It is a mystery to me why researchers in finance and accounting fail to understand 'obvious' features of a model that is so germane to their disciplines. Unlike Rick, I come from an economic, asset pricing tradition (e.g., Diamond and Verrecchia, 1981) and so would probably go so far as to say that there's nothing in LLV that wasn't well known or understood 4 decades ago – but perhaps wasn't well

> articulated prior to LLV. …I'm laughing as I write this because nearly all the referee reports associated with either LLV or our follow-up paper, Lambert, Leuz and Verrecchia (2012), fell into one of two camps – we were repeatedly told by editors and referees that our results were either 'obvious' or incorrect (or, in the case of some referees, obvious and incorrect!). (Private email correspondence, Jan 3, 2014).

The question for teachers is about when and how to teach the CAPM correctly. In my experience, the exposition above is not easy to teach to anyone who has already studied the CAPM. Most graduate students (and finance professors) assume that they understand the CAPM and that there is nothing much more to learn. That natural presumption does not do justice to the early theorists who provided a depth of analytical and philosophical interpretation which is now largely out of fashion, or to the hidden depths of CAPM as an equilibrium model rather than as a regression equation.

If we were to teach CAPM correctly, some of what we understand and say would have to change. To underline my argument, take the following apparently easy multiple choice exam question on CAPM.

Possible Exam Questions

Question 1: The expected return on an asset depends on:

(a) the mean of its cash flow.
(b) the risk of its cash flow, defined as its cash flow covariance with the market.
(c) neither of the above.
(d) both its mean cash flow and its cash flow risk or covariance with the market.

Virtually every student who ever successfully graduated in finance or financial economics will tell you that the answer is (b), as everyone knows. The correct answer is (d), as shown above, and the ease of that demonstration does not reflect its fundamental importance.

The more general implications of a deeper understanding of CAPM are too many to list. Let me give just one. I will put it in the form of another exam question.

Question 2: Firm A and Firm B produce cash flows that are perfectly positively correlated (i.e., their correlation coefficient is one). Which of the following is correct according to CAPM:

(a) the two firms have the same beta and cost of capital.
(b) the two firms have the same risk profile under CAPM.
(c) both of the above.
(d) the two firms will have different costs of capital unless their cash flows are proportional to each other.

The correct answer looks "obviously" like (c) but is actually (d).

To be perfectly positively correlated, the two cash flows have a positive linear relationship, $A = m + bB$ with $b > 0$, but they have the same Fama ratio if and only if $m = 0$ (i.e., they must be proportional to one another). By statistical laws, the cash flow means and covariances are then also constant proportions or multiples of one another, with the same constant of proportionality, b.

This point is relevant when, for example, a firm expands its scale of operations. Its new cash flow will not be proportional to its old cash flow, because of economies of scale etc.

So, its new cost of capital under CAPM can be higher or lower than its old cost of capital. That is despite the fact that it remains in the same industry or type of business, which is often incorrectly used to warrant it having the same discount rate.

Question 3: A firm reduces its fixed costs by a given large amount $*K*. All else about its payoff distribution stays the same. Its cost of capital is therefore:

(a) lower because its cash flow is less risky.
(b) lower because its net cash flow has a higher mean.
(c) higher because its costs are now mostly variable.
(d) higher because shareholders get a higher return.

A typical answer here is (a) but the correct answer is (b). The cash flow retains the same variability, and hence covariance with the market, but that variation is around a higher mean, i.e., the cash flow distribution is shifted to the right, exactly as if the firm takes on a new business activity that produces $*K* in risk free cash. So, the firm's Fama ratio is lower, thus reducing its cost of capital.

The firm is now equivalent to the old business plus a new risk-free business paying $*K*, so its average cost of capital across the "two business" will be lower than its old cost of capital (it will be a weighted average of its old cost of capital and the risk-free rate).

Question 4: The firm discovers a new risk. Its new electric car is causing random house fires due to a fault in its batteries. The potential lawsuit and damages could ruin the company. When the stock market is informed of this new risk, should the firm's cost of capital increase?

(a) no, it will stay the same because the firm risk is idiosyncratic and diversifiable.
(b) no, it will decrease because the risk will be discounted at the risk-free rate, because it is diversifiable.
(c) yes, because the new firm-specific risk reduces the firm' mean cash flow leaving the firm with a lower mean and an unchanged cash flow covariance.
(d) yes, because the firm's cash flow is now more correlated with the economy.

The correct answer may seem unclear, because both (a) and (b) seem to fit with standard CAPM thinking. But the correct answer, one that is obvious once we take account of the Fama (1977) and Lambert et al. (2007) CAPM expositions, is (c). That (c) seems to depart so far from finance teaching is indicative of what a cultural change is required to shift finance teaching to a correct CAPM interpretation.

These sample exam questions show how a deeper understanding of CAPM might render much common finance discourse at least partly wrong. But what option is there in an analytical field like asset pricing other than to articulate CAPM correctly, in the way that it was understood by Fama and other early CAPM theorists, even if that makes things harder to understand.

One approach, which I have used successfully with senior undergraduates is to explain to them that they have previously been exposed to a simplified grasp of CAPM, much of which is still fine, but that there is a deeper point of CAPM logic which they can more easily take in now that they have a lot of familiarity with stock returns, the stock's returns beta, the CAPM equation in its returns form, and other essential CAPM constructs. Ultimately, the most convincing proof for most students is to go through actual numerical example calculations, like those above. These are irrefutably correct under CAPM and internally consistent. They are convincing for finance practitioners whose work is typically in calculations rather than just equations.

Summary

These sample exam questions show how a better understanding of CAPM might render much common finance discourse at least partly wrong. That suggestion will not be well received by many. But for teachers, what option is there but to teach CAPM correctly, in the way that it was understood by Fama and other early CAPM theorists, even if that makes things harder for students to understand.

One approach, which I have used successfully with senior undergraduates is to explain to them that they have previously been exposed to a simplified grasp of CAPM, much of which is still fine, but that there is a deeper point of CAPM logic which they can more easily take in now that they have a lot of familiarity with stock returns, the stock's returns beta, the CAPM equation in its returns form, and other essential CAPM constructs. Ultimately, the most convincing proof for most students is to go through actual numerical example calculations, like those above. These are irrefutably correct under CAPM and internally consistent. They are convincing for students who don't work easily with just equations.

Postscript

Since writing this paper, the point regarding "Fama's ratio" has been found explicitly in the earlier work by Stapleton (1971, p.109). It has also been explained and expanded on recently by Babenko, Boguth, and Tserlukevich (2016, p.426), who provide a similar explanation to that first made clear in Lambert, Leuz and Verrecchia (2007).

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Why Business Ethics Education Fails? How Do Professional Financial Designations Work?

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The aim of this qualitative research is twofold: first, to examine the inefficacy of existing business ethics education using virtue ethics theory and offer suggestions; second, to explore the interplay between academic and professional certification programs in the context of industry needs. Regarding the first task, we come up with three compelling reasons: student mistaken belief of individualist self-interest, ineffective pedagogy, and widespread academic misconducts around the world. Remedies include recruiting more competent teachers, encouraging students to earn professional designations, pedagogic innovations and university managers' insistence on academic integrity. For the second task, we point out that there is an apparent gap between academic pursuits and financial industry needs. Professional financial certifications like Chartered Financial Analyst®, Certified Financial Planner® and Financial Risk Manager® provide practitioners avenues to not only enhance ethical awareness but also hone the most sought-after specialized skills in the industry. Additionally, because these designations have received global and professional recognition, they convey more reliable signals to corporate recruiters than ordinary academic qualifications for differentiating applicant's capabilities. Lastly, these flagship programs play vital roles in achieving two sustainable development goals of the United Nations – quality education and partnerships for the goals.

Keywords: Business ethics education, Chartered financial analyst, Certified financial planner, Financial risk manager, Financial designations

Introduction

Over the past decades, the mission of higher education (HE) has significantly altered. Responding to the rising demand for a knowledgeable workforce, HE has shifted its purpose from elite to mass education (Cotronei-Baird, 2017). In the US, attending college remains a rewarding investment (Abel & Deitz, 2014). Bachelor's degree holders can receive a much higher wage premium over high school graduates. Among the different majors of studies, business remains a good choice, as it yields an above-average investment return. Business education remains prominent across many developed countries (Cotronei-Baird, 2017; Lam & Zou, 2018; Sigurjonsson *et al*, 2015). Almost all universities worldwide have established business schools,

offering a wide range of multidisciplinary programs including accounting, economics, and finance. Some have obtained the accreditation from the Association to Advance Collegiate Schools of Business (AACSB) and/or European Quality Improvement System (EQUIS) of the European Foundation for Management Development, which collectively set the international standards for quality business education.

Still, a host of problems remain to be overcome with contemporary business education in colleges. First and foremost, our business ethics courses fail to mold ethically sound graduates for the community (Huo & Kristjansson, 2018; Sigurjonsson *et al*., 2015). This is exemplified by the prevalence of varying forms of academic misconducts by students (Bernardi *et al*., 2008; Ma, 2013; Tsui & Ngo, 2016). Second, faculty promotion and tenure decisions have remained largely adherent to the publish-or-perish rule since the 1990s (Chao & Postiglione, 2017; Keng, 2018; Lam & Zou, 2018). Instead of nurturing students with the recognized certifications and skills to be work-ready, academics are preoccupied with producing papers for prestigious journals that might be of little relevance in ameliorating real-life problems (David *et al*., 2011). Last, and relatedly, academic pursuits have long been at odds with prevailing business needs. Cotronei-Baird (2017) and Barnacle *et al*., (2019) have criticized today's scholars for focusing too much on delivery of singular disciplinary knowledge and disregarding the essential generic workplace skills for student developments.

Research Questions and Approach

Aligned with its title, this paper serves two purposes: firstly, to examine the inefficacy of today's business ethics education using virtue ethics theory and offer our suggestions; secondly, to explore the interplay between academic and professional certification programs in the context of industry needs. To make our research focus more outstanding, the second task considers only financial qualifications and therefore our paper is of particular relevance to finance program administrators, scholars and students. A qualitative approach is deployed wherein we collect data from different sources – literature reviews, Morningstar® investment research company, academic accreditation bodies, professional industry organizations, universities and Chinese government agency. A succinct overview of virtue ethics theory would be presented below. Our findings and discussions pertaining to the aforesaid objectives would be laid out in the following two sections thereafter. In the end, we summarize and conclude.

Virtue Ethics Theory

Pursuant to Dobson (1997), there are basically two approaches to understanding one's intent behind ethical decision-making. The first is action-based or rule-based approach, which is most widely adopted in professional communities with sound legal frameworks. Financial professionals are governed by a multitude of ethical codes, principles and rules, which effectively serve as constraints to behaviors. The second is an agent-based approach underlain by virtue ethics theory. Virtues refer to those desirable character traits commonly thought of as ideals by peers in the profession. Attributes like fairness, honesty, respect, etc. fall into this category of spiritual merits or "internal goods." Under the agent-based approach, virtuous financial planners would not indulge in mis-selling because they firmly believe client interests always prevail, and the commissions (personal gains or "external goods") generated are secondary. They take strong self-initiatives to pursue internal goods without feeling constrained.

Shortfall of Business Ethics Education – Reasons and Suggestions

We have located three reasons for the failure of today's business ethics education. Firstly, economics often takes self-interest and utility maximization as underpinning premises, which are self-fulfilling as students mistakenly believe that the pursuits of external versus internal goods cannot coexist (Dobson, 2003). This calls for proper guidance from competent instructors to learn that there need not be a conflict between one's self-interest and the pursuit of virtuous excellence. Of course, this begs the question of whether the teachers are quipped with integral expertise and industry experience. In case that "many professors begin teaching financial planning without having first practiced it" (Goetz *et al*., 2005, p.248), it is easy to lose the focus of the subject under study.

Secondly, current ethics education follows primarily the rule-based approach. Within one semester, it is nearly impossible to significantly raise student ethical awareness and hone essential reasoning skills (Huo & Kristjansson, 2018; Jagger & Volkman, 2014; Sigurjonsson *et al*., 2015). According to Hauser (2020), if the main objective of an ethics course is to disseminate knowledge and raise student moral sensitivity, lecture is the usual delivery tool. Invariably, it is dominated by teachers. Furthermore, ethics becomes a very dry subject if the content is more about Aristotle, history, technical, and abstract ideas that students may be unable to relate to (Dyck & Kleysen, 2001). To lighten up the class, it is necessary for the instructor to take the extra role of facilitator to include more collaborative tasks like group discussion, occasional funny videos, or real-life case study (McCullough & Munro, 2018; Raman *et al.* 2019). It is therefore paramount for teachers to continue exploring ways to inject life and fun in business ethics.

Critiques of the rule-based pedagogic approach from virtue ethics advocates center on its inability to evoke virtuous behavior in the absence of moral excellence (Dobson, 1997; Dobson, 2003; Jagger & Volkman, 2014; Kupperman, 1999). Even good exam records cannot predict actual behaviors outside the classroom, that is, the so-called preach-and-pretend problem remains unresolved (Hauser, 2020). In addition to ethics-related guest lectures or student-led debates, program administrators might contemplate organizing sports training or spiritual practices to strengthen students' strong character to resist temptations (Goetz *et al*. 2005; Jagger & Volkman, 2014; Kupperman, 1999). Deciding on an appropriate pedagogy is itself a formidable task for lecturers because there are always ethnic differences among students that come into play in choosing the ideal approach. That would be trickier if the audience are from different levels with varying learning and understanding capacities.

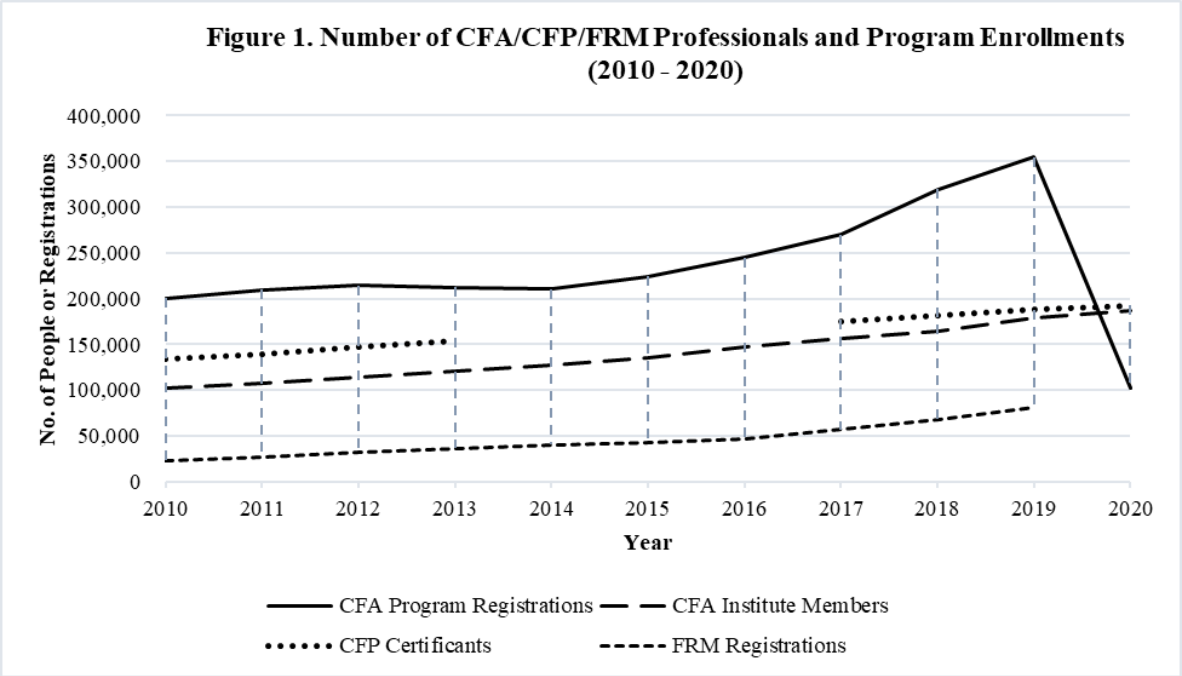
Lastly, and unfortunately, university managers seem unaware of the true essence behind virtue ethics theory that students are learning ethics not entirely within classroom, but more fundamentally, via observations of the actual behaviors of moral exemplars, especially teachers and themselves (Dobson, 1997). In reality, there are just too many reported cases of unethical behavior among academics worldwide (Shaw & Despota, 2013). Worse, the absence of concern for immoral practices of students has underpinned the cheating culture on campus. The procedural hearings on student integrity violations are so complex that invigilators and teachers might refrain from duly exercising their responsibility for monitoring them (Coren, 2011). To students, the shirking of this duty results in "dissonance between what is taught as ethical and what is permitted in practice" (Jagger & Volkman, 2014, p. 178). Because there exists no incongruity on building a culture of integrity and honesty (Floyd *et al.,* 2013), university provosts have to show their uncompromising commitment by enforcing an effective supervisory regime of academic integrity.

Professional Financial Designations and Their Values

Background Information

Financial practitioners are expected to act with honesty and integrity amid ethical quandaries (Huo & Kristjansson, 2018). The observation that university business ethics education is ineffective poses another question – whether our graduates' ethical awareness can be heightened via earning professional designations after entering the job market? Further, how are those certification programs filling the gap between academic and practitioner's needs? Within the financial industry, careers belong to at least three specialized fields – financial analysis and investment management, personal finance, and risk management. With extensive literature review, we have identified three internationally recognized financial designations—Chartered Financial Analyst (CFA), Certified Financial Planner (CFP), and Financial Risk Manager (FRM)—conferred by CFA Institute, Financial Planning Standards Board (FPSB), and Global Association of Risk Professionals (GARP), respectively (Biktimirov, 2012; Bracker & Shum, 2011; Chan *et al*., 2016; David *et al*., 2011; De Franco & Zhou, 2009; FPSB, 2014; Goetz *et al*., 2005; Grieb *et al*., 2017; Kang *et al*., 2018; Shukla & Singh, 1994; Smith *et al*., 2008). For brevity, their program structures as of 2020 are outlined in Appendix 1. Panel A shows that the whole CFA program covers all core topics in the discipline of finance arranged into three levels with varying weightings. The importance of ethical and professional standards has been indicated by their significant weightings throughout all three exam levels. Panel B illustrates the CFP adapted program held by Institute of Financial Planners of Hong Kong (IFPHK) as FPSB's Hong Kong affiliate. As a procedure of background check, when candidates apply for their CFP certifications to the IFPHK after completing all exams, they have to disclose any legal proceedings related to their professional conducts. Under Panel C, FRM is considered a more in-depth program focused on a wide range of risk management topics. And GARP's code of conduct and ethical standards are embedded in the syllabus as foundational knowledge. Of course, the potential preach-and-pretend problem with ethics still persists. But in case there are breaches of ethical standards, credential holders are likely to face disciplinary sanctions by the professional bodies or prosecutions by regulators.

To depict the annual enrollments in CFA and FRM examinations (all levels) and number of CFA Institute members and CFP professionals worldwide from 2010 to 2020 under Figure 1, we have collected the data from the websites of CFA Institute, FPSB (the number of CFP certificants for 2014–2016 are missing) and GARP (the number for 2020 is to be released). As one of the prerequisites for the CFA charter is to maintain annual membership with CFA Institute, we believe the number of CFA Institute members is a good proxy for that of CFA charterholders. In 2010, there were approximately 102,800 CFA Institute members and 133,800 CFP certificants across the globe. In 2020, they have increased steadily to around 186,400 and 192,800, respectively. The gap between the number of these two groups has narrowed down from 31,000 to 6,400, as more candidates have enrolled in the CFA exams and become chartered. Registrations for FRM exams have surpassed 80,000 in 2019, and more than tripled since 2010. However, this amount remains much less than that required for the CFA program. In 2020, the CFA program enrollment has significantly declined by more than two-thirds to roughly 102,200 because of exam cancellations amidst the COVID-19 global pandemic. However, the overall steady uptrend over the preceding 10 years (2010 – 2019) is discernible. We anticipate that these three professional qualifications will continue to be in high demand.



Diversity of Academic Versus Practitioner Qualifications

Whilst a vast majority of finance academics of top-notch universities hold their doctoral degrees, we are uncertain about their professional qualifications. To give a broad overview of their professional status, we have shortlisted the global top 25 universities based on Quacquarelli Symonds (QS) university ranking list 2020 by the subject – accounting and finance (Table 1 – column 1) across nine countries or territories. A rigorous procedure is what follows. We first count the number of regular finance faculties (excluding adjunct, affiliate or visiting professors) based on university webpage information as of the academic year 2020/2021, and then scrutinize their biographies to ascertain how many of them have earned CFA, CFP, and FRM designations (column 4 to 7). In total, there are 836 full-time finance scholars. With less than 4 percent of them holding professional financial qualifications, we conjecture that credential holders are scarce in academia. Meanwhile, there exists at least one CFA charterholder among each of the17 universities' finance teams. In terms of percentage, finance academics are obviously more willing to engage in CFA (3.2%) compared to FRM (0.4%) programs. The only CFP certificant comes from Hong Kong University of Science and Technology. Our overall findings agree with that of earlier surveys that professional qualifications (and especially, CFP certification) are considered unimportant to academic staff (Bracker & Shum, 2011; Chan *et al*., 2016).

Financial practitioners have varying concerns. To assess how well those certifications are recognized in investment management, we checked Morningstar® in May 2019 that there were 688 fund managers across all Fidelity investment funds. Among these, 197 were removed due to nondisclosure of their education levels or professional qualifications. For the remaining 491 samples, basic statistics are tabulated in Table 2. As demonstrated, a bachelor's degree barely suffices nowadays. Plainly, over half of the participants in our samples hold MBA degrees. Nearly 38 percent are CFA charterholders, whereas none are CFP or FRM professionals. Interestingly, about one-fifth are awarded CFA charters and MBA degrees. By contrast, less than 5 percent hold doctoral degrees. Our results partly answer the enquiry about the substitutability of CFA charter

Table 1

QS Top 25 Universities and Finance Faculties' Professional Status – Academic Year 2020/21

Universities (QS Global Ranking 2020: Accounting & Finance) (1)	AACSB-/ EQUIS-Accredited (2)	PRME Signatory School (3)	No. of Finance Faculties (4)	Professional Designations		
				CFA(%) (5)	CFP(%) (6)	FRM(%) (7)
Australia						
• University of New South Wales (15)	Both	Yes	40	2 (5.0)	0	1 (2.5)
• University of Melbourne (16)	Both	Yes	39	1 (2.6)	0	0
• University of Sydney (22)	Both	Yes	43	4 (9.3)	0	0
Canada						
• University of Toronto (24)	AACSB	*No*	45	3 (6.7)	0	0
China (Mainland)						
• Peking University (23)	Both	*No*	28	1 (3.6)	0	0
• Tsinghua University (25)	AACSB	Yes	27	2 (7.4)	0	1 (3.7)
France						
• HEC Paris School of Management (19)	Both	Yes	25	0	0	0
Hong Kong						
• Hong Kong University of Science and Technology (20)	Both	Yes	23	1 (4.4)	1 (4.4)	0
Italy						
• Bocconi University (17)	Both	Yes	48	0	0	0
Singapore						
• National University of Singapore (13)	Both	*No*	29	0	0	1 (3.4)
United Kingdom						
• London School of Economics and Political Science (4)	*None*	*No*	35	0	0	0
• University of Oxford (5)	EQUIS	*No*	21	1 (4.8)	0	0
• University of Cambridge (6)	EQUIS	*No*	14	0	0	0
• London Business School (11)	Both	*No*	27	0	0	0
• University of Manchester (21)	Both	*No*	42	1 (2.4)	0	0
United States						
• Harvard University (1)	AACSB	*No*				
• Massachusetts Institute of Technology (2)	AACSB	*No*	44	2 (4.6)	0	0
• Stanford University (3)	AACSB	*No*	29	1 (3.5)	0	0
• University of Pennsylvania (7)	AACSB	Yes	36	2 (5.6)	0	0
• University of California, Berkeley (8)	AACSB	*No*	42	1 (2.4)	0	0
• University of Chicago (9)	AACSB	*No*	42	2 (4.8)	0	0
• New York University (10)	AACSB	*No*	32	1 (3.1)	0	0
• Columbia University (12)	AACSB	*No*	41	1 (2.4)	0	0
• Yale University (14)	AACSB	Yes	36	0	0	0
• University of California, Los Angeles (18)	AACSB	Yes	21	0	0	0
			27	1 (3.7)	0	0
TOTAL			**836**	**27 (3.2)**	**1 (0.1)**	**3 (0.4)**

Source: QS World University Rankings 2020; university websites

for a postgraduate or MBA degree. Market consensus is on the CFA charter being the gold standard in portfolio management. Academics generally agree that the two qualifications serve different purposes and can complement each other well. In one sense, MBA is for nourishing well-rounded

business leaders whereas CFA, CFP and FRM are suitable for nurturing specialists in the financial industry (Biktimirov, 2012).

Table 2
Highest Education Levels and Certifications of Fidelity Fund Managers in May-2019 (n = 491)

Academic/ Professional Qualifications	Number	Percentage
Bachelor's degree holders	107	21.8
Non-MBA master's degree holders	138	28.1
MBA degree holders	275	56.0
Doctoral degree holders	24	4.9
CFA	186	37.9
CFP	0	0.0
FRM	0	0.0
Non-MBA master's degree + MBA	67	13.6
CFA + MBA	101	20.6
CFA + non-MBA master's degree	45	9.2
CFA + MBA + non-MBA master's degree	22	4.5
CFA + Doctoral degree	8	1.6

Source: Morningstar®

International and Professional Recognition

At present, heavy reliance is placed upon AACSB and EQUIS accreditations or QS global university rankings for assuring the quality of academic business programs. As shown in Table 1 – column 2, almost all the global top 25 business schools are AACSB- and/or EQUIS-accredited. Nevertheless, these accreditation standards might not fully incorporate all the elements with quality education and might lead to biased inter-university comparisons. Ethics, responsibility and sustainability (ERS) are gaining its popularity in today's business education following the initiation of Principles for Responsible Management Education (PRME) by the United Nations (UN) Global Compact in 2007. Amongst the UN's 17 sustainable development goals (SDGs), two are especially noteworthy – SDG 4: Quality Education and SDG 17: Partnerships for the Goals (UN, 2020). Perplexingly, we check that quite a lot leading universities have not joined PRME as signatory schools at the moment (column 3). As accreditation bodies place emphasis on PRME and SDG implementations, more business schools are expected to follow and sign on with PRME.

One of the UN's targets under SDG 4 is "by 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent work and entrepreneurship" (UN, 2020, p.17). This echoes our primary concerns raised in the Introduction. As more business programs are turning to multidisciplinary education in order to reach SDGs (Barnacle *et al.,* 2019; UN, 2020), our standard finance programs might be unable to adequately address the needs of the rapidly-changing world. In the past, finance faculties might easily overlook the significance of the CFA, CFP and FRM certifications. They might not even know that the CFA charter and FRM certification have been benchmarked by the UK National Academic Recognition Information Centre as equivalent to master's degree qualification. Nor are they aware of the wide recognition given by the global financial industry. More detailed information can be obtained under the respective websites of the CFA Institute, FPSB and GARP: (1) nearly 30 national regulatory bodies worldwide have formally recognized the CFA program as

(partial) fulfilment of the licensing requirements for different regulated investment activities; (2) over 25 affiliate organizations spanning different countries have been authorized by FPSB to administer the CFP exams on its behalf; and (3) the FRM certification is approved by the Occupational Skill Testing Authority and the Ministry of Human Resources and Social Security in Mainland China as a National Vocational Qualification Certificate.

To more fully address the premier concern about professional recognition, we endeavor to find some directive policies initiated by the Chinese government as supportive evidence. Guangzhou, one of the nine municipalities in Guangdong Province of China, has been positioned as a global commercial hub within the Guangdong-Hong Kong-Macao Greater Bay Area. The municipal government is proactively proposing incentive packages to retain the accredited financial experts in the city. Guangzhou Local Financial Supervision and Administration has released "Guangzhou High-Level Financial Talents – Catalogue and Assessment Criteria 2020" in 2020 (GLFSA, 2020), wherein there are four categories of financial experts classified as high-level talents. Under the category "senior financial specialist talents," 40 specialized fields in the finance profession have been identified. Table 3 illustrates that the CFA, CFP, and FRM designations have been matched as "recognized professional certifications" across 30, 3, and 25 specific job areas, respectively. The dominance of the CFA charter and FRM certification are construed as wide recognition in the industry owing to their long history and/or rigor of exams. Unlike in the US, however, wealth management in China is in its infancy and financial planners are prone to fierce competitions with accountants and lawyers (FPSB, 2014). Therefore, CFP certification is much less recognized than the other two qualifications in China.

Table 3
Specializations of Senior Financial Specialist Talents and Recognized Professional Certifications

No.	Specializations	CFA	CFP	FRM	No.	Specializations	CFA	CFP	FRM
1	Industry research	✓		✓	21	International finance	✓		
2	Investment banking	✓		✓	22	Asset-liability management	✓		✓
3	Green finance	✓		✓	23	Non-performing asset management	✓		✓
4	Puhui finance	✓		✓	24	Insurance intermediaries	✓		✓
5	Fintech				25	Consumer finance	✓		✓
6	Investment management	✓		✓	26	Futures market	✓		✓
7	Private equity & venture capital	✓		✓	27	Human resources			
8	Risk management	✓		✓	28	Micro-finance	✓		✓
9	Credit approval	✓		✓	29	Auto-financing	✓		✓
10	Compliance and auditing	✓		✓	30	Insurance underwriting			
11	Insurance and actuary				31	Financial factor markets			

12	Supply chain finance	✓		✓	32	Financing guarantee	✓		✓
13	Wealth management	✓	✓		33	Financing leasing	✓		✓
14	Financial regulations				34	Business factoring	✓		✓
15	Personal finance	✓		✓	35	Pawning business	✓		✓
16	Institutional sales	✓	✓		36	Cultural finance	✓		
17	Financial markets	✓	✓		37	Capital market development	✓		✓
18	Financial product development	✓		✓	38	Intellectual property financing			
19	Reinsurance				39	Shipping finance			
20	Clearing and settlement				40	Party financial development	✓		✓
							30	**3**	**25**

Source: Guangzhou Local Financial Supervision & Administration (2020)

Under SDG 17, business schools are encouraged to work in alliance with one another, and also with professional industry associations according to their own competencies. The idea is not new, but it does underscore the persistent gap between academia and business community. For more than a decade, Goetz *et al*. (2005) have proposed various ways to build closer ties between the two sides. These include incorporating internships and service-learning program into business curricula and encouraging students to earn widely recognized professional credentials. Or, as Akimov *et al*. (2014) point out, the CFA Institute's launch of an academic partnership program (currently named the CFA-University Affiliation Program) with business schools has served as a typical example of similar collaborations. Such a program is considered mutually beneficial to all the stakeholders, including students, prospective employers, the CFA Institute, and business schools (Akimov *et al*., 2014; Grieb *et al*., 2017). As a whole, CFA Institute, FPSB and GARP are performing their vital roles in achieving the two SDGs.

Signaling Function

Because of information asymmetry, academic institutions or employers must probe for reliable personal data (as signals) for differentiating the applicants' capabilities. Students with good academic standing usually get a higher chance to be admitted by elite graduate schools or employed by international recruiters. However, university grading systems are becoming less functional than before. Numerous studies have condemned the prevalent practice of grade inflation in HE (Crumbley *et al*., 2010; Franz, 2010; Jewell *et al*., 2013; Keng, 2018). Academics are increasingly taking the role of entertainers, instead of scholars, to satisfy students as customers by all means. In lieu of enhancing the teaching quality, lecturers charged with boosting student academic performance might employ simple measures like lenient marking, assigning easy homework, or course thinning (Crumbley *et al.*, 2010). Consequently, the significance of course grades has been undermined as student relative strengths and talents are warped. As we have noted, academic dishonesty is ubiquitous in HE. And blatant ethical violations of students are sometimes ignored. Only very few business deans would admit that their schools are facing the problem

(Floyd *et al.*, 2013). All these have besmirched the school reputation and the integrity of grading systems.

In this regard, professional certification exams clearly provide much more consistent and objective assessments for each cohort of international candidates without any undue influence by school administrators. Bias towards candidates no longer exists as the markers are not under the threat of students' nuisance (Franz, 2010). The rigor of the programs can be revealed by their respective pass rates in 2019: CFA (41–56%), CFP (38–73%), and FRM (46–59%). This explains why recruiters often place higher trust on the credentials as reliable signals (AACSB, 2018).

Summary and Conclusion

The existing ethics course within business curriculum has been criticized by the AACSB as inefficacious. Based on virtue ethics theory, we aver that the failure is more than a pedagogic issue; it is also due to student mistaken belief in individualistic self-interest, flawed monitoring system and more importantly, the global trend of corruption and fraud in HE. To tackle the problems, we suggest university top management establishing an effective supervisory regime of academic integrity and recruiting competent academic staff with relevant industry experience, faculty members engaging in pedagogical innovations and encouraging students to attain professional designations.

Academics have long been blamed for focusing too much on research or delivering singular disciplinary knowledge and downplaying the importance of student workplace skills. Among the QS top 25 business schools, less than 4 percent of finance faculties have earned professional credentials like CFA, CFP or FRM. By sharp contrast, nearly 38 percent of Fidelity investment managers are CFA charterholders whereas only around 5 percent hold doctoral degrees. This pinpoints the heterogeneity in academic qualifications versus sought-after certifications recognized in the profession. Our research is probably the first to highlight the crucial roles played by the CFA Institute, FPSB and GARP in fulfilling the two overarching SDGs of the UN: quality education and partnerships for the goals. Their flagship programs are globally and professionally recognized and thus deliver more reliable signals to corporate recruiters than ordinary academic qualifications.

One major limitation of our study is that there are many related professional certifications that we cannot analyze them all. We chose to exclude others because those qualifications are traditionally more recognized within disciplines other than finance. For instance, in corporate finance, we heavily rely on assistance from accounting specialists and lawyers. In fintech, what we really need are software developers and computer engineers. In the former case, professional qualifications in accounting and law must be obtained. In the latter, their duties fall within the realm of data science, computer science, and information systems. There are other professional programs that are similar to CFA, CFP and FRM in exam coverage. We selected only the most highly regarded ones for this study. To address the limitation, we might extend our future research to include accounting certifications such as Certified Public Accountant as well.

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APPENDIX 1

Certification Program Structure & Exam Subject Areas in 2020

Panel A: CFA

Exam Subject Area (%) & Level	One	Two	Three
Ethical & Professional Standards	15–20	10–15	10–15
Quantitative Methods	8–12	5–10	0
Economics	8–12	5–10	5–10
Financial Reporting & Analysis	13–17	10–15	0
Corporate Finance	8–12	5–10	0
Equity Investments	10–12	10–15	10–15
Fixed Income	10–12	10–15	15–20
Derivatives	5–8	5–10	5–10
Alternative Investments	5–8	5–10	5–10
Portfolio Management & Wealth Planning	5–8	10–15	35–40

Panel B: CFP*

Education Program Course	Subject
1	Investment planning & asset management
2	Insurance planning & risk management
3	Tax planning & estate planning
4	Financial planning practice

Exam Subject Area (%) & Level	Foundation	One	Two
Financial Planning Principles	27		
Financial Management	23		
Retirement Planning	10		
Investment Planning & Asset Management	20	31	(All areas are covered)
Insurance Planning & Risk Management	20	31	
Tax Planning		20	
Estate Planning		18	

Panel C: FRM

Exam Subject Area (%) & Level	One	Two
Foundations of Risk Management	20	
Financial Markets & Products	30	
Quantitative Analysis	20	
Valuation & Risk Models	30	
Market Risk Measurement & Management		20
Operational Risk & Resiliency		20
Risk Management & Investment Management		15
Credit Risk Measurement & Management		20
Liquidity & Treasury Risk Measurement and Management		15
Current Issues in Financial Markets		10

*According to IFPHK's CFP exam structure (Source: CFA Institute, GARP, IFPHK websites)

Using the Adventure Capitalist Application as a Simulation

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We propose a solution to combine the use of existing technology that most college students access—the mobile device—with a non-expensive method for them to engage their learning outside of the classroom. Using a "free" application called Adventure Capitalist, multiple learning opportunities include simulation grading for performance, a reflection paper by students, and a class period held to debrief and discuss what was learned and how they can apply what they learned to future work in business. Benefits and critiques of the approach are demonstrated with a conclusion on how game-makers could work to enhance simulations for classroom use.

Keywords: simulation, technology, deep learning, experiential learning, ethics

Introduction

The current generation has had the luxury of being raised with a plethora of technology and innovation breakthroughs. One aspect that some may have experienced in the classroom includes games and the gamification of the modern American K-12 classroom (Biech, 2015). Education and entertainment first combined to work together during army training in WWII through Private Snafu. The 1970s continued with Sesame Street and Schoolhouse Rock. Then, computers entered the classroom in the 1980s, and Oregon Trail became widely adopted. Today, history teachers use Civilization IV, biology teachers use Minecraft to teach about cells and DNA extraction, and science teachers use numerous games in class, such as Portal 2 (Hinton, 2014), FoldIt, EteRNA, Eyewire, and Play to cure (Radchuk et al., 2016). These tools reach young people where they are in our technological society and engage them to return to reality and observe how these concepts can come together, which ultimately enhances retention and promotes deep learning.

Kevin Werbach (2015) noted that games should emphasize progression, provide feedback, and stimulate players through long-term happy surprises. Harmful consequences occur if people are manipulated to obtain results outside of their interests or if rewards are the only reason to engage in an activity. A critic of gamification, Margaret Robertson (2010), called the phenomenon "pointsification" because it may focus too much on earning points and badges posted on social scoreboards and ranks for all to see, which diminishes the value of the intention of the exercise. One should be careful when attempting to separate the simulation experience from the learning to ensure that the learning is meaningful for all.

What about business? Business games developed in the early 1970s were mainly used in strategic management and business strategy courses (Faria, 2001). Simulations have emerged in other business disciplines, such as communication and law (Dallas 1995; Saunders, 1997). Business simulations have continued to grow over the decades (Faria, 1998), and the outlook is positive for this growth to continue and expand into other disciplines besides business (Faria et al., 2009).

Is there a similar gaming technology available in business, such as the Oregon Trail for history? Whereas other simulations are available at a price, such as Rollercoaster Tycoon, we propose considering a weeklong or course-long project simulation experience through the current technology called Adventure Capitalist. This application is available across multiple media and provides students with the opportunity to engage in a low-stakes gaming environment in which their tasks are individually focused, but part of the grade is based on their accomplishments in the game. Thus, we intend to promote learning by competition in the game but also provide venues in class and through an additional paper assignment that enables students to think through what they have previously learned or what they are going to learn in the course. The application is "free" and accessible to anyone with a computer or mobile device, which most students have readily available or can access in computer laboratories or libraries across campus. Therefore, when a staff member says to a student, "Stop playing that game!" the student can respond, "but it is for class!"

Literature Review

Pluralism in content and pedagogy prepares students for life after graduation (Peterson and McGoldrick, 2009). Real-world simulations provide this necessary diversification, and computational models can bridge misunderstandings in theory and non-expert issues in practicality (Bohringer, 2003; Faulk et al., 2010). However, most faculty members do not use simulations as a teaching method because of resource constraints (Almohaini et al., 2017). The Adventure Capitalist simulation approach attempts to resolve this issue.

The Internet gives students opportunities to remain engaged through learning activities, such as the Financial System Simulator (Santos, 2002) and opens up opportunities for interactive learning and teaching regardless of platform, hardware, or software specialization (Hardle and Horowitz, 2000). To work, this particular simulation requires Internet use through Facebook, an Internet connection through a cellular device, or cellphone data usage. Carter and Emreson (2012) found no difference in achievement between in-class versus online experiments, but students prefer hand-run experiments given higher classmate interaction. This particular simulation aims to enhance classmate interaction despite the online application component. Recent research suggests that personal computing can provide educational content online, but theoretical use of the content may be reversed ineffectiveness in an online environment. For instance, text works better than graphics in online financial literacy experiments (Hubbard et al., 2016).

Classroom experiments require care, especially with grading incentives given issues of morality, pedagogy, and experimental design (Stodder, 1998). Therefore, the grade for the simulation is not only in the results but also in the learning reflection.

Simulation Itself

Adventure Capitalist, otherwise known as AdCap!, is a simulation game or application that can be downloaded on multiple devices, including PCs, Androids, and iPhones, and is available on social media websites such as Facebook. Players begin the game with only one lemonade stand and continue to click or press the stand to earn money to buy more stands or to invest in other opportunities. If users get bored with earthly investments, they can save to purchase new opportunities on the Moon and Mars. Additionally, monthly events that last approximately one week are held to further challenge and stimulate users to accomplish various tasks and achieve badges, which are marks of achievement to others.

As users progress through the game, they can hire managers who allow them to stop clicking or pressing every few seconds to earn money. Managers increase in expense and are available for all investments. Other managers that cost enormous sums of money are available for purchase to drive down costs. Other upgrades to the assets are available by spending money. These upgrades apply to either specific investments or all investments owned.

The game provides bonuses for having a certain amount of an investment and a certain amount of every investment. As soon as these amounts are reached, usually, a bonus multiplier activates that at least doubles all profits earned on the investment or can provide bonuses for other investments (such as the newspaper investment on Earth). All profits receive a multiplier effect if a user holds a set number of every asset. Although we would love our students to understand why diversification pays off in the end, the game demonstrates and rewards short-term diversification and incentivizes them to do so.

As wealth increases, the swag feature unlocks more items for users, such as cars, houses, boats, and planes. In addition, angel investors accumulate. A user may reset the game and inherit all angel investors, providing a small bonus percentage for each angel to increase its starting profit on all investments. Users may also spend angel investors on investment upgrades. Through these features, users can quickly outgain the level at which they initially started and continue to progress achieving greater wealth at a faster pace. Thus, one can quickly see how this game may become addictive for those with a competitive spirit.

For new users, the startup cost is usually an hour. Subsequently, users can check in once or twice a day to update and purchase more investments. After the initial startup, if a user decides to reset (and does so correctly without losing angel investors), then the startup time is reduced by half, which generally occurs for each startup after the initial one.

Pedagogical Strategies

Teaching Tool 1 provides the actual assignment that we distributed to our students. Our goal for them is to think through their previous learning and experiences and determine what makes sense and what is unrealistic. The learning goal associated with the simulation and the course was to adapt to real-world financial situations. We also want the students to consider the ethos behind the game maker's logic. For instance, is it true that business is all about profit maximization? Our students are taught a new view of finance, which is wealth creation, and not just profits.

Advertising gives users a bonus if they watch a short clip. Does advertising double profits in the business world? Shops exist in which users can spend gold or megabucks earned by completing tasks, or they may purchase them for real dollars (in-game app purchases). We ask students to consider other issues in the game, such as the swag features, statistics, indicating money as the largest number at the top of the screen, and other uses. We also give them space and strongly suggest that they be creative if they are passionate about something beyond the list presented here, which is not meant to be exhaustive but gives them ideas to start their thinking processes. Additionally, note that we do not tell students what we think about the ethos of the game. We want them to think for themselves because they are about to encounter the real business world in a few short periods.

Teaching Tool 1: Class Assignment

Grades will be calculated as the average of your performance on Adventure Capitalist against that of the rest of the class and your individual paper quality according to the rubric.

Write a 3- to 5-page paper (not including the screenshots) that considers the ethics and/or how this is true/false in the real world concerning some of the following issues:

- The language used by the game designers throughout (e.g., the start screen says, "maximize those profits, you job creator!")
- Watching commercials to increase profits
- Providing a shop to boost or fast-forward immediately (i.e., gold and megabucks)
- Initial startup costs
- The swag and stats feature
- Your money at the very top of the screen
- Being able to buy 1, 10, 100, or the maximum of a project
- Time constraints on returns and/or purchases
- The ability to play on different planets or places besides Earth (Mars, Moon, other promotions)
- The ability to further boost profits after buying a certain number of projects
- The ability to boost profits with upgrades using cash, angels, and/or gold
- The costs in the game from projects to upgrades to unlocks
- The ability to hire managers
- The use of "angel" investors
- The use of signing into the app's creator site to boost angel effectiveness
- The ability to use forums, community, forums, change settings, or obtain support
- Other items you notice
- Creativity is considered a huge plus!

In an appendix, submit screenshots of outcomes for EARTH.

Teaching Tool 2 demonstrates the outcomes on which to grade the students based on the screenshots submitted. Instructors can decide to use certain, all, or just a few of the outcomes. If users have bought some in all projects through either equal weighting or value purchasing, they have accomplished the goal of diversification. The amount of cash on hand equals the funds accumulated at the end of the simulation. We highly suggest not basing the grade solely on this amount because some students might invest or upgrade just before the simulation is due. The number of projects available looks at the total number of investments purchased. Bonus opportunities may be available for those who decide to expand outside planet Earth to the Moon and Mars. Because angel investors denote effort on the part of the user running the simulation, we include looking at both the total number used and the amount available. Swag level denotes decorations or items won by saving a certain amount of funds. Badges demonstrate accomplishments in purchasing a certain set of investments or achieving a certain level of savings. Lifetime earnings show how active the user has been, especially if she has reset the game. The number of unlocks completed shows how the user is progressing in purchasing various investments. The number of upgrades completed demonstrates saving funds to invest in already previous and future purchases of investments to make them more efficient concerning cash flow. The number of managers hired demonstrates saving funds to pay workers to help you while you are away from the game, sparing users from having to tirelessly click or press the keys. Our approach is to average the results of all students in the class, rank order them from top to bottom, and assign half of their grade using these results.

Teaching Tool 2: Outcomes to Analyze by the Professor

- The amount of cash on hand
- Diversification of the projects chosen
- The number of projects available
- Expanding to other planets
- The number of angel investors used and/or available
- The swag level reached
- The number of badges achieved
- Lifetime earnings
- The number of unlocks completed
- The number of upgrades purchased
- The number of managers hired

Assurance of Learning

Because we are allowed to modify questions on the online student evaluation forms sent to students at the end of the quarter, we placed a question that aimed to solicit unanimous written feedback from students. We asked, "What did you think about AdCap!?" The results were mixed, as demonstrated in Appendix B.

Students had some criticisms of the approach used. First, real-world money can be used in this "free" app. Most gaming apps today enable one to pay to download or are free to download with the option of in-app purchases. AdCap! represents the latter option, which some students may have taken advantage of. Also noteworthy is that AdCap! provides the user with opportunities to watch advertising videos to gain in-game currency, potentially putting the user's data at risk. Second, students receive higher positive outcomes if they click more, meaning that their scores can be higher as they spend more time on the game. The game could be perceived as a mindless activity that does not attribute anything to learning. The caveat is that once the player has figured out the game to a certain level or degree, mastery is being accomplished or work is being done until it is time for the next stage of the game to be restarted via acquiring more angel investors (i.e., cashing out and beginning the entrepreneurial processes over again). Lastly, the score could be potentially manipulated by altering phone device times, which would change the timing in the game to create more wealth (i.e., create a time machine or warp to access free supplies). This approach could be deemed cheating or a hack that players could use to exploit others in a competition, similar to loopholes in a business. Although not all of these approaches were intended to inflate grade assignments, indeed they may have caused some invalidation and potential issues that need to be addressed in future classes, as well as the simulation, runs through proper directions.

In addition to the written comments, other observations are worth noting. First, students show off how they are doing. Multiple students have shown each other via their cellphones how they are doing, which is a sign of positive peer pressure for those lagging to get them working on the simulation because it is partially for their grade. Second, students have asked us questions about the application itself and our performance in the game. Specifically, one student asked, "How many angel investors do you have?" Therefore, do not be surprised if students ask about the instructor's use of the application. For now, we have disclosed little to the students about our participation, but one positive is that they are engaged in the simulation and take time to work on it daily. The results of their efforts are provided in Appendix C. Any missing data are the result of students not

submitting proper screenshots to demonstrate their progress and/or lack of participation in the simulation.

Lastly, holding a debriefing session with students after the simulation is imperative. Allow students to voice their likes and dislikes and their overall experiences to give the class a sense of how others viewed the simulation, enabling everyone to learn from one another. Constructive questions to lead the discussion may include the following: What are some of the similarities that you noticed between the simulation and your real-world experiences? Other textbook readings? Classroom and other examples? What are the differences? How does the media portray business? Is it similar to what was demonstrated in AdCap!? If you were to redesign the simulation, what would you keep? Add? Subtract? Modify? For those of you entering into your various business roles, how will you take what you learned from this exercise and apply it to accounting? Finance? Economics? Information systems? Marketing? Management? Law? What will you not apply? Think about the ethical implications and assumptions underlying the game. Which are true in the United States (or your country of origin) today? Which are false and/or exaggerated? What is one major takeaway and/or lesson that you received—good or bad—from the simulation that you will apply to your everyday life, work, school, or personal issues?

Suggestions for Future Use

First, the simulation performance will not count as part of the grade because of the hacking issue with the application. We also want to ensure that the gaming component is removed as much as possible to enable deep learning to occur. Second, the game will have a definite start and end date as defined by the events that come out monthly on the application. One suggestion is to introduce the simulation toward the end of a class period, and then have the students do the simulation after the end of the class period, be prepared to discuss it during the following class period, and turn in a mini-paper the following week. Third, we plan to create a video and/or spend class time with students going over how the simulation works. Lastly, we plan to better frame the conversation and explain to students why we chose this particular application as a simulation for the course. The advantages are that it is "free," unlike other software programs; is easy to use with technology such as their phones or computers via Facebook; and that they can have a culminating experience that will allow them to reflect on what they have learned and experienced and how business and finance are portrayed in the public and the media.

Another suggestion involves considering Adventure Capitalist as a part of other simulations to use in the course. An additional clicker game for consideration is Idle Miner Cartoon from Kairosoft. This simulation contains a business frame with a more serious simulation game such as Rollercoaster Tycoon. Rather than being graded based on points, students could be given tasks to achieve in the application, such as opening a target number of businesses or attaining several "angel investors." In addition to the application, a business simulation intended for classroom use could be added for critical comparison. Simulations generally provide variability across multiple dimensions, including business perspective, simulated economic complexity, monetization schemes, and player motivation.

Adventure Capitalist is extreme in its caricature-like feel, lightweight gaming, and monetization scheme linked to its motivational structure of an intermittent reinforcement schedule. This extremism tends not to favor well in terms of combining addictive motivation with ludicrous monetary options of injecting real-world currencies into the game. The game is a Pay2Win variety with winning occurring through a nebulous concept. Kairosoft is a company that offers complete

games generated using a generic game construction tool. The economy is more complex, allowing for short-term failure while almost guaranteeing long-term success. Rollercoaster Tycoon is still a stylized rendition of the economy but allows for long-term failure. The game was transformed from being standalone to a series.

Business simulations are built to be more realistic but carry some of the three elements listed above. Combining genres and experiences allows students to reflect on the imagery of capitalism and business in popular culture, the mechanics of simulated economies, and the monetization schemes of applications and simulations because elements exist in a real economic market of application sales. Such a combination would provide a platform for the critical reflection of mechanisms that make players continue to invest in an application versus chances to learn from the experiences.

Providing multiple simulations would reduce the student anger that is mentioned and demonstrated in their comments over concerns of investing money to attain a certain grade. Multiple simulations would also reduce legal concerns, although research demonstrates that generating relevant emotional-evoking controversies through deception can help achieve learning objectives (Taras and Steel, 2007). Additionally, some may feel that Adventure Capitalist contains built-in attempts to make gamers lose their money, which is an unjust invasion of the economic sphere into education (Walzer, 1983). This issue may be alleviated by asking for a minimum set of attainable goals within a defensible time investment. Contrasting the simulation with others would allow disappointment or concern to be channeled toward deconstructing the perspective of monetarization schemes. Reflecting on the differential affordance of the applications would alleviate voiced concerns about only a singular simulation being a waste of time. In other words, providing a diverse set of simulations to choose from alongside Adventure Capitalist would assure and enhance learning.

Conclusions

We conclude with suggestions for a theoretical simulation based on this research, the study from Radchuk et al. (2016), an article by Dammann and DeSantis (2017) on digital assessment, and an educational model by Zapalska and Brozik (2008) for developing and evaluating simulations. The perfect digital assessment for classroom use is accessible to all students free of charge, would have limited capacity for stealing data or information from users, and would preferably reside on a restricted network that prevents hackers from accessing the information and from hacking the system to manipulate potential results. Second, games can be developed in areas that can contribute meaningfully to the classroom and where gaps still exist in education. For example, in finance, no games are currently available or accessible to encourage major learning objectives, such as the time value of money or financial ratio analysis. Third, gaming can be used in research and innovation processes for participative and prospective technology assessment and multi-modal assessment by professors through multiple-choice or open-ended questions, via video, or through quizzes. Fourth, open-ended play can be explored to deliver relevant information for more analysis, such as the items that take shorter or longer to comprehend, the choke points (causing students to stop or quit), and others. Fifth, communication and other socializing motivators can be integrated to enrich the experience and keep students involved in the activity. Doing so will lead students away from merit systems of points, bonuses, and levels and toward good citizenship and a natural internal intrinsic motivator system that is healthy and preferred. However, the systems in place should have progressed toward certain standards that are necessary

to achieve success in the course. Lastly, the technology in place must be able to bridge learning gaps between the user and the interface, the instructor and the interface, users in the game, the instructor and the user (especially in online environments), and potentially other instructors to create a successful framework that others will use and build on for greater future achievement (Dammann and DeSantis, 2017; Radchuk et al., 2016).

Zapalska and Brozik (2008) suggested identifying the game's problem and structure; defining the learning objective, players, organizations, environment, motives, incentives, goals, and resources available to players; determining the rules of play; formulating evaluation criteria; developing and playing the prototype; and refining the game. When evaluating the simulation at the end, the following questions should be addressed. Did the simulation motivate students and increase their concentration levels? Did the application alter previously held attitudes? Did the students retain and acquire factual and conceptual knowledge? Did the students acquire and improve social skills and the confidence to employ those skills? Did the simulation provide a social laboratory in which to experiment with acquired communication skills and knowledge in an artificial environment to gain comprehension for complex social, economic, and business processes?

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Appendix A
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Appendix B
Student Feedback

Student 1: Liked it. Still play. Please give hard start date though.

Student 2: The simulation was pointless in our opinion. I thought it was pointless and didn't accurately measure anyone's performance. I think that the paper is fine but basing anyone's grade off of that game is pointless.

Student 3: Uggghhhhh I really did not like that game but thought that the paper I had to write was good as a way for us to think how it applies to real life. I just hate phone games.

Student 4: It was a fun simulation. I think that it was an interest outlook on the Capitalist society that I live in!

Student 5: It was interesting. I think there needed to be a start date and somehow it needed to be ended. Not sure how that could work.

Student 6: I think the concept of it was good, but I don't think it ended up working as well as expected. The results favored the people who spent the most time on the their phone, which I don't think should be reflected in a grade. But the game was interesting and writing the paper helped us relate the game play to real life business.

Student 7: The simulation was not helpful. Would not suggest to use it again.

Student 8: Well, I balled out. I thought it was worthless until our conversation, however I know that Morningstar has a similar free program in which you can invest in real stocks. I think that would be worth looking into to. Ask the Investment club students about it.

Student 9: AdCap was not the greatest of simulations. I should have set a start date and explained the app so I understood what I were doing.

Student 10: Oh boy, haha. I think it was great but that the class should not be centered around it. It was a new idea that other classes have not done, so it was nice to change it up a little. However, too many cheaters.

Student 11: It seems ridiculous that half of our grade for the paper was based on how much time I spent on an iPhone game. I saw some kids spend entire class periods for weeks just tapping on their phones. If it's done again, it should just be for a short period of time, such as a week.

Student 12: I thought I was doing really well in the game, in reality I did really poorly. It was fun to play, but I don't know if it contributed to our learning a ton.

Student 13: I liked the game simulation but didn't quite understand the big picture of why I were using it. Hah, as mentioned before…not sure why I worked on it. It was very intense and "fun" but possibly if the class just did one of the other planets for the short time frame it might be better.

Student 14: Addicting and not super relevant to finance when there could have been more useful skills I could have gotten. However, it did a good job of bringing up some of the language of capitalism.

Student 15: I really wished the simulation paper could have been worked out better. I felt like it was really unfair because the start date, time spend on phone, money people spent, etc. were all different. I really hoped the paper would be weighed a lot more than the game. I really wouldn't

recommend AdCap! in the future. It could definitely be improved to make it fair to everyone. It felt unfair to see our grade for the game (not paper) because I saw other classmates spend hours and hours on the game, while I don't spend that much time on our phone. If AdCap! Will be used in the future classes, I think it'd be better to have the paper weigh much more than the game.

Student 16: So stressful! But really fun!

Student 17: AdCap was a bit confusing in the beginning. Maybe having a quick tutorial as a class before starting the game would work better? But there are many great takeaways from playing the games – like angel investors, investing in businesses, etc. However, the way the game worked was unrealistic.

Student 18: I liked it.

Student 19: I didn't like the Adventure Capitalist game at all. I felt like I was playing a child phone game that took up our time and required us to click buttons all the time. I wouldn't recommend using it for next year. I did not think it was a valuable learning experience and mentioned what I thought about it earlier.

Student 20: Thought the game I played in classes that resulted in a grade was very poorly run and I do not recommend doing it next time this course is taught. Hated it. And you can cheat on the game by changing the time on your device which allowed you to make unlimited amounts of money.

Student 21: no comment

Appendix C

Student Data Results

Rank	Cash on Hand	Lifetime Career Earnings	Total Angel Investors	Unlocks Earned	Maximum Number of Investments	Minimum Number of Investments	Gold on Hand	Megabucks on Hand
1	1.2*10^230	1.4*10^273	6.8*10^109	541	7,865	4,316		23
2	1.0*10^174	3.0*10^175	2.1*10^82	456	6,083	3,417	5	
3	5.0*10^168	5.0*10^166	3.0*10^79	448	6,315	3,557		
4	2.9*10^163	3.7*10^163	8.2*10^75	431	5,581	3,181	5	
5	5.6*10^158	2.5*10^158	7.3*10^74	427	5,500	3,127	5	
6	1.0*10^146	1.0*10^146	1.2*10^66	396	4,600	2,740		6
7	8.7*10^143	4.0*10^144	7.1*10^66	400	4,916	2,824		
8	4.8*10^112	8.9*10^112	2.5*10^48	335	3,700	2,230	15	2
…								
19	9.0*10^25	2.7*10^26	6.6*10^6	72	400	335		
20	3.9*10^21	2.0*10^22	6.1*10^5	45	221	171		
21	7.2*10^9	7.2*10^9	5	6	152			

Pisco, Peru, and the Pandemic

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This case describes actual events surrounding Peru's 2020 state of emergency and the potential impacts on a large farm in a region famous for cocaine production. The owner of the farm Geronimo is concerned about the impacts of COVID and the potential of depreciation of the Peruvian Sol (PEN) on his farm's valuation and the lives of his workers. Geronimo's farm represents an alternative to traditional coca farming and is critical to the long-term development of the region. After a chance meeting prior to Peru's quarantine with an international finance expert, Matt Lelander, the case proceeds to outline several potential scenarios that are possible due to COVID. Matt is asked to estimate the impact on the value of Geronimo's farm given these different scenarios and make recommendations.

Keywords*: international finance, case study*

Introduction

Wondering along the colonel buildings in the Barranco barrio of Lima, Matt Lelander reflects on his good fortune.[1] Matt recently returned from an international assignment in Nicaragua and spent just over a month at his home in Colorado before catching a $92 flight to Peru last night for some sunshine and pisco.[2] Matt could hardly believe he was able to find a one-way ticket to Lima for such a fantastic price.

"Hola Senor, lunch?" Matt hears coming from a tourist-oriented restaurant across the street.

"Si, almuerzo!" Matt tries out the little Spanish he knows trying to impress his girlfriend.

"Good afternoon sir, we have excellent ceviche, seafood, chicken and pisco sours," the server says clairvoyantly.

"A couple pisco sours and some ceviche mixto to start," comes Matt's predictable reply.

A few minutes later the pisco sours arrive as Matt is describing to his girlfriend Chau what is in a pisco sour.[3]

[1] For more information on Lima: https://www.peru.travel/en/destinations/lima
[2] For more information on Peru's national drink: https://pisacinn.com/peruvian-pisco-the-story-behind-the-iconic-national-drink/
[3] The traditional pisco sour contains 3 parts Pisco, 1-part gum syrup, 1-part lime juice, 1-egg white, 3 ice cubs, and angostura bitters.

"Where are you from?" asks the server.

"I am from Colorado in the United States and my girlfriend is Vietnamese" responds Matt before raising his glass.

"Salute, to health"

"Speaking of health, how are things in the US now with COVID?"

"It is still a little early to tell. In Colorado they have just closed schools, churches, and restricted large gatherings. However, it seems like the number of cases is slowly increasing." Matt says.

"We just reported our first case of COVID yesterday morning," the waiter responds and then adds, "I am not sure our health care system is ready for a big outbreak."

"Has the government decided on any mitigation strategies?" asks Chau.

"None as of yet," the waiter says at around 1pm on a lovely late summer day (March 15, 2020).

Following lunch Matt and Chau wander along the cliffs that border the Miraflores barrio of Lima and Pacific Ocean happily enjoying the fact that its summer below the equator this time of the year. While wandering the avenue de La Paz, Matt stops into his favorite discount clothing store 5-uenta to pick up some designer shirts at one tenth retail prices.

"Peru produces some of the finest pima cotton in the world," Matt brags to his girlfriend while trying on his 5th shirt.[4]

After patiently waiting Chau suggests they grab another pisco sour on a small calle they passed earlier containing a strip of hip looking restaurants and bars.

After a few minutes of browsing they decide on bar with a friendly hostess named Vanessa who is from Venezuela.

"Are pisco sours still buy one get one?" asks Matt

"Si," Vanessa responds with a smile.

"Dos, por favor," Matt says holding two fingers up.

"Are you guys from the states?" a voice breaks the silence from across the room.

"Yes, I am, but my girlfriend is from Vietnam."

"First time in Peru?" the stranger's voice volleys back.

"It is my first day here, but my boyfriend has been here several times," Chau replies.

"Wonderful, my name is Geronimo welcome to my country."

"It is a pleasure to meet you, I am Matt, and this is my girlfriend Chau," Matt says and excuses himself to go to the restroom.

[4] For more information on the Peruvian cotton industry: https://www.transmodal.net/single-post/2018/02/05/Success-Stories-in-Perus-Garment-Industry

"We do not get many tourists from Vietnam, what do you know about Peru?" Geronimo asks Chau.

Giggling Chau responds, "Machu Pichu and that's about it, but my boyfriend tells me Peru is an amazing country."

"Well where to start, civilization has thrived in Peru for over four thousand years. We were home to the Norte Chico Civilization and the Inca Empire. In fact, Peru is sometimes called the land of the Incas." replies Geronimo while fishing in his bag for his phone.

"Have a look, here is a map of modern Peru. We have it all in my country, the ocean, the mountains, the jungle and amazing lakes. As you can see a large portion of our territory in the north east contains the Amazon river and jungle, in the south we have a massive freshwater lake at 11,000 feet above sea level called lake Titicaca, and in the middle we have the beautiful Andes mountains and of course Machu Pichu," Geronimo informs Chau while showing her the map reproduced below.

Figure 1
Map of Peru

Source: CIA.org

"Wow," responds Chau, "Fantastic looking piece of land, and it has the same shape as my country."

"Ha ha very true. How long are you staying in Peru?"

"We are not sure; Matt is looking for another consulting gig and I work from home as a recruiter in the finance industry." Chau responds sipping on her pisco sour.

"Ready for another round?" Matt rejoins the conversation after extending his bathroom break to practice Spanish with Vanessa.

"Geronimo was just telling me we have lots to see, honey," Chau says attempting to include Matt in their conversation.

"What do you do?" Matt asks.

"I worked for a number of years in agricultural development for the ministry of agriculture of Peru, promoting export development. Now I own and operate a farm in a valley employing local people. We produce organic, natural produce for the local Peruvian market and for export to Europe and your country."

"That's fantastic, I bet this is rewarding work." Chau chimes in.

"Indeed, it is great to see my people do well. The last ten years have been wonderful as the Peruvian and global economies have been growing. The standard of living for my workers has improved significantly and we are seeing higher prices for our produce. Our revenues have been steadily increasing and I am able to share the profits with my employees while continuing to expand."

"Revenues and profits, now you are talking my language," Matt says grinning and continues, "I am an international financial consultant."

"Wonderful, I've learned while growing my business how important good financial planning and stability are in growing a business that will improve communities," says Geronimo.

"Hey guys! Why is everyone watching the TV?" Chau asks concerned.

"That's the President of Peru speaking, Martin Vizacrra," Geronimo says now also listening intently.

For fifteen minutes silence overtakes the bar as everyone's attention is fixated on the television. At the conclusion of the announcement Geronimo speaks to Vanessa in Spanish and then pats Matt on the shoulder.

"I ordered you guys another round on me, you are going to need it." Geronimo says as the mood of the bar has darkened noticeably.

"President Vizacrra has declared a state of emergency due to COVID-19. All non-essential business will be closed until March 30th, international borders will be closed, only essential travel within the country will be allowed and there will be a curfew in place throughout the country from 6pm till 5am." Geronimo informs Matt and Chau as two 1.5-liter bottles of Pilsen arrive.

"What? When does this start?"

"Tonight, at midnight, so in about 2 hours," replies Geronimo as he continues, "I do not know how I will get to my farm which is 350km from Lima as non-essential travel is prohibited."

"We are supposed to go to Lake Titicaca on Wednesday," Chau adds.

The three share the two bottles of Pilsen as the realities of their new lives under COVID sinks in. At midnight Vanessa closes the door to the neighborhood bar.

Background

"Who is calling at this time," Matt says grumbly feeling the effects of the last Pilsen.

"Hello sir, this is the front desk of the hotel. You need to vacate the hotel by 11am today."

"What? We have a reservation for four more nights?"

"I am sorry sir, but all hotels have been ordered to close. You must checkout today," says the female voice on the other line.

Chau immediately begins a search for apartments on Airbnb and Booking.com and after a frustrating hour of looking finds a suitable apartment.

"You are going to have to learn to cook Peruvian food honey," Chau says trying to make the best out of their situation, "the new place has a kitchen."

During the next week Matt and Chau adjust to life under the state of emergency. They find only a few small shops open along with several supermarkets. The police and national guard are a constant presence on the street ensuring that people are wearing face masks and following the curfew rules. It soon becomes evident that the state of emergency will be extended beyond March 30th, and Matt and Chau secure a longer-term rental.

"Your ceviche is almost perfect, another month in Peru and you can open a restaurant?" laughs Chau.

"Ahh restaurants...," Matt signs nostalgically, "…remember when eating inside restaurants was allowed."

"Hey, you should contact Geronimo, I wonder if he ever made it out to his farm?" adds Chau.

"Right on, let me shoot him a WhatsApp message."

"Hey Chau, Geronimo got back to me and he doesn't seem to be having a good go of it", Matt says after receiving a message in return an hour later.

"What do you mean?"

"Seems he cannot get back to his farm. Also, the already month-long quarantine and the government borrowing has him concerned."[5]

"Maybe you can help him. It would give you something to do, so you would leave me alone to get some work done," chuckles Chau.

"You are right, let me give him a call tomorrow. Right now, I need to finish up my chupe de camerones," Matt says in anticipation of another Peruvian classic.

"Buenos dias Geronimo, thanks for all your advice on Peruvian cooking, we have been enjoying our culinary tour over the last month." Matt says as he sips his morning Joe.

"De nada amigo."

"Sorry to hear about your business, sounds like a nightmare. Can you fill me in on the details of your farm?" asks Matt.

"My farm, the Luisiana hacienda is in the valley of the Apurímac and Ene rivers often called VRAE for short. It is one of the major areas of coca-growing in Peru. The area is extremely poor. The VRAEM is an area of such high childhood malnutrition and poverty that the government of Peru selected the VRAEM to launch its National Strategy for Growth program in 2007. I have had a development vision for the area for many years. Finally, in about 2005,

[5] For more information on Peru's stimulus program and IMF support: https://www.bloomberg.com/news/articles/2020-03-30/peru-drawing-up-economic-stimulus-package-equal-to-12-of-gdp

with the auspices and financing of the European Union, the Concerted Development Plans of all the VRAE districts were formulated with a long-term planning horizon."

"How has the development of this region and your work there progressed?" asks Matt.

"We have a challenge that is to promote the development of the valley, for example here we have an exemplary crop: cocoa organic and aromatic, now we have to give it added value, because if we market it only as grain, we will be poor, but if we turn it into good chocolate we will advance one more step. What we still lack and are trying to build is serious technical support to move our initiatives forward."

"Very important and difficult work, does the state or other agencies partner with you?" Matt injects.

"Yes, we attempt to work hand in hand with the State and the PNP to have a climate of peace and development," Geronimo adds and continues, "I am also passionate about reforestation. It is my deeply held belief that by preying on our forests, mainly those found in the highlands, we are condemning our future to suffer the consequences of natural disasters. In order to reverse this situation, the mayors of the VRAE region must undertake ambitious reforestation projects, since through them the farmers will be able to earn a lot of money without cutting trees through the funds of the carbon credits and aid. In this way we protect the environment, prevent more natural disasters, generate higher incomes for farmers, and improve their living conditions."

"Sounds like a great project, I wish we were able to go there and see it for myself," Matt says.

"You are my guest when things open up. My immediate concern is the impact of the on-going COVID crisis on the value of my business. I am concerned that given the recent borrowing of the Peruvian government and general weakness in emerging market currencies that the Peruvian Sol may decline in value. Additionally, what are going to be the impacts of a global recession on agricultural demand? I am concerned for my workers livelihoods. Additionally, we need to roll over some long-term US dollar denominated debt and I am worried about how COVID may impact our valuation as this will impact our ability to obtain additional financing," Geronimo concludes with a deep sigh.

"Can you email me your financials and I can put some scenarios together for you," Matt says in his most reassuring voice.

"I'm a farmer amigo, so the financials will be pretty rough, but I will see what I can come up with and send them over tomorrow."

"Perfecto amigo. I will look for them. For now, I will put my hand to making aji de gallina. Talk to you in a couple days."

"Ciao," Geronimo says as the phone disconnects.

The following morning Matt receives the following email.

"Hola Amigo,

It was nice talking with you yesterday. Please find attached the rough profit and loss statement from last year. Please let me know if you have other questions.

How did your aji de gallina turn out? That's a classic Lima receipt and since you have lived in Lima for 5 weeks you are basically local.

Thanks,

Geronimo"

"You are working hard this morning honey?" Chau says as she peels a mango for breakfast.

"It's really nice to have something to do after so many weeks of quarantine, I am enjoying working through Geronimo's financial information," responds Matt already on his third cup of coffee of the morning.

"I think I am getting his information into a useable format," Matt continues.

"Wonderful, I am off to find people for PIMCO, have fun with your spreadsheet," Chau says moving to the other room.

The following day Matt arranges a Zoom meeting with Geronimo to discuss his questions.

"Good morning Geronimo."

"Hola amigo, how is your Spanish coming along?"

"Duolingo is helping me build my vocabulary, but social isolation is not good for my conversational skills," laughs Matt.

"From the financial information you sent me, I put together the following simple valuation of your business before COVID. Granted it is not perfect, but it will allow us to test various scenarios to see how your business's value may be impacted. Furthermore, we should be able to create strategies to mitigate the impact of adverse events on your firm's value," Matt says getting right down to business.

"Sorry about the lack of detailed financial information, I am not an accounting type."

"No worries amigo, let me share my screen, so you can see what I have put together."

Matt shares his computer screen with Geronimo. The following proforma statement appears.

Figure 2
2020 Pre-COVID

	Units	*Price*	*Total*
Revenue			
Domestic	100,000	100	10,000,000
Export	50,000	130	6,500,000
Total			**16,500,000**
Operating Expenses			
Farm Labor	150,000	20	3,000,000
Sales + Gen admin	25000	60	1,500,000
Local Material	15000	30	450,000
Imported Materials	7500	50	375,000
Overhead			1,650,000
Depreciation			1,000,000
Equals Operating and Taxable Profit			**8,525,000**
Less Tax (29.5%)			2,514,875
Equals Earnings After Tax (in PEN)			**6,010,125**
Net Cash Flow (in PED)			**7,010,125**
Exchange Rate (PED per USD)			3.5
Net Cash Flow (in USD)			**2,002,893**
Discount Rate			20%
Estimated Intrinsic Value			**10,014,464**

"Let me quickly walk you through this proforma. I realize that you have several crops, but I aggregated the crops and used average values throughout this analysis. So, there is an implicit assumption that if you grow you will grow all your products by the same amount. I did distinguish between your domestic market and export market as these markets appear to have different elasticities of demand and revenue structures."

"Yes, this what we observe," Geronimo adds.

"It seems like about 2/3's of your revenues is domestic, and the balance comes from the export market. Additionally, your prices are approximately 30% more in your export market compared to those in the domestic market. These are reflected in the baseline revenue numbers." Matt says walking Geronimo through the numbers presented in Figure 2.

"Sounds about correct, we have been trying to grow the export side of the business for some time for these reasons," adds the farmer.

"On the cost side, I converted your labor costs into two components and attempted to express these costs on a per unit basis. For example, each unit of production requires a unit of physical labor which I estimated using your financial information to cost 20 Peruvian SOL (PEN). On the other hand, each unit of output requires about 1/6 a unit of managerial expertise and marketing, but these costs run about 60 PEN per unit. I based these ratios on your costs last

year. The reason I wanted to express your costs on a per unit basis is so we can see how various COVID scenarios may impact your business and units sold are definitely going to be an important variable."

"Those costs seem about right, though I have never really thought of them on a per unit basis," Geronimo adds while looking at his computer intently, "What about the material costs?"

"These are computed in a similar manner. From my calculations, you produce about 10 units of product on average for each domestic material input and about 20 units output for each unit of imported material. I assume most of your imports are specialize fertilizers and technical equipment?"

"That is basically correct, I see that you have higher costs associated with the imported resources. This is consistent with our experiences at the farm." Geronimo states.

"Last year your overhead was about 10% of sales and depreciation was a bit over one million Sol. I used the Peruvian corporate tax rate of 29.5% to calculate your earnings after-tax. Please note that this is slightly different than what you reported as we did not deduct interest expense," Matt confidently states as he continues, "from there we add back depreciation to find your PEN net cash-flow. Since much of your financing is US dollar based, I convert your PEN cash-flow to USD, which last year was about 2 million dollars."

"Ok, I am mostly following you," mumbles Geronimo.

"Then as a base case, I assume a required rate of return of 20% and that your farm will not grow for the foreseeable future. In finance terms, I am valuing your firm as a perpetuity. This is just the base case, it will be important to consider how different growth forecasts may impact the value of your farm as we begin to think about COVID's potential impact on your business," Matt says over the chirping green parrots outside his window.

"Zero growth might be optimistic, that is as depressing as another 2 weeks of quarantine," Geronimo says trying to keep his sense of humor.

"The president is supposed to talk again today, let's hope he starts to open up a little. Don't scare me Geronimo."

"Well cases are still rising, so you may have a lot of time to keep working on your ceviche," Geronimo laughs, "Let me sleep on these numbers and let's talk tomorrow about how various adverse events and strategies may impact the value of my farm and the lives of my workers."

"Bueno, hasta luego!" Matt says confidently while thinking that Duolingo might be working.

III. So what's the scenario?

"Hola Geronimo, que tal?"

"I assume you saw the quarantine was extended for two additional weeks?"

"What?" Matt replies somewhat shocked.

"Si amigo. Additionally, men are only allowed to conduct routine business such as banking and grocery shopping on Monday, Wednesday and Friday. Chau can go out on Tuesday, Thursday and Saturday," Geronimo responds.

"What about Sunday?"

"No one is allowed out except the Holy Spirit," Geronimo lets out an exasperated laugh.

"What about the curfew?"

"Everyone must now be inside from 6pm till 4am, so if you're an early riser you can get out an hour earlier."

"Luckily, the weather is nice, and I don't have anywhere to get too. Guess we all need to adjust to the new realities of COVID-19. Hopefully these efforts will prevent unnecessary death," Matt says.

"Thanks for the baseline analysis. It was relatively easy to follow, and my accountant agreed with your valuation," Geronimo says changing the subject then continues, "after spending entirely too much time watching the tele and reading news on the internet, I am concerned that the shutdown of the Peruvian economy and Peru's increased borrowing to support its stimulus program will result in negative economic growth and cause the Peruvian Sol to depreciate against major currencies. How might these factors impact the value of my farm and the demand for my products?"

"Excellent questions and sometimes the answers are not straightforward. Maybe as a starting point we could consider a situation where the Sol depreciates by 20% and long-run growth rates are negative 2%," Matt says.

"Sounds like a good place to start," Geronimo agrees.

"Also, as a base case we will assume that export and cross elasticities of demand are both equal to one or more precisely negative one," Matt lets his geek flag fly.

"You lost me amigo."

"Basically, if the PEN depreciates your products become cheaper and more competitive on the international market. By assuming that export elasticities of demand are equal to 1, we are assuming that for every one percent the PEN depreciates your revenues in the export market will increase by one percent. Similarly, by assuming a cross-elasticity of demand equal to one we are assuming that for every one percent the PEN depreciates your domestic revenues will increase by one percent. This is just our base case; we can check other assumptions as well."

"I think I understand, depreciation of the PEN changes the competitive landscape making my goods potentially more attractive," Geronimo adds.

"Perfecto, so if the PEN depreciates by 20% then you can expect revenues to rise by 20% in PEN terms given our assumptions of your elasticities demand. As a starting point, I will run the case where the percent changes in revenues are derived for equal changes in price and quantity. Therefore, if the PEN depreciates by 20% you will increase price by about 10% and expect to sell about 10% more."

"What will happen to my costs?"

Matt adjusts his headphones and starts, "As you know, when the PEN declines in value you are going to have to pay more in PEN for things like fertilizer, tractors, and gasoline. Maybe, we can assume that all your resource prices will increase completely in accord with exchange

rates as a starting point. We might as well be a little pessimist at the beginning. Also, to keep things tractable, I will just assume that overhead costs and depreciation remain the same."

"Brilliant. May I also ask you to run the numbers for a couple other scenarios?"

"What else do I have to do for the next two weeks?" Matt grins through the computer.

"Staying pessimistic, what would happen if the PEN depreciates by 25% and growth rates stay at negative 2%. However, while I think your assumption about the elasticity of demand in the export market is correct, I feel that my domestic customers have an inelastic demand for food," Geronimo squints trying to remember his microeconomics course.

"No worries, I can run a scenario where I assume that export elasticity of demand is negative one and how about a cross-elasticity of demand at negative 0.2."

"Bueno, also since in the medium term I cannot expand capacity, can we assume that changes in revenue are derived completely from changes in prices?"

"Certainly. Would you also like to consider alternative assumptions with regards to resource prices?" Matt says jotting down notes.

"Well, I have a supply of fertilizer and given that the world is likely heading for a serious recession, maybe resources prices will not increase as much as the base case."

"Good points, maybe we can consider a case where resource prices increase by 65% of the depreciation of the PEN," Matt injects for clarity.

"Finally, what would happen if the PEN declines in value by 30% and we leave the elasticities the same as in the second scenario. However, the decline in the value of PEN keeps nominal growth rates at zero," Geronimo asks.

"I can run this scenario as well, maybe I will assume in this situation that imported resource costs increase by the full 30%, but domestic resource prices remain fixed. Does this sound reasonable?" Matt responds.

"Sure, I appreciate your help. Please feel free to work out any alternative scenarios you think plausible given your experience. I look forward to talking through these results with you."

"My pleasure lets discuss again in a couple weeks. Hopefully over a couple more Pilsen at Vanessa's bar," Matt says watching a flock of green parrots fly in front of his window.